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Medium Voltage Electrical Safety Program

UNC CHARLOTTE
9201 UNIVERSITY CITY BLVD., CHARLOTTE, NC 28223

TABLE OF CONTENTS

I.	General Application	1
II.	Training	1
III.	Existing Conditions	2
IV.	Medical Services and First Aid	2
V.	Job Briefing.....	3
VI.	Confined Spaces.....	4
VII.	Personal Protective Equipment (PPE).....	4
VIII.	Ladders	4
IX.	Live Line Tools	4
X.	Working On or Near Exposed Energized Parts.....	5
XI.	Approach Boundaries and Tables	8
XII.	De-energizing Lines and Equipment.....	11
XIII.	Line-clearance Tree Trimming Operations	11
XIV.	Underground Electrical Installations	12
XV.	Special Conditions.....	12
XVI.	Definitions.....	13
	APPENDICES	20
	Appendix A MEDIUM VOLTAGE SAFE OPERATING PROCEDURES ANNUAL INSPECTION.....	23
	Appendix B MEDIUM VOLTAGE JOB BRIEFING FORM.....	25
	Appendix C Table 130.7(C)(16) PERSONAL PROTECTIVE EQUIPMENT (PPE)	28

I. General Application

This section covers the operation and maintenance of electric power and distribution installations, including related equipment accessible only to qualified employees. All applications shall conform to OSHA Standard 1910.269, NFPA 70E Safety Related Work Practices, and **UNC Charlotte Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment.**

- A. For the purposes of this Procedure any voltage exceeding 600 volts on the electrical power and distribution is defined as Medium Voltage.

Note: Supplementary electric generating equipment that is used to supply the workplace for emergencies, standby, or similar purposes only is covered by OSHA 1910 Subpart S.

II. Training

Employees shall be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their respective job assignments. Employees shall also be trained in and familiar with any other safety practices, including applicable emergency procedures, that are not specifically addressed by this section but that are related to their work and are necessary for their safety. Such training should include records of the training and the qualifications of the employees doing the training.

A. Qualified Employees

- 1. In order to be deemed a Qualified Employee for purposes of this Program, the employee must be educated, trained, knowledgeable, and competent in the field of medium voltage electrical work and 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 specified in this section corresponding to the voltages to which the qualified employee will be exposed; and
 - d. The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electric equipment.
 - e. The recognition of electrical hazards to which the employee may be exposed and the skills and techniques necessary to control or avoid these hazards.

B. Annual Inspection

- 1. The appropriate supervisor shall determine, through regular supervision and through inspections conducted on at least an annual basis that each employee is complying with the safety-related work practices required by this section. The annual inspection can be completed utilizing the Medium Voltage Safety Operating Procedures Annual Inspection Form found in Appendix A.

C. Re-Training

1. An employee shall receive additional training (or retraining) under any of the following conditions:
 - a. If the supervision and annual inspections required by this section indicate that the employee is not complying with the safety-related work practices required by this section, or
 - b. If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use, or
 - c. If they must employ safety-related work practices that are not normally used during their regular job duties. **Note: OSHA considers tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.**
 - d. The training required by this procedure shall be of the classroom and/or on-the-job type.
 - e. The training shall establish employee proficiency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.
 - f. The appropriate supervisor shall ensure that each employee has received the training required by this section. Training records shall be maintained for the duration of the employee's employment.

III. Existing Conditions

Existing conditions related to the safety of the work to be performed shall be determined before work on, or near, electric lines or equipment is started. Such conditions include, but are not limited to, the nominal voltages of lines and equipment, the maximum switching transient voltages, the presence of hazardous induced voltages, the presence and condition of protective grounds and equipment grounding conductors, the condition of poles, environmental conditions relative to safety, the locations of circuits and equipment, including power and communication lines and fire protective signaling circuits, and condition of protective grounds and equipment grounding conductors.

IV. Medical Services and First Aid

- A. CPR trained employee for work on equipment energized at 50 volts or more
 1. When employees are performing work on or associated with exposed lines or equipment energized at 50 volts or more, persons trained in first aid including cardiopulmonary resuscitation (CPR) shall be available as follows:

- a. For field work involving two or more employees at a work location, at least two persons trained in first aid and CPR shall be available.
- b. For fixed work locations, the number of trained persons available shall be sufficient to ensure that each employee exposed to electric shock can be reached within 4 minutes by a trained person. However, when the existing number of employees is insufficient to meet this requirement, all employees at the work location shall be trained.

A. First Aid Kits

1. Each first aid kit shall be maintained, shall be readily available for use, and shall be inspected periodically, but frequently enough to ensure that expended items are replaced as needed.

V. Job Briefing

- A. The supervisor shall ensure that the “employee in charge” conducts a job briefing in keeping with the Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment with the employees involved before they start each job. The briefing shall cover at least the following subjects:

1. Hazards associated with the job
2. Work procedures involved
3. Special precautions
4. Energy source controls
5. Personal protective equipment requirements

Note: Please see Appendix B Medium Voltage Job Briefing Form

B. Number of Briefings

1. If the work or operations to be performed during the work day or shift are repetitive and similar, at least one job briefing shall be conducted before the start of the first job of each day or shift. Additional job briefings shall be held if significant changes, which might affect the safety of the employees, occur during the course of the work.

