



The Kenya Power & Lighting  
Co. Ltd

TITLE:

**SPECIFICATION FOR  
TRANSMISSION LINE AND  
SUBSTATION  
ACCESSORIES AND  
FITTINGS.**

Doc. No.

KPLC1/3CB/TSP04/028

Issue No.

1

Revision No.

0

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2011-03-24

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**Note:** the **Guaranteed Technical Particulars** shall be filled and signed by the Manufacturer and submitted together with copies of manufacturer's catalogues, brochures, drawings, technical data, sales records, customer reference letters, details of manufacturing capacity & experience and copies of type test reports for tender evaluation

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**0.1 Circulation List**

COPY NO.	COPY HOLDER
1	Research & Development Manager
2	Procurement Manager
3	Transmission Manager
Electronic copy (pdf) on KPLC 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)

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## FOREWORD

This specification has been prepared by the Research and Development Department in collaboration with Transmission Department both of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for transmission line and substation accessories and fittings. It is intended for use by KPLC in purchasing the accessories and fittings

It shall be the responsibility of the manufacturer to ensure adequacy of the design and good engineering practice in the manufacture of the accessories and fittings for KPLC. The manufacturer shall submit information which confirms satisfactory service experience with products which fall within the scope of this specification.

### 1. SCOPE

This specification is for Transmission Lines and Substations Accessories and Fittings.

### 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 supplier.

ISO 1461: Metallic Coatings – Hot dip galvanized coatings on fabricated ferrous products – Requirements.

BS 3288: Insulator and Conductor Fittings for Overhead Power Lines

BS 4579: Performance of Mechanical and Compression Joints in Electric Cable Wire and Connectors.

ISO 1459 Metallic coatings - Protection against corrosion by hot dip galvanizing - Guiding principles

### 3. TERMS AND DEFINITIONS

For the purpose of this specification, the definitions given in the reference standards shall apply.

### 4. REQUIREMENTS

#### 4.1 SERVICE CONDITIONS

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The accessories and fittings shall be suitable for continuous operation outdoors in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, 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.

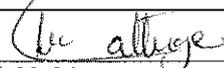
#### 4.2 DESIGN AND CONSTRUCTION

- 4.2.1 The fittings shall be designed and manufactured to BS 3288, the requirements of this specification and shall be suitable for use on 150mm<sup>2</sup> - 450mm<sup>2</sup> Aluminum Conductor Steel Reinforced (ACSR).
- 4.2.2 The fittings shall not damage the conductor except for any deformation necessary to attach the fitting.
- 4.2.3 The conductor fittings shall be made of material of sufficient ductility that the fittings can withstand the dynamic mechanical loads to which they are likely to be subjected in service.
- 4.2.4 The conductor fittings shall not give rise to the generation of visible or audible corona discharge at the specified test voltages.
- 4.2.5 The design of adjacent metal parts and mating surfaces shall be such as to prevent corrosion of the contact surface and to maintain good electrical contact under all service condition.
- 4.2.6 All conductor fittings shall be so designed that bi-metallic corrosion within or between fittings or between a fitting and the conductor does not occur.
- 4.2.7 The fittings shall be free from defects which would likely cause them to be unsatisfactory in service.
- 4.2.8 All parts of each fitting shall be inherently resistant to atmospheric corrosion, both during storage and in service.
- 4.2.9 Ferrous parts shall be protected by hot dip galvanizing as per the requirement of ISO 1461 & ISO 1459. The minimum average coating weight for any individual test area shall be not less than 610g/m<sup>2</sup>.
- 4.2.10 A traceability system shall be available for all batches of produced parts. This system shall at least contain the following information:
- project, batch and part references
  - incoming goods protocols

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- traceability of all applied raw materials during manufacturing, starting at the incoming goods test and ending at the finished and approved part
- traceability of all rejected raw materials and semi-finished parts and components
- traceability of all rejected finished parts and components.
- identification procedure of rejected materials and parts.

The traceability system shall exist of different inspection and control protocols and will be inspected as part of the factory acceptance

4.2.11 Necessary bolts and nuts round washers and spring washers shall be provided for all clamps.

#### 4.2.12 Requirements for processing of materials

Process	Standards	Additional requirements
Shortening		Sharp edges shall be debarred after cutting or sawing.
Drilling	Holes shall be drilled.	Drilled holes shall be smooth and cylindrical, not oval
Punching	<b>Not allowed</b>	Holes shall never be punched
Bending and other deformations		- Plastic deformation by bending or setting while material is in heated state - The deformation shall be performed at a temperature between 780°C and 880 °C.
Welding	<b>Not allowed</b>	Welding of parts for clamps and fittings is not allowed
Hot-dip Galvanizing	ISO 1459 & ISO 1461	- All steel parts of the clamps, fittings and fastening materials shall be resistant to corrosion by means of hot-dip galvanizing - The zinc layer thickness shall be at least 70 micron

