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Title 29: Labor

PART 1926—SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

Subpart V—Electric Power Transmission and Distribution

AUTHORITY: 40 U.S.C. 3701 *et seq.*; 29 U.S.C. 653, 655, 657; Secretary of Labor's Order No. 1-2012 (77 FR 3912); and 29 CFR Part 1911.

§1926.950 General.

(a) *Application—(1) Scope.* (i) This subpart, except for paragraph (a)(3) of this section, covers the construction of electric power transmission and distribution lines and equipment. As used in this subpart, the term “construction” includes the erection of new electric transmission and distribution lines and equipment, and the alteration, conversion, and improvement of existing electric transmission and distribution lines and equipment.

NOTE TO PARAGRAPH (a)(1)(i): An employer that complies with §1910.269 of this chapter will be considered in compliance with requirements in this subpart that do not reference other subparts of this part. Compliance with §1910.269 of this chapter will not excuse an employer from compliance obligations under other subparts of this part.

(ii) Notwithstanding paragraph (a)(1)(i) of this section, this subpart does not apply to electrical safety-related work practices for unqualified employees.

(2) *Other part 1926 standards.* This subpart applies in addition to all other applicable standards contained in this part 1926. Employers covered under this subpart are not exempt from complying with other applicable provisions in part 1926 by the operation of §1910.5(c) of this chapter. Specific references in this subpart to other sections of part 1926 are provided for emphasis only.

(3) *Applicable part 1910 requirements.* (i) Line-clearance tree trimming performed for the purpose of clearing space around electric power generation, transmission, or distribution lines or equipment and on behalf of an organization that operates, or that controls the operating procedures for, those lines or equipment shall comply with §1910.269 of this chapter.

(ii) Work involving electric power generation installations shall comply with §1910.269 of this chapter.

(b) *Training*—(1) *All employees.* (i) Each employee shall be trained in, and familiar with, the safety-related work practices, safety procedures, and other safety requirements in this subpart that pertain to his or her job assignments.

(ii) Each employee shall also be trained in and familiar with any other safety practices, including applicable emergency procedures (such as pole-top and manhole rescue), that are not specifically addressed by this subpart but that are related to his or her work and are necessary for his or her safety.

(iii) The degree of training shall be determined by the risk to the employee for the hazard involved.

(2) *Qualified employees.* Each qualified employee shall also be trained and competent in:

(i) The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,

(ii) The skills and techniques necessary to determine the nominal voltage of exposed live parts,

(iii) The minimum approach distances specified in this subpart corresponding to the voltages to which the qualified employee will be exposed and the skills and techniques necessary to maintain those distances,

(iv) 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, and

(v) The recognition of electrical hazards to which the employee may be exposed and the skills and techniques necessary to control or avoid these hazards.

NOTE TO PARAGRAPH (b)(2): For the purposes of this subpart, a person must have the training required by paragraph (b)(2) of this section to be considered a qualified person.

(3) *Supervision and annual inspection.* The employer 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 subpart.

(4) *Additional training.* An employee shall receive additional training (or retraining) under any of the following conditions:

(i) If the supervision or annual inspections required by paragraph (b)(3) of this section indicate that the employee is not complying with the safety-related work practices required by this subpart, or

(ii) 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

(iii) If he or she must employ safety-related work practices that are not normally used during his or her regular job duties.

NOTE TO PARAGRAPH (b)(4)(iii): The Occupational Safety and Health Administration considers tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.

(5) *Type of training.* The training required by paragraph (b) of this section shall be of the classroom or on-the-job type.

(6) *Training goals.* The training shall establish employee proficiency in the work practices required by this subpart and shall introduce the procedures necessary for compliance with this subpart.

(7) *Demonstration of proficiency.* The employer shall ensure that each employee has demonstrated proficiency in the work practices involved before that employee is considered as having completed the training required by paragraph (b) of this section.

NOTE 1 TO PARAGRAPH (b)(7): Though they are not required by this paragraph, employment records that indicate that an employee has successfully completed the required training are one way of keeping track of when an employee has demonstrated proficiency.

NOTE 2 TO PARAGRAPH (b)(7): For an employee with previous training, an employer may determine that that employee has demonstrated the proficiency required by this paragraph using the following process: (1) Confirm that the employee has the training required by paragraph (b) of this section, (2) use an examination or interview to make an initial determination that the employee understands the relevant safety-related work practices before he or she performs any work covered by this subpart, and (3) supervise the employee closely until that employee has demonstrated proficiency as required by this paragraph.

(c) *Information transfer—(1) Host employer responsibilities.* Before work begins, the host employer shall inform contract employers of:

(i) The characteristics of the host employer's installation that are related to the safety of the work to be performed and are listed in paragraphs (d)(1) through (d)(5) of this section;

NOTE TO PARAGRAPH (c)(1)(i): This paragraph requires the host employer to obtain information listed in paragraphs (d)(1) through (d)(5) of this section if it does not have this information in existing records.

(ii) Conditions that are related to the safety of the work to be performed, that are listed in paragraphs (d)(6) through (d)(8) of this section, and that are known to the host employer;

NOTE TO PARAGRAPH (c)(1)(ii): For the purposes of this paragraph, the host employer need only provide information to contract employers that the host employer can obtain from its existing records through the exercise of reasonable diligence. This paragraph does not require the host employer to make inspections of worksite conditions to obtain this information.

(iii) Information about the design and operation of the host employer's installation that the contract employer needs to make the assessments required by this subpart; and

NOTE TO PARAGRAPH (c)(1)(iii): This paragraph requires the host employer to obtain information about the design and operation of its installation that contract employers need to make required assessments if it does not have this information in existing records.

(iv) Any other information about the design and operation of the host employer's installation that is known by the host employer, that the contract employer requests, and that is related to the protection of the contract employer's employees.

NOTE TO PARAGRAPH (c)(1)(iv): For the purposes of this paragraph, the host employer need only provide information to contract employers that the host employer can obtain from its existing records through the exercise of reasonable diligence. This paragraph does not require the host employer to make inspections of worksite conditions to obtain this information.

(2) *Contract employer responsibilities.* (i) The contract employer shall ensure that each of its employees is instructed in the hazardous conditions relevant to the employee's work that the contract employer is aware of as a result of information communicated to the contract employer by the host employer under paragraph (c)(1) of this section.

(ii) Before work begins, the contract employer shall advise the host employer of any unique hazardous conditions presented by the contract employer's work.

(iii) The contract employer shall advise the host employer of any unanticipated hazardous conditions found during the contract employer's work that the host employer did not mention under paragraph (c)(1) of this section. The contract employer shall provide this information to the host employer within 2 working days after discovering the hazardous condition.

(3) *Joint host- and contract-employer responsibilities.* The contract employer and the host employer shall coordinate their work rules and procedures so that each employee of the contract employer and the host employer is protected as required by this subpart.

(d) *Existing characteristics and conditions.* Existing characteristics and conditions of electric lines and equipment that are related to the safety of the work to be performed shall be determined before work on or near the lines or equipment is started. Such characteristics and conditions include, but are not limited to:

- (1) The nominal voltages of lines and equipment,
- (2) The maximum switching-transient voltages,
- (3) The presence of hazardous induced voltages,
- (4) The presence of protective grounds and equipment grounding conductors,
- (5) The locations of circuits and equipment, including electric supply lines, communication lines, and fire-protective signaling circuits,
- (6) The condition of protective grounds and equipment grounding conductors,

(7) The condition of poles, and

(8) Environmental conditions relating to safety.

[44 FR 8577, Feb. 9, 1979; 44 FR 20940, Apr. 6, 1979, as amended at 80 FR 60040, Oct. 5, 2015]

§1926.951 Medical services and first aid.

(a) *General.* The employer shall provide medical services and first aid as required in §1926.50.

(b) *First-aid training.* In addition to the requirements of §1926.50, when employees are performing work on, or associated with, exposed lines or equipment energized at 50 volts or more, persons with first-aid training shall be available as follows:

(1) *Field work.* For field work involving two or more employees at a work location, at least two trained persons shall be available.

(2) *Fixed work locations.* For fixed work locations such as substations, 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, where the existing number of employees is insufficient to meet this requirement (at a remote substation, for example), each employee at the work location shall be a trained employee.

§1926.952 Job briefing.

(a) *Before each job—(1) Information provided by the employer.* In assigning an employee or a group of employees to perform a job, the employer shall provide the employee in charge of the job with all available information that relates to the determination of existing characteristics and conditions required by §1926.950(d).

(2) *Briefing by the employee in charge.* The employer shall ensure that the employee in charge conducts a job briefing that meets paragraphs (b), (c), and (d) of this section with the employees involved before they start each job.

(b) *Subjects to be covered.* The briefing shall cover at least the following subjects: Hazards associated with the job, work procedures involved, special precautions, energy-source controls, and personal protective equipment requirements.

(c) *Number of briefings—(1) At least one before each day or shift.* 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.

(2) *Additional briefings.* Additional job briefings shall be held if significant changes, which might affect the safety of the employees, occur during the course of the work.

(d) *Extent of briefing—(1) Short discussion.* A brief discussion is satisfactory if the work involved is routine and if the employees, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job.

(2) *Detailed discussion.* A more extensive discussion shall be conducted:

(i) If the work is complicated or particularly hazardous, or

(ii) If the employee cannot be expected to recognize and avoid the hazards involved in the job.

NOTE TO PARAGRAPH (d): The briefing must address all the subjects listed in paragraph (b) of this section.

(e) *Working alone.* An employee working alone need not conduct a job briefing. However, the employer shall ensure that the tasks to be performed are planned as if a briefing were required.

§1926.953 Enclosed spaces.

(a) *General.* This section covers enclosed spaces that may be entered by employees. It does not apply to vented vaults if the employer makes a determination that the ventilation system is operating to protect employees before they enter the space. This section applies to routine entry into enclosed spaces. If, after the employer takes the precautions given in this section and in §1926.965, the hazards remaining in the enclosed space endanger the life of an entrant or could interfere with an entrant's escape from the space, then entry into the enclosed space must meet the permit space entry requirements of subpart AA of this part. For routine entries where the hazards remaining in the enclosed space do not endanger the life of an entrant or interfere with an entrant's escape from the space, this section applies in lieu of the permit-space entry requirements contained in §§1926.1204 through 926.1211.

(b) *Safe work practices.* The employer shall ensure the use of safe work practices for entry into, and work in, enclosed spaces and for rescue of employees from such spaces.

(c) *Training.* Each employee who enters an enclosed space or who serves as an attendant shall be trained in the hazards of enclosed-space entry, in enclosed-space entry procedures, and in enclosed-space rescue procedures.

(d) *Rescue equipment.* Employers shall provide equipment to ensure the prompt and safe rescue of employees from the enclosed space.

(e) *Evaluating potential hazards.* Before any entrance cover to an enclosed space is removed, the employer 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.

NOTE TO PARAGRAPH (e): The determination called for in this paragraph may consist of a check of the conditions that might foreseeably be in the enclosed space. For example, the cover could be checked to see if it is hot and, if it is fastened in place, could be loosened gradually to release any residual pressure. An evaluation also needs to be made of whether conditions at the site could cause a hazardous atmosphere, such as an oxygen-deficient or flammable atmosphere, to develop within the space.

(f) *Removing covers.* When covers are removed from enclosed spaces, the opening shall be promptly guarded by a railing, temporary cover, or other barrier designed to prevent an accidental fall through the opening and to protect employees working in the space from objects entering the space.

(g) *Hazardous atmosphere.* Employees may not enter any enclosed space while it contains a hazardous atmosphere, unless the entry conforms to the confined spaces in construction standard in subpart AA of this part.

(h) *Attendants.* While work is being performed in the enclosed space, an attendant with first-aid training shall be immediately available outside the enclosed space to provide assistance if a hazard exists because of traffic patterns in the area of the opening used for entry. The attendant is not precluded from performing other duties outside the enclosed space if these duties do not distract the attendant from: Monitoring employees within the space or ensuring that it is safe for employees to enter and exit the space.

NOTE TO PARAGRAPH (h): See §1926.965 for additional requirements on attendants for work in manholes and vaults.

(i) *Calibration of test instruments.* Test instruments used to monitor atmospheres in enclosed spaces shall be kept in calibration and shall have a minimum accuracy of ± 10 percent.

(j) *Testing for oxygen deficiency.* Before an employee enters an enclosed space, the atmosphere in the enclosed space shall be tested for oxygen deficiency with a direct-reading meter or similar instrument, capable of collection and immediate analysis of data samples without the need for off-site evaluation. If continuous forced-air ventilation is provided, testing is not required provided that the procedures used ensure that employees are not exposed to the hazards posed by oxygen deficiency.

(k) *Testing for flammable gases and vapors.* Before an employee enters an enclosed space, the internal atmosphere shall be tested for flammable gases and vapors with a direct-reading meter or similar instrument capable of collection and immediate analysis of data samples without the need for off-site evaluation. This test shall be performed after the oxygen testing and ventilation required by paragraph (j) of this section demonstrate that there is sufficient oxygen to ensure the accuracy of the test for flammability.