C. Extent of Briefing

1. The briefing is always required to touch on all the subjects highlighted above in Section V. A brief discussion is satisfactory if the work involved is routine and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job. A more extensive discussion shall be conducted if:
 - a. The work is complicated or particularly hazardous or
 - b. The employee cannot be expected to recognize and avoid the hazards involved in the job.

VI. Confined Spaces

- A. Entry and work in confined spaces shall be conducted in accordance with the **UNC Charlotte Confined Space Program**. Before any entrance cover to a confined space is removed, the trained employee entering the space shall determine whether it is safe to do so by checking for the presence of any atmospheric pressure or temperature differences and by evaluating whether there might be a hazardous atmosphere in the space. Any conditions making it unsafe to remove the cover shall be eliminated before the cover is removed.

VII. Personal Protective Equipment (PPE)

- A. PPE use shall comply with the **UNC Charlotte Personal Protective Equipment Program, UNC Charlotte Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment Manual, and NFPA 70E** (See Appendix C for PPE Table).

VIII. Ladders

- A. Portable metal ladders and other portable conductive ladders may not be used near exposed energized lines or equipment. However, in specialized high-voltage work, conductive ladders shall be used where the employer can demonstrate that nonconductive ladders would present a greater hazard than conductive ladders.

IX. Live Line Tools

A. Design of Tools

- 1. Live-line tool rods, tubes, and poles shall be designed and constructed to withstand the following minimum tests:
 - a. 100,000 volts per foot (3281 volts per centimeter) of length for 5 minutes if the tool is made of fiberglass-reinforced plastic (FRP);
 - b. Live line tools made of wood are prohibited from being used. Other tests that the employer can demonstrate are equivalent.

Note: Live-line tools using rod and tube that meet ASTM F711-02 (2007), Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live-Line Tools, conform to this section.

B. Condition of Tools

- 1. Each live-line tool shall be wiped clean and visually inspected for defects before use each day.
- 2. If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is present after wiping, the tool shall be removed from service and examined and tested in accordance with Section IX.C below before being returned to service.

C. Testing

1. Live-line tools used for primary employee protection shall be removed from service every 2 years and whenever required in Section IX.B above for examination, cleaning, repair, and testing as follows:
 - a. Each tool shall be thoroughly examined for defects.
 - b. If a defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is found, the tool shall be repaired and refinished or shall be permanently removed from service. If no such defect or contamination is found, the tool shall be cleaned and waxed in accordance with manufacture specifications.
 - c. The tool shall be tested in accordance with Sections IX.C.1.d and IX.C.1.e below under the following conditions:
 - i. After the tool has been repaired or refinished; and
 - ii. After the examination for defects if repair or refinishing is not performed then the tool shall be tested as set forth below, unless the tool is made of FRP rod or foam-filled FRP tube and it can be demonstrated and documented that the tool has no defects that could cause it to fail in use.
 - d. The test method used shall be designed to verify the tool's integrity along its entire working length and, if the tool is made of fiberglass-reinforced plastic, its integrity under wet conditions.
 - e. The voltage applied during the tests shall be as follows:
 - i. 75,000 volts per foot (2461 volts per centimeter) of length for 1 minute if the tool is made of fiberglass; or
 - ii. Live line tools made of wood are prohibited from being used.
 - iii. Other tests that can be demonstrated and documented as equivalent.

Note: Guidelines for the examination, cleaning, repairing, and in-service testing of live-line tools are contained in the **Institute of Electrical and Electronics Engineers Guide for In-Service Maintenance and Electrical Testing of Live-Line Tools, IEEE Std. 516-2009**.

X. Working On or Near Exposed Energized Parts

- A. Only Qualified Employees, as defined in Section II.A, may work on or with exposed energized lines or parts of equipment. Only Qualified Employees may work in areas containing unguarded, uninsulated energized lines or parts of equipment operating at 50 volts or more. For electrical systems rated between 50 and 600 volts, please refer to the Electrical Safety in the Workplace Procedures. Electric lines and equipment shall be considered and treated as energized unless the provisions of Lockout Tagout in accordance with OSHA 1910 Subpart S or Deenergization in accordance with OSHA1910.269 are strictly followed.

Qualified employees should use the safe operating procedures for medium voltage electrical distribution equipment, which contain appropriate de energizing procedures.

B. Prohibition of Work on 600 Volts or More

1. **UNC Charlotte employees are prohibited from performing maintenance, repair, installation, or removal of lines that are energized at 600 volts or more. UNC Charlotte employees may ONLY perform Inspection and Switching operations on lines or equipment energized at 600 volts or more when such work can be performed safely and in compliance with OSHA 1910.269. Please refer to the Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment.**

C. Minimum of Two Employees

1. At least two employees must be present.

D. Minimum Approach Distances

1. No employee shall approach or take any conductive object closer to exposed energized parts other than as set forth in OSHA 1910.269 Table R-3 through Table R-9 (NFPA 70E Tables are shown below in section XI), unless:
2. The employee is insulated from the energized part (insulating gloves or insulating gloves and sleeves worn in accordance with section X.E below are considered insulation of the employee only with regard to the energized part upon which work is being performed); or
3. The energized part is insulated from the employee and from any other conductive object at a different potential; or
4. The employee is insulated from any other exposed conductive object.