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Compressing		<p>The inner diameter of the connection (Dconnection) being compressed shall be</p> $\text{connection } D = D_{\text{conductor}} + T_{\text{conductor}} + 0.1 \text{ [mm]}$ <p>with: Dconductor = conductor diameter [mm] Tconductor = positive tolerance of conductor diameter [mm]</p> <p>The tolerance of the inner diameter (Dconnection) equals - 0 and +0,1 mm</p> <p>- The applied material shall not crack during compressing The supplier shall provide a description of the necessary dice with the matching pressing force The material shall be capable of withstanding the cold working due to compression. Steel components shall have sufficient impact strength after compression</p>
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**4.3 PARTICULAR REQUIREMENTS** (Guaranteed Technical Particulars: to be filled and signed by the *Manufacturer* and submitted together with copies of manufacturer's catalogues, brochures, drawings, technical data, sales records, customer reference letters, details of manufacturing capacity & experience and copies of type test reports for tender evaluation)

	Description	Minimum Requirements	Bidder's Offer
1	Splicing Sleeve for ACSR	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <ul style="list-style-type: none"> <li>▪ The fitting shall be full tension type and shall be suitable for open-span applications, joining wire ends and strengthening damaged conductors (restorative-repair).</li> <li>▪ The fitting shall posses positive spring-tension grip and shall not slip even under heavy loading, severe impact or vibration.</li> <li>▪ The fitting shall have mechanical properties at least equal to the corresponding conductor. It shall provide</li> </ul>	

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		<p>electrical conductance greater than the corresponding conductor.</p> <ul style="list-style-type: none"> <li>▪ The fitting shall safeguard underlying strand and shall not damage the parent metal.</li> <li>▪ The fitting shall have a core splice of galvanized steel and outer splice of aluminum alloy.</li> <li>▪ The breaking strength of the conductor and splicing sleeve shall be &gt;95% of the conductors UTS.</li> </ul>	
		Test Certificate and Test Reports	
2	Dead-end Compression Clamp for ACSR	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <ul style="list-style-type: none"> <li>▪ The dead end shall be manufactured from similar basic material to that of the conductor to which it should be applied. The conductor details are given elsewhere in this specification.</li> <li>▪ The rated holding strength of the dead end shall be equal to the full strength of the aluminium strands plus 10% of the steel core.</li> <li>▪ The breaking strength of the conductor and compression clamp shall be &gt;95% of the conductors UTS.</li> <li>▪ The Dead-End Clamp Assembly shall be of compression type and shall be suitable for terminating the Aluminium Conductor Steel Reinforced (ACSR) at the terminal, angle and section towers</li> <li>▪ The Dead-end Clamp Assembly shall have the following components ;               <ul style="list-style-type: none"> <li>a) Conductor Dead-end compression clamp</li> <li>b) Anchor ("U") Shackle</li> <li>c) Horn Holder Socket Eye for ACSR</li> </ul> </li> </ul>	
		Test Certificate and Test Reports	
3	ACSR conductor repair sleeve.	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <ul style="list-style-type: none"> <li>▪ The fitting shall be suitable for installing</li> </ul>	

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		<p>over a damaged conductor in order to restore its electrical and mechanical properties.</p> <ul style="list-style-type: none"> <li>The fitting shall be suitable for aluminium conductors</li> </ul>	
		Test Certificate and Test Reports	
4	Shear Bolts	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <ul style="list-style-type: none"> <li>Torsion Shear Bolts standard :GB/T 3632 --3633-95,ASTM E1852</li> <li>All bolts and nuts shall comply with BS 4190, BS EN 20898 or other approved standard and screw threads shall be to metric standards. Bolts and nuts shall be of steel. Screw threads shall not form part of the shearing plane between members, Bolts of any given diameter shall be of one grade of steel and marked for identification</li> </ul>	
		Test Certificate and Test Reports	
5	Shackle + (Pin and Washer)	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <ul style="list-style-type: none"> <li>70 kN ; BS 3288 Part 2;1990 Ref 15/29</li> <li>125kN ; BS 3288 Part 2;1990 Ref 28/29</li> </ul>	
		Test Certificate and Test Reports	
6	Shackle + (HexBolt, Nut and Split pin)	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <ul style="list-style-type: none"> <li>70 kN ; BS 3288 Part 2;1990 Ref 15/29</li> <li>125kN ; BS 3288 Part 2;1990 Ref 28/29</li> </ul>	
		Test Certificate and Test Reports	
7	Ball end Hook	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <ul style="list-style-type: none"> <li>BS 3288 Part 2;1990 Ref 15/81</li> </ul>	
		Test Certificate and Test Reports	
8	Ball end Eye	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p>	

