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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
उपभोक्ता मामले, खाद्य एवं सार्वजनिक वितरण मंत्रालय
MINISTRY OF CONSUMER AFFAIRS,
FOOD & PUBLIC DISTRIBUTION
9, Bahadur Shah Zafar Marg, New Delhi 110002

व्यापक परिचालन मसौदा

हमारा संदर्भ: सीईडी 04/टी-43 **26 जून 2025**

तकनीकी समिति: इमारती चूना और जिप्सम उत्पाद विषय समिति, सीईडी 04

प्राप्तकर्ता:

क) सिविल इंजीनियरी विभाग परिषद्, सीईडीसी के सभी सदस्य
ख) इमारती चूना और जिप्सम उत्पाद विषय समिति, सीईडी 04 के सभी सदस्य
ग) रूचि रखने वाले अन्य निकाय

प्रिय महोदय/महोदया,

निम्नलिखित भारतीय मानक का मसौदा संलग्न है:

प्रलेख संख्या	शीर्षक
सीईडी 04 (28237)WC	**कैल्शियम सिलिकेट ब्रिक्स — विशिष्टि का भारतीय मानक मसौदा** [IS 4139 का *तीसरा पुनरीक्षण*] ICS 91.100.25

कृपया इस मानक के मसौदे का अवलोकन करें और अपनी सम्मतियॉ यह बताते हुए भेजे कि यदि यह मानक के रूप में प्रकाशित हो तो इस पर अमल करने में आपके व्यवसाय अथवा कारोबार में क्या कठिनाइयाँ आ सकती हैं ।

सम्मतियॉं भेजने की अंतिम तिथि : **28 जुलाई 2025**

सम्मति यदि कोई हो तो कृपया अधोहस्ताक्षरी को उपरिलिखित पते पर संलग्न फोर्मेट में भेजें या **manoj@bis.gov.in** पर ईमेल कर दें ।

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यह प्रलेख भारतीय मानक ब्यूरो की वैबसाइट **www.bis.gov.in** पर भी उपलब्ध हैं।

धन्यवाद ।

भवदीय,

(द्वैपायन भद्र)
प्रमुख (सिविल इंजीनियरी)

संगलन : उपरिलिखित

भारतीय राष्ट्रीय मानक संस्थान
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9, Bahadur Shah Zafar Marg, New Delhi 110002

DRAFT IN WIDE CIRCULATION

Our Ref: CED 04/T-43 **26 June 2025**

Technical Committee: Building Lime and Gypsum Products, Sectional Committee, CED 04

ADDRESSED TO:

a) All Members of Civil Engineering Division Council, CEDC
b) All Members of CED 04
c) All others interests.

Dear Sir/Madam,

Please find enclosed the following document:

Doc No.	Title
CED 04 (28237)WC	**Draft Indian Standard** **Calcium Silicate Bricks — Specification** (*Third Revision* of IS 4139) ICS 91.100.25

Kindly examine the draft standard and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as National Standard.

Last Date for Comments: **28 July 2025**

Comments if any, may please be made in the attached format and mailed to the undersigned at the above address or preferably through e-mail to **manoj@bis.gov.in**.

In case no comments are received or comments received are of editorial nature, you may kindly permit us to presume your approval for the above document as finalized. However, in case of comments of technical in nature are received then it may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

The document is also hosted on BIS website www.bis.gov.in**.**

Thanking you,

Yours faithfully,

(**Dwaipayan Bhadra**)
Head (Civil Engineering)

Encl: As above

FORMAT FOR SENDING COMMENTS ON BIS DOCUMENTS

(Please use A-4 size sheet of paper only and type within fields indicated. Comments on each clause/sub-clause/table/fig etc. be started on a fresh box. Information in column 3 should include reasons for the comments and suggestions for modified working of the clauses when the existing text is found not acceptable. Adherence to this format facilitates Secretariat's work) {Please e-mail your comments to manoj@bis.gov.in}.

