

MASS IMPREGNATED CABLE FOR HVDC VOLTAGES UP TO 800KV

This document is for internal and contract specific use only.

Disclaimer

NGG and NGET or their agents, servants or contractors do not accept any liability for any losses arising under or in connection with this information. This limit on liability applies to all and any claims in contract, tort (including negligence), misrepresentation (excluding fraudulent misrepresentation), breach of statutory duty or otherwise. This limit on liability does not exclude or restrict liability where prohibited by the law nor does it supersede the express terms of any related agreements."

PURPOSE AND SCOPE

This specification forms part of a suite of documents that define National Grid requirements for new plant. The Level 2 Specifications for cable systems, TS 2.5, covers major requirements and there is a series of Level 3 Specifications covering various specific requirements.

This document is a Level 3 Specification giving the requirements for single core, HVDC cables for both land and submarine use utilising mass impregnated paper insulation (also applicable to the Polypropylene Laminated, PPL, variant) and their accessories for DC operating voltages up to 800kV.

PART 1 – PROCEDURAL

1 GENERAL REQUIREMENTS

1.1 Cable

1.1.1 Conductor

The maximum D.C. resistance for conductors with standard cross-sectional areas shall be as specified in IEC 60228 and for conductors with non-standard cross-sectional areas shall be determined from the D.C. resistivity of the conductor material at 20°C.

1.1.2 Metal Sheath

The cable shall be constructed with a metal layer to act as a radial moisture barrier. The metal sheath shall be seamless and of an appropriate lead alloy as specified in BSEN 50307.

Sheaths shall be suitably earthed along the cable length to limit the voltage induced under transient conditions to acceptable levels.

1.1.3 Corrosion Protection Layer

The corrosion protection layer shall be seamless and shall seal to the metal sheath to prevent the passage of moisture along the interface between the two components.

The corrosion protection layer shall be free from imperfections, lumps and indentations.

To reduce the penetration of moisture through the corrosion protection layer it shall comply with the requirements of the Vapour Transmission Test specified in the Type Test Requirements below.

Note: The rate of corrosion of sheath materials is highly dependent on the chemical behaviour of all components. Research suggests that corrosion protection layer materials with high vapour transmission capability provide poorer protection against corrosion than those with low vapour transmission capability.

Where applicable (e.g. cables installed in tunnels), the corrosion protection layer shall not be constructed of materials that may cause unnecessary hazards in the event of fire.

Note: These requirements will exclude the use of currently available polyvinyl chloride (PVC) materials.

Note: Corrosion protection layers may be constructed of multiple layers provided the above requirements are met.

1.1.4 Cable Legend

For all land cables the outer layer shall be indelibly marked with a legend in accordance with the following format:

HVDC Electric Cable XXX V

Where XXX is to be replaced by the cable's nominal working voltage.

The legend shall run along the cable in two or more lines, equally spaced around the circumference of the cable, and the distance between the end of one legend and the start of the next legend shall not be greater than 150 mm. The characters shall be at least 10 mm in height. Any additional information marked on the sheath, such as the manufacturer's name shall not affect the spacing between repetitions of the legend.

Note: Where a cable's outer serving does not permit labelling in accordance with the requirements above, an alternative cable identification method may be proposed subject to agreement from National Grid.

1.1.5 Cable Wire Armouring

Where necessary the cable shall be suitably armoured to meet the mechanical requirements of installation, cable protection and recovery.

Where galvanised steel wire is used, hot dip galvanised protective coatings shall be used. The thickness of the coating shall be obtained by measuring the arithmetical mean of measurements carried out in accordance with the magnetic test method detailed in ISO 2178 and shall not be less than 40 µm, corresponding to a zinc mass of 290 g/m². Where joints in the wire are necessary they shall be brazed or welded and any surface irregularities shall be removed. Joints in wire shall not be less than 1m from the nearest joint in any other wire.

The tensile strength shall not be less than the value calculated in section 4.2 .

The cable armouring shall be covered by a wound or extruded outer serving and a bedding material shall be used to protect the underlying surface of the cable.

1.2 Drumming (Land Cables Only)

Each drum shall bear a distinguishing number, securely marked on the outside of the flange. Particulars of the cable, including voltage, cable type, length, conductor size, number of cores, finish, length number, gross and net weight shall be clearly shown on one flange of the drum. The direction for rolling shall be indicated by an arrow.

1.3 Cable Terminations

Cable terminations that use external oil tanks shall have a visual indication clearly visible from ground level of the amount of oil or pressure in the tank. Preference may be given to designs that incorporate suitable oil level/pressure alarm outputs.

DC creepage requirements for cable terminations shall be as specified in NGTS 2.31.

1.4 Thermal Design

Thermal design shall use Design Parameters for cables as specified in TS 2.05.

1.5 Rating Calculations

Rating Calculations shall be determined as specified in TS 2.05

2 PERFORMANCE REQUIREMENTS

2.1 Conductor Thermal Cycling

The cable and accessories shall be capable of following daily conductor temperature variations between ambient and the maximum design temperature.

2.2 Maximum Conductor Temperatures

The maximum conductor operating temperature and maximum permissible temperature difference across the insulation shall be specified by the manufacturer.

2.3 Maximum DC Stresses

The maximum DC electrical stresses in the insulation shall be specified by the manufacturer and shall not be exceeded under the most onerous temperature and loading scenarios expected under steady state and transient conditions.

2.4 Short Circuit Levels

The cable system design (inclusive of accessories) shall ensure that the maximum DC short circuit level can be carried without risk of thermal, electrical or mechanical damage to the cable system. The short circuit capacity shall be calculated assuming maximum conductor temperature and a stable thermal environment throughout the cable and surrounding materials at the commencement of the fault.

Note: The maximum DC short circuit current will be scheme dependant. This level should be determined between converter station and cable designers.

2.5 Other Electrical Requirements

The cable system shall be resilient to any electrical phenomena that may be generated by the converter stations (e.g. harmonic currents) or that may be propagated from the AC network under normal operation.

3 QUALIFICATION OF NEW INSULATION MATERIALS

Where a novel insulation material or impregnant is to be employed, the manufacturer shall provide evidence of testing demonstrating its long term performance to National Grid's satisfaction.

4 TYPE TEST REQUIREMENTS

The test conditions shall be as generally specified in Electra 189 "Recommendations for Tests of Power Transmission DC Cables for a Rated Voltage up to 800kV" and its addendum.