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		<ul style="list-style-type: none"> <li>▪ Shackle: BS 3288 Part 2;1990 Ref 15/29</li> <li>▪ 70 kN: BS 3288 Part 2;1990 Ref 15/82</li> </ul>	
		Test Certificate and Test Reports	
9	Ball Clevis	Manufacturer & Country Model/Type Reference Number Features (performance requirements) <ul style="list-style-type: none"> <li>▪ 70 kN ; BS 3288 Part 2;1990 Ref 15/83</li> <li>▪ 125kN ; BS 3288 Part 2;1990 Ref 28/83</li> </ul>	
		Test Certificate and Test Reports	
10	Y - Clevis Ball	Manufacturer & Country Model/Type Reference Number Test Certificate and Test Reports	
11	Socket Clevis	Manufacturer & Country Model/Type Reference Number Features (performance requirements) <ul style="list-style-type: none"> <li>▪ 70 kN ; BS 3288 Part 2;1990 Ref 15/84</li> <li>▪ 125kN ; BS 3288 Part 2;1990 Ref 28/37</li> <li>▪ 190kN ; BS 3288 Part 2;1990 Ref 42/46</li> </ul>	
		Test Certificate and Test Reports	
12	Ball Tongue	Manufacturer & Country Model/Type Reference Number Features (performance requirements) <ul style="list-style-type: none"> <li>▪ 300kN ; BS 3288 Part 2;1990 Ref 67/48</li> <li>▪ 400kN ; BS 3288 Part 2;1990 Ref 84/48</li> </ul>	
		Test Certificate and Test Reports	
13	Socket Tongue	Manufacturer & Country Model/Type Reference Number Features (performance requirements) <ul style="list-style-type: none"> <li>▪ BS 3288 Part 2;1990 Ref 15/85</li> </ul>	
		Test Certificate and Test Reports	
14	Guy Grips Pole Top Type	Manufacturer & Country Model/Type Reference Number Features (performance requirements)	
		Test Certificate and Test Reports	
15	Guy Grips, Bottom Thimble Types	Manufacturer & Country Model/Type Reference Number Features (performance requirements)	
		Test Certificate and Test Reports	
16	Vibration Dampers	Manufacturer & Country Model/Type Reference Number Features (performance requirements) <ul style="list-style-type: none"> <li>▪ IEC 61089 Round wire concentric lay</li> </ul>	

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		<p>overhead electrical stranded conductors</p> <ul style="list-style-type: none"> <li>▪ IEC 61284 Overhead lines - requirements and tests for fittings</li> </ul> <p>IEC 61897 Overhead lines requirements and tests for stockbridge type Aeolian vibration dampers.</p> <p>Test Certificate and Test Reports</p>	
17	Arcing Horns	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <p>Test Certificate and Test Reports</p>	
18	Arcing Rings	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <p>Test Certificate and Test Reports</p>	
19	Suspension Clamps	<p>Manufacturer &amp; Country</p> <p>Model/Type Reference Number</p> <p>Features (performance requirements)</p> <ul style="list-style-type: none"> <li>▪ IEC 60120 Dimensions of ball and socket couplings of string insulator units.</li> <li>▪ IEC 60372 Locking devices for ball and socket couplings of string insulator units, dimensions and tests, with amendment 1</li> <li>▪ IEC 601284 Overhead lines - requirements and tests for fittings.</li> <li>▪ The conductor grip (no displacements) shall be more than the maximum working load.</li> <li>▪ At the Corona voltage level no visual discharge may occur on the clamp for phase conductors.</li> </ul> <p>Test Certificate and Test Reports</p>	
20	Clause 1 of this specification		
21	Clause 2 of this specification		
22	Clause 3 of this specification		
23	Clause 4.1 of this specification		
24	Clauses 4.2.1 to 4.3.12 of this specification		
25	Statement of compliance to specification and/or deviations if any		

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

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## 5. TESTS AND INSPECTION

5.1 The accessories and fittings shall be tested in accordance with the relevant requirements of ISO 1461, BS 3288 and 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 Test Certificates and Test Reports by the relevant International or National Testing/ Standards Authority of the country of manufacture or ISO/IEC 17025 accredited and independent testing laboratory shall be submitted with the tender (including certificate of accreditation for laboratory) for the purpose of technical evaluation, all in English Language.

Copies of Test Reports to be submitted shall include the results of the appropriate type tests made on not less than three accessories and fittings identical in all essential details with those to be supplied. The Test Reports shall include Mechanical Type Tests and Electrical Type Tests (Resistance and Electrical Heating Cycle Test).

5.3 Routine and sample test reports for the accessories and fittings to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. The test reports shall include Verification of Dimensions, Mechanical Type Tests and Electrical Type Tests (Resistance and Electrical Heating Cycle Test). KPLC may nominate two engineers to witness acceptance tests at the factory.

5.4 On receipt of the accessories and fittings, KPLC will inspect them for acceptance at stores and may perform or have tests performed in order to verify compliance with this specification. The supplier shall replace without charge to KPLC, any accessories and fittings which upon examination, test or use fail to meet any or all of the requirements in this specification.

## 6. MARKING, LABELLING AND PACKING

6.1 Instructions for installation and details on applicable tools shall be included in each package, all in English Language. The packaging shall protect accessories and fittings against damage.

6.2 The following information shall be marked legibly, indelibly and permanently (during manufacture) on each accessory/fitting:

- Name or trade mark of the manufacturer and Type reference number
- Conductor sizes applicable
- Crimping positions (for compression type)

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