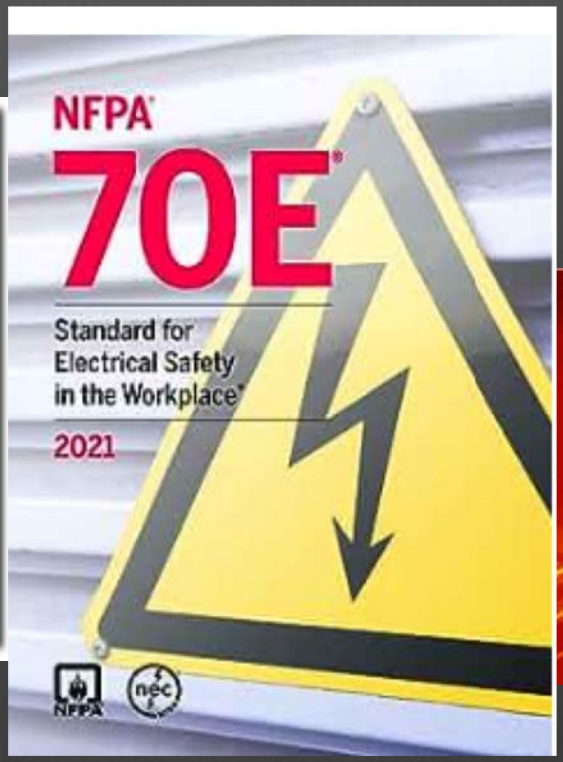
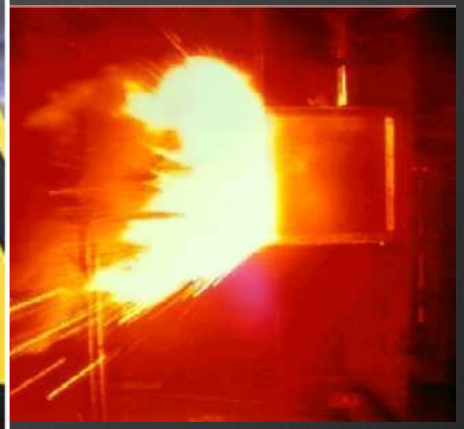




NFPA 70E Electrical Safety, Arc Flash/Blast

LEARNING OBJECTIVES:

- *Why Electrical Safety and Arc Flash Protection?*
- *What is electrical safety and What Does it Consist of?*
- *What does electrical safety look like in the Workplace – What Should You See from Employers*
- *The Elements of Electrical Safe Work Practices*
- *How Can OSHA Cite Elements of NFPA 70E?*

Why Electrical Safety & Arc Flash Protection

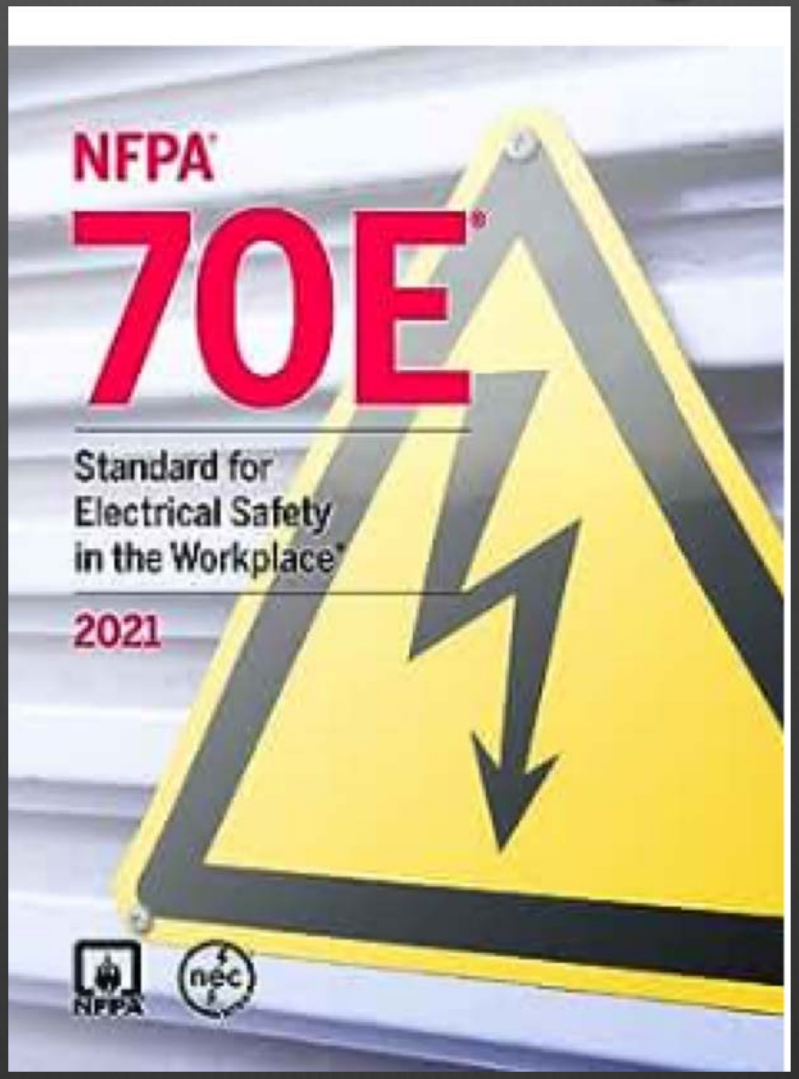

HOSTED ON
LiveLeak

What is Electrical Safety?

What is Electrical Safety

- Protecting workers from the unexpected start-up, or unexpected reenergization of equipment, circuits, or parts while maintenance is being performed.
- Protecting workers from exposure to live electrical parts Including overhead and underground electrical distribution, including systems, equipment, circuits, and parts.

