

## **BEHAVIOR OF VACUUM INTERRUPTERS DURING SWITCHING OPERATIONS WITH A HIGH RATE OF RISE OF RECOVERY VOLTAGE (RRRV)**

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### **ABSTRACT**

Current interruption by circuit breakers requires the rapid restoration of the dielectric strength of the contact gap after the end of arcing. Typical short circuit certification tests for medium voltage (MV) circuit breakers use a transient recovery voltage (TRV) after the end of the short-circuit current with a rate of rise of the recovery voltage (RRRV) in the range of 0.34-3.45 kV/μs. The higher values are used for tests below the full rated short-circuit current (tests T10, T30, T60 for example). Vacuum interrupters are extensively used in MV power systems for applications in circuit breakers, reclosers, tap changers, load break switches and contactors. Occasionally special interruption duties can require RRRV beyond the standard values, such as generator interruption applications which require a RRRV up to 6 kV/μs. Successful tests were performed up to 12.5 kV/μs with the full rated short-circuit current for axial magnetic field contacts (AMF), without observing a performance limit. Similar tests on transverse magnetic field contacts (TMF) were performed up to 9 kV/μs, again without observing a performance limit. Combining new results with previously published data further demonstrated successful tests up to 25 kV/μs with AMF and 15 kV/μs with TMF at lower currents. Therefore, there is no need for grading capacitors or similar techniques when using VI on present electrical power systems. Specialized applications, such as DC interruption with counter current injection, have observed a boundary in the decay of the current at current zero di/dt. So far, the RRRV has a limited effect on the di/dt boundary, again demonstrating the excellent performance of VI at high RRRV values.

Primary = Vacuum Interrupters and Spark Gaps

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