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Siemens 2010 Seminar

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2010 Seminar

TVSS – Transient Voltage Surge Suppressors

- What is an SPD?
- What is new with UL1449 3rd edition code?
- When is UL1449 3rd edition code in effect?
- What is the benefit of the new code?

Arc Fault Circuit Interrupters (AFCI)

- When and where are they required?
- What do they look for?
- How do I troubleshoot an AFCI?
- The AFCI does not trip on my service call. Why?

Selective Coordination

- Where is it being enforced?
- What must I do to comply?
- If I miss it in a spec or the AHJ wants it, now what?

Arc Flash

- How is it related to selective coordination?
- When do I need to wear an arc flash suit?

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TVSS – Transient Voltage Surge Suppressors

What is an SPD?

SURGE PROTECTION DEVICE (SPD)

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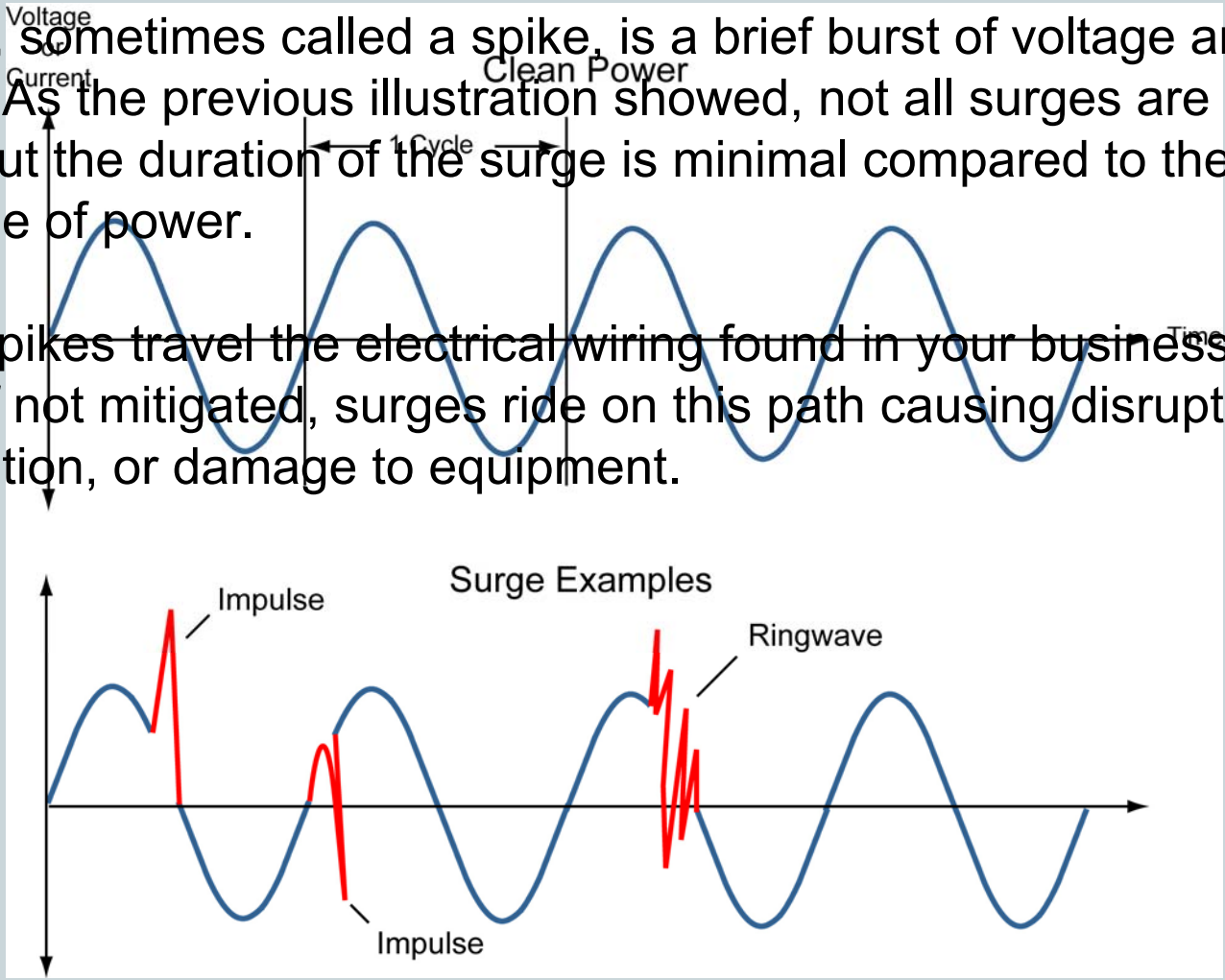
What is a Surge?

A surge, sometimes called a spike, is a brief burst of voltage and current. As the previous illustration showed, not all surges are the same, but the duration of the surge is minimal compared to the length one cycle of power.

These spikes travel the electrical wiring found in your business or home. If not mitigated, surges ride on this path causing disruption, degradation, or damage to equipment.



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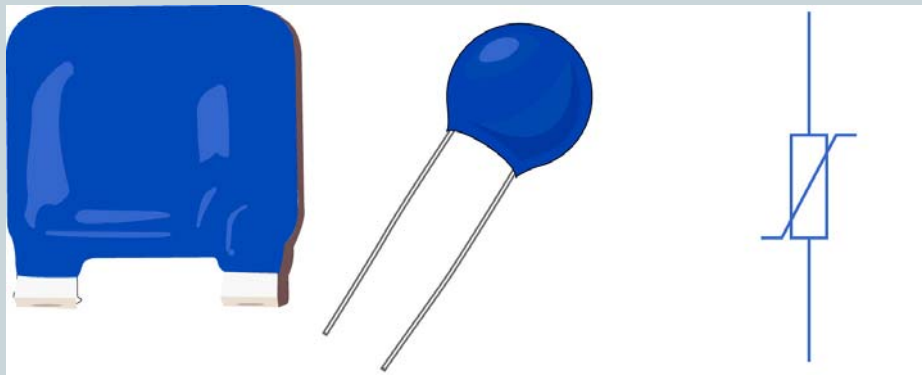
Surge Protection Devices

The function of a surge protection system is to safely channel excess energy to ground.

Today's SPDs incorporate metal oxide varistors (MOVs) or (SAD's). MOV's are used in the majority of SPD's. These semiconductor devices function as voltage sensitive resistors. MOV's are installed between service conductors and neutral and/or ground, MOVs monitor system voltages. As surge voltages increase, MOVs respond in just a few nanoseconds switching from the normal "Open Circuit" to a "Short Circuit" state. This results in suppressing a surge before it has a chance to damage electronic equipment.



Metal Oxide Varistors Circuit Symbol

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SURGE PROTECTION DEVICE (formerly TVSS)

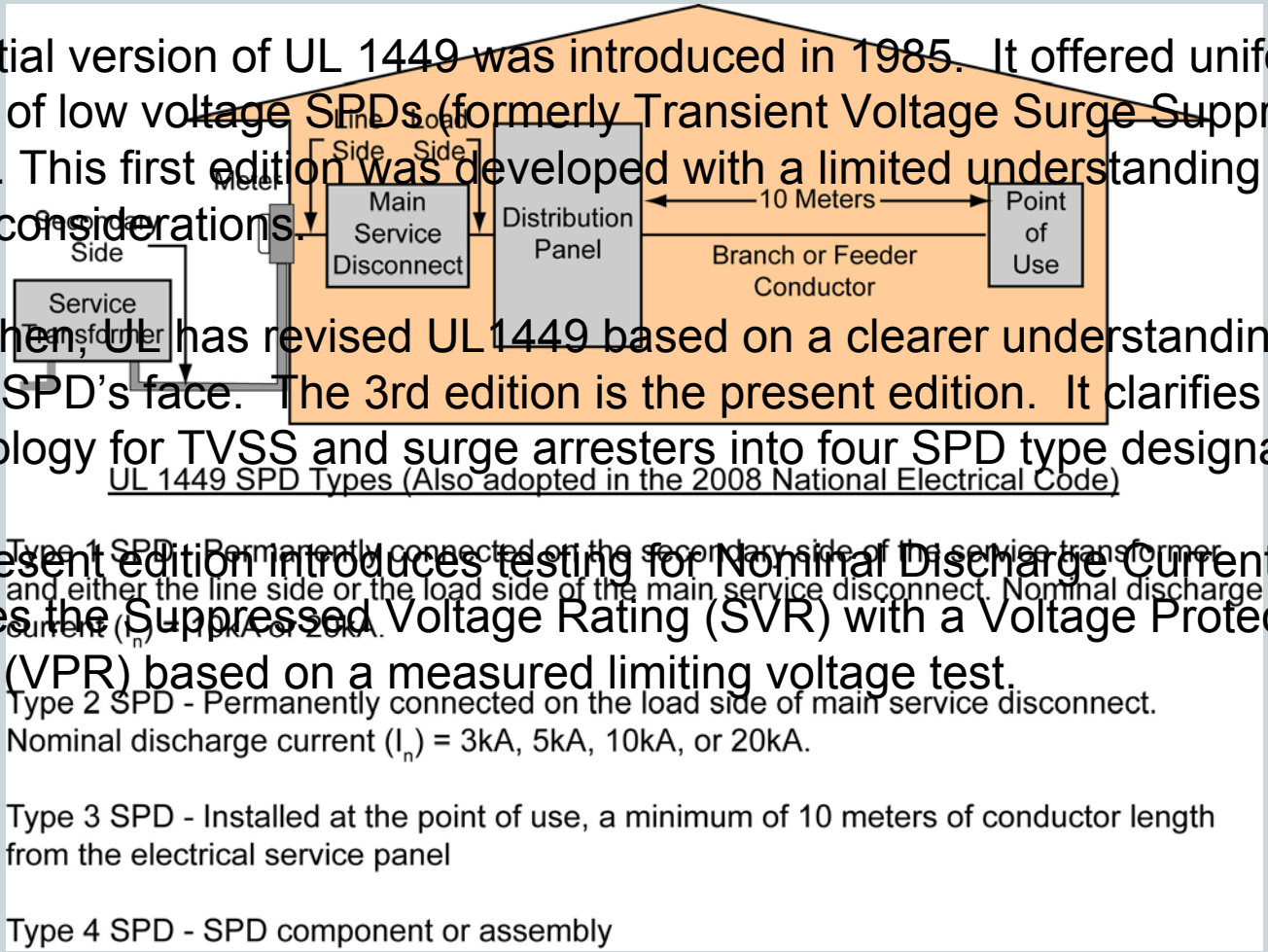
What is new with UL1449 3rd edition code?

UL 1449

The initial version of UL 1449 was introduced in 1985. It offered uniform testing of low voltage SPDs (formerly Transient Voltage Surge Suppressors or TVSS). This first edition was developed with a limited understanding of SPD safety considerations.

Since then, UL has revised UL1449 based on a clearer understanding of the issues SPD's face. The 3rd edition is the present edition. It clarifies terminology for TVSS and surge arresters into four SPD type designations.

The present edition introduces testing for Nominal Discharge Current (In) and replaces the Suppressed Voltage Rating (SVR) with a Voltage Protection Rating (VPR) based on a measured limiting voltage test.



