

Fuses

Selective Coordination



The Association of Electrical Equipment and Medical Imaging Manufacturers





Scope

This presentation provides information for proper application of fuses when selective coordination is either desired for design or required by code



Goals

- Understand key terms related to selective coordination
- Understand where selective coordination is required by Code and where it can be a design goal
- Discern the difference between a “selectively coordinated” system and a “coordinated” system
- Understand the impact of fault current to selective coordination
- Determine how to achieve selective coordination with fuses

Selective Coordination A Design Goal



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Benefits of selective coordination

- Minimize risk of power loss to life safety systems, such as emergency lighting, fire detection, elevators, and others.
- Minimize risk of costly downtime, such as is necessary for IT equipment or continuous process manufacturing operations.
- Faster location and resolution of fault on the system due to isolation (closes OCPD to the fault opens)



Life Safety Requirements

- Power is Important For Life Safety
 - Lights
 - Fire Pumps
 - HVAC
 - Security
 - Communications
 - Visual and Audible Signaling

Reliable Power Systems Are Important For Life Safety



Continuity of Service

- Power is Important For Continuity of Service
 - Computers
 - Manufacturing Equipment
 - Data Storage Systems
 - Office General Lighting
 - Broadcast Equipment
 - Meeting Room Essentials

**Reliable Power Systems Are Important
For Business Profitability**



The Design Goal

Reliability in Refining and Petrochem facilities

- Unplanned outages can cost \$M in lost production, lost productivity, damaged equipment.
 - Average downtime cost \$704,000 USD per hour.

A 100 MW petro-chemical plant produces approximately \$2 billion per year in revenues – or \$228,000 per hour. With an average of 8 hours of downtime per year, an average 100 MW plant will lose over \$1.8 million in revenue annually to electrical system outages



Grocery Store Value Proposition

- Florida's largest supermarket chain has created its own initiative to make sure its stores can open after a hurricane. Publix is spending \$100 million to install 500 kilowatt generators at every store in hurricane prone areas.
- In 2004 alone, Publix lost \$60 million from groceries that went bad after hurricanes knocked out power to its stores.



Grocery Store Value Proposition

- More than 100 South Florida supermarkets now are equipped with stationary generators large enough to restore them to business as usual, fresh and frozen food aisles included, during power outages. Most were installed after Hurricane Wilma hit in 2005. The storm left residents frustrated by long lines and limited food selections when dozens of grocery stores had no power for days.

Definitions



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Definitions

- Fault Current
- Fault Current, Available
- Coordination, Selective (Selective Coordination)

Definitions Fault Current



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Article 100 Fault Current

- New definition in Article 100 for NEC 2020
- Part of a Correlating Committee taskforce to address correlation with NFPA 70E recent changes
- Aligns the use of the terms Short-Circuit current and available fault current

Article 100 Fault Current

Fault Current

The current delivered at a point on the system during a short-circuit condition. (CMP-10)

Definitions

Fault Current, Available (Available Fault Current)



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Fault Current, Available (Available Fault Current)

- New definition for NEC 2020
- Replaces “maximum available short-circuit current” where used in the NEC
- Aligns with NFPA 70E recent changes in use of the same term



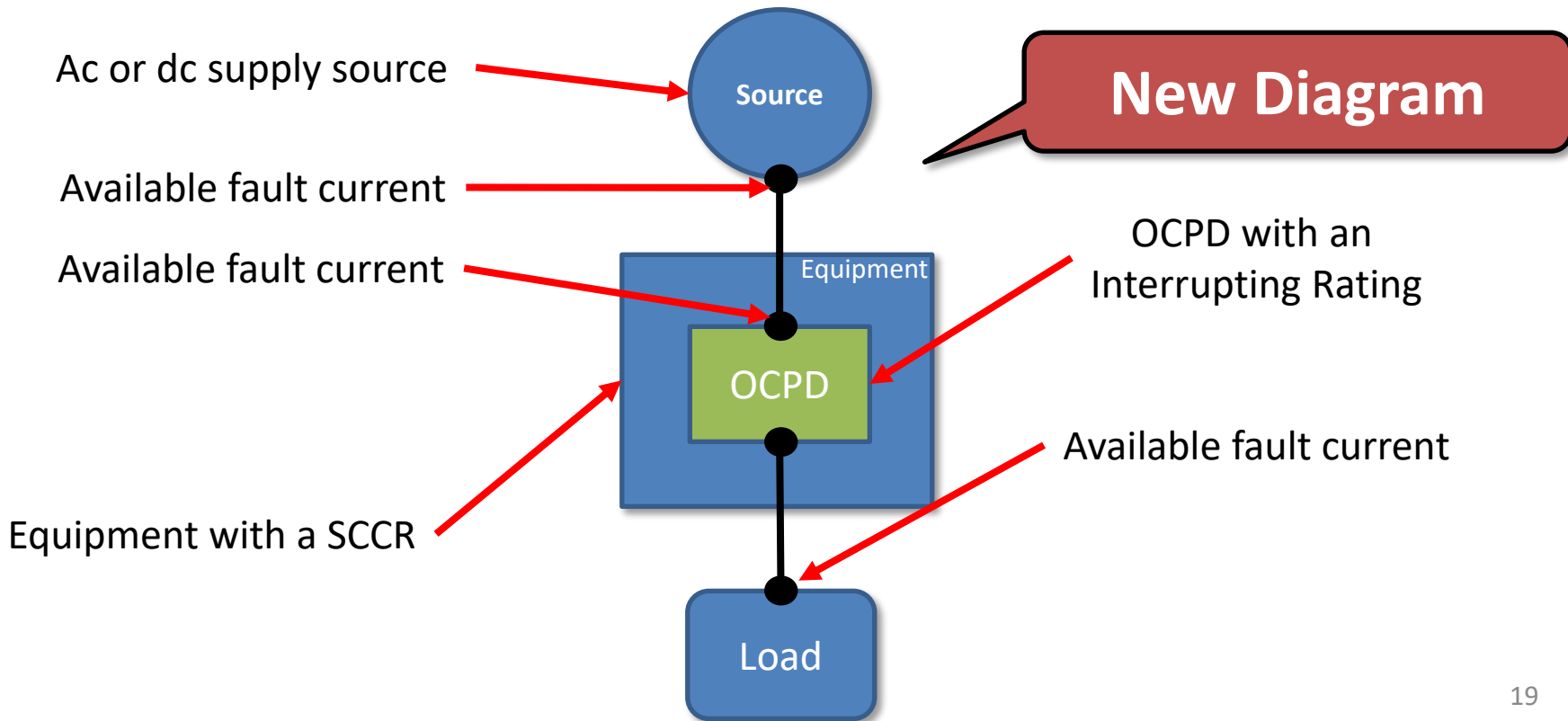
100 Fault Current, Available

The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. (CMP-10)

Informational note: A short-circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground-fault. See Informational Note Figure 100.1



Fault Current, Available (Available Fault Current)





Available Fault Current

- Maximum current is used to evaluate:
 - Interrupting ratings of OCPDs
 - SCCR ratings of equipment
 - Selective Coordination of OCPDs



Available Fault Current

- Rarely occur in power distribution systems
- Commonly associated with first startup after installation or maintenance activities
 - Forgetting to remove shipping straps
 - Forgetting to remove intentional grounding for maintenance



110.9 Interrupting Rating

- **NEC Requires:**
 - OCPDs interrupt fault current and must have an interrupting rating, at nominal circuit voltage, equal to or greater than the current that is available at the line terminals of the equipment
- **Installers and inspectors must ensure the interrupting rating of the OCPD is greater than or equal to the available fault current**



Fuse applications

- Fuses are capable of 200kA and higher interrupting ratings
- For systems not capable of delivering 200kA, applying 200kA fuses removes the need for detailed fault current calculations for the purpose of interrupting rating evaluation



110.10 Circuit Impedance, Short-Circuit Current Ratings, and Other Characteristics

- **NEC Requires:**
 - Equipment must have a short-circuit current rating (SCCR) equal to or greater than the current that is available at the line terminals of the equipment



Short-Circuit Current Rating (SCCR)

- The ability of equipment to withstand magnetic forces and thermal heating of high fault currents passing through the equipment until an OCPD clears the fault
- This is NOT an interrupting rating
- SCCR must be greater than or equal to maximum fault current

Definitions

Coordination, Selective (Selective Coordination)



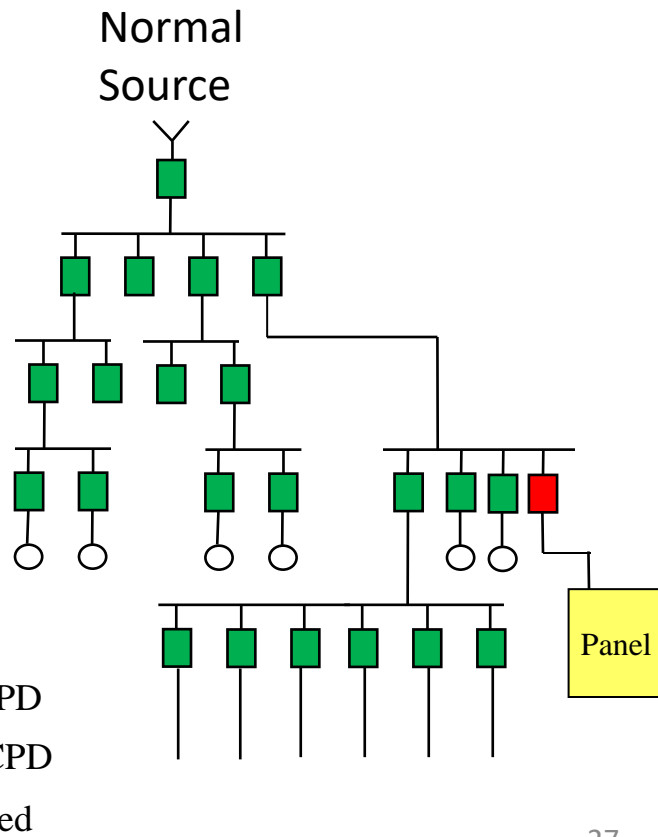
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Selective Coordination

