भारतीय मानक **IS 12950 : 2023**

Indian Standard

बैटरी हाइड्रोमीटर — सीमा-अम्ल बैटरियों के लिए सुवाहय सिरिंज — विशिष्टि

(पहला पुनरीक्षण)

Battery Hydrometer — Portable Syringe Type for Lead-Acid Batteries — Specification

(First Revision)

ICS 17.060

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
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June 2023 **Price Group 7**

Glass, Glassware and Laboratoryware Sectional Committee, CHD 10

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Glass, Glassware and Laboratoryware Sectional Committee had been approved by the Chemical Division Council.

This standard was originally published in 1990 for accurate determination of density of electrolyte in lead-acid storage batteries, where high reliability and long life are essential; for example, those used with computers, telephone exchanges, emergency light, board ships, aircrafts, automobiles, etc. The battery hydrometer prescribed in this standard is based on the density of the electrolyte instead of specific gravity in accordance with the prevailing International practices.

In this first revision, the requirement for wall thickness of bulb has been modified, references have been updated and several editorial changes such as ICS No., Bureau of Indian Standards certification marking clause, etc have also been incorporated.

The composition of the committee responsible for development of this standard is listed in Annex F.

For the purpose of deciding whether a particular requirement of this standard is complied with the final v alue, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. 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

BATTERY HYDROMETER — PORTABLE SYRINGE TYPE FOR LEAD-ACID BATTERIES — SPECIFICATION

(First Revision)

1 SCOPE

This standard prescribes requirements and methods of sampling and test for battery hydrometers meant for checking the condition of a storage battery by determining the density of its electrolyte.

2 REFERENCES

The standards listed below contain provisions which through reference in this text, constitute provisions of and necessary adjuncts to this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the listed below:

IS No.	*Title*
IS 1382 : 1981	Glossary of terms relating to glass and glassware (*first revision*)
IS 3104 (Part 1) : 1982	Specification for density hydrometers: Part 1 Requirements (*first revision*)
IS 4426 : 1992	Methods of sampling laboratory glassware and medical glass instruments (*first revision*)
IS 4825 : 1982	Specification for liquid-in-glass solid — Stem reference thermometers (*first revision*)
IS 4905 : 2015	Random sampling and randomization procedures (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1382 : 1981, in addition to those given below, shall apply.

3.1 Density — The mass in grams per cubic centimetre (g/cm^3) of a liquid at a specified temperature.

3.2 Battery Hydrometer — A portable apparatus for measuring the density of the electrolyte contained in a lead-acid battery or an accumulator. It consists of:

a) a clear, transparent glass barrel containing the hydrometer float;

b) a hydrometer float;

c) a rubber or plastic or elastomeric, flexible nozzle fitted snugly on to the lower end of the barrel;

d) a rubber or elastomeric bulb making an air-tight fit on the upper end of the barrel; and

e) a perforated plug or equivalent device which allows free passage of air but prevents the float from entering the bulb.

3.2.1 An illustration of a typical battery hydrometer is given in Fig. 1.

3.3 Hydrometer Float — A scaled glass float consisting of a weighted bulb and calibrated stem, which floats vertically in a liquid to an immersion depth depending on the density of the liquid. A typical float is shown in Fig. 2.

