HCAI PIN 70 - Electrical Coordination

Webinar Questions and Answers

March 23, 2022

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1. **UCSF facilities under HCAI jurisdiction are typically mix of multiple electrical systems manufactured by GE, Eaton, and Square D. I would say 30 percent old GE and all the new design are based on Eaton or Square D. What is the approach at the point of marrying two dissimilar power systems together? For instance, the upstream is old GE and the new downstream are Eaton? Do we need to replace all the GE upstream distribution panel, paralleling gear, power circuit breaker to provide full coordination OR we can make exception and only localize the miscoordination?**

   Answer: OCPD electrical coordination does not require new and existing electrical distribution equipment to be sourced from the same manufacturer. It is very common for electrical distribution equipment to be a mix of multiple manufacturers. Coordination software systems have comprehensive libraries containing protective devices from all popular equipment manufacturers to allow coordination to be evaluated in electrical systems with a mixture of manufacturers' equipment. Furthermore, only new OCPDs and the existing OCPD one level up and one level down from new OCPDs are required to coordinate. Coordination does not need to be evaluated for the remaining OCPDs in the existing electrical system. See HCAI PIN 70 for more details and examples.

   Per PIN 70, all new work where OCPDs are being added to an existing essential electrical system will require these new OCPDs to coordinate with each other and the existing OCPDs at the point of connection. Please see Figure 7 in PIN 70, which applies to your question.

2. **Due to impossibility or at the bright side of extreme difficulty of coordination dissimilar manufactured breakers like coordinating GE with Eaton etc., don't you think PIN 70 causes monopolization in each facility and won't provide free competing environment for other vendors? For instance, when GE breakers only get coordinated with GE and not Eaton, no chance for the Owner to have new design based on Eaton and have to stick with GE or perform a major power system upgrade from GE to Eaton.**

   Answer: OCPD electrical coordination does not require new and existing electrical distribution equipment to be sourced from the same manufacturer. It is very common for electrical distribution equipment to be a mix of multiple manufacturers. Coordination software systems have comprehensive libraries containing protective devices from all popular equipment manufacturers to allow coordination to be evaluated in electrical systems with a mixture of manufacturers' equipment.

3. Is there still overlap in the red and green breakers on page 12?

Answer: Correct. There is overlap in the red and green breakers on Page #12 slide titled "The right type of circuit breaker is important." Page #12 slide did not provide enough information to interpret the time current curves. The purpose of Page #12 is to demonstrate that the correct type of 400A circuit breaker needs to be specified for the electrical system to coordinate. HCAI apologizes for the confusion.

Here is the interpretation for two graphs shown on Page #12. Both graphs have three time-current curves (TCCs) representing three circuit breakers. The blue TCC represents a 400A circuit breaker downstream of a transfer switch. In the figure on page #11, this 400A circuit breaker would be OCPD #5. The red TCC represents a 1200A circuit breaker for the normal side feeder to the transfer switch. In the figure on page #11, this normal side 1200A circuit breaker would be OCPD #3. The green TCC represents a 1200A circuit breaker for the emergency side feeder to the transfer switch. In the figure on page #11, this emergency side 1200A circuit breaker would be OCPD #4. Since the red and green TCCs represent the normal and emergency transfer switch feeders circuit breakers, these circuit breakers are not required to coordinate, and their TCCs are allowed to overlap. However, the 400A circuit breaker needs to coordinate with both upstream circuit breakers. The graph on the left demonstrates that the 400A circuit breaker does not coordinate with the upstream 1200A circuit breakers. The coordination problem is corrected using a 400A circuit breaker with an electronic trip unit as shown in the graph on the right.

4. For electrical tenant improvement which adds a circuit breaker for a new branch circuit to an existing essential electrical system panel, the coordination is only required through the breaker directly upstream or is the coordination required beyond that?

Answer: The coordination study must demonstrate coordination between the new OCPD and the existing OCPD directly upstream. The coordination study does not need to evaluate OCPDs further upstream. See page 33 in the presentation and Example A in PIN 70.

5. If we find a spare breaker in existing panel does not coordinate with the upstream breaker, will we be required to upgrade all similar breakers in the panel or only the breakers being modified?

