

**BUREAU OF INDIAN STANDARDS**

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<p><b>भारतीय मानक</b></p> <p><b>सामान्य प्रयोजनों के लिए स्टोनवेयर कंटेनरों की — विशिष्टि</b></p> <p><b>( पहला पुनरीक्षण )</b></p> <p><b><i>Indian Standard</i></b></p> <p><b>STONEWARE CONTAINERS FOR GENERAL PURPOSES</b></p> <p><b>— SPECIFICATION</b></p> <p><b>( <i>First Revision</i> )</b></p> <p><b>(ICS 81.060.20; 97.040.60)</b></p>	
Ceramicware Sectional Committee CHD 09	Last date of comments: 29 April 2024

## FOREWORD

*(formal clauses to be added later)*

The main application of non-constructural ceramics is in the home as tableware, kitchenware and vases. Glazed or unglazed household stoneware articles such as pickle jars, *MATKAS*, bowls, butter-milk jugs, *CHUTNEY* sets, etc, are widely used in the country and such articles are covered under this standard.

Stoneware containers are relatively thick and have simple shapes and coloured glossy or matt glazes. As the stoneware containers are articles of utility as well as of beauty the Committee did not specify dimensions, but recommended certain capacities for the containers, to rationalize the manufacture and to help the consumer in selecting a suitable container.

This standard is essentially based on the results of investigation carried out by the Central Glass and Ceramic Research Institute, Calcutta, on the samples of household stoneware articles currently being produced in the country. However, in the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries. This has been met by deriving assistance from B. S. 784:1953 'Methods of test for chemical stoneware' issued by the British Standards Institution.

This standard was first published in 1964. In this revision, the requirement of release of lead and cadmium (Toxic Elements) has been added.

This standard is one of a series of Indian Standards on stoneware articles and the other standard so far published in the series is IS 2839 : 1964 'Specification for industrial stoneware'.

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 : 2022

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'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of these specified value in this standard.

## 1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for stoneware containers for general purposes.

## 2 REFERENCES

The standards listed 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 revisions, and parties to agreements based on this Indian Standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

<i>IS No</i>	<i>Title</i>
IS 264 : 2005	Nitric acid — Specification ( <i>third revision</i> )
IS 266 : 1993	Sulphuric acid — Specification ( <i>third revision</i> )
IS 460 (Part 1) : 2020	Test Sieves — Specification Part 1 Wire Cloth Test Sieves ( <i>fourth revision</i> )
IS 2781 : 2020	Glossary of Terms Relating to Ceramicware ( <i>third revision</i> )
IS 2839 : 1964	Specification for industrial stoneware
IS 9806 : 2001	Methods of test for and permissible limits of toxic materials released from ceramicware, vitreous enamelware, glassware and glass-ceramicware in contact with food ( <i>first revision</i> )

## 3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 2781 shall apply.

## 4 REQUIREMENTS

**4.1 Description** — Stoneware containers shall be fired ceramicware with or without glaze, having a visually opaque and an off-white or coloured body.

**4.2 Material and Workmanship** — The articles shall be of good workmanship and of satisfactory appearance and finish.

**4.3 Capacity** — The articles shall preferably have the following capacities: 250 ml (or ¼ litre); 500 ml (or ½ litre), 1, 2, 5, 8, 10, 15, 25 and 32 litres.

**4.3.1** The tolerances on capacity shall be as follows:

Up to one litre	±3 percent
Above 1 and up to 10 litres	±2 percent
Above 10 litres	±1 percent

**4.4 Glazing** — All visible surfaces, in case of glazed ware, shall be evenly glazed except stopcocks or threaded neck portions where glaze is not required and the surfaces on which the articles are supported in kiln; but in all these cases the unglazed surfaces shall be well finished. The glazed surface shall be free from glazing defects.

**4.5 Craze Resistance** — The glaze shall remain free from craze, when tested in accordance with the method prescribed in **Annex A**.

**4.6 Water Absorption** — The water absorption of the material when tested in accordance with the method prescribed in **Annex B** shall be not more than 3 percent.

**4.7 Modulus of Rupture** — The average modulus of rupture shall be not less than 350 kg/cm<sup>2</sup> when tested in accordance with the method prescribed in **Annex C**.

**4.8 Lead Solubility of the Glaze** — The glaze of the material shall not show lead solubility of more than 2 ppm when tested in accordance with the method prescribed in **Annex D**.

**4.9 Resistance of Body to Acids** — The resistance of body to acid shall be not less than 99 when tested in accordance with the method prescribed in **Annex E**.

