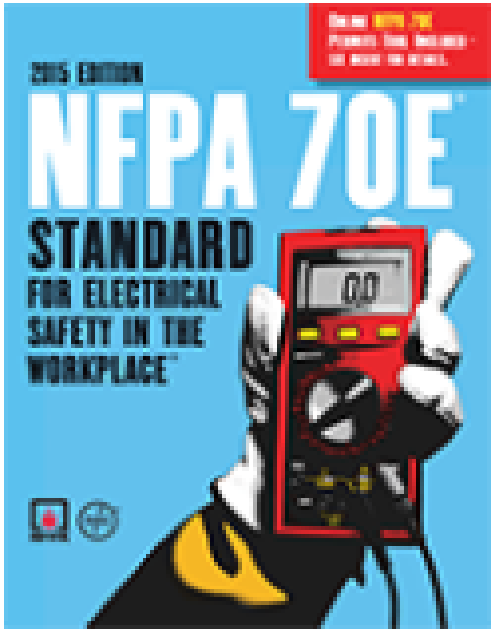

Electrical Safety/NFPA 70E (2015): A "Flash" Forward Overview of Standard Revisions

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Presentation Overview

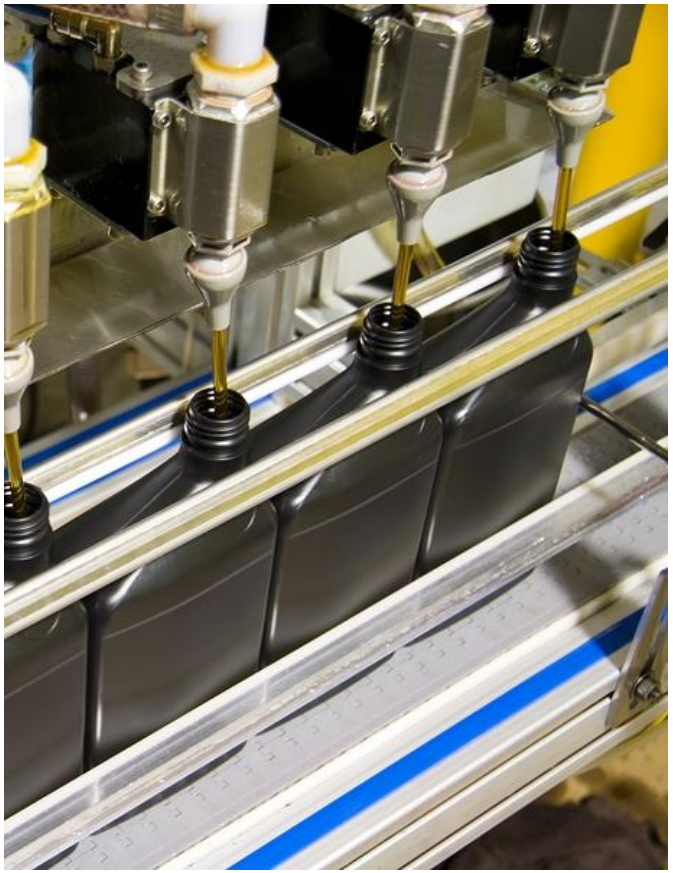
- Justification for energized work
- Electrical Safety Program Considerations
- Work Involving Electrical Hazards
  - Approach Boundaries
  - Equipment Labeling
  - PPE

Presentation Overview

- Risk Assessment Emphasis
  - Hazard addresses the potential for harm (i.e.: Arc Flash **Hazard Analysis** in 2012 editions and before).
  - Risk addresses the combination of severity and likelihood and addresses potential for failure (i.e. Arc Flash ***Risk Assessment*** in 2015 edition).

Justification for Energized Work

- De-energizing introduces *additional or increased* hazard
- De-energizing is infeasible
- Equipment operates at 50 Volts or less



Justification for Energized Work

- Arc flash and shock protection means be implemented during testing and troubleshooting of electrical conductors
- Requirements for protective equipment, training, and electrical safety program apply for activities such as lockout (zero energy state) verification as with a multimeter voltage testing equipment.

