



Kenya Power

TITLE:  
**SPECIFICATION FOR LEAD ACID  
 STARTING, IGNITION AND  
 LIGHTING (SLI) BATTERIES**  
 Part 1: Motor Vehicle Batteries

Doc. No.	KP1/3CB/TSP/13/003-1
Issue No.	1
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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 reports for tender evaluation, all in English Language)*

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**FOREWORD**

This specification has been prepared by the Standards Department in collaboration with Network Management Division – Transport Department of The Kenya Power and Lighting Company Limited (abbreviated as KPLC) and it lays down requirements for **Lead Acid Starting, Ignition and Lighting (SLI) batteries for motor vehicles**, rated voltage of **12 volts**. It is intended for use by Kenya Power in purchasing of the batteries.

**1. SCOPE**

- 1.1. This specification lays down the general mechanical, electrical and functional requirements of the batteries. In line with current usage and practical reference, the batteries covered in this specification shall be rated at 20-h rate only.
- 1.2. The specification also covers characteristics, dimensions, inspection and test of the batteries as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.
- 1.3. The specification stipulates the minimum requirements for the batteries; 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 and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the batteries for The Kenya Power & Lighting Company.
- 1.4. 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.

- IEC 60095-1& 2: Standard specification for lead-acid starter batteries. Part 1: General requirements and methods of test; Part 2: Dimensions of batteries; dimensions and marking of terminals
- IEC 61373: Railway applications – Rolling stock equipment – Shock and vibration tests
- ISO/IEC 17025: General requirements for the competence of calibration and testing laboratories
- ISO 2212: Standard specification for trichloroethylene for industrial use - Methods of test

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- d) The batteries shall give good performance in the temperature range from  $-20^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ .
- e) Storage in the temperature range from  $-30^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$  shall not affect the battery.

#### 4.2. General Requirements

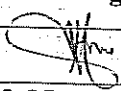
- 4.2.1. The battery shall provide a 12 volts d.c capable for smooth, quick starting, ignition and lighting systems of motor vehicles ranging from passenger to heavy commercial. The battery expected life shall be at least 10 years.
- 4.2.2. It shall have a minimum internal resistance, welded construction, and be at least 80% efficient on recharge.
- 4.2.3. It shall have a robust housing that can withstand vibrations, shock and high temperatures with easily visible electrolyte level indicators. The vibrations and shock shall be tested in accordance with IEC 61373, Section 9, Category 1, Class B at values of:
  - a) Vibration tests - 5-150 Hz, 0.8grms vertical, 0.56grms longitudinal, 0.36grms transverse; 5 hours in each axis for long-life random vibration and
  - b) Shock tests - 30msec. pulses in each axis (3 positive, 3 negative); 3.06g peak vertical, 5.1g peak longitudinal, 3.06g peak transverse for shock.
- 4.2.4. The product manufacturer shall produce the consent/clearances as per the provisions of Environmental Management and Coordination Act, 1999 and Water Quality Regulation, 2006 (Legal notice No. 121)

#### 4.3. Design and Construction

##### 4.3.1. General requirements

- 4.3.1.1. The lead acid SLI batteries shall be designed manufactured and tested to IEC 60095, JIS D5 301, DIN 43 539- 2 and KS 04-185 standard specifications and the requirements of this specification.
- 4.3.1.2. The batteries shall be sealed type (maintenance free) batteries designed in a manner that the oxygen generated during charging is captured and recombined in the battery. The design shall include one of the following options:
  - a) A valve-regulated type (VRLA) having a spring-controlled valve that vents gases at a predetermined pressure of between 2 to 5 psi,
  - b) A replaceable vent plugs,

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4.3.2.2.3. In service, the separator shall be able to maintain good resistance to acid and oxidation. The area of the separator shall be a little larger than the area of the plates to prevent material shorting between the plates.

4.3.2.2.4. The separators shall remain stable over the battery's operating temperature range.

**4.3.2.3. Electrolyte**

4.3.2.3.1. The sulphuric acid and water shall be used for the preparation of the electrolyte to bring the level of electrolyte to approximately the correct level during the course of preparation or testing and they shall conform to KS 03-242 and KS 2258 requirements respectively.

4.3.2.3.2. For the purpose of tests, a fully charged SLI battery with electrolyte level corresponding to the upper level marked on the battery, shall have a specific gravity of  $1.280 \pm 0.01$  and  $1.17 \pm 0.01$  for a discharged cell (corrected to  $27^{\circ}\text{C}$ ) as per IEC 60095-1 requirements.

