January 6, 2026, Meeting Minutes
Redwood Empire Association of Code Officials
1007-B West COLLEGE AVE # 326 SANTA ROSA CA 95401

REACO Annual Membership Meeting: January 6, 2026
HELD AT: Jimmy's Lakeside Grill; 1320 19th Hole Dr. Windsor, CA

1. CALL TO ORDER and PLEDGE OF ALLEGIANCE

The meeting was called to order at 12:01 p.m.

2. SELF INTRODUCTIONS (Officers, Guests, Members). (2 online, 8 in person).

3. APPROVAL OF MINUTES – Motion by Eric Seabrook to approve December, 2025 minutes. 2nd by Rob Spaulding. Approved.

4. OFFICER REPORTS

President: Kevin Scheumann –2025 in review: Joint meetings, Basalite tour, legislative day, Building Codes update, (sponsored by REACO), etc. Would like to sponsor more $3K Scholarships, see website for upcoming trainings.

Treasurer: David Willoughby reporting on behalf of Betty Li–

- Account transactions summaries. David provided a reading of the checking and savings statements and itemizations, along with the 3-CD's summary statement.
- Account transactions summaries.
- **Checking balance**:
  Beginning Balance (December 1, 2025) $4,750.26
  Ending Balance (December 31, 2025) $2,461.92
- $ Deposits: $1,395.59
- $ Withdrawals: $683.93
- $ Checks: -$3,000.00
- **Savings balance:**
  Beginning Balance (December 1, 2025) $5397.02
  Ending Balance (December 31, 2025) $5,397.11
- $ Deposits: $0.09
- $ Withdraws: $ -0-
- **7 Month Featured CD (8075): Next maturity date: 03/06/2026**
  Current Balance: $13,769.62
- **13 Month Featured CD (8088): Next maturity date: 03/06/2026**
  Current Balance: $13,654.83
- **7 Month Featured CD (7738): Next maturity date: 05/08/2026**
  Current Balance: $10,316.71

- Treasurer's report verified by: Ryan Rose

Vice President: Ryan Rose- No Report

Secretary: Rob Spaulding- No Report

Past President: Richard Angley- No Report

LIAISON REPORTS

SCFPO: Devon Gambonini– No Report- Thank you for trainings.

ICC Rep: Karyn Beebe – See Link https://www.iccsafe.org/advocacy/gr-monthly-update/ . Contact her to be added to her email list for information.

CBOAC: Eric Seabrook – No Report

CALBO: Doug Hughes – No Report

CEC Rep: Gagandeep Randhawa- No Report. See Handouts and website

IAEI: Doug Hughes, Mike Stone – No Report

BayREN: John Pazos – See website and agenda for details.

RECSI: Michael Wright- Construction Symposium being planned for March 9, 2026, to be held at North Coast Builder's Exchange 9am-3pm and will include products show. Will be sending save the date and looking for vendors/speakers. Eric Seabrook asks to add ICC CEU's for event training.

COMMITTEE REPORTS

Education Committee: Eric Seabrook, David Willoughby and Kevin Scheumann- Three code update classes coming up in January (Electrical/NFPA 1/9), February (Calif. Residential 2/2, CPC/CMC 2/11). See REACO website for flyer.

Web-Site Committee: David Willoughby – Maintenance/clean up, updates.

ADU Committee: Brad Cannon, Eric Seabrook: No Report

Scholarship Committee: David Willoughby, Richard Angley, Kris Kuntz, Ian Broeske- Applications for Scholarship due in May. Reestablished scholarship program to 3 for $1K or 1 for $3K.

Nominations Committee: David Willoughby, Charles Lucas, Richard Angley: Secretary: Rob Spaulding, President: Kevin Scheumann, Vice President: Ryan Rose, Treasurer: Betty Li, Past President: Richard Angley.

Annual Audit Committee: Will review REACO savings at January Board Meeting

PROGRAM: Tyler Shewbert "Selective Coordination & SCCR Ratings" see attachment

CORRESPONDENCE AND ANNOUNCEMENTS- None.

LEGISLATIVE NEWS-

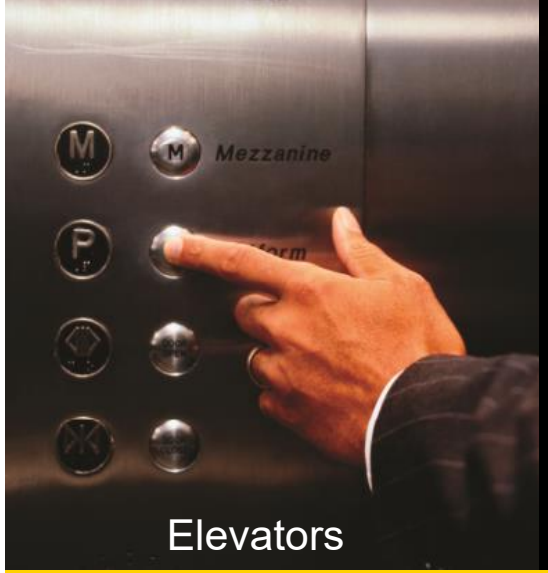
NEW BUSINESS-

a. **REACO Board to review budget at January board meeting**
b. **Pam Miller recommendation that REACO should reach out to membership more fully with meeting invites and review/update REACO mission statement/purpose. Goal of REACO purpose should more fully describe what REACO reps at CSI and other events are trying to convey and why we are there.**

OLD BUSINESS- None

a. Kevin will pursue PO box Rental and discuss at next meeting

ADJOURNMENT at 2:10 p.m. – next meeting will be on Feb. 3, 2026 and HELD AT: Jimmy's Lakeside Grill 1320 19th Hole Dr. Meeting invite will be sent out later in the month for those attending virtually.



Elevators

Emergency Systems

Data Systems

REACO Chapter Meeting: Selective Coordination and SCCR Ratings

Tyler Shewbert, P.E. (CA, NV, WA)
Field Application Engineer
Bussmann Division

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Selective Coordination Overview

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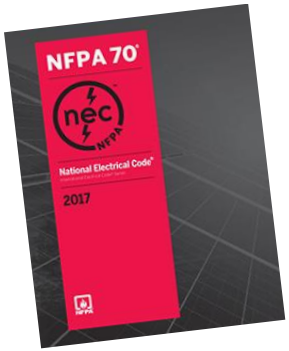
California Electrical Code definition

California Electrical Code Article 100

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.



- Localize and restrict outage
- Accomplished by selection and installation of OCPDs and their ratings and settings
- Full range of available overcurrents
- Full range of opening times

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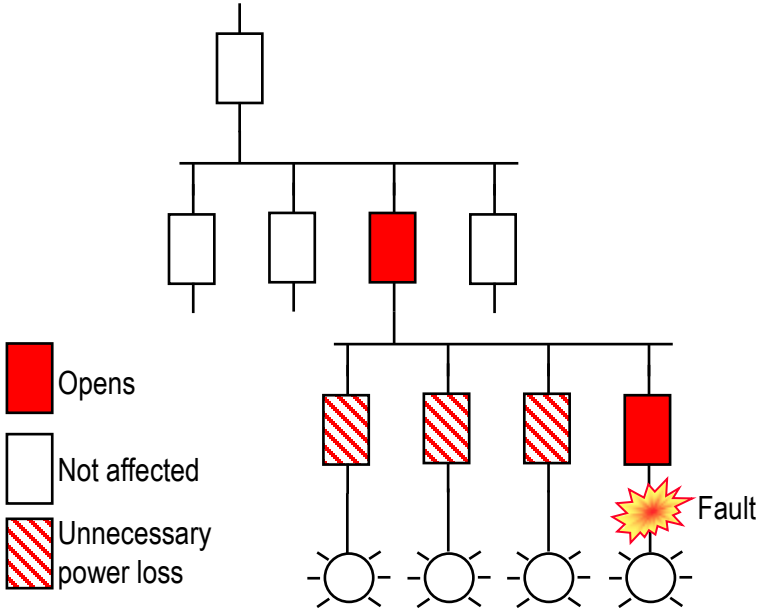
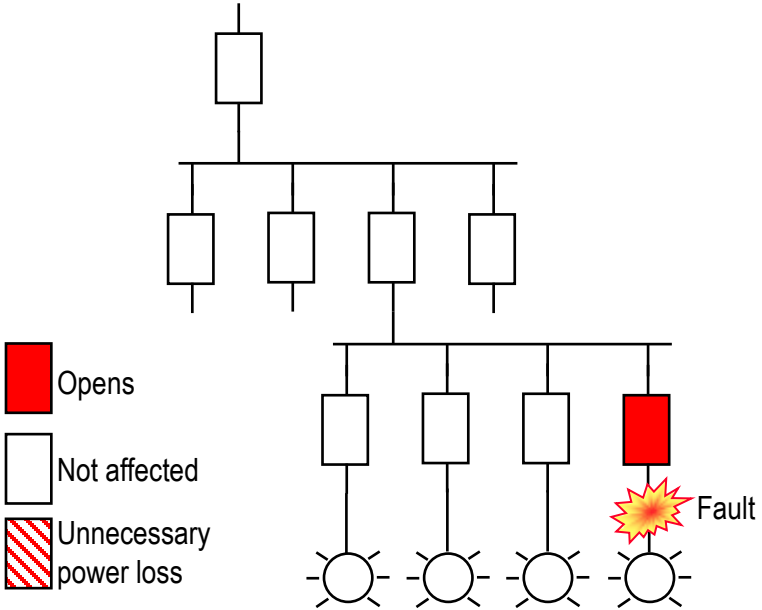
What is selective coordination?

Without selective coordination



With selective coordination



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Importance of selective coordination

- **Life Safety and Emergency Systems**
  - California Electrical Code requires selective coordination of overcurrent protective devices (OCPDs) in critical systems like fire pumps, elevators, emergency lighting, and other critical systems.
  - If an upstream overcurrent device trips during a overcurrent condition, it could shut down the entire emergency system instead of just the affected branch.
  - This could endanger occupants during an evacuation.
- **California Electrical Code and NFPA Requirements**
  - California Electrical Code Articles 620, 645, 695, 700, 701, and 708 require selective coordination
  - NFPA 72 (Fire Alarm Code), NFPA 101 (Life Safety) and NFPA 20 (Fire Pumps) emphasize reliability and egress requirements during fire conditions.
  - Building officials enforce these codes to ensure compliance and occupant safety.

Importance of selective coordination

- **Minimized Service Disruption**
  - Proper coordination ensures only the device closest to the overcurrent condition opens.
  - Prevents unnecessary outages to unaffected circuits.
  - Crucial for hospitals, data centers, and high-occupancy buildings where downtime has severe consequences.
- **Inspection and Liability**
  - Building officials verify electrical installations comply with code and are safe for occupancy.
  - Lack of selective coordination can lead to cascading outages.
  - Could result in legal liability if it contributes to injury or property damage.

Fire & life safety perspective

- **Continuous Operation of Life Safety Systems**
  - Fire pumps, smoke control fans, emergency lighting, and alarms must stay energized during a fire event.
  - If an upstream OCPD trips in addition to the local device, the entire emergency system could fail which can compromise evacuation and firefighting efforts.
- **Preventing Cascading Failures**
  - Without selective coordination, a short circuit in one branch could disconnect all emergency loads.
  - Stairwell lighting, exit signs, and fire alarms could go inoperative.
  - Increases risk during evacuation and delays first responders.
- **Liability and Risk Reduction**
  - Building officials approve installations that protect life safety.
  - Improper coordination could lead to loss of life or property, creating high liability.

Importance of verifying during plan review

- **Prevents Costly Changes Later**
  - Discovering issues during construction often requires replacing panels and OCPDs which is very expensive.
- **Ensures Code Compliance Before Approval**
  - California Electrical Code Articles 620, 645, 695, 700, 701, 708 require selective coordination.
  - Plan reviewer verify compliance during plan review which helps field inspectors.
- **Maintains Fire & Life Safety Integrity**
  - Critical systems must remain operational.
  - Catching issues early ensures proper function during emergencies.
- **Avoids Delays in Occupancy**
  - Late non-compliance can delay inspections, approvals, and occupancy.
  - Reduces Liability
  - Early verification protects officials and owners from claims related to system failure during a fire event.

