



TITLE:

5

**SPECIFICATION FOR LOW  
VOLTAGE CARTRIDGE FUSES  
(FUSE LINKS)**

Doc. No.	KP1/3CB/TSP/11/022
Issue No.	3
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 3 Rev 0	2013-06-05	Cancel and replaces 2 <sup>nd</sup> issue Rev 2 dated July 2004	S. Kimitei 	G. Omuor 

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### 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 **Low Voltage Cartridge Fuses (Fuse Links)**. It is intended for use by KPLC in purchasing of the fuse links.

This specification supersedes all specifications for Low Voltage Cartridge Fuses issued before the revision date. It was prepared to establish and promote uniform requirements for Low Voltage Fuse Links and stipulates the minimum requirements for equipment acceptable for evaluation.

### 1. SCOPE

- 1.1. This specification is for Low Voltage cartridge fuses for use in voltages up to and including 1000V a.c. and 1500V d.c electricity supply network.
- 1.2. This specification is for the following cartridge fuse links:
  - (i) Fuse links for use in consumer input terminals in domestic and similar premises.
  - (ii) Fuse links for use in transformer take – off (Pole mounted cut-out and distribution fuse panel/feeder pillar protection)

Particular requirement for each fuse link is given in section 4.3

- 1.3. The specification also covers inspection and test of the fuse links as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.
- 1.4. The specification stipulates the minimum requirements for Low Voltage Fuse Links acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good engineering practice, adherence to the specification, applicable standards and applicable regulations as well as ensuring good workmanship in the manufacture of the Low Voltage Fuse Links for The Kenya Power & Lighting Company.

The specification does not purport to include all the necessary provisions of a contract.

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## 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 60269-1, 2 and 3: Low – voltage fuses
- BS 88: Part 1 and 5: Cartridge fuses for voltages upto and including 1000V ac. and 1500V d.c
- BS 1361: Cartridge fuses for ac. circuits in domestic and similar premises.
- IEC 60529: Degrees of Protection Provided by Enclosures (IP Code)

## 3. TERMS AND DEFINITIONS

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

## 4. REQUIREMENTS

### 4.1. SERVICE CONDITIONS

- 4.1.1. The fuse link shall be suitable for continuous operation both indoors and outdoors in tropical areas at altitudes of up to 2000m above sea level, humidity's of up to 95%, 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.
- 4.1.2. The fuse link shall be suitable for an a.c. system with a maximum system voltage of 433 Volts and frequency of 50 Hz.

### 4.2. DESIGN & CONSTRUCTION

#### 4.2.1. General Requirements

- 4.2.1.1. The fuse shall be High Rupturing Capacity (HRC) type and constructed as per the requirement of IEC 60269: Part 1 & 2, BS 1361 and BS 88.

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4.2.1.2. The fuse shall be suitable for use in distribution pillars, open type substations boards, heavy duty service cut-outs, underground connecting boxes, and house service cut-outs.

4.2.1.3. The fuse links shall be of class "gG", general purpose fuses as per IEC 60269: Part 1 requirement.

**4.2.2. Mechanical design**

**4.2.2.1. Replacement of fuse-links**

4.2.2.1.1. A fuse-link shall have adequate mechanical strength and its contacts shall be securely fixed. It shall be possible to replace the fuse-links easily and safely.

**4.2.3. Connections, including terminals**

4.2.3.1. The fixed connections shall be such that the necessary contact force is maintained under the conditions of service and operation. No contact force on connections shall be transmitted through insulating material other than ceramic or other material with characteristics not less suitable, unless there is sufficient resilience in the metallic parts to compensate for any possible shrinkage or other deformation of the insulating material.

4.2.3.2. Terminals shall be so arranged that they are readily accessible (after removal of covers, if any) under the intended conditions of installation.

**4.2.4. Fuse-contacts**

4.2.4.1. Fuse-contacts shall be such that the necessary contact force is maintained under the conditions of service and operation, in particular under the conditions corresponding to clause 4.2.9.

4.2.4.2. Contact shall be such that the electromagnetic forces occurring during operation under conditions in accordance with clause 4.2.9 shall not impair the electrical connections between:

- The fuse-carrier and the fuse-link;
- The fuse-link and the fuse-base, or, if applicable, any other support.

