इंटरनेट मानक

Disclosure to Promote the Right To Information

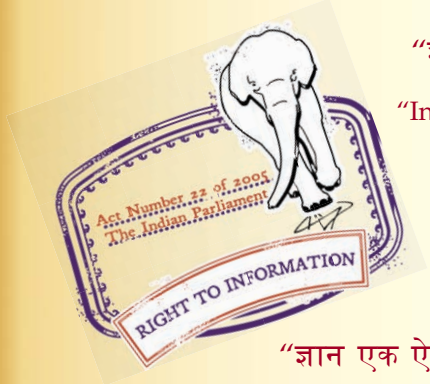
Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 1652 (1991): Stationary cells and batteries,lead-acid type with plante positive plates [ETD 11: Secondary Cells and Batteries]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"



"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

IS 1652 : 1991
(Reaffirmed 2002)

भारतीय मानक

प्लान्टे धनात्मक प्लेटों सहित सीसा अम्ल प्रकार की बैटरियाँ और स्थायी सैल — विशिष्टि

(तीसरा पुनरीक्षण)

Indian Standard

STATIONARY CELLS AND BATTERIES, LEAD-ACID TYPE WITH PLANTE POSITIVE PLATES — SPECIFICATION

(Third Revision)

UDC 621·355·2

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

December 1991

Price Group 3

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Secondary Cells and Batteries Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was first published in 1960, superseding IS 541 : 1954. The standard prescribed the dimensions, capacities and performance requirements of stationary cells and batteries of lead-acid type with plante positive plates. For preparation of this standard, assistance was derived from BS 440 : 1958 Stationary batteries (lead acid plante positive plates) for general electric purposes, issued by the British Standards Institution.

The first revision was brought out in 1972 to cover the storage cells with plastic containers and the plante cells of improved performance, thereby making available cells of a lower internal resistance and correspondingly higher cell output.

The second revision of this standard was brought out in 1984 to cover batteries with high discharge performance requirements as only the batteries with plante positive plates with high performance requirement are manufactured and used in the country. The batteries with low discharge performance requirements would be included later whenever there is a demand from the users and manufacturers of the batteries.

Third revision has been prepared to cover the latest practice in manufacture of stationary cells and batteries, and include additional requirements for overcharging cycle in endurance test.

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, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

STATIONARY CELLS AND BATTERIES, LEAD-ACID TYPE WITH PLANTE POSITIVE PLATES — SPECIFICATION

(Third Revision)

1 SCOPE

This standard specifies rated ampere-hour capacities, overall dimensions, performance requirements and tests for high discharge performance, stationary, lead-acid cells and batteries using plante type positive plates.

2 REFERENCES

The standards listed in Annex A are necessary ajuncts to this standard.

3 TERMINOLOGY

3.0 For the purpose of this standard, the following definitions in addition to those given in IS 1885 (Part 8) : 1986 shall apply.

3.1 High Discharge Performance Cells

Cells containing pure lead plante plates of lemelle type with pasted type negative plates.

3.2 Type Test

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.

3.3 Acceptance Tests

Tests carried out on sample selected from a lot for the purpose of verifying the acceptability of the lot.

3.3.1 *Lot*

All batteries of the same type of 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.

4 RATING AND DESIGNATION

4.1 Ampere-Hour Rating

The rating assigned to the cell shall be the capacity expressed in ampere-hours (after correction to 27°C) stated by the manufacturer to be obtainable when the cell is discharged at the 10 hour rate (C_{10}) to a final voltage of 1·85 volts.

4.2 Designation of Cells

Cells shall be designated by the letter 'P' for plante followed by the standard rating of the cell, a letter indicating the type of cell container a hyphen and the letters HDP for high discharge performance.

The following will be used to indicate container types:

G = glass
H = hard rubber
P = plastics
W = lead-lined wood
f = fibre reinforced plastics (FRP)

Examples:

1 P 40 P-HDP designates a high discharge performance plante type stationary cell of 40 Ah capacity in a plastic container.

2 P 2000 W-HDP designates a high discharge performance cell of 2 000 Ah capacity in a lead-lined wood box.

5 CONSTRUCTIONAL REQUIREMENTS

5.1 Containers

The containers shall be made of hard rubber, glass, lead-lined wood, plastics or fibre reinforced plastics (FRP).

