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These systems are crucial for quite a number of reasons. Their regular maintenance should be a top priority around your operations.

As with so many other aspects of electrical systems, in order to ensure selective coordination in a system, the overcurrent protective device scheme must be properly engineered, installed and maintained. Even if a system is designed and installed properly, a lack of proper maintenance can negate the selective coordination scheme that may be vital for life safety or critical business reasons. The same applies to electrical safety for workers. (See Sidebar on page 44.)

What is selective coordination?

Th e way electrical distribution systems are laid can be likened to a tree. As depicted in Fig. 1, the building service is typically one large ampacity circuit (a tree trunk) that divides into a number of lower ampacity feeders (limbs) that further are divided into many still lower ampacity branch circuits (branches), which supply power to individual end-use equipment such as motors, lighting circuits, computers and HVAC units. Each segment of the electrical distribution system (service, feeder and branch) has a circuit breaker or fuse and sometimes a relay that provides overcurrent protection for its respective segment of the circuit. When overcurrent protective devices in an electrical distribution system are chosen by the engineer to be selectively coordinated, by design, whenever there is an overcurrent condition on a circuit, only the nearest upstream protective device should open for an overcurrent condition (Fig. 2). This is applicable for any overcurrent condition, whether an overload or short-circuit.

Most people assume that if there is a short-circuit condition on a 20A branch circuit, only the 20A circuit breaker or fuse will open and the larger 200A feeder circuit breaker or fuse will not open. This, however, is not always the case (Fig. 3). In some situations, if the engineer did not choose the proper overcurrent protective devices and/or specify the proper settings or amp rating, a feeder (limb) or even the service (truck) overcurrent protective device may unnecessarily open for a branch circuit fault. In the same manner, a short-circuit on a feeder circuit should only open the feeder overcurrent protective device and not cause the service overcurrent protective device to open.

Why is selective coordination important?

Selective coordination of all the overcurrent protective devices for the circuits supplying vital loads improves the reliability of the system to supply power. In today's buildings and manufacturing processes, there is a far greater dependence on electricity.

The ability of the electrical distribution system to provide continuous availability of power to vital

loads is ever more important. Worker productivity, industrial process loads, critical computer business system loads and life safety emergency loads, such as exit lighting and healthcare essential electrical system loads, depend on a continuity of power. In some cases, the unexpected loss of power to some industrial processes can be a hazardous condition. When there is a dangerous overcurrent condition, the overcurrent protective devices are expected to open the circuit. But, if a lack of selective coordination unnecessarily opens higher level upstream overcurrent protective devices, critical loads could be disrupted needlessly.

Selective coordination can be either a design consideration or a mandatory National Electrical Code® (NEC) requirement. The National Electrical Code has mandatory selective coordination requirements in 517.26 Healthcare Essential Electrical Systems, 620.62 Elevator Circuits, 700.27 Emergency Systems, 701.18 Legally Required Standby Systems and 708 Critical Operations Power Systems. Typically, these systems already have periodical maintenance requirements for generators, automatic transfer switches and other key components. This article is advocating maintenance of the overcurrent protective devices wherever selective coordination is an important consideration for the system.

How is selective coordination achieved?

Although it is not within the scope of this article to fully explain how to select fuses or circuit breakers to achieve selective coordination, some mention of this process definitely is in order here. Suffice it to say, in most cases, selective coordination must be designed in up-front for an electrical system. This is especially important with circuit breakers. In some cases with fusible systems, after the installation there is more flexibility to merely change to different fuse types to achieve selective coordination. The best practice occurs during the system design phase, when the electrical engineer does a short-circuit current analysis and coordination analysis of the electrical system. In this process, the engineer must select the proper circuit breakers or fuse types and amp rating/settings to achieve selective coordination.

