



# Specification – MV Cable Accessories

Standard Number: HPC-8DJ-03-0001-2012

Issue Date: 4<sup>th</sup> April 2022

Document Number: 2481102

Print Date: 4/04/2022

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| Document Control                 |  |  |
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| <b>Date Created/Last Updated</b> | 4 April 2022   |  |
| <b>Review Frequency **</b>       | 3 years  |  |
| <b>Next Review Date **</b>       | 4 April 2025   |  |

\* Must be the Process Owner and is the person assigned authority and responsibility for managing the whole process, end-to-end, which may extend across more than one division and/or functions, in order to deliver agreed business results.

\*\* Frequency period is dependent upon circumstances– maximum is 5 years from last issue, review, or revision whichever is the latest. If left blank, the default must be 1 year unless otherwise specified.

| Revision Control |            |                           |
|------------------|------------|---------------------------|
| Revision         | Date       | Description               |
| 0                | 15/04/2013 | Initial Document Creation |
| 1                | 4/04/2022  | First Revision            |

| STAKEHOLDERS   |                                    |
|--|------------------------------------|
| <i>The following positions must be consulted if an update or review is required:</i> |                                    |
| Asset Managers   | Manager Operational Technology     |
| Manager Asset Services   | Manager Systems & Network Planning |
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## 1 SCOPE

This Specification details the requirements for the design and supply of medium-voltage accessories for power cables used on AC systems from 6.6 kV up to and including 33 kV.

The accessories are intended for use on the following types of cable:

- 1) Three-core general purpose impregnated paper-insulated cable with lead sheath and with double galvanised steel tape armour to AS/NZS 1036 [2.];
- 2) Single-core MV XLPE-insulated cable to AS/NZS 1429.1 [3.]; and

The accessories covered by this specification are:

- a) indoor and outdoor terminations of all designs;
- b) straight joints and transition joints of all designs, these joints shall be suitable for use underground (specific requirements apply for use underground with water logged surfaces) or in air;
- c) screened plug-in type or bolted-type dead-break separable connectors; and
- d) Cable end caps, sleeving and insulating compounds.

**NOTE:** Submarine cable accessories are not included as part of this specification.

Approval in terms of this specification must be obtained by one or a combination of the following:

- 1) Successful completion of the appropriate tests (required by this specification) by an independent and accredited test authority.
- 2) Provision of test certificates (from an independent and accredited test authority) based upon an alternative specification, with test requirements at least equivalent to this specification.

**NOTE:** Verification of accreditation of the test authority must be provided by NATA (National Association of Testing Authorities) accredited test house or by a test house possessing accreditation from a NATA MRA (Mutual Recognition Agreement) partner.

## 2 NORMATIVE REFERENCES

### 2.1 Standards

#### 2.1.1 Horizon Power Standards

- [1.] *Horizon Power Environmental Conditions*, standard number HPC-9EJ-01-0001-2013, available at <http://horizonpower.com.au/contractors-suppliers/contractors/manuals-and-standards/> under the 'Standards' heading.

### 2.1.2 Australian Standards

The following standards are available at <http://www.saiglobal.com>.

- [2.] *AS/NZS 1036, Impregnated Paper insulated – for Working Voltages up to and including 19/33(36) kV*, Standards Australia, 1971
- [3.] *AS/NZS 1429.1, Electric Cables – Polymeric Insulated*, Standards Australia, 2006
- [4.] *AS 2067, Substations and high voltage installations exceeding 1 kV a.c.*, Standards Australia, 2016
- [5.] *AS 2629, Separable Insulated Connectors for Power Distribution Systems Above 1 kV*, Standards Australia, 1983
- [6.] *AS/NZS 4325.1, Compression and mechanical connectors for power cables with copper or aluminium conductors - Test methods and requirements*, Standards Australia, 1995
- [7.] *AS/NZS 4805.1, Accessories for Electric Cables - Test Requirements - Power cables with extruded insulation for rated voltages from 1.9/3.3(3.6) kV up to and including 19/33(36) kV*, Standards Australia, 2007
- [8.] *AS/NZS 4805.2, Accessories for Electric Cables - Test Requirements – Impregnated paper-insulated metal-sheathed cables for rated voltages from 1.9/3.3(3.6) kV up to and including 19/33(36) kV*, Standards Australia, 2007
- [9.] *AS 5000.1, Electric cables - Polymeric insulated - For working voltages up to and including 0.6/1 (1.2) kV*, Standards Australia, 2005 (R2017)
- [10.] *AS/NZS 60137, Insulated bushings for alternating voltages above 1 kV*, Standards Australia, 2020

### 2.1.3 International Standards

The following standards are available at <http://www.saiglobal.com>.

- [11.] *IEC 60055-1, Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV (with copper or aluminium conductors and excluding gas pressure and oil filled cables) - Part 1: Tests on cables and their accessories*, International Electrotechnical Committee, 1997 (AMD 1 2005)
- [12.] *IEC 60060-1, High-voltage test techniques – Part 1: General definitions and test requirements*, International Electrotechnical Committee, 2010
- [13.] *IEC 60060-2, High-voltage test techniques – Part 2: Measuring systems*, International Electrotechnical Committee, 2010
- [14.] *IEC 60183, Guide to the selection of high-voltage cables*, International Electrotechnical Committee, 2015
- [15.] *IEC 60502-4, Power cables with extruded insulation and their accessories for rated voltages from 1 kV ( $U_m = 1,2$  kV) up to 30 kV ( $U_m = 36$  kV) - Part 4: Test requirements on accessories for cables with rated voltages from 6 kV ( $U_m = 7,2$  kV) up to 30 kV ( $U_m = 36$  kV)*, International Electrotechnical Committee, 2010
- [16.] *IEC 61238-1, Compression and Mechanical Connectors for power cables for rated voltages up to 30 kV ( $U_m = 36$  kV) – Part 1 Test methods and requirements*, International Electrotechnical Committee, 2018

[17.] *IEEE 592, Exposed Semiconducting Shields on Premoulded High Voltage Cable Joints and Separable Insulated Connectors*, Institute of Electrical and Electronic Engineers, 2018

#### 2.1.4 Compliance with Standards

Various Standards are referenced in this Specification. The Standards have reference to the year they were published. If over the life of the Tender the Standards change, the Vendor is required to conform to the new edition of the Standard.

Unless otherwise specified herein, the *Equipment* shall be designed, manufactured and type and routine tested in accordance with the referenced Australian Standards, including all amendments. Where there is no Australian Standard equivalent, International Standards or Codes as defined in this specification shall be used. The specified documents contain provisions that, through reference in the text, constitute requirements of this Specification. At the time of publication of this Specification, the editions indicated were valid. Information on currently valid national and international standards may be obtained from the Australian Standards website. <http://www.saiglobal.com>.

## 2.2 Definitions and abbreviations

For the purposes of this specification the following definitions apply:

### 2.2.1 Definitions

- 1) **air insulated termination:** metallic enclosure (weatherproof enclosure with a minimum rating of IP54) within which the cable cores are terminated by stress control appropriate to the cable design and voltage with air being the sole insulation for the terminal connections.
- 2) **armour clamp:** A stainless steel clamp used to connect the main earthing conductor of an accessory to the armour wires of a cable.
- 3) **bolted-type separable connector:** A separable connector in which the electrical contact is made by a bolted device.
- 4) **connector:** A metallic device to connect cable conductors together.
- 5) **constant force spring (CFS):** A strip of non-magnetic stainless steel that is wound to form a spring and intended to maintain a constant force on a circular object.
- 6) **deadbreak connector:** A separable connector designed to be connected and disconnected on de-energized circuits only.
- 7) **Equipment:** means MV Cable Accessory in relation to this specification.
- 8) **indoor termination:** A termination intended for use where it is not exposed to either solar radiation or weathering.
- 9) **IP54:** Ingress Protection Rating where:
  - a) Ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment; complete protection against contact.



- b) Water splashing against the enclosure from any direction shall have no harmful effect.
- 10) **main earthing conductor:** A conductor that maintains earth continuity throughout a cable joint or connects the earth circuit of a cable to the metallic enclosure of terminal equipment and that is rated to carry the prospective earth fault current of the system.
- 11) **outdoor termination:** A termination intended for use where it is exposed to either solar radiation or weathering or both.
- 12) **plug-in type separable connector:** A separable connector in which the electrical contact is made by a sliding mechanism.
- 13) **range-taking accessory:** An accessory designed to be used for more than one cross-section of the cable over a specific range.
- 14) **rated voltage:** according to AS/NZS 1429.1 [3.], cables are specified as  $U_0/U$  ( $U_m$ ) where:
- a)  $U_0$  is the cable nominal voltage between the conductor and the metal covering or earth;
- b)  $U$  is the cable nominal voltage between the phase conductors, for 3-phase  $U = \sqrt{3}U_0$ ;
- c)  $U_m$  is the maximum permissible voltage.
- This defines the voltages of cables and wires, by which the construction and the tests in respect of electrical characteristics are to be referred.
- 15) **screened separable connector:** A separable connector that has a fully screened external surface.
- 16) **secondary earthing conductor:** A conductor that for XLPE-insulated cable connects the copper screen of the cable to the main earthing conductor at a joint or termination.
- 17) **separable connector:** A fully insulated termination permitting the connection and the disconnection of a cable to other equipment.
- 18) **straight joint:** An accessory making a connection between two cables to form a continuous circuit.
- 19) **submersible:** Cables or accessories that are designed to function while fully submersed in water (up to a depth of 100 m).
- 20) **termination:** A device fitted to the end of a cable to ensure electrical connection with other parts of the system and to maintain the insulation up to the point of connection.
- 21) **termination tail:** The part of a cable termination that for an impregnated paper-insulated cable extends from the end of the lead sheath to the end of the core insulation and in the case of a TR-XLPE or XLPE-insulated cable extends from the extruded bedding cut to the end of the core insulation.
- 22) **transition joint:** A straight joint making a connection between cables with different types of insulation.
- 23) **trifurcated cable:** cable with three cores each taking up a third of the area, i.e. circle divided into three pieces.

- 24) **waterlogged:** refers to areas that are saturated with water at all times (24 h per day).

### 2.2.2 Abbreviations

- 1) AC: Alternating Current
- 2) AMF: Approved Manufacturing Facility
- 3) AS: Australian Standard
- 4) AS/NZS: Australian / New Zealand Standard
- 5) AWA: Aluminium-wire armoured
- 6) CFS: Constant Force Spring
- 7) DC: Direct Current
- 8) GDSTA: Galvanized double steel-tape armoured
- 9) HDPE: High Density Polyethylene
- 10) kV: kilo Volts
- 11) MIND: Mineral-impregnated non-draining
- 12) MV: Medium Voltage >1000 volts ac; <35 000 volts ac
- 13) PILC: Paper Insulated Lead Cable
- 14) PVC: Polyvinyl Chloride
- 15) SWA: Steel-wire armoured
- 16) TR-XLPE: Tree Retardant Cross-linked polyethylene
- 17) XLPE: Cross-linked polyethylene

## 3 REQUIREMENTS

### 3.1 Power system particulars

The Equipment must be suitable for continuous connection to a power system with the characteristics covered below.

#### 3.1.1 Design Fault Levels

The Maximum design fault currents are as follows:

- 1) 13.1 kA rms/1 second for 33 kV and 22 kV systems
- 2) 18.1 kA rms/1 second for 11 kV and 6.6 kV systems

#### 3.1.2 Maximum Conductor Temperatures

The Equipment shall be suitable for use on cables with conductor temperatures specified in AS/NZS 1036 [2.] & 1429.1 [3.] for normal operation and under fault conditions.

#### 3.1.3 Nominal System Frequency

The nominal system frequency is 50 Hz.

### 3.1.4 System Insulation Levels

The system Basic Impulse Insulation Levels (BIL) are as follows:

**Table 1: System Insulation Levels**

| Nominal System Voltage (kV rms) | System Highest Voltage (kV peak) | Lightning Impulse Withstand Voltage (kV peak) | Power Frequency withstand Voltage (kV peak) |
|---------------------------------|----------------------------------|---|---|
| 6.6                             | 7.2                              | 75  | 20  |
| 11.0                            | 12.0                             | 95  | 28  |
| 22.0                            | 24.0                             | 150   | 50  |
| 33.0                            | 36.0                             | 200   | 70  |

### 3.1.5 Standard Environmental and Operating Conditions

The Equipment must be suitable for use throughout the state of Western Australia in conditions where a wide range of solar radiation, pollution (salt bearing and industrial) and wind velocities are experienced. The Equipment must be suitable for continuous operation under environmental and operating conditions detailed in HPC-9EJ-01-0001-2013 Horizon Power Environmental Conditions [1].

