CIGRE Study Committee A2/D1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG N° A2/D1.66	**Name of Convenor : Daniel Koch (DE)** **E-mail address**: daniel.koch1@ge.com
Strategic Directions #[2]: 1	**Sustainable Development Goal #[3]: 9**
The WG applies to distribution networks: ☒ Yes / ☐ No	
Potential Benefit of WG work #[4] : 5	
Title of the Group: Breathing systems of liquid filled transformers and reactors	

Scope, deliverables and proposed time schedule of the Group

Context

As the liquid in liquid filled transformers and reactors is subject to temperature cycling due to ambient temperature and loading variations, the thermal expansion of the liquid has to be accommodated. For example, that is achieved either by sealed systems such as corrugated tanks or radiators as well as membrane systems or open systems which usually include desiccant breathers, nitrogen blankets or membranes resp. oil/air separators.

Water and oxygen which are naturally available in the environment are known to accelerate the ageing of cellulose transformer insulation and the availability of oxygen affects the performance of additives including those upgrading the thermal performance of cellulose. Moisture and dissolved gas influence the temperature at which bubbling and potential failure occurs on insulated conductors. There have been studies of the impact of oxygen on liquids (Brochures 526) and on cellulose (Brochure 738). The relative merits of different transformer breathing systems, their effect on moisture and oxygen in the transformer liquid and any consequential operational, maintenance or other asset management issues such as lifetime, loading capability maintenance and diagnostics are therefore of great interest. These factors may also be affected by environmental conditions, e.g. at offshore or tropical sites, which have an effect on the drying efficiency or maintenance cycles of open systems including breathers. Thus, condition monitoring of the breather itself is an important aspect to maintain it's desired function.

The impact of oxygen and water or other breather related factors on the insulation system including additives, thermal upgrading treatments and higher temperature operation is also of interest to IEC. Alternative liquids may have different breathing or sealing requirements for example to prevent polymerization in some natural ester liquids.

Scope and aim

The proposed scope of work will be as follows:

1. Give an overview of transformer breather and sealed expansion systems.
2. Investigate and report on their ability to control the oxygen and water content of the liquid and insulation over the transformer lifetime.
3. Report on the likely influence of the systems on transformer operation including thermal capability and lifetime.
4. Report on maintenance and installation/retrofitted upgrades needs and failure rates for the various systems.
5. The effects of a closed system on corrosive sulphur or dissolved gas formation.
6. Gather data from operational transformers.
7. Report on the effect of breathing and sealing systems on any other relevant factors such as DGA interpretation, additive concentration or effectiveness and alternative liquids.
8. Give recommendations on when and how to use breathing and sealing systems.
9. Give recommendation on the choice of system in terms of condition monitoring and lifecycle cost of the breathing system.

Deliverables:

☒Technical Brochure and Executive Summary in Electra
☒ Electra Report
☐ Future Connections
☐ CSE
☒ Tutorial
☐ Webinar

Time Schedule: start: March 2022 **Final Report:** December 2025

Approval by Technical Committee Chairman :

Date : March 22nd, 2022

Notes: [1] Working Group (WG) or Joint WG (JWG), [2] See attached Table 1, [3]See attached Table 2 and CIGRE reference Paper: Sustainability – at the heart of CIGRE's work. [4] See attached Table 3

Table 1: Strategic directions of the Technical Council

1	The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-of-the-art technological advances
2	Making the best use of the existing systems
3	Focus on the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)
4	Preparation of material readable for non-technical audience

Table 2: Environmental requirements and sustainable development goals

	CIGRE selected the 7 SDGs that are the most relevant to CIGRE. In case the WG work refers to other SDGs or do not address any specific SDG, it will be quoted 0.
0	Other SDGs or not applied
7	**SDG 7: Affordable and clean energy** Increase share of renewable energy; e.g. expand infrastructure for supplying sustainable energy services; ensure universal access to affordable, reliable, and modern energy services; energy efficiency; facilitate access to clean energy research and technology
9	**SDG 9: Industry, innovation and infrastructure** Facilitate sustainable infrastructure development; facilitate technological and technical support
11	**SDG 11: Sustainable cities and communities** Increase attention on sustainable and resilient buildings utilizing local (raw) materials, power for electric vehicles, strengthening long-line transmission and distribution systems to import necessary power to cities, developing micro-grids to reinforce the sustainable nature of cities; protect and safeguard the world's cultural and natural heritage; reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and waste management
12	**SDG 12: Responsible consumption and production** E.g. Promote public procurement practices that are sustainable; address reducing use of SF6 and promote alternatives, encourage companies to adopt sustainable practices and to integrate sustainability information into their reporting cycle, address inefficient fossil-fuel subsidies that encourage wasteful consumption
13	**SDG 13: Climate action** E.g. Increase share of renewable or other CO_2-free energy; energy efficiency; expand infrastructure for supplying sustainable energy; strengthen resilience and adaptive capacity to climate-related hazards and natural disasters; integrate climate change measures into national policies, strategies and planning; improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
14	**SDG 14: Life below water** E.g. Effects of offshore windfarms; effects of submarine cables on sea-life
15	**SDG 15: Life on land** E.g. Attention for vegetation management; bird collisions; integration of substations and lines into the landscape

Table 3: Potential benefit of work

1	Commercial, business, social and economic benefits 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 directions
5	Guide or survey related to existing techniques; or an update on past work or previous Technical Brochures
6	Work likely to contribute to improved safety.