Changes to OSHA 1910.269 and 1926 Subpart V

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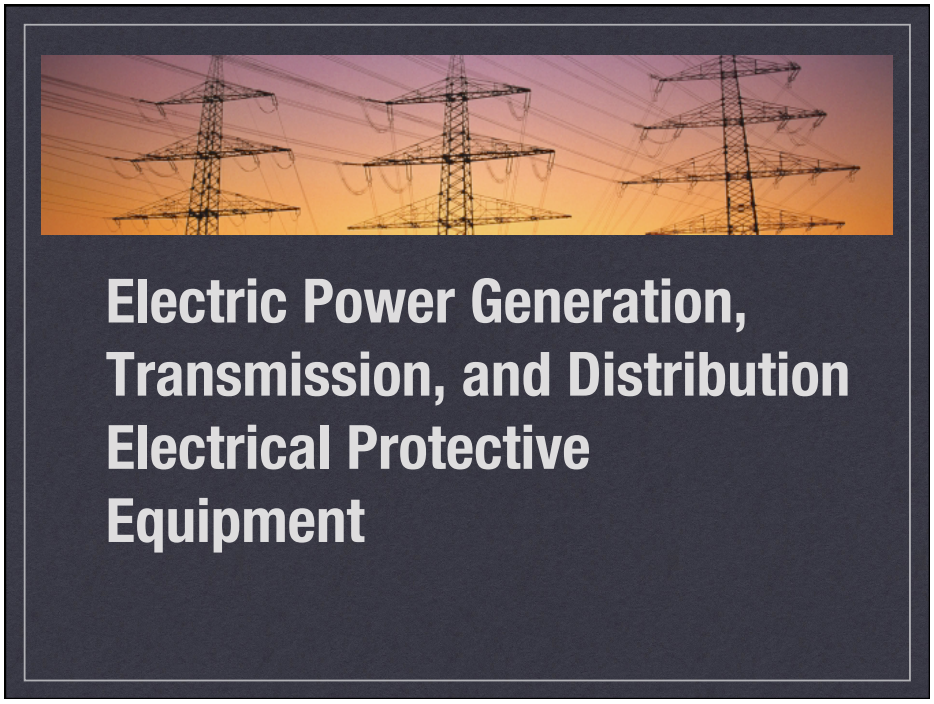
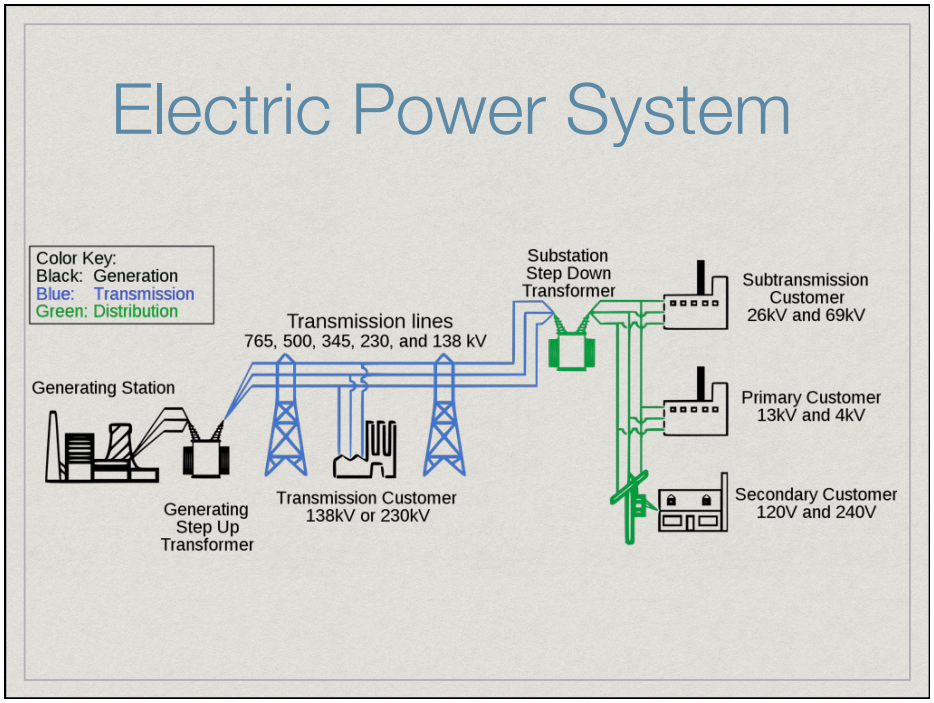

