Indian Standard

SPECIFICATION FOR HARD RUBBER CONTAINERS FO MOTOR VEHICLE BATTERIES

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0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 10 July 1960, after the draft finalized by the Secondary Cells and Batteries Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 Physical, chemical and electrical tests with corresponding requirements have been included in this standard, in order to check the quality of the material of the container as also the reliability of the finished container for use in assembling of lead-acid storage batteries for motor vehicles, and similar other purposes.

0.3 Under physical tests two alternative methods for the impact resistance test have been included; one of them, namely the Izod Impact test is intended for checking the impact resistance of the material of the container and the other, namely the Drop Ball test is for determining the impact strength of the complete container and would evaluate the soundness of the design of the container itself. Though no direct correlation has been established between these two tests, it is expected that manufacturers would ensure that their products pass both the tests so that the purchaser or testing authority may be at liberty to perform either of the tests for acceptance purposes.

0.4 This standard requires reference to IS: 266-1950 Specification for Sulphuric Acid.

0.4.1 Wherever a reference to IS: 266-1950 appears in this specification, it shall be taken as a reference to the latest version of the standard.

0.5 Metric system has been adopted in India and accordingly all the dimensions and other values in this standard have been given in that system. However, in order to familiarize the industry, equivalent fps units have also been indicated wherever considered necessary.

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 the

latest version of IS: 2-1949 Rules for Rounding Off Numerical Values. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

0.7 This standard is intended chiefly to cover the technical provisions relating to hard rubber containers for motor vehicle batteries, and it does not include all the necessary provisions of a contract.

1. SCOPE

1.1 This standard lays down the requirements and the methods of tests for monobloc hard rubber containers normally used in the assembly of lead-acid storage batteries for motor vehicles.

2. MATERIAL, CONSTRUCTION AND WORKMANSHIP

2.1 Material — The basic material used in the preparation of hard rubber shall consist of natural, synthetic or reclaimed rubber or their blends. Hard rubber intended for manufacture of containers shall be prepared from rubber which has been vulcanized to obtain the necessary physical characteristics.

2.2 Construction — The container shall be so constructed as to be robust and to withstand the normal conditions of service. The surfaces of the container shall have a finish, substantially free from blisters, rough spots, rubber scales, blow holes, pittings and other imperfections or deformations.

2.3 Workmanship — The workmanship shall be in accordance with the current trade practice.

3. TESTS REQUIREMENTS

3.1 Standard Conditions for Tests — Unless otherwise specified, all the tests shall be conducted at a temperature of 27°±2°C.

3.2 Sequence of Tests — The tests specified in **3.3** to **3.6** and visual examination of the containers shall be conducted in accordance with the sequence laid down in Appendix A.

3.3 High Voltage Test

3.3.1 *Object* — This test is intended to determine whether cracks and other imperfections exist in the battery container.

3.3.2 *Procedure* — A voltage of $T \times 3\,000$ V (RMS), where T is the minimum thickness, in millimeter, of the walls or base of the container,

shall be applied between the inner and outer surfaces of the walls, partitions and the base.

3.3.3 *Requirement* — The test shall not reveal any flaw, crack or other imperfections in the walls, partitions or base of the container.

3.4 Tests for Impact Resistance

3.4.0 Two alternative methods — one on cut samples (Izod Impact Test) and the other on the entire container (Drop Ball Test) — have been specified in **3.4.2** and **3.4.3** respectively.

3.4.1 *Object* — The purpose of this test is to determine the ability of the container to withstand the impact normally experienced in handling and during service.

3.4.2 *Izod Impact Test on Cut Samples* — The test shall be carried on the cut samples using Izod Impact Testing Machine of the cantilever type in accordance with the method described in **B-1**.

3.4.2.1 *Requirement* — When tested in accordance with **3.4.2**, the average impact strength shall be not less than 0·011 kg-m (or 0·08 ft-lb).

