

**Bangladesh Standard**

**Specification for Common Building Clay Bricks  
(4<sup>th</sup> Revision)**

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BWDB

**ICS 91.100.25**



**BANGLADESH STANDARDS AND TESTING INSTITUTION**  
**MINISTRY OF INDUSTRIES**  
**MAAN BHABAN, 116-A, TEJGAON INDUSTRIAL AREA**  
**DHAKA-1208, BANGLADESH**



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## BDS 208:2022

### Foreword

This Bangladesh Standard (4<sup>th</sup> Revision) was adopted by the Bangladesh Standards and Testing Institution on 30.05.2022 after the draft had been finalized by the Bricks, Blocks, Tiles, Paving Materials and Related Products Sectional Committee and approved by the Engineering (Civil) Divisional Committee.

This Bangladesh Standard cancels and replaces BDS 208:2009 (3<sup>rd</sup> Revision).

In the preparation of this standard assistance has been derived from IS 1077, IS 5454, ASTM C 62 and ASTM C 67 and assistance so derived is acknowledged herein with thanks

This standard is subject to periodical reviews and amendments, if necessary, in order to keep pace with the latest industrial and technological innovations. Any suggestions for improvement will be recorded and placed before the Committee in due course.

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 BDS 103. The number of significant places retained in the rounded off value should be the same as that of the specified value in the standard.

## Bangladesh Standard

### Specification for Common Building Clay Bricks (4<sup>th</sup> Revision)

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## Bangladesh Standard

## SPECIFICATION FOR COMMON BUILDING CLAY BRICKS

## Fourth Revision

**1. SCOPE**

This standard lays down requirements for dimensions, strength and quality of common burnt clay building bricks.

**2. TERMINOLOGY**

For the purpose of this standard following definitions shall apply.

**2.1 Bricks**

The burnt clay building bricks which are commonly used in building and civil engineering construction purposes.

**3. DIMENSIONS**

3.1 Size- The standard dimensions of common burnt clay bricks shall be of following:

**TABLE 1: SIZE OF BRICKS**

|                |         |
|----------------|---------|
| Length         | 24 cm   |
| Width          | 11.5 cm |
| Height / Depth | 7 cm    |

NOTE 1— One bedding face of each brick shall have a recess or panel frog. The size of the recess or panel frog for the standard brick shall not exceed 15cm x 5cm x 1cm, Fig. 1. No part of the recess or panel frog shall be less than 2 (two) cm from any edge of the brick. This provision would not apply to brick manufactured by extrusion process or any special bricks required by the purchaser.

3.2 Variation - Small variation in the dimension shall be permissible to the following extent only:

**TABLE 2: MAXIMUM PERMISSIBLE VARIATION**

| Specified Dimension         | Maximum Permissible Variation |
|-----------------------------|-------------------------------|
| Over 5 cm and up to 7.5 cm  | ± 2.0mm                       |
| Over 7.5 cm and up to 10 cm | ± 3.0mm                       |
| Over 10 cm and up to 15 cm  | ± 5.0mm                       |
| Over 15 cm and up to 20 cm  | ± 6.0mm                       |
| Over 20 cm and up to 25 cm  | ± 7.0mm                       |

**4. CLASSIFICATION**

Three grades of bricks have been incorporated based on their compressive strength properties. These will include reasonable variation in the quality of clays available locally.

**TABLE 3: CLASSIFICATION OF BRICKS**

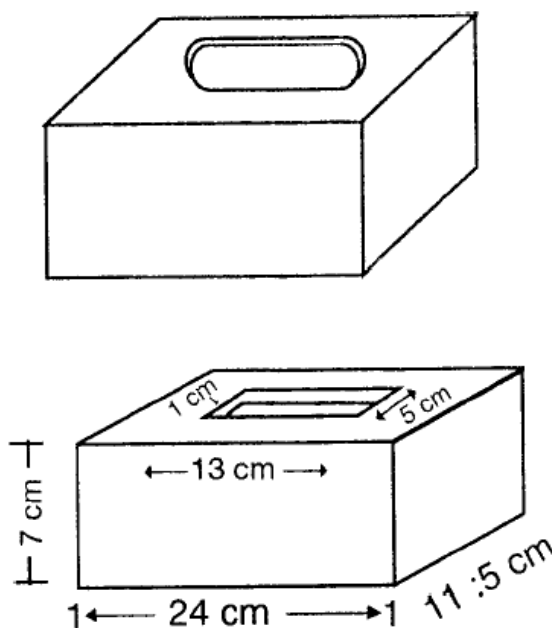
| Grade | Mean for five halved bricks (Minimum) | Minimum for individual halved bricks |
|-------|---------------------------------------|--------------------------------------|
| S     | 27.6 MPa (4000 psi)                   | 24.1 MPa (3500 psi)                  |
| A     | 17.3 MPa (2500 psi)                   | 15.2 MPa (2200 psi)                  |
| B     | 13.8 MPa (2000 psi)                   | 11.7 MPa (1700 psi)                  |

**Grade S:** This type of bricks may be used where very long durability (over 100 years) is required or where the structure may be exposed to corrosive environment or for making coarse aggregate for concrete.

**Grade A:** This type of bricks may be used for general purposes.

**Grade B:** This type of bricks may be used for temporary structure where intended durability is not more than 15 years.

