

Short-Circuit Current Rating of HVAC Equipment

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In order to comply with *NEC*® 110.9 (for the interrupting rating of overcurrent protective devices) and 110.10 (for the short-circuit current rating of circuit components and equipment), the short-circuit current must first be known. Equipment such as switchboards, panelboards, and motor control centers are required by UL standards to be marked with a short-circuit current rating. When installing this equipment, the short-circuit current rating cannot be less than the available fault current at the point of installation. In the past, the short-circuit current rating of other equipment such as heating, ventilation, and air-conditioning (HVAC) equipment; industrial control panels; and industrial machinery was often overlooked, but in the 2005 *NEC*, requirements were added to ensure that this equipment was also required to be marked with the short-circuit current rating.

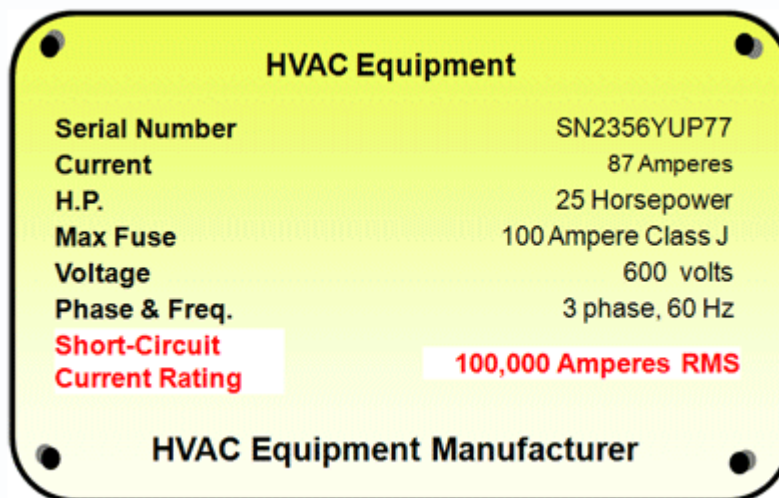
What are the requirements for HVAC equipment?

In order to comply with *NEC* 440.4(B), manufacturers of air-conditioning and refrigeration equipment with multimotor and combination loads must include the short-circuit current rating (SCCR) on the equipment nameplate. There are three exceptions to this marking requirement:

- One- and two-family dwellings
- Cord-and-attachment-plug-connected equipment
- Equipment on a branch circuit protected at 60 A or less

However, most commercial and industrial air-conditioning and refrigeration equipment must bear this SCCR marking on the nameplate, as shown here.

HVAC Equipment nameplate indicating short-circuit current rating.



What is short-circuit current rating?

SCCR, in the past referred to as “withstand rating,” is basically the maximum short-circuit current a component or assembly can safely withstand when protected by a specific overcurrent protective device(s) or for a specified period of time. This term was referenced in several sections of the *NEC* but was not defined until recently. Because the term “short-circuit current rating” appears in multiple locations

in the *Code*, it was defined in Article 100 for the 2008 edition. The new *NEC* definition of short-circuit current rating is:

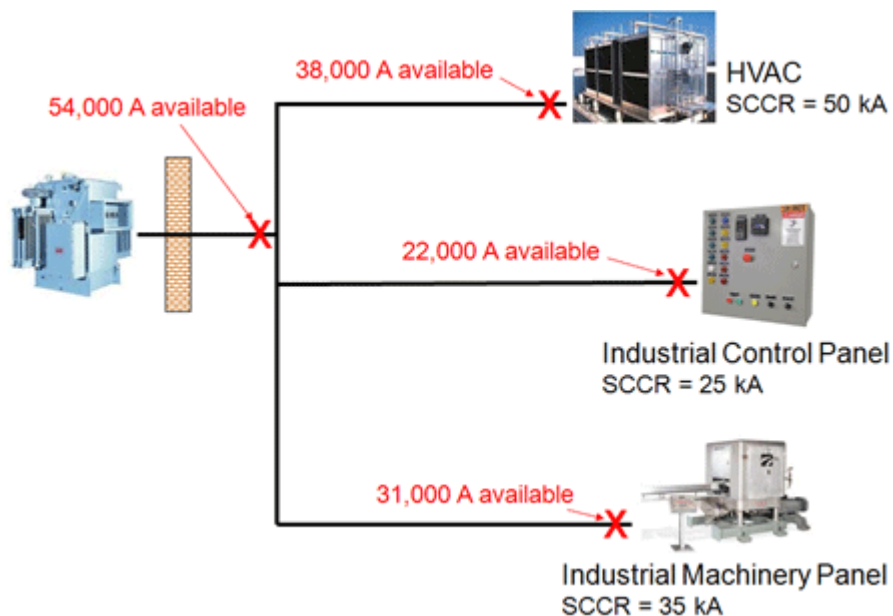
The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria.

