Electricity Specification 400CS132

Issue 1  November 2015

Cable Systems, Including Joints, Terminations, Associated Sealants and Components for use on 132kV Underground Networks (U_m = 145kV)

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Approved for issue by the Technical Policy Panel

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<td>Prepared by: J Scott</td>
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<td>Approved by the Technical Policy Panel and signed on its behalf by: Steve Cox, Head of Engineering.</td>
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CABLE SYSTEMS, INCLUDING JOINTS, TERMINATIONS, ASSOCIATED SEALANTS AND COMPONENTS FOR USE ON 132kV UNDERGROUND NETWORKS (U_m = 145kV)

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1. **INTRODUCTION**

This Specification details 132kV Cable Systems, including Cable Joints, Cable Terminations, Associated Sealants and Components employed on the electricity distribution network owned by Electricity North West Limited (Electricity North West).

Jointing of 132kV cables is a key activity undertaken by Electricity North West and is carried out for a variety of reasons including construction and extension of the Grid and Primary network, to allow for the diversion and re-positioning of established cables and during repairs to existing systems.

Within the current economic environment set down by the industry regulators key aspects of customer service are incentivised to ensure that disruption of service to all customers is minimised. Therefore the speed with which repairs can be completed in order to restore disrupted supplies is an important consideration in the choice of any jointing system.

Minimisation of the overall cost of cable jointing will include consideration of the combination of the major elements of contributory cost. These are the cost of the joints, the time to complete jointing work, the cost of any specialist tools, the cost of excavating joint holes and the cost to reinstate the hole following completion of the jointing works.

Only the 132kV Cable Systems, Joints, Terminations, Associated Sealants and Components listed in Appendices A to H of this Specification shall be used on the Underground Distribution System, within the scope of this Specification.

2. **SCOPE**

This Specification covers the requirements and all components for a 132kV Cable System, including Cables, Cable Joints, Cable Terminations, Associated Sealants and Components to be used on the Underground Cable Distribution System for the purpose of constructing new networks or extending and repairing existing networks. This Specification does not cover oil assisted cables.

All jointing and termination kits shall include connectors or lugs, joint body, grease, mastics, earth bonding cable and clasps, heat shrink tubes, joint shell, shell fixings / clips and sealing materials and all necessary parts to complete the joint / termination.

Approved jointing instructions shall be provided in each kit.

Approved types of cables and specifications are detailed in ES400C14. Only these cable types shall be used.
3. **DEFINITIONS**

**Approval:** Sanction by the Electricity North West Underground Circuits Manager that specified criteria have been satisfied.

**Contract:** The agreement between Electricity North West and the Contractor for the execution of the Works including therein all documents to which reference may properly be made in order to ascertain the rights and obligations of the parties under the said agreement.

**Contractor:** The person or person’s firm or company, including personal representatives, successors and permitted assigns, who’s Tender has been accepted by Electricity North West.

**MDPE:** Medium Density Polyethylene

**Specification:** The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.

**Supplier:** Any person or person’s firm or company who supplies goods to Electricity North West or to its Contractor.

**Tender:** An offer in writing to execute work or supply goods at a fixed price.

**Tenderer:** The person or person’s firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West to submit a Tender.

**XLPE:** Cross Linked Polyethylene.

4. **GENERAL REQUIREMENTS FOR APPROVALS AND TESTING**

4.1 **Product not to be Changed**

No change in the product, packaging or labelling shall be made after Approval has been granted without prior notice to the Electricity North West Underground Circuits Manager, and receipt of a written agreement from the Electricity North West Underground Circuits Manager.

4.2 **Electricity North West Technical Approval**

The Tenderer shall submit, with this Tender, proposals for testing which will demonstrate, to the satisfaction of the Electricity North West Underground Circuits Manager, compliance with this Specification. Such tests shall be carried out without expense to Electricity North West.

Alternatively, the Tenderer may submit technical reports and other data that he considers will demonstrate, to the satisfaction of the Electricity North West Underground Circuits Manager, compliance with this Specification. Acceptance of this evidence shall be at the discretion of the Electricity North West Underground Circuits Manager but will not be unreasonably withheld.

