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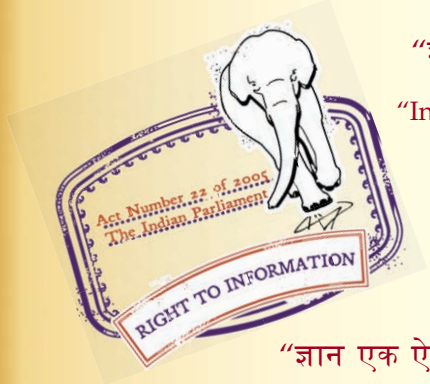

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SPECIFICATION FOR GLAZED FIRE-CLAY SANITARY APPLIANCES

PART I GENERAL REQUIREMENTS

(Second Revision)

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Indian Standard

SPECIFICATION FOR GLAZED FIRE-CLAY SANITARY APPLIANCES

PART I GENERAL REQUIREMENTS

(Second Revision)

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Indian Standard

SPECIFICATION FOR GLAZED FIRE-CLAY SANITARY APPLIANCES

PART I GENERAL REQUIREMENTS

(Second Revision)

0. FOREWORD

0.1 This Indian Standard (Part I) (Second Revision) was adopted by the Indian Standards Institution on 4 May 1979, after the draft finalized by the Sanitary Appliances and Water Fittings Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 This standard was first issued in 1958 and was revised in 1963 to cover requirements for additional glazed earthenware sanitary appliances, such as orissa pan, laboratory sink, squatting plate, slab and stall urinal and half-round channel. In this revision the scope of the standard has been restricted to cover requirements for glazed fire-clay sanitary appliances only since the glazed earthenware sanitary appliances were outdated as well as unhygenic. The Sectional Committee has found that only some of the sanitary appliances were being made in glazed fire-clay and therefore decided to cover the requirements for these appliances only in this revision. The general requirements applicable to all appliances and specific requirements for different appliances have been covered in separate parts of the standard. This standard (Part I) deals with the general requirements of all glazed fire-clay sanitary appliances.

0.3 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*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard (Part I) covers the general requirements for materials, manufacture, finish, methods of test, sampling and inspection of all glazed fire-clay sanitary appliances.

*Rules for rounding off numerical values (*revised*).

1.2 This standard does not cover vitreous sanitary appliances. Requirements of vitreous sanitary appliances have been covered in IS : 2556 (Part I)-1974*.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 **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 dimensions.

2.2 **Bubble** — A raised portion of the surface or a sand speck not more than one millimetre in its maximum dimensions.

2.3 **Craze or Crazing** — Fine hair-line cracks in the glaze.

2.4 **Dull or Egg Shell Finish** — Dead or flat finish with undeveloped glaze slightly matted in appearance or a semi-glazed finish exhibiting numerous very fine pinholes and non-glossy appearance.

2.5 **Dunt** — A hair-line fracture extending through or into the body of the article.

2.6 **Exposed Body** — Unglazed portion 1·5 mm or more in its maximum dimension.

2.7 **Firecheck or Fire-Crack** — A fine, shallow crack in the body, not covered with glaze.

2.8 **Kiln Support Marks** — Large unglazed surfaces resulting from blocks necessary to support the ware while firing.

2.9 **Pinhole** — Unglazed portion or a hole in the body less than 1·5 mm in its maximum dimension.

2.10 **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.

2.11 **Pottery Square** — A square of dimensions 50 × 50 mm selected on the appliances for examining visual defects.

2.12 **Speck** — An area of contrasting colour less than one millimetre maximum dimensions. Specks less than 0·25 mm, maximum dimension, do not constitute a defect unless sufficient in number to form a discolouration.

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*Specification for vitreous sanitary appliances (vitreous china): Part I General requirements (*second revision*).

2.13 Spot — A discoloured portion of the surface not exceeding 3 mm in its maximum dimension.

2.14 Warpage — Distortion of original shape during the manufacturing process.

2.15 Wavy Finish — A defect in the glaze finish having the appearance of numerous runs in the glaze, irregular or mettled.

3. MATERIAL, MANUFACTURE AND FINISH

3.1 Material and Manufacture — Fire-clay bodies are moderately fine, porous, off-white bodies using natural fire clays, ball clays or stoneware clays and clay grogs covered by a glaze properly matured and fitted to the body.

3.2 Permissible Blemishes and Defects

3.2.1 When examined from any point within the viewing circle described below, the appliances shall not show to the unaided eye of a trained observer blemishes or defects in excess of those listed in Table 1.

3.2.1.1 The viewing circle referred to is 1 200 mm in diameter and lies on a plane parallel with and 600 mm above the rim of the appliances. A line joining the centre of the circle and the centre of area of the inside boundary of the rim is perpendicular to the plane of the viewing circle.

