

PROPOSAL FOR THE CREATION OF A NEW JOINT WORKING GROUP (1)

<p>JWG* N° A3.32/CIRED</p>	<p>Name of Convenor : Nenad Uzelac (United States) E-mail address: nuzelac@gwelec.com</p>
<p>Technical Issues # (2):</p>	<p>Strategic Directions # (3): 1, 2</p>
<p>The WG applies to distribution networks (4): Yes</p>	
<p>Title of the Group: Non-intrusive methods for condition assessment of distribution and transmission switchgears</p>	
<p>Scope, deliverables and proposed time schedule of the Group :</p> <p>Background :</p> <p>In the aim to optimise maintenance costs of switchgear equipment 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 advancing transformation of the network to the Smart Grid. The proposed Working Group will focus on circuit breakers (CB) used in HV Air Insulated Substations and on pole top and substation mount CB, reclosers and fault interrupters (CB/R/FI) used in MV.</p> <p>There are many diagnostic techniques available today for the condition assessment of Switchgear equipment. Unfortunately the application of these techniques in many cases are off service i.e. involves schedule outages as the equipment must be isolated from the network. Also, the use of these diagnostic techniques on MV (distribution) equipment is very limited. Taking into account that the MV switchgear designs are moving from SF6 insulation to solid dielectric insulation, the importance of applying predictive diagnostic methods in the field is increasing.</p> <p>In the past, two CIGRÉ working groups analysed issues related to condition monitoring (CM) of HV equipment: 13.09 and B3.12. No work has been done by CIGRE for CM in MV equipment.</p> <ul style="list-style-type: none"> • TB 167 (WG 13.09) gives a general overview on the philosophy and application of CM to HV switchgear. It does not focus on the analysis of the monitoring methods. This work can be used as a reference for the new Working Group but the new focus will be in the detailed review of the state of the art and future trends on specifically non-intrusive methods to apply. • The TB 462 (WG B3.12) treats the issues related to on-line CM in HV substations. The main conclusion is that information obtained from CM can provide the relevant value for asset life management; the economical effectiveness however is not straightforward but can be demonstrated on the basis of probabilistic calculations. <p>Application of continuous CM can be expensive for high voltage circuit-breakers (HVCBs) since, in many cases, involves complex retro-fitting. The implementation of continuous CM may be even more complicated for outdoor equipment than for indoor since in outdoor conditions there is more interferences (electromagnetic and mechanic), influence of weather, presence of live conductors, etc. In this context, it is desirable to develop non-intrusive diagnostic methods which provide a flexible and easy to adapt system to give an early warning of outdoor CB/R/FI failure so an outage for maintenance or repair can be scheduled. There are two levels of non-intrusive condition assessment: in service and off service. Non-intrusive techniques allow a new paradigm for condition assessment: periodic evaluations instead of continuous CM.</p> <p>Many emerging non-intrusive techniques are reported in the literature, most of them allowing in service evaluation: electromagnetic transient emission measurement, partial discharges detection, dynamic resistance measurement, vibrations measurement, gas leaks detection, vacuum integrity inside VI, analysis of gas decomposition products and advanced analysis of</p>	

data from protection relays and digital fault recorders.

The latter topic, in more general scope of high-voltage substation equipment, is a subject of B5.20 working group and is described in TB 424.

This Working Group will review the current and future trends of non-intrusive, especially in service, diagnostic methods to apply in the CM of CB/R/FI (both for High Voltage and Medium Voltage). It will provide user feed-back and return of experience from utilities, manufacturers and service providers. It is proposed to undertake the work in two sub-teams for MV and HV switchgear so the members could focus on their topics though in the larger context.

The Working Group will take into account past works by working groups 13.09 and B3.12 as well as relevant ongoing activities performed by other study committees; especially by B3, for general substation live management concept, by B5 for use of protection and automation enhanced infrastructure and on-line information for improvement of maintenance of CB/R/FI, and finally by D1, for development of new sensors as well as new diagnostic and analyzing methods.

Scope :

1. To review existing state of the art of non-intrusive methods and their field experience applied in HV and MV CB/R/FI to assist in the evaluation of transmission & distribution equipment conditions using the different parameters such as:
 - a. Insulation: gas characteristics (decomposition product, pressure, etc.) and partial discharges
 - b. Switching: operation time, pole discrepancy, re-strike, dielectric stress assessment, arcing time and contact wear
 - c. Current carrying: contact resistance, temperature and position
 - d. Mechanical drive: number of operations, energy, vibrations and damping
 - e. Control and accessories: supply voltage, coil current, auxiliary switch and heat
2. To provide users experiences, case studies and application feed-back
3. To analyse technical vs economical benefit for applying non-intrusive methods on CB/R/FI
4. To identify future trends in the technology and switchgear user requirements

The Working Group should involve the specialists in electrical and mechanical engineering as well as in chemistry.

Deliverables: Electra summary report. Technical brochure. Tutorial.

Time Schedule : start : September 2013

Final report : 2016

Comments from Chairmen of SCs concerned : B3, D1

Approval by CIGRE Technical Committee Chairman :
Date : 20/05/2013



Approval by CIRED Technical Committee Chairman :

Date :

- (1) Joint Working Group (JWG) - (2) See attached table 1 – (3) See attached table 2
(4) Delete as appropriate

Table 1: Technical Issues of the TC project “Network of the Future” (cf. Electra 256 June 2011)

1	Active Distribution Networks resulting in bidirectional flows within distribution level and to the upstream network.
2	The application of advanced metering and resulting massive need for exchange of information.
3	The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation.
4	The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation.
5	New concepts for system operation and control to take account of active customer interactions and different generation types.
6	New concepts for protection to respond to the developing grid and different characteristics of generation.
7	New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics.
9	Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network.
10	An increasing need for keeping Stakeholders aware of the technical and commercial consequences and keeping them engaged during the development of the network of the future.

Table 2: Strategic directions of the TC (cf. Electra 249 April 2010)

1	The electrical power system of the future
2	Making the best use of the existing system
3	Focus on the environment and sustainability
4	Preparation of material readable for non technical audience