**4.10 Resistance of Glaze to Acids** — The loss in weight shall be not more than 10 mg/dm<sup>2</sup> when tested in accordance with the method prescribed in **Annex F**.

**4.11 Release of Lead and Cadmium (Toxic Elements)** — The limit of release of lead. (Pb) and cadmium (Cd) extracted from stoneware crockeryware shall not exceed the following limits when tested as prescribed in IS 9806.

Type of ware	Minimum number of specimen	Unit	Lead Limit	Cadmium Limit
Flatware	4	mg/dm <sup>2</sup>	0.8	0.07
Large hollowware	4	mg/l	1.0	0.25
Small hollowware	4	mg/l	2.0	0.50
Cups and mugs	4	mg/l	0.5	0.25
Storage hollowware	4	mg/l	0.5	0.25
Cooking-ware	4	mg/l	0.5	0.05

NOTE — Flatware shall constitute a minimum source of lead or cadmium burden from porcelain articles. Limits for flatware (lead or cadmium) refer to the value obtained when the individual values of the pieces tested are averaged. All other limits are expressed in absolute maximum values, in that, no individual unit comprising a sample exceeds these levels.

## 5 MARKING AND PACKING

### 5.1 Marking

Each article shall be permanently and legibly marked on its lower surface with the maker's name or his trade-mark, if any, and capacity.

#### 5.2.1 BIS Certification Mark

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

### 5.3 Packing

The packing of the stoneware shall be as agreed to between the purchaser and the supplier.

## 6 SAMPLING

**6.1** Representative samples of the material shall be drawn and their criteria for conformity shall be determined as prescribed in Annex G.

### ANNEX A

(Clause 4.5)

#### TEST FOR CRAZE RESISTANCE

##### A-1 PRINCIPLE

The articles are subjected to a pressure of 5.0 kg/cm<sup>2</sup> in a pressure vessel for five cycles.

##### A-2 TEST PIECES

Six test pieces, each having a surface area of about 50 cm<sup>2</sup> shall be broken from widely separated parts of three or more articles. The two major surfaces shall be glazed surfaces and any other surface shall be unglazed and freshly broken. Care should be taken not to produce cracks in the body or in the glaze; any such pieces may be discarded.

Alternatively, test pieces may be separately made using the same body and glaze materials as used in the making of the wares of the batch and put through the kiln along with the wares.

### A-3 PROCEDURE

**A-3.1** Place the test pieces in a suitable pressure vessel and subject them to constant pressure of  $5.0 \pm 0.2$  kg/cm<sup>2</sup> in saturated steam for one hour after which time release the pressure by the opening of blow valve. Allow the test pieces to cool to room temperature in the pressure vessel. Examine them for cracking or crazing by applying a dye solution to the surface. Subject the test pieces to five cycles of the above test and observe them for crazing or cracking.

**A-3.1.1** None of the test pieces shall show cracking or crazing.

## ANNEX B

(Clause 4.6)

### TEST FOR POROSITY

#### B-1 PRINCIPLE

Porosity of the material is determined by the amount of water absorbed.

#### B-2 TEST PIECES

Six test pieces, each having a surface area of about 50 cm<sup>2</sup> shall be broken from widely separated parts of three or more articles. The two major surfaces shall be glazed surfaces and any other surface shall be unglazed and freshly broken. Care should be taken not to produce cracks in the body or in the glaze; any such pieces may be discarded. Alternatively, test pieces may be separately made using the same body and glaze materials as used in the making of the wares of the batch and put through the kiln along with the wares.

#### B-3 PROCEDURE

Dry the test pieces to a constant weight at a temperature between 110°C and 115°C and then cool to room temperature in a desiccator. Weigh the pieces to an accuracy of not less than 0.01 g and place in a vessel from which the air can be removed maintaining the pressure at less than 3 cm of mercury for one hour. Admit cold freshly-boiled distilled water to the vessel without reducing the vacuum until the pieces are covered. Then admit air to the vessel without removing the pieces and boil in distilled water for not less than 20 minutes. Wipe the pieces with a damp smooth cloth in such a manner as to remove the surface water only and then weigh quickly.

#### B-4 CALCULATION

**B-4.1** Water absorption of the test pieces shall be calculated as follows:

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

Where

$W_1$  = weight of the dry test piece, and

$W_2$  = weight of test pieces after treatment.