5.1.1 Hard rubber and plastics containers shall conform to IS 1146 : 1981.

5.1.2 Glass containers shall be sufficiently robust, transparent and free from flaws.

5.2 Cell Lids

Lids used with sealed or closed type cells shall be of glass, plastics or ebonite and shall be provided with a vent plug(s). Terminal posts shall be suitably sealed at the lid by means of rubber grommets, sealing compound or other suitable devices, to prevent acid spray.

5.3 Venting Device

The venting device shall be of antisplash type with more than one exit hole and shall allow gases to escape freely but shall effectively prevent acid particles or spray from coming out. For capacities 120 Ah and above assembled in opaque container, there shall be two vent holes, one serving as a guide for acid level, indicator for checking of the electrolyte level and the other to permit drawing of electrolyte samples, servicing, checking of specific gravity etc.

5.4 Sealing Compound

The sealing compound when used in sealed or closed cells, if bitumen based, shall conform to IS 3116 : 1965.

5.5 Plates

5.5.1 *Positive Plate*

The plante positive plate shall be of the pure lead lamelle type with plante formation.

5.5.2 *Negative Plate*

The plates shall be pasted construction and of good workmanship.

5.6 Separators

The separators shall conform to IS 6071 : 1986.

5.7 Terminal Posts

Positive and negative terminal posts (where provided of cells shall be clearly and unmistakably indentifiable. The positive terminal shall be marked with red colour in addition to '+' marking.

5.8 Fasteners

Bolts, nuts and washers for connecting the cells shall be effectively lead-coated to prevent corrosion.

5.9 Connectors

Where it is not possible to bolt the cell terminals directly to assemble a battery, separate lead-coated copper of aluminium connectors of suitable size shall be provided to join the cells. In such cases, the coating shall be adequate and tenacious. In some cases, it may be necessary to connect individual cells in parallel as specified by the purchaser. In such cases, suitable connectors shall be used.

5.10 Electrolyte

The sulphuric acid and water used for preparing electrolyte for the cells shall conform to IS 266 : 1977 and IS 1069 : 1964.

5.11 Spray Arrestor

Open cells shall be provided with spray arrestors of adequate area over the plates. These may be of glass sheet at least 3 mm thick or suitable plastics sheet and shall be adequately supported.

6 CAPACITIES AND DIMENSIONS

The capacities and maximum external dimensions of cell boxes shall conform to Table 1. The voltage of each cell shall be 2 V.

7 MARKING

The following information shall be indelibly and durably marked on the outside of the cell:

a) Indicating the source of manufacturer,

b) Ampere-hour capacity at 10-hour rate;

c) Upper and lower electrolyte level in case of transparent containers;

d) Year of manufacture, and

e) Country of origin.

Table 1 Capacities and Maximum Overall Dimension at Cells Boxes

(*Clause* 6.1)

Capacity 10-h Rate	Maximum Overall Dimensions		
	Length	Width	Height
(1)	(2)	(3)	(4)
Ah	mm	mm	mm
20	130	140	225
40	205	140	225
60	205	140	225
80	175	235	370
100	175	235	370
120	175	235	370
150	175	235	370
200	210	235	370
300	290	235	370
400	365	235	370
500	375	310	625
600	375	310	625
800	375	335	625
1 000	385	375	635
1 500	520	390	635
2 000	650	390	635
2 500	785	405	640
4 000	1 160	405	640
5 000	1 350	515	650

NOTES

1 The length and width dimensions given in this table may be interchanged.

2 For capacities not covered in this table, the cell dimensions shall not exceed the dimensions of the cell of next higher size covered by this table.

8 PACKING

The cells shall be suitably packed so as to avoid any loss of damage during transit.

9 MANUAL AND INSTRUCTIONS

9.1 The manufacturer shall supply one copy of instruction manual for initial treatment and routine maintenance during service, with every batch of batteries.

9.2 The following information shall be provided on the instructions cards:

a) Designation of cell or battery (*see* 4.2);

b) Ampere-hour capacity;

c) Nominal voltage;

d) Manufacturer's instructions for filling, initial charging;

e) Normal and finishing charging rates; and

f) Maintenance instruction.

10 CONDITIONS OF SUPPLY

10.1 To facilitate procurement of correct type of stationary cells, it is recommended that the user should furnish information regarding

his requirements as given in Annex B, at the time of enquiry or order similarly, the manufacturer should furnish the information given in Annex C.