4.3.2.3.3. The temperature correction shall be made by the following formula as per IEC 60095-1:

$$SG_{27} = SG_t + 0.0007(t-27)$$

Where,  $SG_{27}$  = specific gravity at  $27^{\circ}\text{C}$ ,  
 $SG_t$  = specific gravity at  $t^{\circ}\text{C}$ , and  
 $t$  = temperature of electrolyte at the time of measurement,  $^{\circ}\text{C}$

**4.3.2.4. Sealing Material**

4.3.2.4.1. The lid shall be of one piece construction, sealed to the container by addition of sealing material (Trichloroethylene) with one positive and one negative terminal.

4.3.2.4.2. The sealing material employed shall be an acid resistant adhesive and shall not be affected by heat sealing or ultrasonic welding. The properties shall be as specified as per Table 2.

**Table 2: Requirements for Sealing Compound.**

	Characteristic	Requirement	Method of Test
1	Penetration at $25^{\circ}\text{C}$ , 100g 5s in o.1mm	17 to 45	BS 2000:Part 49
2	Softening point, $^{\circ}\text{C}$	90 to 110	BS 2000: Part 58
3	Matter insoluble in trichloroethylene, % mass, <i>Max</i>	1	ISO 2212

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4.4.1.1.4. The terminals both positive and negative shall be strong enough to withstand a torque force of 15Nm applied to the adaptors tightly fitted to them.

4.4.1.1.5. The terminals shall be tapered standard type and conform in shape and dimensions given in Fig. 1 as per the requirements of IEC 60095-2 and this specification.

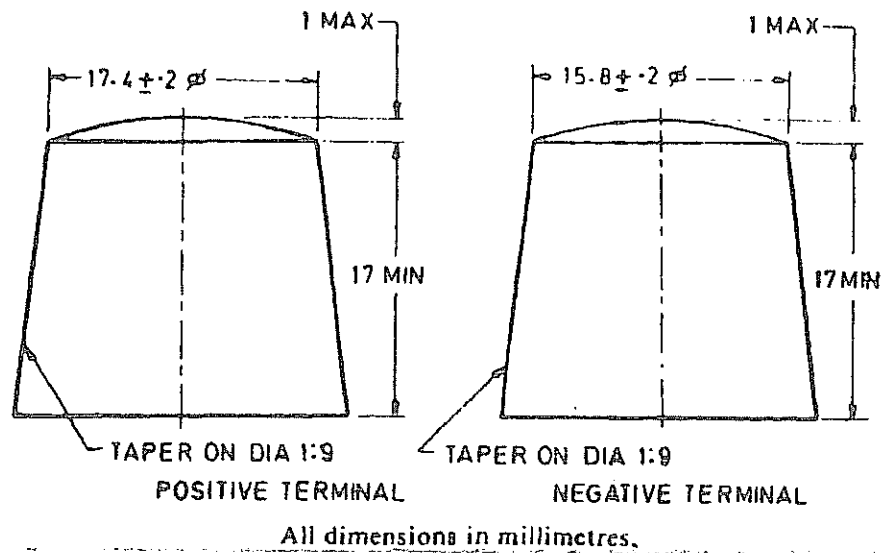


Fig. 1: Tapered Terminal

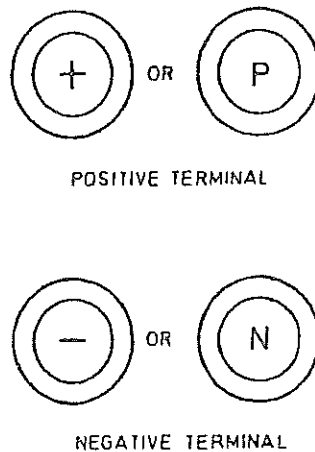
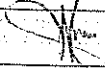
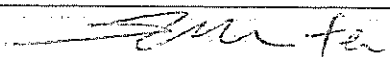


Fig. 2: Terminal markings

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**4.4.3. Ratings**

High performance storage SLI batteries shall be rated at the 20-h rate that is at a constant current,  $I = 0.05C_{20}$  A, until the terminal voltage has fallen to 10.50V for a 12-volt battery, the capacity being corrected to an electrolyte temperature of 27°C. The ratings shall be chosen as per JIS D5 301 standard given as below:

**a) Cold Cranking Amperes (CCA)**

The CCA rating shall specify, in amperes, the discharge load, a fully charged battery at 0°F (-17.8°C) can deliver in 30 seconds while maintaining a voltage of at least 1.2 volts per cell (7.2 volts) for a 12-volt battery. The CCA ratings shall range from 400A – 1000A and are shown in Table 4.

