CIGRE Study Committee B1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG [1]N° B1.70	**Name of Convenor:** Roman Svoma (UK) **E-mail address**: Roman.Svoma@PowersureTechnology.com
Technical Issues #[2]: 9	**Strategic Directions #[3]: 1**
The WG applies to distribution networks[4]: Yes / ~~No~~	
Potential Benefit of WG work #[5]: 1, 2	
Title of the Group: Recommendations for the use and the testing of optical fibres in submarine cable systems	

Scope, deliverables and proposed time schedule of the WG:

Background:

Fibre Optics are used in land cable systems and subsea for control as well as asset condition management. The use of Distributed Sensors (Thermal, Strain, Acoustic) in particular is becoming more prevalent.

The fibres are used in AC and DC applications. Due to the proximity of the power cables, induced voltages and currents are an issue and have produced failures specifically in AC three-core subsea cables. The type of fibre element, batch to batch variance and O&M repair implications have had profound effect on some projects and these recommendations will address these.

WG B1.70 will deal with Subsea Fibre Optic Cables (FOC) however some cross correlation with future WG B1.73 *on Recommendations for the use and the testing of optical fibres in land cable systems* will be required to ensure no conflict between the guidelines is established and the basic tests and the recommendations are aligned.

The WG will develop the recommendations in two stages. Firstly working out a converged view of all the electrical aspects, such as induced voltages in the FOC system. The second stage will address the optical/mechanical/thermal aspects, qualification, testing and future maintenance.

Scope:

The scope is detailed to ensure that the following aspects are fully discussed and evaluated.

1. Design Considerations
    - Configurations/scenarios (Three core AC, Single core AC, Single core DC)
    - Fibres integral to the power cable or separately bundled FOC
    - Fibre Application (type and grade of fibre, communication or sensing)
    - All FOC constructions
        - Tube material (steel, copper, non-metallic)
        - Armoured/non armoured
        - Material and properties of polymer layers
        - Loose tube, tight buffer, other constructions
        - Non Metallic FOC
        - Water absorbing materials and hydrogen inhibition
    - Accessories/Ancillaries
        - Joint electrical characteristics (Short Circuit/Earthing Design/Transient

Voltage withstand)
- Landfall and offshore termination earthing
- FO Connectors / adapters
- Plastic Former Design (housing FOC cable), electrical and mechanical design

- Fibre Optic Monitoring during installation

2. Bonding System
   - Earthing requirements at joints and terminations (currents/resistances)
   - Current and voltage minimum insulation and short circuit requirements for the earth connection
   - Health and Safety implications during maintenance and repair of adjacent assets
3. Induced Voltage
   - Standardised form of calculation
     - Under different operation conditions (continuous, short circuit, transients, harmonics)
     - With correct earthing of metallic parts and with one-end earthing
     - With no breaks and simulating a break
   - Comparison between generic designs with agreed examples
4. Qualification of the FOC and Testing
   - Type Acceptance Test – optical testing before and after mechanical conditioning (ref. CIGRE TB 623)
   - FOC design life, formal verification and basis Fatigue performance (design and confirmation – dynamic cables)
5. Factory Process and Acceptance Tests
   - Joints/connectors - maximum attenuation value
   - Manufacture process controls (fibre strain, fibre excess length, defects on FOC metal tube and plastic sheath)
   - OTDR (Optical Time Domain Reflectometer) at set wavelengths
6. Commissioning
   - Joints/connectors - maximum attenuation value
   - Installation process controls (fibre strain)
   - OTDR at set wavelengths
   - Other checks (Power Meter Attenuation test, measurement of earthing resistances)
7. Operation and Maintenance
   - OTDR (on regular bases and on specific events)
   - Other checks (visual inspection, measurement of earthing resistances)
   - System calibration

Deliverables:

☒ Technical Brochure and Executive Summary in Electra

☐ Electra Report

☒ Tutorial[6]

☐ Webinar[6]

Time Schedule: start: March 2019 **Final Report**: Nov 2021

Approval by Technical Council Chairman:

Date: March 14th, 2019

Notes: [1] Working Group (WG) or Joint WG (JWG), [2] See attached Table 1, [3] See attached Table 2, [4] Delete as appropriate, [5] See attached Table 3, [6] Presentation of the work done by the WG

Table 1: Technical Issues for creation of a new WG

1	Active Distribution Networks resulting in bidirectional power and data flows within distribution levels up to higher voltage networks
2	Digitalization of the Electric Power Units (EPU): Real-time data acquisition includes advanced metering, processing large data sets (Big Data), emerging technologies such as Internet of Things (IoT), 3D, virtual and augmented reality, secure and efficient telecommunication network
3	The growth of direct current (DC) and power electronics (PE) at all voltage levels and its impact on power quality, system control, system operation, system security, and standardisation
4	The need for the development and significant installation of energy storage systems, and electric transportation, considering the impact they can have on the power system development, operation and performance
5	New concepts for system operation, control and planning to take account of active customer interactions, and different generation types, and new technology solutions for active and reactive power flow control
6	New concepts for protection to respond to the developing grid and different generation characteristics
7	New concepts in all aspects of power systems to take into account increasing environmental constraints and to address relevant sustainable development goals.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics
9	Increase of right of way capacity through the use of overhead, underground and submarine infrastructure, and its consequence on the technical performance and reliability of the network
10	An increasing need for keeping Stakeholders and Regulators aware of the technical and commercial consequences and keeping them engaged during the development of their future network

Table 2: Strategic directions of the Technical Council

1	The electrical power system of the future: respond to speed of changes in the industry
2	Making the best use of the existing systems
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, 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.
7	Work addressing environmental requirements and sustainable development goals.