NOTE 2 —Grade A type of bricks may be considered as first class bricks and Grade B type of bricks may be considered as second class bricks.

**Fig. 1**

## 5. WATER ABSORPTION

Cold water absorption (24-h submersion) by weight shall not exceed 20% for bricks of B grade, 15% for bricks of A grade and 10% for bricks of S grade.

## 6. SAMPLING

**6.1 Selection and Preparation of Test Specimens**—For the purpose of these tests, full-size brick units shall be selected by the purchaser or by the purchaser's authorized representative. Specimens shall be representative of the lot of units from which they are selected and shall include specimens' representative of the complete range of colors, textures, and sizes. Specimens shall be free of or brushed to remove dirt, mud, mortar, or other foreign materials unassociated with the manufacturing process. Brushes used to remove foreign material shall have bristles of plastic (polymer) or horsehair. Wire brushes shall not be used for preparing specimens for testing. Specimens exhibiting foreign material that is not removed by brushing shall be discarded to ensure that damaged or contaminated specimens are not tested.

**6.2 Number of Specimens:** For the modulus of rupture, compressive strength, abrasion resistance, and absorption determinations, at least ten individual brick shall be selected for lots of 1000000 brick or fraction thereof. For larger lots, five additional specimens shall be selected from each additional 500000 brick or fraction thereof. Additional specimens are taken at the discretion of the purchaser.

**6.3 Identification**— Each specimen shall be marked so that it is identifiable at any time. Markings shall cover not more than 5% of the superficial area of the specimen.

## 7. SPECIMEN PREPARATION

### 7.1 Drying and Cooling:

**7.1.1 Drying**— Dry the test specimens in a ventilated oven at 105 to 115°C for not less than 24 h and until two successive weighing at intervals of 2 h show an increment of loss not greater than 0.2 % of the last previously determined weight of the specimen.

**7.1.2 Cooling**— After drying, cool the specimens in a drying room maintained at a temperature of 24±8°C with a relative humidity between 30 and 70%. Store the units free from drafts, unstacked, with separate placement, for a period of at least 4 h and until the surface temperature is within 2.8°C of the drying room temperature. Do not use specimens noticeably warm to the touch for any test requiring dry units. The specimens shall be stored in the drying room with the required temperature and humidity maintained until tested.

7.1.2.1 An alternative method of cooling the specimens to approximate room temperature is permitted as follows: Store units, unstacked, with separate placement, in a ventilated room maintained at a temperature of  $24 \pm 8^\circ\text{C}$ , with a relative humidity between 30 and 70% for a period of 4 h and until the surface temperature is within  $2.8^\circ\text{C}$  of the ventilated room temperature, with a current of air from an electric fan passing over them for a period of at least 2 hours. The specimens shall be stored in the ventilated room with the required temperature and humidity maintained until tested.

#### 7.2 Weight Determination:

7.2.1 Weigh five full size specimens that have been dried and cooled (see 7.1). The scale or balance used shall have a capacity of not less than 3000 g and shall be sensitive to 0.5 g.

7.2.2 Report results separately for each specimen to the nearest 0.1 g, with the average of all specimens tested to the nearest 0.1 g.

7.3 *Removal of Silicone Coatings from Brick Units*—The silicone coatings intended to be removed by this process, are any of the various polymeric organic silicone compounds used for water-resistant coatings of brick units. Heat the brick at  $510 \pm 28^\circ\text{C}$  in an oxidizing atmosphere for a period of not less than 3 hours. The rate of heating and cooling shall not exceed  $149^\circ\text{C}$  per hour.

NOTE 3—Additional specimen preparation requirements for specific tests are indicated in the individual test methods.

### 8. MODULUS OF RUPTURE (FLEXURE TEST)

8.1 *Test Specimens*—Test specimens shall consist of whole full-size unit that have been dried and cooled (see 7.1). Five such specimens shall be tested.

#### 8.2 Procedure:

8.2.1 Support the test specimen flatwise unless specified and reported otherwise (that is, apply the load in the direction of the depth of the unit) on a span approximately 25 mm less than the basic unit length and loaded at midspan. Specimens having recesses (panels or depressions) shall be placed so that such recesses are on the compression side. Apply the load to the upper surface of the specimen through a steel bearing plate 6 mm in thickness and 38 mm in width and of a length at least equal to the width of the specimen.

8.2.2 Make sure the supports for the test specimen are free to rotate in the longitudinal and transverse directions of the test specimen and adjust them so that they will exert no force in these directions.

8.2.3 *Speed of Testing*—The rate of loading shall not exceed 9000 N/min. This requirement is considered as being met when the speed of the moving head of the testing machine immediately prior to application of the load is not more than 1.25 mm/min.

