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Eaton molded case circuit breakers—contact resistance outline

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Purpose

One of the primary testing requirements for a molded case circuit breaker (MCCB) is contact resistance, also referred to as a millivolt drop test. The purpose of a contact resistance test is to ensure the electrical integrity of connections and contacts in a circuit breaker. The goal of this whitepaper is to ensure that our customers and end users are placing a breaker into service that they can confirm was tested adequately. Understanding the appropriate testing procedures and correctly interpreting the results is critical for project timeline and cost. Should there be any remaining questions on procedures or results when testing an Eaton MCCB, please reach out to the product line for assistance.

MCCB testing standards

For many breaker manufacturers, NEMA® AB4 is the recognized standard for MCCB breaker testing and provides the most accurate testing guidance and result interpretation. The National Electrical Manufacturers Association (NEMA) develops their standards through a voluntary consensus development process, which brings together volunteers with interest and knowledge in the electrical industry to develop guidelines for testing.

The InterNational Electrical Testing Association (NETA®) is a specification that is commonly referenced during site acceptance testing or preventive maintenance. In this specification, it is suggested that if the contact resistance of an individual pole deviates more than 50% from the lowest pole, then the breaker should be investigated. It is important to note that NETA does not state that this test is a pass/fail of the breaker, but that further investigation should occur, or reach out to the manufacturer for assistance.

A pole contact resistance that deviates 50% from the lowest pole does not indicate failure, but that further investigation is needed. Contact the Eaton MCCB Technical Resource Center at 877-ETN-CARE (386-2273), option 2.

Contact resistance of an MCCB

Contact resistance tests the continuity of the conducting path, which is sometimes referred to as a pole resistance test. When a breaker is closed, the stationary contacts and the moving contacts (Make/Break contacts) make a connection and have a unique resistance between the two. The results of these tests can vary greatly due to extremely low resistance of the electrical contacts and connectors, which is why these results should not predict unacceptable performance.

Testing procedure for contact resistance

Equipment: Test should be conducted using a 24 Vdc, or less, power supply capable of supplying the rated current of the breaker. A Digital Low Resistance Ohmmeter (DLRO), capable of 10–100 A, can be used.

Note: A multimeter or low current ohmmeter should not be used. These will not provide an accurate measurement of millivolt drop.

Safe isolation: To begin the test, the breaker shall be safety isolated from the electrical source. The breaker should be removed from the application, or assembly; however, in some instances, the breaker can be safely isolated without removal.

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Procedure:

1a. If using a 24 Vdc power supply to test, apply the test current across a pole equal to the breaker rating. Do not maintain test current for longer than one minute. Apply current for a short period of time because the duration of current will affect the results.

1b. If using a DRLO, apply test current across a pole of 10 A for breakers less than 100 A. If a breaker is rated for more than 100 A, apply 100 A. Do not maintain test current for longer than one minute. Apply current for a short period of time because the duration of current will affect the results.

2. Record the millivolt drop and test current.

3. Repeat tests for a total of three readings on the pole being tested.

4. Repeat tests for each of the remaining poles of the circuit breaker.

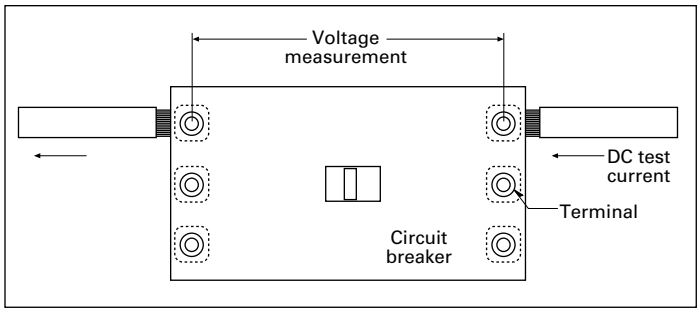

Figure 1.

Interpreting results

Variation of the pole resistance is expected, even in the same breaker, because of the contacts. Each time the breaker is opened and closed, a unique contact interface is formed that can alter the contact resistance results. Results can also vary depending on the breaker frame type, the ampere rating, and the manufacturer. Please note that testing is performed at a lower current value and voltage. In an application, the circuit breaker will be subjected to higher current and voltage of which typically yields improvement in resistance value.

If the average millivolt drop across every pole of the MCCB **exceeds 200 mV**, it is recommended to consult with Eaton. In some cases, the MCCB can be cycled (turned on and off) two to three times and the test results may improve.

Conclusion

It is critical that electrical equipment be tested appropriately prior to energization and during regular preventive maintenance. Interpreting the results is equally as important. Should there be any questions regarding your Eaton MCCB, a contact resistance test, or any other type of electrical testing, please reach out to Eaton's Technical Resource Center at 877-ETN-CARE (386-2273), option 2, for consultation.

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