Approval shall be ‘factory specific’ and is not transferable to another factory without the written Approval of the Electricity North West Underground Circuits Manager.
Major changes to the factory must be notified to the Electricity North West Underground Circuits Manager. It may be considered that the changes have altered the manufacturing plant as to effectively be a completely different factory. It may be considered to re-approve the factory to satisfy QA procedures and previously agreed manufacturing techniques.

Cable Approval may be awarded on the basis of individual extrusion lines.

Approval may be awarded for cable alone, for accessories alone or for complete cable systems.

Approval may be withdrawn at any time by Electricity North West due to failures, defects, non-conformances or any other issue which may affect the performance or lifetime of the cable system.

The Supplier and product shall comply with all the relevant requirements of Electricity North West documents EPD311 and CP311.

4.3 Quality Assurance

The Tenderer shall confirm whether or not Approval is held in accordance with a quality assurance scheme accredited under BS EN ISO 9000. If not, he shall submit a statement of the quality assurance procedures employed to control the quality of the product, including the performance of Suppliers and Sub-Contractors.

The right is reserved for the Electricity North West Underground Circuits Manager to require, from time to time, the repeat of such tests as he may deem to be reasonably necessary to demonstrate continued compliance with the Specification.

The Tenderer shall submit, with his Tender, a list of tests and inspections which are carried out on the product prior to despatch which shall demonstrate, to the satisfaction of the Electricity North West Underground Circuits Manager, fitness for installation and service.

The Tenderer shall provide free of charge to Electricity North West such samples as may, in the opinion of the Electricity North West Underground Circuits Manager, be reasonably required for inspection and/or retention as quality control samples. The Electricity North West Underground Circuits Manager will confirm the requirements for samples at the time of tendering.

The right is reserved for the Electricity North West Underground Circuits Manager to make, from time to time, such inspections of the Tenderer’s facilities as he may deem to be reasonably necessary to ensure compliance with this Specification and any Contract of which it forms a part.

The Tenderer shall submit, with his Tender, such details of product packaging disposal, as will enable Electricity North West to comply with the requirements of BS EN ISO 14001: 2004 - Environmental Management Systems.
4.4 **Formulation**

The Tenderer shall submit, with his Tender, such details of the formulation and use of the product and associated substances as will enable Electricity North West to comply with the obligations of the Health and Safety at Work Act 1974 and the Control of Substances Hazardous to Health Regulations 2002, in the use, storage and disposal of the product. The Tenderer may stipulate, prior to submission of such information, that he requires it to remain confidential and the Electricity North West Underground Circuits Manager will, if requested, confirm his agreement to this prior to receipt of the information.

4.5 **Identification Markings**

The Tenderer shall submit, with his Tender, details of markings which it is proposed to apply to the product or packaging to identify manufacturing batches or items. The forms and content of such markings shall be subject to the Approval of the Electricity North West Underground Circuits Manager, and shall in all cases include the Electricity North West Approved Description and Commodity Code Number. Approved descriptions of Cable Joints and Cable Terminations will be provided by Electricity North West and shall be attached to all products prior to delivery.

The Tenderer shall submit, with his Tender, such details of marking gross weight on components, assemblies and packages, as will enable Electricity North West to comply with the Manual Handling Operations Regulation 1992, for components, assemblies and packages supplied with a gross weight over 1kg. The forms and content of such markings shall be subject to the Approval of the Electricity North West Underground Circuits Manager.

4.6 **Minimum Life Expectancy**

The minimum life expectancy of all products covered by this Specification is 60 years.

4.7 **Product Conformity**

Preference will be given to those Suppliers who can provide suitable product conformity certification to a recognised or specified standard, or an equivalent certification.

4.8 **Confirmation of Conformance**

The Tenderer shall complete the conformance declaration sheets in Appendix J. Failure to complete these declaration sheets may result in an unacceptable bid.
5. **REQUIREMENTS FOR TYPE AND ROUTINE TESTING**

The Electricity North West Underground Circuits Manager shall set out the requirement of the following tests to be carried out by the Supplier at the Supplier’s cost.

5.1 **Requirement for Type Tests at the Supplier’s Premises**

These are a series of one-off type tests, which are carried out to ensure the satisfactory performance of the product design, under extremes of operating stresses, and of endurance, as may be appropriate, to be determined by the Electricity North West Underground Circuits Manager.

These may or may not be destructive tests.

