Best Practice #223

Facility: DOE Complex

Best Practice Title Electrical Safety Processes for Utility/Commingled Distribution Systems

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Brief Description of Best Practice: Many DOE sites have interfaces between public utility, site-owned utility, and facility premises wiring. NFPA 70E provides guidance on facility premises wiring safe work practices, while 29 CFR 1910.269 provides guidance on safe work practices for power generation, transmission, and distribution. This best practice will provide guidance to define service point boundaries and define which safe work practices apply.

Why the best practice should be used: The Best Practice should be used to clarify when 29 CFR 1910.269 applies and when NFPA 70E applies in order to reduce the risk of electrical injury caused by applying the incorrect work practices.

What are the benefits of the best practice: This Best Practice provides consistent implementation guidance for determining the boundaries of interfaces between 29 CFR 1910.269 and NFPA 70E to ensure the appropriate safe work practices are utilized.

What problems/issues were associated with the best practice: No consistent and comprehensive guidance currently exists regarding interfaces between 29 CFR 1910.269 and NFPA 70E. DOE sites' electrical systems are complex, with a variety of differing generation, transmission, and distribution systems and equipment. In addition, most sites have different organizational structures to support the specific systems and equipment at their site.

How will the success of the Best Practice be measured: Several DOE sites have successfully implemented – formally or informally – a service level agreement and program description document defining the applicability of 29 CFR 1910.269, NFPA 70E, or other equivalent standards.

Description of process experience using the Best Practice: The known operating experience to date is limited to a few sites associated with the development of this product who have successfully employed some or all of the components of this Best Practice at their respective sites.

Definitions:

Qualified Person – For the purposes of this Best Practice, Qualified Person refers to someone qualified according to 29 CFR 1910.269

Clearances – De-energizing of transmission and/or distribution lines for employee protection according to 29 CFR 1910.269 (m)

Lockout/Tagout (LOTO) – For the purposes of this Best Practice, establishing an electrically safe work condition is assumed to be performed according to NFPA 70E

Site-owned Utility – Refers to all points between the Public Utility feed to the Service Point at the premises wiring. Typically includes Transmission & Distribution Operations (Medium and High Voltage Maintenance and Operations), and in some instances, lower voltages.

29 CFR 1910.269 – For simplicity sake, within this Best Practice, when 29 CFR 1910.269 is referenced, it infers compliance with the appropriate OSHA Requirements including 1910.269, 1926 Subpart V, or applicable sections of 1910 Subpart S

Subcontractor – Includes all tiers of subcontractors.

Distribution System - Electrical systems 2.4kV to 15kV, not including premises wiring.

Transmission System – Electrical systems greater than 15kV

Service Level Agreement – A documented agreement that defines the service point, the equipment involved, and the boundary between the site-owned utility and facility premises wiring. Roles and responsibilities will also be defined, establishing the interface between the organizations/groups for the purpose of coordinating safe work practices.

Public Utility Service Point – The point of connection between the public utility electric supply system and the onsite utility (medium and high voltage maintenance and operation) electric supply system.

Service Point – The point of connection between the facilities of the serving utility and the premises wiring. [NFPA 70E 2018] Service points defined herein only apply to those within the exclusive control of the Contractor.

Establishing Service Level Agreement

Service level agreements (SLA) are used to clearly define the boundary interface between site-owned utility and facility premises wiring equipment. The service point(s) are established at these boundary locations. The SLA should contain the following components:

Description of the equipment involved at boundary location:

The service point for each boundary location should be identified, describing the organization responsible for maintenance and operation of each piece of equipment included in the boundary interface. Each piece of equipment included in the boundary interface should be clearly documented in the SLA. Configuration management of up-to-date one line diagrams are essential, and should be contained or referenced in the SLA with the service point(s) clearly demarcated. Electrical systems nominal voltages should be clearly identified in the SLA.

Operational Responsibility and Notification

Responsibility for equipment maintenance and operation should be clearly identified within the SLA. Methods of notification for maintenance and operation of equipment that may effect other organization(s) should be documented.

Area Control

Access to boundary interface areas should be limited to those personnel qualified and approved for entry. Access requirements for non-qualified personnel should be clearly defined (i.e. escorted by a person qualified and approved for entry, limited-access training, etc.). Substations, switchyards, switchgear, mobile substation, and generating facilities are examples of areas recommended to have access controls.

Emergency response plans should clearly define access controls for first responders (e.g. security, fire department, EMTs, etc.).

Coordination of clearances with lockout/tagout (LOTO)

The SLA should include, or reference, a process for integrating clearance(s) and LOTO. Responsibilities should be clearly defined to coordinate work being performed that spans the service point.

Subcontractor Interface

The SLA should include responsibilities and scope when subcontractor work is being performed on or adjacent to the service point. The SLA should include appropriate points of contacts between all applicable work groups. The agreement should contain defined methods to provide the Information Transfer required by 29 CFR 1910.269 and/or Host/Contractor Responsibility required by NFPA 70E.

Other Information

Site specific information not already identified in this best practice should be considered in the SLA (e.g. projected maintenance or operational schedules, load/capacity/generation change, etc.).

Program Requirements Implementation Matrix

The program requirements implementation matrix is intended to be an analysis of how 29 CFR 1910.269 requirements are met. The analysis cross references the requirements outlined in 29 CFR 1910.269 with site specific internal operating procedures, training, and qualification programs. The program requirements implementation matrix can be used to identify where other standards or regulations such as NFPA 70E, 29 CFR 1926 Subpart V, 29 CFR 1910 Subpart S may apply. The program requirements implementation matrix is intended to ensure a comprehensive approach to 29 CFR 1910.269 is achieved. A sample matrix is included in Appendix A which may be customized to each specific site, or an equivalent format may be utilized.

Appendix A

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Program Requirements Document

(Organization Name here) 29 CFR 1910.269 Electric Power Generation, Transmission, and Distribution Implementation

REVISION LOG

Rev.	Date	Affected Pages	Revision Description

CONTENTS

1. PURPOSE

This document identifies how (Organization name here) complies with and/or implements OSHA Standard 1910.269 Electric Power Generation, Transmission, and Distribution as the (DOE site name here) transmission and distribution power utility organization.

2. APPLICABILITY

All (DOE site name here) power transmission and distribution activities within the definition of OSHA 1910.269 Electrical Power Generation, Transmission, and Distribution.