NFPA 70E – 2021 Edition
Note: 2024 coming soon

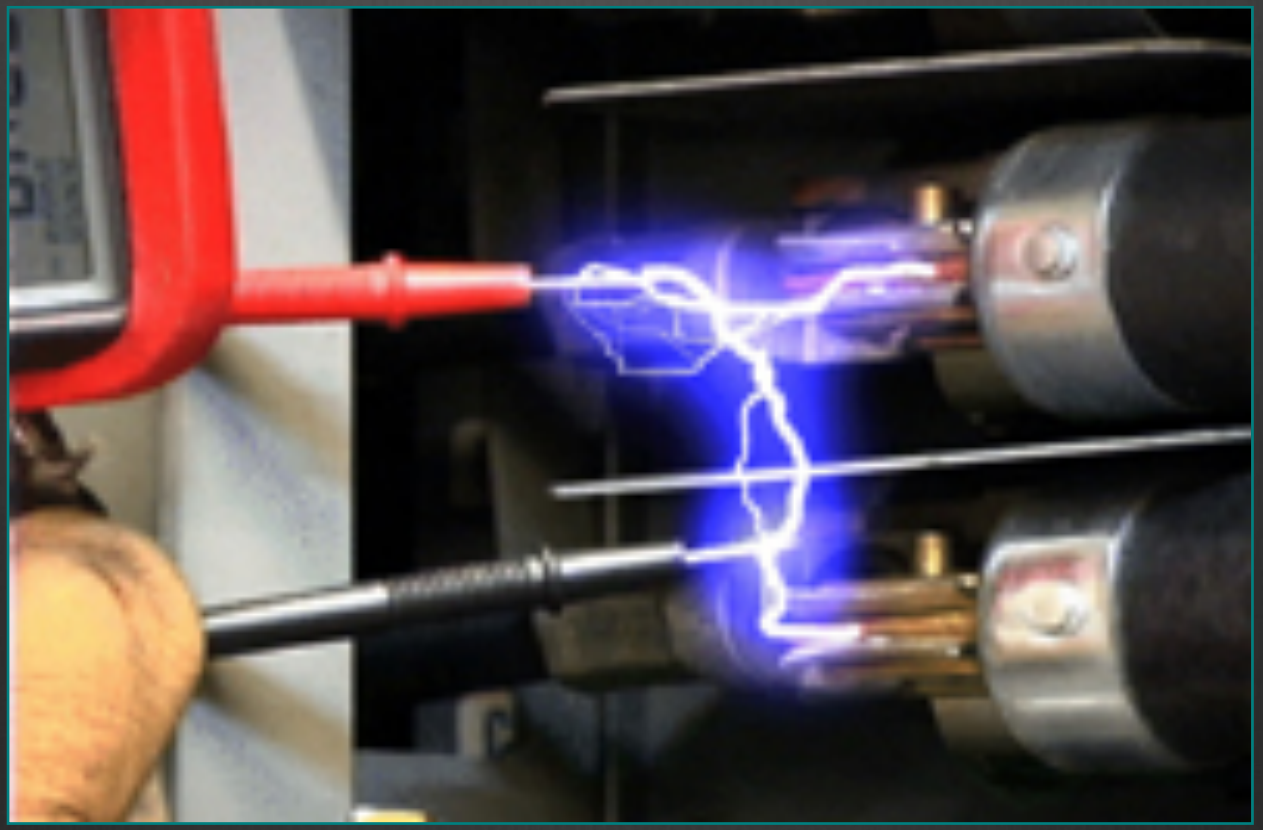


We will cover Key Provisions Later

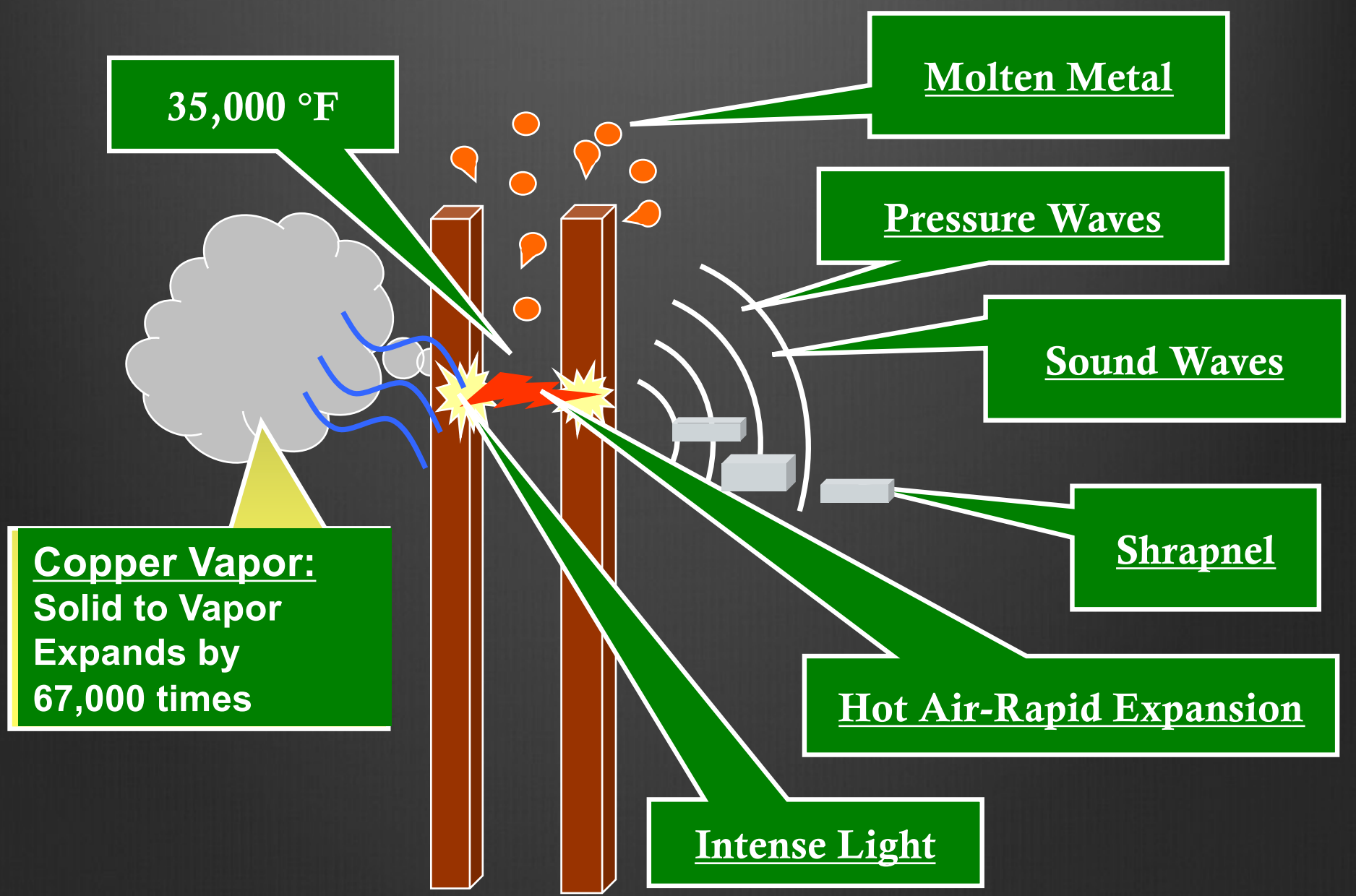
First, The Basic Hazards

What is an Electric Arc?

An electric arc is a short circuit through the air.



Electrical Arc



Characteristics of an Electric Arc

- An electric arc will oscillate and escalate if not constrained.
- A single-phase electric arc can engulf a second or third conductor in only two cycles.
- An electric arc's current propels the arc away from the power source.

What Causes Arc Flash?

- Dust, impurities, corrosion, condensation, animals
- Spark discharge from:
  - Accidental touching
  - Dropping tools
- Over-voltages across narrow gaps
- Failure of insulating materials
- Equipment failure

Severity Factors

Power – amount of energy at the arc

Distance – of the worker to the arc

Time – duration of the arc exposure

Arc Flash Events

Electric arc → Arc flash → Arc blast

Compliments of Salisbury Electrical Safety L.L.C.

Forms of Arc Flash Energy

- Noise
- Expansion
- Vaporization
- Thermal radiation

Electrical Arc Burn Injuries

- Occur from high temperature sources
- Deep and slow to heal
- Involve large areas of body
- Distance from arc determines severity

Electric Shock Injury – Burn

Severe Burns from Arc Flash

Arc flash	up to 35,000° F
Sun	9,900° F

Blindness

- Flash of light is so intense it can damage vision.

Shrapnel Wounds

Material and molten metal can hit the body at over 700 miles per hour.

Blast Lung Injury (BLI)

- Arc blast can cause inhalation injuries. For example:
  - Inhaling high temperature copper vapor
  - More than 100 toxic substances can be found in the fumes.

BLI + Burns = Greater chance of death

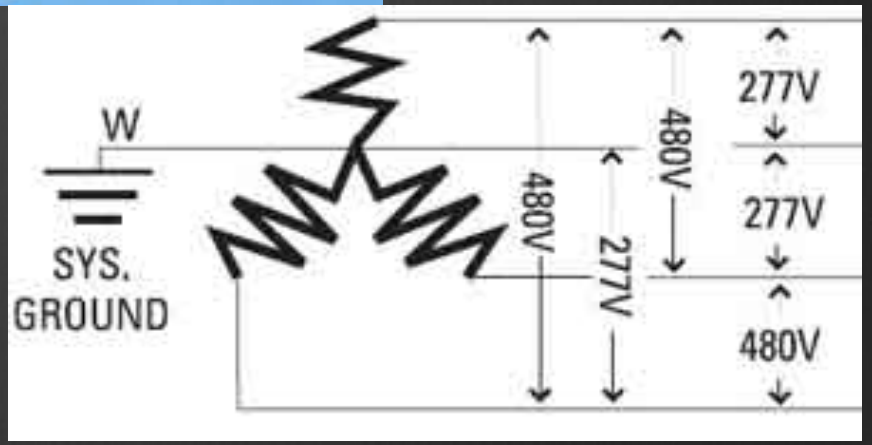
Hearing Damage

Arc blast at 2 feet	145 decibels
Jet engine at 200 feet	132 decibels
Pain threshold	130 decibels


DANGER
208 VOLTS


220 VOLTS
220 VOLTS
220 VOLTS
220 VOLTS
277 VOLTS
4160 VOLTS


DANGER
240V AC
AUTHORISED
ACCESS
ONLY


W
SYS.
GROUND
480V
277V
480V
277V
277V
480V

What Voltages are Present?
What Employers &You Should Know

120V
480V
4160V

What Voltages are Present?

- 7.2KV
- 13.8KV
- 14.4KV

What Voltages are Present?

- 20KV
- 138KV
- 345KV
- 500KV
- 750KV

What Voltages are Present?

What Voltages are Present?

Hazard versus Risk
Understand the Difference
The Hazard is Always There

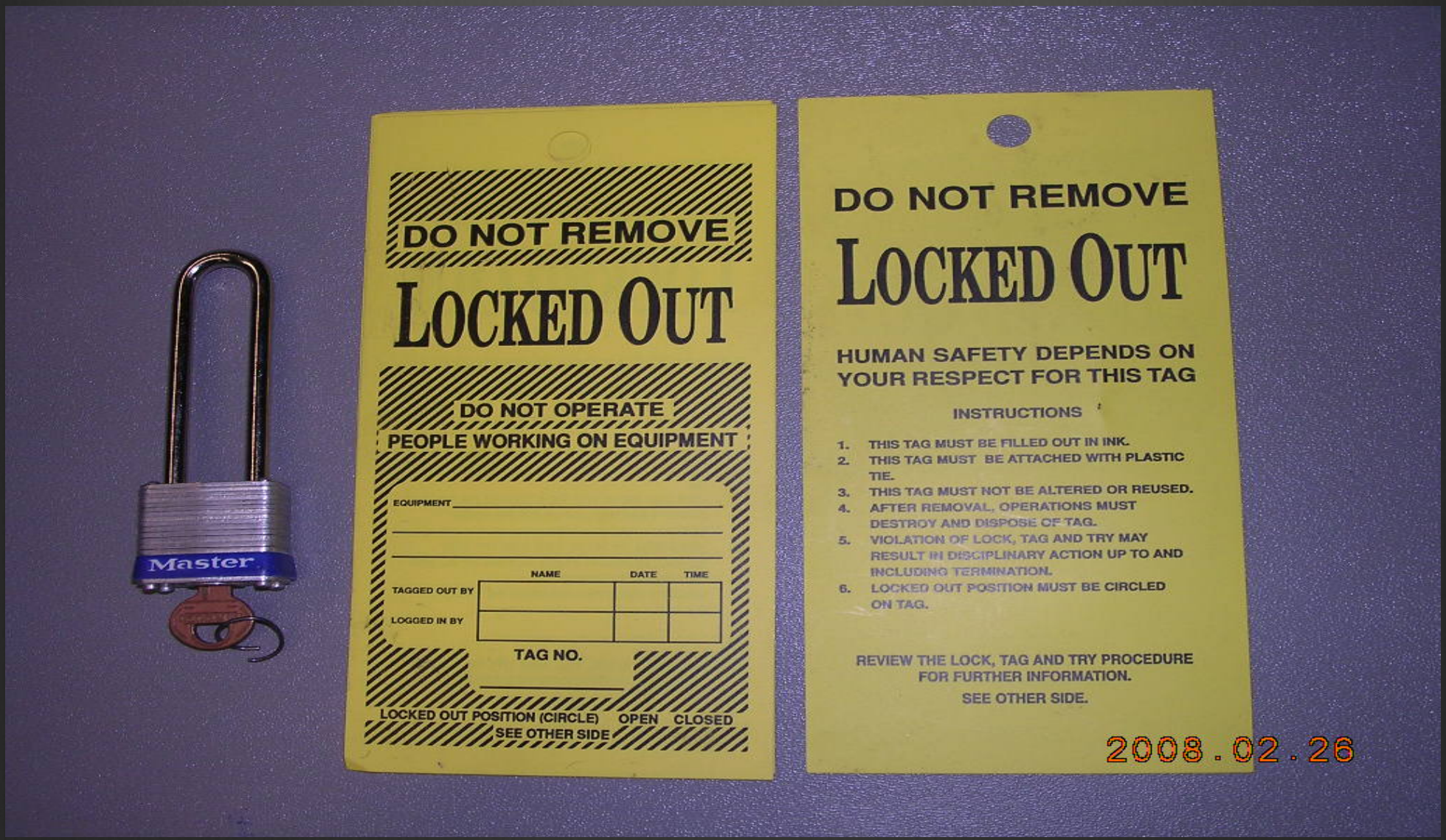
HAZARD
Presence of a material or condition that has the potential for causing loss or harm