All components supplied to this Specification shall have certification to prove that they meet or exceed all the requirements of all the relevant type tests included in HD 632, IEC 60840, CIGRE TB 446 and CIGRE TB 303.

5.1.1 **Additional Type Tests on Terminations**

The following Type Tests are also required on GIS terminations and on outdoor termination insulators:

- **Dielectric Tests on GIS terminations shall be carried out in accordance with the requirements of IEC 62 271-209.**

- **Test methods for evaluating resistance to tracking and erosion and limits of acceptance in the requirements of IEC 60587.**

- **Cantilever Test on GIS terminations. No damage shall result from the termination being subjected to a bending moment of 4.5 kN.m at its base for a minimum of one minute at ambient temperature.**

- **Cantilever tests on O/D termination insulators shall be carried out in accordance with the requirements of IEC 62155.**

- **Salt Fog tests on O/D termination insulators shall be carried out in accordance with the requirements of IEC 60507.**

- **Type Tests on Protective Coverings for Buried Accessories shall be carried out in accordance with IEC 60840 except:-**
  - DC test voltage shall be 25kV applied for 5 mins instead of 20kV applied for 1 min.
  - Impulse test level between sheaths shall be as stated for bonding lead length between 3m and 10m unless the cable system is designed to have SVLs placed adjacent to the joint.

Findings and observations of the final examination shall be recorded in the Type Test Report.

Type test reports shall include the following drawings, each drawing shall have a unique number and contain a modification reference and date:

- A schematic diagram of the test assembly.
- A dimensioned drawing of the cable construction.
- A detailed assembly drawing and parts list for each accessory included in the test.

In addition, type test reports shall contain the following information relating to the tested cable and accessories:

- Manufacturing location and part numbers for accessories and Accessory components (including components such as oil).
- Manufacturing location for cable.

### 5.2 Requirement for Routine Tests at the Supplier’s Premises

These tests may be required to be carried out on every individual unit or component, as specified, or at some regular frequency to be determined by the Electricity North West Underground Circuits Manager.

The results of these tests shall be supplied to Electricity North West with each unit purchased or retained for inspection, at a period to be determined by the Electricity North West Underground Circuits Manager.

### 5.3 Sample Tests

Sample tests for cables and accessories shall be carried out in accordance with IEC 60840 and Electricity North West ES400C14. Sample test reports shall be provided for each order detailing all the results.

### 6. TECHNICAL PARTICULARS

#### 6.1 Operational Requirements

##### 6.1.1 General

The components included in this Specification are for use in power cable terminations and cable joints used on non-effectively earthed electrical systems having a normal working voltage of 132kV ($U_{m} = 145$ kV).

Joints and terminations shall be designed to cater for thermal and mechanical forces which will be developed during maximum three-phase symmetrical fault currents of up to 21.9 kA (5000MVA).

They shall be suitable for indoor, outdoor and underground locations as applicable, unless otherwise specified.

Components used in Cable Joints or Cable Terminations shall not be adversely affected when they come into contact with materials used in the construction of any Cable or Resins, Mastics and Other Sundry Materials listed in this Section (Section 6.1).

Cable Joints and Cable Terminations shall be capable of performing with either mechanical shear-bolt or compression connectors and lugs without any deleterious effect.
Cables and their accessories shall be fully Type Tested as a cable system. The Tenderer shall provide full details of the Type Tests carried out with the appropriate accessories in accordance with IEC 60840.

The Supplier shall forward, with the tender submission, all calculations and data to demonstrate the rating of the cable / system for Electricity North West to verify.

Assembled components forming part of a cable system shall be capable of operating under the normal and fault temperature conditions specified in the relevant cable specifications.

6.1.1.1 Auxiliary Equipment

All auxiliary equipment such as Link Boxes, Braids, Earthing Conductors and Sheath Voltage Limiters shall be included. Link Boxes and Sheath Voltage Limiters shall be provided and manufactured in accordance with Engineering Recommendation C55/4.

6.1.1.2 Joints in Harsh Environmental Conditions

Joints may have to installed and remain in harsh environmental conditions such as flood plains, acidic soils or “Brown field” contaminated land. Alternative systems (cables and joints) shall be offered to provide solutions to harsh environmental conditions.

6.1.1.3 Proven Joint History

Preference shall be given to cable systems that have a proven history and have attained additional Type Tests results demonstrating longevity of the products.

