Kenya Power

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Our Ref: KP1/9A.3/OT/14/21-22/PM/ca

25th July, 2022

TO:

ALL PROSPECTIVE BIDDERS

ADDENDUM 5 TO THE TENDER NO: KP1/9A.3/OT/14/21-22 FOR SUPPLY OF LUGS, JOINTS, TERMINATIONS AND FUSES.

Please refer to the above tender.
We make the following amendments to the above Principal Tender Document

(hereinafter abbreviated as the PTD) for the Supply of Lugs, Joints, Terminations and fuses

1. RELATIONSHIP WITH THE PRINCIPAL TENDER DOCUMENT

Save where expressly amended by the terms of this Addendum, the PTD shall continue to be in full force and effect. The provisions of this Addendum shall be deemed to have been incorporated in and shall be read and construed as part of the PTD.

2. Clarification for specification for 11KV ABC Cables

	Bidders Query	KPLC Response
1	kindly provide specifications for the 11KV ABC Cables Kindly Clarify.	Specifications KPLC1/3CB/TSP/05/012-3 for 11KV ABC Cables provided as attached

3. EXTENSION OF TENDER CLOSING DATE

The tender closing date has been extended from **25th July, 2022 to 29 July, 2022 at 10:00 a.m.**

Kindly adhere to the changes

Yours faithfully,
FOR: THE KENYA POWER & LIGHTING COMPANY PLC

PETER MUCHORI
Ag. GENERAL MANAGER, SUPPLY CHAIN & LOGISTICS

TABLE OF CONTENTS

0.1 Circulation List

COPY NO.	COPY HOLDER
1	Research & Development Manager
2	Procurement Manager
3	Chief Manager, Distribution
Electronic copy (pdf) on Kenya Power Server (currently :Network-\\stima-fprnt-001\techstd&specs	

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
0	2013-09-16	New Issue	Michael Apudo	George 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 **cold shrink straight through joint and terminations kits** for use in 11kV Aerial Bundled Cables (ABC). The Specification is to be used by KPLC in procurement of the items.

1. SCOPE

1.1 This specification is for **cold-shrinkable straight-through joints and terminations** for use specifically with 11-kV XLPE (cross-linked polyethylene) aerial bundled cables (ABC) made of aluminium/copper for Overhead Power Lines.

1.2 This specification covers the following termination and jointing kits:

(i) Cold shrink straight through joints ; and
(ii) Cold shrinkable terminations

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

1.4 The specification stipulates the minimum requirements for 11kV **ABC cold shrink straight through joints and terminations** 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 and shall be complied with by the manufacturer/ supplier.

IEC 60502: Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1.2 kV) up to 30 kV (Um = 36 kV)
Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (Um = 7.2 kV) up to 30 kV (Um = 36 kV

IEC 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).

IEEE 404: Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV.

IEEE-48: Test procedures and requirements for high voltage alternating current cable terminations.

ANSI C 119.4: Electric Connectors - Connectors for Use between Aluminum-to-Aluminum or Aluminum-to-Copper Bare Overhead Connectors

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

ISO 48: Rubber, vulcanized or thermoplastic -- Determination of hardness

ISO 37: Rubber, vulcanized or thermoplastic -- Determination of tensile stress-strain properties

ISO 34-1: Rubber – Determination of Tear Strength – Trouser, Angle and Crescent Test Pieces.

IEC-60507: Salt fog test.

ASTM D149-09: Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.

3. TERMS AND DEFINITIONS

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

4. REQUIREMENTS

4.1 SERVICE CONDITIONS

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

a) At altitudes of up to 2200m above sea level and humidity of up to 95%,

b) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C, in direct sunlight,

c) Heavy saline conditions along the coast and

d) Isokeraunic levels of up to 180 thunderstorm days per year.

4.1.2 The ABC normal system operating conditions shall be:

a) Normal conditions: Voltage rating shall be 12kVmax at 50Hz.
b) Normal conditions: Continuous operation at a conductor temperature of 90^0C for XLPE insulated cables.
c) Fault conditions: Operation at a conductor and screen temperature of 250^0C for XLPE insulated cables

4.2. DESIGN AND CONSTRUCTION FOR JOINTS AND TERMINATIONS

4.2.1. General Requirements

4.2.1.1. The term cold shrink applies to materials, which are capable of shrinking without raising the material above the ambient temperature of its immediate surroundings.

