

## Chapter 18 NFPA 70E – ELECTRICAL SAFETY

The purpose of this standard is to provide a practical safe working area for employees relative to the hazards arising from the use of electricity. No employee at Sign Designs, Inc. is considered “qualified” in regard to electricity. Whenever working on or near electrical devices the device must be de-energized with proper LOTO in place. Be sure to test any device prior to commencing work to assure that the device is de-energized.

When visiting a site Sign Designs shall advise the host employer of the following:

- 1 Any unique hazards presented by the contract employer’s work
- 2 Any unanticipated hazards found during the contract employer’s work that the host employer did not mention
- 3 The measures the Sign Designs took to correct any hazards reported by the host employer to prevent such hazards from recurring in the future.

Unqualified persons shall not be permitted to enter spaces that are required to be accessible to qualified employees only, unless the electric conductors and equipment involved are in an electrically safe work condition.

Employees shall be trained in the skills and techniques to:

- 1 Distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment
- 2 Determine the nominal voltage of exposed energized electrical conductors and circuit parts
- 3 The approach distances specified in Tables and 130.4(C)(b)
- 4 The decision making process necessary to determine the degree and extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely.

Employees shall receive additional training (or retraining) under any of the following conditions:

- 1 If the supervision or annual inspections indicate that the employee is not complying with the safety-related work practices
- 2 If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those that the employee would normally use
- 3 If he or she must employ safety-related work practices that are not normally used during his or her regular job duties.

Retraining shall be performed at least every 3 years.

Program elements include, but are not limited to: evaluations, anticipating unexpected events, all electrical parts are considered live until proven otherwise, work permits, electrical flash arc hazard analysis.

Arc flash risk assessments include determining appropriate safety related work practices, the arc flash boundary requirements, and the PPE required to minimize the risk of electric shock. Assessments must be documented and equipment field marked with a label. These assessments must be reviewed prior to beginning work.

Risk Assessment should contain event severity, frequency, probability and avoidance to determine the level of safe practices employed. The Risk Assessment must be completed by the employee before work is started and account for hazards at the limited approach and arc flash boundaries. The Risk Assessment Procedure must identify the hazards, assess risks, and implement risk control in accordance with a hierarchy of control. This hierarchy places elimination of a hazard as the primary method of control and identifies PPE as the last option if all other options have been exhausted.

A job briefing should be held before starting each job and include all employees involved. The briefing covers hazards associated with the job, work procedures involved, special precautions, energy source controls, PPE requirements, and the information on the energized electrical work permit, if required. Additional job briefings shall be held if changes that might affect the safety of employees occur during the course of work.

Only qualified persons shall perform tasks such as testing, troubleshooting, and voltage measuring within the limited approach boundary of energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists.

Test instruments, equipment, and their accessories shall meet the requirements of ANSI/ISA-61010-1-Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use -Part 1 General Requirements, for rating and design requirements for voltage measurement and test instruments intended for use on electrical systems 1000 Volts and below.

When test instruments are used for the testing for the absence of voltage on conductors or circuit parts operating at 50 volts or more, the operation of the test instrument shall be verified before and after an absence of voltage test is performed.

All PPE used must meet the requirements in Table 130.7(C)(14). PPE requirements in the table apply to many different kinds of PPE: arc rated apparel, insulating aprons, general eye and face protection, arc rated face protection, fall protection, testing methods and specifications for footwear, glove and sleeve testing and care, hard hats, arc rated rainwear, visual inspections of rubber protective products and sleeves. The related standards for each kind of PPE are found in their ASTM or ANSI document in the table.

All insulating tools, PPE, and other equipment must be inspected before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating gloves shall be given an air test, along with the inspection.

Such tests include:

- 1 Blankets-before first issue/every 12 months thereafter
- 2 Gloves-before first issue and every 6 months
- 3 Sleeves before first issue and every 12 months.
- 4 Covers and Line hose shall be testing if insulating value is suspect.

