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मानक

IS 2556-1 (1994): vitreous sanitary appliances (vitreous china): Part 1 General requirements [CED 3: Sanitary Appliances and Water Fittings]



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IS 2556 (Part 1) : 1994 (Reaffirmed 2009)

भारतीय मानक

काचाभ स्वच्छता सचित्रों की विशिष्टि (काचाभ चीनी मिट्टी)

भाष 1 सामान्य अपेकाएँ

(तीसरा पुनरीक्षण)

Indian Standard

VITREOUS SANITARY APPLIANCES (VITREOUS CHINA) — SPECIFICATION

PART 1 GENERAL REQUIREMENTS

(*Third Revision*)

UDC 669'14:666'596

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BUREAU OF INDIAN STANDARDS MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG NEW DELHI 110002

Price Group 5

AMENDMENT NO. 1 OCTOBER 1995 TO IS 2556 (Part 1): 1994 VITREOUS SANITARY APPLIANCES (VITREOUS CHINA) — SPECIFICATION

PART 1 GENERAL REQUIREMENTS

(Third Revision)

(Page 6, clause 10.4.3, Formula) — For circular cross-section substitute the following formula for the existing:

$$S = \frac{0.8 \ PL}{\pi D^3}$$

(CED 3)

AMENDMENT NO. 2 SEPTEMBER 1996 TO IS 2556 (Part 1): 1994 VITREOUS SANITARY

APPLIANCES (VITREOUS CHINA) - SPECIFICATION

PART 1 GENERAL REQUIREMENTS

(Third Revision)

(Page 1, clause 2) — Delete the following references:

'IS 2556 (Part 3): 1994	Specification	for	vitreous	sanitary	appliances
	(vitreous chin	•):	Part 3 Spec	cific requi	rements for
	squatting pans	(fou	nh revision)		

IS 9140 : 1985 Methods of sampling of vitreous and fire clay sanitary appliances (*first revision*) (Reaffirmed 1993)'

(CED 3)

AMENDMENT NO. 3 DECEMBER 1998 TO IS 2556 (Part 1): 1994 VITREOUS SANITARY APPLIANCES (VITREOUS CHINA) — SPECIFICATION PART 1 GENERAL REQUIREMENTS

(Third Revision)

[Page 6, clause 10.4.3 (see also Amendment No. 1)] — Substitute the following for the existing formulae:

$$S = \frac{1.5 PL}{bd^2}$$
 for square cross section, or
$$S = \frac{0.8 PL}{\pi D^3}$$
 for circular cross section

where

 $S = Modulus of rupture is N/mm^2 or MPa.$

(CED 3)

AMENDMENT NO. 4 MARCH 2002 TO IS 2556 (PART 1): 1994 VITREOUS SANITARY APPLIANCES (VITREOUS CHINA) — SPECIFICATION PART 1 GENERAL REQUIREMENTS

(Third Revision)

[Page 6, clause 10.4.3 (see also Amendments No. 1 and 3)] — Substitute the following for the existing formula for circular cross section:

$$S = \frac{8PL}{\pi D^3}$$
 for circular cross section

(CED 3)

Reprography Unit, BIS, New Delhi, India

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AMENDMENT NO. 5 OCTOBER 2008 TO IS 2556 (PART 1) : 1994 VITREOUS SANITARY APPLIANCES (VITREOUS CHINA) --- SPECIFICATION

PART 1 GENERAL REQUIREMENTS

(Third Revision)

(Page 7, Annex B, Table 4, Note 1, line 1) — Insert 'Alcohol ethoxylates or' after 'product of'.

[Page 8, Annex C, clause C-2.2(e)] — Substitute 'Methylene Chloride or Perchloroethylene or Trichloroethylene' for 'Carbon tetrachloride'

(CED 3)

FOREWORD

This Indian Standard (Third Revision), was adopted by the Bureau of Indian Standards after the draft finalized by the Sanitary Appliances and Water Fittings Sectional Committee had been approved by the Civil Engineering Division Council.

This Indian Standard was first published in 1963. The first and second revisions were issued in 1967 and 1974 respectively. In this revision changes in respect to terminology, material, manufacture and finish have been incorporated rendering it more comparable with overseas standards as a measure of export promotion. This revision also incorporates Amendments No. 1 and 2 issued to the standard in 1979 and 1984 respectively. Clauses relating to marking and manufacturer's certificate have been deleted.

