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Author: Ed Larsen
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Cedar Rapids, IA, USA

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100% Rated MCCBs and Standard (Non-100%) Rated MCCBs

What is a 100% rated molded-case circuit breaker (MCCB)?

A 100% rated MCCB is one that is intended for continuous operation at 100% of its marked rating in an enclosure. That means that it will carry 100% of rated current without overheating and without tripping when enclosed. UL® Listed, 100% rated MCCBs will be marked, “Suitable for continuous operation at 100% rating only if used in _____.” The blank identifies the enclosure or equipment in which it may be used.

Aren’t all MCCBs rated 100%?

Standard MCCBs are not rated 100% and are not marked as indicated above. All MCCBs are tested to carry 100% of rated current continuously when connected with conductors sized for their current rating without overheating and without tripping. However, that test is done in open air without an enclosure. When standard MCCBs are enclosed and especially when they are group-mounted such as in a panelboard, they are applied at 80% of their rating. In temperature tests within panelboards, switchboards, circuit breaker enclosures and the like, MCCBs are loaded to 80% of their rating unless they are 100% rated. (See NEC® 210.20 (A).)

Don’t 100% and standard MCCBs trip with the same overcurrent conditions?

It is important to be aware of three separate considerations: rating, characteristic curve and temperature. Imagine a 400 A MCCB connected with two 3/0 AWG copper wires as permitted by the NEC®. Whether 100% or standard rated, the MCCB must carry 400 A in an open-air test without tripping or overheating. It also must trip within 2 hours when it is carrying 135% of rated current, 540 A. The tripping characteristics may be identical. The difference is that the 100% rated MCCB must also be tested in an enclosure, again with two 3/0 AWG conductors and carrying 400 A. If temperature rises are above those permitted for the standard circuit breaker but within acceptable limits for the 100% rated unit, the conductor insulation may be required to be rated 90°C. When the standard MCCB is tested in an enclosure, it will be connected with two 3/0 AWG conductors and will carry 320 A. Both circuit breakers are rated 400 A. The time-current characteristics may be identical or may be slightly different to allow for higher permitted temperatures for the 100% rated MCCB. The 100% rated MCCB may operate at a higher temperature because it is carrying a higher current. Both are safe and permitted under the NEC when applied within their ratings and markings because the load is known and conductors are sized to carry current within the characteristic of the MCCB.

How are the 100% rated MCCBs applied compared to standard MCCBs?

First, for a branch, calculate the load as indicated in NEC® Article 210.20. Select the conductor size as indicated in NEC® 210.19. Then determine the overcurrent protection in accordance with NEC® 210.20. For a feeder, use NEC® 215.2 and 215.3. For services use NEC® 230.42. The 100% rating does not apply for motor circuit protection under NEC® Article 430.

For More Information:

See the following references:

100% Rated Circuit Breakers, Square D® Data Bulletin 0600DB0101.
UL 489, 10th Edition, Sections 7.1.4.3, 9.1.4.4 and 9.1.4.5.
All above references to the NEC® are to the 2005 Edition.

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Schneider Electric USA, Inc.
3700 Sixth St. SW
Cedar Rapids, IA 52404 USA
1-888-SquareD (1-888-778-2733)
www.us.SquareD.com

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