

**SRI LANKA STANDARD 552:1982**

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**SPECIFICATION FOR  
BUILDING LIME**

**SRI LANKA STANDARDS INSTITUTION**



# SPECIFICATION FOR BUILDING LIME

SLS 552:1982

Gr. 7

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BUREAU OF CEYLON STANDARDS

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Sri Lanka.

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This standard does not purport to include all the necessary provisions of a contract.

# SRI LANKA STANDARD SPECIFICATION FOR BUILDING LIME

## FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Bureau of Ceylon Standards on 1982-01-28, after the draft, prepared by the Drafting Committee on Building Lime was approved by the Civil Engineering Divisional Committee.

In Sri Lanka, building lime is manufactured from dolomitic limestone, miocene lime stone, coral stone and sea shells. Different requirements have therefore been specified for building lime manufactured from the above sources. At present lime is used in the building industry mostly for plastering and finishes. Thus this standard specifies only the chemical requirements and fineness.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value expressing the results of a test on analysis, shall be rounded off in accordance with CS 102. The number of figures to be retained in the rounded off value shall be the same as that of the value specified in this standard.

In the preparation of this standard, the assistance derived from the publications of the Indian Standards Institution and a report on lime production in Sri Lanka prepared by Highways Department is gratefully acknowledged.

## 1 SCOPE

This standard covers the requirements for hydrated lime and quicklime, manufactured from crystalline limestone, coral stone, sea shells, and miocene limestone, suitable for masonry work and finishes.

## 2 REFERENCES

- CS 102 Presentation of numerical values  
CS 124 Test sieves  
SLS 522 Water for making concrete.

## 3 DEFINITIONS

For the purpose of this standard, the following definitions shall apply:

**3.1 quicklime:** A calcined material, the major part of which is calcium oxide or calcium oxide with lesser amount of magnesium oxide, capable of slaking with water. This is also known as "unhydrated lime".

**3.2 hydrated lime:** A dry powder obtained by treating quicklime with a quantity of water just sufficient to satisfy its chemical affinity for hydration. It consists essentially of calcium hydroxide and may contain a lesser proportion of magnesium hydroxide.

## 4 CLASSIFICATION

Building lime shall be classified as follows;

- Type 1 - Dolomitic lime  
Type 2 - Coral lime and sea shells  
Type 3 - Burnt miocene limestone.

## 5 CHEMICAL AND PHYSICAL REQUIREMENTS

When tested in the manner described in Appendices A and B building lime shall satisfy the chemical and physical requirements in Tables 1 and 2.

## 6 SAMPLING

### 6.1 Place of sampling

#### 6.1.1 *Quicklime*

In the case of quicklime, the limits of chemical and physical requirements specified in tables 1 and 2, shall apply only if the samples are taken at the point of loading at the manufacturer's works.

#### 6.1.2 *Hydrated lime*

In the case of hydrated lime, the samples shall be taken at the delivery end.

TABLE 1 - Chemical requirements

TYPE OF TEST	TYPE I		TYPE II		TYPE III	
	Hydrated	Quicklime	Hydrated	Quicklime	Hydrated	Quicklime
1 Calcium oxide + magnesium oxide per cent by mass min.	45	45	52	52	60	60
2 Loss on ignition, per cent by mass, max.	-	19	-	32	-	32
3 Magnesium oxide, per cent by mass, max.	25	30	05	05	05	05
4 Insoluble matter including silicon dioxide, per cent by mass, max.	15	15	06	06	05	05
5 Silicon dioxide, per cent by mass, max.	10	10	03	03	04	04

TABLE 2 - Physical requirements

TYPE OF TEST	TYPE I	TYPE II	TYPE III
	Hydrated lime	Hydrated lime	Hydrated lime
Fineness			
Maximum residue on 600 $\mu$ m sieve	40%	10%	10%
Maximum residue on 150 $\mu$ m sieve (but passing 600 $\mu$ m sieve)	70%	30%	30%

## 6.2 Procedure for sampling

### 6.2.1 General

Sampling shall be carried out as quickly as possible so that the material shall not deteriorate. The total time occupied in mixing (and if necessary quartering down) the composite samples, and the preparation (where necessary) of the final samples from these shall not exceed two hours. The final samples shall be three in number and shall be placed immediately in clean, dry, air-tight containers, when testing is not to be carried out immediately. The sample shall be marked and sealed to the satisfaction of all concerned paying special attention to the air-tightness of the containers. Tools and containers shall be of material free from rust and shall be alkali resistant.

