



Ergon Energy Corporation Limited

**Specification for Cable
Accessories, Termination and
Jointing Materials for Underground
Electrical Power Cables for Nominal
System Voltage Up to 33kV**

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Contents

1. Purpose and Scope	1
2. References	1
2.1 Ergon Energy Controlled Documents.....	1
2.2 Other Sources.....	1
3. Definitions, Acronyms and Abbreviations	3
3.1 Definitions	3
3.2 Acronyms and Abbreviations	3
4. Security	4
5. Drawings	4
6. Environmental and Service conditions	4
6.1 Environmental Conditions	4
6.2 Service Conditions	5
6.3 Operating Conditions	6
7. Design and Construction	7
7.1 Cable Types in the Ergon Energy System	7
7.2 33kV Joints, Terminations and Separable Insulated Connectors.....	9
7.3 22kV Joints, Terminations and Separable Insulated Connectors.....	12
7.4 11kV Joints, Terminations and Separable Insulated Connectors.....	16
7.5 LV Joints and Terminations.....	21
8. Ancillary Equipment	22
9. Performance & Testing	22
9.1 Joint and Termination Performance Requirements.....	22
9.2 Type Test Compliance	23
9.3 Batch and Routine Tests.....	23
9.4 Acceptance Tests	24
9.5 Witnessing of Test	24
10. Service Performance	24
11. Risk Assessment	24
11.1 Legislation.....	24
11.2 Documentation.....	24
12. Quality Assurance	25
13. Samples	25
14. Packaging and Labelling	25
14.1 Packing	25

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



14.2	Marking	26
15.	Reliability	26
16.	Training	26
17.	Environmental Considerations	27
18.	Special Tools, Guages & Accessories	27
19.	Information to be Provided	27
19.1	General	27
19.2	Drawings & Information to be supplied by the Successful Tenderer	28
20.	Quality of instructions Provided	29
20.1	Instruction Title Page	29
20.2	Instruction Revisions	29
20.3	Instructions in Electronic Format	29
Schedule A	Technical Details – 33kV Terminations (Indoor & Outdoor)	30
Schedule B	Technical Details – 33kV Joints	32
Schedule C	Technical Details – 22kV Terminations (Indoor & Outdoor)	34
Schedule D	Technical Details – 22kV Joints	37
Schedule E	Technical Details – 11kV Terminations (Indoor & Outdoor)	39
Schedule F	Technical Details – 11kV Joints	42
Schedule G	Technical Details – LV Terminations	44
Schedule H	Technical Details – LV Joints	46
Annex A.	Cable Terminations	48
Annex B.	Cable Joints	57
Annex C.	Cable Cross Section Drawings	61
C.1	33kV Cables	61
C.2	22kV Cables	61
C.3	11kV Cables	61
C.4	LV Cables	61
Annex D.	Cable Termination Constructions	62
D.1	33kV Cable Termination	62
D.2	22kV Cable Termination	62
D.3	11kV Cable Termination	62

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



1. Purpose and Scope

This specification sets out the requirements for the manufacture, testing, supply and delivery of cable accessories, terminating and jointing materials, for the use in the underground electricity distribution system of Ergon Energy.

This specification includes heat shrink, cold shrink and cold applied joints and terminations for LV, 11kV, 22kV and 33kV cable. Included are dead-break separable connectors (elbows) and ancillary equipment for 11kV, 22kV and 33kV single phase or triplex cables that Ergon Energy may purchase to connect to specific 11kV, 22kV and 33kV switchgear and transformers.

Suppliers are encouraged to submit alternative tenders based on their standard products provided that the accessories offered will provide electrical and mechanical in-service performance equivalent to the accessories conforming to this specification. Type Test Certificates or Qualification Test Reports shall be submitted to verify performance. Departures from this specification shall be fully documented in the tender.

2. References

2.1 Ergon Energy Controlled Documents

2.2 Other Sources

The items shall be designed, manufactured and tested in accordance with the latest revision of all relevant Queensland Acts / Regulations and Australian Standards, and all amendments issues from time to time except where varied by this specification.

Should inconsistencies be identified between standards and / or this specification, the Tenderer shall immediately refer such inconsistencies to the Purchaser for resolution.

STANDARD	DESCRIPTION
AS / NZS 1026	Electric cables – Impregnated paper insulated – For working voltage up to and including 19/33 (36)kV
AS / NZS 1125	Conductors in insulated electric cables and flexible cords
AS / NZS 1429.1	Electric cables – Polymeric insulated – For working voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36)kV
AS / NZS 1660 All parts	Test methods for electric cables, cords and conductors

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



STANDARD	DESCRIPTION
AS / NZS 3808	Insulating and sheathing materials for electric cables
AS / NZS 4026	Electric Cables – For underground residential distribution systems
AS / NZS 4325.1	Compression and mechanical connectors for power cables with copper or aluminium conductors – Test methods and requirements
AS / NZS 4805	Accessories for electric cables – Test requirements
AS / NZS 5000.1	Electric cables – Polymeric insulated – For working voltages up to and including 0.6/1 (1.2)kV
AS / NZS ISO 31000	Risk management – Principles and guidelines
AS / NZS ISO 9001	Quality management systems - Requirements
AS 1931	High-voltage test techniques
AS 2629	Separable insulated connectors for power distribution system above 1kV
AS 4068	Flat pallets for materials handling
AS 4169	Electroplated coatings – Tin and tin alloys (ISO 2093:1986, MOD)
AS 60270	High-voltage test techniques – Partial discharge measurements
AS 62271.301	High voltage switchgear and controlgear – Dimensional standardization of terminals
AS ISO 1000	The international system of units (SI) and its application
ASTM D1603	Standard Test Method for Carbon Black Content in Olefin Plastic
Electricity Association Services Ltd. Engineering Recommendation C.55/4	Insulated Sheath Power Cable Systems
IEC 60229	Electric cables - Tests on extruded oversheaths with a special protective function

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



STANDARD	DESCRIPTION
IEC 60502-4	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV)
IEC 60684	Flexible insulating sleeving
IEC 61442	Test methods for accessories for power cables with rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV)
IEC60721	Classification of environmental conditions
IEEE 404	Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV

3. Definitions, Acronyms and Abbreviations

3.1 Definitions

For the purpose of this standard, the following definitions apply:

Term	Definition
Materials	Items, goods or product
Specification	This technical specification
Shall	
Supplier	

3.2 Acronyms and Abbreviations

The following abbreviations and acronyms appear in this standard:

Abbreviation or Acronym	Definition
Al	Aluminium conductor
CONSAC	Sector shaped aluminium conducted 0.6/1kV cable with concentric aluminium sheath
Cu	Copper conductor
CWS	Copper Wire Screen
HDPE	High density polyethylene

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Abbreviation or Acronym	Definition
LY	Lead ally sheath
MDPE	Medium density polyethylene
NJ	Nylon jacket
PLY	Paper insulated lead alloy sheathed
PVC	Polyvinyl chloride
SWA	Galvanised steel wire armoured
SWS	Steel wire armoured and oversheathed
TR-XPLE	Tree retardant cross-linked polyethylene
WB	Water blocked
WBT	Water blocking tape (and / or yarns)
XPLE	Cross-linked polyethylene

4. Security

Nil

5. Drawings

The drawings listed in Appendix A shall be read in conjunction with, and shall form part of this Specification.

6. Environmental and Service conditions

6.1 Environmental Conditions

6.1.1 General Environmental Conditions

The Conditions under which the terminating and jointing materials will be required to operate are:

Ambient Temperatures	50° Summer day time (maximum) -5° Winter night time (minimum)
Maximum Daily Variation	35°C
Solar Radiation Level	1100 watts per square metre with high ultraviolet content (IEC 60721.2.4, Table 1)
Precipitation	An annual rainfall in excess of 2000mm (bureau of Meteorology)

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Wind Speed	Tropical summer storms with gust wind speeds above 160km/h
Humidity	Extended periods of relative humidity in excess of 90% R.H combined with rapid temperature drop (20°C in 20 minutes).
Atmospheric Classification	Level IV – very heavy (for installation in polluted ambient air with areas of costal salt spray and / or industrial pollution refer AS 4436). Equivalent salt deposit densities in the range of 2.0 - 3.0g/m ² (AS 4436, Table 3)
Isokeraunic Level	35 – 40 (Bureau of Meteorology)
Below Ground Soil	Installed directly buried in fine grain bedding material, at normal depth of up to 1000mm.
Below Ground Temperatures	35°C Summer day time (maximum) 18°C Winter night time (minimum)

Note to Tenderers:

Tenderers are to provide information on how the offered items will perform in the above conditions.

6.2 Service Conditions

The underground power cables used within the Ergon Energy distribution system are 19.1/33kV, 12.7/22kV, 6.3/11kV and 240/415V, three phase, 50 hertz.

6.2.1 33kV System

Ergon Energy's 33kV network has the star point either effectively earthed or through a neutral earthing reactor.

The maximum system voltage (phase to phase) is 36kV and the require impulse insulation level is 170kV_p.

6.2.2 22kV System

The star point of Ergon Energy's 22kV network is effectively earthed.

The maximum system voltage (phase-to phase) is 24kV and the required impulse insulation level is 125kV_p.

6.2.3 11kV System

The star point of Ergon Energy's 11kV network is effectively earthed.

The maximum system voltage (phase-to phase) is 12kV and the required impulse insulation level is 95kV_p.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



6.2.4 LV System

The natural of the 240/415 volt system is effectively earthed.

6.3 Operating Conditions

Assembled components forming part of a system shall perform without distress under the following conditions:-

6.3.1 Normal Conditions

Extruded dielectric (Polymeric Insulated) cables – Continuous operation at a conductor temperature of 90°C.

Laminated dielectric (Paper Insulated) cables – Continuous operation at a conductor temperature of 70°C.

6.3.2 Emergency Conditions

Extruded dielectric (Polymeric Insulated) cables – Operated for 2hrs at a conductor temperature of 105°C.

Laminated dielectric (Paper Insulated) cables – Operated for 2hrs at a conductor temperature of 85°C.

6.3.3 Fault Conditions

The table below has the earth fault duty of the HV cables used by Ergon Energy.

Table 6.1: Earth fault duty of HV cables

Cable	Earth Fault Duty
35mm ²	3.4kA for 1 Second
185mm ² & 240mm ²	10kA for 1 Second
400mm ²	13.1kA for 1 Second
630mm ²	13.9kA for 1 Second
50mm ²	4.9kA for 1 Second
300mm ²	13.8kA for 1 Second

Extruded dielectric (Polymeric Insulated) cables – Operated for 5sec max. at a conductor temperature of 250°C.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



7. Design and Construction

7.1 Cable Types in the Ergon Energy System

The cables listed in Table 7.1 to Table 7.4 show the current standard cables being installed in the Ergon Energy's network and existing cables in the network that require jointing and terminating in conjunction with network alterations, extensions and maintenance work.

The cross-sectional dimensions of the cables are shown in Annex C or are otherwise shown in the respective standards.

Insulation screens on 11kV, 22kV and 33kV cables are hand-strippable.

All HV cables are screened unless otherwise stated.

Bold type in the following tables designates current standard cables.