3.4.3 *Impact Test on Whole Container* — When the test is to be carried out on the whole container it shall be done in accordance with the method described in **B-2**.

3.4.3.1 *Requirement* — The minimum requirements for impact limit for different thicknesses of containers shall be as given in Table I.

TABLE I REQUIREMENTS OF IMPACT TEST (BALL DROP METHOD)

*Wall Thickness mm	Minimum Height of Fall	
	Average Value mm	Single Value mm
7·2 to 7·5 (inclusive)	150	100
7·6 to 8·8 (inclusive)	200	150
Greater than 8·8	250	200

*The wall thicknesses given are those below the top band of the container.

3.5 Plastic Yield Test

3.5.1 *Object* — This test is intended to determine the extent of yield of the container which may occur due to heat developed in the battery.

3.5.2 The test shall be carried out in accordance with the procedure specified in Appendix C.

3.5.3 *Requirement* — The average plastic yield, when tested according to **3.5.2**, shall not be greater than 5·0 mm.

3.6 Test for Chemical Inertness

3.6.1 *Object* — This test is intended to assess the ability of the container material to resist acid action.

3.6.2 *Preparation of Test Piece* — The test piece should preferably be cut from the partition walls and shall be of size 125 × 65 mm. The edges of the test piece shall be smoothened and painted with a 15 percent solution of polysterene in toluene. The test piece shall first be washed in cold dilute hydrochloric acid (1: 9) for a few seconds only, and then rinsed with cold distilled water until the last traces of hydrochloric acid have been removed. The test piece shall then be dipped in boiling water for 10 seconds, and dried first by shaking and then by means of a filter paper. When dry, the test piece shall be allowed to stabilize at room temperature, weighed and the dimensions accurately measured.

3.6.3 *Procedure* — The prepared test piece shall then be immersed in 600 ml of dilute sulphuric acid (sp-gr 1·250) in a covered beaker of 800 ml capacity. The beaker shall be maintained at 60° ± 2·5°C for 28 days. The level of the acid shall be kept constant by adding distilled water when necessary. At the end of this period the test piece shall be removed, washed in boiling distilled water for 10 seconds, shaken, dried and allowed to stabilize as before. Its weight and dimensions shall then be determined accurately. Any changes in appearance shall be noted. The volume of the acid shall be measured and the amounts of impurities in it shall be estimated in accordance with IS: 266-1950.

3.6.4 *Requirement*

3.6.4.1 The extractable impurities shall not exceed the following limits:

Iron	0·16	mg/cm²	of unpainted	surface
Chlorine	0·08	,,	,,	,,
Manganese	0·001 6	,,	,,	,,

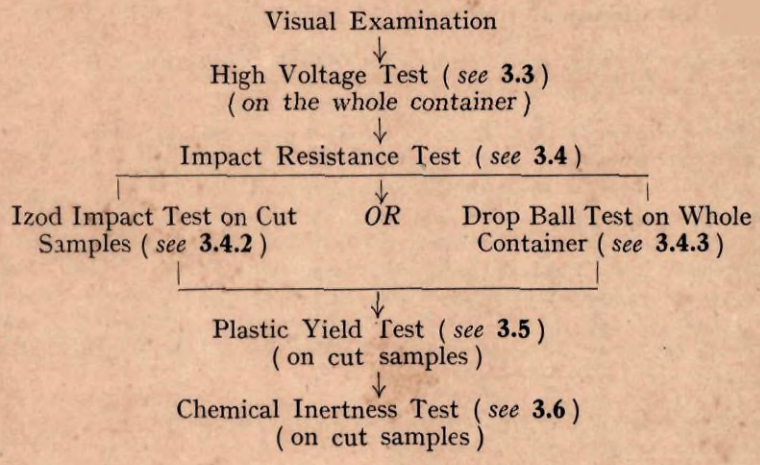
3.6.4.2 The change in weight and volume shall not be more than 4·0 mg/cm² and 1·2 cm³ respectively.

