Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जाने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पूरराने की छोड़ नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Building Lime and Lime Products Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first issued in 1990 covering modular size bricks of only four class designer that is 7.5, 10, 15 and 20.

Pulverized fuel ash commonly known as fly ash is a useful by-product from thermal power stations using pulverized coal as fuel and has considerable pozzolonic activity. This national resource has been gainfully utilized for manufacture of Pulverized fuel ash-lime bricks as a supplement to common burnt clay building bricks leading to conservation of natural resources and improvement in environmental quality.

Pulverized fuel ash-lime bricks are obtained from materials consisting of pulverized fuel ash in major quantity, lime and an accelerator acting as a catalyst. Pulverized fuel ash-lime bricks are generally manufactured by intergrinding or blending various raw materials which are then moulded into bricks and subjected to curing cycles at different temperatures and pressures. On occasion as and when required, crushed bottom fuel ash or sand is also used in the composition of the raw material. Crushed bottom fuel ash or sand is used in the composition as a coarser material to control water absorption in the final product. Pulverized fuel ash reacts with lime in presence of moisture to form a calcium-silicate hydrate which is a binder material. Thus pulversed fuel ash-lime brick is a chemically bonded bricks.

These bricks are suitable for use in masonry construction just like common burnt clay bricks. Production of pulverized fuel ash-lime bricks has already started in the country and it is expected that this standard would encourage its production and use on mass scale. This standard lays down the essential requirements of pulverized fuel ash-lime bricks so as to achieve uniformity in the manufacture of such bricks.

Further technological advancement in this field advocated inclusion of more class designation like 3.5, 5, 12.5, 17.5, 25 and 30 and non modular sizes. Various sizes, class designation and tolerances have been taken on the basis of IS 13757 that is for Burnt clay fly ash building bricks.

The composition of the Committee responsible for formulation of this standard is given in Annex A.

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 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.
(Page 1, clause 2) — Delete the entry ‘3812 : 1981’ along with its title.

(Page 1, clause 2) — Insert the following at the end:

‘15648 : 2006 Pulverized fuel ash for lime pozzolana mixture applications — Specification’

(Page 2, clause 6.1) — Substitute the following for the existing:

‘6.1 Pulverized Fuel Ash

Pulverized fuel ash shall conform to IS 15648.’
1 SCOPE

This standard lays down the requirements for classification, general quality, dimensions and physical requirements of pulverized fuel ash-lime bricks used in buildings.

NOTE — Pulverized fuel ash-lime bricks having wet compressive strength less than 30 N/mm² approximately 300 kgf/cm² are covered in this standard and for higher strength (see IS 2180 and IS 1077).

2 REFERENCES

The following Indian Standards contain provisions which, through reference in this text, constitute provision 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 the standards indicated below:

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>712:1984</td>
<td>Specification for building limes (third revision)</td>
</tr>
<tr>
<td>1727:1967</td>
<td>Methods of test for pozzolanic materials (first revision)</td>
</tr>
<tr>
<td>3495</td>
<td>Methods of tests of burnt clay building bricks:</td>
</tr>
<tr>
<td>(Part 1): 1992</td>
<td>Determination of compressive strength (second revision)</td>
</tr>
<tr>
<td>(Part 2): 1992</td>
<td>Determination of water absorption (second revision)</td>
</tr>
<tr>
<td>3812:1981</td>
<td>Specification for fly ash for use as pozzolana and admixture (first revision)</td>
</tr>
<tr>
<td>4139:1989</td>
<td>Specification for calcium silicate bricks (second revision)</td>
</tr>
<tr>
<td>5454:1978</td>
<td>Methods for sampling of clay burnt building bricks (first revision)</td>
</tr>
</tbody>
</table>

3 GENERAL REQUIREMENTS

3.1 Visually the bricks shall be sound, compact and uniform in shape. The bricks shall be free from visible cracks, warpage and organic matters.