4. MINIMUM THICKNESS

4.1 The thickness at any place in an appliance shall not be less than 8 mm.

5. GLAZING

5.1 All visible surfaces of the body shall be glazed. Surfaces coming in contact with floor or wall and the underside of sinks, etc, and points where appliances are supported in the kiln may be unglazed.

5.2 The glaze shall be uniform, free from craze and shall possess an impervious surface. It shall have a high gloss and shall normally be white but may be supplied in any other colour as agreed to between the manufacturer and the purchaser. In the case of glazes containing lead, the lead content shall not exceed 5 percent of soluble lead when tested by the method described under **5.2.1**.

5.2.1 A quantity of material (glaze) of known mass dried at 100°C shall be shaken continuously for one hour (at room temperature) with 1 000 times its mass of dilute hydrochloric acid. Thereafter, it shall be allowed to stand for one hour and then filtered. The lead salt contained in the clear filtrate shall be precipitated as lead sulphate.

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

TABLE 1 BLEMISHES AND DEFECTS PERMITTED IN VARIOUS APPLIANCES

(*Clauses* 3.2.1, 6.1, *and* 8.1)

Sl No.	Location	Blemish or Defect	Maximum Permitted
(1)	(2)	(3)	(4)
i)	General	Warpage	Not to exceed ± 2 percent on all planes or 10 mm whichever is less
ii)	Service space, top of rim or slab, inside of bowl	Spots and blisters	A total of not over six
		Bubbles, pinholes and specks	A total of not over eight
		Polishing marks and exposed bodies	A total of not over four
iii)	Visible surfaces other than above	Spots and blisters	A total of not over six
		Bubbles, pinholes and specks	Not over three in one pottery square; a total of not over ten
		Polishing marks and exposed bodies	A total of not over four

6. PERFORMANCE REQUIREMENTS

6.1 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* Table 1) does not slide under the appliance without application of force.

6.2 Crazing — When tested in accordance with the procedure given in **8.2** none of the test pieces shall show crazing.

6.3 Water Absorption — The value of water absorption of any of the test pieces, when evaluated as given in **8.3** shall not exceed 15 percent.

6.4 Thermal Shock — When tested in accordance with the procedure given in **8.4** the appliance shall not show any sign of injury.

6.5 Chemical Resistance — When tested by the method described in Appendix A, 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.

6.6 Modulus of Rupture — The average modulus of rupture of ten samples when tested by the method described in **8.6** shall not be less than 20 MPa.

6.6.1 Values taken for determination of the mean value shall not vary more than $\pm$ 20 percent of the mean value. Values above or below 20 percent of the mean may be discarded for the calculation of the mean value. If the fractured surface of test pieces show lamination crack or a cavity at the centre or any other defect, those test pieces shall be rejected.

6.7 Resistance to Staining and Burning — When tested by the method described in Appendix B no stain shall remain on either of the test pieces.

7. PROCESS INSPECTION AND LOT INSPECTION

7.1 The recommended methods for process inspection and lot inspection are given in Appendix C.

8. TEST PROCEDURES

8.1 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 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) 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.

8.2 Crazing — Three test pieces each having an area of not less than 100 cm^2 on one side shall be broken from widely separated parts of the article. 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, sample pieces having the same surface area as mentioned above may be separately prepared, using the same body and glaze materials used in making the appliances of the batch and put through the kiln along with the appliances.

8.2.1 *Test Procedures* — The sample pieces shall be placed in an autoclave and subjected to a constant pressure of 0·35 MPa in saturated steam for 5 hours. The test pieces shall then be allowed to cool to room temperature inside the autoclave. They shall then be examined for crazing by applying a dye solution to the surface.

8.3 Water Absorption Test

8.3.1 The test samples shall consist of three fragments taken from widely separated parts of the appliance, each fragment having at least one of the two major surfaces fully glazed and having a surface area of approximately 75 cm^2. 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, any such pieces 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 material as used in making of the appliances of the batch and put through the kiln along with the appliances.

8.3.2 *Test Procedure* — The test piece shall be dried to a constant mass at 110 ± 5°C and shall then be stored in a desiccator until cooled to room temperature. The specimen shall then be weighed in a balance to an accuracy of 0·5 g. The weighed pieces shall then be placed in distilled water in a suitable vessel and boiled for two hours. They shall be supported so as not to touch the heated bottom of the container. The pieces shall then be allowed to cool and remain in water overnight. The test pieces shall be wiped dry with a damp cloth in such a manner as to remove the surface water only and then weighed.

8.3.3 *Evaluation of Test Pieces* — Water absorption of the test pieces shall be calculated as follows:

$$\text{Percentage of water absorption} = \frac{W_2 - W_1}{W_1} \times 100$$

where

W_2 = mass of test piece after treatment, and

W_1 = mass of the dry piece.