Table 7.1: 19 / 33 (36) kV Cables

19.1 / 33kV Cable Types and Applicable Standards				
Conductor Size (mm²) & Type	Insulation / Oversheath	No. of Cores	Remarks	Applicable Standard
50 stranded Al	TR-XLPE / HDPE	1	Nylon jacket for insect protection	AS / NZS 1429.1
300 stranded Al	TR-XLPE / HDPE	1	Nylon jacket for insect protection	AS / NZS 1429.1

Table 7.2: 12.7 / 22 (24) kV Cables

12.7 / 22kV Cable Types and Applicable Standards				
Conductor Size (mm²) & Type	Insulation / Oversheath	No. of Cores	Remarks	Applicable Standard
630 Al	TR-XLPE / HDPE	3 x 1C Triplex	LAT water blocking layer	AS / NZS 1429.1

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



185 Al	TR-XLPE / HDPE	3 x 1C Triplex	LAT water blocking layer	AS / NZS 1429.1
35 Al	TR-XLPE / HDPE	3 x 1C Triplex	Nylon jacket for insect protection	AS / NZS 1429.1

Table 7.3: 6.35 / 11 (12) kV Cables

6.35 / 11kV Cable Types and Applicable Standards				
Conductor Size (mm ²) & Type	Insulation / Oversheath	No. of Cores	Remarks	Applicable Standard
400 stranded Cu	TR - XPLE / HDPE	1	Nylon Jacket for insect protection	AS / NZS 1429.1
400 stranded Al	TR - XPLE / HDPE	3 x 1C Triplex	Nylon Jacket for insect protection	AS / NZS 1429.1
400 stranded AL	TR - XPLE / HDPE	3 x 1C Triplex		AS / NZS 1429.1
240 stranded Cu	TR-XLPE / HDPE	3 x 1C Triplex	Nylon Jacket for insect protection	AS1429.1
240 stranded Cu	TR-XLPE / HDPE	3		AS1429.1
185 Stranded AL	TR - XPLE / HDPE	3 x 1C Triplex	Nylon Jacket for insect protection	AS / NZS 1429.1
185 stranded Al	TR - XPLE / HDPE	3 x 1C Triplex		AS / NZS 1429.1
35 stranded AL	TR - XPLE / HDPE	3 x 1C Triple	Nylon Jacket for insect protection	AS / NZS 1429.1
35 stranded Al	TR - XPLE / HDPE	3 x 1C Triplex		AS / NZS 1429.1

Table 7.4: 0.6 / 1kV (LV) Cables

0.6/ 1kV (LV) Cable Types and Applicable Standards
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Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Conductor Size (mm ²) & Type	Insulation / Overseath	No. of Cores	Remarks	Applicable Standard
240 stranded Al	XLPE / PVC	4	90 deg. Sector Nylon Jacket	AS / NZS 4026
240 stranded Al	XLPE / PVC	4	90 deg. Sector	AS / NZS 4026
50 stranded Cu	XPLE / PVC	4	Circular Conductors Nylon Jacket	AS / NZS 4026
16 Stranded Cu	XLPE / PVC	4	Circular Conductors Nylon Jacket	AS / NZS 4026
16 Stranded Cu	XLPE / PVC	4	Circular Conductors	AS / NZS 4026
16 Stranded Cu	PVC / PVC	1	Neutral Screen Nylon Jacket	AS / NZS 5000.1
4 Stranded Cu	PVC / PVC	1	Neutral Screen Nylon Jacket	AS / NZS 5000.1

7.2 33kV Joints, Terminations and Separable Insulated Connectors

7.2.1 General

All joints and terminations, except for separable insulated connectors shall be of the heat-shrink, cold-shrink, or cold-applied polymeric type design, manufactured and tested to meet the requirements of the relevant Standards, including AS/NZS 4805 Parts 1 and 2 or equivalent, and shall be suitable for application to Ergon Energy's 33 kV cables as described in Table 7.1 of this specification.

All separable insulated connectors and accessories forming part of the connector system shall be of the dead-break shielded / screened type with a screen break, manufactured and tested to meet the relevant Standards, including AS 2629. The separable insulated connectors shall be suitable for connecting particular single core polymeric cables as described in Table 7.1 to provide 33kV test points adjacent to substation switchgear.

All joint and termination kits shall be supplied complete in unit lots suitably packaged for storage containing all necessary materials. Full detailed installation instructions specific to the cables listed in Table 7.1 shall be supplied with the Tender and with the jointing kits that are subsequently supplied. Ergon Energy will approve all instructions for kits that are purchased for use in Ergon Energy. Ergon Energy will keep a copy of the instructions for their records and the supplier is to supply a copy of the instructions with each kit.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Preference will be shown to the Tender offering bi-metal range taking kits suitable for either aluminium or copper conductors and utilising screwed connectors with shear head bolts or torque tightened bolts, in lieu of kits containing compression connectors.

All joints and termination kits shall be supplied with the required cleansing solvents, cloth and abrasives. Tenderers shall provide with their tender Safety Data Sheets (SDS) for nominated solvents. No unapproved solvents shall be provided without prior agreement of the Purchaser.

If required, sealants shall be supplied to effect seals on joints and terminations and shall be able to accommodate the creep or relaxation that may occur during installation of the accessories or during the normal cyclic loading of the cables. The sealant shall have adhesion properties to maintain hermetic seals at all times between components and the various cable sheath materials and connectors.

Suitable lubricant shall be provided with the kits for separable connectors (elbows, tee connectors and plugs) to facilitate separation of the connector from the bushing or plug socket.

7.2.2 33 kV Straight Joints

All joints shall meet the performance requirements of Clause 9.1 of this specification.

Where cable joint descriptions in Table 7.1 include insect protection the purchaser requires the completed joint to afford protection for attack by the subterranean termite *Mastotermes Darwinists* and the coastal brown ant *Pheidole Megacephala*.

The preference is for a fine woven stainless steel mesh cylindrical sleeve that is applied over the joint and clamped to the cable insect protection layer each side of the joint by a constant force spring arrangement. An outer tube is then provided to finish the joint.

Due to insect damage to the joint components outside the insect protection layer it is necessary to provide the joint with a water / environmental seal to the cable as follows:

- For cables provided with Double Brass Tape (DBT) – the PVC inner sheath below the DBT
- For cables provided with Nylon Jacket (NJ) – the NJ.

Alternative forms for insect protection may be considered by the Purchaser. Alternative offers shall be submitted with full details of the recommendations and supporting evidence of performance including service history.

Where cable description in Table 7.1 includes an extruded water barrier comprised of an Aluminium / PE Laminate Tape the purchaser requires the water / environmental seal to the cable

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



to be to the LAT. It is the purchaser's preference that the LAT is either bridged through at the joint or clamped to the screen of the cable.

Methods for achieving the environmental seal and managing induced voltages on the LAT shall be submitted with full details and supporting evidence of performance including service history.

Mechanical connectors utilising a shear bolt connection are preferred and the connectors shall be supplied with all bolts, pre-greased with conductive grease inserted in the connector, which in turn shall be protected from corrosion.

Where compression connectors are offered the connectors shall be capable of being installed using a standard 23 Tonne Hydraulic Crimper for up to 630 mm². Connectors shall meet the requirements of AS/NZS 4325.1.

All connectors shall be blocked internally to prevent water / oil migration between cables.

Tenderers shall complete Schedule B to state overall length of the completed joint and the required cable pit length to make the joint.

7.2.3 33kV Terminations – Outdoor Type

All terminations shall meet the performance requirements specified in Clause 9.1 of this specification.

The terminations shall be suitable for terminating cables on to a low mount substation structure, or on to a pole using a bracket mounted with 36kV surge arresters for support of three single phase cable tails.

The polymeric stress control sleeve and sheds shall withstand the electrical stress associated with continuous operation at 36kV under the environmental conditions described in Clauses 6.1 and 6.2 above.

Where cable description in Table 7.1 includes an extruded water barrier comprised of an Aluminium / PE Laminate Tape the purchaser requires the water / environmental seal to the cable to be to the LAT. It is the purchaser's preference that the LAT is clamped to the screen of the cable.

Methods for achieving the environmental seal and managing induced voltages on the LAT shall be submitted with full details and supporting evidence of performance including service history.

The kits shall be supplied with phase identification components which can be applied to the phase cores and which are compatible with the terminating materials.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Fully sealed terminal connectors are to be supplied with the kits and shall be of the following type: -

- Lug palms shall be supplied with fully sealed palms and shall have one hole, suitable for a M12 bolt.
- All lugs should preferably be screwed connectors with shear head bolts in lieu of compression lugs.
- TR-XPLE / XLPE Insulated cables shall have bi-metallic or tinned aluminium lugs for the phase conductors and tinned copper or brass lugs for the screen wires.
- Lugs shall meet the test requirements of AS/NZS 4325.1.

Where offered, compression terminal connectors shall be capable of being installed using Ergon Energy's current hydraulic tooling, namely 23 Tonne Hydraulic Crimpers.

7.3 22kV Joints, Terminations and Separable Insulated Connectors

7.3.1 General

All joints and terminations shall be manufactured and tested to meet the requirements of the relevant Standards, including AS/NZS 4805 Parts 1 and 2 or equivalent, and shall be suitable for application to Ergon Energy's 22kV cables as described in Table 7.2 of this specification.

All joints and terminations shall be designed so that a phase cross can be made in the joint or termination without stressing the cable insulation or insulation components.

All joint and termination kits shall be supplied complete in unit lots suitably packaged for storage containing all necessary materials. Full detailed installation instructions specific to the cables listed in Table 7.2 shall be supplied with the Tender and with the jointing kits that are subsequently supplied. Ergon Energy will approve all instructions for kits that are purchased for use in Ergon Energy. Ergon Energy will keep a copy of the instructions for their records and the supplier is to supply a copy of the instructions with each kit.

Preference will be shown to the Tender with bi-metal range taking kits for either aluminium or copper conductors.

All joint kits and termination kits shall be supplied complete with suitable connectors, including screen connectors and lugs, preferably utilising screwed connectors with shear head bolts or torque tightened bolts, in lieu of kits containing compression connectors. All bolts shall be pre-greased with a conductive grease and inserted in the connector, which in turn shall be protected from corrosion

All joints and termination kits shall be supplied with the required cleansing solvents, cloth and abrasives. Tenderers shall provide with their tender Safety Data Sheets (SDS) for nominated solvents. No unapproved solvents shall be provided without prior agreement of the Purchaser.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



If required, sealants shall be supplied to effect seals on joints and terminations and shall be able to accommodate the creep or relaxation that may occur during installation of the accessories or during the normal cyclic loading of the cables. The sealant shall have adhesion properties to maintain hermetic seals at all times between components and the various cable sheath materials and connectors.

Suitable lubricant shall be provided with the kits for separable connectors (elbows, tee connectors and plugs) to facilitate separation of the connector from the bushing or plug socket.

7.3.2 22 kV Straight & Transition Joints

All joints shall have an outer serving which has mechanical strength properties equal to that of the HDPE over-sheath of the cable.

Where cable joint descriptions in Table 7.2 include insect protection the purchaser requires the completed joint to afford protection for attack by the subterranean termite *Mastotermes Darwinists* and the coastal brown ant *Pheidole Megacephala*.

The preference is for a fine woven stainless steel mesh cylindrical sleeve that is applied over the joint and clamped to the cable insect protection layer each side of the joint by a constant force spring arrangement. An outer tube is then provided to finish the joint.

Due to insect damage to the joint components outside the insect protection layer it is necessary to provide the joint with a water / environmental seal to the cable as follows:

- For cables provided with Double Brass Tape (DBT) – the PVC inner sheath below the DBT
- For cables provided with Nylon Jacket (NJ) – the NJ.

Alternative forms for insect protection may be considered by the Purchaser. Alternative offers shall be submitted with full details of the recommendations and supporting evidence of performance including service history.

Where cable description in Table 7.2 includes an extruded water barrier comprised of an Aluminium / PE Laminate Tape the purchaser requires the water / environmental seal to the cable to be to the LAT. It is the purchaser's preference that the LAT is either bridged through at the joint or clamped to the screen of the cable.

Methods for achieving the environmental seal and managing induced voltages on the LAT shall be submitted with full details and supporting evidence of performance including service history.

Annex B show the required cable to cable joint requirement to be supplied in accordance with this specification.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Tenderers shall complete Schedule D to state overall length of the completed joint and the required cable pit length to make the joint.

7.3.3 22kV Terminations – Outdoor Type

All terminations shall meet the performance requirements specified in Clause 9.1 of this specification.

The polymeric stress control sleeve and sheds shall withstand the electrical stress associated with continuous operation at 24kV under the environmental conditions described in Clause 6.1 above.

