
Pulp & Paper Electrical Safety

Ties to LOTO and NFPA 70E

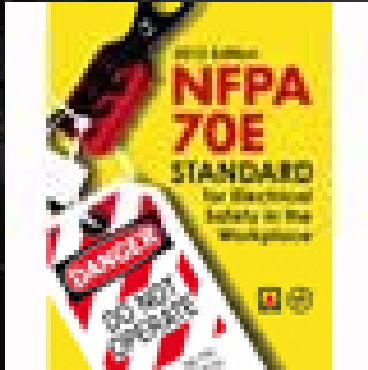


02.07.2005

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Today's Goals: (Electrical Safety Training)

- **Risk and Liability Issues in Today's Industry?**
 - **How to Recognize and Avoid Hazards**
 - **Review Key Codes and OSHA ties to NFPA 70E**
 - **Review of Common Safety Goals and NFPA 70E**
 - **Trends in Today's Market**
 - **Group Discussion**
-

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General Experience on NFPA 70E (What Roles do You Manage Well?):

- What is NFPA 70E?
- What role do I have with safety in our company?
- How can I be safer myself?
- How do I help others take this topic seriously within my company?
- Poll of those in class who have direct responsibility for the safety of others?

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What is Arc Flash?

February 2nd 2010 Incident

An arc flash event can be described as the release of heat energy, blast energy and projectiles that can injure employees when electrical equipment experiences a fault or failure.

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What Incident Increased Awareness in 2003?



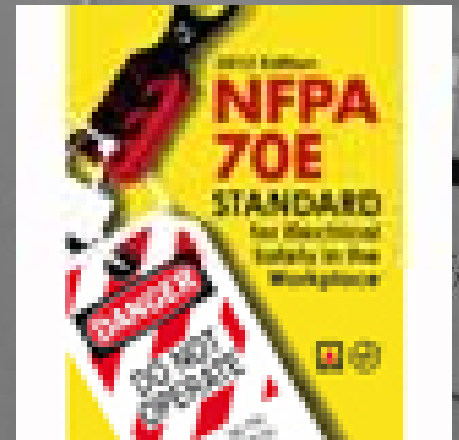
Rack-In Incident



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Overview of 2012 NFPA 70E

- **Our current 70E code has fewer structural PPE changes than the 2004/2009 revisions.**
- **The current 70E code does however have more direct language and some key additions making this code more direct in nature than all previous codes.**
- **Upon reading article 130 it becomes evident that without performing a formal risk assessment, you would be open to liability from a third party standpoint. Simply put, the table approach to PPE does not apply in real life applications.**



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Nature of Electrical Accidents

- Electrical accidents, when initially studied, often appear to be caused by circumstances that are varied and peculiar to the particular incidents.
- Further consideration usually reveals the underlying cause to be a combination of three possible factors:
 - **work involving unsafe equipment & installations**
 - **workplaces made unsafe by the environment**
 - **unsafe work performance (unsafe acts).**
 - ❖ The first two factors are sometimes considered together and simply referred to as unsafe conditions.

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Top 10 Most Frequently Cited OSHA Standards:

1. Scaffolding, general requirements, construction (29 CFR 1926.451)
2. Fall protection, construction (29 CFR 1926.501)
3. Hazard communication standard, general industry (29 CFR 1910.1200)
4. Control of hazardous energy (lockout/tag out), general industry (29 CFR 1910.147) In the Midwest this is #1
5. Respiratory protection, general industry (29 CFR 1910.134)
6. Powered industrial trucks, general industry (29 CFR 1910.178)
7. Electrical, wiring methods, components and equipment, general industry (29 CFR 1910.305)
8. Ladders, construction (29 CFR 1926.1053)
9. Machines, general requirements, general industry (29 CFR 1910.212)
10. Electrical systems design, general requirements, general industry (29 CFR 1910.303)

Monson man dies after factory accident in Douglas

Posted: Apr 06, 2012 8:01 AM CDT Updated: Apr 13, 2012 8:01 AM CDT

By Andrea Lubin - [email](#)

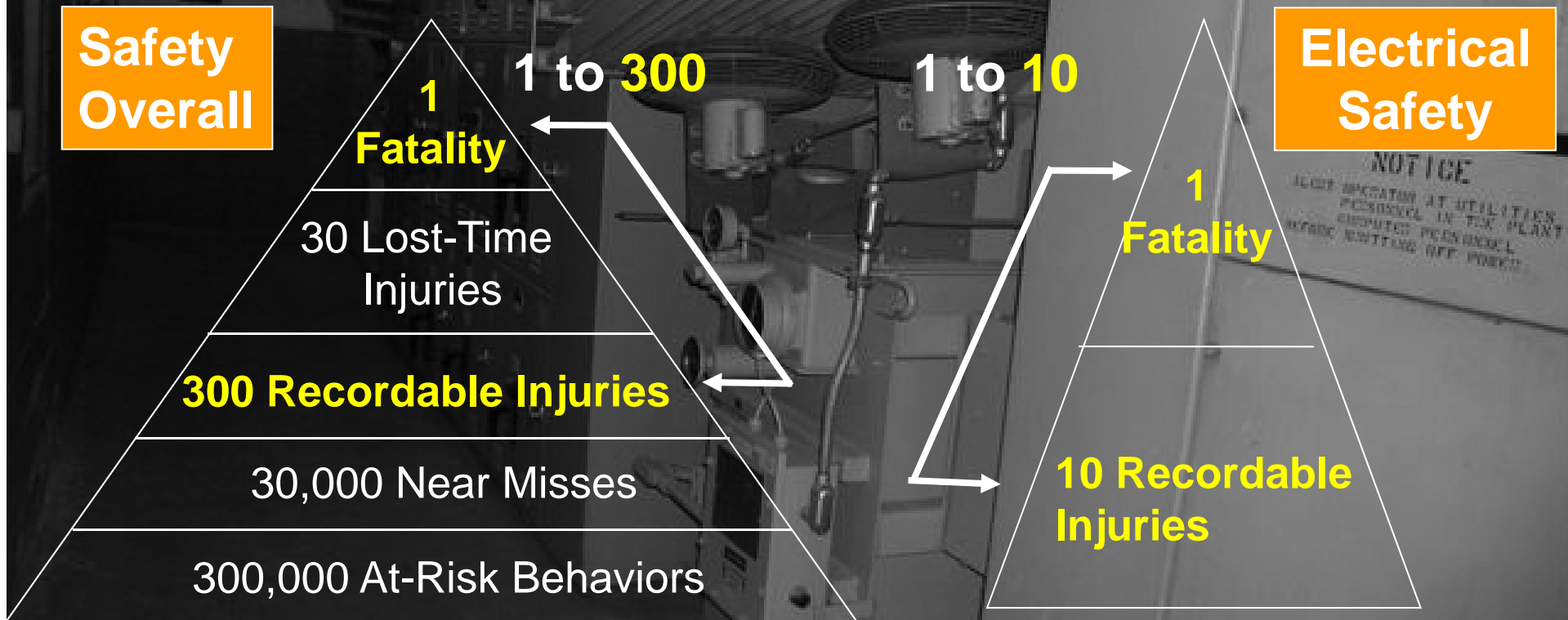
MONSON, MA (WSHM) - A 53-year-old Monson man was electrocuted at an envelope plant in Douglas, MA.