3.7 Sampling for Acceptance — The sampling procedure for acceptance purposes shall be agreed upon between the purchaser and supplier. In the absence of any such agreement, the procedure given in Appendix D is recommended.

APPENDIX A

(*Clause* 3.2)

SEQUENCE OF TESTS



APPENDIX B

(*Clauses* 3.4.2 *and* 3.4.3)

TESTS FOR IMPACT RESISTANCE

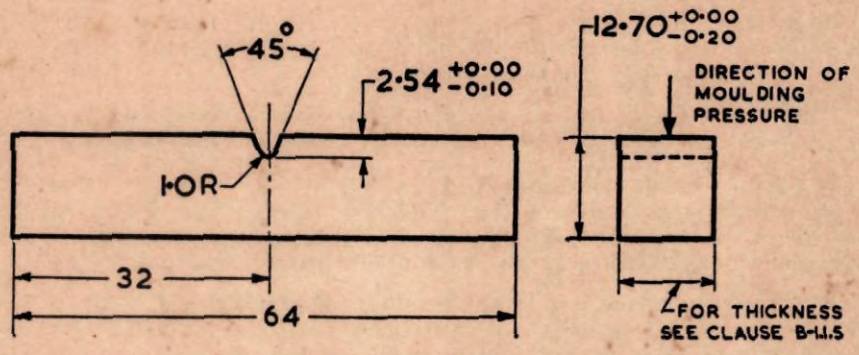
B-1. IZOD IMPACT TEST (ON CUT SAMPLES)

B-1.1 Preparation of Samples

B-1.1.1 Test samples of the material of the container shall be cut vertically from the container walls, neglecting strips of 40 mm at the top and bottom of the container.

B-1.1.2 The samples shall be so prepared that the stress applied by the test is parallel to the wall of the container.

B-1.1.3 The test specimen shall conform to the dimensions shown in Fig. 1. To ensure the correct contour and condition of the specified notch, all specimens shall be notched as specified in **B-1.1.4**.



All dimensions in millimetres.

FIG. 1 SPECIMEN FOR IZOD IMPACT TEST

B-1.1.4 *Notching of Samples*

B-1.1.4.1 Notching shall be done on a milling machine or lathe with a cutter which shall be of the single tooth type. (The single tooth cutter is preferred because it is more readily ground to the desired contour.) The cutting edge shall be carefully ground and honed to ensure sharpness and freedom from nicks and burrs.

B-1.1.4.2 The profile of the cutting tooth shall be such as to produce in the test specimen, at right angle to its principal axis, a notch of contour and depth as specified in Fig. 1.

B-1.1.4.3 The included angle of the notch shall be $45° \pm 1°$ with a radius of curvature of one millimetre at the apex. The plane bisecting the notch angle shall be perpendicular to the face of the test specimen within a tolerance of 2°.

B-1.1.5 *Thickness of Specimen* — The thickness of the specimen shall be same as that of the container wall when this is between 6·5 and 12·7 mm. Should the wall thickness exceed 12·7 mm the sample shall be reduced to 12·7 mm by removal of material from one face only.

B-1.1.5.1 This test is not applicable to specimens of thickness less than 6·5 mm.

B-1.1.6 *Conditioning* — The samples shall be conditioned for 24 hours in circulating air of temperature of $27° \pm 2°C$ at a relative humidity of 65 ± 4 percent before the test is carried out.

B-1.2 Apparatus

B-1.2.1 *Cantilever Beam (Izod Type) Testing Machine* — The machine shall be of the pendulum type, rigid in construction, and accurate to

0·001 4 kg-m (or 0·01 ft-lb) for readings of less than 0·14 kg-m (or one foot-pound) and to one percent for higher values. Accurate correction shall be made for friction and windage losses.

B-1.2.1.1 The dimensions of the machine shall be such that the centre of percussion of the striker coincides with the centre of the striking edge.