The termination shall be suitable for terminating cables on to a low mount substation structure and on to a pole using a bracket as per Drawing No. 5076 mounted with 24kV surge arresters for support of the cable tails. The tail lengths of the terminating kits for three phase cables shall be a **minimum of 800mm** long to allow a phase cross to be installed on the cable. A typical general arrangement is shown on Drawing No. 5076 that is contained in Ergon Energy's Underground Construction Manual, HV Construction folder. A copy is attached with the other drawings included in this specification.

Shorter lengths may be considered provided an assessment by Ergon Energy's field personnel indicate that the kits can be installed without undue difficulty and without stressing the conductor insulation.

The kits shall be supplied with phase identification components which can be applied to the phase cores and which are compatible with the terminating materials.

Terminal connectors, preferably with shear head bolts, are to be supplied with the kits and shall be of the following type: -

- TR-XPLE / XLPE insulated cables shall have bi-metal lugs or tinned aluminium shear bolt connectors for the phase conductors and tinned copper or brass lugs for the screen wires.
- Lug palms shall be supplied with fully sealed palms.
- Lugs shall meet the test requirements of AS/NZS 4325.1
- Lugs shall have a clearance hole suitable for a 12mm bolt for cable up to 300mm² and a clearance hole suitable for a 16mm bolt for larger cables.

7.3.4 22kV Terminations – Indoor Type

All terminations shall meet the requirements of AS/NZS 4325.1 and the performance requirements specified in Clause 9.1 of this specification.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



The terminating kits shall be suitable for terminating in cable boxes of the switchgear listed in Table 7.5 below.

Table 7.5: 24kV Switchgear

Switchgear Manufacturer	Type	Cable Sizes
Ormazabal	F & G	1000 mm ² to 25 mm ²
Merlin Gerin	RM6	300 mm ² to 25 mm ²
Schneider	RM6	300 mm ² to 25 mm ²

7.3.4.1 22kV Terminations to Open Bushings

The tail lengths of the terminating kits for three phase cables shall be of sufficient length to allow a phase cross to be installed on the cable.

All 22kV single core cable kits shall have a **maximum** length of 330mm.

Where the phase to phase and phase to earth clearance of the switchgear cable boxes are not sufficient for air clearance, tenderers shall supply a system of insulating the terminal and lug connection which suits both the cables listed in Table 7.2 and the switchgear listed in Table 7.5. The insulating system for the terminals shall be capable of withstanding an impulse level of 150kV BIL with the largest cable size from Table 7.2 terminated in the cable box. The insulating system offered shall be a cold applied (heat shrink is not acceptable) systems.

Where insulating boots are required these shall be supplied as separate items and listed in the offer under ancillary equipment.

The kits shall be supplied with phase identification components which can be applied to the phase cores and which are compatible with the terminating materials.

Terminal lugs, preferably with shear head bolts, are to be supplied with all kits and shall be of the following type: -

- TR-XLPE / XLPE Insulated cables shall have bi-metal or tinned aluminium lugs for the phase conductors and tinned copper or brass lugs for the screen wires.
- Lug palms shall be supplied with fully sealed palms.
- For conductors up to 630 mm² lug palms shall not exceed 35 mm in width and shall have a clearance hole suitable for a 12 mm bolt.
- Lugs shall meet the test requirements of AS/NZS 4325.1.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Annex A shows the indoor and outdoor terminations kit requirements to be supplied in accordance with this specification.

7.3.5 Dead-break Insulated Separable Connectors (Elbows)

As an alternative to lugged connections to open bushings Ergon Energy will require dead-break screened elbows to connect 3 x 1 core triplex cables to transformers and switchgear with required current ratings as shown in Annex A.

Separable elbow and tee connectors shall comply with the requirements of AS2629 and shall be suitable for all applications including padmount substations, subsurface, vault, indoor, outdoor, direct sunlight, direct buried and continuously submersed in water.

Separable 'Elbow' connectors shall be suitable for connection to DIN type bushings and be fitted with capacitor voltage indication, and shall have accessories available for:

- Earthing
- Testing
- Bypass
- Lightning Surge Protection
- Current Limiting Fusing
- Feed through Junctions / Piggy back

Details of these accessories shall be included in the list ancillary items.

The screened separable connectors shall include a screen break.

The insulated plugs covering the capacitor voltage indicator shall have a moulded eyelet to enable it to be removed using an insulated hook stick

7.4 11kV Joints, Terminations and Separable Insulated Connectors

7.4.1 General

All joints and terminations, except for separable insulated connectors shall be of the heat-shrink, cold-shrink, or cold-applied polymeric type design, manufactured and tested to meet the requirements of the relevant Standards, including AS/NZS 4805 Parts 1 and 2 or equivalent, and shall be suitable for application to Ergon Energy's 11kV cables as described in Table 7.3 of this specification.

All separable insulated connectors and accessories forming part of the connector system shall be of the dead-break shielded / screened type with a screen break, manufactured and tested to meet the relevant Standards, including AS 2629. The separable insulated connectors shall be suitable for connecting particular single core polymeric cables as described in Table 7.3 to provide 11kV test points adjacent to substation switchgear.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



All joint and termination kits shall be supplied complete in unit lots suitably packaged for storage containing all necessary materials. Full detailed installation instructions specific to the cables listed in Table 7.3 shall be supplied with the Tender and with the jointing kits that are subsequently supplied. Ergon Energy will approve all instructions for kits that are purchased for use in Ergon Energy. Ergon Energy will keep a copy of the instructions for their records and the supplier is to supply a copy of the instructions with each kit.

Preference will be shown to the Tender offering bi-metal range taking kits suitable for either aluminium or copper conductors and utilising screwed connectors with shear head bolts or torque tightened bolts, in lieu of kits containing compression connectors.

All joints and termination kits shall be supplied with the required cleansing solvents, cloth and abrasives. Tenderers shall provide with their tender Safety Data Sheets (SDS) for nominated solvents. No unapproved solvents shall be provided without prior agreement of the Purchaser.

If required, sealants shall be supplied to effect seals on joints and terminations and shall be able to accommodate the creep or relaxation that may occur during installation of the accessories or during the normal cyclic loading of the cables. The sealant shall have adhesion properties to maintain hermetic seals at all times between components and the various cable sheath materials and connectors.

Suitable lubricant shall be provided with the kits for separable connectors (elbows, tee connectors and plugs) to facilitate separation of the connector from the bushing or plug socket.

All joints and terminations shall be designed so that a phase cross can be made in the joint or termination without stressing the cable insulation or insulation components.

All joint and termination kits shall be supplied complete in unit lots suitably packaged for storage containing all necessary materials. Full detailed installation instructions specific to the cables listed in Table 7.3 shall be supplied with the Tender and with the jointing kits that are subsequently supplied. Ergon Energy will approve and sign all instructions for kits that are purchased for use in Ergon Energy as an approved master check list, and a copy is to be inserted in each kit by the Supplier.

7.4.2 11 kV Straight & Transition Joints

All joints shall have an outer serving which has mechanical strength properties equal to that of the HDPE over-sheath of the cable.

Where cable joint descriptions include insect protection the purchaser requires the completed joint to afford protection for attack by the subterranean termite *Mastotermes Darwinists* and the coastal brown ant *Pheidole Megacephala*.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



The preference is for a fine woven stainless steel mesh cylindrical sleeve that is applied over the joint and clamped to the cable insect protection layer each side of the joint by a constant force spring arrangement. An outer tube is then provided to finish the joint.

Due to insect damage to the joint components outside the insect protection layer it is necessary to provide the joint with a water / environmental seal to the cable as follows:

- For cables provided with Double Brass Tape (DBT) – the PVC inner sheath below the DBT
- For cables provided with Nylon Jacket (NJ) – the NJ.

Alternative forms for insect protection may be considered by the Purchaser. Alternative offers shall be submitted with full details of the recommendations and supporting evidence of performance including service history.

Annex B shows required cable to cable joint requirements to be supplied in accordance with this specification.

Tenderers shall complete Schedule F to state overall length of the completed joint and the required cable pit length to make the joint.

7.4.3 11kV Terminations – Outdoor Type

All terminations shall meet the performance requirements specified in Clause 9.1 of this specification.

The polymeric stress control sleeve and sheds shall withstand the electrical stress associated with continuous operation at 12 kV under the environmental conditions described in Clauses 6.1.

The termination shall be suitable for terminating cables on to a low mount substation structure and on to a pole using a bracket as per Drawing No. 5101 mounted with 12kV surge arresters for support of the cable tails. The tail lengths of the terminating kits for three phase cables shall be a **minimum of 800mm** long to allow a phase cross to be installed on the cable. A typical general arrangement is shown on Drawing No. 5101 that is contained in Ergon Energy's Underground Construction Manual, HV Construction folder. A copy is attached with the other drawings included in this specification.

Shorter lengths may be considered provided an assessment by Ergon Energy's field personnel indicate that the kits can be installed without undue difficulty and without stressing the cable insulation.

The kits shall be supplied with phase identification components which can be applied to the phase cores and which are compatible with the terminating materials.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Terminal connectors, preferably with shear head bolts, are to be supplied with the kits and shall be of the following type: -

- TRXLPE / XLPE insulated cables shall have bi-metal lugs or tinned aluminium shear bolt connectors for the phase conductors and tinned copper or brass lugs for the screen wires.
- Lug palms shall be supplied with fully sealed palms.
- Lugs shall meet the test requirements of AS/NZS 4325.1
- Lugs shall have a clearance hole suitable for a 12mm bolt for cable up to 300mm² and a clearance hole suitable for a 16mm bolt for larger cables.

7.4.4 11kV Terminations – Indoor Type

All terminations shall meet the requirements of AS/NZS 4325.1 and the performance requirements specified in Clause 9.1 of this specification.

The terminating kits shall be suitable for terminating in cable boxes of the switchgear listed in Table 7.6 below.

Table 7.6: 12kV Switchgear

Switchgear Manufacturer	Type	Cable Sizes
ABB	SafeLink	300mm ² to 25mm ²
ABB	SafeRing	300mm ² to 25mm ²
ABB	SafePlus	300mm ² to 25mm ²
ABB	SDAF	300mm ² to 25mm ²
Eaton	Magnefix MD4	240mm ² to 25mm ²
Merlin Gerin	RM6	300mm ² to 25mm ²
Schneider	RM6	300mm ² to 25mm ²
Schneider	FBX	300mm ² to 25mm ²

7.4.4.1 11kV Terminations to Open Bushings

The tail lengths of the terminating kits for three phase cables shall be of sufficient length to allow a phase cross to be installed on the cable.

All 11 kV single core cable kits shall have a **maximum** length of 330mm.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Where the phase to phase and phase to earth clearance of the switchgear cable boxes are not sufficient for air clearance, tenderers shall supply a system of insulating the terminal and lug connection which suits both the cables listed in Table 7.3 and the switchgear listed in Table 7.6. The insulating system for the terminals shall be capable of withstanding an impulse level of 95kV BIL with the largest cable size from Table 7.3 terminated in the cable box. The insulating system offered should be a cold applied (heat shrink is not acceptable) systems.

Where insulating boots are required these shall be supplied as separate items and listed in the offer under ancillary equipment.

The kits shall be supplied with phase identification components which can be applied to the phase cores and which are compatible with the terminating materials.

Terminal lugs, preferably with shear head bolts, are to be supplied with all kits and shall be of the following type: -

- TR-XPLE / XLPE Insulated cables shall have bi-metal or tinned aluminium lugs for the phase conductors and tinned copper or brass lugs for the screen wires.
- Lug palms shall be supplied with fully sealed palms.
- For conductors up to 400 mm² lug palms shall not exceed 35 mm in width and shall have a clearance hole suitable for a 12 mm bolt.

Lugs shall meet the test requirements of AS/NZS 4325.1.

Annex A shows indoor and outdoor termination kits required to be supplied in accordance with this specification.

7.4.5 Dead-break Insulated Separable Connectors (Elbows)

As an alternative to lugged connections to open bushings Ergon Energy will require dead-break screened elbows to connect 3 x 1 core triplex cables to transformers and switchgear with required current ratings as shown in Annex A.

Separable elbow shall comply with the requirements of AS2629 and shall be suitable for all applications including padmount substations, subsurface, vault, indoor, outdoor, direct sunlight, direct buried and continuously submersed in water.