RISK
A combination of the severity of consequences and the likelihood of occurrence of undesired outcomes

Source: R.W. Johnson, "Risk Management by Risk Magnitudes," *Chemical Health & Safety* 5(5), 1998

What Are the Elements of Electrical Safety?

Lockout Tagout



Energized Electrical Work Permit

Under NFPA 70E, there are only two instances in which an employee can work on live parts. In these situations, a work permit must be completed and approved by an authorized person.

1. When de-energizing would interrupt essential life support, emergency alarms or ventilation systems.
2. When the organization can demonstrate that de-energizing the system would introduce additional or increased hazards or that it is infeasible due to equipment design or operational limitations.

PART 1 TO BE COMPLETED BY THE REQUESTER

Job/Work Order Number _____

1. Description of circuit/equipment/job location: _____
2. Description of work to be done: _____
3. Justification of what the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage: _____

PART II: TO BE COMPLETED BY THE ELECTRICALLY QUALIFIED PERSONS DONG THE WORK

	Check when Complete
1. Detailed job description procedure to be used in performing the above detailed work: _____	❒
2. Description of the safe work practices to be employed: _____	❒
3. Results of the shock hazard analysis: _____	❒
4. Determination of shock protection boundaries: _____	❒
5. Results of the flash hazard analysis: _____	❒
6. Determination of the flash protection boundary: _____	❒
7. Necessary personal protective equipment to safety perform the assigned task : _____	❒
8. Means employed to restrict the access of unqualified persons from the work area: _____	❒
9. Evidence of completion of job briefing including discussion of any job-related hazards: _____	❒

10. Do you agree the above described work can be done safely? ❒Yes ❒No (if no, return to requester)

Electrically Qualified Person(s) Date

PART III: APPROVAL(S) TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED

Manufacturing Manager _____ Maintenance/Engineering Manager _____

Safety Manager _____ Electrically Knowledgeably Person _____

General Manager _____ Date _____

Note: Once the work is complete, forward this form to the site Safety Department for review and retention.