#### 8.3 Calculation and Report:

8.3.1 Calculate and report the modulus of rupture of each specimen to the nearest 0.01 MPa [1 psi] as follows:

$$S = 3W(l/2 - x)/bd^2 \quad (1)$$

Where:

$S$  = modulus of rupture of the specimen at the plane of failure, Pa [ $\text{lb}/\text{in}^2$ ],

$W$  = maximum load indicated by the testing machine, N [ $\text{lb}_f$ ],

$l$  = distance between the supports, mm [ $\text{in.}$ ],

$b$  = net width, (face to face minus voids), of the specimen at the plane of failure, mm [ $\text{in.}$ ],

$d$  = depth, (bed surface to bed surface), of the specimen at the plane of failure, and

$x$  = average distance from the midspan of the specimen to the plane of failure measured in the direction of the span along the centerline of the bed surface subjected to tension, mm [ $\text{in.}$ ]

8.3.2 Calculate and report the average of the modulus of rupture determinations to the nearest 0.01 MPa [1 psi].

### 9. COMPRESSIVE STRENGTH TEST

#### 9.1 Test Specimens:

9.1.1 *Brick*—The test specimens shall consist of half brick units that have been dried and cooled (see 7.1), the full height and width of the unit, with a length equal to one half the full length of the unit  $\pm 25$  mm, except as described below.

When the test specimen, described above, exceeds the testing machine capacity, the test specimens shall consist of dry pieces of brick, the full height and width of the unit, with a length not less than one quarter of the full length of the unit, and with a gross cross-sectional area perpendicular to bearing not less than 90 cm<sup>2</sup>. Test specimens shall be obtained by any method that will produce, without shattering or cracking, a specimen with approximately plane and parallel ends. Five specimens shall be tested.

## 9.2 Capping Test Specimens:

9.2.1 All specimens shall be dry and cool within the meaning of 7.1.1 and 7.1.2 before any portion of the capping procedure is carried out.

9.2.2 Fill recessed or paneled surfaces that will become bearing surfaces during the compression test with a mortar composed of 1 part by weight of cement conforming to the requirements for BDS EN 197-1, and 2 parts by weight of sand. Age the specimens at least 48 h before capping them. Where the recess exceed 12.5 mm, use a brick or tile slab section or metal plate as a core fill. Cap the test specimens using one of the two procedures described in 9.2.3 and 9.2.4.

9.2.3 *Gypsum Capping*—Coat the two opposite bearing surfaces of each specimen with shellac and allow drying thoroughly. Bed one of the dry shellacked surfaces of the specimen in a thin coat of neat paste of calcined gypsum (plaster of paris) that has been spread on an oiled non absorbent plate, such as glass or machined metal. The casting surface plate shall be plane within 0.1 mm in 400mm and sufficiently rigid; and so supported that it will not be measurably deflected during the capping operation. Lightly coat it with oil or other suitable material. Repeat this procedure with the other shellacked surface. Take care that the opposite bearing surfaces so formed will be approximately parallel and perpendicular to the vertical axis of the specimen and the thickness of the caps will be approximately the same and not exceeding 3 mm. Age the caps at least 24 h before testing the specimens.

NOTE 4—A rapid-setting industrial type gypsum is frequently used for capping.

9.2.4 *Sulfur-Filler Capping*—Use a mixture containing 40 to 60 weight % sulfur, the remainder being ground fire clay or other suitable inert material passing a No. 100 [150-μm] sieve with or without plasticizer. The casting surface plate requirements shall be as described in 9.2.3. Place four 25-mm square steel bars on the surface plate to form a rectangular mold approximately 12.5 mm greater in either inside dimension than the specimen. Heat the sulfur mixture in a thermostatically controlled heating pot to a temperature sufficient to maintain fluidity for a reasonable period of time after contact with the surface being capped. Take care to prevent overheating, and stir the liquid in the pot just before use. Fill the mold to a depth of 6 mm with molten sulfur material. Place the surface of the unit to be capped quickly in the liquid, and hold the specimen so that its vertical axis is at right angles to the capping surface. The thickness of the caps shall be approximately the same. Allow the unit to remain undisturbed until solidification is complete. Allow the caps to cool for a minimum of 2 h before testing the specimens.

## 9.3 Procedure:

9.3.1 Test brick specimens flatwise (that is, the load shall be applied perpendicular to the bed surface of the brick with the brick in the stretcher position). Center the specimens under the spherical upper bearing within 2 mm.

9.3.2 The testing machine shall conform to the requirements of Practices BDS ASTM E4.

9.3.3 The upper bearing shall be a spherically seated, hardened metal block firmly attached at the center of the upper head of the machine. The center of the sphere shall lie at the center of the surface of the block in contact with the specimen. The block shall be closely held in its spherical seat, but shall be free to turn in any direction, and its perimeter shall have at least 6 mm clearance from the head to allow for specimens whose bearing surfaces are not exactly parallel. The diameter of the bearing surface shall be at least 125 mm. Use a hardened metal bearing block beneath the specimen to minimize wear of the lower platen of the machine. The bearing block surfaces intended for contact with the specimen shall have hardness not less than HB 650 (HRC60). These surfaces shall not depart from plane surfaces by more than 0.03 mm. When the bearing area of the spherical bearing block is not sufficient to cover the area of the specimen, place a steel plate with surfaces machined to true planes within ±0.03 mm, and with a thickness equal to at least one third of the distance from the edge of the spherical bearing to the most distant corner between the spherical bearing block and the capped specimen.

9.3.4 *Speed of Testing*—Apply the load, up to one half of the expected maximum load, at any convenient rate, after which, adjust the controls of the machine so that the remaining load is applied at a uniform rate in not less than 1 nor more than 2 min.



