

PAKISTAN STANDARD

LEAD-ACID STORAGE BATTERIES FOR MOTOR CYCLES.



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LEAD-ACID STORAGE BATTERIES FOR MOTOR CYCLES

0. FOREWORD

- 0.1 This Pakistan Standard was adopted by the authority of the Board of Directors of Pakistan Standard and Quality Control Authority after the draft prepared by the Technical Committee for **Dry Cell Batteries and Accumulators (TC-6)**” had been approved and endorsed by the National Standards Committee on **31 January 2018**.
- 0.2 This Pakistan Standard was revised on the basis of IS: 1145 to fulfill the local requirements.
- 0.3 This Pakistan Standard is an adoption of IS: 1145 “Lead-acid storage batteries for motor cycles” and its use hereby acknowledged with thanks.
- 0.4 This standard is subject to periodical review in order to keep pace with the development in industry. Any suggestions for improvement shall be recorded and placed before the revising committee in due course.
- 0.5 This standard is intended chiefly to cover the technical provisions relating to this standard and it does not include all the necessary provisions of a Contract.

1. SCOPE

1.1 This standard specifies the ratings, overall dimensions and tests for lead-acid storage batteries of 12 V, used as a source of power in motor cycles for ignition, lighting and other auxiliary purposes.

2. TERMINOLOGY

2.0 For the purpose of this standard, the definitions given in PS :3369 in addition to the following shall apply.

2.1 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.

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

2.2.1 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.

2.3 Routine Tests — Tests carried out on every battery.

3. MATERIALS AND CONSTRUCTION

3.1 Containers - The battery shall be assembled in monobloc containers conforming to PS: 479

3.2 Cell Lids — The lids for individual cells shall be robust and the design shall provide adequate depth for the sealing compound. It shall have acid-tight seals for the two terminals. 'Mono-lid' construction, that is, a single moulded lid to cover ~~more~~ than one cell may also be used for closing the tops of the cells.

3.3 Battery Covers — A suitable battery cover shall be provided.

3.4 Venting Device — Where single lids are used a separate vent plug shall be provided on each single lid which shall be of antisplash type preferably with more than one exit hole and shall allow the gases to escape freely. On removal it shall permit drawing of the electrolyte samples, servicing and checking of the electrolyte level.

3.4.1 Where 'mono-lid' construction is used, the cells may be vented into a common chamber. This chamber shall have at least two exit vents. Separate filling plugs which need not be vented, may be used in such cases to permit topping-up of cells to the correct level.

3.5 Terminals

3.5.1 Terminals shall be in the form of Poles.

3.6 Sealing Compound

3.6.1 Batteries with plastic containers and lids shall be sealed by means of plastic cement or similar materials. The sealing may also be by heating or by employing a suitable glue or a combination of both.

3.7 Electrolyte The electrolyte shall be prepared from battery grade sulphuric acid conforming to PS 38

3.8 Water -Water for storage batteries shall be used in the preparation of electrolyte and also to bring the level of electrolyte to approximately the correct height during the course of operation or testing.

3.9 Separators

3.9.1 The synthetic separators shall conform to PS: 4090

3.9.2 The wooden separators when used, shall conform to PS: 4090

4. RATINGS

4.1 The voltage and capacity ratings of the battery shall be assigned by the manufacturer and shall be chosen from Table 1. The capacity shall be expressed in ampere-hours, obtained when the battery is discharged at the 20-h rate, that is, at a constant current of $Z=0.05 \text{ C } 20 \text{ A}$ until the terminal voltage falls to 10.50 V for 12 V batteries, the capacity being corrected to an electrolyte temperature of 27°C (see 7.10).

5. CAPACITIES AND DIMENSIONS

5.1 The capacities and corresponding maximum overall dimensions of batteries shall be as given in Table 1.

TABLE 1 CAPACITIES AND OVERALL DIMENSIONS

(Clauses 4.1 and 5.1)

TYPE	VOLTAGE	CAPACITY	MAXIMUM OVERALL DIMENSIONS		
			Length	Width	Height
(1)	(2)	(3)	(4)	(5)	(6)
	V	Ah	mm		mm
V	12	7	136	60	132

6. MARKING

6.1 The following information shall be legibly and durably marked on the outside of each battery :

- Manufacturer's name and/or trade mark,
- Nominal voltage and rated ampere-hour capacity and manufacturer's type,
- Acid-level in case of translucent containers,
- Month and year of manufacture, and
- Country of origin.

