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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Research & Development Manager
2	Procurement Manager
3	Chief Manager, Distribution

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
1	2011-12-01	clause 4.6 :To include insulated tap- off connectors	S. Nguli	G. Gathige
2	**2012-12-21**	Clause 4.7: To include MV sleeve joint for the messenger	S. Nguli	G .Gathige

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 Accessories for 11kV Overhead lines using Aerial Bundled Conductors/Cables (ABC). The Specification is to be used by KPLC in procurement of the items.

1. SCOPE

1.1 This specification is for Accessories for 11kV 50Hz Overhead Power Lines using Aerial Bundled Cables/Conductors (ABC). The lines are constructed on wooden and pre-stressed round concrete poles.

1.2 The accessories shall be suitable for 11kV aerial bundled cables consisting of XLPE insulated aluminum phase conductors with a supporting catenary that consists of stranded, galvanized steel wires, PVC covered.

1.3 The specification covers the following accessories:

a) Strain and Suspension Fittings.
b) Current-carrying Connectors and Joints.
c) Cable Ties.
d) HV ABC termination kits.
e) Insulated tap off connections
f) MV sleeve joints

The specification also covers inspection and test of the accessories as well as schedule of Guaranteed Technical Particulars to be filled, signed by the supplier and submitted for tender evaluation.

The specification stipulates the minimum requirements for ABC accessories acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the accessories for KPLC.

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.

ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods.

IEC 60695: Fire Hazard Testing – Glowing/Hot wire based test methods.

NRS 051: Suspension and Strain Fittings for Insulated Neutral Supporting Conductors used in Medium Voltage Aerial Bundled Conductor Systems.

ESI 09-13: Performance specification for high voltage heat shrinkable components for use with high voltage solid type cables up to and including 330000 volts.

3. TERMS AND DEFINITIONS

The terms and definitions given in the reference standards shall apply.

4. REQUIREMENTS

4.1 SERVICE CONDITIONS

The accessories shall be suitable for continuous operation outdoors 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, in direct sunlight, heavy saline conditions along the coast and isokeraunic levels of up to 180 thunderstorm days per year.

4.2 GENERAL REQUIREMENTS *(applicable to all accessories)*

4.2.1 Range of Accessories

The accessories shall be suitable for 11kV aerial bundled cables consisting of XLPE insulated aluminum phase conductors (sizes 70, 95 & 185mm²) and a supporting catenary that consists of stranded, galvanized steel wires, PVC covered (sizes 50 & 70mm²) of the following minimum mechanical characteristics:

Aerial Bundled Cable (core sizes in mm^2)	Supporting Catenary		
	Size (mm^2)	Number & Size of Wires (No/mm)	Minimum Tensile Strength of each Wire (kN)
3 x 70	50	7/3.00	9.26
3 x 95	50	7/3.00	9.26
3 x 185	70	7/3.63	13.13

The 11kV distribution network is constructed on wooden poles or round pre-stressed concrete poles.

4.2.2 Materials

Materials used in the manufacture of accessories covered by this specification shall be:

a) Of adequate strength for the intended application of the accessories and free from any defects that impair performance,

b) Compatible with the cable materials such that there is no detrimental effect on the cable or the accessories as a result of their association and

c) Compliant with the physical and electrical requirements of this specification and retain these characteristics during the normal life of the accessories whilst in an outdoor environment.

4.2.3 Protection against Corrosion

All ferrous parts of accessories shall be hot-dip galvanized (heavy duty) in accordance with ISO 1461. Ferrous parts shall not be electroplated.

4.2.4 Protection against Ultra-Violet Radiation

All components of accessories shall be manufactured from ultra-violet stabilized material. Details of the offered material shall be submitted.

4.2.5 Fire Retardation

All non-metallic components of accessories shall satisfy the glow-wire test requirements as specified in IEC 60695.

4.2.6 Finish

All accessories shall be free from sharp edges, burrs and swarf. The insulating materials used in the manufacture of the accessories shall be black or red in colour.

4.2.7 Fastenings

All threaded fastenings that form part of the fittings/accessories shall have ISO metric threads and at least two full threads shall project clear of the locking device when it is tightened.

4.3 STRAIN AND SUSPENSION FITTINGS

4.3.1 Dead End Clamp

4.3.1.1 Dead end clamps shall be used at the terminal poles, section poles and at road crossings to carry the tension at the end of the line.

4.3.1.2 The clamp shall be so designed that parts need not be detached when the fitting is being attached to the ABC system; for example any wedges used shall be captive wedges.