Plan review flags for selective coordination

- **Multiple Elevators on One Feeder**
  - If more than one elevator is served by a single feeder, verify selective coordination between upstream and branch devices.
- **Generator Feeding Emergency and/or Legally Require ATS**
  - A generator supplying both an Emergency ATS and/or a Legally Required ATS needs proper selective coordination between transfer switches and overcurrent devices.
- **Fire Pump Circuit**
  - Fire pump feeders and controllers must remain energized during overcurrent conditions elsewhere—check California Electrical Code 695 and selective coordination requirements.
- **Data Center Loads**
  - Critical operations power systems (California Electrical Code 708) require selective coordination to avoid cascading outages.
- **Inverter Serving Downstream Panels**
  - Inverters feeding emergency or legally required panels need selective coordination between inverter protection and downstream OCPDs.
- **Shared Emergency Distribution Panels**
  - Panels serving multiple life safety loads (lighting, alarms, smoke control fans) shall have selectively coordinated OCPDs.

Selective coordination study during plan check

- **Confirm Study is Provided**: Require a short-circuit and selective coordination study for all systems where selective coordination is required
- **Verify Scope of Study**: Includes all emergency feeders, branch circuits, transfer switches, fire pumps, elevators, and critical loads.
- **Check Time-Current Curves (TCCs):** Ensure curves show proper separation between upstream and downstream devices for all overcurrent condition levels at all times.
- **Look for Full Range Coordination:** Coordination must cover overload and short-circuit conditions, not just one or the other.
- **Review Device Types and Settings:** Instantaneous trip settings on breakers should not overlap with downstream devices. Confirm fuse and breaker combinations are listed as coordinated per manufacturer data.
- **Confirm Compliance with California Electrical Code Articles:** California Electrical Code 620, 645, 696, 700, 701, 708 require selective coordination for emergency and legally required standby systems.
- **Check Generator and ATS Coordination:** Ensure generator main OCPD coordinates with ATS and downstream emergency OCPDs.
- **Verify Critical Loads:** Elevators, fire pumps, smoke control fans, emergency lighting, and alarms must remain energized during overcurrent conditions elsewhere.
- **Ensure Manufacturer Coordination Tables or Software Output is Included:** Acceptable proof includes published tables or study results from recognized software (e.g., SKM, ETAP, EasyPower).
- **Look for Notes on Field Settings:** Adjustable breakers must have specified settings documented in the study.

Selective coordination during field inspections

- **Confirm Installed Equipment Matches the Study**: Check OCPD type, sizes, and manufacturer as shown in the selective coordination study.
- **Verify Adjustable Settings:** Ensure OCPD settings (long-time, short-time, instantaneous, ground fault) match documented settings in the study.
- **Check Generator and ATS Connections:** Confirm generator main OCPD and ATS wiring align with the plan and coordination study.
- **Inspect Fire Pump Circuit**: Verify fire pump feeder and controller are installed per California Electrical Code 695 and remain isolated from other loads and are selective coordinated when required.
- **Validate Emergency and Legally Required Panels**: Confirm panels serving life safety loads are correctly labeled and fed as shown in the study.
- **Look for Added or Changed Devices**: Any field changes (added breakers, swapped fuses) must be reviewed for impact on coordination.
- **Confirm Inverters/UPS Settings:** Check inverter or UPS protection settings match the study for emergency circuits.
- **Ensure Proper Isolation of Emergency Loads:** Verify emergency circuits are not mixed with non-critical loads unless shown coordinated in the study.
- **Request Updated Study if Changes Occurred:** If equipment or settings differ from the approved plan, require an updated coordination study before final approval.

California Electrical Code articles requiring selective coordination

- Required where reliability of system is essential for safety of human life or where loss of service would disrupt national security, the economy, public health, or safety (critical systems)

California Electrical Code Section	System
620.62	Elevators (multiple elevators on single feeder)
645.27	Critical operations data systems
695.3(C)(3)	Multi-building campus-style complexes (fire pumps)
700.32	Emergency systems
701.27	Legally required standby systems
708.54	Critical operations power systems

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Coordination levels vary by system

System type	Level of coordination required
• Elevators • Critical operations data systems • Multi-building campus-style complexes (fire pumps) • Emergency systems • Legally required standby systems • Critical operations power systems	Selective coordination – all times and all currents • Complete system uptime is imperative for life safety or business continuity
• Essential electrical systems for hospitals	Coordination – separation of curves above 0.1 seconds only • Not selectively coordinated for all times and all currents
• Non-critical systems	None required by Code • Level of selectively based on the level of reliability needed • Selective coordination may be desired • Hospitals or industrial plants

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Common Misconceptions

- **“Selective coordination is only required down to 0.1 or 0.01 seconds.”**
  - California Electrical Code 100 defines selective coordination for the full range of overcurrent opening times and does not specify any specific exception times.
- **“Series-rated systems = Selective Coordination”**
  - False. Series rating only addresses short-circuit current rating, not selective coordination of devices during faults
- **“If devices have the same manufacturer, they’re selectively coordinated”**
  - Not necessarily. Selective coordination depends on time-current characteristics, not just brand.
- **“Instantaneous trip settings don’t matter”**
  - Incorrect. Instantaneous settings often cause upstream breakers to trip before downstream devices, defeating selective coordination.

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Common Misconceptions

- **“Selective coordination only matters for short circuits”**
  - Wrong. California Electrical Code requires full-range selective coordination for both overload and short-circuit conditions.
- **“Emergency systems are always selectively coordinated by default”**
  - No. Coordination must be engineered and documented through a study or manufacturer tables.
- **“If the system passes short-circuit calculations, it’s selectively coordinated”**
  - Passing SCCR checks does not guarantee selective coordination.
- **“Fire pump circuits don’t need coordination because they’re fed from the utility”**
  - This is not always the case in campus style infrastructure.
- **“Selective coordination studies are optional”**
  - Documentation is required to be performed by a PE or other qualified person.

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Selective coordination: All times, all currents

- Full range of overcurrents
  - Overloads and short-circuits (ground faults, arcing faults and bolted faults)
  - Up to the available fault current
- Full range of opening times
  - Low level overcurrents - long opening times (>30 sec.)
  - Available fault current - very fast opening times(<0.01 sec.)

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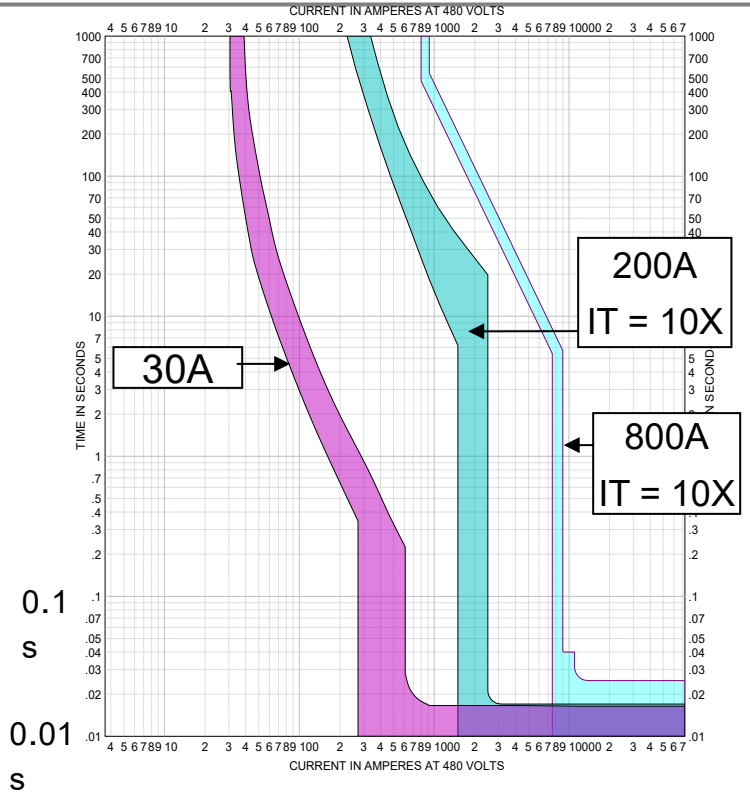
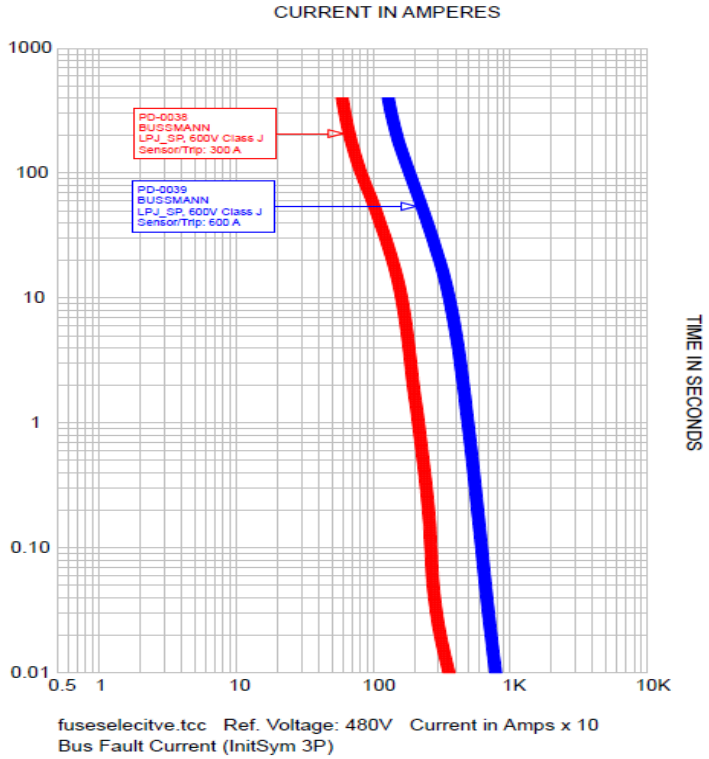
TCC Curves: Coordination vs. Selective Coordination