In the formulation of this standard. assistance has also been derived from BS 3402: 1969 'Specification for Quality of Vitreous China Sanitary Appliances' issued by the British Standards Institution.

The composition of the technical committee responsible for the preparation of this standard is given in Annex D.

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

VITREOUS SANITARY APPLIANCES (VITREOUS CHINA) — SPECIFICATION

PART 1 GENERAL REQUIREMENTS

(Third Revision)

1 SCOPE

This standard (Part 1) covers general requirements relating to terminology, material and manufacture, glazing, defects, minimum thickness, tolerances, performance and methods of test for vitreous sanitary appliances covered by various parts of the standard.

2 REFERENCES

The Indian standards mentioned below are necessary adjuncts to this standard:

IS No. Title

- 2556 Specification for vitreous (Part 3): 1994 sanitary appliances (vitreous china): Part 3 Specific requirements for squatting pans (fourth revision)
- 2781: 1975 Glossary of terms relating to ceramic wares (first revision) (Amendment 1) (Reaffirmed 1992)
- 9140: 1985 Methods of sampling of vitreous and fire clay sanitary appliances (*first* revision) (Reaffirmed 1993)

3 TERMINOLOGY

3.0 For the purpose of this standard, the definitions given in IS 2781: 1975 and the following shall apply. Where there are common terms, the definitions given in this standard shall prevail.

3.1 Blister

A raised portion of the surface protruding not more than one millimetre above the surface and not greater than 3 mm in its maximum dimension.

3.2 Bubble

A raised portion of the surface less than one millimetre maximum diameter.

3.3 Craze or Crazing

Fine cracks in the glaze.

3.4 Discolouration

A coloured spot greater than 6 mm in its maximum dimension or a concentrated number of specks or spots to give the effect of a change in colour.

3.5 Dull Finish

Undeveloped glaze, slightly matt in appearance or a non-glossy finish on a visible surface.

3.6 Dunt

A hair-line fracture extending through the body of the appliance.

3.7 Egg Shell Finish

A uniform semi-matt glaze.

3.8 Exposed Body

Unglazed portion 1.5 mm or more in its maximum dimension.

3.9 Finish

The texture and condition of a surface other than its colour.

3.10 Fire Crack

A fine shallow crack in the body, not covered with glaze. (Fire crack, where not on a visible surface, may not necessarily be detrimental).

3.11 Flushing Surface

The surface visible after installation and which becomes wet during the operation of the appliance.

3.12 Grouping

A number of spots, blisters, pinholes or specks within any pottery square.

3.13 Kiln Support Marks

Large unglazed surfaces resulting from blocks or pins necessary to support the appliance while firing but not visible after installation of the appliance. IS 2556 (Part 1): 1994

3.14 Pinhole

A hole in the body less than 1.5 mm in its maximum dimensions.

3.15 Polishing Mark

A spot where some minor blemish has been ground off and surface polished, the area of the spot not exceeding the area of a 10 mm diameter circle.

3.16 Pottery Square

A square of dimensions 50×50 mm selected on the appliances for examining visual defects.

3.17 Projection

A raised portion of not less than 6 mm in its maximum dimension on a visible surface.

3.18 Speck

An area of contrasting colour less than one millimetre maximum dimension. (Speck less than 0.25 mm, maximum dimension, do not constitute a defect unless sufficient in number to form a discoloration.)

3.19 Spot

An area of contrasting colour on the visible surface more than 1 mm but less than 3 mm in maximum dimension.

3.20 Visible Surface

The surface, which after installation of the appliance, is readily visible to an observer in a normal standing position.

3.21 Warpage

Distortion of original shape during the manufacturing process.

3.22 Wavy Finish

A defect in the finish having the appearance of numerous runs in the glaze; irregular or mottled finish.

4 MATERIAL AND MANUFACTURE

Vitreous sanitaryware is a strong high grade ceramicware made from a mixture of suitable clays and finely ground minerals, such as quartz and felspar. After firing at a high temperature, the ware shall not, even when unglazed, have an average value of water absorption greater than 0.5 percent of the dry weight of the ware, when tested in accordance with 10.3. It shall be coated on all exposed surfaces with an impervious non-crazing vitreous glaze giving a white or coloured finish.