(l) *Ventilation, and monitoring for flammable gases or vapors.* If flammable gases or vapors are detected or if an oxygen deficiency is found, forced-air ventilation shall be used to maintain oxygen at a safe level and to prevent a hazardous concentration of flammable gases and vapors from accumulating. A continuous monitoring program to ensure that no increase in flammable gas or vapor concentration above safe levels occurs may be followed in lieu of ventilation if flammable gases or vapors are initially detected at safe levels.

NOTE TO PARAGRAPH (l): See the definition of "hazardous atmosphere" for guidance in determining whether a specific concentration of a substance is hazardous.

(m) *Specific ventilation requirements.* If continuous forced-air ventilation is used, it shall begin before entry is made and shall be maintained long enough for the employer

to be able to demonstrate that a safe atmosphere exists before employees are allowed to enter the work area. The forced-air ventilation shall be so directed as to ventilate the immediate area where employees are present within the enclosed space and shall continue until all employees leave the enclosed space.

(n) *Air supply.* The air supply for the continuous forced-air ventilation shall be from a clean source and may not increase the hazards in the enclosed space.

(o) *Open flames.* If open flames are used in enclosed spaces, a test for flammable gases and vapors shall be made immediately before the open flame device is used and at least once per hour while the device is used in the space. Testing shall be conducted more frequently if conditions present in the enclosed space indicate that once per hour is insufficient to detect hazardous accumulations of flammable gases or vapors.

NOTE TO PARAGRAPH (o): See the definition of "hazardous atmosphere" for guidance in determining whether a specific concentration of a substance is hazardous.

NOTE TO §1926.953: Entries into enclosed spaces conducted in accordance with the permit space entry requirements of subpart AA of this part are considered as complying with this section.

[44 FR 8577, Feb. 9, 1979; 44 FR 20940, Apr. 6, 1979, as amended at 80 FR 25518, May 4, 2015]

§1926.954 Personal protective equipment.

(a) *General.* Personal protective equipment shall meet the requirements of subpart E of this part.

NOTE TO PARAGRAPH (a): Paragraph (d) of §1926.95 sets employer payment obligations for the personal protective equipment required by this subpart, including, but not limited to, the fall protection equipment required by paragraph (b) of this section, the electrical protective equipment required by §1926.960(c), and the flame-resistant and arc-rated clothing and other protective equipment required by §1926.960(g).

(b) *Fall protection—(1) Personal fall arrest systems.* (i) Personal fall arrest systems shall meet the requirements of subpart M of this part.

(ii) Personal fall arrest equipment used by employees who are exposed to hazards from flames or electric arcs, as determined by the employer under §1926.960(g)(1), shall be capable of passing a drop test equivalent to that required by paragraph (b)(2)(xii) of this section after exposure to an electric arc with a heat energy of 40 ± 5 cal/cm².

(2) *Work-positioning equipment.* Body belts and positioning straps for work-positioning equipment shall meet the following requirements:

(i) Hardware for body belts and positioning straps shall meet the following requirements:

(A) Hardware shall be made of drop-forged steel, pressed steel, formed steel, or equivalent material.

(B) Hardware shall have a corrosion-resistant finish.

(C) Hardware surfaces shall be smooth and free of sharp edges.

(ii) Buckles shall be capable of withstanding an 8.9-kilonewton (2,000-pound-force) tension test with a maximum permanent deformation no greater than 0.4 millimeters (0.0156 inches).

(iii) D rings shall be capable of withstanding a 22-kilonewton (5,000-pound-force) tensile test without cracking or breaking.

(iv) Snaphooks shall be capable of withstanding a 22-kilonewton (5,000-pound-force) tension test without failure.

NOTE TO PARAGRAPH (b)(2)(iv): Distortion of the snaphook sufficient to release the keeper is considered to be tensile failure of a snaphook.

(v) Top grain leather or leather substitute may be used in the manufacture of body belts and positioning straps; however, leather and leather substitutes may not be used alone as a load-bearing component of the assembly.

(vi) Plied fabric used in positioning straps and in load-bearing parts of body belts shall be constructed in such a way that no raw edges are exposed and the plies do not separate.

(vii) Positioning straps shall be capable of withstanding the following tests:

(A) A dielectric test of 819.7 volts, AC, per centimeter (25,000 volts per foot) for 3 minutes without visible deterioration;

(B) A leakage test of 98.4 volts, AC, per centimeter (3,000 volts per foot) with a leakage current of no more than 1 mA;

NOTE TO PARAGRAPHS (b)(2)(vii)(A) AND (b)(2)(vii)(B): Positioning straps that pass direct-current tests at equivalent voltages are considered as meeting this requirement.

(C) Tension tests of 20 kilonewtons (4,500 pounds-force) for sections free of buckle holes and of 15 kilonewtons (3,500 pounds-force) for sections with buckle holes;

(D) A buckle-tear test with a load of 4.4 kilonewtons (1,000 pounds-force); and

(E) A flammability test in accordance with Table V-1.

TABLE V-1—FLAMMABILITY TEST

Test method	Criteria for passing the test
Vertically suspend a 500-mm (19.7-inch) length of strapping supporting a 100-kg (220.5-lb) weight	Any flames on the positioning strap shall self extinguish.
Use a butane or propane burner with a 76-mm (3-inch) flame	The positioning strap shall continue to support the 100-kg (220.5-lb) mass.

Direct the flame to an edge of the strapping at a distance of 25 mm (1 inch).	
Remove the flame after 5 seconds.	
Wait for any flames on the positioning strap to stop burning.	

(viii) The cushion part of the body belt shall contain no exposed rivets on the inside and shall be at least 76 millimeters (3 inches) in width.

(ix) Tool loops shall be situated on the body of a body belt so that the 100 millimeters (4 inches) of the body belt that is in the center of the back, measuring from D ring to D ring, is free of tool loops and any other attachments.

(x) Copper, steel, or equivalent liners shall be used around the bars of D rings to prevent wear between these members and the leather or fabric enclosing them.

(xi) Snaphooks shall be of the locking type meeting the following requirements:

(A) The locking mechanism shall first be released, or a destructive force shall be placed on the keeper, before the keeper will open.

(B) A force in the range of 6.7 N (1.5 lbf) to 17.8 N (4 lbf) shall be required to release the locking mechanism.

(C) With the locking mechanism released and with a force applied on the keeper against the face of the nose, the keeper may not begin to open with a force of 11.2 N (2.5 lbf) or less and shall begin to open with a maximum force of 17.8 N (4 lbf).

(xii) Body belts and positioning straps shall be capable of withstanding a drop test as follows:

(A) The test mass shall be rigidly constructed of steel or equivalent material with a mass of 100 kg (220.5 lbm). For work-positioning equipment used by employees weighing more than 140 kg (310 lbm) fully equipped, the test mass shall be increased proportionately (that is, the test mass must equal the mass of the equipped worker divided by 1.4).

(B) For body belts, the body belt shall be fitted snugly around the test mass and shall be attached to the test-structure anchorage point by means of a wire rope.

(C) For positioning straps, the strap shall be adjusted to its shortest length possible to accommodate the test and connected to the test-structure anchorage point at one end and to the test mass on the other end.

(D) The test mass shall be dropped an unobstructed distance of 1 meter (39.4 inches) from a supporting structure that will sustain minimal deflection during the test.

(E) Body belts shall successfully arrest the fall of the test mass and shall be capable of supporting the mass after the test.

(F) Positioning straps shall successfully arrest the fall of the test mass without breaking, and the arrest force may not exceed 17.8 kilonewtons (4,000 pounds-force). Additionally, snaphooks on positioning straps may not distort to such an extent that the keeper would release.

NOTE TO PARAGRAPH (b)(2): When used by employees weighing no more than 140 kg (310 lbm) fully equipped, body belts and positioning straps that conform to American Society of Testing and Materials *Standard Specifications for Personal Climbing Equipment*, ASTM F887-12^{ast}, are deemed to be in compliance with paragraph (b)(2) of this section.

(3) *Care and use of personal fall protection equipment.* (i) Work-positioning equipment shall be inspected before use each day to determine that the equipment is in safe working condition. Work-positioning equipment that is not in safe working condition may not be used.

NOTE TO PARAGRAPH (b)(3)(i): Appendix F to this subpart contains guidelines for inspecting work-positioning equipment.

(ii) Personal fall arrest systems shall be used in accordance with §1926.502(d).

NOTE TO PARAGRAPH (b)(3)(ii): Fall protection equipment rigged to arrest falls is considered a fall arrest system and must meet the applicable requirements for the design and use of those systems. Fall protection equipment rigged for work positioning is considered work-positioning equipment and must meet the applicable requirements for the design and use of that equipment.

(iii) The employer shall ensure that employees use fall protection systems as follows:

(A) Each employee working from an aerial lift shall use a fall restraint system or a personal fall arrest system. Paragraph (b)(2)(v) of §1926.453 does not apply.

(B) Except as provided in paragraph (b)(3)(iii)(C) of this section, each employee in elevated locations more than 1.2 meters (4 feet) above the ground on poles, towers, or similar structures shall use a personal fall arrest system, work-positioning equipment, or fall restraint system, as appropriate, if the employer has not provided other fall protection meeting subpart M of this part.

(C) Until March 31, 2015, a qualified employee climbing or changing location on poles, towers, or similar structures need not use fall protection equipment, 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. On and after April 1, 2015, each qualified employee climbing or changing location on poles, towers, or similar structures must use fall protection equipment unless the employer can demonstrate that climbing or changing location with fall protection is infeasible or creates a greater hazard than climbing or changing location without it.

NOTE 1 TO PARAGRAPHS (b)(3)(iii)(B) AND (b)(3)(iii)(C): These paragraphs apply to structures that support overhead electric power transmission and distribution lines and equipment. They do not apply to portions of buildings, such as loading docks, or to electric equipment, such as transformers and capacitors. Subpart M of this part contains the duty to provide fall protection associated with walking and working surfaces.

NOTE 2 TO PARAGRAPHS (b)(3)(iii)(B) AND (b)(3)(iii)(C): Until the employer ensures that employees are proficient in climbing and the use of fall protection under §1926.950(b)(7), the employees are not considered "qualified employees" for the purposes of paragraphs (b)(3)(iii)(B) and (b)(3)(iii)(C) of this section. These paragraphs require unqualified employees (including trainees) to use fall protection any time they are more than 1.2 meters (4 feet) above the ground.

(iv) On and after April 1, 2015, work-positioning systems shall be rigged so that an employee can free fall no more than 0.6 meters (2 feet).

(v) Anchorages for work-positioning equipment shall be capable of supporting at least twice the potential impact load of an employee's fall, or 13.3 kilonewtons (3,000 pounds-force), whichever is greater.

NOTE TO PARAGRAPH (b)(3)(v): Wood-pole fall-restriction devices meeting American Society of Testing and Materials *Standard Specifications for Personal Climbing Equipment*, ASTM F887-12^{es}, are deemed to meet the anchorage-strength requirement when they are used in accordance with manufacturers' instructions.

(vi) Unless the snaphook is a locking type and designed specifically for the following connections, snaphooks on work-positioning equipment may not be engaged:

(A) Directly to webbing, rope, or wire rope;

(B) To each other;

(C) To a D ring to which another snaphook or other connector is attached;

(D) To a horizontal lifeline; or

(E) To any object that is incompatibly shaped or dimensioned in relation to the snaphook such that accidental disengagement could occur should the connected object sufficiently depress the snaphook keeper to allow release of the object.

§1926.955 Portable ladders and platforms.

(a) *General.* Requirements for portable ladders contained in subpart X of this part apply in addition to the requirements of this section, except as specifically noted in paragraph (b) of this section.

(b) *Special ladders and platforms.* Portable ladders used on structures or conductors in conjunction with overhead line work need not meet §1926.1053(b)(5)(i) and (b)(12). Portable ladders and platforms used on structures or conductors in conjunction with overhead line work shall meet the following requirements:

(1) *Design load.* In the configurations in which they are used, portable platforms shall be capable of supporting without failure at least 2.5 times the maximum intended load.

(2) *Maximum load.* Portable ladders and platforms may not be loaded in excess of the working loads for which they are designed.

(3) *Securing in place.* Portable ladders and platforms shall be secured to prevent them from becoming dislodged.

(4) *Intended use.* Portable ladders and platforms may be used only in applications for which they are designed.

(c) *Conductive ladders.* 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 when the employer demonstrates that nonconductive ladders would present a greater hazard to employees than conductive ladders.

§1926.956 Hand and portable power equipment.

(a) *General.* Paragraph (b) of this section applies to electric equipment connected by cord and plug. Paragraph (c) of this section applies to portable and vehicle-mounted generators used to supply cord- and plug-connected equipment. Paragraph (d) of this section applies to hydraulic and pneumatic tools.