Electrical Safety Program Considerations

- The employer shall implement and document an overall electrical safety program **(NFPA 70E, Article 110.1)**
- *Risk Assessment* **(NFPA 70E, Article 110.1(G))**
  - *Identify Hazards*
  - *Assess Risk*
  - *Implement control measures in accordance with the hierarchy of controls*
    - *Elimination*
    - *Substitution*
    - *Engineering Controls*
    - *Administrative Controls*
    - *PPE*

Electrical Safety Program Considerations

- Qualified Person **(NFPA 70E, Article 100)**
  - One who has the *demonstrated* skills & knowledge related to the construction and operation of the electrical equipment & installations and has received safety training *to identify* and avoid the hazards involved.

Electrical Safety Program Considerations

- Electrical Safety Program Auditing **(NFPA 70E, Article 110.1(I)(1)-(2))**
  - Program Audit=every three years
  - *Qualified Person Audit=every 1 year*

Question 1

What is the 2015 auditing requirement frequency for qualified persons?

a. 1 year
b. 2 years
c. 3 years
d. 4 years

Question 2

What is the 2015 electrical safety program auditing requirement?

a. 1 year
b. 2 years
c. 3 years
d. 4 years

Work Involving Electrical Hazards

- Equipment shall be place in an electrically safety work condition if any of the following exists: **(NFPA 70E, Article 130.2)**
  - Worker is within the limited approach boundary
  - Conductors are not exposed but likelihood from arc flash exposure exists
  - *Employee is within the arc flash boundary of exposed energized parts or circuit paths*

Question 3

Exception to work permit implementation include(s):

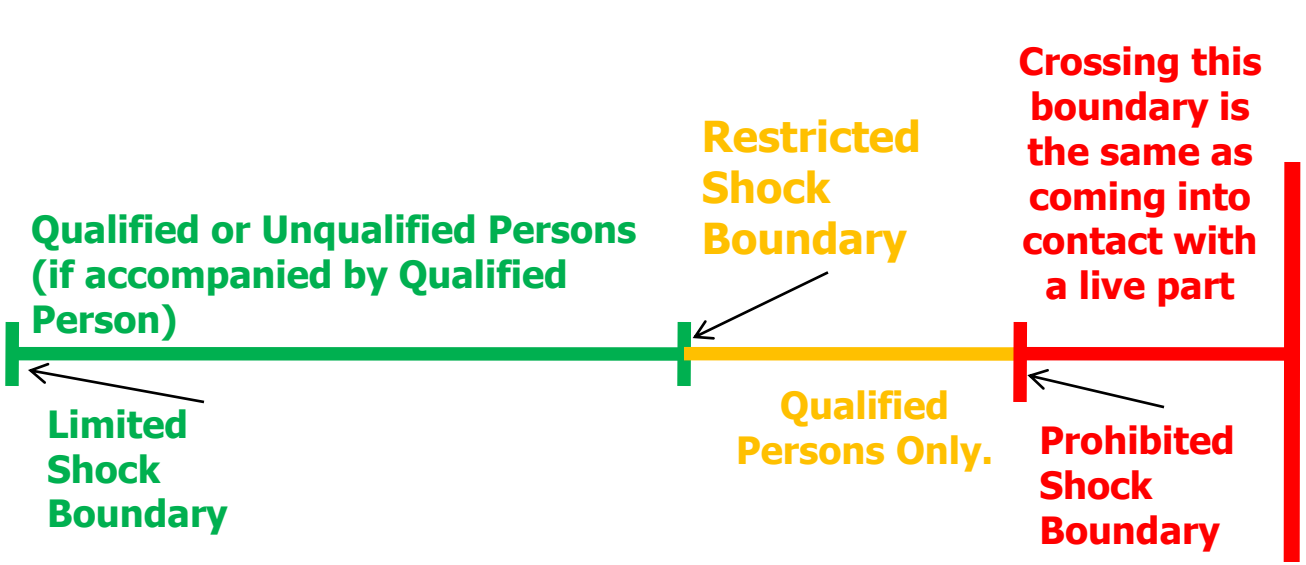
a. The worker does not feel like filling out the work permit

b. It is a routine task, you are using the appropriate PPE, you are testing, troubleshooting, voltage measuring.

