



TITLE:  
**SPECIFICATION FOR LOW  
VOLTAGE FUSE CUT-OUT**

Doc. No.	KPLC1/3CB/TSP/11/023
Issue No.	2
Revision No.	0
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**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 Revision 0	2012-04-16	Cancel and replaces Issue 1 Revision 0 dated 2008-05-28 and all previous issues	S. Kiritei <i>[Signature]</i>	G. K. Gathige <i>[Signature]</i>

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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 Low Voltage (LV) Fuse Cut-out. It is intended for use by Kenya Power in purchasing the items.

It shall be the responsibility of the supplier to ensure adequacy of the design and good engineering practice in the manufacture of the LV Fuse Cut-outs for Kenya Power. The supplier shall submit information which demonstrates satisfactory service experience of the manufacturer with products which fall within the scope of this specification.

### 1. SCOPE

- 1.1 This specification is for low voltage fuse cutouts intended for use at distribution transformer take – off and consumer input terminals.
- 1.2 The specification covers the following cut-outs
- (i) House Service Cut-out
  - (ii) Underground Service Cut-out
  - (iii) Overhead Service Cut-out (Transformer Fuse Cut-out)

Particular requirements for each fuse cut-out type are given in Clause 4.4

### 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.

IEC 60269: Low – voltage fuses.

BS 88: Cartridge fuses for voltages up to and including 1000V a.c. and 1500V d.c.

BS 1361: Cartridge fuses for a.c. circuits in domestic and similar premises.

BS 2874: Specification for copper and copper alloy rods and sections (other than forging stock)

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- BS 7657: Specification for cut-out assemblies up to 100 A rating, for power supply to buildings
- ISO 179-1: Plastics -- Determination of Charpy impact properties -- Part 1: Non-instrumented impact test
- ISO 178: Plastics -- Determination of flexural properties
- ISO 527-2: Plastics -- Determination of tensile properties -- Part 2: Test conditions for moulding and extrusion plastics
- ISO 604: Plastics -- Determination of compressive properties
- ISO 62: Plastics -- Determination of water absorption
- ISO 1183-1: Plastics -- Methods for determining the density of non-cellular plastics -- Part 1: Immersion method, liquid pycnometer method and titration method
- ISO 2577: Plastics -- Thermosetting moulding materials -- Determination of shrinkage
- ASTM D2583: Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- ASTM D1895: Standard Test Methods for Apparent Density, Bulk Factor, and Pourability of Plastic Materials
- ISO 243: Turning tools with carbide tips -- External tools
- ASTM D495: Standard Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation
- ISO 75: Determination of temperature of deflection under load
- UL 94: The Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances testing

**3. TERMS AND DEFINITIONS**

For the purposes of this specification the definitions given in the reference standards and the following definition shall apply:

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- **Fuse Cut-out** – The combination of the fuse base with its fuse carrier (referred to as fuse-holder in BS 88-1).

#### 4. REQUIREMENTS

##### 4.1 SERVICE CONDITIONS – *applicable to all categories of fuse cut-outs*

The LV Fuse Cut-out shall be insulated type suitable for continuous use indoors and outdoors in tropical areas in humidity of up to 90%, average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C and saline conditions along the coast.

Particular requirements for each fuse cut-out type are given in Clause 4.4.

##### 4.2 DESIGN – *applicable to all categories of fuse cut-outs*

The fuse cutouts shall be designed, manufactured and tested to the standards listed in clause 2 of this specification.

##### 4.3 MATERIALS AND CONSTRUCTION – *applicable to all categories of fuse cut-outs*

- 4.3.1 Each fuse cutout shall be supplied as a complete unit incorporating the fuse base and its fuse carrier. It shall be supplied complete with mounting screws.
- 4.3.2 The fuse base shall be moulded in light grey glass reinforced polyester thermoset material. The material shall be DMC type (Dough Moulding Compound).
- 4.3.3 The fuse carrier shall be manufactured from the same materials and colour as the fuse base.
- 4.3.4 The fuse base and the fuse carrier shall interlock fully when fitted to provide weatherproof housing and all live parts fully shielded.
- 4.3.5 The DMC insulation materials used in the manufacture of the cut-out shall be of minimum characteristics given Table 1 of this specification:

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**Table 1: Required characteristics of insulating materials (DMC)**

