CIGRE Study Committee B1
Rev a

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

WG N° B1.63	**Name of Convenor:** Andreas TYRBERG (SE) **E-mail address**: Andreas.tyrberg@nkt.com	
Strategic Directions #[2]: 1		**Technical Issues #[3]: 9**
The WG applies to distribution networks[4]: Yes / ~~No~~		
Potential Benefit of WG work #[6]: 4		
Title of the Group: Recommendations for mechanical testing of submarine cables for dynamic applications		

Scope, deliverables and proposed time schedule of the Group:

Background:

There is a need to develop an international standard for HV dynamic cables systems used to connect floating wind farms and tidal and wave converters to the grid. The existing standards for the design of Oil and Gas umbilical cable systems under mechanical fatigue (ISO 13628-5 and DNV-RP-F401) provide a good basis for specifying MV and HV dynamic cables but they do address all topics adequately. Electrical and thermo-mechanical aspects, and the specificities of floating wind turbines must be considered in addition to mechanical aspects.

Recently, two CIGRE TBs have included dynamic cables in their scope of work: a chapter of CIGRE TB610 deals with generalities of dynamic cable design, and chapters of CIGRE TB623 deal with fatigue analysis and recommendations for dynamic cable type-testing, although many parameters remain to be discussed and defined.

The role of this new CIGRE WG is to develop common and clear guidelines for mechanical test of the whole system (equipment and installation) upon project characteristics (external constraints, life duration expected, safety factor, etc.).

Scope:

Dynamic cable systems includes the cable and its ancillary equipment such as hang-offs, bend stiffeners, bend-restrictors, transition joints, etc.

The purpose of this WG is to develop a stand-alone document providing detailed guidelines for the design and the functional parameters, for the testing of the whole dynamic cable system, for supply and installation requirements, and covering at least floating platform and floating wind turbine cases.

The opportunity to define a base case for dynamic loads and the related basis design will also be assessed by the WG.

For the range of insulated cables referred to in TB623*, this WG will:

1. Review cable design particularities for dynamic behaviour and document the state-of-the-art of cable design for each voltage range
2. Examine relevant standards and recommendations and provide references to standards applicable to dynamic cables
3. Describe system installation design (lazy wave, etc.) and ancillary equipment needed

4. Assess all the parameters leading to mechanical fatigue of dynamic cable systems
5. Assess the functional requirements of dynamic cable systems
6. Write recommendations for dynamic analysis taking ISO 13628-5 as a starting point and making use of the tools available within the scientific community. These recommendations will:
   a. Include detailed input data required,
   b. Provide clear guidelines for safety factors to be used,
   c. Include guidelines to choose the right weather data, and take into account wave statistics,
   d. Develop guidelines to choose representative load cases for extreme load effects and fatigue,
   e. Include marine growth aspects and abrasion issues at the touch-down area.

7. Write test protocols and recommendations to be performed on the cable building upon feedback from cable suppliers and from CIGRE TB623 and DNV-RP-F401 recommendations. These protocols and recommendation will:
   a. Make the link between the fatigue analysis and the tests parameters to be chosen,
   b. Define a full scale fatigue test and the maximum frequency of such a test
   c. Review the feasibility of including thermo-mechanical constraints during testing,
   d. Review the feasibility of including electrical constraints during testing,
   e. Study the technical need to make the fatigue test a preconditioning test to electrical type-tests,
   f. Define specific tests relating to the cable design (e.g. the addition of a specific test for wet design cables).
8. Write recommendations for design verification via software simulations and their complementarity with testing program.
9. Write recommendations for specification of sensors for cable monitoring

* *Cable systems intended to be used in AC and DC power transmission systems with rated voltages above 30 (36) kV AC or 60 kV DC. It is the opinion of the WG that the TB can also be used for voltages down to 6 (10) kV AC or 10 kV DC.*

Deliverables:

☒ Technical Brochure and Executive summary in Electra

☐ Electra report

☒ Tutorial[5]

Time Schedule: start: November 2017 **Final Report**: August 2020

Approval by Technical Council Chairman: M. Waldron

Date: 17/01/2018

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

Rev a - 2020 07 06: Change of Convener

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