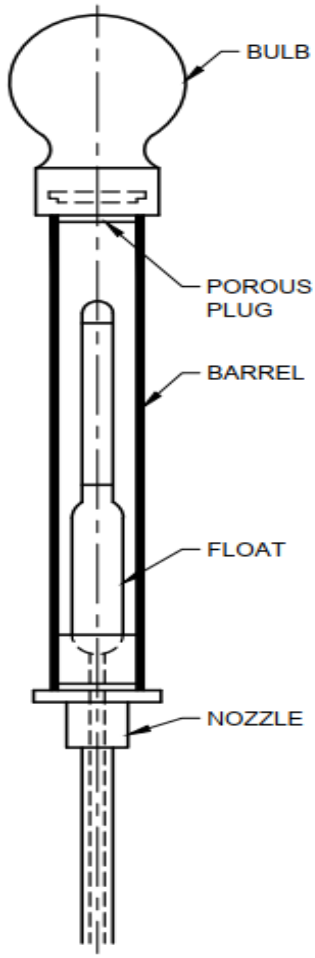


FIG. 1 BATTERY HYDROMETER

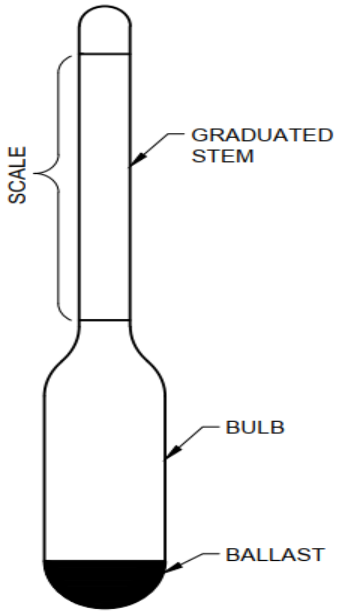


FIG. 2 HYDROMETER FLOAT

4 REQUIREMENTS

4.1 General

The battery hydrometer shall be well made. The design shall be such that a volume of electrolyte may be drawn up and retained within the barrel while reading is observed and may then be returned to the cell, The electrolyte shall be retained without leakage even if the hydrometer is tilted with its main axis up to 45° from the vertical. All elastomeric components shall fit air-tight. They shall be made from a material which resists degradation from exposure to electrolyte. They shall be resistant to cracking, hardening, discolouration and stickiness. They shall be free from foreign matter including mould release agents and moulding flash. They shall be designed to have protection from mechanical shock for the rigid components and to prevent assembled hydrometers from rolling along a surface having a slope up to 15º to the horizontal. The cup with the nozzle shall be so made that in the normal position it fits as a cap over the end of the barrel with the nozzle outwards but when reversed it fits as a stopper to the barrel with the nozzle lying; inside the barrel and preventing the movement of the float. The complete assembly shall be capable of being dismantled to facilitate cleaning.

4.2 Bulb

The bulb shall have the ability to draw into the barrel sufficient distilled water to cover the top of the float to a depth of at least 5 mm when the battery hydrometer is held vertically. It shall return to the original shape after repeated compression and release operations. The bulb shall be made so as to provide on air-tight grip between bulb and barrel which shall remain so even when bulb is bent at right angles to the barrel.

4.3 Plug

A flexible plug membrane or equivalent shall lie fitted to permit free flow of air but shall prevent the float from entering the bulb.

4.4 Nozzle

It shall make a firm air-tight fit with the barrel. It shall be so designed so as to provide cushioning for the float and allow free discharge of electrolyte even when the float is resting against the upper opening of the nozzle The tube section shall be concentric over the length of the nozzle and of suitable length and flexibility to enable adequate quantity of electrolyte to be withdrawn from the cell when the hydrometer axis is inclined up to 45º from the vertical.

4.5 Barrel

The barrel shall be made from clear transparent high grade annealed glass. The ends of the barrel shall be smooth and flame polished. The size of the barrel shall be such as to allow an axial movement of the float of at least 25 mm. The clearance all around between float and the barrel shall not be less than 3 mm.

4.6 Hydrometer Float

4.6.1 *Temperature of Calibration*

The hydrometer shall be calibrated at 27 °C.

4.6.2 *Range of Scale*

The hydrometer float shall cover the range from 1.100 g/cm^3 to 1.300 g/cm^3.

4.6.3 *Surface Tension*

The hydrometer float shall be calibrated on the basis of high surface tension category, that is, 75 mN/m.

4.6.4 *Materials*

4.6.4.1 The hydrometer float shall he made of colourless and transparent glass resistant to chemicals and thermal shock encountered in use.

It shall be as free as possible from strain and visual defects. The coefficient of cubical thermal expansion of glass shall be $(25 \pm 2) \times 10^{-6}$ per degree Celsius.

4.6.4.2 *Loading material*

The loading material shall in the bottom of the float. After the float has been maintained in a horizontal position for 1 hour at 80 °C and subsequently cooled in that position it shall meet the requirements of **4.6.6**. There shall be no loose material whatsoever in any part of the float.

4.6.5 *Pattern*

The float shall be of a pattern shown in Fig. 2.

4.6.6 *Workmanship and Finish*

It shall be circular in cross-section, robust and symmetrical about the main axis. It shall float vertically in an electrolyte having a density within the range of the scale and inclination, if any, from the vertical shall not exceed 2 degrees. Smooth evenly spaced protrusions may be provided on the float to minimize contact between the body of float and the barrel of the hydrometer.

4.6.7 *Scale*

The scale and inscriptions shall be marked on a smooth surface of white or off-white in colour. The scale shall be straight and free from twist. Neither the scale nor the graduations shall distort or discolour when the float is maintained at a temperature of 80 °C for 24 hours. The scale shall be fully enclosed in the float with all the graduation marks clearly visible on the stem.

