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0.1 Circulation List

COPY NO.	COPY HOLDER
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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 1 Rev 0				

FOREWORD

This specification has been prepared by the Research and Development Departmentof the Kenya Power and Lighting Company Limited (abbreviated as KPLC) and it lays down requirements for Guyless Steel Mono Poles for use on overhead power lines. It is intended for use by the company in purchasing and installation of Steel Monopoles.

1. SCOPE

1.1 This specification is for Guyless steel monopoles for use on overhead power lines operating at voltages of 66KV.

1.2 The specification covers the design, manufacturing and installation of both the foundation and the steel pole complete with all associated fittings.

1.3 The specification also covers the fixing of the respective tension type insulator fittings together with stringing of the overhead line to the respective monopole structures.

1.4 The conductor, Earth Wire, ACSR, Tension type Insulators & Hardware Fittings for Earth Wire & ACSR shall be supplied by KPLC.

1.5 The stand alone poles will be used in the following applications:

a) Terminal poles
b) Angle poles.
c) Section Poles

1.6 The specification also covers inspection and test of the steel mono poles as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.

The specification stipulates the minimum requirements for manufacture and installation of the Guyless steel monopoles poles acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship and good engineering practice in the design, manufacture

and installation of both the foundation and the steel monopoles for The Kenya Power & Lighting Company.

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 edition of the referenced documents (including any amendments) applies.

S/no	STANDARD	DESCRIPTION
1	ISO/R/752-1968 ASTM B6	Specification for Zinc.
2	ISO 1461:	Hot dip galvanized coatings on fabricated iron and steel articles- Specifications and test methods
3	ASTM A 123 CAN/CSA G 164.	Method of testing uniformity of coating of zinc coated articles.
4	JIS G 3101	Steel for general structural purpose.
5	JIS G3444	Carbon Steel tubes for general purpose
6	ISO/R/597-1967	Ordinary rapid hardening & low heat Portland Cement
7	ISO/3893-1977	Code of practice for plain and reinforced concrete.
8	CSA S 16.1	Code of practice for use of structural steel in general Building construction
9	IEC 60826 ASCE 52 BS 8100	Code of Practice for use of structural steel in overhead transmission Line Part 1: Load and Permissible stresses. Code of Practice for use of structural steel in overhead transmission line: Fabrication, Galvanising, Inspection and packing. Code of Practice for use
10	BS:4360	Specification for weldable structural steel(Medium and High strength qualities).

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

The Guyless steel monopoles shall be suitable for continuous outdoor use in tropical areas with humidity of up to 90%, average ambient temperature of +30°C with a minimum of -1°C and maximum of +40°C and saline conditions with severe corrosive effects along the coast.

4.2 Design, Materials and Construction

STEEL POLE

4.2.1 The poles shall be round in shape and formed of jointed steel tubes pieces constructed as per JIS G3444 or the equivalent BS and ASTM standard. The jointing shall be by flanges and each jointed piece shall not be more than 8 Metres long.

4.2.2 The steel shall be of atleast grade SS 400 as per JIS G3101-2004 of minimum yield strength of 400Mpa and shall be designed, manufactured and tested to JIS G3101-2004 and the requirements of this specification. Other equivalent but internationally acceptable standards shall be stated by the contractor.

4.2.3 The steel shall be galvanized as per ISO 1461.

4.2.4 The pole shall be designed for specific type and locations and these details shall be availed to the bidders during the tendering process.

4.2.5 The pole shall be so designed that its strength shall be sufficient to take the load due to tension in conductors, wind pressure on conductors, weight of fittings, insulators, conductors and earthwire.

4.2.6 The poles shall either be for terminal (dead end) type or an angle pole. The angle poles shall be designed to cover specific angles as per specific pole locations. The

route profile shall be provided during bid time and it shall be the bidders responsibility to verify the site details.