Electric Power Generation, Transmission, and Distribution
Electrical Protective Equipment


Electric Power System
Color Key:
Black: Generation
Blue: Transmission
Green: Distribution
Generating Station
Generating Step Up Transformer
Transmission lines
765, 500, 345, 230, and 138 kV
Transmission Customer
138kV or 230kV
Substation Step Down Transformer
Subtransmission Customer
26kV and 69kV
Primary Customer
13kV and 4kV
Secondary Customer
120V and 240V

Existing Standards

- General industry (1994)
  - §1910.137—Electrical protective equipment
  - §1910.269—Electric power generation, transmission, and distribution
- Construction (1972)
  - Subpart V—Power transmission and distribution

Final Rule

- General industry
  - §1910.137—Electrical protective equipment
  - §1910.269—Electric power generation, transmission, and distribution
- Construction
  - §1926.97—Electrical protective equipment
  - Subpart V—Electric power transmission and distribution

Goals

- Update standards based on latest consensus standards
- Make the two sets of standards the same
- Provide additional protection beyond current standards
  - Information transfer (host-contractor and job briefing)
  - Fall protection
  - Minimum approach distances (MAD)
  - Protection from electric arcs

Costs and Benefits

Annualized Costs	
Determination of Appropriate Protective Clothing	$2.2 million
Provision of Appropriate Protective Clothing	$17.3 million
Fall Arrest Equipment	$0.6 million
Host/Contractor Communications	$17.8 million
Expanded Job Briefings	$6.7 million
Additional Training	$3.0 million
Other Costs for Work Not Already Covered by §1910.269	$0.2 million
MAD Costs	$1.8 million
Total Annual Costs	**$49.5 million**

Costs and Benefits

Annual Benefits	
Number of Injuries Prevented	118.5
Number of Fatalities Prevented	19.75
Monetized Benefits (Assuming $62,000 per Injury and $8.7 million per Fatality Prevented)	$179.2 million
OSHA Standards That Are Updated and Consistent	Unquantified
Net Benefits (Benefits minus Costs):	**$129.7 million**

Costs and Benefits

- Compliance with the final rule will result in the prevention of one fatality and 6 injuries per $2.5 million in costs, or, alternatively, $3.62 of benefits per dollar of costs.

Information Transfer

Information Transfer

- Existing conditions (§§1910.269(a)(4) and 1926.950(d))
- Host-contractor provisions (§§1910.269(a)(3) and 1926.950(c))
- Job briefing (§§1910.269(c) and 1926.952)

Existing Conditions

- Characteristics of the system related to safety
  - Voltage, maximum overvoltage, induced voltage
  - Presence of grounds
  - Location of circuits and equipment
- Conditions of the installation related to safety
  - Condition of grounds and poles
  - Environmental conditions

§§1910.269(a)(4) & 1926.950(d)

Host-Contractor

- Host employer:

An employer that operates, or that controls the operating procedures for, an electric power generation, transmission, or distribution installation on which a contract employer is performing work covered by [the standard].

- Contract employer:

An employer, other than a host employer, that performs work covered by [the standard] under contract.

§§1910.269(x) & 1926.968

Host-Contractor

- Host provides information to contractors
  - Characteristics listed in §§1910.269(a)(4) and 1926.950(d)
  - Known conditions listed in §§1910.269(a)(4) and 1926.950(d)
  - System design information needed for assessments
  - Other known system information related to safety and requested by contractor

§§1910.269(a)(3)(i) & 1926.950(c)(1)

Host-Contractor—Assessments

Provision	Assessment Required	Type of Information
§1910.269(e), §1926.953(a)	Whether an enclosed space must be entered as a permit-required confined space	Whether an enclosed space contains hazards, other than electrical and atmospheric hazards, that could endanger the life of an entrant or could interfere with escape from the space
§1910.269(e)(12), §1926.953(m)	Whether forced air ventilation has been maintained long enough that a safe atmosphere exists	The size of the enclosed space

Host-Contractor—Assessments

Provision	Assessment Required	Type of Information
§1910.269(l)(3)(i), §1926.960(c)(1)(i)	What is the appropriate minimum approach distance for the work to be performed?	What the operating conditions are for the value of the maximum transient overvoltage provided to the contract employer
§1910.269(l)(8)(i), §1926.960(g)(1)	Whether employees are exposed to hazards from flames or electric arcs	Information on electric equipment, such as safety information provided by manufacturers, that relates to the required hazard assessment