5 APPLICATION OF GLAZING

5.1 The vitreous glazing medium shall be thoroughly fused to the body. Subject to exceptions, given in 5.1.1, 5.1.2 and 5.1.3 all exposed surfaces of an appliance shall be uniformly glazed, shall be free from craze and discolouration and shall possess an impervious surface. It shall have a high gloss and be of such a thickness and opacity as to give a uniform colour and finish to the surface.

5.1.1 Surfaces coming into contact with walls and floors may be without glaze.

5.1.2 On wash basins set away from walls, those portions of the rear aprons used for supporting the appliances in kilns; the backs of overflows and the undersides of outlet bosses may be without glaze.

5.1.3 Appliances may have unglazed portions but the unglazed surfaces shall not be visible when the appliance is installed in the normal manner.

5.2 The materials used for making glaze shall not contain lead or a lead compound. In case of certain colouring oxides used for making coloured glaze, the lead content, if any, shall not exceed 5 percent of the weight of the glaze when tested as per method described in Annex A.

6 PERMISSIBLE BLEMISHES OR DEFECTS

6.1 WC pans, Bidets, Squatting Pans, Urinals, Partition Plates, Pedestals, Short Pedestals and Accessories

When examined from any point on the viewing circle as illustrated in Fig. 1, the appliance shall not show, to the unaided eye of a trained observer, blemishes or defects in excess of those listed in Table 1.

6.2 Wash Basins, Laboratory Sinks and Drinking: Fountains

When examined from a distance of 60 cm, (see Fig.1) the surface of the appliance shall not show to the unaided eye of a trained observer, blemishes or defects in excess of those listed in Table 2.

6.3 Flushing Cisterns, Auto Cisterns and Covers

When examined from a distance of 60 cm (see Fig. 1), the outer surface of the cistern and its cover when assembled shall not show, to the unaided eye of a trained observer, blemishes or defects in excess of those given in Table 3.

6.4 Illumination During Visual Examination

When checking an appliance by visual examination, either in natural or artificial light, the uniform light intensity at the surface of the





Table 1	Blemishes or	Defects	Permitted	in WC	Pans B	idets,	Squatting	Pans,	Urinals,
	Partition	Plates, 1	Pedestals,	Short P	'edestals	1 and	Accessorie	65	

(Clause 6.1)

Location	Blemish or Defect	Maximum Permitted		
	Wavy finish	None on all visible surfaces		
General	Warpage: WC pan and bidets Squatting pans	Not more than 6 mm a) Not more than 6 mm for long pattern of 580 mm size, b) Not more than 10 mm for long pattern of 630 mm size and Orissa patterns of 580 mm and 630 mm sizes		
	Other appliances	Not more than 1 mm per 100 mm; total warpage not more than 6 mm		
	Accessories	Not to exceed 5 mm on any plane		
	L Discoloration	None on all visible surfaces		
Flushing surface and horizontal face	Spots, blisters and pinholes	A total of not over three; no grouping. For coloured appliances, blister and pinhole limited to one each		
of rims of WC pans, squatting pans bldets and urinals	Bubbles and specks	Not over two in one pottery square; a total of not over four. For coloured appliances, a total not over two		
	Polishing marks	One only; none permitted for coloured appliances		
Visible surfaces other than above	Spots, blisters and pinholes	A total of not over five; no grouping. For coloured appliances no blisters are permitted and pinholes are limited to a total of two		
	Bubbles and specks	Not over three in one pottery square; a total of not over ten		
	Polishing marks	Two only. One permitted for coloured appliances		

Location	Blemish or defects	Maximum Permitted		
	Wavy finish	None on all visible surfaces.		
General	Wash basins and drinking fountains	Warpage of slab out of horizontal plane not to exceed 6 mm on all sizes (warpage of backs of wash basins which are attached to the wall not to exceed 3 mm)		
	Laboratory sinks	Warpage not to exceed \pm 3 percent on all planes		
	Discoloration	None on all visible surfaces		
Service space, top of slab, inside of bowl, front of fascia	Spots, blisters and pinholes	A total of not over two; no grouping. For coloured appliances no blisters are permitted and pinhole limited to one only		
	Bubbles and specks	A total of not over four; no grouping. For coloured appliances, a total of not over two		
	Polishing marks	One only, none permitted for coloured appliance		
Face of internal, back and side	Spots, blisters and pinholes	One only; on back or on either side; a total of not over three. For coloured appliances no blisters are permitted and pinholes are limited to a total of two		
	Bubbles and specks	A total of not over four; no grouping		
	Polishing marks	Two only. One permitted for coloured appliances		