B-1.2.2 The pendulum shall be released from such a position that the linear velocity of the centre of the striking edge (centre of percussion) at the instant of impact shall approximately be 2·5 m/s which corresponds to an initial elevation of the point of release of 30·5 cm (or one foot).

B-1.2.3 The striking edge of the pendulum shall be a cylindrical surface of 0·8 mm radius, with its axis horizontal. When the pendulum is hanging free, the cylindrical surface shall be tangential to the specimen in a line $22{\cdot}0 \pm 0{\cdot}5$ mm above the top surface of the vice.

B-1.2.4 The pendulum above the cylindrical portion of the striking edge shall be recessed or inclined at a suitable angle so that there is no chance of its coming in contact with the specimen during the break.

B-1.2.5 Means shall be provided for clamping the specimen rigidly in position with the edges of the supporting surfaces at 90° angle.

B-1.2.6 Means shall be provided for determining the impact value of the specimen, which is the energy expended by the machine in breaking the specimen. This value is equal to the difference between the energy in the pendulum blow and the energy remaining in the pendulum after breaking the specimen, after suitable correction has been made for windage and friction.

B-1.3 Procedure

B-1.3.1 At least five samples shall be tested.

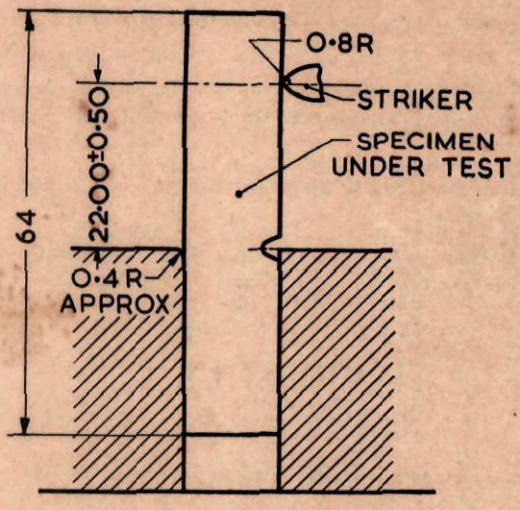
B-1.3.2 The test specimen shall be rigidly clamped (*see* Fig. 2) with the centre line of the notch on the level of the top of the clamping surface and the blow shall be struck on the notched side.

B-1.3.3 The value of energy expended in breaking each individual specimen shall be noted, and the average shall be taken as the impact resistance of the material expressed in kilogram-metre.

B-2. DROP BALL TEST (ON WHOLE CONTAINER)

B-2.1 Conditioning and Preparation of Specimen

B-2.1.1 *Conditioning* — The container shall first be conditioned for one hour in a $27° \pm 2°C$ water-bath and then dried by wiping the surface with a cloth.



All dimensions in millimetres.

FIG. 2 POSITION OF TEST SPECIMEN FOR IZOD IMPACT TEST

B-2.1.2 *Preparation*

B-2.1.2.1 The container shall be laid on its side on a 12·5 mm thick steel plate with the smooth side up (medallion down). The container shall be levelled by placing spacers underneath, flush with the container bottom surface at the back to compensate for the thickness of the top band.

B-2.1.2.2 The impact test equipment shall be set on the container with the base approximately flush with the front edge and centred so that the steel weight shall strike the container midway between the ribs, if the container has ribs, or midway between the partitions of the centre cell, and approximately one-third the distance from the top edge of the container.

B-2.1.2.3 Spacers or adjusting screws may be used under the back edge to level the impact equipment to compensate for the top band of the container.

B-2.1.2.4 A small low wattage lamp may be clipped inside the container to aid in detecting cracks.

B-2.2 Test Procedure

B-2.2.1 A weight of one kilogram shall be suspended from an electromagnet and the distance of the first drop adjusted at 25 mm. Each additional drop shall be increased by 25 mm until a crack appears on the inner surface.

B-2.2.2 The inner surface shall be examined after each drop to determine if the container has cracked.

