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

## 0.1 Circulation List

| COPY NO. | COPY HOLDER |
|---|---|
| 1 | Research & Development Manager |
| 2 | Procurement Manager |
| 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) |
|---|---|---|---|---|
| Issue 2 | 2012-05-30 | Cancels and replaces TSP-09-007 1st Issue Rev 0 dated May 2005 | S. Kimitei | G.K. Gathige |
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## FOREWORD

This specification has been prepared by the Research and Development Department of The Kenya Power and Lighting Company Limited (Kenya Power) and it lays down requirements for Portable Earthing Equipment used for temporary earthing on 66kV, 33kV and 11kV overhead lines. It is intended for use by Kenya Power in purchasing Portable Earthing Equipment used for temporary earthing on 66kV, 33kV and 11kV overhead lines.

It shall be the responsibility of the supplier to ensure adequacy of the design and good engineering practice in the manufacture of the Portable Earthing Equipment for Kenya Power. The supplier shall also submit information which confirms satisfactory service experience with products which fall within the scope of this specification.

## 1. SCOPE

1.1 This standard specifies requirements for Portable Earthing Equipment used as Circuit Main Earths (CME) or Additional Earths on 66kV, 33kV and 11kV overhead lines operating at 50Hz.

1.2 The specification covers the following:

a) Portable Earthing Equipment with Copper Leads

b) Portable Earthing Equipment with Aluminium Leads

Note: The type required shall be specified for each Tender.

## 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.

IEC 61230: Live working – Portable Equipment for Earthing or Earthing and Short-circuiting.

IEC 61138: Cables for Portable Earthing and Short-circuiting Equipment

BS 7454: Method for calculation of thermally permissible short circuit currents, taking into account non-adiabatic heating effects.

## 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 equipment shall be suitable for continuous outdoor operation in tropical areas at altitudes of 2200m above sea level, humidity of upto 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 General Requirements

4.2.1 The portable earthing equipment shall be designed and manufactured in accordance with IEC 61230 and IEC 61138 and shall permit safe earthing of electrical installations.

4.2.2 The portable earthing equipment shall be supplied as a complete kit comprising earth-end clamp, line-end clamp and flexible leads complete with terminations.

4.2.3 After application of the earth-end clamp to the appropriate earth connection, the equipment shall be suitable for application of the line-end clamps in turn by means of non-conducting operating rod to the overhead line conductors.

Note: The operating socket used in the company is of the form shown in fig 2 and is procured with the operating rod separately.

4.2.4 The design of the equipment shall include a separate 'star-point' connection device between the earth lead and phase leads. This 'star-point' connection device shall be provided with a means of supporting the weight of the complete assembly by attachment to the line support, adjacent to the position adopted by the operator, before the application of the line-end clamps.

4.2.5 The method of coupling the operating rod to the line-end clamps shall permit the application of the clamp to the line conductor from an angle of between 45 –90° to the axis of the conductor.

4.2.6 The complete equipment shall withstand the maximum expected short circuit fault current during the selected fault time.

For 66kV, 33kV and 11kV overhead lines, this current is 13kA for 1 sec.

4.2.7 The equipment shall be able to withstand all stresses from the specified fault currents without causing electrical, mechanical, chemical or thermal danger to persons.

4.2.8 All the components shall be resistant to the levels of corrosion and physical handling stresses expected in service.

### 4.3 Earth End Clamp

4.3.1 The earth end clamp shall comprise:

(a) A device for making electrical contact with the earth connection point i.e. earth rod assembly or steel work as appropriate.

(b) Operating screw for tightening (by hand) the device to the earth connection point.

(c) A termination separate from the arrangement given in item 4.3.1(b) for attaching the protective conductor to the device given in item 4.3.1 (a).

4.3.2 The clamp shall be rated for 13kA 1 sec and shall be of the general shape and material details given in fig 1.

4.3.3 The torque necessary to complete the connection shall not exceed 22 Nm and the clamp shall be capable of withstanding over-tightening up to a maximum torque of 45 Nm without damage to the clamp or conductor.

### 4.4 Line End Clamp

4.4.1 The line end clamp shall comprise:

(a) A device for making electrical contact with the overhead conductor.

(b) Operating screw for tightening the device on to the conductor. The operating screw shall be tightened by means of operating socket fitted to the fibre glass operating pole.

(c) Once hooked over the conductor, the clamp shall become self supporting whilst the operating screw is tightened or loosened.

(d) A termination separate from the arrangement given in item 4.4.1(b) for attaching the protective conductor to the device given in item 4.4.1(a).