**9.4 Calculation and Report:**

9.4.1 Calculate and report the compressive strength of each specimen to the nearest 70 kPa [10 psi] as follows:

Compressive strength,  $C = W/A$  (2)

Where:

$C$  = compressive strength of the specimen, kg/cm<sup>2</sup> [or lb/in.<sup>2</sup>] [or MPa],

$W$  = maximum load, kgf, [or lbf] [or N], indicated by the testing machine, and

$A$  = average of the gross areas of the upper and lower bearing surfaces of the specimen, cm<sup>2</sup> [or in<sup>2</sup>].

9.4.2 Calculate and report the average of the compressive strength determinations to the nearest 70 kPa [10 psi].

**10. DETERMINATION OF WATER ABSORPTION****10.1 Accuracy of Weighing:**

10.1.1 The scale or balance used shall have a capacity of not less than 2000 g, and shall be sensitive to 0.5 g.

**10.2 Test Specimens:**

10.2.1 The test specimens shall consist of half brick conforming to the requirements of 9.1.1. Five specimens shall be tested.

**10.3 5-h and 24-h Submersion Tests:****10.3.1 Procedure:**

10.3.1.1 Dry and cool the test specimens in accordance with 7.1 and weigh each one in accordance with 7.2.

10.3.1.2 *Saturation*—Submerge the dry, cooled specimen, without preliminary partial immersion, in clean water (soft, distilled or rain water) at for the specified time. Remove the specimen, wipe off the surface water with a damp cloth and weigh the specimen. Complete weighing of each specimen within 5 min after removing the specimen from the bath.

**10.3.2 Calculation and Report:**

10.3.2.1 Calculate and report the cold water absorption of each specimen to the nearest 0.1 % as follows:

Absorption, % =  $100 (W_s - W_d)/W_d$  (3)

Where:

$W_d$  = dry weight of the specimen, and

$W_s$  = saturated weight of the specimen after submersion in cold water.

10.3.2.2 Calculate and report the average cold water absorption of all specimens to the nearest 0.1 %.

**10.4 1-h, 2-h, and 5-h Boiling Tests:**

10.4.1 *Test Specimens*—The test specimens shall be the same five specimens used in the 5-h or 24-h cold-water submersion test where required and shall be used in the state of saturation existing at the completion of that test.

10.4.1.1 Dry and cool the test specimens in accordance with 7.1 when performing the boiling water absorption test without previously conducting the cold water absorption test.

**10.4.2 Procedure:**

10.4.2.1 Return the specimen that has been subjected to the cold-water submersion to the bath, and subject it to the boiling test as described in 10.4.2.2.

10.4.2.2 Submerge the specimen in clean water (soft, distilled or rain water) at 15.5 to 30°C in such a manner that water circulates freely on all sides of the specimen. Heat the water to boiling, within 1 h, boil continuously for specified time, and then allow to cool to 15.5 to 30°C by natural loss of heat. Remove the specimen, wipe off the surface water with a damp cloth, and weigh the specimen. Complete weighing of each specimen within 5 min after removing the specimen from the bath.

10.4.2.3 When the tank is equipped with a drain so that water at 15.5 to 30°C passes through the tank continuously and at such a rate that a complete change of water takes place in not more than 2 min, make weighing's at the end of 1 hour.

**10.4.3 Calculation and Report:**

10.4.3.1 Calculate and report the boiling water absorption of each specimen to the nearest 0.1 % as follows:

Absorption, % =  $100 (W_b - W_d)/W_d$  (4)

Where:

$W_d$  = dry weight of the specimen, and

$W_b$  = saturated weight of the specimen after submersion in boiling water.

10.4.3.2 Calculate and report the average boiling water absorption of all specimens to the nearest 0.1 %.

### 10.5 Saturation Coefficient:

10.5.1 Calculate and report the saturation coefficient of each specimen to the nearest 0.01 as follows:

$$\text{Saturation coefficient} = (W_{c(24)} - W_d) / (W_{b(5)} - W_d) \quad (5)$$

Where:

$W_d$  = dry weight of the specimen,

$W_{c(24)}$  = saturated weight of the specimen after 24-h submersion in cold water, and

$W_{b(5)}$  = saturated weight of the specimen after 5-h submersion in boiling water.

10.5.2 Calculate and report the average saturation coefficient of all specimens to the nearest 0.01.

## 11. INITIAL RATE OF ABSORPTION (SUCTION) (LABORATORY TEST)

### 11.1 Apparatus:

11.1.1 *Trays or Containers*—Watertight trays or containers, having an inside depth of not less than 12.5 mm, and of such length and width that an area of not less than 2000 cm<sup>2</sup> of water surface is provided. The bottom of the tray shall provide a plane, horizontal upper surface, when suitably supported, so that an area not less than 200 mm in length by 150 mm in width will be level when tested by a spirit level.

11.1.2 *Supports for Brick*—Two non-corrodible metal supports consisting of bars between 125 and 150 mm in length, having triangular, half-round, or rectangular cross sections such that the thickness (height) will be approximately 6 mm. The thickness of the two bars shall agree within 0.03 mm and, when the bars are rectangular in cross section, their width shall not exceed 8 mm.

11.1.3 *Means for Maintaining Constant Water Level*—Suitable means for controlling the water level above the upper surface of the supports for the brick within  $\pm 0.25$  mm (see Note 4), including means for adding water to the tray at a rate corresponding to the rate of removal by the brick undergoing test (see Note 5). For use in checking the adequacy of the method of controlling the rate of flow of the added water, a reference brick or half brick shall be provided whose displacement in 3 mm of water corresponds to the brick or half brick to be tested within  $\pm 2.5$  %. Completely submerge the reference brick in water for not less than 3 h preceding its use.