6.1.1.4 Water Blocking Requirements

Conductors shall be water blocked. The Tenderer shall meet or exceed the requirements of the water penetration test detailed in IEC 60840 and additional water blocking tests for phase conductors specified in BS7912 Annex D.

6.1.1.5 “As Installed” Drawings

Final copies of the general arrangement drawings of each design are required in AutoCAD 2010 electronic format. A memory stick or CD-ROM is to be provided containing all drawings.

One copy of the routine test certificate and one copy of the certificate of compliance are to be supplied. These documents are to be sent, at the time of Tender award, to:

Electricity North West Limited
Policy Department
Preston Offices
Hartington Road
Preston PR1 8PQ

FAO Electricity Standards Manager
6.1.2 XLPE-Insulated Cables

Components specified shall be suitable for use with cross-linked polyethylene (XLPE) insulated cables complying with the following Specifications:

(a) BS 7912 Power Cables with XLPE insulation and metal sheath.
(b) BS 7970 Metal Foil & Longitudinally welded aluminium sheath.
(c) ENA TS 09 16 Tests on Power Cables with XLPE Insulation and Metallic sheath.
(d) IEC 60840 Power Cables with extruded insulation and their accessories for rated voltages above 30kV (Um = 36kV) up to 150kV (Um = 170kV) Test Methods and requirements.
(e) ES400C14 132kV Cables with Extruded XLPE Insulation.

6.1.3 Resins, Mastics and Other Sundry Materials

All supplied components shall be compatible with all the resins, mastics and tapes provided by the Tenderer. All components shall be compatible with Electricity North West's cleaning solvents (refer to ES400W10).

6.2 Identification and Packaging

6.2.1 Identification

In addition to the Electricity North West Commodity Code (CC) number as specified above, under General Approvals and Testing, components or their immediate packaging shall be clearly and permanently marked in a prominent position with the manufacturer’s or Supplier’s name and product batch identification.

Extruded components (tubings and wrap-arounds), supplied as continuous or discrete lengths, shall additionally be marked with the expanded and fully recovered diameters or equivalent information. Markings on extruded components shall be repeated along the length with gaps of not more than 200mm.

Electrically conductive components shall be marked to indicate that the materials are conductive. This requirement does not apply to composite components comprising both conductive and insulating materials.

6.2.2 Packaging

Packaging shall be designed to protect against mechanical damage and the ingress of dirt and moisture. Opaque packaging shall be labelled with the information described under Identification above. Where tubing is supplied on reels, these shall have adequate flanges to contain and protect the tubing. The reel shall be identified in accordance with Identification above; and shall be marked with the length of tubing contained.

Components with a shelf life shall have the final date of use prominently and indelibly displayed on the packaging.

Components supplied with pressure activated sealant coating shall be packed in such a manner that coated surfaces cannot stick to each other (or other measures shall be taken to ensure that this does not occur).
6.3 132kV Cable Joints

6.3.1 General

The joint shall comply with the requirements of IEC 60840 and IEC 62067.

A cold applied joint body shall be provided with a conductive Faraday cage that shall be designed to cover and overlap the connector. The joint body shall also have geometric-stress cones which shall be designed to make contact with the cable semi-conducting screen at either end of the cable joint.

6.3.2 Connectors

6.3.2.1 Mechanical Connector

Centralised bores shall be provided. They shall be suitable for round stranded copper and stranded aluminium conductors.

Each side of the connector shall have a minimum of four shear-off connection bolts. When sheared, these bolts shall not protrude higher than the connector body. Nor shall they produce any sharp edges which may eventually damage the cold applied joint body. Each hole shall be filled with a plug.

6.3.2.2 Connectors

All connectors shall be water blocked. Centralised bores shall be provided. They shall be suitable for round shaped stranded copper and aluminium conductors.

In order to assist construction of the joint and reduce the required joint hole size, preference shall be given to the split type connector. Alternative solid type connectors will be considered, but only with the agreement of the Electricity North West Underground Circuits Manager. The Tenderer shall clearly notify with the Tender return the type of connector to be supplied.

6.3.3 Screen/Earth Connections

Copper interwoven braids shall be provided to carry the screen/earth connection across all cable joints. The tinned copper braid shall be used in conjunction with mechanical connectors and/or roll springs to make connection to the screen/earth or sheath of the cables being jointed.

