IS 5913 (2003): Asbestos Cement Products - Methods of Test
[CED 53: Cement Matrix Products]

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भारतीय मानक

एस्बेस्टास सीमेंट उत्पाद — परीक्षण पद्धति

(दूसरा पुनरीक्षण)

Indian Standard

ASBESTOS CEMENT PRODUCTS — METHODS OF TEST

(Second Revision)

ICS 91.100.40

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Price Group 7

FOREWORD

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

This standard was first published in 1970 and subsequently revised in 1989. The major changes in the revision included modification of the transverse crushing test for pipes, specifying the temperature of water as 15 to 35°C instead of 27 ± 2°C for some tests and covering a new method for checking the straightness of pipes.

In this revision, apart from other modification made, the test method for hydraulic bursting test has been fully aligned with ISO 160 : 1980.

In revising this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been done by deriving assistance from the following ISO standards:

ISO 160 : 1980 Asbestos cement pressure pipes and joints

ISO 393-1 : 1983 Asbestos cement products — Part 1 Corrugated sheets and fittings for roofing and cladding

ISO 396-1 : 1980 Products in fibre reinforced cement — Part 1 Asbestos cement flat sheets

The composition of the Committee responsible for the 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.

Indian Standard

ASBESTOS CEMENT PRODUCTS — METHODS OF TEST

(Second Revision)

1 SCOPE

This standard covers the following tests applicable to the products indicated along side:

a) Visual inspection — for all products;
b) Water absorption test — for building pipes, sheets and building boards;
c) Test for impermeability — for sheets;
d) Acid resistance test — for corrugated, semi-corrugated and flat sheets; building pipes, and sewerage and drainage pipes;
e) Load bearing capacity test — for corrugated and semi-corrugated sheets, flat sheets and building boards;
f) Transverse crushing test — for pipes;
g) Hydraulic pressure test — for pipes;
h) Hydraulic bursting test — for pipes;
j) Longitudinal bending test — for pipes;
k) Straightness test — for pipes;
m) Measurement of density — for flat sheets;
n) Frost cracking test — for sheets; and
p) Determination of colour and staining power of pigments to be used for colouring corrugated and semi-corrugated sheets.

2 REFERENCES

The standards given below 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 the standards indicated below:

IS No.	*Title*
269 : 1989	Specification for 33 grade ordinary portland cement (*fourth revision*)
459 : 1992	Specification for corrugated and semi-corrugated asbestos cement sheets (*third revision*)
1592 : 2003	Specification for asbestos cement pressure pipes and joints (*fourth revision*)

3 VISUAL INSPECTION

3.1 The sheets and boards shall be inspected visually to check the following:

a) Uniformity of texture,
b) Flatness,
c) Neatness and straightness of the trimmed edges and squareness of the corners, and
d) Rectangularity.

3.2 The pipes shall be inspected visually to check the following:

a) Smoothness of inner and outer surface,
b) Concentricity of inner and outer surface, that is, uniformity of thickness, and
c) Uniformity of texture.

4 WATER ABSORPTION TEST

4.1 Specimen

From each of the sheets, boards or building pipes selected in accordance with the sampling method given in the relevant specification, a specimen 175 mm × 75 mm in case of sheets or boards and 25 mm long in case of building pipes shall be cut.

4.2 Procedure

4.2.1 The specimens shall be completely immersed in water at 15 to 35°C for a period of 18 h. These shall be taken out and weighed after removing surplus moisture with a damp cloth (M_1). The specimens shall then be placed in an air-oven capable of being raised to 150°C and then maintained at that temperature constantly.

NOTE — In colder regions of the country the temperature of water may be less than 15°C but not less than 5°C.

4.2.2 The heating shall be commenced with the oven ventilator wide open, raising the temperature from about 105 to 150°C to dry the specimens to constant mass. The test pieces shall then be cooled for at least 1 h in a desiccator containing anhydrous calcium chloride and weighed (M_2).

4.3 Reporting of Result

The absorption shall be calculated as follows:

$$\text{Absorption, percent} = \frac{M_1 - M_2}{M_2} \times 100$$

where

M_1 = mass, in g, of specimen after absorption; and

M_2 = mass, in g, of specimen after heating.

4.3.1 The specimens shall not be placed in contact with one another, but shall be distributed uniformly throughout the oven. Wet specimens shall not be introduced into an oven in which the drying of other specimens is already in progress.

5 TEST FOR IMPERMEABILITY

5.1 Test for impermeability shall be carried out by either of the methods described in **5.2** and **5.3**.

5.2 Method 1

5.2.1 *Specimen*

This test is performed on asbestos cement sheets. From each of the sheets selected in accordance with the sampling method given in the relevant specification, one square test piece about 100 mm × 100 mm shall be cut.

5.2.2 *Procedure*

5.2.2.1 A transparent or metallic tube of 35 ± 5 mm diameter and 300 mm long shall be sealed to the middle of the test piece and held vertically. The test piece shall be supported on a suitable arrangement, which provides the bottom surface to be inspected. The sealing of the tube shall be done for corrugated sheets at the centre of the valley and for semi-corrugated sheets in the flat portion between corrugations. The tubes may be suitably shaped at the bottom for this purpose, as necessary.

5.2.2.2 The tube shall be filled up with water carefully to about 250 mm height, if necessary by providing overflow line to maintain the required constant height and it shall be ensured that water does not leak through the sealing. Arrangement shall be provided in the test equipment to evacuate entrapped air.

