Hosted by Manitoba Hydro

Cigré Tutorials

Wednesday, October 4, 2017 | 08:00 – 17:00

RBC Convention Centre Winnipeg | Meeting Room 4 (ground floor)
Lunch is provided for participants in Meeting Rooms 2 & 3 (ground floor)

TUTORIAL #1: WG D1.44 - Pollution Test of Naturally and Artificially Contaminated Insulators
08:00 to 09:00

Presenter: Igor Gutmann | STRI, Sweden

This tutorial covers the results of work of WG D1.44 established at the direct request of CIGRÉ/IEC after it was considered that there was a lack of standardization with respect to test methods for the quick but reliable evaluation of the flashover performance of NATURALLY POLLUTED external insulation, including ceramic and polymeric insulators at AC and DC. Special time-efficient and cost-effective pollution test methods need to be developed. The presentation concentrates on pollution testing of NATURALLY POLLUTED insulators and the conclusion is that both the Rapid Flashover test (simulating solid layer pollution) and the Quick Flashover test (simulating wet salt fog pollution) can be applied for both ceramic and composite insulators for both AC and DC. Practical limitations in the application of such methods as well as some of the limitations in the interpretation and application of the results are presented and discussed. Compilation and analysis of the results from different laboratories which used rapid procedures test method made it possible to derive a procedure which can be used as the preliminary basis for future round robin testing and further test standardization. It is intended that the same or similar procedure be applicable for ceramic and polymeric insulators as well as for AC and DC voltages. Recently a number of practical applications of such rapid methods were even reported for ARTIFICIAL pollution for both AC and DC voltages, as well as for ceramic and composite insulators. The examples are also included in the tutorial. The repeatability of such methods and even a limited verification of the reproducibility of the results appeared to be satisfactory. This may open the way for a round robin test in different laboratories.

TUTORIAL #2: WG D1.33 - High-Voltage On-Site Testing with Partial Discharge Measurement
09:00 to 10:00

Presenter: | Ralf Pietsch | HIGHVOLT Prüftechnik Dresden GmbH, Germany

The tutorial discusses and presents the commonly used High Voltage (HV) sources and Partial Discharge (PD) measurement techniques developed for on-site tests. As opposed to most dielectric measurements which are characteristics of the whole dielectric volume, partial discharges are “weak point phenomena” as it is also the electric breakdown. In case of the new insulation, the critical defects/weak points are e.g. the result of an assembling failure which can be found by a routine test consisting of the HV withstand test including PD measurement. In case of the insulation of HV equipment in service (which has been tested successfully and which operates for years) a critical defect might be caused by high electrical, thermal or mechanical stresses and by the “aging” of the insulation itself. The tutorial will show that HV onsite testing with PD measurement will play an increasing role for the improvement of the reliability of equipment for electric power generation, transmission and distribution.

Break
10:00 – 10:30

TUTORIAL #3: JWG A3/B4/D1 – DC Switchgears
10:30 to 11:30

Presenter: Christian Franck | Swiss Federal Institute of Technology, Switzerland

The new applications projected for future DC grids and multi-terminal DC systems at different voltages suggest that various DC equipment may be required; in particular all sorts of switching devices. The requirements for DC switching capabilities are different from those for AC equipment. Moreover, standards for DC system and equipment performance testing are lacking. Thus, a joint working group between study committees A3 and B4 was created to investigate into these topics.

The working group reviewed the technical requirements of DC switching equipment and investigated the technical capabilities and limitations of existing and projected switching equipment to facilitate the development of new DC switching equipment. The work focused on switchgear for HVDC, and included all sorts of switchgear such as disconnecting switches, earthing switches, transfer switches and circuit breakers.

The tutorial will give an overview on the capabilities of existing HVDC switchgear and anticipated new requirements in near future applications, such as multi-terminal networks. Focus of the tutorial will be on HVDC circuit breakers, where only prototypes have been presented and a limited number of laboratory tests were conducted, so far.

TUTORIAL #4: JWG A3.32/CIRED – Non-Intrusive Methods for Condition Assessment
11:30 to 12:30

Presenter: Nenad Uzelac | G&W Electric Company, United States

There is a general trend in the utilities to move from systematic (time-based) maintenance to condition based maintenance and risk based maintenance taking advantage of modern diagnostic tools and the transformation of the network to the Smart Grid. The application of many of commonly used diagnostic method of switchgear is off-service, i.e. involves scheduled outages, or even worse, requires partial dismantling of switchgear. The application of continuous condition monitoring for existing high voltage circuit breakers is expensive since involves complex retro-fitting. Moreover, the use of these diagnostic techniques on medium voltage equipment is limited. The needs of introducing new efficient diagnostic methods for switchgear in the field are increasing.

