CIGRE Study Committee A3

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

WG A3.39	**Name of Convenor: Robert le Roux (Ireland)** **E-mail address: robert.leroux@esbi.ie**
Strategic Directions #[2]: 2	**Technical Issues #[3]: 3, 6**
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #[6]: 3, 5	
Title of the Group: Application and field experience with Metal Oxide Surge Arresters	

Scope, deliverables and proposed time schedule of the Group:

Background:

Metal Oxide Surge Arresters (MOSAs) are applied to different locations in AC power systems to protect substation equipment and transmission and distribution lines from various transient overvoltages caused by lightning strokes and switching operations. MOSA's also protect series and shunt capacitor banks. MOSA's are also used for the energy absorbing unit of DC switching equipment.

CIGRE had investigated technical requirements of MOSA designs mainly on protection levels and energy absorbing capability and recommended MOSA testing methods. In 1991, CIGRE WG 33.06 published TB60 describing protection effects of a gapless MOSA from various overvoltages. In 2013, WG A3.17 published TB544 summarizing design requirements and testing requirements for MOSA including energy handling capability and its testing requirements. WG A3.25 will soon publish a TB dealing with MOSA for emerging system conditions, which covers the long-term performance of MOSA, UHV AC & DC requirements, MOSA with/without a gap.

The remaining issues for MOSA investigation are to clarify a consistency of design and testing requirements for MOSA's based on field experience. A reliability survey can help to understand how actual field stresses can be covered by the requirements on MOSA's, including the consequences of short-circuit. However, MOSA reliability should be considered with the reliability of substation equipment in power systems along with users' policies on the MOSA specifications, when considering the role of MOSA's in power systems.

A specific application of a MOSA is commonly a compromise between its protection levels, its withstand capability against temporary overvoltages and its energy handling capability. Higher protection levels can increase the reliability of a MOSA to survive temporary and transient overvoltages, whereas it reduces the margin of protection for substation equipment protected by the MOSA. In some applications, a sacrificed or destroyed MOSA is intentionally accepted, because even in this case the arrester protects the transmission system from severe overvoltages. Therefore, it is important to investigate the users' policy on MOSA applications and selections, along with field experience of power equipment protected from transient overvoltages by MOSA's, when MOSA reliability is discussed. It should be also realized that MOSA failures in distribution systems have not been investigated in the most cases. Normally a failed MOSA is just replaced like a fuse as the most cost effective option.

The reliability of MOSA's along with field experience of power equipment protected by MOSA's in power systems has not been investigated previously, including the failure

analysis of MOSA and damage to related substation equipment under various transient overvoltages. The survey will also deal with utilities policy of MOSA applications, selections and maintenance practices, field experience of MOSA used for HVDC grids and DC switching equipment.

Scope: The WG will investigate the following subjects focusing on field experience:

- Reliability surveys of MOSA's and related power equipment in power systems (start at transmission level) – considering applications, impact on other equipment and failure analysis: causes (excessive stress or design and manufacturing responsible), operating conditions, imposed field stresses.
- Utilities' policy on MOSA applications and selections, maintenance practices, replacement criteria of MOSA's for different applications in AC power systems. The use of the IEEE arrester standards in the US versus the IEC standards in the rest of the world will be compared. What is the experience with the guides for selection and application for surge arresters (IEC 60099-5 and relevant standards from ANSI/IEEE)? Have the utilities additional or own standards?
- Field experience of power equipment (effect of substation equipment reliability with/without MOSA, if available) protected from transient overvoltages by MOSA. Especially power transformers and cables are here of interest, because the repetition rate and steepness of overvoltages have an influence on the ageing process of liquid and solid insulation.
- Field experience of MOSA in DC applications (e.g. energy dissipation with DC switching equipment)
- Field experience of MOSA at distribution voltages and comparison with the experience at transmission voltages
- Influence of apparatus in the substation. The capacitance of equipment in the substation close to the MOSA influences the steepness of incoming overvoltage and therefore has an influence on the protection performance of the MOSA.

Deliverables:

☒ Technical Brochure and Executive summary in Electra

☒ Electra report

☒ Tutorial[5]

Time Schedule: start: March 2017 **Final Report**: December 2020

Approval by Technical Committee Chairman:

Date: 06/02/2017

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