3. REQUIREMENTS

Section	Subject	Citation	Compliance/ Implementation Method
1910.269(a) General			
1910.269(a)(2)(i)	Training	All employees performing work covered by this section shall be trained as follows: (A) Each employee shall be trained in, and familiar with, safety-related work practices, safety procedures, and other safety requirements that pertain to his or her job assignments. (B)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 section but that are related to his or her work and are necessary for his or her safety. (C)The degree of training shall be determined by the risk to the employee for the hazard involved.	
1910.269(a)(2) (ii)	Training	Each qualified employee shall also be trained and competent in: (A)The skills and techniques necessary to distinguish	

Section	Subject	Citation	Compliance/ Implementation Method
		exposed live parts from other parts of electric equipment. (B)The skills and techniques necessary to determine the nominal voltage of exposed live parts. (C)The minimum approach distances specified in the section corresponding to the voltages to which the qualified employee will be exposed and the skills and techniques necessary to maintain those distances. (D)The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment, and (E)The recognition of electrical hazards to which the employee may be exposed and the skills and techniques necessary to control or avoid these hazards.	
1910.269(a)(2) (iii)		Each line-clearance tree trimmer who is not a qualified employee shall also be trained and competent in: (A)The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment. (B)The skills and techniques necessary to determine the nominal voltage of exposed live parts, and	

Section	Subject	Citation	Compliance/ Implementation Method
		(C)The minimum approach distances specified in this section corresponding to the voltages to which the employee will be exposed and the skills and techniques necessary to maintain those distances.	
1910.269(a)(2) (iv)		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 section.	
1910.269(a)(2) (v)		An employee shall receive additional training (or retraining) under any of the following conditions: (A)If the supervision or annual inspections required by paragraph (a)(2)(iv) of this section indicate that the employee is not complying with the safety-related work practices required by this section, or (B) If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use, or (C)If he or she must employ safety-related work practices that are not normally used during his or her regular job duties. Note to paragraph (a)(2)(v)(C): The Occupational Safety and Health Administration considers tasks that are	

Section	Subject	Citation	Compliance/ Implementation Method
		performed less often than once per year to necessitate retraining before the performance of the work practices involved.	
1910.269(a)(2) (vi)		The training required by paragraph (a)(2) of this section shall be of the classroom or on-the-job type.	
1910.269(a)(2) (vii)		Training shall establish employee proficiency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.	
1910.269(a)(2) (viii)		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 (a)(2) of this section.	
1910.269(a)(3)	Information Transfer	(a)(3) Information Transfer	
1910.269(a)(3)(i)		Before work begins, the host employer shall inform contract employers of: (A)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 (a)(4)(i) through (a)(4)(v) of this section; (B)Conditions that are related to the safety of the work to be performed, that are listed in paragraphs (a)(4)(vi) through (a)(4)viii) of this section, and	•

Section	Subject	Citation	Compliance/ Implementation Method
		that are known to the host employer; (C)Information about the design and operation of the host employer's installation that the contract employer needs to make the assessments required by this section; and (D)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.	
1910.269(a)(3)(ii)		Contract employers shall comply with the following requirements: (A)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 (a)(3)(i) of this section. (B)Before work begins, the contract employer shall advise the host employer of any unique hazardous conditions presented by the contract employer's work. (C)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	

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		mention under paragraph (a)(3)(i) of this section. The contract employer shall provide this information to the host employer within 2 working days after discovering the hazardous condition.	
1910.269(a)(3)(iii)		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 section.	
1910.269(a)(4)	Existing characteristic 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 electric lines or equipment is started. Conditions include, but are not limited to: (i)The nominal voltages of lines and equipment, (ii)The maximum switching-transient voltages, (iii)The presence of hazardous induced voltages, (iv)The presence of protective grounds and equipment grounding conductors, (v)The locations of circuits and equipment, including electric supply lines, communication lines, and fire protective signaling circuits, (vi)The condition of poles, and	

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		(vii)Environmental conditions relating to safety.	
1910.269(b)	Medical Services and First Aid	Employer shall provide medical services and first aid as required in 1910.151. In addition to the requirements of 1910.151, the following requirements also apply:	
1910.269(b)	First Aid Training	When employees are performing work on, or associated with, exposed lines or equipment energized at 50 volts or more, persons with first-air training shall be available as follows:	
1910.269(b)(1)(i)	Cardio-pulmonary Resuscitation and First Aid Training	For field work involving two or more employees at a work location, at least two trained persons shall be available. However, for line-clearance tree trimming operations performed by line-clearance tree trimmers who are not qualified employees, only one trained person need be available if all new employees are trained in first aid within 3 months of their hiring dates.	
1910.269(b)(1) (ii)		For fixed work locations such as substations, the number of trained persons 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	

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		employee at the work location shall be a trained employee.	
1910.269(b)(2)	First Aid Supplies	First aid supplies required by 1910.151(b) shall be placed in weatherproof containers if the supplies could be exposed to the weather.	
		The employer shall maintain each first-aid kit, shall ensure that it is readily available for use, and shall inspect it frequently enough to ensure that expended items are replaced. The employer also shall inspect each first aid kit at least once per year.	
1910.269(c)(1)	Before each job	(i)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 paragraph (2)(4) of this section. (ii)The employer shall ensure that the employee in charge conducts a job briefing that meets paragraphs (c)(2), (c)(3), and (c)(4) of this section with the employees involved before they start each job.	
1910.269(c)(2)	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	

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		personal protective equipment requirements.	
1910.269(c)(3)	Number of Briefings	(i)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. (ii)Additional job briefings shall be held if significant changes, which might affect the safety of employees, occur during the course of the work.	
1910.269(c)(4)	Extent of Briefing	(i)A brief discussion is satisfactory if the work involved is routine and if the employee s, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job. (ii)A more extensive discussion shall be conducted (A) If work is complicated or particularly hazardous (B) If the employee cannot be expected to recognize and avoid the hazards involved in the job. Note to paragraph (c)(4): The briefing must address all the subjects listed in paragraph (c)(2) of this section.	
1910.269(c)(5)	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.	

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1910.269(d)(1)	Application	The provisions of paragraph (d) of this section apply to the use of lockout/tagout procedures for the control of energy sources in installations for the purpose of electric power generation, including related equipment for communication or metering. Locking and tagging procedures of the deenergizing of electric energy sources which are used exclusively for purposes of transmission and distribution are addressed by paragraph (m) of this section.	
1910.269(e)	Enclosed Spaces	This paragraph 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 paragraph applies to routine entry into enclosed spaces in lieu of the permit-space entry requirements contained in paragraphs (d) through (k) of 1910.146. If, after the employer takes the precautions given in paragraphs (e) and (t) of this section, the hazards remaining in the enclosed space endanger the life of an entrant or could interfere with an entrant's escape from the space, the entry into the enclosed space shall meet the permit-space entry requirements of paragraphs (d)	

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		through (k) of 1910.146 of this Part are considered as complying with paragraph (e) of this section.	
1910.269(f)	Excavations	Excavation operations shall comply with Subpart P of Part 1926 of this chapter.	
1910.269(g)(1)	General	Personal protective equipment shall meet the requirements of Subpart I of this part.	
1910.269(g)(2)	Fall Protection		
1910.269(g)(2)(i)		Personal fall arrest equipment shall meet the requirements of Subpart M of Part 1926.	
1910.269(g)(2)(ii)		Personal fall arrest equipment used by employees who are exposed to hazards from flames or electric arcs, as determined by the employer under paragraph (l)(8)(i) of this section, shall be capable of passing a drop test equivalent to that required by paragraph (g)(2)(iii)(L) of this section after exposure to an electric arc with a heat energy of 40+or- cal/cm2.	
1910.269(g)(2)(iii)		Body belts, and positioning straps for work-positioning equipment shall meet the following requirements:	

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1910.269(g)(2)(iii)(A)		Hardware for body belts and positioning straps shall meet the following requirements: *(1)* Hardware shall be made of drop-forged steel, pressed steel, formed steel, or equivalent material. *(2)* Hardware shall have a corrosion-resistant finish. *(3)* Hardware surfaces shall be smooth and free of sharp edges.	
1910.269(g)(2)(iii)(B)		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).	
1910.269(g)(2)(iii)(C)		D rings shall be capable of withstanding a 22-kilonewton (5,000-pound-force) tensile test without cracking or breaking.	
1910.269(g)(2)(iii)(D)		Snaphooks shall be capable of withstanding a 22-kilonewton (5,000-pound-force) tension test without cracking or breaking.	
1910.269(g)(2)(iii)(E)		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.	
1910.269(g)(2)(iii)(F)		Plied fabric used in positioning straps and in load-bearing parts of body belts shall be constructed in such a way that	

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		no raw edges are exposed and the plies do not separate.	
1910.269(g)(2)(iii)(G)		Positioning straps shall be capable of withstanding the following tests: *(1)* A dielectric test of 819.7 volts, AC, per centimeter (25,000 volts per foot) for 3 minutes without visible deterioration; *(2)* 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; *(3)* 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; *(4)* A buckle-tear test with a load of 4.4 kilonewtons (1,000 pounds-force); and *(5)* A flammability test in accordance with Table R-2.	
1910.269(g)(2)(iii)(H)		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.	
1910.269(g)(2)(iii)(I)		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.	