6.2 In addition to the information given in **6.1**, the following information shall be given with each battery in the form of a label firmly attached to the battery:

- a) Month and year of manufacture,
- b) Last date of filling-in and charging, and
- c) In case of dry-charged battery, the date of expiry of dry-charged condition together with the instructions thereafter.

6.3 The batteries may also be marked with PS Certification Mark.

7. TESTS

7.1 Classification of Tests

7.1.1 Type Tests- The tests given under 7.1.1.1 shall constitute type tests.

7.1.1.1 Sequence of tests and number of samples — Six samples shall be drawn by the **testing** or inspecting authority. The sequence of tests shall be *as* indicated in the schedule below. A set of components representing those used in the battery shall be supplied, if required, for carrying out type test alongwith the batteries offered for type test.

Test	Battery Number					
	1	2	3	4	5	6
a) Physical examination (7.6)	x	x	x	x	x	x
b) Test for materials and components (if required by the purchaser) (7.7)	(on sample components referred above)					
c) Checking of dimensions (7.8)	x	x	x	x	x	x
d) Air pressure test (7.9)	x	x	x	x	x	x
e) Test for capacity (7.10)	x	x	x	x	x	x
f) Vibration (7.11)	-	-	—	—	x	—

Test	Battery Number					
	1	2	3	4	5	6
g) High rate discharge (for batteries for dyne-starting only) (7.12)	×	×	×	×	—	—
h) Retention of charge (7.13)	—	—	x	x	—	—
j) Resistance to overcharge (7.14)	—	—	—	—	x x	—
k) Life (7.15)	×	×	—	—	—	—
m) Storage (7.16 or 7.17)	—	—	—	—	—	x

7.1.1.2 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.

7.1.2 Acceptance Tests — The following shall constitute the acceptance tests.

- Physical **examination** (7.6),
- Checking of dimensions (7.8),
- Air pressure test (7.9),
- Capacity (**7.10**), and

Note : — In case of dry-charged batteries the above tests except (a), (b), (c) and (d) shall be carried out after the test specified in 7.18 followed by a recharge at the normal rate.

7.1.2.1 Sampling scheme and criteria for acceptance — The sampling scheme and the criteria for acceptance of a lot shall be in accordance with PS: 206-1

7.1.3 Routine Tests — The following shall constitute the routine tests :

- Physical examination (7.6), and
- Air pressure test (7.9).

IS : 1145 - 1980

7.2 Test Equipment — The voltmeters, ammeters, thermometers and hydrometers used for the tests shall comply with the requirements of 5.2 of IS : 8320-1976*.

7.3 Temperature for Tests — The temperature of electrolyte during test discharge shall be within the limits of 20 to 30°C.

7.4 Specific Gravity — For the purpose of test requirements the specific gravity of fully charged batteries, corrected to 27°C shall be 1.280 ± 0.010 .

7.4.1 To correct the specific gravity reading to 27°C.

- a) Add 0.0007 to the observed hydrometer reading for each °C above 27°C, and
- b) Deduct 0.0007 from the observed hydrometer reading for each °C below 27°C.

7.5 First Charge — The first charge to the battery shall be given in accordance with the manufacturers' instructions.

7.6 Physical Examination — The batteries shall be examined visually for conformity to the requirements of 3.2.

7.7 Test for Materials and Components — If required by the purchaser the set of components representing those used in the battery shall be tested for conformity to various Indian Standards specified under 3.1, 3.6.1, 3.7, 3.8 and 3.9.

7.8 Dimensions — The dimensions of the batteries shall be checked in conformity with the requirements of Table 1.

7.9 Air Pressure Test — The sealing of each cell of the battery shall be checked by compressed air at a pressure equal to 700 mm of water. 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 s after the supply is disconnected shall be noted. The air pressure test shall be carried out in dry uncharged condition.

7.9.1 Requirement — The air pressure shall not fall from 700 mm to below 670 mm of water at the end of 15 s.

7.10 Test for Capacity

7.10.1 At 20-h rate — The battery shall be first charged according to manufacturer's instructions and when fully charged the level and specific gravity of the electrolyte of each cell checked and if necessary, adjusted. The electrolyte level shall be that recommended by the manufacturer and shall not be less than 6 mm over the top of separators.