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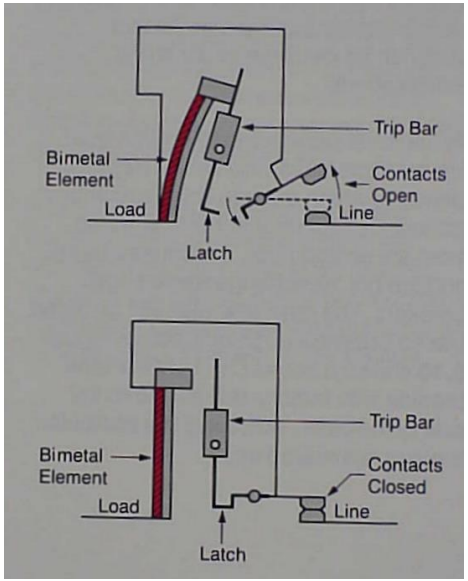
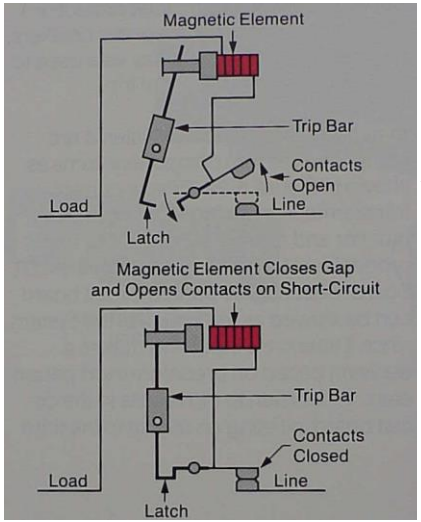
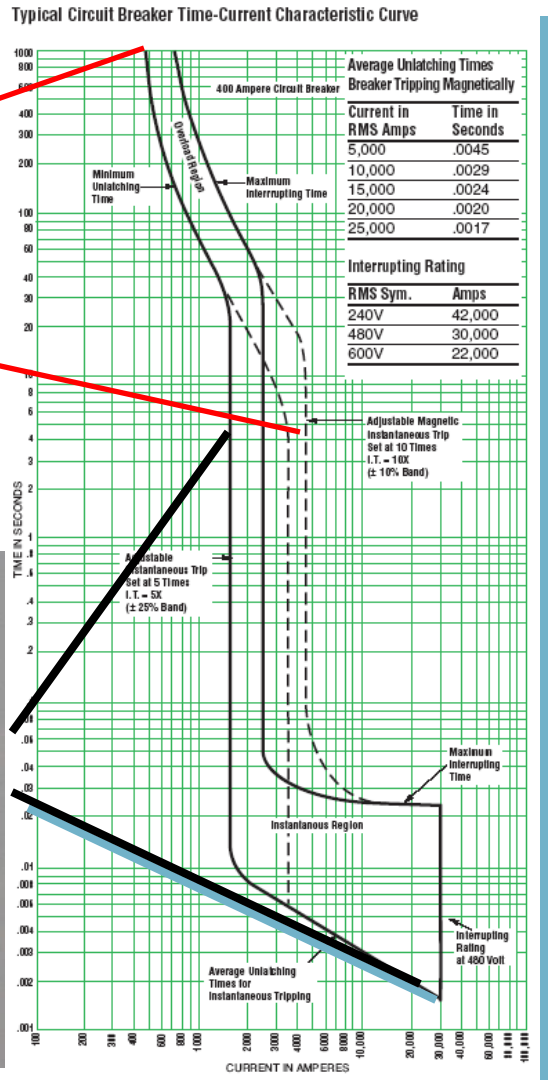
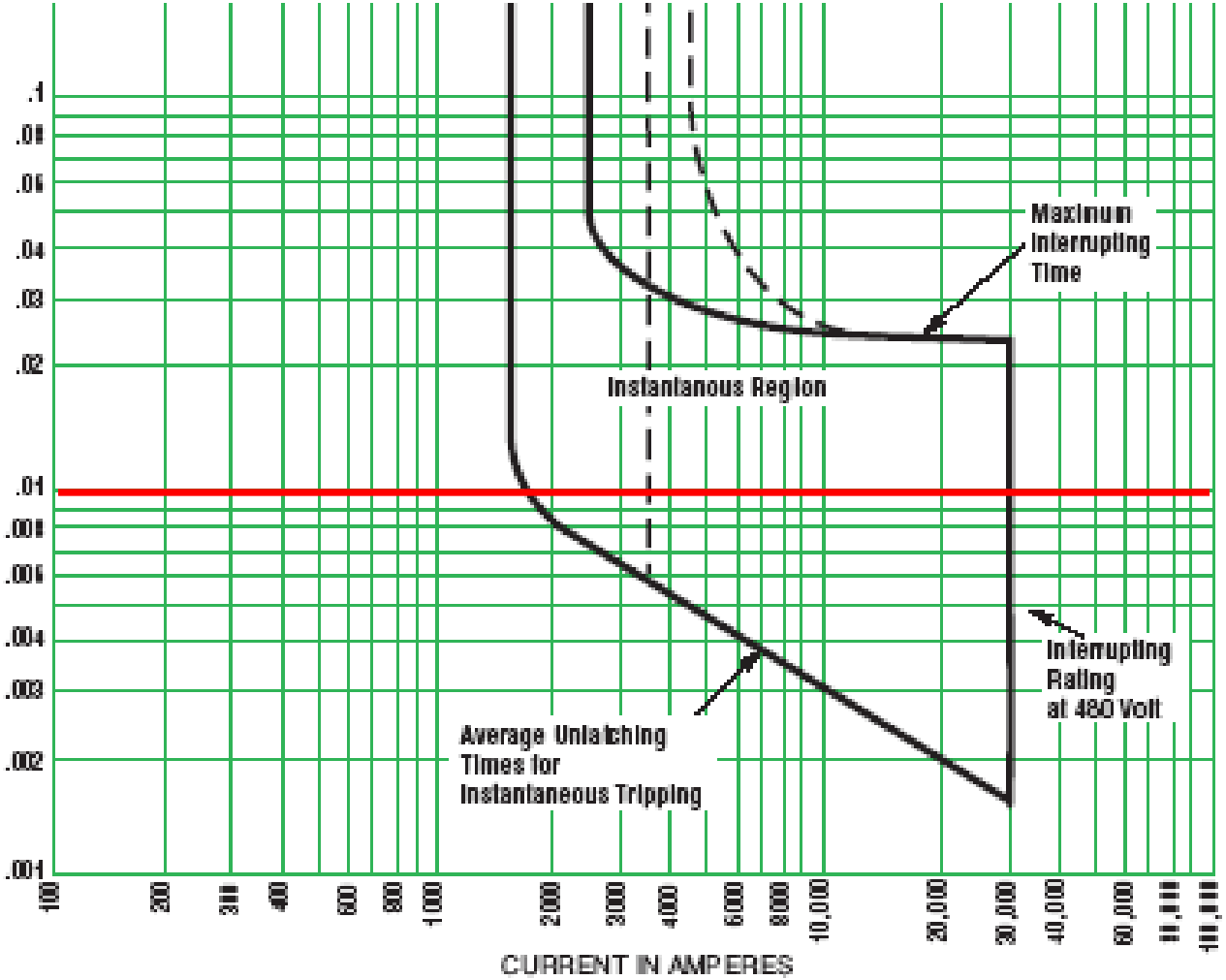






EATON BUSSMANN SERIES



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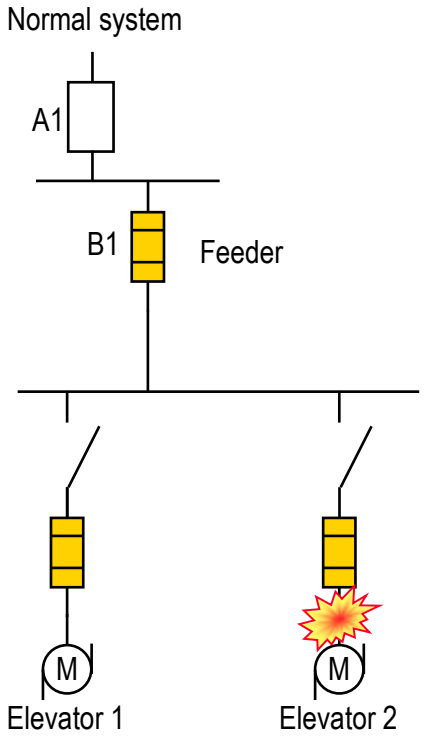
Selective coordination - Elevators

California Electrical Code

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.

- Localize and restrict outage
- Accomplished by selection and installation of OCPDs
- Feeder must remain energized



Must restrict outage such that only elevator 2 loses power

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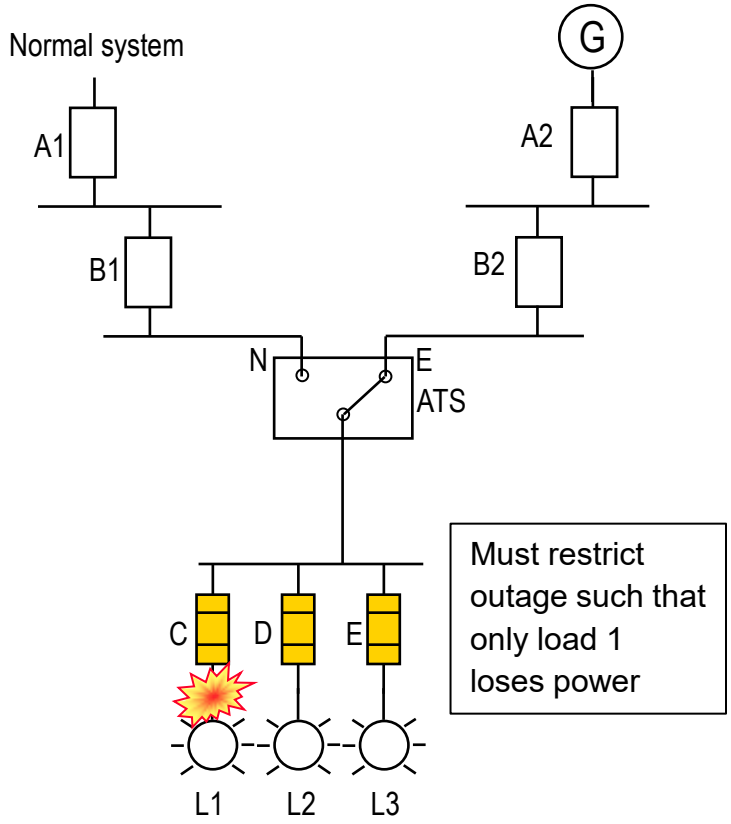
Selective coordination – Critical systems

California Electrical Code

700.32 Selective Coordination.
(A) General.
Emergency system(s) overcurrent devices shall be selectively coordinated with all supply-side and load-side overcurrent protective devices.

- Localize and restrict outage
- Accomplished by selection and installation of OCPDs
- All supply-side OCPDs
- Applies to Articles 645, 701 and 708



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2025 California Electrical Code - Informational Note

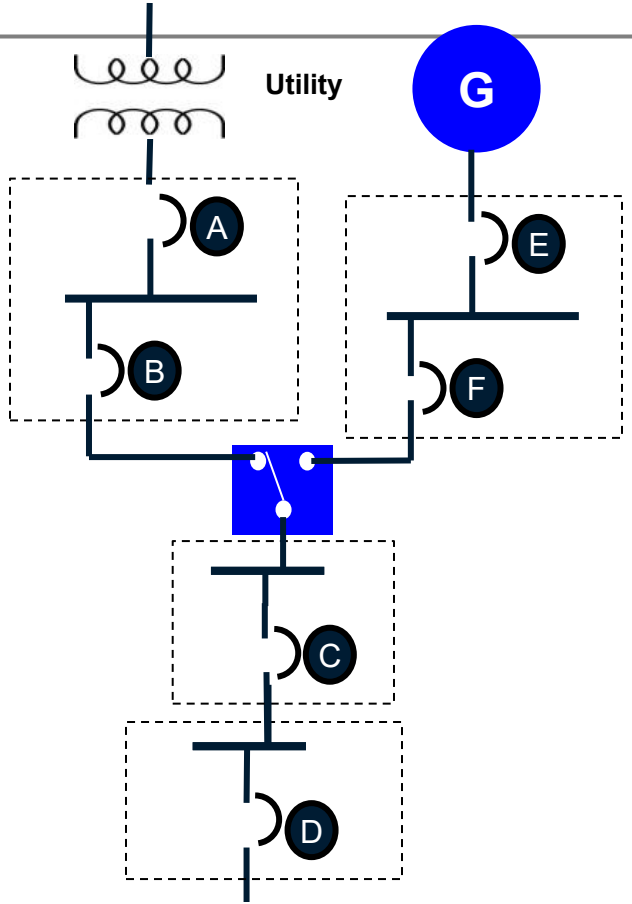
California Electrical Code

700.32 Selective Coordination.
(A) General.
Emergency system(s) overcurrent devices shall be selectively coordinated with all supply-side and load-side overcurrent protective devices.

All supply-side and load-side OCPDs

- 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

Applies also to Articles 645, 701 and 708



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2025 California Electrical Code Additions

California Electrical Code

700.32 Selective Coordination.

(B) Replacements.

Where emergency system(s) OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

California Electrical Code

700.32 Selective Coordination.

(C) Modifications.

If modifications, additions, or deletions to the emergency system(s) occur, selective coordination of the emergency system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

- It is important to maintain selective coordination for the life of the system
- Any time there are modifications, additions, or deletions the selective coordination of the system must be reevaluated to make sure it still complies with 700.32(A).