Why is short-circuit current rating important?

Short-circuit current ratings indicate the level of fault current that a component or piece of equipment can safely withstand (based on a fire and shock hazard external to the enclosure). Without knowing the available fault current and SCCR, it is impossible to determine if components or equipment can be safely installed. If HVAC or another type of equipment is installed where the available fault current exceeds the marked SCCR, a serious hazard exists.

With the SCCR marked on HVAC and other types of equipment as required by the *NEC*, it is much easier for the installer and authority having jurisdiction (AHJ) to ensure that the marked SCCR is adequate and therefore compliant with 110.10.

Proper application of HVAC and other types of equipment with marked short-circuit current ratings that meet or exceed the available fault current at the point of application.



How is short-circuit current rating determined?

For components, the SCCR is typically determined by testing in accordance with the listing (product) standards. For assemblies, the marking can be determined by testing in accordance with the listing standards or by another approved method.

For HVAC equipment, the 2005 edition of UL 1995 does not include requirements to determine and mark the SCCR. However, UL has recently issued a Certification Requirement Decision that is permitted to be used now and will require an SCCR marking for HVAC equipment in accordance with a new clause, 36.20. In this document, clause 36.3 has also been modified to require the marking of the SCCR of the motor controllers or industrial control panel employed with multimotor and combination-load equipment.

The additional text to 36.3 and a portion of the new section 36.20 are shown below:

36.3 The equipment shall be plainly marked, in a permanent manner, with the following:

- y) short-circuit current rating of the motor controllers or industrial control panel when employed with Multimotor and Combination-Load equipment.

Exception: Equipment intended for use in one- and two-family dwellings, cord-and-attachment-plug-connected equipment, or equipment supplied from a branch circuit protected at 60 A or less are not be required to be marked with a short-circuit current rating.

36.20 The short-circuit rating of item (y) of Clause 36.3 shall include the following marking or the equivalent as specified for the motor controllers or industrial control panel: "Short-circuit current: ____ kA rms symmetrical, ____ V maximum"

36.20.1 The short-circuit current rating of the overall equipment panel shall be determined based upon:

- a) establishing the short circuit current ratings of individual power circuit components as specified in 36.20.2
- b) determining the overall panel short circuit current rating as specified in 36.20.3.

If HVAC equipment manufacturers choose to use another approved method, UL 508A, *UL Standard for Safety for Industrial Control Panels*, is available, and Supplement SB to UL 508A provides an analytical method of determining the SCCR of an industrial control panel. This method is essentially the "weakest link approach." That is, the industrial control panel SCCR is limited to the lowest-rated component's SCCR or the lowest-rated overcurrent protective device's interrupting rating. The new clause, 36.20, in UL 1995 is based upon UL 508A, Supplement SB.

Is a specific type of overcurrent protective device required?

According to UL 1995, 36.3(i), the HVAC nameplate can specify the type of overcurrent protective device that must be used. If the nameplate specifies "Maximum overcurrent protective device," then either a circuit breaker or fuse is permitted. If the nameplate is marked "MAX. FUSE____," fuse protection must be provided in accordance with the label. If the nameplate is marked "MAX. CKT. BKR____," a circuit breaker must be provided in accordance with the label.

Why would a specific type of overcurrent protective device be required?

The higher the SCCR of HVAC equipment, the easier it is for designers and installers to comply with *NEC 110.10*. This is often an important consideration for manufacturers of HVAC and other types of equipment. For instance, if the equipment carries an SCCR of 100 kA, the equipment is more widely accepted both for the initial installation and for potential changes in the available fault current due to system changes or relocation of the equipment.

The most effective way to achieve higher SCCR is to use current-limiting overcurrent protective devices with high interrupting ratings. In addition, for some components, a current-limiting overcurrent protective device is required to achieve a high SCCR. Because of this requirement, current-limiting overcurrent devices are often used in equipment with high SCCR.



Summary

In most cases, HVAC equipment manufacturers are required to mark the SCCR on the equipment. Two standards that can be used to determine the SCCR of HVAC equipment and industrial control panels are UL 1995 and UL 508A, Supplement SB. When installing HVAC equipment, the SCCR cannot be less than the available fault current in order to avoid serious safety hazards. To more easily ensure compliance with [NEC 110.10](#), a high SCCR is often preferred. In these cases, a current-limiting overcurrent protective device might be required if indicated on the equipment nameplate.

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