B-2.2.3 The height (in mm) from which the ball is dropped causing the container to fracture shall be taken as the impact limit of that side of the container.

B-2.2.4 The container shall then be turned over and the test repeated on the medallion side.

B-2.2.5 The average of the two readings shall be considered as the impact limit of the whole container.

APPENDIX C

(*Clause* 3.5.2)

PLASTIC YIELD TEST

C-1. PREPARATION OF SPECIMEN

C-1.1 Selection — Three test specimens shall be cut vertically from the container walls, neglecting strips of 40 mm at the top and bottom of the container.

C-1.2 The specimens shall be so prepared that the stress applied by the test is parallel to the wall of the container.

C-1.3 The width of each specimen shall be $10{\cdot}0 \pm 0{\cdot}1$ mm. The thickness of the samples shall be same as that of the container wall when the latter is between 6·5 and 12·5 mm. Should the wall thickness exceed 12·5 mm, the specimen shall be reduced to 12·5 mm by the removal of material from one face only.

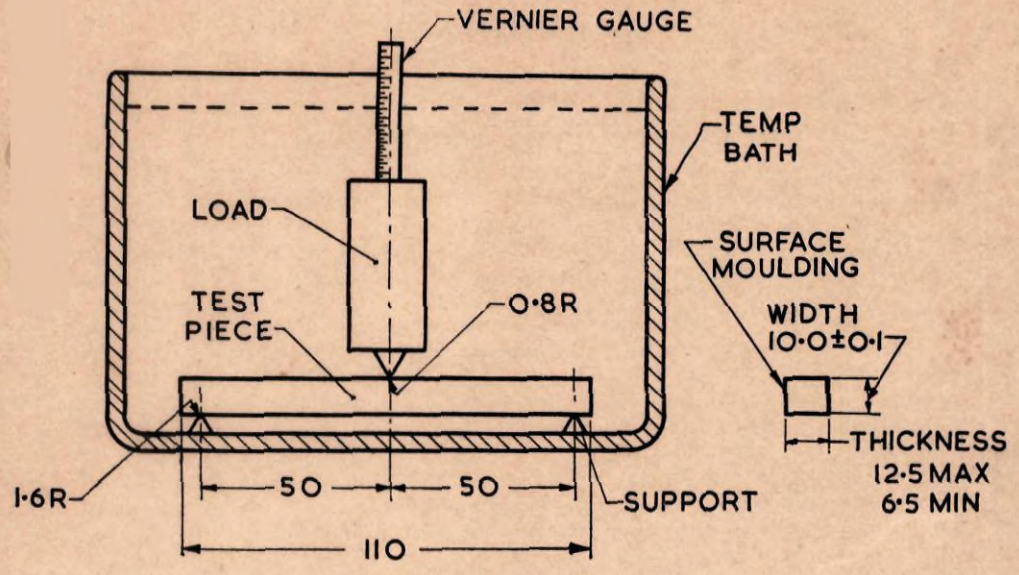
C-1.3.1 This test is not applicable to specimens of thickness less than 6·5 mm.

C-1.4 Conditioning — The specimens shall be conditioned for 24 hours in circulating air of temperature of $27° \pm 2°C$ at a relative humidity of 65 ± 4 percent before the test is carried out.

C-2. APPARATUS

C-2.1 The apparatus shown in Fig. 3 shall be used.

C-2.1.1 The supports for the specimen shall be spaced accurately, and extend beyond the sides of the specimen and have their edges rounded to a radius of 1·6 mm.



All dimensions in millimetres.

FIG. 3 ARRANGEMENT FOR PLASTIC YIELD TEST

C-2.2 The load shall be a weight of 1 000 g for specimens of 12·5 mm thickness and of proportionally lesser weight for specimens of smaller thicknesses.

C-2.2.1 The load shall be applied centrally between the supports, the weight resting on the specimen through a rounded edge of 0·8 mm radius.