4.2.1.2. Complete external leakage insulation between the high voltage conductor and earth potential using anti-track cold shrink material.

4.2.1.3. Electrical stress control using a stress relief tube made of ethylene-propylene rubber (EP rubber) incorporated inside the prestressed tubing (PST) of cold shrink insulator made of silicone rubber.

4.2.1.4. The installed joints and terminations shall meet the electrical requirements laid down in this specification.

4.2.1.5. Outdoor terminations shall incorporate a design feature to prevent flexing of the terminated cores under short circuit conditions.

4.2.1.6. The successful tenderers will be required to supply overhead line insulators and support bracket for outdoor terminations in line with the schedule of quantities.

4.2.1.7. These brackets must be designed for mounting on wooden poles such that the terminating cores may be cut to the same length measured up from the sheath terminus of the cable termination.

4.2.1.8. The joints and terminations shall prove, through the initial and long-term evaluation, to have satisfactory performance, offering outstanding ease of installation.

4.2.1.9. The length of core insulation required with switchgear and transformer terminations shall be 450mm for three and single core 11kV cables.

4.2.1.10. The length of core insulation required with outdoor pole-top terminations shall be 900mm per phase for three and single core 11kV.

4.2.1.11. The length of the complete joint kit shall be 680-700mm per phase for single core 11kV ABC cable.

4.2.1.12. Copper braid shall be provided to connect the metal shield of XLPE cable.

4.2.1.13. The following tables list specific requirements for tests of the supplied joints and terminations:

Table 1: Dimensions of the joints and connectors

No	Application Range of cables*	Cable insulation O.D range	Diameter over outer sheath	Diameter over conductor **
	[mm^2]	[mm]	[mm]	[mm]
1	50-70	15.0 – 19.5	22.0 – 32.0	9.0 – 12.5
2	95 - 240	18.6 - 28.4	26.0 - 39.0	11.0 - 19.2
4	185 - 300	23.2 - 32.6	30.0 - 44.0	15.5 - 23.1

** The application range given in the table is based on polymeric insulated cables according to IEC 60502 with stranded circular conductors. Due to different conductor dimensions and/or cable constructions the minimum and maximum application range may be extendable.*

***The diameter over conductor is needed only for kits supplied complete with connectors. The values given in the selection table refer to aluminium circular conductors and may change for other materials and shapes.*

Table 2: Dimensions of the cold shrink terminations

No	Application Range of cables	Cable insulation O.D range
	[mm^2]	[mm]
1	35-120	16.3-27.4
2	120 - 240	21.1-33.9

Table 3: Required specifications for cold shrink straight through joints and terminations as per IEC 60502-4

Table 3: Technical requirements for Cold Shrinkable Straight through joints

No	Item	Target performance
1	Partial discharge at commercial frequency voltage	10 pC or less at 12 kV
2	Long-term withstand voltage frequency at 50Hz.	28 kV/3 hrs.
3	Lightning impulse withstand voltage	
	Normal temperature	±95 kV/3 times
	High temperature	±75 kV/3 times
4	DC withstand voltage	35 kV/ 15mins
5	AC withstand voltage	39 kV/ 5mins
6	Temperature cycling	105°C/3 hours x 3 times
7	Short-circuit current loading	16 kA/2 sec.
8	Waterproofness	98 kPa at outer pressure for 1 hr.
9	Humidity • All joints • Indoor terminations only	12 kV for 100hours, in humidity chamber with water conductivity of 700±100 µS/cm sprayed at a rate of 0.3±0.1 L/hm^3 of test chamber.
10	Salt Fog • All joint • Outdoor terminations only	12 kV for 1000 hours to salt water with conductivity of 16±2 mS/cm at a rate of 0.4±0.1 L/hm^3.
11	Load cycling	
	In air	23 kV at 95°C conductor temperature 8 hours ON; 16 hours OFF/30 cycles.
	In water	Same as for "in air" with joints immersed in water
	Installation work	Reduced skill level and ease of installation

Table 4: Material properties of silicone and EP rubbers

No	Item	Test Standard	Silicone rubber	EP rubber
1	Ultimate elongation	ISO 37	790%	750%
2	Tensile strength	ISO 37	10 MPa	9.3 MPa
3	Hardness	ISO 48	34	60
4	Tear strength	ISO 34	21.5 N/mm	11.8 N/mm
5	Permanent elongation set at 100%	ISO 37	2.6%	32.4%
6	Dielectric breakdown strength	ASTM D149	20 kV/mm	20 V/mm

4.2.2. Specific Requirements for Cold Shrink Straight Through Joints

4.2.2.1. The cold-shrinkable straight-through joints for use; specifically with 11-kV XLPE (cross-linked polyethylene) ABC cables shall be designed as per the drawing number TSP/05/012-1 attached in Annex B and a complete joint plus its accessories shall look like the pictures in figures 1.