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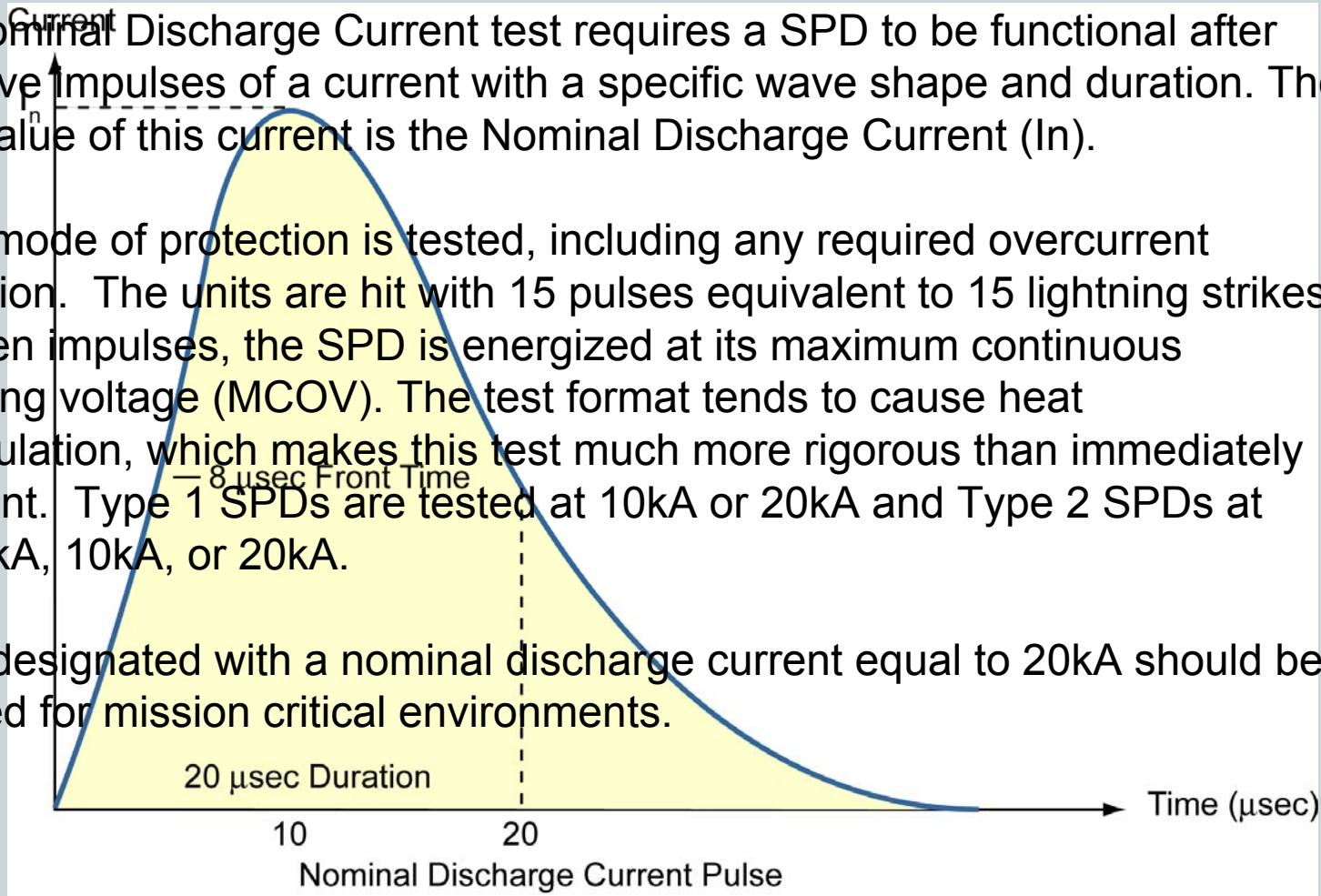
Nominal Discharge Current Test

The Nominal Discharge Current test requires a SPD to be functional after repetitive impulses of a current with a specific wave shape and duration. The peak value of this current is the Nominal Discharge Current (In).

Every mode of protection is tested, including any required overcurrent protection. The units are hit with 15 pulses equivalent to 15 lightning strikes. Between impulses, the SPD is energized at its maximum continuous operating voltage (MCOV). The test format tends to cause heat accumulation, which makes this test much more rigorous than immediately apparent. Type 1 SPDs are tested at 10kA or 20kA and Type 2 SPDs at 3kA, 5kA, 10kA, or 20kA.

SPDs designated with a nominal discharge current equal to 20kA should be selected for mission critical environments.



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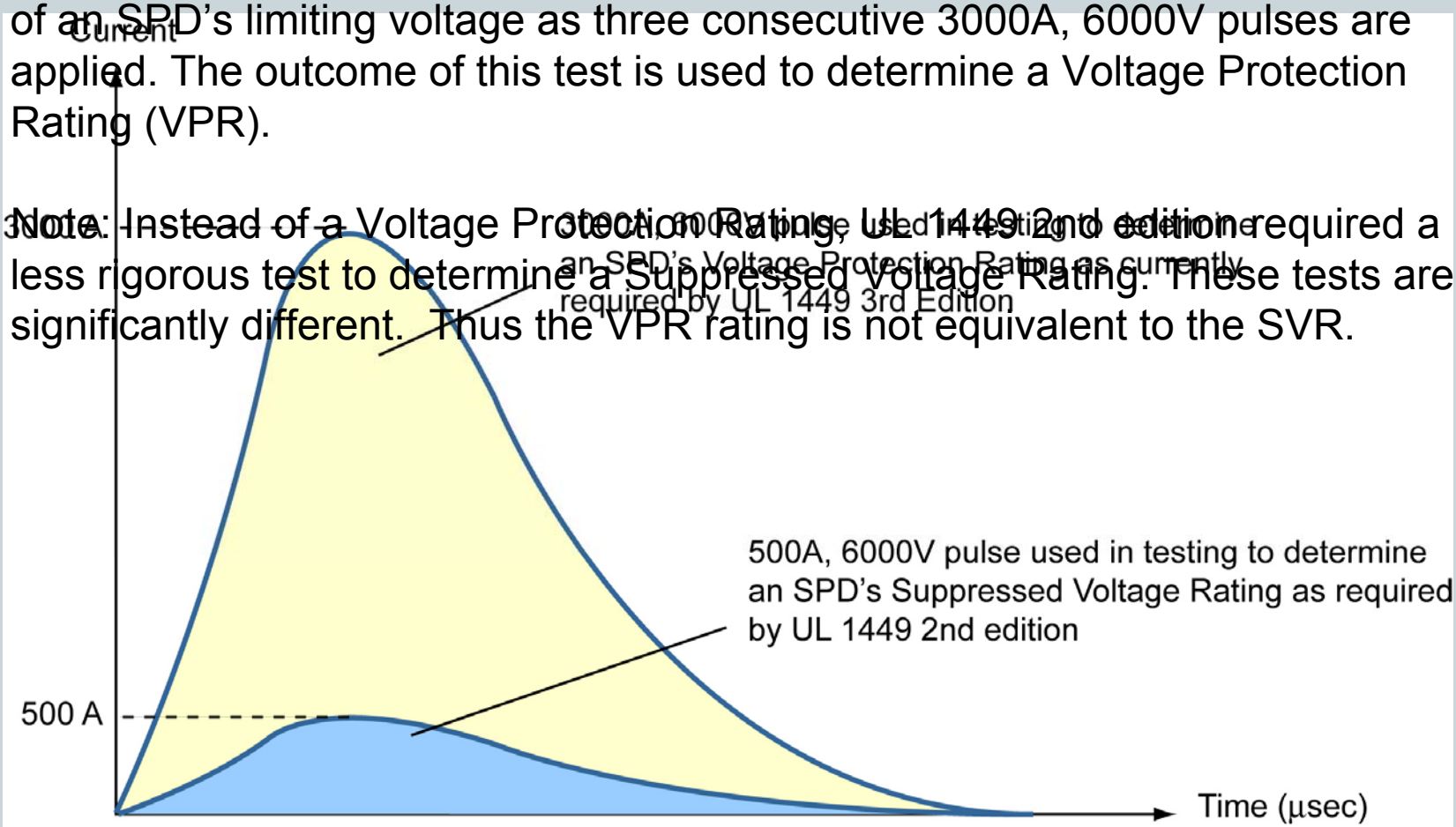
Voltage Protection Rating

Another critical SPD test required by UL 1449 3rd edition is the measurement of an SPD's limiting voltage as three consecutive 3000A, 6000V pulses are applied. The outcome of this test is used to determine a Voltage Protection Rating (VPR).

Note: Instead of a Voltage Protection Rating, UL 1449 2nd edition required a less rigorous test to determine a Suppressed Voltage Rating. These tests are significantly different. Thus the VPR rating is not equivalent to the SVR.



Is your system S.O.L.I.D.?

Service entrance

Outside loads

Lower voltage distribution panels

Individual critical equipment

Data, Telephone and coaxial cables

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SURGE PROTECTION DEVICE (formerly TVSS)

- What is an SPD?
- What is new with 3rd edition?
- When is it in effect?
- What is the benefit?

SURGE PROTECTION DEVICE (formerly TVSS)

When is it in effect?

When is 3rd Edition in effect

9/29/09

- **SURGE PROTECTION DEVICE (formerly TVSS)**
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What is the benefit?

Merged Safety Regulations of Surge Arrestors and TVSS/SPD

Surge Arrestors now are tested to TVSS/SPD Standards

Improved Performance Testing

I nominal testing – Equal to 15 lightning strikes at 20kA

Improved Voltage Protection Rating Test at 500 A to 3000A

Tighter Regulation

Retrofitting will now be limited to Panel Mfgr approved units

Must be 3rd Edition “Listed”

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What do I need to remember from the last 15 minutes?

TVSS is now SPD
Surge Arrestors and SPD are now are tested to the same standards
The Testing is equal to 15 lightning strikes at 20kA
The Voltage Protection Rating Test is 6 times higher
Retrofitting will now be limited to Panel Mfgr approved units
Must be 3rd Edition “Listed”
Manufacturers can exhaust their supply of older, 2nd edition revision units

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Arc Fault Circuit Interrupters (AFCI)

When and where are they required?

210.12 Arc-Fault Circuit-Interrupter Protection.

(A) Definition: Arc-Fault Circuit Interrupter (AFCI). A device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected.

(B) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in **dwelling unit** family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or **similar rooms** or areas shall be protected by a listed arc-fault circuit interrupter, **combination-type**, installed to provide protection of the branch circuit.

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Arc Fault Circuit Interrupters (AFCI)

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Details of an AFCI: Branch/Feeder type

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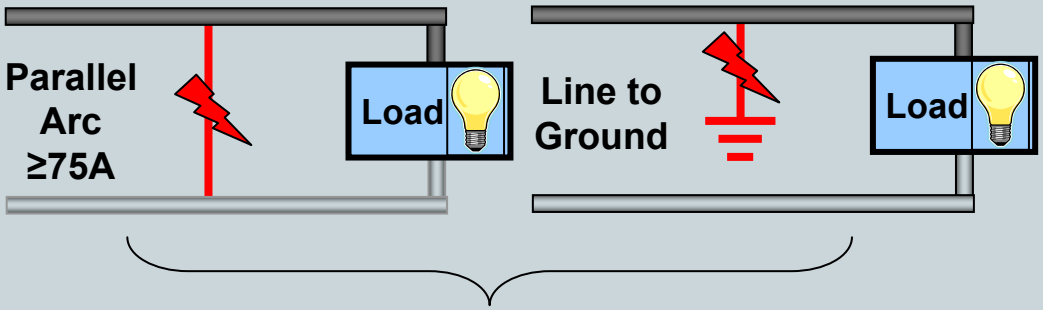
Siemens **Branch/Feeder** type AFCI's consist of two sides

- Mechanical
  - Functions as a normal thermal magnetic circuit breaker
- Electronic
  - Detects the arc and activates a solenoid to trip the mechanical side
  - Detects line-to-neutral arcs ≥75A and line-to-ground arcs



It is **NOT** a replacement for a GFCI (Ground Fault Circuit Interrupter)

- AFCI's are not intended for personnel protection

Details of an AFCI: Combination type

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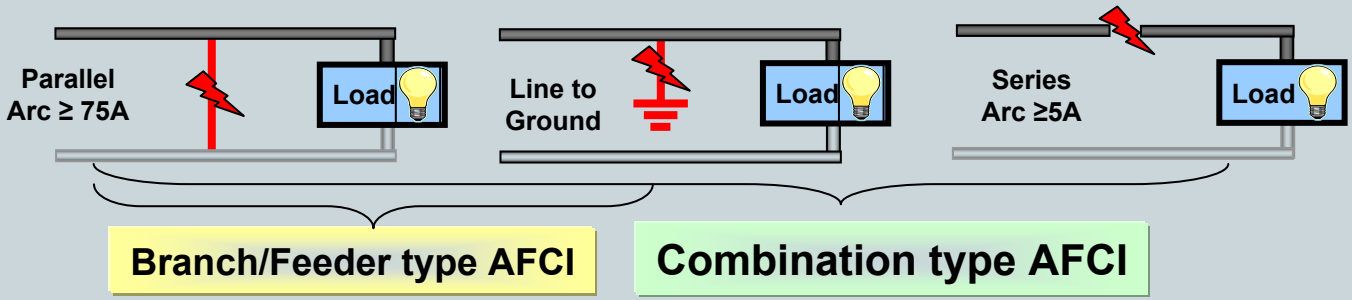
Complies with the UL requirements for both branch/feeder type and outlet circuit type AFCIs.

"Combination" does **NOT** mean an AFCI + GFCI

Provides protection against the high-energy parallel (line-to-neutral and line-to-ground) arcing and low-energy series arcing.

Combination = parallel + series arcing

Protects downstream branch circuit wiring, cord sets and power-supply cords.



