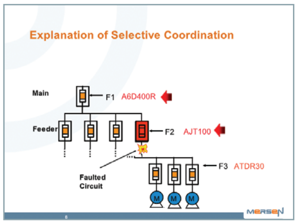
PIQ Quiz Notes

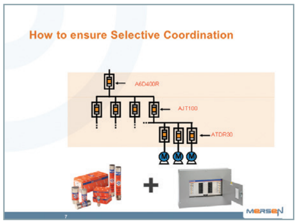
Selective Coordination

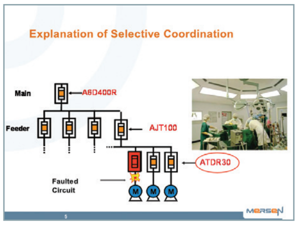
How much do you know about Selective Coordination?
An electrical distribution system can be likened to a person's heart. The electrical distribution system pumps energy throughout a facility and keeps other systems within the facility running efficiently. It runs effortlessly and unnoticed –until something devastating happens – such as a major power failure. Both heart attacks and power failures have the ability to paralyze the system and cause major panic. Therefore, selective coordination is crucial to the smooth operation and reliability of the electrical distribution system.

Question: Which of the following definitions best describes Selective Coordination?
A. The result of an electrical circuit design that is engineered to isolate a fault to its nearest upstream protective device.
B. Any combination of fuses and breakers that have a 2:1 ratio, or
C. The process of determining where to place electrical equipment in order to minimize harmonic noise?

An Explanation of Selective Coordination
To illustrate how Selective Coordination works, lets examine a hospital application in which the loads (Fig. 1) are the hospital rooms located on one floor of one wing. The other feeder fuses protect other floors and wings. If an electrical incident were to occur in one of the branch circuits, as shown by the yellow fire burst, you would hope that the CC fuse protecting that branch circuit would open before the main overcurrent protective device. However, if the feeder opens first, the whole floor goes dark! Worse yet, if the main opens, the whole hospital loses power until the back-up generators come online. Not only an unsafe approach, but very expensive!







Continuing upstream, if there is a fault in the feeder circuit (Fig. 2), you want the feeder's overcurrent protective device to open before the main overcurrent protective device starts to open. In this case, the 100 amp feeder fuse should open before the 400 amp main fuse.

How do you make sure your circuits are selectively coordinated?
You could compare the time-current curves for each protective device. Time-current curves show how long it will take a protective device to open or trips when exposed to different current levels. If the curve for your downstream device overlaps any part of the upstream device's curve, either device may open during an event. In this situation, you risk transferring the fault up the circuit, where it will take out other branches. Getting and comparing these curves takes some work and is hard to do. **The easiest way to achieve selective coordination is to use Amp-Trap 2000 fuses.** As you see in Fig. 3, each level of fusing is at least twice the ampacity of the lower level. When Amp-Trap 2000 fuses are used in this 2:1 ratio, their curves will never overlap, therefore they will always be coordinated. Very easy!

Question: Where is Selective Coordination required?
A. All multi-story buildings
B. Only in hospitals
C. The utility distribution grid, or
D. All circuits deemed Emergency Systems, legally required standby systems, critical operations power systems or multiple elevators?

An Explanation on where Selective Coordination is Required and NEC Requirements
Selective coordination makes sense and should be employed throughout a facility. However, the majority of specifiers only do what is required by the National Electrical Code. As of 2005, Selective Coordination is part of the code. Specifically, Article 700 states that Emergency Systems need to be Selectively Coordinated.

- **Article 517** covers Health Care Facilities, including clinics, medical and dental offices, nursing homes, and hospitals. Article 517.26 requires The Essential Electrical System to meet the requirements of Article 700 regarding Emergency Systems. The Essential Electrical System can be much more inclusive than the Emergency Electrical System, but as a minimum, it is the Emergency Electrical System. The Essential Electrical System covers "all connected distribution systems and ancillary equipment designed to ensure continuity of electrical power to designated areas and functions" whereas the Emergency Electrical System supplies "alternate power to a limited number of prescribed functions vital to the protection of life and safety."

- **Article 701** refers to Legally Required Standby Systems. These are typically installed to serve loads such as HVAC, sewage disposal, lighting and industrial processes, that when stopped during any interruption of the normal electrical supply, could create hazards or hamper rescue or fire-fighting operations. 701-18 requires them to be selectively coordinated.

- **Article 708** refers to Critical Operations Power Systems. These are generally installed in vital infrastructure facilities, that if destroyed or incapacitated, would disrupt national security, the economy, public health or safety. Systems include HVAC, fire alarm, security, communications and signaling.