**B-4.1.1** All the six test pieces shall show a water absorption not more than 3 percent.

## ANNEX C

(Clause 4.7)

### DETERMINATION OF MODULUS OF RUPTURE

#### C-1 PREPARATION OF TEST SAMPLE

Test pieces shall be broken or cut from the ware and ground to 100×25 mm having the same thickness as of the article. In case it is not possible to break or cut suitable test pieces they shall be separately prepared using the same body and glaze materials as used in the making of the stonewares of the batch and put through the kiln along with the wares.

### C-2 PROCEDURE

Determine the modulus of rupture by using 10 such test pieces mounted on supports 76 mm apart loaded rapidly (approximately 5 kg/sec) at the midpoint.

### C-3 CALCULATION

The modulus of rupture shall be calculated from the following formula:

$$S = \frac{1.5 PL}{bd^2}$$

Where

$S$  = modulus of rupture,

$P$  = total load in kg,

$L$  = span of bar in mm,

$b$  = width of the test bar to the nearest 0.1 mm, and

$d$  = depth of the test bar to the nearest 0.1 mm.

### C-4 REPORTING OF TEST RESULTS

**C-4.1** Calculate the average ( $\bar{X}$ ) of the test results. Treat as suspect those observations which are either less than ( $0.8\bar{X}$ ) or more than ( $1.2\bar{X}$ ).

**C-4.2** Finally report the average of the test results after rejecting the suspected value, if any.

## ANNEX D

(Clause 4.8)

### DETERMINATION OF LEAD SOLUBILITY OF THE GLAZE

#### D-1 PRINCIPLE

The articles are treated with acetic acid, and through the solution of acetic acid, hydrogen sulphide is bubbled. The colour of lead sulphide thus generated is compared with standard lead solution through which hydrogen sulphide has already been bubbled.

#### D-2 REAGENT

**Standard Lead Acetate Solution** — 0.274 4 g of lead acetate shall be dissolved in 1 litre of distilled water to make a solution of 150 ppm lead, and 1 ml and 2 ml of this solution shall be pipetted out and poured in a measuring flask and the volume made to 150 ml with distilled water so as to make 1 ppm and 2 ppm lead solutions.

#### D-3 TEST PIECES

Cut or break two test pieces from each of the two fresh, whole articles, each test piece having an area approximately 30 cm<sup>2</sup> on one side. The test pieces shall be more or less flat so that they may dip completely in the test solution. At least two sides of the article shall be glazed.

#### D-4 PROCEDURE

**D-4.1** Take the test pieces in a 500-ml borosilicate glass beaker and cover them completely with suitable quantity of 5 percent acetic acid containing 0.25 percent gelatine. The ratio of the total area of the glazed test pieces and the test solution shall be 4: 5. Use a few glass beads to separate the two test pieces from each other as also from the bottom of the beaker. Bring the solution in the beaker just to boiling on a strong Bunsen flame in two minutes and transfer the

beaker with its contents to a boiling water-bath and heat for 30 minutes. Decant and allow the solution to cool to room temperature. Pass hydrogen sulphide gas through a 50 ml of the solution in a Nessler tube.

**D-4.2** Pass hydrogen sulphide gas through 50 ml of standard lead acetate solutions taken in two Nessler tubes containing 1 ppm and 2 ppm of lead. Compare the colour of the test solutions with the standard lead solution.

**D-4.3** Report the colour of both the test solution as lighter or darker than that of 2 ppm lead solution.

## ANNEX E

(Clause 4.9)

### DETERMINATION OF RESISTANCE OF BODY TO ACIDS

#### E-1 PRINCIPLE

The material is ground and digested in concentrated acid and the loss in weight is calculated.

#### E-2 REAGENTS

**E-2.1 Concentrated Nitric Acid** — conforming to IS 264.

**E-2.2 Concentrated Sulphuric Acid** — conforming to IS 266.

#### E-3 PREPARATION OF THE TEST SAMPLE

The test sample shall be taken from the body of the ware and shall be free from glaze. Crush the sample in a stoneware mortar and mix. Use the fraction which passes 850-micron IS Sieve and is retained by 600-micron IS Sieve [see IS 460 (Part 1)] for testing. The portion so collected shall be not less than 30 g and shall be washed free from dust as follows:

Place the material in a porcelain basin and add about 150 ml of distilled water for each 30 g of sample. Place the basin and contents on a sand-bath and heat until the water is at boiling point; continue heating for one hour taking care to avoid loss by spurting. Decant the water immediately and rinse the particles four times with cold distilled water. Dry the material remaining at 110°C to constant weight (about 4 hours will be normally sufficient).

