Managing Liability for Electrical Hazards

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Faults, Fires, & Outages

- **Faults** – When insulated conductor comes in contact with a grounded conductor or another phase (Short Circuit)
- High currents flow
- A fault can cause a fire and results in an outage.
- **Bolted Faults**
- **Arcing Faults (Arc Flash)**
Faults, Fires, & Outages

These can result in:

- Loss on Income Revenue
- Loss of Production
- Personnel Injury
- Lawsuits
- Can be time consuming and extremely costly!!!
Outages

- Caused by:
  - Faults & Overloads (Breakers Tripping)
  - Loss of Utility
  - Equipment failure / shutdown
  - Operator Error

- Minimize the Impact using:
  - Generators
  - Automatic Transfer Switches (ATS)
  - Uninterruptible Power Supplies (UPS)
Faults, Fires, & Outages

Reduce the Liability by:
- Maintaining the electrical equipment
- Reducing or Eliminating work on Energized Equipment
- Increasing Electrician and Operator Training
- Maintaining, Updating, Revising Electrical One Line Drawings
Faults, Fires, & Outages

- Update your One Line Drawing!!!!!
- It is your road map for the electrical system
- You do not know where you are going without it.
- You may turn off the wrong breaker!
Electrical Maintenance

- Inspection of electrical system conducted by “qualified personnel”
  - Infra-red survey
  - Visual Inspections
  - Mechanical Inspections
  - Electrical Inspections & Tests
Electrical Maintenance

- Start at power sources and work down towards load.
  - Main Service Equipment
  - Emergency Generators
  - UPS

- Concentrate on Critical & Emergency Distribution Systems
Sources and Standards

- NFPA 70B Recommended Practice for Electrical Equipment Maintenance.
- Standards
- Specifications
Other Testing Organizations

- Sigma Six - Auburn
- Advanced Electrical Testing - Sumner
- ERS (ETI) – Auburn
- Square D – Mercer Island
- Eaton Electrical
- General Electric
- Siemens
Arc Flash Faults

- Energy in the form of
  - Thermal
  - radiation
  - chemical
  - mechanical
  - Electrical
Arc Flash Faults Produce

- Dangerous and potentially fatal levels of blast pressure
- Excessive sound waves
- Toxic gases & vapors,
- Heat & ultraviolet radiation
- Flying shrapnel.
Electrical Safety in the Workplace

Reduce Electrical Accidents by:
- Increasing Employee Training
  - Qualified & Non-Qualified
- Installation of Arc Flash Warning Labels
  - Warns employee of the electrical hazards
- Purchase of Personnel Protective Equipment
Industry standards and regulations:

- OSHA 29 CFR 1910 Subpart S
NFPA Approach to Electrical Safety

How to…

BUILD it safely

WORK on it safely

Upgrade/replace latest NEC applies

Maintain/repair latest 70E applies

MAINTAIN it properly
OSHA & Electrical Accidents

- OSHA will Investigate Serious Accidents
- OSHA will ask for:
  - Electrical Safety Training Records
  - Arc Flash Hazard Assessment
- If you are negligent with either item:
  - Fines
  - Lawsuits filed by injured employees
OSHA enforces NFPA 70E under the “General Duty Clause”

- US Occupational Safety and Health Act of 1970
- “General Duty Clause,” requires employers to furnish a workplace which is free from recognized hazards which may cause or are likely to cause death or serious physical harm.
“Employees working in areas where there are potential electrical hazards shall be provided with, and shall use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed”. (PPE)
FACT - (OSHA) inspectors are currently enforcing National Fire Protection Association (NFPA) document NFPA 70E.
Key References in NEC © -2017

- 110.16 Flash Protection. Switchboards, panel boards, industrial control panels, and motor control centers in other than dwelling occupancies, that are likely to require examination, adjustment, servicing, or maintenance while energized, shall be field marked to warn qualified persons of potential electric arc flash hazards.
NEC 110.16 (continued)

- The marking shall meet the requirements in 110.21(B) and shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.
(B) - In other than dwelling units, in addition to the requirements in (A), a permanent label shall be field or factory applied to service equipment rated 1200 amps or more. The label shall meet the requirements of 110.21(B) and contain the following information:
NEC 110.16 (continued)

