

4 steps to determine equipment short-circuit current rating

Wastewater treatment facilities can take advantage of the latest calculation tools to ensure NEC and OSHA compliance.

A key consideration in wastewater treatment facilities is complying with the National Electrical Code (NEC®) and Occupational Safety and Health Administration (OSHA®) requirements by determining if electrical equipment is properly rated for the available short-circuit current. The difficulty with compliance is that short-circuit current levels can change as a result of modifications to the electrical distribution system. For instance, if the transformer supplying the facility is increased in size (kilovolt-amperes or KVA) or the impedance is lowered, the short-circuit current will increase. In addition, when equipment is relocated or added, the available short-circuit current may be higher than expected.

To assist end users with determining the available short-circuit current, web-based tools and mobile apps are available that can simplify fault current level calculations and produce labels for fault current marking.

Short-circuit current ratings defined

Short-circuit current rating (SCCR) is the amount of short-circuit current that electrical equipment is able to safely withstand. SCCR applies to all electrical equipment, such as panelboards, switchboards, motor control centers and industrial control panels. To protect equipment and personnel from certain risks in the event of a short circuit, NEC and OSHA require equipment SCCR to be sufficient for the available short-circuit current at the point of connection. Some of these requirements are:

- NEC 110.10 requires that electrical equipment SCCR is sufficient for the available short-circuit current.
- OSHA regulation (1910.303(b)(5)) requires all electrical equipment SCCR, new or existing, to be sufficient for the available short-circuit current. OSHA does not provide for any exemptions.
- The NEC requires industrial control panels that contain power circuit components to be marked with the equipment SCCR per 409.110 based on its listing and labeling or per an approved method.

- The marked SCCR of industrial control panels must not be less than the available short-circuit current per 409.22.

The NEC does not require industrial control panels to be listed. It does, however, provide an informational note in 409.110 that references Underwriters Laboratories (UL®) 508A, Supplement SB, as an approved method for determining the industrial control panel SCCR. The majority of industrial control panels are typically not listed, but, to comply with the NEC, they must be marked with the SCCR. Some industrial control manufacturers, however, are less familiar with how to determine the equipment SCCR of industrial control panels per UL 508A, Supplement SB.

Further, these entities are probably not verifying the available short-circuit current during the customer's installation.

They also may be unfamiliar with the methods to increase the industrial control panel SCCR to be adequate for their customer's installation where the short-circuit current is above the typical default SCCR of 5,000 amperes (A).

UL 508A, Supplement SB, is basically a "weak-link" analysis of the industrial control panel power circuit components. It can be broken down into a four-step process. The first step deals only with power circuit components (basically anything other than a circuit breaker or fuse) that supplies a load (motor, heating, lighting, appliance and typically receptacles). Per UL 508A, the component SCCR is marked on the component or instructions.

This marking is typically based on proper overcurrent protection by a fuse or circuit breaker. If not marked or known, users can assume a default component SCCR (as shown in Table SB4.1 of UL 508A, Supplement SB).



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Four steps to determine equipment SCCR

1. Determine high-fault rating for power circuit components

Most power circuit components can be tested for an optional high-fault rating that may require a specific circuit breaker or fuse. These optional high-fault ratings can be found on UL's website for combination motor controllers. Other types of component SCCR's, including those of adjustable speed drives, can be more difficult to find. Adjustable speed drives as listed to UL 508C/UL 61800-5-1, may require a special type of overcurrent protection device—in some cases, a semiconductor fuse—to achieve a high SCCR. This required overcurrent protection device often is not marked on the adjustable speed drive but instead in the equipment's installation and operation manual. Where overcurrent devices are used with slash voltage ratings, such as 480/277, or when combination motor controllers that result in slash voltage rating are used, the industrial control panel must be marked with this slash rating as well.

2. Verify whether a current-limiting device is ahead of the branch circuit components (in the feeder circuit).

The branch circuit components would be the components closest to the load, but on the load side of the branch circuit fuse or circuit breaker. The current limiting device in the feeder would then be upstream of the branch circuit fuse or circuit breaker.

- The current-limiting device could be a transformer, current-limiting circuit breaker or current-limiting fuse. If the device is a transformer, the process is relatively simple:
- Find the let-through of the transformer (Table SB4.3 or SB4.4) if the let-through is less than the branch circuit component and overcurrent device ratings, then apply the primary overcurrent device interrupting rating to the entire branch circuit.
- If the device is a current-limiting fuse or circuit breaker, the let-through is determined by Tables SB4.2 for various classes of current-limiting fuses or by published manufacturer data for marked current-limiting circuit breakers.
- If the let-through of the current-limiting fuse or circuit breaker at a given fault current is less than the branch circuit components, raise the component SCCR to the fault current that was referenced.

3. Establish the interrupting ratings for all the fuses and circuit breakers in the feeder and branch circuits.

This includes the fuses and circuit breakers that supply control transformers and power supplies. Fuses or circuit breakers that supply control circuits on the load side of a motor branch circuit overcurrent may be branch circuit overcurrent devices or supplemental overcurrent protection devices, but the interrupting ratings of these overcurrent devices affect the assembly SCCR.

4. Find the lowest component or overcurrent device rating in the assembly based on Steps 1, 2 and 3.

This becomes the industrial control panel SCCR. The UL 508A, Supplement SB, requirements and component short-circuit current ratings can be difficult to understand and apply. For this reason, most industrial control panels are marked with the typical default rating of 5,000 A. This can create problems with NEC and OSHA compliance when the industrial control panel SCCR is not sufficient for the available short-circuit current.

To ensure compliance, the design engineers for wastewater treatment facilities must determine the available short-circuit current where the industrial control panels should be installed. They should also consider that these industrial control panels may be relocated where the available short-circuit current is higher.

Often, a minimum industrial control panel SCCR, such as 50,000 A, is determined to allow for flexible application of industrial control panels in a given facility regardless of location.

Complying with the latest national and local codes and standards is vital for supporting personnel safety and electrical system reliability. Wastewater treatment facilities should consider tapping the latest tools to help meet these requirements and simplify compliance.



Bussmann series OSCAR™ Compliance Software calculates and documents assembly SCCR for a control panel.



SCCR Protection Suite helps equipment designers identify components with the SCCR required.



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