

SRI LANKA STANDARD 671:1984
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**SPECIFICATION FOR
WATER FOR LEAD-ACID BATTERIES**

SRI LANKA STANDARDS INSTITUTION

Gr.6

(Attached Errata Sheet)

SRI LANKA STANDARD
SPECIFICATION FOR WATER, FOR LEAD-ACID BATTERIES

FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 1984-12-20, after the draft, finalized by the Drafting Committee on Chemicals and Chemical Products had been approved by the Chemicals Divisional Committee.

All standard values in this specification are in SI units.

For the purpose of deciding whether a particular requirement of this specification is complied with, the final value, observed or calculated, expressing the result of a test or an analysis, shall be rounded off in accordance with CS 102. The number of significant places retained in the rounded off value should be the same as that of the specified value in this specification.

In the preparation of this specification, the assistance obtained from the publications of the British Standards Institution and the Indian Standards Institution is gratefully acknowledged.

1 SCOPE

1.1 This specification prescribes the requirements and the methods of sampling and test for water intended for use in lead-acid batteries.

2 REFERENCES

- CS 102 Presentation of numerical values
- SLS 428 Random sampling methods

3 REQUIREMENTS

3.1 Description

3.1.1 The material shall be water, purified by distillation or by ion exchange. It shall be clear and colourless when viewed through a depth of 300 mm.

3.1.2 The material shall also comply with the requirements given in Table 1 when tested according to the methods prescribed in Column 4 of the table.

TABLE 1 - Requirements for water, for lead-acid batteries

Sl. No. (1)	Characteristic (2)	Requirements (3)	Methods of Test (Ref. to Clause No. in Appendix A) (4)
i	Non-volatile residue, mg/l, max.	10	A.2
ii	Chlorides	To pass the test	A.3
iii	Ammonia	"	A.4
iv	Heavy metals	"	A.5
v	Calcium	"	A.6
vi	Manganese	"	A.7
vii	Oxidizable matter	"	A.8
viii	Electrical conductivity at $27 \pm 2^\circ\text{C}$, mS/m, max.	1	A.9

4 PACKAGING AND MARKING

4.1 The material shall be packed in clean containers of glass, polyethylene or any other suitable plastic material.

4.2 The containers shall be securely closed, and marked legibly and indelibly with the following:

- a) Name of the material;
- b) Net volume, in ml, of the material;
- c) Name, and address of manufacturer;
- d) Recognized trade mark, if any; and
- e) Batch or code number.

4.2.1 The containers may also be marked with the Certification Mark of the Sri Lanka Standards Institution illustrated below on permission being granted for such marking by the Sri Lanka Standards Institution.



NOTE - The use of the Sri Lanka Standards Institution Certification Mark (SLS Mark) is governed by the provisions of the Sri Lanka Standards Institution Act and the regulations framed thereunder. The SLS mark on products covered by a Sri Lanka Standard is an 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 the Institution and operated by the producer. SLS marked products are also continuously checked by the Institution for conformity to that standard as a further safeguard. Details of conditions under which a permit for the use of the Certification Mark may be granted to manufacturers or processors may be obtained from the Sri Lanka Standards Institution.

5 SAMPLING

5.1 Lot

5.1.1 All containers, containing material manufactured on the same day, under similar conditions of manufacture shall constitute a lot.

5.2 General requirements of sampling

5.2.1 In drawing and handling samples the following precautions and directions shall be observed:

5.2.1.1 The sampling instrument shall be clean when used.

5.2.1.2 Samples shall be placed in clean and air-tight containers of glass, polyethylene or any other suitable plastic material.

5.2.1.3 The sampling instrument and sample containers shall be washed several times with the material to be sampled.

5.2.1.4 Each sample container shall be sealed air tight after filling and marked with necessary details of sampling.

5.2.1.5 To draw representative samples, the contents of each container selected for sampling shall be mixed as thoroughly as possible.

5.3 Scale of sampling

5.3.1 Samples shall be tested from each lot for ascertaining conformity of the material to the requirements of this specification.

5.3.2 The number of containers to be selected from the lot shall be in accordance with Table 2.

TABLE 2 - Scale of sampling

Number of containers in the lot	Number of containers to be selected
Up to 20	04
21 to 50	05
51 to 90	06
91 to 150	07
151 and above	10

5.3.3 The containers shall be selected at random. In order to ensure randomness of selection random number tables as given in SLS 428 shall be used.

5.4 Preparation of composite sample

5.4.1 From each container selected as in 5.3.2, equal quantities of the material shall be taken and mixed together to form a composite sample of not less than 3 litres.

5.5 Number of tests

5.5.1 Each container selected as in 5.3.2, shall be examined for marking requirements (this may be done at the place of sampling).