4.2.7 The steel monopole shall be designed for vertical conductor formation and shall also be able to handle double circuit 66KV lines for the conductors and earthwire shown in table 1.0 and 2.0 respectively. The actual formations shall however be as shall be indicated during the bid for existing 66KV stayed poles to be replaced with the Guyless steel monopoles.

4.2.8 The height of the pole shall be such as to allow a phase to phase clearance of 1800mm in vertical formation and a ground clearance of minimum 6000mm at lowest sag.

4.2.9 The pole shaft shall present the most pleasing appearance consistent with the strength requirements in the specification and drawings. Pole shall be continuously tapered from top to bottom with uniform slope.

4.2.10 The poles shall be designed for a safety factor of 2.5.

4.2.11 The wind pressure shall be assumed to be 40 daN/m² for the purpose of computing the wind loading. However, during actual design for specific locations the contractor is expected to verify applicability of the stated wind pressure.

4.2.12 The bottom piece shall have suitably designed bolting holes to the concrete foundation. The correct torque to achieve the required strength for fixing to the foundation shall be stated by the contractor plus the recommended torque spanners.

4.2.13 The foundation and jointing bolting shall incorporate anti vandal features to deter attempts to carry out any unauthorized removal of bolts. Contractor to clearly state the offered anti-vandal features.

4.2.14 The pole shall incorporate anti-climbing features suitably fitted at a height of 3m above the base foundation to deter any attempts on unaided and unauthorized climbing.

4.2.15 The steel monopole shall however incorporate suitably sized climbing bolts fixed from a height of 1m above the anti-climbing device.

FITTINGS

4.2.16 The pole shall be supplied complete with fittings suitable for the specific pole location, span length and type.

4.2.17 The fittings shall be suitable for supporting tension type insulators, the conductors and earthwire whose characteristics are shown on tables 1.0 and 2.0 respectively.

4.2.18 The fittings shall be so designed that their strength in transverse direction shall be sufficient to take the load due to wind on conductors and attached insulators.

4.2.19 The fittings shall be made such as to provide conductor phase to phase clearance of 1800mm in vertical orientation.

Table 1.0: Conductor mechanical characteristics

Conductor	Wolf (150mm^2)	300mm^2 AAAC
Ultimate strength (daN)	6749	10150
Admissible tension (daN)	2249	4060
Modulus of elasticity (daN/mm2)	7720	
Coefficient of expansion	0,00001173	0.00360
Diameter (mm)	18,13	24.71
Cross-section Area (mm2)	154,3	362
Weight (kg)	0,713187	0.997

Table 2.0 Earthwire mechanical characteristics

1	Standard	BS 183
2	Grade	700
3	Material of earthwire	Galvanized steel
4	No. of earth wires	one
5	No of wires /wire diameter	7/2.65
6	Approximate strand diameter	8.0mm
7	Minimum breaking load of strand	27KN
8	Mass per KG/KM	300

FOUNDATION

4.2.20 The foundation shall be made of concrete specifically made of appropriate mix of sand, ballast and cement to suit the conditions of the particular pole location.

4.2.21 The manufacturer shall provide the respective foundation per pole depending on type of pole and geological formation of the soil.

4.2.22 Bidders are expected to visit the respective sites and collect the necessary data on soil type and other geological details to facilitate foundation design and eventual construction of the foundation

4.2.23 The foundation is expected to hold the pole in position during its lifetime without tilting, sinking or cracking. Base plates shall either be polygonal or circular to accommodate a larger number of bolts. The plate may need to have gusset plates (stiffeners) in order to transfer forces due to axial and bending moment to the pole.

4.2.24 Detailed mechanical forces computations shall be provided to support the designed foundation for the respective pole type.

4.2.25 The foundation shall include supply of materials such as cement, reinforcement steel, sand, coarse aggregates etc. Rates quoted shall include all items of work related to supply and installation of foundations such as form work, excavation and backfilling, setting and providing reinforcement.