	Description	Test Method	Requirements
1	Impact strength	ISO 179	40-50 kJ/m <sup>2</sup>
2	Flexural strength	ISO 178	131-152 Mpa
3	Flexural modulus	ISO 178	14 GPa
4	Tensile strength	ISO 527	48 – 62 MPa
5	Compressive strength	ISO 604	159 MPa
6	Water strength	ISO 62	0.15 %
7	Specific gravity	ISO 1183	1.78
8	Shrinkage	ISO 2577	0.10 – 0.30 %
9	Hardness	ASTM D2583	30 – 50 Barcol
10	Bulk factor	ASTM D1895	2
11	Dielectric strength	ISO 243	11 kV/mm
12	Arc resistance	ASTM D495	180+ seconds
13	Heat deflection temperature @264PSI	ISO 75	>260°C
14	Flame resistance at 1.5mm	UL 94	V-0

4.3.6 The brass used in the manufacture of the brass terminal blocks shall comply with BS 2874 designated CZ12139Pb3 and shall have the following composition:

**Table 2: Required composition of brass used in brass terminal blocks**

	Metal	Composition (content in the brass terminal)
1	Copper	56.5 – 58.5%
2	Lead	2.5 – 3.5%
3	Iron	0.3%
4	Zinc	Balance

4.3.7 In addition, the brass used in the manufacture of the brass terminal blocks shall be of the following minimum physical and mechanical properties:

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**Table 3: Required properties of brass used in brass terminal blocks**

	Property	Required Value
1	Density	8.47kg/m <sup>3</sup>
2	Melting point	875 °C
3	Thermal expansion	20.9x10 <sup>-6</sup> /K
4	Modulus of elasticity	97 Gpa
5	Thermal conductivity	123 W/m.K
6	Electrical resistivity	0.062x10 <sup>-6</sup> Ω.m
7	Proof stress	150 – 420 MPa
8	Tensile strength	360 – 580 MPa
9	Elongation	25 – 5%
10	Hardness Vickers	100 to 160 HV

4.3.8 Detailed drawings of the cut-out offered, data sheets and test reports illustrating the composition and the physical, mechanical and electrical properties of both the DMC and the brass used in the terminal blocks shall be submitted with the tender for evaluation and with the cut-outs during delivery to Kenya Power stores

**4.4 PARTICULAR REQUIREMENTS**

**4.4.1 House Service Cut-out**

In addition to the requirements given in clauses 1, 2, 3, 4.1, 4.2 and 4.3.1 upto and including 4.3.8, the House Service Cut-out shall comply with the following:

4.4.1.1 The House Service cut-out shall be of the following types:

(a) Single pole insulated House Service cut-out without neutral link nor earthing block (designated SP). The classification as per BS 7657 is Type B fuse holder.

(b) Single pole insulated House Service cut-out with combined neutral & earthing block (designated SPNE or CNE). The classification as per BS 7657 is Type A2 fuse-unit.

**Note:** *The SP cutout shall be suitable for use in conjunction with SPNE cutout to make TP+NE sets.*

4.4.1.2 The fuse base shall be complete fitted with solid brass terminal blocks with serrated bores and two pinching brass screws per conductor to suit stranded

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aluminium and copper phase and neutral conductors of 10 to 35mm<sup>2</sup> nominal cross-sectional area. The brass screws shall be of size M8 and have adequate length to accommodate the range of conductors (10 to 35mm<sup>2</sup>).