Vendors must submit with the Proposal, documentation (evidence, test reports, etc.) to demonstrate that the Equipment offered meets the environmental service conditions. Vendors must clearly state in the Proposal, any Equipment that does not meet the environmental service conditions and provide the maximum environmental service conditions the Equipment if capable of withstanding.

## 4 MV CABLE ACCESSORIES

### 4.1 Applicable Cables for Accessories

All MV cables used in Horizon Power are either TR-XLPE insulated, XLPE insulated or PILC cables. PILC cables are no longer used however certain accessories shall be required for existing cables in the network (e.g.: transition joints).

#### 4.1.1 MV Cables – TR-XLPE and XLPE Insulated (new and existing)

The 12.7/22 kV cable is used on the 6.6 kV and 11 kV systems.

- 1) 19.1/33 kV, 3 x 1-core, 50 mm<sup>2</sup>, 630 mm<sup>2</sup> and 1000 mm<sup>2</sup> aluminium and 185 mm<sup>2</sup> copper stranded conductor, semi conductive conductor and insulation screens, heavy duty copper wire screen, water blocking tape, PVC inner and HDPE (2 mm thick) outer sheathed.
- 2) 12.7/22 kV, 3 x 1-core, 95 mm<sup>2</sup>, 185 mm<sup>2</sup> and 400 mm<sup>2</sup> aluminium and 240 mm<sup>2</sup> and 630 mm<sup>2</sup> copper stranded conductor, semi conductive conductor and insulation screens, heavy duty copper wire screen, water blocking tape, PVC inner and HDPE (2 mm thick) outer sheathed.

**NOTE:** Double brass tape may sometimes be used on the 185 mm<sup>2</sup> and 50 mm<sup>2</sup> sizes for termite protection.

- 3) 12.7/22 kV 3 x 1-core, 35 mm<sup>2</sup> aluminium stranded compacted conductor, semi-conductive conductor and insulation screens, heavy duty copper wire screen, water blocking tape, PVC inner and HDPE (2 mm thick) outer sheathed.

A 12.7/22 kV 35 mm<sup>2</sup> 1-core light duty copper wire screen version, similar in other respects to the 3 x 1-core, is also used.

**NOTE:** The 3 x 1-core 35 mm<sup>2</sup> cable may sometimes have an additional nylon 12 sheath for termite protection.

**Table 2: MV XLPE insulated cables**

| Cable Type (Conductor Insulation) | Nom. Conductor CSA (mm <sup>2</sup> ) | Nom. Conductor Diam. (mm) | Nom. Core Insulation Diam. (mm) | Screen Wires Nom. CSA per core (mm <sup>2</sup> ) | Approx. Single Core Diam. (mm) | Approx. Three Core Diam. (mm) |
|-----------------------------------|---------------------------------------|---------------------------|---------------------------------|---|--------------------------------|-------------------------------|
| 33kV Al, XPLE                     | 1000                                  | 39.3                      | 59.1                            | 62.6  | 72.2                           | N/A                           |
| 33kV Al, XLPE                     | 630                                   | 30.2                      | 48.2                            | -   | 60.3                           | N/A                           |
| 33kV Cu, XLPE                     | 185                                   | 16.1                      | 28.9                            | 70  | 42.5                           | 91.5                          |
| 33kV Al, TR-XLPE <sup>A</sup>     | 50                                    | 8.1                       | 25.3                            | 31.8  | 41.1                           | 88.7                          |
| 33kV Al, XLPE                     | 50                                    | 8.2                       | 26.1                            | 32  | 38                             | 82                            |
| 22kV Cu, XLPE                     | 630                                   | 30.3                      | 43.7                            | 70  | 56.0                           | 124.8                         |
| 22kV Al, TR-XLPE                  | 400                                   | 23.4                      | 35.6                            | 68.7  | 48.0                           | 103                           |
| 22kV Al, XLPE                     | 400                                   | 23.5                      | 36.4                            | 70  | 46.0                           | 105.1                         |
| 22kV Cu, XLPE                     | 240                                   | 18.6                      | 31.4                            | 70  | 45.0                           | 97.0                          |
| 22kV Al, TR-XLPE                  | 185                                   | 15.9                      | 28.2                            | 67.2  | 40.7                           | 87.7                          |
| 22kV Al, XLPE                     | 185                                   | 16.1                      | 28.9                            | 70  | 42.5                           | 91.5                          |
| 22kV Al, XLPE <sup>A</sup>        | 185                                   | 16.3                      | 29.2                            | 70  | 46.0                           | 99.0                          |
| 22kV Al, XLPE                     | 95                                    | 11.6                      | 24.5                            | 59  | 37.5                           | 81.0                          |
| 22kV Al, TR-XLPE                  | 35                                    | 7.1                       | 19.3                            | 22.1  | 30.6                           | 66                            |
| 22kV Al, XLPE                     | 35                                    | 7.0                       | 19.8                            | 25.0  | 32.0                           | 69                            |
| 22kV Al, XLPE <sup>B</sup>        | 35                                    | 7.0                       | 19.7                            | 21.5  | 32.0                           | N/A                           |
| 22kV Al, XLPE <sup>C</sup>        | 35                                    | 7.0                       | 19.8                            | 22.0  | 34.2                           | 74                            |

**NOTES:**

- A Double brass tape for termite protection.
- B Light duty copper wire screen version.
- C Nylon 12 sheath for termite protection.

**4.1.2 MV Cables – PILC**

- 1) 12.7/22 kV 3-core, 50 mm<sup>2</sup> and 185 mm<sup>2</sup> aluminium and 240 mm<sup>2</sup> copper shaped stranded conductor, screened.
- 2) 6.35/11 kV 3-core, 70 mm<sup>2</sup> aluminium and 240 mm<sup>2</sup> and 300 mm<sup>2</sup> copper shaped stranded conductor, screened.

**Table 3: MV Paper-Lead insulated cables**

| Cable Type<br>(Voltage, Cond.<br>Insulation) | Nom.<br>Cond.<br>CSA<br>(mm <sup>2</sup> ) | Nom.<br>Cond.<br>Diam.<br>(mm) | Min Insul.<br>Thickness<br>between<br>Cond. &<br>Sheath<br>(mm) | Nom.<br>Thickness<br>of Lead<br>Alloy<br>Sheath<br>(mm) | Max/Min<br>Lead<br>Alloy<br>Sheath<br>Overall<br>Diam.<br>(mm) | Max/Min<br>Overall<br>Cable<br>Diam.<br>(mm) |
|--|--|--------------------------------|---|---|--|--|
| 22kV Cu, PILC                                | 240  | 17.01                          | 4.9   | 2.6   | 69.3 / 66.2  | 86.1 / 81.9                                  |
| 22kV Al, PILC                                | 185  | 14.82                          | 4.9   | 2.4   | 63.9 / 61.0  | 80.3 / 76.2                                  |
| 22kV Al, PILC                                | 50   | 8.90                           | 4.9   | 1.9   | 48.4 / 46.1  | 62.6 / 59.3                                  |
| 11kV Cu, PILC                                | 300  | 18.14                          | 2.8   | 2.4   | 60.1 / 57.3  | 76.5 / 72.6                                  |
| 11kV Cu, PILC                                | 240  | 16.20                          | 2.8   | 2.2   | 55.4 / 52.8  | 70.2 / 66.6                                  |
| 11kV Al, PILC                                | 70   | 8.56                           | 2.8   | 1.7   | 37.5 / 35.5  | 51.0 / 48.1                                  |

**4.2 Jointing Kits**

Horizon Power shall only consider Heat Shrink joints.

**4.2.1 General**

Joint kits shall be suitable to be buried directly in all soil types and ground conditions. The completed joints shall be completely sealed from possibility of any moisture ingress; impervious to petrol & oil and resistant to attack by termites. The Vendor shall ensure that all joints have termite protection (e.g. external wire sock), for the jointing of TR-XLPE insulated, XLPE insulated MV cables with double brass tape or nylon 12 termite protection as detailed in Section 4.1.

The Vendor shall specify the minimum shelf life of the Jointing kits.

**4.2.2 Additional requirements for water logged ground**

Joint kits used for cables installed in water logged surfaces shall have the following requirements in addition to Section 4.2.1:

- Provision of water blocking tubes or additional outer sleeving that shall provide complete moisture and corrosion free sealing to the joint.

- Termimesh layer for joints shall preferably be of a non-corrosive material. They must be compatible with Nylon/ polymer jackets used with the cables.

Preference will be given by Horizon Power towards joint kits that are general purpose with the provision of add on accessories to meet the water logged surface requirements.

#### 4.2.3 Joint Design

The life, electrical and mechanical performance characteristics of the joints shall be at least equal to those of the cables with which they are to be used.

Joint kits shall be supplied with all components necessary to complete the joint (this includes connectors and cable preparation materials). Any excluded parts shall be stated. Preference shall be given to kits that minimise the skill and labour necessary to complete a joint.

All accessories shall be range taking in accordance with the following standard ranges:

**Table 4: Standard accessory ranges for joints**

| 1                                       | 2                                | 3         | 4          | 5          | 6          |
|---|----------------------------------|-----------|------------|------------|------------|
| Rated Voltage<br>(U <sub>o</sub> /U kV) | Cable Size<br>(mm <sup>2</sup> ) |           |            |            |            |
|   | Accessory Range                  |           |            |            |            |
| 6.35/11                                 | 16 to 35                         | 50 to 95  | 120 to 185 | 240 to 400 | 500 to 630 |
| 12.7/22                                 | 25                               | 35 to 70  | 95 to 240  | 300 to 400 | 500 to 630 |
| 19/33                                   | 50 to 70                         | 95 to 150 | 185 to 400 | 500 to 630 | 1000       |

#### 4.2.3.1 Compound

Compound filled kits shall be supplied with sufficient compound to complete each joint for the instance involving the smallest dimension cables that may be utilised, PLUS an additional 10% of compound. Sand fillers may be offered however resin only compound kits are preferred. Vendors shall supply a Gelation-curve for each compound type offered.

The Vendor shall state the type of compound proposed for the filling and detail its characteristics with particular reference to skin irritation effects, fumes and toxicity (refer Section 8). The Vendor may suggest an alternative filling compound, or method, to reduce the packaging required for larger cable sizes.

In its offer, the Vendor shall also detail the type of packaging used for the compound (and fillers if offered) and the method by which it is to be applied (i.e. mixed, poured, cured, etc.) to complete the joint. The packaging used to contain the compound(s) shall be of such a quality that they are substantially resistant to accidental puncture and normal handling.

Uni-packs are preferred where resin only (i.e. no fillers) compound kits is offered. On large joints where uni-packs are offered and significant resin is required, the Vendor shall offer several reasonably sized packs of volume no more than 2.5 litres each. Where fillers are used, a bucket or other suitable container and stirring implement shall be provided as part of the kit for the mixing of the compound.

All compound filled joint kits shall contain clear joint boxes to allow visual indication of the joint during the compound filling process. The joint boxes of cable tee joints shall be suitable for cutting with a suitable manual/automatic cutting tool. If the joint boxes are supplied with the tee-off cut-outs removed, or if joint box is to be used with cables of dimensions smaller than the main cable cut-out, packing (or other suitable accessory) shall be supplied to prevent leakage of the compound during installation.

Preference may be given to compound filled joint kits that positively separate screen wires from the joint box and centre the joint connectors.

#### **4.2.3.2 Joint Connectors**

The Vendor shall fully describe the type of core connector offered for each kit. Mechanical connectors shall meet the test requirements of AS/NZS 4325.1 [6.].

The core connectors on MV joints shall be:

- 1) of the “shear off” type;
- 2) being fully countersunk; with
- 3) the shear off occurring below the upper lip of the countersunk hole and no exposed burrs or edges.

Mastic tape to be provided to cover any sharp edges of the shear off bolt.

**NOTE:** Unless otherwise specified in Schedule E (Appendix I), the joint kit items for connecting MV insulated XLPE to XLPE or TR-XLPE to XLPE cables shall be supplied as single joint kits.

### **4.3 Termination Kits**

Horizon Power shall only consider Heat Shrink terminations.

#### **4.3.1 General**

All termination kits for use shall be of the shrinkable type and complete with sheds (outdoor kits) and fasteners, but without stand-off insulators and support brackets. Indoor termination kits may be offered with or without sheds.