4.2.2.2. Cold shrink straight through joints shall be supplied complete with suitable mechanical connectors made of high strength and high conductivity tin-coated, aluminium alloy for aluminium to aluminium or aluminium to copper cables.

4.2.2.3. Components of cold-shrinkable joints shall be expanded in the factory and shipped as expanded products, fitted on the inner core i.e. as an expansion support.

4.2.2.4. The on the site shrinking and installation of the joints shall only involve a simple pull out mechanism of the inner core without using heat or insertion of force, thereby eliminating any special tools for expansion or shrinking.

4.2.2.5. Cold-shrinking covers shall consist of the splice body and the water proof cover.

a) Splice body

The splice body shall be made of PST silicon rubber with properties as per table 4. It shall form a major part of the joint's insulation and offer stress relaxation characteristics and permanent elongation at set temperatures hence expansion or shrinking qualities shall be achieved.

b) Waterproof protective cover

The protective cover shall be made of ethylene-propylene (EP) rubber for its properties to maintain water-imperviousness at full water immersion irrespective of its high hydrophobic properties. See table 4 for properties.

4.2.2.6. Inner Core design characteristics shall be as follows:

4.2.2.6.1. The splice body and the waterproof cover shall be maintained and stored mounted on the inner core, enabling easy installation by cold-shrinking on site without using any special tool.

4.2.2.6.2. The materials used in the inner core shall be made of polypropylene and polyethylene, which have appropriate strength to maintain expanded splice body and waterproof cover as well as recyclability after use.

4.2.2.6.3. The inner core shall be designed to ensure a sufficient mechanical strength so as to withstand the pressure due to the expanded splice body and waterproof cover to the required diameter.

4.2.2.6.4. The inner core shall comprise of a core ribbon having L-shaped edges, which is formed into a pipe under optimal welding conditions such that the core keeps expanded splice body and waterproof cover properly but collapses easily at on-site shrinking without using any special tool.

4.2.2.7. The structure of grounding fitting shall be solder-less and the type that make installation work easy using no flame tools.

4.2.2.8. It shall be made of high strength and high conductivity tin-coated, aluminium alloy suitable for use in aluminium to aluminium or aluminium to copper conductors.

4.2.2.9. The fittings shall be subjected to a heat cycle and sheath current loading tests at conductor temperatures of 90^0C for 4 hours ON and 4 hours OFF per cycle and sheath current loading of 16A for 1 hour ON and 1 hour OFF per 500 cycles as per ANSI C 119.4 – 2004

4.2.2.10. Mechanical connectors shall be manufactured and tested in accordance with IEC 61238-1 class A and shall be fitted with shear head bolts to ensure a reliable connection for different conductor materials, shapes and types.

4.2.2.11. There shall be a pre-set shear torque of the bolts to ensure that the correct contact pressure is always achieved.

4.2.2.12. The inside contact surface of the connector shall be specially designed to break up any oxide layer and shall ensure reliable service over the entire life of the joint.

4.2.2.13. Different sizes of mechanical connectors corresponding to a wide conductor application ranges are as shown in table 1above.

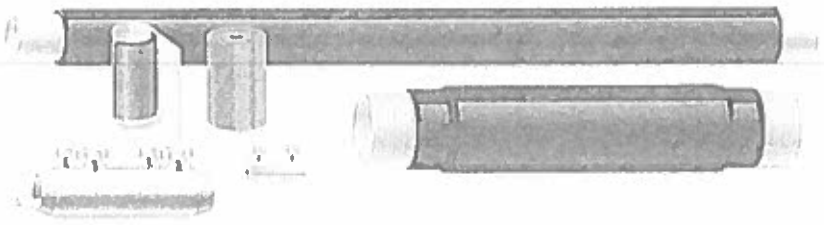

Figure 1: A picture of a complete set of cold shrink straight through joint and accessories

4.2.3. Specific Requirements for Cold Shrinkable Termination Kits

4.2.3.1. The cold shrinkable terminations shall be manufactured and tested as per IEEE Standard 48-1990 Class 1 and IEC 60502-4 standards.