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4.2.4.3. In addition, fuse contacts shall be so constructed and of such material that, when the fuse is properly installed and service conditions are normal, adequate contact is maintained:

- After repeated engagement and disengagement;
- After being left undisturbed in service for a long period

4.2.4.4. Fuse-contacts of copper alloy shall be free from season cracking.

**4.2.5. Mechanical strength of the fuse-link**

4.2.5.1. A fuse-link shall have adequate mechanical strength and its contacts shall be securely fixed.

**4.2.6. Insulating properties and suitability for isolation**

4.2.6.1. The fuses shall be such that they do not lose their insulating properties at the voltages to which they are subjected in normal service.

4.2.6.2. When the equipment is in its normal open position, the fuse-link remaining inside the fuse-carrier, or when the fuse-link, and, where applicable, the fuse-carrier is removed, the fuse shall be suitable for isolation.

4.2.6.3. The minimum creepage distances, clearances and distances through insulating material or sealing compound shall comply with the values of clause 8.2 of IEC 60269-1 requirements.

**4.2.7. Temperature rise, power dissipation of the fuse-link and acceptance**

4.2.7.1. The fuse-link shall be so designed and proportioned as to carry continuously, under standard conditions of service, its rated current without exceeding the rated power dissipation of the fuse-link as indicated by the manufacturer or otherwise specified in the subsequent parts.

4.2.7.2. In particular, the temperature-rise limits specified in IEC 60269-1 Table 5 shall not be exceeded:

- When the rated current of the fuse-link is equal to the rated current of the fuse-holder intended to accommodate this fuse-link;

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- When the power dissipation of the fuse-link is equal to the rated acceptable power dissipation of the fuse-holder.

4.2.7.3. The use of nickel-plated contacts requires, due to its relatively high electrical resistance, certain precautions in the design of the contact, among others the use of a relatively high contact pressure.

#### 4.2.8. Operation

- 4.2.8.1. The fuse-link shall be so designed and proportioned that, when tested as per IEC 60269-1 at rated frequency and an ambient air temperature of  $(20 \pm 5)$  °C,
- It is able to carry continuously any current not exceeding its rated current;
  - It is able to withstand overload conditions as they may occur in normal service;
  - It's fuse-element does not melt, when it carries any current not exceeding the conventional non-fusing current ( $I_{nt}$ );
  - It operates when it carries any current equal to or exceeding the conventional fusing current ( $I_f$ ).

#### 4.2.9. Breaking capacity

- 4.2.9.1. The fuse shall be capable of breaking, at rated frequency, and at a voltage not exceeding the recovery voltage specified in clause 8.5 of IEC 60269-1, any circuit having a prospective current between,
- the current  $I_f$  and
  - the rated breaking capacity at power factors not lower than those shown in Table 20 of IEC 60269, appropriate to the value of the prospective current;

#### NOTE:

*Where fuse-links are used in circuits with system voltages belonging to a range lower than that corresponding to the rated voltage of the fuse-links, consideration should be given to the arc voltage, which should not exceed the value in Table 6 of IEC 60269-1, corresponding to the system voltage.*

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**4.2.10. Cut-off current characteristic**

4.2.10.1. The values of cut-off current measured as specified in clause 8.6 of IEC 60269-1, shall be less than, or equal to, the values corresponding to the cut-off current characteristics assigned by the manufacturer

**4.2.11.  $I^2t$  characteristics**

4.2.11.1. The pre-arcing  $I^2t$  values shall not be less than the characteristics stated by the manufacturer shall lie within the limits given in Tables 1 & 2 as per IEC 60269-1 requirements for "gG" fuse-links.

4.2.11.2. The operating  $I^2t$  values shall be less than, or equal to, the characteristics stated by the manufacturer as per Annex C of IEC 60269-1.

**4.2.12. Overcurrent discrimination of fuse-links**

4.2.12.1. Requirements concerning overcurrent discrimination are dependent upon the fuse system, the rated voltage and the application of the fuse;

**4.3. PARTICULAR REQUIREMENTS**

**4.3.1. Cylindrical House Service Cut-Out Fuse Links**

4.3.1.1. The fuse shall be cylindrical type with steatite ceramics body to withstand higher insulating currents, nickel-plated brass end caps and tin-plated copper leads to offer low resistance, for insertion in a fuse carrier.