The test shall be conducted at 15 to 35°C and at a relative humidity of 45 to 75 percent.

5.2.3 *Reporting of Result*

The specimen is reported to have passed the test, if during 24 h of water remaining in the vertical transparent tube, drops of water are not formed at the lower surface of the sheets. Appearance of traces of moisture at the lower surface is permissible.

5.3 Method 2

5.3.1 *Specimen*

This test is carried out on a whole sheet with a minimum length of 1.20 m, which has been kept for at least 5 days in a controlled environment at a temperature of 15 to 35°C.

5.3.2 *Procedure*

A frame, the form and dimensions of which are given in Fig. 1, shall be sealed on the test piece. After sealing the frame on to the sheet, fill up with water until the level is 20 mm above the top of corrugations. Then place the whole assembly in a controlled environment at 15 to 35°C and at a relative humidity of 45 to 75 percent.

5.3.3 *Reporting of Results*

Examine the under-face after 24 h. The specimen is reported to have passed the test if drops of water are not formed at the lower surface of the sheets. Appearance of traces of moisture at the lower surface is permissible.

6 ACID REISTANCE TEST

6.1 Specimen

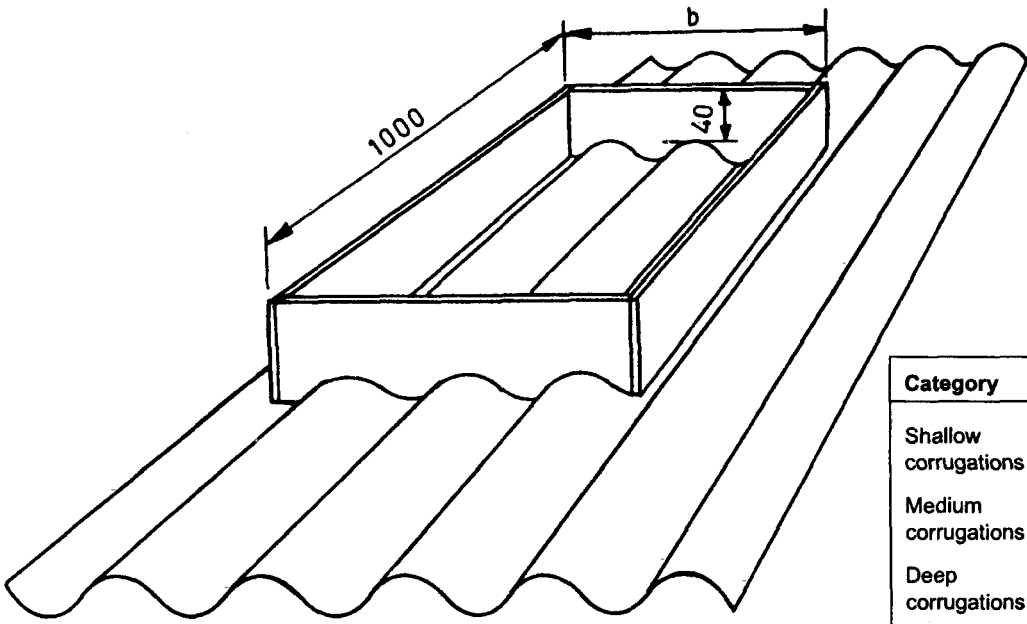
From each of the sheets or pipes selected in accordance with the sampling method given in the relevant standard, three specimens each having a total surface area including edges of approximately 10 000 mm^2 shall be cut.

NOTE — In case of sheets, specimens may be 65 mm × 65 mm and in case of pipes, 65 mm measured along the length and 65 mm measured along the centre of the curved section is recommended so that the total surface area of each piece including edges may be approximately 10 000 mm^2.

6.2 Procedure

6.2.1 Each specimen of pair of specimens (*see* Note) shall be placed upright for 24 h in 270 ml of 5 percent acetic acid solution at 15 to 35°C contained in a vessel of such a size that the specimen is entirely immersed. Separate vessels and solution shall be used for each specimen or pair of specimens. The concentration of the acetic acid shall be determined before and after immersion of the specimen by titration against a solution of sodium hydroxide of known concentration (approximately 0.5 N), using thymol blue as indicator. For titration, 10 ml of the acid solution shall be first stirred, then diluted to 100 ml and 10 drops of thymol blue solution (0.040 g in 100 ml 95 percent alcohol) added to it.

NOTE — This test is for asbestos cement and not for any surface coating which may be applied to it. In the case of material provided with a protective coloured surface coating, such coating



Category	b
Shallow corrugations	6 corrugations
Medium corrugations	4 corrugations
Deep corrugations	3 corrugations
Very deep corrugations	2 corrugations

All dimensions in millimetres.

FIG. 1 PERMEABILITY TEST FOR CORRUGATED SHEET

shall be removed or protected. For materials coated on one side only, the coated side shall be covered with a layer of paraffin wax applied hot and painted over the coating. Pairs of such specimens shall be placed in the test solution to maintain the exposed surface area at approximately 10 000 mm². In the case of materials coated on both sides, the coating shall be removed by abrasion from both sides and the specimen then tested as described in **6.2.1**.