- Selective coordination has been in the vocabulary of the power systems engineer for decades
- Goal is to minimize system outages & increase reliability
- Minimizes system down time
- Fault location on system is more efficient





Coordination, Selective (Selective Coordination)

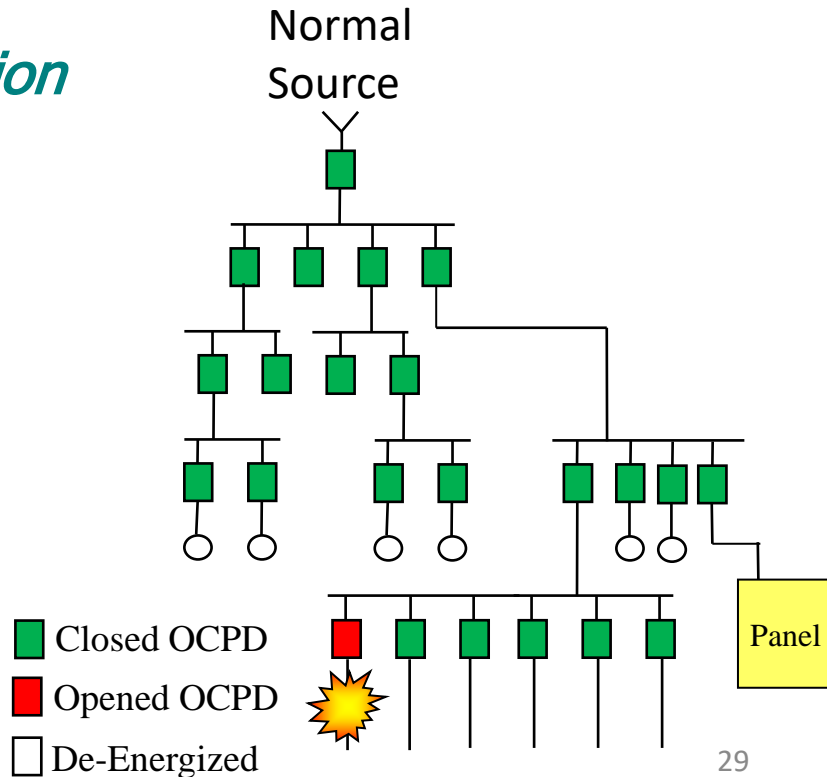
“Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.”



Coordination, Selective (Selective Coordination)

“Localization of an overcurrent condition to restrict outages to the circuit or equipment affected. . .”

- The OCPD Closest To The Fault Opens
- Branch Circuit Fault Opens The Closest Branch Circuit OCPD

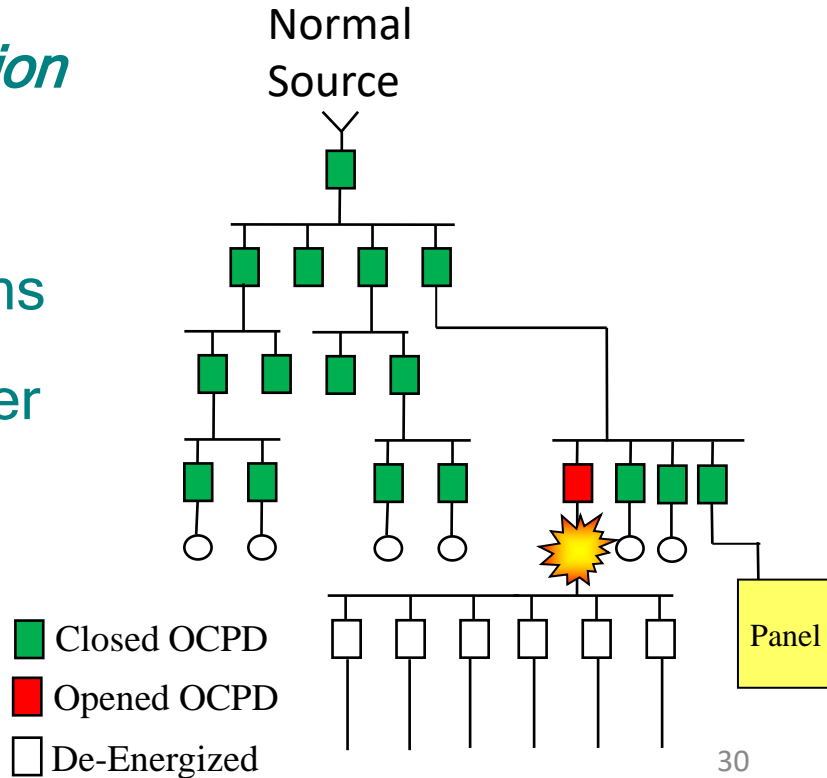




Coordination, Selective (Selective Coordination)

“Localization of an overcurrent condition to restrict outages to the circuit or equipment affected. . .”

- The OCPD closest to the fault opens
- Faulted feeder opens the first feeder OCPD
- Outage to downstream equipment only

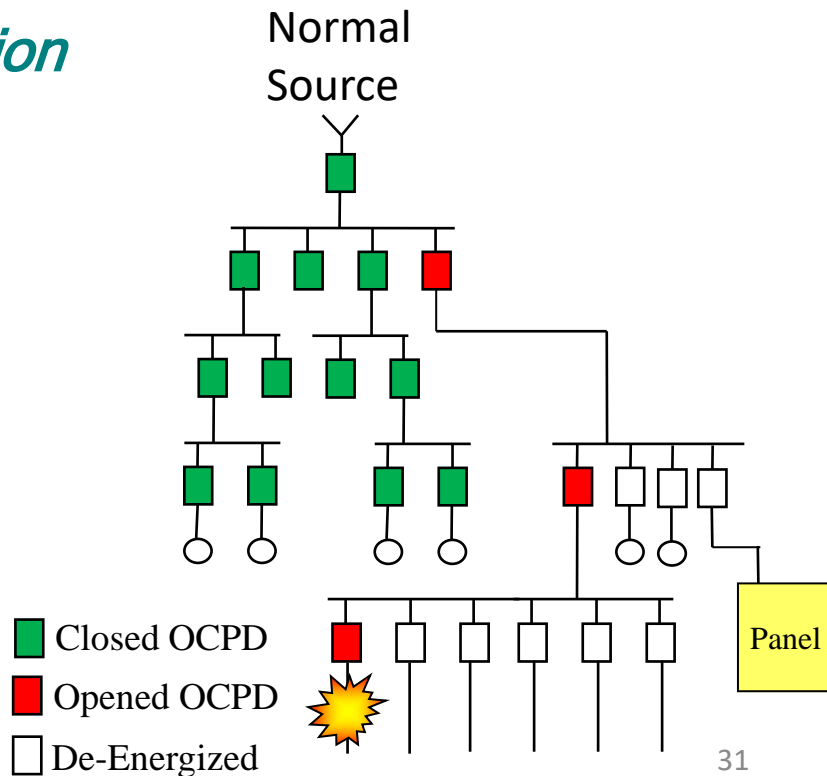




A lack of selective coordination

“Localization of an overcurrent condition to restrict outages to the circuit or equipment affected. . .”

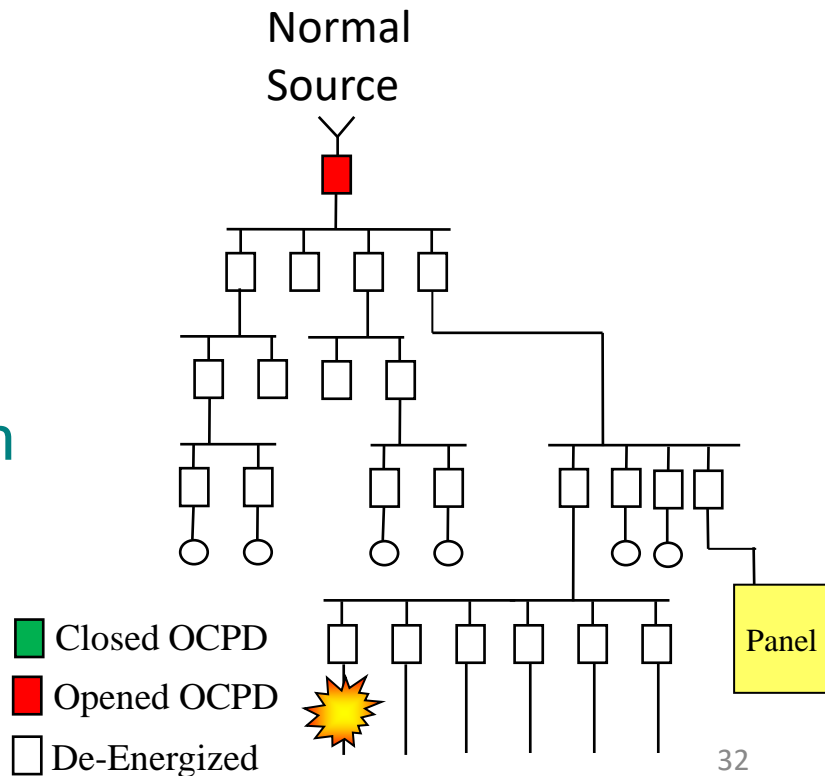
- Multiple OCPDs Open Due To The Fault
- Wide Spread System Outage Is Caused





A lack of selective coordination

- Main OCPD Opens Due To The Fault
- Wide Spread System Outage Is Caused
- Main OCPDs Have Been Known To Open Because of A Lack Of Selective Coordination





Selective Coordination - Article 100

“Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.”

2017 Version NFPA 70, National Electrical Code, Article 100 Definitions

“As selectivity and maximum safety to personnel are critical, engineers should always perform a total short-circuit, coordination, and component protection study for a project. This study first determines the available short-circuit currents at each major component throughout the system. Then it will include time vs. current coordination curves to be drawn and to coordinate time intervals to determine if the overcurrent devices are selectively coordinated at the various available fault currents. Then the study will examine the component withstand ratings to ensure that the device can actually protect the components at the fault current levels that may be present during a fault.”