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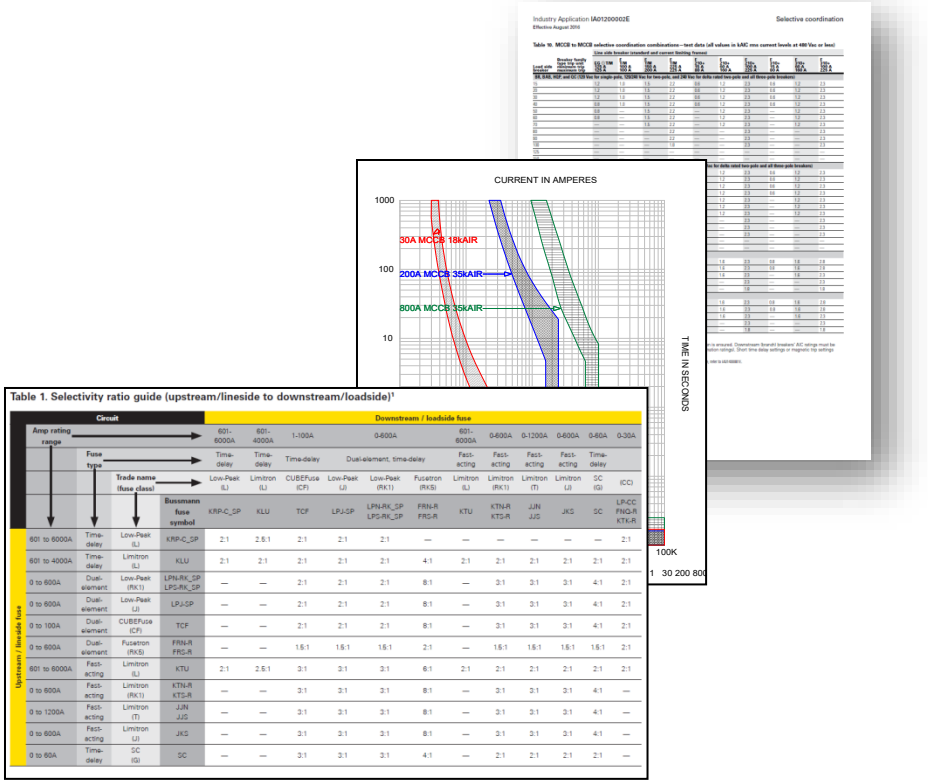
Selective coordination documentation

California Electrical Code Article 620, 700, 701 &

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.

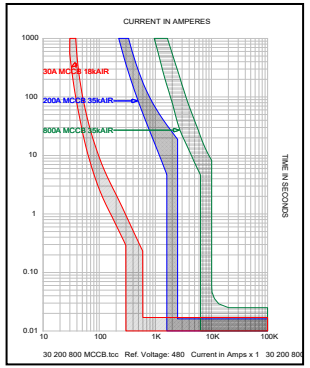
- Must document the selection of selective coordination by P.E. or other qualified person
- May need short-circuit study, coordination study, manufacturer ratio charts and tables

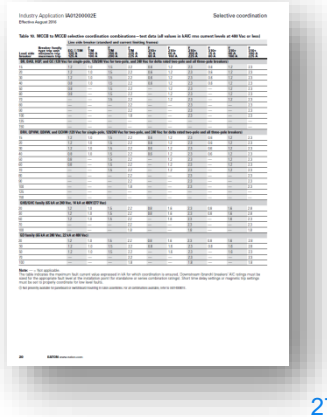


Selective coordination with circuit breakers

Selective coordination with circuit breakers

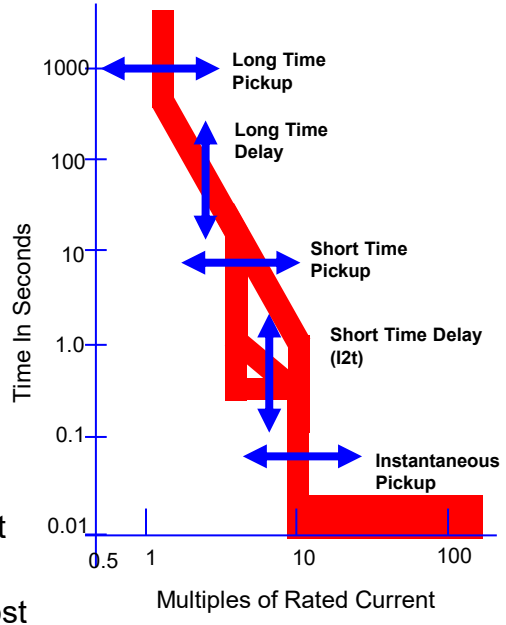
1. Complete short-circuit study
2. Complete coordination study
    1. Compare TCCs to available fault current
    2. Utilize manufacturer's tables for times faster than 0.01 seconds
    3. Identify correct ratings and settings of circuit breakers to selectively coordinate





Circuit breaker types and settings

- Achieve selective coordination by type and setting
  - Current: Adjust instantaneous trip – IT (left/right)
  - Time: Adjust short-time delay – STD (up/down)
- Electronic trip unit or larger frame breaker may be necessary



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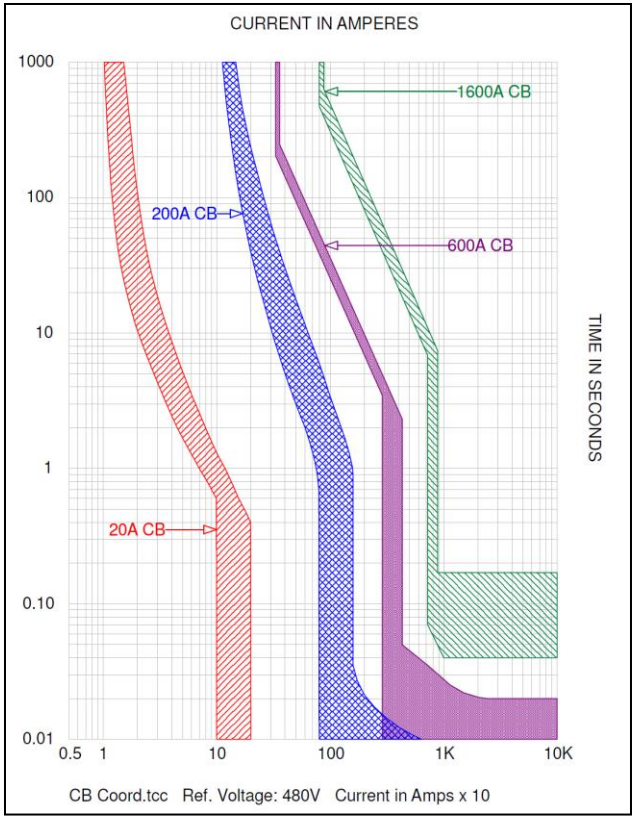
Additional notes on circuit breaker coordination

- Curves vary by manufacturer and type of circuit breaker
- Curves are drawn up to available fault current, but portion of curve may be below 0.01 seconds and not visible
- TCCs by themselves may not assure selective coordination – depends on fault current
- Charts for circuit breaker pairs may be consulted for selective coordination



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1a. CB Manufacturer's SC Table

Line Side Breaker

Load Side Breaker

Load side breaker	Breaker family type trip unit minimum trip maximum trip	Line side breaker (standard and current limiting frames)							
		EG ①T/M 125 A 125 A	F T/M 100 A 100 A	F T/M 150 A 200 A	F T/M 225 A 225 A	F 210+ 15 A 80 A	F 210+ 60 A 160 A	F 210+ 100 A 225 A	F 310+ 15 A 80 A
BR, BAB, HQP, and QC (120 Vac for single-pole, 120/240 Vac for two-pole, and 240 Vac for delta rated two-pole and all three-pole breakers)									
15		1.2	1.0	1.5	2.2	0.6	1.2	2.3	0.6
20		1.2	1.0	1.5	2.2	0.6	1.2	2.3	0.6
30		1.2	1.0	1.5	2.2	0.6	1.2	2.3	0.6
40		0.8	1.0	1.5	2.2	0.6	1.2	2.3	0.6
50		0.8	—	1.5	2.2	—	1.2	2.3	—
60		0.8	—	1.5	2.2	—	1.2	2.3	—
70		—	—	1.5	2.2	—	1.2	2.3	—
80		—	—	—	2.2	—	—	2.3	—
90		—	—	—	2.2	—	—	2.3	—
100		—	—	—	1.8	—	—	2.3	—

Table illustrates the selection of molded case circuit breakers to achieve selective coordination based on maximum level of fault current (not ratios)

Also available where 0.1 seconds is acceptable

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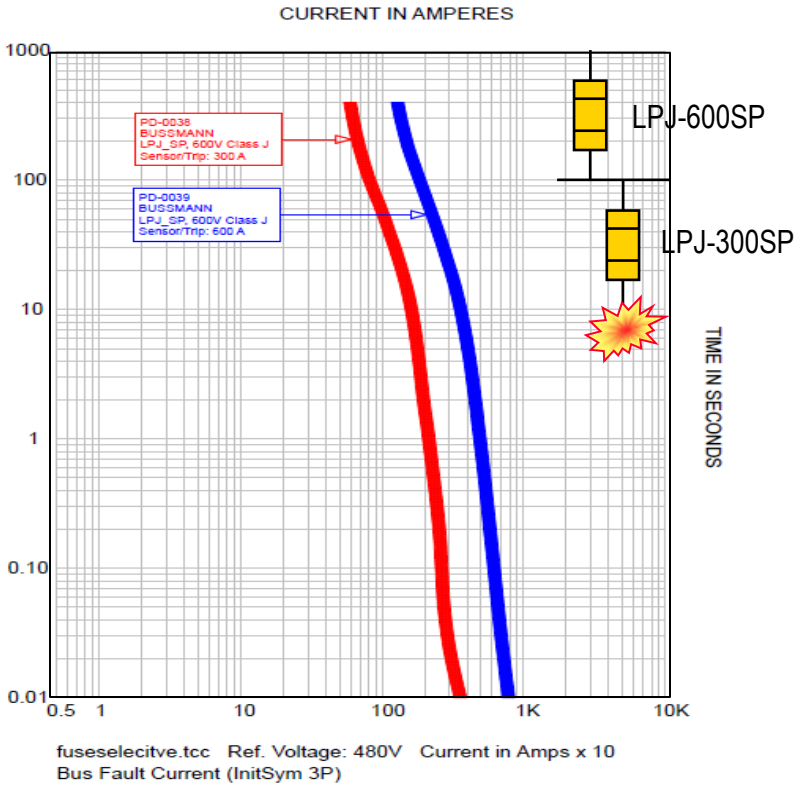
Selective coordination with fuses

Selectively coordinated or not?

- Are the devices selectively coordinated?



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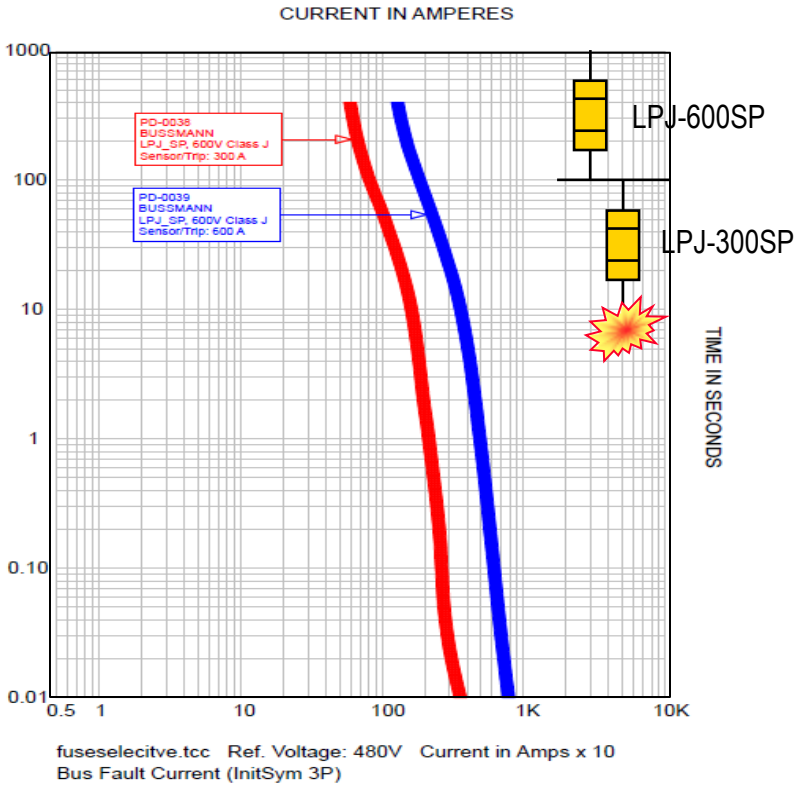
Selectively coordinated or not?