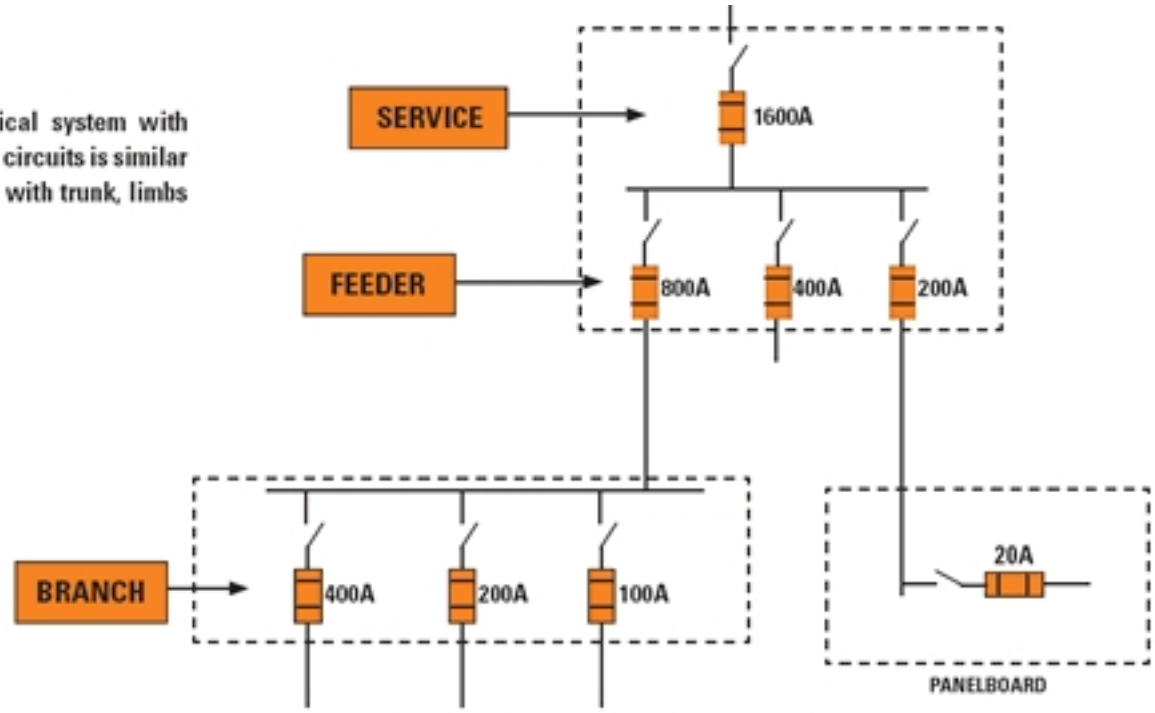
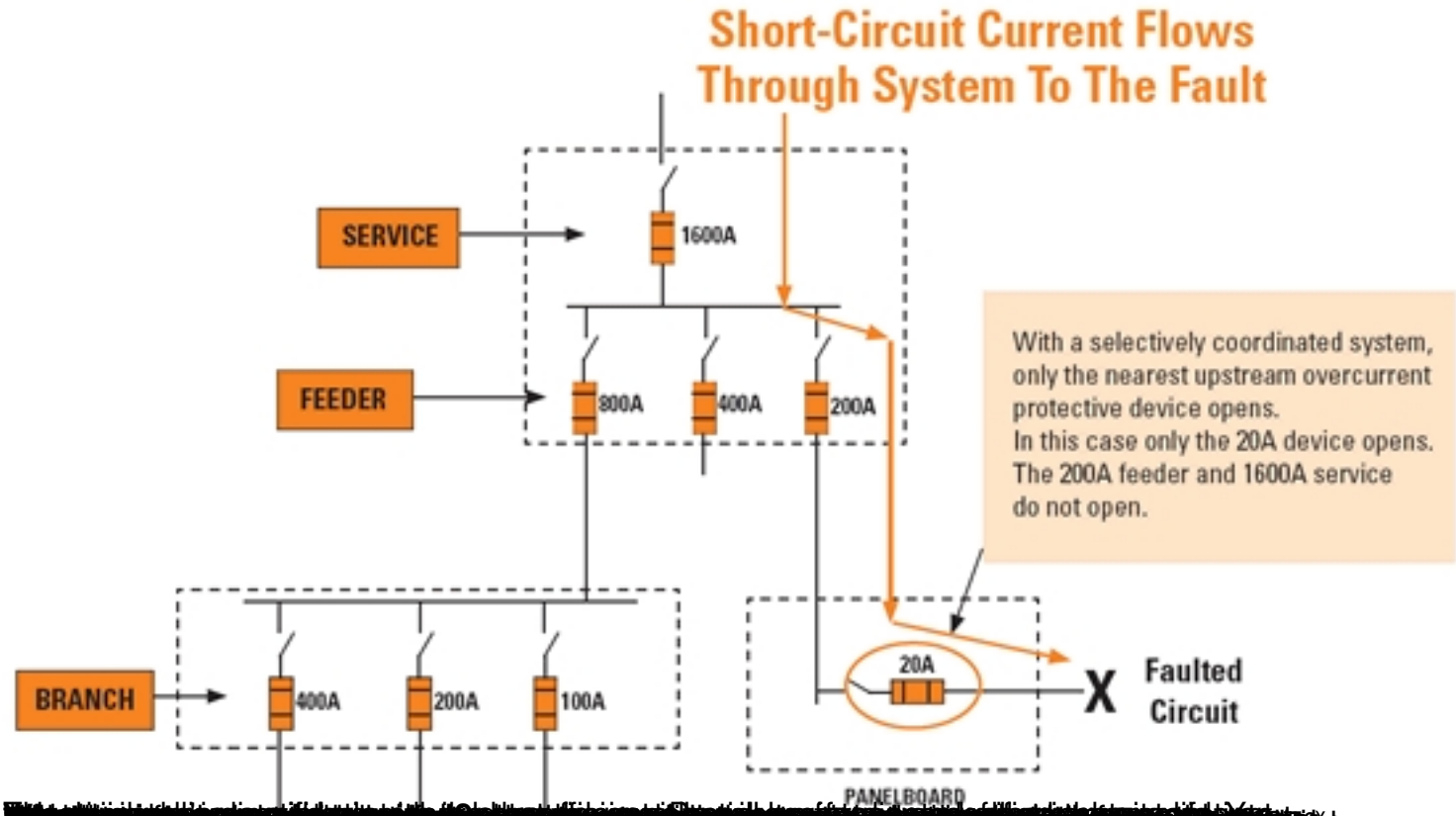