Separable 'Elbow' connectors shall be suitable for connection to DIN type bushings and be fitted with capacitor voltage indication, and shall have accessories available for:

- Earthing
- Testing
- Bypass

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



- Lightning Surge Protection
- Current Limiting Fusing
- Feed through Junctions / Piggy back

Details of these accessories shall be included in the list ancillary items.

The screened separable connectors shall include a screen break.

The insulated plugs covering the capacitor voltage indicator shall have a moulded eyelet to enable it to be removed using an insulated hook stick.

7.5 LV Joints and Terminations

7.5.1 General

All joints and terminations shall meet the performance requirements of Clause 9.1 of this specification and shall be suitable for application to Ergon Energy's LV cables as described in Table 7.4 of this specification.

Sealants shall be used to effectively seal joints and terminations and the properties of the sealants shall be able to accommodate the creep or relaxation that may occur during installation of the accessories or during the normal cyclic loading of the cables. The sealants shall have adhesion properties to maintain hermetic seals at all times between components and the various cable sheath materials and connectors.

All joints and terminations shall be designed so that a phase cross can be made in the joint or termination without stressing the cable insulation or insulation components.

Connectors shall be supplied with the kits. Connectors utilising a mechanical connection with shear head bolts with a range taking ability are preferred to compression connectors. Where compression connectors are supplied the connectors shall be capable of being installed using a standard 12 Tonne Hydraulic Crimper.

Connectors shall meet the test requirements of AS/NZS 4325.1.

All joint and terminations kits shall be supplied complete in unit lots suitably packaged for storage containing all necessary materials including cleansing solvents, cloths and abrasives. Tenderers shall provide with their tender Safety Data Sheets (SDS) for nominated solvents. No unapproved solvents shall be provided without prior agreement of the Purchaser. Full detailed installation instructions specific to the cables listed in Table 7.4 shall be supplied with the jointing kits. Ergon Energy will approve all instructions for kits that are purchased for use in Ergon Energy. Ergon Energy will keep a copy of the instructions for their records and the supplier is to supply a copy of the instructions with each kit.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



7.5.2 LV Straight Joints

All joints shall have an outer serving which has a mechanical strength equal to that of the over-sheath of the cable. The outer serving shall provide a minimum insulation resistance of 1000MΩ.

7.5.3 LV Terminations – Indoor and Outdoor type

All terminations shall meet the performance requirements specified in Clause 9.1.

The tail lengths of the terminating kits shall be of sufficient length to allow a phase cross to be installed on the cable. The minimum length for tails shall be 400 mm.

Terminal connectors are to be supplied with the kits and shall be of the following type:-

- Cable terminations with copper conductors shall have tinned copper lugs whilst aluminium conductor shall have aluminium lugs.
- Lug palms shall be supplied with fully sealed palms.
- For cables up to 300 mm² lug palms shall not exceed 35 mm in width and shall have a clearance hole suitable for a 12 mm bolt.

Lugs shall meet the test requirements of AS/NZS 4325.1.

Connectors utilising a mechanical connection with shear head bolts with a range taking ability are preferred to compression connectors. Where offered, compression terminal connectors shall be capable of being installed using a standard 12 Tonne Hydraulic Crimper.

8. Ancillary Equipment

All items necessary to this specification and not included in the items previously specified shall be termed “Ancillary Equipment”.

The Tenderer shall list such items. A quantity and price shall be shown for each individual item to allow a review of requirements at the time of ordering.

9. Performance & Testing

9.1 Joint and Termination Performance Requirements

9.1.1 Electrical

The Tenderer shall supply joints and terminations that meet the test requirements of the relevant Standards, including AS/NZS 4085 Part 1 and 2, AS/NZS 1600 – All Parts, AS/NZS 4325.1 and IEC61442, and shall complete Schedule A to Schedule H inclusive.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



The joints and terminations shall withstand the electrical stress associated with continuous operation at the highest system voltage under the environmental conditions described in Clause 6.2 of this specification.

9.1.2 Test Certificates

The Tenderer shall provide test Certificates in duplicate for all test undertaken by the manufacturer under this specification.

Such test certificates shall be signed by a properly authorised person and forwarded to Ergon Energy.

Ergon Energy may appoint a representative to be present for inspection and witnessing of tests at any time during the manufacture of the accessories.

9.2 Type Test Compliance

Note to Tenderers:

Copies of original Type Test certificates / reports shall be included in full in accordance with IEC 60502-4 (including all drawings, revisions and test results as stipulated in the applicable standards as specified in this Specification) with the tender regardless of whether or not the equipment has been supplied previously to Ergon Energy. Where company details have changed with regard to the original Type Testing, and the original Type Testing is submitted, these company details changes shall be detailed in the tender submission, for every company change up to the time of submission of tender. Type Test certificates/reports shall be complete and copies of front pages only shall not be acceptable.

Where items of a similar design to that previously tested are offered, consideration may be given to accepting previous Type Test reports. Tenderers are requested to substantiate their claims of equivalent Type Test performance with written engineering evaluation, where full Type Test documentation is not submitted for each of the items offered. Such evaluation must provide all relevant details such that Ergon Energy can establish the validity of existing Type Tests.

Ergon Energy requires that all Type Test (for items offered) are certified by a laboratory accredited by an Accreditation Entity. An Accreditation Entity is a signatory to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA), for example; the National Association of Testing Authorities, Australia (NATA). Full accreditation details of the Type Testing facilities and the accreditation certifying entity and any mutual recognition arrangements with other accreditation entities shall be provided by the tenderer.

Ergon Energy may request repeat of Type Tests to prove compliance to this technical specification where the materials used in the equipment offered and / or the manufacturing process and / or the place of manufacture have changed since the equipment was originally type tested.

9.3 Batch and Routine Tests

Note to Tenderers:

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



If tenderers propose to offer items tested to Standards other than those specified in this Specification, full details of these Standards are to be provided at the time of tendering.

9.4 Acceptance Tests

Ergon Energy may carry out acceptance tests on an item to prove it conforms to the requirements of this Specification.

9.5 Witnessing of Test

Ergon Energy reserves the right to witness all testing. The Supplier shall give Ergon Energy reasonable notice of when testing will be carried out.

9.5.1 Electrical

The Tenderer shall supply joints and terminations that meet the test requirements of the relevant Standards, including AS / NZS 4085 Part 1 and 2 or equivalent, AS / NZS 1660 – All Parts, AS / NZS 4325.1 and IEC61442, and shall complete Attachments.

The joints and terminations shall withstand the electrical stress associated with continuous operation at the highest system voltage under the environmental conditions described in Clause 6 of this specification.

10. Service Performance

Note to Tenderers:

Tenderers shall complete schedule "L" detailing current and previous experience within Australia.

11. Risk Assessment

11.1 Legislation

Tenderers must comply with the requirements of the Workplace Health and Safety Act 2011, Queensland Electrical Safety Act 2002 and associated Regulations, Codes of Practice and compliance advisory to Attachment 3.

11.2 Documentation

Tendered items shall be subject to a formal risk assessment. The Plant Code of Practice 2005 requires the Tenderer to perform a risk assessment and provide the resultant documentation to the Purchaser with their tender in accordance with the 'Risk Assessment' schedule (Attachment 3) included with this specification. Where required in the attachment, full details to support answers must be furnished.

If the complete risk assessment documentation is not provided with the tender, or does not meet the required standard, the tender may be rejected. Any documented risk assessment that accompanies the tender must meet the requirements of the Risk Management Advisory Standard 2000 as a minimum standard and address the five main steps of the risk management process. It is preferred that the risk assessment methodology uses an energy model to identify hazards.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



The risk assessment/s shall both state recommended practices and identify hazards to the Corporation's personnel, public and property associated with items offered as follows:

- Installation
- Transport, handling and storage
- Operation and maintenance during life expectancy
- Dismantling / disposal at end of life
- The range of uses for which the offered items are intended
- Effects of environmental conditions

The 'Risk Assessment' schedule (Attachment 3) included with this specification shall be completed by the Tenderer. Where required by some questions, full details to support answers shall be furnished.

12. Quality Assurance

Note to Tenderers:

Tenderers shall complete Schedule "MSI" detailing their Management Systems (Quality Assurance Systems).

13. Samples

Note to Tenderers:

Tenderers must submit, when requested, one (1) production samples of each item tendered to assist in the evaluation of the tender. Samples shall be delivered to the address nominated within ten (10) working days of the request.

The requirements for samples may be waived for the following conditions:

- The tendered item is currently under contract or has previously been supplied to Ergon Energy under contract and there have been no changes to the design or material.
- The tendered items have been supplied to Ergon Energy for approval prior to this tender and there have been no changes to the design or material.

Each sample shall be delivered freight free, suitably packaged and labelled with the following information:

- a) Name of tenderer and this contract No.
- b) Contract Item Numbers
- c) Any supporting data on features or characteristics

14. Packaging and Labelling

14.1 Packing

The packing requirements are set out in Schedule 10 of the contract (Packing and Transport Requirements).

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



14.2 Marking

Each packaged lot and each kit within the packaged lot to be marked with the following information:

Marking Required on Each Kit	Marking Required on Each Packaged Lot
Names of Supplier / Manufacturer	Names of Supplier / Manufacturer
Product Code	Product Code
Item Description	Item Description
Purchaser's Stock Code	Purchaser's Stock Code
Quantity: 1 Kit	Pack Size: No. of Kits
Date of Manufacture	Date of Manufacture
"Use Before" Date if applicable	Pack Mass (kg)

15. Reliability

It is expected that items are designed to have a service life of 35 years under the specified system and environmental conditions.

Note to Tenderers:

Tenderers shall provide evidence in support of the reliability and performance claimed including information of Failure Mode and Effect Analysis with the tender.

16. Training

Training material in the form of jointing and terminating kits, drawings, instructions and / or audio visuals may be required for the items accepted under this offer. This material shall include but is not limited to the following topics:

- Handling
- Storage
- Application (particularly in areas of heavy coastal pollution)
- Installation (including insect protection where applicable)
- Maintenance
- Environmental performance
- Electrical performance
- Mechanical performance
- Disposal

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Tenderers shall provide at their cost, qualified training instructors to undertake training of the Purchaser's cable jointers and other personnel at the commencement of the contract. The training shall be competency based with the successful tenderer being responsible for ensuring that trainees have obtained the required skill for installation of the jointing and terminating materials and that an accreditation certificate is issued to indicate successful completion of the training program. Training shall be allowed for at the following locations:

- Cairns
- Townsville
- Mackay
- Rockhampton
- Maryborough
- Toowoomba

17. Environmental Considerations

Note to Tenderers:

Tenderers shall complete Schedule "R3" Product Environmental Responsibility Questionnaire detailing comments on the environmental soundness of the design / materials; recyclability and disposal at end of service life.

18. Special Tools, Gauges & Accessories

Tenderers are advised that the Purchaser and Contractors to the Purchaser have a wide range of general equipment and special tools available to complete the installations.

Tenderers shall submit separate details, including price, of any special tools, gauges or accessories that are identified as being necessary for installation and ongoing maintenance procedures.

Tools, gauges and accessories that are available from normal commercial outlets should not be included.

19. Information to be Provided

19.1 General

The specific technical requirements for the items offered shall be as stated in Schedule A to Schedule H inclusive of this specification. The Tenderer shall provide all details requested by Schedule A to Schedule H and shall guarantee such data.

In addition to the completed schedules, Tenders shall submit with their tender one copy of a general jointing instruction together with drawings of not less than ¼ scale fully describing the joints offered.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



The general jointing instructions shall state the shelf life of the joint kit.

Tenderers shall supply one copy of a general terminating instruction including drawings of not less than ¼ scale fully describing the cable terminations with the tender documents. The information shall be of sufficient detail to identify what existing components can be re-used or whether modifications to or new components are required.

Tenderers shall provide an estimate of labour hours to complete each joint and termination after cutting of cable(s), in a workshop situation, using experienced jointers.

