



TITLE:
SPECIFICATION FOR HEAT SHRINKABLE CABLE TERMINATIONS AND JOINTING KITS
Part 1: 11kV and 33 kV Kits

Doc. No.	KP1/6C.1/13/TSP/05/026-1
Issue No.	3
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ANNEX A: *Guaranteed Technical Particulars (to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test certificates and type test reports for tender evaluation, all in English Language)*

ANNEX B: **List of expected material quantities in each kit**

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FOREWORD

This specification has been prepared by the Standards Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for Heat Shrinkable 11kV & 33kV Cable Terminations and Jointing Kits. It is intended for use by KPLC in purchasing the product.

The offered product shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous operation, in a manner acceptable to KPLC who will interpret the meaning of the drawings and specifications and shall have the power to reject any work or materials, which in their judgment, are not in full compliance with the specifications.

The manufacturer shall submit information which confirms satisfactory service experience with products which fall within the scope of this specification.

1. SCOPE

- 1.1. This specification covers the general technical requirements of design, manufacture, testing and performance of heat shrinkable cable termination and jointing kits for use on paper insulated lead covered (PILC) and cross linked polyvinyl (XLPE) insulated steel/aluminium wire armoured cables for use on a.c.systems of voltages of up to 36,000 V 50Hz. It also covers termination and jointing kits for submarine cables (XLPE insulated, metal sheathed cables) and aerial bundled cables.
- 1.2. This specification covers the following termination and jointing kits:
 - a) **Indoor and outdoor terminations of heat shrink design; and**
 - b) **Straight Joints and transition joints of heat shrink design for use underground or in air.**
- 1.3. The specification stipulates the minimum requirements for cable jointing kits & end termination kits for under-ground cable using heat shrinkable in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the cables for The Kenya Power & Lighting Company.

The specification does not purport to include all the necessary provisions of a contract.

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2. REFERENCES

The following documents were referred to during the preparation of this specification; in case of conflict the requirements of this specification take precedence.

- ISO 9001: Quality systems - Model for quality assurance in design/development, production, installation and servicing.
- IEC 60502-4: Test requirements on accessories for cables with rated voltages from 6 kV (Um = 7.2 kV) up to 30 kV (Um = 36 kV)
- IEC 61442: Electric cables – test methods for accessories for power cables with rated voltages from 6 kV (Um=7.2 kV) up to 30 kV (Um=36 kV)
- IEC 60055-1: Paper-Insulated Metal-Sheathed Cables for Rated Voltages Up To 18/30 kV (With Copper or Aluminium Conductors and Excluding Gas-Pressure and Oil-Filled Cables) – Part 1: Tests on cables and their accessories
- IEC 61238-1: Compression and mechanical connectors for power cables for rated voltages up to 30 kV (Um = 36 kV) - Part 1: Test methods and requirements
- IEC 60093: Methods of test for insulating materials for electrical purposes; volume resistivity and surface resistivity of solid electrical insulating materials
- IEC 60250: Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including metre wavelengths
- IEC 60270: High-voltage test techniques – Partial discharge measurements
- IEC 60060-1&2: High-voltage test techniques –Part 1: General definitions and test requirements -- Part2: Measuring Systems
- HD 629.1 S2: Test requirements on accessories for use on power cables of rated voltages from 3.6/6(7.2) kV up to 20.8/36 (42) kV
- HD 631.3 S1: Electric cables - Accessories - Material characterisation
 Part 3: Fingerprinting for heat shrinkable components for medium voltage applications from 3.6/6(7.2) kV up to 20.8/36(42) kV
- ASTM 2303-97: Tracking and Erosion Resistance Test (step voltage test method)
- BS 6622: Electric cables. Armoured cables with thermosetting insulation for rated voltages from 3.8/6.6 kV to 19/33 kV. Requirements and test method
- ENA TS 09-13: Performance specification for high voltage heat shrinkable components for use with high voltage solid type cables up to and including 33,000 Volts.

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3. DEFINITIONS

For the purpose of this specification the definitions given in the reference standards and the following shall apply:

XLPE: Cross – Linked Polyethylene
AL (Al): Aluminium
S/C: Single Core
I/D: Indoor
P-X: Paper to XLPE Transition
PILC: Paper Insulated Lead Covered

SWA: Steel Wire Armoured
CU (Cu): Copper
O/D: Outdoor
H/S: Heat Shrink
3/C (3c): Three Core

4. REQUIREMENTS

4.1. Service conditions and System Parameters

4.1.1. Service Conditions

The accessories shall be suitable for continuous operation indoors and outdoors in tropical areas:

- At altitudes of up to 2200m above sea level and humidity of up to 95%,
- Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C, in direct sunlight,
- Heavy saline conditions along the coast and
- Isokeraunic levels of up to 180 thunderstorm days per year.

4.1.2. System Parameters

Nominal Operation Voltage	33kV	11kV
System Highest Voltage	36kV	12kV
Frequency	50 Hz.	50 Hz.
Number of phases	3	3
Type of earthing	Non-effect-earthed system	Effectively earthed system
Symmetrical fault level	25 kA (900MVA)	13.1 kA (157MVA)

4.1.3. Assembled components forming part of a supply system shall perform without distress under the following conditions.

- Normal conditions: Continuous operation at a conductor temperature of 90°C for XLPE insulated cables. Continuous operation at a conductor temperature of 70°C for paper insulated cables.

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- (ii) Fault conditions: Operation at a conductor and screen temperature of 250°C for XLPE. Operation at a peak transient conductor/metal sheath temperature of 160°C and 250°C respectively for PILC.

4.2. DESIGN AND CONSTRUCTION

4.2.1. General

Components specified shall be suitable for cables manufactured to the standards referred to in Clause 2.0 above, and to the sizes referred to in the Schedule of Prices. Components shall not be adversely affected in any manner by contact with other materials normally used in the construction of cable joints and terminations, and shall not increase the rate of corrosion of any metal with which they may come into contact. The cable descriptions based on KPLC specifications namely: KP1/3CB/TSP/05/027, KP1/3CB/TSP/05/024, KP1/3CB/TSP/05/023, KP1/3CB/TSP/05/007, KP1/3CB/TSP/05/008 and KP1/6C.1/13/TSP/05/006-1 amongst others and summarized as follows:

a) XLPE Cables

- (i) Three core cables with circular, stranded, copper or aluminum conductors with triple extruded conductor screen, insulation and insulation screen of which conductor and insulation screen are of semi-conducting materials and insulation is of dry vulcanized cross linked polyethylene, all the individual cores laid up with non-hygroscopic fillers, individual metallic screens of copper tape, armoured with a single layer of galvanized steel wires and overall PVC/PE sheathed suitable for 6350/11000 V & 19000/33000 V volts working voltage, manufactured generally in accordance with IEC 60502 and/or BS 6622 .
- (ii) Single core cables with circular, stranded, copper or aluminum conductors with triple extruded conductor screen, insulation and insulation screen of which conductor and insulation screen are of semi-conducting materials and insulation is of dry vulcanized cross linked polyethylene, metallic screen of copper tape or a concentric layer of wires or both, armoured with a single layer of aluminum wires and overall PVC/PE sheathed suitable for 6350/11000 & 19000/33000 volts working voltage, manufactured generally in accordance with IEC 60502 and/or BS 6622 ..