(b) *Cord- and plug-connected equipment.* Cord- and plug-connected equipment not covered by subpart K of this part shall comply with one of the following instead of §1926.302(a)(1):

(1) The equipment shall be equipped with a cord containing an equipment grounding conductor connected to the equipment frame and to a means for grounding the other end of the conductor (however, this option may not be used where the introduction of the ground into the work environment increases the hazard to an employee); or

(2) The equipment shall be of the double-insulated type conforming to subpart K of this part; or

(3) The equipment shall be connected to the power supply through an isolating transformer with an ungrounded secondary of not more than 50 volts.

(c) *Portable and vehicle-mounted generators.* Portable and vehicle-mounted generators used to supply cord- and plug-connected equipment covered by paragraph (b) of this section shall meet the following requirements:

(1) *Equipment to be supplied.* The generator may only supply equipment located on the generator or the vehicle and cord- and plug-connected equipment through receptacles mounted on the generator or the vehicle.

(2) *Equipment grounding.* The non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles shall be bonded to the generator frame.

(3) *Bonding the frame.* For vehicle-mounted generators, the frame of the generator shall be bonded to the vehicle frame.

(4) *Bonding the neutral conductor.* Any neutral conductor shall be bonded to the generator frame.

(d) *Hydraulic and pneumatic tools—(1) Hydraulic fluid in insulating tools.* Paragraph (d)(1) of §1926.302 does not apply to hydraulic fluid used in insulating sections of hydraulic tools.

(2) *Operating pressure.* Safe operating pressures for hydraulic and pneumatic tools, hoses, valves, pipes, filters, and fittings may not be exceeded.

NOTE TO PARAGRAPH (d)(2): If any hazardous defects are present, no operating pressure is safe, and the hydraulic or pneumatic equipment involved may not be used. In the absence of defects, the maximum rated operating pressure is the maximum safe pressure.

(3) *Work near energized parts.* A hydraulic or pneumatic tool used where it may contact exposed energized parts shall be designed and maintained for such use.

(4) *Protection against vacuum formation.* The hydraulic system supplying a hydraulic tool used where it may contact exposed live parts shall provide protection against loss of insulating value, for the voltage involved, due to the formation of a partial vacuum in the hydraulic line.

NOTE TO PARAGRAPH (d)(4): Use of hydraulic lines that do not have check valves and that have a separation of more than 10.7 meters (35 feet) between the oil reservoir and the upper end of the hydraulic system promotes the formation of a partial vacuum.

(5) *Protection against the accumulation of moisture.* A pneumatic tool used on energized electric lines or equipment, or used where it may contact exposed live parts, shall provide protection against the accumulation of moisture in the air supply.

(6) *Breaking connections.* Pressure shall be released before connections are broken, unless quick-acting, self-closing connectors are used.

(7) *Leaks.* Employers must ensure that employees do not use any part of their bodies to locate, or attempt to stop, a hydraulic leak.

(8) *Hoses.* Hoses may not be kinked.

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§1926.957 Live-line tools.

(a) *Design of tools.* Live-line tool rods, tubes, and poles shall be designed and constructed to withstand the following minimum tests:

(1) *Fiberglass-reinforced plastic.* If the tool is made of fiberglass-reinforced plastic (FRP), it shall withstand 328,100 volts per meter (100,000 volts per foot) of length for 5 minutes, or

NOTE TO PARAGRAPH (a)(1): 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*, are deemed to comply with paragraph (a)(1) of this section.

(2) *Wood*. If the tool is made of wood, it shall withstand 246,100 volts per meter (75,000 volts per foot) of length for 3 minutes, or

(3) *Equivalent tests*. The tool shall withstand other tests that the employer can demonstrate are equivalent.

(b) *Condition of tools*—(1) *Daily inspection*. Each live-line tool shall be wiped clean and visually inspected for defects before use each day.

(2) *Defects*. 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 according to paragraph (b)(3) of this section before being returned to service.

(3) *Biennial inspection and testing*. Live-line tools used for primary employee protection shall be removed from service every 2 years, and whenever required under paragraph (b)(2) of this section, for examination, cleaning, repair, and testing as follows:

(i) Each tool shall be thoroughly examined for defects.

(ii) 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.

(iii) The tool shall be tested in accordance with paragraphs (b)(3)(iv) and (b)(3)(v) of this section under the following conditions:

(A) After the tool has been repaired or refinished; and

(B) After the examination if repair or refinishing is not performed, unless the tool is made of FRP rod or foam-filled FRP tube and the employer can demonstrate that the tool has no defects that could cause it to fail during use.

(iv) 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.

(v) The voltage applied during the tests shall be as follows:

(A) 246,100 volts per meter (75,000 volts per foot) of length for 1 minute if the tool is made of fiberglass, or

(B) 164,000 volts per meter (50,000 volts per foot) of length for 1 minute if the tool is made of wood, or

(C) Other tests that the employer can demonstrate are equivalent.

NOTE TO PARAGRAPH (b): Guidelines for the examination, cleaning, repairing, and in-service testing of live-line tools are specified in the Institute of Electrical and Electronics Engineers' *IEEE Guide for Maintenance Methods on Energized Power Lines*, IEEE Std 516-2009.

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§1926.958 Materials handling and storage.

(a) *General*. Materials handling and storage shall comply with applicable material-handling and material-storage requirements in this part, including those in subparts N and CC of this part.

(b) *Materials storage near energized lines or equipment—(1) Unrestricted areas*. In areas to which access is not restricted to qualified persons only, materials or equipment may not be stored closer to energized lines or exposed energized parts of equipment than the following distances, plus a distance that provides for the maximum sag and side swing of all conductors and for the height and movement of material-handling equipment:

(i) For lines and equipment energized at 50 kilovolts or less, the distance is 3.05 meters (10 feet).

(ii) For lines and equipment energized at more than 50 kilovolts, the distance is 3.05 meters (10 feet) plus 0.10 meter (4 inches) for every 10 kilovolts over 50 kilovolts.

(2) *Restricted areas*. In areas restricted to qualified employees, materials may not be stored within the working space about energized lines or equipment.

NOTE TO PARAGRAPH (b)(2): Paragraph (b) of §1926.966 specifies the size of the working space.

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§1926.959 Mechanical equipment.

(a) *General requirements—(1) Other applicable requirements*. Mechanical equipment shall be operated in accordance with applicable requirements in this part, including subparts N, O, and CC of this part, except that §1926.600(a)(6) does not apply to operations performed by qualified employees.

(2) *Inspection before use*. The critical safety components of mechanical elevating and rotating equipment shall receive a thorough visual inspection before use on each shift.

NOTE TO PARAGRAPH (a)(2): Critical safety components of mechanical elevating and rotating equipment are components for which failure would result in free fall or free rotation of the boom.

(3) *Operator*. The operator of an electric line truck may not leave his or her position at the controls while a load is suspended, unless the employer can demonstrate that no employee (including the operator) is endangered.

(b) *Outriggers*—(1) *Extend outriggers*. Mobile equipment, if provided with outriggers, shall be operated with the outriggers extended and firmly set, except as provided in paragraph (b)(3) of this section.

(2) *Clear view*. Outriggers may not be extended or retracted outside of the clear view of the operator unless all employees are outside the range of possible equipment motion.

(3) *Operation without outriggers*. If the work area or the terrain precludes the use of outriggers, the equipment may be operated only within its maximum load ratings specified by the equipment manufacturer for the particular configuration of the equipment without outriggers.

(c) *Applied loads*. Mechanical equipment used to lift or move lines or other material shall be used within its maximum load rating and other design limitations for the conditions under which the mechanical equipment is being used.

(d) *Operations near energized lines or equipment*—(1) *Minimum approach distance*. Mechanical equipment shall be operated so that the minimum approach distances, established by the employer under §1926.960(c)(1)(i), are maintained from exposed energized lines and equipment. However, the insulated portion of an aerial lift operated by a qualified employee in the lift is exempt from this requirement if the applicable minimum approach distance is maintained between the uninsulated portions of the aerial lift and exposed objects having a different electrical potential.

(2) *Observer*. A designated employee other than the equipment operator shall observe the approach distance to exposed lines and equipment and provide timely warnings before the minimum approach distance required by paragraph (d)(1) of this section is reached, unless the employer can demonstrate that the operator can accurately determine that the minimum approach distance is being maintained.

(3) *Extra precautions*. If, during operation of the mechanical equipment, that equipment could become energized, the operation also shall comply with at least one of paragraphs (d)(3)(i) through (d)(3)(iii) of this section.

(i) The energized lines or equipment exposed to contact shall be covered with insulating protective material that will withstand the type of contact that could be made during the operation.

(ii) The mechanical equipment shall be insulated for the voltage involved. The mechanical equipment shall be positioned so that its uninsulated portions cannot approach the energized lines or equipment any closer than the minimum approach distances, established by the employer under §1926.960(c)(1)(i).

(iii) Each employee shall be protected from hazards that could arise from mechanical equipment contact with energized lines or equipment. The measures used shall ensure that employees will not be exposed to hazardous differences in electric potential. Unless the employer can demonstrate that the methods in use protect each employee from the hazards that could arise if the mechanical equipment contacts the energized line or equipment, the measures used shall include all of the following techniques:

- (A) Using the best available ground to minimize the time the lines or electric equipment remain energized,
- (B) Bonding mechanical equipment together to minimize potential differences,
- (C) Providing ground mats to extend areas of equipotential, and
- (D) Employing insulating protective equipment or barricades to guard against any remaining hazardous electrical potential differences.

NOTE TO PARAGRAPH (d)(3)(iii): Appendix C to this subpart contains information on hazardous step and touch potentials and on methods of protecting employees from hazards resulting from such potentials.

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§1926.960 Working on or near exposed energized parts.

(a) *Application.* This section applies to work on exposed live parts, or near enough to them to expose the employee to any hazard they present.

(b) *General—(1) Qualified employees only.* (i) Only qualified employees may work on or with exposed energized lines or parts of equipment.

(ii) Only qualified employees may work in areas containing unguarded, uninsulated energized lines or parts of equipment operating at 50 volts or more.

(2) *Treat as energized.* Electric lines and equipment shall be considered and treated as energized unless they have been deenergized in accordance with §1926.961.

(3) *At least two employees.* (i) Except as provided in paragraph (b)(3)(ii) of this section, at least two employees shall be present while any employees perform the following types of work:

- (A) Installation, removal, or repair of lines 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, and
- (E) Other work that exposes an employee to electrical hazards greater than, or equal to, the electrical hazards posed by operations listed specifically in paragraphs (b)(3)(i)(A) through (b)(3)(i)(D) of this section.

(ii) Paragraph (b)(3)(i) of this section does not apply to the following operations:

(A) Routine circuit switching, when the employer can demonstrate that conditions at the site allow safe performance of this work,

(B) Work performed with live-line tools when the position of the employee is such that he or she is neither within reach of, nor otherwise exposed to contact with, energized parts, and

(C) Emergency repairs to the extent necessary to safeguard the general public.

(c) *Live work*—(1) *Minimum approach distances*. (i) The employer shall establish minimum approach distances no less than the distances computed by Table V-2 for ac systems or Table V-7 for dc systems.

(ii) No later than April 1, 2015, for voltages over 72.5 kilovolts, the employer shall determine the maximum anticipated per-unit transient overvoltage, phase-to-ground, through an engineering analysis or assume a maximum anticipated per-unit transient overvoltage, phase-to-ground, in accordance with Table V-8. When the employer uses portable protective gaps to control the maximum transient overvoltage, the value of the maximum anticipated per-unit transient overvoltage, phase-to-ground, must provide for five standard deviations between the statistical sparkover voltage of the gap and the statistical withstand voltage corresponding to the electrical component of the minimum approach distance. The employer shall make any engineering analysis conducted to determine maximum anticipated per-unit transient overvoltage available upon request to employees and to the Assistant Secretary or designee for examination and copying.

NOTE TO PARAGRAPH (c)(1)(ii): See appendix B to this subpart for information on how to calculate the maximum anticipated per-unit transient overvoltage, phase-to-ground, when the employer uses portable protective gaps to reduce maximum transient overvoltages.

(iii) The employer shall ensure that no employee approaches or takes any conductive object closer to exposed energized parts than the employer's established minimum approach distance, unless:

(A) The employee is insulated from the energized part (rubber insulating gloves or rubber insulating gloves and sleeves worn in accordance with paragraph (c)(2) of this section constitutes insulation of the employee from the energized part upon which the employee is working provided that the employee has control of the part in a manner sufficient to prevent exposure to uninsulated portions of the employee's body), or

(B) The energized part is insulated from the employee and from any other conductive object at a different potential, or

(C) The employee is insulated from any other exposed conductive object in accordance with the requirements for live-line barehand work in §1926.964(c).

(2) *Type of insulation*. (i) When an employee uses rubber insulating gloves as insulation from energized parts (under paragraph (c)(1)(iii)(A) of this section), the employer shall ensure that the employee also uses rubber insulating sleeves. However, an employee need not use rubber insulating sleeves if:

(A) Exposed energized parts on which the employee is not working are insulated from the employee; and

(B) When installing insulation for purposes of paragraph (c)(2)(i)(A) of this section, the employee installs the insulation from a position that does not expose his or her upper arm to contact with other energized parts.