4.2.3.2. The material of the rubber insulator used in the Cold Shrink Terminations shall be PST silicone rubber which shall be factory expanded and placed on a removable core. The removing of the core when the termination is positioned over the cable shall cause the termination to shrink.

4.2.3.3. The termination shall maintain a compressive force on the cable continuously throughout the life of the product. This pressure will ensure a complete moisture seal without the use of adhesives.

4.2.3.4. Electric field stress control shall be achieved by using a high dielectric constant cold shrink electrometric tube. This tube shall be completely covered by a cold shrinkable silicone insulator having adequate track resistance. The two pieces shall be prestretched in the factory and placed on the one removable core.

4.2.3.5. The material used for the terminations shall also display a high surface tension or hydrophobic property. This is essential to minimize surface wetting and in turn minimize or eliminate damaging leakage currents.

4.2.3.6. These components shall be weather, ultra violet light and salt pollution resistant.

4.2.3.7. The termination kit shall have three main components namely:

a) 3-finger PST silicone rubber cold shrink break out boot.
b) PST silicone rubber insulator which shall include :

- PST silicone rubber cold shrink insulators with water shed skirts and with a high dielectric constant PST cold shrink stress relief tube (11kV outdoor termination).
- PST silicone rubber cold shrink insulators without water shed skirts and with a high dielectric constant PST cold shrink stress relief tube (indoor termination 11kV).
- Straight & right angle boots shall be provided for indoor terminations.

c) Termination accessories including sealing and semi conductive tapes, earthing clamps and earthing braid.

4.2.3.8. Major accessories for cold shrinkable cable terminations shall be:

a) Two hole crimping lugs/connectors.
b) Sealant mastic butyl tape.
c) Silicon rubber tape (for outdoor termination).
d) Non-tracking rubber module skirts.
e) Pre-moulded stress cone (s)
f) Ground clamp.
g) Ground wire.
h) Jacketing tape/PVC tape.
i) Constant force spring.
j) Grounding flat copper braid.
k) Trifurcating boot (for 3 core cables).
l) Cold shrinkable tubing (for 3 core cables - outdoor terminations).
m) Cold shrinkable straight right angle boots (for indoor terminations only).
n) Silicon grease.
o) Complete with lubricant, wiping cloth, installation instructions.
p) Stand-off silicon rubber insulator rated 12kV maximum with creepage distance 450mm with bracket (3 Nos. insulators + 1 No. bracket) (For outdoor terminations only)

4.2.3.9. A full drawing of the termination including all parts must be forwarded with the tender documents.

5 TESTS AND INSPECTION

5.1 The cold shrink straight through joint and terminations shall be inspected and tested in accordance with the requirements of IEC 60502-4, IEC 61238-1, ANSI C 119.4, IEEE 404:2012, IEEE 48:1990 and ISO standards. It shall be the responsibility of the

supplier to perform or to have performed the tests specified and whatever other tests he normally performs at works.

5.2 The A.C/D.C voltage, Partial Discharge, Lightning Impulse, Heating Cycle and general examination tests shall be done in accordance with the requirement of IEC 60502-4, IEC 61442, IEC 61238-1, IEEE 48:1990 and IEEE 404:2012 standards.

5.3 Chemical product analysis for Silicon rubber and EP rubber shall be tested as per requirements of relevant ASTM/ISO standards.

5.4 Heat cycle and sheath current loading test shall be carried out as per requirements of ANSI C 119.4 – 2004 standards and this specification.

