IS : 2512 - 1978
(Reaffirmed 2003)

Indian Standard

SPECIFICATION FOR MINERS' CAP-LAMP BATTERIES (LEAD-ACID TYPE)

(First Revision)

First Reprint MARCH 1992

UDC 622.474:621.355.2

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

December 1978

Indian Standard

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(First Revision)

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(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 26 September 1978, after the draft finalized by the Secondary Cells and Batteries Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 Miners' cap-lamps (operated by lead-acid batteries) are mostly used in gassy mines. Such lamp assemblies are in extensive use in India. These lamp assemblies are neither explosion-proof nor intrinsically safe and, hence, great care is to be taken in their design as they will be the suspected source of ignition when an explosion occurs in the mine. The internal construction and assembly of cap-lamp batteries shall therefore be such as to prevent any hazard during their normal life.

0.3 The concerned authorities give approval only for the complete lamp assembly and not for individual component units, such as battery, lamp, etc.

0.4 The complete miners' cap-lamp assembly and components, such as bulbs and cables are covered by the following Indian Standards:

IS : 2593-1964 Specification for flexible cables for miners' cap-lamps

IS : 2596-1964 Specification for bulbs (lamps) for miners' cap-lamps

IS : 5679-1970 Specification for miners' cap-lamps

0.5 In the preparation of this standard assistance has been derived from BS 4945 : 1973 'Specification for miners' cap-lamp assemblies (incorporating lead-acid type batteries)' issued by the British Standards Institution.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the

*Rules for rounding off merical values (*revised*).

rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers performance and other requirements, and methods of test for lead-acid batteries of nominal voltage of 4V and of a nominal capacity of 9 Ah, for use with miners' cap-lamps.

2. TERMINOLOGY

2.1 For the purpose of this standard, the following definitions in addition to those given in IS : 1885 (Part VIII)-1965* and IS : 8320-1976† shall apply.

2.1.1 *Type Tests* — Tests carried out to prove conformity with the requirements of this standard. These are intended to prove the general quality and design of a given type of battery.

2.1.2 *Acceptance Tests* — Tests carried out on samples selected from a lot for the purpose of verifying the acceptability of the lot.

2.1.2.1 *Lot*— All batteries of the same type, design and rating, manufactured by the same factory during the same period, using the same process and materials, offered for inspection at a time shall constitute a lot.

2.1.3 *Routine Tests* — Tests carried out on every battery.

3. MATERIALS

3.1 Container — The rubber and plastics containers shall conform to IS: 1146-1972‡.

3.2 Electrolyte — The sulphuric acid used for the electrolyte in the battery shall conform to IS : 266-1961§.

3.3 Water — The water used for the electrolyte in the battery shall conform to IS : 1069-1964‖.

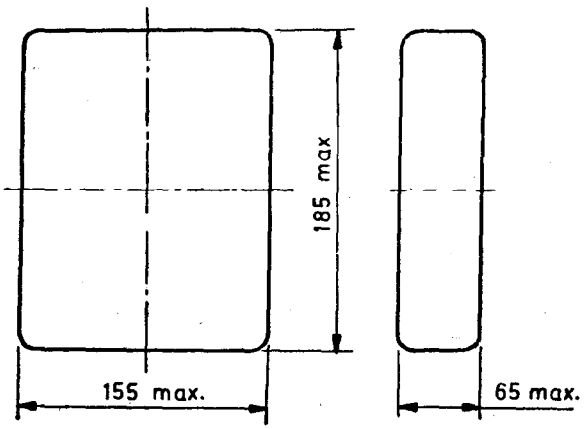
*Electrotechnical vocabulary: Part VIII Secondary cells and batteries.
†General requirements and methods of test for lead-acid storage batteries.
‡Specification for rubber and plastic containers for lead-acid storage batteries (*first revision*).
§Specification for sulphuric acid (*revised*).
‖Specification for water for storage batteries (*revised*).

4. CONSTRUCTIONAL AND GENERAL REQUIREMENTS

4.1 General — Battery for miners' cap-lamp shall be complementary unit of the cap-lamp. It shall be robust and durable in construction and suitable for use in underground service. When used with the cap-lamp assembly, the battery shall offer no possibility of an explosion hazard in mines in which dust, flammable gases or vapours may be present or of bodily hazard to the miners due to spillage of electrolyte.

