Controlled Switching Systems for Gas Circuit Breakers; State of the Art

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Abstract

Controlled switching systems (CSS) for gas circuit breakers have become an economical solution and commonly applied to reduce switching surges on various circuit breaker operations. Since the late 1990's, the number of installations has increased rapidly due to satisfactory service performance with more than 2000 units in operation as of 2001.

Basic theory and technology in application of CSS have been discussed and summarized in several reports by CIGRE WG A3.07, and more complicated technical subjects for practical operations are being discussed recently. Since CSS requires accurate operation consistency of circuit breakers, it is important to compensate for variations of the circuit breaker operating times under various operating condition. Recent research by CIGRE WG A3.07 reveals that some hydraulic mechanisms generate a considerable delay of the closing time after every few hours of idle time. Accordingly, the idle time compensation is essential for practical applications even daily-operated system if the circuit breaker shows this dependence. Contact erosion after current interruptions is also important parameter to change a Rate of Decay of Dielectric Strength between circuit breaker contacts(RDDS), which plays important role in controlled switching.

In addition to circuit breaker characteristics, the study for the technology has been consecutively performed on load condition to be switched, i.e. a residual flux in transformer core that makes difficult to reduce an inrush current on energization by conventional CSS. The effort has progressed with an innovative measuring scheme of a residual flux and realized a CSS application for transformer switching taking into account of residual flux in iron cores. The system has now put in service for reduction of inrush current.

This paper presents detail evaluations of these technical subjects and satisfactory service experiences of CSS for shunt capacitor bank switching as well as shunt reactor switching based on the practical operating data those are measured and stored in the switching controllers. The latest technology for controlled switching system for no-load transformer taking into account of residual flux is also presented its successful field evaluation results.