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भारतीय मानक मसौदा

प्लास्टिक धारकों के लिए परीक्षण की विधियाँ

(IS 2798 *का दूसरा पुनरीक्षण*)

Draft Indian Standard

METHODS OF TEST FOR PLASTICS CONTAINERS

(*Second Revision of* IS 2798)

(ICS 55.120)

Plastics Packaging Sectional Committee, PCD 21	Last date for comments: **27th May 2025**

FOREWORD
(*Formal clauses will be added later*)

This standard was published in 1964 covering methods of tests for polyethylene containers only because the containers manufactured in the country at that point of time were mainly from polyethylene material. In the absence of a general standard for testing plastic containers, the methods were included in individual product standards. Consequently, tests like leakage, drop impact, and ink adhesion have been repeated across these standards and subsequently revised in 1998. The first revision expanded the standard to cover all plastic containers, avoiding repetition of common test methods in individual standards. Tests for dimensions, capacity, load, leakage, pressure, handle strength, ink adhesion, and product resistance, with an updated drop test method were added. Tests for permeability, chemical resistance, and neck cracking were removed as separate standard exists for these tests.

For methods of determination of overall/global migration and stress crack resistance, separate Indian standards exists that are IS 9845: 1986 'Methods of analysis for the determination of specific and/or overall migration of constituents of plastics materials and articles intended to come into

contact with foodstuffs *(first revision)'* and IS 8747: 1977 'Method of test for environmental stress crack resistance of blow moulded polyethylene containers' respectively.

This (*second*) revision has been brought out to incorporate editorial alignment and compliance with various applicable regulations. The major modifications in this revision are as follows:

a. all amendments have been incorporated;
b. volume correction factors for Water Temperatures upto 45°C has been incorporated; and
c. cross-references standards have been updated
d. method of test for determination of overall/ global migration and method of test environment stress crack resistance test have been deleted as separate Indian standard exists that are IS 9845 and IS 8747 respectively.

The present revision has been taken up to expand scope of standard to include recycled polymers as well.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'.

1 SCOPE

This standard prescribes the methods of test for plastics containers.

2 REFERENCES

The following Indian Standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. Al1 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
IS 2828 : 2019/ ISO 472: 2013	Plastics — Vocabulary (*second revision*)
IS 7019 : 1998	Glossary of terms in plastics and flexible packaging, excluding paper (*second revision*)
IS 7028 (Part 1) : 2002/ ISO 2234: 2000	Performance tests for complete, filled transport packages: Part 1 stacking tests using static load (*second revision*)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2828 and IS 7019 shal1 apply.

4 MEASUREMENT OF DIMENSIONS

4.1 Overall Height

4.1.1 *Apparatus*

4.1.1.1 *Micrometer height gauge*

4.1.2 *Procedure*

Place the container on a surface plate and measure to the highest point on the container using a micrometer height gauge at two positions as follows:

a) Close to but avoiding the part line; and
b) At 90° to the position specified at (a).

4.1.3 *Calculation*

The height is recorded as the mean of the two readings. The accuracy or measurement shall be 0.1 mm.

4.2 Diameter

4.2.1 *Apparatus*

4.2.1.1 *Vernier caliper or circumference gauge*

4.2.2 *Procedure*

The container diameter shall be ascertained by either of the caliper or circumference gauge method.

4.2.2.1 *Vernier caliper method*

By using a vernier caliper, measure the diameter of the container at a specified height as follows:

a) Close to but avoiding the part line; and
b) At 90° to the position specified at (a).

The accuracy of measurement shall be 0.1 mm. The diameter is recorded as the mean of the two diameters at right angles.

4.2.2.2 *Circumference gauge method*

By using a circumference gauge, measure the circumference at a specified height.

Record the diameter as the circumference multiplied by 0.318.

NOTE - The circumference gauge normally gives the mean diameter directly.

4.3 Measurement of Neck Height

4.3.1 *Apparatus*

4.3.1.1 *Micrometer depth gauge*

4.3.2 *Procedure*

Place the anvil of the depth gauge on the neck face, and move the instrument laterally until the spindle touches the outermost neck feature. See that the tip of the spindle is allowed to touch the container shoulder and read the scale.