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1910.269(g)(2)(iii)(J)		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.	
1910.269(g)(2)(iii)(K)		Snaphooks shall be of the locking type meeting the following requirements: *(1)* The locking mechanism shall first be released, or a destructive force shall be placed on the keeper, before the keeper will open. *(2)* 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. *(3)* 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).	
1910.269(g)(2)(iii)(L)		Body belts and positioning straps shall be capable of withstanding a drop test as follows: *(1)* 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	

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		increased proportionally (that is, the test mass must equal the mass of the equipped worker divided by 1.4) *(2)* 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. *(3)* 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. *(4)* 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. *(5)* Body belts shall successfully arrest the fall of the test mass and shall be capable of supporting the mass after the test. *(6)* Positioning straps shall successfully arrest the fall of the test mass without breaking, and the arrest force may not exceed 17.8 kilonewtons (4,00 pounds-force). Additionally, snaphooks on positioning straps may not distort to such	

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		an extent that the keeper would release.	
1910.269(g)(2) (iv)		The following requirements apply to the care and use of personal fall protection equipment.	
1910.269(g)(2) (iv)(A)		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.	
1910.269(g)(2) (iv)(B)		Personal fall arrest systems shall be used in accordance with 1926.502(d).	
1910.269(g)(2) (iv)(C)		The employer shall ensure that employees use fall protection systems as follows: (1)Each employee working from an aerial lift shall use a fall restraint system or a personal fall arrest system. Paragraph (c)(2)(v) of 1910.67 does not apply. (2)Except as provided in paragraph (g)(2)(iv)(C)(3) 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 D of this part. (3)Until March 31, 2015, a qualified employee climbing or	

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		changing location on poles, towers, or similar structures…	
1910.269(g)(2) (iv)(D)		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).	
1910.269(g)(2) (iv)(E)		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.	
1910.269(g)(2) (iv)(F)		Unless the snap hook is a locking type and designated specifically for the following connections, snap hooks on work-positioning equipment may not be engaged: *(1)*Directly to webbing, rope, or wire rope; *(2)*To each other; *(3)*To a D ring to which another snap hook or other connector is attached; *(4)*To a horizontal lifeline: or *(5)*To any object that is incompatibly shaped or dimensioned in relation to the snap hook such that accidental disengagement could occur should the connected object sufficiently depress the snap hook keeper to allow release of the object.	
1910.269(h)(1)	General	Requirements for portable ladders contained in Subpart D of this Part apply in addition to	

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		the requirements of paragraph (h) of this section, except as specifically noted in paragraph (h)(2) of this section.	
1910.269(h)(2)	Special Ladders and Platforms	Portable ladders used on structures or conductors in conjunction with overhead line work need not meet 1910.25(d)(2)(i) and (d)(2)(iii) or 1910.26(c)(3)(iii) of 1910.26. Portable ladders and platforms used on structures or conductors in conjunction with overhead line work shall meet the following requirements:	
1910.269(h)(2)(i)		In the configurations in which they are used, portable ladders and platforms shall be capable of supporting without failure at least 2.5 times the maximum intended load.	
1910.269(h)(2) (ii)		Portable ladders and platforms may not be loaded in excess of the working loads for which they are designed.	
1910.269(h)(2) (iii)		Portable ladders and platforms shall be secured to prevent them becoming dislodged.	
1910.269(h)(2) (iv)		Ladders and platforms may be used only in applications for which they were designed.	
1910.269(h)(3)	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	

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		employer demonstrates that nonconductive ladders would present a greater hazard than conductive ladders.	
1910.269(i)(1)	General	Paragraph (i) (2) of this section applies to electric equipment connected by cord and plug. Paragraph (i)(3) of this section applies to portable and vehicle-mounted generators used to supply cord and plug connected equipment. Paragraph (i)(4) of this section applies to hydraulic and pneumatic tools.	
1910.269(i)(2)	Cord- and Plug-Connected Equipment	Cord and plug connected equipment not covered by Subpart S of this part shall comply with one of the following instead of 1910.243(a)(5):	
1910.269(i)(2)(i)		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	
1910.269(i)(2)(ii)		The equipment shall be of the double-insulated type conforming to Subpart S of this Part; or	
1910.269(i)(2)(iii)		The equipment shall be connected to the power supply through an isolating transformer with an	

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		ungrounded secondary of not more than 50 volts.	
1910.269(i)(3)	Portable and Vehicle-Mounted Generators	Portable and vehicle-mounted generators used to supply cord- and plug-connected equipment covered by paragraph (i)(2) of this section shall meet the following requirements.	
1910.269(i)(3) (i)		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.	
910.269(i)(3)(ii)		The non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles shall be bonded to the generator frame.	
1910.269(i)(3) (iii)		For vehicle-mounted generators, the frame of the generator shall be bonded to the vehicle frame.	
1910.269(i)(3) (iv)		Any neutral conductor shall be bonded to the generator frame.	
1910.269(i)(4)	Hydraulic and Pneumatic Tools		
1910.269(i)(4)(i)		Safe operating pressures for hydraulic and pneumatic tools, hoses, valves, pipes, filters, and fittings may not be exceeded.	
1910.269(i)(4)(ii)		A hydraulic or pneumatic tool used where it may contact exposed energized parts shall	

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		be designed and maintained for such use.	
1910.269(i)(4) (iii)		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.	
1910.269(i)(4) (iv)		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.	
1910.269(i)(4)(v)		Pressure shall be released before connections are broken, unless quick acting, self-closing connectors are used.	
1910.269(i)(4) (vi)		Employees must ensure that employees do not use any part of their bodies to locate, or attempt to stop, a hydraulic leak.	
1910.269(i)(4) (vi)		Hoses may not be kinked.	
1910.269(j)(1)	Design of Tools	Live-line tool rods, tubes, and poles shall be designed and constructed to withstand the following minimum tests:	
1910.269(j)(1) (i)		If the tool is made of fiberglass-reinforced plastic (FRP), it shall withstand 3281 volts per meter	

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		(100,000 volts per foot) of length for 5 minutes, or	
1910.269(j)(1) (ii)		If the tool is made of wood, it shall withstand 2461 volts per meter (75,000 volts per foot) of length for 3 minutes, or	
1910.269(j)(1) (iii)		The tool shall withstand other tests that the employer can demonstrate are equivalent.	
1910.269(j)(2)	Condition of Tools		
1910.269(j)(2) (i)		Each live-line tool shall be wiped clean and visually inspected for defects before use each day.	
1910.269(j)(2) (ii)		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 (j)(2)(iii) of this section before being returned to service.	
1910.269(j)(2) (iii)		Live-line tools used for primary employee protection shall be removed from service every 2 years and whenever required under paragraph (j)(2)(ii) of this section for examination, cleaning, repair, and testing as follows:	
1910.269(j)(2) (iii) (A)		Each tool shall be thoroughly examined for defects.	
1910.269(j)(2) (iii) (B)		If a defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is found, the tool shall	