b) PILC Cables

Three core cables with compact sectoral stranded copper or aluminum conductors with carbon black impregnated semi-conducting paper tapes conductor shield, insulation of paper, of 100% high quality sulphate – processed wood pulp paper tapes and insulation shielding of copper tapes intercalated with carbon black semi-conducting paper tapes over

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individual insulation. A binder of semi-conducting tapes (20 mil maximum), paper tapes (20 mil maximum) or copper tapes intercalated with paper tapes; armoured with a single layer of galvanized steel wires, pure lead sheath and polyvinyl chloride (PVC) outer jacket in accordance with IEC 60055-1.

4.2.2. Design

Adequate consideration shall be given in the design of terminations, straight through joints and transition joints in respect of the following (Documentary evidence shall be furnished along with the tender).

- (a) Adequate stress relief at the screen cut back in case of screened cables (11kV XLPE S/C, & 33kV PILC) and in the crutch region in case of belted cables.
- (b) Reinstatement of primary insulation with a co-extruded bonded screen to the primary insulation (for joints).
- (c) Prevention of corrosion and sealing against ingress of moisture.
- (d) Provision of excellent electrical earth continuity across the straight through joints.
- (e) Non tracking, erosion and weather resistant performance for termination.
- (f) Proper earthing of screen/armour at the termination.
- (g) Lugs/Mechanical connectors with shear bolts to be suitable for proper connection of conductors as detailed in clause 4.2.1.
- (h) Compatibility of component materials.
- (i) Ensuring that proper clearances are maintained between cores and between each core and earthed parts.
- (j) Toxicity of compound.
- (k) Adequate shelf life (minimum 2 years).

4.2.3. Ability to withstand load & Short circuit conditions

The ability to withstand electrical and mechanical stress that occur under normal, emergency and short circuit conditions, in the cable joints and the terminations shall not be less than that of the cable and as per Table 1.

4.2.4. Electrical Stress Relief

- 4.2.4.1. Electrical Stress Control for the cable insulation screen in terminations and joints shall be achieved by means of a heat shrinkable tubing having a defined impedance characteristic, volume resistivity and dielectric constant stable over time, in spite of variation in electrical stress, and changes in temperature, when measured in accordance with IEC 60093, IEC 60250 and Table 1.

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- 4.2.4.2. Electrical Stress relief shall be adequate enough so as to withstand voltages at twice the rated phase voltage to earth which shall be proved by partial discharge testing in accordance with IEC 60270 and Table 1.
- 4.2.4.3. Partial Discharge measured at twice the rated voltage shall be less than 20pC. The materials shall withstand the maximum permissible overload temperature of the cable concerned, thermal ageing and stress variations.
- 4.2.4.4. The bidder shall submit test data on the effects of temperature variation and thermal ageing on the impedance of the stress control tubing.
- 4.2.4.5. In addition to the heat shrinkable stress control tubing some form of stress relief material shall be provided which shall fill up voids and force air out of critical regions in the screen cutback area to prevent discharge.
- 4.2.4.6. In case of joints and terminations of belted cables (viz. PILC) the Crutch region shall be completely filled with a stress relieving high permittivity oil resistant material to ensure discharge free operation during service

4.2.5. Reinstatement of Primary Insulation (Joints)

- 4.2.5.1. A systematic buildup of insulation shall be provided to reinstate the primary insulation. This shall be by means of a heat shrinkable tube made from a discharge resistant polymer.
- 4.2.5.2. To ensure a completely discharge free interface between the insulation & screen, the insulation and screen shall be reinstated using a single Triple Extruded Elastomeric screened insulating tubing. The recovered thickness of the insulation shall be at least 1.2 times the cable insulation thickness.
- 4.2.5.3. The recovery force of the tube shall be such that it eliminates the need for application of any grease over the cable insulation which is likely to attract dust or dirt and must be avoided. (the evidence of this should be established by way of a type test report)
- 4.2.5.4. The metallic shield continuity over the joint core shall be reinstated by means of a fine mesh of tinned copper.

4.2.6. Mechanical strength, armour continuity and sealing (Joints)

- 4.2.6.1. In case of straight through joints, steps shall be taken to restore the mechanical strength over the joints.

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- 4.2.6.2. The material used shall be of stainless steel and the design shall be of light weight, impact resistant and capable of wrapping around over the complete length of the joint.
- 4.2.6.3. Heat shrinkable sleeves and filling materials to provide outer sealing against ingress of moisture and corrosion shall be provided and included in the kits for joints and terminations.

4.3. TYPES OF JOINTS AND TERMINATION

- 4.3.1. The Termination Kits and Jointing Kits for the following shall be complete with all necessary components required for a complete Joint or a complete Termination as indicated in the Annex B - General Information (Kit Content).
 - (a) Indoor cable terminations suitable for XLPE and PILCSWA U.G. Cable
 - (b) Outdoor cable terminations suitable for XLPE and PILCSWA U.G. Cables.
 - (c) Straight through joints suitable for XLPE and PILCSWA Cables.
 - (d) In-line Transition Joints suitable for joining PILCSWA to XLPE Insulated U.G. Cables.
- 4.3.2. The components in contact with impregnating oil in the paper insulated cables shall be of oil resisting material.
- 4.3.3. In the case of Straight Through Joints and Transition Joints they shall include mechanical connectors with shear head bolts of removable type, suitable for the cables and conforming to the requirements of IEC 61238-1 (Class A).
- 4.3.4. The completed Straight Through Joints and In-line Transition Joints shall be designed to be used directly buried in ground and in water logged conditions. These joints enclosures shall have sufficient space which permit crossed core jointing.
- 4.3.5. Terminations shall have a minimum core length (trifurcation of cable to lug) as follows.
 - a) Indoor 12kV terminations : 450 mm
 - b) Indoor 36kV terminations : 650 mm
 - c) Outdoor 12kV terminations : 800 mm
 - d) Outdoor 36kV terminations : 1200 mm

4.4. BASIC COMPONENTS

4.4.1. General

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4.4.1.1. All components and materials used in the cable jointing kits and terminations shall conform to the relevant IEC 60502-4, HD 629.1 S2, ASTM 2303-97, ENA TS 09-13 and associated standards as per clause 2.0.