Dated Insulated Gloves

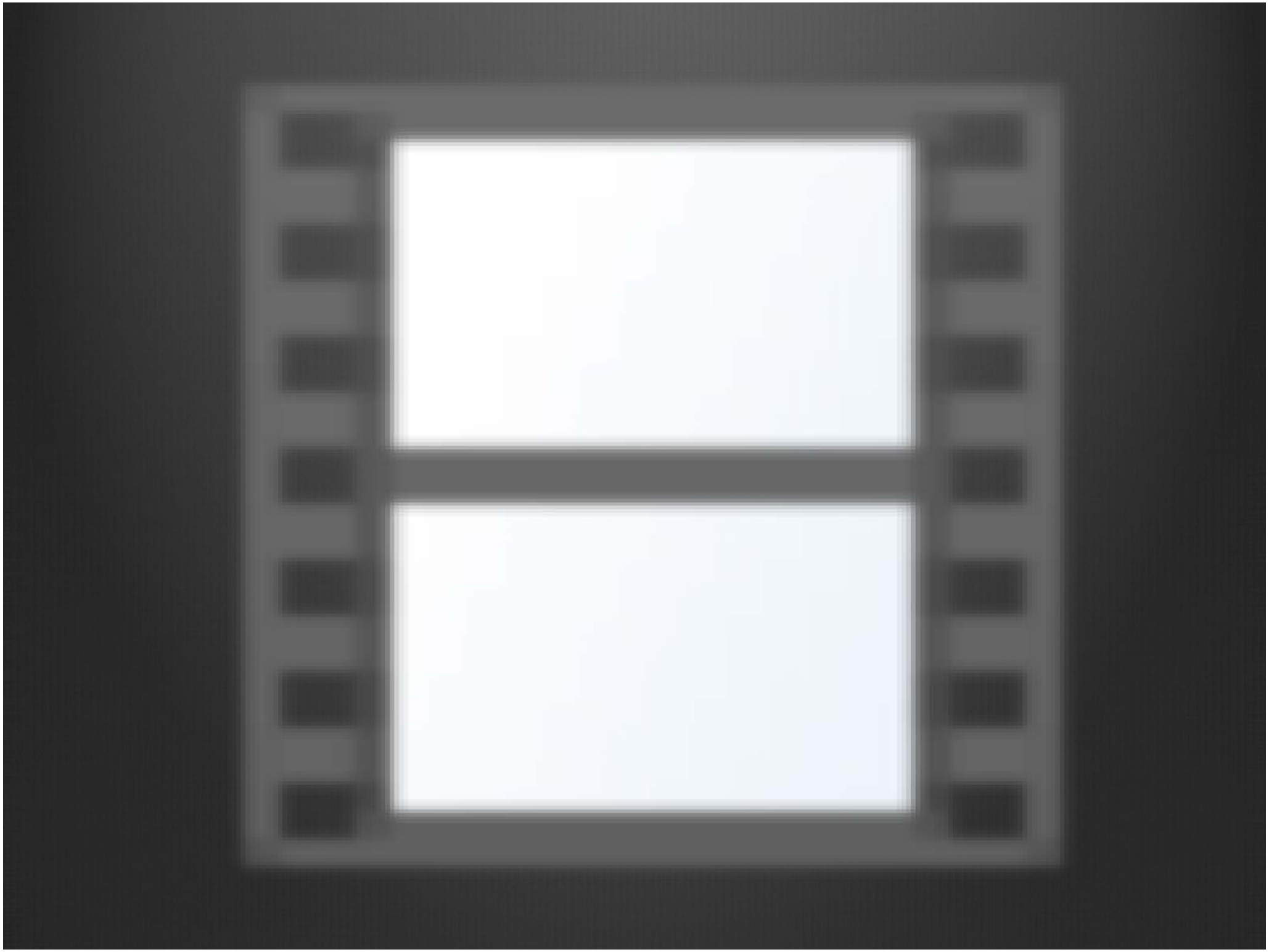
Protective Clothing

Meter Safety-Does meet requirements of 120.1(5) – NFPA 70E

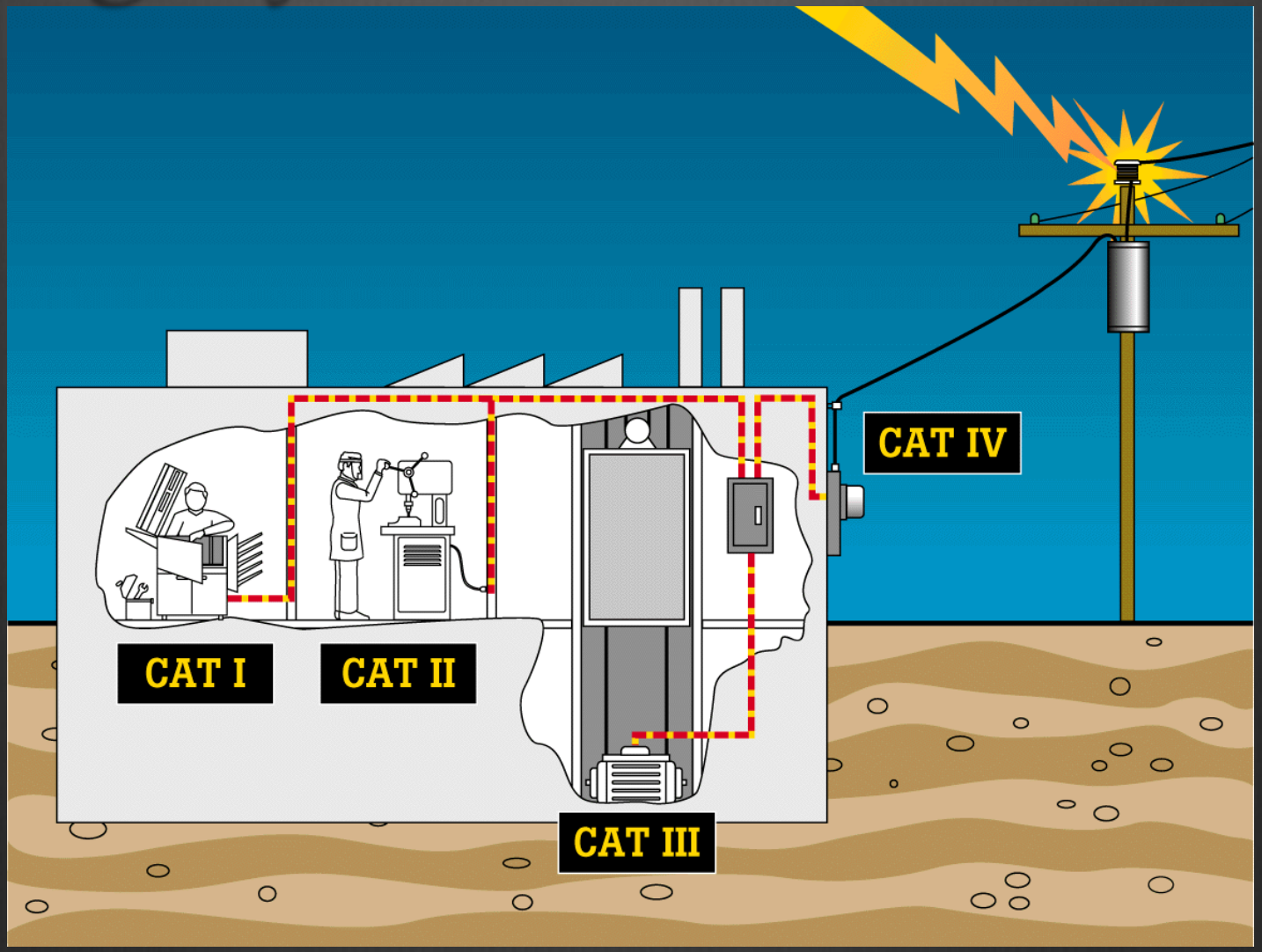
CAT III-1000 V
CAT IV -600V

CAT IV-600 V
CAT III-1000 V

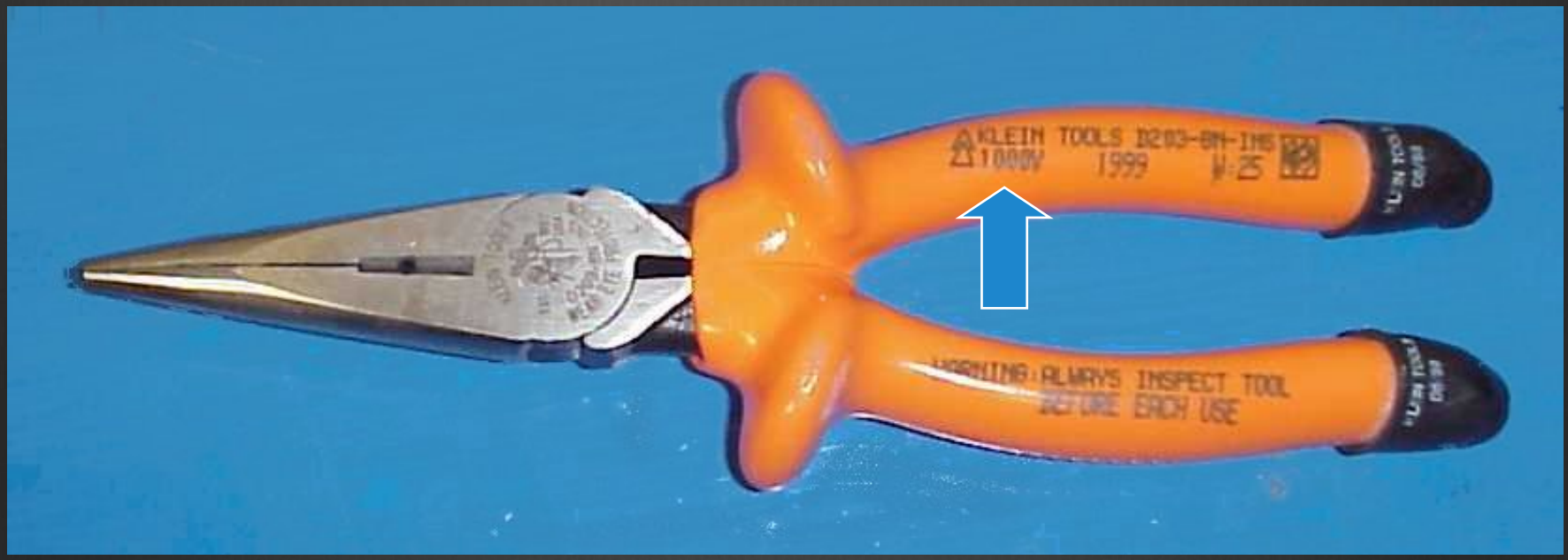
CAT III-600 V



Category locations



Voltage Rated Tools



Insulated Screwdrivers


6-PIECE ELECTRICAL SCREWDRIVER
■ CHROME VANADIUM STEEL FOR LONGER LIFE AND DURABILITY
■ HARDNESS MEETS OR EXCEEDS SPECS
TASK FORCE® TAIWAN #0 X 3"
TASK FORCE® TAIWAN #1 X 4"
TASK FORCE® TAIWAN #2 X 6"
TASK FORCE® TAIWAN 1/4"X6"
TASK FORCE® TAIWAN 3/16"X4"
TASK FORCE® TAIWAN 1/8"X3"
CONTENTS: SLOTTED 1/8" X 3" , 3/16"X4",1/4"X6" PHILLIPS#0X3" , #1X4" , #2X6"
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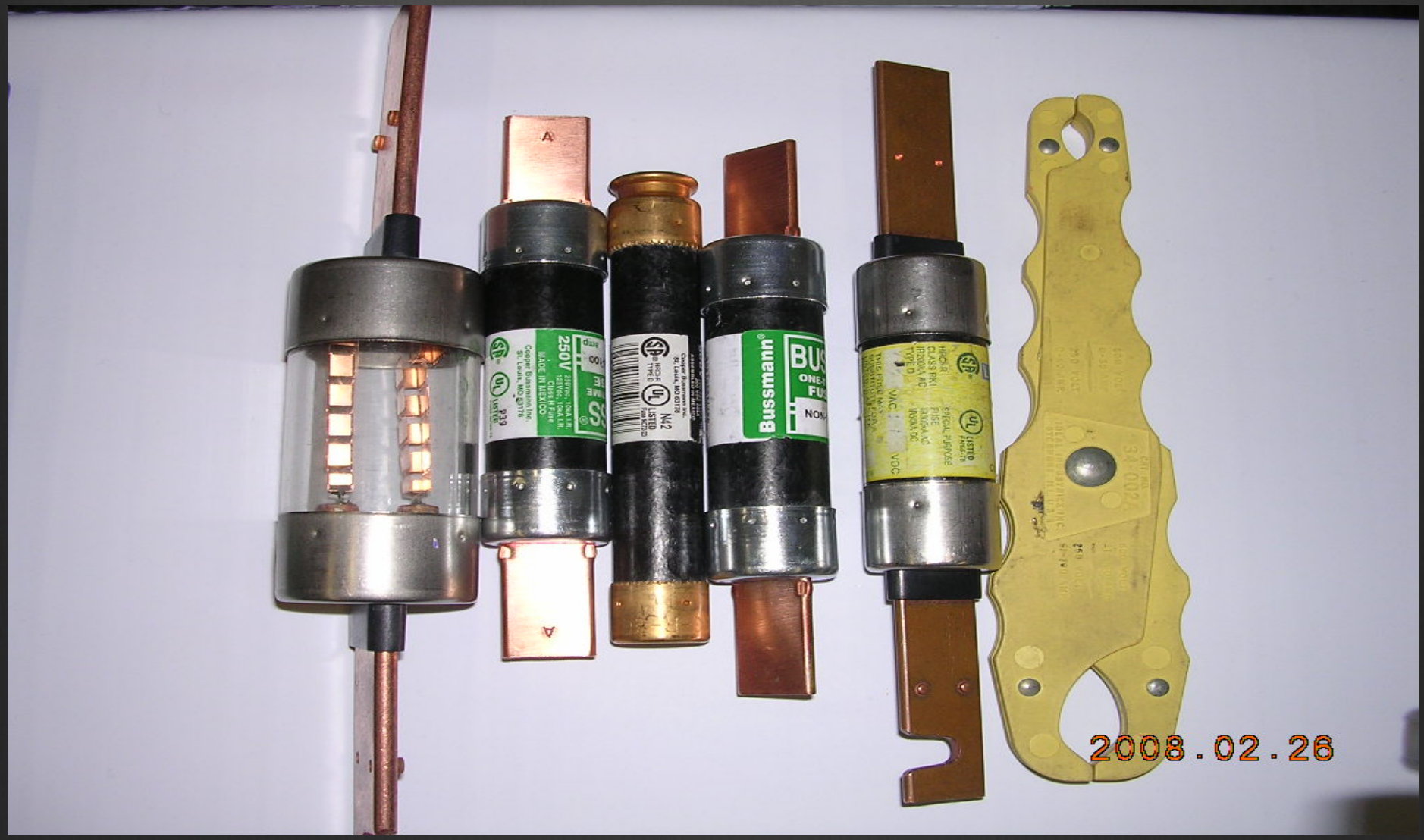
Fuses



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Based on Voltages & Hazards Present - Establish Procedures

- Determine Voltage & Arc Flash Hazards
- Determine Who is Exposed
- Determine Protective Measures
- Determine OSHA Requirements
- Determine What NFPA 70E Procedures that Will be Followed

PPE Selection – Using the NFPA 2021 Method & Tables

Selecting Arc Flash Protection

1. Calculate incident energy and select PPE based upon that calculation.

2. By Task by Equipment, determine if Arc Flash PPE is Required.

3, Then Determine the hazard risk category by voltage and type of equipment.

4. *Then* select PPE based upon hazard/risk category.