#### E-4 PROCEDURE

Weigh 25 g of the prepared sample accurately within  $\pm 1$  mg and transfer in a 11 cm diameter porcelain basin. Then add a mixture of 7 ml of nitric acid, 13 ml of sulphuric acid and 65 ml of distilled water. Place the basin and its contents on a sand-bath and heat carefully, avoiding spurting, till all nitric acid has evaporated and sulphuric acid starts fuming profusely. Cool the basin and contents. Add then 90 ml of distilled water and 10 ml of nitric acid (sp gr 1.42). Repeat the heating process, until the sulphuric acid again fumes strongly. Cool the basin and contents and decant the acid carefully. Then add about 150 ml of cold distilled water and heat up to boiling point and decant. The cycle of addition of fresh water, boiling and decantation shall continue until the decanted liquor is found to be free from sulphuric acid when tested with barium chloride solution. No particle shall be lost in the process. After the final decantation, dry the sample at 110° C to constant weight.

#### E-4 CALCULATION

$$\text{Resistance to acid} = \frac{\text{Final Weight in grams}}{\text{Initial weight in grams}} \times 100$$

## ANNEX F

(Clause 4.10)

### DETERMINATION OF RESISTANCE OF GLAZE TO ACIDS

#### F-1 PRINCIPLE

The resistance of the glaze to acid is determined by reacting it with hydrochloric acid.

## F-2 PREPARATION OF TEST SAMPLES

Test sample having a capacity of 250 ml shall be separately prepared using the same body and glaze materials as used in the making of the stoneware of the batch and put through the kiln along with the wares.

## F-3 REAGENTS

**F-3.1 Hydrochloric Acid Solution** — 5 percent.

## F-4 PROCEDURE

**F-4.1** Wash the vessel in cold dilute hydrochloric acid followed by distilled water, dry to constant weight at 120°C and when cold, tare against a similar vessel. Fill the vessel to three quarters of its total capacity with hydrochloric acid solution, cover with a clock-glass and heat on steam for four hours. Empty the test vessel and wash thoroughly with distilled water and dry to constant weight at 120°C taring against the same vessel as before. Calculate the weight loss per square decimeter of the test vessel carried by the acid.

**F-4.2** There shall not be any noticeable pitting of the glaze.

## ANNEX G

(Clause 6.1)

### SAMPLING AND CRITERIA FOR CONFORMITY

#### G-1 SCALE OF SAMPLING

**G-1.1 Lot** — All the stoneware articles of the same type, produced under essentially similar conditions of manufacture and offered for inspection at the same time, shall be grouped together to constitute a lot.

**G-1.2** The conformity of the lot to the requirements of this specification shall be ascertained separately for each individual lot. For this purpose samples shall be taken in accordance with col 1 and 2 of Table 1.

**TABLE 1 NUMBER OF SAMPLES AND TEST**

No. OF ARTICLES IN THE LOT <i>N</i>	No. OF ARTICLES IN THE SAMPLE <i>n</i>	PERMISSIBLE No. OF DEFECTIV ARTICLES	No. OF COMPLETE SERIES OF TESTS FOR CLAUSES 3.6 TO 3.10
(1)	(2)	(3)	(4)
Up to 50	8	8	1
51 to 100	13	13	1
101 to 500	20	20	1
501 to 3 000	32	32	1
Over 3 000	50	50	2

**G-1.3** The samples shall be selected at random from the lot. To ensure randomness of selection, use shall be made of random number tables. If such a table is not available, the following procedure shall be adopted.

Starting from any article in the lot count them as 1, 2 up to *r* and so on where *r* is the integral part of  $N/n$  (*N* being the number of articles in the lot and *n* being the number of articles in the sample). Every *r*th article thus counted shall be withdrawn to constitute the sample.



**G-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY**

**G-2.1** Each of the articles in the sample as selected in **G-1.3** shall be inspected for requirements **3.1** to **3.5**. An article failing to meet any one or more of these requirements shall be termed as a defective article. The number of defective articles in the sample shall not exceed the number given in col 3 of Table 1, otherwise the lot shall be considered as not conforming to the requirements.

**G-2.2** The number of tests for requirements **3, 6 to 3, 10** shall be as indicated in col 4 of Table 1. The lot shall be considered as conforming to the requirements of these clauses, if all the tests so conducted are found satisfactory. If one or more of the tests fail, the lot shall be declared as not conforming to the requirements of this specification.