5.5.2 The composite sample prepared as in 5.4 shall be tested for all requirements specified in this specification.

6 METHODS OF TEST

6.1 Tests shall be carried out according to the methods prescribed in Column 4 of Table 1.

7 CONFORMITY TO STANDARD

7.1 A lot shall be declared as conforming to the requirements of this specification if the following conditions are satisfied:

7.1.1 Each container examined as in 5.5.1 satisfies the marking requirements.

7.1.2 The test results on the composite sample satisfy the relevant requirements.

APPENDIX A

ANALYSIS OF WATER FOR LEAD-ACID BATTERIES

A.1 QUALITY OF REAGENTS

A.1.1 During the analysis unless otherwise stated, use only reagents of recognized analytical grade and only distilled water or water of equivalent purity.

A.2 DETERMINATION OF NON-VOLATILE RESIDUE

A.2.1 Procedure

A.2.1.1 Transfer 500 ml of the material to a silica dish or a glass dish and evaporate to about 50 ml. Transfer the liquid to a small tared platinum or porcelain dish, rinsing the previous dish well with distilled water, and again evaporate. Dry the residue at 105 ± 2 °C, cool and weigh. Repeat drying, cooling and weighing processes until the difference in mass between two successive weighings does not exceed 0.01 mg. Report the mass of the residue in terms of milligrams/litre of the material.

A.3 TEST FOR CHLORIDES

A.3.1 Outline of method

A.3.1.1 The turbidity produced by the material with silver nitrate solution is matched with that obtained with standard chloride solution.

A.3.2 Apparatus

A.3.2.1 *Nessler tubes*, 50-ml capacity.

A.3.3 Reagents

A.3.3.1 *Nitric acid, dilute*, cautiously add 300 ml of nitric acid (rel. den. 1.42) to 700 ml of distilled water, cool, then dilute to 1 litre in a measuring cylinder.

A.3.3.2 *Silver nitrate, solution*, approximately 5 per cent (m/V).

A.3.3.3 *Standard chloride solution*, dissolve 0.164 g of sodium chloride in water and make up the volume to 1 000 ml. Dilute 10 ml of this solution to 100 ml with distilled water. One millilitre of this solution is equivalent to 0.01 mg of chloride (as Cl).

A.3.4 Procedure

A.3.4.1 Transfer 10 ml of the material to a nessler tube. Add 1 ml of dilute nitric acid (A.3.3.1) and 1 ml of silver nitrate solution (A.3.3.2). Carry out a control test in another nessler tube with 30 ml of water, 1 ml of standard chloride solution (A.3.3.3), 1 ml of dilute nitric acid and 1 ml of silver nitrate solution. Make up the solutions in both nessler tubes to 50 ml. Shake and observe the opalescence after three minutes.

A.3.5 The material shall be taken to have passed the test if any opalescence produced with the material is not greater than that produced in the control test.

A.4 TEST FOR AMMONIA

A.4.1 Outline of method

A.4.1.1 The brown colour produced by the material with nessler reagent is matched with that obtained with standard ammonium chloride solution.

A.4.2 Apparatus

A.4.2.1 *Nessler tubes*, 50-ml capacity.

A.4.3 Reagents

A.4.3.1 *Nessler reagent*

A.4.3.1.1 Dissolve 35 g of potassium iodide in 100 ml of ammonia-free distilled water. Add to it a cold saturated solution of mercuric chloride until after thorough mixing, a slight red precipitate remains. Add 120 g of sodium hydroxide, and when dissolved, dilute to 1 litre with ammonia-free water. Finally, add a little more of mercuric chloride solution to produce a red colour. Set aside to clear. The reagent shall be shaken occasionally.

A.4.3.2 *Standard ammonium chloride solution*

A.4.3.2.1 Dissolve 3.14 g of ammonium chloride in sufficient water to produce 1 000 ml. Dilute 10 ml of this solution to 1 000 ml with water. One millilitre of this dilute solution contains 0.01 mg of ammonia (as NH_3).

A.4.4 Procedure

A.4.4.1 Transfer 10 ml of the material to a nessler tube and add 5 drops of nessler reagent (A.4.3.1). Carry out a control test in another nessler tube using 2 ml of standard ammonium chloride solution (A.4.3.2) and 5 drops of nessler reagent. Make up the volume of liquid in the two tubes to 50 ml with distilled water. Shake and compare the colour after three minutes.

A.4.5 The material shall be taken to have passed the test if the intensity of colour produced with the material is not greater than that produced in the control test.

A.5 TEST FOR HEAVY METALS

A.5.1 Apparatus

A.5.1.1 *Nessler tubes*, 100-ml capacity.

A.5.2 Reagent

A.5.2.1 *Sodium sulfide solution*, 10 per cent (m/V).

A.5.3 Procedure

A.5.3.1 Transfer 100 ml of the material to a nessler tube. Add 1 ml of sodium sulfide solution (A.5.2.1) and mix well.

A.5.4 The material shall be taken to have passed the test if no colour appears within two minutes.

A.6 TEST FOR CALCIUM

A.6.1 Reagents

A.6.1.1 *Ammonium oxalate solution*, dissolve 3.5 g of ammonium oxalate in sufficient water to make 100 ml.