4.2 Container and Lid

4.2.1 The container and cell lids shall be of rubber or plastics. Elastomer or other suitable polymeric material may also be used, subject to the suitability of the latter being established by authoritative tests. The container shall comprise of two cells and shall conform to the maximum overall dimensions shown in Fig. 1.



All dimensions in millimetres.

FIG. 1 MAXIMUM OVERALL DIMENSIONS OF CONTAINER

4.2.2 Means shall be provided for attachments to fix the battery to a belt. Provision shall be made for securing a protective top cover to the battery. An entry port giving access to the individual cells of the battery for initial filling and subsequent topping up of electrolyte shall be provided on the outer face of the container. The port shall be provided with a plug. Cell lids shall be securely sealed to the box. The seal shall prevent leakage of electrolyte under normal conditions of use.

4.3 Cell Post Sealing — The seal between cell post and cell lid shall prevent electrolyte leakage under normal conditions of use.

4.4 Cell Venting — Suitable venting arrangements shall be provided to permit free escape of gases produced inside each cell, preventing at the same time, any leakage of electrolyte.

4.5 Fuse — The battery shall have provision for a replaceable cartridge type or totally-enclosed fuse unit.

NOTE — The fuse is intended for restricting the amount of current flow between the conductors of the cord, if short-circuited just outside the battery container or the cord armour, to such a value as will not produce sparks that will ignite an explosive mixture of methane and air.

4.6 Terminals — The terminals of the battery shall be so designed and constructed and so disposed that they are not likely to become short-circuited.

4.7 Mass — The mass of the battery, when filled and charged, shall not exceed 2·0 kg.

5. MARKING

5.1 Each battery shall be distinctly and durably marked to indicate the following particulars:

a) Manufacturer's name or trade-mark,

b) Country of origin,

c) Voltage,

d) Maximum nominal bulb rating for which the battery is designed, and

e) Any other special mark(s) specified for safety requirements.

5.1.1 The positive terminal location shall be marked on the container with a positive symbol (+).

5.1.2 The battery may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6. TESTS

6.1 Classification of Tests

6.1.1 *Type Tests* — The tests given in **6.1.1.2** shall constitute the type tests.

6.1.1.1 *Number of samples* — Six samples shall be drawn at random for the type tests by the testing or the inspecting authority.

6.1.1.2 *Sequence of tests* — The sequence of type tests shall be as indicated in the schedule below:

Test	*Battery Number*					
	1	2	3	4	5	6
a) Physical examination and mass (**6.5**)	×	×	×	×	×	×
b) Air pressure test (**6.6**)	×	×	×	×	×	×
c) Non-spillability test (**6.7**)	×	×	×	×	×	×
d) Capacity test (**6.8**)	×	×	×	×	×	×
e) Life test (**6.9**)	—	—	—	×	×	×
f) Drop test (**6.10**)	×	×	×	—	—	—

6.1.1.3 If any of the samples fail in the relevant type test, the testing authority may call for fresh samples not exceeding twice the original number and subject them again to the test(s) in which failure occurred. If there is any failure in the retest(s), the type shall be considered as not having passed the requirements of this standard.

6.1.2 *Acceptance Tests* — The following shall comprise the acceptance tests:

a) Physical examination and mass (**6.5**),

b) Air pressure test (**6.6**),

c) Non-spillability test (**6.7**), and

d) Capacity test (**6.8**).

6.1.3 *Sampling Scheme and Criteria for Acceptance* — The sampling scheme and the criteria for acceptance shall be in accordance with **5.1.4** of IS : 8320-1976*.

6.1.4 *Routine Tests* — The following shall constitute the routine tests:

a) Physical examination and mass (**6.5**), and

b) Air pressure test (**6.6**)

*General requirements and methods of tests for lead acid storage batteries.

6.2 Temperature for Tests

6.2.1 The capacity and life tests specified in this standard shall be carried out at an ambient temperature of 27 ± 2°C.

6.2.1.1 It is preferable to conduct the tests in an air-conditioned room maintained at the standard temperature specified. In case, however, such an arrangement is not available, the tests shall be carried out at the standard temperature maintained by any suitable means.

6.3 Test Equipment

6.3.1 *Voltmeter* — The voltmeter used for tests shall be of an accuracy class not inferior to 0·5 in accordance with IS : 1248-1968*. The resistance of voltmeter used shall be at least 1 000 ohms per volt. The range of voltmeter used shall be such that the magnitude of the voltage to be measured falls in the last third part of the scale.