The termination shall be sealed against moisture ingress. This includes sealing by mastic (or similar) at the connector, and of the screen wires at the base of the termination. All terminations shall be termite proof.

The Vendor shall specify the minimum shelf life of the Termination kits.

Preference shall be given to kits that minimise the skill and labour necessary to complete a termination.



### 4.3.2 Termination Design

- 1) Terminations shall be classified as:
  - a) indoor air insulated termination;

**NOTE:** Clearance within the enclosure shall be in accordance with Table 3.1 in AS 2067 [4.].

- b) outdoor terminations.
- 2) The design of the termination shall take into account changes to the electrical field distribution caused by pollution deposited on the surface of the termination in indoor and outdoor applications.
- 3) The creepage distance shall be stated in Schedule B (Appendix F).

**NOTE:** The creepage distance shall be measured from the end of the cable insulation at the lug, along the surface of the termination tail, to the nearest exposed earthed point (i.e. typically the main earth lead of the termination or conductive break-out boot if applicable).

- 4) The termination design shall include termite protection.

All termination kits shall be supplied with all components necessary to complete the termination (this includes the main cable and screen lugs).

All accessories shall be range taking in accordance with the following standard ranges:

**Table 5: Standard accessory ranges for terminations**

| 1                                       | 2                                | 3             | 4             | 5             | 6              | 7    |
|---|----------------------------------|---------------|---------------|---------------|----------------|------|
| Rated Voltage<br>(U <sub>o</sub> /U kV) | Cable Size<br>(mm <sup>2</sup> ) |               |               |               |                |      |
|   | Accessory Range                  |               |               |               |                |      |
| 6.35/11                                 | 16 to 35                         | 50 to 95      | 120 to<br>185 | 240 to<br>400 | 500 to<br>800  | 1000 |
| 12.7/22                                 | 25 to 50                         | 70 to 185     | 240 to<br>300 | 400 to<br>630 | 800 to<br>1000 |      |
| 19/33                                   | 50 to 95                         | 120 to<br>185 | 240 to<br>500 | 630           | 1000           |      |

#### 4.3.2.1 Compound

As described in Section 4.2.3.1.

#### 4.3.2.2 Termination Connectors

The Vendor shall fully describe the type of core connector offered for each kit. Mechanical connectors shall meet the test requirements of AS/NZS 4325.1 [6.].

The core connectors on MV terminations shall be:

- 1) of the “shear off” type;
- 2) being fully countersunk; with



- 3) the shear off occurring below the upper lip of the countersunk hole and no exposed burrs or edges.

All connector lugs shall be sized to suit a M12 bolt. All screen lugs shall be sized to suit a M10 bolt. Mastic tape to be provided to cover any sharp edges of the shear off bolt. Any excluded parts shall be stated.

**NOTE:** The MV insulated TR-XLPE, XLPE cable termination kits items shall be supplied as single termination kits, unless otherwise specified in Schedule E (Appendix I).

**4.3.3 Phase Identification**

All outdoor termination kits shall be supplied with a coloured cable banding method (tape, heatshrink, etc.) suitable for the long-term phase identification of cable cores. The banding shall be UV-stabilised to prevent fading due to exposure in sunlight.

**4.3.4 Termination Tail Length**

Unless otherwise specified in Schedule A of the enquiry document (Appendix F), cable termination tail lengths shall be as specified in Table 6 and Table 7.

**Table 6: Tail Length for three-core cable terminations**

| 1                                    | 2                |
|--------------------------------------|------------------|
| Rated Voltage (U <sub>0</sub> /U kV) | Tail Length (mm) |
| 6.35/11                              | 650              |
| 12.7/22                              | 800              |
| 19/33                                | 800              |

**Table 7: Tail Length for single-core cable terminations**

| 1                                    | 2                |
|--------------------------------------|------------------|
| Rated Voltage (U <sub>0</sub> /U kV) | Tail Length (mm) |
| 6.35/11                              | 350              |
| 12.7/22                              | 450              |
| 19/33                                | 650              |

**4.4 Separable Insulated Connectors**

Separable insulated connectors shall be similar or equivalent manufacture to those makes specified in the item description of Schedule E (Appendix I), to enable proper connection or mating at the interface with associated parts such as insert junctions, equipment bushings and other separable components. The connectors shall conform to AS 2629 [5.].

Connectors shall have an electrically conductive shield conforming to IEEE 592 [17.]. All elbow connectors shall have provision for connecting the shield to an external earth connection. For testing purposes, it is preferred that the shield may be temporarily disconnected from the external earth connection.

Test points shall be provided on all separable elbow and straight connectors. Hold-down bails are required on all dead-break connectors of the non-bolted type.

The Vendor shall state in its Proposal if elbow or straight connector items include jacket seals (cold shrinkable sleeving for sealing at neck of cable entry into connector).

Termination kits of the elbow connector type illustrated in Figure E1 of Appendix E for use with ring main switchgear (refer to Items 3.1 to 4.3 in Schedule E (Appendix I)) shall be of suitable design to ensure that any unscreened or non-shockproof parts of the termination lie totally within the switchgear cable compartment.

For all separable connectors, preference shall be given to kits that utilise screw connectors:

- 1) of the "shear off" type;
- 2) being fully countersunk; with
- 3) the shear off occurring below the upper lip of the countersunk hole and no exposed burrs or edges.

Mastic tape to be provided to cover any sharp edges of the shear off bolt. Mechanical connectors shall meet the test requirements of AS/NZS 4325.1 [6.].

The Vendor shall specify the minimum shelf life of the kits.

Preference shall be given to kits that minimise the skill and labour necessary to complete a termination.

All separable connectors shall be supplied with all components necessary to complete the termination (this includes lugs). Any excluded parts shall be stated.

**NOTE:** Unless otherwise specified in Schedule E (Appendix I), the separable connector kit items shall be supplied as single connector kits.

#### **4.4.1 Unscreened Separable Connectors**

Unscreened separable connectors shall be:

- a) fitted with insulated backplugs where applicable;
- b) range taking in accordance with the standard ranges specified in Table 5;
- c) suitable for application with a 630 A Type C bushing of AS/NZS 60137 [10.] with an M16 x 2 thread;
- d) supplied with stainless steel fixing stems that reduce from M16 x 2 to M12 x 1,75. The length of each threaded section shall be 30 mm.

Each fixing stem shall have a stainless steel nut, washer and spring washer;

- e) tested at the minimum phase-to-phase and phase-to-earth clearances recommended as per Table 3.1 of AS 2067 [4.]. The minimum recommended clearances if a different shall be stated in Schedule B of the enquiry document (Appendix F).

#### **4.4.2 Screened Separable Connectors**

Extensible and non-extensible connectors shall be:

- a) range taking in accordance with the standard ranges specified in Table 5;
- b) connect to either 630 A Type C bushing of AS/NZS 60137 [10.] with an M16 x 2 thread or a 200 A Type A bushing with a straight connector type (for transformer circuits).
- c) supplied with stainless steel fixing stems and lugs for the cable size specified in Schedule A (Appendix F).

#### **4.4.3 Line Voltage Detection (option)**

Separable connectors to include the option of capped line voltage test point, provided by means of a capacitive voltage divider between the MV conductor and a conductive, isolated plate under the outer shield of the connector.

#### **4.5 Sealing End Caps and Sleeving**

Shrinkable sleeving or tubing, where their length is not specified, shall be supplied in unbroken rolls.

Specified dimensions of gloves (finger sleeves), tubing and end caps are nominal expanded measurements in millimetres. Specified wall thicknesses are fully recovered measurements.

Vendors may offer re-usable alternatives to the shrinkable sealing end cap items detailed in Schedule E (Appendix I). If re-useable, the Vendor shall detail the number of times the end caps may be used and methods (if any) to identify the number of uses. The Vendor shall guarantee that the cap will not allow moisture in if reused for the proposed number of times. Vendors may also offer cold applied alternatives to the heat shrinkable repair kit items detailed in Schedule E (Appendix I).

Sealing End Caps and Sleeving shall be termite proof.

The Vendor shall specify the minimum shelf life of the kits and items.

Preference shall be given to sealing end caps and sleeving that minimise the skill and labour necessary to complete a termination.

## 4.6 Accessory Earthing

- 1) Unless specified otherwise in Schedule A (Appendix F) the main earthing conductor shall be tinned copper braid with a cross-sectional area of 70 mm<sup>2</sup>.
- 2) Constant force springs (CFS's) used to connect the main earthing conductor to the lead sheath or armour of a cable shall have a minimum width of 20 mm and shall be suitable for the relevant cable dimensions.
- 3) Armour clamps shall be stainless steel with a nominal thickness of 1 mm and nominal width of at least 20 mm. Fastening shall be by means of a socket or spanner only.
- 4) CFS's that form part of the main earthing connection shall not be used to secure any ferrous metal enclosures used for mechanical protection of a three-core cable joint.
- 5) The main earthing conductor of a joint shall be separated from the individual core insulation by a collective insulating inner sleeve that:
  - a) for an impregnated paper-insulated cable extends from lead sheath to lead sheath;
  - b) for an XLPE-insulated cable extends from bedding to bedding; and
  - c) for a transition joint extends from lead sheath to bedding;

and that is effectively sealed at each bedding or lead sheath interface.

- 6) The sharp edges of a CFS or armour clamp shall be smoothed using a suitable filler tape positioned around the CFS or clamp. In the case of CFS, the filler tape will also serve to restrain the spring.
- 7) The main earthing conductor supplied with a termination shall be 700 mm long and shall be terminated with a tinned copper connector having an M12 fixing hole.
- 8) The cable termination earthing conductor shall be water blocked to prevent ingress of moisture into the termination. The method of water blocking shall be stated in Schedule B of the enquiry document (Appendix F). The positioning of the water block shall be clearly indicated in the accessory installation instruction.
- 9) TR-XLPE and XLPE-insulated cables:
  - a) Secondary earthing conductors shall be tinned copper braid and shall have a cross-sectional area of at least 20 mm<sup>2</sup>.
  - b) The connection between secondary earthing conductor and the copper screen of each cable core shall be made with a CFS.
  - c) The main earthing conductor of a three-core joint or termination shall be connected to the armour wires of the cable with a CFS or an armour clamp.
  - d) The armour wires directly below the CFS or armour clamp shall be supported. The method of support shall be indicated in Schedule B of the enquiry document (Appendix F).

**NOTE:** Support below the armour wires is required to accommodate the triangular shape of certain XLPE-insulated cables.

10) Impregnated paper-insulated cables:

The main earthing conductor of a joint or termination shall be:

- a) connected to the lead sheath of the cable by a CFS. A layer of tinned copper mesh shall be provided for application under the CFS; and
- b) connected to the armouring of the cable with a CFS.

#### **4.7 Special Requirements**

- 1) Where heat shrink materials are used for the purpose of electrical insulation, they shall have a minimum wall thickness as per Table 2.1 of AS 1429.1 [3.].
- 2) Outdoor three-core cable terminations shall be provided with crutch support to prevent damage to the cable crutch and core insulation from over-trifurcating.
- 3) Three-core cable terminations shall be designed to accommodate crossing of cable cores within the screened section of the trifurcated cores. The method of core crossing along with minimum clearances shall be indicated in the termination instruction.
- 4) Three-core cable joints shall be designed to accommodate crossing of cable cores within the joint. The method of core crossing shall be indicated in the termination instruction.
- 5) The termination tail insulating tube length shall allow for at least 100 mm of additional length that is required to cover the lug barrel. Alternatively lug insulating tubes of at least 150 mm shall be provided.
- 6) For the accessory range indicated in Schedule A of the enquiry document (Appendix F); a transition joint shall be supplied that allows for the connection of a 3-core PILC cable to three single-core TR-XLPE or XLPE-insulated cables. The joint shall:
  - a) make provision within the joint for connection of the main earthing conductor to a 70 mm<sup>2</sup> copper PVC insulated conductor that complies with AS/NZS 5000;
  - b) allow the 70 mm<sup>2</sup> PVC insulated conductor to be brought out of the joint without affecting the integrity of the joint sealing arrangement.
- 7) Cleaning kits shall consist of at least the following:
  - a) non-oil based cleaning solvent supplied in a sealed container that prevents leakage or evaporation;
  - b) 50 mm x 600 mm aluminium-oxide or glass based abrasive tape;
  - c) 1 m of twine for cutting core insulation (supplied only with accessories for TR-XLPE and XLPE-insulated cables);
  - d) eight pieces of 150 mm x 150 mm lint free cloth; and
  - e) a material safety data sheet.

