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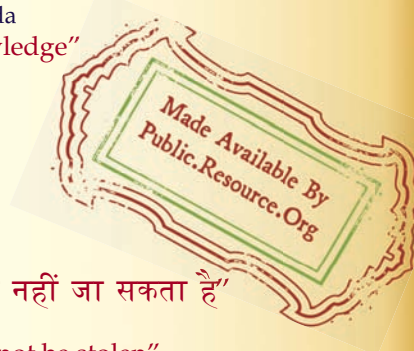
IS 1091 (1985): Nitrocellulose [CHD 26: Explosives and Pyrotechnics]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS : 10918 - 1984

Indian Standard
SPECIFICATION FOR
VENTED TYPE NICKEL CADMIUM
BATTERIES

UDC 621.355.82 : 620.1



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

Indian Standard

SPECIFICATION FOR VENTED TYPE NICKEL CADMIUM BATTERIES

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Indian Standard

SPECIFICATION FOR VENTED TYPE NICKEL CADMIUM BATTERIES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 February 1984, after the draft finalized by the Secondary Cells and Batteries Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard covers the requirements and tests for vented type of nickel-cadmium alkaline batteries.

0.3 In the preparation of this standard, assistance has been derived from the following:

IEC Pub 623 (1978) Open nickel cadmium prismatic rechargeable cells . International Electrotechnical Commission.

Specification No. *DTD & P(AIR) E & I* 329 Issue, 1 January 1976- Specification for nickel cadmium batteries sintered plate, vented type, 24V-40 Ah. Directorate of Technical Development and Production (Air), Ministry of Defence.

MIL-B-23272-1962 Military specification battery storage: Alkaline, nickel cadmium, Department of Defence USA.

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

1. SCOPE

1.1 This standard covers the requirements and methods of test for vented type of nickel cadmium alkaline batteries.

*Rules for rounding off numerical values (revised).

2. TERMINOLOGY

2.0 For the purpose of this standard, the definitions given in IS : 1885 (Part 8)-1965* and IS : 8320-1982† in addition to the following, shall apply.

2.1 Vented Cell — Vented cells are cells in which products of electrolysis are not consumed during the course of charging. Provision for venting the gases evolved during overcharging is provided.

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

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

2.3.1 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.

2.4 Routine Test — Tests carried out on each battery to check the requirements which are likely to vary during production.

3. MATERIALS AND CONSTRUCTION

3.1 Containers

3.1.1 Battery Container and Lid — The battery container and lid (whenever provided) shall be of high strength alkali-resistant material and shall have smooth sides except for the receptacles, hold-down bar, vent tubes, name plate, latches and polarity marking. The location of receptacles, hold-down bar, vent tubes, name plate, latches and polarity marking shall conform to the relevant individual specification.

3.1.2 Cell Containers — The cell container shall be of high strength alkali-resistant material suitably chosen, either nickel-plated mild steel or nonporous plastic according to the specific requirements for specific applications.

3.2 Cell Lids — The requirements for cell lids shall be as given in the individual specifications.

3.3 Terminals — The terminals shall be designed according to individual specifications.

*Electrotechnical vocabulary: Part 8 Secondary cells and batteries.

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

3.4 Venting Device — The venting device shall be of antispash type and shall allow the gases to escape freely and shall effectively prevent the electrolyte from coming out. Provision shall be made for drawing electrolyte samples, checking and topping up of the electrolyte.

3.5 Electrolyte — The electrolyte used shall be a solution of potassium hydroxide in distilled water made up to the specific gravity at 27°C as specified in the manufacturer's instructions.

3.6 Separators — The separator used for the cells shall be porous alkali-resistant and have insulating capacity to avoid shorting or leakage of the current between the plates of opposite polarity. The separator shall also be dimensionally stable without deformation or determination at the temperatures of use.

4. CELL DESIGNATION

4.1 Vented nickel cadmium prismatic rechargeable cells shall be designated by the letter ' K ' followed by a second letter referring to the positive plates:

- T for cells with tubular plates,
- P for cells with pocket plates, and
- S for cells with sintered plates.

The second letter shall be followed by a third letter:

- L for low rate of discharge (below 0.5 C_5),
- M for medium rate of discharge (between 0.5 C_5 and 3.5 C_5),
- H for high rate of discharge (between 3.5 C_5 and 7 C_5), and
- X for very high rate of discharge (above 7 C_5).

The group of three letters shall then be followed by a group of figures indicative of the capacity of the cell in ampere-hours, for example KSH 185. Cells in cases of plastic material shall be marked with the letter ' P ' after the figures, for example KSH 185 P.