(ii) When an employee uses rubber insulating gloves or rubber insulating gloves and sleeves as insulation from energized parts (under paragraph (c)(1)(iii)(A) of this section), the employer shall ensure that the employee:

(A) Puts on the rubber insulating gloves and sleeves in a position where he or she cannot reach into the minimum approach distance, established by the employer under paragraph (c)(1) of this section; and

(B) Does not remove the rubber insulating gloves and sleeves until he or she is in a position where he or she cannot reach into the minimum approach distance, established by the employer under paragraph (c)(1) of this section.

(d) *Working position*—(1) *Working from below*. The employer shall ensure that each employee, to the extent that other safety-related conditions at the worksite permit, works in a position from which a slip or shock will not bring the employee's body into contact with exposed, uninsulated parts energized at a potential different from the employee's.

(2) *Requirements for working without electrical protective equipment*. When an employee performs work near exposed parts energized at more than 600 volts, but not more than 72.5 kilovolts, and is not wearing rubber insulating gloves, being protected by insulating equipment covering the energized parts, performing work using live-line tools, or performing live-line barehand work under §1926.964(c), the employee shall work from a position where he or she cannot reach into the minimum approach distance, established by the employer under paragraph (c)(1) of this section.

(e) *Making connections*. The employer shall ensure that employees make connections as follows:

(1) *Connecting*. In connecting deenergized equipment or lines to an energized circuit by means of a conducting wire or device, an employee shall first attach the wire to the deenergized part;

(2) *Disconnecting*. When disconnecting equipment or lines from an energized circuit by means of a conducting wire or device, an employee shall remove the source end first; and

(3) *Loose conductors*. When lines or equipment are connected to or disconnected from energized circuits, an employee shall keep loose conductors away from exposed energized parts.

(f) *Conductive articles*. When an employee performs work within reaching distance of exposed energized parts of equipment, the employer shall ensure that the employee removes or renders nonconductive all exposed conductive articles, such as keychains or

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

(g) *Protection from flames and electric arcs*—(1) *Hazard assessment*. The employer shall assess the workplace to identify employees exposed to hazards from flames or from electric arcs.

(2) *Estimate of available heat energy*. For each employee exposed to hazards from electric arcs, the employer shall make a reasonable estimate of the incident heat energy to which the employee would be exposed.

NOTE 1 TO PARAGRAPH (g)(2): Appendix E to this subpart provides guidance on estimating available heat energy. The Occupational Safety and Health Administration will deem employers following the guidance in appendix E to this subpart to be in compliance with paragraph (g)(2) of this section. An employer may choose a method of calculating incident heat energy not included in appendix E to this subpart if the chosen method reasonably predicts the incident energy to which the employee would be exposed.

NOTE 2 TO PARAGRAPH (g)(2): This paragraph does not require the employer to estimate the incident heat energy exposure for every job task performed by each employee. The employer may make broad estimates that cover multiple system areas provided the employer uses reasonable assumptions about the energy-exposure distribution throughout the system and provided the estimates represent the maximum employee exposure for those areas. For example, the employer could estimate the heat energy just outside a substation feeding a radial distribution system and use that estimate for all jobs performed on that radial system.

(3) *Prohibited clothing*. The employer shall ensure that each employee who is exposed to hazards from flames or electric arcs does not wear clothing that could melt onto his or her skin or that could ignite and continue to burn when exposed to flames or the heat energy estimated under paragraph (g)(2) of this section.

NOTE TO PARAGRAPH (g)(3): This paragraph prohibits clothing made from acetate, nylon, polyester, rayon and polypropylene, either alone or in blends, unless the employer demonstrates that the fabric has been treated to withstand the conditions that may be encountered by the employee or that the employee wears the clothing in such a manner as to eliminate the hazard involved.

(4) *Flame-resistant clothing*. The employer shall ensure that the outer layer of clothing worn by an employee, except for clothing not required to be arc rated under paragraphs (g)(5)(i) through (g)(5)(v) of this section, is flame resistant under any of the following conditions:

(i) The employee is exposed to contact with energized circuit parts operating at more than 600 volts,

(ii) An electric arc could ignite flammable material in the work area that, in turn, could ignite the employee's clothing,

(iii) Molten metal or electric arcs from faulted conductors in the work area could ignite the employee's clothing, or

NOTE TO PARAGRAPH (g)(4)(iii): This paragraph does not apply to conductors that are capable of carrying, without failure, the maximum available fault current for the time the circuit protective devices take to interrupt the fault.

(iv) The incident heat energy estimated under paragraph (g)(2) of this section exceeds 2.0 cal/cm².

(5) *Arc rating.* The employer shall ensure that each employee exposed to hazards from electric arcs wears protective clothing and other protective equipment with an arc rating greater than or equal to the heat energy estimated under paragraph (g)(2) of this section whenever that estimate exceeds 2.0 cal/cm². This protective equipment shall cover the employee's entire body, except as follows:

(i) Arc-rated protection is not necessary for the employee's hands when the employee is wearing rubber insulating gloves with protectors or, if the estimated incident energy is no more than 14 cal/cm², heavy-duty leather work gloves with a weight of at least 407 gm/m² (12 oz/yd²),

(ii) Arc-rated protection is not necessary for the employee's feet when the employee is wearing heavy-duty work shoes or boots,

(iii) Arc-rated protection is not necessary for the employee's head when the employee is wearing head protection meeting §1926.100(b)(2) if the estimated incident energy is less than 9 cal/cm² for exposures involving single-phase arcs in open air or 5 cal/cm² for other exposures,

(iv) The protection for the employee's head may consist of head protection meeting §1926.100(b)(2) and a faceshield with a minimum arc rating of 8 cal/cm² if the estimated incident-energy exposure is less than 13 cal/cm² for exposures involving single-phase arcs in open air or 9 cal/cm² for other exposures, and

(v) For exposures involving single-phase arcs in open air, the arc rating for the employee's head and face protection may be 4 cal/cm² less than the estimated incident energy.

NOTE TO PARAGRAPH (g): See appendix E to this subpart for further information on the selection of appropriate protection.

(6) *Dates.* (i) The obligation in paragraph (g)(2) of this section for the employer to make reasonable estimates of incident energy commences January 1, 2015.

(ii) The obligation in paragraph (g)(4)(iv) of this section for the employer to ensure that the outer layer of clothing worn by an employee is flame-resistant when the estimated incident heat energy exceeds 2.0 cal/cm² commences April 1, 2015.

(iii) The obligation in paragraph (g)(5) of this section for the employer to ensure that each employee exposed to hazards from electric arcs wears the required arc-rated protective equipment commences April 1, 2015.

(h) *Fuse handling.* When an employee must install or remove fuses with one or both terminals energized at more than 300 volts, or with exposed parts energized at more than 50 volts, the employer shall ensure that the employee uses tools or gloves rated for the voltage. When an employee installs or removes expulsion-type fuses with one or both terminals energized at more than 300 volts, the employer shall ensure that the

employee wears eye protection meeting the requirements of subpart E of this part, uses a tool rated for the voltage, and is clear of the exhaust path of the fuse barrel.

(i) *Covered (noninsulated) conductors.* The requirements of this section that pertain to the hazards of exposed live parts also apply when an employee performs work in proximity to covered (noninsulated) wires.

(j) *Non-current-carrying metal parts.* Non-current-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 these parts are exposed, unless the employer inspects the installation and determines that these parts are grounded before employees begin performing the work.

(k) *Opening and closing circuits under load.* (1) The employer shall ensure that devices used by employees to open circuits under load conditions are designed to interrupt the current involved.

(2) The employer shall ensure that devices used by employees to close circuits under load conditions are designed to safely carry the current involved.

Table V-2—AC Live-Line Work Minimum Approach Distance

<p>The minimum approach distance (MAD; in meters) shall conform to the following equations.</p> <p>For phase-to-phase system voltages of 50 V to 300 V: ¹</p> <p>MAD = avoid contact</p>	
<p>For phase-to-phase system voltages of 301 V to 5 kV: ¹</p> <p>MAD = $M + D$, where</p> <p>$D = 0.02$ m</p> <p>$M = 0.31$ m for voltages up to 750 V and 0.61 m otherwise</p>	<p>the electrical component of the minimum approach distance</p> <p>the inadvertent movement factor</p>
<p>For phase-to-phase system voltages of 5.1 kV to 72.5 kV: ^{1,4}</p> <p>MAD = $M + AD$, where</p> <p>$M = 0.61$ m</p> <p>$A =$ the applicable value from Table V-4</p> <p>$D =$ the value from Table V-3 corresponding to the voltage and exposure or the value of the electrical component of the minimum approach distance calculated using the method provided in Appendix B to this subpart.</p>	<p>the inadvertent movement factor</p> <p>the altitude correction factor</p> <p>the electrical component of the minimum approach distance</p>

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Table V-2 (Continued)

For phase-to-phase system voltages of more than 72.5 kV, nominal:^{2,4}
 $MAD = 0.3048(C + a)V_{L-G}TA + M$, where

$C =$ 0.01 for phase-to-ground exposures that the employer can demonstrate consist only of air across the approach distance (gap),
 0.01 for phase-to-phase exposures if the employer can demonstrate that no insulated tool spans the gap and that no large
 conductive object is in the gap, or
 0.011 otherwise

$V_{L-G} =$ phase-to-ground rms voltage, in kV
 $T =$ maximum anticipated per-unit transient overvoltage; for phase-to-ground exposures, T equals T_{L-G} , the maximum per-unit
 transient overvoltage, phase-to-ground, determined by the employer under paragraph (c)(1)(ii) of this section; for phase-
 to-phase exposures, T equals $1.35T_{L-G} + 0.45$

$A =$ altitude correction factor from Table V-4
 $M =$ 0.31 m, the inadvertent movement factor
 $a =$ saturation factor, as follows:

Phase-to-Ground Exposures			
V_{Peak}	$T_{L-G}V_{L-G}\sqrt{2}$	635 kV or less	915.1 to 1,050 kV
a		0	$(V_{Peak} - 635)/140,000$
Phase-to-Phase Exposures ³			
V_{Peak}	$(1.35T_{L-G} + 0.45)V_{L-G}\sqrt{2}$	630 kV or less	848.1 to 1,131 kV
a		0	$(V_{Peak} - 630)/155,000$

More than 1,050 kV
 $(V_{Peak} - 675)/125,000$

1,131.1 to 1,485 kV
 $(V_{Peak} - 628)/153,846$

More than 1,485 kV
 $(V_{Peak} - 350.5)/203,666$

¹Employers may use the minimum approach distances in Table V-5, if the worksite is at an elevation of more than 900 meters (3,000 feet), see footnote 1 to Table V-5.
²Employers may use the minimum approach distances in Table V-6, except that the employer may not use the minimum approach distances in Table V-6 for phase-to-phase exposures if an insulated tool spans the gap or if any large conductive object is in the gap. If the worksite is at an elevation of more than 900 meters (3,000 feet), see footnote 1 to Table V-6. Employers may use the minimum approach distances in Table 7 through Table 14 in Appendix B to this subpart, which calculated MAD for various values of T , provided the employer follows the notes to those tables.
³Use the equations for phase-to-ground exposures (with V_{Peak} for phase-to-phase exposures) unless the employer can demonstrate that no insulated tool spans the gap and that no large conductive object is in the gap.
⁴Until March 31, 2015, employers may use the minimum approach distances in Table 6 in Appendix B to this subpart.

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TABLE V-3—ELECTRICAL COMPONENT OF THE MINIMUM APPROACH DISTANCE (D; IN METERS) AT 5.1 TO 72.5 kV

Nominal voltage (kV) phase-to-phase	Phase-to-ground exposure	Phase-to-phase exposure
	D (m)	D (m)
5.1 to 15.0	0.04	0.07

15.1 to 36.0	0.16	0.28
36.1 to 46.0	0.23	0.37
46.1 to 72.5	0.39	0.59

TABLE V-4—ALTITUDE CORRECTION FACTOR

Altitude above sea level (m)	A
0 to 900	1.00
901 to 1,200	1.02
1,201 to 1,500	1.05
1,501 to 1,800	1.08
1,801 to 2,100	1.11
2,101 to 2,400	1.14
2,401 to 2,700	1.17
2,701 to 3,000	1.20
3,001 to 3,600	1.25
3,601 to 4,200	1.30
4,201 to 4,800	1.35
4,801 to 5,400	1.39
5,401 to 6,000	1.44

TABLE V-5—ALTERNATIVE MINIMUM APPROACH DISTANCES FOR VOLTAGES OF 72.5 kV AND LESS¹

Nominal voltage (kV) phase-to-phase	Distance			
	Phase-to-ground exposure		Phase-to-phase exposure	
	m	ft	m	ft
0.050 0.300 ²	Avoid contact		Avoid contact	
0.301 to 0.750 ²	0.33	1.09	0.33	1.09
0.751 to 5.0	0.63	2.07	0.63	2.07
5.1 to 15.0	0.65	2.14	0.68	2.24
15.1 to 36.0	0.77	2.53	0.89	2.92
36.1 to 46.0	0.84	2.76	0.98	3.22
46.1 to 72.5	1.00	3.29	1.20	3.94

¹Employers may use the minimum approach distances in this table provided the worksite is at an elevation of 900 meters (3,000 feet) or less. If employees will be working at elevations greater than 900 meters (3,000 feet) above mean sea level, the employer shall determine minimum approach distances by multiplying the distances in this table by the correction factor in Table V-4 corresponding to the altitude of the work.