6.2.2 The end-point to be taken is that of the colour change from yellow to blue corresponding to *p*H value 8.0 to 9.5, the small amount of gelatinous precipitate formed does not interfere.

6.3 Reporting of Result

The result shall be reported in terms of grams of acetic acid per square metre of area of the specimen and this value shall be calculated from the fall in concentration, assuming that one millilitre of 0.5N sodium hydroxide solution is equivalent to 0.030 g of acetic acid as follows:

$$\text{Mass, in g, of acetic acid used per m}^2 = \frac{0.030 \times 270 (x - y)}{10A} = \frac{0.81(x - y)}{A}$$

where

x = volume, in ml, of 0.5 N sodium hydroxide used at the initial titration,

y = volume, in ml, of 0.5N sodium hydroxide used at the final titration, and

A = area, in m², of unprotected asbestos cement of the specimen.

6.3.1 The average of the test results for three specimens from the same sheet or pipe shall be considered as the test result for the sheet or pipe as a whole.

7 LOAD BEARING CAPACITY TEST

7.1 Load Bearing Capacity Test for Corrugated and Semi-Corrugated Sheets

7.1.1 *Specimen*

The specimens for test shall consist of full sheets or 1.25 m long cut from full sheet and shall be selected in accordance with the method of sampling given in the relevant standard.

7.1.2 *Procedure*

Immediately prior to test, the specimens shall be completely immersed in water at 15 to 35 °C for a period of 24 h. Each specimen shall be freely and evenly supported with its smooth side up on parallel rigid hardwood, cast iron or steel bearers 50 mm wide and of a length at least as great as the width of the specimen, and set at right angles to the corrugations as shown in Fig. 2. The bearers shall be placed 1 m from centre to centre. The sheets shall be loaded at mid span by means of a self aligning rigid flat beam

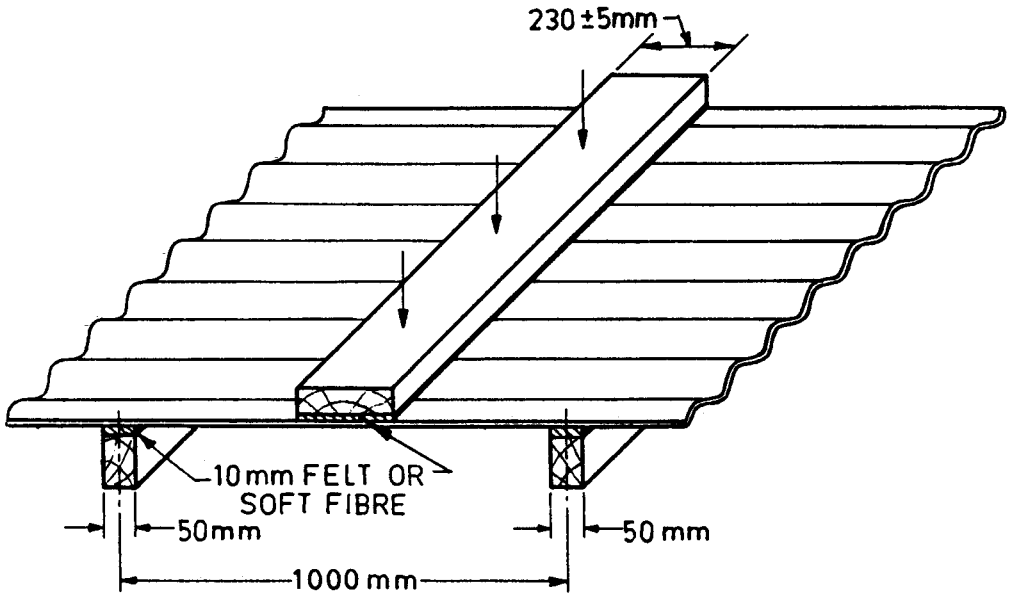


FIG. 2 LOAD BEARING CAPACITY TEST FOR CORRUGATED AND SEMI-CORRUGATED SHEETS

230 ± 5 mm wide, parallel to the supports. Strips of felt or soft fibre about 10 mm thick shall be interposed between the test piece and the supports and under the beam by which the load is applied. The load shall be applied at a uniform rate not greater than 2 000 N/min.

NOTE — In colder regions of the country the temperature of water may be less than 15°C but not less than 5°C.

7.1.3 *Reporting of Result*

The load at which the sheet breaks shall be recorded and the load in N/mm width of the specimen shall be computed.

7.2 Load Bearing Capacity Test for Flat Sheets and Building Boards

7.2.1 *Specimen*

From each sheet selected in accordance with the method of sampling given in the relevant standard, two specimens each measuring 250 mm × 250 mm shall be cut. The test pieces shall be cut from the same part of the sheet as shown in Fig. 3(a) (the distance of 200 mm is typical). The fibre direction shall be marked on each of the test pieces. The specimens shall be tested in both longitudinal and transverse direction in accordance with **7.2.2** to **7.2.3** [*see* Fig. 3(b) and 3(c)].

NOTE — When the direction of the fibre is difficult to identify, it is permissible to carry out the bending test with the loading bar successively put on two perpendicular directions.

7.2.2 *Procedure*

7.2.2.1 Immediately prior to the test, the specimens shall be completely immersed in water at 15 to 35 °C for a period of 24 h. The test specimen shall be placed centrally on self-aligning bearers, *A*, *B* and *C* as shown in Fig. 4. The underside of specimen shall be in contact with bearers *A* and *B*. The bearers shall be of mild steel 40 mm in diameter and shall be in the same horizontal plane and parallel to each other.