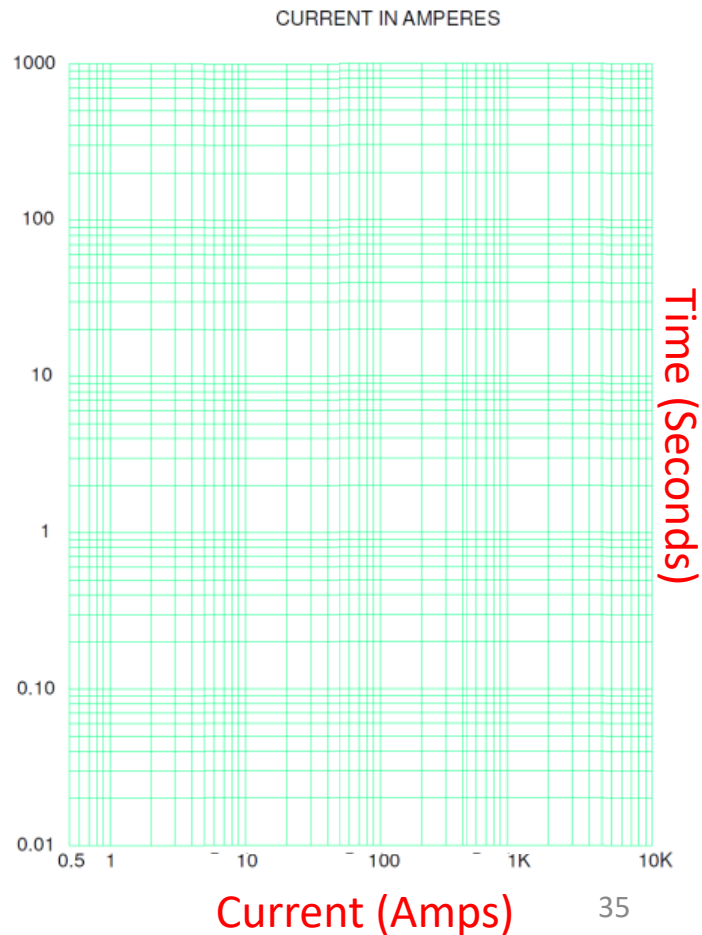
IEEE Std. 602-2007, “Electric Systems in Health Care Facilities” Page 113

Selective Coordination At Various Available Fault Currents Should Be Achieved – Life Safety



The TCC curve

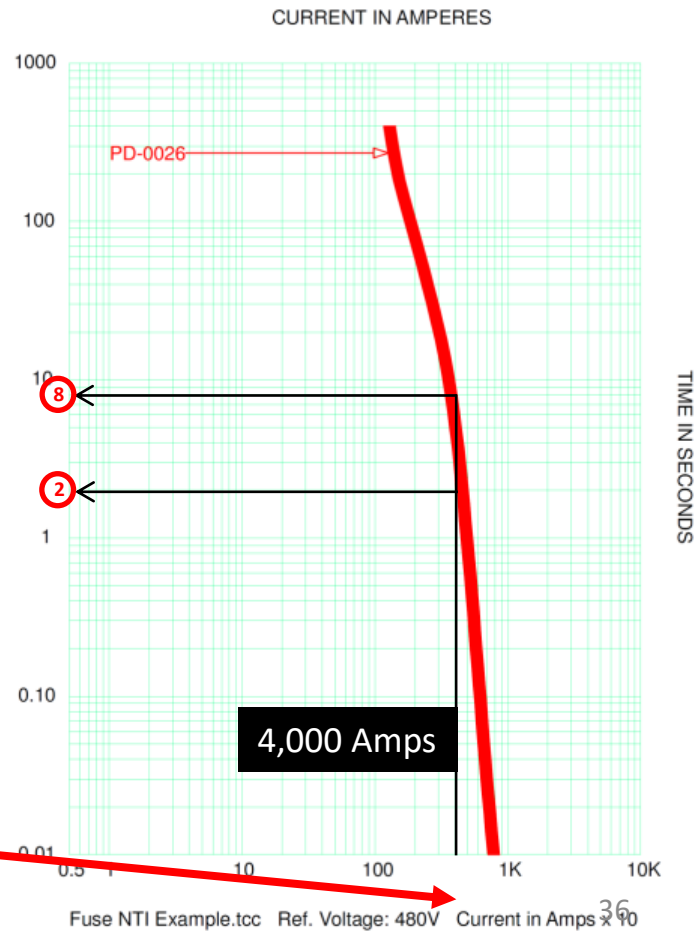
- The TCC plots time versus current
- Log-log paper to enable plotting of trip characteristics





The TCC curve

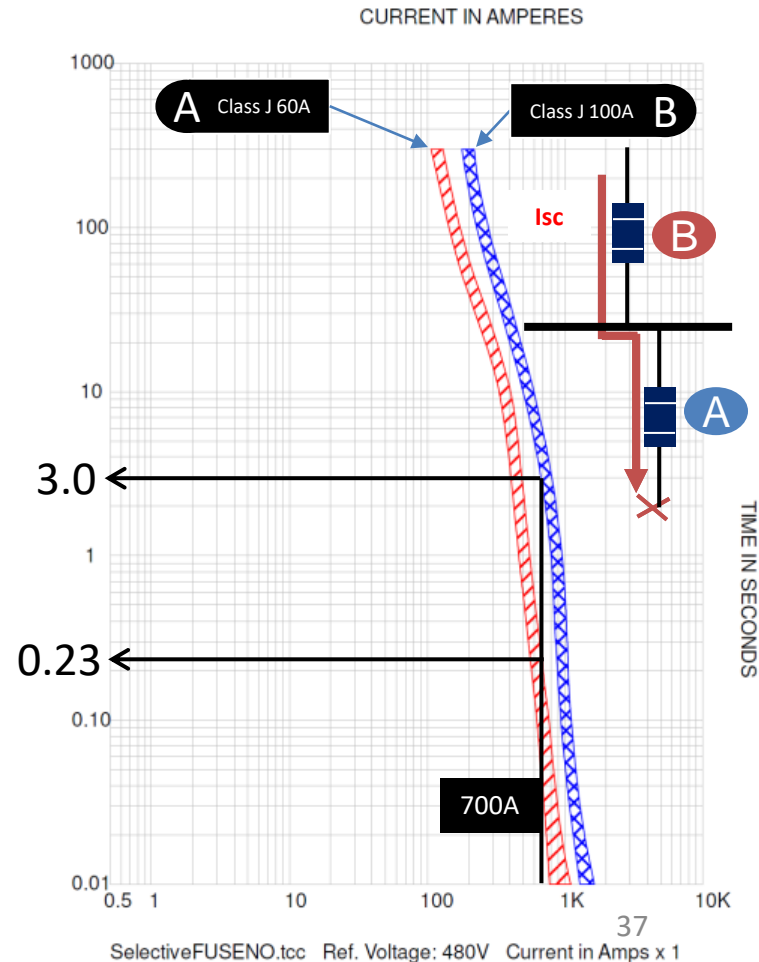
- The TCC curve provides information as to how the fuse will respond to current
- 4,000A flowing through this fuse will open it anywhere between 2 & 8 seconds
- Be aware of the scale (Current in amps X 10)





Selective Coordination

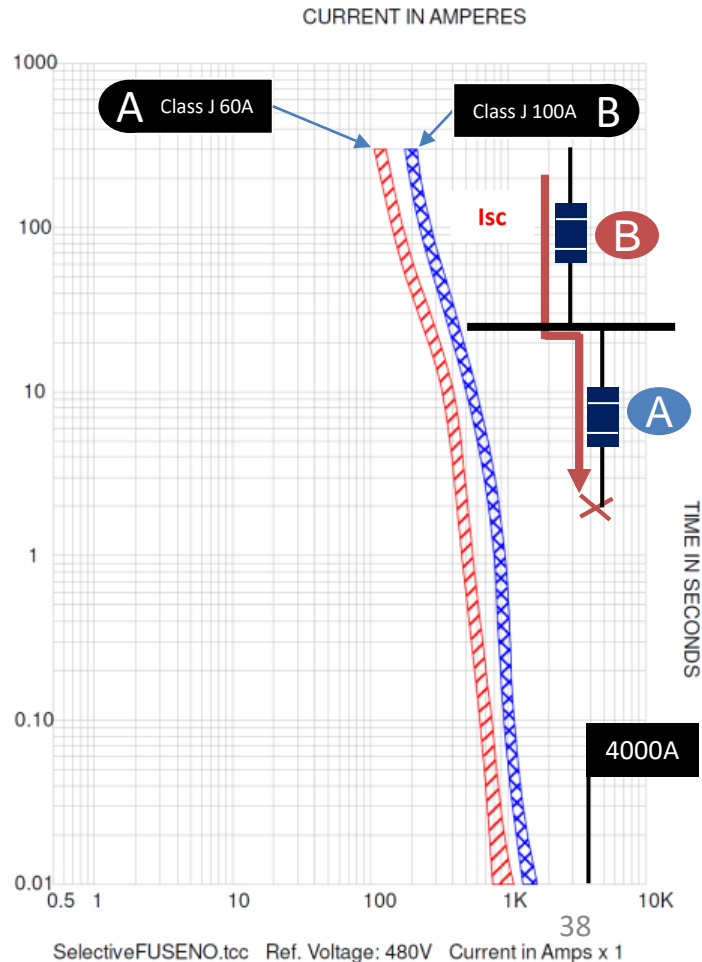
- The TCC curve provides information as to how the fuse will respond to current
- 700A flowing through both fuses
 - Fuse A maximum clearing time is 0.23 seconds
 - Fuse B Minimum melt time is 3.0 seconds
- These devices are selectively coordinated at 700A