## 4.8 Conditions and Range of Approval

- 1) For three-core PILC cable:
  - a) approval of the range of cross-sections up to and including 50 mm<sup>2</sup> shall be obtained by successfully completing the type tests listed in Tables 2 and 3 of IEC 60055-1 [11.] on the smallest size offered.
  - b) approval of the range of cross-sections from 95 mm<sup>2</sup> to 300 mm<sup>2</sup> shall be obtained by successfully completing the type tests listed in Tables 2 and 3 of IEC 60055-1 [11.], on a cable cross-section as indicated in Section 8.1.2.
- 2) For three-core XLPE-insulated cables:
  - a) approval of the range of cross sections up to and including 50 mm<sup>2</sup> shall be obtained by successfully completing the type tests listed in Tables 4 to 9 of IEC 60502-4 [15.] on the smallest size offered.
  - b) approval of the range of cross-sections from 95 mm<sup>2</sup> to 300 mm<sup>2</sup> shall be obtained by successfully completing the type tests listed in Tables 4 to 9 of IEC 60502-4 [15.], on a cable cross-section as indicated in Section 8.1.2.
- 3) Extension of approval to a range wider than that given above shall be achieved by carrying out the additional tests listed in Table 10 of IEC 60502-4 [15.] on the smallest and/or largest conductor cross sectional areas of the required range.
- 4) Tests carried out according to 1) or 2) on a single or three-core cable shall provide approval of that type of accessory for use on single-core cables up to the largest sizes included in the relevant cable specification. Tests carried out on a single-core cable however, shall not provide approval for use of that accessory on three-core cables.
- 5) All other conditions stated in clause 24 of IEC 60055-1 [11.] and clause 7 of IEC 60502-4 [15.] shall apply.

## 4.9 Marking/Packing

### 4.9.1 Marking

All accessories shall be clearly and durably marked as follows:

- a) the manufacturer's identification mark and reference/catalogue number (to be visible on the completed accessory after installation);
- b) the accessory range (to be visible on the accessory packaging);
- c) all components forming part of an accessory shall be marked with the manufacturer's identification mark as well as a part number. This part number shall be referenced in the bill of materials;

**NOTE:** Components that are physically impossible to mark shall be individually packed and the packaging shall be marked.

- d) all components or consumables that are subject to a shelf life limitation, shall be individually packed and have the expiry date prominently and permanently shown on the packaging.

- e) where an accessory contains components or consumables that have an expiry date it shall be clearly marked on the outside of the cardboard container.

#### **4.9.2 Packing**

- 1) Each accessory shall be packed in a cardboard container to protect it from mechanical damage. Individual parts shall be packed in sealed plastic bags completely sealed from dust and moisture. The package shall contain:
  - a) an installation instruction;
  - b) all necessary components and consumables required to complete the installation in accordance with the instruction i.e. accessory components, cleaning kit and earthing kit;
  - c) a bill of materials;
  - d) Material Safety Data Sheets (MSDS), see Section 8
- 2) Plastic packing shall be such as to permit easy identification of the components without their removal from the packing.
- 3) The packaging used to contain the compound(s) shall be of such a quality that they are substantially resistant to accidental puncture and normal handling.

Where accessories are bulk packed the mass of each container shall not exceed 30 kg. The container shall be marked with the following information:

- a) the name of the manufacturer;
- b) the accessory reference;
- c) the number of accessories per container;
- d) the batch number; and
- e) the purchaser's order number.

#### **4.10 Tagging of Equipment**

The Vendor shall offer as an option to Horizon Power, a method for indelibly tagging all joint, termination, separable connector, and submersible pit connector kit items with a random 6-digit number. This number shall be used to reference the cable jointer undertaking the installation of the joint or termination. It is expected that the tagging system, as well as the numbered marking, shall last the life of the installed equipment.

Vendors shall also provide as an option a method to record approximate installation date on the tag.

### **5 TOOLS AND SPARE EQUIPMENT**

Separate prices are required with the offer for the following:

- 1) Any spares necessary for the continuous operation of each item of Equipment; and



- 2) Any special tools or handling equipment required for installation and/or maintenance shall be stated in Schedule B of the enquiry document (Appendix F).

All spares must be labelled with manufacturer's part number.

It is required that the validity period of the Proposal, as far as spares are concerned, be extended until such time as Horizon Power places an order for spares.

## **6 STORAGE**

Components must be capable of being stored without deterioration within the temperature range in Section 3.1.5 for at least 24 months.

## **7 RELIABILITY**

Vendors must comment on the reliability of the Equipment and the performance of the materials offered over an **operational life of 30 years** under the specified field of application and conditions of service.

Evidence must provide evidence in support of the claimed reliability and performance for the Equipment offered, including information on Failure Mode and Effect Analysis.

## **8 SAFETY**

Material Safety Data Sheets (MSDS) applicable for each different product or chemical ingredient in the product which is considered harmful to personnel or environment in any manner, must be supplied with the Proposal.

### **8.1 Environmental Considerations**

Vendors must comment on the environmental soundness of the design and the materials used in the manufacture of the Equipment offered. In particular, comments should address such issues as recyclability and disposability at the end of service life as well as disposability of used or unused materials supplied.

## **9 TESTS**

### **9.1 Assembly of Accessories to be Tested**

#### **9.1.1 Identification**

- 1) The paper-insulated and TR-XLPE or XLPE-insulated cables used for testing shall comply with AS/NZS 1036 [2.] & 1429.1 [3.] respectively and shall be the same rated voltage as the accessories to be tested.

Cables shall be correctly identified in accordance with Appendix C.

- 2) Connectors to be used with the accessories shall comply with AS 2629 [5.] and shall be correctly identified with respect to:
  - a) the assembly technique;
  - b) the tooling and necessary setting;



- c) the preparation of contact surfaces;
  - d) the type, reference number and any other identification of the connector; and
  - e) the details of the type test approval.
- 3) Accessories to be tested shall be correctly identified with respect to:
- a) the name of manufacturer and the brand name;
  - b) the type, designation, manufacturing date and part number;
  - c) the minimum and maximum cable cross-sections, material and shape of cable conductor;
  - d) the minimum and maximum cable insulation diameters;
  - e) the rated voltages (see Section 2.2.1);
  - f) the cable construction (see Appendix C);
  - g) the installation instructions (reference and date) and associated bill of materials;
  - h) the tail lengths tested (where applicable); and
  - i) the cross-sectional area of the main earth leads.

### 9.1.2 Test Installation and Connections

- 1) Unless otherwise specified, the following cable sizes shall be used:
- a) for terminations, joints and stop ends see Tables 2 & 3;  
**NOTE:** This does not override the requirements of Section 4.8 but must be read in conjunction with it; and
  - b) for separable connectors: each rating shall be tested in accordance with 5.2.1 b) of IEC 60502-4 [15.].
- 2) The phase-to-phase and phase-to-earth clearances for indoor terminations screened separable connectors shall be not greater than that specified in Table 3.1 of AS 2067 [4.].
- 3) Installation and connections shall be in accordance with IEC 60055-1 [11.] or IEC 60502-4 [15.].
- 4) Test Assemblies of the required number of connectors and associated cables shall be made as follows:
- a) Fit the connectors to the cables in accordance with the manufacturer's installation instructions.
  - b) Steadily apply torque until the shear head is broken.

## 9.2 Test Requirements

Tests carried out shall be according to AS/NZS 4805 Part 1 [7.] and 2 [8.], IEC 60060-1 [12.] & IEC 60060-2 [13.].

### **9.2.1 Type Tests**

Evidence shall be submitted by the Vendor indicating that all type tests required by the relevant Australian Standards listed in Section 2.1 have been satisfactorily carried out on Equipment of an identical design.

Where Equipment has been tested to International Standards only, sufficient type test evidence shall be submitted to confirm equivalence of Equipment performance to the relevant Australian standard.

### **9.2.2 Routine Tests**

Routine tests, according to the standards listed in Section 2, shall be carried out on each item of Equipment thereof.

### **9.2.3 Accessory Test Requirements**

- 1) Test requirements for impregnated-paper-insulated cables shall be in accordance with IEC 60055-1 [11.] with the voltage levels shown in Table 9 of this specification.
- 2) Test requirements for TR-XLPE and XLPE-insulated cables shall be in accordance with IEC 60502-4 [15.] with voltage levels shown in Table 10 of this specification.

### **9.2.4 Batch Test**

The following tests shall be carried out for every batch of the equipment supplied Horizon Power:

- 1) The thermal short circuit (screen) test shall be performed at 10 kA for 1 second except where this requirement exceeds the earth fault rating of the cable, in which case the test shall be carried out at the 1 second earth fault rating of the cable.

Where the earthing circuit is deemed to be independent of the accessory it may be tested in accordance with AS/NZS 4325.1 [6.] at the above-mentioned current levels. It shall be tested as installed for service.

- 2) Cable joints for armoured cables shall be subjected to an impact test in accordance with Section 9.2.5.

**Table 9: Test voltages for PILC-insulated cables**

| Test                  | Test Voltage | Rated Voltage ( $U_0/U$ kV) |         |       | Requirements   |
|-----------------------|--------------|-----------------------------|---------|-------|--|
|                       |              | 6.35/11                     | 12.7/22 | 19/33 |  |
| Humidity and salt fog | 1.25 $U_0$   | 7.94                        | 15.9    | 23.8  | No failure or flashover<br>No more than 3 trips<br>No substantial damage <sup>1)</sup> |
| Thermal cycles        | 1.5 $U_0$    | 9.5                         | 19.1    | 28.5  | No failure or flashover  |
| AC withstand/15 min   | 2.5 $U_0$    | 15.9                        | 31.8    | 47.5  | No failure or flashover  |
| AC withstand/1 min    | 4 $U_0$      | 25.4                        | 50.8    | 76    | No failure or flashover  |
| AC withstand/5 min    | 4.5 $U_0$    | 28.6                        | 57.1    | 85.5  | No failure or flashover  |
| Impulse (peak)        |              | 95                          | 150     | 200   | No failure or flashover  |

<sup>1)</sup> It is considered that substantial damage has occurred when it is evident that the performance of the accessory has been severely reduced by loss of dielectric quality of the surface due to tracking or erosion.

**Table 1: Test voltages for TR-XLPE/XLPE-insulated cables**

| Test                  | Test Voltage | Rated Voltage ( $U_0/U$ kV) |         |       | Requirements   |
|-----------------------|--------------|-----------------------------|---------|-------|--|
|                       |              | 6.35/11                     | 12.7/22 | 19/33 |  |
| Humidity and salt fog | 1.25 $U_0$   | 7.94                        | 15.9    | 23.8  | No failure or flashover<br>No more than 3 trips<br>No substantial damage <sup>1)</sup> |
| Thermal cycles        | 1.73 $U_0$   | 11                          | 22      | 33    | No failure or flashover  |
| AC withstand/15 min   | 2.5 $U_0$    | 15.9                        | 31.8    | 47.5  | No failure or flashover  |
| AC withstand/1 min    | 4 $U_0$      | 25.4                        | 50.8    | 76    | No failure or flashover  |
| AC withstand/5 min    | 4.5 $U_0$    | 28.6                        | 57.1    | 85.5  | No failure or flashover  |
| Impulse (peak)        |              | 95                          | 150     | 200   | No failure or flashover  |

<sup>1)</sup> It is considered that substantial damage has occurred when it is evident that the performance of the accessory has been severely reduced by loss of dielectric quality of the surface due to tracking or erosion.

### 9.2.5 Impact Test on Cable Joints for Armoured Cables

The impact test arrangement for armoured cable joints is illustrated in Figure D1 of Appendix D. The test shall be conducted on a separate sample from all other tests. Prior to impacting, the insulation resistance shall be measured between the conductor and the metallic screen/sheath. The DC test voltage shall be 500 V and shall be applied for a sufficient time to reach a reasonably steady measurement, but for not less than one minute and not more than five minutes. The joint shall also be subjected to an AC withstand voltage of 2,5  $U_0$  for 1 minute.

The joint shall be placed on a hard base, e.g. a concrete slab or floor, and solidly supported in a box filled with sand to the horizontal centre line of the accessory.

A wedge shaped block of mass 4 kg having a 90 degree angle with a 2 mm radius impacting edge shall be dropped freely from a height of 1 m on to the joint so that the impacting edge is horizontal and at right angles to the axis of the joint. There shall be one impact at each end of the joint and one impact at a position over the conductor connectors.

The impact at the end of the joint in a TR-XLPE or XLPE-insulated cable shall be at the outer sheath cut back and at the lead sheath cut back in the case of an impregnated paper-insulated cable.