4.4.2 Each line-end clamp shall be suitable for connection to aluminium multi-stranded line conductor in both new and oxidized conditions of diameters 6-20mm and copper bus-bar tubes of 38mm diameter. The clamps shall be suitable for connection to both tension and non-tension conductors.

4.4.3 The design of the clamp shall be such that its attachment to the conductor does not result in the inevitable deformation of the later. It shall slide smoothly onto the overhead conductor.

4.4.4 The torque necessary to complete the connection shall not exceed 22 Nm and the clamp shall be capable of withstanding over-tightening up to a maximum torque of 45 Nm without damage to the clamp or conductor.

4.4.5 The clamp shall be rated for 13KA for 1 sec and shall be of the general shape and material details given in fig 3.

### 4.5 Flexible Cable with terminations

#### 4.5.1 General Requirements

The cable shall be of low weight and flexible over a wide range of temperature.

The insulating covering shall offer protection against mechanical and chemical damage.

The earthing and short-circuiting cables shall withstand a fault current of 13KA for 1 sec.

#### 4.5.2 Construction

The cable shall be manufactured in accordance with IEC 61138.

The covering of the cable shall be based on a compound of thermoplastic polyvinyl chloride suitable for indoor and outdoor use within -5°C to 70°C in accordance with IEC 61138. The mean value of the thickness of the covering shall be not less than 1.8mm.

**a) Type 1: Copper**

The conductor shall consist of annealed copper tinned wires. The maximum diameter and electrical resistance (at 20°C) of the conductor wires shall be 0.21mm and 0.277ohm/km respectively (in accordance with IEC 61138).

Copper Cables for use in overhead lines (66kV, 33kV, 11kV) portable earthing equipment shall be 70mm$^2$ in cross sectional area and 13.9mm overall conductor diameter.

**b) Type 2: Aluminium**

The flexible lead shall be manufactured from fine stranded commercially pure aluminium sheathed with clear PVC. The maximum diameter and electrical resistance (at 20°C) of the conductor wires shall be 0.46mm and 0.326ohm/km respectively (in accordance with IEC 61138).

Aluminium Cables for use in overhead lines (66kV, 33kV, 11kV) portable earthing equipment shall be 95mm$^2$ in cross sectional area and 17mm overall conductor diameter.

### 4.5.3 Terminations

The cables shall be supplied complete with terminations ready for connection to line end and earth end clamps by use of single bolts.

Excellent fatigue resistance is required for the connections of cables to clamps and connecting cluster ('star-point'). The terminations used shall obviate fraying of conductor strands and wear on protective PVC insulation and shall be fitted with transparent heatshrink flexible sleeves to provide additional support (design as per fig 4, for aluminium, similar design for copper cables).

The connections shall ensure that the specified minimum characteristic of the cable are maintained. Terminal lugs shall be supplied fully compressed onto the leads.

## 5. TESTS AND INSPECTION

5.1 The complete earthing kit shall be tested according to the requirements of IEC 61230. The earthing and short circuiting cables shall be tested in accordance with IEC 61138. 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 shall be submitted together with other bid documents for tender evaluation. The test report shall be form ISO/IEC 17025 accredited testing laboratory.

5.3 Upon completion of manufacturing process, the equipment shall be inspected by two Kenya Power Engineers at place of manufacture and sample tests carried out in their presence before shipment.

Routine and Sample Test Reports shall be completed and submitted to the purchaser Kenya Power for approval before shipment of the equipment.

5.4 The purchaser (Kenya Power) shall perform or have performed any of the specified tests to confirm compliance of the received equipment with the specifications before acceptance to stores. The supplier shall replace any portable earthing equipment that fails any of the inspection/test at stores or when used in the field.

## 6.0 INSTRUCTIONS, MARKING AND PACKING

6.1 Instruction for use shall be included in each package ( all in English Language).

6.2 Each component shall be marked with the following markings:

a) Manufacturer's name or trade mark.

b) Model or type reference number for the device.

c) Cross-section in mm2, material and a double triangle symbol at 1m intervals on each cable.