Table 2 Blemishes or Defects and Permitted in Wash Basins, Laboratory Sinks and Drinking Fountains

(Clause 6.2)

Table 3 Blemishes or Defects Permitted in Flushing Cisterns, Auto Cisterns and Covers when Assembled

(Clause 6.3)

Location	Blemish or defect	Maximum Permitted
General {	Warpage	Warpage of the flat back portion in case of cisterns not to exceed 5 mm and for bottom portion in case of coupled cistern not to exceed 3 mm.
l	Discoloration	None on visible surfaces
ſ	Wavy finish	Not more than 2 500 mm ^a , on ends only; none on cover,
Visible surface	Spots, blisters and pinholes	A total of not over four; on grouping. However, a total of not over one on covers. For coloured appliances, blister and pinholes limited to one each, none on covers.
AIBIDIG BULIACO	Bubbles and specks	Not over two in one pottery square; total of not over six; including not over two on cover
	Polishing marks	One only; none on cover; none permitted for coloured appliance

appliance shall be $300 l_x$ when checked with a light meter. Artificial lighting when used, shall be provided by one or more fluorescent lamps of colour temperature 6 500 K, positioned 2 m minimum above the top of the appliance. The appliance shall be positioned so that it is between the light source and the observer.

NOTE — Mnoir imperfections which do not affect the appearance or efficiency of the appliance shall not constitute valid reasons for rejection.

7 MINIMUM THICKNESS

The thickness at any place in an appliance shall not be less than 6 mm.

8 TOLERANCES

Except where otherwise specified in various parts of this standard, the following tolerances

shall apply:

- a) On dimensions 75 mm and more \pm 2 percent of the specified dimension or \pm 2 mm whichever is more.
- b) On dimensions less than 75 mm $-\pm$ 5 percent of the specified dimension or \pm 2 mm whichever is more.
- c) On the height of the fluth outlet of P-traps, or horizontal outlets ± 5 mm; and
- d) On all angles $-\pm 3^{\circ}$.

9 PERFORMANCE REQUIREMENTS

9.1 Warpage

The appliance shall be considered to be within the warpage limits, if a feeler gauge of thickness equal to the maximum warpage specified (see Tables 1, 2 or 3) does not slide under the appliances without application of force, as detailed in 10.1.

9.2 Crazing

When tested in accordance with the procedure given in 10.2, none of the test piece shall show crazing.

9.3 Water Absorption

The average value of water absorption of the test piece, when evaluated as given in 10.3 shall not exceed 0.5 percent. No individual result shall exceed 0.75 percent.

9.4 Modulus of Rupture

The average modulus of rupture of ten samples when tested by the method described in 10.4 shall not be less than 60 MPa.

9.4.1 Values taken for determination of the average shall not vary more than ± 20 percent of the average value. Values above or below 20 percent of the average may be discarded for the calculation of the average value. If the fractured surface of test pieces show lamination, erack or a cavity at the centre or any other defect, those test pieces shall be rejected but minimum ten test pieces shall be available for working out the average value.

9.5 Chemical Resistance

When tested by the method described in Annex B, none of the test pieces shall appear to the unaided eye of a trained observer to have suffered any loss of reflectivity of the glaze when compared with the control sample.

9.5 Resistance to Staining and Burning

When tested by the method described in Annex C, no stain shall remain on either of the test piece.

10 TEST PROCEDURE

10.1 Warpage

The appliance shall be placed face down on a flat surface, preferably a surface plate to ascertain the amount of deviation from the horizontal plane that exists at the edges of the appliance. If the appliance rocks, on two points, a horizontal plane shall be determined by placing the feeler gauge of a thickness equal to the maximum warpage permitted for the appliance (*see* Table 1, 2 or 3) under one low corner and forcing the appliance down on this gauge. If a second feeler gauge of the same thickness does not slide at any other point, the appliance shall be considered as not warped out of the horizontal plane and to be in conformity with the permissible warpage limits.