Work on energized electrical conductors or circuit parts that are not placed in an electrically safe work condition, shall be considered energized electrical work and shall be performed by written permit only. Work performed on electrical conductors and circuit parts operating at less than 50 volts shall not be required to be de-energized if it is determined that there will be no increased exposure to electrical burns or explosion.

Employees shall not enter spaces containing electrical hazards unless illumination is provided that enables the employees to perform the work safely. Where lack of illumination or an obstruction precludes

observation of the work to be performed, employees shall not perform any task within the Limited Approach Boundary of energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists.

Employees shall be alerted to potential electrical hazards. Alerting techniques include safety signs and tags, barricades, and attendants. Safety signs must meet the requirements of ANSI Z535 Table 130.7(F). Barricades must be used in conjunction with safety signs and never by themselves. Any technique used must not increase the potential for employee injury.

Employees shall be trained in safety-related work practices and procedural requirements as necessary to provide protection from the electrical hazards associated with their respective jobs. Employees shall be trained to identify and understand the relationship between electrical hazards and possible injury.

Documentation shall be made when the employee demonstrates proficiency, be maintained for the duration of the employee's employment, and contain the content of the training, each employee's name, and date of training.

An audit must be performed every year to ensure the requirements in the written program are being performed by the employees. The written program must be updated if auditing determines that employees are not following it or if another issue is identified with potential hazardous exposure.

NFPA 70E Table 130.4 (C) (a)

Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection for Alternating Current Systems (all dimensions are distances from energized electrical conductor or circuit parts to employee)

(1)	(2)	(3)	(4)	(5)
<i>Limited Approach Boundary<sup>b</sup></i>				
<i>Nominal System Voltage Range, Phase to Phase<sup>d</sup></i>	<i>Exposed Movable Conductor</i>	<i>Exposed Fixed Circuit Part</i>	<i>Restricted Approach Boundary<sup>b</sup>; Includes Inadvertent Movement Adder</i>	<i>Prohibited Approach Boundary<sup>b</sup></i>
50 V	Not Specified	Not Specified	Not Specified	Not Specified
50 V – 300 V	3.0 m (10 ft. 0 in.)	1.0 m (3 ft. 6 in.)	Avoid Contact	Avoid Contact
301 V – 750 V	3.0 m (10 ft. 0 in.)	1.0 m (3 ft. 6 in.)	0.3 m (1 ft. 0 in.)	25 mm (0 ft. 1 in.)
751 V – 15 kV	3.0 m (10 ft. 0 in.)	1.5 m (5 ft. 0 in.)	0.7 m (2 ft. 2 in.)	0.2 m (0 ft. 7 in.)
15.1 kV – 36 kV	3.0 m (10 ft. 0 in.)	1.8 m (6 ft. 0 in.)	0.8 m (2 ft. 7 in.)	0.3 m (0 ft. 10 in.)
36.1 kV – 46 kV	3.0 m (10 ft. 0 in.)	2.5 m (8 ft. 0 in.)	0.8 m (2 ft. 9 in.)	0.4 m (1 ft. 5 in.)
46.1 kV – 72.5 kV	3.0 m (10 ft. 0 in.)	2.5 m (8 ft. 0 in.)	1.0 m (3 ft. 3 in.)	0.1 m (2 ft. 2 in.)
72.6 kV – 121 kV	3.3 m (10 ft. 8 in.)	2.5 m (8 ft. 0 in.)	1.0 m (3 ft. 4 in.)	0.8 m (2 ft. 9 in.)
138 kV – 145 kV	3.4 m (11 ft. 0 in.)	3.0 m (10 ft. 0 in.)	1.2 m (3 ft. 10 in.)	1.0 m (3 ft. 4 in.)
161 kV – 169 kV	3.6 m (11 ft. 8 in.)	3.6 m (11 ft. 8 in.)	1.3 m (4 ft. 3 in.)	1.1 m (3 ft. 9 in.)
230 kV – 242 kV	4.0 m (13 ft. 0 in.)	4.0 m (13 ft. 0 in.)	1.3 m (4 ft. 3 in.)	1.6 m (5 ft. 2 in.)
345 kV – 363 kV	4.7 m (15 ft. 4 in.)	4.7 m (15 ft. 4 in.)	2.8 m (9 ft. 2 in.)	2.6 m (8 ft. 8 in.)
500 kV – 550 kV	5.8 m (19 ft. 0 in.)	5.8 m (19 ft. 0 in.)	3.6 m (11 ft. 10 in.)	3.5 m (11 ft. 4 in.)
765 kV – 800 kV	7.2 m (23 ft. 9 in.)	7.2 m (23 ft. 9 in.)	4.9 m (15 ft. 11 in.)	4.7 m (15 ft. 5 in.)