4.6.7.1 Appropriate means shall be incorporated to ensure that any displacement of the scale or of the strip bearing the scale is readily apparent.

4.6.8 *Graduation Lines*

4.6.8.1 The graduation lines shall be distinct and of uniform thickness not exceeding 0.2 mm or one-fifth of the distance between the centres of adjacent lines, whichever is less.

4.6.8.2 There shall be no evident local irregularities in the spacing of the graduation lines.

4.6.8.3 The graduation lines shall be perpendicular to the axis of the float.

4.6.8.4 The long graduation lines shall occur every 0.020 g/cm^3 and shall be marked over the full width of the scale. When the scale is rolled, the long graduation lines shall meet without a discontinuity of greater than one-fifth of the distance between the centres of the adjacent line. The medium graduation lines shall occur at every 0.010 g/cm^3 and their length shall be approximately 0.75 times the circumference of the stem. The short graduation lines shall depict 0.005 g/cm^3 and their length shall approximately be 0.5 times the circumference of the stem. (*see* Fig. 3)

4.6.8.5 The cross-section of the stem shall remain unchanged for at least 5 mm below the lowest graduation line.

4.6.8.6 The stem shall extend at least 15 mm above the upper most graduation line.

4.7 Dimensions

4.7.1 The dimensions of the battery hydrometer and the hydrometer float shall conform to the requirements given in Table 1.

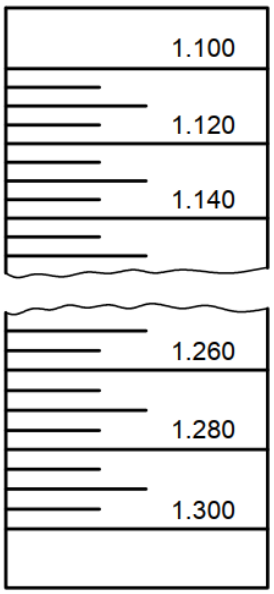


FIG. 3 SCALE FOR HYDROMETER

Table 1 Requirements for Battery Hydrometer and Hydrometer Floats
(*Clause* 4.7.1)

Sl No.	Particulars	Dimension
(1)	(2)	(3)
a) Hydrometer Assembly		
i)	Overall length of complete hydrometer, mm, *Max*	400
ii)	Outer diameter of elastomeric bulb, mm	60 - 65
iii)	Wall thickness of elastomeric bulb, mm, *Min*	2
iv)	Length of nozzle tubings, mm	50 - 80
v)	Bore of the nozzle tubing, mm	2 - 3
vi)	Wall thickness of nozzle tubing, mm	2 - 3
vii)	Axial movement of hydrometer float, mm, Min	25
viii)	Clearance between hydrometer float and barrel at the smallest diameter, mm, *Min*	3

Table 1 (*Concluded*)

Sl No.	Particulars	Dimension
(1)	(2)	(3)
b) Hydrometer Float		
i)	Overall length, mm, *Max*	170
ii)	Number of scale division and values of the scale, g/cm^3	40 × 0.005
iii)	Scale length, mm, *Min*	60
iv)	Stem diameter, mm	6 ± 0.5
v)	Bulb diameter, mm	15 ± 1
vi)	Volume below scale, cm^3	10 ± 1
vii)	Tolerance at any point, g/cm^3	± 0.005

4.8 Performance Requirements

4.8.1 *Accuracy of Float*

The error at any point on the scale shall not exceed ± 0.005 g/cm^3 when tested in accordance with the procedure prescribed in Annex A.

4.8.2 *Elastomeric Components (Bulb and Nozzle)*

4.8.2.1 *Performance test*

When the elastomeric components are tested in accordance with procedure prescribed in Annex B, the difference between the mass of water drawn into the barrel and that expelled out from it shall not be greater than 1 g.

4.8.2.2 *Suitability test*

When elastomeric components are immersed in diluted sulphuric acid of density 1.5 g/cm^3 at 27 °C ± 2 °C for 24 hours, they shall not develop cracks, tackiness, stiffness nor the acid shall become coloured or turbid alter the test.

4.8.3 *Resistance of the Barrel to Thermal Shock*

When barrel is tested according to the procedure prescribed in Annex C there shall be no evidence of visible deterioration or damage.

4.8.4 *Resistance to Mechanical Shock*

When the carton complete with hydrometer components is tested in accordance with Annex D, no component shall be damaged nor shall any component be dislodged within the package in such a way as to increase its liability to damage in the normal handling.