4.2.26 Appropriate standards of carrying out the mixing shall be stated with evidence of meeting the particular state of soil condition for each pole. Clear instructions on curing and backfilling processes shall be stated with reference standards to support the works. Water quality shall also be stated.

ERECTION OF THE POLES

4.2.27 The contractor shall erect the pole on its foundation , connect the respective fittings and in liaison with KPLC carry out the conductor stringing.

4.2.28 The details of the scope of erection work shall include the cost of labour, all tools and plants and all other incidental expenses in connection with the erection and stringing works.

4.2.29 The contractor shall be responsible for transportation of all the materials as per the scope of work to site, proper storage and preservation at their own cost till such time the erected line is taken over by KPLC.

4.2.30 Incase of repairs to damaged galvanizing, this shall be carried out as per ISO 1461. The same shall be treated with zinc rich paint (commercial grade) (having at least 90% zinc content) before erection.

4.2.31 The method followed for the erection of monopoles, shall ensure the following:

(a) Straining of the members shall not be permitted for bringing them into position.

(b) The erection shall be in accordance with approved design instructions on erection to prevent any mishap during monopole erection.

(c) Monopole shall be fitted with number plate, danger plate, and anti climbing device as described in the design.

4.2.32 The nuts shall be tightened properly using correct size spanner/torque wrench. Before tightening, it will be seen that filler washers and plates are placed in gaps between members wherever applicable bolts of proper size and length are inserted, and spring washers are inserted wherever required.

4.2.33 All the brackets to support the respective pole formation as per respective pole design details including the earthwire shall be correctly mounted in readiness for fixing of insulators and stringing of conductors.

4.3 **EXPERIENCE**

4.3.1 The contractor should have should have successfully designed, manufactured and completed 10 similar projects in the last 3 years.

4.3.2 The contractor should have been in this particular business for a period of not less than 5 years.

4.3.3 Supporting evidence for the requirements on experience shall be submitted together with the rest of the bid documents for evaluation. Details of name and email contacts for the relevant utilities where the above works have been carried out shall also be included to facilitate authenticating the information.

4.4 Quality Management System

4.4.1 The contractor shall submit a quality assurance plan (QAP) that will be used to ensure that the steel poles materials, manufacture, 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 for imported poles and the Diamond Mark of Quality for locally produced poles.

4.4.2 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 (or for locally manufactured poles, the Diamond Mark of Quality from Kenya Bureau of Standards) shall be submitted with the tender for evaluation.

4.5 SUBMISSION OF DRAWINGS

4.5.1 After award of tender, the contractor shall submit the following documents for Approval

1. Technical /Geological analysis report for each of the pole locations plus the soil investigation reports.
2. Detailed survey report and profile drawings showing ground clearance and monopole locations.
3. Details of concrete foundation making and bolts for the foundation plus the relevant drawing on the same.
4. Technical computations based on conductor size and configuration to be connected giving the design strength requirements for the pole and fittings.
5. Design drawings for the sections to be jointed together plus the complete pole with fittings.
6. Details on parts and material requirements including jointing bolts and welding and anti climbing features.
7. All drawings submitted by the Contractor including those submitted at the time of Bid shall be with sufficient detail to indicate the type, size, arrangement, dimensions, material description, bill of materials, weight of each component, break-up for packing and shipment, fixing arrangement required, the dimensions required for installation and any other information specifically requested in these specifications.