NOTE 5—A suitable means for obtaining accuracy in control of the water level is provided by attaching to the end of one of the bars two stiff metal wires that project upward and return, terminating in points; one of which is 3.00  $\pm$  0.25 mm and the other 3.00  $\pm$  0.25 mm above the upper surface or edge of the bar. Such precise adjustment is obtainable by the use of depth plates or a micrometer microscope. When the water level with respect to the upper surface or edge of the bar is adjusted so that the lower point dimples the water surface when viewed by reflected light and the upper point is not in contact with the water, the water level is within the limits specified. Any other suitable means for fixing and maintaining a constant depth of immersion shall be permitted when equivalent accuracy is obtained. An example of such other suitable means is the use of rigid supports movable with respect to the water level.

NOTE 6—A rubber tube leading from a siphon or gravity feed and closed by a spring clip will provide a suitable manual control. The so-called “chicken-feed” devices as a rule lack sensitivity and do not operate with the very small changes in water level permissible in this test.

11.1.4 *Balance*, having a capacity of not less than 3000 g, and sensitive to 0.5 g.

11.1.5 *Drying Oven* that provides a free circulation of air through the oven and is capable of maintaining a temperature between 105 and 115°C.

11.1.6 *Timing Device*—A suitable timing device, preferably a stop watch or stop clock, which shall indicate a time of 1 min to the nearest 1 s.

11.2 *Test Specimens*, consisting of whole brick. Five specimens shall be tested.

### 11.3 Procedure:

11.3.1 The initial rate of absorption shall be determined for the test specimen as specified, either oven-dried or ambient air-dried. When not specified, the initial rate of absorption shall be determined for the test specimens oven-dried. Dry and cool the test specimens in accordance with the applicable procedures 11.3.1.1 or 11.3.1.2. Complete the test procedure in accordance with 11.3.2, 11.3.3, and 11.3.4.

NOTE 7—There is no correlated relationship between the value of initial rate of absorption for ambient air-dried and oven-dried units. The test methods provide different information.

11.3.1.1 *Oven-dried Procedure*—Dry and cool the test specimens in accordance with 7.1.

11.3.1.2 *Ambient Air-dried Procedure*—Store units unstacked, with separate placement in a ventilated room maintained at a temperature of  $24 \pm 8^{\circ}\text{C}$  with a relative humidity between 30 % and 70 % for a period of 4 h, with a current of air from an electric fan passing over them for a period of at least 2 hours. Continue until two successive weighing at intervals of 2 h show an increment of loss not greater than 0.2% of the last previously determined weight of the specimen.

11.3.2 Measure to the nearest 1.25 mm the length and width of the flatwise surface of the test specimen of rectangular units or determine the area of other shapes to similar accuracy that will be in contact with the water. Weigh the specimen to the nearest 0.5 g.

11.3.3 Adjust the position of the tray for the absorption test so that the upper surface of its bottom will be level when tested by a spirit level, and set the saturated reference brick (11.1.3) in place on top of the supports. Add water until the water level is  $3.00 \pm 0.25$  mm above the top of the supports.

11.3.4 After removal of the reference brick, set the test brick in place flatwise, counting zero time as the moment of contact of the brick with the water. During the period of contact ( $1 \text{ min} \pm 1 \text{ s}$ ) keep the water level within the prescribed limits by adding water as required. At the end of  $1 \text{ min} \pm 1 \text{ s}$ , lift the brick from contact with the water, wipe off the surface water with a damp cloth, and reweigh the brick to the nearest 0.5 g. Wiping shall be completed within 10 s of removal from contact with the water, and weighing shall be completed within 2 min.

NOTE 8 —Place the brick in contact with the water quickly, but without splashing. Set the brick in position with a rocking motion to avoid the entrapping of air on its under surface. Test brick with frogs or depressions in one flatwise surface with the frog or depression uppermost. Test molded brick with the struck face down.

#### 11.4 Calculation and Report:

11.4.1 The difference in weight in grams between the initial and final weighing is the weight in grams of water absorbed by the brick during 1-min contact with the water. When the area of its flatwise surface (length time's width) does not differ more than report, the gain in weight of each specimen shall be to the nearest 0.1 g, as its initial rate of absorption in 1 min.

11.4.2 When the area of its flatwise surface differs more than  $\pm 5 \text{ cm}^2$  ( $\pm 2.5 \%$ ) from  $200 \text{ cm}^2$ , calculate the equivalent gain in weight from  $200 \text{ cm}^2$  of each specimen to the nearest 0.1 g as follows:

$$X = 30 W/LB \text{ (metric } X = 200 W/LB) \quad (6)$$

Where,

$X$  = gain in weight corrected to basis of  $200 \text{ cm}^2$  flatwise area,

$W$  = actual gain in weight of specimen, g,

$L$  = length of specimen, cm, and

$B$  = width of specimen, cm.

11.4.3 Report the corrected gain in weight,  $X$ , of each specimen to the nearest 0.1 g, as the initial rate of absorption in 1 min.

11.4.4 When the test specimen is a cored brick, calculate the net area and substitute for  $LB$  in the equation given in 11.4.2. Report the corrected gain in weight,  $X$ , of each specimen to the nearest 0.1 g, as the initial rate of absorption in 1 min.