6.3.2 *Ammeter* — The ammeter used for tests shall have an accuracy class not inferior to 1·0 (*see* IS : 1248-1968*). The range of ammeter used shall be such that the magnitude of the current to be measured falls in the last third part of the scale.

6.3.3 *Thermometer* — Thermometers with an appropriate scale shall be used for measuring temperatures, and one division of the graduated scales shall represent at the most 1°C. The accuracy of the calibration shall be not less than 0·5°C.

6.3.4 *Hydrometer* — The specific gravity of the electrolyte shall be measured by hydrometers provided with a graduated scale, one division of which shall represent at the most 0 005 unit of specific gravity.

NOTE — Alternatively for the purpose of this standard the specific gravity of electrolyte may be measured by any other suitable method.

6.4 First Charge — The battery shall be first charged in accordance with the manufacturer's instructions.

6.4.1 *Specific Gravity of Electrolyte* — For the purpose of the tests covered in this standard, the specific gravity of electrolyte in fully charged condition shall be between 1·280 and 1·285 corrected to 27°C when corrected in accordance with **3.2.2** of IS : 8320-1976†.

6.5 Physical Examination and Mass — The batteries shall conform to the requirements of **4**.

6.6 Air Pressure Test — The sealing of each cell of the battery shall be checked by compressed air at a pressure equal to 700 mm height of water column. The volume of the tubes and ancilliary parts connected to the cell under pressure shall not exceed 0·5 litres.

*Specification for direct acting electrical indicating instruments (*first revision*).
†General requirements and methods of tests for lead acid storage batteries.

6.6.1 *Requirement* — The air pressure shall not fall below 670 mm of water column in 15 seconds after the air supply to the cell is disconnected.

6.7 Non-spillability Test — The charged battery shall be subjected to a static non-spillability test by keeping it upside down for 2 hours.

6.7.1 *Requirement* — There shall be no visible spillage of electrolyte during and at the completion of 2 hours.

6.8 Capacity Test

6.8.1 The battery shall be prepared and charged in accordance with the manufacturer's instructions.

6.8.2 The battery shall be discharged and charged as many times as recommended by the manufacturer, up to a maximum of 5 such conditioning cycles.

6.8.3 After not less than 2 hours and not more than 24 hours from the completion of the charge in accordance with the manufacturer's instructions, and at an ambient temperature of 27 $\pm$ 2°C, the battery shall be discharged continuously through a suitable resistance at a constant current of 1·0 A until the battery terminal voltage falls to 3·70 V.

6.8.4 *Requirement* —The battery shall have a capacity of not less than 9·0 Ah or a duration of not less than 9 hours.

NOTE — This battery (9 Ah nominal capacity) is suitable for bulbs of rating up to and including 0·8 A.

6.9 Life Test

6.9.1 The life test shall be performed on three batteries which have passed the tests in accordance with **6.5**, **6.6**, **6.7** and **6.8**.

6.9.2 Each battery shall be subjected to a series of continuous charges and discharges as follows:

a) Discharge continuously at a current of 0·8 A for 9 hours through a suitable resistance.

b) Recharge for a period of 15 hours at a constant potential source of 5·1 V with a resistance of 0·35 ohm in series with the battery.

c) The sequence of discharges and charges are repeated, one complete cycle being completed in 24 hours.

6.9.3 After every 25 cycles, each battery may be subjected to a full recharge in accordance with the manufacturer's instructions.

6.9.4 After each series of 100 cycles up to the 500th cycle and after each series of 50 cycles thereafter, after correction of electrolyte levels and after receiving a recharge in accordance with the manufacturer's instructions, each battery shall be subjected to a capacity test in accordance with **6.9.5**.

6.9.5 After not less than 2 hours and not more than 24 hours from the completion of charge, the battery shall be discharged at a continuous current of 0·8 A through a suitable resistor until the terminal voltage of the battery falls to 3·70 V.

6.9.6 After each capacity test, the battery shall be recharged in accordance with the manufacturer's instructions and the cycles of discharge and recharge resumed.

6.9.7 The life test is terminated when the duration of the discharge at 0·8 A to 3·70 V in the capacity test falls below 9·0 hours.

6.9.8 *Requirement* — The number of charge and discharge cycles shall be not less than 600.

