

Year 2001
Progress Report of Study Committee 13
Switching Equipment

by E. Kynast, Secretary of SC 13

Field of activities

Study Committee 13 is dealing with switching equipment in high voltage networks. The apparatus itself as well as its interactions with networks as complex systems and their components are considered.

The study of reliability of switchgear in service, in particular of high-voltage circuit-breakers is a basic task of the Study Committee combined with investigations concerning reduction of life-cycle costs, extension of life expectancy and increase of availability.

The future situation of energy transport and distribution will lead to an increased utilization of the equipment capabilities and therefore to higher equipment stresses. This means that a more detailed knowledge of stresses switching equipment might be exposed to in the future systems is required to propose adequate test procedures with the aim to improve equipment reliability.

New technologies and possible alternatives to presently used switching devices and their impact on transient behavior of network and other equipment are continuously observed.

Requirements for higher flexibility of system and equipment controls are given by trends in the energy market. The demand of advanced techniques for monitoring, diagnostic and application of controlled switching has been investigated. The future trends of application of digital control systems in substations as well as in switching equipment itself lead to an increased activity concerning the reliability of control systems and their possibilities of implementing advanced features.

Activities and Cooperation with other bodies

Cooperation CIGRE SC 13 / IEEE Switchgear Committee

The cooperation with IEEE Switchgear Committee provides information on their recent activities. Generally, harmonization efforts with IEC continues, even accelerate. A Task Force has been created to consider issues surrounding IEEE adoption of IEC standards, and which "in-country" clauses would be needed.

A new Task Force to review TRV's from transformer fed faults has been established. The Task Force is working with the IEEE Transformer Committee to gather updated transformer data first.

Cooperation SC 13 with IEC TC 17 and SC 17A

The exchange of information between SC 13 and IEC TC 17/17A is practiced continuously due to some personal engagement in both committees. Beside the work in WG 13.11 the main items of interests for SC 13 which are under discussion are the following:

- A proposal concerning "Electrical Endurance" based on the survey of CIGRE WG 13.08 is under discussion
- To standardize requirements for grading capacitors for circuit breakers has been just started in TC 33
- The next new projects will be:
 - Revision of IEC 60427 "Synthetic testing" and IEC 60694 "High voltage equipment";
 - upgrade the report IEC 61233 "Inductive currents" to a standard;
 - by-pass circuit breaker and equipment with combined functions;
 - review standards on seismic testing and calculation, based on IEEE 693.

Activities of Working Groups

Advisory Group on International Standardization

Convener: I. Bonfanti (Italy)

To increase the speed of working progress it was decided to establish this Advisory Group, which will define the demand, specify the tasks and give them to small ad hoc Task Forces with adequate experts. The main object of the Advisory Group is to coordinate the activities of SC 13 required to support international switchgear standardization activities, especially IEC SC 17A in due time. The following topics has been settled:

Out-of-phase stresses and testing: The work gives support to IEC 17A WG23 to finalize their Committee Draft for Voting concerned with harmonization of IEC and ANSI TRVs for high voltage circuit-breakers. The work has been positively used by IEC.

TRV in HV networks: The concern was that the material used by IEC is about 30 years old and question was weather these TRVs are still representative for actual conditions. A collection of historical material was made to appreciate how the present status was reached to support any conclusion. The conclusion was that the Advisory Group sees no reason to propose a WG to SC 13 for reconsidering TRV values above 100 kV for the time being.

WG 13.07: Controlled Switching

Convener: K. Fröhlich (Switzerland)

The Working Group is covering the field of conditions for controlled switching for various possible applications, systems and circuit-breaker requirements as well as system and load response. The characteristics of the circuit-breakers has to be considered by these investigations.

In continuation to the document "Controlled Switching of HVAC Circuit Breakers - Guide for Application", the Working Group has finished a second document titled "Planning, Specification and Testing of controlled switching systems".

The intention of this document is to give guidance to users and manufacturers of controller-breaker systems how to proceed when implementing controlled switching. Also in examples guidance is given what kind of pre-studies should be carried out. These studies are the basis how to specify the controller-breaker system taking into account that controller and breaker may be from different manufacturers. Recommendations are given how to type test such a controller-breaker system. Questions of responsibility for the entire system are covered.

The Working Group currently is focusing on the subject of the economical impact of controlled switching. For certain switching cases templates has been created which should give assistance to consider all related aspects..The templates summarize in a very compact format all technical facts which are related to controlled switching, how they are connected and it is tried to evaluate the costs or cost savings. As a tentative result it turns out that controlled switching may be an effective measure for cost reduction due to stress reduction on the breaker itself and/or on adjacent equipment.

WG 13.10: Specifications for short current limiters
Convener: A. H. Schmitt (Germany)

The uprating of the load carrying capacity of medium and high voltage distribution systems leads to considerations to use short circuit current limiters. The first report of the Working Group "Functional specifications for short circuit current limiters" has been finished and published. The report points out the critical features that must be addressed for special designs. To give a specific list of requirements is not possible at this time. A great variety of techniques are applied at present which are described in 26 applications, most of them industrial. The results of an inquiry among potential users of fault current limiters out of industry as well as utilities are incorporated.

The future program of work for WG 13.10 will be the exploration of the topics "State of the art", "Testing" and "System demands" related to fault current limiters.

WG 13.11: Application Guide for IEC 62271-100 and IEC 60694
Convener: H.H. Schramm (Germany)

To support users and to provide them with background information a guide will be worked out upon the requirements of the Standards IEC 62271-100 "High-voltage alternating-current circuit-breakers" and IEC 60694 "Common specifications for high-voltage switchgear and controlgear standards".

The Working Group has reviewed the topics to be included in the application guide and got a long list of detailed tasks in this field. The first part has been finished containing the topics: Classification of circuit-breakers, Short-line fault and Terminal fault considering Short-circuit current, Arcing time and TRV-circuit currents.

The second part of the guide is nearly finished covering among others the topics

- Rated normal current and temperature rise
- Insulation coordination
- Capacitive and small inductive current switching
- Out-of-phase condition
- Impulse voltage withstand procedures
- Gas and vacuum tightness

WG 13.12: Circuit-breaker controls
Convener: P. Högg (Switzerland)

The Working Group 13.12, has been established under the convenership of P. Högg, Switzerland in the beginning of 2001. The task of WG 13.12 is to investigate the recent developments in circuit-breaker control technology, as change from conventional to electronic control. The integration into substation control in respect on the requirements of circuit-breakers and systems and the future trends in this area will be lined out.

Background of the work for WG 13.12 is that circuit breaker controls have a major impact on the reliability of circuit breakers. In the 2nd International Enquiry on high voltage circuit breaker failures and defects in service control systems were identified as the cause of 24 % of all major failures. Circuit breaker controls have typically become more complicated in recent years and have many special requirements for each utility customer. Also in recent years circuit breaker control system functions have been expanding to include controlled switching, monitoring and diagnostics.