NOTE — In colder regions of the country the temperature of water may be less than 15°C but not less than 5 °C.

7.2.2.2 The distance between the bearers *A* and *B* at the lines of contact with the specimen shall be 225 mm. Bearer *C* shall be midway between *A* and *B* measured horizontally and rests upon the surface of the specimen.

7.2.2.3 The load shall be applied at a uniform rate and so regulated that breaking occurs after not less than 5 s. Measure the thickness at two points along the section of breakage as indicated in Fig. 3(b). Re-assemble the broken pieces and submit to a second bending test with the line of load application at right angles to that of the first. Measure the thickness of the test piece in two points along with new section of breakage as indicated in Fig. 3(c).

7.2.3 *Reporting of Result*

The unit bending stress (R_f) expressed in MN/m^2 for longitudinal and transverse directions shall be calculated separately as below and the arithmetical means of two values so obtained shall be considered for each of the specimens:

$$R_f = \frac{M}{W}$$

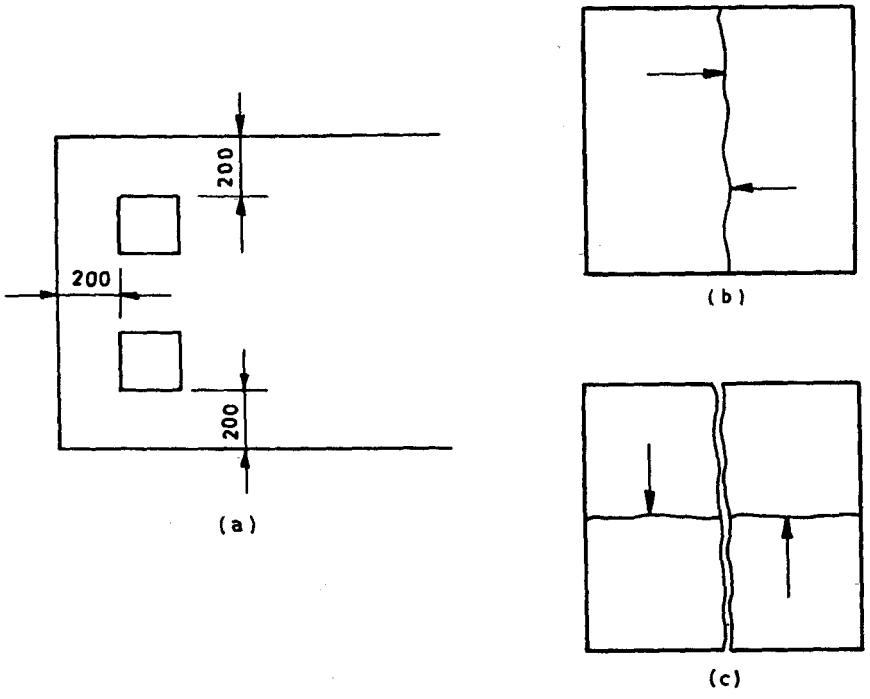


FIG. 3 SPECIMEN FOR LOAD CAPACITY TEST FOR FLAT SHEET

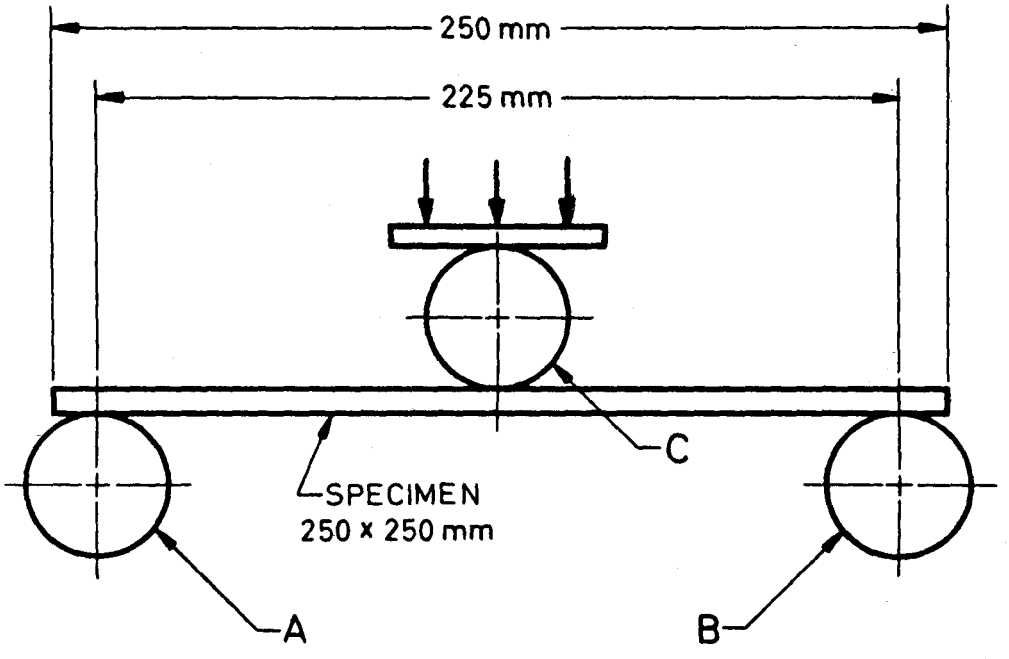


FIG. 4 LOAD BEARING CAPACITY TEST FOR FLAT SHEETS

where

$$M = \frac{pl}{4}$$

$$W = \frac{be^2}{6}$$

where

p = breaking load, in N;

l = clear span between the supports, in mm;

b = actual width of the test piece, in mm; and

e = actual thickness of the test piece in the breaking section, in mm.

