

ARC FLASH "What You Need to Know"

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Why are Arc Flash Hazard Studies Needed?

- Personal safety
- Safety for your fellow workers
- Comply with applicable regulations



What is Arc Flash

Arc Flash: Violent eruption of energy from an electrical source.



- Arc temperature can reach 35,000°F.
- Fatal burns can occur at distances over 10 feet.
- Over half of all arc flashes occur at 277 volts.

29



Breaker Replacement



Myth One:

- OSHA does not enforce NFPA 70E for Arc-Flash and electrical safety compliance.



U.S. Department of Labor
Occupational Safety & Health Administration
www.osha-slc.gov

OSHA News Release
2003 - 12/04/2003 - OSHA Investigations Leads to \$148,500 in Penalties for Patrick Cudahy, Inc.

OSHA Regional News Release
U.S. Department of Labor
Office of Public Affairs Region 5

Region 5 News Release 03-755-CH2
Dec. 4, 2003
Contact: Brad Mitchell
Phone: 312-353-6976

OSHA Investigations Leads to \$148,500 in Penalties for Patrick Cudahy, Inc.

MILWAUKEE, Wis. — Heat packing giant Patrick Cudahy, Inc., is facing \$148,500 in fines proposed by the U.S. Labor Department's Occupational Safety and Health Administration (OSHA) following an inspection opened in May 2003 in response to reports of an industrial accident in which three employees were severely burned.

Three workers were reported to have been troubleshooting electrical switchgear at the Cudahy, Wis., facility when electricity arched and exploded. OSHA's investigation revealed that the three workers, all of whom received first, second and third degree burns throughout their bodies, were not using insulated tools, were not wearing proper personal protective equipment, and were not following appropriate safety standards. OSHA issued verbal and written violations to Cudahy for allegedly failing to provide such equipment, and warning or training the workers about flash hazards.

*The Labor Department's significant fine of \$148,500 sends a message that the Administration will enforce safety and health

Myth Two:

- Because OSHA does not have jurisdiction in Washington State,
- WISHA is not enforcing NFPA 70E for Arc-Flash and electrical safety compliance.

Washington Industrial Safety and Health Act (WISHA)

- What is OSHA and its relationship to WISHA?
- OSHA allows States to run their own safety and health programs.
 - Must be at least as effective as OSHA.
 - Employers in WA are subject to enforcement by L&I

OSHA in WA State

- OSHA covers workplaces with federal employees, nonfederal employees working on
 - federal reservations
 - military bases
 - employees working on floating worksites
 - employees working for tribal employers on tribal lands.

When is there an arc flash hazard?

Technically, anytime the power is on.

Practically, anytime you **change the state** of the equipment by exposing live parts or **interacting** with energized equipment.

NFPA 70E, Article 100, Definition "Arc Flash Hazard" FPN 1

When is there an arc flash hazard?

- Activities that could create an arc flash include:
 - Opening or closing doors or removing a cover.
 - Operating switches or circuit breakers.
 - Racking a circuit breaker.
 - Using tools or test equipment.
 - Presence of a vibration that could cause a loose part (such as an equipment tag) to fall into an energized part.

NFPA 70E, Article 100, Definition "Arc Flash Hazard" FPN 1

Key References in NEC ® -2008

- 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 be located so as to be **clearly visible** to qualified persons before **examination, adjustment, servicing, or maintenance** of the equipment.

Key References in NEC ® -2008

- **FPN No. 1** : **NFPA 70E-2009**, Standard For Electrical Safety in the Workplace, **provides assistance** in determining severity of potential exposure, planning safe work practices and selecting personal protective equipment.

Industry standards and regulations:

- OSHA 29 CFR 1910 Subpart S
- NFPA 70 - The National Electrical Code (2008 Edition)
- NFPA 70E - Standard for Electrical Safety in the Workplace (2009 Edition)



Washington Cities Electrical Code

- Joint effort between:
 - MyBuildingPermit.com
 - Washington Association of Building Officials
- Created to provide cities with a code document that complies with RCW 19.28.010(3)
- Allows cities to enforce Ordinances equal, higher, or better than the WAC rules.

Washington Cities Electrical Code

Bellevue	Burien	Des Moines
Kirkland	Lacey	Longview
Marysville	Mercer Island	Redmond
Renton	SeaTac	Tukwila
Tumwater	Seattle	Vancouver

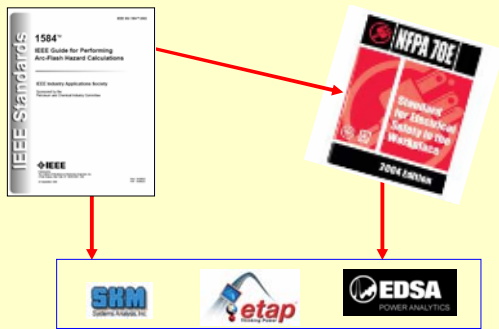
Washington Cities Electrical Code 110.16

- The **flash protection marking** shall be an identification plate or label meeting ANSI Standards Z535.4-1998 or be of a type approved by the Code Official or designated representative.
- The **plate or label** may be installed at the factory or in the field. The plate or label may be mounted using adhesive.