E. Type of Insulation

1. If the employee is to be insulated from energized parts by the use of insulating gloves under, insulating sleeves shall also be used.

F. Working Position

1. No employee shall work in a position from which a slip or shock will bring the employee's body into contact with exposed energized parts at an electrical potential different from the employee. This includes positions on ladders and raised platforms. Employees should use proper fall protection equipment when entering manholes or other restricted spaces.

G. Apparel

1. When work is performed within reaching distance of exposed energized parts of equipment, each employee must remove or render nonconductive all exposed conductive articles, such as key or watch chains, rings, wrist

watches or bands, unless such articles do not increase the hazards associated with contact with the energized parts.

2. Each employee who is exposed to the hazards of flames or electric arcs shall be trained in the hazards associated with wearing improper clothing or conductive articles.
3. Each employee must wear the special-issue University supplied uniforms for the Medium Voltage Department. Employees shall not wear clothing that could increase the extent of injury if they are exposed to flames or electric arcs. Please refer to the Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment for specific apparel.

Note: Clothing made from the following types of fabrics, either alone or in blends, is prohibited by this paragraph, unless it can be demonstrated that the fabric has been treated to withstand the conditions that may be encountered or that the clothing is worn in such a manner as to eliminate the hazard involved: acetate, nylon, polyester, rayon.

H. Fuse Handling

1. When fuses must be installed or removed with one or both terminals energized at more than 300 volts or with exposed parts energized at more than 50 volts, tools or gloves shall be rated for the voltage. When expulsion-type fuses are installed with one or both terminals energized at more than 300 volts, the employer shall ensure that each employee wears eye protection meeting the requirements of the PPE standard, uses a tool rated for the voltage, and is clear of the exhaust path of the fuse barrel. Please refer to the Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment for specific instruction regarding fuses.

I. Covered (non-insulated) Conductors

1. The requirements of this section which pertain to the hazards of exposed live parts also apply when work is performed in the proximity of covered (non-insulated) wires.

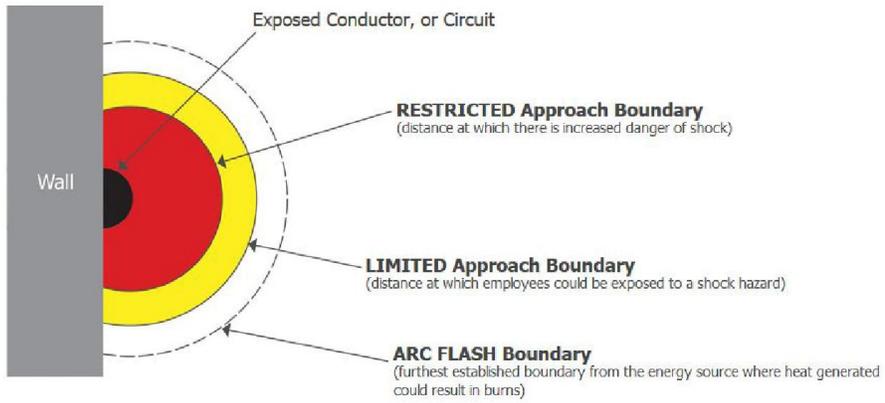
J. Noncurrent-carrying Metal Parts

1. Noncurrent-carrying metal parts of equipment or devices, such as transformer cases and circuit breaker housings, shall be treated as energized at the highest voltage to which they are exposed, unless the installation is inspected and documented that these parts are grounded before work is performed.

K. Opening Circuits Under Load

1. Devices used to open circuits under load conditions shall be designed to interrupt the current involved.

XI. Approach Boundaries and Tables



**NFPA 70E Table 130.4(E)(a) Electric Shock Protection Approach
Boundaries to Exposed Energized Electrical Conductors or Circuit Parts
for Alternating-Current Systems**

(1)	(2)	(3)	(4)
Limited Approach Boundary^b			
Nominal System Voltage Range, Phase to Phase^a	Exposed Movable Conductors	Exposed Fixed Circuit Part	Restricted Approach Boundary^b; Includes Inadvertent Movement Adder
<50 V	Not specified	Not specified	Not specified
50 V-150 V ^d	3.1 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
151 V-750 V	3.1 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.31 m (1 ft 0 in.)
751 V-5 kV	3.1 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.63 m (2 ft 2 in.)
5.1 kV-15 kV	3.1 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.65 m (2 ft 7 in.)
15.1 kV-36 kV	3.1 m (10 ft 0 in.)	1.8 m (6 ft 0 in.)	0.77 m (2 ft 7 in.)
36.1 kV-46 kV	3.1 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	.84 m (2 ft 10 in.)
46.1 kV-72.5 kV	3.1 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 4 in.)
72.6 kV-121 kV	3.3 m (10 ft 8 in.)	2.5 m (8 ft 0 in.)	1.2 m (3 ft 10 in.)
121.1 kV-145 kV	3.4 m (11 ft 0 in.)	3.1 m (10 ft 0 in.)	1.3 m (4 ft 3 in.)
145.1 kV-169 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.5 m (4 ft 10 in.)
169.1 kV-242 kV	4.0 m (13 ft 0 in.)	4.0 m (13 ft 0 in.)	2.1 m (6 ft 8 in.)
242.1 kV-362 kV	4.7 m (15 ft 4 in.)	4.7 m (15 ft 4 in.)	3.5 m (11 ft 2 in.)
362.1 kV-420 kV	5.8 m (19 ft 0 in.)	5.8 m (19 ft 0 in.)	4.3 m (14 ft 0 in.)
420.1 kV-550 kV	5.8 m (19 ft 0 in.)	5.8 m (19 ft 0 in.)	5.1 m (16 ft 8 in.)
550.1 kV-800 kV	7.2 m (23 ft 9 in.)	7.2 m (23 ft 9 in.)	6.9 m (22 ft 7 in.)

