

SRI LANKA STANDARD 114 : 1987

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SPECIFICATION FOR
SCHOOL CHALKS
(FIRST REVISION)

SRI LANKA STANDARDS INSTITUTION

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SLS 114:1987

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FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 1987-01-07, after the draft, finalized by the Drafting Committee on School Chalk, had been approved by the Chemicals Divisional Committee.

This specification was first published in 1971. After consideration of the present manufacturing practices of chalks in Sri Lanka and being satisfied with the quality of these chalks, the drafting committee concerned decided to amend the limits for moisture content and calcium sulfate content in this revision. A requirement for the content of toxic materials such as lead, arsenic and hexavalent chromium has also been introduced. The sampling scheme has been modified.

All values given 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 analysis, shall be rounded off in accordance with CS 102. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this specification.

In the preparation of this specification, the assistance derived from the publications of the American National Standards Institute, British Standards Institution, Indian Standards Institution, Singapore Institute of Standards and Industrial Research and South African Bureau of Standards is gratefully acknowledged.

1 SCOPE

This specification prescribes requirements, methods of sampling and tests for moulded, white and coloured chalks of circular or other cross section commonly used for educational purposes.

2 REFERENCES

- CS 102 Presentation of numerical values
- CS 124 Test sieves
- SLS 312 Determination of arsenic
- SLS 428 Random sampling methods.

3 REQUIREMENTS

3.1 General requirements

3.1.1 *Materials*

The main raw material shall be calcined mineral gypsum to which other suitable materials required for manufacturing process may be added. This whole shall form a homogeneous mass, free from grit or hard particles and shall not leave more than 1 per cent residue when passed through a 150- μ m sieve conforming to CS 124.

3.2 Finish

The surface of the chalks shall be smooth, without any depressions or signs of crumbling.

3.3 Writing qualities and freedom from grit

Chalks shall be free from grit, flint or sandy particles and shall be capable of making continuous uniform marks on a blackboard. The marks shall be easily erased with a dry eraser and the chalks shall not scratch the blackboard.

3.4 Colour

Chalks packed in a box shall be white, or coloured or an assortment of six colours distinct from each other when used on a blackboard.

3.5 Toxic substances

3.5.1 Soluble lead content in a chalk when tested by the method prescribed in Appendix A shall not be more than 250 mg/kg.

3.5.2 Soluble arsenic content in a chalk when tested by the method prescribed in Appendix A shall not be more than 100 mg/kg.

3.5.3 Soluble hexavalent chromium content in a chalk when tested by the method prescribed in Appendix A shall not be more than 100 mg/kg.

3.6 Other requirements

Chalks shall also comply with the requirements given in Table 1, when tested according to the relevant methods given in Column 5 of the table.

TABLE 1 - Requirements for school chalk

| Sl. No. (1) | Characteristic (2) | Requirement | | Method of test (5) |
|-------------|---|-------------|--------------|--------------------|
| | | White (3) | Coloured (4) | |
| i | Length of chalks, mm | 80 ± 3 | 80 ± 3 | - |
| ii | Mass per 100 chalks, g, min. | 500 | 400 | 6.1 |
| iii | Transverse breaking force, N, min. | 10.0 | 8.0 | 6.2 |
| iv | Moisture, per cent by mass, | 15.0 | 15.0 | 6.3 |
| v | Calcium sulfate (as CaSO ₄ ·2H ₂ O), per cent by mass, min. | 80 | 80 | 6.4 |

4 PACKAGING AND MARKING

4.1 The chalks shall be packed in quantities of 100 chalks, in a suitable container which offers adequate protection to the chalks during handling and transportation. A corrugated liner or suitable cushioning material may be used to prevent movement within the container.

4.2 Each container shall be legibly and indelibly marked with the following information:

- a) Name of the product;
- b) The word "white", "coloured" or "Assorted colours", as appropriate;
- c) Name and address of the manufacturer (including country of origin);
- d) Registered trade mark, if any;
- e) Brand name, if any; and
- f) Batch or code number.

4.3 Each container 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 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 Certification Mark may be granted to manufacturers or processors may be obtained from the Sri Lanka Standards Institution.

5 SAMPLING

5.1 Lot

In any consignment all the containers of same type (i.e. containing white or coloured or assorted coloured chalks) packed on the same day and manufactured under similar conditions, shall constitute a lot.

5.2 Scale of sampling

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

5.2.2 The number of containers to be selected from each lot shall be in accordance with Table 2. From each container so selected, ten chalks shall be picked up at random to represent all available colours, where applicable.

