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0.1 Circulation List

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2	Supply Chain Manager (Procurement)
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0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 2 Rev 0	2014-03-21	Cancels & replaces Issue 1 Rev 3 dated 2011-12-21	S. Kimitei	G. Owuor

FOREWORD

This specification has been prepared by the Research and Development Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for cable termination and jointing kits. It intended for use by KPLC in purchasing the items.

It shall be the responsibility of the supplier to ensure adequacy of the design and good engineering practice in the manufacture of the cable termination and jointing kits for KPLC. 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 is for cable termination and jointing kits for paper insulated lead covered cables and XLPE-insulated steel wire armoured cables for use on a.c. systems of voltages of up to 33,000V 50Hz. It also covers termination and jointing kits for submarine cables (XLPE insulated, metal sheathed cables) and aerial bundled cables.

Cable termination and jointing kits for 66kV cables are covered by specification number KP1/3CB/TSP/05/026-2.

1.2 This specification covers the following termination and jointing kits:

(i) Indoor and outdoor terminations of heat shrink and cold shrink design; and

(ii) Straight joints and transition joints of heat shrink and cold shrink design for use underground or in air.

Note: Range of cable terminations and joints used in KPLC appear in Annex B.

The specification stipulates the minimum requirements for cable accessories acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations in the manufacture of the cable accessories for The Kenya Power & Lighting Company Ltd.

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

2. REFERENCES

The following standards contain provisions which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) apply.

ESI 09-13: Performance specification for high voltage heat-shrinkable components for use with high voltage solid type cables up to and including 33000 volts.

NRS 053: Accessories for Medium Voltage Power Cables (3.8/6.6kV to 19/33 kV).

IEC 60502: Power cables with extruded insulation and their accessories.

IEC 61442: Test methods for accessories for power cables with rated voltages from 6kV (Um = 7.2kV) up to 30kV (Um = 36kV).

3. TERMS AND 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 XPLE Transition
PILC: Paper Insulated Lead Covered
4/C (4C): Four Core
SWA: Steel-Wire Armoured
CU (Cu): Copper
O/D: Outdoor
H/S: Heat Shrink
LV: Low Voltage
3/C (3C): Three Core
ABC: Aerial Bundled Cable

4. REQUIREMENTS

4.1 SERVICE CONDITIONS

The terminations and jointing materials shall be suitable for continuous operation indoor or outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 95%, average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C and heavy saline conditions along the coast. Outdoor terminations and jointing materials shall be exposed to direct sunlight.

4.2. MATERIAL AND CONSTRUCTION

4.2.1. The termination and jointing kits shall be designed and manufactured to IEC 61442 and shall be of heat or cold shrinkable material suitable for use in terminating and jointing PILC and XLPE cables having aluminium or copper stranded conductors.

4.2.2. The termination and jointing kits shall be complete with all components and materials necessary for terminating/jointing of specified cable type and size. The components and materials for each category of termination and jointing kits shall include the following items:

4.2.2.1 PILC JOINT (11kV & 33kV)

(i) Internal insulation tubing
(ii) Stress control tubing
(iii) Anti-track tubing
(iv) Moisture sealant
(v) Compression/mechanical connectors for appropriate size of cable
(vi) Suitable tubing to hold oil in place.
(vii) Resin that melts on heating and solidifies on cooling to remove voids from joint and keep away moisture ingress or resin that can be poured and solidifies on setting (clear oil barrier tubing).
(viii) Sufficient duty earth strip
(ix) Constant tension clips to connect the earth strip
(x) Cable breakout to separate the cores.

4.2.2.2 PILC TERMINATION (11kV & 33kV)

(i) Internal insulation tubing
(ii) Stress control tubing
(iii) Anti-track tubing
(iv) Moisture sealant
(v) Compression/mechanical/lugs for appropriate size of cable
(vi) Sufficient duty earth strip
(vii) Constant tension clips to connect earth strip
(viii) Insulating boots for indoor termination and shields to provide adequate creepage for outdoor termination -boots will be angle or straight to be specified on order.
(ix) Suitable tubing to hold the oil in place
(x) Cable breakout to separate the cores.

