

## TECHNICAL SPECIFICATION OF REWIREBLE KIT- KAT FUSES

### 1. Scope

This application cover the manufacture, testing at works and supply of porcelain rewireable kit kat fuses suitable for AC 3 phase 415 V 50 HZ solidly grounded neutral system.

### 2. Weather condition:

The material used in construction of the fuse unit shall be suitable for use under following weather condition:-

I	Temp. Range	0° to 50° C
II	Relative Humidity	2% to 100%
III	Altitude	Up to 1000 meters
IV	Use	Outdoor, inside distribution box or indoor at consumer's premises.

### 3. Rated voltage and frequency.

The fuses shall be suitable for continuous operation at AC 415 V and frequency 50 Hz.

### 4. Rated currents:

The rated currents of fuses units shall be 16/32/63/100/200 Amps.

### 5. Application standards:

- I) IS: 2086/1993 with latest amendment for fuses up to 100 A & This specification.
- II) This specification for 200 A kit kat fuses.
- III) PGVCL's Drawing Nos. PGVCL/FUSE/01

### 6. General construction requirements of Kit Kat fuses:

#### 6.1 Materials:

This rewireable fuses units shall be made of ceramic which shall be of sand fine grain homogenous non-porous chemically inert and high electrical and mechanical strength and shall be thoroughly verified and smoothly glazed. It shall be non-ignitable/ the porcelain and glaze shall be white or cream in color. The glaze shall cover at least those surfaces which are exposed when the, fuses have been mounted in the intended manner. The mounting surface may be left unglazed. The materials should not have any defect such as:

I	Crazing	A hairline crack in glaze of ceramic material.
II	Dent	A hair line fracture extending through the body and the glaze and caused by strains set-up in the process of manufacture of ceramics materials.
III	Projection	A raised imperfection, projecting more than 0.75 mm above the Surface of the ceramic material.
IV	Water	The ceramics material shall not absorb more than absorption 2% of its weight of water when broken and tested for.

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**6.2 The design and dimension of the fuses shall be in accordance with the PGVCL drawing no.**

- 1) PGVCL/FUSE/01/63 Amp for 63 Amp
- 2) PGVCL/FUSE/02/100 Amp for 100 Amp
- 3) PGVCL/FUSE/03/200 Amp for 200 Amp

**6.3 Protection**

The carrier and fuse base when installed in the intended manner shall have all live parts so protected as to prevent inadvertent contact with such live parts.

**6.4 Handling grip**

The fuse carrier shall be provided with a handle or grip and shall be shaped in acceptable manner so that it will be easy to withdraw the carrier without use of any tools and without danger to any L.M. or operator.

**6.5 Metal Parts:**

All metal parts shall be protected against corrosion by suitable methods.

**6.6 Fuse base:**

**6.6.1** The fuses base shall be provided with two fixing holes for fixing the fuse base by means of screwier bolts.

**6.6.2** The fuse base shall have contacts for suitably engaging with the contacts of the fuse carrier rigidly under any condition. The contacts shall be made out of such a metal which will not lose its electricity due to heating of the contacts on full load with 20% overload current or heat generated and required pressure is maintained even after repeated engagements and disengagement. The contact for rating 63 A and above will also have extended strips for fixing cable lugs by means of bolt.

**6.6.3** Live parts on the underside of the fuse base for surface mounting shall be either covered by a shield or barrier of insulating materials or be counter sunk not less than 3mm below the surface of the base and covered with water proof insulating sealing compound which will not deteriorate or flow at a temp. lower than 100 degree C or on full load current with 20% overload or blowing of fuse under short circuit condition or shall have clearance of not less than 6.0 mm for 16A and 32A and 9mm for 63A, 100A and 200A size from the mounting surface and reliably prevented from loosening.

**6.7 Fuse carrier:**

**6.7.1** The fuse carried shall have contacts suitable for engaging with fuse base contacts. They shall be provided with suitable terminals for the connection of the fuse elements. The fuse carrier shall be so constructed that it is capable of being reversible for introduction into the fuse base. The contacts shall be made out of the metal which will not lose its elasticity on account of heating of the contacts on full load with 20% overload conditions or heating due to blowing of the fuse element due to short circuit and required pressure is maintained and even after repeated engagement and disengagement.

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**6.7.2** Live parts of the fuse carrier shall be covered either by a shield for barrier of insulating materials or be counter sunk not less than 3 mm below surface of the base and covered with water proof insulating sealing compound which will not deteriorated or flow at temperature lower than 100° C.

**6.8** The asbestos cloth to be provided in fuse base shall be fire proof insulating and of sufficient length width and thickness.