The incident occurred Wednesday afternoon at the XXXX company. The Worcester district attorney's office tells CBS 3 XXXX was working on a piece of machinery when he was electrocuted. He was taken to a hospital where he was pronounced dead. Authorities tell CBS 3 that XXXX was working on a blower motor of a machine used to make envelopes when the incident occurred.

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Why Electrical Safety Recordable vs. Fatality Rates



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Activities that Cause The Most Failures or Incidents Are:

- Troubleshooting on energized equipment
- Operating Equipment (Physical movement of the device during the switching procedures)

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So When Operating This Handle, How Many Times Will it Take Before A Failure Occurs?



NOTICE
UNAUTHORIZED PERSONNEL AT UTILITIES
PERSONNEL IN THE PLANT
EQUIPMENT PERSONNEL
KEEPING OFF PROPERTY

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Can we Base Training Methods on “Common Sense”?



NOTICE
ALICE BAKGATEY AT UTILITIES
PERSONNEL IN THE PLANT
EMPLOYED PERSONNEL
BY THE UNITING OFF POWER

FEB

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Recent Near Miss:

- On Wednesday March 9th at 1:30 pm, Shift maintenance crew was notified that there was a fire in the bag house. Once Shift Maintenance arrived they determined the fire was in the auxiliary motor control panel (MCC). It was also witnessed that there was water dripping from the race way onto the motor control center. While keeping safe distance they determined it was best to power down the motor control center. *Before they were able to complete this process they heard a popping noise from the cabinet. Employees immediately started to duck and headed for the exit door. During this process the breaker in the cabinet arced out.* Maintenance replaced the arced out breaker and cleaned up the area. After reviewing what happened it was determined that the Maintenance crew followed NFPA 70E procedures thereby preventing this from being a bigger issue.

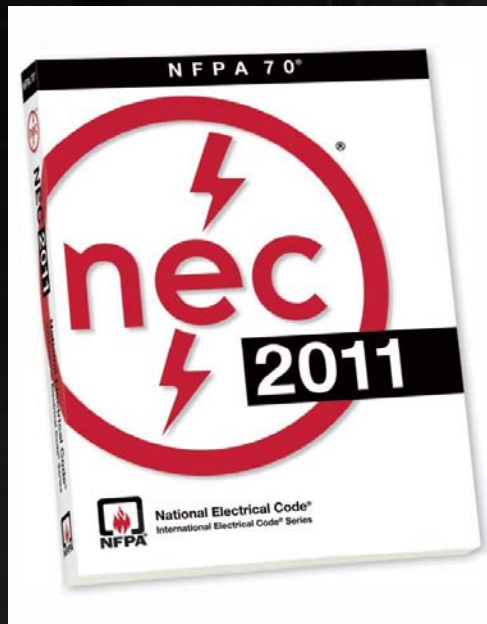
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How did the Equipment Look?

Note this MCC did have PPE Labeling in place



Changes to the 2011 NEC® You Must Know



- New and Revised Labeling/Marking Requirements
- Available Fault Current Labeling
- Equipment Identification Required

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Article 110 –Requirements for Electrical Installations 110.24 Available Fault Current

➤ **Article 110 –Requirements for Electrical Installations
110.24 Available Fault Current**

➤ **(A)Field Marking.**

Service equipment in other than dwelling units shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault current calculation was performed and be of sufficient durability to withstand the environment involved.

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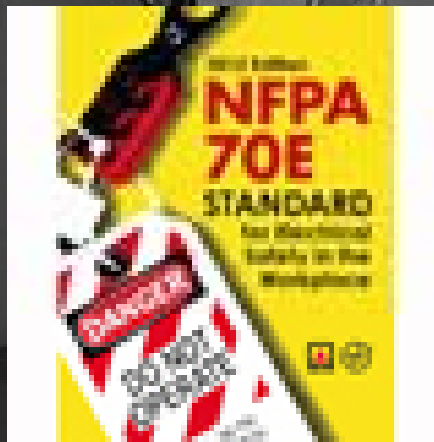
Article 408.4 Field Identification Required

(B) Source of Supply:

- All switchboards and panelboards supplied by a feeder in other than one- or two-family dwellings shall be marked to indicate the device or equipment where the power supply originates.

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2012 NFPA 70E Code Review:



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Article 90.2 Scope:

Scope:(This article will be used if you ask OSHA what your responsibilities are as the employer)

- (A) Covered. This standard addresses electrical safety-related work practices for employee workplaces that are necessary for the practical safeguarding of employees relative to the hazards associated with electrical energy during activities such as the installation, inspection, operation, maintenance, and demolition of electric conductors, equipment, signaling and communications conductors and equipment, and raceways.

Article 100 Definitions

Enclosure:

The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage

Note: When you consider electrical exposure you must consider the entire enclosure

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Article 100 Definitions:

Incident Energy Analysis:

- A component of an arc flash analysis used to predict the incident energy of an arc flash for a specified set of conditions.
- “Component” is the key word. Engineering is just one part of a good risk assessment process.

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Article 100 Definitions:

Working On (Energized electrical conductors or circuit parts):

- Intentionally coming in contact with energized electrical conductors or circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing.