- Are the devices selectively coordinated?
- Depends on fuse type
- Yes – if using Low-Peak fuses and maintaining a 2:1 ratio
- No need to plot curves or calculate the available fault current



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Fuse selectivity ratio guide

Bussmann series fuse selectivity ratios

Circuit				Downstream / loadside fuse											
Amp rating range →				601-6000 A	601-4000 A	1-100 A	0-600 A			601-6000 A	0-600 A	0-1200 A	0-600 A	0-60 A	0-30 A
	Fuse type →			Time-delay	Time-delay	Time-delay	Dual-element, time-delay			Fast-acting	Fast-acting	Fast-acting	Fast-acting	Time-delay	
		Trade name (fuse class) →		Low-Peak (L)	Limitron (L)	CUBEFuse (CF^2)	Low-Peak (J)	Low-Peak (RK1)	Fusetron (RK5)	Limitron (L)	Limitron (RK1)	Limitron (T)	Limitron (J)	SC (G)	(CC)
			Bussmann fuse symbol	KRP-C_SP	KLU	TCF	LPJ-SP	LPN-RK-SP LPS-RK-SP	FRN-R FRS-R	KTU	KTN-R KTS-R	JJN JJS	JKS	SC	LP-CC FNQ-R KTK-R
Upstream / lineside fuse	601 to 6000 A	Time-delay	Low-Peak (L)	KRP-C-SP	2:1	2.5:1	2:1	2:1	2:1	4:1	2:1	2:1	2:1	2:1	2:1	2:1
	601 to 4000 A	Time-delay	Limitron (L)	KLU	2:1	2:1	2:1	2:1	2:1	4:1	2:1	2:1	2:1	2:1	2:1	2:1
	0 to 600 A	Dual-element	Low-Peak (RK1)	LPN-RK-SP LPS-RK-SP	—	—	2:1	2:1	2:1	8:1	—	3:1	3:1	3:1	4:1	2:1
	0 to 600 A	Dual-element	Low-Peak (J)	LPJ-SP	—	—	2:1	2:1	2:1	8:1	—	3:1	3:1	3:1	4:1	2:1
	0 to 100 A	Dual-element	CUBEFuse (CF^2)	TCF	—	—	2:1	2:1	2:1	8:1	—	3:1	3:1	3:1	4:1	2:1
	0 to 600 A	Dual-element	Fusetron (RK5)	FRN-R FRS-R	—	—	1.5:1	1.5:1	1.5:1	2:1	—	1.5:1	1.5:1	1.5:1	1.5:1	2:1
	601 to 6000 A	Fast-acting	Limitron (L)	KTU	2:1	2.5:1	3:1	3:1	3:1	6:1	2:1	2:1	2:1	2:1	2:1	2:1
	0 to 600 A	Fast-acting	Limitron (RK1)	KTN-R KTS-R	—	—	3:1	3:1	3:1	8:1	—	3:1	3:1	3:1	4:1	—
	0 to 1200 A	Fast-acting	Limitron (T)	JJN JJS	—	—	3:1	3:1	3:1	8:1	—	3:1	3:1	3:1	4:1	—
	0 to 600 A	Fast-acting	Limitron (J)	JKS	—	—	3:1	3:1	3:1	8:1	—	3:1	3:1	3:1	4:1	—
	0 to 60 A	Time-delay	SC (G)	SC	—	—	3:1	3:1	3:1	4:1	—	2:1	2:1	2:1	2:1	—

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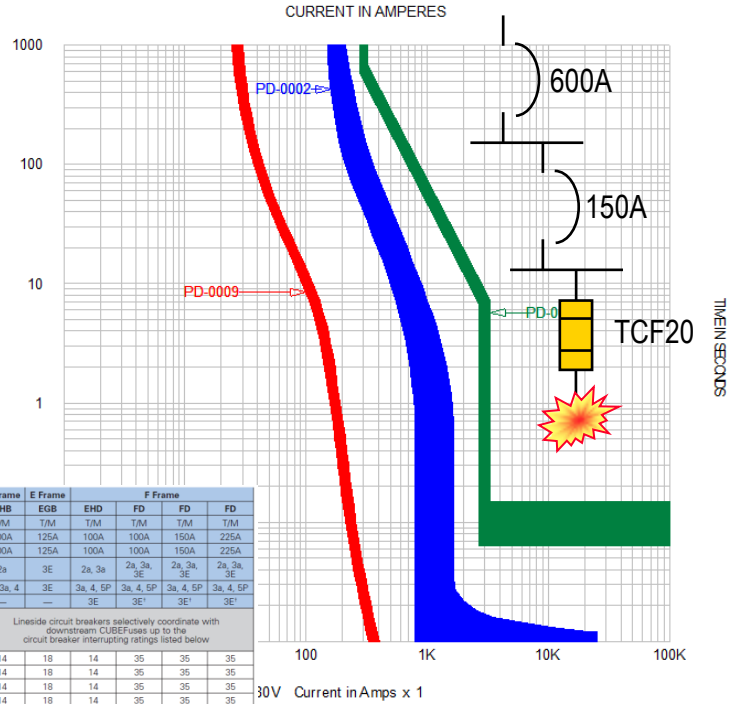
Selective coordination with fuses and circuit breakers

Fuses and circuit breakers

- Plot curves and calculate fault current
- Consult tables and tested combinations
- Analyze instantaneous pick up of upstream breakers – adjust settings
- Downstream branch fuses provide flexibility in designs



Upstream Breaker / Downstream Fuse	Frame Family	G Frame	E Frame	F Frame			
	Circuit Breaker Family	GHB	EGB	EHD	FD	FD	FD
	Trip Unit Type	T/M	T/M	T/M	T/M	T/M	T/M
	Minimum Amp Rating	100A	125A	100A	100A	150A	225A
	Maximum Amp Rating	100A	125A	100A	100A	150A	225A
	Pow-R-Line: Main	2a	3E	2a, 3a	2a, 3a, 3E	2a, 3a, 3E	2a, 3a, 3E
	Pow-R-Line: Branch	2a, 3a, 4	3E	3a, 4, 5P	3a, 4, 5P	3a, 4, 5P	3a, 4, 5P
	Pow-R-Line: Sub-Feed	—	—	3E	3E[1]	3E[1]	3E[1]
CUBEFuse (TCF/FCF)**				Lineside circuit breakers selectively coordinate with downstream CUBEFuses up to the circuit breaker interrupting ratings listed below			
Fuse amps	Fusible Panelboard: Main	Branch	Sub-Feed****				
15	QSCP with 30A switch***	QSCP	—	14	18	14	35	35	35
20		QSCP	—	14	18	14	35	35	35
25		QSCP	—	14	18	14	35	35	35
30		QSCP	—	14	18	14	35	35	35
35	QSCP with 60A switch***	QSCP	—	14	18	14	35	35	35
40		QSCP	—	14	18	14	35	35	35
50		QSCP	—	14	18	14	35	35	35
60		QSCP	—	—	18	—	—	35	35
70	QSCP with 100A switch***	QSCP	—	—	—	—	—	35	35
80		QSCP	—	—	—	—	—	—	35
90		QSCP	—	—	—	—	—	—	35
100		QSCP	—	—	—	—	—	—	35

* For circuit breakers with an adjustable instantaneous trip, selective coordination is based upon instantaneous trip set at maximum.

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Tested combinations of fuses and breakers

Upstream Breaker → / Downstream Fuse ↓	Frame Family	G Frame	E Frame	F Frame			
	Circuit Breaker Family	GHB	EGB	EHD	FD	FD	FD
	Trip Unit Type	T/M	T/M	T/M	T/M	T/M	T/M
	Minimum Amp Rating	100A	125A	100A	100A	150A	225A
	Maximum Amp Rating	100A	125A	100A	100A	150A	225A
	Pow-R-Line: Main	2a	3E	2a, 3a	2a, 3a, 3E	2a, 3a, 3E	2a, 3a, 3E
	Pow-R-Line: Branch	2a, 3a, 4	3E	3a, 4, 5P	3a, 4, 5P	3a, 4, 5P	3a, 4, 5P
	Pow-R-Line: Sub-Feed	—	—	3E	3E†	3E†	3E†

CUBEFuse (TCF/FCF)**				Lineside circuit breakers selectively coordinate with downstream CUBEFuses up to the circuit breaker interrupting ratings listed below					
Fuse amps	Fusible Panelboard								
	Main	Branch	Sub-Feed****						
15	QSCP with 30A switch***	QSCP	—	14	18	14	35	35	35
20		QSCP	—	14	18	14	35	35	35
25		QSCP	—	14	18	14	35	35	35
30		QSCP	—	14	18	14	35	35	35
35	QSCP with 60A switch***	QSCP	—	14	18	14	35	35	35
40		QSCP	—	14	18	14	35	35	35
50		QSCP	—	14	18	14	35	35	35
60		QSCP	—	—	18	—	—	35	35
70	QSCP with 100A switch***	QSCP	—	—	—	—	—	35	35
80		QSCP	—	—	—	—	—	—	35
90		QSCP	—	—	—	—	—	—	35
100		QSCP	—	—	—	—	—	—	35

* For circuit breakers with an adjustable instantaneous trip, selective coordination is based upon instantaneous trip set at maximum.

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Selective coordination compliance

- Design phase
  - Calculate available fault current at each overcurrent protective device
  - Choose basis of design that selectively coordinates for all times and all currents
- Approval phase
  - Verify any changes meet same the performance as BOD
  - Review third party power systems studies meet selective coordination requirements
- Construction phase
  - Verify proper installation, settings and ratings on all OCPDs

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Short-Circuit Current Ratings

Tyler Shewbert, P.E. (CA, NV, WA)
Field Application Engineer
Bussmann Division

Contact info:
Phone: 628 786-8620
Email: TylerShewbert@eaton.com

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Definitions versus Colloquialisms

Technical Definition	Colloquialisms
Interrupt Rating	AIC, ampere interrupting capacity, interrupting capacity, fault rating
Short-circuit current ratings	Withstand rating, bus bracing, short-circuit withstand

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Interrupt Rating

Interrupting rating

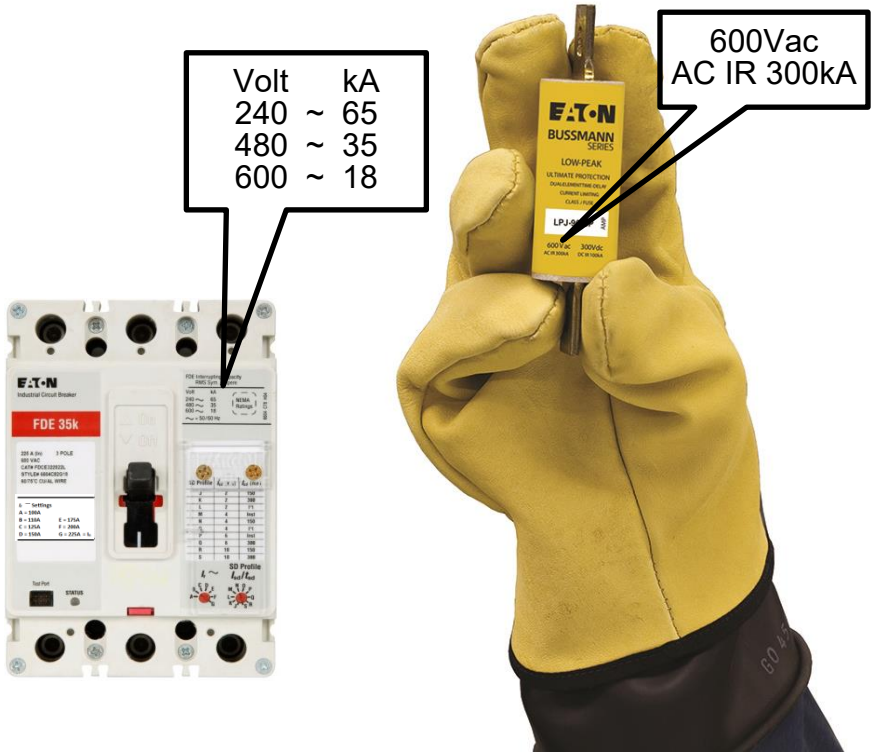
NEC Article 100 Definition

Interrupting Rating. The highest current at rated voltage that a device is identified to interrupt under standard test conditions.