Doc. No.: **CED 04 (28237) WC**

Title: **Draft Indian Standard Calcium Silicate Bricks — Specification**
(*Third Revision* of IS 4139) ICS 91.100.25

LAST DATE OF COMMENTS: **28/07/2025**

NAME OF THE COMMENTATOR/ORGANIZATION: _____

Sl. No.	Clause/Para/Table/ Figure No. Commented	Comments/Modified Wordings	Justification of the Proposed Change

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

(*Not to be reproduced without the permission of BIS or used as an Indian Standard*)

Draft Indian Standard

CALCIUM SILICATE BRICKS — SPECIFICATION

(*Third Revision* of IS 4139)

ICS 91.100.25

Building Lime and Gypsum Products, Section Committee, CED 04	Last Date of Comments **28 July 2025**

FOREWORD

(*Formal Clauses will be added later*)

Calcium silicate bricks derive their strength from the formation of calcium silicate hydrates in crystallized form by the reaction of hydrated lime with active siliceous materials. Such active siliceous materials may include finely ground sand, siliceous rock or fly ash. The chemical reaction leading to formation of calcium silicate hydrates (and calcium aluminates in case of addition of fly ash) are carried out under, autoclaving at elevated temperature and pressure of steam. Materials, such as, ground sand containing mostly quartz, the crystalline form of silica, react rather slowly and require prolonged autoclaving at high steam pressure. Limited quantity of fly ash may be used in the mix. Coloured calcium silicate bricks can also be made by adding pigments to the raw mix before pressure casting. These bricks may be used for masonry construction just like burnt clay bricks. Calcium silicate bricks may also be used as facing bricks. There is good scope for production of such bricks on a commercial scale and their use, especially in those areas where good clay is not available for manufacture of burnt clay bricks. This would also help in boosting the rural economy and rural housing. This standard lays down the essential requirements of calcium silicate bricks to help in the control of its quality in manufacture and use.

This standard was first published in 1967 under the title 'Specification for sand lime brick' and subsequently revised in 1976. The second revision under the modified title 'Calcium silicate bricks — Specification' has allowed the use of fly ash, a waste product from thermal power stations, in the manufacture of such bricks and also allows the manufacture of such bricks in conventional sizes by mutual agreement between the purchaser and the manufacturer.

This Third revision has been taken up to align the standard in line with present good practices being followed in the country and abroad. For revising this standard an R&D project was awarded to Birla Institute of Technology and Science, Pilani (BITS Pilani) funded by Bureau of Indian standards. Based on the research, the principle modifications in this revision are as follows:

a) Use of silica fume, lime-pozzolana mixture, and Additives are permitted;
b) Requirements for density, water absorption, moisture movement and efflorescence have been added;
c) Guidelines for the manufacturing have been provided;
d) Dimensional tolerance has been aligned with the similar products Indian standards; and
e) Reference of Indian Standards has been updated.

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 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.

Draft Indian Standard

CALCIUM SILICATE BRICKS — SPECIFICATION

(Third Revision)

1 SCOPE

This standard covers classification, dimensions, manufacturing, physical requirements, sampling and criteria of conformity of calcium silicate bricks used in construction.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of 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 these standards.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 6508 and the following definition shall apply.

3.1 Bricks — A unit not exceeding 300 mm in length, 150 mm in width or 100 mm in height.

3.2 Frog — The depression made in one or both of larger sides of bricks in order to form a key for the mortar at the joints.

4 MANUFACTURING

Calcium silicate bricks are produced by autoclaving the mixture of silica (SiO_2), lime (CaO) and water. Silica (SiO_2) may be sourced from sand, pulverized fuel ash (fly ash), silica fume or any other material which have around 70 percent and above silica content. Silica content makes up about 50-60 percent of the brick composition. Lime (CaO) acts as a binding material in the mixture and start reacting with silica after addition of water and forming calcium silicate hydrates. Other additives such as cement, gypsum, slag and pigments may be added to enhance brick performance and aesthetic properties. These bricks can be manufactured with or without frog. The manufacturing process start with mixing of silica, lime, and water to form a uniform paste, after that the paste is placed into molds and compressed using hydraulic or mechanical presses. The molded bricks are then transferred to autoclave where they undergo high-pressure steam curing. This process triggers a chemical reaction that forms calcium silicate hydrates, giving the bricks their strength, hardness, and durability. The duration, temperature and pressure of autoclaving for high-pressure steam curing is very manufacturer to manufacturer, generally it is done for about 8 to 12 hours at approximately 800 kPa pressure and around 190°C temperature. After autoclaving, the bricks are allowed to cooled slowly to minimize internal stress and prevent cracks.