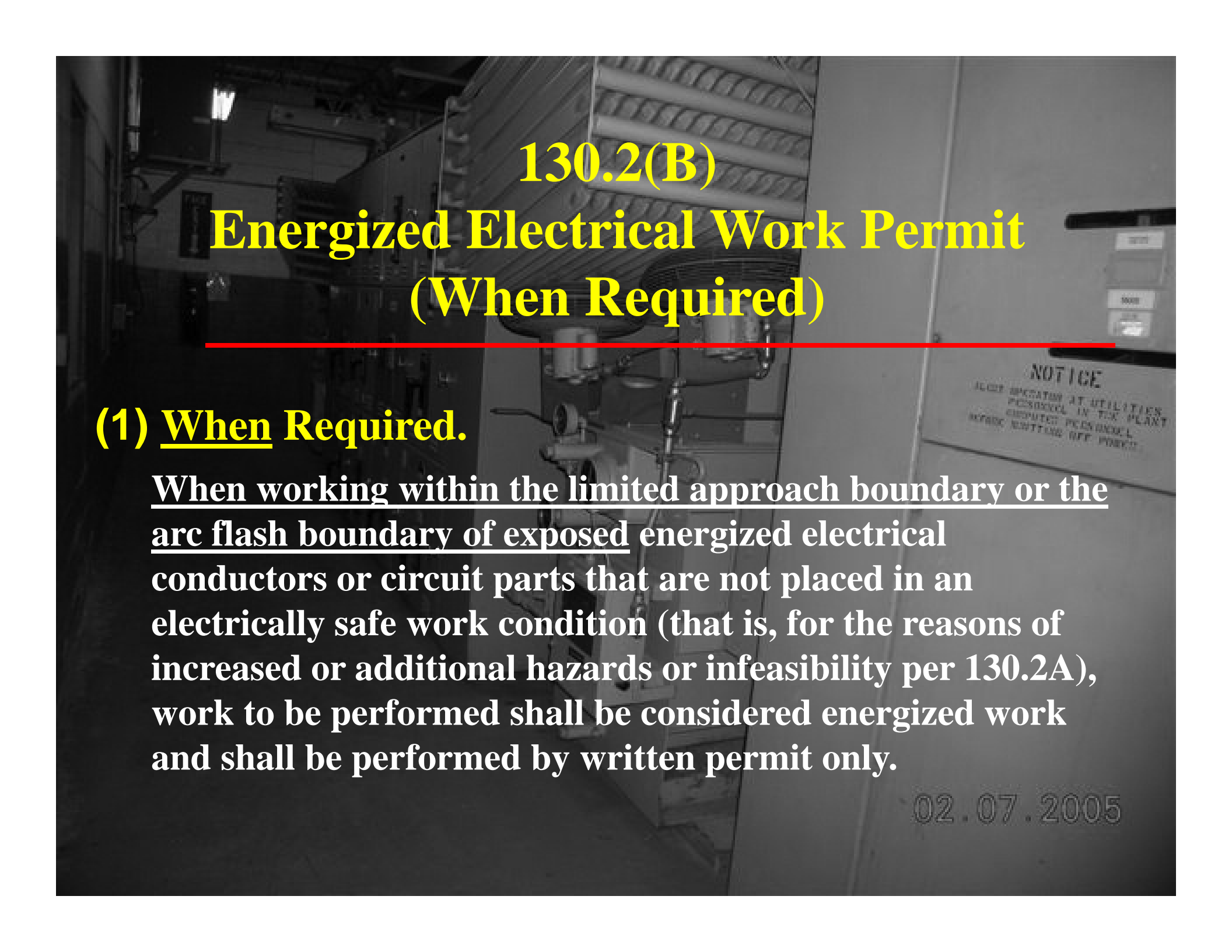
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Article 100 Definitions:

Working On (Energized electrical conductors or circuit parts):

- There are two categories of “Working On”
- **Diagnostic (testing)** is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment
- **Repair** is any physical alteration of electrical equipment (such as making or tightening connections, removing or replacing components, etc.

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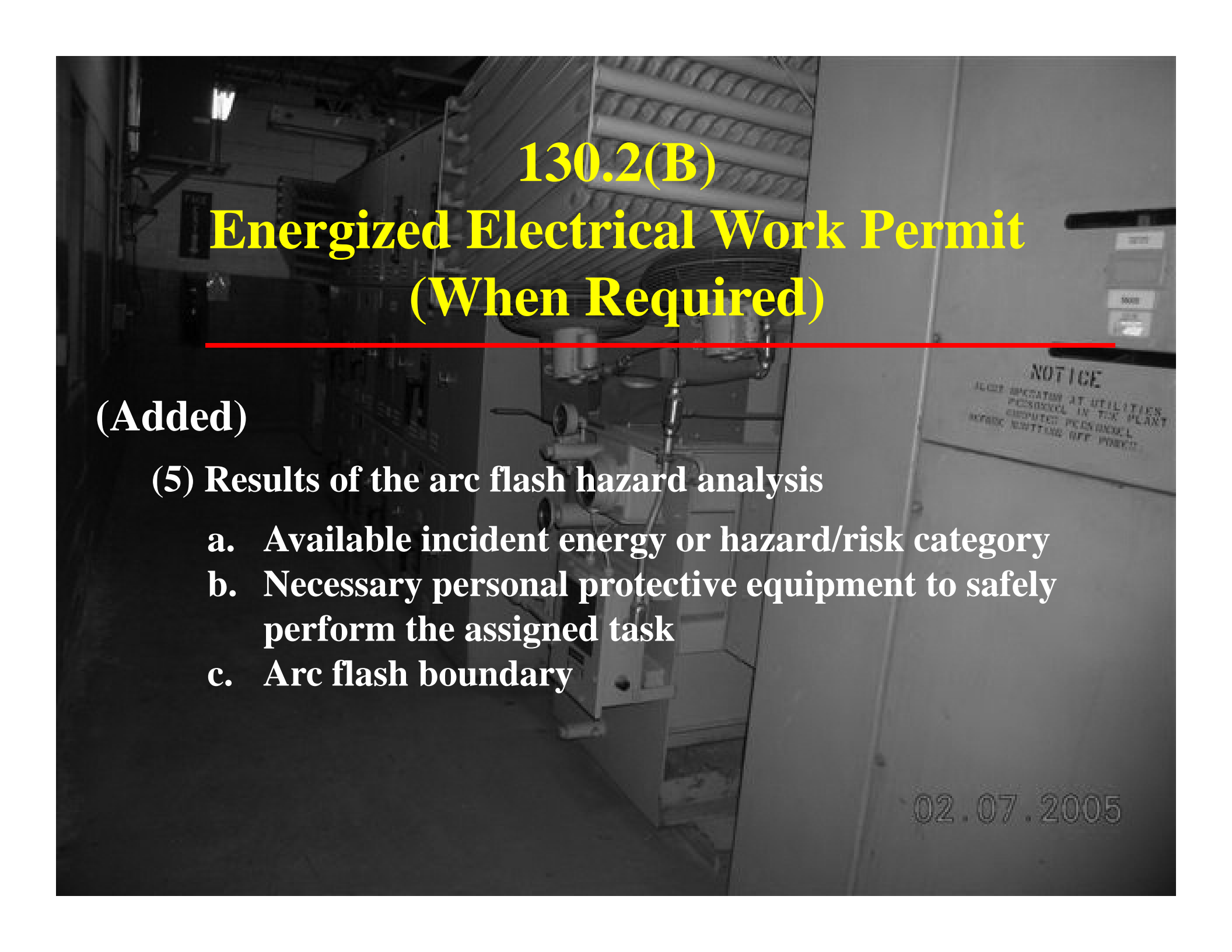


130.2(B) Energized Electrical Work Permit (When Required)

(1) When Required.

When working within the limited approach boundary or the arc flash boundary of exposed energized electrical conductors or circuit parts that are not placed in an electrically safe work condition (that is, for the reasons of increased or additional hazards or infeasibility per 130.2A), work to be performed shall be considered energized work and shall be performed by written permit only.