Host-Contractor—Assessments

Provision	Assessment Required	Type of Information
§1910.269(l)(8)(ii), §1926.960(g)(2)	What is the estimated incident energy from an electric arc?	The electrical parameters needed to calculate incident energy, such as maximum fault current, bus spacings, and clearing times
§1910.269(l)(12), §1926.960(k)	Whether devices are designed to open or close circuits under load conditions	Load current for, and the opening and closing ratings of, devices used to open and close circuits under load

Host-Contractor—Assessments

Provision	Assessment Required	Type of Information
§1910.269(m) and (w)(7), §§1926.961 and 1926.967(h)	What are the known sources of electric energy (including known sources of backfeed) supplying electric circuits?	All known sources of electric energy, including known sources of backfeed
§1910.269(d)	What are the sources of hazardous energy, including sources of potentially hazardous stored or residual energy?	All sources of hazardous energy, including sources of potentially hazardous stored or residual energy, and any conditions that can lead to the reaccumulation of residual or stored energy to a hazardous level

Host-Contractor—Assessments

Provision	Assessment Required	Type of Information
§1910.269(n)(4)(i), §1926.962(d)(1)(i)	Whether protective grounds have adequate current-carrying capacity	The maximum fault current and clearing time for the circuit
§1910.269(n)(7), 1926.962(g)	Whether there is a possibility of hazardous transfer of potential should a fault occur	Potential rise on remote grounds under fault conditions

Host-Contractor—Assessments

Provision	Assessment Required	Type of Information
§1910.269(q)(1)(i), 1926.964(a)(2)	Whether overhead structures such as poles and towers are capable of sustaining stresses imposed by the work	The design strength of the pole or structure

Host-Contractor

- Contractor instructs its employees in the hazardous conditions, relevant to employees' work, of which the contractor is aware as a result of information communicated by the host.

§§1910.269(a)(3)(ii)(A) & 1926.950(c)(2)(i)

Host-Contractor

- Contractor advises the host of:
  - Any unique hazardous conditions presented by the contract employer's work
  - Any unanticipated hazardous conditions not mentioned by the host

§§1910.269(a)(3)(ii)(B), (C) & 1926.950(c)(2)(ii), (iii)

Host-Contractor

- Contractor and host must coordinate work rules and procedures so that each employee is protected

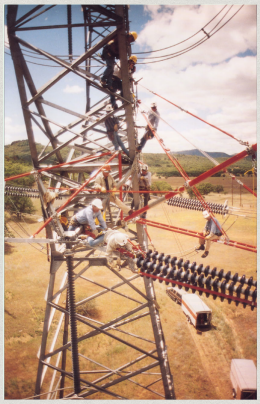
§§1910.269(a)(3)(iii) & 1926.950(c)(3)

Job Briefing

- Employer must provide the employee in charge with all available information that relates to the determination of existing characteristics and conditions under §§1910.269(a)(4) and 1926.950(d):
  - Information on existing characteristics
  - Information about existing conditions

§§1910.269(c)(1)(i) & 1926.952(a)(1)

Fall Protection

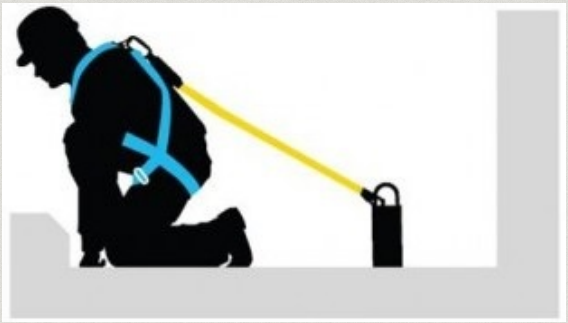


Fall Protection—Types

- Fall restraint system
  - A system that prevents the user from falling any distance
- Work positioning equipment
  - A system rigged to allow an employee to be supported on an elevated vertical surface and work with both hands free while leaning
- Personal fall arrest equipment
  - A system used to arrest an employee in a fall from a working level

§§1910.269(x) & 1926.968

Fall Restraint System



Work Positioning Equipment

Personal Fall Arrest Equipment

Fall Protection?