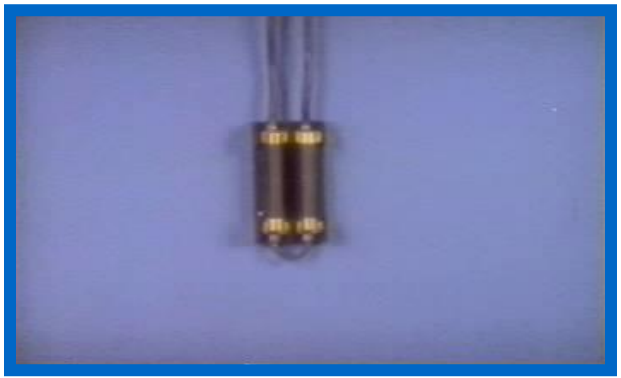
NEC Requirement

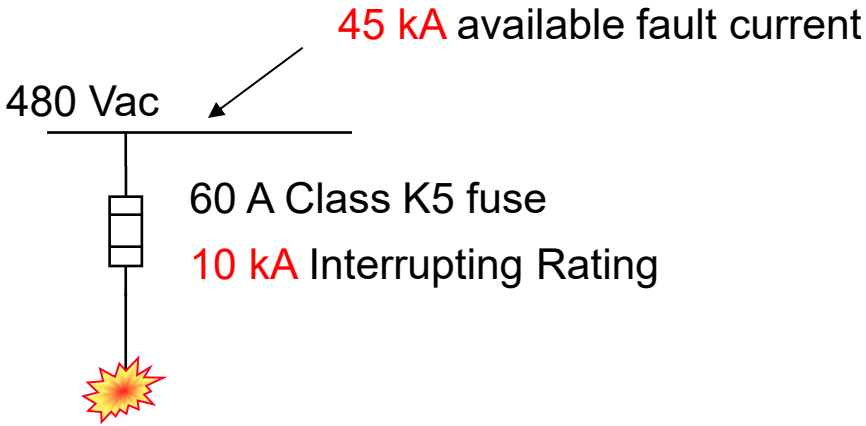
110.9 Interrupting Rating. Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage at least equal to the current that is available at the line terminals of the equipment.

- The highest current a fuse or breaker can *safely* interrupt – self protection rating
- Must be equal to or greater than the available fault current at the line terminals



Importance of interrupting rating





Violates NEC 110.9 and OSHA 1910.303(b)(4)

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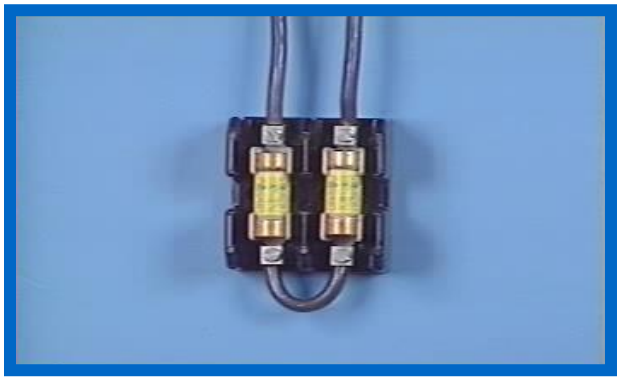
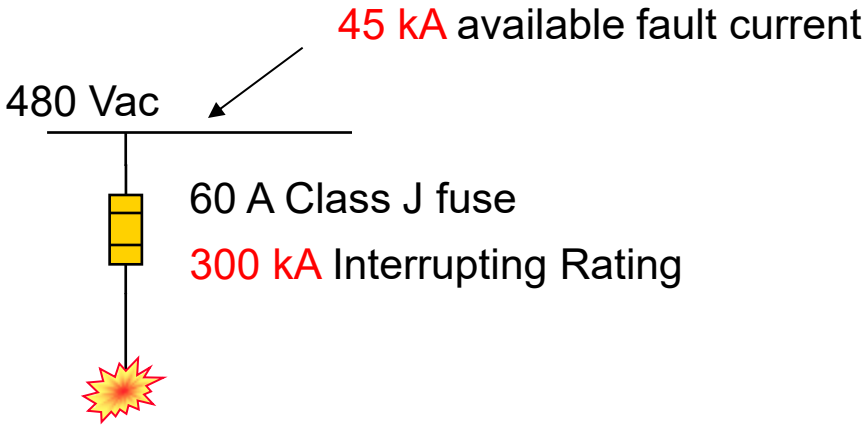
Still photos of misapplication

Interrupting rating – proper application





Complies with NEC 110.9 and OSHA 1910.303(b)(4)

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Short-Circuit Current Rating (SCCR)

SCCR is not interrupting rating

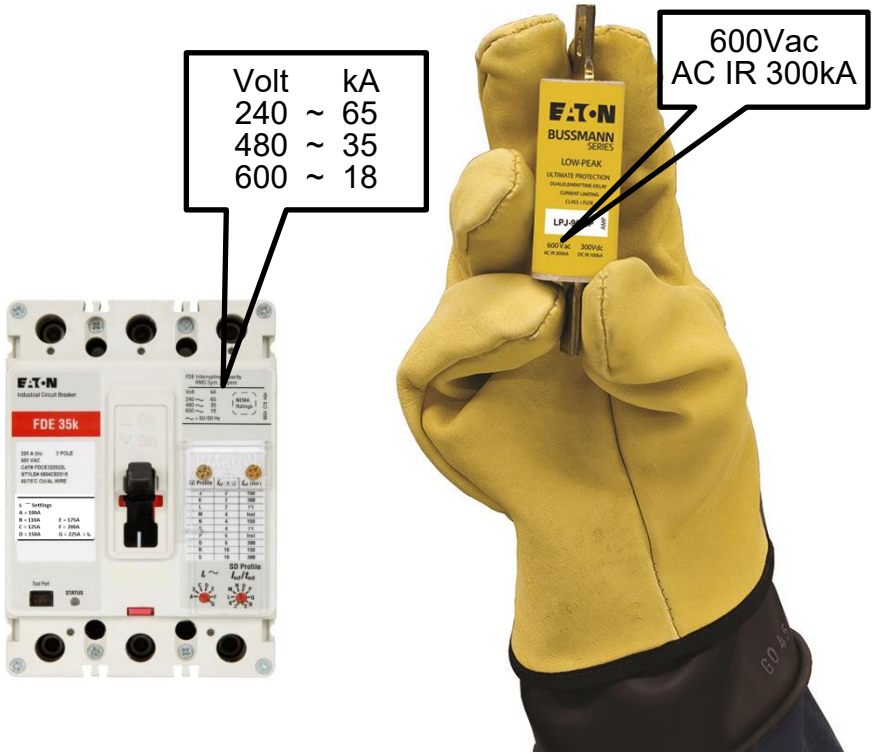
NEC Article 100 Definition

Interrupting Rating. The highest current at rated voltage that a device is identified to interrupt under standard test conditions.

NEC Requirement

110.9 Interrupting Rating. Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage at least equal to the current that is available at the line terminals of the equipment.

- The highest current a fuse or breaker can *safely* interrupt – self protection rating
- Must be equal to or greater than the available fault current at the line terminals

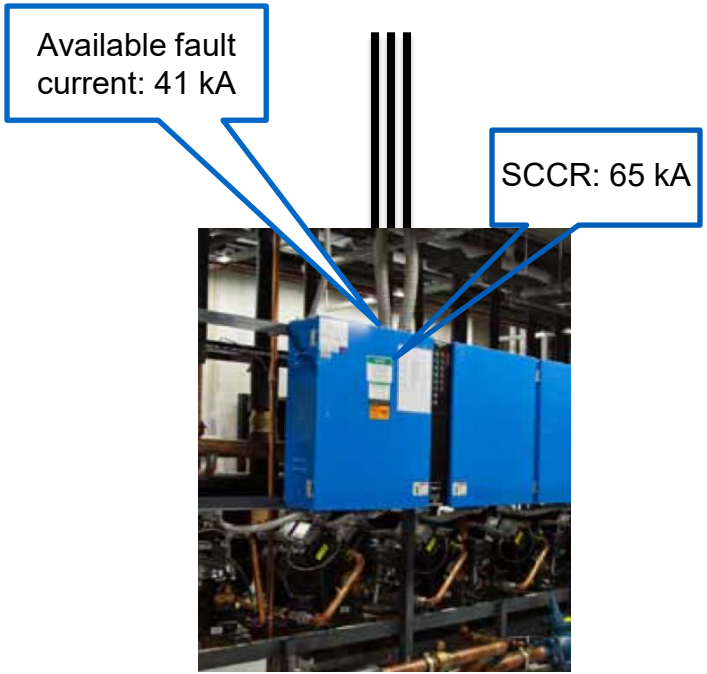


Key requirement for SCCR

NEC Requirement

110.10 Circuit Impedance & Other Characteristics. The overcurrent protective devices, the total impedance, the component short-circuit current ratings, and other characteristics shall be selected and coordinated to permit the circuit-protective devices used to clear a fault to do so without extensive damage to the electrical components of the circuit.

- OCPDs and SCCR must be *“selected and coordinated”*
- OCPDs must clear fault without extensive damage
- SCCR applies to the device or equipment



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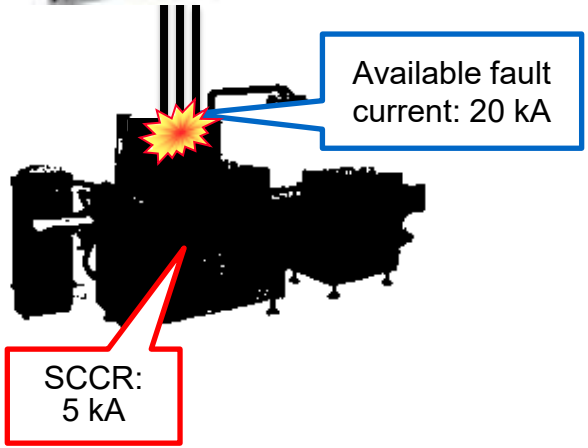
What is short-circuit current rating?

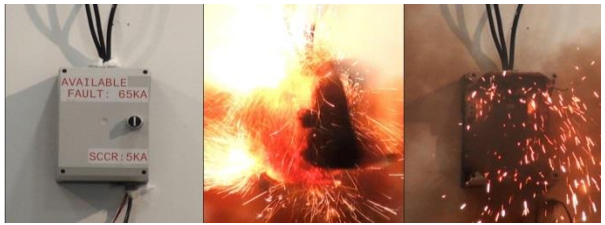


NEC Article 100 Definition

Short-Circuit Current Rating. The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptable criteria.