4.3.1.3 It shall not be possible to assemble the clamp in an incorrect manner.

4.3.1.4 The clamp shall not slip or release the supporting catenary during normal use.

4.3.1.5 The clamp shall have at least two bolts for tightening and the hooking end shall be provided with hot dip galvanized nut and bolts with safety lock. The clamps shall be suitable for use in conjunction with the dead end hooks detailed in 4.3.2.

4.3.2 Dead End Hook

4.3.2.1 Dead end hooks shall be suitable for mounting through wood poles (by single bolt) and attachment to pre-stressed round concrete poles (by two steel bands). The diameter of the pole at the point of mounting shall be 170 to 230mm.

4.3.2.2 Each dead end hook shall be supplied complete with two steel bands (for use on concrete poles).

4.3.3 Suspension Clamp

4.3.3.1 The clamp shall secure the ABC by clamping around the supporting catenary only.

4.3.3.2 It shall allow easy attachment to the suspension hook detailed in 4.3.4 and shall be of a type which can be installed without the use of specialized tools.

4.3.3.3 The clamp shall hold the supporting catenary without any slippage to within 5% of the specified breaking force of the supporting catenary.

4.3.3.4 The clamp shall be designed for use on line deviations of up to 45°.

4.3.3.5 The clamp shall not cause any damage to the supporting catenary. The components shall not allow entrapment of water within the clamp assembly.

4.3.4 Suspension Hook

4.3.4.1 Suspension hooks shall be suitable for mounting through wood poles (by single bolt) and attachment to pre-stressed round concrete poles (by two steel bands). The Diameter of the pole at the point of mounting shall be 170 to 230mm.

4.3.4.2 The suspension hook shall be supplied complete with two steel bands (for use on concrete poles).

4.4 CURRENT-CARRYING CONNECTORS AND JOINTS

4.4.1 General

4.4.1.1 Connectors and Joints shall be suitable for use with Aerial Bundled Conductors of aluminum construction with conductor cross-section area of 70mm², 95mm² and 185mm².

4.4.1.2 The connectors shall be designed to allow them to be fitted without having to dismantle components. All segments of the connector shall be held captive when opened for fitting to the conductors.

4.4.1.3 All connectors and joints shall be such that their current-carrying capacity is greater than that of the larger conductor to which they are intended to be connected.

4.4.1.4 In addition to Clause 4.1, materials used in the manufacture of the connectors or joints shall be of a quality that ensures that the material does not split and does not deteriorate from its intended state during the application process.

4.4.1.5 The connectors shall be designed to withstand physical and chemical processes expected in service i.e. oxidation, corrosion, thermal expansion etc.

4.4.2 Specific Requirements for Crimped Joints and Lugs

4.4.2.1 Crimped joints shall be of the insulated type.

4.4.2.2 Joints and termination connectors (lugs) shall be designed to exclude moisture from conductors.

4.4.2.3 Joints and termination connectors shall be of the tubular compression type and shall be suitable for crimping.

4.4.2.4 All tubular compression joints shall be tension type and shall have a conductor stop positioned at the centre of the sleeve barrel.

4.4.2.5 All compression fittings shall be prefilled with jointing compound detailed below and shall be capped.

4.4.2.6 The lugs shall be such that they are suitable for use on M12 studs and conductor size ranges given in 4.2.1.

4.4.3 End Caps

4.4.3.1 End caps shall be suitable for sealing the open ends of insulated conductors (ABC) against water ingress.

4.4.3.2 End caps shall be suitable for conductors sizes 70mm², 95mm² and 185mm²

4.4.3.3 End caps shall not require any special tools for installation and shall be held in position by elastic forces only.

4.4.3.4 End caps shall be black in color.

4.4.4 Core Separators (in pairs)

4.4.4.1 The core separators shall essentially comprise two wedges to facilitate the installation of connectors on tensioned ABC cable. The two separators shall be joined together with a nylon cord.

4.4.4.2 The two separators, which shall be made from rigid plastic, shall be so shaped as to be capable of being positively locked in position. The separators shall be supplied in pairs and complete with relevant nylon cord.

4.4.5 Joint Compound

4.4.5.1 The joint compound shall be suitable for prevention of oxidation on aluminum surfaces.

4.4.5.2 The compound shall be used to reduce the transition resistance and protect the connection from corrosion.

4.4.5.3 The compound shall contain no skin-irritant ingredients.

4.4.5.4 It shall be supplied in tubes of 250g each.

4.5 CABLE TIES

4.5.1 The cable tie shall be a single piece assembly.

4.5.2 The material of the cable tie shall be polyamide, colored black, weather-stabilized and corrosion resistant.

4.5.3 Cable ties shall be of uniform quality and shall be free from sharp edges, irregularities or defects that could affect their performance, reliability or durability.