Details of an AFCI: Conventional Circuit Protection

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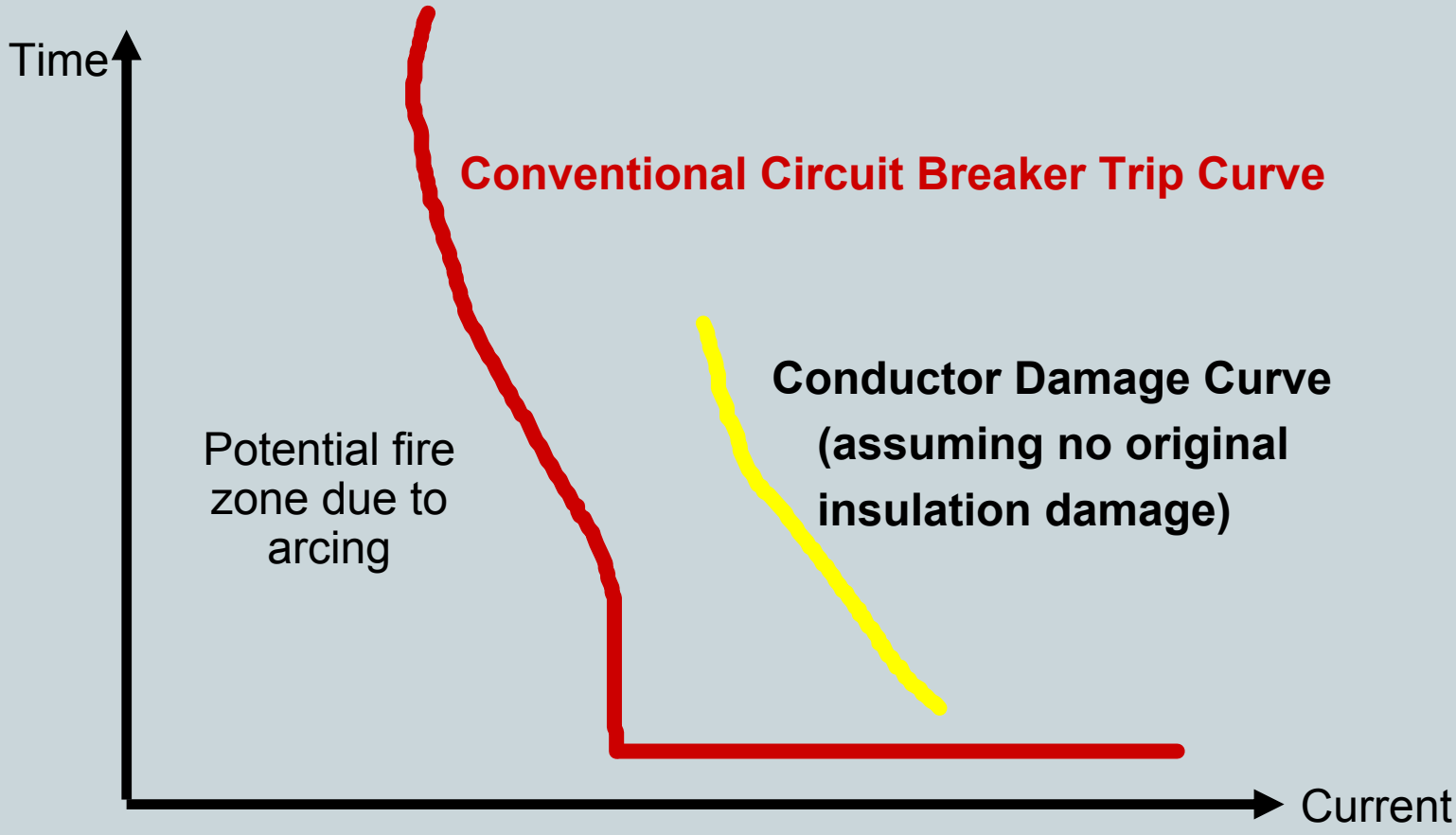

Details of an AFCI:
Branch/Feeder type AFCI Circuit Protection

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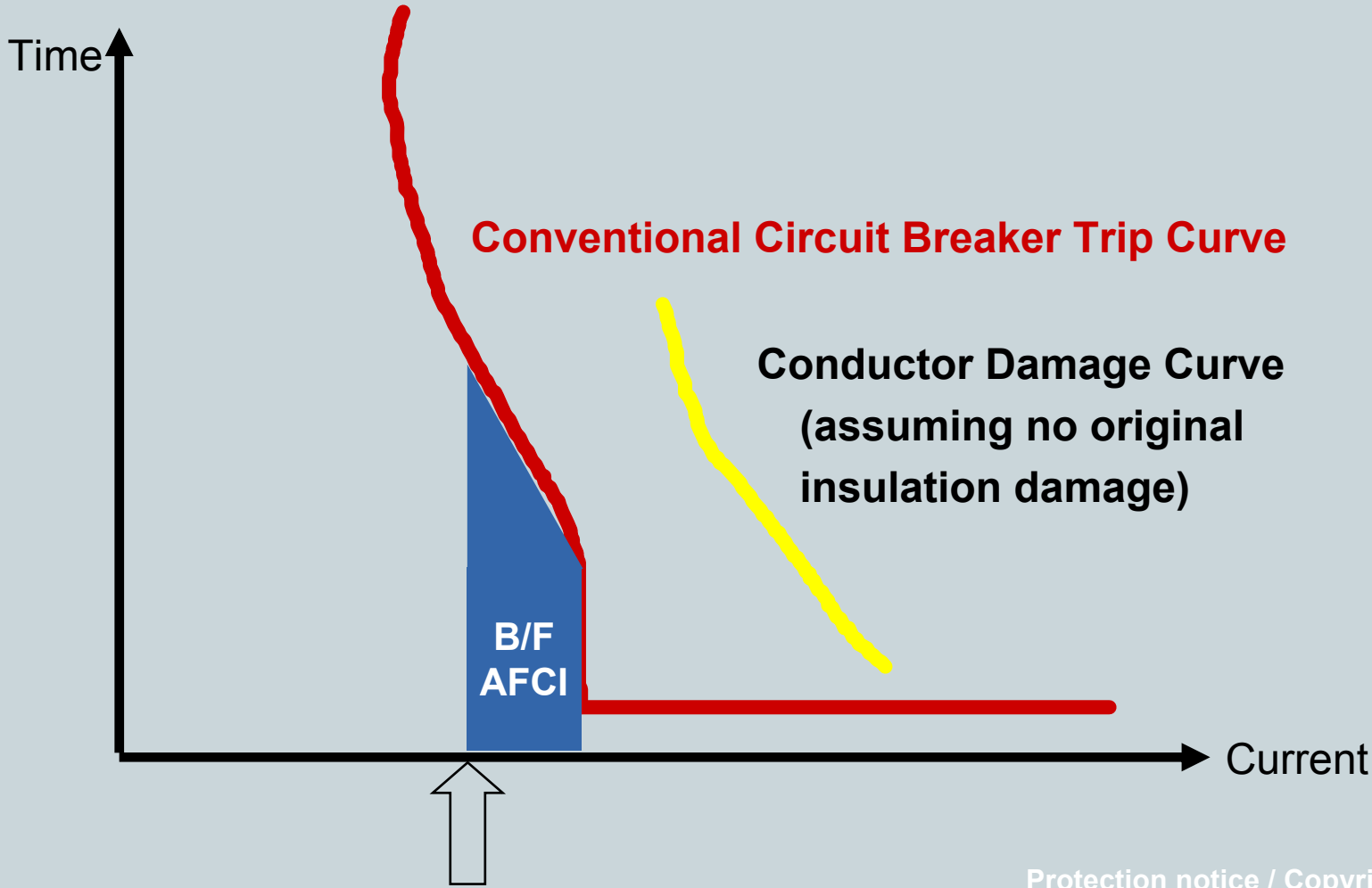

Details of an AFCI:
Combination type AFCI Circuit Protection

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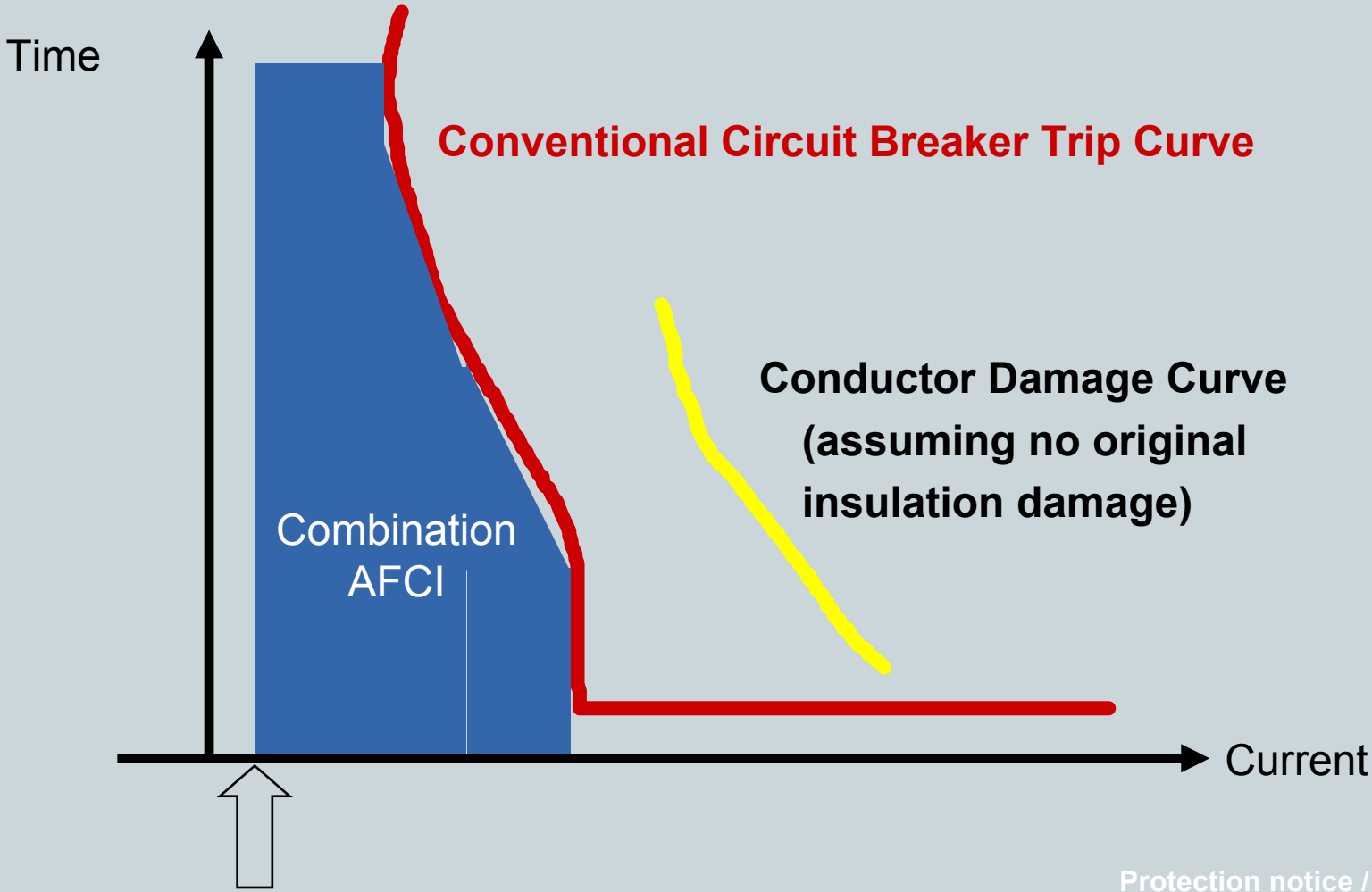

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AFCI Video

Siemens Branch AFCI Circuit Breaker

Protects against branch and parallel arc faults
Push to test button
Easy wiring
Compatible with current Siemens, ITE, Gould, and Siemens-Allis products
Same size as standard breaker

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Arc Fault Circuit Interrupters (AFCI)

When and where are they required?

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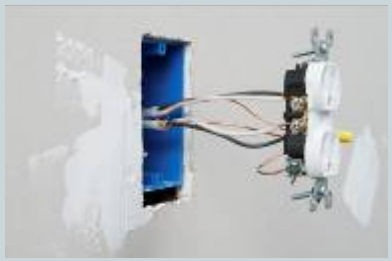
Arc Faults and Potential Causes

Arc faults may occur anywhere in the home's electrical system as a result of:

- Worn electrical insulation or damaged wire
- Misapplied or damaged plug-in appliance cords and equipment
- Loose electrical connections
- Accidentally piercing electrical cable behind drywalls with drill bit, nail, or screw
- Hammering electrical cable too tightly against studs during installation
- Pushing furniture against cords plugged into outlets



When these issues cause AFCIs to trip, the source may be difficult to isolate and resolve even when a root cause appears to be obvious.

Determining the root cause of an undesired AFCI trip can require multiple trips and many hours of evaluation

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The need for a Diagnostic Tool

- AFCIs either trip or don't trip – no "in between" information
- Minimum current level required to trip Combination Type AFCIs (UL)
- AFCI trips can be intermittent
- AFCI's do not tell you where the fault is located or how many are present (added together)
- Intermittent trips do not always occur with the contractor present (multiple visits)
- Wiring practices can be a root cause for nuisance tripping
- AFCI's have less than a 0.1% failure rate. *"The breaker must be bad."* Odds are against it.

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BUT, doesn't a tester already exist?