**b) Reserve Capacity (RC)**

The RC rating shall specify, in minutes, the length of time a fully charged battery at 80°F (27°C) can be discharged at 25A while maintaining a voltage of at least 1.75 volts per cell (10.5 volts total) for a 12-volt battery. The RC ratings range from 75 to 160 minutes. Refer to Table 4.

**c) Power (Watts)**

The Power rating, in watts, shall be determined by multiplying the current available in the battery at 0°F (-17.8°C) and rated voltage. The power ratings shall range from 4,000 to 12,000 watts.

**d) Amp-Hour (Ah)**

The Ah rating shall specify, in amp-hours, the current the battery can provide for 20 hours at 80°F (27°C) while maintaining a voltage of at least 1.75 volts per cell (10.5 volts total) for a 12-volt battery. The Ah ratings shall be as per Table 4.

**4.4.4. Charging**

4.4.4.1. The initial and normal charging of batteries shall be done in accordance with the manufacturer's instructions. The following shall be provided with the manufacturer's instructions:

- a) The last date of filling in and charging
- b) For dry charged batteries, the date of expiry of dry charged condition together with instructions.

4.4.4.2. A battery shall be deemed fully charged when the terminal voltage and specific gravity of the electrolyte (corrected for temperature) measured every 30 minutes towards the

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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.

- 4.6.2. The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2008 certificate shall be submitted with the tender for evaluation.
- 4.6.3. The bidder shall indicate the delivery time of the batteries, manufacturer's monthly & annual production capacity and experience in the production of the type and size of the batteries being offered.

**5.0. TESTS AND INSPECTION**

- 5.1. The SLI batteries shall be inspected and tested in accordance with the requirements of IEC 60095-1&2, KS 04-185, KS 03-242, KS 04-1067-2, DIN 43 539-2, JIS D5 301, IEC 61373, ASTM E49, BS EN 12659, KS 2258, ISO 2212 and BS 2000 standards. 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 document (all in English Language)
- 5.3. Copies of type test reports to be submitted with the tender in accordance with the standards mentioned in clause 5.1 (by bidder) for evaluation shall be as stated below:
  - a) Short circuit current and internal resistance test
  - b) Ampere- hour and watt-hour efficiency tests
  - c) Test for voltages during discharge
  - d) 20-hour capacity check  $C_e$
  - e) Reserve capacity check  $Cr_e$
  - f) Cranking performance test
  - g) Endurance test for batteries
  - h) Life Cycle Test
  - i) Vibration resistance test
  - j) Type tests for separator materials
- 5.4. Routine and sample test reports for the batteries to be supplied shall be submitted to KPLC for approval before shipment/delivery. KPLC Engineers will witness tests at the factory

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- 6.1.2. In addition to the foregoing, detailed instructions regarding climate classification, vent plugs, cleaning, specific gravity of the electrolyte for initial filling, initial charging and maintenance of the battery shall be printed on a label and fixed on the body of the battery.
- 6.1.3. A label that will indicate "best before dates" i.e. 42 months from date of manufacture and /or embossed marking indicating free replacement of battery shall be provided if the battery does not perform as best before dates.
- 6.1.4. The labels shall be durable, acid resistant and the instructions shall be legible during use of the battery till completion of all the specified tests.

**6.2. PACKAGING**

- 6.2.1. The battery shall be supplied in dry and uncharged condition suitably packed, securely in wooden crates tightly strapped with metallic straps.
- 6.2.2. Packing shall be suitable for handling during transit by rail/road and secured to avoid any loss or damage during transit.
- 6.2.3. The cases shall be furnished with an illustrated safety, operating and maintenance instructions for the batteries.

**7. DOCUMENTATION**

- 7.1 The bidder shall submit its tender 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 signed by the manufacturer;
  - b) Copies of the Manufacturer's catalogues, brochures, and technical data sheets for battery and battery layout drawings;
  - c) Product Data: Electrical characteristics of selected battery.
  - d) Sales records for the last five years and at least four customer reference letters;
  - e) Details of manufacturing capacity and the manufacturer's experience;
  - f) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025;
  - g) Copy of accreditation certificate to ISO/IEC 17025 for the third party testing laboratory;
  - h) Manufacturers letter of authorization, ISO 9001:2008 certificate and other technical documents required in the tender.

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b) Reserve Capacity (RC) in minutes		
c) Power in watts		
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6. Marking & Packaging		
6.1. Marking		

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