11.4.5 When the specimen is non-prismatic, calculate the net area by suitable geometric means and substitute for  $LB$  in the equation given in 11.4.2.

11.5 Calculate and report the average initial rate of absorption of all specimens tested to the nearest  $0.1 \text{ g/min}/200 \text{ cm}^2$ .

11.6 Report the method of drying as oven-dried (in accordance with 11.3.1.1) or ambient air-dried (in accordance with 11.3.1.2).

## 12. EFFLORESCENCE TEST

### 12.1 Apparatus:

12.1.1 *Trays and Containers*—Watertight shallow pans or trays made of corrosion-resistant metal or other material that will not provide soluble salts when in contact with distilled water containing leaching from brick. The pan shall be of such dimensions that it will provide not less than a 25-mm depth of water. Unless the pan provides an area such that the total volume of water is large in comparison with the amount evaporated each day, suitable apparatus shall be provided for keeping a constant level of water in the pan.

12.1.2 *Drying Room*, maintained at a temperature of  $24 \pm 8^\circ\text{C}$ , with a relative humidity between 30 and 70%, and free from drafts.

12.1.3 *Drying Oven that provides a free circulation of air through the oven and is capable of maintaining a temperature between 105 and 115°C*.

12.1.4 *Brush*, a soft-bristle brush.

### 12.2 Test Specimens:

12.2.1 The sample shall consist of ten full-size brick.

12.2.2 The ten specimens shall be sorted into five pairs so that both specimens of each pair are similar in appearance.

12.3 *Preparation of Specimens*—Remove by brushing any adhering dirt so as not to mistake it for efflorescence. Dry and cool the specimens in accordance with 7.1.

### 12.4 Procedure:

12.4.1 Set one specimen from each of the five pairs, on end, partially immersed in distilled water to a depth of approximately 25 mm for 7 days in the drying room. When several specimens are tested in the same container, separate the individual specimens by a spacing of at least 50 mm.

NOTE 9—Do not test specimens from different sources simultaneously in the same container, because specimens with a considerable content of soluble salts will contaminate salt-free specimens.

NOTE 10—Empty and clean the pans or trays after each test.

12.4.2 Store the second specimen from each of the five pairs in the drying room without contact with water.

12.4.3 At the end of 7 days, inspect the first set of specimens and then place both sets in the drying oven without contact with water for 24 hours.

12.5 *Examination and Rating*—After drying, examine and compare each pair of specimens, observing the top and all four faces of each specimen from a distance of 3 m under an illumination of not less than  $540 \text{ lm/m}^2$  by an observer with normal vision. When under these conditions no difference is noted, report the rating as “not effloresced.” When a perceptible difference due to efflorescence is noted under these conditions, report the rating as “effloresced.” Report the appearance and distribution of the efflorescence.

12.6 *Precision and Bias*—No information is presented about either the precision or bias of the test method for efflorescence because the test result is no quantitative.

## 13. MEASUREMENT OF SIZE

13.1 *Apparatus*—Either a gauge or caliper having a scale ranging from 25 to 300 mm, graduated in 0.05 mm divisions, and having parallel jaws, shall be used for measuring the individual units. Calipers of corresponding accuracy and size required shall be used for measurement of larger brick.

NOTE 11—It is common in both the manufacturing process and in the field to assess unit size using a steel rule. However, for determination of conformance to clay masonry unit standard specifications, the apparatus such as a scale or balance sensitive to within 0.2 % of the weight of the smallest specimen shall be used.

13.2 *Procedure*—Measure ten whole full-size units that have been dried and cooled (see 7.1). These units shall be representative of the lot and shall include the extremes of color range and size as determined by visual inspection. (It is permissible to use the same samples for determining efflorescence and other properties.)

13.3 *Individual Measurements of Width, Length, and Height*—Measure the width across both ends and both beds from the midpoints of the edges bounding the faces. Record these four measurements to the nearest 0.25 mm and record the average to the nearest 0.5 mm as the width. Measure the length along both beds and along both faces from the midpoints of the edges bounding the ends. Record these four measurements to the nearest 0.25 mm and record the average to the nearest 0.5 mm as the length. Measure the height across both faces and both ends from the midpoints of the edges bounding the beds. Record these four measurements to the nearest 0.25 mm and record the average to the nearest 0.5 mm as the height. Use the apparatus described in 13.1. Retest by the same method when required.

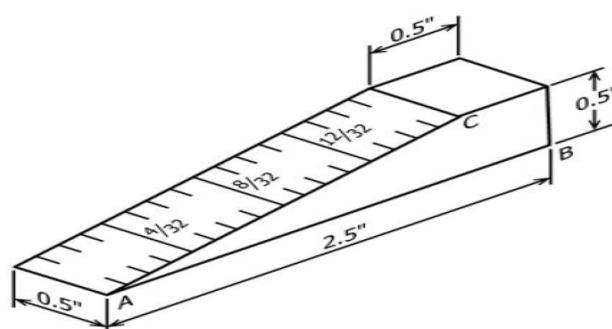
13.4 *Report*—Report the average width, length, and height of each specimen tested to the nearest 1.0 mm.