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		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.	
1910.269(j)(2) (iii) (C)		The tool shall be tested in accordance with paragraphs (j)(2)(iii)(D) and (j)(2)(iii)(E) of this section under the following conditions:	
1910.269(j)(2) (iii) (C)(1)		After the tool has been repaired or refinished; and	
1910.269(j)(2) (iii) (C)(2)		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.	
1910.269(j)(2) (iii) (D)		The test method used shall be designed to verify the tool's integrity along its entire working length and, if the tool is made of fiberglass-reinforced plastic, its integrity under wet conditions.	
1910.269(j)(2) (iii) (E)		The voltage applied during the tests shall be as follows:	
1910.269(j)(2) (iii) (E)(1)		246,100 volts per meter (75,000 volts per foot) of length for 1 minute if the tool is made of fiberglass, or	
1910.269(j)(2)		164,000 volts per meter (50,000 volts per foot) of length	

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(iii) (E)(2)		for 1 minute if the tool is made of wood, or	
1910.269(j)(2) (iii) (E)(3)		Other tests that the employer can demonstrate are equivalent.	
1910.269(k)(1)	General	Material handling and storage shall comply with applicable material handling and material storage requirements in this part, including those in Subpart N of this Part.	
1910.269(k)(2)	Materials Storage Near Energized Lines or Equipment		
1910.269(k)(2) (i)		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.	
1910.269(k)(2) (i)(A)		For lines and equipment energized at 50 kilovolts or less, the distance is 3.05 meters (10 feet).	
1910.269(k)(2) (i)(B)		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.	

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1910.269(k)(2) (ii)		In areas restricted to qualified employees, material may not be stored within the working space about energized lines or equipment.	
		This paragraph applies to work on exposed live parts, or near enough to them to expose the employee to any hazard they present.	
1910.269(l)(1)	General	(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. (iii)Electric lines and equipment shall be considered and treated as energized unless they have been deenergized in accordance with paragraph (d) or paragraph (m) of this section.	
1910.269(l)(2)	<u>At least two employees</u>		
1910.269(l)(2) (i)		Except as provided in paragraph (l)(1)(ii) of this section, at least two employees shall be present while any employees perform the following types of work:	

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1910.269(l)(2) (i)(A)		Installation, removal, or repair of lines that are energized at more than 600 volts,	
1910.269(l)(2) (i)(B)		Installation, removal, or repair of deenergized lines if an employee is exposed to contact with other parts energized at more than 600 volts.,	
1910.269(l)(2) (i)(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,	
1910.269(l)(2) (i)(D)		Work involving the use of mechanical equipment, other than insulated aerial lifts, near parts energized at more than 600 volts.	
1910.269(l)(2) (i)(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 (l)(2)(i)(A) through (l)(2)(i)(D) of this section.	
1910.269(l)(2) (ii)		Paragraph (l)(2)(i) of this section does not apply to the following operations:	
1910.269(l)(2) (ii) (A)		Routine circuit switching, when the employer can demonstrate that conditions at the site allow safe performance of this work.	
1910.269(l)(2) (ii)(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	

Section	Subject	Citation	Compliance/ Implementation Method
1910.269(l)(2) (ii)(C)		Emergency repairs to the extent necessary to safeguard the general public.	
1910.269(l)(3)	Minimum Approach Distances		
1910.269(l)(3) (i)		The employer shall establish minimum approach distances no less than the distances computed by Table R-3 for ac systems or Table R-8 for dc systems.	
1910.269(l)(3) (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 R-9. 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	

Section	Subject	Citation	Compliance/ Implementation Method
		designee for examination and copying.	
1910.269(l)(3) (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 (l)(4) 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 of live-line bare-hand work in paragraph (q)(3) of this section.	
1910.269(l)(4)	Type of Insulation		
1910.269(l)(4) (i)		When an employee uses rubber insulating gloves as insulation from energized parts (under paragraph (l)(3)(iii)(A) of this	

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		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 (l)(4)(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	
1910.269(l)(4) (ii)		When an employee uses rubber insulating gloves or rubber insulating gloves and sleeves as insulation from energized parts (under paragraph (l)(3)(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 (l)(3)(i) 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 (l)(3)(i) of this section.	
1910.269(l)(5)(i)	Working Position	The employer shall ensure that each employee, to the extent that other safety-related	

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		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.	
1910.269(l)(5)(ii)		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 paragraph (q)(3) of this section, the employee shall work from a position where he or she cannot reach into the minimum approach distance, established by the employer under paragraph (l)(3)(i) of this section.	
1910.269(l)(6)	Making Connections	The employer shall ensure that employees make connections as follows:	
1910.269(l)(6) (i)		In connecting de-energized equipment or lines to an energized circuit by means of a conducting wire or device, an employee shall first attach the wire to the de-energized part;	
1910.269(l)(6) (ii)		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	

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1910.269(l)(6) (iii)		When lines or equipment are connected to or disconnected from energized circuits, an employee shall keep loose conductors away from exposed energized parts.	
1910.269(l)(7)	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.	
1910.269(l)(8)	Protection from flames and electric arcs		
1910.269(l)(8) (i)		The employer shall assess the workplace to identify employees exposed to hazards from flames or from electric arcs.	
1910.269(l)(8) (ii)		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.	
1910.269(l)(8) (iii)		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	

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		when exposed to flames or the heat energy estimated under paragraph (l)(8)(ii) of this section.	
1910.269(l)(8) (iv)		The employer shall ensure that the outer layer of clothing worn by an employee, except for clothing not required to be arc rated under paragraph (l)(8)(v)(A) through (l)(8)(v)(E) of this section, is flame resistant under any of the following conditions: (A)The employee is exposed to contact with energized circuit parts operating at more than 600 volts, (B)An electric arc could ignite flammable material in the work area that, in turn, could ignite the employee's clothing. (C)Molten metal or electric arcs from faulted conductors in the work area could ignite the employee's clothing, or (D)The incident heat energy estimated under paragraph (l)(8)(ii) of this section exceeds 2.0 cal/cm2.	
1010.269(l)(8)(v)		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 (l)(8)(ii) of this section whenever that estimate exceeds 2.0 cal/cm2. This protective equipment shall	

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		cover the employee's entire body, except as follows: (A)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 (13 oz/yd2), (B)Arc-rated protection is not necessary for the employee's feet when the employee is wearing heavy-duty work shoes or boots, (C)Arc-rated protection is not necessary for the employee's head when the employee is wearing head protection meeting 1910.135 if the estimated incident energy is less than 9 cal/cm2 for exposures involving single-phase arcs in open air of 5 cal/cm2 for other exposures, (D)The protection for the employee's head may consist of head protection meeting 1910.135 and a face shield 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 (E)For exposures involving single phase arcs in open air, the arc rating for the employee's head and face protection may be 4cal/cm2	

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		less than the estimated incident energy.	
1910.269(l)(8)(vi)	Dates		
1910.269(l)(8)(vi)(A		The obligation in paragraph (l)(8)(ii) of this section for the employer to make reasonable estimates of incident energy commences January 1, 2015.	
1910.269(l)(8)(vi)(B)		The obligation in paragraph (l)(8)(iv)(D) 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.	
1910.269(l)(8)(vi)(C)		The obligation in paragraph (l)(8)(v) 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.	
1910.269(l)(9)	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 I of this Part, uses a tool rated for the voltage, and	