Evidence shall be provided that all connections are capable of carrying fault levels of 21.87kA Phase – Earth (for 2 seconds).

6.3.4 Types of Cable Joints

6.3.4.1 Fully Compatible Type Test

Standard cable designs and sizes are detailed in the Appendix A below. The Tenderer shall provide a fully compatible and fully Type tested cable system accessory for new installations.
6.3.4.2 **Joints for Old Cable to New Cable**

The standard XLPE insulation thickness is 16mm as detailed in ES400C14. However, early design of XLPE cables on the Electricity North West System could have an insulation thickness of minimum 20mm to maximum 22mm. It may be required to joint old design to new design of cables. The Tenderer shall offer an alternative joint to enable the extension or repair to the existing cable system.

6.3.4.3 **Alternative Joints for Harsh Environmental Conditions**

Joints may have to installed and remain in harsh environmental conditions such as flood plains, acidic soils or “Brown field” contaminated land. Alternative joints shall be offered to provide solutions to harsh environmental conditions.

6.3.4.4 **Straight Joints and Screen Sectionalising Joints**

Joints shall be available as both straight joint and screen sectionalising joint designs.

6.4 **132kV Cable Terminations**

6.4.1 **General**

Dry type non filled accessories are preferred where service history and testing can be demonstrated by the Tenderer.

Terminations to comply with relevant standards from IEC 60840.

6.4.2 **Outdoor Terminations**

Outdoor termination insulators shall be of composite polymeric type to Class 1A of 3.5 IEC 60587.

Porcelain insulators are not acceptable.

Pollution severity shall be regarded as “Heavy” as defined in IEC 60815 and shall have a minimum phase to Earth creepage distance appropriate for the pollution severity.

Ice coating may be assumed not to exceed 10mm.

Wind pressure may be assumed not to exceed 700Pa.

6.4.3 **GIS Terminations**

Gas Insulated Switchgear terminations shall comply with the requirements of IEC 60840 and IEC 62271-209. Preference shall be given to plug-in type.

6.5 **Storage Requirements**

Components shall be capable of being stored without deterioration within the temperature range -10°C to +40°C when protected from direct sunlight.
6.6 Technical Support

During the Contract period questions will arise regarding unusual or non-standard applications where advice will be required on matters such as jointing non-standard cable types etc. The successful Tenderer(s) will be expected to support Electricity North West with technical advice on these matters.

Product familiarisation training may be required for jointers and engineers. The Tenderer shall include for any such training costs in the Tender.

6.6.1 Cable Joints/Terminations Instructions

The Supplier shall provide detailed step by step jointing instructions. These instructions shall clearly show all cable stripping dimensions, shrinking dimensions for all tube sets, etc. To supplement the written description, a drawing shall also be provided for each jointing step. The individual jointing instructions (paper copy) shall be included in each kit and records be kept by both manufacturer and Electricity North West Ltd.

6.6.2 Joint and Termination Failures

Electricity North West manages an electricity distribution network that has a supply utilisation availability of over 99.99%, and is striving to improve on this figure. Therefore, jointing and termination systems shall have reliability greater than this figure. Any joint or termination failures which occur throughout the life of the Contract shall be fully investigated. A full report, by the Supplier, shall be issued within two weeks of the date of the failure of the termination or joint clearly detailing the failure mode.

7. DOCUMENTS REFERENCED


Control of Substances Hazardous to Health Regulations 2002.


BS EN ISO 9000: Quality management systems.


IEC 60228: Conductors of Insulated cables

IEC 60507: Artificial Pollution test on high voltage insulator to be used on AC systems

IEC 60587: Electrical insulating materials used under severe ambient conditions. Test methods for evaluating resistance to tracking and erosion.

BS 7912: Power Cables with XLPE insulation and metal sheath, and their accessories, for rated voltages from 66kV (Um 72.5kV) to 132kV (Um 145kV). (Implementation of HD632)
BS 7970: Electric cables – Metal foil and longitudinally welded aluminium sheath constructions of power cables having XLPE insulation for rated voltages from 66kV (Um 72.5kV) to 132 kV (Um 145kV).

Cigre TB 303 – 2006: Revision of qualification procedures for high voltage and extra high voltage AC extruded underground cable systems.