4.2.2.3 XLPE JOINT (11kV & 33kV)

(i) Internal insulation tubing
(ii) Stress control tubing
(iii) Anti track tubing

(iv) External protective tubing
(v) Compression/mechanical connectors for appropriate size of cable
(vi) Sufficient duty earth strip/wire gauze for earth continuity
(vii) Constant tension clips.

4.2.2.4 XLPE TERMINATION (11kV & 33kV)

(i) Insulation tubing
(ii) Stress control tubing
(iii) Anti track tubing
(iv) Moisture sealant
(v) Compression/mechanical lugs for appropriate size of cable
(vi) Sufficient duty earth strip
(vii) Constant tension clips for the earth connection
(viii) Insulating boots for indoor termination and shields to increase creepage for outdoor termination. Boots are either angle or straight depending on use
(ix) Cable break out to separate the cores.

4.2.2.5 TRANSITION JOINT PILC-XLPE (11kV & 33kV)

(i) Insulation tubing
(ii) Stress control tubing
(iii) Anti-track tubing
(iv) External protective tubing
(v) Moisture sealant
(vi) Compression/mechanical connectors for appropriate size of cable
(vii) Clear oil barrier tubing
(viii) Resin that melts to cover voids and deter moisture ingress
(ix) Sufficient duty earth strip
(x) Constant tension clips to connect earth
(xi) Cable breakout to separate cores.

4.2.2.6 LV CABLE JOINTS

(i) Internal insulation tubing
(ii) External protective tubing
(iii) Compression/mechanical connectors for appropriate size cable.

4.2.2.7 S/C ABC TERMINATION (11kV & 33kV)

These shall be single core XLPE cable heat shrink outdoor termination kits complete with lugs and the following:

(i) Insulating tubing
(ii) Stress control tubing
(iii) Anti track tubing
(iv) Moisture sealant

(v) Compression/mechanical lugs for appropriate size of cable
(vi) Insulating straight boots for outdoor termination and shields to increase creepage.

The terminations shall be suitable for ABC cable whose mechanical and electrical characteristics are shown in the table below

Table 1: Electrical and Mechanical Characteristics for 11kV ABC

Conductor size, mm^2	70	95	185
Diameter over conductor, nominal, mm	9.3-10.2	11.6	16.4
Thickness of dielectric Nominal, mm Minimum at a point, mm	 3.4 2.96	 3.4 2.96	 3.4 2.96
Diameter over insulation Nominal, mm	16.1-17.0	21.3	25.9
Diameter over semi-conducting core screen Nominal, mm	18.1-19	23.3	27.9
Thickness of copper tape Nominal, mm	0.15	0.15	0.15
Thickness of sheath Nominal, mm Minimum at a point, mm	 1.8 1.43	 1.8 1.43	 1.9 1.51
Catenary size, mm^2	50	50	70
Overall diameter of bundle, Nominal, mm	Cable supplier data	67.8	79.2
Nominal mass, kg/m	Cable supplier data	3.25	4.65

4.2.3. The termination and jointing components and materials shall be of the following minimum characteristics:

a) Internal Insulation Tubing

Flexible polymeric tubing for use in internal construction of cable terminations and joints. The tubing shall provide adequate insulation at rated voltage.

b) Stress Control Tubing

Flexible polymeric tubing possessing properties to provide electrical stress control over insulated cores in cable joints and terminations.

c) Anti-track Tubing

Flexible polymeric tubing possessing anti-track and erosion-resistant properties for use as external covering of insulated cores in cable joints and terminations.

d) External Protective Tubing

Flexible polymeric tubing for protecting exposed metallic sheaths and sheath/earth connections on cable joints and terminations.

4.2.4. The termination and jointing kits shall be designed and manufactured to ensure that all components and materials shall be weather-resistant and suitable for use in the atmospheric conditions stated in clause 4.1 and submarine cables where specified.

4.2.5. The termination and jointing kits shall be free from defects which would likely cause them to be unsatisfactory in service. The use of tapes to provide primary insulation, screening or stress control is not acceptable.

4.2.6. The components and materials shall be manufactured to ensure high moisture sealing capacity, resistance to fungal and insect attack, proper stress control and resistance to tracking when in service.