3.2 The bricks shall be solid and with or without frog 10 to 20 mm deep on one of its flat side. The shape and size of the frog shall conform to either Fig. 1A or Fig. 1B.

3.3 In case of non-modular size of bricks, frog dimensions shall be the same as for modular size bricks.

3.4 Hand-moulded bricks of 90 mm or 70 mm height shall be moulded with a frog 10 to 20 mm deep on one of its flat sides; the shape and size of the frog shall conform to either Fig. 1A or Fig. 1B (see 5.1.1 for L, W and H). Bricks of 40 or 30 mm height as well as those made by extrusion process may not be provided with frogs.

3.5 The bricks shall have smooth rectangular faces with sharp corners and shall be uniform in shape and colour.

All dimensions in millimetres.

FIG. 1 SHAPE AND SIZE OF FROGS IN BRICKS
4 CLASSIFICATION

4.1 Pulverized fuel ash-lime bricks shall be classified on the basis of average wet compressive strength as given in Table 1.

Table 1 Classes of Pulverized Fuel Ash-Lime Bricks

<table>
<thead>
<tr>
<th>Class Designation</th>
<th>Average Wet Compressive Strength not Less Than</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N/mm² kgf/cm² (Approx)</td>
</tr>
<tr>
<td>(1)</td>
<td>(2) (3)</td>
</tr>
<tr>
<td>30</td>
<td>30.0 (300)</td>
</tr>
<tr>
<td>25</td>
<td>25.0 (250)</td>
</tr>
<tr>
<td>20</td>
<td>20.0 (200)</td>
</tr>
<tr>
<td>17.5</td>
<td>17.5 (175)</td>
</tr>
<tr>
<td>15</td>
<td>15.0 (150)</td>
</tr>
<tr>
<td>12.5</td>
<td>12.5 (125)</td>
</tr>
<tr>
<td>10</td>
<td>10.0 (100)</td>
</tr>
<tr>
<td>7.5</td>
<td>7.5 (75)</td>
</tr>
<tr>
<td>5</td>
<td>5.0 (50)</td>
</tr>
<tr>
<td>3.5</td>
<td>3.5 (35)</td>
</tr>
</tbody>
</table>

5 DIMENSIONS AND TOLERANCES

5.1 Dimensions

5.1.1 The standard modular sizes of pulverized fuel ash-lime bricks shall be as follows (see Fig. 1A and 1B):

<table>
<thead>
<tr>
<th>Length (L)</th>
<th>Width (W)</th>
<th>Height (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>190</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>190</td>
<td>90</td>
<td>40</td>
</tr>
</tbody>
</table>

5.1.2 The following non-modular sizes of the bricks may also be used (see Fig. 1A and Fig. 1B):

<table>
<thead>
<tr>
<th>Length (L)</th>
<th>Width (W)</th>
<th>Height (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>230</td>
<td>110</td>
<td>70</td>
</tr>
<tr>
<td>230</td>
<td>110</td>
<td>30</td>
</tr>
</tbody>
</table>

5.1.2.1 For obtaining proper bond arrangement and modular dimensions for the brickwork, with the non-modular sizes, the following sizes of the bricks may also be used:

<table>
<thead>
<tr>
<th>Length (L)</th>
<th>Width (W)</th>
<th>Height (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>70</td>
<td>110</td>
<td>70 1/3 length brick</td>
</tr>
<tr>
<td>230</td>
<td>50</td>
<td>70 1/2 width brick</td>
</tr>
</tbody>
</table>

5.2 Tolerances

The dimensions of bricks when tested in accordance with 5.2.1 shall be within the following limits per 20 bricks:

a) For Modular Size

<table>
<thead>
<tr>
<th>Length (L)</th>
<th>Width (W)</th>
<th>Height (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3720 to 3880 mm (3800 ± 80 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1760 to 1840 mm (1800 ± 40 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1760 to 1840 mm (1800 ± 40 mm)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) For Non-modular Size