Answer: Only the new work needs to demonstrate compliance with coordination requirements. The new work in this question is a new branch circuit connected to an existing spare circuit breaker. If the spare circuit breaker associated with the new branch circuit does not coordinate to the existing system, then a different circuit breaker that coordinates would need to be used. The remaining existing circuit breakers used for existing electrical circuits do not need to be upgraded per HCAI CAN 2-102.6 Remodel.

6. **Newbie to coordination studies question: why is it ok for the instantaneous sections to overlap?**

   Answer: Allowing overlap of the time-current curves below 0.1 second (i.e., instantaneous region) for essential electrical system's OCPD is a compromise introduced in NFPA 99. NFPA 99 annex states, "It is important that the various overcurrent devices be coordinated, as far as practicable, to isolate faulted circuits and to protect against cascading operation on short-circuit faults. In many systems, however, full coordination could compromise safety and system reliability. Primary consideration also should be given to prevent overloading of equipment by limiting the possibilities of large current inrushes due to instantaneous reestablishment of connections to heavy loads." Please see coordination discussion in the NFPA 99 handbook for additional information.

   It should be noted that other systems in the CEC, like elevators supplied by a common feeder require selective coordination for the full range of available overcurrents.

7. **Often the existing circuit breaker information is hidden by panelboard and/or switchboard enclosures. To get at this information may require removing covers that may be too dangerous to remove while live. How do we address this situation to determine coordination?**

   Answer: HCAI understands the challenges of obtaining information on a "live" electrical system, but the existing circuit breaker information must be collected to evaluate coordination for new work during the design phase. The design professional will need to work with the facility to safely collect this information. Electrical outages approved by Licensing may be required to perform this work.

8. **Does signing of the study mean including the PE stamp and signature or only the submittal review stamp?**

   Answer: Per CAC 7-115(b), EEOR shall affix their PE stamp and sign the coordination study prepared under their charge.

9. **Can you speak to designs where loads are added to existing circuits? For example, receptacles being added to a circuit that already has 2 receptacles.**

   Answer: Adding receptacles, luminaires, FSD, etc., to an existing branch circuit would not require coordination to be evaluated because no OCPD is being added to the electrical system.

10. **Regarding manufacturer coordination tables: many of these tables indicated coordination of just the instantaneous trips (not relevant to 0.1 sec coordination) and do not indicate coordination of long time and short time functions.**

    Answer: Understood. However, HCAI does not want to exclude the use of the manufacturer's coordination tables if they are available. HCAI would require the manufacturer's coordination tables to demonstrate coordination for the necessary time period. That is, period of time that a fault's duration extends beyond 0.1 seconds for essential electrical systems and period of time from available fault current to overload for other systems requiring selective coordination.

11. **I am assuming if third party firm prepares the coordination study, that firm's engineer will need to be added as a delegate to the project. Please confirm.**

    Answer: It is unnecessary to add the third-party firm as a delegate to the project. The EEOR is responsible for the electrical design including electrical coordination.

12. **If you are replacing fluorescent lights with lower wattage LED type fixtures and are utilizing the existing branch circuit, do you need to show coordination for the existing branch circuit?**

    Answer: No. Relamping luminaires or replacing luminaires are replacements of utilization equipment. OCPD is not being affected by this work, so coordination is not required to be evaluated per PIN 70.

13. **What if I have a small project where I'm adding a single 20 amp branch circuit, however it becomes obvious the existing system does not coordinate (e.g., there are other 20 amp existing circuits in the same panelboard), does HCAI expect the whole existing system to be upgraded, such that the final 20A circuit can be added (and coordinate)?**

    Answer: The new 20A branch circuit OCPD must coordinate with the existing next-level OCPD. If the new 20A OCPD will not coordinate with the existing next-level OCPD, the EEOR needs to develop a solution to meet coordination requirements. See Example A in PIN 70. The design will not need to address coordination of existing OCPD's that feed existing circuits.

14. **Would that exception apply if the 50A fuse was a smaller size, but still in series?**

    Answer: CEC 517.31(G), Exception No. 2 shown on Page #14 states the same size in series. However, HCAI would not require electrical coordination between the 50A circuit breaker in series with a smaller fuse. The opening of either OCPD would remove power from Equipment 'M', so the equipment outage is the same.