NOTE — In case of building board, the breaking load in newton for longitudinal and transverse directions shall be recorded separately and the arithmetic mean of the two values so recorded shall be considered for each of the specimens.

8 TRANSVERSE CRUSHING TEST FOR PIPES

8.1 Specimen

From each pipe selected in accordance with the method of sampling for pipes given in the relevant standards, pieces of 200 mm length up to 300 mm diameter pipes, and pieces of 300 mm length for diameter above 300 mm shall be cut for this test. The test shall be carried out on these pieces after immersion for 48 h in water.

NOTE — The same procedure shall be applicable for non-immersed specimens also, except immersion of pieces for 48 h in water (*see* Notes below **3.4.3.3** of IS 1592).

8.2 Procedure

8.2.1 The load shall be applied through press-blocks as shown in Fig. 5, at a constant rate regulated so that the rupture occurs after at least 15 s and not more than 30 s, according to the diameter.

8.2.2 The lower press block consists of a V-shaped support having an included angle of 150°, made of metal or hard wood; the flat upper press-block, made of the same material, has a width b varying with the nominal diameter of the pipe. The values of b are given in Table 1.

8.2.3 The load may be applied either horizontally or vertically.

8.2.4 The strips of rubber of suitable width and length shall be interposed between the press-blocks and the test piece. The rubber strips shall be 15 mm thick and of a hardness of 60 ± 5 shore A degrees.

Table 1 Width of Upper Press Block

(*Clause* 8.2.2)

Sl No. (1)	Nominal Diameter mm (2)			Width, b mm (3)
i)	50	to	250	25
ii)	300	to	350	35
iii)	400	to	450	50
iv)	500	to	600	60
v)	700	to	800	85
vi)	900	to	1 000	105
vii)	1 100	to	1 200	130
viii)	1 300	to	1 400	150
ix)	1 500	to	1 600	175
x)	1 700	to	1 800	195
xi)	1 900	to	2 000	220
xii)	2 100	to	2 200	240
xiii)	2 300	to	2 400	265
xiv)	2 500			290

8.3 Reporting of Result

The unit transverse crushing strength, R_c expressed in N/mm^2, is given by the formula:

$$R_c = K\frac{M_c}{W_c}$$

where

$K = \frac{3d+5e}{3d+3e}$ is a factor resulting from the cur-

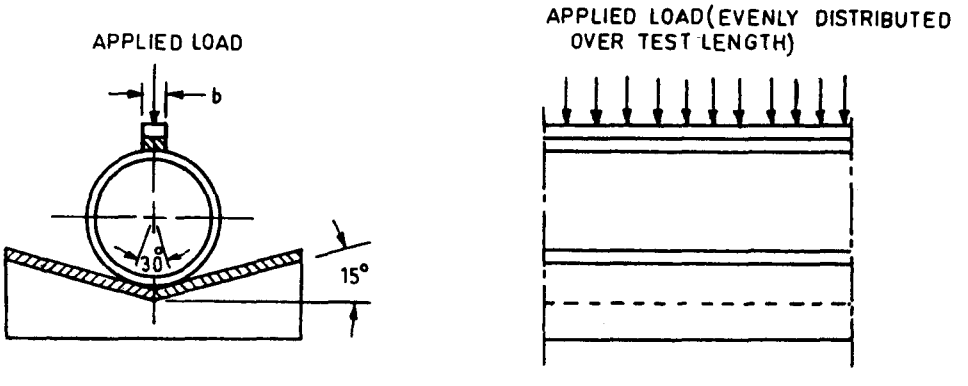


FIG. 5 LOADING IN TRANSVERSE CRUSHING TEST

vature of the pipe;

d = actual internal diameter of the test piece, in mm, taken as the average of two perpendicular measurments;

e = actual thickness of the wall of the test piece in the broken section, in mm, taken as the average of three measurements made along the line of fracture at the top of the ring;

$M_e = nP_c\frac{(d+e)}{2}$ is the maximum ring bending moment;

n = 0.26 for diameters up to 100 mm; 0.30 for diameters exceeding 100 mm;

P_c = the breaking load, in N; and

$W_e = \frac{1}{6}le^2$ is the modulus of resistance of the wall of the pipe

where

l = actual length of the test piece, in millimetres.

NOTE —The value of R_c may be derived directly from the formula:

$$R_c = n\frac{P_c}{l}\frac{(3d+5e)}{e^2}$$

the terms being expressed in the same units as above.

9 HYDRAULIC PRESSURE TEST FOR PIPES

9.1 Specimen

The specimen shall consist of full length of pipes, including socket ends (in case of building pipes), selected according to the procedure for sampling given in the relevant standards.