5. RATINGS AND DIMENSIONS

5.1 Nominal Voltage — The nominal voltage of a single cell shall be 1.2 V.

5.2 Rated Ampere-Hour Capacity — The rated capacity in ampere-hours (C) when tested in accordance with 10.7 shall be not less than the capacity declared by the manufacturer at the rate specified.

5.3 Dimensions — The preferred dimensions are given in Table 1.

TABLE 1 THESE DIMENSIONS ARE VALID FOR OPEN NICKEL-CADMIUM PRISMATIC CELLS IN STEEL CONTAINERS AND PLASTIC CONTAINERS

(Clause 5.3)

STEEL CONTAINER		PLASTIC CONTAINER	
Max. Width, <i>b</i>	Max. Height, <i>h</i>	Max. Width, <i>b</i>	Max. Height, <i>h</i>
(1)	(2)	(3)	(4)
mm	mm	mm	mm
81	291	62	178
105	350	81	241
131	409	87	273
148	409	123	273
157	409	138	406
188	409	147	285
—	—	165	406
—	—	173	375
—	—	195	406

NOTE 1 — The dimensions, given in Table 1, represent preferred values.

NOTE 2 — The widths relate to the overall width dimension of the cell excluding the thickness of the lug flanges.

NOTE 3 — The maximum height relates to the total height dimensions over terminals or closed cell valves.

The data for heights given in Table 1 are maximum values, no lower limits being stated.

NOTE 4 — It is not possible to make proposals for length dimensions (*d*) at this stage.

NOTE 5 — The dimensions shown in Table 1 are not coupled to particular cell capacities. They apply to all kinds of open prismatic nickel-cadmium cells, such as L, M, H, and X types.

6. MARKING AND PACKING

6.1 Marking — The batteries shall be marked with the following:

- Manufacturer's name and/or trade-mark;
- Month and year of manufacture;
- Nominal voltage;
- Rated ampere-hour capacity;
- Country of origin; and
- Cell designation.

6.1.1 Polarity Marking — The polarity of the terminals shall be marked for identification. The positive terminal may be identified by 'P' or a '+' sign or red colour mark and the negative terminal may be identified by an 'N' or '-' sign or a blue colour mark. Marking shall be permanent and nondeteriorating.

6.1.2 Warning Marking — The battery/cell shall be furnished with a warning plate located at the conspicuous place specifying the use of **ALKALINE ELECTROLYTE ONLY** (in block letters) and specifying the proper fill level of electrolyte. Marking shall be permanent and nondeteriorating.

6.2 Packing — The batteries shall be suitably packed so as to avoid any damage during transit.

7. MANUAL OF INSTRUCTIONS

7.1 Instructions for commissioning the battery into service shall be provided with each battery. The instructions shall be printed on a plate attached to each battery container on the side opposite to that with marking plate wherever possible, and a copy of instructions manual for initial treatment and the maintenance on its service shall be supplied by the manufacturer with every battery ordered.

8. CONDITION OF SUPPLY

8.1 Conditions of supply shall be subject to agreement between the purchaser and the supplier. It is recommended that the purchaser should furnish information regarding his requirements giving specific details about the following:

- a) Ampere-hour capacity,
- b) Nominal voltage,
- c) Mass,
- d) Size, and
- e) Application of batteries.

9. CHARGING OF CELLS

9.1 The charge preceding the various discharge tests scheduled shall be carried out at an ambient temperature of $27 \pm 5^{\circ}\text{C}$ and at a constant current according to manufacturer's instructions.

9.1.1 Prior to charging, the cell shall have been discharged down to a voltage of 1.0 V at a constant current according to the manufacturer's instructions.

10. TESTS

10.1 Classification of Tests

10.1.1 Type Tests — The type tests shall be chosen from the following:

- a) Physical examination (**10.2**);
- b) Dimensions, mass and layout (**10.3**);
- c) Marking (**10.4**);
- d) Polarity and absence of short circuit (**10.5**);
- e) Air pressure test (**10.6**);
- f) Ampere-hour capacity (**10.7**);
- g) Cranking ability (excluding types L and M);
- h) Endurance test;
- j) Retention of charge (**10.8**);
- k) Discharge performance at low temperature (**10.9**);
- m) Life cycle test (**10.10**);
- n) Environmental tests;
- p) Insulation resistance (**10.11**);
- q) Dielectric;
- r) High temperature float charge; and
- s) Storage (**10.12**).

NOTE — Tests (g), (h), (j), (n) and (r) are only required for special applications mainly for defence purposes; the tests shall be carried out according to agreed specifications between the manufacturer and the purchaser.

10.1.1.1 Type test shall be carried out on not less than four samples drawn at random by the inspecting or testing authority and the sequence of type tests shall be in accordance with individual specifications.

