

Benchmark Tests of Single-Break and Double-Break Design Principles

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Abstract— In this paper test results of low voltage molded case circuit breakers are discussed with a special respect to two basic design principles: single-break and double-break). Experimental tests were carried out using a discharge bank test system as well as single-phase and three-phase AC-power tests at various fault current levels.

Test results show the two basic design principles have different influences on characteristic switching parameters such as arc voltage, arc current, short circuit interruption duration, I_2t , VI_{dt} , and pressure. At low current levels, the single break design seems to have advantages over the double break design because double break design re-closes during short circuit events which causes a longer arcing duration and consequently a higher I_2t and VI_{dt} . It seems that strong interaction of the arc with the chamber material in a small chamber volume as well as two arcs generated by the double-break design leads to an effective current limiting (by fast increasing of the arc voltage to a high level), but it causes strong material evaporation. Single-break design seems to also have advantages in thermal performance or temperature rise tests after switching or interruption tests over double-break design due to the fact contact interface is one of the major heat sources in a breaker.

Key words: Single break, double break, capacitor bank test, short circuit test, re-closing, arc, arc chamber, I_2t , VI_{dt} ,