In this context, non-intrusive diagnostic methods, which are flexible and easy to use, emerge as a solution for a first-round assessment of critical parameters and detection of incipient switchgear malfunctions. CIGRÉ/CIRED Joint Working Group A3.32 was formed with the task to research the existing state of the art of non-intrusive methods and their field experience applied in HV and MV switchgear to assist in the evaluation of T&D switchgear conditions. In this tutorial, the overview of the existing non-intrusive switchgear diagnostic methods will be presented and definitions will be introduced."

Lunch – Meeting Rooms 2 & 3 (ground floor)
12:30 – 13:30

TUTORIAL #5: WG B4.63 – Commissioning of VSC HVDC Schemes
13:30 to 14:30

Presenter: Les Brand | Amplitude Consultants, Australia

Voltage Source Converter (VSC) technology has emerged as a commercially viable alternative to Line Commutated Converter (LCC) technology for certain applications of HVDC power transmission. VSC has become the preferred, if not the only, choice of technology for specific applications, including low power transfer applications, the connection of weak networks, offshore wind farm connections and d.c. grid developments. The process of commissioning VSC projects has developed over the first fifteen years of its commercial operation, based initially on a similar process for commissioning LCC HVDC projects (i.e. Cigré Technical Brochure 97) and expanded upon and modified by the suppliers of VSC technology. Whilst there are many similarities in the processes and procedures for commissioning the two technologies, there are some notable and significant differences that justified the need for a separate technical brochure covering the commissioning requirements for VSC projects. This tutorial will work through the Technical Brochure prepared by WG B4.63, which is due for imminent release. The tutorial will start with an overview of the stages and sequence of commissioning a VSC system, and will then walk through these stages covering off-site testing of the control and protection system, subsystem testing, system testing (including power quality and interference and a.c. network interaction tests). The tutorial will also address various key issues associated with commissioning HVDC systems, particularly those that have become prevalent since the release of the Technical Brochure TB97 including topics on commissioning management and coordination and addressing the practical limitations of site testing, including limitations presented by current VSC applications such as off shore wind farms, commissioning within constrained networks and commissioning in an electricity market environment.

TUTORIAL #6: WG B4.67 – Harmonic Aspects of VSC HVDC, and Appropriate Harmonic Limits
14:30 to 15:30

Presenter: Nigel Shore | ABB, United Kingdom

The tutorial will give an overview of the Technical Brochure being prepared by WG B4/67, which is nearing completion. Voltage Source HVDC converters have revolutionized the HVDC industry over the last 20 years. Because they are capable of producing a near sine-wave voltage waveform, and of controlling their reactive power output independently of real power throughput, they do not need the huge banks of switched AC filters associated with Line Commutated Converters. However, issues with harmonic performance remain, particularly concerning higher frequency harmonics, inter-harmonics, and the interaction of the VSC and its control system with the AC network and its pre-existing harmonic distortion. The tutorial will discuss these issues. The nature of harmonic generation from different configurations of VSC will be analyzed, and the nature of the VSC as a harmonic impedance investigated. Mitigation measures will be considered, which may entail a small AC side filter but more often can be dealt with by appropriate use of the converter control system. The possible need to adapt existing practice in determining appropriate harmonic performance limits will be discussed. Finally the Tutorial will look at methods of modeling VSCs for harmonic studies, considering the benefits of both frequency and time domain approaches. Practical illustrations from actual projects are introduced where appropriate.

Break
15:30 – 16:00

TUTORIAL #7: WG B4.53 – Guidelines for the Procurement and Testing of STATCOMS
16:00 to 17:00

Presenter: Dan Kell | TransGrid Solutions, Canada

A static synchronous compensator (STATCOM) is a reactive power regulating device based on the voltage sourced converter (VSC) used to maintain ac system voltages and enhance the stability of the ac system.

As these power electronic devices are becoming more and more prevalent in the power-system, it is becoming more important than ever to have a set of guidelines in place to enable the industry to adequately procure and test these devices to ensure safe, efficient and reliable operation, while maintaining the capability to allow the “future-proofing” of the system for future upgrades.