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Methodology for analysing post-arc currents of test circuit measurements in vacuum interrupters

As interest in SF6-free technologies increases, the demand for vacuum interrupters (VIs) capable of operating at higher voltage levels is also growing. To meet these demands, design innovations such as larger contact gaps and the series connection of multiple VIs have been implemented.

During the current interruption process, a high plasma density forms between the electrodes. Once the current is interrupted, the residual ions and electrons allow for the detection of a significantly smaller post-arc current, which typically ranges from 1 to 10 A. Accurately quantifying these post-arc currents after high short-circuit currents, exceeding 1 kA, presents considerable challenges, as it is crucial that the plasma is fully extinguished to ensure a successful interruption. Therefore, understanding the characteristics of this plasma is essential for analysing the switching behaviour of VIs and for designing new arrangements of vacuum circuit breakers to meet higher voltage requirements.

The small post-arc currents obscured by the circuit response current of the test circuit. To resolve this issue, a novel methodology for isolating post-arc currents from circuit-related disturbances are developed. This advancement enables more precise analyses and allows the results to be compared and traced for the first time. This capability is particularly important in high-voltage switch applications, where stray capacitances can significantly influence measurements.

To validate the foundational aspects of this methodology, investigations of post-arc currents during current interruptions of up to 15 kA, utilizing contact gaps of 10 mm are conducted.

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