Hazards of insufficient SCCR

- *Shock:* Enclosure becomes energized from conductors pulling away from terminations
- *Fire:* Explosive power blows off door exposing flames and molten metal to exterior
- *Projectile (shrapnel):* Enclosure door explosively blows open emitting failing device debris



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SCCR is a safety issue

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A serious misapplication

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SCCR marking requirements

California Electrical Code Section	Equipment type
408.6	*Panelboards, switchboards, switchgear*
409.110(A)	Industrial control panels
430.8	Motor controllers
430.98	Motor control centers
440.4(B)	*Air Conditioning and refrigeration equipment*
620.16(A)	*Elevator control panel*
670.3(A)(4)	Industrial machinery
700.5(E), 701.5(D), 702.5, 708.24(E)	*Equipment transfer switches*

Red italic text indicates 2017 change

Blue Italic text indicates 2020 change

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Available fault current requirements

California Electrical Code Section	Equipment type
110.24	*Service entrance equipment* (mark/document)
408.6	*Panelboards, switchboards and switchgear* (mark)
409.22(B)	*Industrial control panels* (document)
430.99	*Motor control centers* (document)
440.10(B)	*Air Conditioning and refrigeration equipment (document)*
620.51(D)(2)	*Elevator control panel (mark)*
670.5(2)	*Industrial machinery* (mark)

Red italic text indicates 2017 change

Blue Italic text indicates 2020 change

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408.6 Short-Circuit Current Rating

408.6 Short-Circuit Current Rating.

Switchboards, switchgear, and panelboards shall have a short-circuit current rating not less than the available fault current. In other than one- and two-family dwelling units, the available fault current and the date the calculation was performed shall be field marked on the enclosure at the point of supply. The marking shall comply with 110.21(B)(3).

408.6 Short-Circuit Current Rating

COOPER Bussmann

Quik-Spec™ Coordination Panelboard

Panel Voltage	600 Vac	Panel Amps	200 A		
System Voltage	480 / 277 Vac	Phase	3	Wire	4Y
Short-Circuit Current Rating	200 kA	Neutral Amps	200 A		
Date Code	AM4210	Enclosure Type	NEMA 1		
Negotiation Number		Panel ID Number	P0001		

3A1063 R2

EATON BUSSMANN SERIES

FC² available fault current calculator

Project Name:	Corner Mall - Unit 1
Fault Name:	X2
System:	Three-Phase
Avail. Fault Current L-L-L (Amps):	52,509
Voltage L-L (Volts):	480
Calculation Performed On:	Sep 1, 2016 @ 4:53pm

Calculation performed via Eaton's Bussmann Series Available Fault Current Calculator v1.5

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408.6 Short-Circuit Current Rating

- SCCR not marked on nameplate
- May need to remove covers and deadfronts to identify circuit breaker interrupting rating
- SCCR equals lowest rated IR of CB installed (fully rated)
- May be series rated

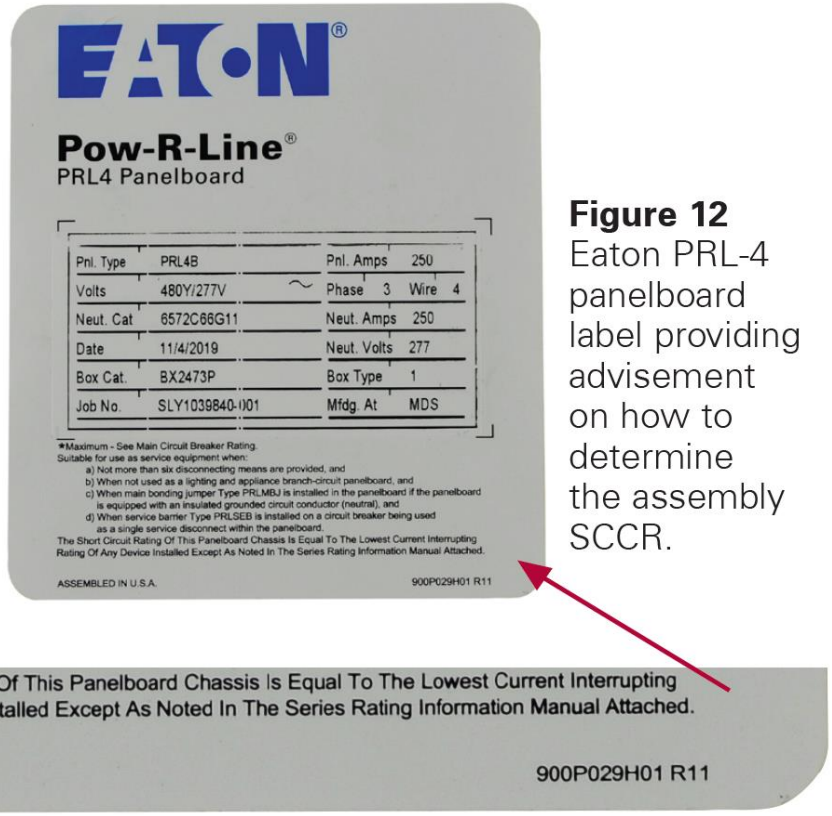
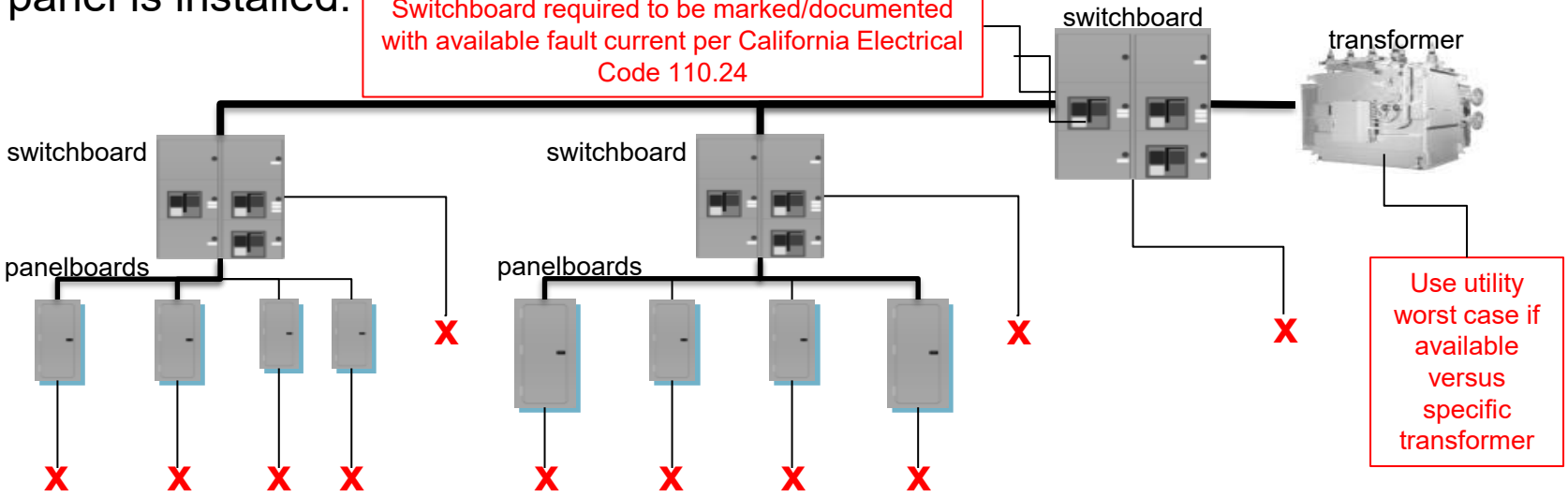


Figure 12
Eaton PRL-4 panelboard label providing advisement on how to determine the assembly SCCR.

How much SCCR is necessary?

Equipment short-circuit current rating must be equal to or greater than the available short-circuit current at the location where the control panel is installed.



All Switchboards, Switchgear & Panelboards required to be field marked with the available fault current per 2020 California Electrical Code 408.6

X = machine/equipment location

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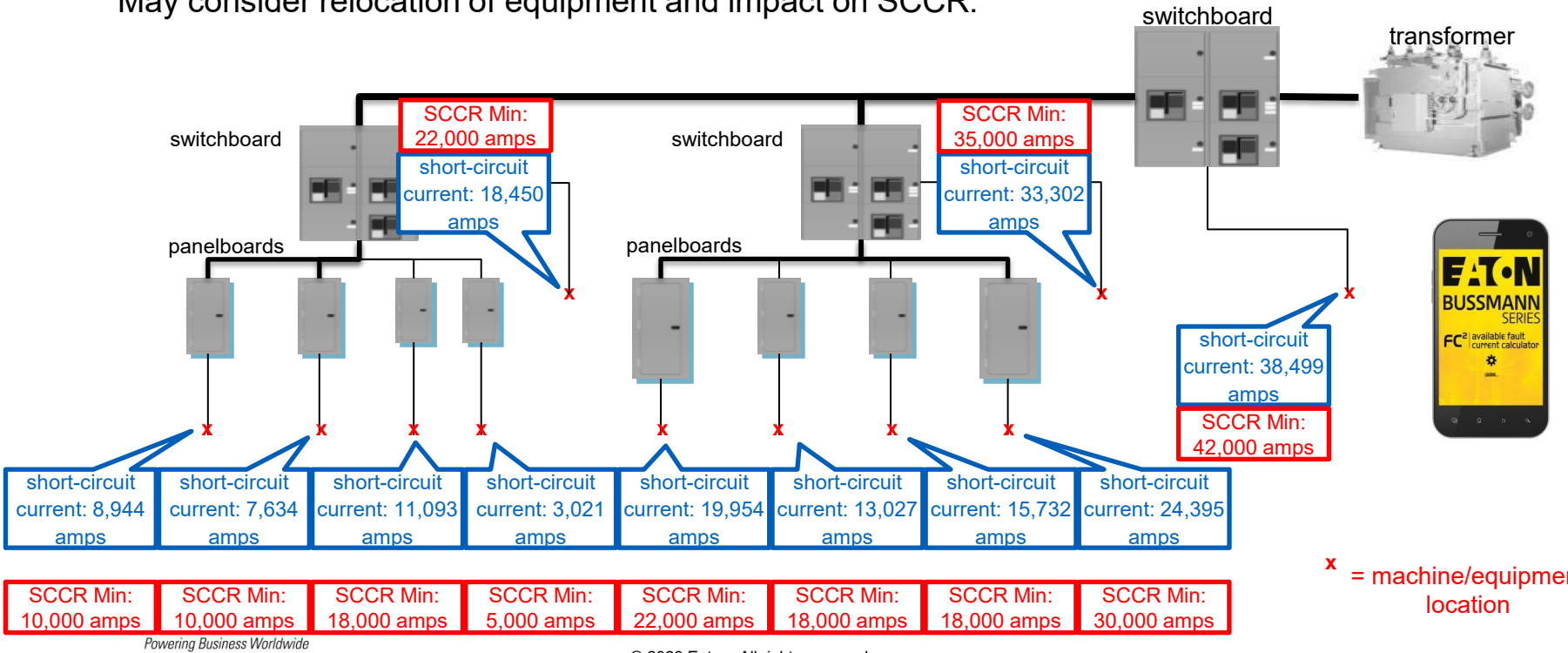
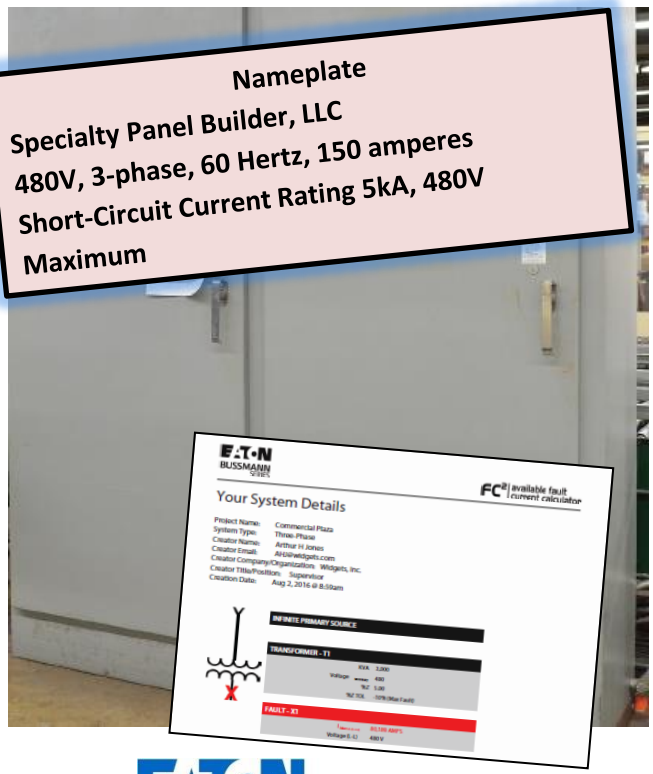
Setting an SCCR requirement

SCCR is based on the available fault current of each machine (use FC^2).
May consider relocation of equipment and impact on SCCR.