10.2 Other conditions of supply shall be subject to agreement between the purchaser and the supplier.

11 GENERAL REQUIREMENT FOR TEST

11.1 Temperature for Test

The temperature of electrolyte during test discharge shall be within the limits of 160°C and 38°C.

11.2 Specific Gravity

For the purpose of test requirements, the specific gravity of electrolyte of fully charged cell shall be 1·200 + 0·005 corrected to 27°C. Temperature correction for hydrometer readings of specific gravity shall be made as follows:

a) For each 1°C, above 27°C, 0·000 7 to be added to the observed reading and

b) For each 1°C, below 27°C, 0·000 7 to be subtracted from the observed reading.

11.3 Test Equipment

The voltmeter, ammeters, thermometers and hydrometers used for the tests shall comply with the requirements of **10.2** of IS 8320 : 1982.

11.4 Classification of Tests

11.4.1 *Type Tests*

The following shall constitute type tests and shall be carried out in the sequence given below:

a) Verification of constructional requirements (**5**),

b) Verification of marking (**7**),

c) Verification of dimensions (**6.1**),

d) Test for capacity (**11.6**) – Test for voltage during discharge (**11.11**),

e) Ampere-hour and watt-hour efficiency tests (**11.10**),

f) Test for retention of charge (**11.8**), and

g) Endurance test (**11.9**).

11.4.2 Type test shall be carried out on three (3) cells. Two (2) cells shall undergo all tests except endurance test while the other would undergo endurance test preceded by a capacity test.

For capacities above 500 Ah, however a test cell with suitable number of positive plates alongwith other components to be fabricated in a suitable sized container such that capacity does not exceed 500 Ah. All other tests would be carried out on two (2) cells of respective capacity.

11.4.3 *Acceptance Tests*

The following shall constitute the acceptance tests:

a) Verification of marking (**7.1**),

b) Verification of dimensions (**6.1**),

c) Test for capacity (**11.6**), and

d) Test for voltage during discharge (**11.11**),

11.4.3.1 Acceptance tests shall, normally, be carried out, at the discretion of the purchaser, on each cell after installation at site. The date and place of testing shall be subject to agreement between the purchaser and the supplier.

11.4.3.2 The sampling scheme and criteria for acceptance for cells up to and including 600 Ah capacity shall be in accordance with **11.1.4** of IS 8320 : 1982. For capacity more than 600 Ah, it shall be as agreed between the purchaser and the manufacturer.

11.5 First Charge

The cell of battery, if received in the dry uncharged condition, shall be filled with the electrolyte and charged in accordance with the manufacturer's instructions.

11.6 Tests for Capacity

11.6.1 After standing on open circuit for not less than 12 hours and not more than 24 hours from completion of a full charge, the cell or battery shall be discharged through a suitable variable resistance at constant current of $I = 0{\cdot}1\ C_{10}\ A$. The discharge shall be stopped when the closed circuit voltage accross the battery falls to $1{\cdot}85 \times nv$, where n is the number of cells.

11.6.1.1 The rated capacity shall be reached within 3 discharge subsequent to the initial charge. Once the rated capacity has been met, further discharges for capacity shall be discontinued.

11.6.2 *Requirement*

The period of discharge shall not be less than $10 + 0{\cdot}09\ (t - 27)$ hours nor exceed $12 - 0{\cdot}09\ (t - 27)$ hours, t being the test temperature in degrees Celsius.

11.7 Alternate Rated Test Discharge

Test for capacity may, by agreement between the purchaser and the supplier, be carried out at rates other than the 10-hour rate. In such cases, the 5-hour rate is recommended, capacities at various rates of discharge and corresponding final voltages are given in Table 2. For the purpose of acceptance, the capacity test shall be carried out at one rate only.