<table>
<thead>
<tr>
<th>Length (L)</th>
<th>Width (W)</th>
<th>Height (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4520 to 4680 mm (4600 ± 80 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2160 mm to 2240 (2200 ± 40 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1360 mm to 1440 (1400 ± 40 mm)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.2.1 Twenty (or more according to the size of stack) whole bricks shall be selected at random from the sample selected under 8. All blisters, loose particles of clay and small projections shall be removed. They shall then be arranged upon a level surface successively as indicated in Fig. 2A, 2B and 2C in contact with each other and in a straight line. The overall length of the assembled bricks shall be measured with a steel tape or other suitable inextensible measure sufficiently long to measure the whole row at one stretch. Measurement by repeated application of short rule or measure shall not be permitted. If, for any reason it is found impracticable to measure bricks in one row, the sample may be divided into rows of 10 bricks each which shall be measured separately to the nearest millimetre. All these dimensions shall be added together.

NOTE — By the agreement between the purchaser and the manufacturer pulverized fuel ash-lime bricks may be manufactured in other sizes also. The tolerance requirements of length, width and height shall remain the same as given above.

6 MATERIALS

6.1 Pulverized Fuel Ash (Commonly Known as Fly Ash)

Pulverized fuel ash commonly known as fly ash shall conform to Grade 1 or Grade 2 of IS 3812.

6.2 Bottom Ash

Bottom ash used as replacement of sand shall not have more than 12 percent loss on ignition when tested according to IS 1727.
6.3 Sand
Deleterious materials, such as clay and silt in sand, shall preferably be less than 5 percent.

6.4 Lime
Lime shall conform to Class C hydrated lime of IS 712.

6.5 Additives
Any suitable additive considered not detrimental to the durability of the bricks such as gypsum, cement, etc., may be used.

7 PHYSICAL CHARACTERISTICS

7.1 Compressive Strength
The minimum average wet compressive strength of pulverized fuel ash-lime bricks shall not be less than the one specified for each class in 4.1 when tested as described in IS 3495 (Part 1). The wet compressive strength of any individual brick shall not fall below the minimum average wet compressive strength specified for the corresponding class of bricks by more than 20 percent.

NOTE — In case any of the test results of wet compressive strength exceed the upper limit for the class, the same shall be limited to the upper limit of the class for the purpose of averaging.

7.2 Drying Shrinkage
The average drying shrinkage of the bricks when tested by the method described in IS 4139, being the average of three units, shall not exceed 0.15 percent.

7.3 Efflorescence Test
The bricks 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 12.5 and 'slight' for higher classes.

7.4 Water Absorption
The bricks, when tested in accordance with the procedure laid down in IS 3495 (Part 2), after immersion in cold water for 24 h, shall have average water absorption not more than 20 percent by mass up to class 12.5 and 15 percent by mass for higher classes.

8 SAMPLING AND CRITERIA FOR CONFORMITY

8.1 Sampling and criteria for conformity of the bricks shall be as given in IS 5454.

9 MARKING

9.1 Each brick shall be marked in a suitable manner with the manufacturer's identification mark or initials.

9.2 BIS Certification Marking
The bricks may also be marked with the Standard Mark.

9.2.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.
ANNEX A
(Foreword)

COMMITTEE COMPOSITION

Building Limes and Lime Products Sectional Committee, CED 4

Organization

Central Building Research Institute, Roorkee
Ansal Properties and Industries Ltd, New Delhi
Building Material and Technology Promotion Council, New Delhi
Central Building Research Institute, Roorkee (UP)
Central Public Works Department, New Delhi
Central Road Research Institute, New Delhi
Central Soil and Materials Research Station, New Delhi
Department of Mines and Geology, Government of Rajasthan, Udaipur
Dyerslime and Chemicals Pvt Ltd, Delhi
Fly Ash Mission, Department of Science and Technology, New Delhi
Gujarat Engineering Research Institute, Vadodara (Gujarat)