Following the impact test the joint shall be fully immersed in water for 24 hour at ambient temperature and the insulation resistance shall again be measured as specified above between the conductor and the metallic screen/sheath and between the metallic screen/sheath (if insulated) and the water.

The minimum measured insulation resistance shall be as follows:

- a) impregnated-paper-insulated cables > 10 MΩ; and
- b) TR-XLPE or XLPE-insulated cables > 10<sup>3</sup> MΩ.

The joint shall then be subjected to an AC withstand voltage test at 2,5 U<sub>0</sub> for 15 min. No breakdown shall occur.

Details of any visible effects and the position of the impacts on the joint shall be recorded by photographs and included in the test report.

### **9.3 Schedule of Tests**

The testing schedule includes Electrical Heat Cycle, Thermal Stability Under Load, Integrity of Seal and Connector Insulation, Long Duration Insulation Resistance, and Shear Head Fracture Torque tests.

#### **9.3.1 Electrical Heat Cycle**

The test shall be conducted as per AS/NZS 4805 Part 1 [7.] and 2 [8.].

#### **9.3.2 Thermal Stability of Insulated System Under Load**

The test shall be conducted as per AS/NZS 4805 Part 1 [7.] and 2 [8.].

#### **9.3.3 Mechanical Test**

The test shall be conducted as per Chapter 7 of IEC 61238 [16.].

### **9.4 Acceptance of Alternative Type Tests**

Accessories that have been successfully type tested in accordance with other International Standards not specified above at their respective test voltages shall be accepted provided that:

- a) an additional impulse withstand voltage test is performed at the voltage levels as designated by AS/NZS 1429.1 [3.];
- b) for cable joints, impact tests are performed in accordance with Section 9.2.5;
- c) a written guarantee is provided stating that the accessories are suitable for cables manufactured to AS/NZS 1036 [2.] and 1429.1 [3.];
- d) the accessory complies with all other requirements of this specification; and
- e) the range of approval is as per Section 4.8.

## **10 DOCUMENTATION AND SAMPLES**

**NOTE:** All documentation shall be in English.

### **10.1 Installation Instructions**

Installation instructions shall:

- a) be unique to the rated voltage and the cable type for which the accessory has been designed;
- b) include manufacturer specific part number for accessory;
- c) be supported by legible illustrations, that clearly indicate the application and assembly of all components of the accessory;
- d) reference the bill of materials by utilising the short description and by quoting the relevant part number at least once when describing the components;
- e) indicate a date of issue and revision number; and
- f) unit of measure to be in metric system.

### **10.2 Bill of Materials (BOM)**

The bill of materials shall provide the following information for each component:

- a) a short description;
- b) the quantity;
- c) a part number.

### **10.3 Type Test Certificates/Reports**

- 1) Type test certificates and reports shall be submitted with a tender.
- 2) The type test reports shall include an installation instruction and bill of materials that form an integral part of the test report issued by the test authority.

### **10.4 Samples**

For the purpose of evaluation, test samples of the Equipment may be requested by Horizon Power. When requested, the Vendor shall supply Horizon Power test samples free of charge and within 4 weeks of the request.

The samples, supplied in either kit or assembled form, shall be provided with a complete set of installation instructions. Any deviations between the Equipment supplied as a sample to Horizon Power and the Equipment offered in the Proposal shall be detailed by the Vendor.

A sample of the accessory shall be supplied with the tender where specified in Schedule A of the enquiry document (Appendix F).

## 11 TRAINING

The Vendor shall propose a one week training program for installation and operation of the Equipment in the field. This training shall be conducted at a venue nominated by Horizon Power. The Vendor shall supply all materials required for training purposes.

The training program shall be offered as an option to Horizon Power and costed as a separate item.

The supplier shall provide the following details with regard to training offered:

- a) the available training courses;
- b) the duration;
- c) the cost per delegate;
- d) the minimum number of delegates required;
- e) the certification of delegates; and
- f) on-site training.

**APPENDIX A REVISION INFORMATION**


(Informative) Horizon Power has endeavoured to provide standards of the highest quality and would appreciate notification of errors or queries.

Each Standard makes use of its own comment sheet which is maintained throughout the life of the standard, which lists all comments made by stakeholders regarding the standard.

A comment sheet found in **DM# 1547052** can be used to record any errors or queries found in or pertaining to this standard. This comment sheet will be referred to each time the standard is updated.

| Date       | Rev No. | Notes  |
|------------|---------|--|
| 16/02/2015 | 0       | First Issue  |
| 4/04/2022  | 1       | Reviewed Document, Changes to Standards applied, document reformatted into new template. |
|            |         |  |
|            |         |  |

**APPENDIX B QUALITY ASSURANCE (TO BE COMPLETED BY STORES)**

|                           |                                     |                           |  |  |                   |                |                                   |                                   |                    |                 |
|---------------------------|-------------------------------------|---------------------------|--|--|-------------------|----------------|-----------------------------------|-----------------------------------|--------------------|-----------------|
| <b>DOCUMENT NUMBER</b>    |                                     | HPC-8DJ-03-0001-2012      |  |  |                   |                | <b>QUALITY ASSURANCE</b>          |                                   | <b>DM NUMBER</b>   |                 |
| <b>DEVICE DESCRIPTION</b> |                                     | <b>LABEL MATERIAL NO.</b> |  |  |                   |                | <b>CABLE ACCESSORIES PURCHASE</b> |                                   | <b>ASSET OWNER</b> |                 |
|                           |                                     | <b>ASSET ID/ STOCK NO</b> |  |  |                   |                |                                   |                                   |                    |                 |
| <b>MANUFACTURER</b>       |                                     |                           |  | <b>DIMENSION</b>   |                   |                |                                   |                                   |                    |                 |
| <b>ITEM</b>               | <b>OPERATION/EQUIPMENT/FACILITY</b> |                           |  | <b>DOCUMENT REF.</b>   | <b>WHO CHECKS</b> | <b>INITIAL</b> | <b>DATE/TIME</b>                  | <b>QUALITY ASSURANCE CRITERIA</b> | <b>PASS Y/N</b>    | <b>COMMENTS</b> |
| 1                         | LABELLING                           |                           |  |  |                   |                |                                   |                                   |                    |                 |
| 1.1                       | Name of Manufacturer                |                           |  |  |                   |                |                                   | *****                             |                    |                 |
| 1.2                       | Week & Year of Manufacture          |                           |  |  |                   |                |                                   | MM/CCYY                           |                    |                 |
| 1.3                       | Name of Accessory and Range         |                           |  |  |                   |                |                                   | *****                             |                    |                 |
| 1.4                       | Reference / catalogue number        |                           |  |  |                   |                |                                   | *****                             |                    |                 |
| 1.5                       | Rated Voltage                       |                           |  |  |                   |                |                                   | 33 kV / 22 kV                     |                    |                 |
| 1.6                       | Weight                              |                           |  |  |                   |                |                                   | < 20 kg                           |                    |                 |
| 1.7                       | Batch Number                        |                           |  |  |                   |                |                                   | *****                             |                    |                 |
| 1.8                       | Shelf Life                          |                           |  |  |                   |                |                                   | years                             |                    |                 |
| 1.9                       | End of Life (EOF)                   |                           |  |  |                   |                |                                   | MM/CCYY                           |                    |                 |
| 1.10                      | Termite/Water Protection            |                           |  |  |                   |                |                                   | *****                             |                    |                 |



|                           |                             |                                  |  |             |  |  |  |  |
|---------------------------|-----------------------------|----------------------------------|--|-------------|--|--|--|--|
| 2                         | CONTENTS                    |                                  |  |             |  |  |  |  |
| 2.1                       | Installation Instructions   |                                  |  |             |  | Clear, Legible and in English  |  |  |
| 2.2                       | Bill of Materials           |                                  |  |             |  | Clear, Legible and in English  |  |  |
| 2.3                       | Material Safety Data Sheets |                                  |  |             |  | Clear, Legible and in English of all materials   |  |  |
| 2.4                       | Accessories                 |                                  |  |             |  | As per Bill of Materials   |  |  |
| 2.5                       | Test and Inspection Reports |                                  |  |             |  | As per Standards referenced in the specification.  |  |  |
| 3                         | PACKAGING                   |                                  |  |             |  |  |  |  |
| 3.1                       | Accessory in Cardboard box  |                                  |  |             |  | Strong enough to prevent mechanical damage   |  |  |
| 3.2                       | Items in Clear Plastic      |                                  |  |             |  | Easily identifiable through plastic  |  |  |
| 3.3                       | Compound Packaging          |                                  |  |             |  | Resistant to inadvertent puncture or handling  |  |  |
| 3.4                       | Items Individually Marked   |                                  |  |             |  | Each item clearly marked (identifiable) or placed in a clear plastic package with labelling there-on |  |  |
| SYMBOLS AND ABBREVIATIONS |                             |                                  |  |             |  |  |  |  |
| H = HOLD POINT            |                             | S = SUPERVISOR                   |  |             |  |  |  |  |
| W = WITNESS POINT         |                             | T = TECHNICIAN, EL = ELECTRICIAN |  | REVISION    |  |  |  |  |
| V = VERIFICATION POINT    |                             | E = ENGINEER                     |  | DATE        |  |  |  |  |
| S/C = SUBCONTRACTOR       |                             | PM = PROJECT MANAGER             |  | APPROVED BY |  |  |  |  |

## APPENDIX C CABLE INFORMATION

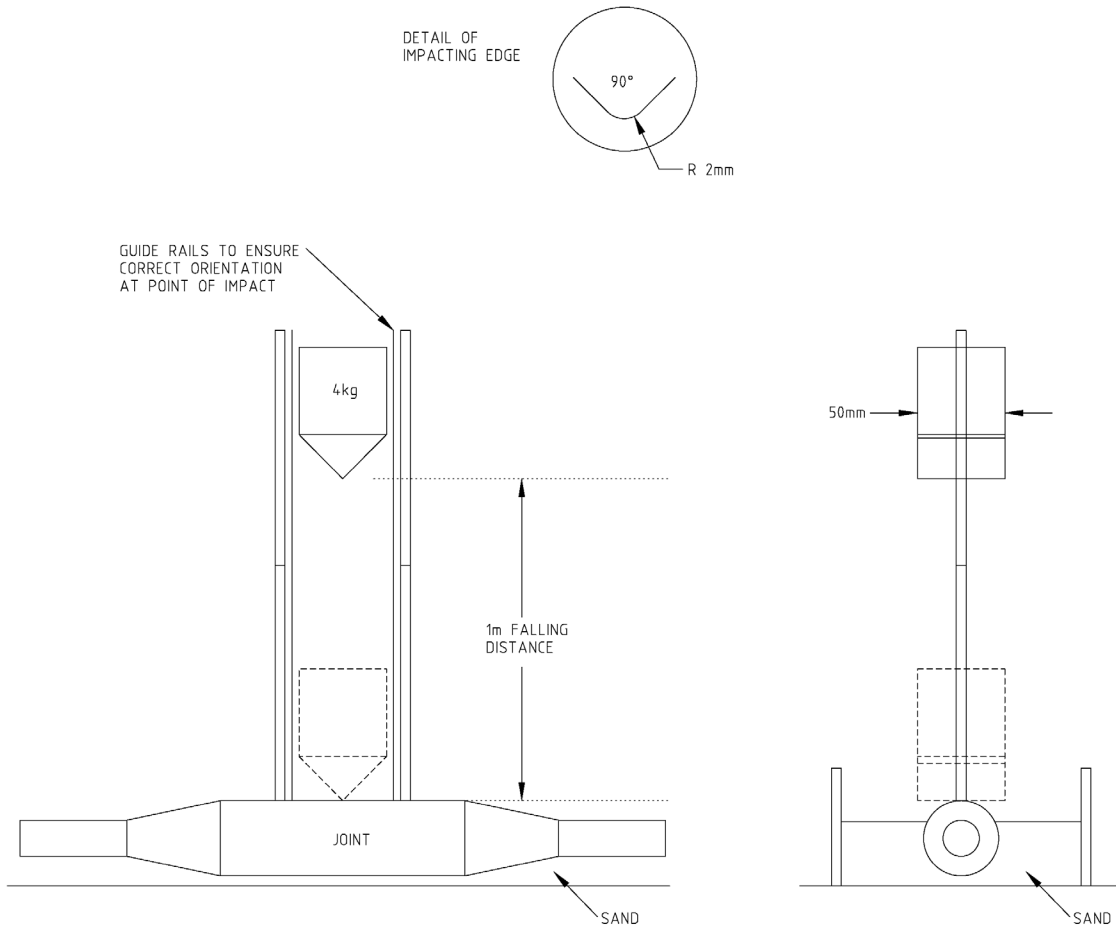
(Informative – taken from AS 4805.2 [8.] Appendix A)

| Identification of PILC-Insulated Cable – A1 |                             |  |                       |    |
|---|-----------------------------|--|-----------------------|----|
| Rated voltage $U_o/U$ ( $U_m$ )             |                             |  | kV                    |    |
| Batch Number                                |                             |  |                       |    |
| Construction                                | Single Core                 |  | Three Core            |    |
|   | Belted                      |  | Individually screened |    |
|   | SL -Type                    |  |                       |    |
| Conductor(s)                                | Aluminium                   |  | Copper                |    |
|   | Stranded                    |  | Solid                 |    |
|   | Round                       |  | Shaped                |    |
|   | 120 mm <sup>2</sup>         |  | 150 mm <sup>2</sup>   |    |
|   | 185 mm <sup>2</sup>         |  | 240 mm <sup>2</sup>   |    |
|   | 300 mm <sup>2</sup>         |  |                       |    |
| Impregnation                                | Draining                    |  | Non-draining          |    |
| Metallic sheath                             | Lead                        |  | Aluminium             |    |
|   | Plain                       |  | Corrugated            |    |
| Outer covering                              | Fibrous                     |  | Extruded              |    |
|   | PVC                         |  | PE                    |    |
| Diameters                                   | Conductor                   |  |                       | mm |
|   | Insulation including screen |  |                       | mm |
|   | Metal sheath                |  |                       | mm |
|   | Outer covering              |  |                       | mm |