4.4.1.2. The components shall be compatible with solid dielectric cable insulation and with each other and shall be non-toxic. (Documentary evidence certifying non-toxicity shall be furnished during tender).

4.4.2. Heat Shrinkable Tubing & Moulded Parts

4.4.2.1. The term "Heat Shrinkable" refers to extruded or moulded polymeric material which are cross linked to develop elastic memory and supplied in an expanded or otherwise deformed size and shape.

4.4.2.2. Subsequent heating in an unconstrained state to a temperature above the shrink temperature results in the material recovering or shrinking to its original shape.

4.4.2.3. All heat shrinkable polymeric tubing exposed to direct sunlight shall be ultra violet stable, non-tracking and suitable for operation in the presence of severe external contamination and environmental pollution.

4.4.2.4. Materials offered shall have good electrical and environmental performance and comply with requirements of IEC 60502-4, all the associated standards and Table 1.

4.4.3. Tubing Components

4.4.3.1. Internal Insulation Tubing

Heat Shrinkable flexible polymeric tubing, having suitable thickness, dielectric strength elongation, tensile strength, high permittivity etc., for use in internal construction of cable joints and terminations at installations where it is not be exposed to day light.

4.4.3.2. Stress Control Tubing

Heat Shrinkable flexible polymeric tubing possessing properties to provide electric stress control over the insulated cores in cable joints and terminations installations where it will not be exposed to day light.

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4.4.3.3. Anti-track Tubing (Indoor/Outdoor Termination)

- 4.4.3.3.1. A heat Shrinkable flexible polymeric tubing, easily distinguishable by colour from non-anti-track material, preferably coloured red, possessing anti-track and erosion resistance properties for use as an external covering of insulated cores in cable joints and termination at indoor and outdoor installations.
- 4.4.3.3.2. The anti-track tubing for terminations at its ends shall have adequate anti-track adhesive coating applied internally so as to provide sufficient bonding in order to prevent the ingress of moisture.
- 4.4.3.3.3. The Anti-track Tubing shall conform to the requirements of List 2 of ENA TS 09-13.
- 4.4.3.3.4. The anti-track tubing shall also pass the Xenon Arc Lamp Weather Ohm Meter Test as given below:
 - a) The material shall have a percentage elongation to break in excess of 100%, after 15,000 hours of 24 hours cycling.
 - b) Each 24 hour cycling consisting of
 - (i) 9 periods of 102 minutes of UV light followed by 18 minutes of light plus water spray i.e. 18 hours.
 - (ii) 6 hours in the dark only.

NOTE: *The test reports shall be submitted with the bid for evaluation.*

4.4.3.4. External Protective Tubing

A heat shrinkable flexible polymeric tubing, preferably coloured black, for protecting exposed metallic sheaths and sheath/earth connections on cable joints and terminations at indoor and outdoor installations.

4.4.4. Moulded Components

4.4.4.1. Glove (Indoor/Outdoor Terminations)

- 4.4.4.1.1. A heat shrinkable flexible polymeric permanently coloured black, possessing electrical conducting properties, for sealing a prepared crutch in cable joints and terminations at indoor and outdoor installations.
- 4.4.4.1.2. The Glove shall be pre-coated with a sealant adhesive so as to seal effectively onto the cable sheath.
- 4.4.4.1.3. The glove (breakout) shall conform to the requirements of List 2 of ENA TS 09-13.

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4.4.4.2. Anti-track Weather Sheds (Indoor/Outdoor Terminations)

- 4.4.4.2.1. A heat shrinkable flexible polymeric moulding easily distinguishable from non-anti-track material preferably red in colour, possessing anti-track and erosion resistant properties, for application over prepared cable cores.
- 4.4.4.2.2. The shrinkable part of the sheds shall be internally coated with an anti-track adhesive so as to provide sufficient bonding in order to prevent the ingress of moisture.
- 4.4.4.2.3. The total creepage distance shall not be less than 372 mm and 1116 mm for 12 kV and 36 kV respectively
- 4.4.4.2.4. The Anti-Track Weather sheds shall conform to the requirements of List 2 of ENA TS 09-13.

4.4.4.3. Anti-track Lug Sealing End Boots - (Indoor Terminations)

A heat shrinkable flexible polymeric shaped moulding possessing anti-track and erosion resistant properties, for sealing onto the cable lugs of the terminations.

4.4.5. Sealants

- 4.4.5.1. Wherever required, sealant shall be used in conjunction with heat-shrinkable components to effect seals in joints and terminations, and shall be able to accommodate the creep or relaxations that may occur with recovered heat shrink materials.
- 4.4.5.2. The sealant shall have adhesive properties to maintain hermetic or oil seals between components at all time when used on polymeric or paper insulated cables respectively.
- 4.4.5.3. The 12kV, and 36kV Sealants shall be anti-tracking and shall conform to the requirements of List 3 of ENA TS 09-13.

4.4.6. Mechanical and corrosion protection inner/outer sleeve

- 4.4.6.1. The mechanical strength over the straight through joint shall be provided by a wraparound joint casing in order to prevent damage at the joint.
- 4.4.6.2. It shall be of light weight by design and made out of galvanized steel in order to be impact resistive and to provide earth fault current capacity.

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4.4.6.3. The metallic parts shall be protected against corrosion by heat shrinkable sleeve internally and fully with adhesive so as to prevent the ingress of moisture.

4.4.7. Cable Lugs and Mechanical connectors

All Cable Sockets (Lugs) and Mechanical connectors shall be suitable for use with the cable types referred to in the Schedule of Prices.

- (a) For 11kV and 33kV Cable Terminations, the lugs shall be of high conductivity tinned copper and shall be suitable for hexagonal compression type crimping.
- (b) For 11kV and 33kV Cable Joints, the mechanical connectors (tested in accordance with IEC 61238-1 (Class A)) shall be of high conductivity copper with tinned aluminum shear head bolts (minimum tin thickness of 100µm).
- (c) Bi-metallic mechanical connectors supplied for Al/Cu connection shall conform to the relevant standard and suitable for aluminium/copper cables referred to in the schedule of prices.
- (d) Bi-metallic lugs (Al/Cu connection) shall be of friction welded single part fitting, conform to the relevant standard, and suitable for aluminium cables referred to in the schedule of prices.