A.6.1.2 *Ammonium hydroxide, dilute*, 175 g/l.

A.6.2 Procedure

A.6.2.1 Transfer 10 ml of the material to a test tube. Add 10 drops of ammonium oxalate solution (A.6.1.1) and 5 drops of dilute ammonium hydroxide (A.6.1.2). Shake the mixture and heat for about a minute. Allow to cool.

A.6.3 The material shall be taken to have passed the test if no opalescence or turbidity appears.

A.7 TEST FOR MANGANESE

A.7.1 Reagents

A.7.1.1 *Sulfuric acid, concentrated*, relative density = 1.84.

A.7.1.2 *Ammonium nitrate*.

A.7.1.3 *Phosphoric acid, syrupy*.

A.7.1.4 *Potassium periodate*.

A.7.2 Procedure

A.7.2.1 Transfer 100 ml of the material to a 250-ml beaker. Add 10 ml concentrated sulfuric acid (A.7.1.1). Evaporate to fuming, adding a small amount of ammonium nitrate, if necessary, to oxidize any organic matter. Allow to cool. Dilute to about 50 ml, add 2 ml of phosphoric acid (A.7.1.3) and 0.2 g of potassium periodate. Boil for 5 minutes and maintain at boiling point for a further 15 minutes.

A.7.3 The material shall be taken to have passed the test if no perceptible pink colouration is produced.

A.8 TEST FOR OXIDIZABLE MATTER

A.8.1 Reagents

A.8.1.1 *Sulfuric acid, dilute*, 10 per cent (w/v).

A.8.1.2 *Potassium permanganate solution*, 0.32 g/l.

A.8.2 Procedure

A.8.2.1 Transfer 100 ml of the material to a beaker. Add 10 ml of dilute sulfuric acid (A.8.1.1) and 1 ml of potassium permanganate solution (A.8.1.2). Boil for 10 minutes.

A.8.3 The material shall be taken to have passed the test if the colour of potassium permanganate is not completely destroyed.

A.9 DETERMINATION OF CONDUCTIVITY

A.9.1 Outline of method

A.9.1.1 A sample of the material is boiled in a conical flask for a period of 5 min. The flask is sealed and the flask and contents cooled to 27 ± 2 °C and the conductivity measured within 15 min.

A.9.2 Apparatus

A.9.2.1 *Conical flask, 500-ml, fitted with a ground glass joint.*

A.9.2.2 *Guard tube, fitted with a ground glass joint, containing soda lime, nominal aperture size 0.71 mm to 1.18 mm.*

A.9.2.3 *Conductivity meter.*

A.9.3 Procedure

A.9.3.1 Transfer 400 ml of the material into the flask. Heat the flask until the water boils and continue boiling for 5 min. Remove the flask from the heat and immediately insert the guard tube. Cool the flask and contents rapidly under running water.

A.9.3.2 Measure the conductivity within 15 min of cooling to 27 ± 2 °C.

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TABLE 1 Sl. No. viii

Requirement for electrical conductivity at $27 \pm 2^{\circ}\text{C}$, mS/m,
max. The value of "1" shall be corrected to read as "1.0".

SLS CERTIFICATION MARK

The Sri Lanka Standards Institution is the owner of the registered certification mark shown below. Beneath the mark, the number of the Sri Lanka Standard relevant to the product is indicated. This mark may be used only by those who have obtained permits under the SLS certification marks scheme. The presence of this mark on or in relation to a product conveys the assurance that they have been produced to comply with the requirements of the relevant Sri Lanka Standard under a well designed system of quality control inspection and testing operated by the manufacturer and supervised by the SLSI which includes surveillance inspection of the factory, testing of both factory and market samples.

Further particulars of the terms and conditions of the permit may be obtained from the Sri Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.



SRI LANKA STANDARDS INSTITUTION

The Sri Lanka Standards Institution (SLSI) is the National Standards Organization of Sri Lanka established under the Sri Lanka Standards Institution Act No. 6 of 1984 which repealed and replaced the Bureau of Ceylon Standards Act No. 38 of 1964. The Institution functions under the Ministry of Science & Technology.

The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

The Institution is financed by Government grants, and by the income from the sale of its publications and other services offered for Industry and Business Sector. Financial and administrative control is vested in a Council appointed in accordance with the provisions of the Act.

The development and formulation of National Standards is carried out by Technical Experts and representatives of other interest groups, assisted by the permanent officers of the Institution. These Technical Committees are appointed under the purview of the Sectoral Committees which in turn are appointed by the Council. The Sectoral Committees give the final Technical approval for the Draft National Standards prior to the approval by the Council of the SLSI.

All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution endeavours to ensure adequate representation of all view points.

In the International field the Institution represents Sri Lanka in the International Organization for Standardization (ISO), and participates in such fields of standardization as are of special interest to Sri Lanka.