TCC curve

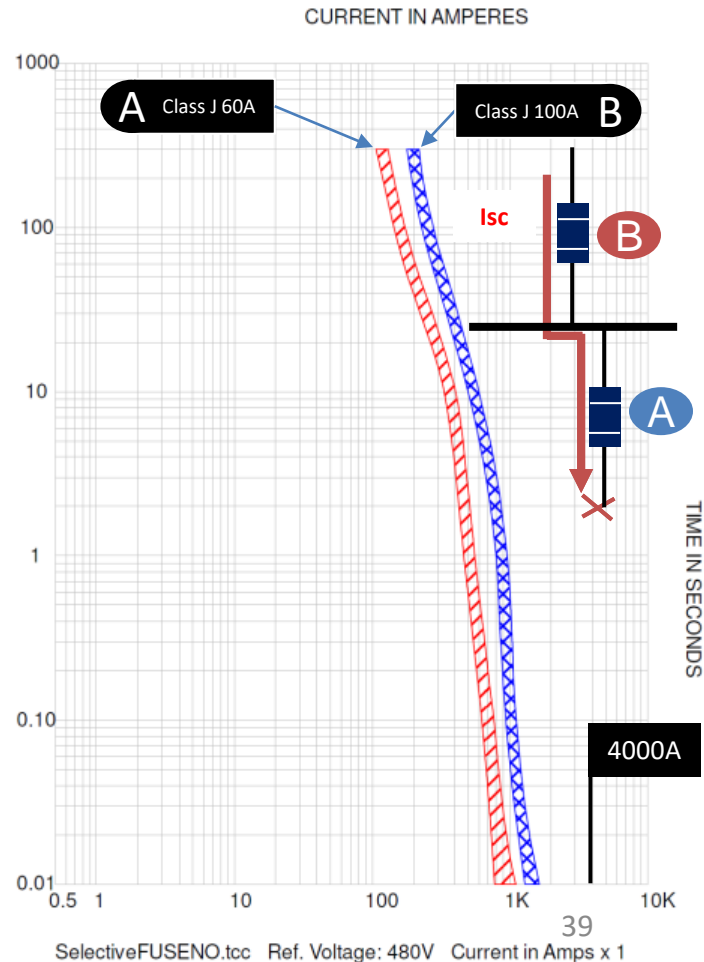
- 4000A flowing through both fuses
 - Based on the TCC selective coordination is NOT achieved
 - Fuse ratio tables provide tested data to determine selectivity





TCC curve

- Class J fuses must maintain a ratio of 2:1 for selectivity
 - Ratio of upstream to downstream fuses
- This example ratio = $100/60 < 2:1$ so selective coordination is NOT achieved
- Upstream fuse must be 120A or greater to selectively coordinate for ALL fault currents up to 200kA

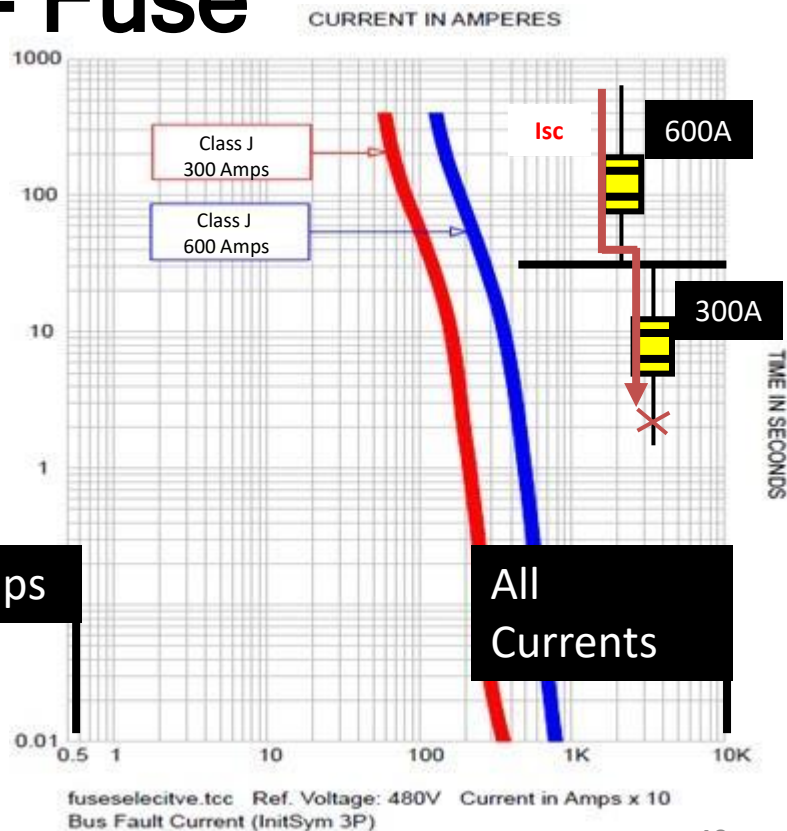




Selective Coordination - Fuse

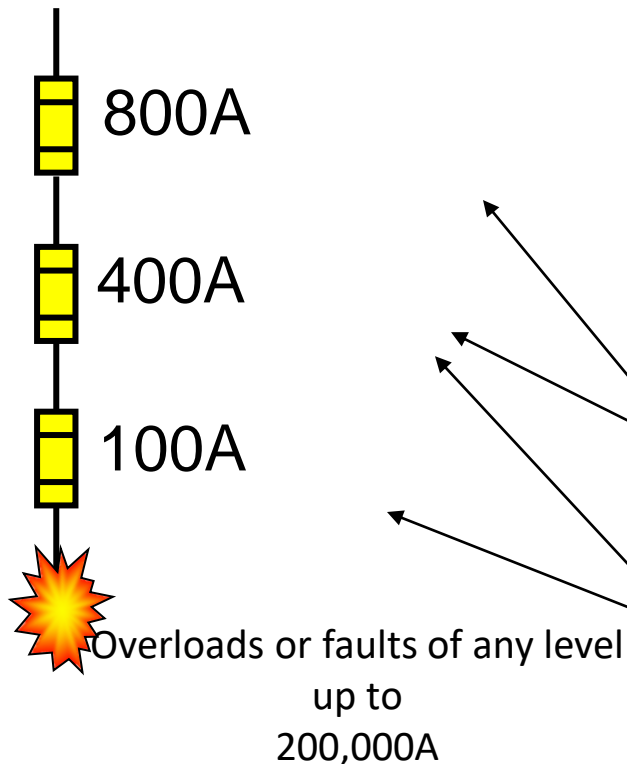
- Example system - two Class J fuses that must selectively coordinate
- Fuse curves **MAY** be plotted
- Maintaining a ratio of 2:1 for these fuses ensures selective coordination for all currents up to 200kA

“... from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times ...”





Selective Coordination - Fuse



**Maintain a 2:1 Ratio for
these Class fuses**

800/400 = 2:1 **only 2:1 needed**
Selective Coordination **achieved**

400/100 = 4:1 **only 2:1 needed**
Selective Coordination **achieved**
between these two fuses

Selective Coordination NEC Requirements



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National Electrical Code Requirements

Art	Title	NEC
100	<i>Definitions</i>	2005
517	<i>Healthcare Facilities</i>	1975 GF 2005 "Selective" 2014 "Coordination"
620	<i>Elevators, Dumbwaiters, Escalators, Moving Walks, Wheel Chair Lifts, and Stairway Chair Lifts</i>	1993
645	Information Technology Equipment	2014
695	Fire Pumps	2011
700	<i>Emergency Systems</i>	2005
701	<i>Legally Required Standby Systems</i>	2005
708	<i>Critical Operations Power Systems (COPS)</i>	2008 ⁴³



NFPA 70 NEC 2017 Requirements

Article 517 Health Care Facilities

517.17 Ground-Fault Protection

Article 620 Elevators, Dumbwaiters, Escalators, Moving Walks, Platform Lifts, and Stairway Chairlifts

620.62 Selective Coordination

Article 645 Information Technology Equipment

645.27 Selective Coordination

Article 695 Fire Pumps

695.3 Power Source(s) for Electric Motor-Driven
Fire Pumps.

Article 700 Emergency Systems

700.32 Selective Coordination

Article 701 Legally Required Standby Systems

701.27 Selective Coordination

Article 708 Critical Operations Power Systems (COPS)

708.52 Ground-Fault Protection of Equipment
708.54 Selective Coordination



Article 517 - Health Care Facilities

517.17 Ground-Fault Protection.

(C) Selectivity. Ground-fault protection for operation of the service and feeder disconnecting means shall be fully selective such that the feeder device, but not the service device, shall open on ground faults on the load side of the feeder device. Separation of ground-fault protection time-current characteristics shall conform to manufacturer's recommendations and shall consider all required tolerances and disconnect operating time to **achieve 100 percent selectivity.**



Article 620 - Elevators, Dumbwaiters, Escalators, Moving Walks, Platform & Stairway Chairlifts

620.62 Selective Coordination. Where more than one driving machine disconnecting means is supplied by a single feeder, the overcurrent protective devices in each disconnecting means shall be selectively coordinated with any other supply side overcurrent protective devices.

Selective coordination shall be selected by a licensed professional engineer or other qualified person engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.



Article 645 - Modular Data Centers

645.27 Selective Coordination. Critical operations data system(s) overcurrent protective devices shall be selectively coordinated with all supply-side overcurrent protective devices.



Article 695 - Fire Pumps

695.3 Power Source(s) for Electric Motor-Driven Fire Pumps. Electric motor-driven fire pumps shall have a reliable source of power.

- (A) Individual Sources. . . .
- (B) Multiple Sources. . . .
- (C) Multibuilding Campus-Style Complexes.

If the sources in 695.3(A) are not practicable and the installation is part of a multibuilding campus-style complex, feeder sources shall be permitted if approved by the authority having jurisdiction and installed in accordance with either (C)(1) and (C)(3) or (C)(2) and (C)(3).

- (1) Feeder Sources. . . .
- (2) Feeder and Alternate Source. . . .
- (3) **Selective Coordination.** The overcurrent protective device(s) in each disconnecting means shall be selectively coordinated with any other supply-side overcurrent protective device(s).



Article 700 - Emergency Systems

700.32 Selective Coordination.

Emergency system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices.

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.



Article 701 - Legally Required Standby Systems

701.27 Selective Coordination.

Legally required standby system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices.

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.



Article 708 - Critical Operations Power Systems

708.54 Selective Coordination.

Critical operations power system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices.