### 6.2.2 Sampling quicklime

Three final samples, each of not less than 1 kg shall be drawn as specified under 6.2.2.1 for lump quicklime and under 6.2.2.2 for powdered quicklime.

#### 6.2.2.1 Lump quicklime

An initial sample shall first be taken from which the final samples to be tested shall be obtained by quartering. This initial sample shall not be less than 3 kg per tonne of material to be tested and shall be drawn as follows:

- a) *In bulk* - When lump lime is loose, approximately equal proportions shall be drawn from as many different positions as possible, corresponding to not less than two selected places for every 3 m, so as to be fairly representative of the material.
- b) *In packages* - With lump lime in bags, barrels or other packages the initial sample shall be made up by approximately equal proportions taken from not less than one package for every tonne. When the number of packages is less than 20, the sample shall be drawn from at least three or half the number of packages whichever is less. Packages for sampling shall be chosen at random.

Sufficient material shall be taken from each package sampled to reduce a total initial sample of at least 3 kg per tonne, of material to be tested. Samples shall not be drawn from broken packages. The minimum sample size should not be less than 3 kg.

In either case (a) or (b), part of the initial sample shall be broken down to pass through 12.5 mm test sieve\*. This should be collected and thoroughly mixed in a clean dry surface preferably on a steel plate, and then reduced to about 2.5 kg by coning and quartering (2.5 kg may be necessary when all the tests are to be carried out, if not, lime lumps may be broken down further to the required quantity for the tests).

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\*Test sieves shall conform to CS 124.



#### 6.2.2.2 Powdered quicklime

Sufficient material for the sample or samples shall be drawn direct in approximately equal proportions from different positions, corresponding to not less than two selected spots for every 3 m<sup>3</sup> of the stock when the lime is not loose; or where the number of packages is less than 20 from at least three or half the number of packages whichever is less, chosen at random. The quantity of material drawn shall be not less than 1.5 kg per tonne of material of the consignment.

#### 6.2.3 Sampling hydrated lime

The final sample of at least 1 kg shall be taken direct in the same manner as described in 6.2.2.2 for powdered quicklime.

#### 6.2.4 Material for testing

The sample chosen as described under 6.2.1 and 6.2.2 shall be thoroughly mixed on a clean dry surface and divided into approximately four equal parts by coning and quartering. One part is taken for chemical analysis and the balance three parts are used for sieve analysis.

##### 6.2.4.1 Material for chemical analysis

Subsequently, at the time and place at which the tests and chemical analysis are to be carried out, the sample taken as described under 6.2 shall be crushed to pass through 2.36 mm test sieve\* and to be followed by mixing thoroughly. The quantity of lime which should be a little more than is sufficient for conducting the tests shall be taken in such a manner to be as representative as possible.

From the material finally chosen, a small quantity shall be ground and rejected in order to ensure absence of contamination in grinding equipment. About 100 g of the sample shall be rapidly ground using a ceramic or agate grinding media with as little exposure to air and water vapour as possible. The grinding shall be continued until the material could pass through a 300 µm test sieve and placed in a small airtight container.

6.2.5 Water to be used in all operations shall, unless otherwise appropriate (e.g. in chemical analysis where distilled or de-ionized water is necessary) be pure and free from soluble salts specified in SLS 522.

## 7 TESTS

7.1 All tests shall be carried out as prescribed in appendices A and B.

### 7.2 Temperature for testing

The temperature at which physical tests may be carried out shall, as far as possible, be  $27 \pm 2$  °C.

\*Test sieve shall conform to CS 124.

## 8 PACKING AND STORAGE

Quicklime shall be stored in one of two ways. It shall be stored in gunny bags and stored in a shed by stacking them one on top of the other, if the lime is to be consumed within a short period.

If the lime (quicklime or hydrated lime) is to be kept for a long period it shall be packed either in rough paper bags or in polythene bags so as to be satisfactorily airtight, and shall be marked with:

- a) Manufacturer's name and address
- b) Date of packing.
- c) Whether quicklime or hydrated lime

When hydrated lime is stored, storing in a water tank shall be permissible.