(Informative – taken from AS 4805.1 [7.] Appendix A)

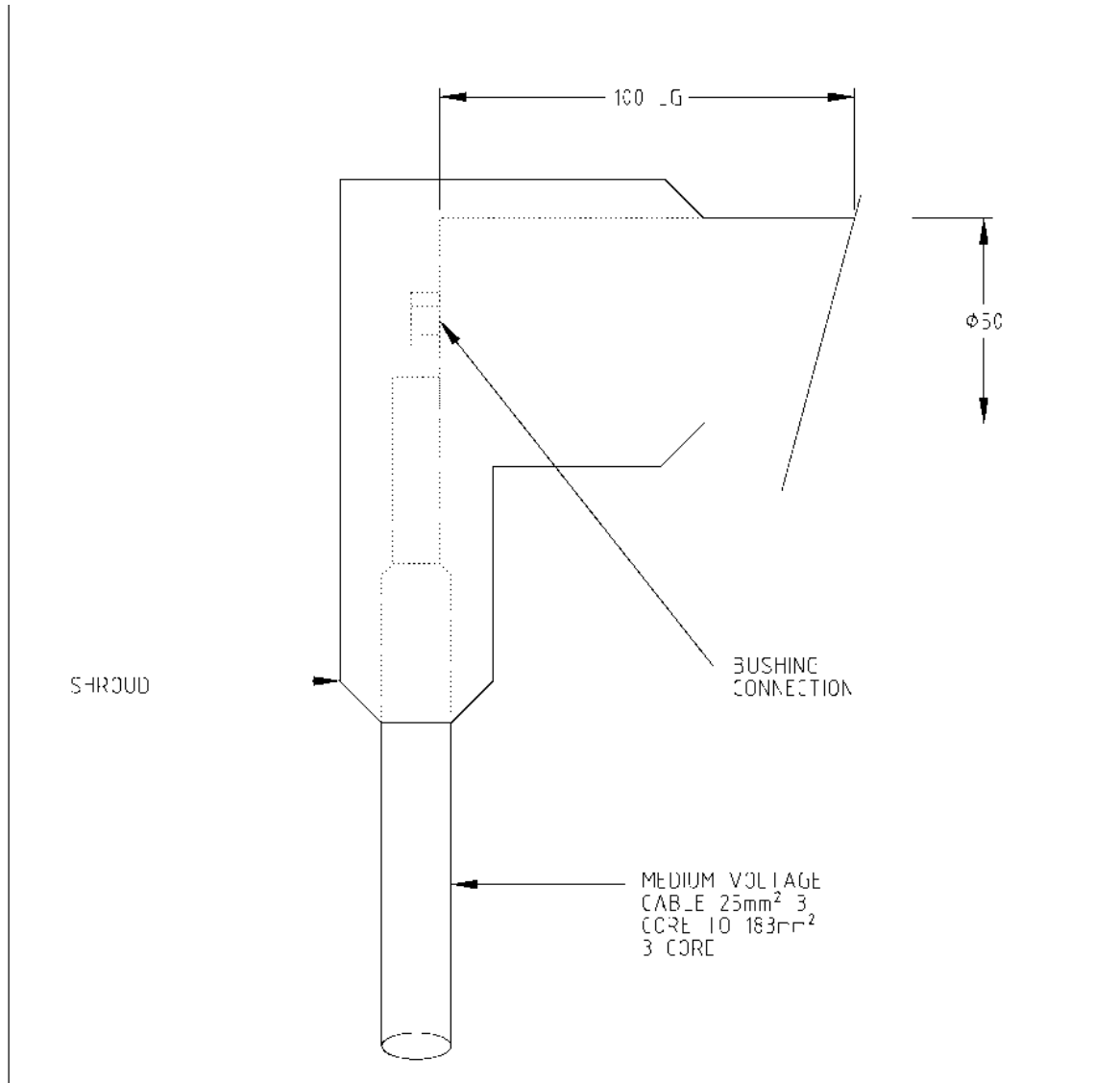
| Identification of TR-XLPE/XLPE-Insulated Cable – A2 |                             |  |                       |    |
|---|-----------------------------|--|-----------------------|----|
| Rated voltage $U_o/U$ ( $U_m$ )                     |                             |  |                       | kV |
| Batch Number  |                             |  |                       |    |
| Construction  | Single Core                 |  | Three Core            |    |
|   | Not individually screened   |  | Individually screened |    |
| Conductor(s)  | Aluminium                   |  | Copper                |    |
|   | Stranded                    |  | Solid                 |    |
|   | Round                       |  | Shaped                |    |
|   | 120 mm <sup>2</sup>         |  | 150 mm <sup>2</sup>   |    |
|   | 185 mm <sup>2</sup>         |  | 240 mm <sup>2</sup>   |    |
|   | 400 mm <sup>2</sup>         |  | 630 mm <sup>2</sup>   |    |
| Impregnation  | PVC                         |  | XLPE                  |    |
| Insulation screen                                   | EPR                         |  | HEPR                  |    |
| Metallic sheath                                     | Wires                       |  | Tapes                 |    |
|   | Extruded                    |  |                       |    |
| Outer covering                                      | PVC                         |  | HDPE                  |    |
| Water blocking                                      | In conductor                |  | Under over-sheath     |    |
| Diameters   | Conductor                   |  |                       | mm |
|   | Insulation including screen |  |                       | mm |
|   | Metal sheath                |  |                       | mm |
|   | Outer covering              |  |                       | mm |

## APPENDIX D IMPACT TEST ARRANGEMENT



**Figure D1: - Impact test arrangement**

## APPENDIX E SEPARABLE INSULATED CONNECTIONS




**Figure E1: - Medium voltage elbow connection to bushing terminal**

## APPENDIX F ENQUIRY DOCUMENT: SCHEDULES A & B

Completion of the listed schedules below by the vendor shall indicate the product offered is fully compliant with the nominated Clauses in this specification. All information provided shall be in English and measurement units shall be in metric units.

Any deviation from the specification shall be listed on the “Technical Deviation Schedule C”, provided in Appendix G with motivation to Horizon Power for consideration and written approval.

|   |                              |                      |
|---|------------------------------|----------------------|
|  | <b>SPECIFICATION ENQUIRY</b> | HPC-8DJ-03-0001-2012 |
|   | <b>VENDOR'S NAME</b>         |                      |
|   | <b>DATE</b>                  |                      |

### TECHNICAL SCHEDULES A & B

#### ITEM 1: Joint kits for single-core TR-XLPE/XLPE cable

|                |       |         |         |       |       |        |         |         |  |
|----------------|-------|---------|---------|-------|-------|--------|---------|---------|--|
| <b>VOLTAGE</b> | 33 kV | 33 kV   | 33 kV   | 33 kV | 22 kV | 22 kV  | 22 kV   | 22 kV   |  |
| <b>ITEM</b>    | 1.1   | 1.2     | 1.3     | 1.4   | 1.5   | 1.6    | 1.7     | 1.8     |  |
| <b>RANGE</b>   | 50    | 150-185 | 500-630 | 1000  | 35-95 | 95-240 | 185-400 | 500-800 |  |

#### SCHEDULE A: Horizon Power's specific requirements

#### SCHEDULE B: Particulars of equipment to be supplied (to be completed by Vendor)


| Item     | Clause   | Description   | Schedule A  | Schedule B                   |
|----------|--|---|---|------------------------------|
|          |  | Distribution Standard Buyers Guide drawing  |   | xxxx                         |
| <b>1</b> | 3.1.1.1  | <b>Cable parameters</b><br>Rated voltage (kV)<br>Type of cable: AS/NZS 1429.1<br>Type of armouring (SWA/None)<br>Type of conductor (Stranded Cu/Al)<br>Type of serving (PVC/PE)   | As above<br><br>SWA<br><br>PVC                      | <br><br>xxxx<br>xxxx<br>xxxx |
| <b>2</b> | 4.2.3<br>Table 5<br><br>9.2.5                                    | <b>Joint requirements</b><br>Accessory range (mm <sup>2</sup> )<br>Type (Straight, Transition)<br>Impact test required (Yes/No)   | According to listed items<br>Straight<br>Yes        | xxxx<br>xxxx<br>xxxx         |
| <b>3</b> | 4.2.1<br><br>5   | <b>Joint characteristics</b><br>Jointing method (Heatsrink only)<br>Components with limited shelf life? (Yes/No)<br>State type of components and expected shelf life<br>Tools required for preparation of cable and installation of joint<br>Approximate time required for preparation of cable and completion of joint (min.)                    | xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx                |                              |
| <b>4</b> | 9.1.1 1)<br>9.1.1 2)<br>9.1.1 3)<br>10.3<br>10.2<br>10.1<br>10.4 | <b>Type test certificate requirements</b><br>Tested cable identified according to Appendix C<br>Connector/s correctly identified?<br>Accessory correctly identified?<br>Type test certificate provided according to IEC 60502-4, Table 5?<br>Bill of materials included?<br>Installation instructions included?<br>Sample to be provided (yes/no) | xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>Yes |                              |

|   |  |   |     |      |
|---|--|---|-----|------|
| 5 |  | Manufacturer<br>Brand / Catalogue No. / Model<br>Country of Manufacture<br>Termite/Water Protection | Yes | xxxx |
|---|--|---|-----|------|





|      | 10.4   | Sample to be provided (yes/no)  | Yes        |            |
|------|--------|---|------------|------------|
| Item | Clause | Description   | Schedule A | Schedule B |
| 5    |        | Manufacturer<br>Brand / Catalogue No. / Model<br>Country of Manufacture<br>Termite/Water Protection | Yes        | xxxx       |

|   |                              |                      |
|---|------------------------------|----------------------|
|  | <b>SPECIFICATION ENQUIRY</b> | HPC-8DJ-03-0001-2012 |
|   | <b>VENDOR'S NAME</b>         |                      |
|   | <b>DATE</b>                  |                      |

**TECHNICAL SCHEDULES A & B**

**ITEM 3: Termination kits for single-core TR-XLPE/XLPE cable**


|         |       |         |       |       |       |        |         |         |  |
|---------|-------|---------|-------|-------|-------|--------|---------|---------|--|
| VOLTAGE | 33 kV | 33 kV   | 33 kV | 33 kV | 22 kV | 22 kV  | 22 kV   | 22 kV   |  |
| ITEM    | 3.1   | 3.2     | 3.3   | 3.4   | 3.5   | 3.6    | 3.7     | 3.8     |  |
| RANGE   | 50    | 150-185 | 630   | 1000  | 35-95 | 95-185 | 185-400 | 400-630 |  |