c. The task is not routine

d. There are no exemptions to an energized electrical work permit

Approach Boundaries Prior to 2015



Equipment

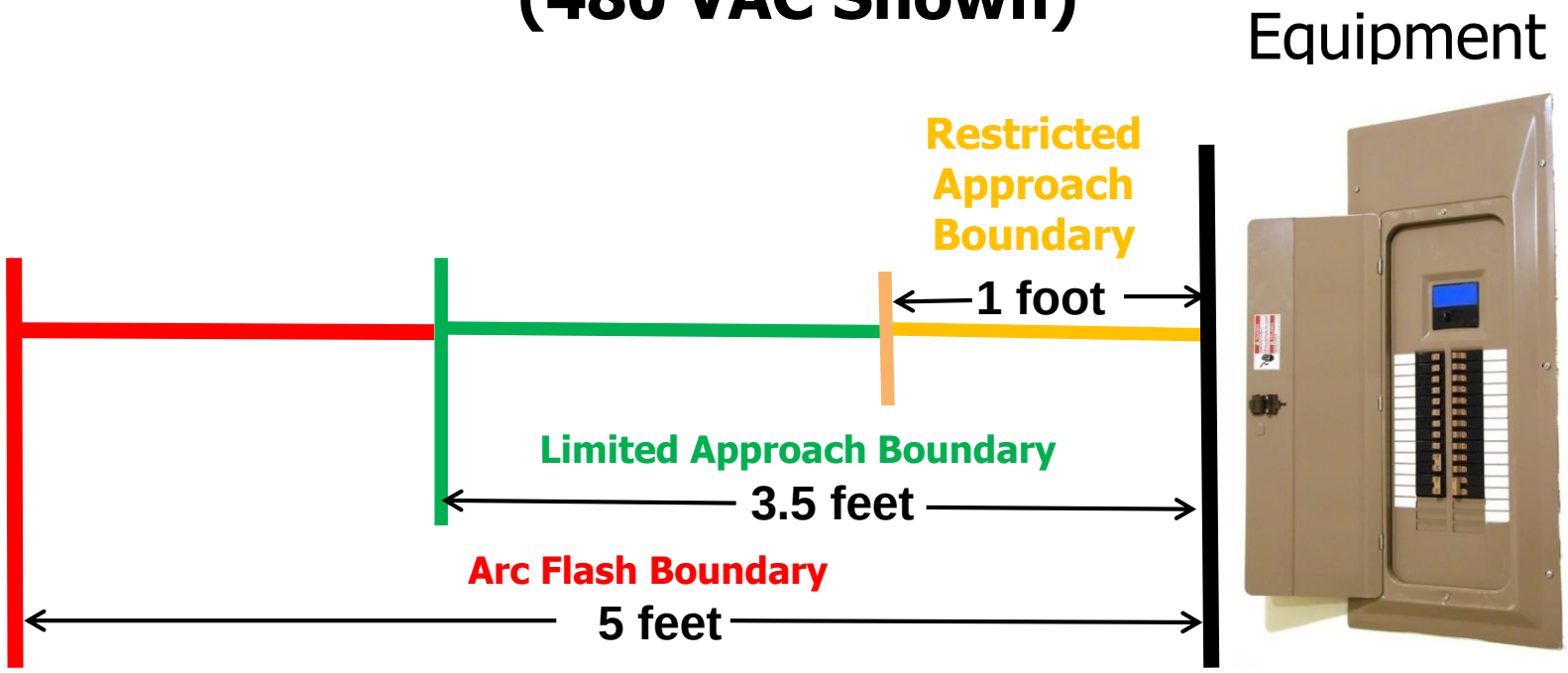
Approach Boundaries-Definitions (For shock hazard)

- Limited approach boundary: Outermost boundary that can be crossed by qualified person.
- Restricted Approach Boundary: Safest distance before qualified worker is required to use shock protection equipment and techniques. Unqualified persons may not cross the boundary under any circumstances.
- ~~Prohibited Approach Boundary: Crossing this boundary is the same as coming into contact with a live part~~

Work Involving Electrical Hazards

- Approach Boundaries *for shock protection* **(NFPA 70E, Article 130.4)**
  - *Prohibited Approach boundary was eliminated in 2015*
  - Included are
    - Limited
    - Restricted

Approach Boundaries-2015 (480 VAC Shown)



Question 4

In 2015, which boundary was eliminated?

a. Limited Approach
b. Restricted Approach
c. Prohibited Approach
d. Arc Flash Boundary

Work Involving Electrical Hazards

- Arc Flash Boundaries **(NFPA 70E, Article 130.5)**
- Distance at which incident energy equals 1.2 cal/cm^2
- Termed Arc Flash *Risk Assessment*
  - *Determine if arc flash hazard exists*
  - *Appropriate work practices implemented*
  - *Arc Flash Boundary*
  - *PPE to be used inside of arc flash boundary*
  - Updated every 5 years