Note (1): For arc flash boundary, see 130.5 (A)

Note (2): All dimensions are distance from exposed energized electrical conductors or circuit part to employee.

^aFor single-phase systems above 250V, select the range that is equal to the system's maximum phase-to-ground voltage multiplied by 1.732.

^bSee definition in Article 100 and text in 130.4(D)(2) and informative Annex C for elaboration.

^cExposed movable conductors describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

^dThis includes circuits where the exposer does not exceed 120V.

**NFPA 70E Table 130.4(E)(b) Electric Shock Protection Approach
Boundaries to Exposed Energized Electrical Conductors or Circuit Parts
for Direct-Current Voltage Systems (DC)**

(1)	(2)	(3)	(4)
Limited Approach Boundary			
Nominal Potential Difference	Exposed Movable Conductors^a	Exposed Fixed Circuit Part	Restricted Approach Boundary^b; Includes Inadvertent Movement Adder
<50 V	Not specified	Not specified	Not specified
50 V-300 V	3.1 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
301 V-1 kV	3.1 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)
1.1 kV-5 kV	3.1 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)
5 kV-15 kV	3.1 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.8 m (2 ft 7 in.)
15.1 kV-45 kV	3.1 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 7 in.)
45.1 kV-75 kV	3.1 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 3 in.)

75.1 kV-150 kV	3.3 m (10 ft 8 in.)	3.1 m (10 ft 0 in.)	1.0 m (3 ft 4 in.)
150.1 kV-250 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.2 m (3 ft 10 in.)
250.1 kV-500 kV	6.0 m (20 ft 0 in.)	6.0 m (20 ft 0 in.)	3.5 m (11 ft 6 in.)
500.1 kV-800 kV	8.0 m (26 ft 0 in.)	8.0 m (26 ft 0 in.)	5.0 m (16 ft 5 in.)

Note: All dimensions are distance from exposed energized electrical conductors to worker
 *Exposedmovable conductors describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

XII. De-energizing Lines and Equipment

Note: UNC Charlotte Qualified Employees may deenergize equipment and circuits above 600 volts for Inspection and Switching purposes ONLY. Any maintenance, repair, installation or removal of lines must be performed by qualified contract personnel. See UNC Charlotte Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment.

- A. Clearance
 - 1. One employee in the crew shall be designated as being in charge of the clearance and shall take the place of the system operator, as necessary. Clearance is considered “taken” when the clearance to work is provided to the crew doing the work and is “given back” when the clearance is given up by the crew doing the work. Authorization alone is insufficient.
- B. Securing Disconnecting Means
 - 1. Any disconnecting means that are accessible to persons outside the Medium Voltage Department control shall be rendered inoperable while they are open for the purpose of protecting employees.
- C. De-energizing
 - 1. All switches, disconnectors, 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 so permit, and locked and tagged to indicate that employees are at work.
 - 2. Automatically and remotely controlled switches that could cause the opened disconnecting means to close shall also be locked and tagged at the point of control. The automatic or remote control feature shall be rendered inoperable, unless its design does not so permit.
 - 3. Tags shall prohibit operation of the disconnecting means and shall indicate that employees are at work.
 - 4. The lines and equipment to be deenergized shall be tested to verify de-energization. Please refer to the Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment.

XIII. Line-clearance Tree Trimming Operations

- A. UNC Charlotte personnel are prohibited from conducting line-clearance tree-trimming operations.

XIV. Underground Electrical Installations

A. Access

A ladder or other climbing device, as specified in Section 8, shall be used to enter and exit a manhole or subsurface vault exceeding 4 feet (122 cm) in depth. No employee may climb into or out of a manhole or vault by stepping on cables or hangers.

B. Lowering Equipment into Manholes

Equipment used to lower materials and tools into manholes or vaults shall be capable of supporting the weight to be lowered and shall be checked for defects before use. Before tools or material are lowered into the opening for a manhole or vault, each employee working in the manhole or vault shall be clear of the area directly under the opening.

C. Manholes are Confined Spaces

All manholes are considered as Permit Required Confined Space and UNC Charlotte Confined Space Procedures shall be followed.

D. Qualified Employees to Enter Manholes

Only Qualified Employees, as defined in Section II.A, may enter manholes containing parts of electric equipment operating at 50 volts or more.

XV. Special Conditions

A. Capacitors

1. The following additional requirements apply to capacitors and on lines connected to capacitors:
 - a. Capacitors shall be disconnected from energized sources and, after a wait of at least 5 minutes from the time of disconnection, short-circuited.
 - b. Before the units are handled, each unit in series-parallel capacitor banks shall be short-circuited between all terminals and the capacitor case or its rack. If the cases of capacitors are on ungrounded substation racks, the racks shall be bonded to ground.
 - c. Any line to which capacitors are connected shall be short-circuited before it is considered grounded.