4.2.7. Cable Terminations

4.2.7.1 The specific creepage for indoor and outdoor terminations shall be at least 31mm/kV.

4.2.7.2 Cable termination tail lengths shall be as specified in Table 2 below.

Table 2: Tail lengths for three core and single core cable terminations

Rated Voltage Uo/U kV	Tail length (mm) for three core cable terminations		Tail length (mm) for single core cable terminations (indoor & outdoor)
	Indoor	Outdoor	
6.35/11	650	1000	350
19/33	900	1200	650

4.2.7.3 Other components shall be dimensioned such as to allow for core crossing in the screened section of the termination. The method of core crossing along with the minimum clearances shall be indicated in the termination instruction.

4.2.7.4 The design of the cable termination shall ensure that no part of the armour or lead sheath of the cable is exposed once the termination is completed.

4.2.7.5 Cable terminations shall be provided with a method of sealing the interface between the termination tail insulating tube and the lug barrel. The method used and application shall be clearly indicated in the termination instruction.

4.2.7.6 Single core cable terminations shall either be straight boot design or angle boot design. The design required shall be stated in the tender.

4.2.8. Cable Joints shall be of the filled type i.e.

a) Heat shrink type shall be provided with a core separator and filler mastics; and
b) Cold shrink, resin protected and slip-on type joints shall be resin filled.

5. TESTS AND INSPECTION

5.1. Type tests and routine tests shall be in accordance with IEC 61442, relevant parts of IEC 60502 and the requirements of this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified.

5.2. Copies of previous Type Tests Reports 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 to ISO/IEC 17025 for the same third party testing laboratory used shall also be submitted with the tender (all in English Language).

Copies of type test reports to be submitted with the tender for evaluation shall be as per IEC 61442 and shall include the following:

a) AC voltage test
b) DC voltage test
c) Impulse voltage test
d) Partial discharge test
e) Tests at elevated temperature
f) Heating cycle voltage tests
g) Thermal short circuit test (screen)
h) Thermal short circuit test (conductor)
i) Dynamic short circuit test
j) Humidity and salt fog tests
k) Impact test at ambient temperature
l) Screen resistance measurement

m) Screen leakage current measurement
n) Screen fault current initiation test

5.3. Routine test reports for the termination and jointing kits to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods.

KPLC Engineers (2) will witness routine tests and the following sample tests as per this specification and IEC 61442 at the factory before shipment:

a) Tests on components:

The characteristics of each component shall be verified in accordance with the specifications of the accessories manufacturer through tests. The manufacturer of a given accessory shall provide a list of the tests to be performed on each component, indicating the frequency of each test. The components shall be inspected against their drawings. There shall be no deviations outside the declared tolerances.

b) Tests on complete accessory:

Tests on complete accessory shall be in accordance with IEC 61442 and shall include the following:

(i) Partial discharge tests
- At ambient temperature
- At high temperatures;

(ii) AC and DC voltage tests
(iii) Impulse voltage test
(iv) Examination of the accessories before and after completion of the above tests.

The above tests in 5.3 shall be performed on one accessory of each type per contract. If the sample fails either of the above tests, two further samples of the same accessory type shall be taken from the contract and subjected to the same tests. If both additional samples pass the tests, the other accessories of the same type from the contract shall be regarded as having complied with the requirements of this specification. If either fails, this type of accessory of the contract shall be regarded as having failed to comply.

During acceptance testing, the manufacturer shall demonstrate that the accessories are mechanically and electrically fit for the cable size specified.

5.4. On receipt of the termination and jointing kits, KPLC may perform tests in order to verify compliance with specification.

The supplier shall replace without charge to KPLC, any termination and jointing kits, which upon examination, test or use fail to meet any of the requirements in this specification.

6. MARKING, LABELLING AND PACKAGING

6.1. All accessories shall be clearly and indelibly marked by the manufacturer to indicate the following:

a) The manufacturer's identification mark and reference/catalogue number (visible on the completed accessory).

b) The accessory range (visible on the accessory packaging)

c) The manufacturer's identification mark and a part number (visible on all components forming part of an accessory). This part number shall be referenced in the bill of materials. Components that are physically impossible to mark shall be individually packed and the packaging shall be marked.

d) The expiry date (visible on the packaging of all components or consumables that are subjected to a shelf life limitation). These components or consumables shall be individually packed.

