CIGRE Study Committee A2 & D1

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

JWG* N° A2/D1.51 (1)	**Name of Convenor : Sebastian Coenen (DE)** **E-mail address**: **sebastian.coenen@siemens.com**
Technical Issues # (2): 8	**Strategic Directions #(3): 2**
The WG applies to distribution networks (4) : Yes	
Title of the Group: Improvement to Partial Discharge Measurements for Factory and Site Acceptance Tests of Power Transformers	

Scope, deliverables and proposed time schedule of the Group :

Background :

Partial discharges (PD) in an electrical insulation system indicate flaws which may develop into a full insulation breakdown. International standards such as IEC 60270 or IEEE C57.12.90 include electrical tests and measurements to detect PD as routine tests. The apparent charge Q_{IEC} has therefore become an important indicator of transformer quality despite the fact that the measured level of apparent charge depends strongly on the position of the PD within the active part of the transformer and the measurement bandwidth.

In the last few years, alternative methods for PD measurement, such as acoustic and electro-magnetic ultra-high frequency (UHF) measurements, have been developed. These methods have proven to be very sensitive in detecting PD and can assist in determining the location of PD faults. Compared to electrical measurement methods, the UHF method is more robust against external noise than current technology (acoustic) and allows a differentiation of external and internal PD. This makes the UHF method suitable for use in the manufacturer's test laboratory (low ambient noise,) and on-site after transportation and installation of transformers (usually high ambient noise).

For alternative PD measurements to become an accepted indicator of a transformer's quality that can be used as an acceptance tests, the methods need to be proven to be reliable. Calibration of the sensors and measurement set-up, sensitivity, sensibility to noise, number of and placement of sensors, comparability with electrical measurements, and procedures for acceptance tests in the factory and on-site, will all need to be further investigated.

Scope :
The proposed brochure will focus on:

- Discussion and Comparison of given methods in international standards
- Discussion and Evaluation of alternative methods
- Recommendations for improved PD Factory/Site Acceptance Tests

The Working Group will:

- Review and compare available publications about detection of PD in transformers
- Investigate the emission spectrum of different types of PD in oil
- Determine the attenuation of coupling paths for PD signals
- Evaluate the factors influencing signal quality (like sensor characteristics)
- Identify the most common sources of noise and recommend measures to optimize signal to noise ratio (SNR)
- Compare the sensitivity of the alternative methods with electrical measurements. Propose a sensitivity check (calibration)
- Make recommendations about sensor characteristics and sensor placement
- Make recommendations about frequency ranges and signal amplification
- Make recommendations about the best practices for PD detection, PD type identification and PD localization, combining electrical and alternative PD measurements during factory acceptance tests and site acceptance tests

Deliverables : The work will be finalized with a brochure, a workshop and a short report in Electra: **Main Tasks and Time Schedule: Start:** : August 2014 **Final report:** September 2017
Comments from Chairmen of SC concerned : D1
Approval by Technical Committee Chairman : **Date** : 26/02/2014

(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