B. Current Transformer Secondaries

1. The secondary of a current transformer may not be opened while the transformer is energized. If the primary of the current transformer cannot be deenergized before work is performed on an instrument, a relay, or other section of a current transformer secondary circuit, the circuit shall be bridged so that the current transformer secondary will not be opened. This is prevented with grounding blocks that short out the leads on the secondary side of the current transformer.

C. Series Streetlighting

1. If the open-circuit voltage exceeds 600 volts, the series streetlighting circuit shall be worked in accordance with OSHA 1910.269 Overhead Lines or Underground electrical installations as appropriate.

D. Illumination

1. Sufficient illumination shall be provided to enable the employee to perform the work safely.
 - a. Employee Protection in Public Work Areas
 - b. Traffic control signs and traffic control devices shall be used for the protection of employees.
 - c. Before work is begun in the vicinity of vehicular or pedestrian traffic that may endanger employees, warning signs or flags and other traffic control devices shall be placed in conspicuous locations to alert and channel approaching traffic.
 - d. Where additional employee protection is necessary, barricades shall be used.
 - e. Where an arc flash boundary may extend to or near the public, a temporary barricade shall be constructed to prevent access to the restricted zone.
 - f. At night, warning lights shall be prominently displayed.

E. Backfeed

1. If there is a possibility of voltage backfeed from sources of cogeneration or from the secondary system (for example, backfeed from more than one energized phase feeding a common load), the lines or equipment shall be considered to be energized *and handled accordingly*.

XVI. Definitions

- A. Affected employee. An employee whose job requires him or her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him or her to work in an area in which such servicing or maintenance is being performed.
- B. Attendant. An employee assigned to remain immediately outside the entrance to an enclosed or other space to render assistance as needed to employees inside the space.

- C. Authorized employee. An employee who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.
- D. Automatic circuit recloser. A self-controlled device for interrupting and reclosing an alternating current circuit with a predetermined sequence of opening and reclosing followed by resetting, hold-closed, or lockout operation.
- E. Barricade. A physical obstruction such as tapes, cones, or A-frame type wood or metal structures intended to provide a warning about and to limit access to a hazardous area.
- F. Barrier. A physical obstruction which is intended to prevent contact with energized lines or equipment or to prevent unauthorized access to a work area.
- G. Bond. The electrical interconnection of conductive parts designed to maintain a common electrical potential.
- H. Bus. A conductor or a group of conductors that serve as a common connection for two or more circuits.
- I. Bushing. An insulating structure, including a through conductor or providing a passageway for such a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purposes of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.
- J. Cable. A conductor with insulation, or a stranded conductor with or without insulation and other coverings (single-conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).
- K. Cable sheath. A conductive protective covering applied to cables. Note: A cable sheath may consist of multiple layers of which one or more is conductive.
- L. Circuit. A conductor or system of conductors through which an electric current is intended to flow.
- M. Clearance (between objects). The clear distance between two objects measured surface to surface.
- N. Clearance (for work). Authorization to perform specified work or permission to enter a restricted area.
- O. Communication lines. (See Lines, communication.)
- P. Conductor. A material, usually in the form of a wire, cable, or bus bar, used for carrying an electric current.
- Q. Confined space A working space, such as a manhole, vault, tunnel, or shaft, that has a limited means of egress or entry, that is designed for periodic employee entry under normal operating

conditions, but that may contain a hazardous atmosphere under abnormal conditions.

R. Covered conductor. A conductor covered with a dielectric having no rated insulating strength or having a rated insulating strength less than the voltage of the circuit in which the conductor is used.

S. Current-carrying part. A conducting part intended to be connected in an electric circuit to a source of voltage. Non-current-carrying parts are those not intended to be so connected.

T. Deenergized. Free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of the earth.

Note: The term is used only with reference to current-carrying parts, which are sometimes energized (alive).

U. Designated Employee (or Designated Person). An employee (or person) who is designated by the employer to perform specific duties under the terms of this section and who is knowledgeable in the construction and operation of the equipment and the hazards involved.

V. Electric line truck. A truck used to transport personnel, tools, and material for electric supply line work.

W. Electric supply equipment. Equipment that produces, modifies, regulates, controls, or safeguards a supply of electric energy.

X. Electric supply lines. (See Lines, electric supply)

Y. Electric utility. An organization responsible for the installation, operation, or maintenance of an electric supply system.

Z. Enclosed space (or Confined space). A working space, such as a manhole, vault, tunnel, or shaft, that has a limited means of egress or entry, that is designed for periodic employee entry under normal operating conditions, but that may contain a hazardous atmosphere under abnormal conditions.

AA. Energized (alive, live). Electrically connected to a source of potential difference or electrically charged so as to have a potential significantly different from that of earth in the vicinity.

BB. Energy isolating device. A physical device that prevents the transmission or release of energy, including, but not limited to, the following: a manually operated electric circuit breaker, a disconnect switch, a manually operated switch, a slide gate, a slip blind, a line valve, blocks, and any similar device with a visible indication of the position of the device. (Push buttons, selector switches, and other control-circuit-type devices are not energy isolating devices.)

CC. Energy source. Any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, or other energy source that could cause injury to personnel.