- This item is NOT a TESTER ⟶
  -This device may or may not make an AFCI trip
  -Can only produce limited simulated arcs. Many of the arcs "look" like household appliances to an AFCI
  -This device is not endorsed by UL or any NEMA manufacturer of AFCI for the purpose of testing an AFCI

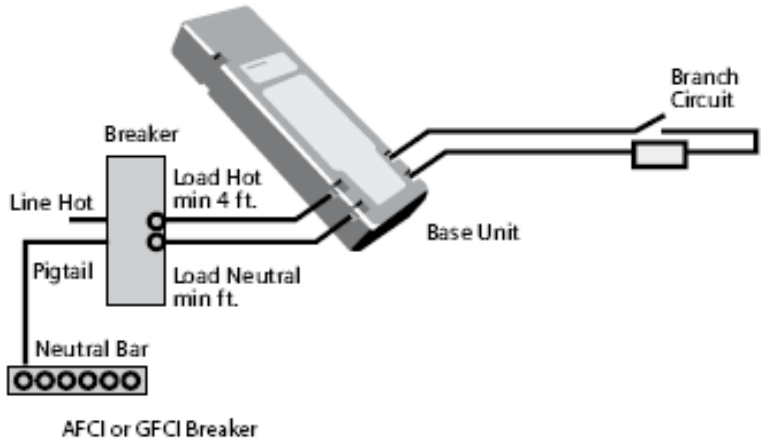
- Intelli-Arc is NOT a TESTER either!
  -It IS a tool designed to help diagnose the cause of an undesired AFCI trip
  -It WILL save your contractors time and money!

<u>The push to test button remains the ONLY way to test whether or not an AFCI is functioning properly</u>

Intelli-Arc: Basic Components

2 Main Components

- "Base Unit"
  - Wired in series with the AFCI breaker
  - Monitors & transmits data
  - Powered by breaker
- "Hand held Unit"
  - Receives data from the base unit via wireless
  - Displays amperage, ground fault, arc fault relevant data about the circuit
  - Powered by batteries



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How Does the Contractor Use It?

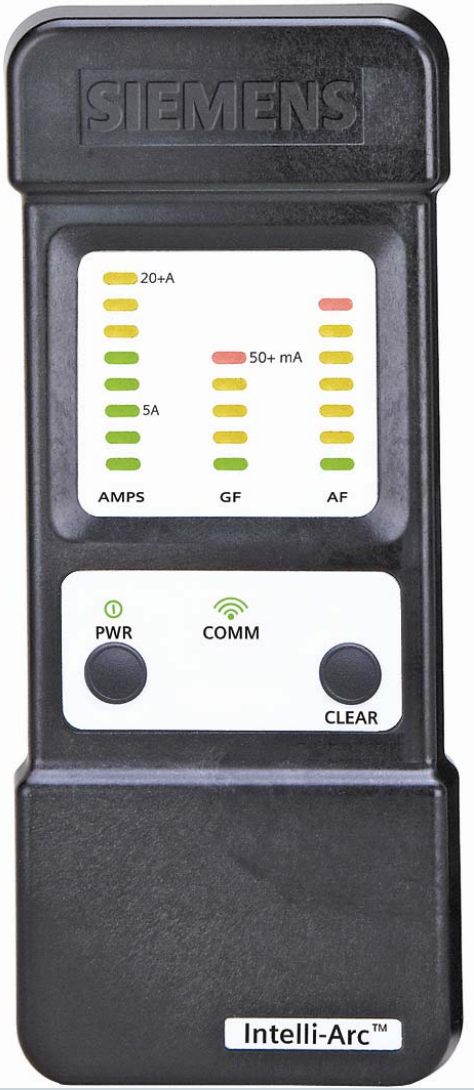
Installation

- Contractor shuts off AFCI & all down stream devices.
- Contractor wires in the base unit. The load “hot” and “neutral” wires from the AFCI go into the base unit and out to the circuit. AFCI pigtail remains installed.
- Contractor re-energizes breaker. Power & communication lights come on. Note base unit is powered by the breaker it is wired to. There are no batteries in the base unit.

Operation

- Contractor energizes and de-energizes each device on the circuit sequentially starting with the closest device to the breaker being tested.
- As each device is energized the hand held will display colored LEDs (green, yellow, red) indicating the level of ampacity, ground fault, and arc fault the AFCI breaker sees.
- If no device appears to be tripping the AFCI then the contractor begins at step one again, but leaves each device on.
- The device that shows the highest level of arc fault or ground fault should be investigated first.

What will the contractor see?



Amperage

- Used for reference- the AFCI needs a minimal level of current to consider an arc dangerous (use 500W as a guideline)
- Scale goes to 20A: anything above this will trip the thermal-mag portion of the breaker

Ground Fault

- LEDs indicate the “leakage” to ground.
- This is for reference - LEDs are not in standard increments.
- Red LEDs indicate an event that will cause the AFCI to trip.
- Yellow LEDs from individual devices can add up to a red LED

Arc Fault

- LEDs indicate how close an event comes to tripping the AFCI. This can be based on size, duration, type, etc. of the arc
- Red LED’s indicate an event that will cause the AFCI to trip
- Yellow LEDs from individual devices can add up to a red LED
- Devices that produce “noise” on a circuit (IE low voltage lighting) will show up here

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Intelli-Arc Diagnostic Tool – Benefit

- Provides significant level of information in between “trip” and “no trip”
- Provides fault information regardless current level
- Helps to display intermittent issues during “on” and “off” operation of loads
- Along with good troubleshooting techniques, helps to narrow down portion of branch circuit containing the issue
- Reduces the number of trips required to diagnose issue
- Can be used to diagnose ANY AFCI circuit

Does not replace good troubleshooting techniques!

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Arc Fault Circuit Interrupters (AFCI)

When and where are they required?

What do they look for?

How do I troubleshoot an AFCI?

The AFCI does not trip on my service call. Why?

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Story Time!

The lamp in my daughter's bedroom

Example 1

Known Information from homeowner:

-AFCI Trips when vacuum is turned on

-LED indicates electronic trip

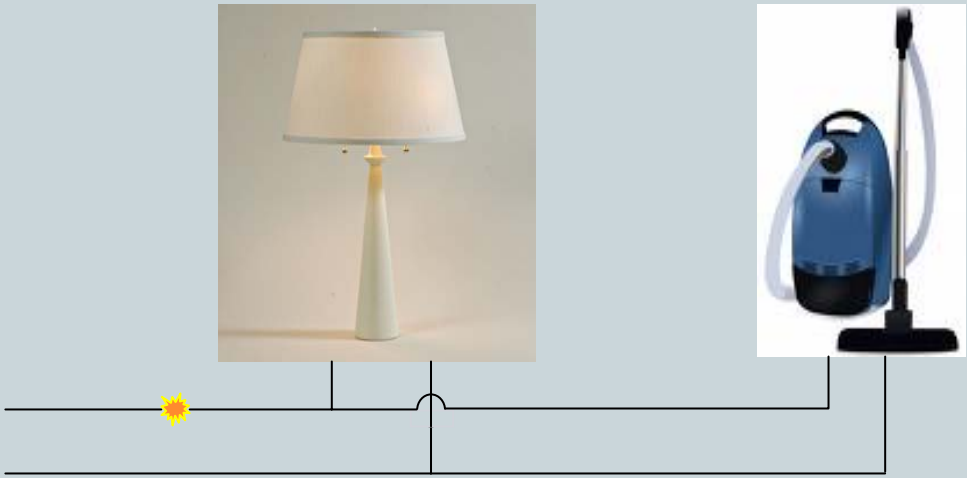
Known Information from contractor:

-AFCI doesn't trip when vacuum turned on

-Turned off all other devices on circuit

-PTT indicates breaker functioning

Example 1- What is happening?



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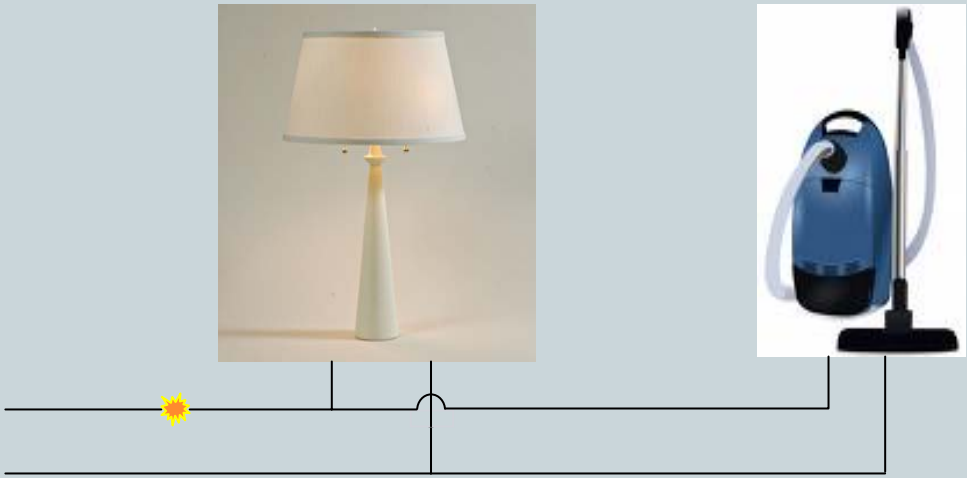
What is happening:
- Lamp cord has a short - creating an arc
- Lamp only drawing 60W - need 500W or more to trip AFCI
- Combined load of vacuum cleaner plus lamp over 500W - trips AFCI
- Homeowner thinks it's the vacuum - but was vacuuming with the lamp on…

Example 1- How would Intelli-Arc Help?



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Contractor could have:
- Individually evaluated lamp and vacuum
- Been able to see load on lamp was low
- Been able to show homeowner the problem graphically on the Intelli-Arc Display

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Story Time!

The alarm clock in my daughter's bedroom

New Construction in South Carolina

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What do I need to remember from the last 15 minutes?

Troubleshooting an AFCI is difficult.
The actual reason is not always obvious.
A diagnostic tool exists from Schaedler Yesco.
AFCI's can help save lives.
Siemens has a breaker with 30 day (resetable) memory.
Intelli-Arc will work on ANY manufacturers breaker.

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Selective Coordination

Where is it being enforced?

What must I do to comply?

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Selective Coordination

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Selective Coordination

Where is it being enforced?

"It is much like a speeding ticket, except it is not."

Selective Coordination

What must I do to comply?

First, who are you?

A Business Owner

An Electrician

A Local Code Official

A Consulting Engineer

"I'll just put a note on the drawing."

Saying what? "The contractor and gear manufacturer shall install Selectively Coordinated equipment."

Translation: Someone else needs to finish my job for me.

"But I do not know which manufacturer I am getting. How can I design for everyone?