4.5.4 The cable tie shall have a guaranteed minimum serviceable life of 7 years.

4.5.5 The cable tie shall be of width at least 9mm, have 350mm usable length measured from the inside of the tie clamp and tapered to facilitate insertion into the tie clamp.

4.6 Insulated tap off connectors.

4.6.1 The insulated tap off connectors shall be designed to facilitate loop –in and loop – out connections so that no bare conductors are exposed

4.6.2 This shall consist of a metallic base (suitable for vertical or horizontal mounting on a steel cross arm), an insulator, and an aluminum bus bar..This shall be of the general shape shown in the photograph below.

4.6.3 The insulator shall be of porcelain or polymer with a minimum Creepage distance of 300mm and impulse withstand voltage of 95KV for 1.2/50 µs

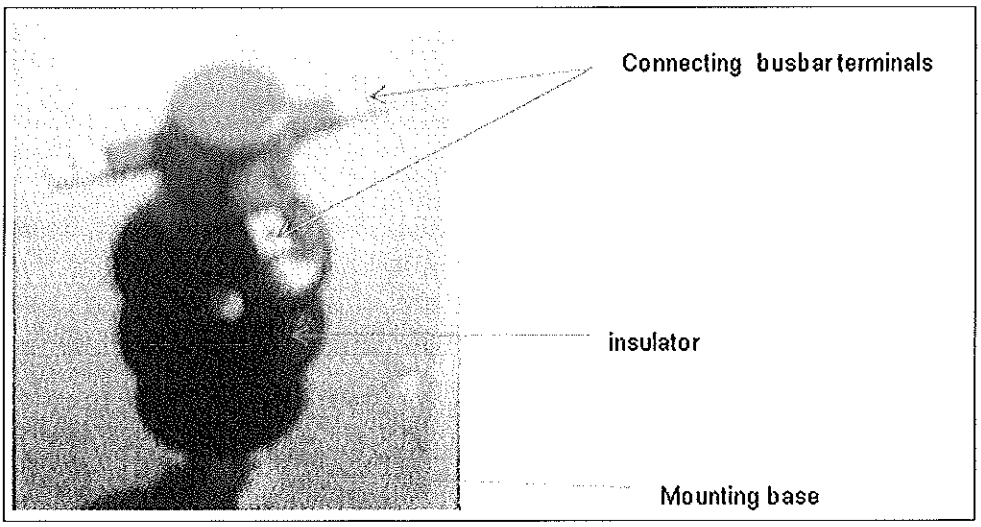
4.6.4 The bus bar shall be of aluminum of adequate dimensions capable of carrying 30% above the rated current of 70-95 mm² Aerial Bundled Cables (ABC) at rated voltage

4.6.5 The insulated tap off connectors shall be designed for four, three and two connections points. **These shall be specified in the tender.**

4.6.6 The insulation of the tap off connectors shall feature high track resistance and be climatically stabilized.

4.6.7 The connections shall be of simple bolted type. The connecting bolts shall be provided and shall be suitable for connecting the ABC termination lugs for 70mm² and 95mm² cables.

Photo 1: 3 way tap off connector



4.7 MV sleeve joints

The MV sleeve joints shall be used for jointing the galvanized steel wire (Messenger).

4.7.1 The messenger has the following technical characteristics

Nominal cross-sectional area	Mm^2	50
stranding	No/mm	7/3.15
Overall diameter	mm	9.45
Minimum breaking load	KN	62