## 14. MEASUREMENT OF WARPAGE

### 14.1 *Apparatus:*

#### 14.1.1 *Steel Straightedge:*

14.1.2 *Rule or Measuring Wedge*—A steel rule graduated from one end in 1-mm [or 1/32-in.] divisions, or alternatively, a steel measuring wedge 60 mm [2.5 in.] in length by 12.5 mm [0.5 in.] in width by 12.5 mm [0.5 in.] in thickness at one end and tapered, starting at a line 12.5 mm [0.5 in.] from one end, to zero thickness at the other end. The wedge shall be graduated in 1-mm [or 1/32-in.] divisions and numbered to show the thickness of the wedge between the base, *AB*, and the slope, *AC*, Fig. 2.



**Fig. 2- Measuring Wedge**

14.1.3 *Flat Surface*, of steel or glass, not less than 300 by 300 mm [12 by 12 in.] and plane to within 0.025 mm [0.001 in.].

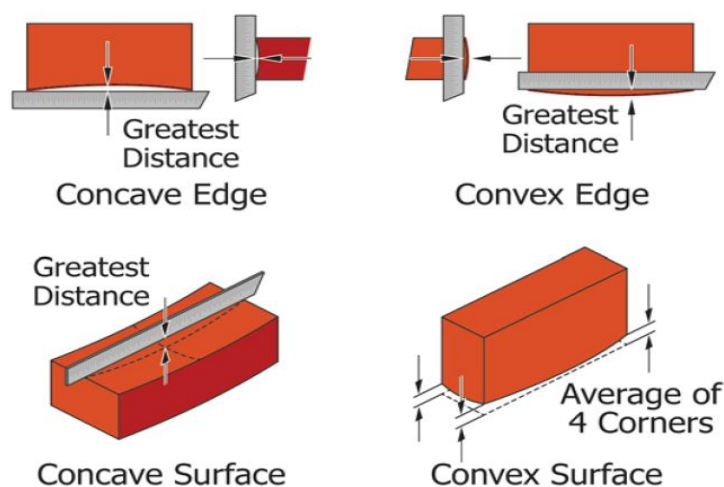
14.1.4 *Brush*, a soft-bristle brush.

14.2 *Sampling*—Use the sample of ten units selected for determination of size.

14.3 *Preparation of Samples*—Test the specimens as received, except remove any adhering dirt by brushing.

### 14.4 *Procedure:*

14.4.1 *Concave Surfaces*—Where the warpage to be measured of a surface and is concave, place the straight edge lengthwise or diagonally along the surface to be measured, selecting the location that gives the greatest departure from straightness. Select the greatest distance from the unit surface to the straightedge. With the help of the steel rule or wedge, measure this distance to the nearest 1 mm and record as the concave warpage of the surface. See Fig. 3.



**Fig. 3- Warpage Measurements**



14.4.2 *Concave Edges*—Where the warpage to be measured of an edge and is concave, place the straightedge between the ends of the concave edge to be measured. Select the greatest distance from the unit edge to the straightedge. With the help of the steel rule or wedge, measure this distance to the nearest 1 mm and record as the concave warpage of the edge.

14.4.3 *Convex Surfaces*—When the warpage to be measured of a surface and is convex, place the unit with the convex surface in contact with a plane surface and with the corners approximately equidistant from the plane surface. With the help of the steel rule or wedge, measure the distance to the nearest 1 mm of each of the four corners from the plane surface. Record the average of the four measurements as the convex warpage of the unit.

14.4.4 *Convex Edges*—Where the warpage to be measured of an edge and is convex, place the straightedge between the ends of the convex edge. Select the greatest distance from the unit edge to the straightedge. With the help of the steel rule or wedge, measure this distance to the nearest 1 mm and record as the convex warpage of the edge.

14.5 *Report*—Report all recorded warpage measurements of each specimen tested to the nearest 1 mm.

## 15. WORKMANSHIP AND FINISH

15.1 Molding and burning- Bricks shall be hand or machine molded, allowance shall be made for shrinkage in drying and burning. The bricks shall have rectangular plain faces with parallel sides' sharp straight right angled edges. This would not apply in strict sense to the special bricks for different shapes. The bricks shall be thoroughly burnt but not over or under burnt.

15.2 Appearance - The bricks shall be sound of compact structure, uniform in shape and colour true to pattern free from cracks, chips warps, twists, pebbles, nodules of line and other ingredients which may eventually affect the serviceability or strength or may cause staining.

NOTE 12- There are no special tests for checking the workmanship and finish of the bricks except for visual tests. The right angled edges and plain faces can however be observed with a steel tri-square.

15.3 Scale of sampling and Criteria for conformity for visual and dimensional characteristics.

15.3.1 The bricks shall be selected and inspected for each lot separately for ascertaining their conformity to the requirements of the relevant specification.

15.3.2 The number of bricks to be selected from a lot shall depend upon the size of the lot and shall be in accordance with Col. 1 and 2 of Table 3. All these bricks shall be selected following the methods detailed in Sec. 6.

**TABLE 4: SCALE OF SAMPLING FOR VISUAL AND DIMENSIONAL CHARACTERISTICS**

| No. of bricks in the lot | No. of bricks to be selected in the lot | Permissible number of defectives in the samples |
|--------------------------|---|---|
| 2001 to 10000            | 20                                      | 1   |
| 10 001 to 35000          | 32                                      | 2   |
| 35 001 to 50000          | 50                                      | 3   |

NOTE13- In case the lot contains 2000 or less bricks, the sampling shall be subject to agreement between the purchasers and the supplier.