DD. Equipment (electric). A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like used as part of or in connection with an electrical installation.

- EE. Exposed. Not isolated or guarded.
- FF. Ground. A conducting connection, whether intentional or accidental, between an electric circuit or equipment and the earth, or to some conducting body that serves in place of the earth.
- GG. Grounded. Connected to earth or to some conducting body that serves in place of the earth.
- HH. Guarded. Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or accidental contact by persons or objects.
- Note:** Wires which are insulated, but not otherwise protected, are not considered as guarded.
- II. Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a confined space), injury, or acute illness from one or more of the following causes:
1. Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);
 2. Airborne combustible dust at a concentration that meets or exceeds its LFL. (**Note:** This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less);
 3. Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
 4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, "Occupational Health and Environmental Control", or in Subpart Z, "Toxic and Hazardous Substances," of OSHA 1910 and which could result in employee exposure in excess of its dose or permissible exposure limit (**Note:** An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.)
 5. Any other atmospheric condition that is immediately dangerous to life or health. (**Note:** For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the OSHA Hazard Communication Standard, 1910.1200, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.)
- JJ. High-power tests. Tests in which fault currents, load currents, magnetizing currents, and line-dropping currents are used to test equipment, either at the equipment's rated voltage or at lower voltages.
- KK. High-voltage tests. Tests in which voltages of approximately 1000 volts are used as a practical minimum and in which the voltage source has sufficient energy to cause injury.

- LL. High wind. A wind of such velocity that the following hazards would be present:
1. An employee would be exposed to being blown from elevated locations, or
 2. An employee or material handling equipment could lose control of material being handled, or
 3. An employee would be exposed to other hazards not controlled by the standard involved.

Note: Winds exceeding 40 miles per hour (64.4 kilometers per hour), or 30 miles per hour (48.3 kilometers per hour) if material handling is involved, are normally considered as meeting this criteria unless precautions are taken to protect employees from the hazardous effects of the wind.

- MM. Immediately dangerous to life or health (IDLH). Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Note: Some materials - hydrogen fluoride gas and cadmium vapor, for example - may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

- NN. Insulated. Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current. **Note:** When any object is said to be insulated, it is understood to be insulated for the conditions to which it is normally subjected. Otherwise, it is, within the purpose of this section, uninsulated.

- OO. Insulation (cable). That which is relied upon to insulate the conductor from other conductors or conducting parts or from ground.

- PP. Line-clearance tree trimmer. An employee who, through related training or on-the-job experience or both, is familiar with the special techniques and hazards involved in line-clearance tree trimming.

- QQ. Line-clearance tree trimming. The pruning, trimming, repairing, maintaining, removing, or clearing of trees or the cutting of brush that is within 10 feet (305 cm) of electric supply lines and equipment.

- RR. Lines.

1. Communication lines. The conductors and their supporting or containing structures which are used for public or private signal or communication service, and which operate at potentials not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed 150 watts. If the lines are operating at less than 150 volts, no limit is placed on the transmitted power of the system. Under certain

conditions, communication cables may include communication circuits exceeding these limitations where such circuits are also used to supply power solely to communication equipment.

Note: Telephone, telegraph, railroad signal, data, clock, fire, police alarm, cable television, and other systems conforming to this definition are included. Lines used for signaling purposes, but not included under this definition, are considered as electric supply lines of the same voltage.

2. Electric supply lines. Conductors used to transmit electric energy and their necessary supporting or containing structures. Signal lines of more than 400 volts are always supply lines within this section, and those of less than 400 volts are considered as supply lines, if so run and operated throughout.

- SS. Manhole. A subsurface enclosure which personnel may enter and which is used for the purpose of installing, operating, and maintaining submersible equipment or cable.
- TT. Manhole steps. A series of steps individually attached to or set into the walls of a manhole structure.
- UU. Minimum approach distance. The closest distance an employee is permitted to approach an energized or a grounded object.
- VV. Qualified employee (qualified person). One knowledgeable and experienced in the construction and operation of the electric power generation, transmission, and distribution equipment involved, along with the associated hazards.

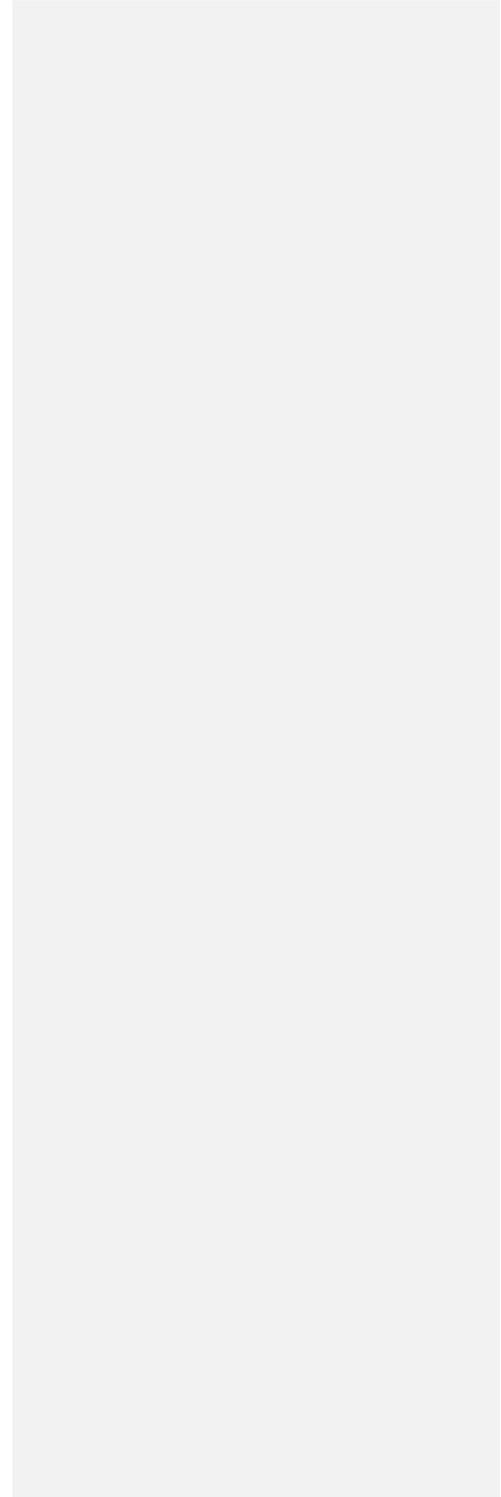
Note 1: An employee must have the training required by Section II in order to be considered a qualified employee.