19.2 Drawings & Information to be supplied by the Successful Tenderer

All information to be supplied under this specification shall be in the English language and all drawings shall be dimensioned in metric units in accordance with AS ISO 1000. Where a drawing is dimensioned in imperial units, the equivalent metric units shall be shown in brackets adjacent to it.

When requested by the Purchaser, the Supplier shall:

- Provide within two (2) weeks of the date of the formal execution of the Standing Order, a comprehensively detailed program of works indicating timing for all activities required to achieve contract performance.
- Within six (6) weeks from the date of the formal execution of the Standing Order, the Supplier will provide three copies of drawings and information necessary to enable the Purchaser to examine the general design and arrangement.

The Purchaser will comment on drawings supplied under this contract in relation to how the equipment interfaces with the Purchaser's design, construction, operation, maintenance and other requirements.

Comments about drawings by the Purchaser will not in any way absolve the Supplier of responsibility for the safety and reliability aspects of the plant or equipment supplied. The Supplier will amend the drawings as directed and resubmit them to the Purchaser within one (1) week.

In the event of the Supplier proceeding with work before such comment has been given in writing, any necessary alterations and modifications will be carried out at the Tenderer's own expense.

Drawings will include a fully dimensioned general arrangement drawing.

If the drawings submitted for approval require modification by either the Supplier or the Purchaser, the Supplier shall carry out the modifications and submit the modified drawings for comment. This procedure shall continue until the Purchaser notifies the Supplier that the drawings are acceptable.

When requested by the Purchaser, the Supplier shall supply no later than four weeks prior to the date of dispatch of the equipment from the supplier the following:

- Final copies of all drawings listed in this section of the specification.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



- Final Inspection and Test Plan covering at minimum the manufacturing and packaging procedures.
- Certified copies of test reports called for in this specification verifying compliance with this specification.

20. Quality of instructions Provided

20.1 Instruction Title Page

The title page of the instructions shall include the following information:

- Unique document number for the instructions
- A title of the termination / joint kit. The title shall be a concise description of the kit, including the type of cable it is suitable for (e.g. Single Core XPLE)
- A table, or other concise form showing the following information:
 - Termination / joint kit number
 - Maximum cable diameter (mm)
 - Insulation Diameter Range (mm)
 - Cable size (mm²)
 - Connector Diameter Range (mm)
 - Maximum connector length (mm)
- Revision Number / Letter
- Revision Date

20.2 Instruction Revisions

A revision space shall as a minimum be provided on the title page as per clause 20.1. Revisions can be indicated by either a number or a letter. The original issue of the instruction is usually indicated as either 'A' or '0', the first revision is therefore 'B' or '1'.

A revision history shall be included with the instructions, with a description providing brief and concise information as to what has changed between the revisions. The revision history shall contain:

- The revision letter or number
- A brief description of the revision
- The author's initials
- An approval signature and date

20.3 Instructions in Electronic Format

Tenderers shall provide final copies of instructions in electronic format. The purchaser has a preference for instructions to be supplied PDF format.

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Schedule A Technical Details – 33kV Terminations (Indoor & Outdoor)

Note to Tenderer:

A separate schedule it to be provided for each item offered.

	Response
Item No. (Refer Annex A)	
Manufacturer's Name and Address	
Country of Manufacturers	
Manufacturer's Catalogue No.	
Type Test Certificate No.	

Particulars	Unit	Specified Value / Requirement	Response / Guaranteed Value
Type Offered	Cold / Heat / Premoulded		
Rated Voltage	kV		
15 minute dry A.C. Voltage Withstand	15 min at 2.5 U ₀ (45kV)	No breakdown or flashover	
5 minute dry A.C. Voltage Withstand	5 min. at 4.5 U ₀ (81kV)	No breakdown or flashover	
(Outdoor Only) A.C. Voltage withstand wet	1 min at 4 U ₀ (72kV)	No breakdown or flashover	
15 minute dry D.C. Voltage Withstand	15 min at 4 U ₀ (72kV)	No breakdown or flashover	
Partial Discharge – maximum	1.73 U ₀ (30kV)	10 pC max.	
Impulse Level	170kV	No breakdown or flashover	
Type of Lug	Mechanical / Compression		
Lug Manufacturer			

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Lug Manufacturer's part number			
(Compression Lug Only) Across Flat Distance of the Die	mm		
Lug Conductor diameter range	mm		
Tail Lengths	mm		
Creepage Distance	mm		
Colour of housing / Sheds			
Diameter over cable insulation range	mm		
Detailed Instructions to suit type and voltage included in kits	Yes / No		
(Indoor Only) Terminal insulation available to suit cable sizes listed in Table 7.1, plus compatible with cable termination components	Yes / No		
Terminal insulation removable and reusable for testing of switchgear	Yes / No		
Pack Size			
Pack Mass	kg		
Shelf Life	Years		
Labour estimate to complete termination	hours		

Name of Tenderer:		
Signature of Tenderer:		
Date:		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Schedule B Technical Details – 33kV Joints

Note to Tenderer:

A separate schedule it to be provided for each item offered.

	Response
Item No. (Refer Annex B)	
Supplier's Name and Address:	
Manufacturer's Name and Address	
Country of Manufacturers	
Manufacturer's Catalogue No.	
Applicable drawings including lugs:	
Type Test Certificate No.	

Particulars	Unit	Specified Value / Requirement	Response / Guaranteed Value
Type Offered	Cold / Heat / Premoulded		
Rated Voltage	kV		
15 minute dry A.C. Voltage Withstand	15 min at 2.5 U ₀ (45kV)	No breakdown or flashover	
5 minute dry A.C. Voltage Withstand	5 min. at 4.5 U ₀ (81kV)	No breakdown or flashover	
15 minute dry D.C. Voltage Withstand	15 min at 4 U ₀ (72kV)	No breakdown or flashover	
Partial Discharge – maximum	1.73 U ₀ (30kV)	10 pC max.	
Impulse Level	170kV	No breakdown or flashover	

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Type of Connector	Mechanical / Compression		
Connector Manufacturer			
Connector Manufacturer's part number			
(Compression Connector Only) Across Flat Distance of the Die	mm		
Connector Conductor diameter range	mm		
Creepage Distance	mm		
Colour of housing / Sheds			
Diameter over cable insulation range	mm		
Overall Length of joint	mm		
Required Pit Length	mm		
Detailed Instructions to suit type and voltage included in kits	Yes / No		
Pack Size			
Pack Mass	kg		
Shelf Life	Years		
Labour estimate to complete termination	hours		

Name of Tenderer:		
Signature of Tenderer:		
Date:		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Schedule C Technical Details – 22kV Terminations (Indoor & Outdoor)

Note to Tenderer:

A separate schedule it to be provided for each item offered.

	Response
Item No. (Refer Annex A)	
Manufacturer's Name and Address	
Country of Manufacturers	
Manufacturer's Catalogue No.	
Type Test Certificate No.	

Particulars	Unit	Specified Value / Requirement	Response / Guaranteed Value
Type Offered	Cold / Heat / Premoulded		
Rated Voltage	kV		
15 minute dry A.C. Voltage Withstand	15 min at 2.5 U ₀ (30kV)	No breakdown or flashover	
5 minute dry A.C. Voltage Withstand	5 min. at 4.5 U ₀ (54kV)	No breakdown or flashover	
(Outdoor Only) A.C. Voltage withstand wet	1 min at 4 U ₀ (48kV)	No breakdown or flashover	
15minute dry D.C. Voltage Withstand	15 min at 4 U ₀ (48kV)	No breakdown or flashover	
Partial Discharge – maximum	1.73 U ₀ (20kV)	10 pC max.	
Impulse Level	125kV	No breakdown or flashover	
Type of Lug	Mechanical / Compression		
Lug Manufacturer			

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Lug Manufacturer's part number		
(Compression Lug Only) Across Flat Distance of the Die	mm	
Lug Conductor diameter range	mm	
Tail Lengths	mm	
Creepage Distance	mm	
Colour of housing / Sheds		
Diameter over cable insulation range	mm	
Detailed Instructions to suit type and voltage included in kits	Yes / No	
(Indoor Only) Terminal insulation available to suit all switchgear listed in Table 7.5 and cable sizes listed in Table 7.2, plus compatible with cable termination components	Yes / No	
Terminal insulation removable and reusable for testing of switchgear	Yes / No	
Pack Size		
Pack Mass	kg	
Shelf Life	Years	
Labour estimate to complete termination	hours	

Name of Tenderer:		
Signature of Tenderer:		
Date:		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Schedule D Technical Details – 22kV Joints

Note to Tenderer:

A separate schedule it to be provided for each item offered.

	Response
Item No. (Refer Annex B)	
Manufacturer's Name and Address	
Country of Manufacturers	
Manufacturer's Catalogue No.	
Type Test Certificate No.	

Particulars	Unit	Specified Value / Requirement	Response / Guaranteed Value
Type Offered	Cold / Heat / Premoulded		
Rated Voltage	kV		
15 minute dry A.C. Voltage Withstand	15 min at 2.5 U ₀ (30kV)	No breakdown or flashover	
5 minute dry A.C. Voltage Withstand	5 min. at 4.5 U ₀ (54kV)	No breakdown or flashover	
15 minute dry D.C. Voltage Withstand	15 min at 4 U ₀ (48kV)	No breakdown or flashover	
Partial Discharge – maximum	1.73 U ₀ (20kV)	10 pC max.	
Impulse Level	125kV	No breakdown or flashover	
Type of Connector	Mechanical / Compression		
Connector Manufacturer			
Connector Manufacturer's part number			

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



(Compression Connector Only) Across Flat Distance of the Die	mm		
Connector Conductor diameter range	mm		
Creepage Distance	mm		
Colour of housing / Sheds			
Diameter over cable insulation range	mm		
Overall length	mm		
Required Pit Length	mm		
Detailed Instructions to suit type and voltage included in kits	Yes / No		
Pack Size			
Pack Mass	kg		
Shelf Life	Years		
Labour estimate to complete termination	hours		

Name of Tenderer:		
Signature of Tenderer:		
Date:		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Schedule E Technical Details – 11kV Terminations (Indoor & Outdoor)

Note to Tenderer:

A separate schedule it to be provided for each item offered.

	Response
Item No. (Refer Annex A)	
Manufacturer's Name and Address	
Country of Manufacturers	
Manufacturer's Catalogue No.	
Type Test Certificate No.	

Particulars	Unit	Specified Value / Requirement	Response / Guaranteed Value
Type Offered	Cold / Heat / Premoulded		
Rated Voltage	kV		
15 minute dry A.C. Voltage Withstand	15 min at 2.5 U ₀ (15kV)	No breakdown or flashover	
5 minute dry A.C. Voltage Withstand	5 min. at 4.5 U ₀ (27kV)	No breakdown or flashover	
(Outdoor Only) A.C. Voltage withstand wet	1 min at 4 U ₀ (24kV)	No breakdown or flashover	
15 minute dry D.C. Voltage Withstand	15 min at 4 U ₀ (24kV)	No breakdown or flashover	
Partial Discharge – maximum	1.73 U ₀ (10kV)	10 pC max.	
Impulse Level	95kV	No breakdown or flashover	
Type of Lug	Mechanical / Compression		
Lug Manufacturer			

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Lug Manufacturer's part number		
(Compression Lug Only) Across Flat Distance of the Die	mm	
Lug Conductor diameter range	mm	
Tail Lengths	mm	
Creepage Distance	mm	
Colour of housing / Sheds		
Diameter over cable insulation range	mm	
Detailed Instructions to suit type and voltage included in kits	Yes / No	
(Indoor Only) Terminal insulation available to suit all switchgear listed in Table 7.6 and cable sizes listed in Table 7.3, plus compatible with cable termination components	Yes / No	
Terminal insulation removable and reusable for testing of switchgear	Yes / No	
Pack Size		
Pack Mass	kg	
Shelf Life	Years	
Labour estimate to complete termination	hours	

Name of Tenderer:		
Signature of Tenderer:		
Date:		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Schedule F Technical Details – 11kV Joints

Note to Tenderer:

A separate schedule it to be provided for each item offered.