## 9 CRITERIA FOR CONFORMITY

A consignment of building lime shall be deemed to have conformed to the standard provided the following two requirements are satisfied:

- a) A sample from consignment drawn according to Clause 6 satisfy physical and chemical requirements specified in Clause 5.
- b) The consignment complies with Clause 8.

### APPENDIX A

#### CHEMICAL ANALYSIS OF QUICKLIME AND HYDRATED LIME

##### NOTES

- 1 All reagent used shall be of analytical grade.
- 2 The chemical analysis of the quicklime samples shall be carried out immediately on receipt.

#### A.1 DETERMINATION OF AVAILABLE CALCIUM OXIDE

##### A.1.1 Apparatus and reagents

The following apparatus and reagents are required:

- a) A 250 ml reagent bottle with an airtight stopper
- b) A suction pump
- c) A pipette

- d) A burette
- e) A titration flask
- f) Few beakers
- g) A buchner filter
- h) 0.1N HCl, phenolphthaleine, cane sugar, alcohol.

### A.1.2 Method

Place 50 ml of distilled water in a reagent bottle and transfer about 1 g of accurately weighed sample to the bottle and shake the bottle to disperse the sample. Add 10 g of cane sugar, shake thoroughly for about 15 minutes and allow the contents to settle for about 30 minutes.

Filter the solution by means of a buchner filter and the suction pump using two No. 42 Whatman filter paper or equivalent and wash with six 25 ml portion of cold distilled water. The clear filtrate is titrated with 0.1N HCl using phenolphthaleine as indicator.

### A.1.3 Reporting of results

The percentage of calcium oxide (as Cao %) shall be reported using the formula:-

$$\text{Cao \%} = \frac{2.8035 \times V \times N}{m}$$

where,

$V$  = Volume of HCl used (ml)

$N$  = Normality of HCl

$m$  = Mass of sample (g)

## A.2 DETERMINATION OF LOSS ON IGNITION

### A.2.1 Apparatus and reagents

- a) An analytical balance or a weighing scale with similar accuracy.
- b) A platinum crucible with a lid.
- c) A muffle furnace capable of reaching a temperature of 1 000 - 1 200 °C.

### A.2.2 Method

Place about 1 g of the accurately weighed sample in a weighed platinum crucible and cover with a lid. When ignite it at a temperature not less than 1100 °C to constant mass. The difference between the original mass and final mass of the sample represents the loss on ignition.

### A.2.3 Reporting of results

The results shall be expressed as a percentage of the mass of the sample taken.

## A.3 DETERMINATION OF INSOLUBLE MATTER INCLUDING SILICON DIOXIDE CONTENT

### A.3.1 Apparatus and reagents

The following apparatus and reagents are required;

- a) *Evaporating dish*
- b) *Water bath*
- c) *Oven* capable of maintaining a temperature of 110 °C to 120 °C.
- d) *Filter paper* and *funnel*
- e) *Platinum crucible*
- f) *Concentrated hydrochloric acid*: relative density 1.16
- g) *Dilute hydrochloric acid* prepared by diluting hydrochloric acid of relative density 1.16 with water in the ratio 1:99 by volume.

### A.3.2 Procedure

Transfer the ignited sample from A.2 into an evaporating dish and mix with water into a thin slurry. Add 10 ml of concentrated hydrochloric acid into the dish and digest the contents with the acid on gentle heat and agitate until dissolved. Then evaporate the solution to dryness on a water bath. When the sample is nearly dry, place it in an oven for one hour. Maintain the temperature of the oven at 100 °C to 120 °C. Take out the sample, cool and add about 10 ml of concentrated hydrochloric acid. Allow to stand for few minutes. Add an equal volume of water, cover the dish and place on the water bath for 10 minutes.

Filter and wash the residue with hot dilute hydrochloric acid (1:99) and finally wash twice with hot water, evaporate the filtrate to dryness and then bake at 110 °C to 120 °C for one hour. Extract it with hydrochloric acid as before and filter through a second smaller filter paper. Reserve the filtrate for conducting further tests. Transfer the wet filter papers containing the residue to a weighed platinum crucible and char without allowing the paper to catch fire and finally ignite to constant mass at 1100 °C. This gives the mass of insoluble matter including silicon dioxide in the sample tested.