Table 2 Capacities Discharge Current at 27°C or High Discharge Performance Cells at Various Rates of Discharge

(*Clause* 11.7)

Period of Discharge	Ah Capacities as Percentage of Standard Rating		Discharge Capacity as Percentage of Standard Rating		Cell End Voltage	Percentage Variation of Capacity per °C
	8 and 25 Ah Plates	10Ah Plates	8 and 25 Ah Plates	100 Ah Plates		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
hours	Percent	Percent	Percent	Percent	Volts	
1	60·0	60·0	60·0	60·0	1·75	1·33
2	73·0	73·8	36·5	36·9	1·78	1·12
3	80·0	81·1	26·6	27·0	1·80	1·04
4	84·8	86·2	21·0	21·5	1·81	0·99
5	88·0	90·0	17·6	18·0	1·82	0·95
6	91·0	93·0	15·2	15·5	1·83	0·94
7	93·3	95·1	13·3	13·6	1·83	0·92
8	95·0	97·1	12·0	12·1	1·84	0·92
9	98·0	98·8	10·9	11·0	1·84	0·90
10	100·0	100·0	10·0	10·0	1·85	0·90

11.8 Loss of Capacity on Storage

11.8.1 This test shall be carried out on the two cells which have successfully passed the capacity test in accordance with **11.6**

11.8.2 The cells shall be fully recharged at the current specified by the manufacturer and shall then be submitted to two consecutive capacity tests in accordance with **11.6**, the value of the initial capacity *C* being calculated as the mean of the two results thus obtained.

11.8.3 After a complete recharge and the cleaning of electrolyte from its surface the cells shall be left on open circuit for a period of 28 days without disturbance at a temperature of 27 ± 2°C.

11.8.4 After the storage for 28 days, the cell shall be discharged in accordance with **11.6**. The value of capacity measured after storage is denoted by *C'*.

11.8.5 The less of capacity *S* expressed as a percentage is calculated from the following formula:

$$S = \frac{C - C'}{C} \times 100$$

11.8.6 *Requirement*

The loss in capacity thus measured shall not exceed 15 percent.

11.9 Endurance Test

11.9.1 The test shall be made on cell, which has been subjected to only capacity test. No further tests shall be made on this sample after this test.

11.9.2 The test shall be conducted on a complete cell up to a capacity 500 Ah. For those cells above this rating, test cells with suitable number of positive plates (of the type used in that particular cell alongwith negative plates and separators and other accessories) such that the cell capacity does not exceed 500 Ah, shall be built in a suitable sized container.

11.9.3 One cell shall be subjected to an overcharging current of $0{\cdot}1 \times 0_{10}$ Amperes at a test temperature of 40 ± 3°C for total periods of 2 000 hours as given in **11.9.4.**

11.9.4 *Overcharging Periods*

a) 2-cycles of 300 h charging followed by test discharge,

b) 3-cycles of 200 h charging followed by test discharge, and

c) 8 cycles of 100 h charging followed by test discharge.

11.9.5 Throughout these periods of charge the cells shall be immersed in a tank of water the temperature of which shall be maintained at 40 ± 3°C. The cells shall be so immersed that the top of each cell is 25 mm above the water level in the tank. If the two cells are placed in the same tank, a distance between a cell and the sides of the tank shall be at least 25 mm.

11.9.6 At the end of each period of charging (a), (b), (c), as specified in **11.9.4** the cells shall be subjected without redrawing to a test discharge (C_{10}) to an end voltage 1·85 V in accordance with **11.6.**

11.9.7 When the test discharge is completed, the cells shall be immediately subjected to the next period of continuous charge without any recharging.

11.9.8 *Requirement*

The cell shall give not less than 9 h of discharge of the final test discharge after the last period of charge.

11.10 Ampere-Hour and Watt-Hour Efficiency Test

11.10.1 *Ampere-Hour Efficiency*

A fully charged cell shall be discharged at $I = 0{\cdot}1 \times C_{10}$ A to an end voltage of 1·85 volts, careful calculations being made of the exact number of ampere-hours delivered. On recharge the same number of ampere-hours are put back at the same current. A second discharge shall than be made to the same out-off voltage as before. The efficiency of the cell is then calculated as the ratio of the ampere-hour delivered during the second discharge to the ampere-hour put in on the charge.

11.10.1.1 *Requirement*

The ampere-hour efficiency when calculated as described in **11.10.1** shall be not less than 10 percent

11.10.2 *Watt-Hour Efficiency*

The watt-hour efficiency shall be calculated by multiplying the ampere-hour efficiency by the ratio of average discharge and recharge voltage. The values of discharge and recharges voltage shall be calculated from the log sheets for ampere-hour efficiency.

11.10.2.1 *Requirement*

The watt-hour efficiency when calculated as described in **11.10.2** shall be not less than 75 percent.

11.11 Test for Voltages During Discharge

The cell need not be discharged specially for this test. For the purposes of this test the voltages shall be obtained from the log sheets for capacity test in which the cell meets the rated capacity.