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

7.10.1.1 Within a period of 2 to 12 h from the end of charge and with an electrolyte temperature of 20 to 30°C the battery shall be discharged at a constant current $I=0.05 C_{20}$ A, until the terminal voltage has fallen to 10.50 V in case of 12-V battery.

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

- a) the battery terminal voltage,
- 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 half-hourly intervals when the total battery voltage has fallen below $1.80 \times n$ V where n is the number of cells in the battery and at 15 min intervals thereafter.

7.10.1.3 The capacity obtained by multiplying the rate of discharge in amperes by the duration of discharge in hours shall be corrected for the temperature by the use of the following formula:

$$C_{27} = \frac{C_t}{1 + 0.01(t - 27)}$$

Where

C_{27} = the capacity in Ah at an average temperature of 27°C,

C_t = the capacity in Ah obtained at an average electrolyte temperature of $t^\circ\text{C}$, and

t = the average value in °C of the initial and final electrolyte temperature measured in the central cell(s).

7.10.1.4 After discharge the battery shall be recharged at the normal rate.

7.1.0.2 *At 10-h rate* — Alternatively batteries may be subjected to an equivalent 10-h capacity rate which shall be calculated by the following formula:

$$C_{10} = 0.88 C_{20} \text{ at } 27^\circ\text{C}.$$

7.10.2.1 The test shall be carried out in accordance with 7.10.1.1 to **7.10.1.3** with the discharging current $Z = 0.1 C_{10}$ A. The battery shall be charged at the normal charging rate immediately after the discharge.

7.103 *Requirements* — The battery shall reach its rated capacity in three discharges.

7.11 Vibration Test The test shall be performed in accordance with relevant Pakistan Standard. The samples shall be first tested for capacity test at 20-h rate and recharge before putting on vibration test. The test shall consist of vibrating the at a frequency of 16 Hz with a displacement of 5 mm for a period of 2 h. During vibration the batteries shall be discharged at $Z = 0.05 \times C$ 20 A.

7.11.1 Requirement There shall not be any sudden drop, either in the current or voltage values and there shall be no spillage of electrolyte during the test.

7.12 Retention of Charge Test The battery shall be fully charged at the current specified by the manufacturer and the level and specific gravity of the electrolyte in each cell adjusted, if necessary.

7.12.1 The battery shall then be subjected to two consecutive capacity tests in accordance with 7.10, the initial capacity C being calculated as the mean of the two results obtained.

7.12.2 After a complete recharge and cleaning of electrolyte from its surface, the battery is stored for a period of 28 days, without disturbance, at a temperature of $27 \pm 2^\circ\text{C}$.

7.12.3 After 28 days of storage, the battery shall be submitted to a capacity test in accordance with 7.10. The value of the capacity measured after storage is denoted by C' .

The loss of capacity S expressed as a percentage is calculated from the following formula :

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

7.13.4 Requirement— The loss of capacity shall not exceed 20 percent.

7.14 Resistance to Overcharge **Test**

7.14.1 The battery shall be charged continuously at a current of $I = 0.1 \times C$ 20 A for a period of 100 h. Throughout this period, the battery shall be immersed in a tank of water the temperature of which is maintained at $40 \pm 3^\circ\text{C}$. The battery shall be so immersed that the top of the battery case is 25 mm above the water level in the tank. If several batteries are placed in the same tank, a distance of 25 mm shall be maintained between them. This distance between a battery and the sides of the tank shall be at least 25 mm.

7.14.2 When the overcharge is completed the battery shall be left disconnected in the tank of water at $40 \pm 3^\circ\text{C}$ for a period of 68 h.

At the end of this period, the battery is subjected without recharging to a 20-h rate of discharge test in accordance with 7.10. However, the temperature correction for capacity shall not be applicable.

7.14.3 When the discharge is completed the battery shall be immediately subjected to the next cycle of overcharge, without previous charging.

Each period of 100-h charge and 68-h stand, constitute one overcharge cycle.

The cycle shall be repeated to give a total of 4 overcharging cycles, with checking discharges at $I = 0.05 \times C$ 20 A.

7.14.4: Requirement — Each of the four 20-h rate checking discharges shall give a duration not less than 80 percent of C **20** before the battery terminal voltage falls to 10.50 V in case of 12-V battery.