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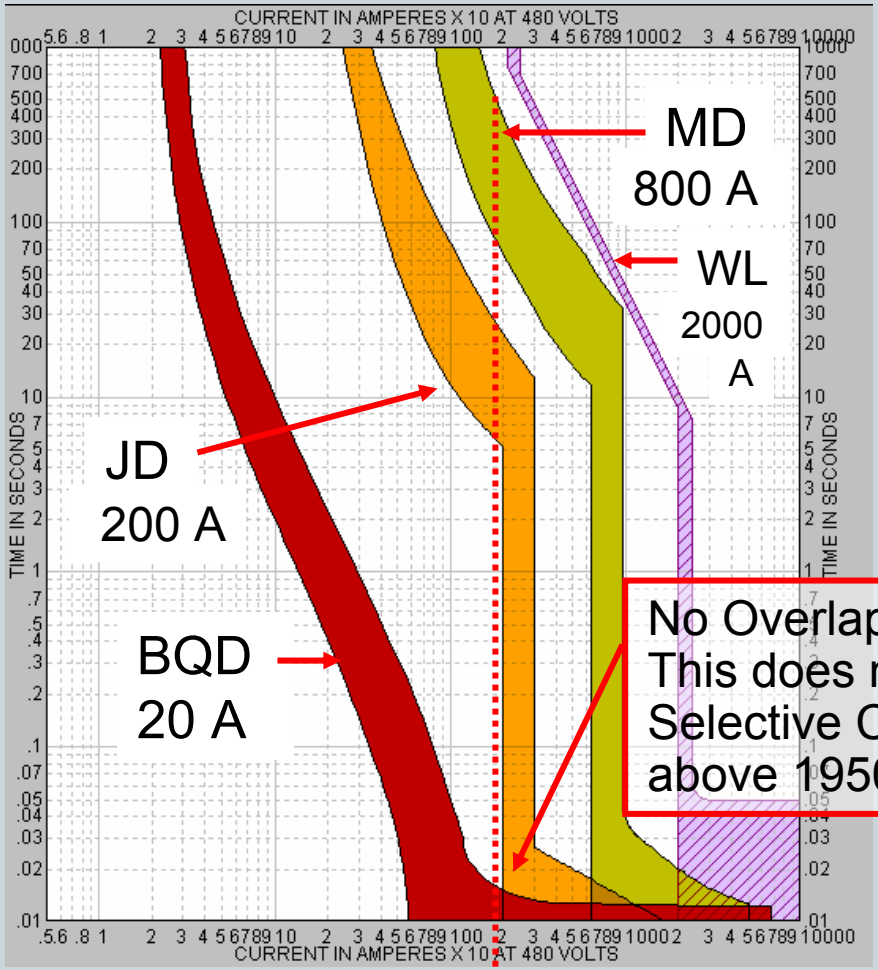
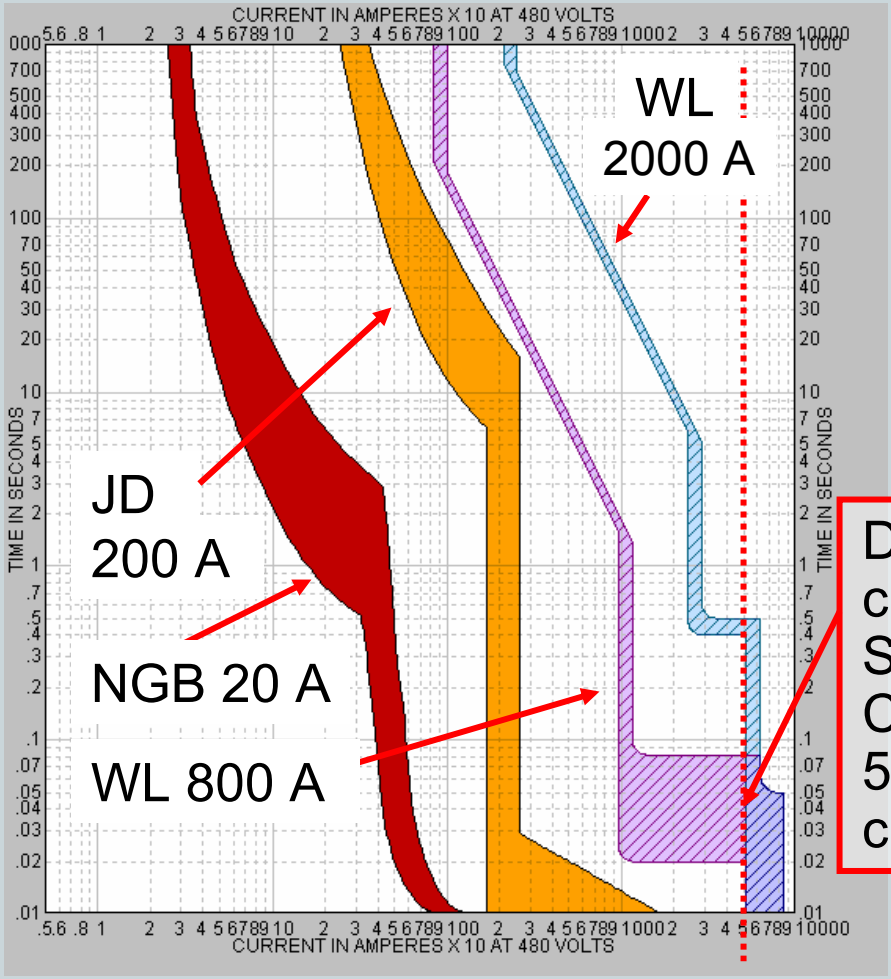
Typical Condition

2000A Main, 800A Distribution, 200A Panel, 20A Branch



Selective Coordination

2000A Main, 800A Distribution, 200A Panel, 20A Branch



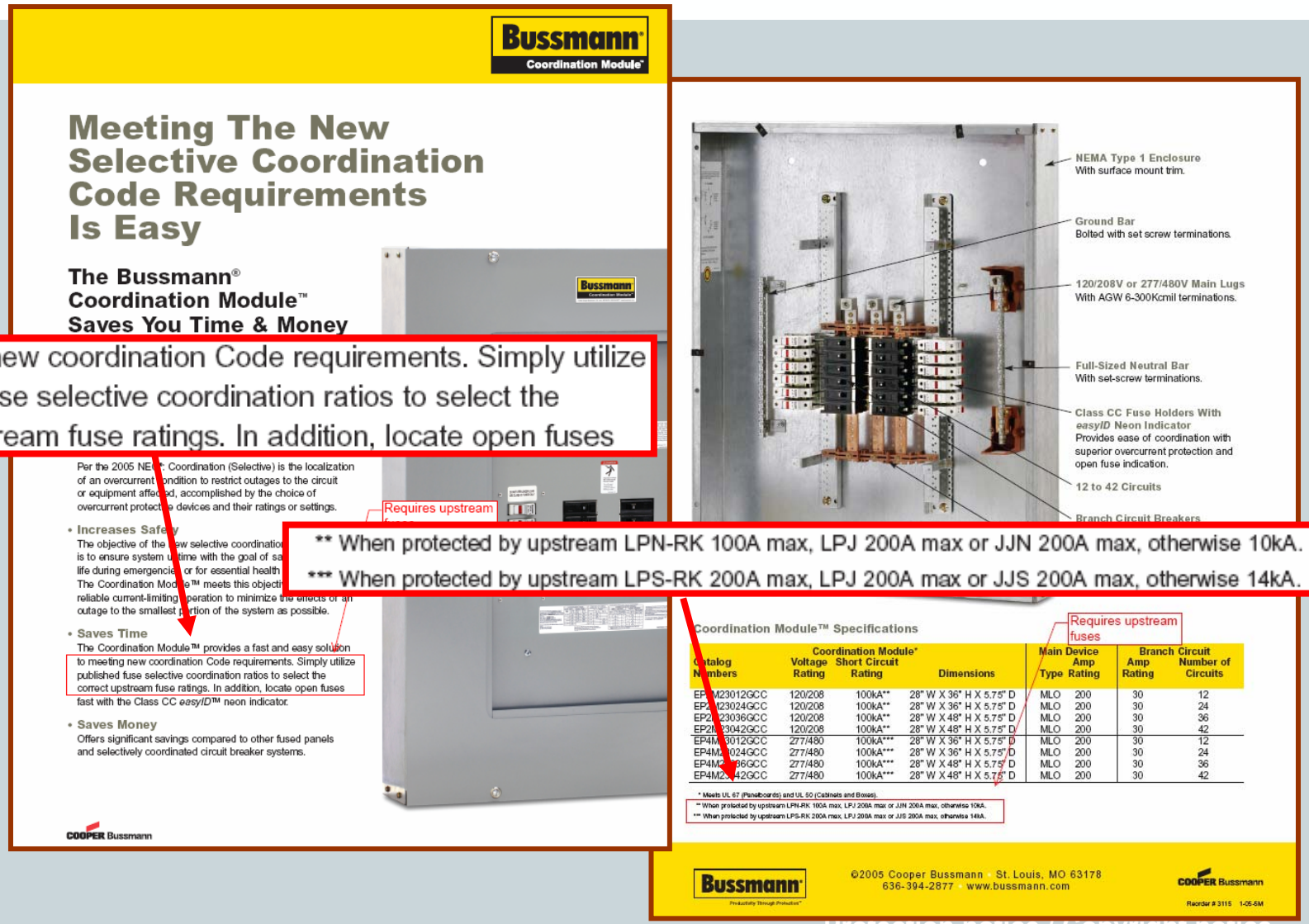
Different devices chosen to allow Selective Coordination up to 50kA available fault current

Selective Coordination

A quick survey:

Raise your hand if you know someone who has been shocked by electricity.
Keep your hand up if you know of someone who was hurt by electricity.
Keep your hand in the air, if you or someone you know was injured by an arc flash event.
Keep your hand up if you know of anyone who was injured or killed due to two breakers tripping simultaneously due to a lack of selective coordination.

Fused Solution?



Bussmann Coordination Module

Meeting The New Selective Coordination Code Requirements Is Easy

The Bussmann® Coordination Module™ Saves You Time & Money

to meeting new coordination Code requirements. Simply utilize published fuse selective coordination ratios to select the correct upstream fuse ratings. In addition, locate open fuses

Per the 2005 NEC®, Coordination (Selective) is the localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the choice of overcurrent protective devices and their ratings or settings.

- Increases Safety
The objective of the new selective coordination is to ensure system uptime with the goal of safe life during emergencies or for essential health The Coordination Module™ meets this objecti reliable current-limiting operation to minimize the effects of an outage to the smallest portion of the system as possible.
- Saves Time
The Coordination Module™ provides a fast and easy solution to meeting new coordination Code requirements. Simply utilize published fuse selective coordination ratios to select the correct upstream fuse ratings. In addition, locate open fuses fast with the Class CC *easyID*™ neon indicator.
- Saves Money
Offers significant savings compared to other fused panels and selectively coordinated circuit breaker systems.

Requires upstream

COOPER Bussmann

NEMA Type 1 Enclosure
With surface mount trim.

Ground Bar
Bolted with set screw terminations.

120/208V or 277/480V Main Lugs
With AGW 6-300Kcmil terminations.

Full-Sized Neutral Bar
With set-screw terminations.

Class CC Fuse Holders With *easyID* Neon Indicator
Provides ease of coordination with superior overcurrent protection and open fuse indication.

12 to 42 Circuits

Branch Circuit Breakers

** When protected by upstream LPN-RK 100A max, LPJ 200A max or JJN 200A max, otherwise 10kA.

*** When protected by upstream LPS-RK 200A max, LPJ 200A max or JJS 200A max, otherwise 14kA.

Coordination Module™ Specifications

Requires upstream fuses

Catalog Numbers	Coordination Module* Voltage Rating	Short Circuit Rating	Dimensions	Main Device Type	Amp Rating	Branch Circuit Amp Rating	Number of Circuits
EP2M23012GCC	120/208	100kA**	28" W X 36" H X 5.75" D	MLO	200	30	12
EP2M23024GCC	120/208	100kA**	28" W X 36" H X 5.75" D	MLO	200	30	24
EP2M23036GCC	120/208	100kA**	28" W X 48" H X 5.75" D	MLO	200	30	36
EP2M23042GCC	120/208	100kA**	28" W X 48" H X 5.75" D	MLO	200	30	42
EP4M23012GCC	277/480	100kA***	28" W X 36" H X 5.75" D	MLO	200	30	12
EP4M23024GCC	277/480	100kA***	28" W X 36" H X 5.75" D	MLO	200	30	24
EP4M23036GCC	277/480	100kA***	28" W X 48" H X 5.75" D	MLO	200	30	36
EP4M23042GCC	277/480	100kA***	28" W X 48" H X 5.75" D	MLO	200	30	42

* Meets UL 67 (Panelboards) and UL 50 (Cabinets and Boxes).
** When protected by upstream LPN-RK 100A max, LPJ 200A max or JJN 200A max, otherwise 10kA.
*** When protected by upstream LPS-RK 200A max, LPJ 200A max or JJS 200A max, otherwise 14kA.

Bussmann Productivity Through Protection

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Reorder # 3115 1-05-5M

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Are Fuses the Solution?

Traditional disadvantages of fuses remain:

Additional hazard to owner and requires training

Misapplications can occur

Single phasing hazard

Spares and storage required

Proper coordination

Additionally, arc flash hazards can occur for any device

Selective Coordination

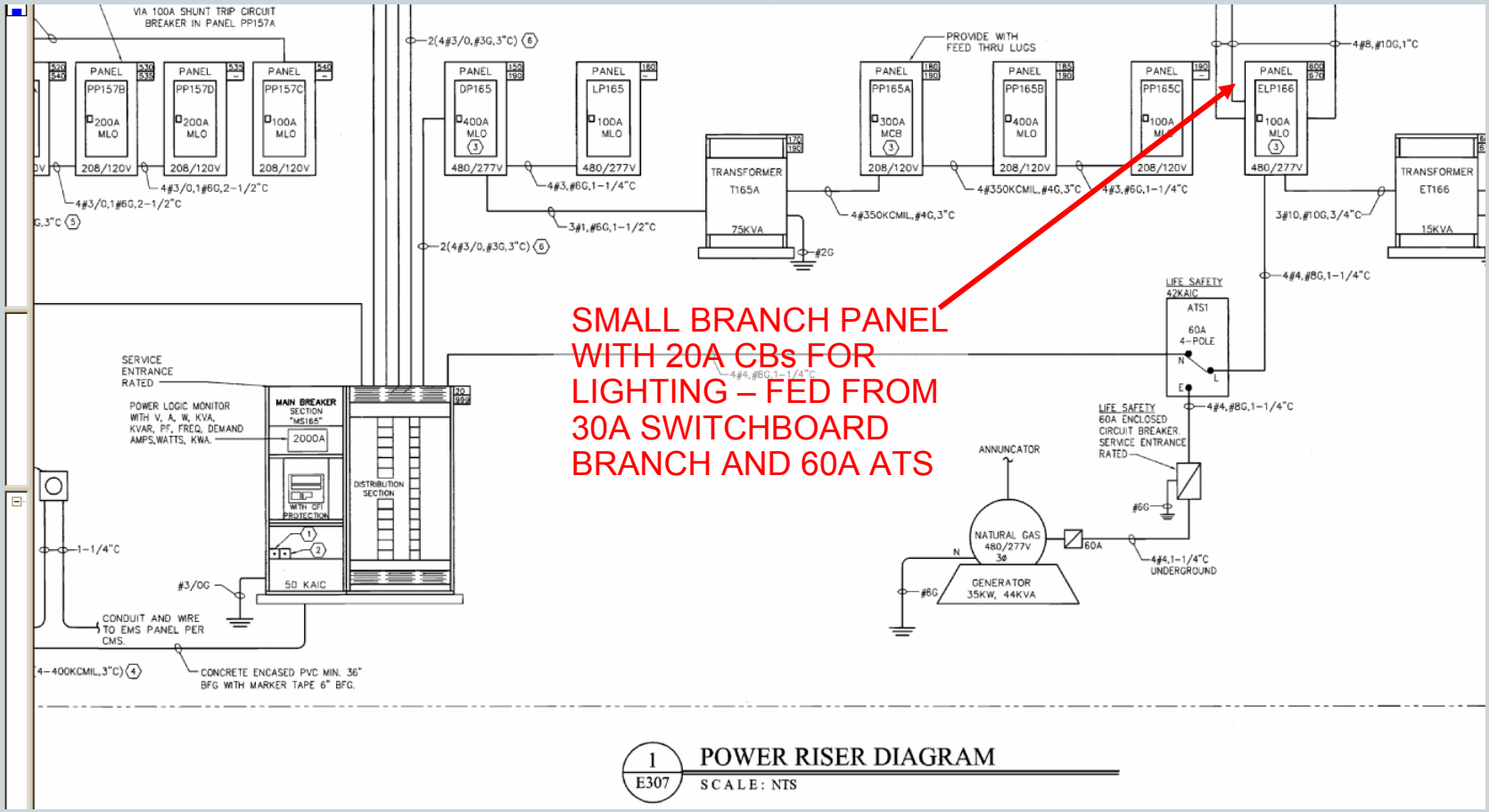
Selective Coordination

If I miss it in a spec or the AHJ wants it, now what?