6.2. Each accessory shall be packed in a strong cardboard container to protect it from mechanical damage. Individual parts shall be packed in strong sealed plastic bags to protect them from ingress of dirt and moisture. The cardboard container shall have:

a) Installation instructions indicating the tools required for each stage all in English Language.

b) All necessary components and consumables required to complete the installation as per the instructions, i.e. accessory components, cleaning kit and earthing kit as well as connectors. It shall not be left to the jointer to decide the quantity to use in each application.

c) A bill of materials referenced according to the component part numbers.

Packing shall be such as to permit easy identification of the components without their removal from the packaging.

6.3. The supplier shall indicate measures taken to ensure prudent management of material with limited shell life. These measures may include staggered delivery of such material.

6.4. The manufacturer shall provide a detailed safe procedure for decommissioning and disposal of the termination and jointing kits. This may include retrieval of decommissioned kits by the manufacturer from KPLC for safe disposal.

Note: The characters used in marking shall be at least 3mm high.

7. DOCUMENTATION

7.1. The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation.

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 filled and signed by the manufacturer,
b) Design manufacturer's drawings showing outline of joints, terminations and accessories together with all pertinent dimensions. Any variation in these dimensions due to manufacturing tolerances shall be indicated.
c) Catalog for all the components used. Catalog numbers for the offered items shall be high-lighted.
d) Construction and method of assembly of joints and terminations shall be clearly set out in illustrated installation instructions supplied at the time of tendering and included in every product kit during delivery. All documentation shall be in English Language.
e) Duly completed attached technical data schedule for each offered item.
f) Complete list of items contained in each joint and termination kit along with the price for each item of kit contents.
g) Quality Assurance Plan (QAP) that will be used to ensure that the 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.
h) Test Program to be used after manufacture
i) Marking details and method to be used in marking of the joints and terminations to ensure that the marking is permanent, legible and durable,
j) Supplier's undertaking to ensure adequacy of the design, good workmanship, good engineering practice and adherence to applicable standards in the manufacture of the joints and terminations kits for KPLC,

k) Packaging details (including packaging materials, total number of joints/terminations per packaging).

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 joints/terminations to KPLC stores.

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ANNEX A: SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR OFFERED CABLE ACCESSORIES

(to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, installation instructions, sales records, four customer reference letters, details of manufacturing capacity, the manufacturer's experience, copies of complete type test reports and accreditation certificate to ISO/IEC 17025 for the testing laboratory for tender evaluation, all in English Language)

TENDER NO..... BIDDER'S NAME & ADDRESS .....

Clause No.	Description	Bidder's offer
	Name and address of the Manufacturer	State
	Country of manufacture	State
	Manufacturer's Letter of Authorization	State
	Model/Type Reference No. of the offered cable accessories	State
	Manufacturer's warranty and guarantee for the offered cable accessories	State
1	Scope	State
2	Applicable Standards	State
3	Terms and Definitions	State
4	Requirements	State
4.1	Service Conditions	State
4.2	Materials and Construction	State
4.2.1	Type	State
4.2.2	The cable accessories shall be complete with all required components and materials	State
4.2.2.1	PILC Joint (11&33kV)	State
4.2.2.2	PILC Termination (11&33kV)	State
4.2.2.3	XLPE Joint (11&33kV)	State
4.2.2.4	XLPE Termination (11&33kV)	State
4.2.2.5	Transition Joint PILC-XLPE (11&33kV)	State
4.2.2.6	LV Cable Joints	State
4.2.2.7	S/C ABC Termination (11&33kV)	State
4.2.3	Characteristics of termination & jointing components	State
	a) Internal insulation tubing	State
	b) Stress control tubing	State
	c) Anti-track tubing	State
	d) External protective tubing	State