4.4.8. Conductivity of Lead Sheath and earthing

- 4.4.8.1. This shall be achieved by the use of a Roll Spring Wrapping over the lead sheath and Tinned Copper braid of adequate length and shall withstand the short circuit current at the symmetrical fault level stipulated under system parameters clause 4.1.2
- 4.4.8.2. The tinned copper braid used for earthing the Lead Sheath or Copper Tape Shield of a Cable Termination shall be solder blocked against ingress of moisture and shall be pre-terminated at one end with a lug.
- 4.4.8.3. The continuity of lead sheath across the PILC joints shall be made by means of a single tinned copper braid of suitable length and cross section.

4.5. PERFORMANCE REQUIREMENTS FOR TERMINATIONS AND JOINTS

The performance parameters of the cable terminations and joints be tested as per the sequence of Table 1. The test methods shall be as per the relevant standards in clause 2.0.

Table 1: Performance Requirements for Terminations and Joints as per IEC 61442, IEC 60502-4 and ENA TS 09-13

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Sr. No.	Test Sequence		Test Voltage (Phase to ground)		Required Result	
			U _o /U _l /U _m			
	Voltage designation		U _o /U _l /U _m			
1	Nominal Voltage - phase to phase		6.35/11/12 kV	19.1/33/36kV		
2	Impact Test - 4kg. wedge dropped 6 times from 2m (armoured cable joints only)		-	-	No functional damage	
3	AC or D.C Voltage withstand for 5min at 4.5U _o		28 kV	85 kV	No breakdown / No flashover	
4	Partial Discharge (XLPE Cable only) for 10s – 2U _o slowly reducing to 1.73U _o at ambient temperature of 20°C±15°C		12.5kV	38kV	≤10pC	
5	Impulse Voltage Withstand 10 positive and 10 negative 1.2/50µs between conductor and grounded screen.		95 kV	200 kV	No breakdown / No flashover	
6	Thermal cycles in air –three cycles at θ _t and 2.5U _o		16 kV	48 kV	No breakdown No flashover	
7	Partial Discharge (XLPE cables only) at θ _t and at ambient temperature of 20°C±15°C for 2U _o		12.5 kV	38kV	≤10pC	
8	Thermal cycles	Terminations – 30cycles at θ _t and 2.5U _o	In air	12.5 kV	38kV	No visible signs of damage
		Joints – 60 cycles at θ _t and 2.5U _o	In water			
9	Partial Discharge (XLPE cables only) at θ _t and at ambient temperature of 20°C±15°C for 2U _o		12.5 kV	38kV	≤10pC	
10	Thermal short circuit (screen) – Two (2) short circuits at I _{sc} of the cable screen -		-	-	No visible deterioration	
11	Thermal short circuit (screen) – Two (2) short circuits to raise conductor to θ _{sc} of the cable – 250°C		-	-	No visible deterioration	
12	Dynamic Short Circuit- One (1) short circuit at I _d		63 kA	63 kA	No visible deterioration	
13	Impulse Voltage Withstand 10 positive and 10 negative 1.2/50µs between conductor and grounded screen.		95 kV	200 kV	No breakdown / No flashover	
14	AC Voltage withstand for 15min at 2.5U _o		16 kV	48 kV	No breakdown / No flashover	
15	Humidity tests (only for outdoor terminations – 300h) at 1.25U _o		7.5 kV	22.5 kV	No breakdown / No flashover	
16	Salt fog test (only for outdoor terminations) Concentration: 224kg/m ³ - 1,000h at 1.25U _o		7.5 kV	22.5 kV	No flashover	

NOTE: θ_t is the maximum cable conductor temperature in normal operation +5 K to 10 K.

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Part 1: 11kV and 33 kV Kits

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4.6. QUALITY MANAGEMENT SYSTEM

- 4.6.1. The bidder shall submit a quality assurance plan (QAP) that will be used to ensure that the cable joints and terminations design, material, workmanship, tests, service capability, maintenance and documentation, will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.
- 4.6.2. The Manufacturer's Declaration of Conformity to reference standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2008 certificate shall be submitted with the tender for evaluation.
- 4.6.3. The bidder shall indicate the delivery time of the cable joints and terminations, manufacturer's monthly & annual production capacity and experience in the production of the type and size of conductor being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar rating of cable joints and terminations sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation.

5. TESTS AND INSPECTION

- 5.1. The cable joints and terminations shall be inspected and tested in accordance with IEC 6052-4, IEC 61442, IEC 60055-1, IEC 61238-1, IEC 60093, IEC 60250, IEC 60270, IEC 60112, HD 631.3 S1, ASTM 2302-97 and the requirements of this specification. It shall be the responsibility of the supplier to perform or to have performed all the tests specified.
- 5.2. Copies of previous Test Reports confirming full conformity to clause 4.0 requirements for the cable issued by a **third party testing laboratory that is accredited to ISO/IEC 17025** shall be submitted with the tender for the purpose of technical evaluation. The accreditation certificate for the third party testing laboratory shall also be submitted with the tender (all in English Language).
- 5.3. Type Test Reports for the cable joints and terminations to be supplied under the contract shall be submitted to The Kenya Power & Lighting Company for approval before shipment/delivery and shall include the following:
- A. Material Tests:**
- The following tests shall be performed to verify the quality of material requirements. The tests shall be carried out in the manner specified in ENA TS 09-13, Parts 3 and 4 and shall satisfy the requirements stated therein:
- a) Tests for Tubing and Moulded Components**
- (i) Corrosion Resistance
 - (ii) Density

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- (iii) Dimensions
- (iv) Electric strength
- (v) Flame Retardance
- (vi) Fungus resistance
- (vii) Heat Shock
- (viii) Low Temperature Flexibility
- (ix) Relative permittivity
- (x) Secant Modulus
- (xi) Solvent Resistance
- (xii) Tensile strength and ultimate elongation
- (xiii) Thermal Ageing
- (xiv) Tracking Resisting
- (xv) Visual Examination
- (xvi) Volume Resisting
- (xvii) Water Absorption
- (xviii) Water Vapour Permeability
- (xix) Weather Resistance

b) Tests for Sealants

- (i) Corrosion Resistance
- (ii) Electric strength
- (iii) Flow at elevated temperature
- (iv) Internal pressure sealing ability
- (v) Low temperature flexibility
- (vi) Peel strength
- (vii) Solvent Resistance

B. Electrical Performance Tests

The following tests shall be carried out to check the electrical performance of the components in the sequence specified in Table 1:

- a) A.C. Voltage withstand -for indoor termination as per IEC 60060-1 & 2 and IEC 61442 clause 4 or 5
- b) Partial discharge -for screened cables as per IEC 60270, IEC 60885-2 and IEC 61442, clause 7
- c) Impulse voltage withstand as per IEC 61442 clause 6 and IEC 60230
- d) Thermal cycles as per IEC 61442, clause 9
- e) Thermal short circuit as per IEC 61442 clause 11
- f) D.C. Voltage withstand as per IEC 60060-1
- g) Humidity -for termination as per IEC 61442 clause 13
- h) Dynamic short circuit as per IEC 61442 clause 12
- i) Salt fog -Outdoor termination as per IEC 60507 and IEC 61442 clause 13