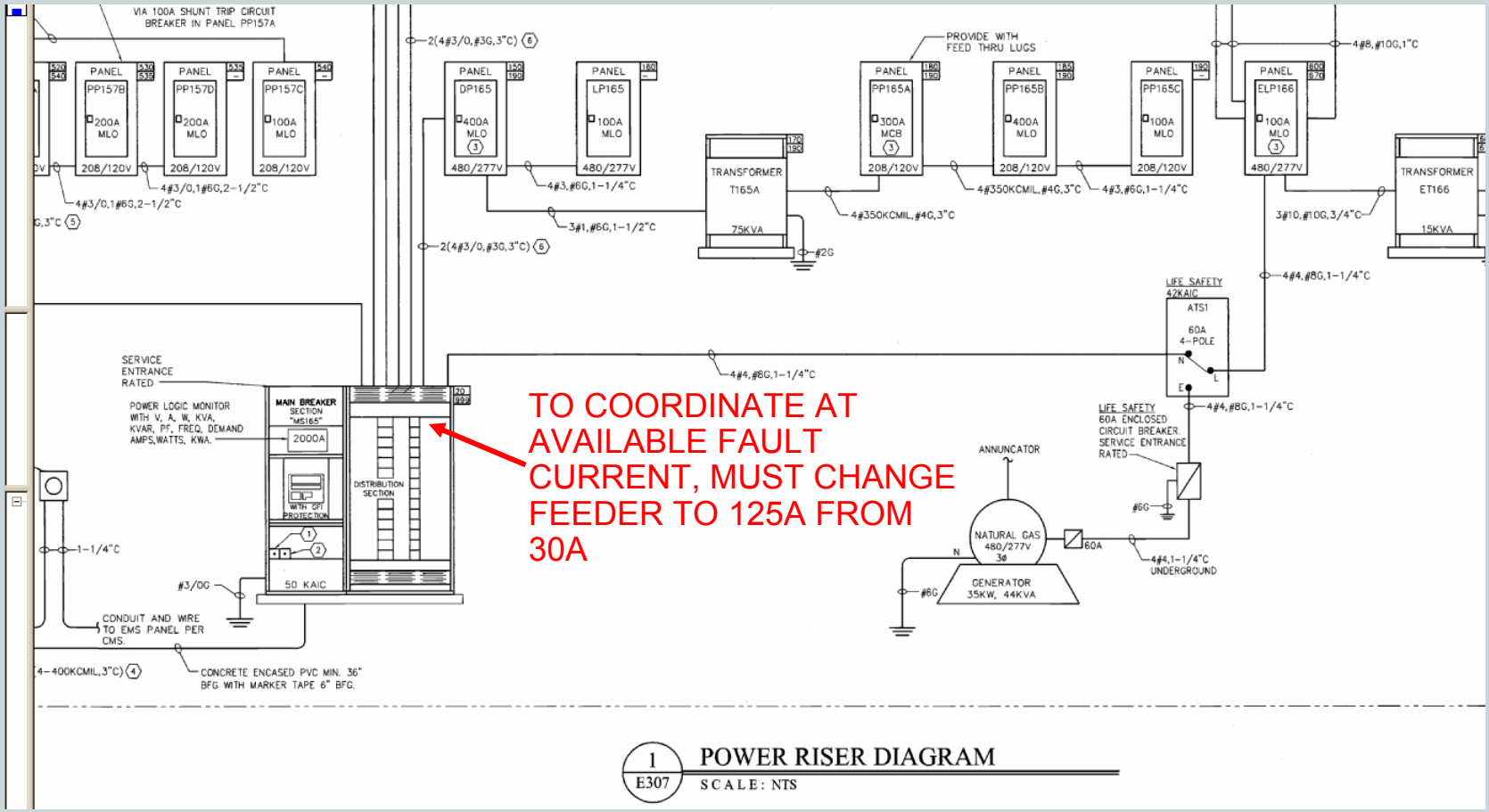
Again, IT IS DESIGN.

Let's look at a simple, real world example from an engineer in Pennsylvania.

Example



Example



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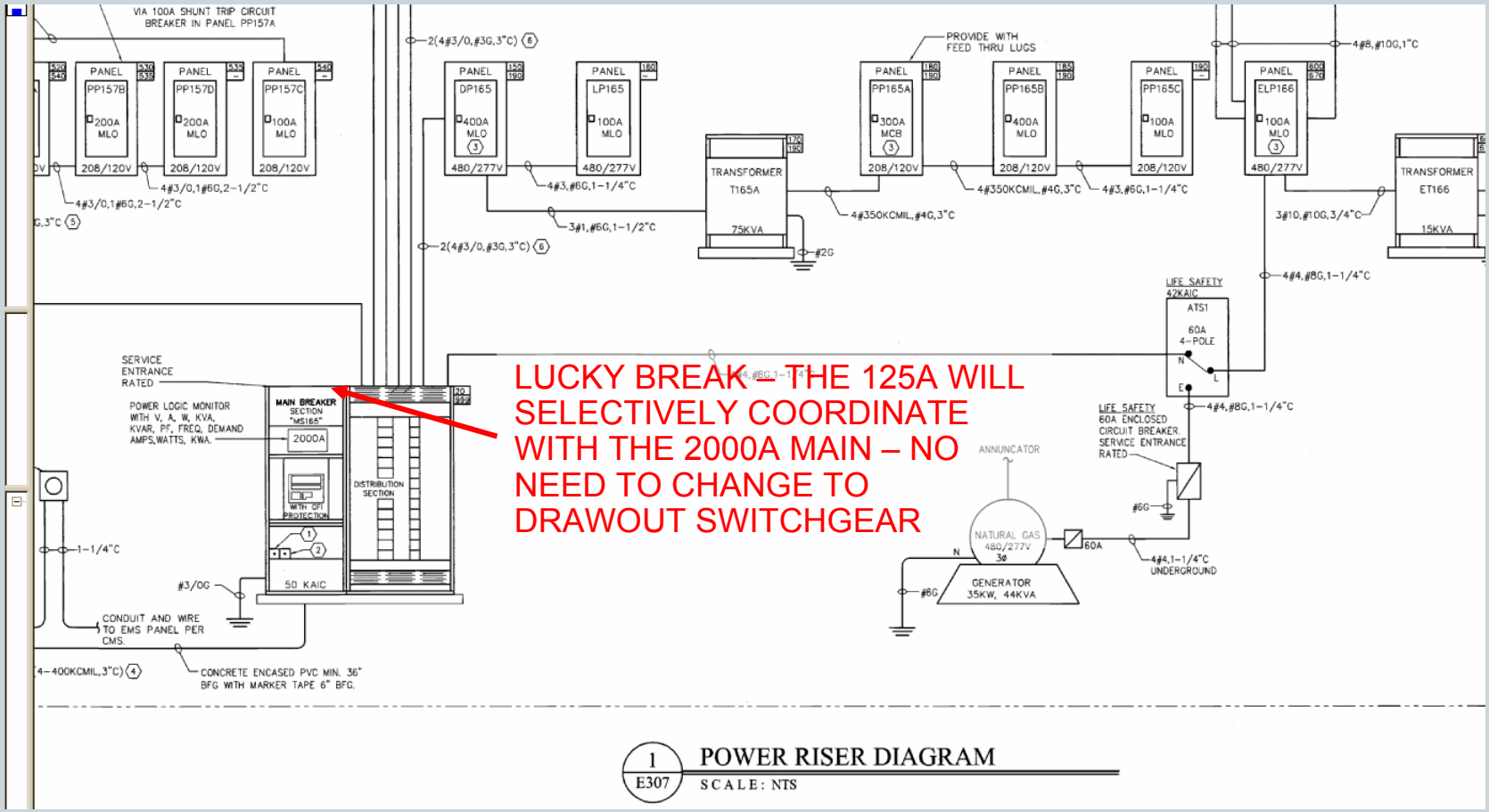