4.3.1.2. Each end cap shall have a cylindrical contact surface which shall be co-axial with the body of the fuse. End caps shall be suitably protected against corrosion, by silver plating.

4.3.1.3. The maximum diameter (d) of the cartridge between the end caps shall be less than the diameter (D) of the end caps at all times as shown in Fig. 1.

4.3.1.4. The fusing factor shall not exceed 1.5 and shall be determined in accordance with the requirements of IEC 60269: Parts 1 & 2 and BS 1361.

4.3.1.5. The rated minimum fusing current shall be that current corresponding to a time 4h on the time/current characteristics.

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- 4.3.1.6. The fuse link shall be capable of opening any circuit in which the maximum voltage does not exceed 1.1 times the rated voltage.
- 4.3.1.7. The degree of protection shall be at least IP2X when the fuse is under normal service conditions.

**4.3.2. Type 'J' Slotted Cylindrical Fuse Links for Utility Applications**

- 4.3.2.1. The 'J' Type Slotted Fuse Links shall comply with the requirements of BS 88: Part 1 & 5 and shall have been ASTA Certified for category of duty 415V ac, i.e. 46,000A r.m.s symmetrical at 415V.
- 4.3.2.2. They shall be designed for use with wedge type fuse carriers in distribution pillars, open type substation boards, heavy duty service cutouts and underground connecting boxes.
- 4.3.2.3. The fuse link shall be designed with steatite ceramics body, nickel-plated brass end caps and tin-plated copper leads end caps for use in pole or wall mounted outdoor service fuse units
- 4.3.2.4. They shall have a fusing factor not exceeding 1.5 times the rated current with category of duty 415AC46 Class Q1 as specified in BS 88: Part 5.
- 4.3.2.5. The fuse link shall have fixing centers at 82mm and other dimensions as specified in Fig. 2 for fuse-links with 'U' type tags on respective current ratings.
- 4.3.2.6. The rated minimum fusing current shall be that current corresponding to a time 4h on the time/current characteristics.
- 4.3.2.7. The degree of protection shall be at least IP2X when the fuse is under normal service conditions.

**4.4. RATINGS/ DIMENSIONS**

**4.4.1 Fuses for domestic and similar premises**

- 4.4.1.1. The ratings and the dimensions of the cylindrical house service cut-out fuses are as shown below as per the requirements of IEC 60269: Parts 1 & 3 and BS 1361.

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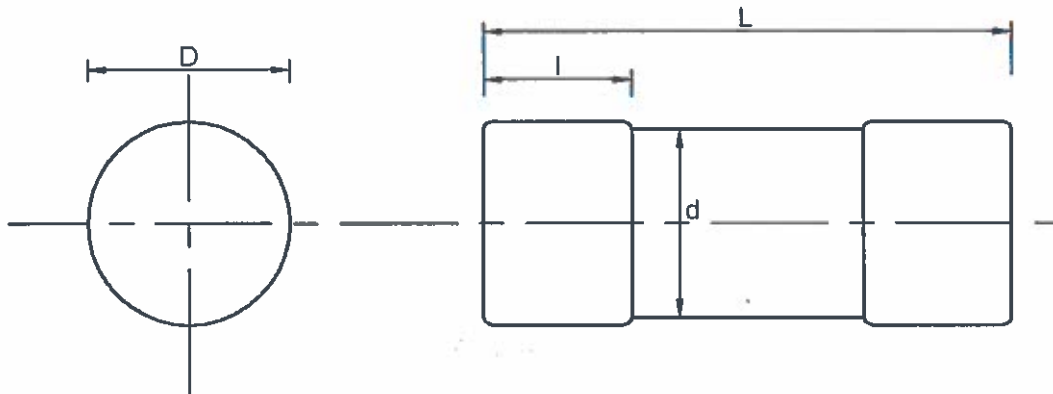
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**Table 1: Cylindrical House Service Cut-Out Fuse Links – Rating as per IEC 60269 - 1**