²For single-phase systems, use voltage-to-ground.

TABLE V-6—ALTERNATIVE MINIMUM APPROACH DISTANCES FOR VOLTAGES OF MORE THAN 72.5 kV^{1 2 3}

Voltage range phase to phase (kV)	Phase-to-ground exposure		Phase-to-phase exposure	
	m	ft	m	ft
72.6 to 121.0	1.13	3.71	1.42	4.66
121.1 to 145.0	1.30	4.27	1.64	5.38
145.1 to 169.0	1.46	4.79	1.94	6.36
169.1 to 242.0	2.01	6.59	3.08	10.10
242.1 to 362.0	3.41	11.19	5.52	18.11
362.1 to 420.0	4.25	13.94	6.81	22.34
420.1 to 550.0	5.07	16.63	8.24	27.03
550.1 to 800.0	6.88	22.57	11.38	37.34

¹Employers may use the minimum approach distances in this table provided the worksite is at an elevation of 900 meters (3,000 feet) or less. If employees will be working at elevations greater than 900 meters (3,000 feet) above mean sea level, the employer shall determine minimum approach distances by multiplying the distances in this table by the correction factor in Table V-4 corresponding to the altitude of the work.

²Employers may use the phase-to-phase minimum approach distances in this table provided that no insulated tool spans the gap and no large conductive object is in the gap.

³The clear live-line tool distance shall equal or exceed the values for the indicated voltage ranges.

TABLE V-7—DC LIVE-LINE MINIMUM APPROACH DISTANCE (IN METERS) WITH OVERVOLTAGE FACTOR ¹

Maximum anticipated per-unit transient overvoltage	distance (m) maximum line-to-ground voltage (kV)				
	250	400	500	600	750
1.5 or less	1.12	1.60	2.06	2.62	3.61

1.6	1.17	1.69	2.24	2.86	3.98
1.7	1.23	1.82	2.42	3.12	4.37
1.8	1.28	1.95	2.62	3.39	4.79

¹The distances specified in this table are for air, bare-hand, and live-line tool conditions. If employees will be working at elevations greater than 900 meters (3,000 feet) above mean sea level, the employer shall determine minimum approach distances by multiplying the distances in this table by the correction factor in Table V-4 corresponding to the altitude of the work.

TABLE V-8—ASSUMED MAXIMUM PER-UNIT TRANSIENT OVERVOLTAGE

Voltage range (kV)	Type of current (ac or dc)	Assumed maximum per-unit transient overvoltage
72.6 to 420.0	ac	3.5
420.1 to 550.0	ac	3.0
550.1 to 800.0	ac	2.5
250 to 750	dc	1.8

[79 FR 20696, Apr. 11, 2014, as amended at 79 FR 56962, Sept. 24, 2014; 80 FR 60040, Oct. 5, 2015]

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§1926.961 Deenergizing lines and equipment for employee protection.

(a) *Application.* This section applies to the deenergizing of transmission and distribution lines and equipment for the purpose of protecting employees. Conductors and parts of electric equipment that have been deenergized under procedures other than those required by this section shall be treated as energized.

(b) *General—(1) System operator.* If a system operator is in charge of the lines or equipment and their means of disconnection, the employer shall designate one employee in the crew to be in charge of the clearance and shall comply with all of the requirements of paragraph (c) of this section in the order specified.

(2) *No system operator.* If no system operator is in charge of the lines or equipment and their means of disconnection, the employer shall designate one employee in the crew to be in charge of the clearance and to perform the functions that the system operator would otherwise perform under this section. All of the requirements of paragraph (c) of this section apply, in the order specified, except as provided in paragraph (b)(3) of this section.

(3) *Single crews working with the means of disconnection under the control of the employee in charge of the clearance.* If only one crew will be working on the lines or equipment and if the means of disconnection is accessible and visible to, and under the

sole control of, the employee in charge of the clearance, paragraphs (c)(1), (c)(3), and (c)(5) of this section do not apply. Additionally, the employer does not need to use the tags required by the remaining provisions of paragraph (c) of this section.

(4) *Multiple crews.* If two or more crews will be working on the same lines or equipment, then:

(i) The crews shall coordinate their activities under this section with a single employee in charge of the clearance for all of the crews and follow the requirements of this section as if all of the employees formed a single crew, or

(ii) Each crew shall independently comply with this section and, if there is no system operator in charge of the lines or equipment, shall have separate tags and coordinate deenergizing and reenergizing the lines and equipment with the other crews.

(5) *Disconnecting means accessible to general public.* The employer shall render any disconnecting means that are accessible to individuals outside the employer's control (for example, the general public) inoperable while the disconnecting means are open for the purpose of protecting employees.

(c) *Deenergizing lines and equipment—(1) Request to deenergize.* The employee that the employer designates pursuant to paragraph (b) of this section as being in charge of the clearance shall make a request of the system operator to deenergize the particular section of line or equipment. The designated employee becomes the employee in charge (as this term is used in paragraph (c) of this section) and is responsible for the clearance.

(2) *Open disconnecting means.* The employer shall ensure that 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 are open. The employer shall render such means inoperable, unless its design does not so permit, and then ensure that such means are tagged to indicate that employees are at work.

(3) *Automatically and remotely controlled switches.* The employer shall ensure that automatically and remotely controlled switches that could cause the opened disconnecting means to close are also tagged at the points of control. The employer shall render the automatic or remote control feature inoperable, unless its design does not so permit.

(4) *Network protectors.* The employer need not use the tags mentioned in paragraphs (c)(2) and (c)(3) of this section on a network protector for work on the primary feeder for the network protector's associated network transformer when the employer can demonstrate all of the following conditions:

(i) Every network protector is maintained so that it will immediately trip open if closed when a primary conductor is deenergized;

(ii) Employees cannot manually place any network protector in a closed position without the use of tools, and any manual override position is blocked, locked, or otherwise disabled; and

(iii) The employer has procedures for manually overriding any network protector that incorporate provisions for determining, before anyone places a network protector in a closed position, that: The line connected to the network protector is not deenergized for the protection of any employee working on the line; and (if the line connected to the network protector is not deenergized for the protection of any employee working on the line) the primary conductors for the network protector are energized.

(5) *Tags.* Tags shall prohibit operation of the disconnecting means and shall indicate that employees are at work.

(6) *Test for energized condition.* After the applicable requirements in paragraphs (c) (1) through (c)(5) of this section have been followed and the system operator gives a clearance to the employee in charge, the employer shall ensure that the lines and equipment are deenergized by testing the lines and equipment to be worked with a device designed to detect voltage.

(7) *Install grounds.* The employer shall ensure the installation of protective grounds as required by §1926.962.

(8) *Consider lines and equipment deenergized.* After the applicable requirements of paragraphs (c)(1) through (c)(7) of this section have been followed, the lines and equipment involved may be considered deenergized.

(9) *Transferring clearances.* To transfer the clearance, the employee in charge (or the employee's supervisor if the employee in charge must leave the worksite due to illness or other emergency) shall inform the system operator and employees in the crew; and the new employee in charge shall be responsible for the clearance.

(10) *Releasing clearances.* To release a clearance, the employee in charge shall:

(i) Notify each employee under that clearance of the pending release of the clearance;

(ii) Ensure that all employees under that clearance are clear of the lines and equipment;

(iii) Ensure that all protective grounds protecting employees under that clearance have been removed; and

(iv) Report this information to the system operator and then release the clearance.

(11) *Person releasing clearance.* Only the employee in charge who requested the clearance may release the clearance, unless the employer transfers responsibility under paragraph (c)(9) of this section.

(12) *Removal of tags.* No one may remove tags without the release of the associated clearance as specified under paragraphs (c)(10) and (c)(11) of this section.

(13) *Reenergizing lines and equipment.* The employer shall ensure that no one initiates action to reenergize the lines or equipment at a point of disconnection until all protective grounds have been removed, all crews working on the lines or equipment

release their clearances, all employees are clear of the lines and equipment, and all protective tags are removed from that point of disconnection.

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§1926.962 Grounding for the protection of employees.

(a) *Application.* This section applies to grounding of transmission and distribution lines and equipment for the purpose of protecting employees. Paragraph (d) of this section also applies to protective grounding of other equipment as required elsewhere in this Subpart.

NOTE TO PARAGRAPH (a): This section covers grounding of transmission and distribution lines and equipment when this subpart requires protective grounding and whenever the employer chooses to ground such lines and equipment for the protection of employees.

(b) *General.* For any employee to work transmission and distribution lines or equipment as deenergized, the employer shall ensure that the lines or equipment are deenergized under the provisions of §1926.961 and shall ensure proper grounding of the lines or equipment as specified in paragraphs (c) through (h) of this section. However, if the employer can demonstrate that installation of a ground is impracticable or that the conditions resulting from the installation of a ground would present greater hazards to employees than working without grounds, the lines and equipment may be treated as deenergized provided that the employer establishes that all of the following conditions apply:

(1) *Deenergized.* The employer ensures that the lines and equipment are deenergized under the provisions of §1926.961.

(2) *No possibility of contact.* There is no possibility of contact with another energized source.

(3) *No induced voltage.* The hazard of induced voltage is not present.

(c) *Equipotential zone.* Temporary protective grounds shall be placed at such locations and arranged in such a manner that the employer can demonstrate will prevent each employee from being exposed to hazardous differences in electric potential.

NOTE TO PARAGRAPH (c): Appendix C to this subpart contains guidelines for establishing the equipotential zone required by this paragraph. The Occupational Safety and Health Administration will deem grounding practices meeting these guidelines as complying with paragraph (c) of this section.

(d) *Protective grounding equipment—(1) Ampacity.* (i) Protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault.

(ii) Protective grounding equipment shall have an ampacity greater than or equal to that of No. 2 AWG copper.

(2) *Impedance.* Protective grounds shall have an impedance low enough so that they do not delay the operation of protective devices in case of accidental energizing of the lines or equipment.

NOTE TO PARAGRAPH (d): American Society for Testing and Materials *Standard Specifications for Temporary Protective Grounds to Be Used on De-Energized Electric Power Lines and Equipment*, ASTM F855-09, contains guidelines for protective grounding equipment. The Institute of Electrical Engineers *Guide for Protective Grounding of Power Lines*, IEEE Std 1048-2003, contains guidelines for selecting and installing protective grounding equipment.

(e) *Testing.* The employer shall ensure that, unless a previously installed ground is present, employees test lines and equipment and verify the absence of nominal voltage before employees install any ground on those lines or that equipment.

(f) *Connecting and removing grounds—(1) Order of connection.* The employer shall ensure that, when an employee attaches a ground to a line or to equipment, the employee attaches the ground-end connection first and then attaches the other end by means of a live-line tool. For lines or equipment operating at 600 volts or less, the employer may permit the employee to use insulating equipment other than a live-line tool if the employer ensures that the line or equipment is not energized at the time the ground is connected or if the employer can demonstrate that each employee is protected from hazards that may develop if the line or equipment is energized.

(2) *Order of removal.* The employer shall ensure that, when an employee removes a ground, the employee removes the grounding device from the line or equipment using a live-line tool before he or she removes the ground-end connection. For lines or equipment operating at 600 volts or less, the employer may permit the employee to use insulating equipment other than a live-line tool if the employer ensures that the line or equipment is not energized at the time the ground is disconnected or if the employer can demonstrate that each employee is protected from hazards that may develop if the line or equipment is energized.

(g) *Additional precautions.* The employer shall ensure that, when an employee performs work on a cable at a location remote from the cable terminal, the cable is not grounded at the cable terminal if there is a possibility of hazardous transfer of potential should a fault occur.

(h) *Removal of grounds for test.* The employer may permit employees to remove grounds temporarily during tests. During the test procedure, the employer shall ensure that each employee uses insulating equipment, shall isolate each employee from any hazards involved, and shall implement any additional measures necessary to protect each exposed employee in case the previously grounded lines and equipment become energized.

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§1926.963 Testing and test facilities.

(a) *Application.* This section provides for safe work practices for high-voltage and high-power testing performed in laboratories, shops, and substations, and in the field and on electric transmission and distribution lines and equipment. It applies only to testing involving interim measurements using high voltage, high power, or combinations

of high voltage and high power, and not to testing involving continuous measurements as in routine metering, relaying, and normal line work.