4.3.3 *Calculation*

Record the neck height as the mean of the two readings taken at right angles at the neck face.

4.4 Measurement of Neck and Thread Diameters

4.4.1 *Apparatus*

4.4.1.1 *Micrometer or Vernier caliper,* giving an accuracy of measurement of 0.02 mm.

4.4.2 *Procedure*

Measure the neck with a vernier caliper or micrometer as follows:
a) Close to but avoiding the part line; and
b) At 90° to the position specified at (a).

4.4.3 *Calculation*

The diameter is recorded as the mean of the two diameters at right angles.

4.5 Measurement of Wall Thickness

4.5.1 *Apparatus*

4.5.1.1 *Micrometer/screw gauge,* fitted with ball point tips or dial caliper gauge fitted with spherical anvils giving an accuracy of measurement of 0.02 mm.

4.5.2 *Procedure*

The container wall thickness shall be ascertained by either of the methods indicated below.

4.5.2.1 *Micrometer method*

Cut the container horizontally into three pieces (top, middle and bottom) with a pair of scissors or hacksaw blade. Measure the wall thickness with a micrometer or screw gauge fitted with ball point tip, at four places in each section. Take the average of four readings and report as wall thickness at top, middle and bottom.

4.5.2.2 *Dial caliper gauge method*

Measure the wall thickness with the help of dial caliper fitted with spherical anvils. Care shall be taken to avoid movement of the container during measurement as this may affect the reading obtained. The measurement shall be to an accuracy of 0.02 mm. Take the mean of three readings at any location (top, middle and bottom) as wall thickness.

4.6 Measurement of Fill Point

In production, the containers are filled to a specific height. It is necessary that the fill point or the liquid level at rated contents shall be held consistent.

4.6.1 *Procedure*

Fill the containers with water to its rated capacity and determine fill point by depth micrometer measurement from top sealing surface to surface of liquid.

5 DETERMINATION OF BRIMFUL CAPACITY

5.1 Apparatus

5.1.1 A rigid transparent plastics disc with a slot *(see* Fig. 1) big enough to completely cover the neck face of the container.

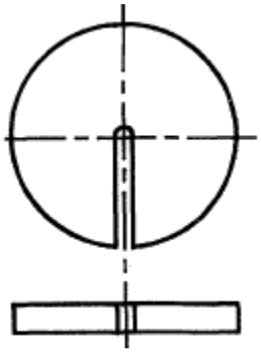

FIG. 1 TRANSPARENT PLASTIC DISC

5.1.2 Weighing balance to determine the mass of the container to an accuracy of at least 0.1 percent the weight being measured.

5.2 Procedure

Weigh the empty container and the rigid transparent plastic disc to an accuracy of at least 0.1 percent the weight being measured.

Fill the container with distilled water to within approximately 3 mm of brim. The water used shall be at ambient temperature or in case of dispute, at (27 ±2)°C.

Place the rigid transparent plastic disc on the neck face and top-up by carefully pouring water through the slot by a dropper or a pipette until the distilled water is seen just contacting the underside of the disc.

Weigh the filled container, together with the rigid transparent plastic disc to an accuracy of at least 0.1 percent the weight being measured.

The difference in weighing is the mass of the distilled water recorded in grams. The results shall be expressed to the nearest 0.1 percent the weight being measured.

Alternately the volume of water can be measured directly to the nearest millilitres using measuring jar.

5.3 Result

5.3.1 The mass of the distilled water in grams or volume of water measured is numerically equal to the brimful capacity of the container in millilitres.

5.3.2 For expressing the brimful capacity of a container at a uniform temperature of 4 ºC, the value obtained at **5.3.1** shall be multiplied by the correction factor Cf corresponding to the water temperature given in Table 1.

Table 1 Volume Correction Factors for Water Temperatures

Water Temperature	**Correction Factor**
(ºC)	(Cf)
(1)	**(2)**
12	1.0005
14	1.0008
16	1.0011
18	1.0014
20	1.0018
22	1.0022
24	1.0027
26	1.0033
28	1.0038
30	1.0044
32	1.0050

34	1.0056
36	1.0063
38	1.0071
40	1.0078
41	1.0082
42	1.0086
43	1.0090
44	1.0094
45	1.0099

6 LEAKAGE TEST

6.1 Closure Leakage

6.1.1 *Procedure*

Fill the container up to nominal capacity with coloured water or the material to be packed at ambient temperature, and close tight with the closure. Keep the container in an inverted position on a white blotting paper without any external support for at least 30 min. The container shall be examined for any leakage which would be evident from any visible stains on the blotting paper.