Fig. 1. A building's electrical system with service, feeders and branch circuits is similar in typology to that of a tree with trunk, limbs and branches.



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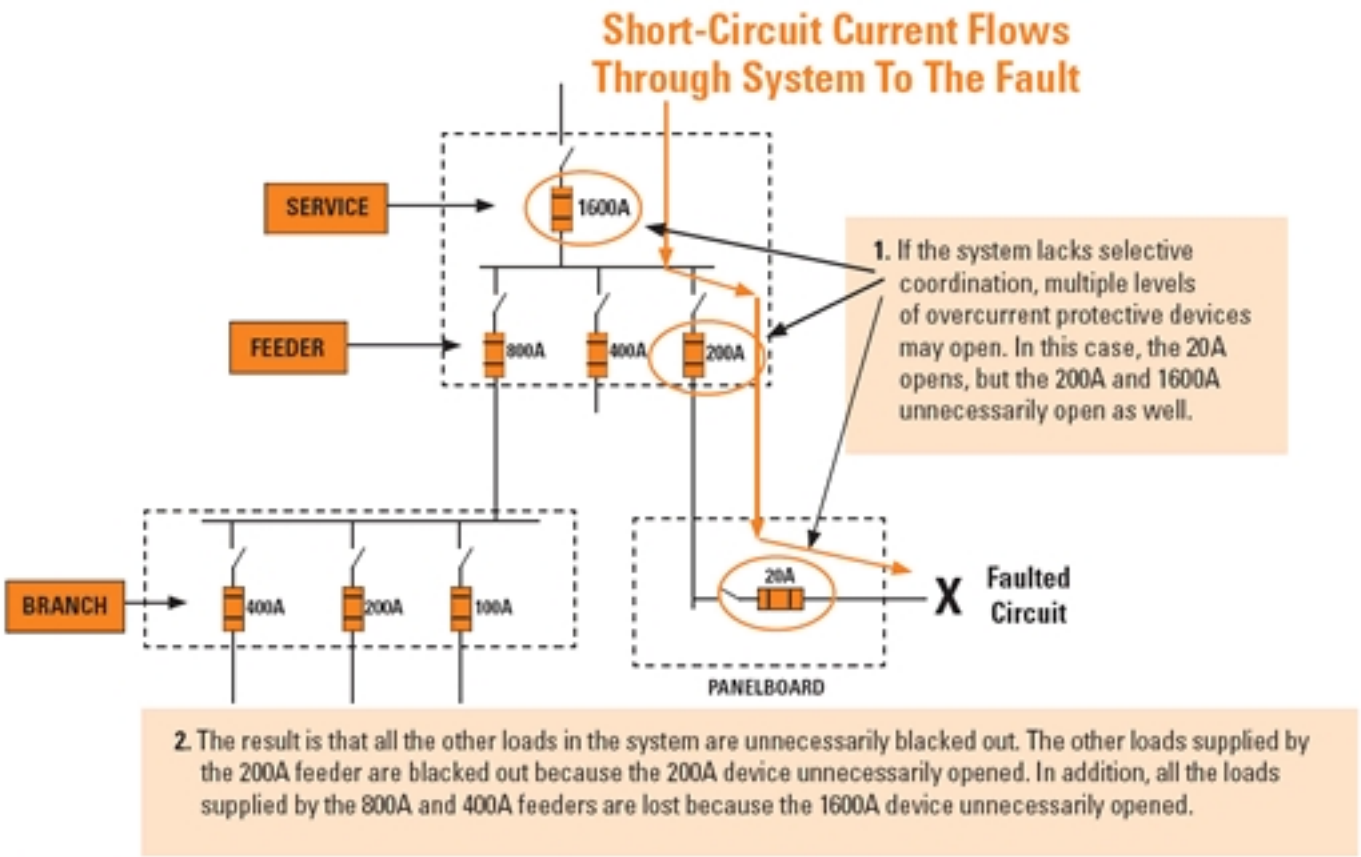

Fig. 3. In this diagram, a lack of selectively coordinated overcurrent protective devices that causes an unnecessary blackout to other loads.

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