NOTE TO PARAGRAPH (a): OSHA considers routine inspection and maintenance measurements made by qualified employees to be routine line work not included in the scope of this section, provided that the hazards related to the use of intrinsic high-voltage or high-power sources require only the normal precautions associated with routine work specified in the other paragraphs of this subpart. Two typical examples of such excluded test work procedures are “phasing-out” testing and testing for a “no-voltage” condition.

(b) *General requirements—(1) Safe work practices.* The employer shall establish and enforce work practices for the protection of each worker from the hazards of high-voltage or high-power testing at all test areas, temporary and permanent. Such work practices shall include, as a minimum, test area safeguarding, grounding, the safe use of measuring and control circuits, and a means providing for periodic safety checks of field test areas.

(2) *Training.* The employer shall ensure that each employee, upon initial assignment to the test area, receives training in safe work practices, with retraining provided as required by §1926.950(b).

(c) *Safeguarding of test areas—(1) Safeguarding.* The employer shall provide safeguarding within test areas to control access to test equipment or to apparatus under test that could become energized as part of the testing by either direct or inductive coupling and to prevent accidental employee contact with energized parts.

(2) *Permanent test areas.* The employer shall guard permanent test areas with walls, fences, or other barriers designed to keep employees out of the test areas.

(3) *Temporary test areas.* In field testing, or at a temporary test site not guarded by permanent fences and gates, the employer shall ensure the use of one of the following means to prevent employees without authorization from entering:

(i) Distinctively colored safety tape supported approximately waist high with safety signs attached to it,

(ii) A barrier or barricade that limits access to the test area to a degree equivalent, physically and visually, to the barricade specified in paragraph (c)(3)(i) of this section, or

(iii) One or more test observers stationed so that they can monitor the entire area.

(4) *Removal of safeguards.* The employer shall ensure the removal of the safeguards required by paragraph (c)(3) of this section when employees no longer need the protection afforded by the safeguards.

(d) *Grounding practices—(1) Establish and implement practices.* The employer shall establish and implement safe grounding practices for the test facility.

(i) The employer shall maintain at ground potential all conductive parts accessible to the test operator while the equipment is operating at high voltage.

(ii) Wherever ungrounded terminals of test equipment or apparatus under test may be present, they shall be treated as energized until tests demonstrate that they are deenergized.

(2) *Installation of grounds.* The employer shall ensure either that visible grounds are applied automatically, or that employees using properly insulated tools manually apply visible grounds, to the high-voltage circuits after they are deenergized and before any employee performs work on the circuit or on the item or apparatus under test. Common ground connections shall be solidly connected to the test equipment and the apparatus under test.

(3) *Isolated ground return.* In high-power testing, the employer shall provide an isolated ground-return conductor system designed to prevent the intentional passage of current, with its attendant voltage rise, from occurring in the ground grid or in the earth. However, the employer need not provide an isolated ground-return conductor if the employer can demonstrate that both of the following conditions exist:

(i) The employer cannot provide an isolated ground-return conductor due to the distance of the test site from the electric energy source, and

(ii) The employer protects employees from any hazardous step and touch potentials that may develop during the test.

NOTE TO PARAGRAPH (d)(3)(ii): See appendix C to this subpart for information on measures that employers can take to protect employees from hazardous step and touch potentials.

(4) *Equipment grounding conductors.* For tests in which using the equipment grounding conductor in the equipment power cord to ground the test equipment would result in greater hazards to test personnel or prevent the taking of satisfactory measurements, the employer may use a ground clearly indicated in the test set-up if the employer can demonstrate that this ground affords protection for employees equivalent to the protection afforded by an equipment grounding conductor in the power supply cord.

(5) *Grounding after tests.* The employer shall ensure that, when any employee enters the test area after equipment is deenergized, a ground is placed on the high-voltage terminal and any other exposed terminals.

(i) Before any employee applies a direct ground, the employer shall discharge high capacitance equipment or apparatus through a resistor rated for the available energy.

(ii) A direct ground shall be applied to the exposed terminals after the stored energy drops to a level at which it is safe to do so.

(6) *Grounding test vehicles.* If the employer uses a test trailer or test vehicle in field testing, its chassis shall be grounded. The employer shall protect each employee against hazardous touch potentials with respect to the vehicle, instrument panels, and other conductive parts accessible to employees with bonding, insulation, or isolation.

(e) *Control and measuring circuits—(1) Control wiring.* The employer may not run control wiring, meter connections, test leads, or cables from a test area unless

contained in a grounded metallic sheath and terminated in a grounded metallic enclosure or unless the employer takes other precautions that it can demonstrate will provide employees with equivalent safety.

(2) *Instruments.* The employer shall isolate meters and other instruments with accessible terminals or parts from test personnel to protect against hazards that could arise should such terminals and parts become energized during testing. If the employer provides this isolation by locating test equipment in metal compartments with viewing windows, the employer shall provide interlocks to interrupt the power supply when someone opens the compartment cover.

(3) *Routing temporary wiring.* The employer shall protect temporary wiring and its connections against damage, accidental interruptions, and other hazards. To the maximum extent possible, the employer shall keep signal, control, ground, and power cables separate from each other.

(4) *Test observer.* If any employee will be present in the test area during testing, a test observer shall be present. The test observer shall be capable of implementing the immediate deenergizing of test circuits for safety purposes.

(f) *Safety check—(1) Before each test.* Safety practices governing employee work at temporary or field test areas shall provide, at the beginning of each series of tests, for a routine safety check of such test areas.

(2) *Conditions to be checked.* The test operator in charge shall conduct these routine safety checks before each series of tests and shall verify at least the following conditions:

(i) Barriers and safeguards are in workable condition and placed properly to isolate hazardous areas;

(ii) System test status signals, if used, are in operable condition;

(iii) Clearly marked test-power disconnects are readily available in an emergency;

(iv) Ground connections are clearly identifiable;

(v) Personal protective equipment is provided and used as required by subpart E of this part and by this subpart; and

(vi) Proper separation between signal, ground, and power cables.

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§1926.964 Overhead lines and live-line barehand work.

(a) *General—(1) Application.* This section provides additional requirements for work performed on or near overhead lines and equipment and for live-line barehand work.

(2) *Checking structure before climbing.* Before allowing employees to subject elevated structures, such as poles or towers, to such stresses as climbing or the installation or removal of equipment may impose, the employer shall ascertain that the structures are capable of sustaining the additional or unbalanced stresses. If the pole or other structure cannot withstand the expected loads, the employer shall brace or otherwise support the pole or structure so as to prevent failure.

NOTE TO PARAGRAPH (a)(2): Appendix D to this subpart contains test methods that employers can use in ascertaining whether a wood pole is capable of sustaining the forces imposed by an employee climbing the pole. This paragraph also requires the employer to ascertain that the pole can sustain all other forces imposed by the work employees will perform.

(3) *Setting and moving poles.* (i) When a pole is set, moved, or removed near an exposed energized overhead conductor, the pole may not contact the conductor.

(ii) 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 or her body.

(iii) To protect employees from falling into holes used for placing poles, the employer shall physically guard the holes, or ensure that employees attend the holes, whenever anyone is working nearby.

(b) *Installing and removing overhead lines.* The following provisions apply to the installation and removal of overhead conductors or cable (overhead lines).

(1) *Tension stringing method.* When lines that employees are installing or removing can contact energized parts, the employer shall use the tension-stringing method, barriers, or other equivalent measures to minimize the possibility that conductors and cables the employees are installing or removing will contact energized power lines or equipment.

(2) *Conductors, cables, and pulling and tensioning equipment.* For conductors, cables, and pulling and tensioning equipment, the employer shall provide the protective measures required by §1926.959(d)(3) when employees are installing or removing a conductor or cable close enough to energized conductors that any of the following failures could energize the pulling or tensioning equipment or the conductor or cable being installed or removed:

- (i) Failure of the pulling or tensioning equipment,
- (ii) Failure of the conductor or cable being pulled, or
- (iii) Failure of the previously installed lines or equipment.

(3) *Disable automatic-reclosing feature.* If the conductors that employees are installing or removing cross over energized conductors in excess of 600 volts and if the design of the circuit-interrupting devices protecting the lines so permits, the employer shall render inoperable the automatic-reclosing feature of these devices.

(4) *Induced voltage.* (i) Before employees install lines parallel to existing energized lines, the employer shall make a determination of the approximate voltage to be induced in the new lines, or work shall proceed on the assumption that the induced voltage is hazardous.

(ii) Unless the employer can demonstrate that the lines that employees are installing are not subject to the induction of a hazardous voltage or unless the lines are treated as energized, temporary protective grounds shall be placed at such locations and arranged in such a manner that the employer can demonstrate will prevent exposure of each employee to hazardous differences in electric potential.

NOTE TO PARAGRAPH (b)(4)(ii): Appendix C to this subpart contains guidelines for protecting employees from hazardous differences in electric potential as required by this paragraph.

NOTE TO PARAGRAPH (b)(4): If the employer takes no precautions to protect employees from hazards associated with involuntary reactions from electric shock, a hazard exists if the induced voltage is sufficient to pass a current of 1 milliamperes through a 500-ohm resistor. If the employer protects employees from injury due to involuntary reactions from electric shock, a hazard exists if the resultant current would be more than 6 milliamperes.

(5) *Safe operating condition.* Reel-handling equipment, including pulling and tensioning devices, shall be in safe operating condition and shall be leveled and aligned.

(6) *Load ratings.* The employer shall ensure that employees do not exceed load ratings of stringing lines, pulling lines, conductor grips, load-bearing hardware and accessories, rigging, and hoists.

(7) *Defective pulling lines.* The employer shall repair or replace defective pulling lines and accessories.

(8) *Conductor grips.* The employer shall ensure that employees do not use conductor grips on wire rope unless the manufacturer specifically designed the grip for this application.

(9) *Communications.* The employer shall ensure that employees maintain reliable communications, through two-way radios or other equivalent means, between the reel tender and the pulling-rig operator.

(10) *Operation of pulling rig.* Employees may operate the pulling rig only when it is safe to do so.

NOTE TO PARAGRAPH (b)(10): Examples of unsafe conditions include: employees in locations prohibited by paragraph (b)(11) of this section, conductor and pulling line hang-ups, and slipping of the conductor grip.

(11) *Working under overhead operations.* While a power-driven device is pulling the conductor or pulling line and the conductor or pulling line is in motion, the employer shall ensure that employees are not directly under overhead operations or on the crossarm, except as necessary for the employees to guide the stringing sock or board over or through the stringing sheave.

(c) *Live-line barehand work.* In addition to other applicable provisions contained in this subpart, the following requirements apply to live-line barehand work:

(1) *Training.* Before an employee uses or supervises the use of the live-line barehand technique on energized circuits, the employer shall ensure that the employee completes training conforming to §1926.950(b) in the technique and in the safety requirements of paragraph (c) of this section.

(2) *Existing conditions.* Before any employee uses the live-line barehand technique on energized high-voltage conductors or parts, the employer shall ascertain the following information in addition to information about other existing conditions required by §1926.950(d):

(i) The nominal voltage rating of the circuit on which employees will perform the work,

(ii) The clearances to ground of lines and other energized parts on which employees will perform the work, and

(iii) The voltage limitations of equipment employees will use.

(3) *Insulated tools and equipment.* (i) The employer shall ensure that the insulated equipment, insulated tools, and aerial devices and platforms used by employees are designed, tested, and made for live-line barehand work.

(ii) The employer shall ensure that employees keep tools and equipment clean and dry while they are in use.

(4) *Disable automatic-reclosing feature.* The employer shall render inoperable the automatic-reclosing feature of circuit-interrupting devices protecting the lines if the design of the devices permits.

(5) *Adverse weather conditions.* The employer shall ensure that employees do not perform work when adverse weather conditions would make the work hazardous even after the employer implements the work practices required by this subpart. Additionally, employees may not perform work when winds reduce the phase-to-phase or phase-to-ground clearances at the work location below the minimum approach distances specified in paragraph (c)(13) of this section, unless insulating guards cover the grounded objects and other lines and equipment.

NOTE TO PARAGRAPH (c)(5): Thunderstorms in the vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that make live-line barehand work too hazardous to perform safely even after the employer implements the work practices required by this subpart.

(6) *Bucket liners and electrostatic shielding.* The employer shall provide and ensure that employees use a conductive bucket liner or other conductive device for bonding the insulated aerial device to the energized line or equipment.

(i) The employee shall be connected to the bucket liner or other conductive device by the use of conductive shoes, leg clips, or other means.

(ii) Where differences in potentials at the worksite pose a hazard to employees, the employer shall provide electrostatic shielding designed for the voltage being worked.

(7) *Bonding the employee to the energized part.* The employer shall ensure that, before the employee contacts the energized part, the employee bonds the conductive bucket liner or other conductive device to the energized conductor by means of a positive connection. This connection shall remain attached to the energized conductor until the employee completes the work on the energized circuit.