15. **Would a feed thru panel be consider in series and would not be required to coordinate?**

    Answer: A downstream electrical panel without a main OCPD connected to an upstream panel by feed-through lugs would be considered electrically continuous with each other since there is no OCPD between these electrical panels. Essentially, they are the same electrical panel from a power flow perspective, and both electrical panels are supplied by the same feeder and protected by the same upstream OCPD. All OCPD supplying downstream loads in these panels must coordinate with the upstream OCPD.

16. **If I provide a coordination study for another EEOR. Will I need to sign a VCR or just the EEOR?**

    Answer: Only the EEOR signs the verified compliance report (VCR). See CAC 7-151.

17. **Are individual 20A/1P breakers within a panelboard required to coordinate with the main breaker of the panel or the upstream subfeed breaker if panel is main lugs only?**

    Answer: Yes. Please see page #20 of the presentation and examples A and B in PIN 70.

18. **If we are adding new loads but utilizing existing spare breakers, is a coordination study required?**

    Answer: Yes. Please see Example C in PIN 70.

19. **Are all product submittals such as panelboards, switchboards, breakers, fuses, to be included with the coordination study to HCAI for review and approval?**

    Answer: No. Product submittals are not required to be part of the coordination study. See page #24 of presentation for a list of items needed to be in a coordination study.

20. **Slide 13 - define a set of breakers vs a "tree" of breakers with distribution.**

    Answer: 517.31(G), Exception 1 states, "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." The term "only one...set of overcurrent devices" describes a transformer's secondary feeder protected by a set of fuses. This definition matches the left figure on page #13 of the presentation, and it does not describe multiply loads connected to the transformer's secondary as shown on the right figure.

21. **TIO Section B, EES coordination study testing... Can these tests be performed off site or after equipment installation or both? Also, should the testing agency be listed on the TIO as the responsible party?**

    Answer: The purpose of the EES coordination study testing is to verify that the installed OCPDs match the equipment listed in the coordination study and adjustable circuit breakers are set to the settings listed in the coordination study. Therefore, the “test” is a visual verification conducted in the field.

    The EEOR or a third-party testing agency needs to be listed as the responsible party on the TIO. The IOR by default needs to verify the work performed. The IOR will not be listed as the responsible person on the TIO.

22. **How far upstream is coordination required when you are modernizing an existing electrical system.? For instance, adding a new OCPD to an existing legacy system.**

    Answer: All new work where OCPD's are added to an existing essential electrical system will require these new OCPDs to coordinate with each other and with the existing OCPDs at the point of connection. HCAI only requires a coordination study to demonstrate electrical coordination to the next-level existing OCPD. See PIN 70 for additional information.

23. **Is a coordination study required for temporary power OCPDs?**

    Answer: Yes, if new OCPDs are added to connect temporary power to the existing essential electrical system. There is an allowance in PIN 70 for temporary generators. Per PIN 70 EES Item 14, it is acceptable to match the size of OCPD in the existing permanent generator and not be required to evaluate coordination.

24. **For the TIO (B-E18 Essential Electrical System Coordination Study), to satisfy that line item, do we show the Compliance Officer the approved electrical coordination study? Is the responsible agency/individual the EEOR (or qualified person) that prepared the study? What is expected of the IOR?**

    Answer: The EEOR needs to be listed as the responsible in charge or third-party tester. The IOR by default needs to verify and is not listed as responsible person on the TIO.

25. **Do we need to show available fault current on our TCC's? What if it coordinates in all ranges already?**

    Answer: Showing the available fault currents on TCCs are not required for essential electrical systems.

26. **Per PIN 70 - Example C require to provide coordination for existing spare breaker. Does it require coordination for 20 amp – 1pole branch breaker?**

    Answer: Yes. Please see page #20 of the presentation.

27. **Sometime circuit breaker TCC Curves have small overlaps with upstream circuit breaker. How will HCAI deal with this? This situation means majority of the time, breaker will coordinate but, in some cases, it is a race between downstream and upstream?**

    Answer: TCCs for the essential electrical system OCPDs that are required to coordinate shall have no overlap of time current curves for faults that last 0.1 second or more. Also, there shall be no overlap of time current curves for the full range of available overcurrents for OCPDs required to meet selective coordination requirements.

28. **There are a lot of existing breakers that do not have setting adjustment. How should coordination CAN be accomplished if there is no adjustment?**

    Answer: Electrical coordination is a code requirement, and the new work must meet these requirements. It is crucial to investigate electrical coordination during design phase. If the new OCPD will not coordinate with the existing OCPD at the point of connection, the EEOR needs to develop a solution to meet coordination requirements.

