

SCCR

Technical Brief – Short Circuit Current Rating

August 2020

Overview

The Short Circuit Current Rating (SCCR) states the maximum amperage (fault current) a component, enclosure, or unit can withstand during a short circuit event thereby limiting personal injury, damage to the premises, and damage to equipment. A fault occurs when a wiring error or failure inadvertently connects one phase directly to another or a phase to ground. The energized circuit passes current that equals the available power of the distribution panel that feeds it. The excessive amperage is usually in orders of magnitude larger than the full load amps (FLA) of the HVAC unit. The excessive current can damage the equipment, cause a fire or an explosion. The net result of the electrical short can be catastrophic to equipment, the building, and most importantly occupant safety. Figure 1 shows a typical building electrical power distribution where the entire design must be protected from a fault condition. The electrical system designer must design the lowest cost power distribution system for the building.

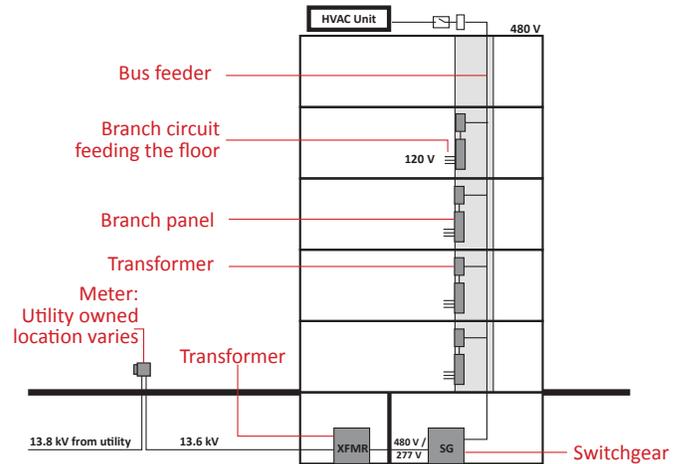


Figure 1. Typical building power distribution layout

The National Electrical Code (NEC) governs the calculation, product label, and application of SCCR as outlined in articles 110.9, 110.10, 409.22, 409.110, 440.4 (B), 670.3 (A)(4). For HVAC equipment the rules can be paraphrased as follows:

- The HVAC equipment must have an SCCR equal to its fault current but no lower than a minimum of 5,000 A (5 kA) as ca. This means the equipment can handle a minimum 5000 amps of electrical short circuit current flowing through it before the as fuses and breakers interrupt the current within 16.67 milliseconds (1 cycle of 60 hz power).
- The HVAC equipment must not be connected to a power panel with a higher fault current than the equipment SCCR. The short circuit amperage between the distribution power panel and the HVAC unit cannot exceed the HVAC unit capacity to survive without damage thereby preventing catastrophic failure.
- National Electrical Code (NEC) requires units SCCR value to be placed on or near the rating plate of HVAC units.
- The code provides the calculations to determine the fault current. The calculation take into account the electrical rating of motor controllers, relays, fuses, circuit breakers, push buttons, selector switches, timers, terminal blocks wiring, and other devices in the electrical circuit.

Even though the core ideas seem simple, the rules strongly influence the design of building and facility electrical system. Looking at Figure 1, can the HVAC unit source its power from a panel sharing loads with other equipment?

Determining the SCCR to use

The HVAC equipment's SCCR is determined by the NEC calculation method. The fault current of the equipment is often less than the minimum 5 kA. The HVAC equipment components are often selected to reduced cost while meeting most application needs resulting in 5 kA SCCR. The NEC code requires that the power distribution panel serving the units cannot provide a fault current that exceeds the SCCR of the units. The power panel fault current is also calculated in the same manner as SCCR therefore, the two terms are often used interchangeably. Figure 2 shows a scenario with multiple pieces of equipment requiring power. Ideally, we would like the lowest cost power distribution solution where one panel serves all the needs of the facility. However, the sketch shows that one power panel design results in too high or too low a power panel SCCR to serve all of the equipment. If the power panel is limited to an available fault current of 5 kA, than the other pieces of equipment do not have enough power to operate or, if the power panel provides the necessary power. For the industrial equipment, the fault current would exceed the 5 kA SCCR of the HVAC equipment. If the HVAC equipment is connected to a power panel serving the industrial machinery, a fault condition could be catastrophic.

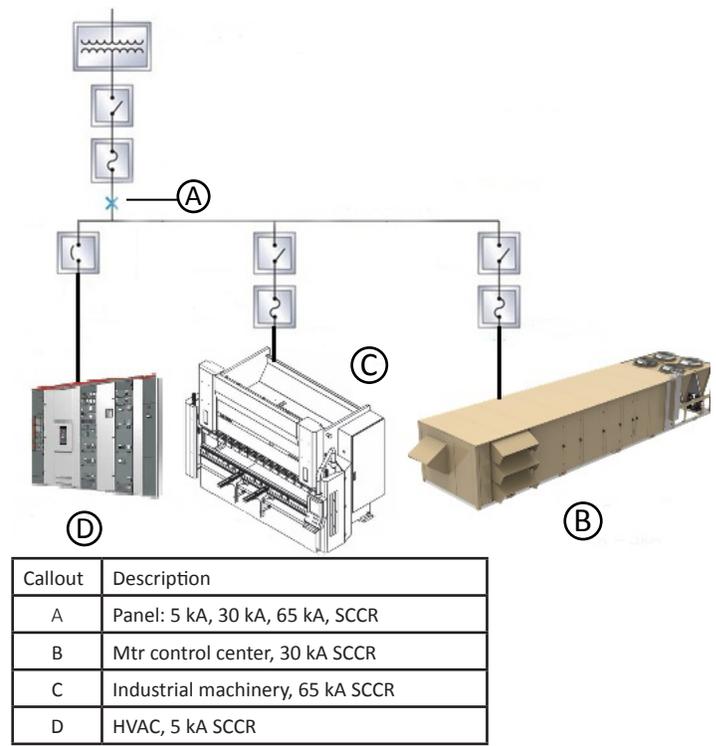


Figure 2. Power requirements

The electrical system designer has the following options when coordinating equipment SCCR and power panel fault currents:

- Upgrade the equipment level SCCR to match the available fault current of the power panel such as, increasing from 5 kA to 65 kA. Therefore the package unit can handle a fault equal to 65 kA associated with the industrial equipment. Note that upgrading the package from 5 kA to 65 kA SCCR does not mean the package unit draws more power.
- Provide separate distribution panels that have a fault current value that matches the SCCR of the connected equipment such as, the 5 kA SCCR equipment has a separate distribution panel from the 30 kA and the 65 kA equipment.
- Add a true current limiting device (fuse) in the feeder circuit to the equipment. The current limited fuse with a higher SCCR interrupts the current during a fault condition thereby protecting the associated equipment. The fuse's interrupting current must be sufficient to disconnect the power at the equipment. The current limiting device allows the equipment to be connect to the high fault current power panel because the fuse's higher SCCR value is used instead of the equipment's SCCR.
- A combination of the above three options.

Selecting the SCCR

It is typically not necessary to provide higher SCCR equipment which carries a higher cost for an installation that normally does not have high fault current, for example, providing 65 kA equipment for residential facilities is not needed. However, you may need a 65 kA SCCR for a manufacturing building when there is a need to connect small amp draw units to existing large capacity power panels. As the building power requirements increase, so does the equipment SCCR relevance.