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- 5.4. The cable joints and terminations shall be subject to acceptance tests at the manufactures' works before dispatch. Acceptance tests (routine & sample tests) will be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC).
- 5.5. Routine and sample test reports for the cable joints and terminations to be supplied shall be submitted to KPLC for approval before shipment of the goods. Tests to be witnessed by KPLC Engineers at the factory before shipment shall include all the tests in clause as routine tests by the respective test standards and the following:
- a) Density to be tested as per ISO/R 1183 Method A
 - b) Tensile Strength to be tested as per ISO 37
 - c) Ultimate Elongation to be tested as per ISO 37
 - d) Low Temperature Flexibility to be tested as per ASTM D 2671 Procedure C
 - e) Thermal Endurance to be tested as per IEC 60216
 - f) Electric Strength to be tested as per IEC 60243
 - g) Di-electric Constant to be tested as per IEC 60250
 - h) Volume Resistivity to be tested as per IEC 60093
- 5.6. Upon delivery of the cable joints and terminations, KPLC will inspect them and may perform or have performed any of the relevant tests in order to verify compliance with the specification. The supplier shall replace/rectify without extra or additional charge to KPLC, cable joints and terminations which upon examination, test or use fail to meet any of the requirements in the specification.

6.0. MARKING AND PACKING

6.1 Marking

The following shall be marked on all heat shrinkable tubing and moulded parts;

- a) Name of original manufacturer
- b) Part number of item
- c) Manufacturing batch number (for traceability).
- d) Standard of manufacture and Year of Manufacture for identification purpose.
- e) The letters, "Property of KPLC"

6.2 Packing

- 6.2.1 For the purposes of identification, gloves shall be marked clearly and permanently in a prominent position with the supplier's name and reference number.

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- 6.2.2 Electrically conducting components shall be marked "Conducting clearly and permanently".
- 6.2.3 Components shall normally be supplied in a package as a complete joint or termination which shall be clearly marked with the supplier's name, reference number, batch references, voltage, application and cable size. In addition, KPLC part numbers as indicated in the bill of quantity shall be marked on the package.
- 6.2.4 Packaging shall be designed to protect against ingress of moisture and mechanical damage. Components supplied with adhesive coatings shall have means to prevent the coated surfaces from adhering to each other. The complete heat shrinkable components, required to complete in all respects one termination shall be supplied in a kit form; one joint to be supplied in kit form surfaces from adhering to each other.

6.3 Storage

- 6.3.1 Component shall be capable of being stored without deterioration within the temperature range -1°C to $+40^{\circ}\text{C}$ for a minimum period of 2 years.
- 6.3.2 Components of materials if subject to a shelf life limitation, shall have the final date of use prominently and permanently shown on all packaging. However, shelf life of any of these components shall not be less than 2 years in local ambient conditions (tropical humidity)

7.0. DOCUMENTATION

- 7.1. The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:
- Guaranteed Technical Particulars fully filled and signed by the manufacturer;
 - Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
 - Sales records and customer reference letters;
 - Details of manufacturing capacity and the manufacturer's experience;
 - Detailed documentary evidence in support of conformity of various materials and components to specified standards. The information shall include the following.
 - Step by step instruction procedures supported with illustrated drawings.
 - List of materials indicating quantities in each kit (as indicated in Annex B). Names of the manufacturers whose components are included in the kits shall be indicated.
 - Time required for carrying out a complete joint or termination.
 - Performance Test Certificates as per the test sequence referred below. Names of the manufacturers whose components were in the joints/terminations which were tested must be submitted.

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(v) Type approval and quality assurance test certificates for sealants shall accompany the Tender.

(vi) Natural weathering data on the materials offered.

(vii) Accelerated weathering test certificates on the materials offered.

- f) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025; This test performance for the materials shall include the parameters in Table 1 and any deviation shall analytically be justified:
- Relative humidity
 - Temperature variation
 - Contaminant concentration
 - Programme of 24 hour cycle describing UV exposure; light and water spray and darkness
 - Per year equivalence of weather ohm meter hours

The test certificates shall include the graphical illustrations of variations of elongation and electrical strength with ageing.

- Total creepage distance and protected creepage distance provided in the termination.
- Minimum tail lengths for indoor and outdoor terminations

g) Type Test Certificate of the following test shall also be submitted with the tender:

- Power Frequency Withstand Voltage test - As per IEC 60060
- Impulse Withstand Voltage test - As per IEC 60060
- Partial discharge test - As per IEC 60270
- Tracking and Erosion resistance test - As per ASTM D2303
- Load cycle test - As per IEC 60230

NOTE: For straight through joints, load cycle tests with the cable joint submerged in water, shall also be included.

- Thermal short circuit test - As per IEC 60230
- Humidity withstand test - As per IEC 60466

(vi) Impact Test

A wedge shaped weight of 4 (four) kg shall be dropped from a minimum height of one meter and shall be followed by 48 (forty eight) hours of immersion in water at a pressure of 0.05 Mpa.

- Quality Control/Assurance Standards: Bidders shall submit evidence of approval of their manufacturing operation against ISO 9001 standard.
- Copy of accreditation certificate to ISO/IEC 17025 for the testing laboratory.
- Manufacturer's warranty and guarantee
- Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2008/ KEBS Diamond mark certificate and other technical documents required in the tender.

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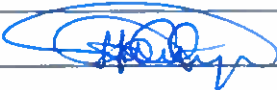

l) **Manufacturers who have not previously supplied the joints and terminations to KPLC shall submit a list of electrical utilities which are using the quoted joints and terminations.**

7.2. The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

- a) Guaranteed Technical Particulars,
- b) Design Drawings and construction details of the cable joints and terminations,
- c) Quality assurance plan (QAP) that will be used to ensure that the cable design, material, workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008
- d) Detailed test program to be used during factory testing,
- e) Marking details and method to be used in marking the cable joints and terminations,
- f) Manufacturer's undertaking to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the cable joints and terminations for The Kenya Power & Lighting Company
- g) Packaging details (including packaging materials).

7.3. The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the cable joints and terminations to KPLC stores.

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ANNEX A: Guaranteed Technical Particulars (to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records, four customer reference letters, the manufacturer's experience and copies of complete type test reports for tender evaluation, all in English Language)

Tender No.