(1) Nominal system voltage
(2) Available fault current at the service overcurrent protective devices
(3) The clearing time of service overcurrent protective devices based on the available fault current at the service
(4) The date the label was applied

Exception: Service equipment labeling shall not be required if an arc flash label is applied in accordance with acceptable industry practice.
NEC 110.16 (continued)

Informational Notes No. 1 & 3 Point to NFPA-70E for guidance as to how to determine the values & information to put on the labels.
130.5(A) **General.** An arc flash risk assessment shall be performed:

- (1) To identify arc flash hazards
- (2) To estimate the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health
- (3) To determine if additional protective measures are required, including the use of PPE
**NFPA 70E - Flash Hazard Analysis**

- **130.5(F) Arc Flash PPE.** One of the following methods shall be used for the selection of arc flash PPE:
  - (1) The incident energy analysis method in accordance with 130.5(G)
  - (2) The arc flash PPE category method in accordance with 130.7(C)(15)*

* - Use with extreme caution!!!
Arc Flash Hazard Analysis Key Steps

- Determine
  - Incident energy levels
  - Arc Flash hazard distance
  - Hazard/Risk Category
  - Required PPE
  - Install Arc Flash Labels
NFPA 70E – Arc Flash Labeling

(1) Nominal system voltage
(2) Arc flash boundary
(3) At least one of the following:
   a. Available incident energy and the corresponding working distance, or the arc flash PPE category in Table 130.7(C)(15)(a) or Table 130.7(C)(15)(b) for the equipment, but not both.
   b. Minimum arc rating of clothing
   c. Site-specific level of PPE
The data shall be reviewed for accuracy at intervals not to exceed 5 years.
- (Arc Flash Refresher Study)

The **owner** of the electrical equipment shall be responsible for the documentation, installation, and maintenance of the marked label.
Generic Labels not Acceptable!

- May meet the NEC Requirements
- Do not meet the intent of NFPA 70E
Acceptable & Informative Labels

**DANGER**

Arc Flash & Shock Hazard
Appropriate PPE Required

- Flash Hazard Category
- Min Arc Rating (cal/cm²)
- Isolated Hazard
- Flash Protection Boundary
- Limited Approach Boundary
- Restricted Approach Boundary
- Prohibited Approach Boundary

**WARNING**

**Arc Flash and Shock Hazard**

- Flash Hazard Boundary: 11 Ft 5 In
- Flash Hazard at 1 Ft 6 In: 33.0 cal/cm²
- Arc Rated Clothing Required (See NFPA 70E-2018 Table 130.5(G) for additional PPE)

- 208 VAC: Shock Hazard when cover is removed
- 00: Glove Class
- 3 Ft 6 In: Limited Approach (Fixed Circuit)
- 1 Ft 0 In: Restricted Approach

**Equipment ID:**

- Equipment: SWBD MSB2
- Device: MSB2 MAIN

- Scenario 2 - 50% UTILITY Max Fault Current: 20.0 kA

Study Performed By PowerStudies, Inc. (253) 639-8535
Obtain Equipment Nameplate Data & Settings

Short Circuit Fault Study

Arcing Fault Current

Coordination (PDC) Study

Device Operating Time

Arc Flash Study

3 Phase Bolted Fault Current

Arc Flash Label
- Energy Level
- Boundaries
- Required PPE
Reduce Liability of Electrical Hazards - Summary

- Maintain the Electrical System
- Document & Revise the Electrical Drawings
- Train the Employees Using NFPA 70E as a guide.
- Perform an Arc Flash Hazard Assessment
- Install Arc Flash Warning Labels on Electrical Equipment
Need more Information

- www.powerstudies.com
  - Articles
  - Links
  - Specifications for Power System Studies
    - Short Circuit
    - Protective Device Coordination
    - Arc Flash Hazard

- Phone: 253-639-8535
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Thank you for your time!

- Questions??????
Who are we?

- We Specialize in performing Power System Studies
- Established in 1986
- 95% of our business is in performing Power System Studies