IEC 60840: Power cables with extruded insulation and their accessories for rated voltages from 30 kV (U_m = 36 kV) up to 150 kV (U_m = 170 kV) – Test methods and requirements.

ENA TS 09-16: ENA TS 09 16 Tests on Power Cables with XLPE Insulation and Metallic sheath and their accessories, for rated voltages of 66kV, 110 kV and 132 kV.


EPD311: Approval of Equipment.

CP311: Equipment Approval Process.

ES400C14: 132kV Cables with Extruded XLPE Insulation.

8. KEYWORDS

132kV; cable system, joint; jointing; termination.
APPENDIX A

APPROVED CABLE TYPES

A1 EXISTING XLPE INSULATION CABLE TYPES

- Single core Copper conductor, XLPE insulated, Lead Sheath, PVC / MDPE over sheath (185mm – 1600mm conductor).
- Single core Copper conductor, XLPE insulated, Corrugated Aluminium Sheath, PVC / MDPE over sheath (185mm – 1600mm conductor).
- Single core Copper conductor, XLPE insulated, Copper Foil Laminate with Copper wire screen, MDPE over sheath (300mm – 1000mm conductor).
- All above with insulation thickness of 20-22mm.

A2 NEW XLPE CABLE TYPES

- Single core Copper conductor, XLPE insulated, Lead Sheath, PVC / MDPE over sheath (185mm – 1600mm conductor).
- Single core Aluminium conductor, XLPE insulated, Copper Foil Laminate with Copper Wire Screen, MDPE over sheath (300mm – 1000mm conductor).
- Single core Aluminium conductor, XLPE insulated, Aluminium Foil Laminate with Copper Wire Screen, MDPE over sheath (300mm – 1000mm conductor).
- Single core Copper conductor, XLPE insulated, Copper Foil Laminate with Copper Wire Screen, MDPE over sheath (300mm – 1000mm conductor).
- Single core Copper conductor, XLPE insulated, Aluminium Foil Laminate with Copper Foam Screen, MDPE over sheath (300mm – 1000mm conductor).
- Single core Copper conductor, XLPE insulated, Smooth Welded Aluminium Sheath, MDPE over sheath (300mm – 1000mm conductor).
- All above with minimum insulation thickness of 16mm.
APPENDIX B

SINGLE CORE XLPE - XLPE JOINT (ALUMINIUM – ALUMINIUM CONDUCTOR)

STRAIGHT JOINT

Appendix A lists the types of approved cables and the sizes of conductors. Table B breaks down the specific joint requirement so that a cost comparison can be made between different Suppliers. It is recognised that a particular joint may cover a number of different cable sizes.

Table B

<table>
<thead>
<tr>
<th>For Aluminium conductor with new design insulation of 16mm thickness</th>
<th>Straight joint with same conductor size, Laminate - Laminate</th>
<th>Straight joint with same conductor size, Laminate - SWAS</th>
<th>Straight joint with same conductor size, SWAS - SWAS</th>
<th>Straight joint with same conductor size, Lead - Lead</th>
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<tbody>
<tr>
<td>300mm</td>
<td>B-LL1</td>
<td>B-LS1</td>
<td>B-SS1</td>
<td>B-Pb1</td>
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<tr>
<td>400mm</td>
<td>B-LL2</td>
<td>B-LS2</td>
<td>B-SS2</td>
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<td>B-LL3</td>
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<td>B-LL4</td>
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APPENDIX C

SINGLE CORE XLPE - XLPE JOINT (COPPER – COPPER CONDUCTOR)

STRAIGHT JOINT

Appendix A lists the types of approved cables and the sizes of conductors. Table C breaks down the specific joint requirement so that a cost comparison can be made between different Suppliers. It is recognised that a particular joint may cover a number of different cable sizes.