Clause No.	Description	Bidder's offer
4.2.4	Weather resistance and suitability for required service conditions	State
4.2.5	Free from defects	State
4.2.6	High moisture sealing capacity, resistance to fungal & insect attack, proper stress control and resistance to tracking when in service	State
4.2.7.1	Specific creepage distance	State
4.2.7.2	Tail lengths: a) three core – 11kV	State
	three core – 11kV	State
	b) Single core, indoor – 11kV	State
	Single core, indoor – 33kV	State
	c) Single core, outdoor – 11kV	State
	Single core, outdoor – 33kV	State
4.2.7.3	Core crossing and clearances	
4.2.7.4	No part of armour or lead sheath of the cable shall be exposed after completing termination	State
4.2.7.5	Method of sealing the interface between the termination tail insulating tube and lug barrel	State
4.2.7.6	Angle boot & straight boot design	State
4.2.8	Cable joint type	State
5.	Tests and Inspection	State
5.1	Test standard & responsibility of testing	State
5.2	Copies of previous type test reports	State
	AC voltage test	State
	DC voltage test	State
	Impulse voltage test	State
	Partial discharge test	State
	Tests at elevated temperature	State
	Heating cycle voltage tests	State
	Thermal short circuit test (screen)	State
	Thermal short circuit test (conductor)	State
	Dynamic short circuit test	State
	Humidity and salt fog tests	State
	Impact test at ambient temperature	State
	Screen resistance measurement	State
	Screen leakage current measurement	State
	Screen fault current initiation test	State
5.3	Tests to be witnessed by KPLC at the factory	State
5.4	Re-test on receipt	State

Clause No.	Description	Bidder's offer
6	Marking, Labeling and Packaging	
6.1	Marking	State
6.2	Packing	State
6.3	Measures to manage material with limited shelf life	State
6.4	Decommissioning	State
7.0	Documentation	State
7.1	Documents submitted with the tender for evaluation	State
7.2	Documents to be submitted to KPLC for approval before manufacture	State
8.0	Manufacturer's Guarantee and Warranty	State
9.0	List catalogues, brochures, technical data and drawings submitted to support the offer.	State
10.0	List customer sales records & four customer reference letters submitted to support the offer.	State
11.0	List Test Reports submitted with tender	State
12.0	List test reports to be submitted to KPLC for approval before shipment	State
13.0	Statement of compliance to specification (indicate deviations if any & supporting documents)	State

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Manufacturer's Name, Signature, Stamp and Date

ANNEX B: RANGE OF CABLE TERMINATIONS AND JOINTS USED IN KPLC

Table B1: LV (0.6/1kV) Terminations and Jointing Kits

	TYPE	CABLE SIZES
1	Joint, straight LV 4/C AL, XLPE	25, 70, 120, 185MM²
2	Joint, straight LV S/C CONCENTRIC AL, XLPE	16, 25 & 35MM²
3	Joint, straight LV S/C CONCENTRIC CU, XLPE	10, 16 & 25MM²

Table B2: 11kV Terminations and Jointing Kits

	TYPE	CABLE SIZES
1	Termination 11kV O/D 3/C AL, XLPE or PAPER	50, 70, 95, 120, 185 & 300MM²
	Termination 11kV I/D 3/C AL, XLPE or PAPER	
2	Termination 11kV O/D 3/C CU, XLPE or PAPER	50, 70, 95, 120, 185 & 300MM²
	Termination 11kV I/D 3/C CU, XLPE or PAPER	
3	Termination 11kV O/D S/C AL, XLPE or PAPER	400 & 630MM²
	Termination 11kV I/D S/C AL, XLPE or PAPER	
4	Termination 11kV O/D S/C CU, XLPE or PAPER	400 & 630MM²
	Termination 11kV I/D S/C CU, XLPE or PAPER	
5	Joint, straight 11kV 3/C AL, XLPE or PAPER	50, 70, 95, 120, 185 & 300MM²
	Joint, straight 11kV 3/C CU, XLPE or PAPER	
6	Joint, straight 11kV S/C AL, XLPE or PAPER	400 & 630MM²
	Joint, straight 11kV S/C CU, XLPE or PAPER	
7	Joint, transition 11kV 3/C AL, P-X	50, 70, 95, 120, 185 & 300MM²
	Joint, transition 11kV 3/C CU, P-X	
8	Joint, transition 11kV S/C AL, P-X	400 & 630MM²
	Joint, transition 11kV S/C CU, P-X	

Table B3: 33kV Terminations and Jointing Kits

	TYPE	CABLE SIZES
1	Termination 33kV O/D 3/C AL, XLPE or PAPER	300MM²
	Termination 33kV I/D 3/C AL, XLPE or PAPER	
2	Termination 33kV SUBMARINE S/C CU, XLPE	300MM²
3	TERMINATION, 33kV, INDOOR, 3/C CU XLPE or PAPER	185MM²
4	TERMINATION, 33kV, OUTDOOR, 3/C CU XLPE or PAPER	185MM²