5 MATERIALS

The following raw materials may be used for the manufacturing of calcium silicate bricks:

5.1 Lime

The Lime used for the manufacturing of calcium silicate bricks shall conform to IS 712.

5.2 Sand

The sand used for the manufacturing of calcium silicate bricks shall not have more than 5 percent, deleterious materials when tested as per IS 383.

5.4 Pulverized Fuel Ash

The pulverized fuel ash commonly known as fly ash used in production of calcium silicate bricks shall conform to the requirements specified in Grade 1 or Grade2 of IS 3812 (Parts 1 and 2).

5.3 Pulverized Fuel Ash for Lime-Pozzolana Mixture

The Pulverized fuel ash use for lime-pozzolana Mixture in the manufacturing of calcium silicate bricks shall conform to IS 15648.

5.5 Silica Fume

The silica fume used in production of calcium silicate bricks shall conform to the requirements specified in IS 15388

5.6 Water

The water used in production of calcium silicate bricks shall conform to the requirements specified in IS 456.

5.7 Additives

Any suitable additive that does not detrimental to the durability of calcium silicate bricks may be added to enhance their performance and aesthetic properties. These additives may include cement, gypsum, slag, admixtures, pigments, fibers or any other compatible materials.

6 CLASSIFICATION

The calcium silicate bricks shall be of four classes depending upon their average compressive strength as given in Table 1.

Table 1 Classes of Calcium Silicate Bricks
(*Clause* 6)

Sl No.	**Class Designation**	**Compressive Strength** (N/mm^2), *Min*
(1)	(2)	(3)
i)	7.5	7.5
ii)	10	10
iii)	15	15
iv)	20	20

7 DIMENSIONS

The calcium silicate bricks can be manufactured in any dimensions as per agreement between the purchaser and the manufacturer, within the limit given in **3.1**. Generally, these bricks are manufactured in the dimensions as given in Table 2.

Table 2 Typical Dimensions of Calcium Silicate Bricks
(*Clause* 7)

Sl No.	Length × Width × Thickness
(1)	(2)
i)	190 mm × 90 mm × 90 mm
ii)	190 mm × 90 mm × 40 mm
iii)	230 mm × 110 mm × 70 mm
iv)	230 mm × 110 mm × 30 mm

8 PHYSICAL REQUIREMENTS

8.1 General

Visually, the calcium silicate bricks shall be sound, free from visible cracks, and uniform in shape and colour. They shall have smooth rectangular faces with sharp corners.

8.2 Dimensions

For an individual calcium silicate brick the tolerance on the declared dimension is as given in Table 3. Minor chipping remitting from customary method of handling during delivery shall not be deemed ground for rejection.

Table 3 Dimensional Tolerances
(*Clause* 8.2)

Sl No	Dimension	Tolerance
(1)	(2)	(3)
i)	Length and width	± 1 percent
ii)	Height	± 2 percent

8.3 Density

The density of calcium silicate brick when determined according to of IS 2185 (Part 1) shall not be less than 1 000 kg/m^3.

8.4 Water Absorption

The calcium silicate brick, when tested in accordance with the procedure laid down in IS 3495 (Part 2), after immersion in cold water for 24 h, shall have water absorption not more than 20 percent by mass.

8.5 Moisture Movement

The moisture movement of the calcium silicate brick on immersion in water, shall not exceed 0.09 percent, when determined in accordance to IS 2185 (Part 1).

8.6 Compressive Strength

The minimum compressive strength of calcium silicate brick shall not be less than that specified for each class in **6** when tested as described in IS 3495 (Parts 1).

8.7 Efflorescence Test

The calcium silicate brick when tested in accordance with the procedure laid down in IS 3495 (Part 3), shall have the rating of efflorescence not more than 'moderate' up to Class 10 and 'slight' for higher classes.

8.8 Drying Shrinkage

The drying shrinkage of calcium silicate brick when tested as described in Annex B shall be not greater than that given in Table 4.