Table C

<table>
<thead>
<tr>
<th>For Copper conductor with new design insulation of 16mm thickness</th>
<th>Straight joint with same conductor size, Laminate - Laminate</th>
<th>Straight joint with same conductor size, Laminate - SWAS</th>
<th>Straight joint with same conductor size, SWAS - SWAS</th>
<th>Straight joint with same conductor size, Lead - Lead</th>
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<tr>
<td>185mm</td>
<td>C-LL1</td>
<td>C-LS1</td>
<td>C-SS1</td>
<td>C-Pb1</td>
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<td>C-LL2</td>
<td>C-LS2</td>
<td>C-SS2</td>
<td>C-Pb2</td>
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<td>300mm</td>
<td>C-LL3</td>
<td>C-LS3</td>
<td>C-SS3</td>
<td>C-Pb3</td>
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<td>C-LS4</td>
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<td>C-LL5</td>
<td>C-LS5</td>
<td>C-SS5</td>
<td>C-Pb5</td>
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<tr>
<td>630mm</td>
<td>C-LL6</td>
<td>C-LS6</td>
<td>C-SS6</td>
<td>C-Pb6</td>
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<td>800mm</td>
<td>C-LL7</td>
<td>C-LS7</td>
<td>C-SS7</td>
<td>C-Pb7</td>
</tr>
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<td>1000mm</td>
<td>C-LL8</td>
<td>C-LS8</td>
<td>C-SS8</td>
<td>C-Pb8</td>
</tr>
</tbody>
</table>
APPENDIX D

SINGLE CORE XLPE TO XLPE (COPPER – COPPER CONDUCTOR)

STRAIGHT JOINT

Appendix A lists the variation in cables and sizes for which cable joints will be needed. Table D further breaks down the specific joint requirement so that a cost comparison can be made between different Suppliers. It is recognised that a particular joint may cover a number of different cable sizes.

Table D

<table>
<thead>
<tr>
<th>Existing Copper conductor with 20-22mm insulation and Lead sheath construction</th>
<th>Straight joint with same conductor size, 16mm XLPE insulation and Laminate sheath construction</th>
<th>Straight joint with same conductor size, 16mm XLPE insulation and SWAS construction</th>
<th>Straight joint with same conductor size, 16mm XLPE insulation and Lead sheath</th>
</tr>
</thead>
<tbody>
<tr>
<td>185mm</td>
<td>D-L1</td>
<td>D-S1</td>
<td>D-Pb1</td>
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<tr>
<td>240mm</td>
<td>D-L2</td>
<td>D-S2</td>
<td>D-Pb2</td>
</tr>
<tr>
<td>300mm</td>
<td>D-L3</td>
<td>D-S3</td>
<td>D-Pb3</td>
</tr>
<tr>
<td>400mm</td>
<td>D-L4</td>
<td>D-S4</td>
<td>D-Pb4</td>
</tr>
<tr>
<td>500mm</td>
<td>D-L5</td>
<td>D-S5</td>
<td>D-Pb5</td>
</tr>
<tr>
<td>630mm</td>
<td>D-L6</td>
<td>D-S6</td>
<td>D-Pb6</td>
</tr>
<tr>
<td>800mm</td>
<td>D-L7</td>
<td>D-S7</td>
<td>D-Pb7</td>
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<tr>
<td>1000mm</td>
<td>D-L8</td>
<td>D-S8</td>
<td>D-Pb8</td>
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</table>
APPENDIX E

SINGLE CORE XLPE TO XLPE (COPPER – ALUMINIUM CONDUCTOR)

STRAIGHT JOINT

Appendix A lists the variation in cables and sizes for which cable joints will be needed. Table E further breaks down the specific joint requirement so that a cost comparison can be made between different Suppliers. It is recognised that a particular joint may cover a number of different cable sizes.

Table E

<table>
<thead>
<tr>
<th>Existing Copper conductor with 20-22mm insulation and Lead sheath construction</th>
<th>Straight joint to Aluminium Conductor with 16mm insulation and Laminate sheath construction</th>
<th>Joint reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>185mm</td>
<td>300mm</td>
<td>EL1</td>
</tr>
<tr>
<td>240mm</td>
<td>400mm</td>
<td>EL2</td>
</tr>
<tr>
<td>300mm</td>
<td>500mm</td>
<td>EL3</td>
</tr>
<tr>
<td>400mm</td>
<td>630mm</td>
<td>EL4</td>
</tr>
<tr>
<td>500mm</td>
<td>800mm</td>
<td>EL5</td>
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<tr>
<td>630mm</td>
<td>1000mm</td>
<td>EL6</td>
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APPENDIX F

SINGLE CORE XLPE TO XLPE (COPPER – ALUMINIUM CONDUCTOR)

STRAIGHT JOINT

Appendix A lists the variation in cables and sizes for which cable joints will be needed. Table F further breaks down the specific joint requirement so that a cost comparison can be made between different Suppliers. It is recognised that a particular joint may cover a number of different cable sizes.