6. Ensure PPE conforms to the code requirements

Selecting Flash Protection

Let's Review The Tables in 70E 2021

They are Simplified

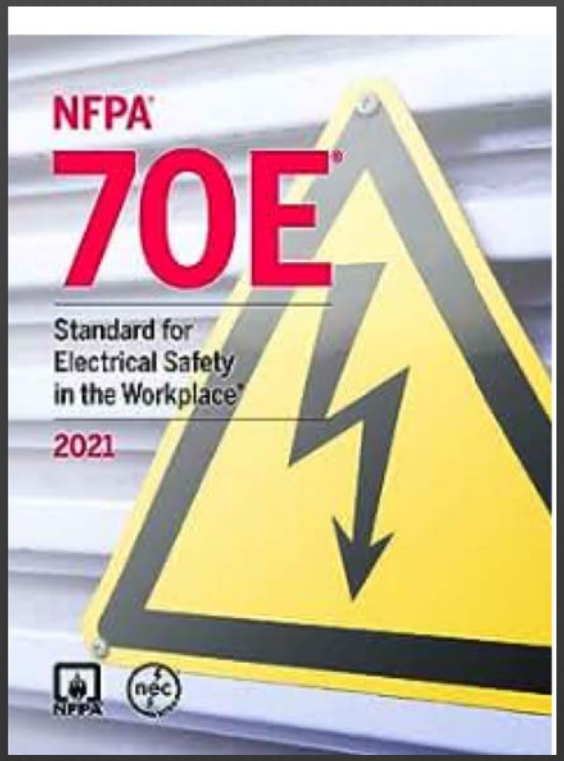


Table 130.7(C)(14) Informational Note: Standards for PPE

Subject	Document Title	Document Number
Clothing — Arc Rated	Standard Performance Specification for Flame Resistant and Electric Arc Rated Protective Clothing Worn by Workers Exposed to Flames and Electric Arc	ASTM F1506
	Standard Guide for Industrial Laundering of Flame, Thermal, and Arc Resistant Clothing	ASTM F1449
	Standard Guide for Home Laundering Care and Maintenance of Flame, Thermal and Arc Resistant Clothing	ASTM F2757
	Live working — Protective clothing against the thermal hazards of an electric arc — Part 1-1: Test methods — Method 1: Determination of the arc rating (ELIM, ATPV, and/or EBT) of clothing materials and of protective clothing using an open arc	IEC 61482-1-1
	Live working — Protective clothing against the thermal hazards of an electric arc — Part 2: Requirements	IEC 61482-2
Aprons — Insulating	Standard Specification for Electrically Insulating Aprons	ASTM F2677
Eye and Face Protection — General	American National Standard for Occupational and Educational Professional Eye and Face Protection	ANSI/ISEA Z87.1
Face — Arc Rated	Standard Test Method for Determining the Arc Rating and Standard Specification for Personal Eye or Face Protective Products	ASTM F2178
Fall Protection	Standard Specification for Personal Climbing Equipment	ASTM F887
Footwear — Dielectric Specification	Standard Specification for Dielectric Footwear	ASTM F1117
Footwear — Dielectric Test Method	Standard Test Method for Determining Dielectric Strength of Dielectric Footwear	ASTM F1116
Footwear — Standard Performance Specification	Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear	ASTM F2413
Footwear — Standard Test Method	Standard Test Methods for Foot Protections	ASTM F2412
Gloves — Arc Rated	Standard Test Method for Determining Arc Ratings of Hand Protective Products Developed and Used for Electrical Arc Flash Protection	ASTM F2675/F2675M
Gloves — Leather Protectors	Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens	ASTM F696
Gloves — Rubber Insulating	Standard Specification for Rubber Insulating Gloves	ASTM D120
Gloves and Sleeves — In-Service Care	Standard Specification for In-Service Care of Insulating Gloves and Sleeves	ASTM F496
Head Protection — Hard Hats	American National Standard for Head Protection	ANSI/ISEA Z89.1
Rainwear — Arc Rated	Standard Specification for Arc and Flame Resistant Rainwear	ASTM F1891
Rubber Protective Products — Visual Inspection	Standard Guide for Visual Inspection of Electrical Protective Rubber Products	ASTM F1236
Sleeves — Insulating	Standard Specification for Rubber Insulating Sleeves	ASTM D1051

Table 130.7(C)(15)(a) Arc Flash PPE Categories for Alternating Current (ac) Systems

Equipment	Arc Flash PPE Category	Arc Flash Boundary
Panelboards or other equipment rated 240 volts and below Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	1	485 mm (19 in.)
Panelboards or other equipment rated greater than 240 volts and up to 600 volts Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	2	900 mm (3 ft)
600-volt class motor control centers (MCCs) Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	2	1.5 m (5 ft)
600-volt class motor control centers (MCCs) Parameters: Maximum of 42 kA available fault current; maximum of 0.33 sec (20 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	4	4.3 m (14 ft)
600-volt class switchgear (with power circuit breakers or fused switches) and 600-volt class switchboards Parameters: Maximum of 35 kA available fault current; maximum of up to 0.5 sec (30 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	4	6 m (20 ft)
Other 600-volt class (277 volts through 600 volts, nominal) equipment Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	2	1.5 m (5 ft)
NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Metal-clad switchgear, 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Metal enclosed interrupter switchgear, fused or unfused type construction, 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Other equipment 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Arc-resistant equipment up to 600-volt class Parameters: DOORS CLOSED and SECURED; with an available fault current and a fault clearing time that does not exceed the arc-resistant rating of the equipment*	N/A	N/A
Arc-resistant equipment 1 kV through 15 kV Parameters: DOORS CLOSED and SECURED; with an available fault current and a fault clearing time that does not exceed the arc-resistant rating of the equipment*	N/A	N/A

N/A: Not applicable

Table 130.7(C)(15)(b) Arc Flash PPE Categories for dc Systems

Equipment	Arc Flash PPE Category	Arc Flash Boundary
Storage batteries, dc switchboards, and other dc supply sources Parameters: Greater than or equal to 100 volts and less than or equal to 250 volts Maximum arc duration and minimum working distance: 2 sec @ 455 mm (18 in.)		
Available fault current less than 4 kA	2	900 mm (3 ft)
Available fault current greater than or equal to 4 kA and less than 7 kA	2	1.2 m (4 ft)
Available fault current greater than or equal to 7 kA and less than 15 kA	3	1.8 m (6 ft)
Storage batteries, dc switchboards, and other dc supply sources Parameters: Greater than 250 volts and less than or equal to 600 volts Maximum arc duration and minimum working distance: 2 sec @ 455 mm (18 in.)		
Available fault current less than 1.5 kA	2	900 mm (3 ft)
Available fault current greater than or equal to 1.5 kA and less than 3 kA	2	1.2 m (4 ft)
Available fault current greater than or equal to 3 kA and less than 7 kA	3	1.8 m (6 ft.)
Available fault current greater than or equal to 7 kA and less than 10 kA	4	2.5 m (8 ft)

Notes:

(1) Apparel that can be expected to be exposed to electrolyte must meet both of the following conditions:

(a) Be evaluated for electrolyte protection

Informational Note: ASTM F1296, *Standard Guide for Evaluating Chemical Protective Clothing*, contains information on evaluating apparel for protection from electrolyte.

(b) Be arc rated

Informational Note: ASTM F1891, *Standard Specification for Arc and Flame Resistant Rainwear*, contains information on evaluating arc-rated apparel.

(2) A two-second arc duration is assumed if there is no overcurrent protective device (OCPD) or if the fault clearing time is not known. If the fault clearing time is known and is less than 2 seconds, an incident energy analysis could provide a more representative result.

Informational Note No. 1: When determining available fault current, the effects of cables and any other impedances in the circuit should be included. Power system modeling is the best method to determine the available short-circuit current at the point of the arc. Battery cell short-circuit current can be obtained from the battery manufacturer. See D.5 for the basis for table values and alternative methods to determine dc incident energy. Methods should be used with good engineering judgment.

Informational Note No. 2: The methods for estimating the dc arc flash incident energy that were used to determine the categories for this table are based on open-air incident energy calculations. Open-air calculations were used because many battery systems and other dc process systems are in open areas or rooms. If the specific task is within an enclosure, it would be prudent to consider additional PPE protection beyond the value shown in this table.

Table 130.7(C)(15)(c) Personal Protective Equipment (PPE)