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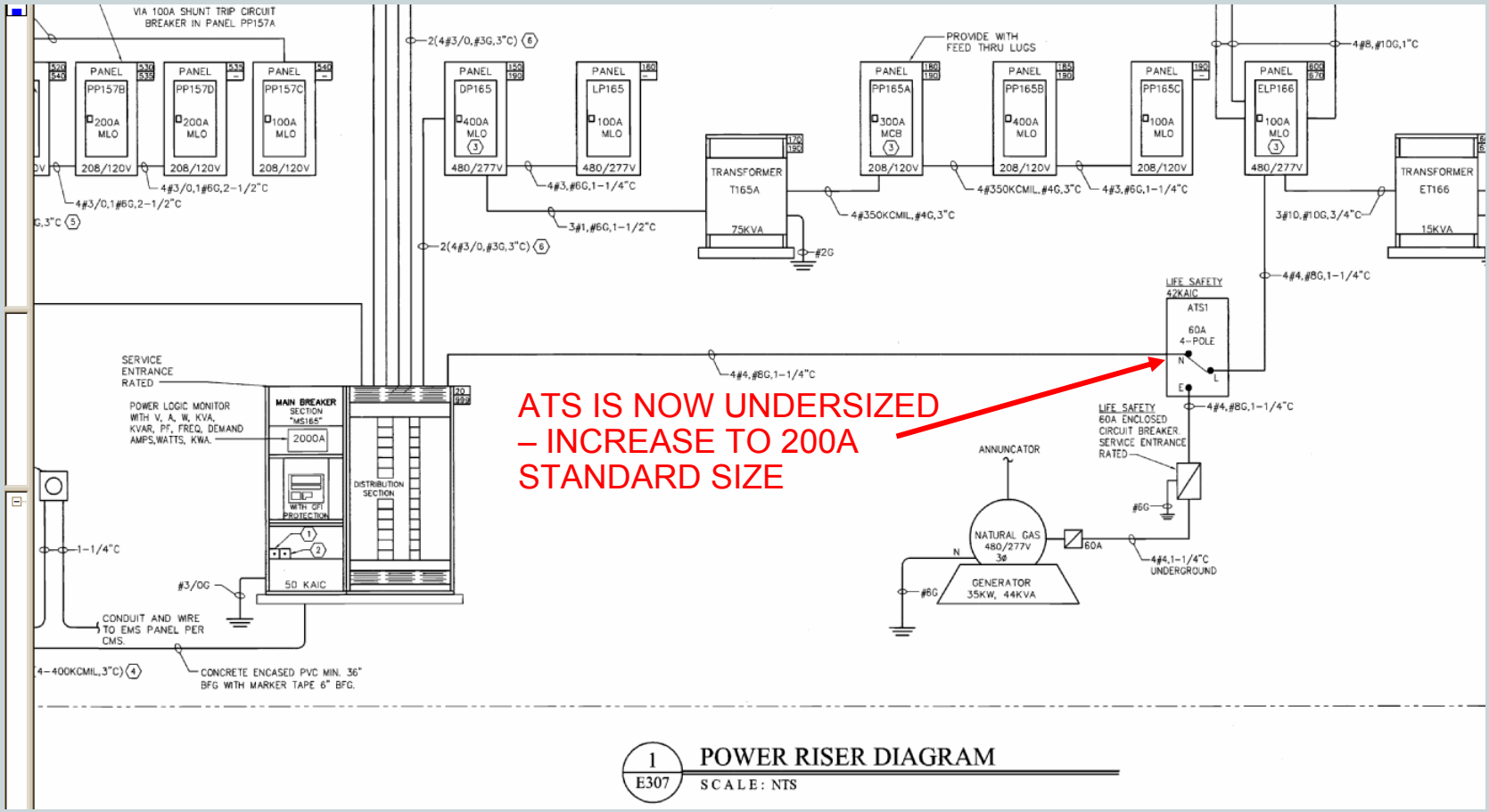
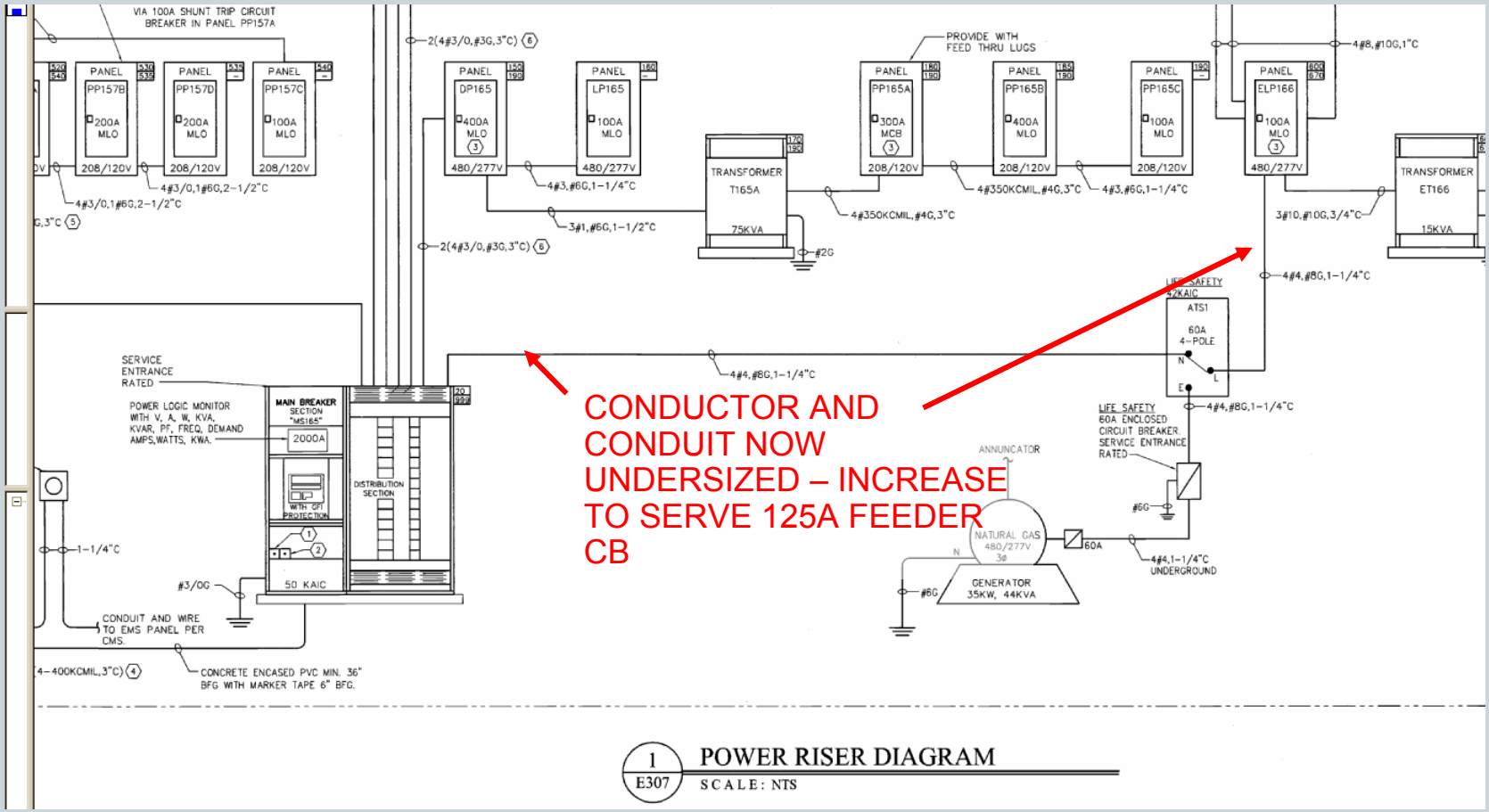


Example



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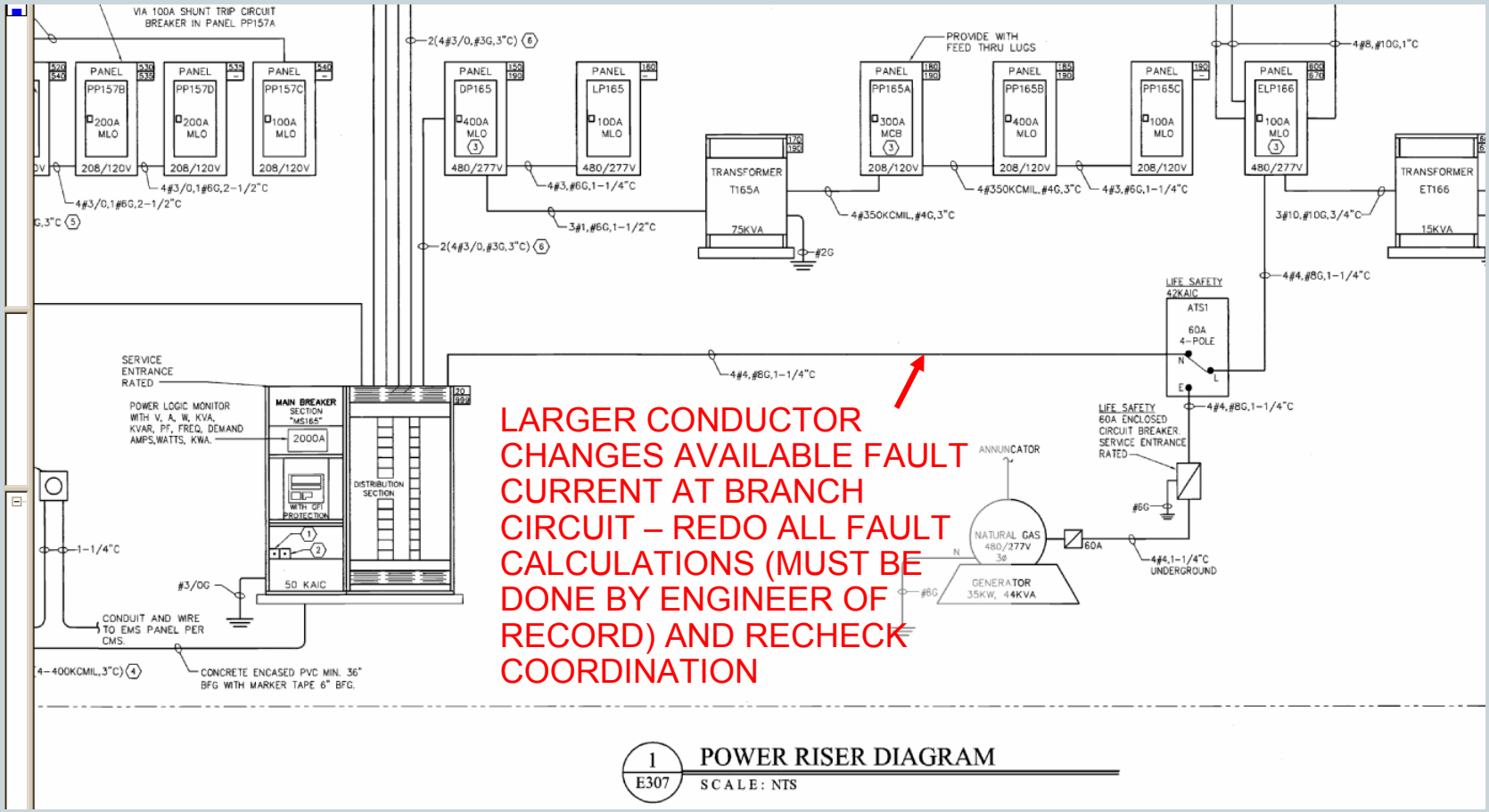
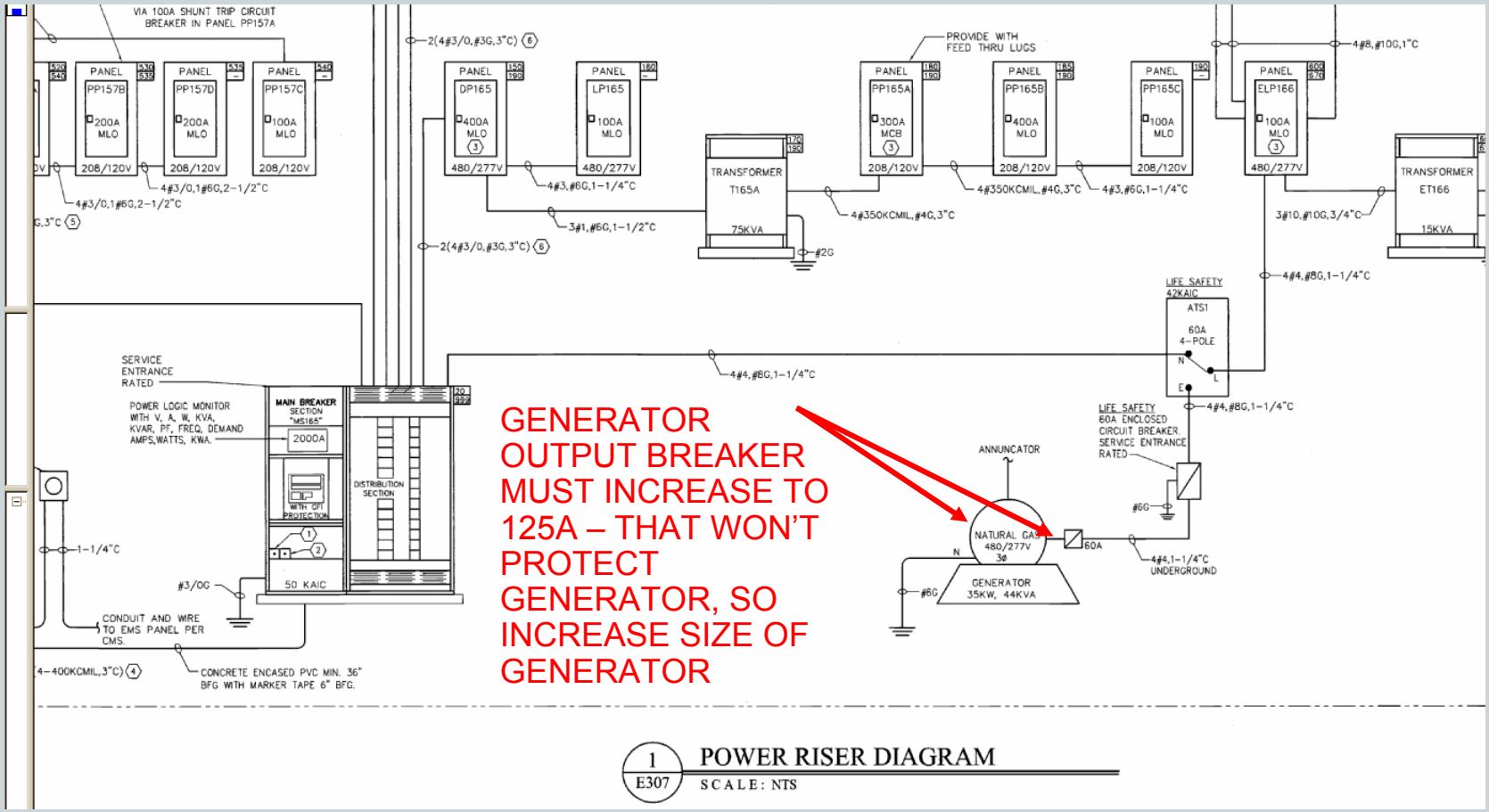