**6.9** **SPRING FOR BASE PHOSPHOR BRONZE CONTACT (For 200 Am KK FUSE only)**  
This should be round/elliptical made from high quality spring steel sufficient to maintain uniform pressure on the contact surface when fuse carrier is fitted. The spring shall be of sufficient width and having 1 mm thickness.

### **6.10** Screws:

- I) Screws upon which the general assembly of the fuse base and carriers' terminals and contacts depend shall be prevented from loosening or backing out buy lock, washers, stacking or other reliable means.
- II) If screws used in the assembly of a fuse are loosened or removed in order to install the fuse elements or to connect the fuse into a circuit they should be thread into metal and shall be provided with washers.

### **6.11** Current carrying parts:

- I) Current carrying parts shall be of robust construction and capable of carrying their rated current without exceeding the temperature rise limits clause 4.2.1 of IS specification 2086-1993 i.e. 55°C for rating 16 Amps to 100 Amps & 65°C for 200 Amps kit Kat fuse.
- II) Iron and steel parts shall not be used for current carrying parts except as clamping device or pressure such as punching screws, clamps or wire binding screws and nuts.

### **6.12** Contacts:

The contacts of the fuse base, fuse carrier, terminal blocks/strips shall be as under:

Sr No	Description	For 16/32/63/100 Amps	For 200 Amps
1	Fuse carrier contacts (Male contacts)	Tinned copper	Tinned brass
2	Fuse base contacts (Female contacts)	Phosphor bronze	Phosphor bronze
3	Terminal block / Strips	Tinned brass	Tinned brass

The current carrying screws and washers shall be of tinned brass while the screw, washers not carrying current shall be M.S. Galvanized M.S. Electro Galvanized bolt and nut with one plain washer and one spring washer suitable for 25mm<sup>2</sup>, 50mm<sup>2</sup>, 150mm<sup>2</sup> & 185 mm<sup>2</sup> cable lugs shall be provided with extended strips for 16A, 63A, 100A and 200A fuse respectively.

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### 6.13 Chemical composition of the contacts.

Electrolytic copper (tinned phosphor bronze (Tinned) used for contacts of Kit Kat fuse shall confirm to various IS as stated below.

Sr No	Material	Required Confirmation to IS
1	Electrolytic copper	Copper strips used for contacts of Kit Kat fuse should confirm to IS: 1897/1983 with latest amendments. The material shall be of electrolytic tough pitch (ETP) grade with minimum 99.9% of copper & silver as per table I of IS191 part IV.
2	Phosphor bronze	The phosphor bronze used for contacts of KK fuse shall confirm to any of the grade-I, II or III given in IS: 7814/1985 (with latest amendments). The requirement of metal composition should be as per IS-7814.
3	Brass	It shall confirm to grade LCB1/DCB2 of IS-1264/1997 (with latest amendment)/IS 4101/1977 with latest amendment). The metal composition for casting shall be as per IS 1264 and that of brass sheet, as per IS 410

6.14 The contact fixing screw holes in fuses shall be fitted with insulating material fully into the surface of the Kit Kat fuse carrier.

### 7. Embossing:

7.1 Every fuse carrier shall be clearly and indelibly embossed with the following information.

- I) Rated Current
- II) Rated voltage
- III) Size of fuse wire
- IV) Manufacturer's name/Trade mark.
- V) PGVCL name in short

7.2 Every fuse base shall be clearly and indelibly marked with the following.

- I) Manufacturers name/Trade mark.
- II) PGVCL name in short

### 8.0 Type test certificates:

8.1 The firm has to submit type test certificates for test conducted on their own brand name make for Kit Kat fuses for all the tests as per clause no. 9.0.3.1 of IS: 2086/1993 (with latest amendment) carried out at NABL/Govt. approved laboratory. Such type test certification must have been carried out within period of past 7 years from Schedule date of opening of tender.

8.2 The firm has to submit chemical composition certificates for each contact used in each rating of Kit Kat fuses offered for sample tested at ERDA Baroda or any Govt. recognized laboratory as per relevant IS.

8.3 The above type test certificates and metal composition certificates shall be complete viz. for all tests and for all parts and submitted along with the offer. Incomplete/delayed test certificates and metal composition certificates shall not be considered.

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### 9.0 Acceptance:

#### 9.1 Sampling criteria:

The Number of fuse carriers and fuse bases to be selected from the lot shall be in accordance with Appendix-B of IS: 2086/1993. However, the lot size shall constituted of all the fuse carriers and fuse bases of the same ratings.

#### 9.2 Acceptance tests:

The fuse carriers and fuse bases selected as per 9.1 (of this specification) shall be subject to the acceptance test in following order.