10.2 Crazing

10.2.1 Test Pieces

Three test pieces each having a surface area of not less than 250 cm³ shall be broken from widely separated parts of the appliance. At least one major surface shall be glazed surface. Care shall be taken not to produce cracks either in the body or in glaze; any such pieces shall be discarded. Surfaces other than major surfaces shall be unglazed and freshly broken. Alternatively, test pieces of surface area not less than 250 cm² and 10 mm minimum thickness with one major surface glazed may be separately made using the same body and glaze materials as used in the making of the appliance of the batch and put through the kiln along with the alternative pieces, grooves of 2 mm deep shall be cut with grinding wheels to expose the inside of the body.

10.2.2 Test Procedure

The test pieces shall be placed for 10 hours or, for two periods of five hours each, in a vessel in an autoclave in which saturated steam is maintained at a pressure between 0.34 to 0.37 MPa. The test pieces shall be allowed to cool to room temperature inside the autoclave and afterwards soaked for 12 hours in a solution of dye to which a small quantity of wetting agent has been added. Examine the test pieces for crazing.

10.3 Water Absorption Test

10.3.1 The test sample shall consist of three

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pieces, each having a surface area of approximately 100 cm², taken from widely separated parts of the appliance. At least one major surface shall be a glazed surface. Surfaces other than major surfaces shall be unglazed and freshly broken. Care shall be taken not to produce cracks either in the body or in the glaze. Such test pieces with cracks shall be discarded. Alternatively, test pieces of the same surface area and 10 mm minimum thickness with one major surface glazed shall be separately made using the same batch and glaze materials as used in making of the appliances of the batch and put through the kiln along with the appliances. In the unglazed faces of the alternative pieces, grooves of 2 mm deep shall be cut with grinding wheels to expose the inside of the body.

10.3.2 Test Procedure

The test pieces shall be dried to a constant mass at a temperature between 110°C and 115°C and then cooled to room temperature in a desiccator. The pieces shall be weighed to an accuracy of not less than 0.01 g and placed in a vessel from which the air can be removed, maintaining the pressure at less than 4.2 KPa (3 cm mercury) for one hour. Cold freshly boiled distilled water shall then be admitted to the vessel without reducing the vacuum until the pieces are covered. Air is then admitted to the vessel and the pieces removed and boiled in distilled water for not less than 20 minutes. The pieces shall then be allowed to cool and remain in this water overnight. The test pieces shall be wiped dry with a damp and smooth cloth in such a manner as to remove the surface water only and then weighed.

10.3.3 Evaluation of Test Pieces

Water absorption of the test pieces shall be calculated as follows:

Percentage of water =
$$\frac{M_s - M_1}{M_1} \times 100$$

where

 $M_3 = Mass$ of test piece after Treatment, and $M_1 = Mass$ of the dry test piece.

10.4 Modulus of Rupture

10.4.1 Test Pieces

Sample test bars shall be separately prepared, using the same body materials as used in making the appliances of a batch and shall be fired in the same kiln along with the appliances. They shall be square or circular in section and the crosssectional area shall not be less than 150 mm⁸ and 150 mm long and shall not be glazed.

10.4.2 Test Procedures

The modulus of rupture shall be determined by using at least 10 of these bars mounted on supports, 125 mm apart, and loaded rapidly (approximately 5 kg/s) at the mid-point.

10.4.3 Evaluation of Results

The modulus of rupture shall be calculated from the formula:

$$S = \frac{0.15 PL}{bd^2}$$
 for rectangular cross section, or

$$S = \frac{0.8 PL}{D^3}$$
 for circular cross section

where

- S = Modulus of rupture,
- P =total load in N,
- L =length of span in mm,
- b = width of test bar (in mm) to the nearest 0⁻¹ mm,
- d = depth of test bar (in mm) to the nearest 0⁻¹ mm,
- D = diameter of test bar in mm.

10.5 Procedure for Taking Samples for Test

Samples for crazing, water absorption, and modulus of rupture tests shall be taken as follows:

- a) In the case of tunnel kilns, two test pieces for crazing test and two test pieces for water absorption test shall be kept in one trolley during a shift of 8 h. A lot of 20 pieces shall be kept in the centre of the trolley or in different parts of the platform for purpose of carrying out modulus of rupture test on minimum of 10 pieces twice a week.
- b) If the firing is done in intermittent kiln/ batch type furnaces, the samples for all tests should be kept at least at 12 places. The samples after firing shall be collected and stored.
- c) Number of samples as specified under each test shall be selected out of the test pieces obtained from (a) and (b) above.