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Selective Coordination Exceptions



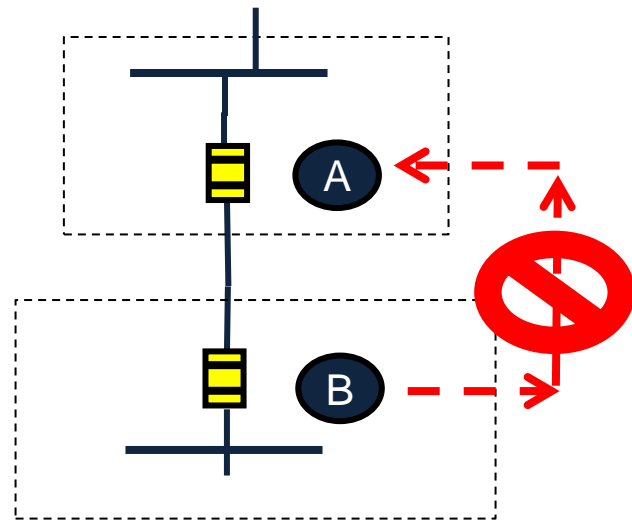
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Selective Coordination Requirements

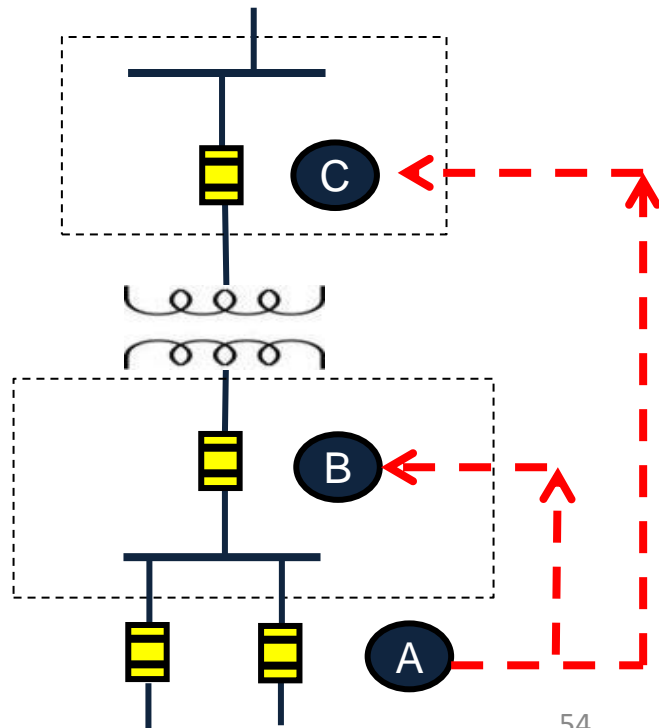
“Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.”





Selective Coordination Requirements

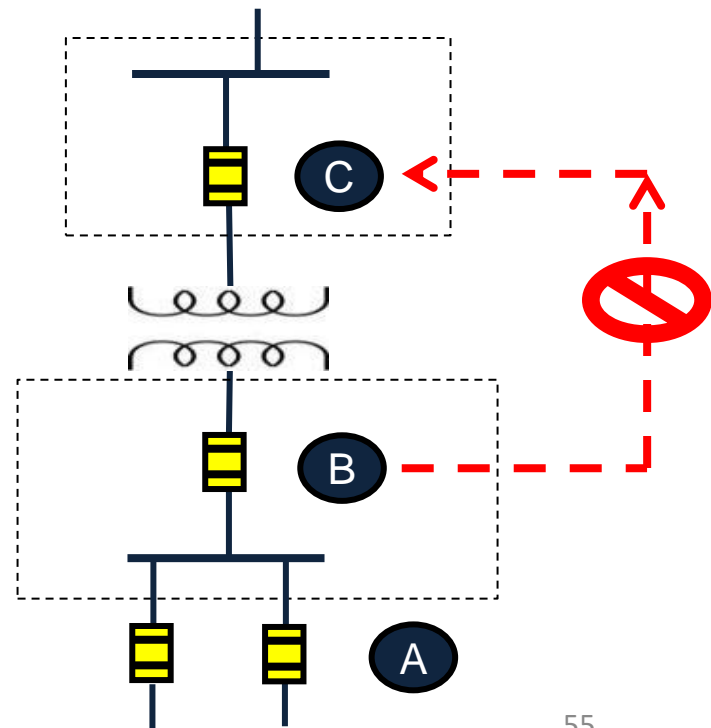
Branch devices “A” must selectively coordinate with devices “B” and “C”.





Selective Coordination Requirements

“Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.”





All supply-side overcurrent devices

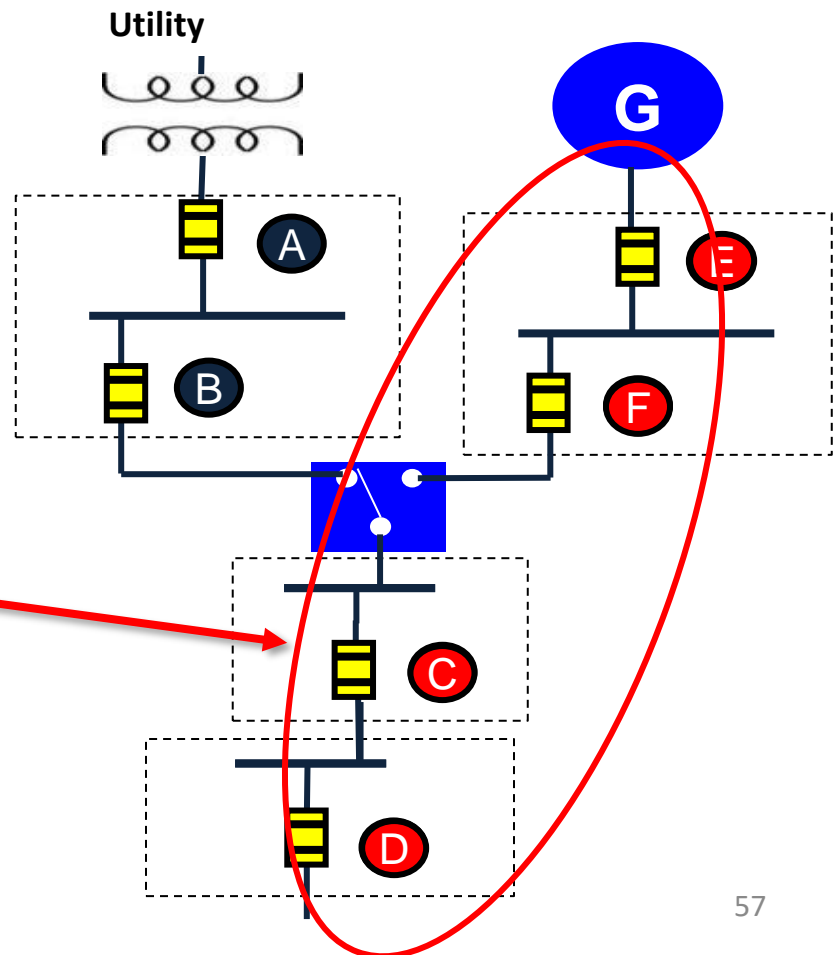
NEC requirements are consistent in all areas of the NEC mandating selective coordination that devices must selectively coordinate with all supply-side overcurrent protective devices.

NEC 2020 added an informational note to 700.32, 701.32, and 708.54 to clarify what devices must selectively coordinate



Selective Coordination Requirements

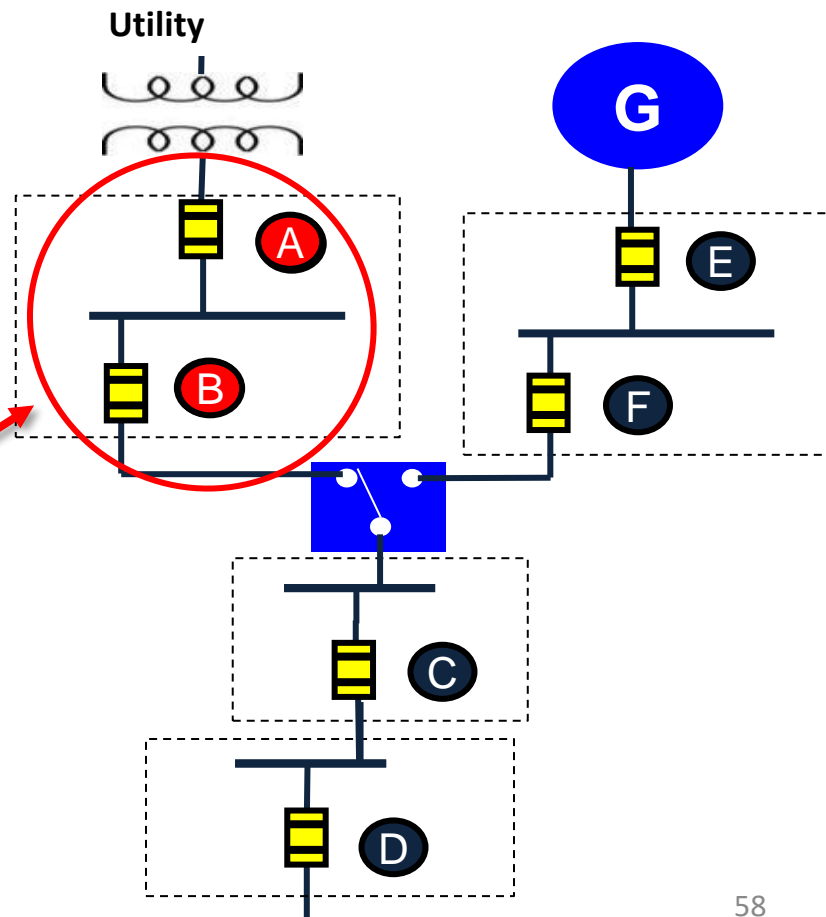
- 700, 701 and 708 power system overcurrent devices
- OCPDs on Emergency side of transfer switch