TABLE 2 - Scale of sampling

| Number of containers in the lot (1) | Number of containers to be selected (2) | Total number of chalks to be selected (3) | Acceptance number (4) |
|--|--|--|--------------------------|
| Up to 25 | 2 | 20 | 1 |
| 26 to 100 | 3 | 30 | 2 |
| 101 to 500 | 5 | 50 | 3 |
| 501 to 2 000 | 7 | 70 | 5 |
| 2 001 and above | 10 | 100 | 6 |

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

5.3 Number of tests

5.3.1 Each container selected as in 5.2.2 shall be inspected for packaging and marking requirements and colour.

5.3.2 The chalks selected from each container as in 5.2.2 shall be examined for mass.

5.3.3 Each chalk of the sample selected as in 5.2.2 shall be examined for length, finish and writing qualities.

5.3.4 One chalk if the lot contains 500 or less containers or two chalks, if the lot contains more than 500 containers shall be drawn for each colour and tested for breaking strength. In case of white or coloured chalks six chalks shall be selected and materials of each chalk shall be min and tested for the same.

5.3.5 One chalk from each colour shall be selected from the remaining chalks and tested for soluble lead, soluble arsenic and soluble hexavalent chromium contents. In case of white or coloured chalks six chalks if the lot contains 500 or less containers or twelve chalks if the lot contains more than 500 containers shall be selected and tested for the same.

5.3.6 A suitable number of chalks shall be selected from the remaining chalks and tested for the requirements of moisture and calcium sulfate content given in Table 1.

6 METHODS OF TEST

6.1 Determination of mass

6.1.1 Procedure

Weigh 10 chalks, drawn from the same container and compute the mass per 100 chalks for each container.

6.2 Determination of transverse breaking force

6.2.1 Apparatus

The apparatus as shown in Fig. 1 shall be of such construction that a chalk can be supported at two points 50 mm apart, and a can suspended from the chalk midway between the supports into which lead shots could be poured in gradually. Further, the chalk should project out equally from both sides of the supports.

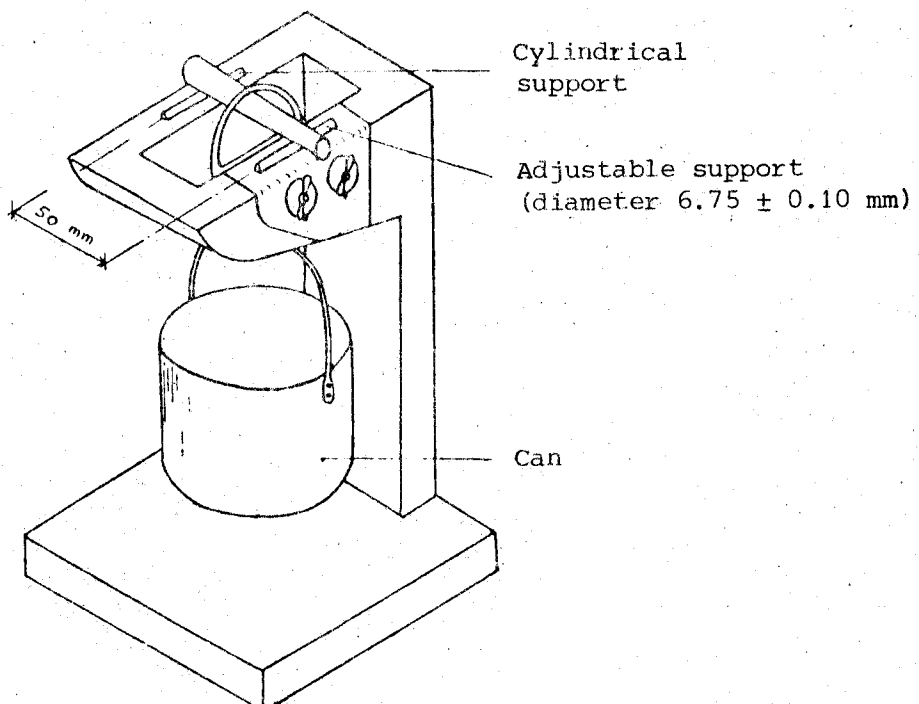


FIGURE 1 - Apparatus for determination of transverse breaking force

6.2.2 Procedure

Before testing, dry the chalks for a period of 24 hours at 38 ± 3 °C to ensure that they are completely dry. Place the chalk in position on the two supporting points, so that the tapering end of the chalk lies on the adjustable support, which could be adjusted to make the central axis of the chalk horizontal. Suspend the can from the chalk midway between the two supports and pour lead shots gradually until the chalk breaks. The transverse breaking force of the chalk shall be based on the mass of the can and the lead shots in it.