ANNEX A

(Clause 5.2)

LEAD SOLUBILITY TEST

A-1 A weighed quantity of material (glaze) in the clear filtrate shall be precipitated as lead dried at 100°C shall be shaken continuously for one hour (at room temperature) with 1 000 times its weight of dilute hydrochloric acid (50 percent dilution, specific gravity 1.18). Thereafter, it shall be allowed to stand for one hour and then filtered. The lead salt contained

sulphate. The weight of lead sulphate calculated as lead monoxide shall not exceed 5 percent of the dry weight of the sample taken for the test.

NOTE - The above test shall preferably be conducted at the manufacturer's works.

ANNEX B

(Clause 9.5)

TESTS FOR CHEMICAL RESISTANCE

B-2 PROCEDURE

B-1 CONTROL TEST PIECE SIZE

B-1.1 The test sample shall consist of eight pieces each not smaller than $75 \text{ mm} \times 25 \text{ mm} \times 6 \text{ mm}$ taken from the glazed part of the appliance. One piece placed in a desiccator and is used as a control test piece.

B-2.1 The other seven test pieces are partially immersed, one in each of the seven solutions. listed in Table 4. The strength of solution, lengths of time for immersion and the temperature shall be as stated in Table 4. Solution are all aqueous.

S I No.	Name of Chemical	Strength of Solution Percent	Time Hours	Temperature °C
(1)	(2)	(3)	(4)	· (5)
i)	Acetic acid	10	16	100
ii)	Citric acid	10	16	100
iii)	Detergent (Note 1)	(See Note 1)	48	60
ív)	Hydrochloric acid	(See Note 2)	48	25-35
v)	Sodium hydroxide	5	0.2	60
vi)	Sodium stearate	0.12	48	60
vii)	Sulphuric acid	3	16	100

Table 4 Chemical Solutions

NOTES

1 This consists of an aqueous solution containing 0.04 percent (wt/vol) of a condensation product of nonylphenol with 8-10 molecules of ethylene oxide.

2 This solution consists of equal volumes of water and of hydrochloric acid of specific gravity 1.18.

ANNEX C

(Clause 9.6)

TESTS FOR RESISTANCE TO STAINING AND BURNING

C-1 TEST PIECE SIZE

C-2 PROCEDURE

C-1.1 The test sample shall consist of two pieces, each not smaller than 75 mm × 25 mm × 6 mm taken from the glazed part of the appliance.

C-2.1 One of the test pieces is placed, at room temperature, with a glazed surface level, uppermost, clean and dry. One spot, not less

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than 10 mm diameter, of each of the six chemicals listed in C-2.2 is then placed on the glazed surface and allowed to dry. Any residue is then removed with a clean cloth which has been moistened with distilled water only.

C-2.2 The chemicals are the following:

- a) 0.5 percent aqueous solution of methylene blue,
- b) A solution of sodium hypochlorite, 10-14 percent w/v available chlorine.
 A 10 percent dilution is prepared for the test,

- c) 3 percent aqueous solution of hydrogen peroxide,
- d) Amyl acetate,
- e) Carbon tetrachloride, and
- f) 13 g of iodine in 1 litre of ethanol.

C-2.3 The other piece is placed, at room temperature, with a glazed surface level uppermost, clean and dry. A lighted cigarette is placed on the glazed surface, and allowed to remain for 15 minutes and then removed. The stained area is wiped with a clean cloth which has been moistened with distilled water only.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Sanitary Appliances and Water Fittings Sectional Committee, CED 3

Delhi

Chairman

SHRI S. PRAKASH

Member

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REPRESENTATIVE REPRESENTATIVE SHRI J. VENKATARAMAN, Director (Civ Engs)

Delhi Water Supply and Sewage Disposal Undertaking (MCD),

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Engineer-in-Chief's Branch, Army Headquarters, New Delhi

Hindustan Shipyard Ltd, Visakhapatnam

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Central Public Works Department, New Delhi

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