(8) *Aerial-lift controls.* Aerial lifts used for live-line barehand work shall have dual controls (lower and upper) as follows:

(i) The upper controls shall be within easy reach of the employee in the bucket. On a two-bucket-type lift, access to the controls shall be within easy reach of both buckets.

(ii) The lower set of controls shall be near the base of the boom and shall be designed so that they can override operation of the equipment at any time.

(9) *Operation of lower controls.* Lower (ground-level) lift controls may not be operated with an employee in the lift except in case of emergency.

(10) *Check controls.* The employer shall ensure that, before employees elevate an aerial lift into the work position, the employees check all controls (ground level and bucket) to determine that they are in proper working condition.

(11) *Body of aerial lift truck.* The employer shall ensure that, before employees elevate the boom of an aerial lift, the employees ground the body of the truck or barricade the body of the truck and treat it as energized.

(12) *Boom-current test.* The employer shall ensure that employees perform a boom-current test before starting work each day, each time during the day when they encounter a higher voltage, and when changed conditions indicate a need for an additional test.

(i) This test shall consist of placing the bucket in contact with an energized source equal to the voltage to be encountered for a minimum of 3 minutes.

(ii) The leakage current may not exceed 1 microampere per kilovolt of nominal phase-to-ground voltage.

(iii) The employer shall immediately suspend work from the aerial lift when there is any indication of a malfunction in the equipment.

(13) *Minimum approach distance.* The employer shall ensure that employees maintain the minimum approach distances, established by the employer under §1926.960(c)(1)(i), from all grounded objects and from lines and equipment at a potential different from that to which the live-line barehand equipment is bonded, unless insulating guards cover such grounded objects and other lines and equipment.

(14) *Approaching, leaving, and bonding to energized part.* The employer shall ensure that, while an employee is approaching, leaving, or bonding to an energized

circuit, the employee maintains the minimum approach distances, established by the employer under §1926.960(c)(1)(i), between the employee and any grounded parts, including the lower boom and portions of the truck and between the employee and conductive objects energized at different potentials.

(15) *Positioning bucket near energized bushing or insulator string.* While the bucket is alongside an energized bushing or insulator string, the employer shall ensure that employees maintain the phase-to-ground minimum approach distances, established by the employer under §1926.960(c)(1)(i), between all parts of the bucket and the grounded end of the bushing or insulator string or any other grounded surface.

(16) *Handlines.* The employer shall ensure that employees do not use handlines between the bucket and the boom or between the bucket and the ground. However, employees may use nonconductive-type handlines from conductor to ground if not supported from the bucket. The employer shall ensure that no one uses ropes used for live-line barehand work for other purposes.

(17) *Passing objects to employee.* The employer shall ensure that employees do not pass uninsulated equipment or material between a pole or structure and an aerial lift while an employee working from the bucket is bonded to an energized part.

(18) *Nonconductive measuring device.* A nonconductive measuring device shall be readily accessible to employees performing live-line barehand work to assist them in maintaining the required minimum approach distance.

(d) *Towers and structures.* The following requirements apply to work performed on towers or other structures that support overhead lines.

(1) *Working beneath towers and structures.* The employer shall ensure that no employee is under a tower or structure while work is in progress, except when the employer can demonstrate that such a working position is necessary to assist employees working above.

(2) *Tag lines.* The employer shall ensure that employees use tag lines or other similar devices to maintain control of tower sections being raised or positioned, unless the employer can demonstrate that the use of such devices would create a greater hazard to employees.

(3) *Disconnecting load lines.* The employer shall ensure that employees do not detach the loadline from a member or section until they safely secure the load.

(4) *Adverse weather conditions.* The employer shall ensure that, except during emergency restoration procedures, employees discontinue work when adverse weather conditions would make the work hazardous in spite of the work practices required by this subpart.

NOTE TO PARAGRAPH (d)(4): Thunderstorms in the vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that make this work too hazardous to perform even after the employer implements the work practices required by this subpart.

§1926.965 Underground electrical installations.

(a) *Application.* This section provides additional requirements for work on underground electrical installations.

(b) *Access.* The employer shall ensure that employees use a ladder or other climbing device to enter and exit a manhole or subsurface vault exceeding 1.22 meters (4 feet) in depth. No employee may climb into or out of a manhole or vault by stepping on cables or hangers.

(c) *Lowering equipment into manholes—(1) Hoisting equipment.* 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.

(2) *Clear the area of employees.* Before anyone lowers tools or material 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.

(d) *Attendants for manholes and vaults—(1) When required.* While work is being performed in a manhole or vault containing energized electric equipment, an employee with first-aid training shall be available on the surface in the immediate vicinity of the manhole or vault entrance to render emergency assistance.

(2) *Brief entries allowed.* Occasionally, the employee on the surface may briefly enter a manhole or vault to provide nonemergency assistance.

NOTE 1 TO PARAGRAPH (d)(2): Paragraph (h) of 1926.953 may also require an attendant and does not permit this attendant to enter the manhole or vault.

NOTE 2 TO PARAGRAPH (d)(2): Paragraph (b)(1)(ii) of §1926.960 requires employees entering manholes or vaults containing unguarded, uninsulated energized lines or parts of electric equipment operating at 50 volts or more to be qualified.

(3) *Entry without attendant.* For the purpose of inspection, housekeeping, taking readings, or similar work, an employee working alone may enter, for brief periods of time, a manhole or vault where energized cables or equipment are in service if the employer can demonstrate that the employee will be protected from all electrical hazards.

(4) *Communications.* The employer shall ensure that employees maintain reliable communications, through two-way radios or other equivalent means, among all employees involved in the job.

(e) *Duct rods.* The employer shall ensure that, if employees use duct rods, the employees install the duct rods in the direction presenting the least hazard to employees. The employer shall station an employee at the far end of the duct line being rodded to ensure that the employees maintain the required minimum approach distances.

(f) *Multiple cables.* When multiple cables are present in a work area, the employer shall identify the cable to be worked by electrical means, unless its identity is obvious

by reason of distinctive appearance or location or by other readily apparent means of identification. The employer shall protect cables other than the one being worked from damage.

(g) *Moving cables.* Except when paragraph (h)(2) of this section permits employees to perform work that could cause a fault in an energized cable in a manhole or vault, the employer shall ensure that employees inspect energized cables to be moved for abnormalities.

(h) *Protection against faults—(1) Cables with abnormalities.* Where a cable in a manhole or vault has one or more abnormalities that could lead to a fault or be an indication of an impending fault, the employer shall deenergize the cable with the abnormality before any employee may work in the manhole or vault, except when service-load conditions and a lack of feasible alternatives require that the cable remain energized. In that case, employees may enter the manhole or vault provided the employer protects them from the possible effects of a failure using shields or other devices that are capable of containing the adverse effects of a fault. The employer shall treat the following abnormalities as indications of impending faults unless the employer can demonstrate that the conditions could not lead to a fault: Oil or compound leaking from cable or joints, broken cable sheaths or joint sleeves, hot localized surface temperatures of cables or joints, or joints swollen beyond normal tolerance.

(2) *Work-related faults.* If the work employees will perform in a manhole or vault could cause a fault in a cable, the employer shall deenergize that cable before any employee works in the manhole or vault, except when service-load conditions and a lack of feasible alternatives require that the cable remain energized. In that case, employees may enter the manhole or vault provided the employer protects them from the possible effects of a failure using shields or other devices that are capable of containing the adverse effects of a fault.

(i) *Sheath continuity.* When employees perform work on buried cable or on cable in a manhole or vault, the employer shall maintain metallic-sheath continuity, or the cable sheath shall be treated as energized.

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§1926.966 Substations.

(a) *Application.* This section provides additional requirements for substations and for work performed in them.

(b) *Access and working space.* The employer shall provide and maintain sufficient access and working space about electric equipment to permit ready and safe operation and maintenance of such equipment by employees.

NOTE TO PARAGRAPH (b): American National Standard *National Electrical Safety Code*, ANSI/IEEE C2-2012 contains guidelines for the dimensions of access and working space about electric equipment in substations. Installations meeting the ANSI provisions comply with paragraph (b) of this section. The Occupational Safety and Health Administration will determine whether an installation that does not conform to this ANSI standard complies with paragraph (b) of this section based on the following criteria:

(1) Whether the installation conforms to the edition of ANSI C2 that was in effect when the installation was made;

(2) Whether the configuration of the installation enables employees to maintain the minimum approach distances, established by the employer under §1926.960(c)(1)(i), while the employees are working on exposed, energized parts; and

(3) Whether the precautions taken when employees perform work on the installation provide protection equivalent to the protection provided by access and working space meeting ANSI/IEEE C2-2012.

(c) *Draw-out-type circuit breakers.* The employer shall ensure that, when employees remove or insert draw-out-type circuit breakers, the breaker is in the open position. The employer shall also render the control circuit inoperable if the design of the equipment permits.

(d) *Substation fences.* Conductive fences around substations shall be grounded. When a substation fence is expanded or a section is removed, fence sections shall be isolated, grounded, or bonded as necessary to protect employees from hazardous differences in electric potential.

NOTE TO PARAGRAPH (d): IEEE Std 80-2000, *IEEE Guide for Safety in AC Substation Grounding*, contains guidelines for protection against hazardous differences in electric potential.

(e) *Guarding of rooms and other spaces containing electric supply equipment—(1) When to guard rooms and other spaces.* Rooms and other spaces in which electric supply lines or equipment are installed shall meet the requirements of paragraphs (e)(2) through (e)(5) of this section under the following conditions:

(i) If exposed live parts operating at 50 to 150 volts to ground are within 2.4 meters (8 feet) of the ground or other working surface inside the room or other space,

(ii) If live parts operating at 151 to 600 volts to ground and located within 2.4 meters (8 feet) of the ground or other working surface inside the room or other space are guarded only by location, as permitted under paragraph (f)(1) of this section, or

(iii) If live parts operating at more than 600 volts to ground are within the room or other space, unless:

(A) The live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or

(B) The live parts are installed at a height, above ground and any other working surface, that provides protection at the voltage on the live parts corresponding to the protection provided by a 2.4-meter (8-foot) height at 50 volts.

(2) *Prevent access by unqualified persons.* Fences, screens, partitions, or walls shall enclose the rooms and other spaces so as to minimize the possibility that unqualified persons will enter.

(3) *Restricted entry.* Unqualified persons may not enter the rooms or other spaces while the electric supply lines or equipment are energized.

(4) *Warning signs.* The employer shall display signs at entrances to the rooms and other spaces warning unqualified persons to keep out.

(5) *Entrances to rooms and other.* The employer shall keep each entrance to a room or other space locked, unless the entrance is under the observation of a person who is attending the room or other space for the purpose of preventing unqualified employees from entering.

(f) *Guarding of energized parts—(1) Type of guarding.* The employer shall provide guards around all live parts operating at more than 150 volts to ground without an insulating covering unless the location of the live parts gives sufficient clearance (horizontal, vertical, or both) to minimize the possibility of accidental employee contact.

NOTE TO PARAGRAPH (f)(1): American National Standard *National Electrical Safety Code*, ANSI/IEEE C2-2002 contains guidelines for the dimensions of clearance distances about electric equipment in substations. Installations meeting the ANSI provisions comply with paragraph (f)(1) of this section. The Occupational Safety and Health Administration will determine whether an installation that does not conform to this ANSI standard complies with paragraph (f)(1) of this section based on the following criteria:

(1) Whether the installation conforms to the edition of ANSI C2 that was in effect when the installation was made;

(2) Whether each employee is isolated from energized parts at the point of closest approach; and

(3) Whether the precautions taken when employees perform work on the installation provide protection equivalent to the protection provided by horizontal and vertical clearances meeting ANSI/IEEE C2-2002.

(2) *Maintaining guards during operation.* Except for fuse replacement and other necessary access by qualified persons, the employer shall maintain guarding of energized parts within a compartment during operation and maintenance functions to prevent accidental contact with energized parts and to prevent dropped tools or other equipment from contacting energized parts.

(3) *Temporary removal of guards.* Before guards are removed from energized equipment, the employer shall install barriers around the work area to prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.

(g) *Substation entry—(1) Report upon entering.* Upon entering an attended substation, each employee, other than employees regularly working in the station, shall report his or her presence to the employee in charge of substation activities to receive information on special system conditions affecting employee safety.

(2) *Job briefing.* The job briefing required by §1926.952 shall cover information on special system conditions affecting employee safety, including the location of energized equipment in or adjacent to the work area and the limits of any deenergized work area.

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§1926.967 Special conditions.

(a) *Capacitors.* The following additional requirements apply to work on capacitors and on lines connected to capacitors.

NOTE TO PARAGRAPH (a): See §§1926.961 and 1926.962 for requirements pertaining to the deenergizing and grounding of capacitor installations.

(1) *Disconnect from energized source.* Before employees work on capacitors, the employer shall disconnect the capacitors from energized sources and short circuit the capacitors. The employer shall ensure that the employee short circuiting the capacitors waits at least 5 minutes from the time of disconnection before applying the short circuit.