**NOTE: Termination as per section 3.8 6)**

**SCHEDULE A: Horizon Power's specific requirements**

**SCHEDULE B: Particulars of equipment to be supplied (to be completed by Vendor)**

| Item     | Clause   | Description   | Schedule A   | Schedule B                           |
|----------|--|---|--|--------------------------------------|
|          |  | Distribution Standard Buyers Guide drawing  |  | xxxx                                 |
| <b>1</b> | 3.1.1.1  | <b>Cable parameters</b><br>Rated voltage (kV)<br>Type of cable: AS/NZS 1429.1<br>Type of armouring (SWA/None)<br>Type of conductor (Stranded Cu/Al)<br>Type of serving (PVC/PE)   | As above<br><br>SWA<br>Cu<br>PVC                         | <br><br>xxxx<br>xxxx<br>xxxx<br>xxxx |
| <b>2</b> | 4.3.2<br>Table 6<br>4.3.2  | <b>Termination requirements</b><br>Accessory range (mm <sup>2</sup> )<br>Application (Indoor/Outdoor)   | According to<br>listed items<br>Both                     | xxxx<br><br>xxxx                     |
| <b>3</b> | 4.3.2 3)<br>4.3.4<br>4.6 8)<br>10.2.1<br>5                       | <b>Termination characteristics</b><br>Termination method (Heatshrink, Coldshrink, etc.)<br>Termination creepage distance (mm)<br>Termination tail length (mm)<br>Method of water blocking<br>Components with limited shelf life? (Yes/No)<br>State type of components and expected shelf life<br>Tools required for preparation of cable and installation of termination<br>Approximate time required for preparation of cable and completion of termination (min.) | <br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx |                                      |
| <b>4</b> | 9.1.1 1)<br>9.1.1 2)<br>9.1.1 3)<br>10.3<br>10.2<br>10.1<br>10.4 | <b>Type test certificate requirements</b><br>Tested cable identified according to Appendix B<br>Connector/s correctly identified?<br>Accessory correctly identified?<br>Type test certificate provided according to IEC 60502-4, Table 4?<br>Bill of materials included?<br>Installation instructions included?<br>Sample to be provided (yes/no)   | <br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>Yes  |                                      |
| <b>5</b> |  | Manufacturer<br>Brand / Catalogue No. / Model<br>Country of Manufacture   |  |                                      |

|   |                              |                      |
|---|------------------------------|----------------------|
|  | <b>SPECIFICATION ENQUIRY</b> | HPC-8DJ-03-0001-2012 |
|   | <b>VENDOR'S NAME</b>         |                      |
|   | <b>DATE</b>                  |                      |

**TECHNICAL SCHEDULES A & B**

**ITEM 4: Termination kits for three-core PILC (MIND) cable**


|         |       |         |       |  |  |  |  |  |  |
|---------|-------|---------|-------|--|--|--|--|--|--|
| VOLTAGE | 22 kV | 22 kV   | 11 kV |  |  |  |  |  |  |
| ITEM    | 4.1   | 4.2     | 4.3   |  |  |  |  |  |  |
| RANGE   | 70    | 185-240 | 50    |  |  |  |  |  |  |

**NOTE: Termination as per section 3.8 6)**

**SCHEDULE A: Horizon Power's specific requirements**

**SCHEDULE B: Particulars of equipment to be supplied (to be completed by Vendor)**

| Item     | Clause   | Description   | Schedule A   | Schedule B                           |
|----------|--|---|--|--------------------------------------|
|          |  | Distribution Standard Buyers Guide drawing  |  | xxxx                                 |
| <b>1</b> | 3.1.1.1  | <b>Cable parameters</b><br>Rated voltage (kV)<br>Type of cable: AS/NZS 1036<br>Type of armouring (SWA/GDSTA)<br>Type of conductor (Stranded Cu/Al)<br>Core screening (Individual/Collective)<br>Type of serving (PVC/PE/ Fibrous)   | As above<br>Non-draining<br>GDSTA<br>Cu<br>Individual<br>PVC | xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx |
| <b>2</b> | 4.3.2<br>Table 6<br>4.3.2  | <b>Termination requirements</b><br>Accessory range (mm <sup>2</sup> )<br>Application (Indoor/Outdoor)   | According to<br>listed items<br>Both                         | xxxx<br>xxxx                         |
| <b>3</b> | 4.3.2 3)<br>4.3.4<br>4.6 8)<br>10.2.1<br>5                       | <b>Termination characteristics</b><br>Termination method (Heatshrink, Coldshrink, etc.)<br>Termination creepage distance (mm)<br>Termination tail length (mm)<br>Method of water blocking<br>Components with limited shelf life? (Yes/No)<br>State type of components and expected shelf life<br>Tools required for preparation of cable and installation of termination<br>Approximate time required for preparation of cable and completion of termination (min.) | xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx         |                                      |
| <b>4</b> | 9.1.1 1)<br>9.1.1 2)<br>9.1.1 3)<br>10.3<br>10.2<br>10.1<br>10.4 | <b>Type test certificate requirements</b><br>Tested cable identified according to Appendix B<br>Connector/s correctly identified?<br>Accessory correctly identified?<br>Type test certificate provided according to IEC 60055-1, Table 2?<br>Bill of materials included?<br>Installation instructions included?<br>Sample to be provided (yes/no)   | xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>Yes          |                                      |
| <b>5</b> |  | Manufacturer<br>Brand / Catalogue No. / Model<br>Country of Manufacture   |  |                                      |

|   |                              |                      |
|---|------------------------------|----------------------|
|  | <b>SPECIFICATION ENQUIRY</b> | HPC-8DJ-03-0001-2012 |
|   | <b>VENDOR'S NAME</b>         |                      |
|   | <b>DATE</b>                  |                      |

**TECHNICAL SCHEDULES A & B**

**ITEM 5: Extensible screened separable connectors**

|         |       |       |       |         |       |       |         |       |  |
|---------|-------|-------|-------|---------|-------|-------|---------|-------|--|
| VOLTAGE | 33 kV | 33 kV | 33 kV | 33 kV   | 22 kV | 22 kV | 22 kV   | 22 kV |  |
| ITEM    | 5.1   | 5.2   | 5.3   | 5.4     | 5.5   | 5.6   | 5.7     | 5.8   |  |
| RANGE   | 50    | 50    | 50-95 | 185-300 | 35    | 35    | 185-400 | 630   |  |

**SCHEDULE A: Horizon Power's specific requirements**

**SCHEDULE B: Particulars of equipment to be supplied (to be completed by Vendor)**

| Item     | Clause   | Description   | Schedule A   | Schedule B   |
|----------|--|---|--|--------------|
|          |  | Distribution Standard Buyers Guide drawing  |  | xxxx         |
| <b>1</b> | 3.1.1.1  | <b>Cable parameters</b><br>Rated voltage (kV)<br>Type of cable: (PILC/XLPE)<br>Type of conductor (Stranded Cu/Al)   | As above<br>XLPE<br>Cu   | xxxx<br>xxxx |
| <b>2</b> | 3.3.2<br>Table 6<br>4.4.2<br>4.7 3)                              | <b>Connector requirements</b><br>Accessory range (mm <sup>2</sup> )<br>Cable size to be terminated (mm <sup>2</sup> )<br>Trifurcating kit to be provided?<br>Intermediate bushings to be provided<br>End plug and test point caps to be provided<br>Blank insert to be provided   | See standard<br>ranges<br>xxxx<br>Yes/No<br>Yes/No<br>Yes/No<br>Yes/No | xxxx         |
| <b>3</b> | 9.2.4<br>4.7 3)<br>5   | <b>Connector characteristics</b><br>Connector material<br>Method of installation<br>Earthing kit tested subjected to thermal short-circuit test (screen)?<br>Minimum recommended clearances:<br>a) Phase-to-phase (mm)<br>b) Phase-to-earth (mm)<br>Tools required for preparation of cable and installation of separable connector<br>Approximate time required for preparation of cable and installation of three connectors (min.) | xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx                   |              |
| <b>4</b> | 9.1.1 1)<br>9.1.1 2)<br>9.1.1 3)<br>10.3<br>10.2<br>10.1<br>10.4 | <b>Type test certificate requirements</b><br>Tested cable identified according to Appendix B<br>Connector/s correctly identified?<br>Accessory correctly identified?<br>Type test certificate provided according to IEC 60502-4, Table 7?<br>Bill of materials included?<br>Installation instructions included?<br>Sample to be provided (yes/no)   | xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>xxxx<br>Yes                    |              |
| <b>5</b> |  | Manufacturer<br>Brand / Catalogue No. / Model<br>Country of Manufacture   |  |              |



**APPENDIX H COMPLIANCE DOCUMENTATION SCHEDULE D**

The Vendor shall indicate below whether this offer is fully compliant with the nominated clause in this Specification. A **YES** shall ONLY be indicated if the offer is 100% compliant with the relevant Clause. If **NO** is indicated and supporting documents are submitted, then mark the **ATT** box with the attachment number.

|         | <b>CLAUSE NUMBER</b>                                   | <b>YES</b>               | <b>NO</b>                | <b>ATT.</b>              |
|---------|--|--------------------------|--------------------------|--------------------------|
| 3       | REQUIREMENTS   |                          |                          |                          |
| 3.1     | Power System Particulars                               |                          |                          |                          |
| 3.1.1   | <i>Design Fault Levels</i>                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.1.2   | <i>Maximum Conductor Temperatures</i>                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.1.3   | <i>Nominal System Frequency</i>                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.1.4   | <i>System Insulation Levels</i>                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.1.5   | <i>Standard Environmental and Operating Conditions</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.      | MV CABLE ACCESSORIES                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.1     | Applicable Cables for Accessories                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.1.1   | <i>MV Cables – TR-XLPE/XLPE Insulated</i>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.1.2   | <i>MV Cables – PILC</i>                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.2     | Jointing Kits  |                          |                          |                          |
| 4.2.1   | <i>General</i>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.2.2   | <i>Additional Requirements for Water Logged Ground</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.3.3   | <i>Joint Design</i>                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.3.3.1 | <i>Compound</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.3.3.2 | <i>Joint Connectors</i>                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.3     | Termination Kits                                       |                          |                          |                          |
| 4.3.1   | <i>General</i>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.3.2   | <i>Termination Design</i>                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.3.1.1 | <i>Compound</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.3.1.2 | <i>Termination Connectors</i>                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.3.3   | <i>Phase Identification</i>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.3.4   | <i>Termination Tail Length</i>                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.4     | Separable Insulated Connectors                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.4.1   | <i>Unscreened Separable Connectors</i>                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.4.2   | <i>Screened Separable Connectors</i>                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.4.3   | Line Voltage Detection (option)                        |                          |                          |                          |
| 4.5     | Sealing End Caps and Sleeving                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

|       | <b>CLAUSE NUMBER</b>                                    | <b>YES</b>               | <b>NO</b>                | <b>ATT.</b>              |
|-------|---|--------------------------|--------------------------|--------------------------|
| 4.6   | Accessory Earthing                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.7   | Special Requirements                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.8   | Conditions and Range of Approval                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.9   | Marking/Packing   |                          |                          |                          |
| 4.9.1 | <i>Marking</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.9.2 | <i>Packing</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.10  | Tagging of Equipment                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5.    | TOOLS AND SPARE EQUIPMENT                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6.    | STORAGE   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7.    | RELIABILITY   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.    | SAFETY  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.1   | Environmental Conditions                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.    | TESTS   |                          |                          |                          |
| 9.1   | Assembly of Accessories to be Tested                    |                          |                          |                          |
| 9.1.1 | <i>Identification</i>                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.1.2 | <i>Test Installation and Connections</i>                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.2   | Test Requirements                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.2.1 | <i>Type Tests</i>                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.2.2 | <i>Routine Tests</i>                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.2.3 | <i>Accessory Test Requirements</i>                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.2.4 | <i>Batch Tests</i>                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.2.5 | <i>Impact Test on Cable Joints for Armoured Cables</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.3   | Schedule of Tests                                       |                          |                          |                          |
| 9.3.1 | <i>Electrical Heat Cycle</i>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.3.2 | <i>Thermal Stability of Insulated System Under Load</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.3.3 | <i>Mechanical Tests</i>                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.4   | Acceptance of Alternative Type Tests                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.   | DOCUMENTATION AND SAMPLES                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.1  | Installation Instructions                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.2  | Bill of Materials                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

|      | <b>CLAUSE NUMBER</b>           | <b>YES</b>               | <b>NO</b>                | <b>ATT.</b>              |
|------|--------------------------------|--------------------------|--------------------------|--------------------------|
| 10.3 | Type Test Certificates/Reports | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.4 | Samples                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.  | TRAINING                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