6.3 Determination of moisture

6.3.1 Procedure

Grind in a mortar about four chalks so as to pass through a 100- μ m sieve conforming to CS 124. Weigh, to the nearest milligram, approximately 10 g of the ground sample and spread it in a thin layer in a petri dish. Dry in an oven at 100 ± 2 °C, cool and weigh. Repeat the drying, cooling and weighing operations until the difference in mass between two successive weighings does not exceed one milligram.

6.3.2 Calculation

$$\text{Moisture, per cent by mass} = \frac{(m_1 - m_2)}{m_1} \times 100$$

where,

m_1 = mass, in g, of the ground material taken for the test; and

m_2 = mass, in g, of the material after drying.

6.4 Determination of calcium sulfate content

6.4.1 Reagents

6.4.1.1 Reagents used shall be of recognized analytical grade and only distilled water or water of equivalent purity shall be used.

6.4.1.2 Ammonium acetate solution

Dissolve 113.5 g of ammonium acetate in 500 ml of water. Add ammonium hydroxide to make the solution distinctly ammoniacal.

6.4.1.3 Diatomaceous silica

Wash kieselguhr free from soluble matter and dry to constant mass at 105 °C to 110 °C.

6.4.1.4 Ammonium hydroxide, 20 per cent (m/m).

6.4.1.5 Ammonia wash solution

Dilute 100 ml of ammonium hydroxide to one litre with water.

6.4.2 Procedure

Grind the sample in a mortar so as to pass through a 250- μm sieve conforming to CS 124. Weigh, to the nearest milligram, about 4 g of the sample and transfer to a 600-ml beaker. Add 350 ml of ammonium acetate solution (6.4.1.2) and stir the mixture thoroughly to loosen all of the solid matter from the bottom of the beaker. Add about 0.2 g of diatomaceous silica (6.4.1.3), weighed to the nearest milligram, to the mixture and heat at 70 °C on a steam bath for 30 minutes with frequent stirring; keep the solvent distinctly ammoniacal during this period, by adding ammonium hydroxide (6.4.1.4) as necessary. Filter the mixture through a weighed Gooch crucible applying suction if necessary, stirring frequently to keep the diatomaceous earth suspended in the liquid. Wash the residue in five 10 ml portions of hot ammonium acetate solution, draining thoroughly after each washing. Repeat washing with eight 10 ml portions of hot ammonia wash solution (6.4.1.5). Dry the crucible in an oven at 70 °C cool and weigh. Repeat the drying, cooling and weighing operations until the differences in mass between two successive weighings does not exceed one milligram.

6.4.3 Calculation

Calcium sulfate (as $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), per cent by mass

$$= \left[\frac{m_1 (100 - M)}{100} + (m_3 - m_2) \right] \times \left[\frac{100}{m_1 (100 - M)} \times 100 \right]$$

where,

m_1 = mass, in g, of the material taken for the test;

m_2 = initial mass, in g, of the crucible plus mass, in g, of diatomaceous silica used as filter aid;

m_3 = final mass, in g, of the crucible and the contents after drying; and

M = percentage of moisture (see 6.3.2).

7 CRITERIA FOR CONFORMITY

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

- 7.1 Each container inspected as in 5.3.1 satisfies the relevant requirements.
- 7.2 The value of the expression $(\bar{x} - 0.8s)$ (see Notes) calculated using the test results on mass (see 5.3.2) and breaking strength (see 5.3.4) is not less than the specified value for each requirement.

NOTES

1 Mean (\bar{x}) =
$$\frac{\text{Sum of the observed values}}{\text{Number of values}}$$

2 Standard deviation (s) = The positive square root of the quotient obtained by dividing the sum of squares of the deviations of the test results from their arithmetic mean by one less than the number of test results.

7.3 The number of chalks failing to meet one or more of the requirements given in 5.3.3 is less than or equal to the corresponding acceptance number given in Column 4 of the Table 2.

7.4 The test results obtained when tested as in 5.3.5 satisfy the relevant requirement.

7.5 The chalks tested as in 5.3.6 satisfy the relevant requirements.

APPENDIX A

DETERMINATION OF TOXIC SUBSTANCES

A.1 REAGENTS

Reagents used shall be of recognized analytical grade and only distilled water or water of equivalent purity shall be used.

A.1.1 *1,1,1 trichloroethane*

A.1.2 *Hydrochloric acid*, 0.6 per cent (V/V) solution prepared using concentrated hydrochloric acid (rel. den. = 1.18).

A.1.3 *Sulfuric acid*, 0.6 per cent (V/V) solution prepared using concentrated sulfuric acid (rel. den. = 1.84).