Example



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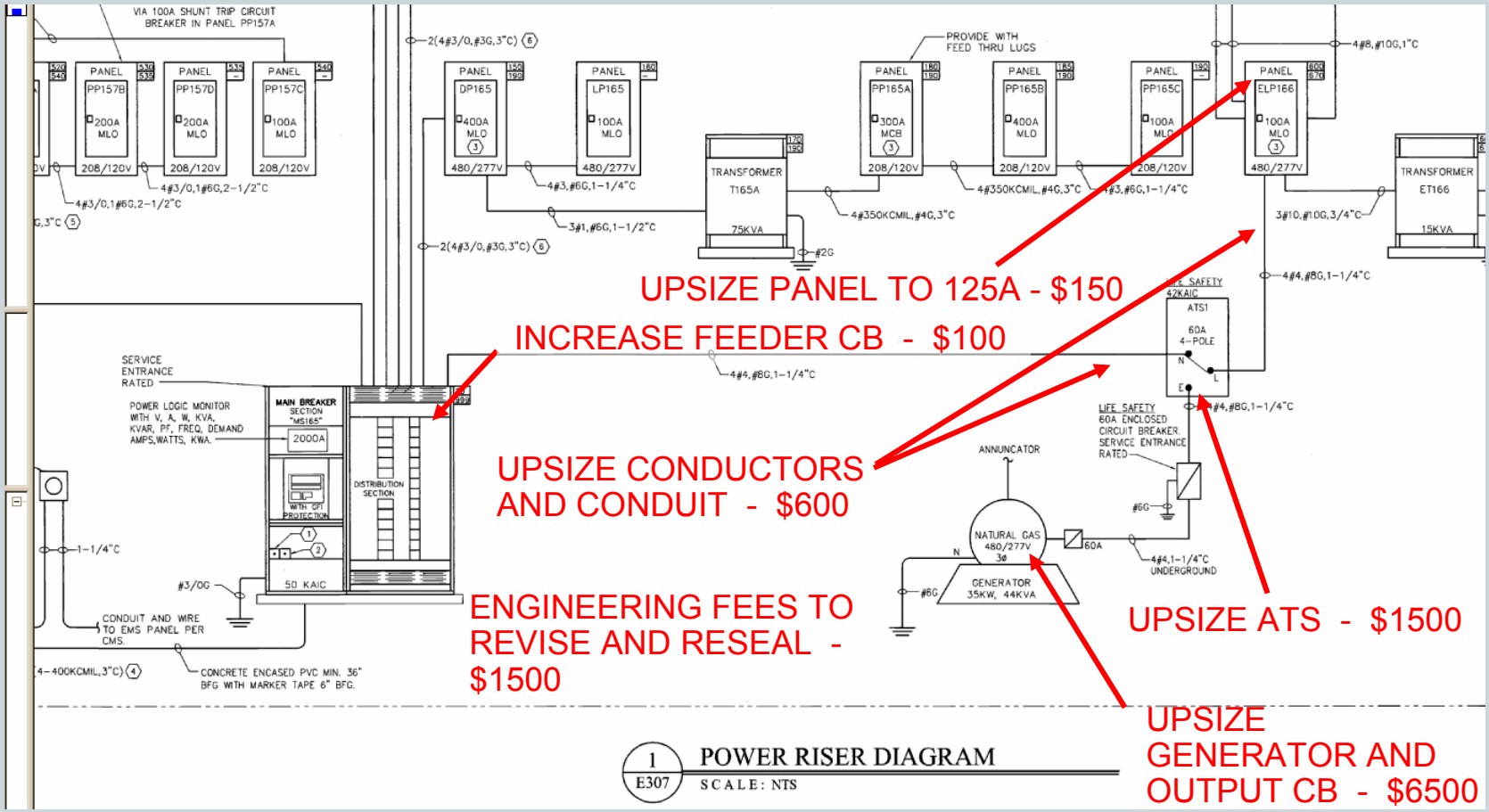
Example

Estimated Cost Of Changes To Selectively Coordinate



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What do I need to remember from the last 15 minutes?

Selective Coordination is DESIGN.
It is not a note on a drawing or a field fix.
Fuses don't magically fix Selective Coordination.
Breakers don't magically fix Selective Coordination.
If you take a job and take on the liability of selective coordination you are at risk.

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- **Surge Protection Device (formerly TVSS)**
- What is an SPD?
- What is new with 3rd edition?
- When is it in effect?
- What is the benefit?
- **Arc Fault Circuit Interrupters (AFCI)**
- When and where are they required?
- What do they look for?
- How do I troubleshoot an AFCI?
- The AFCI does not trip on my service call. Why?
- **Selective Coordination**
- Where is it being enforced?
- What must I do to comply?
- If I miss it in a spec or the AHJ wants it, now what?
- **Arc Flash**
- How is it related to selective coordination?
- When do I need to wear an arc flash suit?

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Arc Flash

How is it related to selective coordination?

When do I need to wear an arc flash suit?

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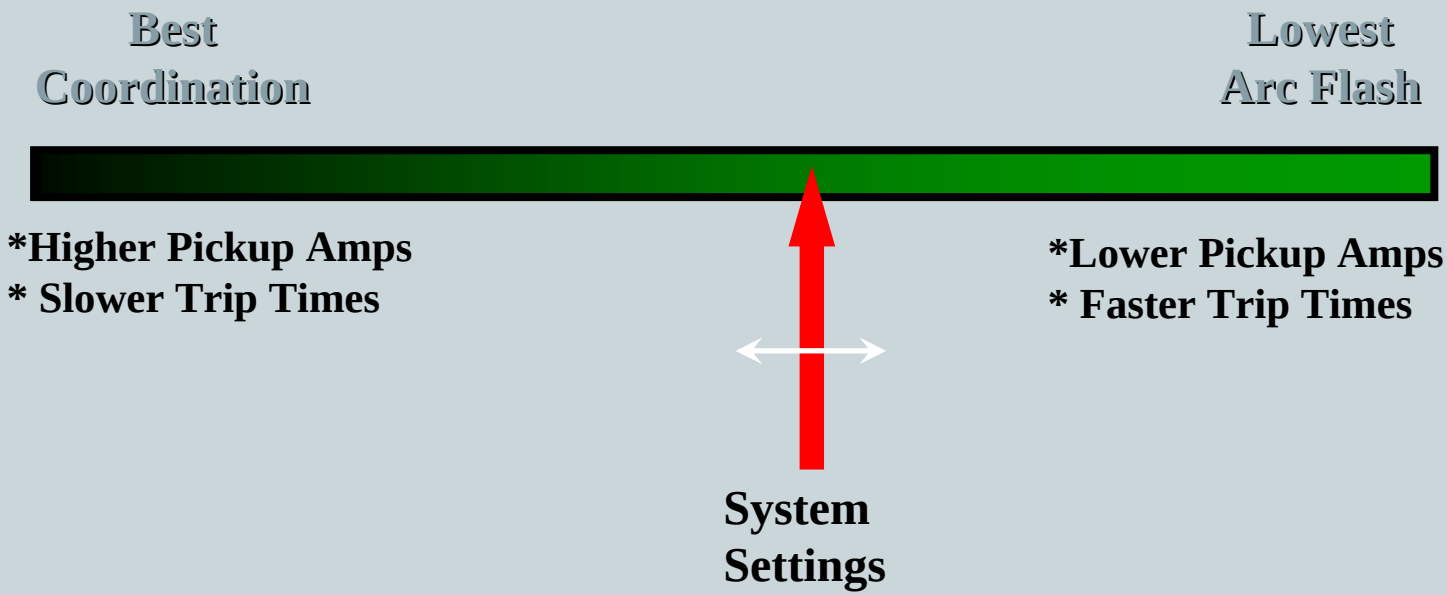
Arc Flash

- How is it related to selective coordination?
- When do I need to wear an arc flash suit?

How is it related to selective coordination?

Selective Coordination and Arc Flash

A spectrum of decisions.



Arc Flash

When do I need to wear an arc flash suit?

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OSHA Mandates Compliance

OSHA announces employer-paid PPE final rule

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=NEWS_RELEASES&p_id=14739

WASHINGTON -- OSHA announced [on November 14, 2007] ... all PPE, with a few exceptions, will be provided at no cost to the employee. The rule will be published in the Federal Register on November 15, 2007. The rule also provides an enforcement deadline of six months from the date of publication to allow employers time to change their existing PPE payment policies to accommodate the final rule. "Employees exposed to safety and health hazards may need to wear PPE to be protected from injury, illness and death caused by exposure to those hazards," said Assistant Secretary of Labor for OSHA Edwin G. Foulke Jr. "This final rule will clarify who is responsible for paying for PPE, which OSHA anticipates will lead to greater compliance and potential avoidance of thousands of workplace injuries each year."

Applicable Standards

OSHA -- ANSI/NFPA/NEC -- NFPA 70E-2000 -- IEEE 1584-2002

OSHA states, "***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***."

NFPA 70E further clarifies the preceding OSHA requirement. Examples of "additional or increased hazards" include the interruption of life support systems, emergency alarm systems, or hazardous location ventilation. Examples of "infeasible conditions" include startup testing, troubleshooting and diagnostics, or a continuous process segment.

Standards

2005 NEC Article 110.16 Flash Protection.

"Switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are in other than dwelling occupancies and 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. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment."

FPN No. 1: NFPA 70E-2000. *Electrical Safety Requirements for Employee Workplaces,* provides assistance in determining severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

Risk Categories, Energy Levels From NFPA70E-2000 Table 3-3.9.3 Protective Clothing Characteristics

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Category	Energy Level	Typical PPE Examples
0	N/A	Non-melting, flammable materials (e.g. untreated cotton, wool, rayon, etc.)
1	4 cal/cm^2	FR shirt and FR pants
2	8 cal/cm^2	Cotton underwear plus FR shirt & pants
3	25 cal/cm^2	Cotton underwear plus FR shirt & pants plus FR coverall
4	40 cal/cm^2	Cotton underwear plus FR shirt & pants plus double layer switching coat and pants

*Note: Voltage rated gloves may also be required for Cat 1 & 2

*Face protective switching hood and hearing protection may also be required

NFPA 70E
Basic Hazard/Risk Categories
Summarized from Table 3-3.9.1

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	Operate Breaker Covers in Place	Operate Breaker Covers Removed	Voltage Test/ Work Energized	Add/Remove Drawout Unit
Panelboard 240V <10kA	0	0	0	-
Panelboard 240V 25kA, 2 Cy	0	1	1	-
Panel/Switchboard 241-600V <10kA	0	0	1	-
Panel/Switchboard 241-600V 25kA, 2 Cy	**0**	**1**	**2**	**-**
600V Switchgear <25kA	0	0	1	2
600V Switchgear 65kA, 60 Cy	0	1	2	3
600V MCC <10kA	0	0	1	2
600V MCC 65kA, 20 Cy	0	1	2	3

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Arc Flash

Selective Coordination is required by NEC 2005.
Curves must not overlap or the devices must be a listed pair.
One method is to raise the time delay or set instantaneous higher which allows increased arc flash energy.

Example	Bolted Fault (kA)	Arcing Fault (kA)	Clearing Time (sec)	Incident Energy/PPE
A	30	15.72	0.13	
B	24	13.06	1.25	

Arc Flash

Selective Coordination is required by NEC 2005.
Curves must not overlap or the devices must be a listed pair.
One method is to raise the time delay or set instantaneous higher which allows increased arc flash energy.

Example	Bolted Fault (kA)	Arcing Fault (kA)	Clearing Time (sec)	Incident Energy/PPE
A	30	15.72	0.13	7.0 cal/cm^2 Level 2.
B	24	13.06	1.25	53.7 cal/cm^2 Level > 4.

PPE Category 4

40 CAL/CM²

SUIT is constructed of
layers of KEVLAR® barrier material
sandwiched between navy NOMEX® IIIA

55 CAL/CM²

SUIT is constructed of
layers of KEVLAR® barrier material
sandwiched between INDURA® Ultra Soft™
and navy NOMEX® IIIA

NFPA 70E

COMPLIANCE REQUIRES:

Wearing The Complete Suit
Hood, Jacket & Over Pant

AS ONE UNIT

Arc Flash

Perhaps your solution is ... “I’ll just use the tables in NFPA 70E – Table 3-3.9.1.”

Example	Arcing Fault (kA)	Table 3-3.9.1		Actual
208V Panelboard	4.2 kA	1		?
480V MCC	16.0 kA	2		?

Table Category 1 (FR Shirt and Pants)
Table Category 2 (FR Shirt, Pants, Gloves, Hearing Protection, with Double Layer Hood)

Arc Flash

Perhaps your solution is ... “I’ll just use the tables in NFPA 70E – Table 3-3.9.1.”

Example	Arcing Fault (kA)	Table 3-3.9.1	Clearing Time (sec)	Actual
208V Panelboard	4.2 kA	1	>2 sec	?
480V MCC	16.0 kA	2	0.01 sec	?

Table Category 1 (FR Shirt and Pants)
Table Category 2 (FR Shirt, Pants, Gloves, Hearing Protection, with Double Layer Hood)

Arc Flash

Perhaps your solution is ... “I’ll just use the tables in NFPA 70E – Table 3-3.9.1.”

Example	Arcing Fault (kA)	Table 3-3.9.1	Clearing Time (sec)	Actual
208V Panelboard	4.2 kA	1	>2 sec	4
480V MCC	16.0 kA	2	0.01 sec	0

This slide and the previous slide are calculation presented by the Lewellyn Company and reproduced here with written permission.

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What do I need to remember from the last 15 minutes?

Arc Flash is real.
It can injure or kill.
There is clothing to protect you, but **YOU** must protect **YOU.**

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Brad Zilch

Thank you

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“The hardest thing in the world to understand is the income tax.”

- Albert Einstein