I	Visual examination	II	Dimensional check
III	Test for Mechanical endurance	IV	Test for withdrawal force
V	Test for temperature rise	VI	Insulation resistance test
VII	High voltage test	VIII	Temp. Cycle test

N.B.: For purpose of temperature cycle test and temperature rise test one sample from every batch of 10000 (or less) for each current rating has to selected and tested.

### 10.0 Routine tests:

The routing test certificate duly signed by the testing engineers of the firm clearly stating that the following routine tests has been conducted by him on each fuse unit, shall be kept ready and submitted to the inspecting officer prior inspection of lot offered and testing of samples.

I) Visual examination II) High voltage test.

### 11.0 Verification of ceramic parts properties/composition and metallic composition of contacts:

11.1 PGVCL reserves the right to draw the samples of ceramic/metallic parts of Kit Kat fuses for verifications of their properties/composition at the time of manufacture from the lot offered for inspection. In addition to this, the samples will be drawn from the lots received by the consignees for verification of ceramic/metallic composition. In the event the metallic composition does not confirm to our specifications. The PGVCL reserves the right to cancel the order at the cost and risk of the supplier.

### 12.0 Packaging:

The fuses shall be packed in suitable manner in good quality thermo plastic container to avoid breakage or loosening of components marking stamp shall be a fixed on each box containing the KK fuses.

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## Guaranteed Technical Particulars

Manufacturer's Name & Address:

Technical information & guaranteed information for supply of Kit Kat fuses.

### PART-A

Bidders has to confirm following important requirements:

Sr No	Particulars	Confirmation
1	General construction & requirement of Kit Kat fuse shall be as per PGVCL specification Cl. No. 6 DRG & IS No. 2086/1993.	
2	Rated voltage shall be 415 volts	
3	Rated current of Kit Kat fuse shall be	
	63A	
	100A	
	200A	
4	Embossing every fuse carrier shall be clearly & indelibly embossed with the following.	
	i) Rated current	
	ii) Rated voltage	
	iii) Size of fuse wire	
	iv) Manufacturer's name/Trade mark	
	v) PGVCL name in short	
5	Every fuse base shall be clearly & indelibly embossed with the following	
	i) Manufacturer's & Name/ Trade mark	
	ii) PGVCL name in short	

**Signature & seal of tenderer**

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## Part-B:

Bidders has to furnish below details about materials

1. Manufacturer's trade name

## Part-C

Bidder has to enclose following documents and has to confirm for the same

Sr. No.	Particulars	Confirmation
1	Type test report as per IS-2086/1993 with the latest amendment carried out at CPRI Bhopal/Bangalore ERDA, Baroda or any other Govt .approved laboratory for the following size.	
	63 A	
	100 A	
	200 A	
2	The chemical composition report of metal parts as per specification Clause no. 6.13 for following size	
	63 A	
	100 A	
	200 A	
3	Six Nos. of sample as per PGVCL's drawing as under to be sent with tender.	
	Rating	Drawing No.
	63 A	
	100 A	
	200 A	
4	List of plant & machinery submitted	
5	List of testing equipment submitted	
6	List of orders pending/executed at least for past two years for the item offered.	
	a) with PGVCLs	
	b) with the purchase PGVCLs	

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**Technical requirements and test procedures for 200 Amps Kit Kat fuse as per IS: 2086-1993**

Sr No	Particulars of tests	Clause no.	Requirement as per specification
<b>A Mechanical test sequence</b>			
1.0	Visual examination	9.1	The fuse - carrier and bases shall be visually examined
2.0	Test for dimensions	As per PGVCL drawing no.	Drawing No.
3.0	Test for mechanical endurance (For reversible type)	9.3	<ul style="list-style-type: none"> <li>▪ Test cycles - 100 nos.</li> <li>▪ The contact shall not work loose</li> <li>▪ No damage shall be caused to any part of the fuse carrier or fuse base</li> <li>▪ No displacement of any of the component part</li> <li>▪ The serviceability of the fuse shall not have been impaired</li> </ul>
4.0	Test of mechanical strength	As per stated procedure	Fuse base and fuse carrier shall be neither cracked nor permanent deformed such as will impair its compliance with the standard  # 250 mg metal piece to be dropped freely from height of 25 cms in fiber base plate 3 times with each of three different vertical axis
	Test for withdrawal force	9.5	<b>Limits of withdrawal force</b> Minimum - 147 Newton Maximum - 686 Newton
<b>B Electrical test sequence</b>			
1.0	Test for temperature rise	9.6	<ul style="list-style-type: none"> <li>▪ Test current - 200 A.</li> <li>▪ Diameter of fuse wire (mm) - <math>2.00 \pm 0.020 \times 2</math> Nos.</li> <li>▪ Cross section of Aluminum conductor (Sq. mm.) - 150</li> </ul> <b>Measurement of temperature rise Point of measurement</b> i) Upper fuse carrier contact adjacent to the fuse element (°C) - $\leq 65$ ii) Upper fuse carrier contact adjacent to the connecting conductor (°C) - $\leq 65$ iii) Ambient air temperature (°C) - $\leq 40$
2.0	Insulation Resistance test	9.7	<ul style="list-style-type: none"> <li>▪ Test Voltage 500 Volts DC</li> </ul> <b>Measurement of IR value</b> i) Between live terminals and exposed metal parts $\geq 10 \text{ M}\Omega$ ii) Between incoming live terminals and outgoing live terminals $\geq 10 \text{ M}\Omega$