9.2 Procedure

The pipes are placed on hydraulic press, the tightness of ends being ensured by a device avoiding as far as possible any axial compression of pipes. The internal hydraulic pressure is measured accurately by pressure gauge calibrated to give accurate readings within 0.05 N/mm^2. The internal hydraulic pressure is steadily raised upto 0.1N/mm^2 for building pipes. For other pipes the internal hydraulic pressure shall be raised gradually until the gauge registers a figure corresponding to the class of pipe. The pressure shall be maintained for 30 s to check that there is no fissure, leakage or sweating (*see also* **5.2.2** of IS 1592).

The duration of the test may be reduced to 5 s for pipes of 350 mm diameter or less, without changing the class, provided that the internal pressure is increased by 10 percent.

9.3 Reporting of Result

Fissure, leakage or sweating on the outside surface of pipes shall be reported, if any.

10 HYDRAULIC BURSTING TEST FOR PIPES

10.1 Procedure

The test shall be carried out on a test piece after immersion in water for 48 h, using either internal or external sealing arrangements, according to the choice of the manufacturer. Pipes of nominal diameter exceeding 2 000 shall be tested with internal sealing only. The length of the test piece depends on the method of sealing when put under pressure and shall be as follows:

a) If the test piece is sealed internally, its length shall be not less than 500 mm and not more than 1 000 mm for all diameters.

b) If the test piece is sealed externally, its minimum length shall be as indicated in Table 2 or calculated from the formula, whichever is less.

$$l = 500 + 2a + 6.5d\sqrt{e/d}$$

where

l = length of the test piece, in mm;

a = distance between the plain end of the test piece and the sealing rubber ring, in mm;

e = nominal wall thickness, in mm; and

d = diameter, in mm.

NOTE — The same procedure shall be applicable for non-immersed specimens also, except immersion of pieces for 48 h in water (*see* Notes below **3.4.3.3** of IS 1592).

The test piece shall be put under pressure in a suitable device designed to avoid any axial compression of the pipe when the pressure approaches its ultimate value.

The hydraulic pressure shall be applied at a constant rate and shall be regulated so that the rupture occurs after at least 15 s and not more than 30 s.

NOTE — In case (a), the test piece shall be cut from the barrel of the pipe without machining. In case (b), the ends of the test piece may be machined to not less than the nominal wall thickness, including tolerances.

10.2 Reporting of Result

The unit bursting strength R_t, expressed in newton per square millimetre, is given by the formula:

$$R_t = \frac{p(d+e)}{2e}$$

where

p = internal pressure at rupture, in MPa;

d = Actual internal diameter of the test piece, in mm; taken as the average of two perpendicular measurements made at both ends of the test piece; and

e = Actual thickness of the wall of the test piece in the broken section, in millimetres, taken as the average of three equidistant measurements along the whole line of fracture.

NOTE — When agreed to between the purchaser and the manufacturer, tensile tangential strength of the material may be determined or another acceptable method which does not involve application of internal hydraulic pressure.

Table 2 Test Piece Lengths
(*Clause* 10.1)

Sl No.	Nominal Diameter mm	Minimum Length of Bursting Test Piece mm
(1)	(2)	(3)
i)	From 50 to 100	750
ii)	From 125 to 250	1 000
iii)	From 300 to 500	1 500
iv)	From 600 to 700	2 000
v)	From 800 to 1 000	2 500
vi)	From 1 100 to 1 300	3 000
vii)	From 1 400 to 1 600	3 500
viii)	From 1 700 to 2 500	4 000

11 LONGITUDINAL BENDING TEST

11.1 Taking into account the practical possibilities of carrying out the test and the nature of the bending stresses, this test should be called for only on pipe of 150 mm diameter and less.

11.2 Specimen

The specimen shall be the full pipe or part of a pipe at least 2.2 m long, which has been immersed in water for 48 h.

NOTE — The same procedure shall be applicable for non-immersed specimens also, except immersion of pieces for 48 h in water (*see* Notes below **3.4.3.3** of IS 1592).

11.3 Procedure

The specimen selected shall be placed on two metal V-shaped supports having an included angle of 120°, presenting a face 50 mm wide to the pipe and free to move in the plane of bending on two horizontal axes 2 000 mm apart (*see* Fig. 6).

11.4 Reporting of Result

The unit longitudinal bending strength R_f, expressed in newton per square millimetre, is given by the following formula:

$$R_f = \frac{M_f}{W_f}$$

where

$$M_f = \frac{P_f l_2}{4}$$

where

P_f = breaking load, in N, and

l_2 = distance between centres of supports, in mm;

$$W_f = \frac{\pi}{32} \times \frac{(d+2e)^4 - d^4}{d+2e}$$

where

d = actual internal diameter of the pipe, in mm; taken as the average of two perpendicular measurements at the broken cross-section, and

e = actual thickness of the wall of the pipe in the broken section, in mm, taken as the average of three measurements made along the line of fracture.