5.5 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 document (all in English Language)

5.6 Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall be as stated below:

5.6.1 **Type Tests**

a) **Cold Shrink Straight Through Joint and Terminations**

1. Temperature cycling tests
2. Waterproof tests
3. Load cycling tests
4. Partial discharge tests
5. Long term withstand voltage tests
6. Lightning impulse withstand voltage tests
7. AC/DC withstand voltage tests
8. Short circuit current tests.
9. Humidity tests
10. Salt fog tests on outdoor terminations only
11. Heating cycle voltage test.

b) **Silicon/EP rubber**

a) Ultimate elongation tests
b) Tensile strength tests
c) Hardness tests

d) Tear strength tests
e) Dielectric breakdown tests

c) **Earthing Fitting/Metallic Connector for Cold Shrink Joints**

a) Heat cycle tests
b) Sheath current loading tests

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

5.8 On receipt of the goods KPLC may perform any of the tests specified in order to verify compliance with this specification. The supplier shall replace without charge to KPLC the joints, terminations and accessories, which upon examination, test or use; fail to meet any of the requirements in the specification.

5.9 Tests to be witnessed by KPLC Engineers at the factory before shipment shall be in accordance with IEC 60502-4, IEC 61442, IEEE 404:2012, ANSI C 119.4 – 2004 and this specification and shall include the following:

5.9.1 **Routine Tests on the complete joints and terminations**

a) Partial discharge Test
b) DC/AC withstand tests
c) Temperature cycling tests
d) Load cycling tests
e) Waterproof tests
f) Physical examination for cracking, moisture path, corrosion/tracking/leakage of accessories and leakage of any insulating materials.

6 MARKING AND PACKING

6.1 Marking and Packaging

6.1.1 Components shall normally be supplied in a package as a complete joints/ termination, which shall be clearly marked with:

a) The supplier's name,
b) Joint/termination/accessories catalog number
c) Voltage, application and cable size.
d) The standard of manufacture (IEC 61442, IEEE 404 and ASTM D 119-1)

e) Date of expiry
f) Words "**PROPERTY OF KPLC**".

6.1.2 Packaging shall be designed to protect against ingress of moisture and mechanical damage. Self-fusing tapes shall have means to prevent the fusing of surfaces from each other.

6.1.3 The complete cold shrinkable components, required to complete in all respects one joint/termination, shall be supplied in a kit form.

6.1.4 The following information shall be printed on a suitable label firmly attached to each packaging:

a) Purchase order number/tender
b) Manufacturer's name
c) Year of manufacture
d) Date of expiry
e) Joint/termination/separable elbow/accessories catalog number
f) Gross weight in kilograms (pounds)
g) Position of slinging points and other relevant handling instructions.
h) The words, "**PROPERTY OF KENYA POWER & LIGHTING CO.**"

6.1.5 For Cold shrink kits,

a) For the purposes of identification, PST silicone cold shrink break out boots shall be marked clearly and permanently in a prominent position with the supplier's name.
b) Electrically semi-conducting tape shall be marked "Semi Conducting" clearly and permanently.

6.2 Storage

6.2.1 Components shall be capable of being stored without deterioration within the temperature range of -10^0C to 45^0C.

6.2.2 Components or materials, if subject to a shelf life limitation shall have the final date of use, date of manufacture prominently and permanently shown on all packaging.

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,
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) Duly completed attached technical data schedule for each offered item.
e) Complete list of items contained in each joint and termination kit along with the price for each item of kit contents
f) 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.
g) Test Program to be used after manufacture
h) Marking details and method to be used in marking of the joints and terminations,
i) 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 for KPLC,
j) Packaging details (including packaging materials, total number of joints/terminations per packaging).

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	
1.4	
2.0 Applicable Standards (References)	
3.0 Terms & definitions	
4.1 Service conditions	
4.1.1 Physical and climatic conditions	
4.1.2 System operating conditions	
4.2 General requirements Joints and terminations	
(4.2.1 – 4.2.1.13)	
4.2.1.14 Required specifications for tests	
Table 1: Sizes of joints and connectors	
Table 2: Sizes of terminations	
Table 3; Required test specifications	
Table 4: Properties of Silicon and EP rubber	
4.2.2 Specific requirements for Cold shrink straight through joints	
(4.2.2.1-4.2.2.13)	
4.2.3 Specific requirements for cold shrinkable termination kits	
(4.2.3.1-4.2.3.9)	
4.3.2.2 Main components	
5.0 Tests and Inspection	
(5.1-5.6)	
5.6.1 Type Tests	
5.6.1.1 Joints and terminations	

5.6.1.2 Silicon /EP rubber	
5.6.1.3 Earthing fitting/Mechanical connector	
(5.8-5.9)	
5.9.1 Routine tests	
6.0 Marking and Packing	
6.1 Identification and Packing	
(6.1.1 -6.1.2)	
6.2 Storage	
(6.2.1-6.2.2)	
7.0 Documentation.	
7.1 Fully filled and signed GTP	
7.2Catalogues, brochures, drawings & technical data submitted with offer	
8 Customer reference letters	
9 Sales records	
10 Details on manufacturer's experience & production capacity	
11 ISO 9001:2008 certificate	

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Supplier's Name, Signature, Stamp and Date

ANNEX B: Structure for cold-shrinkable straight joint for ABC cables.

