CIGRE Study Committee A3

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP[1]

JWG N° A3.43/CIRED	**Name of Convenor:** Nicola Gariboldi (Switzerland)
Strategic Directions #[2]: 1, 2	**Technical Issues #[3]: 8**
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #[6]: 1, 2	
Title of the Group: Tools for lifecycle management of T&D switchgear based on data from condition monitoring systems	

Scope, deliverables and proposed time schedule of the Group:

Background:

The vast majority of the T&D switchgear users are purchasing and installing the on-line sensors to monitor the existing condition of the equipment and identify the trends to:

- avoid unnecessary maintenance outages;
- reduce the cost of the periodic testing;
- improve budget planning for maintenance and repair based on actual trends in equipment behaviour;
- identify possibilities to increase the equipment loading without making capital investments into the replacement or upgrades;
- predict the end of life of the equipment.

Over the past several decades with the significant advancements in the sensing technologies multiple systems were introduced into the marketplace which allow the condition monitoring of the T&D switchgear. These systems provide various condition parameters such as values of the load current, partial discharge, contact temperature, breaker operating times, vibration, pressure, capacitance of the dielectrics, transient electromagnetic emission, etc. The Technical Report of CIGRE/CIRED JWG A3.32 provided a comprehensive summary of various diagnostic methods and monitoring systems. It provided technical and economical evaluation of various methods and identified future trends in T&D switchgear condition monitoring.

The new Working Group will take into account the work performed by JWG A3.32 and focus on integration of various condition monitoring systems into the maintenance and operation process of T&D switchgear. Also, the new Working Group will address the need to combine the data from various sources such as sensing systems, diagnostics and historical data, evaluate them automatically and provide the specific recommendations to the equipment users. Automation of analysis allows realization of a concept of self-diagnostic switchgear.

These require development of analytical tools which would be custom tailored to the specific switchgear equipment but expressed in simple and general way, for example as a flow diagram. Some papers call it Asset Health Index (AHI). The analytical tool should be capable to evaluate the trends of each monitored parameter over time to assist in the switchgear lifecycle management. These would allow a true integration of condition monitoring into the T&D switchgear's lifecycle management process and deliver the fact-based information to the equipment users to be able to establish the necessary maintenance activities and estimated end of life of the equipment. The new Working Group will consider the previous work of WG A3.29. In the chapter 3 of the recently published TB 725, it is provided a comprehensive

overview circuit breaker functionality, its ageing phenomena, failure modes, detection techniques and mitigation techniques typically applied.

This new WG will focus on what to do with the data collected from diagnostic activity and monitoring systems to assess the switchgear condition and estimate its end of life.

Finally, the new Working Group will collect and analyze the volunteered information provided by utilities and manufacturers about the way how the end-of-life of T&D switchgear is estimated. This is of particular interest for SF6 gas circuit breakers (HV and MV as well), considering the environmental issues and the fact that the first generations are reaching its end-of-life. The members of the new WG will aim to gather and share knowledge and experience about life cycle of CBs and the ways how to assess and predict its condition with a look to future trends. With support from SC B5, the Integration in digital substation with process bus to collect data from condition monitoring system can be also addressed.

The final target is having a toolbox to enhance the use of monitoring and diagnostic data in a shared and more comprehensive way to reach a more quantitative description of the current state of the switchgear condition.

Scope:

1. Identify critical condition indicators of T&D switchgear
2. Providing user's experiences of using continuous condition monitoring systems and periodic diagnostics into the existing T&D switchgear
3. Establish criteria for development of an analytical tool for Switchgear Health Index (SHI)
4. Provide user's experiences of end-of-life of T&D switchgear
5. Identify future trends in end-of-life management
6. Compliance with digital substation for collecting data via process bus (SC B5 support)

Deliverables:

☒ Technical Brochure and Executive summary in Electra

☒ Electra report

☒ Tutorial[5]

Time Schedule: start: January 2019 **Final Report**: December 2021

Approval by Technical Committee Chairman:

Date:November 13th, 2018

Approval by CIRED Technical Committee Chairman :

Date :

Notes: [1] or Joint Working Group (JWG), [2] See attached Table 2, [3]See attached Table 1, [4] Delete as appropriate, [5] Presentation of the work done by the WG, [6] See attached table 3

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
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 (ref. 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

Table 3: Potential benefit of work

1	Commercial, business or economic benefit for industry or the community can be identified as a direct result of this work
2	Existing or future high interest in the work from a wide range of stakeholders
3	Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry
4	State-of-the-art or innovative solutions or new technical direction
5	Guide or survey related to existing techniques. Or an update on past work or previous Technical Brochures
6	Work likely to have a safety or environmental benefit