Table 4 Drying Shrinkage of Calcium Silicate Bricks
(*Clause* 8.8)

Sl No.	Class Designation	Drying Shrinkage (Percent of Wet Length)
(1)	(2)	(3)
i)	7.5	0.06
ii)	10	0.06
iii)	15	0.04
iv)	20	0.04

9 SAMPLING AND CRITERION FOR CONFORMITY

The sampling of the calcium silicate brick and the criterion for conformity shall be as given in IS 5454.

10 MANUFACTURER'S CERTIFICATE

The manufacturer shall ensure that the calcium silicate brick conforms to the requirements of this standard and, if requested, shall provide a certificate to this effect to the purchaser or their representative.

11 MARKING

11.1 Each calcium silicate brick shall be marked with the manufacturers' identification mark or initials and the class of brick, it should be marked in the frog where provided otherwise marked on any of the faces.

11.2 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 product(s) may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 383 : 2016	Coarse and fine aggregate for concrete — Specification (*third revision*)
IS 456 : 2000	Plain and reinforced concrete — Code of practice (*fourth revision*)
IS 712 : 1984	Specification for building limes (*third revision*)
IS 2185 (Part 1) : 2005	Concrete masonry units — Specification: Part 1 hollow and solid concrete blocks (*third revision*)
IS 3495	Burnt clay building bricks — Methods of tests:
(Part 1) : 2019	Determination of compressive strength (*fourth revision*)
(Part 2) : 2019	Determination of water absorption (*fourth revision*)
(Part 3) : 2019	Determination of efflorescence (*fourth revision*)
(Part 4) : 2019	Determination of warpage (*fourth revision*)
IS 3812	Pulverized fuel ash — Specification:
(Part 1) : 2013	For use as pozzolana in cement, cement mortar and concrete (*third revision*)
(Part 2) : 2013	For use as admixture in cement mortar and concrete (*third revision*)
IS 5454 : 2024	Burnt clay bricks and burnt clay tiles — Methods of sampling (*second revision*)
IS 6508 : 1988	Glossary of terms relating to building lime (*first revision*)
IS 15388 : 2003	Silica fume — Specification
IS 15648 : 2006	Pulverized fuel ash for lime-pozzolana mixture applications — Specification

ANNEX B

(*Clause* 8.8)

METHOD FOR DETERMINATION OF DRYING SHRINKAGE

B-1 TEST SPECIMEN

The samples selected in accordance with **9**, three shall be tested for drying shrinkage.

B-2 APPARATUS (*see* Fig. 1)

B-2.1 Measuring Apparatus

A measuring apparatus shall be used which incorporates a micrometer gauge or a suitable dial gauge reading accurately to 0.002 mm. This gauge shall be rigidly mounted in a measuring frame and shall have a recessed end which may be located upon a 5 mm diameter ball or other reference point cemented on the specimen. The other end of the frame shall have a similar recessed seating which may be located upon the other ball or the reference point in the specimen. An Invar steel rod of a suitable length with 5 mm diameter hemispherical ends, or with 5 mm diameter steel balls mounted in the ends,