Selective Coordination Requirements

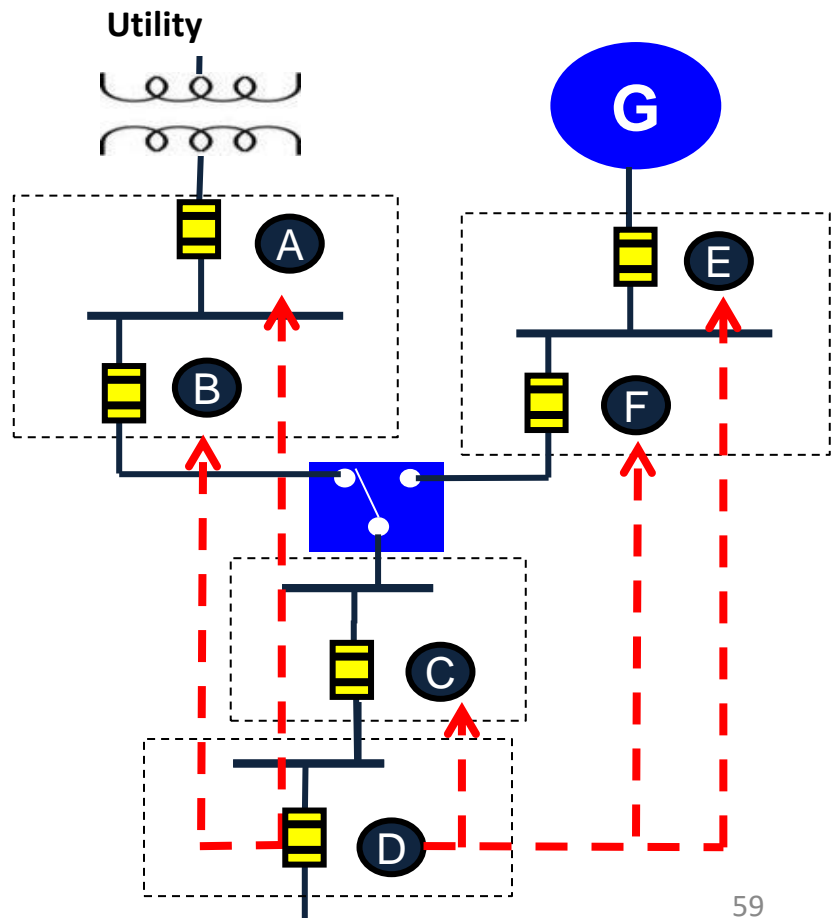
- 700, 701 and 708 power system overcurrent devices
- Devices On The Normal Power Supply System





Selective Coordination Requirements

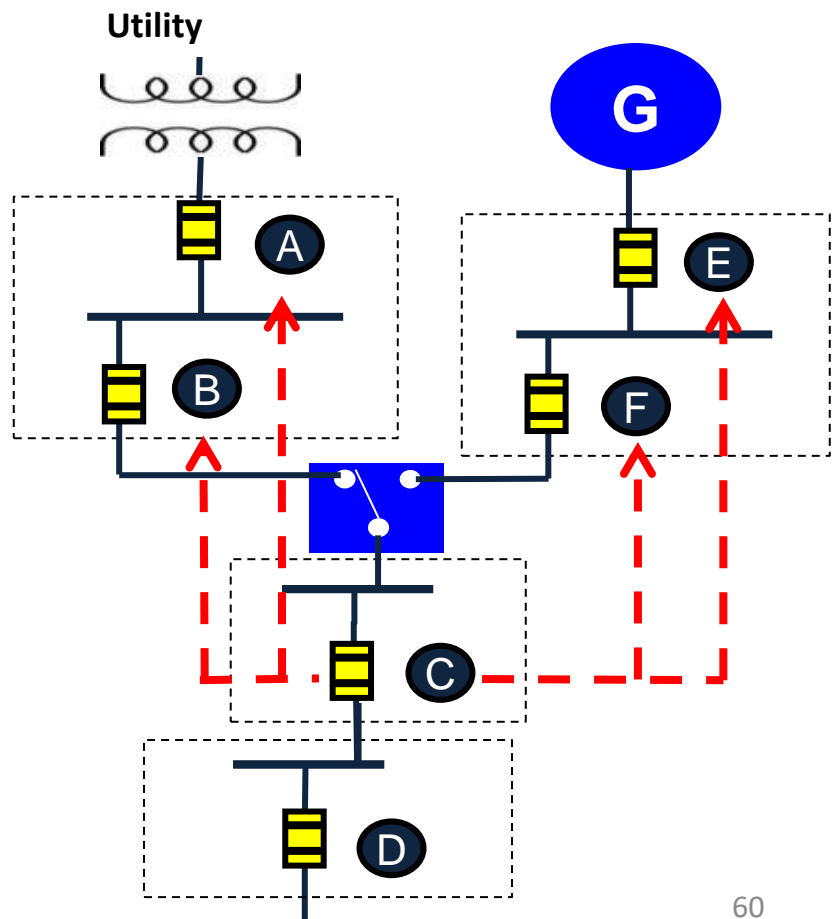
- 700, 701, and 708 OCPDs must selectively coordinate with all upstream overcurrent protective devices:
 - **D must Selectively Coordinate with C, F, E, B and A**
 - C must Selectively Coordinate with F, E, B and A
 - F must selectively Coordinate with E
- OCPDs A and B do not have to selectively coordinate with each other





Selective Coordination Requirements

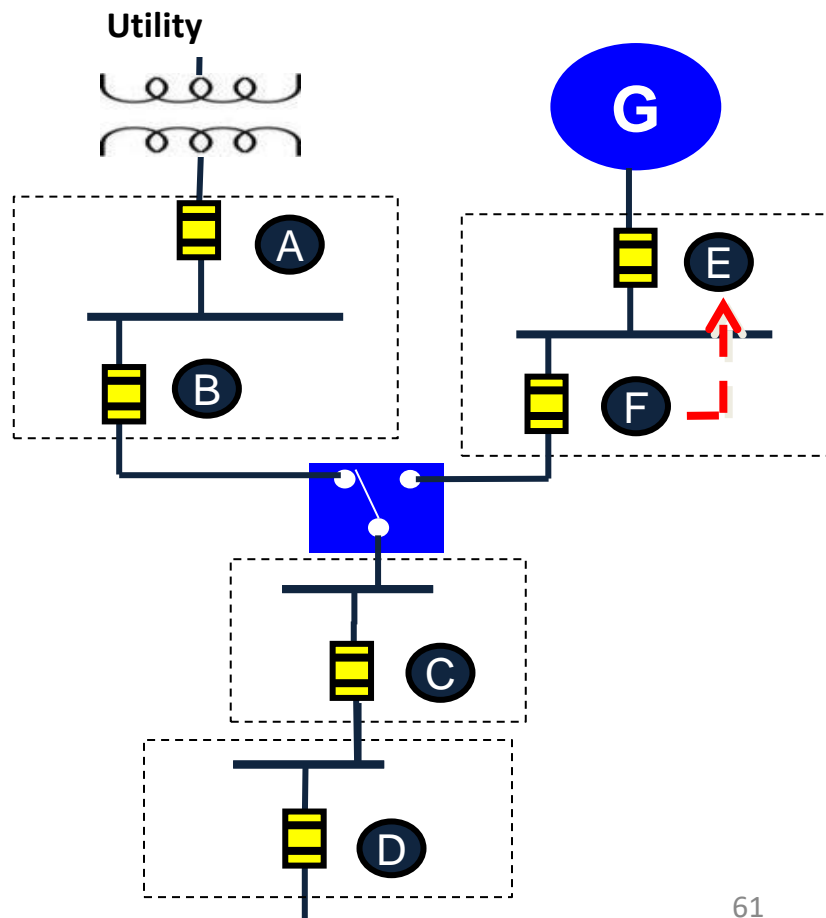
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 - D must Selectively Coordinate with C, F, E, B and A
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- OCPDs A and B do not have to selectively coordinate with each other





Selective Coordination Requirements

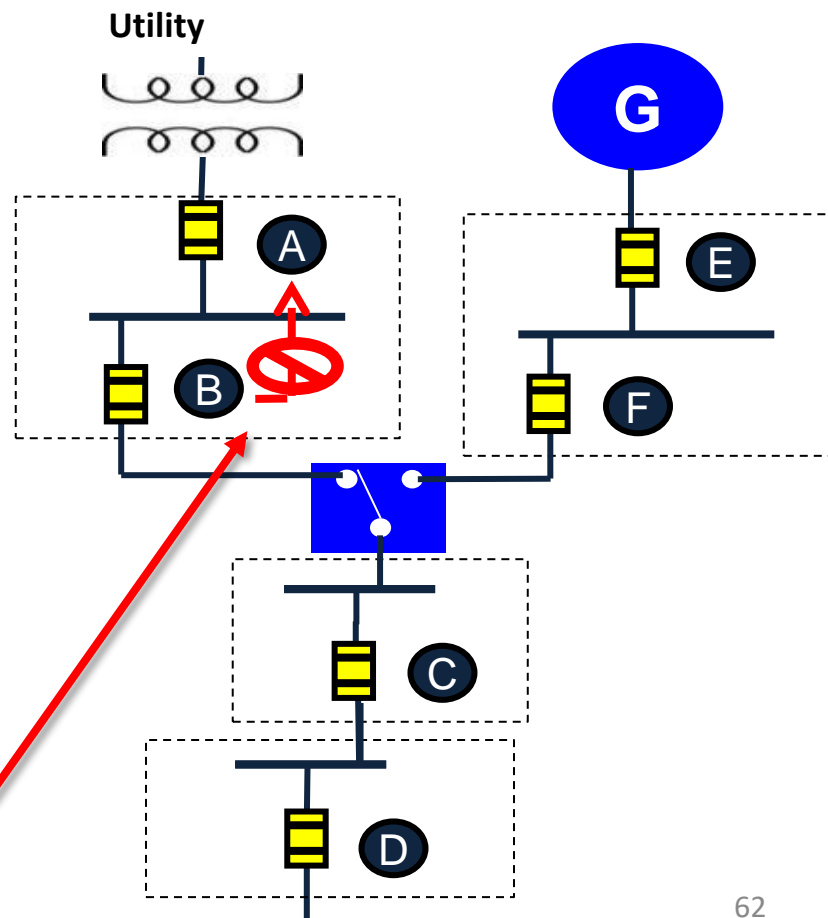
- 700, 701, and 708 OCPDs must selectively coordinate with all upstream overcurrent protective devices:
 - D must Selectively Coordinate with C, F, E, B and A
 - C must Selectively Coordinate with F, E, B and A
 - **F must selectively Coordinate with E**
- OCPDs A and B do not have to selectively coordinate with each other





Selective Coordination Requirements

- 700, 701, and 708 OCPDs must selectively coordinate with all upstream overcurrent protective devices:
 - D must Selectively Coordinate with C, F, E, B and A
 - C must Selectively Coordinate with F, E, B and A
 - F must selectively Coordinate with E
- **OCPDs A and B do not have to selectively coordinate with each other**





Coordination vs. Selective Coordination

- Selective coordination is not the same as coordination as required in 517.30(G)



NEC Article 517 - Coordination

517.30(G) Coordination. Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second.