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130.2(B)

Energized Electrical Work Permit (When Required)

(Added)

(5) Results of the arc flash hazard analysis

- a. Available incident energy or hazard/risk category**
- b. Necessary personal protective equipment to safely perform the assigned task**
- c. Arc flash boundary**

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130.1(A)(3)

Energized Electrical Work Permit (Exemptions to Work Permit)

Unchanged since 2009 Code:

• Work performed within the Limited Approach Boundary of energized electrical conductors or circuit parts by qualified persons related to tasks such as testing, troubleshooting, voltage measuring, etc. shall be permitted to be performed without an energized electrical work permit, provided appropriate safe work practices and personal protective equipment in accordance with Chapter 1 are provided and used. If the purpose of crossing the Limited Approach Boundary is only for visual inspection and the Restricted Approach Boundary will not be crossed, then an energized electrical permit shall not be required.

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Article 105.3 Responsibility

105.3 Responsibility.

The employer shall provide the safety-related work practices and shall train the employee, who shall implement them.

**** Performing a “study” is just one small aspect to this overall topic. Good field applications of the code along with sound policy and training is required to cover all aspects of 70E well!**

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Article 110.2 Training Requirements

110.2 (C) Emergency Procedures.

(C) Emergency Procedures. Employees exposed to shock hazards and those employees responsible for taking action in case of emergency shall be trained in methods of release of victims from contact with exposed energized electrical conductors or circuit parts. Employees shall be regularly instructed in methods of first aid and emergency procedures, such as approved methods of resuscitation, if their duties warrant such training. Training of employees in approved methods of resuscitation and automatic external defibrillator (AED) use, shall be certified by the employer annually.

Article 110.2 Training Requirements

110.2 D (1)(f) Qualified Person:

(1) Qualified Person:

(c) An employee who is undergoing on-the-job training for the purpose of obtaining the skills and knowledge necessary to be considered a qualified person and who in the course of such training, has demonstrated an ability to perform specific duties safely at his or her level or training and who is under the direct supervision of a qualified person shall be considered to be a qualified person for the performance of those specific duties.

Article 110.2 Training

110.2 D (1)(f) Qualified Person:

(1) Qualified Person: (All New)

(f) The employer shall determine, through regular supervision and through inspections conducted on at least an annual basis that each employee is complying with the safety-related work practices required by this standard.

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Article 110.2 Training

110.2 D (2) Unqualified Person:

(2) Unqualified Persons:

Unqualified persons shall be trained in, and be familiar with , any electrical safety-related practices necessary for their safety.

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110.6 Training Requirements.

➤ (E) Training Documentation

The employer shall document that each employee has received the training required by paragraph 110.6(D). This documentation shall be made when the employee demonstrates proficiency in the work practices involved and shall be maintained for the duration of the employee's employment. The documentation shall contain each employee's name and dates of training.

➤ **The 2012 NFPA 70E code will require evidence of the content of your training done!**

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Article 110.4 (F) Hazard Identification

(F) Hazard Identification and Risk Assessment

Procedure:

- An electrical safety program shall include a hazard identification and a risk assessment procedure to be used before work is started within the limited approach boundary or within the arc flash boundary of energized electrical conductors and circuit parts operating at 50volts or more or when an electrical hazard exists. The procedure shall identify the process to be used by the employee before work is started to identify hazards and assess risks, including potential risk mitigation strategies.

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Article 130 Work Involving Electrical Hazards:

➤ 130.2 Electrically Safe Working Conditions

Energized electrical conductors and circuit parts to which an employee might be exposed shall be put into an *electrically safe work condition* before an employee performs work if either of the following conditions exist:

1. The employee is within the Limited Approach Boundary
2. The employee interacts with equipment where conductors or circuit parts are not exposed, but an increased risk injury from an exposure to an arc flash hazard exists

Electrical Lock Out vs. Machine Specific Lock Out:

North Wall



South Side View



North West Side View



Correct Upstream LOTO
Point for Electrical Disconnecting Means





Common Equipment Disconnect

Ensure the Correct E1 and E2 Source Locations are on your Sheets:

Only E1 is listed on the LOTO sheet.

On this example it is correct but commonly we see the equipment disconnect only listed!

ALWAYS PERFORM A MACHINE STOP BEFORE LOCKING OUT DISCONNECTS

ID	Source	Location	Method	Check	Device
 E-1	Electrical 480V	Disconnect located at the MCC located on North Wall	Move E-1 disconnect to off. Lock out.	Attempt restart at CP-1.	Lockout Hasp and Lock
 W-1	Hot Water Supply	Disconnect Above the Boiler. Valve on West Side.	Turn W-1 valve off. Lock out.	Verify pressure has bled off.	Cable Lockout
 W-2	Hot Water Return	Disconnect Above the Boiler. Valve on West Side.	Turn W-2 valve off. Lock out.	Verify pressure has bled off.	Cable Lockout
 G-1	Gas Natural Gas	Disconnect on West side of Boiler unit.	Turn G-1 valve off. Lock out.	Verify pressure has bled off.	Universal Ball Valve Lockout

CP = CONTROL PANEL E = ELECTRICAL W = WATER P = PNEUMATIC C = V = VALVE G = GAS S = STEAM

OPENING A GUARD DOES NOT CONSTITUTE A LOCKOUT!

DANGER
 Any machine modifications must be shown in procedure. Contact facilities to update procedure.
 DANGER

Labeling Goals for Arc Flash and Shock (LOTO) Programs

- Equipment Labeling should include three key components which are:
1. Complete Arc flash hazard ratings and PPE
 2. Shock hazard ratings and glove needs
 3. A means for identifying “what” the equipment is called and more importantly “where” it is being fed from in order to obtain a de-energized state.

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New 130.5 (C) Equipment Labeling Codes for 2012 Edition:

1. At least one of the following:
 - ❖ Available incident energy and the corresponding working distance
 - ❖ Minimum arc rating of clothing
 - ❖ Required level of PPE
 - ❖ Highest Hazard/Risk Category (HRC) for the equipment

! WARNING	
ARC FLASH AND SHOCK HAZARD APPROPRIATE PPE REQUIRED	
142" Flash Hazard Boundary 36 cal/cm ² Flash Hazard at an 18" Working Distance Category 4 PPE Level, FR Shirt & Pant + FR Coverall, Double Layer Switching Coat and Hood, Safety Glasses, Hearing Protection	
480 VAC Shock Hazard when Cover is Open/Removed 42" Limited Approach 12" Restricted Approach - Class 00 500Volt Gloves 1" Prohibited Approach - Class 00 500Volt Gloves	
Live Entry Requires Management Approval	
Device Name: PNL-DRY	Fed From: MDP-DRY-1
Fault Current: 11.62 kA	Date: 2-21-11 Faith Technologies 800-274-2345

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New 130.5 (C) Equipment Labeling Codes for 2012 Edition: (Cont)