Clause number	KPLC requirement		Bidder's offer
Manufacturer's Name and address			specify
Country of Manufacture			specify
Bidder's Name and address			specify
Type designation of cable jointing kit/ termination kit			specify
Operating voltage Uo/U			specify
1.	Scope		specify
1.1-1.2			
2.	Applicable Standards		specify
3.	Terms & Definitions		specify
4.	REQUIREMENTS		specify
4.1.1	Service Conditions		specify
4.1.2	System parameters	Nominal operation voltage	Specify
		System highest voltage	Specify
		Frequency	Specify
		Number of phases	Specify
		Type of earthing	Specify
		Symmetrical fault level	specify
4.1.3	Normal conditions	Continuous operation at 90°C XLPE	specify
		temperature 70°C PILC	Specify
	Fault conditions	Operation at a conductor and screen temperature of 250°C for XLPE	Specify
		Operation at peak transient temperature for PILC	Conductor 160°C metal sheath 250°C
4.2	DESIGN AND CONSTRUCTION		Provide
4.2.1	Our scope XLPE cables three core and single core		Specify
	PILC cables		Specify
4.2.2	Design with consideration of below		Provide
	Adequate stress relief at screen cut back/crutch region for screened cables/belted cables respectively		Specify
	Reinstatement of primary insulation with a co-extruded bonded screen to the primary insulation		Specify

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Clause number	KPLC requirement		Bidder's offer
	Prevention of corrosion and sealing against ingress of moisture		Specify
	Provision of excellent electrical earth continuity across the straight through joints		Specify
	Non tracking, erosion and weather resistant performance for termination		Specify
	Proper earthing of screen/armour at the termination		Specify
	Lugs/mechanical connectors with shear bolts to be suitable for proper connection of conductors detailed in clause 4.2.1		Specify
	Compatibility of component materials		Specify
	Ensuring that proper clearances are maintained between cores and between each core and earthed parts		Specify
	Toxicity of compound		Specify
	Adequate shelf life		Specify
4.2.3	Ability to withstand load and short circuit conditions		Specify
4.2.4	Electrical stress relief		Provide
4.2.4.1	Achieved by heat shrinkable tubing	Impedance characteristic	Specify
		Volume resistivity	Specify
		Dielectric constant, and its stability under stress	Specify
4.2.4.2	Can withstand twice rated voltage		Specify
4.2.4.3	Partial discharge at twice rated voltage less than 20pC		Specify
	Materials shall withstand maximum permissible overload temperature, thermal ageing and stress variations		Provide test data
4.2.4.5	Besides heat shrinkable stress control, specify other stress relief material provided		Specify
4.2.4.6	For PILC high permittivity oil resistant stress relief material provided		Specify
4.2.5	Reinstatement of primary insulations (joints)		Specify
	Type of insulation provided		Specify
	Recovered thickness shall be at least 1.2 times cable insulation thickness		Specify
	The recovery force of the tube shall eliminate need of application of any grease over the cable insulation likely to attract dust		Specify
	Metallic shield material of manufacture		Specify
4.2.6	Mechanical strength, armour continuity and sealing (joints)		Provide
	Mechanical strength restored		Specify
	Material for restoration of mechanical strength		Specify
	Heat shrinkable sleeves and filling material provided		Specify
4.3	TYPES OF JOINTS AND TERMINATIONS		Specify
4.3.1	Indoor cable terminations for XLPE and PILCSWA U.G cable		Specify
	Outdoor cable terminations for XLPE and PILCSWA U.G cables		Specify
	Straight through joint for XLPE and PILCSWA cables		Specify

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Clause number	KPLC requirement	Bidder's offer
	In-line transition joints for joining PILCSWA to XLPE U.G cables	Specify
4.3.2	For PILC oil resisting material provided	Specify
4.3.3	For straight through and transition joints, mechanical connectors with shear head bolts of removable type provided	Specify
4.3.4	Straight through joints and transition joints suitable for burying in ground and water logged areas	Specify
	Have sufficient space to permit crossed core jointing	Specify
4.3.5	Indoor 12kv terminations core length	Specify
	Indoor 36kv terminations core length	Specify
	Outdoor 12kv terminations core length	Specify
	Outdoor 36kv terminations core length	Specify
4.4	BASIC COMPONENTS	Provide
4.4.1	Follows standards	Provide proof
	Non- toxic	Provide proof
	Compatible to dielectric cable insulation and to each other	Provide proof
4.4.2	All heat shrinkable material shall can recover original state on heating in unconstrained state at temperature above shrink temperatures	Specify /proof
	Ultra Violet stable and non- tracking	Specify
	Good for severe external contamination and environmental pollution	Specify
	Materials offered with good electrical and environmental performance	Provide proof
4.4.3	Tubing components	
Internal insulation tubing	Heat shrinkable flexible polymeric tubing	Specify
	Thickness	Specify
	Dielectric strength	Specify
	Elongation	Specify
	Tensile strength	Specify
	High permittivity	Specify
Stress control tubing	Heat shrinkable flexible polymeric tubing	Specify
	Provides electric stress control over the insulated cores in joints and terminations	Specify
Anti-track tubing	Heat shrinkable flexible polymeric tubing	Specify
	Easily distinguishable by colour from anti track material (RED)	Specify
	Has anti-track and erosion resistance properties	Specify
	Anti-track tubing with adequate anti-track adhesive coating internally	Specify
	Shall pass the xenon arc lamp weather ohm meter test	Provide test report
External protective	Heat shrinkable flexible polymeric tubing	Specify
	Colour	Specify

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Clause number	KPLC requirement		Bidder's offer
	tubing	Protects exposed metallic sheaths	specify
4.4.4	Moulded components		Provide
4.4.4.1	Glove(indoor/outdoor terminations)	Heat shrinkable flexible polymeric colour black	
		State its electrical conducting properties	Specify
		Pre coated with sealant adhesive	Specify
4.4.4.2	Anti-track weather sheds	Heat shrinkable flexible polymeric moulding	Specify
		Easily distinguishable by colour from anti track material (RED)	Specify
		Has anti-track and erosion resistance properties	Specify
		Shrinkable parts of sheds internally coated with anti-track adhesive	Specify
		Creepage distance and voltage	Specify
4.4.4.3	Anti-track lug sealing end boots	Heat shrinkable flexible polymeric shaped moulding	Specify
		Has anti-track and erosion resistance properties	Specify
4.4.5	Sealants		Specify
	Adequate provided to work with heat-shrinkable components		Specify
	Can accommodate creep or relaxations of heat shrink materials		Specify
	Shall have adhesive properties		Specify
	Shall be anti-tracking		Provide test report
4.4.6	Mechanical and corrosion protection sleeve		
	Wrap around joint casing provided		Specify
	Light weight		Specify
	Material of manufacture of joint casing		Specify
	Impact resistive		Specify
	Can provide earth fault current capacity		Specify
	Heat shrinkable sleeve to prevent corrosion of metallic parts provided		Specify
4.4.7	Cable lugs and mechanical connectors		Provide
	For 11kV and 33kV Cable Terminations, the lugs shall be of high conductivity tinned copper and shall be suitable for hexagonal compression type crimping.		Specify
	For 11kV and 33kV Cable Joints, the mechanical connectors shall be of high conductivity copper with tinned aluminum shear head bolts (minimum tin thickness of 100µm).		Specify
	Bi-metallic mechanical connectors supplied for Al/Cu connection shall conform to the relevant standard and suitable for aluminium/copper cables referred to in the schedule of prices.		Specify