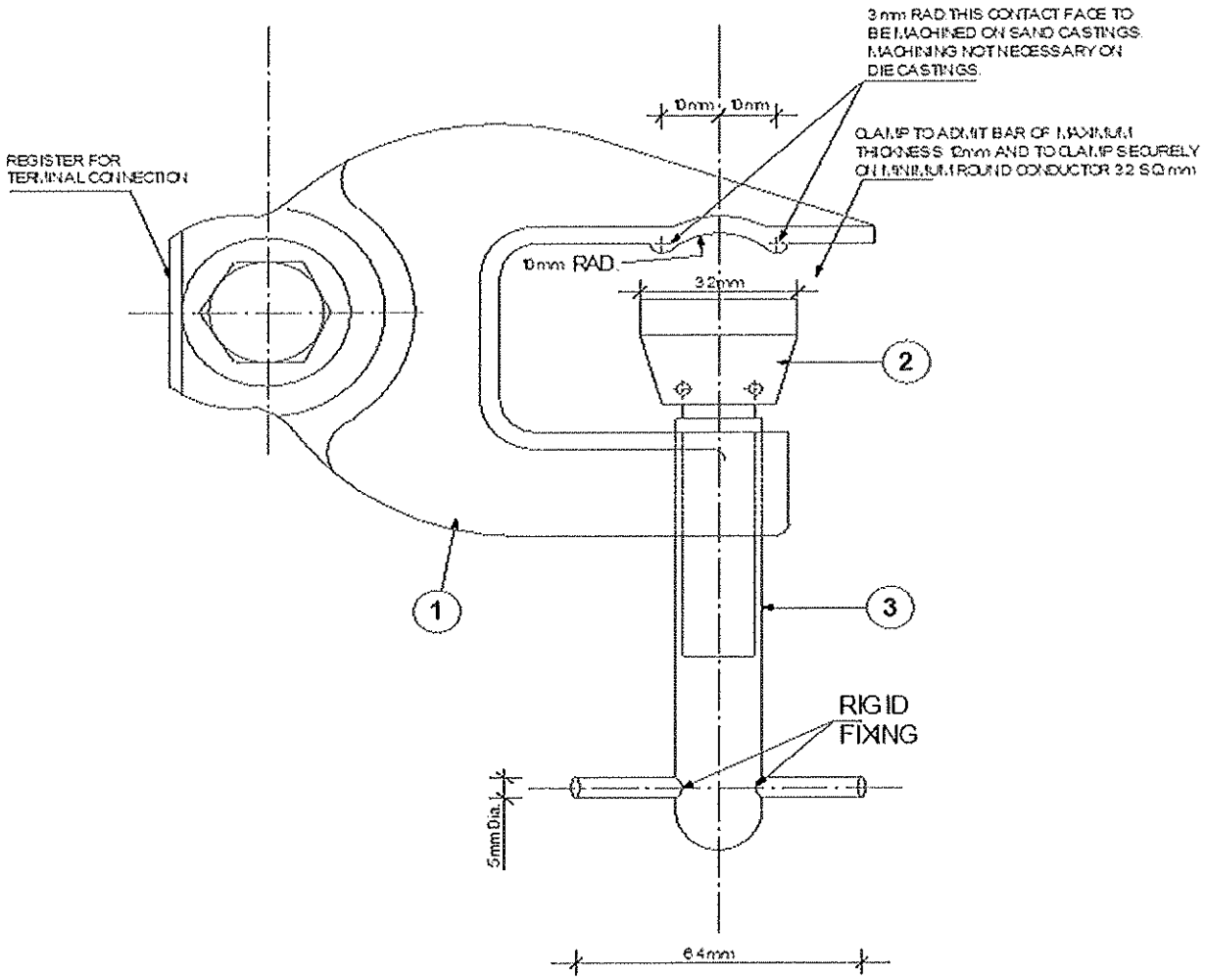
d) Year of manufacture.

e) Rated current Ir (kA r.m.s) for rated time tr(s) of the device (example 13kA/1s).

f) The words 'PROPERTY OF KPLC' (Note: Authority to use this inscription shall be given together with the approval for design drawings before manufacture.

6.3 Markings shall be clearly legible, durable and consist of letters at least 3mm high. All markings shall be in the English Language.

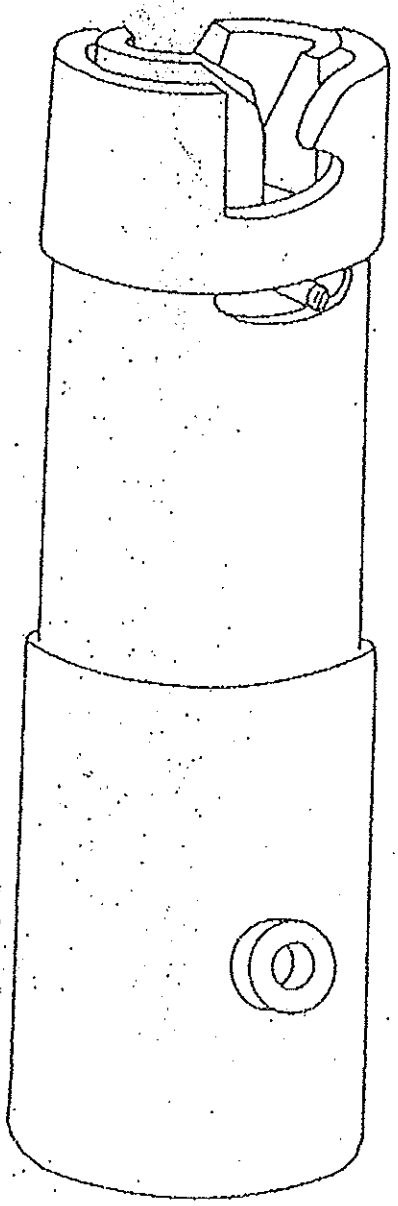
6.4 The portable earthing equipment shall be supplied packed in a carrying case made of strong and durable canvas material or better.