(2) *Short circuiting units.* Before employees handle the units, the employer shall short circuit each unit in series-parallel capacitor banks between all terminals and the capacitor case or its rack. If the cases of capacitors are on ungrounded substation racks, the employer shall bond the racks to ground.

(3) *Short circuiting connected lines.* The employer shall short circuit any line connected to capacitors before the line is treated as deenergized.

(b) *Current transformer secondaries.* The employer shall ensure that employees do not open the secondary of a current transformer while the transformer is energized. If the employer cannot deenergize the primary of the current transformer before employees perform work on an instrument, a relay, or other section of a current transformer secondary circuit, the employer shall bridge the circuit so that the current transformer secondary does not experience an open-circuit condition.

(c) *Series streetlighting—(1) Applicable requirements.* If the open-circuit voltage exceeds 600 volts, the employer shall ensure that employees work on series streetlighting circuits in accordance with §1926.964 or §1926.965, as appropriate.

(2) *Opening a series loop.* Before any employee opens a series loop, the employer shall deenergize the streetlighting transformer and isolate it from the source of supply or shall bridge the loop to avoid an open-circuit condition.

(d) *Illumination.* The employer shall provide sufficient illumination to enable the employee to perform the work safely.

NOTE TO PARAGRAPH (d): See §1926.56, which requires specific levels of illumination.

(e) *Protection against drowning—(1) Personal flotation devices.* Whenever an employee may be pulled or pushed, or might fall, into water where the danger of drowning exists, the employer shall provide the employee with, and shall ensure that the employee uses, a personal flotation device meeting §1926.106.

(2) *Maintaining flotation devices in safe condition.* The employer shall maintain each personal flotation device in safe condition and shall inspect each personal flotation

device frequently enough to ensure that it does not have rot, mildew, water saturation, or any other condition that could render the device unsuitable for use.

(3) *Crossing bodies of water.* An employee may cross streams or other bodies of water only if a safe means of passage, such as a bridge, is available.

(f) *Excavations.* Excavation operations shall comply with subpart P of this part.

(g) *Employee protection in public work areas—(1) Traffic control devices.* Traffic-control signs and traffic-control devices used for the protection of employees shall meet §1926.200(g)(2).

(2) *Controlling traffic.* Before employees begin work in the vicinity of vehicular or pedestrian traffic that may endanger them, the employer shall place warning signs or flags and other traffic-control devices in conspicuous locations to alert and channel approaching traffic.

(3) *Barricades.* The employer shall use barricades where additional employee protection is necessary.

(4) *Excavated areas.* The employer shall protect excavated areas with barricades.

(5) *Warning lights.* The employer shall display warning lights prominently at night.

(h) *Backfeed.* When 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 requirements of §1926.960 apply if employees will work the lines or equipment as energized, and the requirements of §§1926.961 and 1926.962 apply if employees will work the lines or equipment as deenergized.

(i) *Lasers.* The employer shall install, adjust, and operate laser equipment in accordance with §1926.54.

(j) *Hydraulic fluids.* Hydraulic fluids used for the insulated sections of equipment shall provide insulation for the voltage involved.

(k) *Communication facilities—(1) Microwave transmission.* (i) The employer shall ensure that no employee looks into an open waveguide or antenna connected to an energized microwave source.

(ii) If the electromagnetic-radiation level within an accessible area associated with microwave communications systems exceeds the radiation-protection guide specified by §1910.97(a)(2) of this chapter, the employer shall post the area with warning signs containing the warning symbol described in §1910.97(a)(3) of this chapter. The lower half of the warning symbol shall include the following statements, or ones that the employer can demonstrate are equivalent: “Radiation in this area may exceed hazard limitations and special precautions are required. Obtain specific instruction before entering.”

(iii) When an employee works in an area where the electromagnetic radiation could exceed the radiation-protection guide, the employer shall institute measures that ensure that the employee's exposure is not greater than that permitted by that guide. Such measures may include administrative and engineering controls and personal protective equipment.

(2) *Power-line carrier.* The employer shall ensure that employees perform power-line carrier work, including work on equipment used for coupling carrier current to power line conductors, in accordance with the requirements of this subpart pertaining to work on energized lines.

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§1926.968 Definitions.

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.

Automatic circuit recloser. A self-controlled device for automatically interrupting and reclosing an alternating-current circuit, with a predetermined sequence of opening and reclosing followed by resetting, hold closed, or lockout.

Barricade. A physical obstruction such as tapes, cones, or A-frame type wood or metal structures that provides a warning about, and limits access to, a hazardous area.

Barrier. A physical obstruction that prevents contact with energized lines or equipment or prevents unauthorized access to a work area.

Bond. The electrical interconnection of conductive parts designed to maintain a common electric potential.

Bus. A conductor or a group of conductors that serve as a common connection for two or more circuits.

Bushing. An insulating structure that includes a through conductor or that provides a passageway for such a conductor, and that, when mounted on a barrier, insulates the conductor from the barrier for the purpose of conducting current from one side of the barrier to the other.

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).

Cable sheath. A conductive protective covering applied to cables.

NOTE TO THE DEFINITION OF "CABLE SHEATH": A cable sheath may consist of multiple layers one or more of which is conductive.

Circuit. A conductor or system of conductors through which an electric current is intended to flow.

Clearance (between objects). The clear distance between two objects measured surface to surface.

Clearance (for work). Authorization to perform specified work or permission to enter a restricted area.

Communication lines. (See *Lines; (1) Communication lines.*)

Conductor. A material, usually in the form of a wire, cable, or bus bar, used for carrying an electric current.

Contract employer. An employer, other than a host employer, that performs work covered by subpart V of this part under contract.

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.

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.

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

NOTE TO THE DEFINITION OF "DEENERGIZED": The term applies only to current-carrying parts, which are sometimes energized (alive).

Designated employee (designated person). An employee (or person) who is assigned by the employer to perform specific duties under the terms of this subpart and who has sufficient knowledge of the construction and operation of the equipment, and the hazards involved, to perform his or her duties safely.

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

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

Electric supply lines. (See "*Lines; (2) Electric supply lines.*")

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

Enclosed 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, and that, under normal conditions, does not contain a hazardous atmosphere, but may contain a hazardous atmosphere under abnormal conditions.

NOTE TO THE DEFINITION OF "ENCLOSED SPACE". The Occupational Safety and Health Administration does not consider spaces that are enclosed but not designed for employee entry under normal operating conditions to be enclosed spaces for the purposes of this subpart. Similarly, the Occupational Safety and Health Administration does not consider spaces that are enclosed and that are expected to contain a hazardous atmosphere to be enclosed spaces for the purposes of this subpart. Such spaces meet the definition of permit spaces in subpart AA of this part, and entry into them must conform to that standard.

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.

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

Entry (as used in §1926.953). The action by which a person passes through an opening into an enclosed space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

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.

Exposed, Exposed to contact (as applied to energized parts). Not isolated or guarded.

Fall restraint system. A fall protection system that prevents the user from falling any distance.

First-aid training. Training in the initial care, including cardiopulmonary resuscitation (which includes chest compressions, rescue breathing, and, as appropriate, other heart and lung resuscitation techniques), performed by a person who is not a medical practitioner, of a sick or injured person until definitive medical treatment can be administered.

Ground. A conducting connection, whether planned or unplanned, between an electric circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Grounded. Connected to earth or to some conducting body that serves in place of the earth.

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 inadvertent contact by persons or objects.

NOTE TO THE DEFINITION OF "GUARDED": Wires that are insulated, but not otherwise protected, are not guarded.

Hazardous atmosphere. An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from an enclosed 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 TO THE DEFINITION OF "HAZARDOUS ATMOSPHERE" (2): This concentration may be approximated as a condition in which the dust obscures vision at a distance of 1.52 meters (5 feet) 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 D, *Occupational Health and Environmental Controls*, or in Subpart Z, *Toxic and Hazardous Substances*, of this part and which could result in employee exposure in excess of its dose or permissible exposure limit;

NOTE TO THE DEFINITION OF "HAZARDOUS ATMOSPHERE" (4): 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 TO THE DEFINITION OF "HAZARDOUS ATMOSPHERE" (5): For air contaminants for which the Occupational Safety and Health Administration has not determined a dose or permissible exposure limit, other sources of information, such as Safety Data Sheets (SDS) that comply with the Hazard Communication Standard, §1910.1200, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

High-power tests. Tests in which the employer uses fault currents, load currents, magnetizing currents, and line-dropping currents to test equipment, either at the equipment's rated voltage or at lower voltages.

High-voltage tests. Tests in which the employer uses voltages of approximately 1,000 volts as a practical minimum and in which the voltage source has sufficient energy to cause injury.

High wind. A wind of such velocity that one or more of the following hazards would be present:

(1) The wind could blow an employee from an elevated location,

(2) The wind could cause an employee or equipment handling material to lose control of the material, or

(3) The wind would expose an employee to other hazards not controlled by the standard involved.

NOTE TO THE DEFINITION OF "HIGH WIND": The Occupational Safety and Health Administration normally considers winds exceeding 64.4 kilometers per hour (40 miles per hour), or 48.3 kilometers per hour

(30 miles per hour) if the work involves material handling, as meeting this criteria, unless the employer takes precautions to protect employees from the hazardous effects of the wind.

Host employer. An employer that operates, or that controls the operating procedures for, an electric power generation, transmission, or distribution installation on which a contract employer is performing work covered by subpart V of this part.

NOTE TO THE DEFINITION OF "HOST EMPLOYER": The Occupational Safety and Health Administration will treat the electric utility or the owner of the installation as the host employer if it operates or controls operating procedures for the installation. If the electric utility or installation owner neither operates nor controls operating procedures for the installation, the Occupational Safety and Health Administration will treat the employer that the utility or owner has contracted with to operate or control the operating procedures for the installation as the host employer. In no case will there be more than one host employer.

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 TO THE DEFINITION OF "IMMEDIATELY DANGEROUS TO LIFE OR HEALTH": 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.

Insulated. Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

NOTE TO THE DEFINITION OF "INSULATED": When any object is said to be insulated, it is understood to be insulated for the conditions to which it normally is subjected. Otherwise, it is, for the purpose of this subpart, uninsulated.

Insulation (cable). Material relied upon to insulate the conductor from other conductors or conducting parts or from ground.

Isolated. Not readily accessible to persons unless special means for access are used.

Line-clearance tree trimming. The pruning, trimming, repairing, maintaining, removing, or clearing of trees, or the cutting of brush, that is within the following distance of electric supply lines and equipment:

- (1) For voltages to ground of 50 kilovolts or less—3.05 meters (10 feet);
- (2) For voltages to ground of more than 50 kilovolts—3.05 meters (10 feet) plus 0.10 meters (4 inches) for every 10 kilovolts over 50 kilovolts.

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 TO THE DEFINITION OF "COMMUNICATION LINES": 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 subpart, and those of less than 400 volts are considered as supply lines, if so run and operated throughout.

Manhole. A subsurface enclosure that personnel may enter and that is used for installing, operating, and maintaining submersible equipment or cable.

Minimum approach distance. The closest distance an employee may approach an energized or a grounded object.

NOTE TO THE DEFINITION OF "MINIMUM APPROACH DISTANCE": Paragraph (c)(1)(i) of §1926.960 requires employers to establish minimum approach distances.

Personal fall arrest system. A system used to arrest an employee in a fall from a working level.

Qualified employee (qualified person). An employee (person) knowledgeable in the construction and operation of the electric power generation, transmission, and distribution equipment involved, along with the associated hazards.

NOTE 1 TO THE DEFINITION OF "QUALIFIED EMPLOYEE (QUALIFIED PERSON)": An employee must have the training required by §1926.950(b)(2) to be a qualified employee.

NOTE 2 TO THE DEFINITION OF "QUALIFIED EMPLOYEE (QUALIFIED PERSON)": Except under §1926.954(b)(3) (iii), an employee who is undergoing on-the-job training and who has demonstrated, in the course of such training, 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 a qualified person for the performance of those duties.

Statistical sparkover voltage. A transient overvoltage level that produces a 97.72-percent probability of sparkover (that is, two standard deviations above the voltage at which there is a 50-percent probability of sparkover).

Statistical withstand voltage. A transient overvoltage level that produces a 0.14-percent probability of sparkover (that is, three standard deviations below the voltage at which there is a 50-percent probability of sparkover).

Switch. A device for opening and closing or for changing the connection of a circuit. In this subpart, a switch is manually operable, unless otherwise stated.

System operator. A qualified person designated to operate the system or its parts.

Vault. An enclosure, above or below ground, that personnel may enter and that is used for installing, operating, or maintaining equipment or cable.

Vented vault. A vault that has provision for air changes using exhaust-flue stacks and low-level air intakes operating on pressure and temperature differentials that provide for airflow that precludes a hazardous atmosphere from developing.

Voltage. The effective (root mean square, or rms) potential difference between any two conductors or between a conductor and ground. This subpart expresses voltages 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.

Work-positioning equipment. A body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a utility pole or tower leg, and work with both hands free while leaning.

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