

State of Oregon
Building Codes Division

Contact: Dennis Clements, Electrical Program Chief
(503) 378-4459 or dennis.l.clements@state.or.us

Statewide Alternate Method No. OESC 08-04
(Ref.: ORS 455.060)

August 18, 2008

Selective coordination of overcurrent protective devices
Oregon Electrical Specialty Code, ref. NEC 100, 700.27, 701.18, and 708.54

Statewide Alternate Methods are approved by the division administrator in consultation with the appropriate advisory board. The advisory board's review includes technical and scientific findings of the proposal. In addition:

- *Building officials shall approve the use of any material, design or method of construction addressed in a statewide alternate method;*
- *The decision to use a statewide alternate method is at the discretion of the designer; and*
- *Statewide alternate methods do not limit the authority of the building official to consider other proposed alternate methods encompassing the same subject matter*

REQUESTED BY: National Electrical Contractors Association, Oregon Pacific-Cascade Chapter

REASON FOR RULING:

The National Electrical Code states a requirement to coordinate emergency and other system overcurrent protection (OCP) devices with all supply side overcurrent protective devices but gives no guidance on how this is to be achieved.

APPLICABLE CODE SECTIONS:

National Electrical Code articles 100, 700.27, 701.18, and 708.54.

BACKGROUND:

The controversy surrounding compliance with the selective coordination requirements has not abated as a result of the OESC amendments. Contractors and engineers continue to struggle with achieving "total" selective coordination and seek a clear standard for the application of this requirement.

There was a proposal in the national 2008 NEC process to limit the selective coordination requirement to faults with a duration 0.1 seconds or longer. This was accepted by a majority of the code making panel members at the comment stage but was not adopted because it failed to reach the 2/3 majority vote required by NFPA rules.

PROCEDURAL HISTORY:

Oregon BCD formed a task force to research the issue in March 2007 and the group met on April 26th, June 14th, and August 20th. Their recommendation was submitted to the Oregon Electrical Specialty Code review committee. This committee met on October 11th and 25th, and November 15th and 26th. On December 6th the review committee presented its recommendations to the Elevator and Electrical Board. The following and similar language was approved by the board as amendments to Articles 700.27, 701.18, and 708.54 of the model code:

For the purposes of this section, supply side overcurrent protection means those protective devices on the emergency system supply side and not on the normal power supply side. The protection shall be coordinated using the higher of the normal power supply fault current levels or emergency system fault current levels.

Exception: The requirements for selective coordination described in 708.54 are not required where the critical operations power system(s) was installed prior to April 1, 2005. For new critical operations power system(s) that are supplied from an existing emergency system installed prior to April 1, 2005, the new portion of the critical operations power system(s) must comply with NEC 708.54. The ground fault sensing function of overcurrent protective devices will only be required to selectively coordinate with the ground fault sensing functions of other protective devices.

Concerned that building officials might establish inconsistent local and regional standards for selective coordination, the division provided that “Building Officials and inspectors administering and enforcing the state building code...shall not inspect for compliance with Section 700.27, 701.18, or 708.54, refuse to perform or finalize inspections, refuse to issue a certificate of occupancy, or use other methods to ensure compliance with Sections 700.27, 701.18, or 708.54.” OAR 918-305-0280(1). The board determined that compliance inspections conducted by building officials were unnecessary so long as an instantaneous standard for selective coordination applied statewide.

TECHNICAL DISCUSSION:

The requirement for selective coordination in new articles 700.27, 701.18, and 708.54 introduced in the 2005 NEC may result in more reliable emergency systems but selective coordination is not always possible or practical for all fault current levels when protection is provided by molded case circuit breakers. The requirement for “total” selective coordination means that OCP devices must be coordinated for all faults, regardless of their magnitude or duration, including the most extreme case, the bolted fault. However, bolted three phase faults which rapidly generate extremely high current in the instantaneous range rarely occur in practice, except at start-up when interruption of power due to a lack of coordination is not likely to compromise safety. The typical fault involves a lower level line-to-ground fault. While a line-to-ground fault can escalate into a three phase arcing fault, this arcing fault takes much longer to develop than the three phase bolted fault. The typical fault is slow enough to allow selective coordination in the non-instantaneous region between the upstream and downstream breakers.

The following statements in support of limiting coordination to the non-instantaneous range are excerpted from materials submitted to CMP 13 during the 2008 NEC cycle:

“NEMA strongly supports selective coordination as a valuable safety asset in the current range where overloads most often occur. However, NEMA does not support the mandate for Selective Coordination for ALL current ranges and ALL overcurrent devices because safety and reliability can both actually be diminished. This is due to increased hazardous arc flash energy with increased equipment damage and potential fire initiation, decreased reliability, and extended downtime before service restoration. Mandates for selective coordination for ALL current ranges and ALL overcurrent devices will not always provide the optimum safety solution or optimum reliability.

“The paralleling of generators is often done to enhance system reliability, which is the stated objective of the CMP. However, in order to meet the requirement for selective coordination each generator overcurrent device and controller must selectively coordinate with all downstream overcurrent devices. This may not be possible if the generators are of unequal size. The upgrade or expansion of an existing building may require the replacement of existing upstream equipment so that it will selectively coordinate with the new downstream equipment it must feed.

“Systems are normally designed for selective coordination in the overload region of the overcurrent device time-current curves. If this were not so, they would not operate under normal conditions, so what is really being called for in this requirement is overload and short circuit selective coordination.

“In order to achieve total short circuit selective coordination, the size of upstream overcurrent protective devices may need to be increased and/or time delay trip characteristics increased, thereby possibly increasing the arc flash hazard.

“In other words, by forcing selective coordination for an event that most likely will never occur, namely a bolted fault, the hazards involved in performing tasks which most likely will occur, namely system maintenance, may be increased.”

FINDINGS:

By omitting the instantaneous range from the requirements for selective coordination, reasonable and effective safety can be achieved. Signing supervisors and engineers can use readily available and published time current curves to determine if a system is selectively coordinated to a substantial degree without having to rely on unregulated manufacturer testing data and inconsistent engineering and design practices.

APPLICABLE CODE CITATION:

2008 Oregon Electrical Specialty Code, reference NEC 700.27, 701.18, and 708.54

STATEWIDE ALTERNATE METHOD:

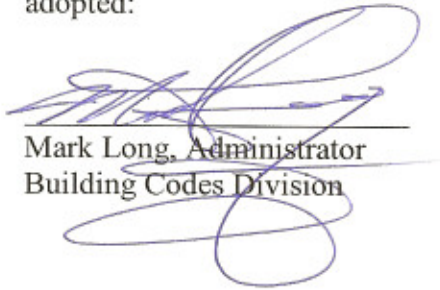
The requirements in NEC 700.27, 701.18, and 708.54 for selective coordination may be demonstrated by providing a selective coordination study utilizing trip-curve data in the range of 0.1 seconds or more.

Electrical systems built to the selective coordination standard established by this statewide alternate method are subject to inspection by building officials and inspectors to ensure compliance with the established standard range of 0.1 seconds or more.

Electrical licensees shall indicate compliance with the selective coordination requirement by submitting a coordination study signed by either an Oregon registered professional engineer or the project's signing supervisor to the local building official or inspector. Acceptance of the coordination study by either the architect or engineer of record is not required.

The building official or inspector shall verify that the installed electrical system conforms to the submitted coordination study, including the settings of all circuit breakers or other programmable devices. No additional acceptance or third-party testing may be required.

The recommendation and findings of the Elevator and Electrical Board are accepted and are adopted:



Mark Long, Administrator
Building Codes Division

August 18, 2008
Date