**APPENDIX I ITEM DESCRIPTION: SCHEDULE E**

| ITEM | DESCRIPTION   | DISTRIBUTION STANDARD DRAWING |
|------|---|-------------------------------|
| 1    | <b>Joint kits for single-core TR-XLPE/XLPE cables</b>   |                               |
| 1.1  | Short Description:<br>JOINT KIT 1C 33 kV 50 SQ XLPE<br>Technical Description:<br>STRAIGHT JOINT; ELECT CABLE;<br>19.1/33 kV XLPE INSULATED CABLE;<br>1 CORE 50 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                    |                               |
| 1.2  | Short Description:<br>JOINT KIT 1C 33 KV 150-185 SQ XLPE<br>Technical Description:<br>STRAIGHT JOINT; ELECT CABLE;<br>19.1/33 kV XLPE INSULATED CABLE;<br>1 CORE 150 mm SQ to 185 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT |                               |
| 1.3  | Short Description:<br>JOINT KIT 1C 33 KV 500-630 SQ XLPE<br>Technical Description:<br>STRAIGHT JOINT; ELECT CABLE;<br>19.1/33 kV XLPE INSULATED CABLE;<br>1 CORE 500 mm SQ to 630 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT |                               |
| 1.4  | Short Description:<br>JOINT KIT 1C 33 KV 1000 SQ XLPE<br>Technical Description:<br>STRAIGHT JOINT; ELECT CABLE;<br>19.1/33 kV XLPE INSULATED CABLE;<br>1 CORE 1000 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                |                               |
| 1.5  | Short Description:<br>JOINT KIT 1C 22 kV 35-95 SQ XLPE<br>Technical Description:<br>STRAIGHT JOINT; ELECT CABLE;<br>12.7/22 kV XLPE INSULATED CABLE;<br>1 CORE 35 mm SQ to 95 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT     |                               |
| 1.6  | Short Description:<br>JOINT KIT 1C 22 kV 95-240 SQ XLPE<br>Technical Description:<br>STRAIGHT JOINT; ELECT CABLE;<br>12.7/22 kV XLPE INSULATED CABLE;<br>1 CORE 95 mm SQ to 240 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT   |                               |
|      |   |                               |

| ITEM     | DESCRIPTION   | DISTRIBUTION STANDARD DRAWING |
|----------|---|-------------------------------|
| 1.7      | Short Description:<br>JOINT KIT 1C 22 kV 185-400 SQ XLPE<br>Technical Description:<br>STRAIGHT JOINT; ELECT CABLE;<br>12.7/22 kV XLPE INSULATED CABLE;<br>1 CORE 185 mm SQ to 400 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT   |                               |
| 1.8      | Short Description:<br>JOINT KIT 1C 22 kV 500-800 SQ XLPE<br>Technical Description:<br>STRAIGHT JOINT; ELECT CABLE;<br>12.7/22 kV XLPE INSULATED CABLE;<br>1 CORE 500 mm SQ to 800 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT   |                               |
| <b>2</b> | <b>Transition joint kits for three-core PILC cables to single-core TR-XLPE/XLPE cables</b>  |                               |
| 2.1      | Short Description:<br>JOINT KIT 3C 22 kV 35-70 SQ PILC TO 3 x 1C 35 SQ XLPE<br>Technical Description:<br>STRAIGHT TRANSITION JOINT; ELECT CABLE;<br>12.7/22 kV PILC AND XLPE INSULATED CABLE;<br>3 CORE 35 mm SQ to 70 mm SQ PILC;<br>3 x 1 CORE 35 mm SQ XLPE<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                        |                               |
| 2.2      | Short Description:<br>JOINT KIT 3C 22 kV 185-240 SQ PILC TO 3 x 1C 185-240 SQ XLPE<br>Technical Description:<br>STRAIGHT TRANSITION JOINT; ELECT CABLE;<br>12.7/22 kV PILC AND XLPE INSULATED CABLE;<br>3 CORE 185 mm SQ to 240 mm SQ PILC;<br>3 x 1 CORE 185 mm SQ to 240 mm SQ XLPE<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT |                               |
| <b>3</b> | <b>Termination kits for single-core TR-XLPE/XLPE cables</b>   |                               |
| 3.1      | Short Description:<br>TERMINATION KIT 1C 33 kV 50 SQ XLPE<br>Technical Description:<br>OUTDOOR TERMINATION; ELECT CABLE;<br>19.1/33 kV XLPE INSULATED CABLE;<br>1 CORE 50 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT   |                               |
| 3.2      | Short Description:<br>TERMINATION KIT 1C 33 kV 150-185 SQ XLPE<br>Technical Description:<br>OUTDOOR TERMINATION; ELECT CABLE;<br>19.1/33 kV XLPE INSULATED CABLE;<br>1 CORE 150 mm SQ to 185 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT  |                               |

| ITEM | DESCRIPTION  | DISTRIBUTION STANDARD DRAWING |
|------|--|-------------------------------|
| 3.3  | Short Description:<br>TERMINATION KIT 1C 33 KV 630 SQ XLPE<br>Technical Description:<br>OUTDOOR TERMINATION; ELECT CABLE;<br>19.1/33 kV XLPE INSULATED CABLE;<br>1 CORE 630 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                  |                               |
| 3.4  | Short Description:<br>TERMINATION KIT 1C 33 KV 1000 SQ XLPE<br>Technical Description:<br>OUTDOOR TERMINATION; ELECT CABLE;<br>19.1/33 kV XLPE INSULATED CABLE;<br>1 CORE 1000 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                |                               |
| 3.5  | Short Description:<br>TERMINATION KIT 1C 22 kV 35-95 SQ XLPE<br>Technical Description:<br>OUTDOOR TERMINATION; ELECT CABLE;<br>12.7/22 kV XLPE INSULATED CABLE;<br>1 CORE 35 mm SQ to 95 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT     |                               |
| 3.6  | Short Description:<br>TERMINATION KIT 1C 22 kV 95-185 SQ XLPE<br>Technical Description:<br>OUTDOOR TERMINATION; ELECT CABLE;<br>12.7/22 kV XLPE INSULATED CABLE;<br>1 CORE 95 mm SQ to 185 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT   |                               |
| 3.7  | Short Description:<br>TERMINATION KIT 1C 22 kV 185-400 SQ XLPE<br>Technical Description:<br>OUTDOOR TERMINATION; ELECT CABLE;<br>12.7/22 kV XLPE INSULATED CABLE;<br>1 CORE 185 mm SQ to 400 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT |                               |
| 3.8  | Short Description:<br>TERMINATION KIT 1C 22 kV 400-630 SQ XLPE<br>Technical Description:<br>OUTDOOR TERMINATION; ELECT CABLE;<br>12.7/22 kV XLPE INSULATED CABLE;<br>1 CORE 400 mm SQ to 630 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT |                               |
|      |  |                               |

| ITEM     | DESCRIPTION   | DISTRIBUTION STANDARD DRAWING |
|----------|---|-------------------------------|
| <b>4</b> | <b>Termination kits for three-core PILC cables</b>  |                               |
| 4.1      | Short Description:<br>TERMINATION KIT 3C 22 kV 70 SQ PILC<br>Technical Description:<br>TERMINATION; ELECT CABLE;<br>12.7/22 kV PILC INSULATED CABLE;<br>3 CORE 70 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                     |                               |
| 4.2      | Short Description:<br>TERMINATION KIT 3C 22 kV 185-240 SQ PILC<br>Technical Description:<br>TERMINATION; ELECT CABLE;<br>12.7/22 kV PILC INSULATED CABLE;<br>3 CORE 185 mm SQ to 240 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT  |                               |
| 4.3      | Short Description:<br>TERMINATION KIT 3C 11 kV 50 SQ PILC<br>Technical Description:<br>TERMINATION; ELECT CABLE;<br>6.35/11 kV PILC INSULATED CABLE;<br>3 CORE 50 mm SQ<br>Kit consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                     |                               |
| <b>5</b> | <b>Separable Insulated Connectors</b>   |                               |
| 5.1      | Short Description:<br>CONNECTOR PLUG 33 kV 50 SQ XLPE<br>Technical Description:<br>CONNECTOR PLUG ELECT ELBOW;<br>19.1/33 kV XLPE INSULATED CABLE;<br>200 A; 3 x 1 CORE 50 mm SQ<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                |                               |
| 5.2      | Short Description:<br>CONNECTOR PLUG 33 kV 50 SQ XLPE<br>Technical Description:<br>CONNECTOR PLUG ELECT STRAIGHT;<br>19.1/33 kV XLPE INSULATED CABLE;<br>200 A; 3 x 1 CORE 50 mm SQ<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT             |                               |
| 5.3      | Short Description:<br>CONNECTOR PLUG 33 kV 50-95 SQ XLPE<br>Technical Description:<br>CONNECTOR PLUG ELECT ELBOW;<br>19.1/33 kV XLPE INSULATED CABLE;<br>630 A; 3 x 1 CORE 50 mm SQ to 95 mm SQ<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT |                               |
|          |   |                               |

| ITEM | DESCRIPTION   | DISTRIBUTION STANDARD DRAWING |
|------|---|-------------------------------|
| 5.4  | Short Description:<br>CONNECTOR PLUG 33 kV 185-300 SQ XLPE<br>Technical Description:<br>CONNECTOR PLUG ELECT ELBOW;<br>19.1/33 kV XLPE INSULATED CABLE;<br>630 A; 3 x 1 CORE 185 mm SQ to 300 mm SQ<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT |                               |
| 5.5  | Short Description:<br>CONNECTOR PLUG 22 kV 35 SQ XLPE<br>Technical Description:<br>CONNECTOR PLUG ELECT ELBOW;<br>12.7/22 kV XLPE INSULATED CABLE;<br>200 A; 3 x 1 CORE 35 mm SQ<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                    |                               |
| 5.6  | Short Description:<br>CONNECTOR PLUG 22 kV 35 SQ XLPE<br>Technical Description:<br>CONNECTOR PLUG ELECT STRAIGHT;<br>12.7/22 kV XLPE INSULATED CABLE;<br>200 A; 3 x 1 CORE 35 mm SQ<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                 |                               |
| 6.7  | Short Description:<br>CONNECTOR PLUG 22 kV 185-400 SQ XLPE<br>Technical Description:<br>CONNECTOR PLUG ELECT ELBOW;<br>12.7/22 kV XLPE INSULATED CABLE;<br>630 A; 3 x 1 CORE 185 mm SQ to 400 mm SQ<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT |                               |
| 5.8  | Short Description:<br>CONNECTOR PLUG 22 kV 630 SQ XLPE<br>Technical Description:<br>CONNECTOR PLUG ELECT ELBOW;<br>12.7/22 kV XLPE INSULATED CABLE;<br>630 A; 3 x 1 CORE 630 mm SQ<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS; INSULATING COMPONENTS; EARTHING KIT AND CLEANING KIT                  |                               |
| 5.9  | Short Description:<br>CONNECTOR TEE 22 kV<br>Technical Description:<br>22 kV CONNECTOR TEE ELECT ELBOW;<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS   |                               |
| 5.10 | Short Description:<br>CONNECTOR DEAD END 33 kV<br>Technical Description:<br>33 kV CONNECTOR CAP;<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS  |                               |
|      |   |                               |

| ITEM     | DESCRIPTION  | DISTRIBUTION STANDARD DRAWING |
|----------|--|-------------------------------|
| 5.11     | Short Description:<br>CONNECTOR DEAD END 22 kV<br>Technical Description:<br>22 kV CONNECTOR CAP;<br>Consists of:<br>INSTRUCTION SHEET; BILL OF MATERIALS |                               |
| <b>6</b> | <b>Sealing End Caps and Sleeving</b>   |                               |
| 6.1      | Short Description:<br>INSULATION SLEEVING 10-35 mm<br>Technical Description:<br>BOOT SHRINK;<br>WATER RESISTANT; RE-USABLE                               |                               |
| 6.2      | Short Description:<br>INSULATION SLEEVING 35-50 mm<br>Technical Description:<br>BOOT SHRINK;<br>WATER RESISTANT; RE-USABLE                               |                               |
| 6.3      | Short Description:<br>INSULATION SLEEVING 120-185 mm<br>Technical Description:<br>BOOT SHRINK<br>WATER RESISTANT; RE-USABLE                              |                               |
| 6.4      | Short Description:<br>INSULATION SLEEVING 185-240 mm<br>Technical Description:<br>BOOT SHRINK;<br>WATER RESISTANT; RE-USABLE                             |                               |
| 6.5      | Short Description:<br>INSULATION SLEEVING 25-38 mm<br>Technical Description:<br>SLEEVE SHRINK;<br>WATER RESISTANT; RE-USABLE                             |                               |