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3.0	High Voltage test	9.8	<ul style="list-style-type: none"> <li>▪ <del>Test Voltage - 2500 Volts</del></li> <li>▪ Test duration (Minute) - 1.0</li> </ul> <p><b>Application of test voltage</b></p> <ul style="list-style-type: none"> <li>i) Between live terminals and exposed metal parts - There shall be no puncture or flashover during the test</li> <li>ii) Between incoming live terminals and outgoing live terminals - There shall be no puncture or flashover during the test</li> </ul>
3.1	Immediately after above test:  Insulation Resistance test	9.7	<ul style="list-style-type: none"> <li>▪ Test Voltage 500 Volts DC</li> </ul> <p><b>Measurement of IR value</b></p> <ul style="list-style-type: none"> <li>i) Between live terminals and exposed metal parts <math>\geq 10 M\Omega</math></li> <li>ii) Between incoming live terminals and outgoing live terminals <math>\geq 10 M\Omega</math></li> </ul>

**Technical requirements and test procedures for 200 Amps Kit Kat fuse as per IS: 2086-1993**

Sr No	Particulars of tests	Clause no.	Requirement as per specification
4.0	Test for breaking capacity (For 415 V grade fuse)	9.9	<ul style="list-style-type: none"> <li>▪ Test current (A) <math>4000 \pm 15 \%</math></li> <li>▪ Test voltage (V) <math>415 \pm 15 \%</math></li> <li>▪ Power factor <math>\leq 0.4</math></li> <li>▪ Three individual fuses have to be connected as per the fig.3 and surrounded by a screen of woven wire cloth. The metal mounting plate has to be connected to earth through a fine wire fuse</li> <li>▪ Total no. of shots - 3</li> <li>▪ Recovery voltage maintained for <math>\geq 30</math> seconds</li> <li>i) At least two adjacent fuses should blow in each shot</li> <li>ii) Any part of the carrier or the base should not ignite</li> <li>iii) The fuse carrier should not eject</li> <li>iv) Any part of fuse should not get damaged.</li> <li>v) Fine wire fuse in earth circuit should be intact</li> </ul> <p>IR measured at 500 V DC within 3 minutes after shot no. 3 should be <math>&gt; 100 K\Omega</math></p>
<b>C</b>	<b>Tests for proving material properties</b>		
1.0	Test for water absorption (Non ceramic)	9.10	Not applicable
2.0	Test on ceramic material	9.11	

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2.1	Temperature cycle test	9.11.1	<p><del>Fuse base &amp; carrier to be immersed in water for three times in following cycle:</del></p> <p>i) At a temperature 70 to 75°C for 20 minutes                  ii) Immediately thereafter at a temp. <math>\leq</math> 7°C for 20 minutes</p>
2.1.1	High voltage test	9.8	<ul style="list-style-type: none"> <li>▪ Test Voltage - 2500 Volts</li> <li>▪ Test duration (Minute) - 1.0</li> </ul> <p><b>Application of test voltage</b></p> <p>i) Between live terminals and exposed metal parts - There shall be no puncture or flashover during the test                  ii) Between incoming live terminals and outgoing live terminals- There shall be no puncture</p>
2.2	Water absorption test (For ceramic material)	9.11.2	<ul style="list-style-type: none"> <li>▪ Test piece to be kept at temp. <math>110 \pm 1^\circ\text{C}</math> for 2 hours after that they should be cooled in desiccators</li> <li>▪ Initial mass of test pieces (B) gms.                      Minimum 40 gms.                      Maximum 50 gms</li> <li>i) Test pieces should be immersed in distilled water and brought to boiling temp. for 30 minutes</li> <li>ii) The test pieces still immersed in water should be allowed to cool to ambient temp. not less than 6 hours</li> <li>iii) After removing the test piece from the water, reweigh it.</li> <li>▪ Mass of moisture absorbed (A)gms.  <math>\% \text{ Mass of water absorbed} = (A/B) \times 100 \leq 2.0 \%</math></li> </ul>
3.0	Ignition test	9.12	Not applicable

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