Work Involving Electrical Hazards

Work Involving Electrical Hazards

- Equipment Labeling **(NFPA 70E, Article 130.5(B))**
- At least one of the following:
  - Available incident energy and the corresponding working distance*
  - Minimum arc rating of clothing
  - *Site specific level of PPE*
  - *PPE Category in 130.7(C)(15) for equipment (PPE Category Method-Formerly Hazard Risk Category)**
- Nominal system voltage
- Arc Flash Boundary

***Labels cannot have BOTH PPE Category & Available incident energy**

Work Involving Electrical Hazards

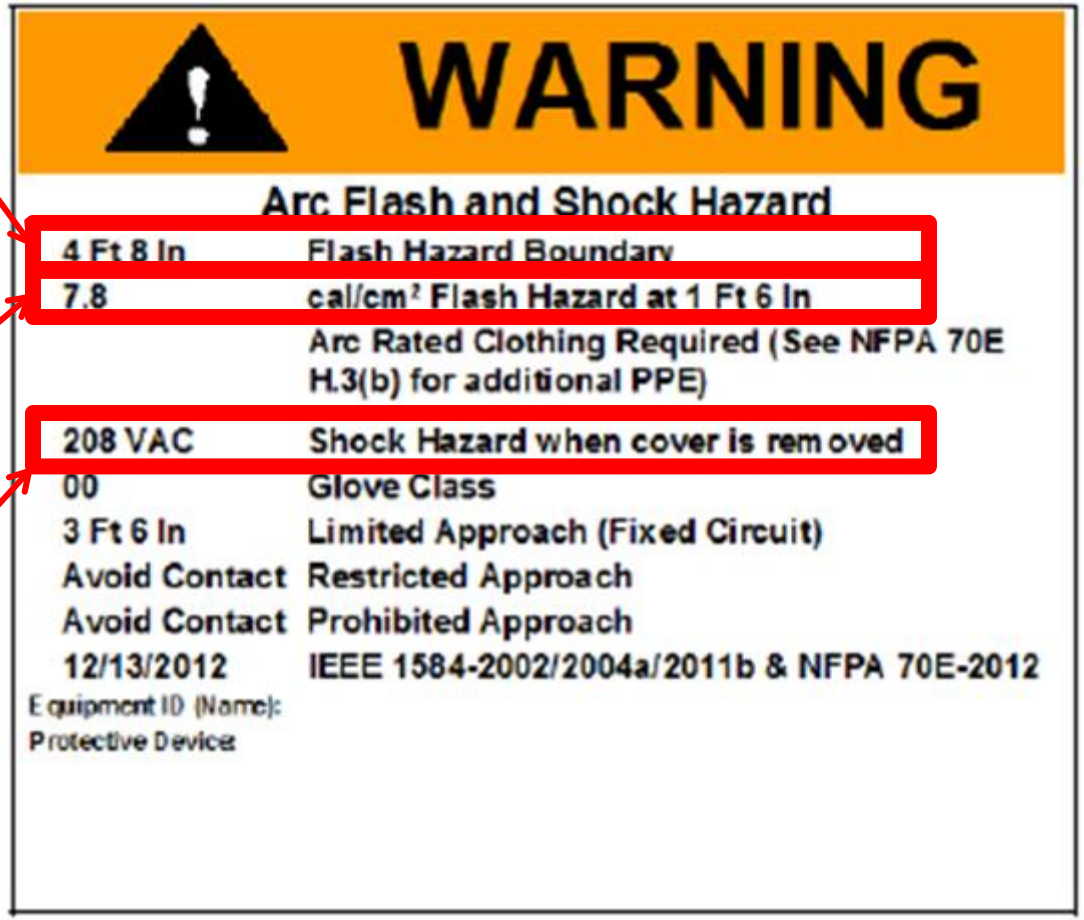
No Longer Acceptable!!