7.15 Life Test

7.15.1 After being fully charged the batteries shall be connected to a circuit which will enable them to be subjected to a **series** of discharges and charges as follows :

Discharge for 1 h at an average current of $Z = 0.1 C \ 20 \ A$.

Charge for 5 h at an average current of $Z = 0.1 C \ 20 \ A$.

7.15.2 Throughout the life test cycle, the batteries shall be immersed in a water tank, the temperature of which is maintained at $40 \pm 3^\circ\text{C}$.

The batteries shall be so immersed that the top of the battery containers shall not be more than 25 mm above the water level in the tank. If several batteries are placed in the same tank, a distance of at least 25 mm shall be maintained between them. The distance between the batteries and the sides of the tank shall also be at least 25 mm.

7.15.3 After each series of 36 discharge and charge cycles, the batteries shall be disconnected from the circuit. They shall be left on open-circuit in the tank for 96 h. After this open-circuit stand, the batteries shall be subjected to a checking discharge. Where high-rate requirements do not apply to the battery (see 1.1 and **7.12**), the battery after 36 cycles and at the end of the 96 h stand shall be subjected to a 20-h discharge according to 7.10 but at an electrolyte temperature of $40 \pm 3^\circ\text{C}$ and without any preliminary recharge. The capacity obtained shall not be corrected for temperature (see Table 3). The batteries for dyno-starting shall be given a high rate checking discharge in accordance with 7.12 (see Table 3). On completion of this discharge, the batteries shall be fully recharged at the normal rate.

7.15.4 The combination of 36 discharge and charge cycles, the 96-h open-circuit stand, the checking discharge and the recharge together constitute one complete unit of life test.

7.15.5 During this test the batteries shall be periodically topped up with pure water so as to maintain the correct electrolyte level. The fully charged specific gravity at **each** capacity test shall be maintained within limits of 1.280 ± 0.010 , if necessary, by adjustment.

7.15.6 **Requirements** — When tested as described above the battery shall have a minimum life as follows :

Single separation — 3 units

Double separation — 4 units.

For each of the checking discharges the deviations of the discharge shall be not less than those specified in Table 3.

TABLE 3 REQUIREMENTS FOR LIFE TEST

(Clauses 7.15.3 and 7.15.6)

CHECKING DISCHARGE	INITIAL TEMPERA- TURE OF ELECTROLYTE	DISCHARGE CURRENT	MINIMUM DISCHARGE TIME			FINAL BATTERY TERMINAL VOLTAGE
						<div>12-volt</div>
(1)	(2)	(3)	(4)			(6)
	°C	A	h	min	s	V
(a) 20-h Rate	40 ± 3	0.05 C ₂₀	16	00	00	10.50
(b) High Rate (when applic- licable)	40 ± 3	3 Go	0	4	00	8.00

7.16 Storage Test

7.16.1 The battery shall be stored in dry uncharged condition for a period of 2 years from the date of manufacture at an ambient temperature of $27 \pm 10^\circ\text{C}$ and a relative humidity not exceeding 90 percent.

7.16.2 Requirements — At the end of the storage period, the battery shall meet the requirements of capacity test (7.10) or high rate discharge test (7.12) (if applicable).

7.17 Storage (for Dry Charged Batteries)

7.17.1 The dry-charged battery shall be stored as per the manufacturer's instructions and with the manufacturer's seal intact at an ambient temperature of $27 \pm 10^\circ\text{C}$ and a relative humidity not exceeding 90 percent for a period of 365 ± 7 days. At the end of the storage period the battery shall be tested for capacity in accordance with 7.10.

7.17.2 Requirement — The battery shall give not less than 65 percent of its rated capacity.

7.18 Test for Dry-Charged Battery

7.18.1 The battery shall be tested within 60 days of manufacture.

7.18.2 The battery shall be maintained at a temperature of $27 \pm 2^\circ\text{C}$ for 24 h prior to test.

7.18.3 The battery shall then be filled with electrolyte of specific gravity 1.280 ± 0.010 . The temperature of the electrolyte before filling shall be $27 \pm 2^\circ\text{C}$.

7.18.4 Twenty minutes after the completion of filling, the battery shall be discharged at a constant current $I = 0.05 C$ 20 A until the terminal voltage has fallen to 10.50 V in case of 12-V battery. The readings during discharge and the calculation of capacity shall be noted as in 7.10.12 and 7.10.13.

7.18.5 Requirements — The battery shall give not less than 80 percent of its rated capacity.