| Item | Description | Material |
|---|---|---|
| 1 | Clamp body | Aluminium alloy to BS 1490 |
| 2. | Rocker body | Aluminium alloy to BS 1476 |
| 3. | Operating screw 12mm | Stainless steel to BS 970 |
| – | Pin,bolt ,nuts & washers | Stainless steel to BS 970 |

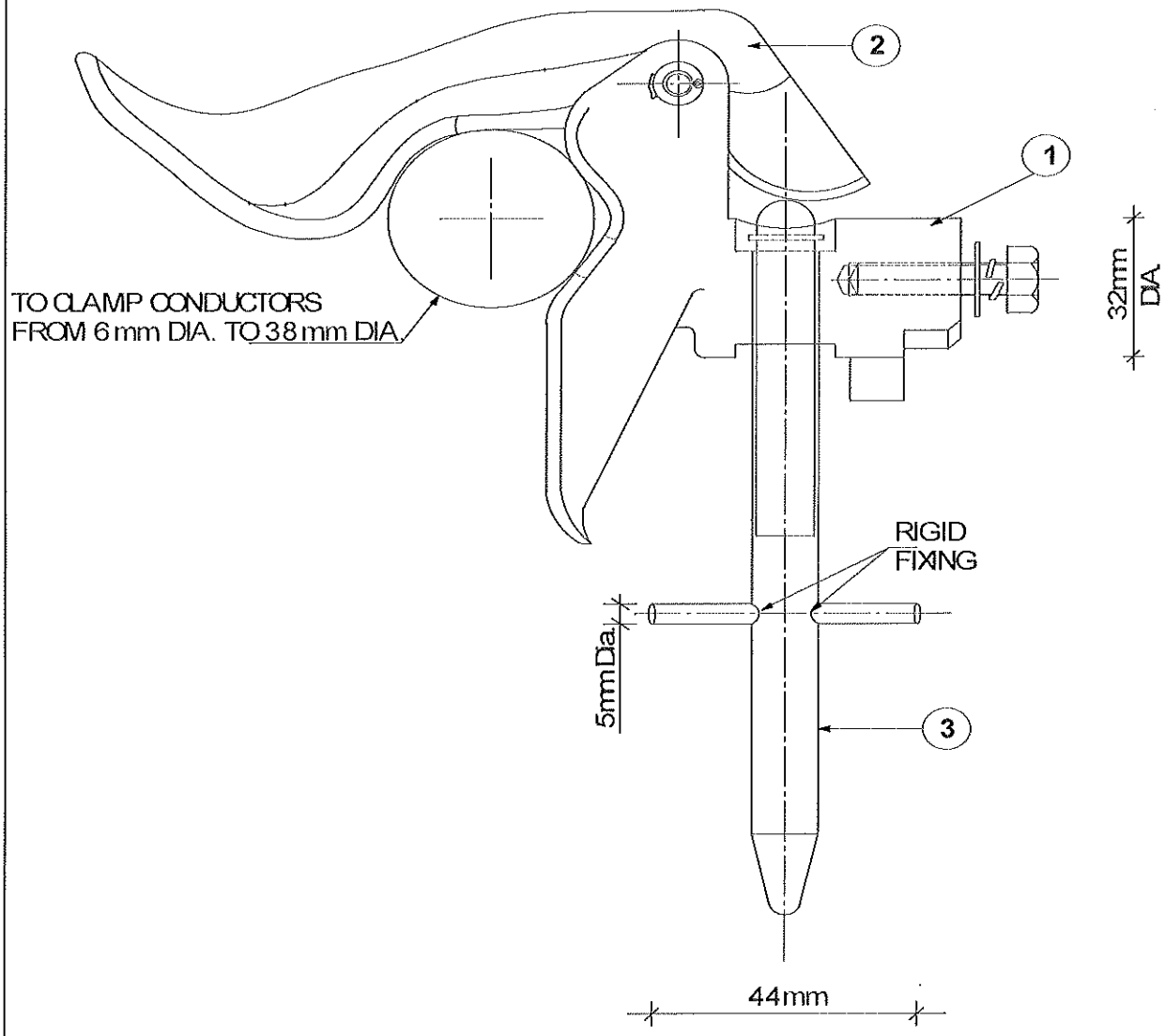
**Fig 1: Earth End Clamp - General Layout**