A.2 PREPARATION OF THE SAMPLE SOLUTION

Weigh, to the nearest milligram, about 4 g of the sample powdered to pass through a sieve of 500- μ m aperture. Remove wax, oil or other similar matter by means of 1,1,1 trichloroethane (A.1.1). Add the sample to 200 ml hydrochloric acid (A.1.2) and shake the mixture for one minute. Adjust pH of the solution to 1.0 ± 0.3 using sulfuric acid (A.1.3) shaking the mixture after addition of each drop. Shake the mixture continuously for one hour and keep for one hour. Transfer the solution to a 250-ml volumetric flask, dilute to the mark, mix and filter.

A.3 DETERMINATION OF SOLUBLE LEAD CONTENT

A.3.1 Reagents

A.3.1.1 *Ammonium hydroxide*, 35 per cent (V/V) solution prepared using concentrated ammonium hydroxide (rel. den. = 0.88).

A.3.1.2 *Potassium cyanide*, 100 g/l solution.

A.3.1.3 *Sodium sulfide*, 120 g/l solution.

A.3.1.4 *Standard lead solution*

Dissolve 1.60 g of lead nitrate, in 50 ml of concentrated nitric acid (rel. den. = 1.42) and dilute to 1000 ml with water. Dilute 1 ml of this solution to 10 ml with water immediately before use. One millilitre of this solution contains 100 μ g of lead.

A.3.2 Procedure

Take 25 ml of the sample solution as prepared in A.2 into a 50-ml Nessler tube. Neutralize with ammonium hydroxide (A.3.1.1) add 15 ml in excess and then add 1 ml of potassium cyanide (A.3.1.2). Dilute with water to 50 ml and add 2 drops of sodium sulfide (A.3.1.3) and min. Carry out a control test in another 50-ml Nessler tube, using 1 ml of standard lead solution (A.3.1.4) treating in the same manner as for the sample and diluting it to the same volume. Compare the intensity of the colour produced in the two tubes.

A.3.3 The sample shall be taken to have satisfied the requirement for soluble lead prescribed in 3.5.1, if the intensity of the colour produced in the test is not greater than that produced in the control test.

A.4 DETERMINATION OF SOLUBLE ARSENIC CONTENT

Analyse the filtrate obtained in A.2 in accordance with the modified Gutzert method given in SLS 312.

A.5 DETERMINATION OF SOLUBLE HEXAVALENT CHROMIUM CONTENT

A.5.1 Reagents

A.5.1.1 *Sulfuric acid*, 0.6 per cent (V/V) solution prepared using concentrated sulfuric acid (rel. den. = 1.84).

A.5.1.2 *Chromium, stock solution*

Dissolve 113.1 mg of potassium dichromate in water and dilute to 1000 ml. One millilitre of this solution contains 40 µg of chromium.

A.5.1.3 *Chromium, standard solution*

Dilute 10 ml of stock chromium solution (A.5.1.2) to 100 ml with water. Transfer 10 ml of this solution to a beaker, and adjust pH of the solution to 1.0 ± 0.3 using sulfuric acid (A.5.1.1). Transfer the solution to a 100-ml volumetric flask, dilute to 100-ml with sulfuric acid. One millilitre of this solution contains 0.4 µg of chromium.

A.5.1.4 *Diphenylcarbazide*

Dissolve 250 mg of 1,5 diphenylcarbazide in 50 ml of acetone. Store in a brown bottle. Discard when solution becomes discoloured.

A.5.2 Procedure

Take 25 ml of the sample solution prepared as in A.2 into a beaker and adjust pH of the solution to 1.0 ± 0.3 using sulfuric acid (A.5.1.1). Transfer the solution to a 100-ml volumetric flask, dilute to 100-ml with sulfuric acid. Take 25 ml of the above solution into a 50-ml Nessler tube. Add 2 ml of diphenylcarbazide solution (A.5.1.4), mix and stand for 5 minutes to 10 minutes for full colour development. Carry out a control test in another 50-ml Nessler tube, using 25 ml of standard chromium solution (A.5.1.3) treating in the same manner as for the sample. Compare the intensity of the colour produced in the two tubes.

A.5.3 The sample shall be taken to have satisfied the requirement for soluble hexavalent chromium content prescribed in 3.5.1, if the intensity of the colour produced in the material is not greater than that produced in the control test.



ERRATA SHEET

SLS 114 : 1984

SRI LANKA STANDARD SPECIFICATION FOR SCHOOL CHALK

Clause 3.6 Other Requirements

TABLE 1 - Requirements for school chalk

SI No. iv, Column 2,
Insert 'max' at the end

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SRI LANKA STANDARDS INSTITUTION

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