- 4.4.1.3 Terminals shall be of the pillar type (offering parallel connections) with direct pressure on the conductor in accordance with BS 7657.
- 4.4.1.4 The terminals shall be silver plated to provide excellent contact between the cable conductor/terminal bores and the fuse clip contact/terminal interface.
- 4.4.1.5 The brass used in the manufacture of the brass terminal blocks and brass screws shall comply with BS 2874 designated CZ12139Pb3 and shall have the composition and characteristics given in clause 4.3.6 and 4.3.7 of this specification.
- 4.4.1.6 The fuse base shall incorporate looping facility (on both incoming and outgoing circuits) to connect banks of cutouts. Two separate brass serrated bores each with two pinching brass screws per connection shall be provided on the terminals for phase and neutral incoming, outgoing and looping connections.
- 4.4.1.7 The dimensions of the combined neutral/earth and phase terminal blocks shall be adequate to accommodate the number of M8 screws required for incoming, outgoing and looping connections specified. Each single connection shall require two M8 brass screws.
- 4.4.1.8 The terminals shall be fixed in position by a suitable retention arrangement.
- 4.4.1.9 The incoming phase terminal on the fuse base shall be marked red.
- 4.4.1.10 The fuse carrier shall be suitable for barrel fuse link Type IIa as specified in BS 1361. It shall incorporate copper fuse clips and phosphor bronze insert/spring designed and constructed to give adequate contact pressure between the clips and fuse end caps as well as between the clips and the terminals in the fuse base.
- 4.4.1.11 Each fuse clip shall be made from copper plate of at least 1.2mm thick and 16mm wide.
- 4.4.1.12 Each fuse clip and its phosphor bronze insert/spring shall be fixed in position by suitable screw and retention arrangement.
- 4.4.1.13 Provision shall be given (on the fuse cutout) for sealing the fuse carrier to the fuse base when fitted.

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4.4.1.14 Each fuse base shall be complete with cable entry plugs on all terminals to prevent unauthorised access.

#### 4.4.2 Underground Cable Service Cut-out

In addition to the requirements given in clauses 1, 2, 3, 4.1, 4.2 and 4.3 the Underground cable Service Cut-out shall comply with the following:

- 4.4.2.1 The fuse base (for phase and neutral) shall be complete with tunnel connector terminal blocks suitable for stranded aluminium conductors of up to 185mm<sup>2</sup> nominal area. The terminal blocks shall be in solid brass of electro-tinned finish and have four M8 screws for clamping the conductor.
- 4.4.2.2 The fuse base shall be suitable for wedge type fuses of 82mm fixing centres as per BS88.
- 4.4.2.3 The fuse base shall incorporate PVC grommets for cable entry and exit.
- 4.4.2.4 The fuse carrier shall be fitted with wedge type thumb screw operated contacts for HRC fuse links at 82mm centres and to BS 88.
- 4.4.2.5 The fuse base and carrier for neutral phase shall be of similar material to the fuse base and carrier of the other phases.
- 4.4.2.6 The fuse carrier for the neutral phase shall be fitted with distinctive cover embossed 'NEUTRAL' and fitted with solid link, 82mm centres. The cover shall be secured by thumb operated knobs.
- 4.4.2.7 The solid link shall be fixed by M12 bolts at 82mm centres and have current rating as per clause 4.5.

#### 4.4.3 Overhead Service Cutout

In addition to the requirements given in clauses 1, 2, 3, 4.1, 4.2 and 4.3 the Overhead Service Cut-out shall comply with the following:

- 4.4.3.1 The overhead service cutout shall be suitable for terminating aluminium and copper cables. The terminal shall be in solid brass of electro-tinned finish.
- 4.4.3.2 The fuse base shall be suitable for mounting on a wooden or fiberglass reinforced plastic cross arm, outdoors, and shall be fitted with conductor terminals to suit stranded aluminium conductors of up to 300 sq. mm nominal area.

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4.4.3.3 The fuse base shall be suitable for wedge type fuses of 82mm fixing centres as per BS 88.

4.4.3.4 The fuse carrier shall be fitted with wedge type brass thumbscrew operated contacts for 82mm centre HRC fuse link to BS 88.

**4.5. RATING**

The rating of the fuse cut-out assembly shall be as follows:-

**4.5.1 House service cutout**

Rated Voltage & frequency	415 Volts, 50Hz
Rated Current	60/80 A

**4.5.2 Overhead and Underground Service Cut-Outs**

Rated Voltage & frequency	415 Volts, 50Hz	
Rated Current	Overhead Service Cut-out	400 A
	Underground Service Cut-out	300 A

**5. TESTS AND INSPECTION**

5.1. The fuse cutouts shall be inspected and tested in accordance with the requirements of BS 88 Part 1 and Part 5, BS 1361, BS 7657, other standards given in this specification and the requirements of this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified and those normally performed at works.

5.2. Copies of previous Test Reports from an ISO/IEC 17025 accredited Laboratory shall be submitted with the tender for the purpose of technical evaluation, all in the English Language. The test reports shall include dimensions, insulating properties, temperature rise and power acceptance, breaking capacity, degree of protection, resistance to heat, non-deterioration of contacts, mechanical strength, freedom from season cracking, resistance to abnormal heat and fire and resistance to rusting tests as per BS 88-1.