(2) Nominal system voltage

(3) Arc flash boundary

⚠ WARNING	
ARC FLASH AND SHOCK HAZARD APPROPRIATE PPE REQUIRED	
142" Flash Hazard Boundary	18" Working Distance
36 cal/cm ² Flash Hazard at an	
Category 4 PPE Level, FR Shirt & Pant + FR Coverall, Double Layer Switching Coat and Hood, Safety Glasses, Hearing Protection	
480 VAC Shock Hazard when Cover is Open/Removed	
42" Limited Approach	
12" Restricted Approach - Class 00 500Volt Gloves	
1" Prohibited Approach - Class 00 500Volt Gloves	
Live Entry Requires Management Approval	
Device Name: PNL-DRY	Fed From: MDP-DRY-1
Fault Current: 11.62 kA Date: 2-21-11 Faith Technologies 800-274-2345	

- **Exception:** Labels applied prior to September 30, 2011 are acceptable if they contain the available incident energy or required level of PPE. (This exception reads poorly)
- **The method of calculating and data to support the information for the label shall be documented.*

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Overview of Informative PPE Label Format:

! WARNING	
ARC FLASH AND SHOCK HAZARD APPROPRIATE PPE REQUIRED	
142" Flash Hazard Boundary 36 cal/cm² Flash Hazard at an 18" Working Distance Category 4 PPE Level, FR Shirt & Pant + FR Coverall, Double Layer Switching Coat and Hood, Safety Glasses, Hearing Protection	
480 VAC Shock Hazard when Cover is Open/Removed 42" Limited Approach 12" Restricted Approach - Class 00 500Volt Gloves 1" Prohibited Approach - Class 00 500Volt Gloves	
Live Entry Requires Management Approval	
Device Name: PNL-DRY	Fed From: MDP-DRY-1
Fault Current: 11.62 kA	Date: 2-21-11 Faith Technologies 800-274-2345

Complete PPE listings

Shows Glove Needs

Supports Electrical LOTO Needs

Date Optional for 70E

Shows Fault Current Levels to Aid in Breaker Applications

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Obtaining a De-Energized State:

De-Energized Work Practices (Supportive PPE Labeling/Process)



- This example shows a standard disconnect with ideal labeling in place which in turn supports the fundamental goal for any safety program.
- If an employee was asked this question, how would they be able to respond now?
- If you had to change a fuse in this disconnect, explain to me how you would do that?

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De-Energized Pop Quiz:

- Employees must know where the correct upstream disconnecting source is located
- Employee must know how to lock/tag out the source
- Employees must show shock hazard tools and techniques are in place including insulated glove tests and on demand air tests
- Employees would then proceed to the enclosure and at that time must know exactly what PPE is required for arc flash exposures before opening the door
- Upon opening the door the employee would then test via point on point contact test to confirm absence of power

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Incomplete Labeling Example:

Parameter	Value	Description
Flash Hazard Boundary	61 Inch	Flash Hazard Boundary
Flash Hazard	4.34 cal/cm ²	Flash Hazard at 36 inches
PPE Level	Category 2	Cotton Underwear + FR Shirt & Pants
Shock Hazard	24900 Volts	Shock Hazard when cover is removed
Limited Approach	60/120 Inch	Limited Approach (Fixed/Movable)
Restricted Approach	26 inch	Restricted Approach
Prohibited Approach	7 inch	Prohibited Approach
Bus Name	B-TS MAIN PLT	
Prot Device	FU-MN PLT SERV	

Color coding is not recommended nor required

Labeling lacked PPE details

No Mention of insulated glove needs in old labels

Bus Names and Protective Device references may not be the ideal references to use for LOTO goals?

Incomplete Label



WARNING

Arc Flash and Shock Hazard
Appropriate PPE Required

64 inch	Flash Hazard Boundary
9.67	cal/cm ² Flash Hazard at 18 inches
Category 3	PPE - Category Appropriate
480 VAC	Shock Hazard when cover is removed
00	Glove Class
42 inch	Limited Approach (Fixed Circuit)
12 inch	Restricted Approach
1 inch	Prohibited Approach

Bus: WasteWtrUnit Prot: WT1A 7

Arc Flash analysis conducted by

NOTICE
ALICE BAKATAY AT UTILITIES
PERSONNEL IN THE PLANT
EQUIPMENT PERSONNEL
NOTICE BAKATAY OFF PERSON

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Protective Device Names will often not be true LOTO points in a system

Common to See PPE Labels Applied at the Wrong Locations

These PPE labels belong on the equipment, not at the fused QMB section.



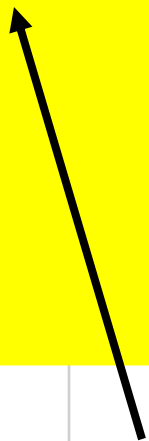
Case Example on Current Installation Methods:



Customer made a decision to separate the new service sections. The resulting arc flash outcome was a dangerous no live entry on the left incoming section and a HRC 1 on the right load center.

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Bus Name	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
ame	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Trip/Delay Time (sec.)	Breaker Opening Time (sec.)	Ground	Equip Type	Gap (mm)	Arc Flash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
	SUB-1-#1	0.480	5.45	3.90	5.45	3.90	0.017	0.000	Yes	PNL	25	6	18	0.20	Category 0
	MDP-1-#2	0.480	19.44	11.57	19.44	11.57	0.017	0.000	Yes	PNL	25	12	18	0.65	Category 0
	MDP-1-#3	0.480	24.46	14.08	23.42	13.48	0.01	0.000	Yes	PNL	25	10	18	0.48	Category 0
	MDP-1-MAIN	0.480	29.68	14.12	28.64	13.62	2	0.000	Yes	PNL	25	256	18	93	Dangerous! (*N3)
	MDP-1-#4	0.480	20.41	12.06	20.41	12.06	0.017	0.000	Yes	PNL	25	13	18	0.68	Category 0
DR CPNL	MDP-1-#3	0.480	14.13	7.49	14.13	7.49	0.016	0.000	Yes	PNL	25	9	18	0.39	Category 0 (*N3)
	MDP-1-#1	0.480	20.82	12.27	20.82	12.27	0.017	0.000	Yes	PNL	25	13	18	0.69	Category 0
untreated sleeve Safety														#Cat 0 = 6	(*N3) - Arcing Current Low Tolerances Use
FR Shirt, FR at, 4 Shield, es														#Cat 1 = 0	(*N5) - Miscoordinated, Upstream Device Tripped
FR Shirt, FR at, 8 Shield, es														#Cat 2 = 0	(*N9) - Max Arcing Duration Reached
FR Shirt & overall, Safety														#Cat 3 = 0	
FR Shirt & overall, Switching d, Safety														#Cat 4 = 0	
gerous! ry Found														#Danger = 1	IEEE 1584 - 2002/2004a Edition



Protective Device Names may not be the LOTO reference you want employees to target for daily use. Spreadsheet data simply dumps to label makers

Minimum AR PPE Content For Labels:

Category	Required Protection FR Clothing
Category 0	Untreated Cotton Long Sleeve Shirt, Pants, Safety Glasses, Hearing Protection
Category 1	AR Shirt, AR Pants, Hard Hat, 4 cal/cm ² Face Shield, Safety Glasses, Hearing Protection
Category 2	AR Shirt, AR Pants, Hard Hat, Balaclava/Hood, 8 cal/cm ² Face Shield, Safety Glasses, Hearing Protection
Category 3	AR Shirt & Pant + AR Coverall, Switching Hood, Safety Glasses, Hearing Protection
Category 4	AR Shirt & Pant + AR Coverall, Double Layer Switching Coat and Hood, Safety Glasses, Hearing Protection

130.7C16 New Protective Clothing and PPE Equipment Table

Table 130.7(C)(16) Protective Clothing and Personal Protective Equipment (PPE)

Hazard/Risk Category	Protective Clothing and PPE
Hazard/Risk Category 0	
Protective Clothing, Nonmelting or Untreated Natural Fiber (i.e. untreated cotton, wool, rayon, or silk or blends of these materials) with a fabric weight of at least 4.5 oz/yd ²	Shirt (long sleeve) Pants (long)
Protective Equipment	Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves (AN) (See Note 1.)


Task Based PPE Table 130.7C15 Review:

Electrical Safety Matrix Table 130.7C(15)(a) Tasks Performed on Energized Equipment	Hazard Risk Category	Rubber Insulating Gloves	Insulated & Insulating Hand Tools
Panelboards or Other Equipment Rated 240 V and Below Parameters: Maximum of 25 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 19 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	0	N	N
Circuit breaker (CB) or fused switch (FS) operation with covers on	0	N	N
CB or fused switch operation with covers off	0	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	1	Y	Y
Remove/install CBs or fused switches	1	Y	Y
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	0	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard	1	Y	Y

Table approach to PPE selection has additional engineering notations at the end of the table.

Also included the Parameters that must be considered in each section such as fault levels, clearing times etc.

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**What is OSHA and/or a Safety
Director's Primary Goal with
Electrical Safety?**

**To work on systems in
a de-energized state!**

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Class Exercise on Work Permits:

- Your goal is to use the work permit sheet to discuss a project you have in mind.
- Break out into groups of two. One person will become the Safety Director and the other person will be the qualified employee.
- Together, fill out the work permit and we will share your examples as a group.
- **Have some fun with this exercise!!!**

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Class Exercise on Work Permits:

NOTICE
ALICE BAKGAW AT UTILITIES
PERSONNEL IN THE PLANT
EMPLOYED PERSONNEL
BY THE BATTERY OFF POWER

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Caution Must Be Taken When Using PPE Table 130.7C15:

Tasks Performed on Energized Equipment	Arc Flash Category	Rubber Insulating Gloves	Insulated & Insulating Hand Tools
Panelboards or Other Equipment Rated 240 V and Below Parameters: Maximum of 25 kA short circuit current available; maximum of 0.03 sec (2 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 19 in.			
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Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	1	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	0	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard	1	Y	Y

(5) For power systems up to 600V the Arc Flash Boundary was determined by using the following information:

★ When 0.03 second trip time was used, that indicated MCC or panelboard equipment protected by a molded-case circuit breaker. Working distance used is (455 mm) 18", arc gap used is 32mm for switchgear and 25 mm for MCC, protective device type 0 for all. When 0.33 or 0.5 second trip time was used, that indicated LVPCB (drawout circuit breaker) in switchgear. Working distance is (610 mm) 24", arc gap used is 32 mm, protective device type 0 for all. All numbers were rounded up or down depending on closest multiple of 5.

(130.7C15) New Direct Current Equipment Table

Table 130.7(C)(15)(b) Hazard/Risk Category Classifications and Use of Rubber Insulating Gloves and Insulated and Insulating Hand Tools-Direct Current Equipment			
Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloved	Insulated and Insulating Hand Tools
Storage Batteries, Direct-Current Switchboards and other DC supply sources > 100V <250V Parameters: Voltage: 250 V Maximum arc duration and working distance: 2 sec @ 18 in.			
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥ 1 kA and < 4 kA Potential arc flash boundry using above parameters at 4 kA: 36 in.	1	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥ 4 kA and < 7 kA. Potential arc flash boundry using above parameters at 7 kA: 48 in.	2	Y	Y
Work on energized electrical conductors and circuit parts, including voltage testing where arcing current is ≥ 7 kA and < 15 kA. Potential arc flash boundry using above parameters at 15 kA: 72 in.	3	Y	Y

On DC systems be sure to check your PPE clothing to make sure your ASTM ratings match this code!

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NOTICE
 ALL PERSONNEL AT UTILITIES
 PERSONNEL IN THE PLANT
 MUST WEAR PROPER PPE
 BEFORE ENTERING OFF PROPERTY

130.5 Arc Flash Hazard Analysis

- **(2012) Edition-** An arc flash hazard analysis shall determine the arc flash boundary, the incident energy at the working distance, and the personal protective equipment people within the arc flash boundary shall use.
 - ❖ The arc flash hazard analysis shall be updated when a major modification or renovation takes place. It shall be reviewed periodically, not to exceed 5 years, to account for changes in the electrical distribution system that could affect the results of the arc flash hazard analysis.
 - ❖ **Be careful to not confuse the intent of this article. If you make changes to your systems you shall update your safety process. Waiting five years between revisions is risky!!**

130.5 Arc Flash Hazard Analysis

- **(2012) Edition-** Informational Note No. 5:
 - ❖ See IEEE1584 for more information regarding arc flash hazards for three-phase systems less than 240 volts.
 - ❖ This new definition follows similar goals the 2009 code edition had however three phase 240 systems must be calculated regardless of the upstream transformers.

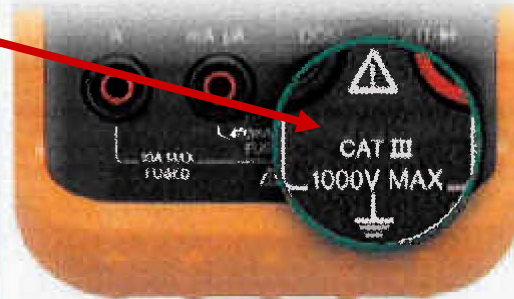
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Required Meter Safety Items

Double check your meter to ensure it is current

New

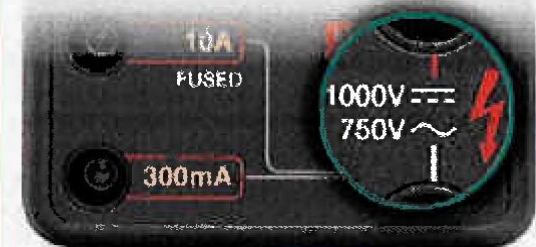
1000 V CAT III and 600 V CAT IV meters designed to withstand 8000 V transients



