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Experimental Investigation on the Second Commutating Process of a Quench Protection Switch

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The quench protection switch (QPS) is an indispensable component to ensure the safety of the magnet coils of a superconductive tokomak when a quench happens. The two most important functions of a QPS are to carry high direct current during normal operation and to interrupt the high direct current when a quench occurs. In this paper, the second commutating process of a QPS based on artificial current zero is investigated. In this process, the current, which has already transferred from the by-pass switch to the main circuit breaker (vacuum circuit breaker), is forced to commutate from the vacuum circuit breaker to the dump resistance by the counter current. A LC oscillating circuit is applied to generate oscillating current to simulate the direct current near its peak which is in the range of 4-20kA. The counter current with frequency of 500Hz and 1000Hz is provided by a pre-charged capacitor bank. The equivalence of the interrupting process between practical direct current source and LC oscillating source is analyzed. The vacuum interrupter of the vacuum circuit breaker adopts a pair of contacts generating transverse magnetic field. The evolution of vacuum arc in the interrupting process is investigated by a high-speed camera with exposure time of 2μs.The experiment results indicate that the initial process and the motion of the vacuum arc before injecting the counter current have crucial impacts on the interruption performance.

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Eligible for student paper award?

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