Table F

<table>
<thead>
<tr>
<th>Existing Copper conductor with 20-22mm insulation and Lead sheath construction</th>
<th>Straight joint to Aluminium Conductor with 16mm insulation and Smooth Welded Aluminium sheath construction</th>
<th>Joint reference</th>
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<tbody>
<tr>
<td>185mm</td>
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<td>800mm</td>
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<tr>
<td>630mm</td>
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APPENDIX G

SINGLE CORE XLPE COMPOSITE OUTDOOR TERMINATION

Appendix A lists the variation in cables sizes for which Outdoor Terminations will be needed. Table G further breaks down the specific termination requirement so that a cost comparison can be made between different Suppliers. It is recognised that a particular termination may cover a number of different cable sizes.

Table G

<table>
<thead>
<tr>
<th>Aluminium Conductor with 16mm insulation and Laminate sheath construction</th>
<th>Termination Reference</th>
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</thead>
<tbody>
<tr>
<td>185mm</td>
<td>G1</td>
</tr>
<tr>
<td>240mm</td>
<td>G2</td>
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<td>300mm</td>
<td>G3</td>
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<tr>
<td>400mm</td>
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<td>630mm</td>
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<td>G7</td>
</tr>
<tr>
<td>1000mm</td>
<td>G8</td>
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<tr>
<td>1600mm</td>
<td>G9</td>
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</table>
APPENDIX H

SINGLE CORE XLPE GAS INSULATED SWITCHGEAR TERMINATION

Appendix A lists the variation in cables sizes for which Outdoor Terminations will be needed. Table G further breaks down the specific termination requirement so that a cost comparison can be made between different Suppliers. It is recognised that a particular termination may cover a number of different cable sizes.

Table H

<table>
<thead>
<tr>
<th>Aluminium Conductor with 16mm insulation and Laminate sheath construction</th>
<th>Termination Reference</th>
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</thead>
<tbody>
<tr>
<td>185mm</td>
<td>H1</td>
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<tr>
<td>240mm</td>
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<td>300mm</td>
<td>H3</td>
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<tr>
<td>400mm</td>
<td>H4</td>
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<tr>
<td>1000mm</td>
<td>H8</td>
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<tr>
<td>1600mm</td>
<td>H9</td>
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</table>
APPENDIX J

CONFORMANCE DECLARATION

SECTION-BY-SECTION CONFORMANCE WITH SPECIFICATION

The Tenderer shall declare conformance or otherwise for each product/service or range of products/services, section-by-section, using the following Conformance Declaration Codes.

Conformance Declaration Codes:

N/A = Section is not applicable/appropriate to the product/service.

C1 = The product/service conforms fully with the requirements of this section.

C2 = The product/service conforms partially with the requirements of this section.

C3 = The product/service does not conform to the requirements of this section.

C4 = The product/service does not currently conform to the requirements of this section, but the manufacturer proposes to modify and test the product in order to conform.

Manufacturer:

Product/Service description:

Product/Service reference:

Assessor details

Name:

Company:

Signature:

Date:
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<th>Section Topic</th>
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<td>Formulation</td>
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<td>4.6</td>
<td>Minimum Life Expectancy</td>
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<td>Product Conformity</td>
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<td>Requirement for Type Tests at the Supplier's Premises</td>
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<td>Additional Type Tests on Terminations</td>
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<td>Requirement for Routine Tests at the Supplier’s Premises</td>
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<td>&quot;As Installed&quot; Drawings</td>
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<td>Screen / Earth Connections</td>
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### SECTION-BY-SECTION CONFORMANCE

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<td>Joints for Old Cable to New Cable</td>
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<td>6.3.4.3</td>
<td>Alternative Joints for Harsh Environmental Conditions</td>
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<td>Straight Joints and Screen Sectionalising Joints</td>
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<td>6.4.2</td>
<td>Outdoor Terminations</td>
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<td>6.4.3</td>
<td>GIS Terminations</td>
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<td>6.6.2</td>
<td>Joint and Termination Failures</td>
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* Applicable specifications shall be stated in the Remarks column where alternatives are quoted within a section. The Remarks column shall also be used to indicate cases where the products or services exceed the quoted specifications.

**Additional Notes:**