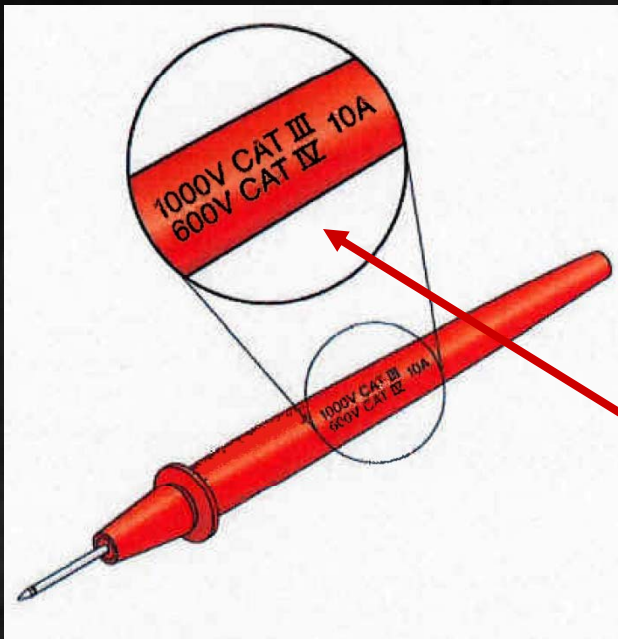
Use meters with these markings:
1000 V CAT III or 600 V CAT IV

Old

Fluke Meters designed to older standards do not show category rating on front of instrument



Do not use meters without proper CAT markings on 480 V circuits



Please make sure your meter leads are correct

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Not Approved!

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5 PC. ELECTRICIAN'S HOLDING SCREWDRIVER SET



Once the screw is set in the holder, you don't have to touch it again. Both the handle and shanks are insulated against up to 1000 volts, only the chrome vanadium tips are exposed.

- Pieces: 5
- Design: flat and cross point
- Description: 5 x 150, 4 x 125, and 3 x 125mm flat-points, 6 x 175 No. 2, and 4 x 125 No. 1 cross points
- Shipping weight: 1 lb.

Look for this symbol to indicate approved tools:



(Hint: these tools don't have it!)

OSHA What's New

- New PPE directive
- What is PPE?
 - ❖ Personal Protective Equipment

➤ [LINK](#)

➤ http://www.osha.gov/OshDoc/Directive_pdf/CPL_02-01-050.pdf

02.07.2005



OSHA INSTRUCTION

U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration

DIRECTIVE NUMBER: CPL 02-01-050

EFFECTIVE DATE: February 10, 2011

SUBJECT: 29 CFR Part 1910, Subpart I, Enforcement Guidance for Personal Protective Equipment in General Industry

ABSTRACT

- Purpose:** This instruction, *Enforcement Guidance for Personal Protective Equipment in General Industry*, establishes OSHA's general enforcement and guidance policy for its standards addressing personal protective equipment (PPE). It instructs OSHA enforcement personnel on both the agency's interpretations of those standards and the procedures for enforcing them.
- Scope:** This instruction applies OSHA-wide.
- References:** See paragraph III.
- Cancellations:** OSHA STD 01-06-006, *Inspection Guidelines for 29 CFR 1910. Subpart I, the revised Personal Protective Equipment Standards for General Industry, June 16, 1995.*

Are Tools PPE?

➤ *NOTE: Insulated protected tools and testing equipment are not considered to be personal protective equipment when working in proximity to exposed electrical parts. These tools are designed to make contact with exposed energized conductors or circuit parts.*

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Question

- **When an employer decides to use flame-resistant clothing (FRC) to protect employees from any type of fire exposure hazard (e.g., flash fire or arc flash) is the employer required to pay for the FRC?**

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Yes

- The employer is required to **provide**, ensure use, and maintain protective clothing in a sanitary and reliable condition whenever it is necessary by reason of hazards, capable of causing injury in any part of the body, as addressed in 29 CFR 1910.132(a). Where employees are exposed to electrical hazards (e.g., substations **or electrical panels** that present the potential for arc flash) refer to **Safeguards for personnel protection. - 29 CFR 1910.335** and **29 CFR 1910.132(a)** for PPE. Where there are flash fire hazards in General Industry occupations e.g., in the oil and gas industry and in petroleum-chemical plants, the employer is required to pay for FRC as indicated in **29 CFR 1910.132(h)(1)**. ...

