Circuit Breaker Testing

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Testing Methods

Primary versus Secondary Injection

Solid State circuit breakers can be tested by either secondary or primary injection. The secondary injection test is performed using OEM designed test kits. The disadvantage of secondary injection is that it only tests the microprocessor trip unit logic and does not test the current sensors, wiring, or the breaker mechanical or current carrying components.

The primary current injection method is usually preferred because it is expected that this method tests that the sensors and wiring, as well as the current carrying path are functioning correctly. The testing should be performed per NEMA and NETA procedures in accordance with manufacturer's recommendations. These tests include:

· Measure contact resistance
· Test Instantaneous Trip function
· Measure overload tripping at 300%
· Test operation of ground fault and short time pickup and delay
· Verify operation of UV, Shunt Trip, Bell Alarm, charging motor, etc
· Check insulation phase to phase and phase to ground and across open contacts

Is it Necessary?

A survey by Hartford Insurance Company found that circuit breakers represent 19.5% of electrical power system failures. Test results by NETA companies show a 15% failure rate of circuit breakers.

Circuit Breakers fail due to a number of causes. They may be programmed incorrectly, have current sensors with broken wires, or are incorrectly wired from the factory. Most commonly circuit breakers fail becuase of dirt, hardened grease, corrosion, misalignment, or frozen or broken parts that prevent operation.

Main contacts and current carrying parts fail because they have been damaged by fault interruption, operating springs have fatigued over time or because an internal bus connection has become loose. Most people don't realize that molded and insulated case breakers are only rated for 1 to 3 full faults.   Repeated closing and tripping of a breaker onto a faulted bus or cable will destroy the internal contacts of a circuit breaker. This rule of thumb does not apply to Air Frame Circuit Breakers which are more robust.

Other causes of circuit breaker failure include: dashpots leaking, nuisance tripping, linkages not adjusted periodically, broken case or cracked insulation, metal fatigue, defective or broken parts, age, overuse or misapplication.

Testing Intervals

Primary injection testing is recommended at initial start-up of equipment and every three (3) years thereafter. Circuit breakers must be de-energized to perform testing.   For primary current injection a power source capable of supplying 100 amps at 208/240 or 60 amp at 480V (preferred) is required to power the test set.

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