	Response
Item No. (Refer Annex B)	
Manufacturer's Name and Address	
Country of Manufacturers	
Manufacturer's Catalogue No.	
Type Test Certificate No.	

Particulars	Unit	Specified Value / Requirement	Response / Guaranteed Value
Type Offered	Cold / Heat / Premoulded		
Rated Voltage	kV		
15 minute dry A.C. Voltage Withstand	15 min at 2.5 U ₀ (15kV)	No breakdown or flashover	
5 minute dry A.C. Voltage Withstand	5 min. at 4.5 U ₀ (27kV)	No breakdown or flashover	
15 minute dry D.C. Voltage Withstand	15 min at 4 U ₀ (24kV)	No breakdown or flashover	
Partial Discharge – maximum	1.73 U ₀ (10kV)	10 pC max.	
Impulse Level	95kV	No breakdown or flashover	
Type of Connector	Mechanical / Compression		
Connector Manufacturer			
Connector Manufacturer's part number			

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



(Compression Connector Only) Across Flat Distance of the Die	mm		
Connector Conductor diameter range	mm		
Creepage Distance	mm		
Colour of housing / Sheds			
Diameter over cable insulation range	mm		
Overall Length	mm		
Required Pit Length	mm		
Detailed Instructions to suit type and voltage included in kits	Yes / No		
Pack Size			
Pack Mass	kg		
Shelf Life	Years		
Labour estimate to complete termination	hours		

Name of Tenderer:		
Signature of Tenderer:		
Date:		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Schedule G Technical Details – LV Terminations

Note to Tenderer:

A separate schedule it to be provided for each item offered.

	Response
Item No. (Refer Annex B)	
Manufacturer's Name and Address	
Country of Manufacturers	
Manufacturer's Catalogue No.	
Type Test Certificate No.	

Particulars	Unit	Specified Value / Requirement	Response / Guaranteed Value
Type Offered	Cold / Heat / Premoulded		
Rated Voltage	kV		
5 minute dry A.C. Voltage Withstand	5 min. at 3.5kV	No breakdown or flashover	
Insulation Resistance	MΩ	1000 MΩ	
Type of Connector	Mechanical / Compression		
Connector Manufacturer			
Connector Manufacturer's part number			
(Compression Connector Only) Across Flat Distance of the Die	mm		
Connector Conductor diameter range	mm		
Creepage Distance	mm		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Colour of housing / Sheds		
Diameter over cable insulation range	mm	
Detailed Instructions to suit type and voltage included in kits	Yes / No	
Pack Size		
Pack Mass	kg	
Shelf Life	Years	
Labour estimate to complete termination	hours	

Name of Tenderer:		
Signature of Tenderer:		
Date:		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Schedule H Technical Details – LV Joints

Note to Tenderer:

A separate schedule it to be provided for each item offered.

	Response
Item No. (Refer Annex B)	
Manufacturer's Name and Address	
Country of Manufacturers	
Manufacturer's Catalogue No.	
Type Test Certificate No.	

Particulars	Unit	Specified Value / Requirement	Response / Guaranteed Value
Type Offered	Cold / Heat / Premoulded		
Rated Voltage	kV		
5 minute A.C. Voltage Withstand	5 min. at 3.5kV	No breakdown or flashover	
Insulation Resistance	MΩ	1000 MΩ	
Type of Connector	Mechanical / Compression		
Connector Manufacturer			
Connector Manufacturer's part number			
(Compression Connector Only) Across Flat Distance of the Die	mm		
Connector Conductor diameter range	mm		
Creepage Distance	mm		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Colour of housing / Sheds			
Diameter over cable insulation range	mm		
Overall Length	mm		
Required Pit Length	mm		
Detailed Instructions to suit type and voltage included in kits	Yes / No		
Pack Size			
Pack Mass	kg		
Shelf Life	Years		
Labour estimate to complete termination	hours		

Name of Tenderer:		
Signature of Tenderer:		
Date:		

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Annex A. Cable Terminations

Normative

Item	Stock code	Termination to Suit	Ellipse description	Cable description	Notes:
0.6 / 1kV Indoor Termination					
1.	2427359	Indoor termination 4-16mm ² Neutral screened PVC cable.	TERMINATION KIT,ELECTRICAL CABLE Underground, Indoor, LV, 4 - 16mm ² Cu, Neutral Screened PVC Insulated, Nylon Jacket, Insect Protection, PVC Sheathed Cable (scm)	0.6/1kV 4-16mm ² 4 - 16mm ² Cu, Neutral Screened PVC Insulated, Nylon Jacket, Insect Protection, PVC Sheathed 2400260, 2406943	
0.6 / 1kV Outdoor Terminations					
2.	2406991	Outdoor termination includes cable termination, Cu links	TERMINATION KIT,ELECTRICAL CABLE Outdoor, 0.6/1kV, 16mm ² , 4C XLPE Cable, Insect Protected, Containing 4 Way Glove 4 x Tubing, Colour Coding Red White & Blue, 4 x 16mm ² Cu Crimp Links,	16mm ² Cu 4 core XLPE with and without insect protection. 1632489 & 2400273 IP	Contains accessories to provide Insect Protection to completed joint
3.	2434132	Outdoor termination includes cable termination, bi-metal lugs, lug seals.	TERMINATION KIT,ELECTRICAL CABLE Outdoor, Heat Shrink, 0.6/1kV, 50mm ² , 4 Core XLPE, Nylon Jacket Cable (incl. insect protected) c/w 4 Way Glove, 4 x Tubing, Red White & Blue Colour	50mm ² 4 core Cu XLPE with insect protection 2410371	Contains accessories to provide Insect Protection to completed joint.
4.	0104293	Outdoor termination includes cable termination, bi-metal lugs, lug seals.	TERMINATION KIT,ELECTRICAL CABLE Outdoor, LV, 240mm ² Al, 4 Core Sector XLPE Cable, Insect Protected c/w Cable Term kit Solvent Wipes, Cable Lugs, EPS0021 ver2 (scm)	240mm ² Al 4 core XLPE with or without insect protection. 1634155 & 2400272 IP	
6.35 / 11kV Indoor Terminations					

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Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Termination to Suit	Ellipse description	Cable description	Notes:
5.	2430171	Feeder cables ABB Safelink Switchgear includes cable termination, cable conductor bi-metal lugs (or Cu lugs for Cu cable) c/w bolts, nuts and washers, and cable screen lugs c/w bolts, nuts and washers	TERMINATION KIT INDOOR 11kV, 35mm2, Al, Triplex (1C wound 3 in hand) TR-XLPE Cable, 11kV ABB SafeLink RMU, Inc Cable Term Kit, Cable Core & Screen Lugs Fixings, Spec EPS0075 (scm)	35mm2 Al Triplex XLPE 2429942	Not suitable for 0104468 DBT cable (perhaps could be made to be?)
6.	2430197 2406986 (in Manual)	Feeder cables - ABB SD Series Switchgear. Includes cable termination, bushing insulation, cable conductor bi-metal lugs (or Cu lugs for CU cable) c/w bolts nuts and washers and cable screen lugs c/w bolts nuts and washers.	TERMINATION KIT INDOOR 11kV, 35mm2, Al, Triplex (1C wound 3 in hand) TR-XLPE Cable, 11kV ABB SD Series RMU, Inc Cable Term Kit, Solvent Wipes Bushing Insulation, Cable Core & Screen	35mm2 Al Triplex XLPE 2429942	Not suitable for 0104468 cable
7.	2430189	Feeder cables ABB Safelink Switchgear includes cable termination, cable conductor bi-metal lugs c/w bolts, nuts and washers, and cable screen lugs c/w bolts, nuts and washers	TERMINATION KIT INDOOR 11kV, 35mm2, Al, Triplex (1C wound 3 in hand) TR-XLPE Cable, Insect Protected, 11kV ABB SafeLink RMU, Inc Cable Term Kit, Cable Core & Screen Lugs & Fixings,	35mm2 Al Triplex XLPE with insect protection 2429967	Bushing insulation supplied with padmount not with termination kit. Not suitable for 0104467 DBT cable
8.	2430155	Feeder cables - Transformer bushing connection - padmounted substation (no HV Switchgear) includes cable termination, connection kit, cable screen lugs c/w bolts nuts and washers. Feeder cables - ABB SD Series Switchgear. Includes cable termination, bushing insulation, cable conductor bi-metal lugs c/w/bolts nuts and washers and cable screen lugs c/w bolts nuts and washers	TERMINATION KIT INDOOR 11kV, 35mm2, Al, Triplex (1C wound 3 in hand) TR-XLPE Cable, Insect Protected, 11kV ABB SD Series RMU, Inc Cable Term Kit, Bush Insulation, Cable Core & Screen	35mm2 Al Triplex XLPE with insect protection 2429967	Not suitable for 0104467 DBT cable

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Termination to Suit	Ellipse description	Cable description	Notes:
9.	2430163	Feeder cables - Magnefix MD Series switchgear includes cable termination, connection kit, cable screen lugs c/w bolts nuts and washers and cable support clamps	TERMINATION KIT INDOOR 11kV, 35mm ² , Al, Triplex (1C wound 3 in hand) TR-XLPE Cable, Insect Protected, 11kV Magnefix MD Series RMU, Inc Cable Term Kit Holec 502.0047/3 Connection Kit	35mm ² Al triplex XLPE with insect protection 2429967	Not suitable for 0104467 DBT cable
10.	2435907	Feeder Cables - Areva FBX Switchgear. Includes cable termination elbows, shear bolt connectors c/w cable screen lugs, bolts nuts and washers	CONNECTOR ELBOW Set of 3, 630A, Bolted, suit 11kV 1 Core 25-120mm ² XLPE Cable, Shear Bolt Connectors, for Areva HV Switchgear (scm)	35mm ² Al triplex XLPE + 35mm ² Al triplex XLPE with insect protection 2429967 NJ, 2429942, 0104467 DBT, 0104468	
11.	0105033	Feeder cables ABB Safelink Switchgear includes cable termination, cable conductor bi-metal lugs c/w bolts, nuts and washers, and cable screen lugs c/w/ bolts, nuts and washers	TERMINATION & CONNECTION KIT 11kV 185mm ² Al (1C wound 3 in hand) XLPE Cable IINo 0104466 for 11kV ABB SafeLink RMU Including Cable Termination Kit Cable Core & Screen Lugs Fixings EPS0077 (scm)	185mm ² Al triplex 0104466 & 2429959	Bushing insulation supplied with padmount not with termination kit
12.	0104288	Feeder cables - Transformer bushing connection - padmounted substation (no HV Switchgear) includes cable termination, connection kit, cable screen lugs c/w bolts nuts and washers. Also Feeder cables - Magnefix MD Series switchgear includes cable termination, connection kit, cable screen lugs c/w bolts nuts and washers and cable support	TERMINATION & CONNECTION KIT 11kV 185mm ² Al Triplex (1C wound 3 in hand) XLPE Cable for 11kV Magnefix MD Series RMU & SFU. Inc Cable Term kit solv wipes Holec 502.0043 Connection Kit Cable (scm)	185mm ² Al triplex 0104466 & 2429959	
13.	2406988	Feeder cables - ABB SD Series Switchgear. Includes cable termination, bushing insulation, cable conductor bi-metal lugs (or Cu lugs for CU cable) c/w/bolts nuts and washers and cable screen lugs c/w bolts nuts and washers.	TERMINATION & CONNECTION KIT, 11kV, 185mm ² Al, Triplex (1C wound 3 in hand) XLPE Cable, for 11kV ABB SD Series RMU, Inc Cable Termination kit & Bushing Insulation, Cable Core & Screen Lugs	185mm ² Al triplex 0104466 & 2429959	