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	Bi-metallic lugs (Al/Cu connection) shall be of friction welded single part fitting, conform to the relevant standard, and suitable for aluminium cables referred to in the schedule of prices.	Specify
4.4.8	Conductivity of lead sheath and earthing	Provide
	Achieved by roll spring wrapping over the lead sheath and tinned copper braid	specify
	Shall withstand short circuit current at symmetrical fault level	Specify
	Tinned copper braid or copper tape shield shall be solder blocked against moisture ingress. Pre terminated at one end with a lug	Specify
	Continuity of PILC joints by means of a single tinned copper braid	Specify its length and cross section
4.5	PERFORMANCE REQUIREMENTS FOR TERMINATIONS AND JOINTS; TABLE 1	
	Nominal voltage- phase to phase	
	Impact test- 4kg. wedge dropped 6 times from 2m (armoured cable joints only)	
	AC or DC voltage withstand for 5 min at 4.5U ₀	
	Partial discharge (XLPE cables only)	
	Impulse Voltage with stand 10 positive and 10 negative 1,2/50uS between conductor and grounded screen	
	Thermal cycles	Terminations
		Joints
	Partial discharge (XLPE cables only)	
	Thermal cycles	Terminations
		Joints
	Partial discharge (XLPE cables only)	
	Thermal short circuit (screen)	
	Thermal short circuit (screen) - 250 ⁰	
	Dynamic short circuit	
	Impulse Voltage with stand 10 positive and 10 negative 1,2/50uS between conductor and grounded screen	
	Ac voltage withstand for 15min at 2.5U ₀	
	Humidity tests (only for outdoor terminations) – 300h at 1.25U ₀	
	800 uS/cm: 100hr spray rate 0.4L/m ³ /hr	
	Salt fog test (only for outdoor terminations) Concentration: 224kg/m ³ - 1,000h at 1.25U ₀	
4.6	Quality Management System	Provide
	Quality Assurance Plan	Provide
	Copy of ISO 9001:2008 Certificate	Provide
	Manufacturer's experience	Provide

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Clause number	KPLC requirement	Bidder's offer
	Manufacturing Capacity (units per month)	Provide
	List of previous customers	Provide
	Customer reference letters	Provide
5.1	Test standards and responsibility of carrying out tests	Provide
5.2	Copies of Type Test Reports submitted with tender	Provide
5.3	Acceptance tests to be witnessed by KPLC at factory before shipment	Provide
5.4	Test reports to be submitted by supplier to KPLC for approval before shipment	Provide
5.5	Replacement of rejected cables	Provide
6.1	Markings	Provide
6.2	Packing	Provide
7.1	Documents submitted with tender	Provide
7.2	Documents to be submitted by supplier to KPLC for approval before manufacture	Provide
8.0	Statement of compliance to specification	Provide

.....
Manufacturer's Name, Signature, Stamp and Date

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ANNEX B: LIST OF EXPECTED MATERIAL QUANTITIES IN EACH KIT

MV INDOOR OUTDOOR END TERMINATION KIT FOR 3-CORE CU/XLPE/SWA CABLE WITHOUT LUGS

Sr. No.	Description	Quantity	
		11KV	33KV
	Termination		
1.	Heat shrinkable high voltage track resistance tubing of size: 529mm for indoor and 900mm for outdoor	3	3
2.	Heat shrinkable stress control tubing	3	3
3.	Stress relieving Mastic tape	3	3
4.	Track resistant sealant tape	1	1
5.	Heat shrinkable cable breakout	1	1
6.	Heat shrinkable high voltage track resistant rain shed (outdoor)	6min	12min
	Armour earthing assembly		
7.	Heat shrinkable sealing sleeve	1	1
8.	Mastic Strip	1	1
9.	Clamping ring	1	1
10.	Insulated copper conductor	1	1
	Solderless earth connection		
11.	Rolling spring	1	1
12.	Copper conductor with water block	1	1
13.	Abrasive stripe	1	1
14.	Cleaning tissue	1	1
15.	Installation instruction	1	1

MV INDOOR/OUTDOOR END TERMINATION KIT FOR 3-CORE, BELTED CU/PILC/SWA CABLE WITHOUT LUGS

Sr. No.	Description	Quantity	
		11KV	33KV
	Termination		
1.	Heat Shrinkable High Voltage Track Resistant Tubing of Size : 520 mm for Indoor and 900 mm for Outdoor	3	3
2.	Heat Shrinkable Stress Control Tubing	3	3
3.	Heat Shrinkable Stress Clear Insulating Tubing	3	3
4.	Stress Relieving Mastic Tape	3	3
5.	Track Resistant Sealant Tape	7	7
6.	Heat Activated High Flow Sealant Tape	1	1
7.	Heat Shrinkable Cable Breakout	1	1
8.	Heat Shrinkable High Voltage Track Resistant Rain Shed (Outdoor)	3	3
9.	Heat Shrinkable High Voltage Track Resistant 3-way skirt (Outdoor)	1	1

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Sr. No.	Description	Quantity	
		11KV	33KV
	Termination		
10	Stress Control Moulded Wedge	1	1
Armour Earthing Assembly			
11	Heat Shrinkable Sealing Sleeve	1	1
12	Mastic Strip	1	1
13	Clamping Ring	1	1
14	Insulated Copper Conductor with Connector	1	1
Solderless earth connection			
15.	Heat Shrinkable Sealing Sleeve	1	1
16.	Mastic Strip	1	1
17.	Copper Shield	1	1
18.	Rolling Spring	1	1
19.	Copper Conductor with water block	1	1
20.	Abrasive Strip	2	2
21.	Cleaning Tissue	7	7
22.	Installation instruction	1	1