4.7.2 The sleeve joint shall consist of steel sleeve and an insulating heat/cold shrinkable tube as per drawing below

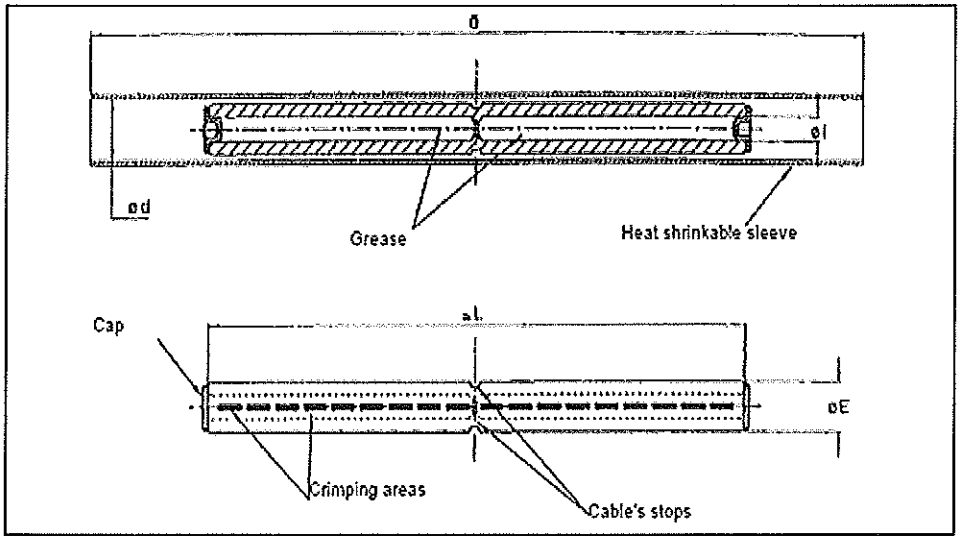


Fig 1: sleeve joint

4.7.3: The dimensions in figure 1 above shall be as follows: a=350mm,d=25mm,E=20.5 and L=245mm

4.7.4: The steel sleeve joint shall consists of two adjustable arms to allow for adaptation of the distance between messenger and phases

4.7.5: The steel sleeve joint shall be greased and equipped with two end caps

4.7.6: The insulating tube shall be UV resistant heat shrinkable to provide protection against corrosion and moisture ingress

4.7.7 The crimping points shall be clearly marked

4.8 Terminations

Cable terminations where required shall be to KPLC Specification number KPLC1/3CB/TSP/05/026 (to be provided by KPLC).

5. TESTS AND INSPECTION

5.1 The accessories shall be inspected and tested in accordance with the requirements of this specification and the declared standard of manufacture. It shall be the responsibility of the manufacturer/supplier to perform or to have performed the tests specified and whatever other tests normally performed at works.

5.2 Copies of previous test certificates and test reports (for each type of accessory) by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation. A copy of accreditation certificate for the laboratory shall also be submitted (all in English Language).

5.3 Routine and sample test reports for the accessories to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. KPLC Engineers (2) will witness these tests at the factory before shipment.

5.4 During delivery of the accessories, 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 charge to KPLC, accessories which upon examination, test or use fail to meet any or all of the requirements in the specification.

5.5 The manufacturer shall have at least seven years experience in the manufacture of the offered accessories and shall have exported similar accessories to at least three utilities. Documentary evidence including customer reference letters, detailed list & contact addresses of previous major customers in the past five years shall be submitted with the tender.

6.0 PACKING, MARKING AND INSTRUCTIONS

6.1 Each item shall be packed in such a manner as to protect it from damage during transportation, handling and storage.

6.2 Each package shall contain relevant instructions for handling and use printed in the English Language.

6.3 Each item shall be engraved legibly and indelibly with the following information:

- Manufacture's Name
- Month and Year of Manufacture
- Type Reference Number
- Electrical and Mechanical Characteristics (as applicable)
- Size
- Standards to which the item complies

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

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ANNEX A: Guaranteed Technical Particulars *(to be filled and signed by the Supplier and submitted together with copies of manufacturer's catalogues, brochures, drawings, technical data, sales records, customer reference letters and copies of certificates/test reports for tender evaluation)*

Tender No. .....

Clause number	**Bidder's offer** (indicate full details of the offered item for each requirement of the tender & specification)
Bidder's Name	
Manufacturer's Name, address and country	
Type reference/model number of item(s) offered	
Scope: 1.1	
1.2	
1.3	
2.0 Applicable Standards (References)	
3.0 Terms & definitions	
4.1 Service conditions	
4.2.1 Cable sizes	
4.2.2 Materials (a) – c)	
4.2.3 Protection against corrosion	
4.2.4 Protection against uv	
4.2.5 Fire retardation	
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4.3.1 Dead end clamps (4.3.1.1 – 4.3.1.5)	
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4.3.3 Suspension clamp (4.3.3.1 – 4.3.3.5)	
4.3.4 Suspension hook (4.3.4.1 – 4.3.4.2)	
4.4 Current carrying connectors (4.4.1.1 – 4.4.1.5)	
4.4.2 Crimped joints & lugs	

(4.4.2.1 – 4.4.2.6)	
4.4.3 End caps (4.4.3.1 – 4.4.3.4)	
4.4.4 Core separators, in pairs (4.4.4.1 – 4.4.4.2)	
4.4.5 Joint compound (4.4.5.1 – 4.4.5.4)	
4.5 Cable ties (4.5.1 – 4.5.5)	
4.6 Cable terminations	
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5.2	
5.3	
5.4	
5.5	
6.1 Packing	
6.2 Instructions	
6.3 Marking	
Catalogues, brochures, drawings & technical data submitted with offer	
Customer reference letters	
Sales records	
Details on manufacturer's experience & production capacity	
ISO 9001:2008 certificate	

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Supplier's Name, Signature, Stamp and Date