NOTE - An external support may be provided for the sole purpose of maintaining the inverted position of the container, ensuring that no weight of the container is transferred to the support.

6.2 Vibration Leakage

The method helps to determine the ability of a closure (on a container) to prevent leakage due to the transportational vibration.

6.2.1 *Vibration Table*

The vibration table, of sufficient size, rigidity and mass-carrying capacity, supported on a mechanism that shall maintain the surface horizontal during vibration. The difference in surface level between the table extremities shall not exceed 10 mm.

The table may be equipped with:

a) low fences to restrict sideways and endways movement during testing;
b) high fences or other means of maintaining a superimposed load in position on the test container during testing; and
c) means to simulate the method of restraining the container during transit.

In addition, the apparatus shall meet the requirements and tolerance given in **6.2.2.**

6.2.2 *Procedure*

Fill the container to its nominal capacity with the product or coloured water and close it with the usual closure in the manner in which it is intended to be used. Place the test container in the predetermined attitude on the vibration table *(see* **6.2.1**), with the centre of its lowest face or its centre of gravity as near as practicable within 10 mm of the centre of the table; if the container is not secured to the table it may be fenced. If a superimposed load is required, the loading procedure shall comply with IS 7028 (Part 1).

Operate the table between 3 Hz, 4 Hz and 6 Hz for the predetermined period to give a peak acceleration in the range of 0.5 g to 1.1 g. The movement shall be such that vertical component is approximately sinusoidal; a rotary movement of the table is acceptable.

> NOTE — If instrumentation is used to determine the vibration level, the accelerometer should be attached to the table near the container, but protected so that the test container shall not come into contact with it. For testing at 1.1 g, in place of instrumentation, the proper frequency setting may be determined by starting the vibration of the table at a frequency of about 2 Hz, and steadily increasing the frequency until some portion of the container repeatedly leaves the table, to ensure that the container receives a continuing series of repetitive shocks.

At the end of the test period, the closure shall show no indication of leakage.

6.2.3 *Precautions*

Before the test is carried out it shall be ensured that the inner plug, if provided, and cap are fully tightened.

6.3 Air Pressure Leakage

6.3.1 *Principle*

The test is carried out by maintaining the specified pressure in the container and detecting any leakage with water or soap solution.

6.3.2 *Equipment*

6.3.2.1 *Air supply equipment*

A pressure line from an air compressor is used for this test. A rubber plug is fixed to the end of the air line. The testing pressure may be regulated by an air pressure valve and read on the pressure gauge connected to the end of the air line. The testing pressure may be regulated by an air pressure valve at 35 kPa to an accuracy of ± 2 percent and read on the pressure gauge connected to the equipment.

6.3.2.2 *Reservoir*

Holding enough water so that the container can be fully or partly immersed in it as required.

In case of large containers, the reservoir may not be necessary, and could be functionally substituted by the use of soap solution,

6.3.3 *Procedure*

Connect the air line to the container by tightly fitting the rubber plug in the mouth of the container. Start the air compressor till the air pressure, as given in the relevant material specification, is obtained. Immerse the container in the water reservoir and detect any leakage by the bubbles of air escaping through the water.

For large containers, detect the leakage by applying soap solution at the various points on the container. The formation of bubbles shall indicate leakage at those points.

7 TEST FOR VERTICALITY

7.1 General

This test determines the combined effect of the offset of mouth with the body and mouth being at an angle of the body.

7.2 Assembly

Assembly for the determination of verticality shall be as shown in Fig. 2.