29. **Does HCAI consider using fuse in lieu of circuit breaker in order to provide proper coordination? This will create more unsafe conditions for patient in hospital in order to restore power due to require fuse replacement.**

    Answer: HCAI enforces the California Building Standards Code. The code does not restrict the use of fuses in an electrical design. It is left to the EEOR to develop the best solution for meeting code requirements and the customer's needs.

30. **Are there any differences in the requirements for the Hospitals and SNFs?**

    Answer: There are different code requirements for Type 1 ESS (Hospitals) and Type 2 ESS (SNFs), but both systems need to meet 0.1 seconds coordination.

31. **What if you are adding a new circuit breaker to an existing system and the existing circuit breakers are old and trip curves are not available. How do we address this?**

    Answer: HCAI understands it can be challenging to obtain data, but the new work must meet the coordination requirements.

32. **It was mentioned EEOR must stamp/sign coordination study. If coordination study is performed as DSI, the "EEOR" would be the electrician's engineer, not the design team's engineer, correct?**

    Answer: Incorrect. HCAI understands third-party electrical engineers like the "electrician's engineer" may assist the EEOR (i.e., design team's engineer) in developing the coordination study. Still, the EEOR is responsible for the electrical design, including electrical coordination. CAC 7.115(B) requires the EEOR to seal and stamp the report.

33. **Does a non-segregated emergency branch with a dedicated ATS fall under these categories?**

    Answer: Yes, a non-segregated emergency branch in a healthcare facility is treated the same as a segregated essential electrical system. 0.1 second coordination is required when a new OCPD is added or an existing spare OCPD is repurposed on a non-segregated emergency branch.

34. **Is coordination required if we are adding load to existing CB?**

    Answer: Adding receptacles, luminaires, FSD, etc. to an existing branch circuit would not require coordination to be evaluated because no OCPD is being added to the electrical system.

35. **Example critical panel board, we are adding receptacle to existing branch circuit.**

    Answer: Coordination study is not required if adding a receptacle to existing critical branch circuit.

36. **When adding new OCP on an existing, fully coordinated system for new equipment, how many levels of coordination must be shown on the reports for the new installation? Will it be all the way back to the service main, up to the nearest OCP, or some level in between the two?**

    Answer: Coordination study would need to show coordination between the new OCPD and the existing OCPD directly upstream and/or downstream of the new OCPD.

37. **If a double conversion UPS system is inserted between two series connected OCPs (e.g., Feeder breaker and main breaker on sub-panel), does the feeder breaker still need to maintain downstream coordination with the breakers in the sub-panel even if the feeder breaker is directly isolated by the UPS?**

    Answer: No, the existing feeder breaker that is connected to the new UPS does not have to coordinate with sub-panel breakers. However, the UPS circuit breaker feeding the sub-panel would need to coordinate with the sub-panel's circuit breakers.

38. **Could you confirm that when using existing spare CB's, those spare CB's must be included in the study?**

    Answer: Yes.

39. **I have a 100A main breaker in Panel 2EC in series with a new 100A feeder breaker in Panel 2EA. Does 100A main breaker in Panel 2EC have to coordinate with the upstream breaker in Panel 2EA? Technically, I don't think it has to. If the first breaker in series coordinates with upstream breaker, it will always trip first if the fault happens downstream of that breaker. Therefore, no tripping on any unnecessary branches will occur.**

    Answer: You are correct. Only the new 100A feeder breaker in Panel 2EA would have to coordinated with upstream main circuit breaker in Panel 2EA. Your question has identified an error in Example B in PIN 70 and in the presentation.

    Example B in the PIN 70 and in the presentation shows a new Panel EH5 being added to an existing electrical system. Only the new 200A feeder circuit breaker installed in Panel EH4 would need to coordinate with the upstream 400A circuit breaker. It is not necessary for the new 200A main circuit breaker in PANEL EH5 to coordinate with the upstream 400A circuit breaker. This will be corrected in PIN 70 by deleting the bullet "400A feeder breaker for PANEL EH4 and the new 200A main breaker in PANEL EH5 requirement."

    Please note that both 200A circuit breakers would need to coordinate with the branch circuit breakers in PANEL EH5.