The fusion of our heritage.
The Power of One Eaton today.

Continue to grow and expand our capabilities worldwide through acquisitions:

1978 Cutler-Hammer
1994 Westinghouse
2004 Powerware
2008 Moeller Group - Europe
2012 Cooper Power Systems
Arc Flash Basics

• 2015 NFPA 70E Article 100
  • Arc Flash Hazard - A dangerous condition associated with the possible release of energy caused by an electric arc.
Arc Flash Basics

• Causes of Arcing
  • Work related incidents (working with tools, removing panels, taking voltage measurements, etc.)
  • Insulation deterioration and failure, electrical corona
  • Loose connections (cable terminations, transformer connections, etc.)
Arc Flash Basics

- Factors affecting the degree of an Arc Flash
  - The **duration** of the arc
  - The **distance** from the arc
  - The **power** of the arc
Arc Flash Basics

• Situations Where an Arc Flash Hazard Exist
  
  • An arc flash hazard may exist when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided a person is interacting with the equipment in such a manner that could cause an electric arc.

  • Under normal operating conditions, enclosed energized equipment that has been properly installed and maintained is not likely to pose an arc flash hazard
About 1 of every 450 nonfatal accidents involved electricity, but....

1 of every 23 **deaths** was caused by electricity.

_National Institute of Occupational Safety Hazard_
Arc Flash Analysis

• Analysis Methods
  1. Incident Energy Analysis Method
  2. Arc Flash PPE Categories Method

Note: OSHA - No later than January 1, 2015, employers must estimate the incident heat energy of any electric-arc hazard to which a worker would be exposed.
Arc Flash Analysis – Incident Energy

• IEEE Std 1584™-2002 provides a method of conducting an arc flash hazard analysis.

• This method uses equations that were developed using statistical analysis of data from arc flash testing performed at laboratories.
Now that we know the incident energy, how can this information be used to reduce the risk to the qualified electrical worker?
Inform the Workers! Arc Flash Labels

Equipment that are likely to require examination, adjustment, servicing or maintenance while energized shall be field marked with a label containing the following (Refer to NFPA 70E-2015, Art. 130.6(D)):

- Nominal systems voltage
- Arc flash boundary
- At least one of the following:
  - Available incident energy and the corresponding working distance, or the arc flash PPE category in Table 130.7(C)(15)(A)(b) or Table 130.7(C)(15)(B) for the equipment, **but not both**
  - Minimum arc rating of clothing
  - Site-specific level of PPE
Arc Flash Labels

WARNING

SHOCK & ARC FLASH HAZARD

Location: LVDP D3
Report #: TQSISE000XXX.003 Rev. 0
Issued: MAR-2015

47' 8" ARC FLASH BOUNDARY

LINE SIDE of MAIN

WARNING

GREATER THAN 40 cal/cm² CALCULATED INCIDENT ENERGY AT 1' - 6" WORKING DISTANCE. REFER TO SITE SAFETY PROGRAM FOR GUIDANCE.

LOAD SIDE of MAIN

4' 8" ARC FLASH BOUNDARY

4.1 cal/cm² CALCULATED INCIDENT ENERGY AT 1' - 6" WORKING DISTANCE

480 V Shock Hazard
Min. Glove Class: 00

Limited Approach Boundary: 3' - 6"
Restricted Approach Boundary: 1' - 0"

NO LOCAL MAIN CONSIDERED FOR ARC FLASH CALCULATIONS. UPSTREAM PROTECTIVE DEVICE APPLIES.

8" ARC FLASH BOUNDARY

0.3 cal/cm² CALCULATED INCIDENT ENERGY AT 18" WORKING DISTANCE

208 V Shock Hazard
Min. Glove Class: 00

Limited Approach Boundary: 3' - 6"
Restricted Approach Boundary: 1' - 0"
No later than **April 1, 2015**, employers generally must provide workers exposed to hazards from electric arcs with protective clothing and other protective equipment with an arc rating greater than or equal to the estimated heat energy.

*The Occupational Safety and Health Administration*
Training

• NFPA 70E 2015, reiterates that qualified persons who perform maintenance on electrical equipment and installations shall be trained and familiar with the specific maintenance and test procedures required.
  • Specifically, Article 205.4 requires the inspection and testing of these devices in accordance with manufacturers’ specifications or industry consensus standards.
  • “Improper or inadequate maintenance can result in increased opening time of the overcurrent protective device, thus increasing the incident energy.”
Decreasing Time Reduces Arc Flash

NEC 2014’s Section 240.87

240.87 Arc Energy Reduction. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1,200 amperes or higher then (A) and (B) shall apply.

(B) Method to Reduce Clearing Time. One of the following or approved equivalent means shall be provided:

1. Zone-selective interlocking or
2. Differential relaying or
3. Energy-reducing maintenance switching with local status indicator or
4. Energy-reducing active arc flash mitigation system or
5. An approved equivalent means
Increase Distance to Reduce Arc Flash

Distance! Move Further Away

VS.
Distance is your Friend

Works on Most LV & MV Power Circuit Breakers With Rotary Levering Systems

Move People Further Away
Why Maintenance?

- NFPA 70E 2015 now specifies that the equipment owner is responsible for electrical equipment maintenance and the documentation of such maintenance. The latest edition of the standard added IEEE 3007.2 Recommended Practice for the Maintenance of Industrial and Commercial Power Systems as a guideline for maintenance frequency, methods, and tests, along with NFPA 70B.
Perform Maintenance
Summarize Solutions to Arc Flash

• Label Equipment and Train Personnel (OSHA)
• Minimize Risk with Good Safety Practices
• Faster Clearing Time (NEC 240.97)
• Move People Further Away
• Reduce Available Fault Current (Retro Solutions)
• Redirect Blast (Engineered Solution)
• Prevent Faults including Preforming Maintenance
Advantages and Deliverables Received

• Employees and Contractors are better informed and protected against the hazards.
• System will have proper coordination. (Minimize Downtime)
• Hazardous Locations will be identified, therefore, can be mitigated or controlled.
• Equipment Inventory!
• Equipment Labeling (ID, Voltage, Hazards, PPE)
• System One Line Diagrams
No later than **April 1, 2015**, employers generally must provide workers exposed to hazards from electric arcs with protective clothing and other protective equipment with an arc rating greater than or equal to the estimated heat energy.
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