11 kV STRAIGHT THROUGH JOINT FOR 3 CORE, CU/XLPE/SWA CABLE

Sr. No.	Description	Quantity
1.	Heat Shrinkable black/red dual wall co-extruded conductor/insulating tubing	3
2.	Heat Shrinkable Red Insulating	3
3.	Heat Shrinkable Stress Controlling Tubing	3
4.	Heat Shrinkable outer Jacket Tubing	3
5.	Stress Relieving Mastic Tape	6
6	Bottle of Conductive ink	1
7	Silicon Grease	3
8	Copper mechanical connector with shear head Bolts	3
9	Tinned Copper Mesh	3
10	Wrapround Armour joint Case	1
11	Armour Supporting	2
12	Armour Clamp	4
13	Textile Tape	1
	Armour Earthing Connection	
14	Rolling Spring	6
15	Abrasive Strip	1
16	. Cleaning Tissue	7
17.	Installation instruction	1

33 kV STRAIGHT THROUGH JOINT FOR 3 CORE, CU/XLPE/SWA CABLE

Sr. No.	Description	Quantity
1.	Heat Shrinkable black/red dual wall co-extruded conductor/insulating tubing	3
2.	Heat Shrinkable Red Insulating	3
3.	Heat Shrinkable Stress Controlling Tubing	3

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Sr. No.	Description	Quantity
4.	Heat Shrinkable Wrapround outer Jacket Tubing	1
5.	Heat Shrinkable Cable Breakout	2
6.	Stress Relieving Mastic for Screen Cut- back	6
7	Stress Relieving Mastic for Mechanical connector	12
8	Track resistant Sealant Tape	6
9	Heat Activated Sealant Tape	4
10	Copper mechanical connector with shear head bolts	3
11	Tinned Copper Mesh	6
12	Galvanised Steel Mesh	1
13	Armour Support Ring	2
14	Armour Clamp	4
15	Textile Tape	1
16	Copper Binding Wire	2
17	Filler Tape	2
18	String	1
19	Insulation Tape	1
Soldered Earth Connection		
20	Rolling Spring	6
21	Abrasive Strip	1
22	Cleaning Tissue	13
23	Installation instruction	1

11 kV STRAIGHT THROUGH JOINT FOR 3-CORE, CU/PILC/SWA CABLE

Sr. No.	Description	Quantity
1.	Heat Shrinkable Transparent insulating Tubing for Short Length	3
2.	Heat Shrinkable Transparent insulating Tubing for Long Length	3
3.	Heat Shrinkable Red Insulating Tubing	3
4.	Heat Shrinkable Black/red, dual wall, co-extruded conducting/insulating tubing	1
5	Heat Shrinkable outer Jacket Tubing	2
6	Heat Activated Sealant	2
7	Stress Relieving mastic Tape	9
8	Track resistant sealant tape	2
9	Core Separator	1
10	Mastic profile	4
11	Oil Resistant moulded wedge	2
12	Copper mechanical connector with shear head bolts	3
13	Copper Braid	1
14	Galvanised Steel Mesh	1
15	Cable Grease	1
16	Abrasive Strip	1
17.	Cleaning Tissue	7
18.	Installation instruction	1

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33 kV STRAIGHT THROUGH JOINT FOR 3 CORE, CU/PILC/SWA CABLE

Sr. No.	Description	Quantity
1.	Heat Shrinkable black/red, dual wall, co-extruded conductor/insulating tubing	3
2.	Heat Shrinkable Red Insulating	3
3.	Heat Shrinkable Stress Controlling Tubing	3
4.	Heat Shrinkable Oil Barrier Tubing	9
5.	Heat Shrinkable conductive Tubing	5
6.	Heat Shrinkable Sealing Tubing	12
7.	Heat Shrinkable Wrapround Outer Jacket Sleeve	1
8.	Heat Shrinkable cable Breakout	2
9.	Heat Relieving Mastic Strip for Screen Cutback	9
10.	Stress Relieving Mastic Strip for Mechanical connector and Crutch Area	18
11.	Heat Activated sealant Tape	4
12.	Track resistant sealant tape	6
13.	Oil Resistant moulded wedge	4
14.	Copper mechanical connector with shear head bolts	3
15.	Tinned Copper mesh	6
16.	Copper Braid	2
17.	Roll Spring	4
18.	Galvanised Steel Mesh	1
19.	Cleaning Tissue	9
20.	Textile Tape	1
21.	String	2
22.	Insulation Tape	2
23.	Nylon Tape	1
24.	Abrasive Strip	1
25.	Cleaning Tissue	7
26.	Installation instruction	1

11 kV TRANSITION JOINT FOR 3-CORE, CU/PILC/SWA CABLE TO 3-CORE, CU/XLPE/SWA CABLE

Sr. No.	Description	Quantity
1	Heat Shrinkable Transparent insulating Tubing for Short Length	3
2	Heat Shrinkable Transparent insulating Tubing for Long Length	3
3	Heat Shrinkable Red Insulating Tubing	3
4	Heat Shrinkable black/red, dual wall, co-extruded conductive/insulating tubing	1
5	Heat Shrinkable outer Jacket Tubing	2
6	Heat Activated Sealant Tape	2
7	Stress Relieving mastic Tape	9
8	Track resistant sealant tape	2
9	Core Separator	1
10	Mastic profile	4
11	Oil Resistant moulded wedge	2
12	Copper mechanical connector with shear head bolts	3

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Sr. No.	Description	Quantity
13	Copper Braid	1
14	Galvanised Steel Mesh	1
15	Cable Grease Transition Module	1
16	Heat Shrinkable cable Breakout	1
17	Heat Shrinkable Tubing	3
18	Track resistant sealant tape	6
19	Stress Relieving Mastic Tape	3
20	Abrasive Strip	1
21	Cleaning Tissue	7
22	Installation instruction	1

33 kV TRANSITION JOINT FOR 3-CORE, CU/PILC/SWA CABLE TO 3-CORE CU/XLPE/SWA CABLE

Sr. No.	Description	Quantity
1	Heat Shrinkable black/red, dual wall, co-extruded conductor/insulating tubing	3
2	Heat Shrinkable Stress Controlling Tubing	3
3	Heat Shrinkable Oil Barrier Tubing	3
4	Heat Shrinkable conductive Tubing	3
5	Paper Cable Compression Sleeve	3
6	Heat Shrinkable Outer Jacket Tubing	3
7	Heat Shrinkable cable Breakout	1
8	Heat Relieving Mastic Strip for Screen Cutback	6
9	Stress Relieving Mastic for Mechanical connector and Crutch Area	9
10	Heat Activated sealant Tape	3
11	Oil Resistant moulded wedge	2
12	Copper mechanical connector with shear head bolts	3
13	Tinned Copper mesh	3
14	Roll Spring	4
15	Wraparound Armour Joint Case	1
16	Armour Support Ring	2
17	Armour Clamp	4
18	Textile Tape	1
19	String	1
20	Insulation Tape	1
21	Nylon Tape	1
22	Abrasive Strip	1
23	Cleaning Tissue	6
24	Installation instruction	1

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