Amp. Rating (A)	$I^2t$ (Amp <sup>2</sup> Seconds)					Total at 240V	Total at 415V	Nominal Watts Loss (W)	Rated Breaking Capacity (kA), min.	Unit Packing
	Pre-arcing (A)									
	I (min) (10s)	I (max) (5s)	I (min) (0.1s)	I (max) (0.1s)						
32	75	150	200	350	2700	5700	3.0	20	10	
63	160	320	450	820	25000	52000	5.0	31.5		
80	215	425	610	1100	41500	58500	5.4			
100	290	580	820	1450	73500	10500	6.1			

**Fig. 1: Cut-out Household fuse**



**Tab. 2: Cylindrical House Service Cut-Out Fuse Links – Dimensions as per IEC 60269-2**

Size	Amp. Rating (A)	Length (L) (mm)	Length (l) (mm)	Diameter (D) of end caps (mm)
I <sub>c</sub>	32	29 ± 0.4	8.0 ± 0.5	12.7 ± 0.1
II <sub>a</sub>	63	57 ± 1.0	9.5 ± 0.5	16.6 ± 0.1
II <sub>a</sub>	80	57 ± 1.0	16 ± 0.5	22.23 ± 0.1
II <sub>b</sub>	100	57 ± 1.0	16 ± 0.5	30.16 ± 0.1

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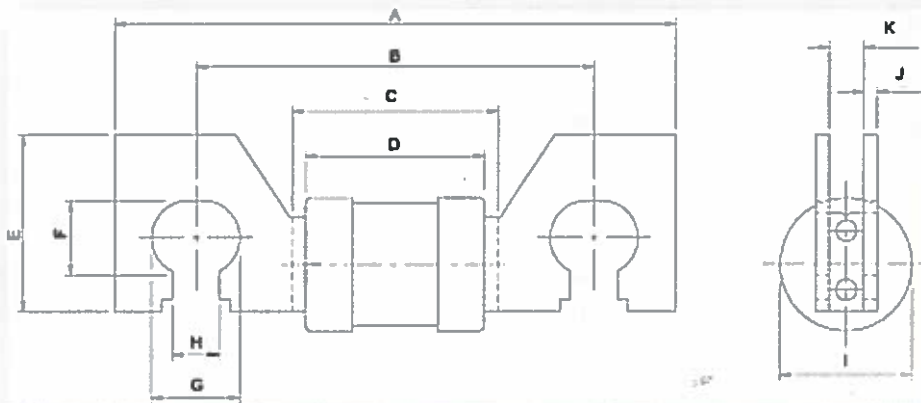
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**4.4.2 Fuses for transformer take – off as per BS 88: Part 1 & 5**

**Table 2: Type 'J' Slotted Cylindrical Fuse Links for Utility Applications – Rating**

Amp. Rating (A)	I <sup>2</sup> t (Amp <sup>2</sup> Seconds)				Nominal Watts Loss	Rated Breaking Capacity (kA), min.	Unit Packing
	Pre-arcing (A)						
	I (min) (10s)	I (max) (5s)	I (min) (0.1s)	I (max) (0.1s)			
100	290	580	820	1450	10	46	10
125	355	715	1100	1910	12		
160	460	950	1450	2590	14		
200	610	1250	1910	3420	18		
315	1050	2200	3420	6000	29		
400	1420	2840	4500	8060	33		

**Fig. 2: Cartridge Fuse**



**Table 3: Type 'J' Slotted Cylindrical Fuse Links for Utility Applications- Dimensions**

Type	A	B	C	D	E	F	G	H	I	J	K
MJ30-8	110	82	45.2	40.5	30	14.8	17.5	9.8	30.9	2.4	6.45/6.53
MJ30-7 (Up to 200A)	110	82	45.2	40.5	30	14.8	17.5	9.8	30.9	2.4	6.45/6.53
MJ30-7 (315-400A)	110	82	44.8	40	30	14.4	17.5	9.8	38	2.4	6.45/6.53
PJ30-7	110	82	44.8	40	30	14.4	17.5	9.8	38	2.4	6.45/6.53

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**5. TESTS AND FACTORY INSPECTION**

5.1 The fuse links shall be inspected and tested in accordance with the requirements of IEC 60269-1, 2 & 3, BS 88: Part 1& Part 5 and BS 1361. 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 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 (all in English Language)

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

**5.2.1.1 Type Tests**

- a) High voltage or dielectric tests,
- b) Temperature rise tests;
- c) Breaking capacity tests;
- d) Mechanical design strength tests;
- e) I<sup>2</sup>t characteristics and overcurrent discrimination tests;
- f) Cut-off characteristics tests