Exception No. 1: Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

Exception No. 2: Between overcurrent protective devices of the same size (ampere rating) in series.

Informational Note: The terms coordination and coordinated as used in this section do not cover the full range of overcurrent conditions.



Coordination Definition - NEMA

Localization of an overcurrent condition to minimize outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings, ensuring separation of their time current curves beyond a specified time period without regard to fault current magnitude or below a specified level of fault current less than the maximum available fault current.

<https://www.nema.org/Standards/Pages/Selective-Coordination-of-Low-Voltage-Circuit-Breakers.aspx#download>

Article 517 Coordination



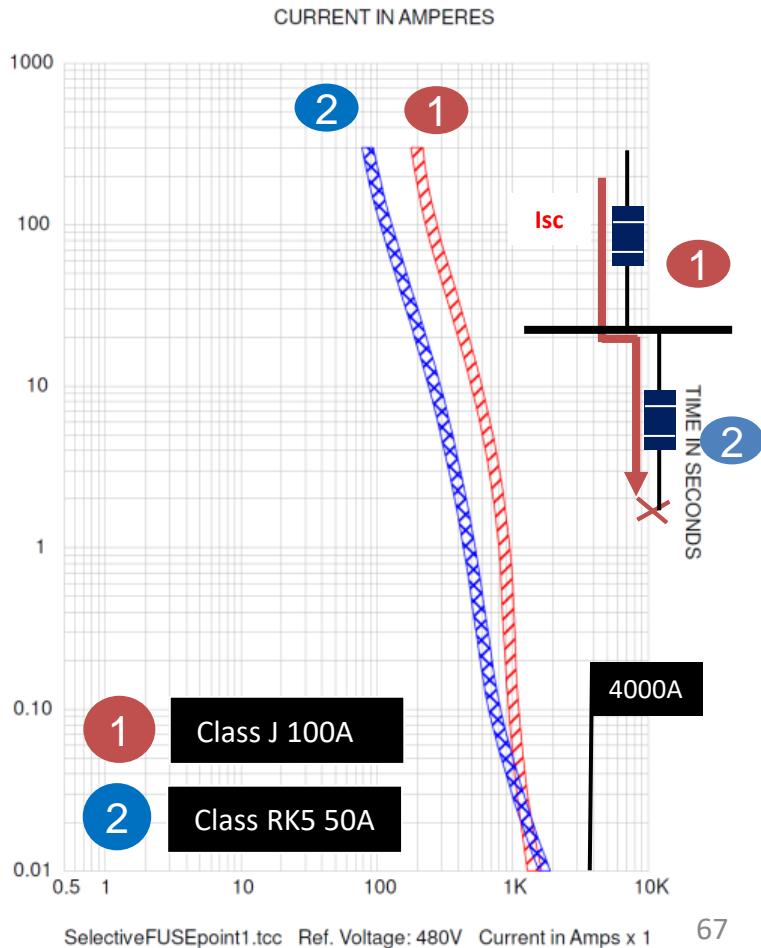
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NEC Article 517 - Coordination

This TCC Curve Shows A Pair Of fuses That Both See 4,000Amps of Fault Current

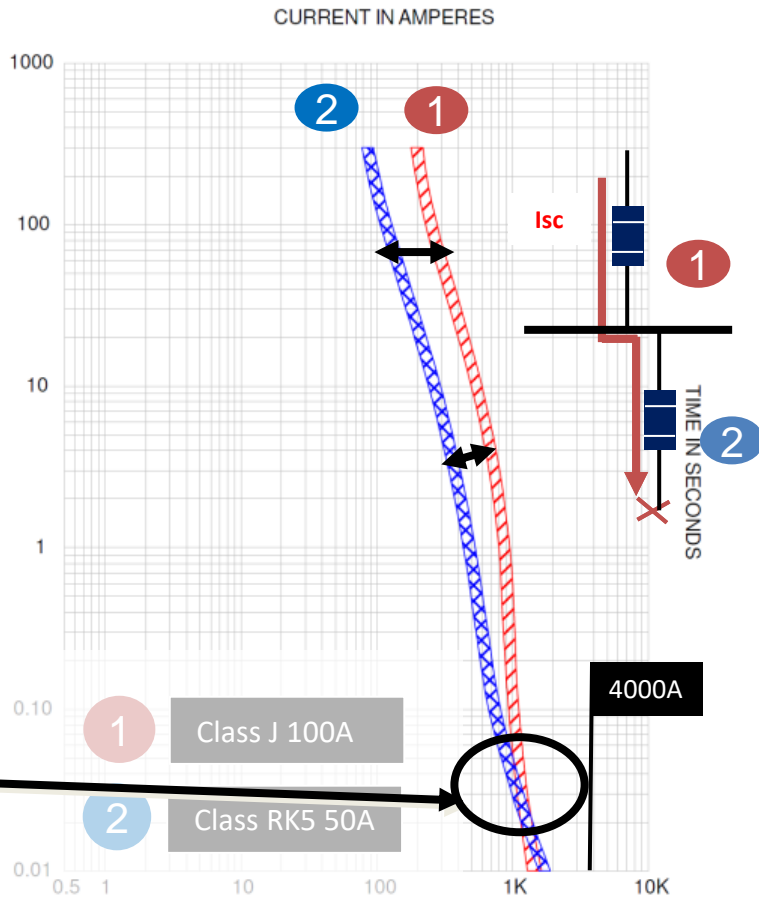




NEC Article 517 - Coordination

“... Separation of their time current curves ..”

- Separation of time current curves looks for space between curves
- Overlap in this example illustrates no separation

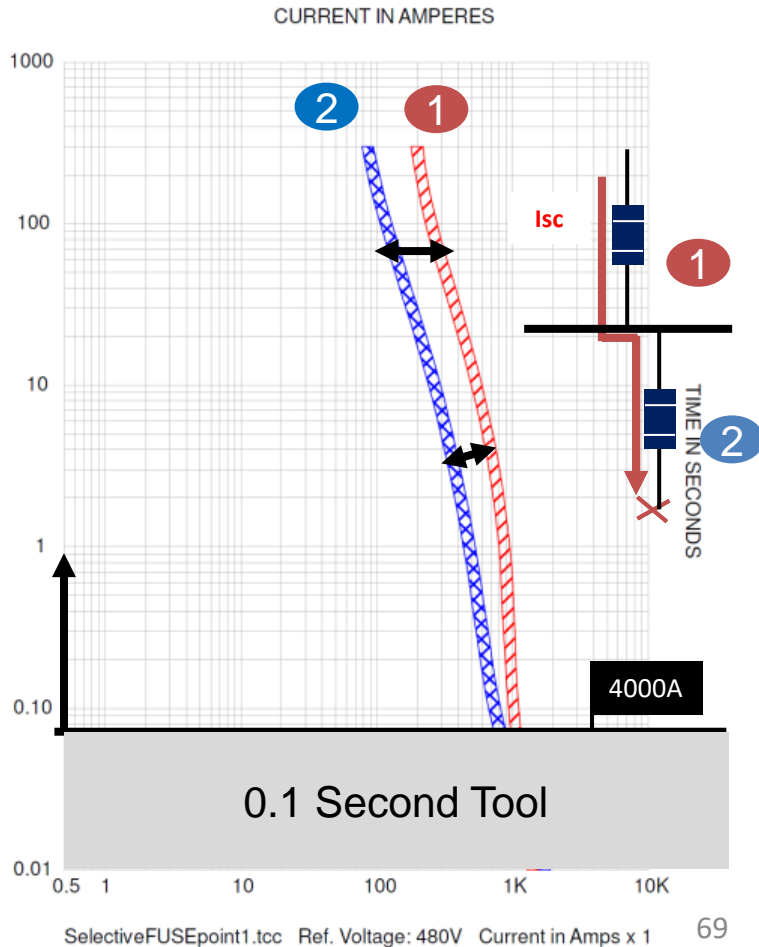




NEC Article 517 - Coordination

“... separation of their time current curves beyond a specified time period . . .”