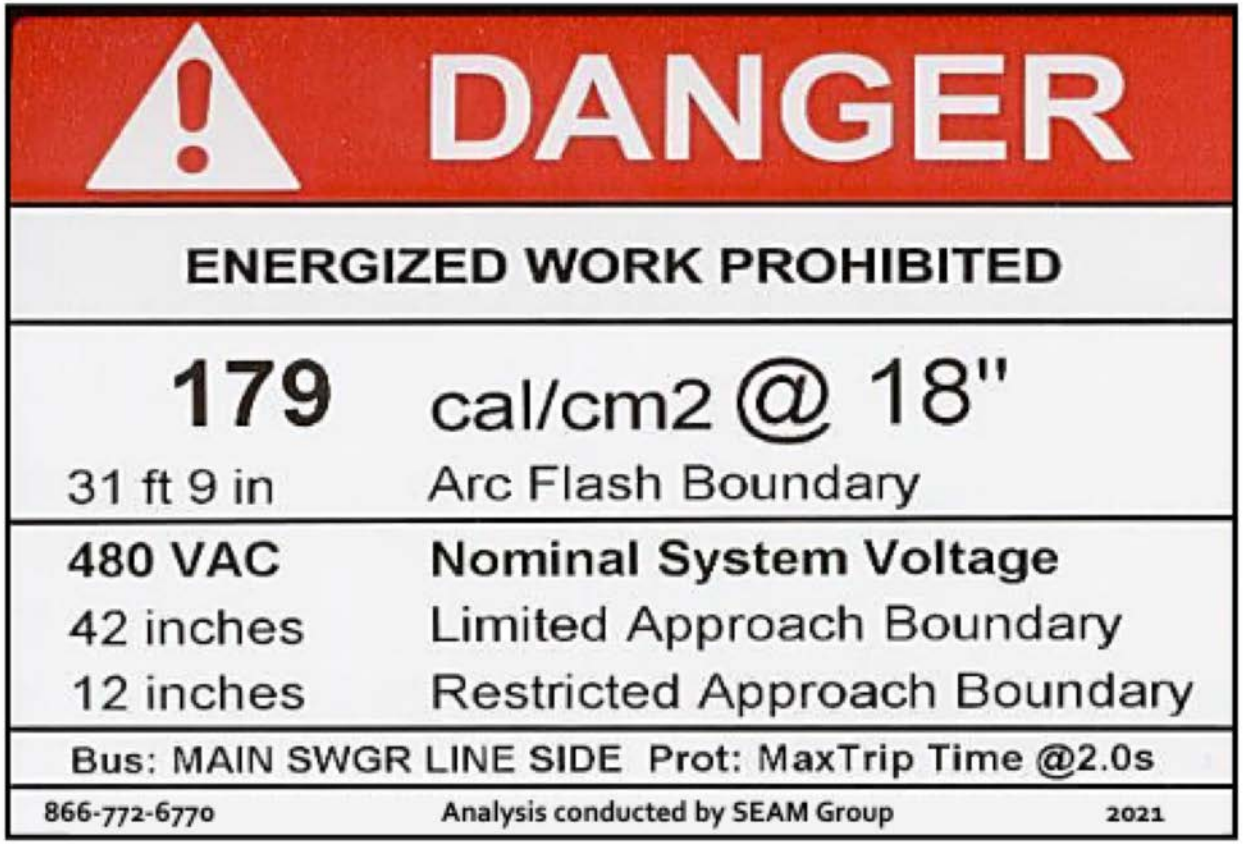
Arc-Flash PPE Category	PPE
	Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm² (16.75 J/cm²)[a]
	Arc-rated long-sleeve shirt and pants or arc-rated coverall
	Arc-rated face shield[b] or arc flash suit hood
	Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)[f]
	Protective Equipment
	Hard hat
	Safety glasses or safety goggles (SR)
	Hearing protection (ear canal inserts)[c]
	Heavy-duty leather gloves, arc-rated gloves, or rubber insulating gloves with leather protectors (SR)[d]
	Leather footwear[e] (AN)
	Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm² (33.5 J/cm²)[a]
	Arc-rated long-sleeve shirt and pants or arc-rated coverall
	Arc-rated flash suit hood or arc-rated face shield[b] and arc-rated balaclava
	Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)[f]
	Protective Equipment
	Hard hat
	Safety glasses or safety goggles (SR)
	Hearing protection (ear canal inserts)[c]
	Heavy-duty leather gloves, arc-rated gloves, or rubber insulating gloves with leather protectors (SR)[d]
	Leather footwear[e]
	Arc-Rated Clothing Selected so That the System Arc Rating Meets the Required Minimum Arc Rating of 25 cal/cm² (104.7 J/cm²)[a]
	Arc-rated long-sleeve shirt (AR)
	Arc-rated pants (AR)
	Arc-rated coverall (AR)
	Arc-rated arc flash suit jacket (AR)
	Arc-rated arc flash suit pants (AR)
	Arc-rated arc flash suit hood
	Arc-rated gloves or rubber insulating gloves with leather protectors (SR)[d]
	Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)[f]
	Protective Equipment
	Hard hat
	Safety glasses or safety goggles (SR)
	Hearing protection (ear canal inserts)[c]
	Leather footwear[e]
	Arc-Rated Clothing Selected so That the System Arc Rating Meets the Required Minimum Arc Rating of 40 cal/cm² (167.5 J/cm²)[a]
	Arc-rated long-sleeve shirt (AR)
	Arc-rated pants (AR)
	Arc-rated coverall (AR)
	Arc-rated arc flash suit jacket (AR)
	Arc-rated arc flash suit pants (AR)
	Arc-rated arc flash suit hood
	Arc-rated gloves or rubber insulating gloves with leather protectors (SR)[d]
	Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)[f]
	Protective Equipment
	Hard hat
	Safety glasses or safety goggles (SR)
	Hearing protection (ear canal inserts)[c]
	Leather footwear[e]

N: As needed (optional). AR: As required. SR: Selection required.
Arc rating is defined in Article 100.

Table 130.7(G) Informational Note: Standards on Other Protective Equipment

Subject	Document	Document Number
Arc Protective Blankets	Standard Test Method for Determining the Protective Performance of an Arc Protective Blanket for Electric Arc Hazards	ASTM F2676
Arc Protective Blankets — Selection, Care, and Use	Standard Guide for Selection, Care, and Use of Arc Protective Blankets	ASTM F3272
Blankets	Standard Specification for Rubber Insulating Blankets	ASTM D1048
Blankets — In-service Care	Standard Specification for In-Service Care of Insulating Blankets	ASTM F479
Covers	Standard Specification for Rubber Insulating Covers	ASTM D1049
Fiberglass Rods — Live Line Tools	Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools	ASTM F711
Insulated Hand Tools	Standard Specification for Insulated and Insulating Hand Tools	ASTM F1505
Ladders	American National Standard for Ladders — Wood — Safety Requirements	ANSI/ ASC A14.1
	American National Standard for Ladders — Fixed — Safety Requirements	ANSI /ASC A14.3
	American National Standard Safety Requirements for Job Made Wooden Ladders	ANSI ASC A14.4
	American National Standard for Ladders — Portable Reinforced Plastic — Safety Requirements	ANSI ASC A14.5
Line Hose	Standard Specification for Rubber Insulating Line Hoses	ASTM D1050
Line Hose and Covers — In-service Care	Standard Specification for In-Service Care of Insulating Line Hose and Covers	ASTM F478
Plastic Guard	Standard Test Methods and Specifications for Electrically Insulating Plastic Guard Equipment for Protection of Workers	ASTM F712
Sheeting	Standard Specification for PVC Insulating Sheeting	ASTM F1742
	Standard Specification for Rubber Insulating Sheeting	ASTM F2320
Safety Signs and Tags	Series of Standards for Safety Signs and Tags	ANSI Z535
Shield Performance on Live Line Tool	Standard Test Method for Determining the Protective Performance of a Shield Attached on Live Line Tools or on Racking Rods for Electric Arc Hazards	ASTM F2522
Temporary Protective Grounds — In-service Testing	Standard Specification for In-Service Test Methods for Temporary Grounding Jumper Assemblies Used on De-energized Electric Power Lines and Equipment	ASTM F2249
Temporary Protective Grounds — Test Specification	Standard Specification for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment	ASTM F855

Label Electrical Systems



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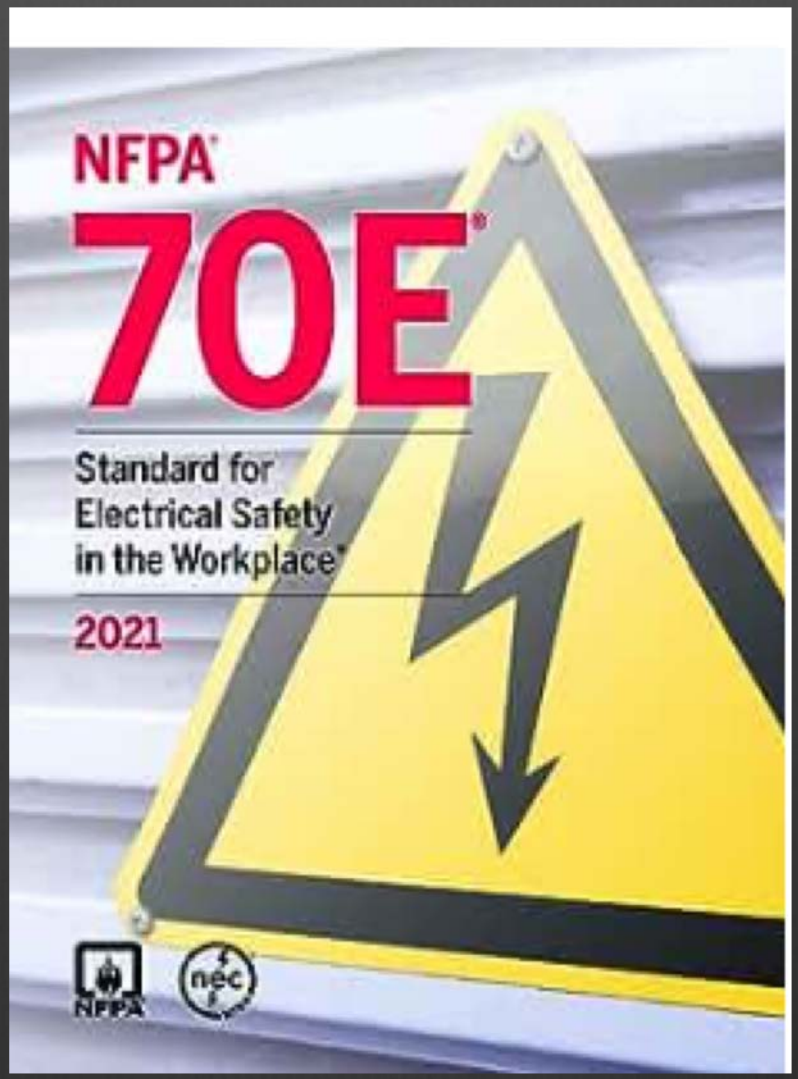
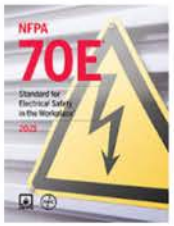
Note: 2024 coming soon



2021 Key Provisions



Number One Priority

PPE

Circuit Breakers

Training

Attendant

Risk Reduction Methods

Battery Safety

Electrical Safety Program

Capacitor Safety

Non-Contact proximity test instruments

2021 Key Provisions

Restructuring of Article 110 General Requirements

2018 Edition

- 110.1 Electrical Safety Program
- 110.2 Training Requirements
- 110.3 Host and Contractor Responsibilities
- 110.4 Test Instruments and Equipment
- 110.5 Portable Plug-and-Cord-Connected Equipment
- 110.6 Ground Fault Circuit Interrupter Protection
- 110.7 Overcurrent Protection Modification

2021 Edition

- 110.1 Priority (moved from 105.4)
- 110.2 General (moved from 120.2(A))
- 110.3 Electrical Safe Work Condition
- 110.4 Energized Work (moved from 130.2(A)
- 110.5 Electrical Safety Program
- 110.6 Training Requirements
- 110.7 Host and Contractor Responsibilities
- 110.8 Test Instruments and Equipment
- 110.9 Portable Plug-and-Cord-Connected Equipment
- 110.10 Ground Fault Circuit Interrupter Protection
- 110.11 Overcurrent Protection Modification
- **110.12 Equipment Use (New Article)**

2021 Key Provisions

Article 110.1 Priority (Formerly Article105.4):

Hazard elimination shall be the priority in the implementation of safety-related work practices.