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		is clear of the exhaust path of the fuse barrel.	
1910.269(l)(10)	Covered (non-insulated) conductors	The requirements of this section that pertain to the hazards of exposed live parts also apply when an employee performs work in proximity of covered (non-insulated) wires.	
1910.269(l)(11)	Noncurrent-carrying metal parts	Noncurrent-carrying metal parts of equipment or devices, such as transformer cases and circuit breaker housings, shall be treated as energized at the highest voltage to which these parts are exposed, unless the employer inspects the installation and determines that these parts are grounded before employees begin performing the work.	
1910.269(l)(12)	Opening and closing circuits under load	(i)The employer shall ensure that devices used by employees to open circuits under load conditions are designed to interrupt the current involved. (ii)The employer shall ensure that devices used by employees to close circuits under load conditions are designed to safety carry the current involved.	
TABLE R-3		AC LIVE-LINE WORK MINIMUM APPROACH DISTANCE	
TABLE R-4		ELECTRICAL COMPONENT OF THE MINIMUM APPROACH DISTANCE AT 5.1 TO 72.5 kV	
TABLE R-5		ALTITUDE CORRECTION FACTOR	
TABLE R-6		ALTERNATIVE MINIMUM APPROACH DISTANCES FOR VOLTAGES OF 72.5 kV AND LESS	

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TABLE R-7		ALTERNATIVE MINIMUM APPROACH DISTANCES FOR VOLTAGES OF MORE THAN 72.5 kV	
TABLE R-8		DC LIVE-LINE MINIMUM APPROACH DISTANCE WITH OVERVOLTAGE FACTOR	
TABLE R-9		ASSUMED MAXIMUMM PER-UNIT TRANSIENT OVERVOLTAGE	
		De-energizing of transmission and distribution lines for employee protection	
1910.269(m)(1)	Application	Paragraph (m) of this section applies to the deenergizing of transmission and distribution lines and equipment for the purpose of protecting employees. See paragraph (d) of this section for requirements on the control of hazardous energy sources used in the generation of electric energy. Conductors and parts of electric equipment that have been deenergized under procedures other than those required by paragraph (d) or (m) of this section, as applicable, shall be treated as energized.	
1910.269(m)(2)	General		
1910.269(m)(2) (i)		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 (m)(3) of this section in the order specified.	

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1910.269(m)(2) (ii)		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 paragraph (m) of this section. All of the requirements of paragraph (m)(3) of this section apply, in the order specified, except as provided in paragraph (m)(2)(iii) of this section.	
1910.269(m)(2) (iii)		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 (m)(3)(i), (m)(3)(iii), and (m)(3)(v), of this section do not apply. Additionally, the employer does not need to use the tags required by the remaining provisions of paragraph (m)(3) of this section.	
1910.269(m)(2) (iv)		If two or more crews will be working on the same lines or equipment, then: (A)The crews shall coordinate their activities under paragraph (m) of this section with a single employee in charge of the clearance for all of the crews and follow the requirements of paragraph (m) of this section as	

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		if all of the employees formed a single crew, or (B)Each crew shall independently comply with paragraph (m) of 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.	
1910.269(m)(2) (v)		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.	
1910.269(m)(3)	De-energizing Lines and Equipment		
1910.269(m)(3) (i)		The employee that the employer designates pursuant to paragraph (m)(2) of this section as being in charge of the clearance shall make a request of the system operator to de-energize the particular section of line or equipment. The designated employee becomes the employee in charge (as this term is used in paragraph (m)(3) of this section) and is responsible for the clearance.	
1910.269(m)(3)		The employer shall ensure that all switches, disconnectors,	

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(ii)		jumpers, taps, and other means through which known sources of electric energy may be supplied to the particular lines and equipment to be de-energized shall be opened. 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.	
1910.269(m)(3) (iii)		The employer shall ensure that automatically and remotely controlled switches that could cause the opened disconnecting means to close are also be tagged at the points of control. The employer shall render the automatic or remote control feature inoperable, unless its design does not so permit.	
1910.269(m)(3) (iv)		The employer need not use tags mentioned in paragraphs (m)(3)(ii) and (m)(3)(iii) 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: (A)Every network protector is maintained so that it will immediately trip open if closed when a primary conductor is deenergized; (B)Employees cannot manually place any network protector in a closed position without the use of tools, and any manual	

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		override position is blocked, locked, or otherwise disabled; and (C)The employer has procedure 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.	
1910.269(m)(3) (v)		Tags shall prohibit operation of the disconnecting means and shall indicate that employees are at work.	
1910.269(m)(3) (vi)		After the applicable requirements in paragraphs (m)(3)(i) through (m)(3)(v) 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.	
1910.269(m)(3) (vii)		The employer shall ensure the installation of protective grounds as required by paragraph (n) of this section.	
1910.269(m)(3)		After the applicable requirements of paragraphs	

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(viii)		(m)(3)(i) through (m)(3)(vii) of this section have been followed, the lines and equipment involved may be considered deenergized.	
1910.269(m)(3) (ix)		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 the employees in the crew; and the new employee in charge shall be responsible for the clearance.	
1910.269(m)(3) (x)		To release a clearance, the employee in charge shall:	
1910.269(m)(3) (x)(A)		Notify each employee under that clearance of the pending release of the clearance;	
1910.269(m)(3) (x)(B)		Ensure that all employees under that clearance are clear of the lines and equipment;	
1910.269(m)(3) (x)(C)		Ensure that all protective grounds protecting employees under that clearance have been removed; and	
1910.269(m)(3) (x)(D)		Report this information to the system operator and then release the clearance.	
1910.269(m)(3) (xi)		Only the employee in charge who requested the clearance may release the clearance, unless the employer transfers responsibility under paragraph (m)(3)(ix) of this section.	

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1910.269(m)(3)(xii)		No one may remove tags without the release of the associated clearance as specified under paragraphs (m)(3)(x) and (m)(3)(xi) of this section.	
1910.269(m)(3)(xiii)		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.	
1910.269(n)		Grounding for the protection of employees	
1910.269(n)(1)	Application	Paragraph (n) of this section applies to grounding of generation, transmission, and distribution lines and equipment for the purpose of protecting employees. Paragraph (n)(4) of this section also applies to protective grounding of other equipment as required elsewhere in this section.	
1910.269(n)(2)	General	For any employee to work transmission and distribution lines or equipment as de-energized, the employer shall ensure that the lines or equipment are deenergized under the provisions of paragraph (m) of this section and shall ensure proper grounding of the lines or equipment as specified in	

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		paragraphs (n)(3) through (n)(8) of this section. However, if the employer can demonstrate that the installation of a ground is impracticable or that the conditions resulting from the installation of a ground would present greater hazards to the 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:	
1910.269(n)(2) (i)		The employer ensures that the lines and equipment are deenergized under the provisions of paragraph (m) of this section.	
1910.269(n)(2) (ii)		There is no possibility of contact with another energized source.	
1910.269(n)(2) (iii)		The hazard of induced voltage is not present.	
1910.269(n)(3)	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 electrical potential.	
1910.269(n)(4)	Protective Grounding Equipment		