NOTE — The life test is intended to give an indication of the service performance of a battery coupled to a cap-lamp fitted with a 4·0 V, 0·8 A bulb.

6.10 Drop Test

6.10.1 Drop tests shall be conducted on three batteries which have passed the tests in accordance with **6.5, 6.6, 6.7** and **6.8.**

6.10.2 A test platform shall be prepared in accordance with Appendix A.

6.10.3 Each battery shall be subjected to a total of six drops on to the test platform from a height of one metre. The six drops shall comprise two on the base and one on each of the four sides of the battery respectively. The face containing the terminals shall not strike the platform.

6.10.4 *Requirement* — There shall be no crack in the battery container after six drops. If the battery case falls into pieces, the battery is considered too brittle for satisfactory service and is rejected.

After six drops each battery when discharged through a suitable resistor shall give a continuous discharge of 0·8 A for 7·0 hours before the voltage at the battery terminals falls below 3·70 V.

APPENDIX A

(*Clause* 6.10.2)

TEST PLATFORM FOR DROP TEST

A-1. The test platform will be a square block 450 × 450 mm comprising 25 mm thick wooden boards laid over a concrete block 90 mm thick making up a total height of 115 mm.

A-2. The wooden boards shall be selected from one of the following woods and shall be well-seasoned and free from knots:

a) Kokko (*Albizzia* lebbek),

b) Benteak (*Lagerstrolmia* lanceolata),

c) Kindal (*Terminalia* paniculata),

d) Kharsu (*Quercus* semecarpifolia), and

e) Teak or Indian teak.

A-3. CONSTRUCTION

A-3.1 Starting with a square wooden frame pour concrete to a height of 90 mm. Lay the 25 mm floor boards over the finished concrete and plane outer frame flush with wooden flooring.

NOTE — It is advisable to surround the test platform with rubber or foam mats since the cap-lamp battery generally bounces off the platform when dropped and sustains additional knocks on the surrounding floor.

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Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 MARCH 1985

TO

IS:2512-1978 SPECIFICATION FOR MINERS' CAP-LAMP BATTERIES (LEAD-ACID TYPE)

(First Revision)

(*Page 8, clause 6.3.3*) - Add the following note after this clause:

'NOTE - The voltmeter, ammeter and the thermometer of digital read-out type of similar accuracy also can be used.'

(ETDC 11)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 FEBRUARY 1993
TO
IS 2512 : 1978 SPECIFICATION FOR MINERS' CAP-LAMP BATTERIES (LEAD-ACID TYPE)

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[*Page* 7, *clause* **6.1.4** (a)] — Delete 'and mass (**6.5**)'.

(ETD 11)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 MARCH 2002
TO
IS 2512 : 1978 SPECIFICATION FOR MINERS' CAP-LAMP BATTERIES (LEAD-ACID TYPE)

(First Revision)

(*Page* 4, *clause* **1.1**, *last line*) — Substitute the following for the existing:

'nominal capacity of 9 Ah/12 Ah for use with miners' cap-lamps'.

(*Page* 9, *clause* **6.8.4**) — Add the following at the end:

'For batteries suitable for bulb ratings above 0.8 A, up to and including 1.0 A, the discharge test conducted according to **6.8.3** shall have a capacity not less than 12 Ah or give a duration not less than 12 hours at a discharge current of 1.0A.'

(*Page* 10, *clause* **6.9.5**, *line* 3, *after* 0.8 A) — Add the following :

'for 9 Ah battery and 1.0 A for 12 Ah battery'.

(*Page* 10, *clause* **6.9.7**, *line* 2, *after* 0.8 A) — Add the following:

'for 9 Ah battery and 1.0 A for 12 Ah battery'.

(*Page* 10, *clause* **6.9.8**, *line* 2) — Add the following at the end:

'for batteries suitable for a bulb rating of 4 V, 1.0 A, the discharge current under **6.9.2**(a), **6.9.5** and **6.9.7** shall be at 1.0 A in lieu of 0.8 A.'

(*Page* 10, *clause* **6.10.4**) — Add the following at the end:

'NOTE — For cap-lamp batteries used with 4 V, 1.0 A bulb, the continuous discharge (under **6.10.4**) should be at 1.0 A in lieu of 0.8 A.'

(ETD 11)

Reprography Unit, BIS, New Delhi, India