

CIGRE Study Committee B1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

TF ¹N° B1.92	Name of Convenor: Massimiliano MAURI (Norway) E-mail address: massimiliano.mauri@nexans.com
Strategic Directions #²: 1,3	Sustainable Development Goal #³:7,13,14
The WG applies to distribution networks: <input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No	
Potential Benefit of WG work #⁴ : 2,3,4	
Title of the Group: Qualification of Lead-free Submarine Cables at 72.5kV<Um<170 kV	
<p>Scope, deliverables and proposed time schedule of the WG:</p> <p>Background:</p> <p>The SC B1 meeting held as part of the Paris Session 2022 requested the formation of a Task Force (B1.92) to review the qualification of lead-free submarine cables at 72.5kV<Um<170 kV.</p> <p>The work completed by TF B1.92 has identified that there are significant gaps to be filled with respect to both wet and dry cable designs. Consultation with users from the countries represented by the TF has provided a broad range of topics where gaps exist in the industrial knowledge. Two separate strands of work, on nominally Dry and Wet cable designs, were presented in the TF report. To facilitate division of labour within the WG, this split is also included in the scope presented here.</p> <p>Scope:</p> <p>Considering only Lead-free Submarine Cables at 72.5kV<Um<170 kV:</p> <ol style="list-style-type: none"> 1. Building upon the TF B1.92 technical report, evaluate gaps in the existing Cigre and IEC recommendations relative to the customer needs. The intention is to identify additional requirements/recommendations, relevant for the specified voltage range, beyond those in the existing documents. The output should not duplicate content from earlier TBs/standards. 2. For Dry Design cable systems: <ol style="list-style-type: none"> a. Review the existing TB722 water barrier qualification tests and confirm if these tests are sufficiently severe for systems operating at higher nominal stresses. b. Assess if any additional thermal or mechanical qualification regimes beyond those in TB722 would be needed to reflect the operational conditions seen by the cables in service c. Consider if water barrier integrity should be verified after mechanical fatigue for cables where dynamic operation is expected, and if any supplement is needed to the TB862 recommendations when considering the effect of the fatigue on the insulation system performance. d. Determine whether the binary “Dry/Wet” division should be retained, or if the Semi-Dry (eg glued foil overlap) designs require additional checks. e. Assess whether the water barrier of factory joints should be qualified separately, and whether any wet ageing tests are needed for such joints. 	

3. For Wet Design cable systems:

- a. Review the service experience for cable designs not including a continuous metallic water barrier (including land cable systems)
 - b. Produce a failure modes analysis by reviewing the technical and scientific literature concerning insulation ageing mechanisms at relevant stress levels to assess if all factors which affect the electrical performance of a wet design cable are being adequately tested.
 - c. Evaluate if changes to the target cable system lifetime necessitate a change in the qualification routine or not (eg is a test for 25 years the same as 40 years?). Confirm the rationale for the conclusion, including any limitations of knowledge.
 - d. Confirm if the existing IEC Pre-Qualification test would be sufficient for cables with screen stresses above 8kV/mm at the conductor and/or 4kV/mm at the insulation screen.
 - e. Determine how joints (factory or repair) in a wet design cable should be qualified, including whether it should be a formal part of the wet ageing tests.
 - f. With regard to wet ageing tests:
 - i. Using the latest available information, investigate whether 50Hz and 500Hz tests can be considered comparable and if so under what circumstances (technology choice, materials etc)
 - ii. Assess whether the use of higher electrical stresses than in current generation $U_m=72.5\text{kV}$ systems will require changes to the test or the pass criteria
 - iii. Consider whether the existing pre-conditioning protocol will remain valid for $U_m>72.5\text{kV}$
 - iv. Consider whether the test specification should account for any material dependent properties (eg permeability to water)
 - v. Assess if scale effects need to be considered (noting that TB722 limit of validity is a 15mm insulation wall thickness)
 - vi. Provide guidance on how the results of the breakdown testing should be interpreted, with pass/fail criteria if possible
4. Produce clear recommendations towards industry, research institutes and academia concerning additional work which needs to be done to close any gaps which cannot be closed based on the existing knowledge.

Remarks:

Within the TF, there was discussion of whether both the Dry and Wet design work should be completed inside the same WG. The opinion of the TF is that the dry design work is less far reaching and could be concluded in less time, but also that on its own it would not be substantive enough to form a standalone WG (and not one of 3 years in length). The recommendation is to assess both topics within one WG, but potentially to issue two separate publications to ensure that the recommendations for Dry Design cables can be made in a timely manner.

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: start: Jan 2024

Final Report: June 2026

Approval by Technical Council Chairman:



Date: January 10th, 2024

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.