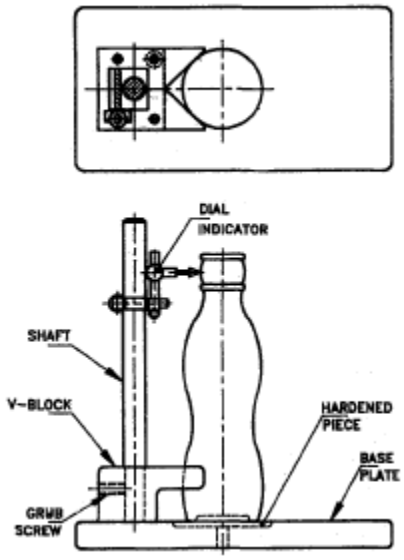

FIG. 2 ASSEMBLY FOR TESTING VERTICALITY

7.3 Procedure

Fill the container with water in order to give more stability and place it on its base on the flat smooth plate having a pillar bolted to it at right angles. Adjust the 'V' block mounted on the pillar

in such a manner that it is in contact with the outer diameter of the container at about the middle. Adjust the dial indicator fitted to the pillar so that its measuring point comes in contact with the outer edge of the neck of the container. Rotate the container, keeping the body always in contact with the 'V' block. Note down the maximum deflection on the indicator.

Half of the total deflection shown by an indicator shall be the variation in verticality. Unless specified otherwise in the container standard, the permissible limit of variation shall be ± 1.5 mm.

8 DROP IMPACT TEST

8.1 Principle

The drop test is used to measure the ability of the container to withstand rough handling while in a packed condition.

8.2 Equipment

Any suitable equipment may be used provided that it conforms to the following requirements:

a) permits accurate prepositioning of the container to assure an unobstructed fall from rest and impact at the specified places and in the desired direction;
b) permits accurate and convenient control of the height of drop; and
c) provides a solid surface of concrete to absorb all shock without deflection.

8.3 Drop Height

Unless specified otherwise in the container standard, the drop height of the containers up to 5 kg or 5 litres capacity shall be 1.2 m, for containers of 10 kg or 10 litres capacity 1.0 m, for containers of 15 kg or 15 litres and 20 kg or 20 litres capacity it shall be 0.5 m respectively.

8.4 Sample Size

The sample size shall be six containers, taken at random from a batch, divided into two sets of 3 each, designated as Set 1 and Set 2.

8.5 Procedure

Fill each container to its nominal capacity with water at standard conditions as specified in the specification of the individual containers (in case, conditions have not been specified, it shall be taken as ambient conditions).

Close each container with its usual closure specified in the relevant product standard.

Drop the containers under free fall condition in Set 1 squarely on their base on to a rigid flat horizontal surface of steel or smooth concrete as the dropping surface.

Drop the containers under free fall condition in Set 2 on their side (the body of the container being parallel to the impacting floor) onto the dropping surface.

The containers shall not rupture nor there be any leakage from the walls of the container. Slight deshaping of the body shall not render the containers unacceptable in the test.

NOTE - If the liquid to be packed is of high density, the material itself or a suitable material of similar density should be used instead of water.

8.5.1 *Test at* 0 ºC

8.5.1.1 This test is normally carried out only for multi-trip containers for transport of hazardous goods liable to be subjected to low temperatures. The container shall be filled to the nominal capacity with a liquid at test temperature (for example, for polyethylene containers, 12 percent methylated spirit in water or an ethylene glycol/water mixture is suitable). The filled containers shall then be chilled to a temperature in the range -4 ºC to 0 ºC and stored at that range for at least 4 h.

8.5.1.2 The containers shall be subjected to drop test as per the procedure specified at **8.5.**

9 STACK LOAD TEST

9.1 Principle

A force is applied to the top face of the package equivalent in magnitude to the total weight of identical packages stacked on top to a minimum stack height of 3 m. The duration is 24 h.

9.2 Sample Size

Four containers shall be used for each single test.

9.3 Procedure

Fill the containers with water at ambient temperature up to nominal capacity and close with the usual closure to the nominal torque (if the liquid to be packed is of high density, it should be used as the test medium).

Arrange the containers in a block at 2 × 2 on a rigid, level, flat surface. Apply a top load evenly distributed on a flat plate placed on the unsupported containers. The total superimposed load along with the load of the flat surface for different sizes of containers shall be as specified in the specifications of the individual container.

Examine the containers after 24 h of test period. The containers shall not show any cracks or permanent buckling likely to reduce their strength, cause leakage or reduction in effectiveness of the closure or cause instability in stacks.