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Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Termination to Suit	Ellipse description	Cable description	Notes:
14.	0105034	Feeder cables ABB Safelink Switchgear includes cable termination, cable conductor bi-metal lugs (or Cu lugs for Cu cable) c/w bolts, nuts and washers, and cable screen lugs c/w bolts, nuts and washers	TERMINATION & CONNECTION KIT 11kV 185mm2 Al (1C wound 3 in hand) XLPE Insect Protected Cable IINo 0104465 for 11kV ABB Safelink RMU Including Cable Termination Kit Cable Core & Screen Lugs	185mm2 Al triplex with insect protection 0104465 DBT & 2429975 NJ	Bushing insulation supplied with padmount not with termination kit.
15.	0104492	Feeder cables - ABB SD Series Switchgear. Includes cable termination, bushing insulation, cable conductor bi-metal lugs (or Cu lugs for CU cable) c/w bolts nuts and washers and cable screen lugs c/w bolts nuts and washers.	TERMINATION & CONNECTION KIT, 11kV, 185mm2 Alu, Triplex (1C wound 3 in hand) XLPE Cable Insect Protected, for 11kV ABB SD Series RMU, Inc. Cable Term kit & Bushing Insulation, Cable Core & (scm)	185mm2 Al triplex with insect protection 0104465 DBT & 2429975 NJ	
16.	2435915	Feeder Cables - Areva FBX Switchgear. Includes cable termination elbows, shear bolt connectors c/w cable screen lugs, bolts nuts and washers	CONNECTOR ELBOW Set of 3, 630A, Bolted, suit 11kV 1 Core 185-300mm2 XLPE Cable, Shear Bolt Connectors, for Areva HV Switchgear (scm)	185mm2 Al triplex XLPE + 185mm2 Al triplex XLPE with insect protection 2429959 & 2429975 IP	
17.	0104491	Feeder cables - Magnefix MD Series switchgear includes cable termination, connection kit, cable screen lugs c/w bolts nuts and washers and cable support clamps. Also Feeder cables - Transformer bushing connection - padmounted substation (no HV Switchgear) includes cable termination, connection kit, cable screen lugs c/w bolts nuts and washers.	TERMINATION&CONNECTION KIT 11kV 185mm2 Al Triplex (1C wound 3 in hand) XLPE Cable Insect Protected, for 11kV Magnefix MD Series RMU, Inc Cable Term kit, Holec 502.0043 Connection Kit Cable	185mm2 Al triplex XLPE with insect protection. Provided with extra mastic to allow use with DBT or Nylon IP. 0104465 & 2429975	

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Termination to Suit	Ellipse description	Cable description	Notes:
18.	2434215	Feeder cables ABB Safelink Switchgear includes cable termination, cable conductor bi-meatal lugs (or Cu lugs for Cu cable) c/w bolts, nuts and washers, and cable screen lugs c/w bolts, nuts and washers	TERMINATION KIT,ELECTRICAL CABLE 11kV, 400mm2, Al, 3 x 1 Core Triplex, TR-XLPE Cable (3 per Set) to suit Cable IIN2433811 for 11kV ABB SafeLink RMU incl Cable Termination Kit, Cable Core &	400mm2 Al Triplex 2433811	
19.	2434199	Feeder cables ABB Safelink Switchgear includes cable termination, cable conductor bi-meatal lugs c/w bolts, nuts and washers, and cable screen lugs c/w bolts, nuts and washers	TERMINATION KIT,ELECTRICAL CABLE 11kV, 400mm2, Al, 3 x 1 Core Triplex, TR-XLPE Cable, Insect Protected (3 per Set) to suit Cable IIN2433829 for 11kV ABB SafeLink RMU incl Cable Termination	400mm2 Al Triplex with insect protection 2433829	
20.	2435923	Feeder Cables - Areva FBX Switchgear. Includes cable termination elbows, shear bolt connectors c/w cable screen lugs, bolts nuts and washers	CONNECTOR ELBOW Set of 3, 630A, Bolted, suit 11kV 1 Core 400mm2 XLPE Cable, Compression Type Connectors, for Areva HV Switchgear (scm)	400mm2 Al triplex + 400mm2 Al triplex with insect protection 2433811 & 2433829 IP	
21.	0104318	Feeder cables - Transformer bushing connection - padmounted substation (no HV Switchgear) includes cable termination, connection kit, cable screen lugs c/w bolts nuts and washers.	TERMINATION&CONNECTION KIT 11kV 240mm2 Cu Triplex (1C wound 3 in hand) XLPE Cable Insect Protected, connect to 11kV Bushings of P/mounted Sub, Inc Cable Term kit, Holec 502.0065/3 Kit Cable	240mm2 Cu Triplex XLPE with insect protection. Provided with extra mastic to allow use with DBT or Nylon IP. 2429983 NJ, 2417756, 0104464 DBT	
22.	0105035	Feeder cables ABB Safelink Switchgear includes cable termination, cable conductor , Cu lugs for Cu cable c/w bolts, nuts and washers, and cable screen lugs c/w bolts, nuts and washers	TERMINATION & CONNECTION KIT 11kV 240mm2 Cu 1C XLPE Insect Protected Cable IINo 0104464 for 11kV ABB SafeLink RMU Including Cable Termination Kit Cable Core & Screen Lugs Fixings EPS0078 (scm)	240mm2 Cu Triplex XLPE with insect protection 0104464 DBT, 2429983 NJ	

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Termination to Suit	Ellipse description	Cable description	Notes:
23.	0104281	Feeder cables - ABB SD Series Switchgear. Includes cable termination, bushing insulation, cable conductor bi-metal lugs (or Cu lugs for CU cable) c/w bolts nuts and washers and cable screen lugs c/w bolts nuts and washers.	TERMINATION & CONNECTION KIT 11kV 240mm2 Cu Triplex (1 C wound 3 in hand) XLPE Cable Insect Protected for 11kV ABB SD Series RMU, Inc Cable Termination kit & Bushing Insulation, Cable Core & (scm)	11kV 240mm2 Cu Triplex (1 C wound 3 in hand) XLPE Cable Insect Protected. This kit has a "special" 240mm lug which has a longer palm. 0104464 DBT, 2429983 NJ	This kit has a "special" 240mm lug which has a longer palm.
24.	0105008	Feeder cables ABB Safelink Switchgear includes cable termination, cable conductor, Cu lugs c/w bolts, nuts and washers, and cable screen lugs c/w/ bolts, nuts and washers	TERMINATION & CONNECTION KIT 11kV 400mm2 Cu 1C XLPE Insect Protected Cable IINo 0104732 for 11kV ABB SafeLink RMU Including Cable Termination Kit & Bushing Insulation Cable Core & Screen	400mm2 Cu 1 core XLPE Insect protected 0104732 & 2433811	Contains accessories to suit Nylon Jacket insect protection and semiconductive oversheath.
6.35 / 11kV Outdoor Terminations					
25.	2430130	Outdoor Termination includes cable termination, cable conductor bi-metal lugs, cable screen lugs	TERMINATION KIT OUTDOOR 11kV, 35mm2, Al, Triplex (1C wound 3 in hand) TR-XLPE Cable, Inc Cable Term Kit Solvent Wipes, Cable Core & Screen Lugs, Spec EPS0025 (scm)	35mm2 Al triplex 2429942	
26.	2430148	Outdoor Termination includes cable termination, cable conductor bi-metal lugs, cable screen lugs	TERMINATION KIT OUTDOOR 11kV, 35mm2, Al, Triplex (1C wound 3 in hand) TR-XLPE Cable, Insect Protected, Inc Cable Term Kit Solvent Wipes, Cable Core & Screen Lugs, Spec EPS0035 (scm)	35mm2 Al triplex with insect protection 2429967	
27.	2406990	Outdoor Termination includes cable termination, cable conductor bi-metal lugs, cable screen lugs	TERMINATION KIT OUTDOOR 11kV 185mm2 Al Triplex (1 C wound 3 in hand) XLPE Cable. Including Cable Termination kit solvent wipes Cable Core Lugs Cable Screen Lug, Ergon Purchasing Spec. (scm)	185mm2 Al triplex XLPE 2429959	

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Termination to Suit	Ellipse description	Cable description	Notes:
28.	2429876	Outdoor Termination includes cable termination, cable conductor bi-metal lugs, cable screen lugs	TERMINATION KIT OUTDOOR 11kV, 185mm ² , Al, Triplex (1C wound 3 in hand) TR-XLPE Cable, Insect Protected, Inc Cable Term Kit Solvent Wipes, Cable Core & Screen Lugs, Spec EPS0036 (scm)	185mm ² Al triplex XLPE with insect protection 2429975	
29.	2434207	Outdoor Termination includes cable termination, cable conductor bi-metal lugs, cable screen lugs	TERMINATION KIT,ELECTRICAL CABLE Outdoor, 11kV, 400mm ² , Al, 3 x 1 Core Triplex, TR-XLPE Cable (3 per Set) c/w Cable Term Kit Solvent Wipes, Cable Core & Screen Lugs, For cable 2433811 (scm)	400mm ² Al Triplex XLPE 2433811	
30.	2434181	Outdoor Termination includes cable termination, cable conductor bi-metal lugs, cable screen lugs	TERMINATION KIT,ELECTRICAL CABLE Outdoor, 11kV, 400mm ² , Al, 3 x 1 Core Triplex, TR-XLPE Cable, Insect Protected (3 per Set) c/w Cable Term Kit Solvent Wipes, Cable Core & Screen Lugs	400mm ² Al Triplex XLPE with insect protection 2433829	
31.	0104283	Outdoor Termination includes cable termination, cable conductor lugs, Cu lugs for Cu cable, cable screen lugs	TERMINATION KIT,ELECTRICAL CABLE Outdoor, 11kV, 240mm ² Cu Triplex, 1 C wound 3 in hand, XLPE Cable Insect Protected c/w Cable Term Kit Solvent Wipes, Cable Core Lugs, Cable Screen lugs	11kV 240mm ² Cu Triplex (1 C wound 3 in hand) XLPE Cable Insect Protected. Provided with extra mastic to allow use with DBT or Nylon IP. 0104464 DBT, 2429983 NJ	
32.	0105009	Outdoor Termination includes cable termination, cable conductor Cu lugs, cable screen lugs	TERMINATION KIT,ELECTRICAL CABLE Outdoor, 11kV, 400mm ² Cu, 1 Core, XLPE Insect Protected c/w Cable Term Kit Cable Core & Screen Lugs, EPS0055, suit Cable 104732 (scm)	400mm ² Cu 1 core XLPE Insect protected 0104732 NJ, 2429918 NJ	
12.7 / 22kV Indoor Terminations (Connector Elbows & Deadbreak Elbow Kits)					
33.	0136053	Feeder Cable - Transformer bushing connection - padmounted substation (no HV Switchgear) 200A Deadbreak elbow	CONNECTOR ELBOW 200A, to suit QESI 22kV 35mm ² Al, 3 x 1C XLPE Cable (Single Elbow Kit Only) Transformer & RMU Terminations, Elastimold 156LR-F-220 (scm)	35mm ² AL Triplex XLPE with insect protection (DBT) 0104467, 2429991 NJ	