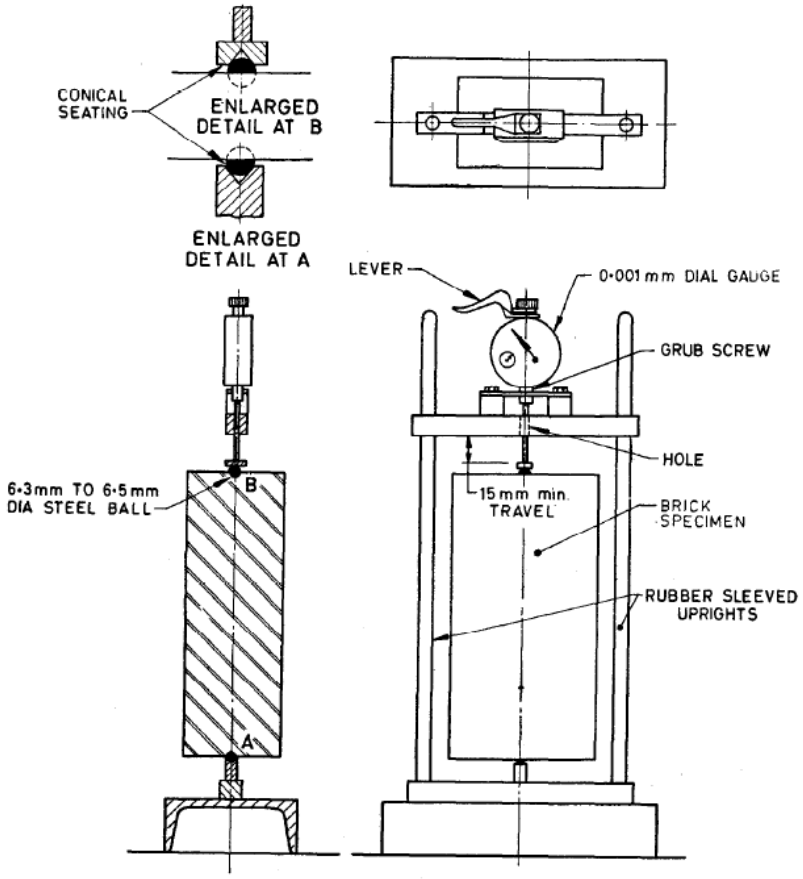

FIG. 1 TYPICAL APPARATUS FOR DRYING SHRINKAGE

shall be used as a standard of length against which readings of the gauge may be tested, thus enabling corrections to be made for any changes in the dimensions of the apparatus between successive

measurements of a test specimen. The apparatus should preferably be adjusted for specimens of different lengths and Invar rods of lengths near to those of the specimens to be tested should be available.

B-2.2 Drying Oven

The drying oven shall comply with the following requirements:

a) It shall have an internal volume equivalent to not less than 8 litres per specimen, with a minimum total volume of 50 litres.
b) It shall be reasonably air-tight and shall be provided with a fan to keep the air circulating effectively during the drying of the specimens.
c) It shall be maintained at a temperature of 50 °C ± 1 °C.
d) The humidity of the air in the oven shall be controlled at approximately 17 percent relative humidity by means of saturated calcium chloride solution. Suitable dishes or trays containing this solution shall be provided to give an exposed area of solution not less than 10 cm^2 for each litre volume of the oven. The dishes or trays shall contain sufficient solid calcium chloride to show it above the surface of the solution throughout the test.

B-3 PREPARATION OF SPECIMENS

Two reference points consisting of 5 mm diameter steel balls or other suitable reference points providing a hemispherical bearing shall be cemented with neat rapid hardening Portland cement or other suitable cementing material at the centre of each end of each specimen after drilling or cutting a shallow depression. After fixing, the surface of the steel balls shall be wiped clean of cement, and dried and coated with lubricating grease to prevent corrosion. The specimens shall then be completely immersed in water for four days, the temperature being maintained at 27 °C ± 2 °C at least for the last 4 h.

B-4 PROCEDURE

B-4.1 Immediately after removal of the specimens from the water, the grease shall be wiped from the steel balls and the length of each specimen measured to an accuracy of 0.002 mm by the apparatus described in **B-2.1**. This shall be taken as the wet length.

NOTE —The instruments reading required is not the absolute length of the specimen but the difference in length between the specimen and an Invar rod of approximately the same length.

B-4.2 The specimens shall then be dried for at least 44 h in an oven of the type described in **B-2.2** at the specified temperature and humidity. The specimens shall then be removed from the oven and cooled for at least 4 h in a desiccator containing solid calcium chloride or a saturated solution of calcium chloride. Each specimen shall then be measured as described in **B-4.1**, at a temperature of 27 °C ± 2 °C.

B-4.3 The cycle of drying, cooling and measuring shall be repeated until constant length is attained, that is, when the difference between two consecutive readings separated by a period of drying of at least 44 h, followed by cooling for at least 4 h, is less than 0.005 mm. The final reading shall be taken as the dry length.

B-4.4 During the above drying process, further wet specimens shall not be placed in the same oven and there shall be free access of air to all surfaces of the specimens.

B-5 CALCULATION OF DRYING SHRINKAGE

The drying shrinkage shall be calculated for each specimen as the difference between the wet length and the dry length expressed as a percentage of the wet length. The arithmetic mean of the drying shrinkage of three bricks shall be taken as the drying shrinkage of the batch under test.