5 PACKING AND MARKING

5.1 Packing

The battery hydrometer shall be packed in a carton in such a way as to fulfil the requirement under **4.8.4**.

5.2 Marking

5.2.1 The battery hydrometer shall be marked legibly and indelibly with the following:

a) Indication of the source of manufacture;

b) Calibration temperature, that is, 27 °C;

c) g/cm^3 to indicate the unit of density on the scale; and

d) Batch No. or code No.

5.2.2 BIS *Certification Marking*

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

6 SAMPLING AND CRITERIA FOR CONFORMITY

6.1 Representative sample of the battery hydrometers shall be drawn as prescribed in Annex E.

ANNEX A

(*Clause* 4.8.1)

METHOD FOR TESTING THE ACCURACY OF HYDROMETER FLOAT

A-1 GENERAL

Accuracy of hydrometer float shall be tested by comparison against a standard hydrometer of an appropriate range complying with IS 3104 (Part 1) : 1982, series M-100 high surface tension category, in an electrolyte solution of appropriate density.

A-2 APPARATUS

A-2.1 Overflow Vessel

A vessel, provided with an arrangement for over-flowing of liquid in such a way that surface film is constantly removed, shall be used for taking readings of hydrometer float. A recommended type of overflow vessel is shown in Fig. 4.

A-2.2 Thermometer — Solid-stem liquid-in-glass type of a suitable range and capable of reading with an accuracy of ± 0.5 °C (*see* IS 4825 : 1982).

A-2.3 Water Bath — capable of maintaining a temperature of 27 °C ± 1 °C .

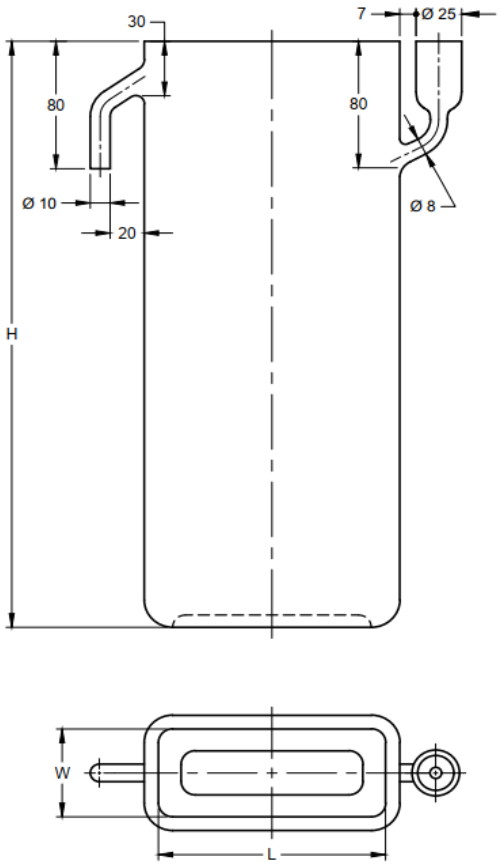
A-3 LIQUIDS

Electrolyte solutions of appropriate density to cover at least four points on the scale.

A-4 PROCEDURE

A-4.1 Pour the electrolytic solution of appropriate density into the overflow vessel almost to the brim. Stir out to drive out any air bubbles that might be present in it and fill the vessel up to the brim. Insert the standardized hydrometer along with the hydrometer float under test into the solution and allow them to attain the temperature of the liquid. Note the readings of the two hydrometers.

A-4.1.1 Any difference in the readings of the standard hydrometer and the hydrometer float under test shall be treated as error at that point. Repeat the test to cover at least four points on the scale.



L = 135 ± 5, W = 55 ± 3 and H = 360 ± 5

All dimensions in millimetres

FIG. 4 OVERFLOW VESSEL

ANNEX B

(*Clause* 4.8.2.1)

METHOD FOR EVALUATING THE PERFORMANCE OF THE ELASTOMERIC COMPONENTS

B-1 GENERAL

This prescribes a method for testing elastomeric components of an assembled battery hydrometer, in particular the following:

a) The elastic bulb, in relation to its:

   1) filling time;
   2) ability to fill the barrel to the top of the system of the float on the compressor and release;
   3) airtightness;
   4) retention masses; and
   5) resistance to leakage.

b) The elastic nozzle, in relation to its ability to retain without leaking, the fluid contents.

B-2 APPARATUS

B-2.1 Stop Watch — accuracy ± 1 s.