NOTE — The value of R_f may be derived directly from the formula:

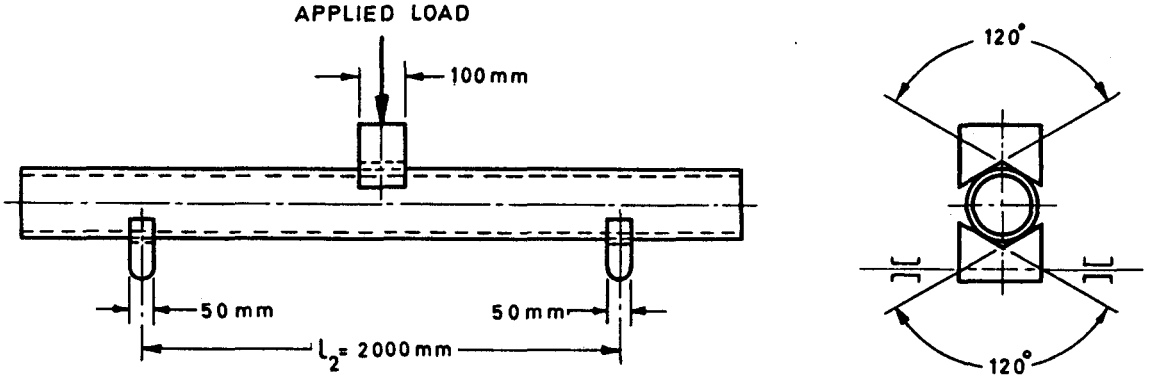


FIG. 6 LOADING IN LONGITUDINAL BENDING TEST

measurements at the broken cross-section, and

e = actual thickness of the wall of the pipe in the broken section, in mm, taken as the average of three measurements made along the line of fracture.

NOTE — The value of R_f may be derived directly from the formula:

$$R_f = 2.547 \frac{P_f l_2 (d + 2e)}{(d + 2e)^4 - d^4}$$

the terms being expressed in the same unit as above.

12 STRAIGHTNESS TEST FOR PIPES

12.1 Specimen

The specimen shall consist of the full pipe selected in accordance with the procedure for sampling given in the relevant standard.

12.2 Procedure

Straightness of pipes shall be checked by either of the two methods described in **12.2.1** and **12.2.2** to be chosen by the manufacturer.

12.2.1 The pipe shall be rolled on two parallel runners placed at a distance apart equal to two thirds the nominal length of the pipe. The method is illustrated in Fig. 7(a).

12.2.2 The pipe shall be rolled on an even flat floor as shown in Fig. 7(b).

12.3 Reporting of Result

Report the deviation f measured on the external surface at mid span when tested in accordance with **12.2.1** as shown in Fig. 7(a) or the deviation j measured from the floor to the outer surface at the ends of the pipe when tested in accordance with **12.2.2** as shown in Fig. 7(b).

13 DETERMINATION OF DENSITY

13.1 Specimen

The test shall be carried out on a 40 mm × 60 mm uncoated sample of material selected according to the procedure for sampling given in the relevant standard.

13.2 Procedure

Determine the dry mass of the test specimen after drying the sample to constant mass at a temperature of 100 to 105 °C in an oven. Determine the volume of the test specimen by immersing saturated test specimen in water and measuring the volume of displaced water or by any precise method.

13.3 Reporting of Result

Calculate density by the following formula:

$$\rho = \frac{M}{V}$$

where

ρ = density, in g/cm^3;

M = dry mass of the test specimen, in g; and

V = volume of the test specimen, in cm^3.

14 FROST CRACKING TEST

This test is generally applicable only to sheets.

14.1 Specimen

Two square pieces of 250 mm size are cut out of sheets selected according to procedure for sampling given in the relevant standard.

14.2 Procedure

The test specimen shall be immersed in water for 48 h, after which they shall be submitted to 25 cycles of alternate freezing and thawing between temperatures

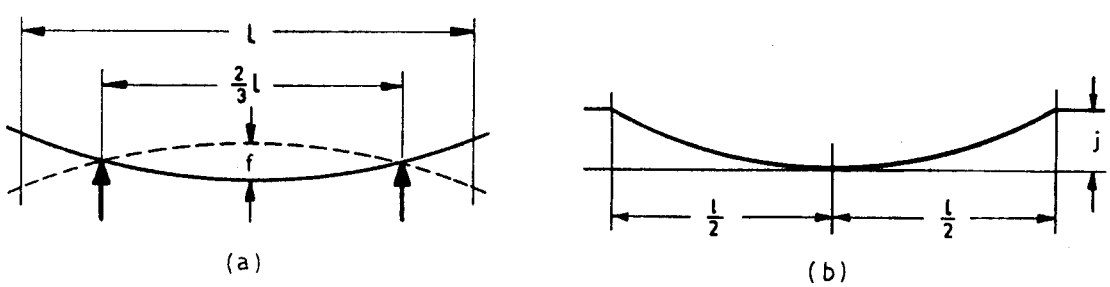


FIG. 7 STRAIGHTNESS TEST FOR PIPE

of – 20 °C and +20 °C (with a tolerance of ± 3 °C). The duration of extreme limits of temperature shall be agreed to between the supplier and the user in the context of the use to which the sheets are proposed to be put.

14.3 Reporting of Result

The test shall be considered to be satisfactory if the test pieces after testing do not show signs of cracking or surface alteration.

15 DETERMINATION OF COLOUR AND STAINING POWER OF PIGMENTS

15.1 General

This test covers the method of determination of colour and staining power of pigments which are embodied in asbestos for colouring purposes. The pigments shall, however, conform to the relevant Indian Standard.

15.2 Colour

The colour of the pigments shall closely match that of the agreed sample, if any, when compared in the manner described under **15.4.**

15.3 Staining Power

The staining power of the pigments shall closely match and shall not be inferior to that of the agreed sample, if any, when compared in the manner described under **15.4**.