NFPA 70E -Flash Hazard Analysis

- 130.3 – A flash hazard analysis shall be done in order to protect personnel from the possibility of being injured by an arc flash.
- The analysis shall determine:
 - Flash Protection Boundary
 - Personal protective equipment
- Calculate using
 - Formulas in 130.3.A and Table 130.7(C)(9)(a)* in NFPA 70E
 - * - Use with extreme caution!!!
 - Equations in IEEE 1584

Arc Flash Hazard Calculations



Arc Flash Hazard Analysis Key Steps

- Use NFPA 70E* Tables, IEEE 1584, or Lee Equations to Determine
 - Incident energy levels
 - Arc Flash hazard distance
- * Use with extreme caution!

NFPA 70E Table 130.7(C)(9)(a)

NFPA Disclaimers:

- The tables **do not cover all applications** or installations of electrical equipment.
- Tables are **intended to be conservative** for most applications
- They **may not enable** the user to select adequate protection.

IEEE 1584 - Flash Hazard Analysis

- Provides techniques and equations to calculate:
 - Arc flash hazard distance
 - Incident energy level
- Step by Step Process
- **Three Phase Systems only!**
- Not for:
 - Single Phase (i.e. 120V L-N)
 - DC Systems

IEEE 1584 - Flash Hazard Analysis

- 50 & 60 Hz
- Bolted Fault Currents 700 to 106,000 Amperes
- 208 V to 15 kV (Three Phase)
- Use Lee Equations for Voltages over 15 kV

IEEE 1584 Analysis Key Steps

- Determine:
 - Bolted Fault Currents (Short Circuit Study)
 - Arcing Fault (AF) Current
 - Upstream Protective Device Clearing Times (PDC Study) using AF

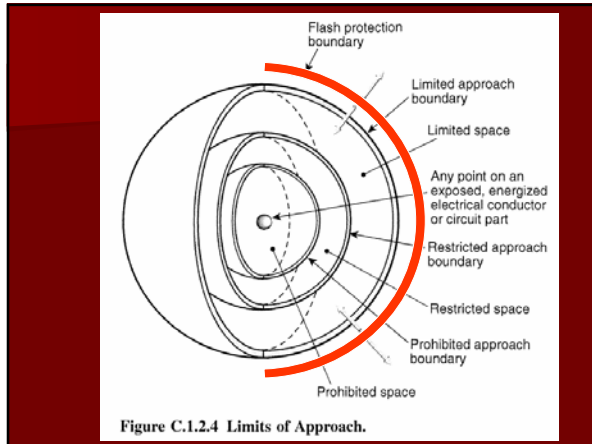
IEEE 1584 Analysis Key Steps

- Calculate Arc Flash Energy
- Use NFPA 70E Tables to determine:
 - Hazard Risk Category (HRC)
 - Required PPE for:
 - Shock Prevention
 - Arc Flash
 - Shock Boundaries
 - Limited Approach Boundary
 - Prohibited Approach Boundary
 - Restricted Approach Boundary

Arc Flash Hazard Analysis Key Steps (Summary)

- Use
 - Calculated Incident Energy
 - NFPA 70E Table 130.7(C)(11)
 - to determine
- Hazard/Risk Category
- Required PPE





Arc Flash Warning Labels

- What does it mean?

Arc Flash Hazard Labels - Bus

Label for the Main Bus

NFPA 70 130.3 (C)

Best Practice Label.

Features of SC, PDC, & AF Studies

- Report
- Hazards, un-safe Equipment, or Conditions
- New Settings for Protective Devices
- Updated One line Drawings
- AF Hazard Warning Labels listing the details
- Ways to Reduce AF Energy

Benefits of SC, PDC, & AF Studies

- Increases Personnel Safety
- Reduces Accident Liability Exposure
- Increases Power System Reliability
- Increases Power System Efficiency
- Reduces Operating Costs
- Increases Equipment Protection
- Reduces Future Engineering Design Costs

What is easier for the employees?



Use NFPA 70E Task Tables to Determine Hazard Classification & Required PPE Boundaries or.....

WARNING	
Arc Flash and Shock Hazard	
Appropriate PPE Required	
1 Ft 3 in	Flash Hazard Boundary
0.91	cal/cm ² Flash Hazard at 1 Ft 6 in
Category 0	Untreated Cotton
480 VAC	Shock Hazard when cover is removed
00	Glove Class
3 Ft 6 in	Limited Approach (Fixed Circuit)
12 in	Restricted Approach
1 in	Prohibited Approach
01/07/2008	Arc Flash Study Date IEEE 1584-2004a
Equipment ID Number:	WCC1 (ARC-F)
Protected Device:	WCC 1
Line Size of:	WCC 1 MAIN
Revision: 01 - Revised with IEEE 1584-2004a	
Study Performed By PowerStudies.com (253) 639-8535	

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Thank you for your time!

- Questions?????