8.4 Thermal Shock — This test shall be applicable only to kitchen sinks and laboratory sinks.

8.4.1 *Test Procedures* — The appliance shall be filled with hot water at 90°C and the water kept for 20 to 30 minutes depending on the dimension until the appliance gets heated throughout, after which the hot water shall be quickly emptied from the appliance and the appliance immediately filled with cold water of temperature 3°C. The cold water

shall be kept in the appliance for 20 to 30 minutes until the appliance gets thoroughly cooled, after which the cold water shall be quickly emptied from the appliance and the cycle repeated. After the repetition of the cycle for 5 times, the appliance shall not show any sign of injury.

8.5 Tests for Chemical Resistance — The test procedure for chemical resistance is given in Appendix A.

8.6 Modulus of Rupture

8.6.1 *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 cross-sectional area shall not be less than 150 mm^2 and 150 mm long and shall not be glazed.

8.6.2 *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 50 N per second) at the mid point.

8.6.3 *Evaluation of Results* — The modulus of rupture shall be calculated from the formula:

$$S = \frac{1{\cdot}5\ PL}{bd^2} \text{ for square sections}$$

$$= \frac{8\ PL}{\pi D^3} \text{ for circular sections}$$

where

S = modulus of rupture,
P = total load in N,
L = length of span in mm,
b = width of test bar to the nearest 0·1 mm,
d = depth of test bar to the nearest 0·1 mm, and
D = diameter of test bar in mm.

8.7 Test for Resistance to Staining and Burning — The test procedures shall be as given in Appendix B.

9. INSPECTION AND MANUFACTURER'S CERTIFICATE

9.1 The appliances shall be subjected to visual inspection in good light and they shall not show any of the following defects beyond the limits laid down under terminology:

a) Dunts,
b) Crazing,
c) Warpage,
d) Unglazed patches,
e) Fire-cracks, and
f) Egg shell finish.

9.2 Where agreed to between the purchaser and the vendor, the purchaser or his representative shall be given all facilities for inspection of the goods at all stages of manufacture and finally prior to despatch from the manufacturer's works.

9.3 When no inspection of the goods is made by the purchaser or his representative at the manufacturer's works, the manufacturer, if requested to do so, shall supply a certificate stating that the goods supplied conform in all respects to this standard. The manufacturers certificate will not be necessary if the article bears the ISI Certification Mark.

9.4 The purchaser shall be at liberty to reject any goods purporting to have been supplied to this standard, if they do not comply with the requirements of this standard.

10. MARKING

10.1 Appliances shall be clearly and indelibly marked at a prominent place, visible even after the appliances are installed, with the name or trade-mark of the manufacturer.

10.1.1 The fire clay sanitary appliances conforming to the specific requirements as prescribed in the relevant parts of this standard may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

APPENDIX A

(*Clauses* 6.5 *and* 8.5)

TEST FOR CHEMICAL RESISTANCE

A-1. CONTROL TEST PIECE SIZE

A-1.1 The test sample shall consist of 8 pieces each not smaller than 75 × 25 × 8 mm taken from the glazed part of the appliance. One piece placed in a desiccator and is used as a controlled test piece.

A-2. PROCEDURE

A-2.1 The other 7 test pieces are partially immersed one each of the 7 solutions listed in Table 2 at the strength of solution for the length of time and at temperature stated; the solutions are all aqueous.

TABLE 2 CHEMICAL SOLUTION FOR CHEMICAL RESISTANCE TEST

Sl 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
iv)	Hydrochloric acid	(*see* Note 2)	48	25-35
v)	Sodium hydroxide	5	½	60
vi)	Sodium stearate	0·15	48	60
vii)	Sulphuric acid	3	16	100

Note 1 — This consists of an aqueous solution containing 0·04 percent (mass/vol) of a condensation product of nonyphenol with 8-10 molecules of a ethylene oxide.

Note 2 — This solution consists of equal volumes of water and of hydrochloric acid of specific gravity 1·18.

APPENDIX B

(*Clauses* 6.7 *and* 8.7)

TEST FOR RESISTANCE TO STAINING AND BURNING

B-1. TEST PIECE SIZE

B-1.1 The test sample shall consist of two pieces each not smaller than 75 × 25 × 8 mm taken from the glazed part of the appliance.

B-2. PROCEDURE

B-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 than 10 mm of each of the six chemicals listed in **B-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 water only.

B-2.2 The chemicals are the following:

a) 0·5 percent solution of methylene blue,

b) 10 percent aqueous solutions of sodium hypochlorite,

c) 3 percent aqueous solutions of hydrogen peroxide,

d) Amyl acetate,

e) Carbon tetrachloride, and

f) 13 g of iodine in one litre of ethyl alcohol.