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1910.269(n)(4) (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.	
1910.269(n)(4) (ii)		Protective grounding equipment shall have an ampacity greater than or equal to that of No. 2 AWG copper.	
1910.269(n)(4) (iii)		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.	
1910.269(n)(5)	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.	
1910.269(n)(6)		Connecting and removing grounds	
1910.269(n)(6)(i)	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	

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		can demonstrate that each employee is protected from hazards that my develop if the line or equipment is energized.	
1910.269(n)(6)(ii)	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.	
1910.269(n)(7)	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.	
1910.269(n)(8)	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	

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		necessary to protect each exposed employee in case the previously grounded lines and equipment become energized.	
1910.269(o)(1)	Application	Paragraph (o) of 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 utilizing high voltage, high power, or combinations of both, and not to testing involving continuous measurements as in routine metering, relaying, and normal line work.	
1910.269(o)(2)	General Requirements		
1910.269(o)(2)(i)		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.	
1910.269(o)(2)(ii)		The employer shall ensure that each employee, upon initial assignment to the test area, receives training in safe work practices, with retraining as	

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		required by paragraph (a)(2) of this section.	
1910.269(o)(3)	Safeguarding of test areas		
1910.269(o)(3)(i)		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.	
1910.269(o)(3)(ii)		The employer shall guard permanent test areas with walls, fences, or other barriers designed to keep employees out of the test areas.	
1910.269(o)(3)(iii)		In field testing, or at a temporary test site not guarded by permanent fences and gates, the employer shall ensure one of the following means to prevent employees without authorization from entering:	
1910.269(o)(3)(iii)(A)		Distinctively colored safety tape supported approximately waist high with safety signs attached to it.	
1910.269(o)(3)(iii)(B)		A barrier or barricade that limits access to the test area to a degree equivalent, physically and visually, to the barricade specified in paragraph (o)(3)(iii)(A) of this section, or	

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1910.269(o)(3) (iii)(C)		One or more test observers stationed so that they can monitor the entire area.	
1910.269(o)(3) (iv)		The employer shall ensure the removal of the safeguards required by paragraph (o)(3)(ii) of this section when employees no longer need the protection afforded by the safeguards.	
1910.269(o)(4)	Grounding Practices		
1910.269(o)(4)(i)		The employer shall establish and implement safe grounding practices for the test facility.	
1910.269(o)(4)(i) (A)		The employer shall maintain at ground potential all conductive parts accessible to the test operator while the equipment is operating at high voltage.	
1910.269(o)(4)(i) (B)		Wherever ungrounded terminals of test equipment or apparatus under test may be present, they shall be treated as energized until determined by tests to be deenergized.	
1910.269(o)(4) (ii)		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	

Section	Subject	Citation	Compliance/ Implementation Method
		equipment and the apparatus under test.	
1910.269(o)(4) (iii)		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 need not be provided if the employer can demonstrate that both the following conditions exist:	
1910.269(o)(4) (iii)(A)		The employer cannot provide an isolated ground-return conductor due to the distance of the test site from the electric energy source, and	
1910.269(o)(4) (iii)(B)		The employer protects employees from any hazardous step and touch potentials that may develop during the test.	
1910.269(o)(4) (v)		For tests in which using the equipment 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.	

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1910.269(o)(4) (v)		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.	
1910.269(o)(4) (v)(A)		Before any employee applies a direct ground, the employer shall discharge high capacitance equipment through a resistor rated for the available energy.	
1910.269(o)(4) (v)(B)		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.	
1910.269(o)(4) (vi)		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.	
1910.269(o)(5)	Control and Measuring Circuits		
1910.269(o)(5)(i)		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	

Section	Subject	Citation	Compliance/ Implementation Method
		employees with equivalent safety.	
1910.269(o)(5) (ii)		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 is provided 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.	
1910.269(o)(5) (iii)		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.	
1910.269(o)(5) (iv)		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.	
1910.269(o)(6)	Safety Check		
1910.269(o)(6)(i)		Safety practices governing employee work at temporary or field test areas shall provide, at the beginning of each series of	

Section	Subject	Citation	Compliance/ Implementation Method
		tests, for a routine safety check of such test areas.	
1910.269(o)(6) (ii)		The test operator in charge shall conduct these routine safety checks before each series of tests and shall verify at least the following conditions:	
1910.269(o)(6) (ii)(A)		Barriers and safeguards are in workable condition and placed properly to isolate hazardous areas;	
1910.269(o)(6) (ii)(B)		System test status signals, if used, are in operable condition;	
1910.269(o)(6) (ii)(C)		Clearly marked test power disconnects are readily available in an emergency;	
1910.269(o)(6) (ii)(D)		Ground connections are clearly identifiable	
1910.269(o)(6) (ii)(E)		Personal protective equipment is provided and used as required by Subpart I of this Part and by this section; and	
1910.269(o)(6) (ii)(F)		Proper separation between signal, ground, and power cables.	
1910.269(p)(1)	General Requirements		
1910.269(p)(1)(i)		The critical safety components of mechanical elevating and rotating equipment shall receive a thorough visual inspection before use on each shift.	

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1910.269(p)(1) (ii)		No motor vehicle or earthmoving or compacting equipment having an obstructed view to the rear may be operated on off-highway jobsites where any employee is exposed to the hazards created by the moving vehicle, unless:	
1910.269(p)(1) (ii)(A)		The vehicle has a reverse signal alarm audible above the surrounding noise level, or	
1910.269(p)(1) (ii)(B)		The vehicle is backed up only when a designated employee signals that it is safe to do so.	
1910.269(p)(1) (iii)		Rubber-tired self-propelled scrapers, rubber-tire front-end loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler-type tractors, crawler-type loaders, and motor graders, with or without attachments, shall have rollover protective structures that meet the requirements of Subpart W of Part 1926 of this chapter.	
1910.269(p)(1) (iv)		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.	
1910.269(p)(2)	Outriggers		
1910.269(p)(2)(i)		Mobile equipment, if provided with outriggers, shall be operated with the outriggers extended and firmly set, except as provided in paragraph	

Section	Subject	Citation	Compliance/ Implementation Method
		(p)(2)(iii) of this section as necessary for the stability of the specific configuration of the equipment.	
1910.269(p)(2) (ii)		Outriggers may not be extended or retracted outside of clear view of the operator unless all employees are outside the range of possible equipment motion.	
1910.269(p)(2) (ii)		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.	
1910.269(p)(3)	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.	
1910.269(p)(4)	Operations Near Energized Lines or Equipment		
1910.269(p)(4)(i)		Mechanical equipment shall be operated so that the minimum approach distances, established by the employer under paragraph (l)(3)(i) of this section 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	

Section	Subject	Citation	Compliance/ Implementation Method
		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.	
1910.269(p)(4) (ii)		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 (p)(4)(i) of this section is reached, unless the employer can demonstrate that the operator can accurately determine that the minimum approach distance is being maintained.	
1910.269(p)(4) (iii)		If, during operation of the mechanical equipment, that equipment could become energized, the operation also shall comply with at least one of paragraphs (p)(4)(iii)(A) through (p)(4)(iii)(C) of this section.	
1910.269(p)(4) (iii)(A)		The energized lines exposed to contact shall be covered with insulating protective material that will withstand the type of contact that could be made during the operation.	
1910.269(p)(4) (iii)(B)		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	