Checked by: S. Kiniti
Drawn by: J.M.Kahare
Date: 09.07.2002



Material Aluminium alloy casting with aluminium insert

**Fig 2: General layout of operating head (supplied separately)**

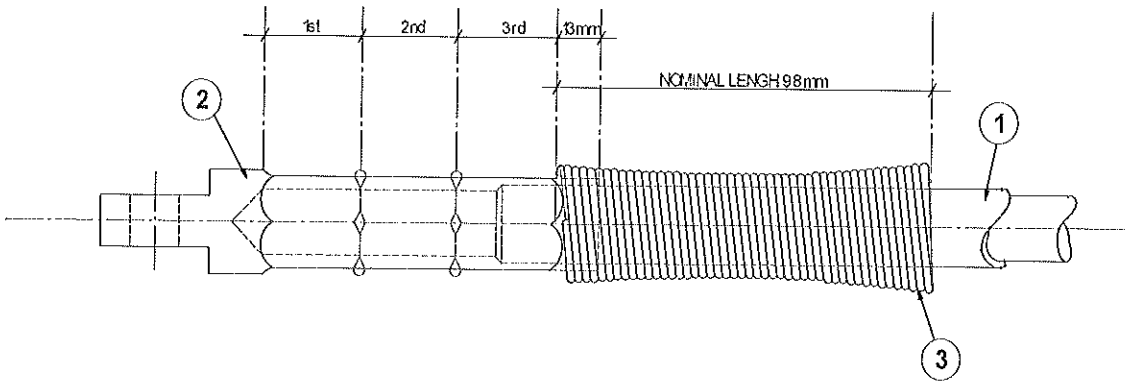



| Item | Description | Material |
|---|---|---|
| 1 | Clamp body | Alminium alloy to BS 1490 |
| 2. | Trigger | Alminium alloy to BS 1476 |
| 3. | Operating screw | Stainless steel to BS 970 |
| — | Spindle,washers,split Pin, & bolt. | Stainless steel to BS 970 |

**Fig. 3 :Line End Clamp 6 - 38 mm Dia. Conductor - General Layout**

Checked by: S. Kimitei
Drawn by: J.M.Kahare
Date: 10/07/2002

3 COMPRESSIONS ( 50 Ton Press or Equivalent )




| Item | Description | Material |
|---|---|---|
| 1 | Cable | Commercial pure Aluminium |
| 2. | Fitting | Commercial pure Aluminium |
| 3. | Spring | 12SWG Austenitic stainless steel to BS 970 |

Fig. 4 :Cable Termination - General Configuration

Checked by: S. Kimitei
Drawn by: J.M.Kahare
Date: 19/07/2002

**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 and copies of certificates/test reports for tender evaluation)*

**Tender No. .....**

| **Clause number** | **Bidder's offer** (indicate full details of the offered equipment for each requirement of the specification) |
|---|---|
| 1. Scope | |
| 1.1 | |
| 1.2 | |
| 4. Requirements | |
| 4.1 Service Conditions | |
| 4.2 General Requirements | |
| 4.2.1 | |
| 4.2.2 | |
| 4.2.3 | |
| 4.2.4 | |
| 4.2.4 | |
| 4.2.5 | |
| 4.2.6 | |
| 4.2.7 | |
| 4.2.8 | |
| 4.3 Earth End Clamp | |
| 4.3.1 | |
| 4.3.2 | |
| 4.3.3 | |
| 4.4 Line End Clamp | |
| 4.4.1 | |
| 4.4.2 | |
| 4.4.3 | |
| 4.4.4 | |
| 4.4.5 | |
| 4.5 Flexible Cable with terminations | |
| 4.5.1 | |
| 4.5.2 | |
| 4.5.3 | |
| Test & Inspection | |
| 5.1 | |
| 5.2 | |
| 5.3 | |
| 5.4 | |
| Marking & Instructions | |
| 6.1 | |
| 6.2 | |
| 6.3 | |

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**Supplier's Name, Signature, Stamp and Date**