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Termination to Suit	Ellipse description	Cable description	Notes:
34.	0104404	Feeder cables - F&G/Ormazabal switchgear connection. 630A Deadbreak bolted elbow connector assembly.	CONNECTOR ELBOW Set of 3, 630A, Bolted, suit 22kV 1 Core 35mm ² Al, XLPE Cable, Insect Protected Cable Double Brass Tape, F & G Type CB (scm)	35mm ² AL Triplex XLPE with insect protection (DBT) 0104467	
35.	2404218		CONNECTOR ELBOW 400A to suit 185mm ² Cable (Single Elbow) Elastimold K400LRG-HB-185km-12-1	185mm ² AL Triplex XLPE with Laminated Aluminium Tape (LAT) 0104470, 2429934	
36.	2430221		CONNECTOR ELBOW Set of 3, 630A, Bolted, suit 22kV 1 Core 185mm ² Al XLPE Cable, Sudkabel (scm)	185mm ² AL Triplex XLPE with Laminated Aluminium Tape (LAT) 0104470, 2429934	
37.	2404223	Feeder Cable - Transformer bushing connection - padmounted substation (no HV Switchgear) 200A Deadbreak elbow	CONNECTOR ELBOW 200A Deadbreak, to suit 22kV 185mm ² Al 1C XLPE Cable, Transformer Termination Lug suit 95mm ² Conductor (Single Elbow Kit Only) Elastimold 156LR-J-260 (scm)	185mm ² AL Triplex XLPE with Laminated Aluminium Tape (LAT). Earthing of LAT is not required. 0104471, 2429934	Earthing of LAT is not required.
38.	2430221	Feeder cables - F&G/Ormazabal switchgear connection. 630A Deadbreak bolted elbow connector assembly.	CONNECTOR ELBOW Set of 3, 630A, Bolted, suit 22kV 1 Core 185mm ² Al XLPE Cable, Sudkabel (scm)	185mm ² AL Triplex XLPE with Laminated Aluminium Tape (LAT). Earthing of LAT is not required. 0104471, 2429934	Earthing of LAT is not required.
39.	0104463	Feeder cables - F&G/Ormazabal switchgear connection. 630A Deadbreak bolted elbow connector assembly.	CONNECTOR ELBOW Set of 3, 630A, Bolted, suit 22kV 1C 630mm ² Al XLPE Cable, F & G Type AST20/630, w/o Metal Housing Code No. 31 573 63 (scm)	630mm ² AL Triplex XLPE with Laminated Aluminium Tape (LAT). Earthing of LAT is not required. 0104469 & 2429926	Earthing of LAT is not required.
12.7 / 22kV Outdoor Terminations					

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Termination to Suit	Ellipse description	Cable description	Notes:
40.	2429884	Outdoor termination. Includes cable termination, cable conductor, bi-metal lugs, cable screen lug	TERMINATION KIT OUTDOOR 22kV, 35mm2, Al, Triplex (1C wound 3 in hand) TR-XLPE Cable, Insect Protected, Inc Cable Term Kit Solvent Wipes, Cable Core & Screen Lugs, Spec EPS0005 (scm)	35mm2 Al Triplex XLPE with insect protection. 2429991	
41.	0104285	Outdoor termination. Includes cable termination, cable conductor, bi-metal lugs, cable screen lug	TERMINATION KIT,ELECTRICAL CABLE Outdoor, 22kV, 185mm2 Al Triplex 1C Cable wound 3 in hand, XLPE Cable c/w Cable Term Kit Solvent Wipes, Cable Core Lugs, Cable Screen Lug (scm)	185mm2 AL Triplex XLPE with Laminated Aluminium Tape (LAT). Earthing of LAT is not required. 0104470, 2429934	Earthing of LAT is not required.
42.	0104477	Outdoor termination. Includes cable termination, cable conductor, bi-metal lugs, cable screen lug	TERMINATION KIT,ELECTRICAL CABLE Outdoor, 22kV, 630mm2, Al, 1 Core Cable XLPE Cable c/w Cable Termination Kit Solvent Wipes, Cable Core Lugs, Cable Screen Lug, EPS 0037 (scm)	630mm2 AL Triplex XLPE with Laminated Aluminium Tape (LAT). Earthing of LAT is not required. 0104469 & 2429926	Earthing of LAT is not required.
19.1 / 33kV Outdoor Terminations					
43.	2434140	Outdoor termination. Includes cable termination, cable conductor, bi-metal lugs, cable screen lug	TERMINATION KIT,ELECTRICAL CABLE Outdoor, 19.1/33kV, 50mm2, Al, 1 Core, TR-XLPE Cable, Insect Protected (3 per Set) c/w Cable Term Kit Solvent Wipes, Cable Core & Screen Lugs,	50mm2 Al 1 core 2423655	
44.	2434165	Outdoor termination. Includes cable termination, cable conductor, bi-metal lugs, cable screen lug	TERMINATION KIT,ELECTRICAL CABLE Outdoor, 19.1/33kV, 300mm2, Al, 1 Core, TR-XLPE Cable, Insect Protected, (3 per Set) c/w Cable Term Kit Solvent Wipes, Cable Core & Screen Lugs,	300mm2 Al 1 core 2424984	

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Annex B. Cable Joints

Normative

Item	Stock code	Joint to Suit	Ellipse description	Cable Description	Notes:
0.6/1kV Joint – Straight Joints					
45.	0104266	Underground straight joint includes cable joint kit, links.	JOINT ELECTRICAL CABLE UNDERGROUND LV, 240mm ² Al 4 Core Sector XLPE Cable Insect Protected c/w Cable Joint Kit, Cable Links, EE Purchase Spec. EPS0011 (scm)	240mm ² Al 4 core XLPE with insect protection. 2400272	
46.	0104268	Underground straight joint includes cable joint kit, links.	JOINT ELECTRICAL CABLE UNDERGROUND LV, 240mm ² Al 4 Core Sector XLPE Cable, c/w Cable Joint Kit, Cable Links, EE Purchase Spec. EPS0009 (scm)	240mm ² Al 4 core XLPE 1634155	
47.	0104308	Underground straight joint includes cable joint kit, links.	JOINT ELECTRICAL CABLE UNDERGROUND LV, 16mm ² Stranded Cu 4 Core XLPE Cable, c/w Cable Joint kit Cable Crimp Links Suit 6.3mm A/F Hex Dies Kit, Include Solvent Wipes, Installation Instructions	16mm ² Cu 4 core XLPE 1632489	
48.	0104307	Underground straight joint includes cable joint kit, links.	JOINT ELECTRICAL CABLE UNDERGROUND LV, 16mm ² Cu 4 Core Sector XLPE Cable Insect Protected c/w Cable Joint Kit, Cable Links, EE Purchase Spec. EPS0030 (scm)	16mm ² Cu 4 core XLPE with insect protection 2400273	
49.			50mm cable		
6.35/11kV Joints					

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Joint to Suit	Ellipse description	Cable Description	Notes:
50.	2451060		JOINT,ELECTRICAL POWER CABLE 11kV, 35mm ² Al Triplex, 1C wound 3 in hand, XLPE Cable c/w Cable Joint Kit Solvent Wipes, Mechanical Cable Connectors, Cable Screen Links (scm)	35mm ² AL Triplex XLPE 2429942, 0104468	
51.	2451078		JOINT,ELECTRICAL POWER CABLE 11kV, 35mm ² Al Triplex, 1C wound 3 in hand, XLPE Cable, Insect Protected c/w Cable Joint Kit Solvent Wipes, Mechanical Cable Connectors, Cable Screen Links	35mm ² AL Triplex XLPE with insect protection 2429967, 0104467	
52.	2451045		JOINT,ELECTRICAL POWER CABLE 11kV, 185mm ² Al Triplex, 1C wound 3 in hand, XLPE Cable c/w Cable Joint Kit Solvent Wipes, Connectors, Cable Screen Links, EPS 0015	185mm ² Al triplex XLPE 2429959, 0104466	
53.	2451052		JOINT,ELECTRICAL POWER CABLE 11kV, 185mm ² Al Triplex, 1C wound 3 in hand, XLPE Cable, Insect Protected c/w Cable Joint Kit Solvent Wipes, Connectors, Cable Screen Links	185mm ² Al triplex XLPE with insect protection 2429975, 0104465	
54.	2434108		JOINT ELECTRICAL CABLE UNDERGROUND 11kV, 400mm ² Al, 3 x 1 Core Triplex, TR-XLPE Cable (3 per Set)c/w Cable Joint Kit Solvent Wipes, Cable Links, Cable Screen Links, suit cable 2433811 (scm)	400mm ² Al triplex 2433811	
55.	2434090		JOINT ELECTRICAL CABLE UNDERGROUND 11kV, 400mm ² Al, 3 x 1 Core Triplex, TR-XLPE Cable, Insect Protected (3 per Set) c/w Cable Joint Kit Solvent Wipes, Cable Links, Cable Screen Links,	400mm ² Al triplex with insect protection 2433829	

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Joint to Suit	Ellipse description	Cable Description	Notes:
56.	0104270		JOINT ELECTRICAL CABLE UNDERGROUND 11kV, 240mm ² Cu Triplex 1 C wound 3 in hand XLPE Cable Insect Protected c/w Cable Joint kit solvent wipes Cable Links Cable Screen Links (scm)	11kV 240mm ² Cu Triplex (1 C wound 3 in hand) XLPE Cable Insect Protected. Provided with extra mastic to allow use with DBT or Nylon IP. 0104464 DBT, 2429983 NJ	
57.	2451086		JOINT, ELECTRICAL POWER CABLE 11kV, 400mm ² Cu, 1C, XLPE, Insect Protected (Set of 3), Cable Joint Kit 400mm ² Cu, Connectors, EPS 0080 (scm)	400mm ² Cu 1 Core XLPE insect protected 2429918, 0104372	
12.7 / 22kV Joint					
58.	2404219		JOINT, ELECTRICAL POWER CABLE 22kV, 35mm ² Al Triplex, 1C wound 3 in hand, XLPE Cable, Insect Protected c/w Cable Joint Kit Solvent Wipes, Mechanical Cable Connectors, Cable Screen Links	35mm ² Al triplex XLPE with insect protection 2429991	
59.	2404220		JOINT, ELECTRICAL POWER CABLE 22kV, 185mm ² Al Triplex, 1C wound 3 in hand, XLPE Cable c/w Cable Joint Kit Solvent Wipes, Mechanical Cable Connectors, Cable Screen Links (scm)	185mm ² Al triplex XLPE 2429934	
60.	2404221		JOINT, ELECTRICAL POWER CABLE 22kV, 630mm ² Al Triplex, 1C, XLPE Cable, Insect Protected c/w Cable Joint Kit Solvent Wipes, Mechanical Cable Connectors, Cable Screen Links (scm)	630mm ² Al 1 core XLPE 2429926	
61.	2426120	Transition joint 185mm ² Paper lead to 185mm ² XLPE	JOINT KIT 3M, Cold Shrink, Transition Joint, T/S 1C, 22kV, 185SQMM, PLY/XLPE	185mm Paper lead to 185mm 22kV XLPE cable joint	Transition Joint
19.1/33kV Joints					

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Item	Stock code	Joint to Suit	Ellipse description	Cable Description	Notes:
62.	2434074		JOINT ELECTRICAL CABLE UNDERGROUND 19.1/33kV, 50mm ² Al, 1 Core, TR-XLPE Cable, Insect Protected (3 per Set) c/w Cable Joint Kit Solvent Wipes, Cable Links, Cable Screen Links,	50mm ² Al 1 core insect protected 2423655	
63.	2434082		JOINT ELECTRICAL CABLE UNDERGROUND 19.1/33kV, 300mm ² Al, 1 Core, TR-XLPE Cable, Insect Protected (3 per Set) c/w Cable Joint Kit Solvent Wipes, Cable Links, Cable Screen Links,	300mm ² Al 1 core insect protected 2424984	

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Annex C. Cable Cross Section Drawings

C.1 33kV Cables



33kV 2424984.pdf



33kV 2423655.pdf

C.2 22kV Cables



22kV 2429934.pdf



22kV 2429926.pdf



22kV 0104471 -
XLNA18TB003.pdf



22kV 2429991.pdf

C.3 11kV Cables



11kV 2433829.pdf



11kV 2433811.pdf



11kV 2429983 -
Midland Metals 2010v



11kV 2429975.pdf



11kV 2429967.pdf



11kV 2429959.pdf



11kV 2429942.pdf



11kV 2429918.pdf



11kV 0104467 -
XJNA18TB003.pdf



11kV 0104465 -
XJNA25TB003.pdf



11kV 0104464 -
XJNP26TB003.pdf



11kV 240mm² Cu
3core IP.pdf

C.4 LV Cables



LV 1632489.pdf



LV 2410371.pdf



LV 2400273.pdf



LV 2400272.pdf



LV 2400271 -
XDDS23AA004CXAA.



LV 2400260.pdf



LV 1634155.pdf

Specification for Cable Accessories, Termination and Jointing Materials for Underground Electrical Power Cables For Nominal System Voltage Up to 33kV



Annex D. Cable Termination Constructions

D.1 33kV Cable Termination



33kV Cable
Termination Construc

D.2 22kV Cable Termination



22kV Cable
Termination Construc

D.3 11kV Cable Termination



11kV Cable
Termination Construc