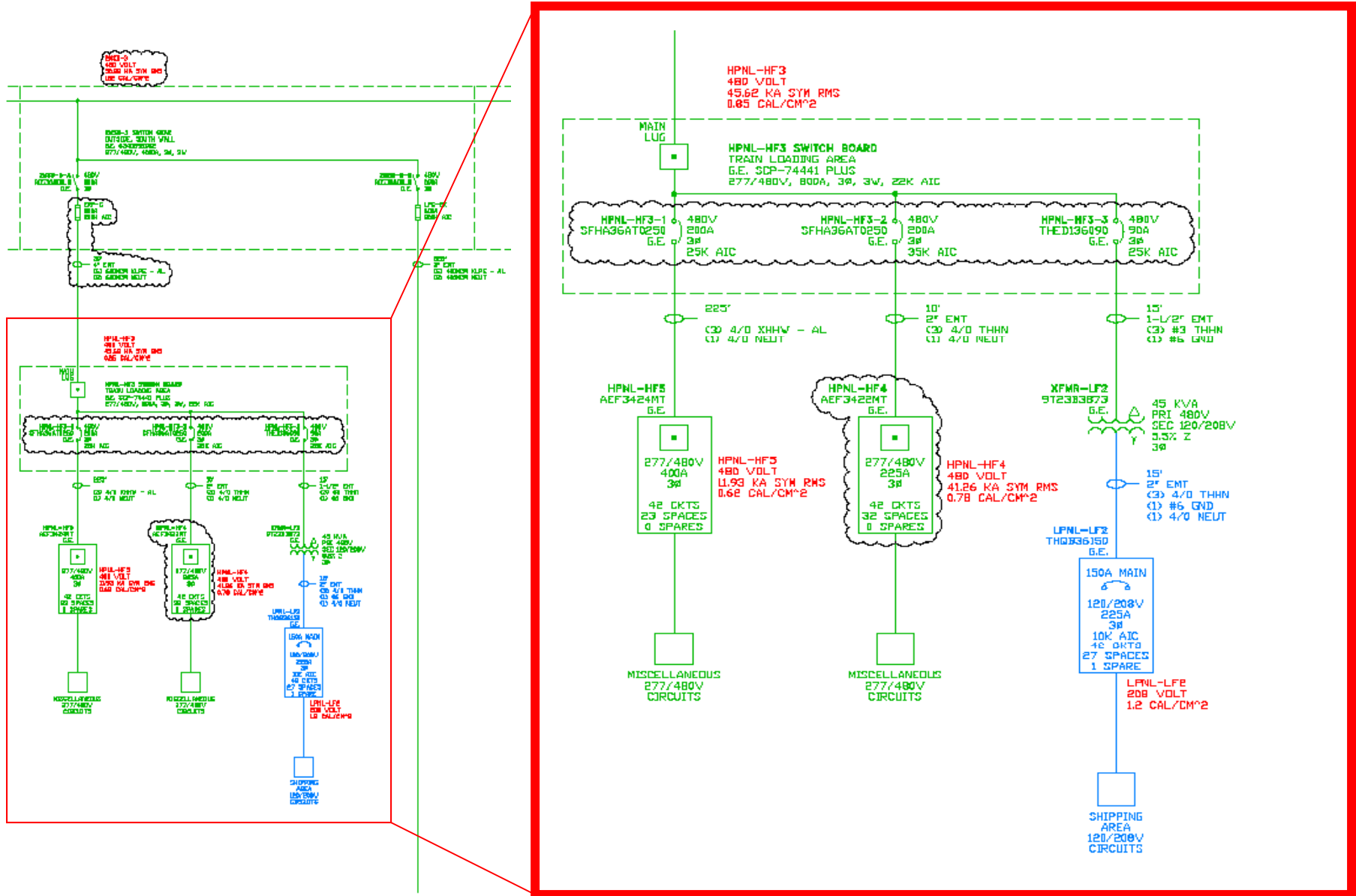
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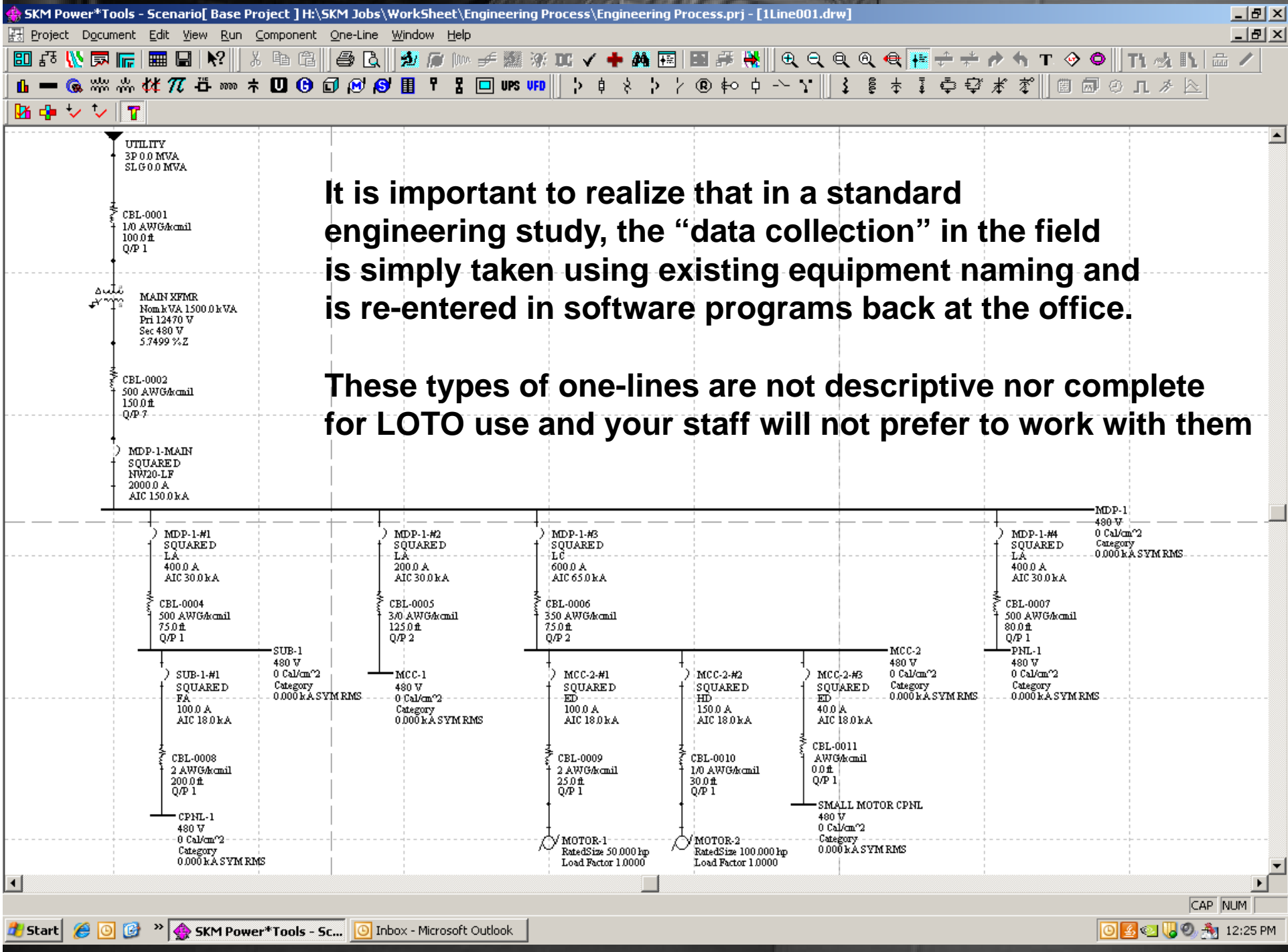
Value of Good Prints:

- A good electrical print should show all connecting devices including engineering information, OEM information along with short circuit findings in order to consolidate all aspects of maintenance and safety LOTO needs.
- Engineering software program one-lines alone are not recommended for LOTO use and are often not end user friendly nor complete.

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Detailed One-Lines Show Valuable End User Needed Information





It is important to realize that in a standard engineering study, the “data collection” in the field is simply taken using existing equipment naming and is re-entered in software programs back at the office.

These types of one-lines are not descriptive nor complete for LOTO use and your staff will not prefer to work with them



OSHA 1910.303(b)(5)...

****Adds requirements for the coordination of over current protection for circuits and equipment.**

This is a separate presentation in itself

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2012 Additions for Maintenance

➤ 205.3 General Maintenance Requirements:

Electrical equipment shall be maintained in accordance with manufacturers' instructions or industry consensus standards to reduce the risk of failure and the subsequent exposure of employees to electrical hazards.



What Might OSHA Look For?:

- Will look for PPE labeling
- Will seek inspection of tools and PPE use
- Will seek supporting data on training efforts to show evidence of qualified staff
- May seek evidence of the process used for risk assessments
- Will review and quantify your use of energized work permits and job briefings
- **Bottom Line, How do you manage de-energized work methods**

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1910.333(a)(1) De-energized parts.

“Live parts to which an employee may be exposed shall be de-energized before the employee works on or near them, unless the employer can demonstrate that de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.”



02.07.2005

Questions?

NOTICE
ALICE BAKGATEY AT UTILITIES
PERSONNEL IN THE PLANT
EMPLOYED PERSONNEL
MAYBE EXITING OFF PREMISES

02.07.2005