Note 2: Except under OSHA 1910.269(g)(2)(v), an employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.

- WW. Step bolt. A bolt or rung attached at intervals along a structural member and used for foot placement during climbing or standing.
- XX. Switch. A device for opening and closing or for changing the connection of a circuit. In this section, a switch is understood to be manually operable, unless otherwise stated.
- YY. System operator. A qualified person designated to operate the system or its parts. "Vault." An enclosure, above or below ground, which personnel may enter and which is used for the purpose of installing, operating, or maintaining equipment or cable.

- ZZ.* Vented vault. A vault that has provision for air changes using exhaust flue stacks and low-level air intakes operating on differentials of pressure and temperature providing for airflow which precludes a hazardous atmosphere from developing.
- AAA.* Voltage. The effective (rms) potential difference between any two conductors or between a conductor and ground. Voltages are expressed in nominal values unless otherwise indicated. The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The operating voltage of the system may vary above or below this value.

APPENDICES



Appendix A MEDIUM VOLTAGE SAFE | OPERATING | PROCEDURES ANNUAL INSPECTION

Employee _____ Department _____

Supervisor _____ Date _____

Commented [JS1]: This checklist should be reformatted to show questions, answers and then comments from left to right.

Check the following	Y	N	N/A	Notes/Comments
Is the employee qualified to work as a medium voltage technician?				
Does the employee have current medium voltage training adequately documented?				
Is First Aid and CPR training current?				
Are existing conditions related to the safety of the work to be performed determined before work is begun on or near electric lines or equipment?				
Are daily or job specific briefings attended?				
Is lockout/tagout used when appropriate and in accordance with the LOTO Procedure?				
Is appropriate PPE used?				
Is PPE inspected with appropriate documentation maintained?				
Are ladders used in accordance with the appropriate safety-related work practices?				
Are appropriate hand and power tools used?				
Are portable and vehicle-mounted generators used according to appropriate safety-related work practices?				
Are hydraulic and pneumatic tools used according to established guidelines?				

Are appropriate live-line tools used?				
Are live-line tools visually inspected before use, examined, tested, and removed as appropriate?				
Are materials handling and storage maintained in accordance with accepted procedures?				
Is work on or near exposed energized parts conducted in accordance with appropriate safe operating procedures for medium voltage electrical distribution equipment?				
Are at least two employees present when work involves more than 600 volts?				
Are minimum approach distance procedures being followed?				
Are proper working positions being used?				
Is appropriate apparel being worn?				
Are conductors and parts deenergized using proper procedures?				
Are lines and equipment tested to ensure they are deenergized?				
Are protective grounds installed as required using appropriate grounding procedures?				
Are proper clearance procedures being followed and all employees notified of clearance release?				
Are proper testing procedures being followed?				
Is mechanical equipment thoroughly inspected before use?				
Is mechanical equipment operated so that minimum approach distances are maintained?				

Are proper procedures followed while work is performed on or near overhead lines?				
Does line-clearance tree trimming follow appropriate guidelines?				
Are appropriate guidelines followed for work in communication facilities?				
Are appropriate safety-related work practices followed for work on underground electrical installations?				
Is this a Confined Space requiring a Permit?				
Are required safety-related work practices used for special conditions such as work with capacitors, current transformer secondaries, series street lighting, poor lighting, public work areas, potential backfeeds, and lasers?				