B-2.3 The other piece is placed at room temperature with a glazed surface level uppermost, clean and dry. 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 cloth which has been moistened with distilled water only.

APPENDIX C

(*Clause* 7.1)

PROCESS INSPECTION AND LOT INSPECTION

C-1. PROCESS INSPECTION

C-1.1 The inspection done by the manufacturer during production is to ensure uniformity and reduce quality fluctuations to the minimum whereas the object of inspecting sanitary appliances by the purchaser is to ensure its uniformity to the specification requirements. For process control the manufacturer shall take the representative samples of the product at regular intervals to control the quality fluctuations. For items of the same type, inspection levels given below are recommended for routine control over the manufacturing process:

Characteristics/Tests	*Frequency of Inspection/Tests*
Visual examination (permissible blemishes and defects)	Each individual appliance
Warpage	Each individual appliance
Minimum thickness	Two pieces of each type of pattern from a day's production in case of a continuous kiln and from each firing in case of an intermittent kiln

Characteristics/Tests	*Frequency of Inspection/Tests*
Dimensions of appliance	Two pieces of each type of pattern from a week's production in case of a continuous kiln and from each firing in case of an intermittent kiln
Construction	Each individual appliance
Water absorption	Three sample pieces every day in case of a continuous kiln and from every firing in case of an intermittent kiln
Crazing	Three sample pieces twice a week in case of a continuous kiln and from every firing in case of an intermittent kiln
Test for chemical resistance	Eight sample test pieces once a week in case of a continuous kiln and from every firing in case of an intermittent kiln
Test for staining and burning	Two sample pieces once a week in case of a continuous kiln and from every firing in case of an intermittent kiln
Test for modulus of rupture	Ten sample pieces twice a week in case of a continuous kiln and twenty sample pieces from every firing in case of an intermittent kiln
Test for thermal shock	Two sample pieces once a week in case of a continuous kiln and from every firing in case of an intermittent kiln

C-1.2 For effective process control, the use of statistical quality control techniques is recommended and helpful guidance may be obtained in this respect from IS : 397-1972*.

C-1.3 The inspection data or the results of tests done at the place of manufacturer may be made available along with the items supplied to enable the purchaser to judge the acceptability of the lot.

*Method of statistical quality control during production.

C-1.4 When such information cannot be made available to the purchaser and when the purchaser so desires, the procedure laid down in **C-2** shall be followed for judging the conformity of the lot to the requirements of this standard.

C-2. LOT INSPECTION

C-2.1 In any consignment all the appliances of the same type and size shall be grouped to 200 pieces or less. Each such group shall constitute a lot.

C-2.1.1 Samples shall be taken from each lot separately to ascertain the conformity of the appliances to the requirements of the specification.

C-2.2 Number of Tests and Criteria for Conformity of Crazing Water Absorption, Chemical Resistance, and Resistance to Staining and Burning — The number of tests to be made and the criteria to ascertain conformity or otherwise of lot to the requirements of these tests shall be as given in the relevant test method.

C-2.3 Number of Tests and Criteria for Conformity for Finish, Thickness, Dimensions, Construction Glazing and Warpage — The number of appliances to be selected shall depend upon the size of the lot and shall be in accordance with col 3 and 4 of Table 3.

C-2.4 The appliances shall be selected at random from the lot and in order to ensure the randomness of selection, random number tables may be used. In case random number tables are not available the following procedure shall be adopted:

> 'Starting from any appliance in the lot count them as 1,2,3,....., up to r and so on, in one order, where r is the integral part of N/n (N being the lot size and n being the sample size). Every rth appliance thus conuted shall be withdrawn to constitute a sample.'

C-2.5 Each of the appliances selected in the sample shall be inspected for finish, thickness (*see* Note under Table 3) dimensions, construction glazing and warpage. Any appliance failing to meet any one or more requirements of the above characteristics shall be considered as defective.

C-2.6 If the number of defective appliances found is less than or equal to the corresponding permissible number given in col 3 of Table 3, the lot shall be considered as conforming to the requirements of the above characteristics, otherwise not.

TABLE 3 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES

(*Clauses* C-2.3, C-2.5 *and* C-2.6)

Sl No.	Characteristics	No. of Appliances in the Lot	No. of Appliances to be Selected	Permissible No. of Defective
(1)	(2)	(3)	(4)	(5)
i)	For finish, glazing and warpage	2 to 8	2	0
		9 to 15	3	0
		16 to 25	5	0
		26 to 50	8	0
		51 to 100	13	1
		101 and above	20	2
ii)	For minimum thickness, dimensions and construction	Up to 25	8	1
		26 to 50	13	2
		51 to 100	20	3
		101 and above	32	5

Note — Special calipers can be used for measuring thickness without having to break the appliance for checking the minimum thickness.

(*Continued from page* 2)

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