5.2.2 Routine and sample test reports for the fuse links 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.

5.2.3 Tests to be witnessed by KPLC Engineers at the factory before shipment shall be in accordance with IEC 60269-1, 2 & 3, BS 88: Part 1& Part 5 and BS 1361, this specification and shall include the following:

**5.2.3.1 Routine Tests**

- a) Verification of dimensions, material and method of manufacture;
- b) Temperature-rise limit, power dissipation and acceptance tests;
- c) Non-deterioration of contacts tests;
- d) Operation and time/current characteristics tests;
- e) Verification of cut-off characteristics;
- f) Insulating properties tests;

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- g) Breaking current capacity tests;
- h) I<sup>2</sup>t characteristics and overcurrent discrimination tests;
- i) Verification of compliance for fuse link at 0.01 seconds;
- j) Verification of fuse links of homogeneous series;
- k) Verification of degree of protection.

5.2.4 On receipt of the cutouts, KPLC will inspect them and may perform or have performed the relevant tests in order to verify compliance with the specification. The manufacturer shall replace without charge to KPLC, fuse cutouts which upon examination, test or use fail to meet any or all of the requirements during the inspection.

5.2.5 The cost of inspection and witnessing of tests (except cost of air travel to the nearest International airport) shall be borne by the manufacturer.

## 6. PACKING AND MARKING

### 6.1 Packing

6.1.1 All fuse links shall be supplied separately package in a robust card board boxes.

6.1.2 These boxes shall allow for access (by the KPLC acceptance personnel) so that the fuses may be easily removed for inspection and then be easily repacked and sealed for holding in store.

### 6.2 Marking

6.2.1 The marking shall be durable and easily legible.

6.2.2 Fuse links shall be clearly marked with the following information:

- a) The manufacturer's trade name,
- b) The number and appropriate part number of the standard (e.g. BS 88: Part 1)
- c) Type reference and designation,
- d) Rated voltage and current,
- e) Kind of current and rated frequency,
- f) Rated power dissipation ,
- g) Breaking range and utilization category,
- h) Rated breaking capacity ,
- i) Dimensions or size,
- j) The permanent words "KPLC."

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6.2.3 Each packaged lot shall be marked with the following information:

- a) The manufacturer's trade name;
- b) The manufacturer's identification reference,
- c) The number and appropriate part number of the standard (e.g. BS 88: Part 1)
- d) The rated voltage,
- e) The rated current and frequency,
- f) The rated power dissipation,
- g) The purchasers name. **"PROPERTY OF KENYA POWER & LIGHTING CO."**
- h) The order number;
- i) Any other contract particulars.

6.3.3. Instructions for storage, handling and installation shall be provided, all in English.

## 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 drawings and construction details of the fuse links,
  - c) Quality Assurance Plan (QAP) that will be used to ensure that the fuse link design, material, workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations.
  - d) Test Program to be used after manufacture,
  - e) Marking details and method to be used in marking the fuse links,
  - f) Manufacturer's undertaking to ensure adequacy of the design, good workmanship, good engineering practice and adherence to applicable standards in the manufacture of the fuse links for KPLC,
  - g) Packaging details.

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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)

**Table 3: Guaranteed Technical Particulars.**

1 Item	2 Description	Units	3 Schedule 1 (KPLC)	4 Schedule 2 (Tenderer)
1	<b>Manufacturer and manufacturer's identification reference,</b>		Specify	
1.1	<b>Country of manufacture</b>		Specify	
1.2	<b>Name and address of Bidder</b>		Specify	
2	<b>Reference standards</b>		Specify	
3	<b>Terms and definitions</b>		Specify	
4	<b>Requirements</b>			
4.1	<b>Service conditions</b>			
4.1.1	<ul style="list-style-type: none"> <li>• Altitude</li> <li>• Humidity</li> <li>• Temperature range</li> <li>• Salinity requirements</li> </ul>		Specify	
4.1.2	<b>Voltage and frequency rating</b>		Specify	
4.2	<b>Design and Construction</b>			
4.2.1	<b>General requirements</b>			
4.2.1.1	<b>Fuse category - HRC</b>		Specify	
4.2.1.2	<b>Applicability</b>		Specify	
4.2.1.3	<b>Class of the fuse – gG class</b>		Specify	
4.2.2	<b>Mechanical design</b>			
4.2.2.1	<b>Replacement of fuses</b>		Specify	
4.2.3	<b>Connections including terminals</b>			
4.2.3.1	<b>Mode of contacts</b>		Specify	
4.2.3.2	<b>Accessibility to contacts</b>		Specify	
4.2.4	<b>Fuse-contacts</b>			
4.2.4.1	<b>Degree of contact</b>		Specify	
4.2.4.2	<b>Electrical connections during contacts</b>		Specify	
4.2.4.3	<b>Materials of contacts</b>		Specify	
4.2.5	<b>Mechanical strength of fuse links</b>			
4.2.5.1	<b>Magnitude</b>		Specify	
4.2.6	<b>Insulating properties and isolation</b>		Specify	