NFPA 70E Table 130.4 (C) (a)

Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection for Direct Current Voltage Systems

(1)	(2)	(3)	(4)	(5)
<i>Limited Approach Boundary<sup>b</sup></i>				
<i>Nominal Potential Difference</i>	<i>Exposed Movable Conductor<sup>c</sup></i>	<i>Exposed Fixed Circuit Part</i>	<i>Restricted Approach Boundary<sup>b</sup>; Includes Inadvertent Movement Adder</i>	<i>Prohibited Approach Boundary<sup>b</sup></i>
<100 V	Not Specified	Not Specified	Not Specified	Not Specified
100 V – 300 V	3.0 m (10 ft. 0 in.)	1.0 m (3 ft. 6 in.)	Avoid Contact	Avoid Contact
301 V – 1 kV	3.0 m (10 ft. 0 in.)	1.0 m (3 ft. 6 in.)	0.3 m (1 ft. 0 in.)	25 mm (0 ft. 1 in.)
1.1 kV – 5 kV	3.0 m (10 ft. 0 in.)	1.5 m (5 ft. 0 in.)	0.5 m (1 ft. 5 in.)	0.1 m (0 ft. 4 in.)
5.1 kV – 15 kV	3.0 m (10 ft. 0 in.)	1.5 m (5 ft. 0 in.)	0.7 m (2 ft. 2 in.)	0.2 m (0 ft. 7 in.)
15.1 kV – 45 kV	3.0 m (10 ft. 0 in.)	2.5 m (8 ft. 0 in.)	0.8 m (2 ft. 9 in.)	0.4 m (1 ft. 5 in.)
45.1 kV – 75 kV	3.0 m (10 ft. 0 in.)	2.5 m (8 ft. 0 in.)	1.0 m (3 ft. 2 in.)	0.7 m (2 ft. 1 in.)
75.1 kV – 150 kV	3.3 m (10 ft. 8 in.)	3.0 m (10 ft. 0 in.)	1.2 m (4 ft. 0 in.)	1.0 m (3 ft. 2 in.)
150.1 kV – 250 kV	3.6 m (11 ft. 8 in.)	3.6 m (11 ft. 8 in.)	1.6 m (5 ft. 3 in.)	1.5 m (5 ft. 0 in.)
250.1 kV – 500 kV	6.0 m (20 ft. 0 in.)	6.0 m (20 ft. 0 in.)	3.5 m (11 ft. 6 in.)	3.3 m (10 ft. 10 in.)
500.1 kV – 800 kV	8.0 m (26 ft. 0 in.)	8.0 m (26 ft. 0 in.)	5.0 m (16 ft. 5 in.)	5.0 m (16 ft. 5 in.)

<sup>a</sup> All dimensions are distance from exposed energized electrical conductors or circuit parts to worker.

<sup>b</sup> This term describes a condition in which the distance between the conductor and a person is not under the control of the person. The term normally is applied to overhead line conductors supported by poles.