15.4 Method for the Comparison of Colour and Staining Power

15.4.1 *For Pigments Other Than Carbon Black (or Vegetable Black)*

The comparison of colour and the staining power shall be done by reducing the pigment with ordinary Portland cement conforming to IS 269 in the following proportions:

a) *Comparison of colour* — 2 g of pigment to 20g of ordinary portland cement.

b) *Staining power* — 0.2 g of pigment to 20 g of ordinary portland cement.

15.4.1.1 The test shall be carried out in the following manner:

A 115 ml wide necked glass stoppered glass bottle shall be charged with 50 g of 3 to 4 mm diameter solid glass beads. The cement and pigment in the appropriate proportions specified under **15.4.1** shall be added and the stopper firmly replaced. The beads, cement and pigment shall be mixed by shaking the bottle by hand for 3 min at the rate of approximately 200 shakes per minute. The contents shall then be discharged on to a 1.18 mm IS Sieve and the mixture of pigments and cement separated from the glass beads. The agreed sample shall be treated in same way. A comparison of colour or of staining power shall be made by placing a portion of each powder (about one-third of the total quantity) on a clean colourless glass plate about 0.04 m^2 in size and then covering it with a similar plate. The two plates shall then be pressed together without rotation to within 3 mm of each other and the samples shall be arranged in such a manner that under this condition they form two areas with a common boundary.

The comparisons shall then be made on mixtures which have been freshly prepared by immediately observing the colour through the upper plate.

15.4.1.2 In cases of dispute or when specially required by the purchaser, the method prescribed for carbon black (or vegetable black) shall be used.

15.4.2 *For Carbon Black (or Vegetable Black)*

In the case of carbon black or (vegetable black) if the above method is not satisfactory the following method shall be carried out:

a) *Comparison of colour* – The comparison of colour shall be made by reducing the pigment with ordinary Portland cement (conforming to IS 269) in the following proportions:

Carbon black (or vegetable black)— 2 g of pigment to 20 g of ordinary portland cement.

The mixture of cement and pigment shall be mixed as described under **15.4.1.1.** A sufficient and measured quantity of water shall be mixed with the pigmented cement to produce a uniform paste of stiff plastic consistency. This paste shall be transferred to a mould not less than 13 mm deep and allowed to set. The agreed sample of pigment shall be treated in the same way, using the same quantity of water for mixing. After 24 h curing in a moist atmosphere the pats shall be transferred from the moulds and dried for 3 h in an oven maintained at a temperature of 100 ± 2°C. The comparison of colour shall be made by breaking the pats across and comparing the fractured surfaces.

b) *Comparison of staining power* — The comparison of staining power shall be made by reducing the pigment with ordinary Portland cement (conforming to IS 269) in the following proportions:

Carbon black – 0.05 g of pigment to 20 g

of ordinary portland cement.

Vegetable black – 0.15 g of pigment to 20 g of ordinary portland cement.

A sufficient and measured quantity of water shall be mixed with the pigmented cement to produce a uniform soft paste. The paste shall be immediately covered suitably, as for example, with a petri dish in order to reduce loss of water by evaporation. The agreed sample of pigment shall be treated in the same way using the same quantity of water for mixing. A portion of each of the pastes (about one-third of the total quantity) shall be placed on a clean colourless glass plate and then covered with a similar plate. The two plates shall be pressed together without rotation to within 3 mm of each other and the paste samples shall be arranged in such a manner that under this condition they form two areas with a common boundary.

The comparisons shall be made on mixtures which have been freshly prepared by immediately observing the colour through the upper plate.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Cement Matrix Products Sectional Committee, CED 53

Organization	*Representative(s)*
Gammon India Limited, Mumbai	SHRI S. A. REDDI (***Chairman***)
All India A.C. Pipe Manufacturers' Association, Secunderabad	SHRI N. KISHAN REDDY SHRI P. S. KALANI (*Alternate*)
Central Building Research Institute, Roorkee	DR B. K. RAO DR S. K. AGARWAL (*Alternate*)
Central Pollution Control Board, Delhi	REPRESENTATIVE
Central Public Works Department, New Delhi	SHRI P. SUBRAMANIAN SHRI K. P. ABRAHAM (*Alternate*)
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Fly Ash Mission, Department of Science & Technology, New Delhi	DR VIMAL KUMAR SHRI MUKESH MATHUR (*Alternate*)
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National Test House, Kolkata	SHRI D. K. KANUNGO SHRI T. CHOUDHURY (*Alternate*)
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Spun Pipes Manufacturer's Association of Maharashtra, Nanded	SHRI C. Y. GAVHANE SHRI D. N. JOSHI (*Alternate*)
Structural Engieering Research Centre (CSIR), Chennai	SHRI N. P. RAJAMANE DR M. NEELAMEGAM (*Alternate*)
Tamil Nadu Water Supply & Drainage Board, Chennai	SHRI S. HARIRAMASAMY

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Organization	*Representative(s)*
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BIS Directorate General	SHRI S. K. JAIN, Director & Head (CED) [Representing Director General (*Ex-officio*)]

Member Secretary
SHRI J. C. ARORA
Director (CED), BIS

Fibre Reinforced Cement Products Subcommittee, CED 53:1

In personal capacity (*35, Park Avenue, Annamang, Naicker Street, Kuniamuthur, Coimbatore 640087*)	DR C. RAJ KUMAR (***Convener***)
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