#### A.4 DETERMINATION OF SILICON DIOXIDE

##### A.4.1 Apparatus and reagents

The following apparatus and reagents are required;

- a) *A platinum crucible*
- b) *A heating device* such as a water bath, sand bath, a low temperature hot plate or an infra red lamp.
- c) *Hydrofluoric acid* - approximately 40 per cent by mass
- d) *Concentrated sulphuric acid* - relative density 1.84.

##### A.4.2 Procedure

Treat the insoluble matter including silicon dioxide obtained under A.3 in the crucible with 5 ml of water and 5 ml of hydrofluoric acid and one or two drops of concentrated sulphuric acid. Evaporate to dryness in the heating device specified in 4.1 Ignite the residue for two or three minutes and weigh again. Repeat this procedure till the mass obtained is constant within  $\pm 0.1$  per cent.

##### A.4.3 Evaluation and report of test results

The difference between the mass obtained under A.3 and that obtained under A.4 gives the mass of silicon dioxide.

#### A.5 DETERMINATION OF MAGNESIUM OXIDE CONTENT

##### A.5.1 Sample for analysis

The filtrate reserved under A.3 shall be used for analysis.

##### A.5.2 Apparatus and reagents

The following apparatus and reagents are required;

- a) *Beakers and stirrers*
- b) *Funnels and filter papers*
- c) *Crucible* of suitable material other than glass
- d) *Dilute hydrochloric acid* - 1:1 by volume
- e) *Dilute hydrochloric acid* - 1:4 by volume.
- f) *Diammonium hydrogen phosphate solution* - 25 per cent solution
- g) *Ammonium hydroxide* - approximately relative density 0.90
- h) *Ammonium nitrate wash solution* - prepared by diluting ammonium hydroxide with distilled water until the solution contain 2.5 per cent of ammonia by mass, then adding 3 or 4 drops of concentrate nitric acid (relative density 1.42).

### A.5.3 Procedure

Acidify the combined filtrate in A.3.2 with hydrochloric acid and concentrate to about 150 ml. Add 10 ml of diammonium hydrogen phosphate solution to this solution and cool the same by placing in a beaker of ice water. After the solution cools down add ammonium hydroxide drop by drop, stir the contents constantly until crystalline magnesium orthophosphate begins to form.

Add excess of ammonium hydroxide solution to the extract of 5 to 10 per cent of the volume of the solution. Continue the stirring for several minutes. Allow the liquid to stand in a cool atmosphere for 12 to 48 hours and then filter. Dissolve the precipitate in hot dilute hydrochloric acid (1:4) and dilute the solution with water to about 100 ml. Add one millilitre of diammonium hydrogen phosphate solution and ammonium hydroxide drop by drop while stirring constantly until the precipitate is again formed as described above and the ammonium hydroxide is present in moderate excess. Allow to stand in a cool atmosphere for 12 to 48 hours, filter and wash it with ammonium nitrate wash solution. Burn the filter paper off at a low temperature and finally ignite the residue to constant mass at 1 100 °C, in the crucible.

### EVALUATION AND REPORT OF TEST RESULTS

The magnesium oxide content shall be calculated from the following formula:

$$\text{Magnesium oxide, per cent by mass} = \frac{m_1}{m_2} \times 36.2$$

where,

$m_1$  = mass of magnesium pyrophosphate; and

$m_2$  = mass of the ignited sample described in A.2.2.

The magnesium oxide content shall be reported as a percentage of the mass of sample taken.

## APPENDIX B

### B.1 DETERMINATION OF FINENESS OF HYDRATED LIME

#### B.1.1 Apparatus

The test sieves of nominal aperture size 600  $\mu\text{m}$  and 150  $\mu\text{m}$  conforming to SLS 124 is required.

#### B.1.2 Procedure

The two test sieves are superimposed with the coarser sieve at the top and the finer sieve at the bottom. 100 g of the hydrated lime is placed on the top sieve and the material washed through the sieve with a moderate jet of water from a flexible tube, the whole operation not taking more than 30 minutes. The residue should not be rubbed through the sieve. The residue on each sieve is dried at  $100 \pm 100$  °C to a constant mass, and weighed.

#### B.1.3 Reporting of results

The residue on each sieve expressed as a percentage of the mass of hydrated lime taken shall be reported.

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## **SRI LANKA STANDARDS INSTITUTION**

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