Informational Note 1: *Elimination is the risk control method listed first in the hierarchy of risk control identified in 110.5(H)(3). See Annex F for examples of hazard elimination.*

Informational Note 2: *An electrically **safe work condition is a state** wherein all hazardous electrical conductors or circuit parts to which a worker might be exposed are placed and maintained in a deenergized state, for the purpose of temporarily eliminating electrical hazards. See Article 120 for requirements to establish an electrically safe work condition for the period of time for which the state is maintained. See Informative Annex F for information regarding the hierarchy of risk control and hazard elimination.*

Electrically Safe Work Condition Policy Policy must comply with Article 110.3 (electrical Safe Work Condition)

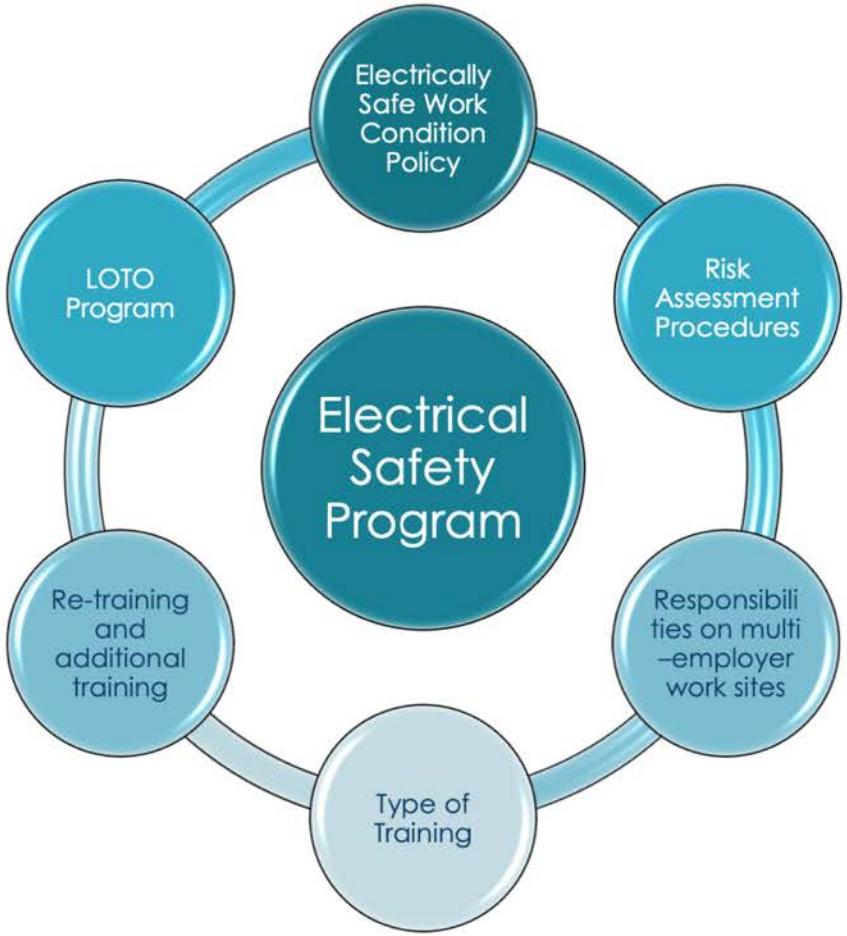
LOTO Program – Company ESP must include or have reference to your LOTO program

Risk Assessment Procedure
Identifying when a second person could be required

Responsibilities/Documentation – On multiple employer work sites safety is a shared responsibility (Article 110.7 (C)

Type of Training - Classroom training can now include interactive web- based training

Additional Training and Retraining



Article 110.6(A)(3) **Additional Training and Retraining**: An expansion on the concept of training and whether it is material covered before or if it is something new to the trainee in which it would be classified as additional or supplemental training not covered prior.

Article 110.6(A)(4) Type of Training

Informational Note: *Classroom training can include interactive electronic or interactive web-based training components.*

Article 110.7 Host and Contractor Employer's Responsibilities.

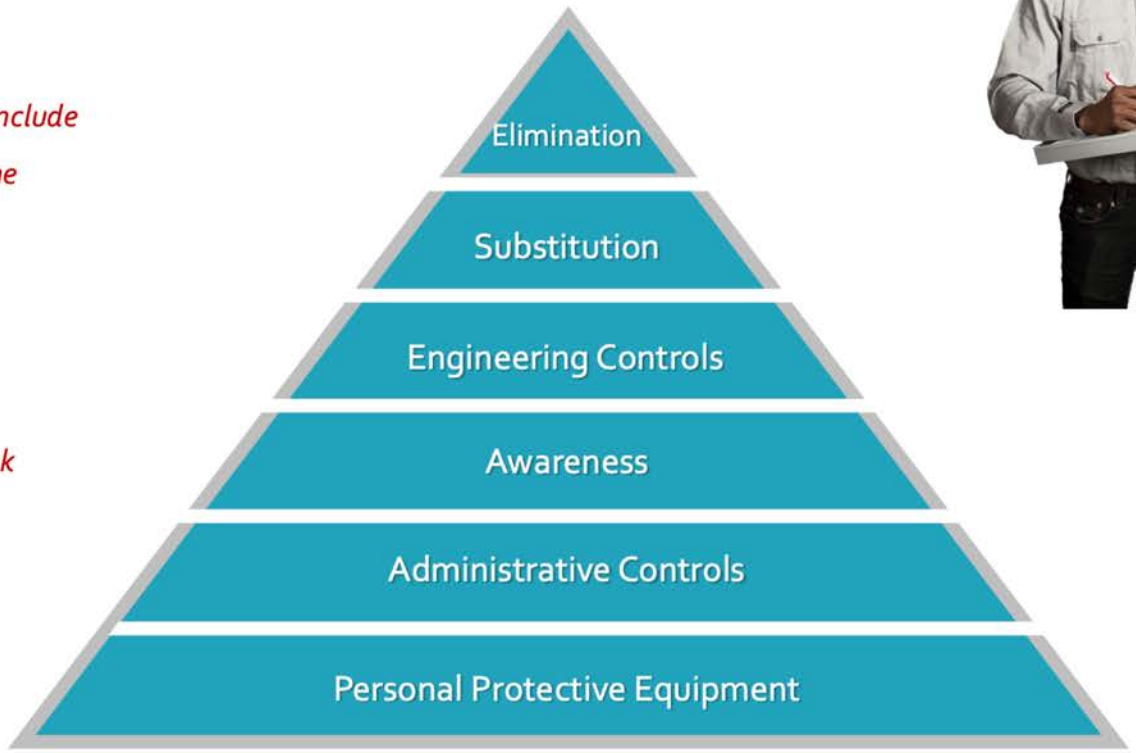
New Informational Note to 110.7: On multi-employer worksites (in all industry sectors), more than one employer can be responsible for identifying hazardous conditions and creating safe work practices.

OSHA®

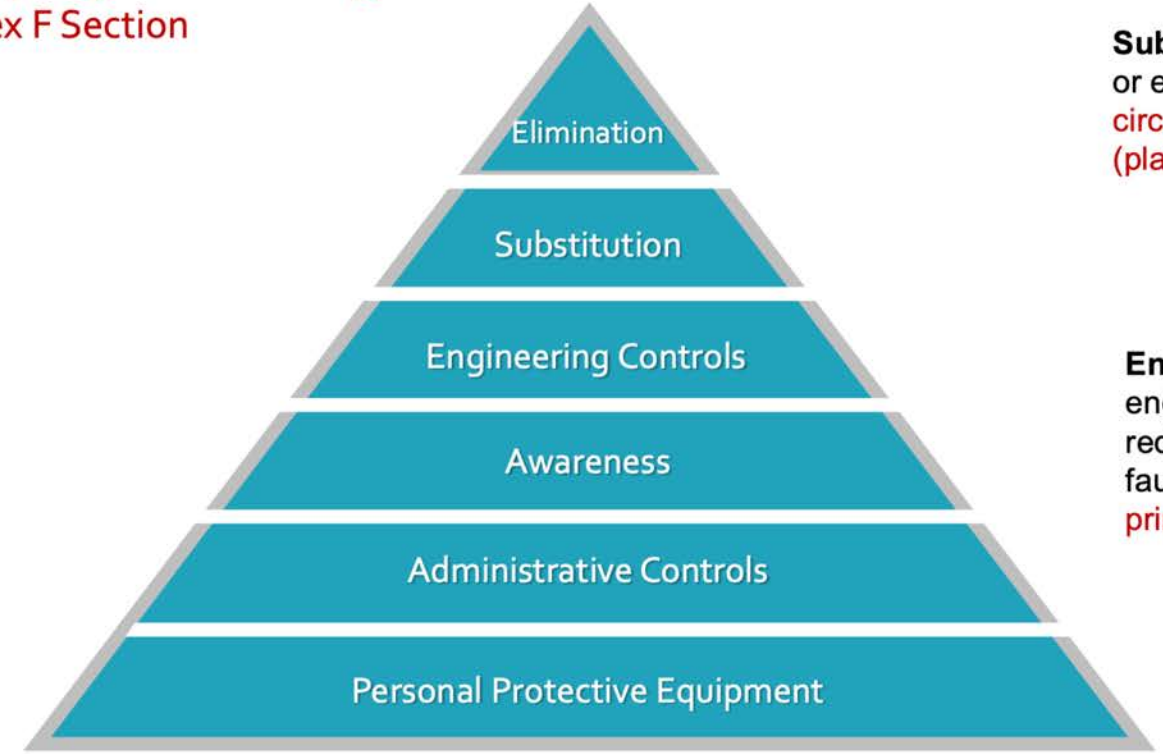
Article 110.5 (H)(1) Elements of a Risk Assessment Procedure