Section	Subject	Citation	Compliance/ Implementation Method
		established by the employer under paragraph (l)(3)(i) of this section.	
1910.269(p)(4) (iii)(C)		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 potential. Unless the employer can demonstrate that the methods in use protect each employee from the hazards that might arise if the mechanical equipment contacts the energized line or equipment, the measures used shall include all of the following techniques:	
1910.269(p)(4) (iii)(C)*(1)*		Using the best available ground to minimize the time the lines remain energized.	
1910.269(p)(4) (iii)(C)*(2)*		Bonding mechanical equipment together to minimize potential differences.	
1910.269(p)(4) (iii)(C)*(3)*		Providing ground mats to extend areas of equipotential, and	
1910.269(p)(4) (iii)(C)*(4)*		Employing insulating protective equipment or barricades to guard against any remaining hazardous potential differences.	
1910.269(q)(1)	General	This paragraph provides additional requirements for work performed on or near	

Section	Subject	Citation	Compliance/ Implementation Method
		overhead lines and equipment and for live-line barehand work.	
1910.269(q)(1)(i)		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.	
1910.269(q)(1) (ii)		When a pole is set, moved, or removed near an exposed energized overhead conductor, the pole may not contact the conductor.	
1910.269(q)(1) (iii)		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.	
1910.269(q)(1) (iv)		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.	

Section	Subject	Citation	Compliance/ Implementation Method
1910.269(q)(2)	Installing and Removing Overhead Lines	The following provisions apply to the installation and removal of overhead conductors or cable (overhead lines).	
1910.269(q)(2)(i)		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.	
1910.269(q)(2) (ii)		For conductors, cables, and pulling and tensioning equipment, the employer shall provide the protective measures required by paragraph (p)(4)(iii) of this section 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:	
1910.269(q)(2) (ii)(A)		Failure of the pulling or tensioning equipment,	
1910.269(q)(2) (ii)(B)		Failure of the conductor or cable being pulled, or	
1910.269(q)(2)(ii)) (C)		Failure of the previously installed lines or equipment.	

Section	Subject	Citation	Compliance/ Implementation Method
1910.269(q)(2) (iii)		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.	
1910.269(q)(2) (iv)		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. 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.	
1910.269(q)(2) (v)		Reel handling equipment, including pulling and tensioning devices, shall be in safe operating condition and shall be leveled and aligned.	
1910.269(q)(2) (vi)		The employer shall ensure employees do not exceed load ratings of stringing lines, pulling lines, conductor grips, load-	

Section	Subject	Citation	Compliance/ Implementation Method
		bearing hardware and accessories, rigging, and hoists.	
1910.269(q)(2) (vii)		The employer shall repair or replace defective pulling lines and accessories.	
1910.269(q)(2) (viii)		The employer shall ensure that employees do not use conductor grips on wire rope unless the manufacturer specifically designed the grip for this application.	
1910.269(q)(2) (ix)		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.	
1910.269(q)(2) (x)		Employees may operate the pulling rig only when it is safe to do so.	
1910.269(q)(2) (xi)		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 cross arm, except as necessary for the employees to guide the stringing sock or board over or through the stringing sheave.	
1910.269(q)(3)	Live-Line Bare-Hand Work	In addition to other applicable provisions contained in the section, the following requirements apply to live-line barehand work:	
1910.269(q)(3)(i)		Before an employee uses or supervises the use of the live-	

Section	Subject	Citation	Compliance/ Implementation Method
		line bare-hand technique on energized circuits, the employer shall ensure that the employee completes training conforming to paragraph (a)(2) of this section in the technique and in the safety requirements of. paragraph (q)(3) of this section.	
1910.269(q)(3) (ii)		Before any employee uses the live-line bare-hand technique on energized high-voltage conductors or parts, the employer shall ascertain following information in addition to information about other existing conditions required by paragraph (a)(4) of this section:	
1910.269(q)(3) (ii)(A)		The nominal voltage rating of the circuit on which employees will perform the work.	
1910.269(q)(3) (ii)(B)		The clearances to ground of lines and other energized parts on which employees with perform the work, and	
1910.269(q)(3) (ii)(C)		The voltage limitations of equipment employees will use.	
1910.269(q)(3) (iii)		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 bare-hand work.	
1910.269(q)(3) (iv)		The employer shall ensure that employees keep tools and equipment clean and dry while they are in use.	

Section	Subject	Citation	Compliance/ Implementation Method
1910.269(q)(3) (v)		The employer shall render inoperable the automatic-reclosing feature of circuit-interrupting devices protecting the lines, if the design of the devices permits.	
1910.269(q)(3) (vi)		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 section. 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 (q)(3)(xiv) of this section, unless insulating guards cover the grounded objects and other lines and equipment.	
1910.269(q)(3) (vii)		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.	
1910.269(q)(3) (vii)(A)		The employee shall be connected to the bucket liner or other conductive device by the use of conductive shoes, leg clips, or other means.	
1910.269(q)(3) (vii)(B)		Where differences in potentials at the worksite pose a hazard to employees, the employer shall provide electrostatic shielding designed for the voltage being worked.	

Section	Subject	Citation	Compliance/ Implementation Method
1910.269(q)(3) (viii)		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 work on the energized circuit.	
1910.269(q)(3) (ix)		Aerial lifts used for live-line bare-hand work shall have dual controls (lower and upper) as follows:	
1910.269(q)(3) (ix)(A)		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.	
1910.269(q)(3) (ix)(B)		The lower set of controls shall be located near the base of the boom, and they shall be so designed that they can override operation of the equipment at any time.	
1910.269(q)(3) (x)		Lower (ground-level) lift controls may not be operated with an employee in the lift, except in case of emergency.	
1910.269(q)(3) (xi)		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.	

Section	Subject	Citation	Compliance/ Implementation Method
1910.269(q)(3) (xii)		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.	
1910.269(q)(3) (xiii)		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.	
1910.269(q)(3) (xiii)(A)		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.	
1910.269(q)(3) (xiii)(B)		The leakage current may not exceed 1 microampere per kilovolt of nominal phase-to-ground voltage.	
1910.269(q)(3) (xiii)(C)		The employer shall immediately suspend work from the aerial lift when there is any indication of a malfunction in the equipment.	
1910.269(q)(3) (xiv)		The employer shall ensure that employees maintain the minimum approach distances, established by the employer under paragraph (l)(3)(i) of this section, from all grounded objects and from lines and equipment at a potential different from that to which the live-line bare-hand equipment is bonded, unless insulating guards cover such grounded	

Section	Subject	Citation	Compliance/ Implementation Method
		objects and other lines and equipment.	
1910.269(q)(3) (xv)		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 paragraph (l)(3)(i) of this section, 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.	
1910.269(q)(3) (xvi)		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 paragraph (l)(3)(i) of this section, between all parts of the bucket and the grounded end of the bushing or insulator string or any other grounded surface.	
1910.269(q)(3) (xvii)		The employer shall ensure that employees do not us handlines between the bucket and the boom or between the bucket and the ground. However, employees may use non-conductive-type hand lines from conductor to ground if not supported from the bucket. The employer shall ensure that no one uses ropes used for live-line bare-hand work for other purposes.	

