

CIGRE Study Committee D1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG ¹N° D1/A2.80	Name of Convenor: Dejan Vukovic (DE) E-mail address: dejan.vukovic@hitachienergy.com
Strategic Directions #²: 1	Sustainable Development Goal #³: 9
The WG applies to distribution networks: <input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No	
Potential Benefit of WG work #⁴ : 3	
Title of the Group: Functional properties of non-metallic solid materials for liquid filled transformers and reactors and their compatibility with insulating liquids	
<p>Scope, deliverables and proposed time schedule of the WG:</p> <p>Background:</p> <p>Specification of materials is important for design and long-term performance of transformers. The materials should satisfy the functional requirements demanded by the manufacturing and operation of transformers. International standards are expected to define the parameters to characterise the material performance and to describe the corresponding test methods. However, there is often a lack of effective or valid standards for testing important functional properties of non-metallic solid materials used in liquid filled transformers. Furthermore, design and operation of transformers are facing new challenges e.g. arrival of new materials in the markets, change of service stresses towards the energy transition and so on. To support the adoption of new materials and control of material and product quality, there is a need to review the functional properties of non-metallic solid materials that are required for both design and operation of transformers. Meanwhile review of existing standards and identification of the gap are needed.</p> <p>IEC TC 14 has already made a survey on the functional properties of insulating liquids used in transformers (IEC TR 60076-26). It includes an overview of functional parameters of transformer liquids, existing IEC/ISO standards, suggestions for standard revisions and new standards. Similar work needs to be done for the non-metallic solid materials used in transformers. IEC TC 14 has expressed interests and support the proposal in this ToR. Focus for this WG will be non-metallic solid materials comprising:</p> <ul style="list-style-type: none"> • Solid insulating materials including conductor insulation, spacers, and barriers for the windings and intake leads • Other non-metallic materials e.g. gaskets, enamels and so on • Compatibility of these materials with insulating liquids <p>The materials should withstand mechanical, dielectric, thermal and environmental stresses experienced during transformer operation. Compatibility of these materials with various insulating liquids is important to be investigated.</p> <p>Purpose/Objective/Benefit of this work:</p> <p>The brochure aims to summarise the functional properties of non-metallic solid materials used in liquid filled transformers, identify the gap in terms of testing standards, make suggestions for revising existing standards or developing new standards.</p>	

Scope:

The scope of the work is limited to application in liquid filled transformers, both dry-type and gas insulated transformers are out of scope. The working group would investigate and report on:

1. Establish an overview of non-metallic solid materials used in transformers with their functional properties.
2. Provide an overview of relevant stresses that materials are exposed to.
3. Report on merits and limits of existing standards for testing the material properties
4. Propose further work on revising existing standards or developing new standards.

Remarks:

CIGRE has already reported on cellulose ageing (Brochure 738), WG D1.65 reports on mechanical properties of solid insulating materials, and WG D1.76 investigates test methods for cellulose paper. Also, IEC 60076-14 has issued a survey of high temperature materials for transformers.

Deliverables:

- Annual Progress and Activity Report to Study Committee
- Technical Brochure and Executive Summary in Electra
- Electra Report
- Future Connections
- CIGRE Science & Engineering (CSE) Journal
- Tutorial
- Webinar

Time Schedule:

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| • Recruit members (National Committees) | Q2 2023 |
| • Develop final work plan | Q4 2023 |
| • Draft TB for Study Committee Review | Q2 2026 |
| • Final TB | Q4 2026 |
| • Tutorial | Q2 2027 |
| • Webinar | Q4 2027 |

Approval by Technical Council Chairman:

Date: April 20th, 2023



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

WG Membership: refer Comments at end of document

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.

Comments:

1) CIGRE Official Study Committee Rules: WG Membership

<https://www.cigre.org/GB/about/official-documents>

- a. Only one member per country (by exception of SC Chair)
- b. WG nominees must first be supported by their National Committee (or local SC Member) as an appropriate representative of their country.
- c. Acceptance of the nomination is granted by the SC Chair and advised to the WG Convener

2) Collaboration Space

<https://www.cigre.org/article/GB/collaborative-tools-2>

CIGRE will provision the WG with a dedicated Knowledge Management System Space.

The WG will use the KMS for drafting collaboration, capture and retention of discussion and meeting records.

Official country WG Members will be sent registration instructions by the Convener.

Official country WG Members may request the WG Convener to allow additional access for an extra national subject matter specialist to aid in the work at the national level, including NGN members.