Fall Protection

- Aerial Lifts
  - Fall restraint system, or
  - Personal fall arrest system

§§1910.269(g)(2)(iv)(C) & 1926.954(b)(3)(iii)

Fall Protection

- Poles, towers, and similar structures, more than 1.2 m above the ground
  - Fall restraint system,
  - Work positioning equipment, or
  - Personal fall arrest system
  - As appropriate

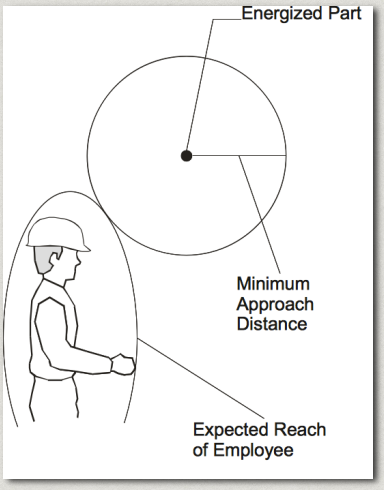
§§1910.269(g)(2)(iv)(C) & 1926.954(b)(3)(iii)

Fall Protection

- Use fall protection while climbing or changing location
  - Limited exemption
  - Provides anchorage
  - Effective April 1, 2015

§§1910.269(g)(2)(iv)(C) & 1926.954(b)(3)(iii)

MAD



§§1910.269(l)(3), (l)(4)(ii), (l)(5)(ii) & 1926.960(c)(1), (c)(2), (d)(2)

MAD

- Employer must establish minimum approach distances based on formulas in the standard
- For voltages up to 72.5 kV, the default distances are the same as proposed
- For voltages exceeding 72.5 kV, the distances are based on the equations used to calculate the proposed distances ($D = TOV \times (C + a) + M$)
- MAD is based on probability of 1/1000 of sparkover

§1910.269(l)(3) & Table R-3, & §1926.960(c)(1) & Table V-2

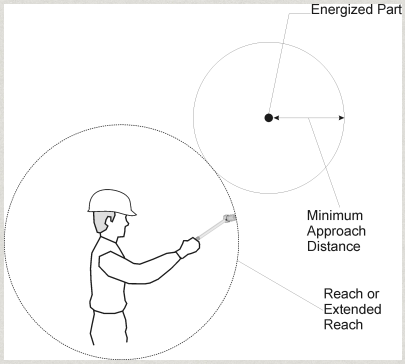
MAD—Changes for Voltages >72.5 kV

- Maximum transient overvoltage (TOV)
  - Highest is 3.5 rather than 3.0
  - Final rule anticipates that most employers will determine maximum TOV
  - Appendix B includes MAD tables for various values of maximum TOV
- MAD for phase-to-phase exposures increases substantially for voltages >350 kV because of error

§1910.269(l)(3) & Table R-3, & §1926.960(c)(1) & Table V-2

Approach Distance

- Put on and take off rubber insulating gloves in a position where the worker cannot reach into MAD.



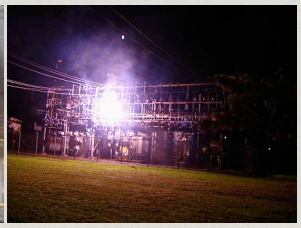
§§1910.269(l)(4)(ii) & 1926.960(c)(2)(ii)

Approach Distance

- For work near live parts of >600 volts but ≤ 72.5 kV, work from a position where the worker cannot reach into MAD, except:
  - wearing rubber insulating gloves,
  - protected by insulating equipment,
  - using live-line tools, and
  - performing live-line barehand work.

§§1910.269(l)(5)(ii) & 1926.960(d)(2)

Electric Arc Protection


Electric Arc Protection

CON EDISON ARC FLASH DOCUMENTARY

Electric Arc Protection

- Assess workplace for hazards from flames or electric arcs
- If there is exposure, estimate incident energy
- Prohibit clothing when incident energy could ignite clothing
- Require FR under certain conditions
- Select clothing with an arc rating greater than the estimated incident energy

§1910.269(l)(8) & §1926.960(g)

Electric Arc Protection Appendix E Guidelines

- Assessment guidelines with examples
- Estimating available heat energy
  - Selecting an appropriate calculation method
  - Selecting reasonable input parameters (in particular, distance to arc and arc gap)
  - Tables for single-phase arc in open air
- Selecting protective clothing and other protective equipment

Appendix E to §1910.269 & Subpart V

Electric Arc Protection Appendix E Guidelines

Table 3—Selecting a Reasonable Incident-Energy Calculation Method[1]