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1910.269(q)(3) (xviii)		The employer shall ensure that employees do not pass uninsulated equipment or material may between a pole or structure and an aerial lift while an employee working from the bucket is bonded to an energized part.	
1910.269(q)(3) (xix)		A non-conductive measuring device shall be readily accessible to employees performing live-line barehand work to assist them in maintaining the required minimum approach distance.	
1910.269(q)(4)	Towers and Structures	The following requirements apply to work performed on towers or other structures that support overhead lines.	
1910.269(q)(4)(i)		The employer shall ensure that no employee is under a tower or structure while work is in progress, except where the employer can demonstrate that such a working position is necessary to assist employees working above.	
1910.269(q)(4) (ii)		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.	
1910.269(q)(4) (iii)		The employer shall ensure that employees do not detach the loadline from a member or section until they safely secure the load .	

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1910.269(q)(4) (iv)		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 section.	
1910.269(r) Entire Section	Line Clearance Tree Trimming Operations	This paragraph provides additional requirements for line-clearance tree-trimming operations and for equipment used in these operations.	
1910.269(s) Entire Section	Comm. Facilities		
1910.269(t)		This paragraph provides additional requirements for work on underground electrical installations.	
1910.269(t)(1)	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.	
1910.269(t)(2)	Lowering Equipment into Manholes	(i)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. (ii)Before anyone lowers tools or material into the opening for a manhole or vault, each employee working in the	

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		manhole or vault shall be clear of the area directly under the opening.	
1910.269(t)(3)	Attendants for Manholes		
1910.269(t)(3)(i)		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.	
1910.269(t)(3)(ii)		Occasionally, the employee on the surface may briefly enter a manhole or vault to provide nonemergency assistance.	
1910.269(t)(3) (iii)		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.	
1910.269(t)(3) (iv)		The employer shall ensure the employees maintain reliable communications, through two-way radios or other equivalent means, among all employees involved in the job.	
1910.269(t)(4)	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	

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		duct line being rodded to ensure that the employees maintain the required minimum approach distances.	
1910.269(t)(5)	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.	
1910.269(t)(6)	Moving Cables	Except when paragraph (t)(7)(ii) 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.	
1910.269(t)(7)	Protection against faults	(i)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 de-energize 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	

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		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. (ii)If the work employees will perform in a manhole or vault could cause a fault in a cable, the employer shall de-energize 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.	
1910.269(t)(8)	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.	
1910.269(u)		This paragraph provides additional requirements for substations and for work performed in them.	

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1910.269(u)(1)	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.	
1910.269(u)(2)	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 inoperative if the design of the equipment permits.	
1910.269(u)(3)	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 difference in electric potential.	
1910.269(u)(4)	Guarding of rooms and other spaces containing electric supply equipment		
1910.269(u)(4)(i)		Rooms and spaces in which electric supply lines or equipment are installed shall meet the requirements of paragraphs (u)(4)(ii) through (u)(4)(v) of this section under the following conditions:	
1910.269(u)(4)(i)(A)		If exposed live parts operating at 50 to 150 volts to ground are located within 2.4 meters (8 feet) of the ground or other	

Section	Subject	Citation	Compliance/ Implementation Method
		working surface inside the room or space,	
1910.269(u)(4)(i)(B)		If live parts operating at 151 to 600 volts and located within 2.4 meters (8 feet) of the ground or other working surface inside the room or space are guarded only by location, as permitted under paragraph (u)(5)(i) of this section, or	
1910.269(u)(4)(i)(C)		If live parts operating at more than 600 volts to ground are within the room or other space, unless:	
1910.269(u)(4)(i)(C)(1)		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	
1910.269(u)(4)(i)(C)(2)		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.	
1910.269(u)(4)(ii)		Fences, screens, partitions, or walls shall enclose the rooms or other spaces so as to minimize the possibility that unqualified persons will enter.	
1910.269(u)(4)(iii)		Unqualified persons may not enter the rooms or other spaces while the electric supply lines or equipment are energized.	

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1910.269(u)(4) (iv)		The employer shall display signs at entrances to the rooms and other spaces warning unqualified persons to keep out.	
1910.269(u)(4) (v)		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.	
1910.269(u)(5)	Guarding of Energized Parts		
1910.269(u)(5)(i)		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.	
1910.269(u)(5) (ii)		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.	
1910.269(u)(5) (iii)		Before guards are removed from energized equipment, the employer shall install barriers around the work area to	

Section	Subject	Citation	Compliance/ Implementation Method
		prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.	
1910.269(u)(6)	Substation Entry		
1910.269(u)(6)(i)		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.	
1910.269(u)(6) (ii)		The job briefing required by paragraph (c) of this section 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 de-energized work area.	
1910.269(v) Entire Section	Power Generation	This paragraph provides additional requirements and related work practices for power generating plants.	
1910.269(w)(1)	Capacitors	The following additional requirements apply to work on capacitors and on lines connected to capacitors.	
1910.269(w)(1) (i)		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	

Section	Subject	Citation	Compliance/ Implementation Method
		employee short circuiting the capacitors waits at least 5 minutes from the time of disconnection before applying the short-circuit.	
1910.269(w)(1) (ii)		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.	
1910.269(w)(1) (iii)		The employer shall short circuit any line connected to capacitors before the line is treated as de-energized.	
1910.269(w)(2)	Current transformer secondaries	The employer shall ensure that employees to not open the secondary of a current transformer while the transformer is energized. If the employer cannot de-energize 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.	
1910.269(w)(3)	Series Street Lighting		
1910.269(w)(3) (i)		If the open-circuit voltage exceeds 600 volts, the employer shall ensure that employees work on series street lighting circuits in	

Section	Subject	Citation	Compliance/ Implementation Method
		accordance with paragraph (q) or (t) of this section, as appropriate.	
1910.269(w)(3) (ii)		Before any employee opens a series loop, the employer shall de-energize the streetlighting transformer and isolated it from the source of supply or shall bridge the loop to avoid an open-circuit condition.	
1910.269(w)(4)	Illumination	The employer shall provide sufficient illumination to enable the employee to perform the work safely.	
1910.269(w)(5)	Protection Against Drowning		
1910.269(w)(5) (i)		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 U.S. Coast Guard approved personal flotation device.	
1910.269(w)(5) (ii)		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.	
1910.269(w)(5) (iii)		An employee may cross streams or other bodies of water only if a safe means of passage, such as a bridge, is available.	

Section	Subject	Citation	Compliance/ Implementation Method
1910.269(w)(6)	Employee Protection in Public Work Areas		
1910.269(w)(6) (i)		Traffic control signs and traffic-control devices used for the protection of employees shall meet 1926.200 (g)(2) of this chapter.	
1910.269(w)(6) (ii)		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.	
1910.269(w)(6) (iii)		The employer shall use barricades where additional employee protection is necessary.	
1910.269(w)(6) (iv)		The employer shall protect excavated areas with barricades.	
1910.269(w)(6) (v)		The employer shall display warning lights prominently at night.	
1910.269(w)(7)	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 paragraph (l) of this section apply if employees will work the lines or equipment as energized, and the requirements of paragraphs	

Section	Subject	Citation	Compliance/ Implementation Method
		(m) and (n) of this section apply if employees will work the lines or equipment as de-energized.	
1910.269(w)(8)	Lasers	The employer shall install, adjust, and operate laser equipment in accordance with 1926.54 of this Chapter.	
1910.269(w)(9)	Hydraulic Fluids	Hydraulic fluids used for the insulated sections of equipment shall provide insulation for the voltage involved.	

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4. DEFINITIONS

Refer to 29 CFR 1910.269(x)

5. REFERENCES

29 CFR 1910.269 Electric Power Generation, Transmission, and Distribution.

National Electric Safety Code

Other Applicable Standards, Procedures, or Requirements documents