Arc Flash Label with Incident Energy Method

Arc Flash Boundary

Available incident energy and the corresponding working distance

System Voltage



Question 5

Arc Flash Labels must contain:

a. Nominal system voltage
b. Arc flash boundary
c. Required level of PPE
d. All of the above

Work Involving Electrical Hazards

- Personal Protective Equipment **(NFPA 70E, Article 130.5(C))**
  - When it is determined that work will be performed within the arc flash boundary, one of the following methods shall be used to determine PPE:
    - Incident Energy Analysis (Arc Flash Hazard Analysis)
    - *Arc Flash PPE Categories* (Formerly Hazard Risk Categories)

Work Involving Electrical Hazards

- PPE Selection Based on *PPE Category* (Formerly HRC) in lieu of arc flash hazard analysis **(NFPA 70E, Article 130.7(C)(15)(a))**
  - *Criteria for using tables*
    - *Task must be listed in tables*
    - *Power system applied is less than estimated maximum short circuit current used for tables*
    - *Power system applied is shorter than clearing times used for tables*
    - *Tasks are greater than or equal to minimum working distances listed in table*

Work Involving Electrical Hazards

- *Tables List*
  - *Arc Flash Hazard Identification* **(NFPA 70E, Table 130.7(C)(15)(A)(a))**
    - *Task* (examples)
      - *Voltage Testing*
      - *Infrared Thermography*
    - *Equipment Condition*
      - *Any*
      - *Proper Electrical Installation*
      - *Improper Electrical Installation*
    - *Arc Flash Hazard*
      - *Yes*
      - *No*

Question 6

Arc Flash Hazard Identification Example (*Flash Hazard Identification Table)*

- Task: Normal Operation of Circuit Breaker or Switch
- Equipment Properly Installed
- Arc Flash Hazard?
  a. Yes
  b. No

Question 7

Arc Flash Hazard Identification Example (*Flash Hazard Identification Table)*

- Task: Voltage Testing
- Any Equipment Condition
- Arc Flash Hazard?
  a. Yes
  b. No

- *Tables List*
  - *Arc Flash PPE Categories* **(NFPA 70E, Table 130.7(C)(15)(A)(b))**
    - *Equipment* (examples)
      - *Panelboard*
      - *MCC*
    - *Parameters for PPE Category*
      - *Short Circuit Current (kiloAmps)*
      - *Fault Clearing Time (Seconds)*
      - *Working Distance (18 inches)*
    - *PPE Category (1, 2, 3, 4)**
    - *Default Arc Flash Boundary*

***NOTE: 2015 edition has eliminated Category 0**

Work Involving Electrical Hazards

Equipment*	Arc Flash PPE Category	Arc Flash Boundary
Panelboards ≤ 240 V	1	19 in
Panelboards >240-600 V	2	3 ft

*Parameters apply

Question 8

Criteria for using the PPE Category Tables include:

a. Task must be listed in table

b. Power system applied is less than estimated maximum short circuit current used for tables

c. Tasks are greater than or equal to minimum working distances listed in table

d. All of the above

Arc Face Shield	***Arc Face Shield + Head Sock***	***Arc Flash Suit Hood***
		
PPE-C=1 or incident energy 1.2 to 12 cal/cm^2 (back of head not in AFB)	PPE-C=2 or incident energy 1.2 to 12 cal/cm^2 (back of head inside AFB)	PPE-C=3 or 4 or incident energy greater than 12 cal/cm^2

- Face shields must be worn in combination with safety glasses.
- Arc Rating of face shields must correspond to *PPE Category* or for available incident energy.

- Arc Rated Clothing:
  - Clothing made from fabrics that self extinguish
  - Fabrics are a combination of natural and synthetic materials
  - Most severe burn injuries and fatalities are caused by non-flame resistant clothing igniting and continuing to burn.

2012 NFPA 70E has replaced the term Flame Resistant with *Arc Rated*

Work Involving Electrical Hazards

- Flame retardants are chemicals that inhibit sustained combustion.
- The term Flame Resistant has been replaced with the term Arc Rated.
- Arc Rated Clothing (ARC) is the characteristic of not supporting combustion in air.
- ARC should be appropriate to hazard.
- ARC required above an incident energy threshold of 1.2 cal/cm^2

When using the *PPE Category* method, clothing must meet the incident energy corresponding category number.

PPE Category	Arc Thermal Protection Value (ATPV)
1	4 cal/cm^2
2	8 cal/cm^2
3	25 cal/cm^2
4	40 cal/cm^2

Work Involving Electrical Hazards

- Employees shall wear hearing protection whenever working within the arc flash boundary

Question 9

Criteria for using the balaclava head sock include:

a. Back of head is within the arc flash boundary, incident energy between 1.2 & 12 cal/cm^2

b. Arc Flash PPE Category of 3

c. Incident energy exposure is greater than 12 cal/cm^2

d. Back of head outside the arc flash boundary