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Kenya Power

TITLE:

**SPECIFICATION FOR LOW VOLTAGE CARTRIDGE FUSES (FUSE LINKS)**

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4.2.6.1	Insulating properties		Specify
4.2.6.2	Ease of isolation		Specify
4.2.6.3	Minimum creepage	mm	Specify
4.2.7	<b>Temperature rise and power dissipation</b>		
4.2.7.1	Power dissipation	W	Specify
4.2.7.2	Rated temperature rise values	°C	Specify
4.2.7.3	Contact material		Specify
4.2.8	<b>Operation</b>		
4.2.8.1	Current ratings during operation		
	• Short circuit withstand current	kA	Specify
	• Non-fusing current, $I_{nf}$	A	Specify
	• Fusing current rating, $I_f$	A	Specify
4.2.9	<b>Breaking capacity</b>		
	• Breaking voltage	V	Specify
	• Breaking capacity at rated power factor, 0.1-0.2; 0.2-0.3; 0.3-0.5	kA	Specify
4.2.10	<b>Cut-off characteristics</b>		
4.2.10.1	Values as per IEC 60269-1		Specify
4.2.11	$I^2t$ characteristics		Specify
4.2.12	Overcurrent discrimination of the fuse link		
4.2.12.1	Requirements		Specify
4.3	Particular requirements		
4.3.1	<b>Cylindrical house service fuse link</b>		Specify
4.3.1.1	Materials used		Specify
4.3.1.2	End cap design		Specify
4.3.1.3	End cap and body diameters	mm	Specify
4.3.1.4	Fusing factor		Specify
4.3.1.5	Fusing current		Specify
4.3.1.6	Voltage at operation	V	Specify
4.3.1.7	Degree of protection		Specify
4.3.2	<b>Type 'J' slotted cylindrical fuse link</b>		
4.3.1.1	Standards of manufacture		Specify
4.3.1.2	Fuse type and application		Specify
4.3.1.3	Material of end cap		Specify
4.3.1.4	Fusing factor and category class		Specify
4.3.1.5	End cap and body diameters	mm	Specify
4.3.1.6	Voltage at operation	V	Specify
4.3.1.7	Degree of protection		Specify
4.4			
4.4.1.	Fuse link dimensions		
	L	mm	Specify
	I	mm	Specify
	D	mm	Specify

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4.4.2	Dimensions of the fuse link parts	mm	Specify	
	A	mm	Specify	
	B	mm	Specify	
	C	mm	Specify	
	D	mm	Specify	
	E	mm	Specify	
	F	mm	Specify	
	G	mm	Specify	
	H	mm	Specify	
	I	mm	Specify	
	J	mm	Specify	
	K	mm	Specify	
5	List of Tests to be witnessed by KPLC Engineers at the factory before shipment		As per clauses 5.2. 1. and 5.2.3.	
6	Packing and marking (parameters to be indicated and method of marking)		Specify	
7	Installation and technical manuals to be provided during delivery		Specify	
8	List of catalogues, brochures, drawings, technical data and customer sales records submitted to support the offer.		Specify	
9	Statement of compliance to tender specifications		Specify	
10	Deviations from tender specifications		Specify	
11	Inspection/Tests by KPLC during delivery before acceptance to stores/site.		Specify	

**NB:** - This schedule does not in any way substitute for detailed information required elsewhere in the specification.

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

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