- Separation of curves for times > 0.1 seconds
- Overlaps for times < 0.1 seconds are ignored

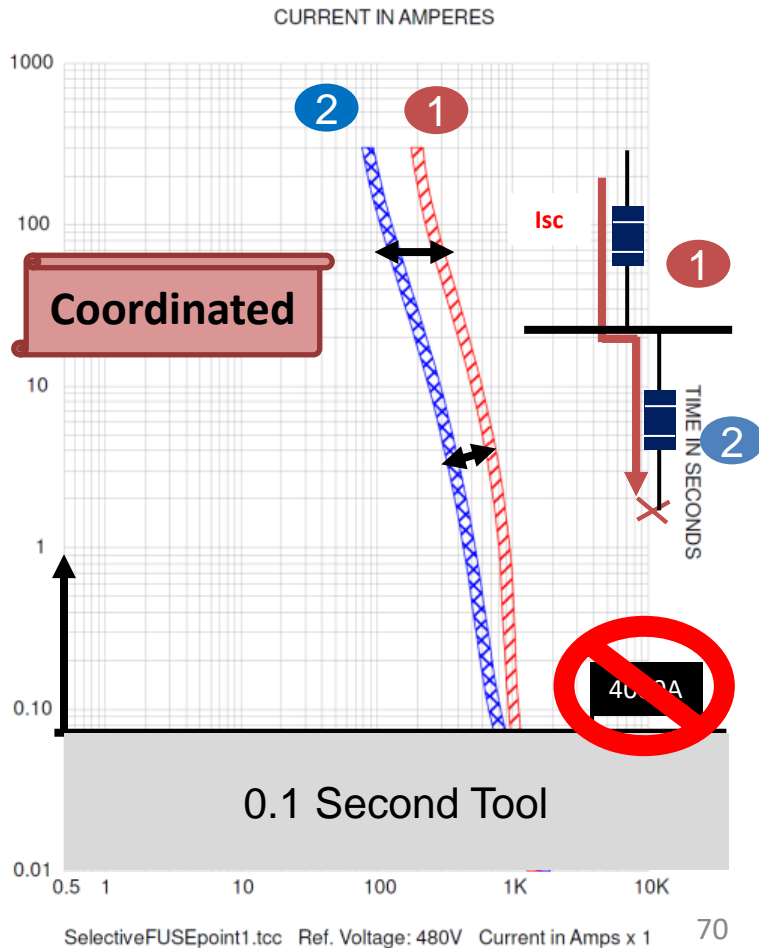




NEC Article 517 - Coordination

“... separation of their time current curves beyond a specified time period without regard to fault current magnitude”

- Disregard Calculated Maximum Isc Current
- “Informational Note: The terms coordination and coordinated as used in this section do not cover the full range of overcurrent conditions.” (NEC 2014 change)





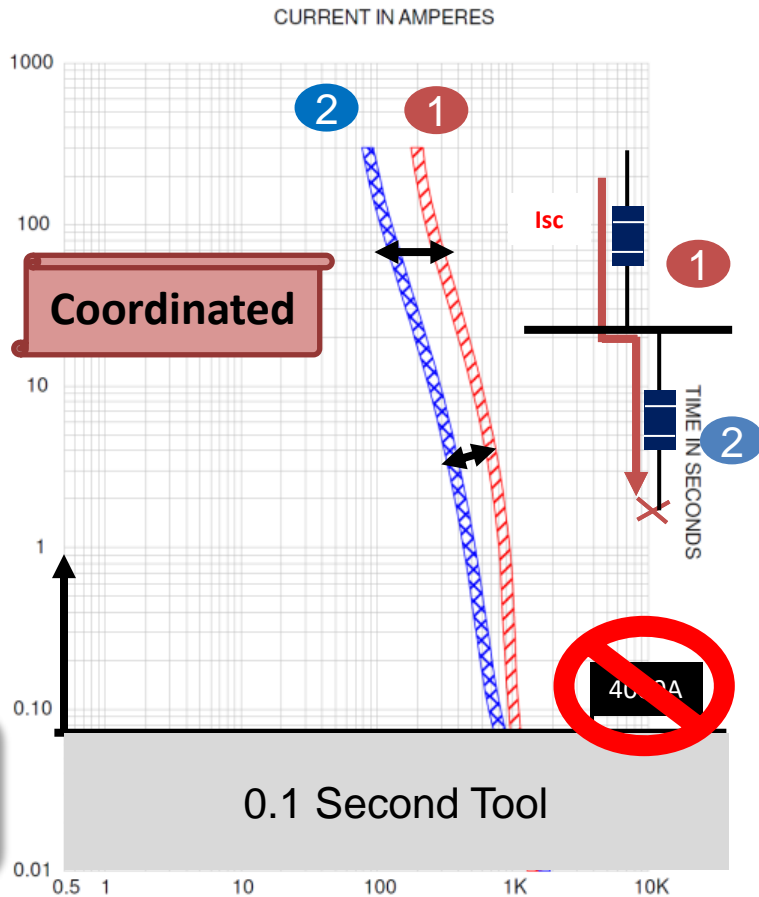
NEC Article 517 - Coordination

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Exception No. 2: Between overcurrent protective devices of the same size (ampere rating) in series.

Informational Note: The terms coordination and coordinated as used in this section do not cover the full range of overcurrent conditions.





NEC Article 517 - Coordination

- Selectively Coordinated fuses Will exceed coordination requirements found in Article 517 (0.1 Seconds)
- Coordinated fuses May Not Selectively Coordinate to maximum available fault current
- Fuses that achieve selective coordination exceed the performance of a coordinated system



Typical Selective Coordination Process

- Short circuit study
- Equipment Evaluation
- Selective Coordination Evaluation

1.0 EXECUTIVE SUMMARY

This report contains the results of analysis performed on the electrical distribution system for the Atlanticare Regional Medical Center in Hammonton, New Jersey. The purpose of this study is to evaluate new electrical equipment provided for this facility, as detailed below.

The executive summary contains the description and guide to the rest of the report. In addition, it also contains the recommendations of the entire study.

1.1 Objectives

1. Short-Circuit Study

Perform a short-circuit study on the new electrical distribution system shown in order to determine the available fault current at pertinent locations throughout the distribution system. The scope of the study includes:

- Analysis begins at the incoming 12.47 kV utility service, continues through the low voltage substations, and ends at the low voltage panelboards shown in contract drawings E0.1 & E0.2 dated 05/24/10.

The available fault currents determined by the short-circuit study will be used in the coordination and device evaluation analysis.

2. Equipment Evaluation

Evaluate the short-circuit ratings of new protective devices and other distribution equipment supplied by Eaton under this contract.

3. Selective Coordination Evaluation

Review the selection of protective devices within the portion of the distribution system required to be selectively coordinated. Utilize manufacturer selectivity ratio tables and time current curves to verify selective coordination.

4. Coordination Study

Develop time-current coordination plots to derive coordinated settings for new protective devices.

5. Arc Flash Analysis

Perform an arc flash hazard analysis per NFPA 70E on the electrical distribution system described in item #1 above.

Selective Coordination - Specifications



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Clarity in specifications is important for all involved

- Consultant creates a specification
- Contractors work with distributors and manufacturers to quote the system seeking value engineering opportunities that could jeopardize selectivity
 - Series rated solutions may selected which compromises selective coordination goals

Specifications must be clear and specific to ensure what the consultant expects is what is quoted



Examples of Selective Coordination Specification Language

A Nationally used specification service

260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

- G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

260573 - 4

Graphic illustration may or may not provide enough information for selective coordination.

Need for clear specification language



Examples of Selective Coordination Spec Language

A Nationally used specification service

4. For emergency, legally required standby and health care essential power systems, such systems must selectively coordinate to the values indicated below unless local amendments to the National Electrical Code require a different value.
- | | | |
|----|--|--------------|
| a. | Emergency (NEC article 700) | 0.01 seconds |
| b. | Legally Required Standby (NEC article 701) | 0.01 seconds |
| c. | Elevator Systems (NEC article 620) | 0.01 seconds |
| d. | Health Care Essential Electrical Systems (NEC article 517) | |
| | 1) Equipment Branch | 0.10 seconds |
| | 2) Critical Branch | 0.01 seconds |
| | 3) Life-Safety Branch | 0.01 seconds |

Does 0.01 mean “Selective Coordination”? Does this meet NEC definition of selective coordination? Does this meet design goals?

Need for clear specification language



Examples of Selective Coordination Spec Language

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- E. Overcurrent protective devices in the electrical distribution system shall be selectively coordinated to 0.10 seconds. Selective coordination shall not be required between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exist(s) on the transformer secondary. Selective coordination shall not be required between overcurrent protective devices of the same size (ampere rating) in series.

Terms 0.1 and “Selective Coordination” contradict one another. More information is needed to determine if this is an Article 700, 701, 708 or other type of system requiring selective coordination.

Need for clear specification language



Suggested Specification Language - Selective Coordination

- Those portions of this design that specify selective coordination, or are required by the National Electrical Code to selectively coordinate, are intended to localize the impact of an overcurrent condition thus restricting outages to the circuit or equipment affected and shall meet the following:
 - a. Overcurrent protective devices must selectively coordinate for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.
 - b. A preliminary short-circuit study with available fault currents at each bus is available from << design engineer firm name here >>



Suggested Specification Language - Selective Coordination

- Those portions of this design that specify selective coordination, or are required by the National Electrical Code to selectively coordinate, are intended to localize the impact of an overcurrent condition thus restricting outages to the circuit or equipment affected and shall meet the following:
 - c. Overcurrent devices shall selectively coordinate with all supply-side overcurrent protective devices up through the normal source (i.e. utility) and alternate sources (i.e. generator).
 - 1. OCPD devices on the emergency side (secondary) of a transfer switch shall selectively coordinate with all line side OCPD devices up through the normal source.
 - 2. Standard exceptions identified in the National Electrical Code apply



Suggested Specification Language - Selective Coordination

- Those portions of this design that specify selective coordination, or are required by the National Electrical Code to selectively coordinate, are intended to localize the impact of an overcurrent condition thus restricting outages to the circuit or equipment affected and shall meet the following:
 - d. The OCPD devices on the “Normal” side of the emergency system transfer switch:
 - <<SELECT ONLY ONE OF THE FOLLOWING>>
 - Are not required to selectively coordinate for this design (Meets NEC Requirement)
 - Ensure separation of trip curves for all times greater than 0.1 seconds and beyond (Exceeds NEC Requirements)
 - Selectively coordinate (Exceeds NEC Requirements)



Suggested Specification Language - Selective Coordination

- Those portions of this design that specify selective coordination, or are required by the National Electrical Code to selectively coordinate, are intended to localize the impact of an overcurrent condition thus restricting outages to the circuit or equipment affected and shall meet the following:
 - e. Documentation shall be included in the forms of manufacturer selective coordination tables and/or Time Current Characteristic (TCC) Curves that demonstrate selective coordination has been achieved.
 - f. The selective coordination study shall be performed by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems



Achievements - Now we . . .

- Understand key terms related to selective coordination
- Understand where selective coordination is required by Code and where it can be a design goal
- Discern the difference between a “selectively coordinated” system and a “coordinated” system
- Understand the impact of fault current to selective coordination
- Determine how to achieve selective coordination with fuses



Closing Remarks

- Selective Coordination is important for system reliability
- When TCC curves are used plotting fault current is critical to determining selectivity
- Leverage the fuse ratio tables to ensure selectivity without impact of changing fault current levels
- Ensure a qualified individual and/or a Professional Engineer performs the study



Thank you!

Questions?

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