409.22 Short-Circuit Current Rating



(A) Installation.

An industrial control panel shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 409.110(4).

(B) Documentation.

If an industrial control panel is required to be marked with a short-circuit current rating in accordance with 409.110(4), the available fault current at the industrial control panel and the date the available fault current calculation was performed shall be documented and made available to those authorized to inspect, install, or maintain the installation.

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430.98/99 Motor Control Center

430.98 Marking

(A) Motor Control Centers.

Motor control centers shall be marked according to 110.21, and the marking shall be plainly visible after installation. Marking shall also include common power bus current rating and motor control center short-circuit current rating.

430.99 Available Fault Current

The available fault current at the motor control center and the date the available fault current calculation was performed shall be documented and made available to those authorized to inspect, install, or maintain the installation.

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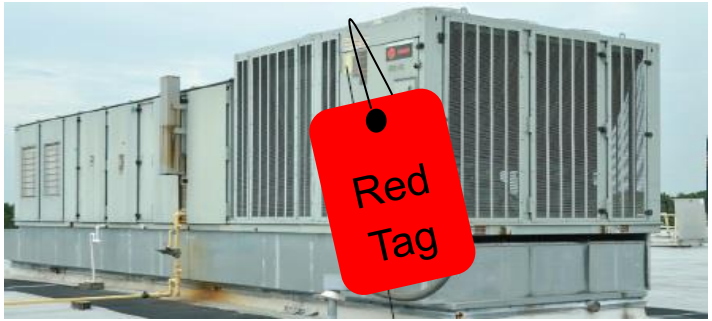
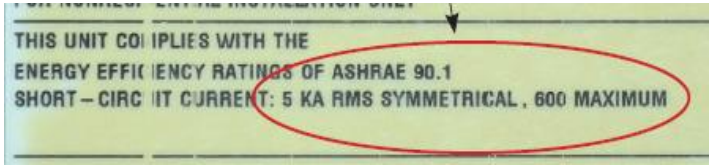
440.10 Short-Circuit Current Rating





Summary of Short-Circuit Current Study for Ernest Operations, Inc.
January, 23, 2017
By Fred Byrd
The calculations are on the pages following this summary table

Equipment Designation	Available Short-Circuit Current amps rms sym.
Service Equipment	45,340
Motor Control Center 1	30,600
HVAC Rooftop — North	13,700
HVAC Rooftop — South	9,980

(A) Installation.

Motor controllers or industrial control panels of multimotor and combination-load equipment shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 440.4(B).

(B) Documentation.

When motor controllers or industrial control panels of multimotor and combination-load equipment are required to be marked with a short circuit current rating, the available fault current and the date the ~~short~~ available fault current calculation was performed shall be documented and made available to those authorized to inspect, install, or maintain the installation.

620.16 Short-Circuit Current Rating

620.16(A) Marking.

Where an elevator control panel is installed, it shall be marked with its short-circuit current rating, based on one of the following:

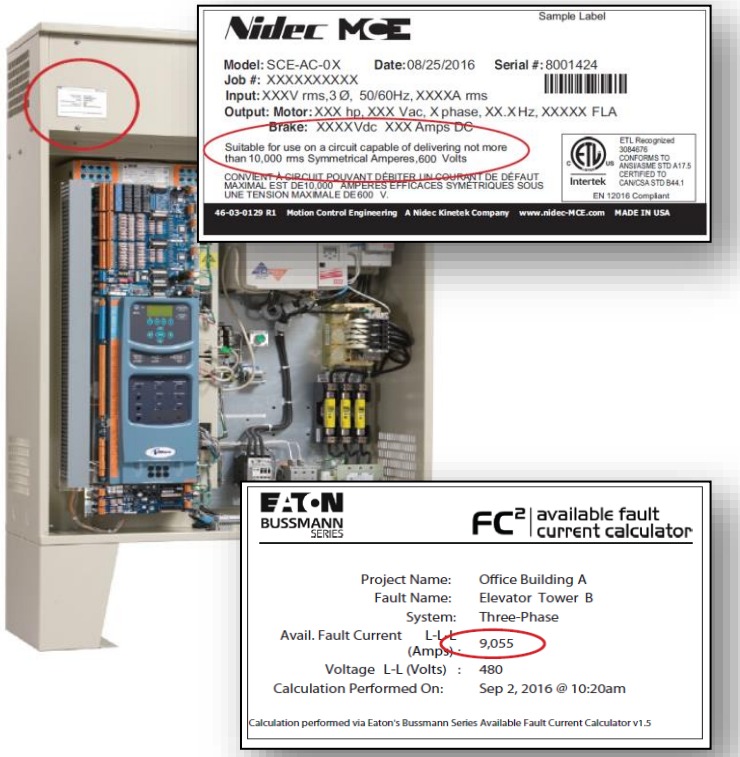
(1) Short-circuit current rating of a listed assembly

(2) Short-circuit current rating established utilizing an approved method

Informational Note: UL 508A-2013, *Standard for Industrial Control Panels*, Supplement SB, is an example of an approved method.

620.16(B) Installation.

The elevator control panel shall not be installed where the available fault current exceeds its short-circuit current rating, as marked in accordance with 620.16(A).



Equipment and nameplate photos courtesy of MCE

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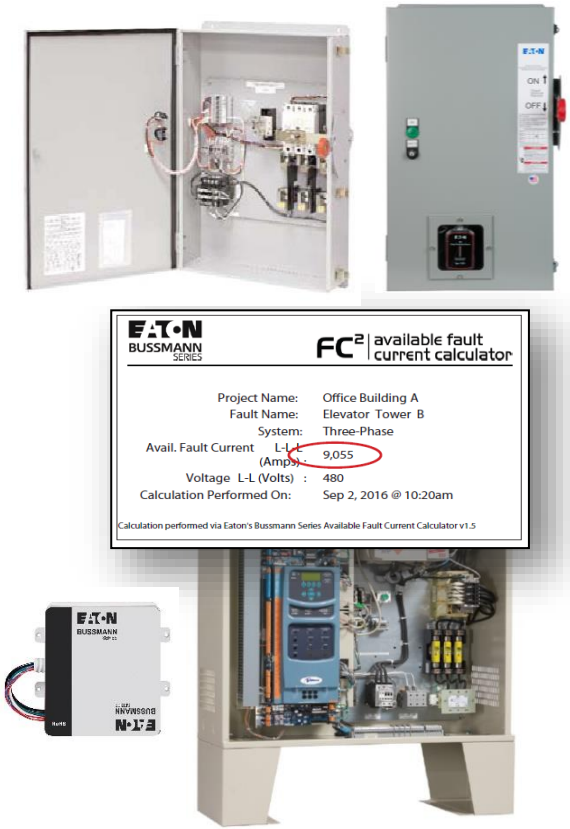
620.51 Disconnecting Means

(A) Type The disconnecting means shall be an enclosed externally operable fused motor circuit switch or circuit breaker that is lockable only in the open position in accordance with 110.25. The disconnecting means shall be a listed device. Informational Note: For additional information, see ASME A17.1- ~~2013~~2016/CSA B44-~~13~~16, Safety Code for Elevators and Escalators. Exception No. 1: ... Exception No. 2: ...

(D) Identification and Signs (2) Available Fault Current Field Marking. Where an elevator control panel is used, it shall be legibly marked in the field with the available fault current at its line terminals. The field marking(s) shall include the date the available fault current calculation was performed and be of sufficient durability to withstand the environment involved. When modifications to the electrical installation occur that affect the available fault current at the elevator control panel, the available fault current shall be verified or recalculated as necessary to ensure the elevator control panel's short-circuit current rating is sufficient for the available fault current at the line terminals of the equipment. The required field marking(s) shall be adjusted to reflect the new level of available fault current.

(E) Surge Protection. Where any of the disconnecting means in 620.51 has been designated as supplying an emergency system load, a legally required system load, or a critical operation power system load, listed surge protection shall be provided.



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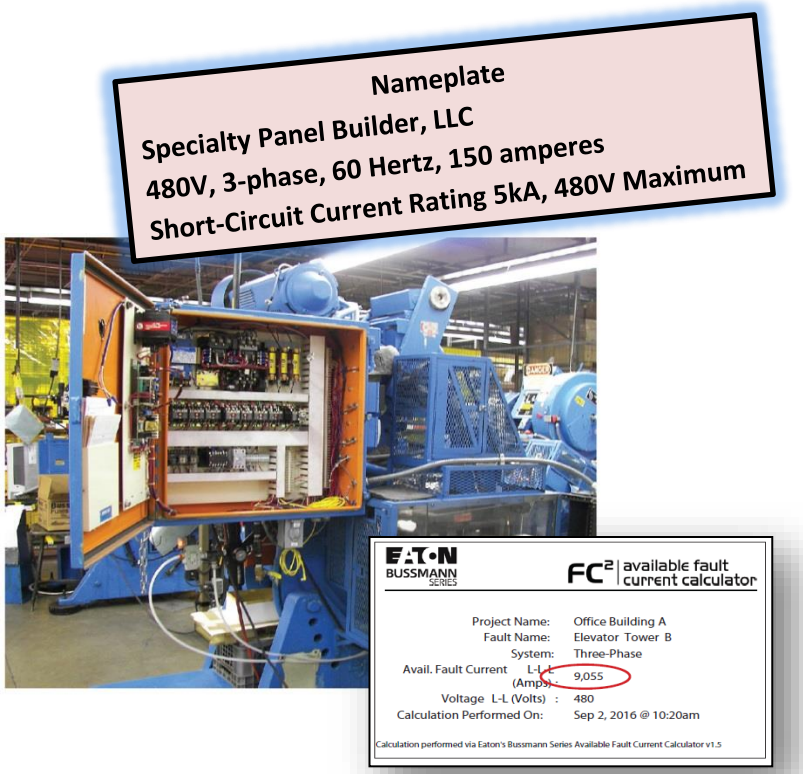
670.5 Short-Circuit Current Rating.



(1) Industrial machinery shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 670.3(A)(4).

(2) Industrial machinery shall be legibly marked in the field with the fault current. The field marking(s) shall include the date the available fault current calculation was performed and be of sufficient durability to withstand the environment involved.

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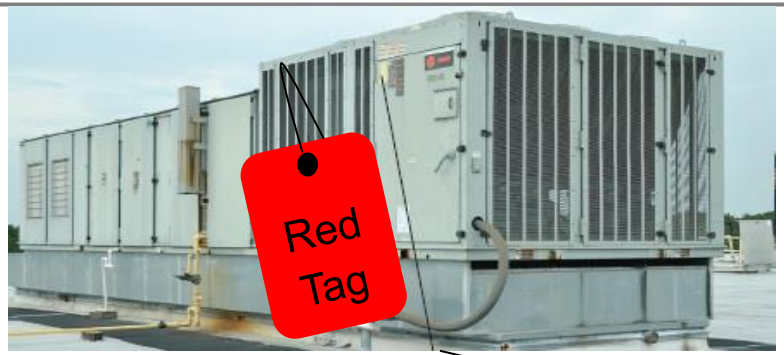
Methods to fix inadequate equipment SCCR

Field issues after installation

- Install transformer
- Increase conductor length
- Field evaluation and equipment modification
- Install current-limiting fuses where permitted per the AHJ. In this application, if overcurrent devices are present, they must have an interrupting rating equal or great to the calculated available fault current.



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