Incident-Energy Calculation Method	600 V and Less[2]			601 V to 15 kV[2]			More than 15 kV		
	1Φ	3Φa	3Φb	1Φ	3Φa	3Φb	1Φ	3Φa	3Φb
NFPA 70E-2012 Annex D (Lee equation)	Y-C	Y	N	Y-C	Y-C	N	N[3]	N[3]	N[3]
Doughty, Neal, and Floyd	Y-C	Y	Y	N	N	N	N	N	N
IEEE Std 1584b-2011	Y	Y	Y	Y	Y	Y	N	N	N
ARCPRO	Y	N	N	Y	N	N	Y	Y[4]	Y[4]

Appendix E to §1910.269 & Subpart V

Electric Arc Protection Appendix E Guidelines

Table 5—Selecting a Reasonable Arc Gap

Class of Equipment	Single-Phase Arc mm (inches)	Three-Phase Arc mm[1] (inches)
Cable	NA[2]	13 (0.5)
Low voltage MCCs and panelboards	NA	25 (1.0)
Low-voltage switchgear	NA	32 (1.25)
5-kV switchgear	NA	104 (4.0)
15-kV switchgear	NA	152 (6.0)
Single conductors in air, 15 kV and less	51 (2.0)	Phase conductor spacing
Single conductor in air, more than 15 kV	Voltage in kV × 2.54 (Voltage in kV × 0.1), but no less than 51 mm (2 inches)	Phase conductor spacing

Appendix E to §1910.269 & Subpart V

Electric Arc Protection Appendix E Guidelines

Table 6—Incident Heat Energy for Various Fault Currents, Clearing Times, and Voltages of 4.0 to 46.0 kV: Rubber Insulating Glove Exposures Involving Phase-to-Ground Arcs in Open Air Only[*][‡]

Voltage Range (kV)[**]	Fault Current (kA)	Maximum Clearing Time (cycles)			
		4 cal/cm^2	5 cal/cm^2	8 cal/cm^2	12 cal/cm^2
4.0 to 15.0	5	46	58	92	138
	10	18	22	36	54
	15	10	12	20	30
	20	6	8	13	19
15.1 to 25.0	5	28	34	55	83
	10	11	14	23	34
	15	7	8	13	20
	20	4	5	9	13
25.1 to 36.0	5	21	26	42	62
	10	9	11	18	26
	15	5	6	10	16
	20	4	4	7	11
36.1 to 46.0	5	16	20	32	48
	10	7	9	14	21
	15	4	5	8	13
	20	3	4	6	9

Appendix E to §1910.269 & Subpart V

Electric Arc Protection

- Requires FR clothing for incident energy exceeding 2.0 cal/cm^2
- Protection for head and face
  - Starts at 9 cal/cm^2 for single-phase arcs in air
  - Starts at 5 cal/cm^2 for other exposures
- Protection for hands (rubber gloves with protectors or, for exposures ≤ 14 cal/cm^2, heavy-duty (12-oz) leather work gloves)
- Protection for feet (heavy work shoes or boots)

§1910.269(l)(8) & §1926.960(g)

Compliance Deadlines

- Final rule is effective on July 11, 2014
- Fall protection—April 1, 2015
- New minimum approach distances—April 1, 2015
- Incident energy estimates—January 1, 2015
- Arc-flash protection—April 1, 2015

Miscellaneous Changes

- Training
  - Degree of training determined by risk for the hazard involved
  - Qualified employees to be able to recognize and control electrical hazards
  - Line-clearance tree trimmer's training similar to qualified employee training
  - Records no longer required

Miscellaneous Changes

- Deenergizing distribution and transmission lines
  - Multiple crews working on the same line must either: (1) coordinate under single employee or (2) comply independently
- Protective grounding
  - Expanded appendix information on equipotential zone
- Underground installations
  - Precautions when work could cause cable to fail

Miscellaneous Changes

- Electrical protective equipment
  - Updated consensus standards
  - Class 00 rubber insulating gloves
  - Requirements for equipment other than rubber
- Foot protection
  - Supplementary form of protection

Miscellaneous Changes

- Definitions
  - Entry (into enclosed space)—new
  - First-aid training—new, includes CPR
  - Line-clearance tree trimming—add 0.1 m per 10 kV for voltages over 50 kV
  - Statistical sparkover and withstand voltage—new

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