Lubrication Failures in Circuit Breakers

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Statistics published for a broad spectrum of circuit breakers indicate that a significant number fail due to malfunctions in the operating speed of their mechanical components. Frequently, these operating mechanism failures can be traced to poor maintenance. This Technical Brief explains the role lubrication plays in circuit breaker operations and reviews maintenance best practices to help ensure their mechanical reliability.

The condition of circuit breaker lubrication is a primary factor of the overall ability of a circuit breaker to successfully interrupt fault current. If a breaker is designed to interrupt a fault in five cycles and the lubrication system is preventing the breaker from operating at the speed at which the breaker was designed, the arc energy in the interrupter may exceed acceptable design limits. Due to reduced operating speeds, a circuit breaker may exceed the maximum acceptable arcing times obtained during its original design tests. If the thermal limit of the arcing contact design is exceeded due to these lengthened arcing times, catastrophic failure may occur.

Given circuit breakers' long intervals of dormancy, it is advisable to test them periodically. There are several commercially-available methods to test the speed of circuit breakers to ensure they are operating at proper design speed when opening them for the first time in each maintenance cycle. These “first-shot” methods of determining the operating capacity of circuit breakers after long periods of latency are valuable tools in determining the quality of aged lubricants.

The required interval and type of maintenance of any circuit breaker is dependent on the cleanliness of the mechanism and the condition of the lubrication. The control of dust, dirt, humidity, and contamination all play a part and must be considered in designing a maintenance program.

When re-lubricating circuit breakers, it is important that the load bearing surfaces be properly cleaned and re-lubricated per the manufacturer’s recommendations. There are dangers in mixing lubrications, such as utilizing the wrong lubrication so that a chemical bond is formed that does not have the lubricity of the grease originally designed and tested for the equipment. The use of aerosol or other inappropriate lubricants can slow a breaker down to the point that it will never successfully interrupt fault current, even though it may break load current repeatedly.

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