Appendix B MEDIUM VOLTAGE JOB BRIEFING FORM

Department: _____ Date: _____

Name of Equipment: _____

Location: _____

Fed From: _____

Drawing Number: _____ (if applicable)

HAZARDS ASSOCIATED WITH JOB		
<i>Check all that apply:</i>		
<input type="checkbox"/> Less than 50 volts	<input type="checkbox"/> List voltage involved	<input type="checkbox"/> Other (describe)
<input type="checkbox"/> Less than 600 volts	<input type="checkbox"/> Secondary voltage source	
<input type="checkbox"/> Greater than 600 volts	<input type="checkbox"/> Emergency power source	

WORK TO BE PERFORMED, PROCEDURES, AND SPECIAL PRECAUTIONS (*Please refer to Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment*) including, but not limited to, shock protection boundaries, potential for arc flash, flash protection boundaries, potential for backfeeds, grounding, unusual work conditions, and who else needs to be informed):

ENERGY SOURCE CONTROLS AND JUSTIFICATION FOR EQUIPMENT TO REMAIN ENERGIZED (Reason for equipment to remain energized beyond LOTO and/or grounding):

PERSONAL PROTECTIVE EQUIPMENT (PPE)		
<i>Check all that apply</i>		
<u>100% Cotton Clothing</u>	<u>Fire Retardant Clothing</u>	<u>ARC Flash Protection Clothing</u>
<input type="checkbox"/> Pants	<input type="checkbox"/> FR Pants	<input type="checkbox"/> Salisbury Hood/Visor/Hardhat FH20BL
<input type="checkbox"/> Long-sleeve shirt	<input type="checkbox"/> FR long sleeve shirt	<input type="checkbox"/> Salisbury Jacket
<input type="checkbox"/> Tee shirt (short)	<input type="checkbox"/> FR Coverall	<input type="checkbox"/> Salisbury Pants
	<input type="checkbox"/> FR Jacket	<input type="checkbox"/> American Safety Gloves & Arm Shields
		<input type="checkbox"/> American Safety Rubber Overshoes

TOOLS and TESTING EQUIPMENT		
<i>Check all that apply – Tools and Testing Equipment that will be used AND are in proper working order.</i>		
<input type="checkbox"/> Salisbury#4544 Audio Visual Volt Detector	<input type="checkbox"/> Hiokt #3129 600 V Phase Detector	<input type="checkbox"/> Fluke #TI45 – IR Flex Cam
<input type="checkbox"/> Thomas and Betts PD35 Capacitive Tester	<input type="checkbox"/> 3M Scotchtrak IR-1600 Heat Tracer Gun	<input type="checkbox"/> Fluke #177 – True RMS Multimeter
<input type="checkbox"/> RK1 #3 Four Gas Confined Space Meter	<input type="checkbox"/> A.B. Chance 7’ Hot Stick	<input type="checkbox"/> Sting Telescoping Hot Stick / Manhole Barrier and HV Blankets / Clips
<input type="checkbox"/> Cooper 3 and 8 foot High Line Poles	<input type="checkbox"/> Hasting 8108 9’ Shot Gun Stick	<input type="checkbox"/> Hercules 8’ Tri-pod with winch – 350 pound capacity
<input type="checkbox"/> Mighty EVAC Confined Space Winch and Miller Tripod – 315 pound capacity	<input type="checkbox"/> Overload Vent Blower and associated equipment, hoses, etc.	<input type="checkbox"/> Louisville 14’ Fiberglass Ladder
<input type="checkbox"/> Confined Space entry harness and lanyard (if necessary)	<i>All equipment to be used has been thoroughly examined by the user/s. The equipment if operating properly and can safely be used to conduct the work required on this job.</i>	<input type="checkbox"/> Tools, equipment and PPE checked and in good condition, they are safe and ready for use.

JOB BRIEFING ATTENDANCE

NAME:	SIGNATURE	DEPARTMENT/ COMPANY	DATE

Appendix C Table 130.7(C)(16) PERSONAL PROTECTIVE EQUIPMENT (PPE)

Table 130.7(C)(16) Personal Protective Equipment (PPE)

PPE Category	PPE
1	<p>Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm² (see Note 1) Arc-rated long-sleeve shirt and pants of arc-rated coverall Arc-rated face shield (see Note 2) or arc flash suit hood Arc-rated jacket, parka, rainwear, or hard hat liner (AN)</p> <p>Protective Equipment Hard hat Safety glasses or safety goggles (SR) Hearing protection(ear canal inserts) Heavy duty leather gloves(see Note 3) Leather footwear(AN)</p>
2	<p>Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm² (see Note 1) Arc-rated long-sleeve shirt and pants of arc-rated coverall Arc-rated flash suit hood or arc-rated face shield (seeNote2)and arc-rated balaclava Arc-rated jacket, parka, rainwear, or hard hat liner (AN)</p> <p>Protective Equipment Hard hat Safety glasses or safety goggles (SR) Hearing protection(ear canal inserts) Heavy duty leather gloves(see Note 3) Leather footwear(AN)</p>
3	<p>Arc-Rated Clothing, Minimum Arc Rating of 25 cal/cm² (see Note 1) Arc-rated long-sleeve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves (see Note 1) Arc-rated jacket, parka, rainwear, or hard hat liner (AN)</p> <p>Protective Equipment Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather footwear</p>
4	<p>Arc-Rated Clothing Selected so That the System Arc Rating Meets the Required Minimum Arc Rating of 40 cal/cm² (see Note 1) Arc-rated long-sleeve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves (see Note 1) Arc-rated jacket, parka, rainwear, or hard hat liner (AN)</p> <p>Protective Equipment Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather footwear</p>

Notes:

- (1) Arc rating is defined in Article 100.
- (2) Face shields are to have wrap-around guarding to protect not only the face but also the forehead, ears, and neck, or, alternatively, an arc-rated arc flash suit hood is required to be worn.
- (3) If rubber insulating gloves with leather protectors are used, additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirement.