


<i>HEALTH AND SAFETY MANUAL</i>		
Title: NFPA 70 E		
Approved by: Greg Savoy		Rev. 5/22/12

1 Purpose/Scope:

Many workers are injured or die every year due to electrical incidents that occur on the job. This Program will help address these safety concerns and keep our employees safe is the NFPA 70E, Standard for Electrical Safety in the Workplace. Electrical hazards include electric shock, arc flash, and arc blast.

This Program is a guideline for how to work safely around electrical parts and equipment and applies to qualified and unqualified employees performing work on:

- Premises wiring
- Connecting to supply
- Other wiring
- Optical fiber cable

2 Definitions/Responsibilities:

2.1 Definitions:

2.1.1 **“Qualified Person”** – 29CFR1910.399 One who has received training in and has demonstrated skills and knowledge in the construction and operation of electrical equipment and installation and the hazards involved.

2.1.2 **“Electrical Hazards”** – A dangerous condition such that contact or equipment failure can result in:

- Electric Shock
- Arc Flash Burn
- Thermal Burn
- Arc Blast

2.1.3 **“Electric Shock”**

- Received when current passes through the body
- Severity of the shock depends on:
 - PATH of current through the body
 - AMOUNT of CURRENT flowing through the body
 - LENGTH of TIME the body is in the circuit



- ***NOTE: LOW VOLTAGE DOES NOT MEAN LOW HAZARD***

2.1.4 **“Arc Flash”** - Electrical short circuit that occurs when air flashes from an exposed live conductor, to either another conductor or to ground.

“Arc Flash Effects” include:

- Severe Burns
- Broken Bones
- Vision Damage
- Hearing Loss
- Brain/Internal Injuries
- Punctures and Lacerations
- Death

“Causes of Arc Flash” include:

- Improper Training
- Improper Work Procedures
- Dropped Tools
- Accidental Contact With Electrical Systems
- Installation Failure
- Voltage Testing With Inappropriate Equipment

2.1.5 **“Arc Blast”** includes:

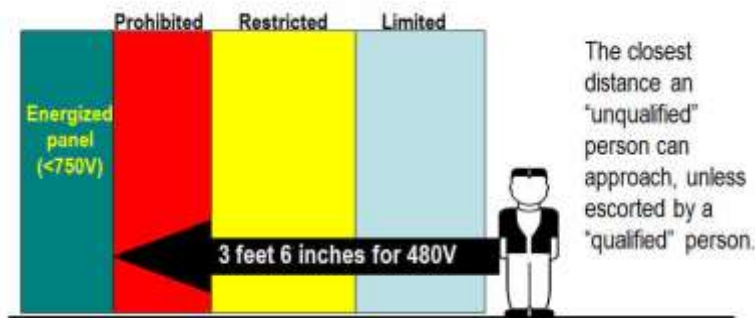
- Concentrated Energy Explodes Outward
- High Intensity Flash
- Temperatures Can Reach 35,000 degrees
- Pressure Wave Can Reach 200 lbs./sq. inch
- Vaporize Conductors and Copper and Explode Particles Like Buckshot.

“Causes of Arc Blast” include:

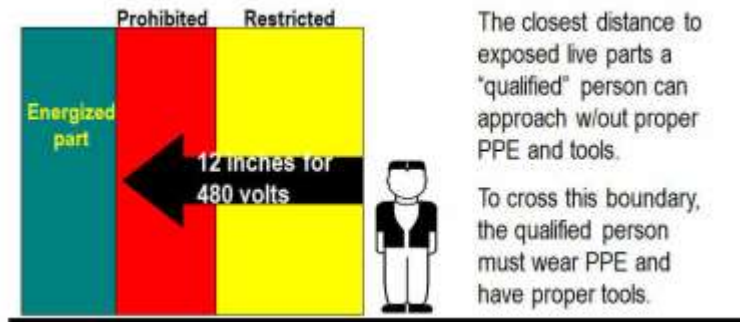
- Buildup of Dust, Corrosion On Insulating Surfaces
- Improper Maintenance
- Sparks Produced During Racking of Breakers, Replacement of Fuses and Closing Into Faulty Lines.
- Inattentiveness / Overconfidence

2.1.6 **“Limits of Approach”**:

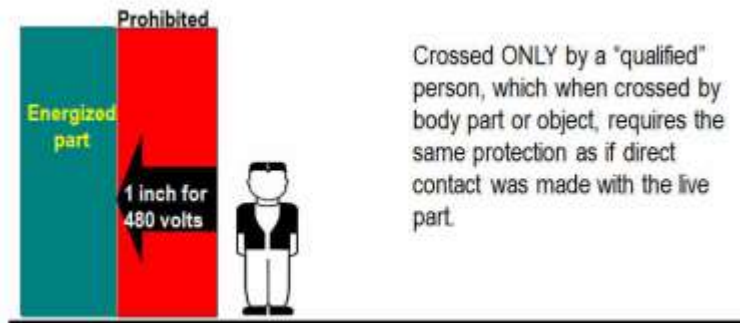
2.1.6.1 **“Limited Approach Boundary”**



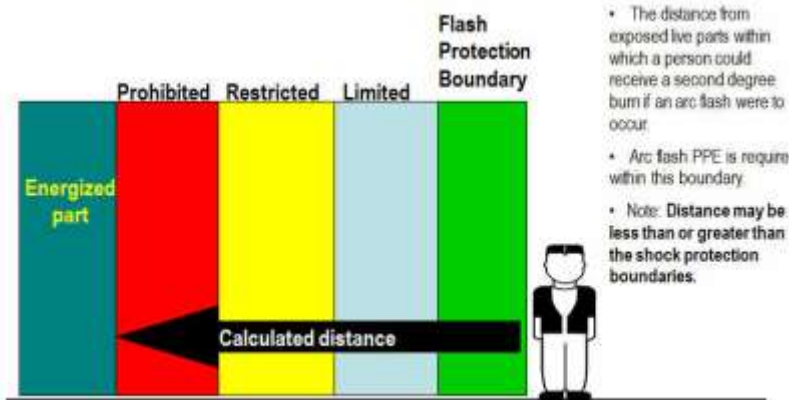
2.1.6.2 “Restricted Approach Boundary”



2.1.6.3 “Shock”



2.1.6.4 “Flash Protection Boundary”



2.1.8 “Approach Boundaries for Shock Protection”


TABLE 130.2(C) Approach Boundaries to Live Parts for Shock Protection.
(All dimensions are distance from live part to employee.)

(1) Nominal System Voltage Range, Phase to Phase	(2) Limited Approach Boundary ¹		(4) Restricted Approach Boundary ¹ ; Includes Inadvertent Movement Adder	(5) Prohibited Approach Boundary ¹
	Exposed Movable Conductor	Exposed Fixed Circuit Part		
Less than 50	Not specified	Not specified	Not specified	Not specified
50 to 300	3.05 m (10 ft 0 in.)	1.07 m (3 ft 6 in.)	Avoid contact	Avoid contact
301 to 750	3.05 m (10 ft 0 in.)	1.07 m (3 ft 6 in.)	304.8 mm (1 ft 0 in.)	25.4 mm (0 ft 1 in.)
751 to 15 kV	3.05 m (10 ft 0 in.)	1.53 m (5 ft 0 in.)	660.4 mm (2 ft 2 in.)	177.8 mm (0 ft 7 in.)
15.1 kV to 36 kV	3.05 m (10 ft 0 in.)	1.83 m (6 ft 0 in.)	787.4 mm (2 ft 7 in.)	254 mm (0 ft 10 in.)
36.1 kV to 46 kV	3.05 m (10 ft 0 in.)	2.44 m (8 ft 0 in.)	838.2 mm (2 ft 9 in.)	431.8 mm (1 ft 5 in.)
46.1 kV to 72.5 kV	3.05 m (10 ft 0 in.)	2.44 m (8 ft 0 in.)	965.2 mm (3 ft 2 in.)	635 mm (2 ft 1 in.)
72.6 kV to 121 kV	3.25 m (10 ft 8 in.)	2.44 m (8 ft 0 in.)	991 mm (3 ft 3 in.)	812.8 mm (2 ft 8 in.)
138 kV to 145 kV	3.36 m (11 ft 0 in.)	3.05 m (10 ft 0 in.)	1.093 m (3 ft 7 in.)	939.8 mm (3 ft 1 in.)
161 kV to 169 kV	3.56 m (11 ft 8 in.)	3.56 m (11 ft 8 in.)	1.22 m (4 ft 0 in.)	1.07 m (3 ft 6 in.)
230 kV to 242 kV	3.97 m (13 ft 0 in.)	3.97 m (13 ft 0 in.)	1.6 m (5 ft 3 in.)	1.45 m (4 ft 9 in.)
345 kV to 362 kV	4.68 m (15 ft 4 in.)	4.68 m (15 ft 4 in.)	2.59 m (8 ft 6 in.)	2.44 m (8 ft 0 in.)
500 kV to 550 kV	5.8 m (19 ft 0 in.)	5.8 m (19 ft 0 in.)	3.43 m (11 ft 3 in.)	3.28 m (10 ft 9 in.)
765 kV to 800 kV	7.24 m (23 ft 9 in.)	7.24 m (23 ft 9 in.)	4.55 m (14 ft 11 in.)	4.4 m (14 ft 5 in.)

Note: For Flash Protection Boundary, see 130.3(A).

¹See definition in Article 100 and text in 130.2(D)(2) and Annex C for elaboration.

2.2 “Typical equipment Label”



WARNING

Arc Flash and Shock Hazard Appropriate PPE Required

24 inch Flash Hazard Boundary
3 cal/cm² Flash Hazard at 18 inches

480 VAC Shock Hazard when **Cover is removed**
42 inch Limited Approach
12 inch Restricted Approach - **500 V Class 00 Gloves**
1 inch Prohibited Approach - **500 V Class 00 Gloves**

Date: 6/28/2001

Bldg. ECR #1 **Equipment Name: Slurry Pump Starter**

2.3 “Examples of Personal Protective Equipment (PPE)”

2.3.1 All insulating PPE shall be inspected prior to each day’s use and immediately after any incident.



3 Requirements:

3.1 General:

- 3.1.1 Company will advise the host employer of unique hazards in the workplace presented by the contractor’s work, unanticipated hazards, and any measures taken to correct hazards reported to them by the host employer.
- 3.1.2 All test equipment, instruments and their accessories shall be rated for circuits and equipment to which they will be connected.
- 3.1.3 Test instruments shall be verified to be in proper working order before and after in the event an absence of voltage test is performed.
- 3.1.4 A hazard/risk (JSA) evaluation shall be performed prior to work being done within the Limited Approach Boundary.
- 3.1.5 Job briefings (JSA) shall be performed prior to the commencement of work and the scope of work details shall be covered during the briefing.
- 3.1.6 Proper illumination shall be provided in all work areas.
- 3.1.7 The testing interval for rubber insulating personal protective equipment is every 3 months.

3.2 Training:

- 3.2.1 Employees who face a risk of electric shock that is not reduced to a safe level installation requirements must be trained.
- 3.2.2 Occupations listed in Table S – 4 must be trained (see Appendix A).

- 3.2.3 Other employees if they face a risk of shock must also be trained.
- 3.2.4 Employees shall be trained to understand the specific hazards associated with electrical energy.
- 3.2.5 Unqualified persons shall not be permitted to enter spaces that are required to be accessible to qualified employees only.
- 3.2.6 Employees shall be trained to understand specific hazards associated with electrical energy and trained:
- in safety related work practices and procedural requirements for specific jobs or tasks
 - to understand the relationship between electrical hazards and possible injury
 - training shall be classroom or on-the-job type or combination
 - in the release of victims from contact who are working on or near energized conductors
 - in recognizing live parts
 - in determining voltage of live parts
 - in clearance distances specified in 29CFR1910.333
- 3.2.7 Employees shall complete additional training requirements for qualified persons who are allowed to work within Limited Approach Boundaries.
- A qualified person shall be trained and knowledgeable of construction and operation of equipment or work method and trained to recognize and avoid hazards, also trained:
 - to be familiar with precautionary techniques, PPE including arc flash, insulating and shielding materials, insulated tools and test equipment
 - to distinguish exposed energized parts from other parts
 - to determine nominal voltage of live parts
 - to understand safe approach distances
 - to determine PPE requirements for each task
 - understand how to inspect voltage rated gloves in the field:

- Visual Inspection
- Inflation
- Reverse glove and repeat
- Store in appropriate glove bag



- 3.2.8 Re-training will be conducted when the employee is found to be not complying with safety-related work practices or when workplace changes necessitate the use of safety-related work practices that are different from those that the employee would normally use.
- 3.2.9 Re-training shall be performed every 3 year (36 months).

3.2.10 Training shall be documented and maintained for the duration of each employee's employment.

3.3 Safe Work Practices For Working Within the Limited Approach Boundary:

3.3.1 ONLY qualified persons shall complete tasks such as testing, troubleshooting and voltage measuring within the limited approach boundary.

▪ **How to protect the shock and arc flash approach boundaries from an unqualified person?**

- Barrier tape
- Orange cones
- Signage
- Plastic chain
- Use an attendant to warn others approaching the area



- **Don't reach blindly into areas that might contain exposed live parts**
- **Provide illumination in spaces to enable safe work**
- **Conductive articles of jewelry and clothing such as watchbands, bracelets, necklaces shall not be worn**
- **Use only insulated tools rated for voltage when working inside the Limited Approach Boundary of exposed live parts where contact might be made**

3.4 Energized Electrical Work Permit

Company will utilize customer Energized Electrical Work Permit while performing work on customer site.

4 References:
29 CFR 1910 Subpart S - Electrical

5 Exhibits:

Appendix "A" - **Occupations That Must Receive Training**

APPENDIX “A”

Occupations That Must Receive Training

- Blue collar supervisors
- Electrical and electronic engineers
- Electrical and electronic equipment assemblers
- Electrical and electronic technicians
- Electricians
- Industrial machine operators
- Material handling equipment operators
- Mechanics and repairers
- Painters
- Riggers and roustabouts
- Stationary engineers
- Welders

Footnote (1) Workers in these groups do not need to be trained if their work or the work of those they supervise does not bring them or the employees they supervise close enough to exposed parts of electric circuits operating at 50 volts or more to ground for a hazard to exist.