10.1.1.2 If any sample fails 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 tests in which failure occurred. If there is any failure in retests the type shall be considered as not having passed the requirements.

10.1.2 Acceptance Tests — The following shall constitute acceptance tests:

- a) Physical examination (**10.2**);
- b) Dimensions, mass and lay out (**10.3**);
- c) Marking (**10.4**);
- d) Polarity and absence of short circuit (**10.5**);

- e) Air pressure test (**10.6**);
- f) Ampere-hour capacity (**10.7**);
- g) Cranking ability (when applicable, excluding types L and M);
- h) Retention of charge (**10.8**); and
- j) Insulation resistance (**10.11**).

10.1.2.1 Sampling scheme and criteria for acceptance — The sampling scheme and criteria for acceptance shall be in accordance with IS : 8320-1982*.

10.1.3 Routine tests — The following shall constitute the routine test:

- a) Physical examination (**10.2**);
- b) Dimensions, mass and layout (**10.3**);
- c) Marking (**10.4**); and
- d) Polarity and absence of short circuit (**10.5**).

10.1.4 Test Equipment — The test equipment for carrying out the tests specified in this standard shall be in accordance with the requirements of **5.2** of IS : 8320-1982*.

10.2 Physical Examination — The battery shall be examined for conformity with the requirements of **3**.

10.3 Dimensions, Mass and Layout — The battery shall be checked for conformity with the requirements given in individual specifications.

10.4 Marking — The battery shall be examined for conformity with the requirements of **4** and **6**.

10.5 Polarity — The polarity of plates in relation to that of the terminals or inter-cell connectors to which they are connected shall be verified electrically or visually.

10.5.1 Absence of Short-Circuiting — This shall be checked by checking the terminal voltage of each cell electrically.

10.6 Air Pressure Test — The sealing of each cell of the battery shall be checked by compressed air at a pressure equal to 150 mm H₂O. The volume of the tubes and auxiliary parts in connection with the cell under pressure shall not exceed 0.5 litre. The air pressure in the cell 15 seconds after the supply has been disconnected shall be noted. The air pressure test shall be carried out in dry uncharged condition.

*General requirement and methods of tests for lead-acid storage batteries (*first revision*).

10.6.1 Requirement — The air pressure shall not fall from 150 mm H₂O to below 120 mm H₂O at the end of 15 seconds.

10.7 Ampere-Hour Capacity

10.7.1 The battery shall be first charged according to 9.1 and the electrolyte level shall be that recommended by the manufacturer.

10.7.2 After standing on open circuit at $27 \pm 5^\circ\text{C}$ for not less than 16 hours and not more than 24 hours from completion of full charge, the cells shall be discharged at the same temperature through a suitable variable resistance at a constant current as specified by the manufacturers until the terminal voltage falls to 1.0 V per cell or $1.0 \times n \text{ V}$ for a battery where n is the number of cells.

10.7.3 During the discharge, the following values shall be checked and noted at suitable intervals:

- a) The terminal voltage of the cell/battery,
- b) The discharge current, and
- c) The temperature of the electrolyte.

The measurements shall normally be taken hourly, but the voltage shall be checked at 15-minute intervals when the total battery voltage has fallen below $1.05 \times n \text{ V}$ where n is the number of cells in the battery.

10.7.4 The capacity obtained by multiplying the rate of discharge in ampere by the duration of discharge in hours shall be the ampere-hour capacity of the cell.

10.7.5 Requirement — The capacity obtained in any one of the first five cycles shall not be less than 95 percent of the rated capacity specified by the manufacturer.

10.8 Retention of Charge — The cell/battery shall be fully charged according to 9.1 and shall then be subjected to two consecutive capacity tests in accordance with 10.7. The value of the initial capacity C_i being calculated as the mean of the two results thus obtained. After a complete recharge and cleaning of electrolyte from its surface, the battery shall then be left on open circuit for a period of 28 days without disturbance at $27 \pm 5^\circ\text{C}$.