15.3.3 All the bricks selected as in 15.3.2 shall be examined for visual and dimensional characteristics. If the number of defective bricks found in the sample is less than or equal to the corresponding number as specified in Col. 3 of Table 4, the lot shall be considered as satisfying the requirements of the visual and dimensional characteristics. However, if the number of defective brick in the sample is greater than the corresponding permissible number of defectives, the lot shall be deemed as not having met the visual and dimensional requirements.

15.4 Scale of sampling and criteria for conformity for requirements of compressive strength, water absorption, efflorescence and warpage.

15.4.1 The lot which has been found satisfactory in respect of the visual and dimensional requirements (see 15.3.3) shall next be tested for physical characteristics like compressive strength, water absorption, efflorescence and warpage. The bricks for this purpose shall be taken at random from those already drawn in 15.4.2. The number of bricks to be selected and tested for this purpose shall be in accordance with Table 5 and the relevant standard.

**TABLE 5: SAMPLE SIZE FOR COMPRESSIVE STRENGTH**

| Lot size       | Sample size |
|----------------|-------------|
| 2001 to 10000  | 5           |
| 10001 to 35000 | 10          |
| 35001 to 50000 | 15          |

NOTE14- In case the lot contains 2000 or less bricks, the sampling shall be subjected to agreement between the purchaser and the supplier.

15.4.2 If the number of bricks failing to satisfy the requirements for these characteristics in the sample is less than or equal to the corresponding permissible number of defectives, the lot shall be declared as conforming to the requirements of this characteristics. However, if the number of defective bricks in the sample is greater than the corresponding permissible number of defectives (Table 6), the lot shall be deemed as not having met the requirements in respect of these characteristics.

**TABLE 6: SCALE OF SAMPLING FOR PHYSICAL CHARACTERISTICS**

| Lot Size       | Compressive strength, Water Absorption and Efflorescence |                               | Warpage     |                               |
|----------------|--|-------------------------------|-------------|-------------------------------|
|                | Sample Size  | Permissible No. of Defectives | Sample Size | Permissible No. of Defectives |
| 2001 to 10000  | 5  | 0                             | 10          | 0                             |
| 10001 to 35000 | 10   | 0                             | 20          | 1                             |
| 35001 to 50000 | 15   | 1                             | 30          | 2                             |

NOTE15- In case the lot contains 2000 or less bricks, the sampling shall be subjected to agreement between the purchaser and the supplier.

## 16. RESPONSIBILITY FOR COST OF TESTS

16.1 Whenever the purchaser requires a consignment to be tested the requisite sample shall be taken in the presence of both the parties, i.e. the purchaser and the manufacturer or the seller. Unless otherwise specified, the cost of the tests and the sample shall be borne as follows:

- By the purchaser, if the results show that the bricks comply with the standards,
- By the manufacturer or seller, if the results show that the bricks do not comply.

## 17. GENERAL

17.1 Testing shall be done in the presence of the manufacturer or his agent as far as possible. Unless otherwise specified, bricks of higher grade shall be accepted in lieu of a lower grade e.g. S or A shall be accepted in lieu of B grade.

17.2 The purchaser shall specify size, shape, grade and water absorption of bricks.

17.3 Wherever bricks are to be delivered at site of work, the breakage shall not be allowed more than 5%.

## ANNEXA (Informative)

### FIELD TESTS FOR BRICKS

Where the laboratory facilities are not readily available, the field testing may be carried out for the satisfaction of the purchaser. The field tests are essentially the same as provided in the actual standard with the exception of the temperature controls which have been relaxed. The results of the field tests shall only be taken as a guide by the purchaser and have no legal force what-so-ever. This shall not apply to the measurement test which is adopted as a field test without any modification.

#### a) Dimension and Measurement

As per procedure set out in clause 13 of this standard

#### b) Water absorption

Test specimens of six full size dried bricks shall be weighed individually ( $W_1$ ) and immersed in potable water for 24 hours. The specimens shall then be taken out and weighed individually ( $W_2$ ) after wiping of with damp cloth. The water absorption percentage by weight is determined as provided in the standard i.e.

$$\text{Absorption, \%} = 100 (W_2 - W_1) / W_1$$

#### c) Efflorescence:

Test specimens consisting of six whole bricks to be placed on end in non-absorbent dish and potable poured for 25 mm depth so that it surrounds each bricks by 25 mm only. The bricks allowed standing in room temperature till bricks appear to be dry. After which the same quantity of water shall be poured and further drying allowed. The efflorescence tendency be observed as "Nil", "Slight", "Moderate", "Heavy" or "Serious" as the may be in accordance with the followings:

*Nil* - No perceptible deposit of efflorescence,

*Slight* - Not more than 10 percent of the area of the bricks covered with a thin deposit of salts.

*Moderate* - A heavier deposit than under "Slight" and covering up to 50 percent of the area of the brick surface but unaccompanied by powdering or flaking of the surface,

*Heavy* - A heavy deposit of salts covering 50 percent or more of the bricks surface but unaccompanied by powdering or flaking of the surface,

*Serious* - A heavy deposit of salts accompanied by powdering and/or flaking of the surfaces.



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