5. TESTS AND INSPECTION

5.1 Copies of previous Test Certificates and Test 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.

5.2 The accreditation certificate for the third party testing laboratory shall also be submitted with the tender (all in English Language)

5.3 The Test Reports be submitted with the tender shall not be more than five years old.

The submitted tests shall include the following:

a. The type of tested monopole

b. The name and address of the monopole manufacturer
c. The name and address of the client.
d. The dates and location of testing.
e. The name of persons present during the tests.
f. A list of various assembly and shop drawings relating to the monopole tested, including any modification of the drawings referred to.
g. A dimensioned line diagram of the monopole showing the various load points and directions of loading to be applied and table with the specified load.
h. Diagram showing the rigging arrangement used to apply the test loads.
i. Brief description of the test facility including the number, location, range and calibration charts or tables of every load transducer, as well as the accuracy of the equipment used to measure the test loads.
j. One table per test, showing the loads required at the various points on the structure and for the various loading steps.
k. One table per test, showing the various deflection values which may have been recorded.
l. In the case of failure :

i. a table showing the maximum loads applied to the structure, just before the collapse.
ii. a brief description of the failure ; and
iii. the dimensional and mechanical characteristics of the failed elements.

m. A certain number of photographs, showing the whole of the structure and, possibly, details of the failure

5.4 The complete steel pole shall be inspected and tested to the requirements of this specification. It shall be the responsibility of the supplier to perform or to have performed all the tests as specified. All standard tests including quality control tests in accordance with relevant ASTM, BS shall be carried out .

5.5 After completion of works, final checking of the line shall be done by the Contractor to ensure that all the foundation works, monopole erection, and stringing have been done strictly according to the specifications and as approved by KPLC. All the works shall be thoroughly inspected keeping in view of the following main points:

i. Sufficient backfilled earth is lying over each foundation pit and it is adequately compacted.
ii. All the monopole members are correctly used, strictly according to final approved drawing and are free of any defect or damage, whatsoever.
iii. All bolts are properly tightened and punched/tack welded.

iv. The stringing of the conductors and earthwire has been done as per the approved sag and tension charts and desired clearances are clearly available.
v. All conductor and earthwire accessories are properly installed.
vi. All other requirements to complete the work like fixing of danger plate phase plate, number plate, anti climbing device etc. are properly installed.
vii. All monopoles are to be properly grounded as per requirements of the specification.
viii. The line is tested satisfactorily for commissioning purpose.

6. MARKING

6.1 Each steel monopole pole shall be marked permanently by embossing on a permanently secured corrosion resistant plate at a position 1.5m above the pole Ground line with the following details.

a) Manufacturer's name
b) Date of manufacture (mm/yy)
c) Length of pole (meters) and Tip dimensions (mm)
d) Ultimate/Working load/Strength Class
e) Weight of pole
f) Standard to which the pole complie
g) The words "PROPERTY OF KPLC"

The plate used shall be made of stainless steel, securely affixed to the pole. In all cases the lettering shall be not less than 5mm high legibly impressed.

7. DOCUMENTATION

7.1 The bidder shall submit the tender documents 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:

a) Guaranteed Technical Particulars;
b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
c) Sales records for the last five years and at least four customer reference letters;

d) Details of manufacturing capacity and the manufacturer's experience;

e) Copies of required test reports by a third party testing laboratory accredited to ISO/IEC 17025. The test reports shall not be more than five years old . Ultimate load.

f) Copy of accreditation certificate for the testing laboratory;

g) Copy of the manufacturer's ISO 9001:2008 certificate or for local manufacturer's valid Diamond Mark of Quality Certificate issued by KEBS.

7.2 Detailed test program to be used during factory testing,

a) Marking details and method to be used in marking the steel poles .

b) Contractors'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 steel poles for The Kenya Power & Lighting Company.

c) Packaging details (including packaging materials and their dimensions).

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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, 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)*

Tender No. .....

Clause number	**Bidder's offer** (indicate full details of the offered equipment for each requirement of the specification)
Name and Address of the Manufacturer, and Country of manufacture	
Name & address of Bidder	
1. Scope	
1.1	
1.2	
1.3	
1.4	
1.5	
1.6	
Reference standards	
2.0	
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STEEL POLE	

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5	
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7	
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5.5	
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6.1 (a) to (g)	
DOCUMENTATION	
7.1 (a) to (g)	
7.2 (a) to (c)	

.....

Manufacturer's Name, Signature, Stamp and Date