11.11.1 *Requirement*

The closed-circuit voltage of cell shall not be below the values given in col 2.

Duration After Commencement of Discharge (1)	*Closed-circuit Voltage at Cell Terminals* (2)
a) Six minutes after putting on load	1·99 *Min*
b) 7 hours	1·92 *Min*
c) 10 hours	1·85 *Min*

ANNEX A
(*Items* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*	*IS No.*	*Title*
266 : 1977	Sulphuric acid (*second revision*)	3116 : 1965	Sealing compound for lead-acid batteries
1069 : 1964	Water for storage batteries (*revised*)	6071 : 1986	Synthetic separators for lead-acid batteries (*first revision*)
1146 : 1981	Rubber and plastics containers for lead-acid storage batteries (*second revision*)	8320 : 1982	General requirements and methods of tests for lead-acid storage batteries (*first revision*)
(Part 8) : 1986 1885	Electrotechnical vocabulary: Part 8 Secondary cells and batteries (*first revision*)		

ANNEX B
(*Clause* 10)

INFORMATION TO BE FURNISHED BY THE PURCHASER WITH ENQUIRY OR ORDER

B-1 When enquiring for or ordering stationary cells lead-acid type the following information should be furnished by the purchaser:

a) Number of identical batteries required;
b) Number of cells per battery;
c) Details if it is proposed to use any of the cells of a battery at different rates of charge and discharge;
d) Capacity (in ampere-hours at the 10-hour rate) and discharge duty of batteries;
e) Cell designation in accordance with this standard;
f) The proposed method of working, that is charge-discharge, float working, or stand-by with or without trickle charging (in case of float working, the floating voltage, the limits of regulation are to be indicated;
g) Whether stands or stillages required and if so, details of layout or space available;
h) The proposed location and installation and the expected dates of tests to be conducted;
j) Accessories and spares required, if any; and
k) Special conditions; if any.

ANNEX C
(*Clause* 10.1)

INFORMATION TO BE FURNISHED BY THE SUPPLIER

C-1 When supplying stationary cells and batteries, the following particulars should be furnished by the supplier:

a) Capacity of battery at the 10-hour rate;
b) Manufacturer's name;
c) Type of negative plates;
d) Method of connection between cells, that is, whether bolted or burns;
e) Recommended starting and finishing rates of charge;
f) Voltage of cell at the end of charge at the finishing rate;
g) Recommended trickle charging rates for different types of working;
h) The type and material of the separators;
j) Material of container;
k) Amount and specific gravity of electrolyte at the end of the discharge at 10-hour rate;
m) Overall dimensions of each cell;
n) Distance between the centres of cells when erected;
p) Weight of cell complete with acid;
q) Recommended maximum period of storage before charge; and
r) Internal resistance of the cell.

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard 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 BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promoto harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Revision of Indian Standards

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent to BIS giving the following reference :

Doc : No. ETD 11 (3268)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	331 01 31 331 13 75
Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054	37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43
Southern : C.I.T. Campus, IV Cross Road, MADRAS 600113	2350216
Western : Manakalaya, E9 MIDC, Marol, Andheri (East), BOMBAY 400093	6 32 92 95

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. PATNA. THIRUVANANTHAPURAM.

Printed at Swatantra Bharat Press, Delhi, India

AMENDMENT NO. 1 OCTOBER 2000
TO
IS 1652 : 1991 STATIONARY CELLS AND BATTERIES, LEAD-ACID TYPE WITH PLANTE POSITIVE PLATES — SPECIFICATION

(Third Revision)

(*Page* 3, *clause* **11.1**) — Substitute '16°C' *for* '160°C'.

(*Page* 3, *clause* **11.2**) — Substitute '1.200 ±0.005' *for* '1.200 + 0.005'.

(*Page* 4, *clause* **11.9.6**) — Insert the following at the end of the clause:

"This discharge test shall be conducted without undue delay and without removing the cell from water bath and shall be made within 2 hours of termination of charging current.

If for any reason the time between the termination of charging and the test discharge exceeds 2 hours, the cell in water bath may, at the option of the manufacturer, be kept on a 'trickle charge' not exceeding $I = 0.01 \times C_{10}$ amperes until the time of test discharge."

(ETD 11)

Reprography Unit, BIS, New Delhi, India