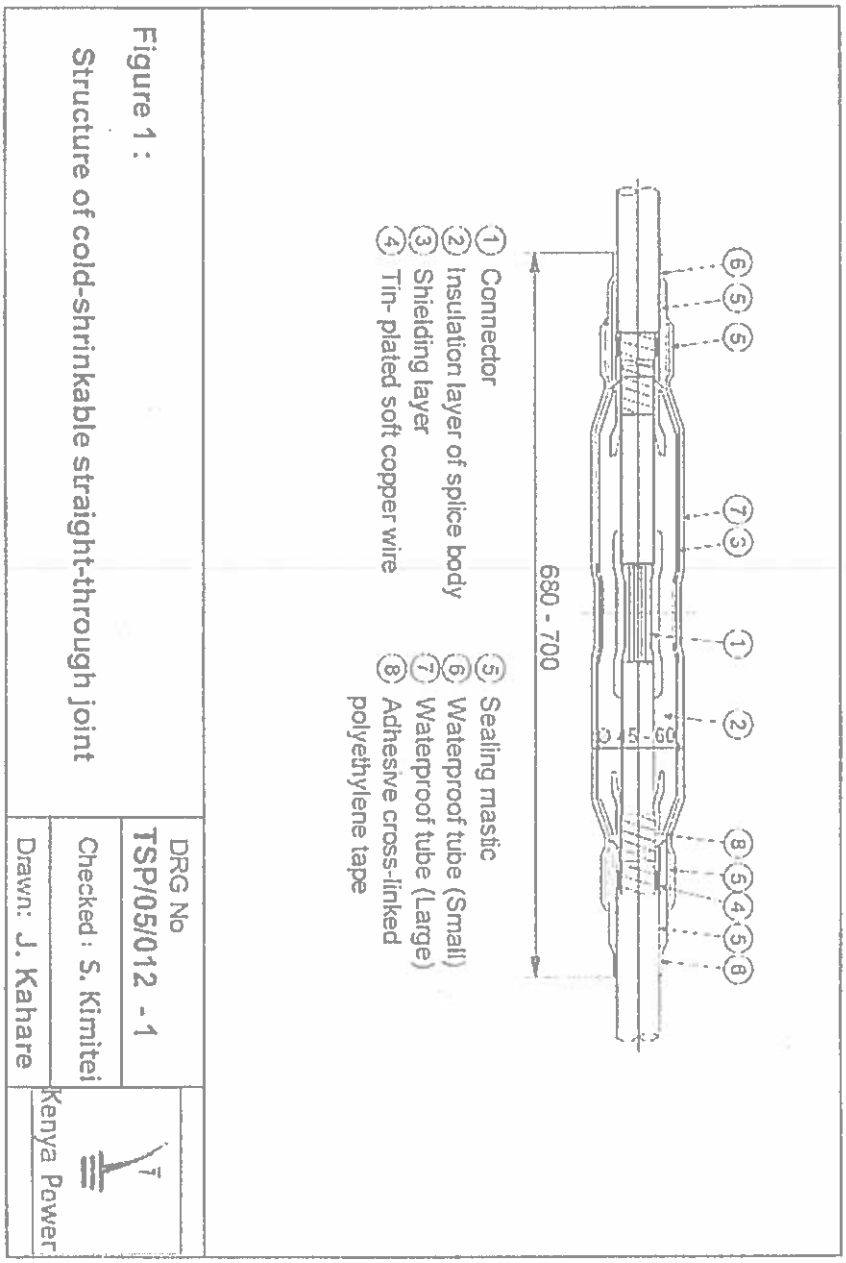

Figure 1 : Structure of cold-shrinkable straight-through joint

Issued by: Head of Section, Technical Stds & Specs	Authorized by: Head of Department, R&D
Signed:	Signed:
Date: 2013-09-16	Date: 2013-09-16