After 28 days storage, the battery shall be discharged in accordance with 10.7. The value of capacity obtained after storage is denoted as C_s . The loss of capacity ' S ' expressed as percentage is calculated from the following formula:

$$S = \frac{C_i - C_s}{C_i} \times 100$$

10.8.1 Requirement — The loss in the capacity 'S' shall not exceed 35 percent.

10.9 Discharge Performance at Low Temperature — The cell shall be charged according to 9.1. After charging, the cell shall be stored for not less than 16 hours and not more than 24 hours at an ambient temperature of $-18 \pm 2^\circ\text{C}$. It shall be discharged at the same ambient temperature and as specified in Table 2. The duration of discharge shall not be less than the minimum specified in the table:

TABLE 2 REQUIREMENTS FOR DISCHARGE PERFORMANCE AT LOW TEMPERATURE

DISCHARGE CONDITIONS		MINIMUM DISCHARGE DURATIONS		
Rate of Constant Current	End Voltage	Type H	Type M	Type L
(1)	(2)	(3)	(4)	(5)
A	V			
0.1 C	1.0	3 h 30 min	2 h 30 min	2 h
0.5 C	0.9	30 min	15 min	—
1.0 C	0.9	9 min	—	—

NOTE — C is the rated capacity specified by the manufacturer.

10.10 Life Cycle Test

10.10.1 The cell/battery shall be given a conditioning cycle as follows:

The cell/battery shall be charged according to 9.1 and discharged according to 10.7, and the capacity obtained shall not be less than 95 percent of the rated ampere-hour capacity.

10.10.2 Accelerated Life Cycle — The life test shall consist of cycles of charging and discharging performed at an accelerated rate.

10.10.2.1 The life cycle test shall be carried out at an ambient temperature of $27 \pm 5^\circ\text{C}$ in the manner described in 10.10.3 to 10.10.6.

10.10.3 On the first cycle the cell/battery shall be charged at a constant current of $0.1 C_5\text{A}$ for a minimum of 14 hours and until there is no further voltage increase for 3 consecutive hourly readings. The cell shall then be discharged at a constant current of $0.2 C_5\text{A}$ for 2 hours 30 minutes.

10.10.4 On cycles 2 to 24 the cell/battery shall be charged for 3 hours 30 minutes and immediately discharged for 2 hours 30 minutes. The charge and discharge current shall be $0.2 C_5\text{A}$. At the twenty-fourth cycle

after discharge for 2 hours 30 minutes the voltage at the terminals shall still be above 1.0 V per cell. The discharge shall be continued until the value of terminal voltage in any cell is reached up to 1.0 V per cell.

10.10.5 On cycle 25 the cell shall be charged at a constant current of 0.1 C₅A for a minimum of 14 hours and until there is no further voltage increase for 3 consecutive hourly readings. The cell/battery shall then be discharged at an ambient temperature and at a constant current of 0.2 C₅A until the voltage at the terminals falls below 1.0 V for any cell.

10.10.6 Cycles 1 to 25 shall be repeated until the ampere-hour capacity on any twenty-fifth cycle becomes less than 0.6 C₅Ah. The number of cycles obtained with a capacity above 0.6 C₅ Ah shall not be less than 500.

10.11 Insulation Resistance Test — The insulation resistance when measured between the negative terminal and the outer case (based to effect a good electrical contact) shall not be less than 10 MΩ when measured with a 250 V dc supply.

10.12 Storage Test

10.12.1 The cell/battery shall be charged according to **9.1** before this test.

10.12.2 The fully charged cell/battery shall be stored at an ambient temperature of $27 \pm 10^{\circ}\text{C}$ and a relative humidity not exceeding 90 percent for a period of 3 years. After storage for the above period, the cell/batteries shall be discharged according to **10.7** (at a constant current of 0.1 C₁₀A) to an end voltage of 1.0 V per cell after carrying out the instructions of the manufacturer for commissioning back the cell/battery. The Ah capacity of the cell shall then be measured in accordance with **10.7**. The capacity obtained in any one of the first five cycles shall not be less than 0.95 C₅.

AMENDMENT NO. 1 JULY 2007
TO
IS 10918 : 1984 SPECIFICATION FOR VENTED
TYPE NICKEL CADMIUM BATTERIES

(Page 5, clause 3.6, line 4) — Substitute 'deterioration' for 'determination'.

(Page 5, clause 4.1) — Add the following new cell designations after S:

Fr for cells with fibre plates

Fm for cells with foam plates

(Page 7, clause 9.1, line 2) — Substitute ' $27 \pm 5^{\circ}\text{C}$ ' for ' $27 + 5^{\circ}\text{C}$ '.

(Page 9, clause 10.1.2) — Delete 'h) Retention of charge (10.8); and'.

(Page 10, clause 10.7.2, lines 1 and 2) — Substitute 'for not less than 1 hour and not more than 4 hours' for 'for not less than 16 hours and not more than 24 hours.'

(Page 11, clause 10.8.1, line 2) — Substitute '20 percent' for '35 percent'.

(Page 12, clause 10.11, line 2) — Substitute 'battery crate/battery rack' for 'outer case'.

(Page 12, clause 10.12.2) — Substitute '1 year' for '3 years' in third line and 'C₅' for 'C₁₀' in fifth line.