Consequences of Vacuum Interrupter Failure

March 1, 1991

Users and prospective users of vacuum circuit breakers frequently ask us what happens if a vacuum interrupter fails to interrupt. The short answer to this question is that the interrupter is usually destroyed and must be replaced. However, this short answer needs some additional comment to be really informative.

First, failure of a properly applied vacuum interrupter to interrupt a fault current within its rating is a very rare event. In the 8 years that we have been building PowlVac® vacuum circuit breakers, we have manufactured over 3200 breakers. Assuming an average of two years in service for these breakers, we have a history of nearly 20,000 interrupter-years of service. We have never heard of a failure to interrupt by any of these circuit breakers. We are proud of this history, but, based on industry statistics, we are not surprised by it.

Second, even if an interrupter does fail, the consequences are not the disastrous burn down that some people imagine. During some recent design tests of a prototype of a new version of the PowlVac® breaker, we drove an interrupter far past its rated contact life span and had a failure. Photo 1 shows the failed interrupter. When failure occurred, the internal shield was burned through and the ceramic envelope, exposed directly to the arc, broke apart. The arc continued for several cycles, until the circuit was opened by a backup circuit breaker. Aside from the failed interrupter, the only damage to the circuit breaker was a small area of smoke and burn discoloration on the nearby insulating material. Photo 2 shows this area, which was about 6 inches square. Five minutes with an industrial cleaner and a couple of paper towels removed all but about one square inch of this discoloration. The remaining area seemed to be singed, but there was no detectable erosion of the surface of the insulating material. Had this breaker been in service, it could have been returned to service immediately after replacing the interrupter.
Summing up, interrupter failures are rare, and when they do happen, most are not a major disaster.

Photo 1
Failed Vacuum Interrupter

Photo 2
Discolored Insulation at Failure Location

Baldwin Bridger, P.E.
Technical Director