



Cutler-Hammer

Determining Breaker Integrity After a Fault

Application Note

November 2007
New Information

Questions have been raised in the industry regarding the integrity of a circuit breaker after interrupting a fault. These questions are typically generated by fuse manufacturers; NOT the result of documented problems with breakers in the field. The fuse manufacturers suggest that interrupting a fault shortens the useful life of a circuit breaker, bringing in questions about the ability of a circuit breaker to continue to perform its protective function. They imply that adequate testing of the circuit breaker can not be performed in the field and therefore its integrity can not be verified. In this way, they claim, a circuit breaker is no different than a fuse and should be replaced after clearing a fault.

Molded case circuit breakers are designed and tested to be capable of safely clearing many overcurrents during their normal span of operation. Since their introduction in 1928, breakers have proven this capability through decades of safe, reliable performance. The number of overcurrents a specific breaker can clear depends greatly on the magnitude of the overcurrents interrupted. The Underwriter's Laboratories test standard for molded case circuit breakers, UL489, requires that a breaker must safely clear its maximum current, which is the short circuit current rating of the breaker, twice

and still be functional. In addition, the UL489 test requires that a breaker, depending on the frame size, must operate up to 50 times under a 600% overcurrent and up to 6000 times under rated continuous current.

In actual application, high fault levels are extremely rare (less than 2% of all faults). An arcing fault is by far the most common type of a fault and the only type of a fault that can occur after installation. Arcing faults are usually the result of an insulation failure within a motor or wiring system. Such faults are initially very low level faults that if not cleared quickly can escalate rapidly. Arcing faults can also occur as the result of accidental contact between exposed live conductors, such as the dropping of a tool across exposed terminals. Molded case circuit breakers have dead front construction with no exposed live parts to help prevent such "accidental contact" faults. Molded case circuit breakers can be expected to safely clear such faults many times and still be operable.

Because the past history of a given circuit breaker and the actual magnitude of a given fault is usually not known, some customers have expressed a need to be able to verify the integrity of a circuit breaker after it has interrupted a fault. For this reason, inspection, preventative maintenance and testing procedures have been established for molded case circuit breakers by the

National Electrical Manufacturers Association (NEMA). NEMA Standards Publication No. AB4-2003 outlines procedures for regular preventative maintenance, simple visual inspection and performance testing of molded case circuit breakers. As with all electrical equipment, regular preventative maintenance is recommended including evaluation of the operating environment and inspection of all electrical connections. If a breaker interrupts a fault, the inspection procedures can be used to easily determine if the breaker can be placed back in service or if further investigation is required. When the procedures suggest further investigation, testing procedures for performance testing a circuit breaker are detailed. In most cases, the simple visual inspection will indicate that the breaker needs no further testing.

By following the guidelines for preventative maintenance established in NEMA Standards Publication No. AB4-2003 at regular periodic intervals, and performing inspection of the breakers as needed after clearing overcurrents, molded case circuit breakers provide safe, reliable and productive overcurrent protection for decades. Copies of the NEMA documents can be obtained by contacting NEMA directly at 1300 North 17th Street, Suite 1752, Rosslyn, Virginia 22209 or visiting their website at www.nema.org.

Eaton Corporation
Electrical Group
1000 Cherrington Parkway
Moon Township, PA 15108
United States
877-ETN CARE (877-386-2273)
Eaton.com



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