C-2.3 A vernier scale, or a dial indicator, shall be used to observe the deflection of the weight during the test.

C-3. PROCEDURE

C-3.1 After conditioning as specified in **C-1.4**, the specimens shall be maintained at a temperature of 60·0°±0·5°C for two hours and then tested at that temperature.

C-3.1.1 During this test, the apparatus shall also be maintained at 60·0°±0·5°C.

C-3.2 The position of the unloaded pile shall first be checked when it is in contact with the test piece and locked in that position. The load shall then be applied to the pile, and the locking device shall be released, the position of the pile with the weight shall be recorded again at the end of 30 minutes. The difference (in mm) between the two positions shall be taken as the plastic yield of the specimen.

APPENDIX D

(*Clause* 3.7)

SAMPLING FOR ACCEPTANCE

D-1. SCALE OF SAMPLING

D-1.1 Lot — In any consignment, all the containers of the same size shall be grouped together to constitute a lot.

D-1.2 Sub-lot — For the purpose of inspection, a consignment, that is, a lot, shall be divided into a minimum number of sub-lots, the size of the sub-lot being 1 000 or less. The containers required for testing shall be selected separately from each sub-lot and the acceptance or otherwise of the sub-lot shall be decided on the basis of results of tests on these containers.

D-1.3 The number of containers to be selected from a sub-lot shall depend upon its size and shall be in accordance with Table II. If necessary, additional number of containers as required for re-test purposes shall be selected from the sub-lot (*see* **D-3.2**).

TABLE II SAMPLE SIZE

SIZE OF THE SUB-LOT	NUMBER OF CONTAINERS TO BE SELECTED
N	*n*
(1)	(2)
Up to 200	2
201 „ 500	3
501 „ 800	4
801 „ 1 000	5

D-1.4 These containers shall be selected at random. In order to ensure randomness, all containers in the sub-lot shall be arranged in a serial order and starting from any container taken at random, every rth container shall be included in the sample, r being the integral part of N/n, where N is the size of sub-lot, and n is the sample-size.

D-2. NUMBER OF TESTS

D-2.1 The samples selected, shall be subjected to all the tests in accordance with the sequence shown in Appendix A.

D-3. CRITERION FOR CONFORMITY

D-3.1 A sub-lot shall be considered as conforming to the requirements of this standard, if all the containers selected from the sub-lot satisfy the requirements of all the tests.

D-3.2 If one or more containers fail to satisfy the requirements of any of the tests, twice the number of containers specified under column 2 of Table II shall be selected from the lot and subjected to the tests in which failure(s) has (have) occurred. If any one or more of these containers fail, the lot shall be considered as not conforming to the requirements of this standard.

HANDBOOK OF ISI PUBLICATIONS 1959

(Pages 132, Price Rs 3·00)

The Handbook of ISI Publications 1959 is a reference manual of the publications and work of ISI, ISO and IEC, and is divided into the following four parts:

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Part II — ISI Certification Marks — Besides giving a brief review of the working of the Certification Marking Scheme, and its benefits to the users and manufacturers, this part gives a complete classified list of the manufacturers using ISI Certification Marks as on 1 March 1959, and designations of standards on the basis of which the marks have been issued.

Part III — International Standardization — This part deals with the association of ISI with ISO and IEC and gives complete lists of the technical committees of each of the two world organizations and particulars of the publications issued by them.

Part IV — Index — For the purpose of quick reference, a subject index based on all-through alphabetization is included in this part.

The Handbook should be of particular interest to producers, traders, technologists, technical and research organizations, purchase departments of the Union Government and State Governments, local bodies and trade associations. Its study should be of immense use to those concerned with the purchase and sale of goods especially of goods covered by the standards reviewed in it. The Indian Standards Institution is greatly honoured by Shri Lal Bahadur Shastri, Union Minister for Commerce & Industry, Government of India, who spared his valuable time to write the foreword of this Handbook.