Housing and Urban Development Corporation, New Delhi
Khadi and Village Industries Commission, Mumbai
Lime Manufacturers Association of India, Delhi
Lime Manufacturer Association of Doon Valley, Dehra Dun (Uttaranchal)
Ministry of Environment and Forests, Government of India, New Delhi
National Council for Cement and Building Materials, Ballabgarh (Haryana)
National Test House, Kolkata/Ghaziabad (U.P.)
Office of the Development Commissioner (SSI), Ministry of Industry, New Delhi
Rajasthan Housing Board, Jaipur (Rajasthan)
Regional Engineering College, Warangal, Andhra Pradesh
Research, Designs and Standards Organization (Ministry of Railways), Lucknow (U.P.)

BIS Directorate General

Representative(s)

Dr. C. L. Verma (Chairman)

Shri Karan Kumar Mahajan
Shri Ashok Dalwani (Alternate)

Shri J. Sengupta
Shri V. K. Sethi (Alternate)

Shri R. L. Gupta
Shri S. K. Malhotra (Alternate)

Suptd. Engineer (S&S)
Executive Engineer (S&S) (Alternate)

Shri Satinder Kumar

Shri S. S. Suri
Shri Murari Ratnam (Alternate)

Shri S. G. Bohra
Shri G. L. Vyas (Alternate)

Shri N. Macedo

Shri Vimal Kumar
Shri Mukesh Mathur (Alternate)

Chief Engineer
Research Officer (Material Testing Division) (Alternate)

Shri S. K. Tanuja
Shri D. P. Singh (Alternate)

Deputy Chief Executive Officer
Director (Limes) (Alternate)

Shri A. K. Johar
Shri S. P. Gujral (Alternate)

Shri Harish Marwah

Dr. R. R. Khan
Dr. M. A. Hague (Alternate)

Dr. K. M. Sharma
Dr. M. M. Ali (Alternate)

Shri D. K. Kanungo
Shri R. Kapoor (Alternate)

Shri A. S. Sood
Shri K. Jaichandran (Alternate)

Shri S. C. Sharma

Prof. D. Gangadharan

Deputy Director Standards (B&F)
Assistant Design Engineer (B&F) (Alternate)

Shri S. K. Jain, Director and Head (Civ Engg)
[Representing Director General (Ex-officio Member)]

Member-Secretary

Shri R. K. Gupta
Joint Director (Civ Engg), BIS
Bureau of Indian Standards

BIS is a statutory institution established under the Bureau of Indian Standards Act, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc : No. CED 4 (6005).

<table>
<thead>
<tr>
<th>Amend No.</th>
<th>Date of Issue</th>
<th>Text Affected</th>
</tr>
</thead>
</table>

BUREAU OF INDIAN STANDARDS

Headquarters:
Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones: 323 01 31, 323 33 75, 323 94 02

Regional Offices:
Central: Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002
Telephones: 323 76 17, 323 38 41

Eastern: 1/14 C. I. T. Scheme VII M, V. I. P. Road, Kankurgachi
KOLKATA 700 054
Telephones: 337 84 99, 337 85 61, 337 86 26, 337 91 20

Northern: SCO 335-336, Sector 34-A, CHANDIGARH 160 022
Telephones: 60 38 43, 60 20 25

Southern: C. I. T. Campus, IV Cross Road, CHENNAI 600 113
Western: Manakalaya, E9 MIDC, Marol, Andheri (East)
Mumbai 400 093

Branches: AHMADABAD, BANGALORE, BHOPAL, BHUBANESHWAR, COIMBATORE,
FARIDABAD, GHAZIABAD, GUWAHATI, HYDERABAD, JAIPUR, KANPUR,
LUCKNOW, NAGPUR, NALAGARH, PATNA, PUNE, RAJKOT, THIRUVANANTHAPURAM.

Printed at New India Printing Press, Khurja, India