5.3. Routine and sample test reports for the fuse cutouts to be supplied shall be submitted (by the supplier) to Kenya Power for approval before shipment/delivery of the goods. Kenya Power Engineers will witness acceptance tests at the factory before shipment.

Acceptance tests shall include the following tests as per BS 88 Part 1 and Part 5, BS 1361 and applicable latest IEC, ISO and ASTM standards:

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- 5.3.1 Verification of dimensions;
- 5.3.2 Verification of insulating properties
- 5.3.3 Temperature rise
- 5.3.4 Degree of protection
- 5.3.5 Resistance to heat
- 5.3.6 Non-deterioration of contacts
- 5.3.7 Mechanical strength
- 5.3.8 Resistance to abnormal heat and fire
- 5.3.9 Resistance to rusting tests.
- 5.3.10 Verification of the material properties given in this specification

**6. MARKING, PACKING AND INSTRUCTIONS**

6.1 The following information shall be marked indelibly, legibly and permanently on the fuse cut-out:

- i) Manufacturers name or trademark
- ii) Type designation and type reference of suitable fuse links
- iii) Rated current and rated frequency
- iv) Rated voltage
- v) Standard to which the fuse cut-out complies
- vi) The letters 'PROPERTY OF KPLC'

Both the fuse base and fuse carrier of each cut-out shall be marked with the letters 'PROPERTY OF KPLC' for the purpose of identification.

6.2 The fuse cut-outs shall be packed in such a manner as to protect them from damage during transportation and storage.

The fuse cut-outs shall be packed in wooden crates which are reinforced and held closed by external steel wire bindings. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep the crate firmly closed and permit easy and rapid opening at time of issue.

The crates shall then be stacked on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat-shrinkable polyethylene film.

6.3 Instructions for storage, handling and installation shall be provided, all in the English Language. Cut-outs requiring special tools (other than screwdriver) for installation shall be supplied complete with the relevant tools.

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**ANNEX A: Guaranteed Technical Particulars** (to be filled and signed by the Manufacturer and submitted together with copies of the manufacturer's catalogues, brochures, drawings, technical data, sales records, customer reference letters, details of manufacturing capacity & experience and copies of type test certificates and type test reports for tender evaluation, all in English language)

**Tender No** .....

<b>Description</b>	<b>Bidder's Offer</b> (indicate technical details of offered item)
1. Manufacturer's name & address	
2. Type Reference Number of fuse cut-out offered	
3. Applicable Standards	
4.1 Service Conditions	
4.2 Design Standards	
4.3.1 Components	
4.3.2 DMC material	
4.3.3	
4.3.4	
4.3.5 Characteristics of insulating materials (DMC)	
-Impact strength	
-Flexural strength	
-Flexural modulus	
-Tensile strength	
-Compressive strength	
-Water strength	
-Specific gravity	
-Shrinkage	
-Hardness	
-Bulk factor	
-Dielectric strength	
-Arc resistance	
-Heat deflection temperature @264PSI	
-Flame resistance at 1.5mm	
4.3.6 Composition of brass used in terminals	
-Copper	
-Lead	
-Iron	
-Zinc	
4.3.7 Minimum physical and mechanical properties of the brass used in the terminals	

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-Melting point	
-Thermal expansion	
-Modulus of elasticity	
-Thermal conductivity	
-Electrical resistivity	
-Proof stress	
-Tensile strength	
-Elongation	
-Hardness Vickers	
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6.1	
6.2 (i)	
6.2 (ii)	
6.2 (ii)	
6.2 (iv)	
6.3	
7. List of copies of Design and Type Test Reports submitted (indicate Test Report Numbers, Testing Authority and contact addresses)	
8. List Acceptance Tests to be witnessed by KPLC Engineers at the factory	
9. List of catalogues, brochures, technical data, drawings and customer sales records submitted to support the offer.	
10. Marking (indicate parameters and method of marking to be used during manufacture)	
11. Copy of ISO 9001:2008 Certificate submitted (indicate validity)	
12. Quality Assurance Plan	
13. Deviations from tender specifications and supporting data, test reports, technical documents etc.	

Note: Please indicate the technical details of offered item. Entries like comply, agree or yes without supporting details will not be accepted.

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

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