Informational Note 1: *Risk assessment procedure could include identifying when a second person could be required and the training and equipment that person should have. (First Aid ,CPR, Safe Release of Victims)*

Informational Note 2: *For more information regarding risk assessment and the hierarchy of risk control, see Informative Annex F for examples of risk reduction methods.*



Examples given in Table F.3
Annex F Section



Substitution – Less hazardous equipment, system or energy, (reduce energy by replacing 120V control circuitry with a 24 Vac or Vdc control circuitry) (place controls on the outside)

Engineering – Guard (Physically obstruct) energized electrical conductors and circuit parts to reduce the likelihood of electrical contact or arcing faults ,remote operators (Barrier on, line side/ primary side)

Job Safety Plan Checklist

TO BE COMPLETED BY AN ELECTRICALLY QUALIFIED PERSON:

(1) Description of the job and the electrical hazards associated with each task:

_____
_____
_____
_____

(2) Can electrical work be performed de-energized (Y/N)

(3) Is the work exempt from an EEWP? (voltage measuring, troubleshooting, IR, ultra sound (Y/N)

(4) Was absence of voltage verified with a test instrument, if de-energized (Y/N)

(5) Is an EEWP (Energized Electrical Work Permit) required to be filled out? (Y/N)

(6) Electrical equipment marked with an arc flash label? (Y/N)

(7) Results of the Shock Risk Assessment

- Electrical System Nominal Voltage_____
- Limited Approach Boundary Distance_____
- Restricted Approach Boundary Distance_____
- Is Shock Boundary marked off with barricades /warning tape? (Y/N)
- **PPE Required to perform Work**
- Rubber Insulated Gloves with Leather Protectors
- Insulated tools used in restricted boundary (Y/N)
- Insulating blanks to be used for job task? (Y/N)

(8) Results of the Arc Flash Risk Assessment

- Available Incident Energy Level _____cal/cm2
- Arc Flash Approach Boundary Distance_____
- Is Arc Flash Boundary marked off with barricades/ warning tape? (Y/N)
- **PPE Required to perform Work**
- Rubber Insulated Gloves with Leather Protectors
- Arc rated clothing /arc flash suit (Y/N)
- Arc rated face shield (Y/N)

(9) Special precautions that may be necessary: (Standby person necessary, capacitors need to be discharged)_____
_____

(10) Necessary energy sources controls: (LOTO completed? any secondary energy source used? electrical disconnect located?

_____
_____

(11) Was a pre-job safety briefing performed with all workers involved? (Y/N)?

I acknowledge that a pre-job briefing has been performed and I understand this job safety plan checklist and will comply with all the safety requirements.

Electrically Qualified Person Signature:
_____Date: ____/____/_____

Additional Workers involved Signatures
_____ Date: ____/____/_____

Company Name
ENERGIZED ELECTRICAL WORK PERMIT

130.7(C)(1) Personal Protective Equipment Informational Note

Informational Note: Where the estimated incident energy exposure is greater than the arc rating of commercially available arc rated PPE, then for the purpose of testing for the absence of voltage, the following examples of risk reduction methods could be used to reduce the likelihood of occurrence of an arcing event or the severity of exposure:

Examples of Risk Reduction Methods

Example III

- Increase the working distance
- Use current limiting devices within the system design to reduce the incident energy level.
- CB put in maintenance mode

Example II

- If equipment allows, observe visible air gaps between equipment conductors and circuit parts and the electrical source supply

Example I

Use a non-contact proximity test instrument or measurement of voltage on the secondary side of a low voltage transformer mounted in the equipment before using a contact test instrument to test for the absence of voltage below 1000 volts

Table 130.5(G) & Table 130.7 (C)(15)(c)

For footwear: Footwear other than leather or dielectric shall be permitted to be used provided it has been tested to demonstrate no ignition, melting, or dripping at the estimated incident energy exposure.

For Outerwear "Safety Vests": The arc rating of outer layers worn over arc rated clothing as protection from the elements or for other safety purposes, and that are not used as part of a layered system, shall not be required to be equal to or greater than the estimated incident energy exposure.

Definition Changed: (The words hood, and sock removed)

New Definition:

An arc rated head-protective fabric that protects the neck and head except for a small portion of the facial area.

New Informational Note:

Some balaclava designs protect the neck and head area except for the eyes .....while others leave the eyes and nose area unprotected.

NEW Table 130.7(C)(7)(a)

Glove Class (00), (0), (1) etc.

Maximum Voltage use ac & dc

Minimum distance between Rubber glove and leather protector

Minimum Distance

Installation of new a circuit breaker or switch or completion of maintenance ex:(bolts tightened, parts replaced)

Table 130.5(C)

Task:
Operation of a CB or switch the first time after installation or completion of maintenance in the equipment

Equipment Condition:
Any

Likelihood of an arc flash occurrence
Yes

Article 130.5 moved to Article 110.4 (D)

New article 110.12 Equipment Use:
Equipment shall be used in accordance with the manufacture's instructions

Article 130.5 Information Note: No 2 :
Inadequate maintenance of electrical equipment can result in increased opening time of overcurrent protective device increasing the incident energy.

Assessing Hazards Associated with Work on Batteries Annex F

Flow Chart

- System Voltage 100 volts or above
- Can batteries be segmented (put into separate groups to get below 100V)
- Arc flash risk assessment completed
- Arc flash risk assessment must be completed by an engineer
- Wear appropriate PPE for arc flash and shock protection

PPE – The Last Line of Defense But, Necessary for this Hazard

Arc Flash Rated Face Shield


CANTEX
CIP
Certified Insulated Products
2008.02.26

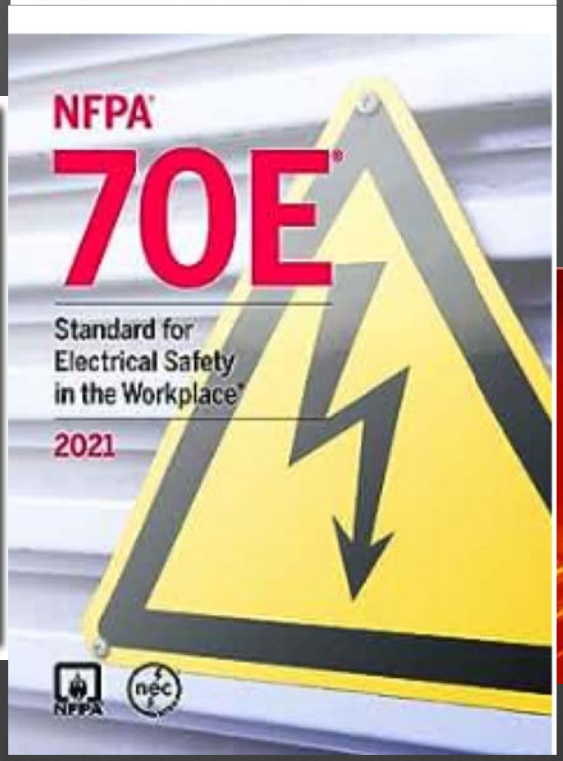

réutilisables, avec cordon
Tapones reutilizables
con cordón para los oídos
una colocación sencilla y los
hace más cómodos
Corded Design Prevents
Lost Earplugs
Le cordon prévient la perte
des bouchons d'oreille
Su diseño con cordón evita
que se pierdan los tapones
NRR 25 dB
AOSafety
1
pair
paire
par
2008.02.26

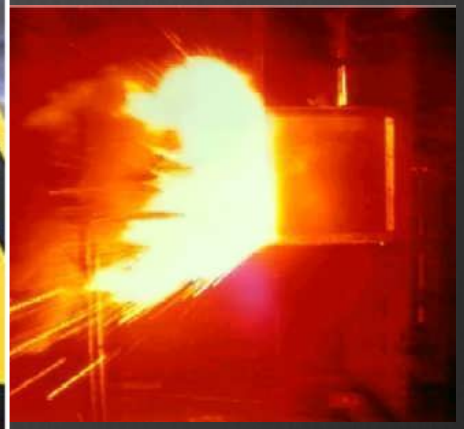
This is closer to what it should look like!

Can you find the shortcoming of this PPE for a Hazard Classification 2 ?

(480/277 VAC)

NCDOL
N.C. Department of Labor





NFPA 70E Electrical Safety, Arc Flash/Blast