B-2.2 Protractor

B-3 PROCEDURE

Weigh to the nearest 0.1 g, a beaker containing water. With the nozzle below the water surface and the main hydrometer axis in a vertical position, fill a clean dry hydrometer to the top of the float stem with distilled water. The time taken to fill the barrel shall not be longer than 5 seconds. After ensuring the bulb is fully released, carefully lift the filled hydrometer and hold the barrel vertically for 5 seconds noting any signs of air or water leaks. Expel the water into the beaker from which it was taken within the next 5 s, taking care that no water is lost by splashing. Reweigh the beaker and contents and determine the retention mass. Refill the hydrometer except that the filling shall be done at an angle of 45º ± 2º. The filling time shall be no longer than 5 seconds. Withdraw the filled hydrometer, keeping it at 45º ± 2º instead of in a vertical position. Note any signs of air or water leaks. Empty the hydrometer.

ANNEX C

(*Clause* 4.8.3)

METHOD FOR DETERMINATION OF ESISTANCE OF THE BARREL TO THERMAL SHOCK

C-1 APPARATUS

C-1.1 Stop Watch — with an accuracy ± 1 s.

C-1.2 Water Bath — to maintain temperature at 50 °C ± 1 °C and 0 °C ± 1 °C, respectively.

C-2 PROCEDURE

Disassemble the battery hydrometer. Closely examine the barrel taking note of its colour and clarity and any marking, aberrations and imperfections present. Immerse the barrel in the water bath at 0 °C . After a 5 min immersion, take the barrel out from the water bath at 0 °C , quickly drain, and immediately plunge it into the water bath at 50 °C . After 1 minute immersion, take the barrel out from the water bath at 50 °C , quickly drain, and immediately plunge it into the water bath at 0 °C again. After 5 minute, remove the barrel, drain and dry. Examine and compare to its original description for any signs of visible deterioration or damage.

ANNEX D

(*Clause* 4.8.4)

METHOD FOR DETERMINATION OF RESISTANCE TO MECHANICAL SHOCK

D-1 PROCEDURE

D-1.1 Lift the package and hold it over an even horizontal concrete surface so that a corner and the centre of gravity of the package shall be vertically above the point of impact at a drop height of 700 mm ± 25 mm.

NOTE — The drop height is defined as the distance between the lowest point on the package at the time of release and the nearest point of the impact surface.

D-1.2 Release the package from its drop height.

D-1.3 Repeat steps **D-1.1** and **D-1.2** as follows:

a) for any three other corners chosen at random;

b) so that any one side face, chosen at random, impacts squarely on the concrete surface; and

c) So that any one end face, chosen at random, impacts squarely on the concrete surface.

D-1.4 Make an external examination of the package

and note any signs of damage which would impair protection of the contents in any ensuring normal handling.

D-1.4.1 Note any severe displacement of the hydrometer components within the package which would impair their protection in normal handling.

D-1.4.2 Examine the contents and note any signs of damage to the battery hydrometer which would affect the performance of the apparatus.

NOTE — Particular attention should be paid to the float components.

ANNEX E

(*Clause* 6.1)

SAMPLING OF BATTERY HYDROMETERS

E-1 LOT

E-1.1 All battery hydrometers of the same type manufactured by the same unit and offered for inspection at one time shall constitute a lot. From each lot samples shall be taken and tested for acceptance.

E-2 SCALE OF SAMPLING

E-2.1 From each lot samples shall be taken at random in accordance with Table 2 for various tests. For random selection methods guidance may be had from IS 4905 : 1968.

E-2.2 Samples drawn as per col (2) of Table 2 shall be tested for the requirements given in **4.1** to **4.7.** Any hydrometer failing in one or more of the requirements shall be deemed defective. The number of defective in the sample shall not exceed the acceptance number given in col (3) of Table 2 if the lot is to be accept under this clause.

E-2.3 The sample drawn as per col (4) of Table 2 shall be tested for the performance requirements as per **4.8.** There shall be no failure if the lot is to be accepted under this clause.

Table 2 Scale of Sampling for Battery Hydrometers
(*Clauses* E-2.1, E-2.2 and E-2.3)

Lot Size	Sample Size for Tests as per 4.1 to 4.7	Acceptance Number	Sub-sample for 4.8
(1)	(2)	(3)	(4)
Up to 25	3	0	1
26 to 50	5	0	1
51 to 100	5	0	1
101 to 150	8	0	2
151 to 300	13	1	2
301 and above	13	1	3

ANNEX F
(*Foreword*)

COMMITTEE COMPOSITION
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Amendments Issued Since Publication

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