10 HYDROSTATIC PRESSURE TEST

10.1 Apparatus

10.1.1 A water supply at ambient temperature connected to a tapered rubber plug will seal the mouth of the container. A suitably modified screw cap may be used instead of the rubber plug.

10.1.2 A means of raising the water pressure and a pressure gauge of range 0 kg/cm^2 to 15 kg/cm^2.

10.2 Procedure

The container shall be fitted with water to exclude all air and then connected to the water supply. The pressure shall be increased to a level as specified in the individual specifications and held for a period of 5 min.

Any sign of rupture or leakage from the container other than from around the mouth or localized bulging of the container shall be deemed to indicate failure.

11 HANDLE PULL TEST

11.1 General

Two methods are prescribed, namely Method A and Method B.

11.2 Sample Size

Three containers shall be used for each single test.

11.3 Method A

11.3.1 *Apparatus*

A suitable device to hold the container firmly in inverted position near the shoulder.

11.3.2 *Procedure*

Fill the container to the nominal capacity with water and close in the normal manner. Fix the container in inverted position and attach weight equal to double the nominal capacity of the container through a hook on the handle. Keep for 24 h and examine for any damage to the handle or the hinges.

11.4 Method B

11.4.1 *Procedure*

Fill one of containers with water to its nominal capacity and secure the closure.

Attach a rope to the balance point of the handle of the container leaving more than 30 cm slack.

Allow the container to fall freely for 30 cm.

Subject the container to two further drops.

There shall be no damage to the handle or the hinges.

12 TEST FOR COMPATIBILITY

12.1 General

This method is for determination of compatibility of plastics containers for an intended purposes. For specific application for packaging of food pharmaceuticals and drinking water, further reference may be made to Indian Standards on specific products.

12.2 Principle

Piece of plastics material with which the container is made are treated at an elevated temperature with the liquid which the container is intended to transport. Any changes in organoleptic characteristics, weight, odour or flavour, size, shape and colour that occur in the test specimens are noted. For dry products, the tests may be carried out only on the containers filled with the product as in **12.4.2**.

12.3 Test Specimens

12.3.1 *Material*

Three test pieces of approximately 15 cm × l5 cm size shall be cut from any convenient part of the container. Each test piece shall be cleaned, wiped and dried. It shall be measured for length, width and thickness to the nearest 0.05 mm and weighed to the nearest milligram.

12.3.2 *Container*

Six samples of specific container intended for packing of particular product shall be tested in accordance with the test procedure given at **12.4.2.**

12.4 Procedure

12.4.1 *Testing of Material*

The liquid which is intended to be filled in the container shall be introduced into a glass vessel and test pieces completely immersed, avoiding unnecessary contact with the other pieces or the walls of the glass vessel. Where the density of plastics material is less than that of the liquid, small weights, inert to the liquid, may be used to prevent the test pieces from either floating or curling.

The test shall be carried out continuously over 28 days at a temperature of (50 ± 2)°C. The liquid and the test pieces shall be thoroughly agitated every 24 h.

After the required test period has elapsed, the test pieces shall be removed from the liquid, suitably cleaned, dried, weighed and measured as in **12.3.1.**

12.4.2 *Testing of Container*

In order to assess the compatibility of the container, the container shall be filled with the product to nominal capacity, sealed and capped in the manner intended and kept at a temperature of (50 ± 2) °C for a period of 28 days. At the end of this period the containers shall be examined for the following:

a) Visible cracks, if any;
b) Change in colour;
c) Change in weight; and
d) Change in shape.

12.5 Test Result and Interpretation

12.5.1 Any change in weight, dimensions or alterations in other characteristics (such as colour, blooming, etc) or any other deterioration in quality of the product shall be used by manufacturer and purchaser in reaching agreement as to the stability of the plastics material for its intended purpose.

12.5.2 *Further Testing*

Where, in the opinion of either the manufacturer or the purchaser, it is considered that further information on compatibility is required (for example at low temperature) further testing may be carried out on a sample container filled with liquid to be transported. Precise requirements shall be determined by agreement between the manufacturer and the purchaser.

12.5.3 The actual storage test shall be carried out at the room temperature for one-third of the anticipated shelf life period for the products that are not stable at the suggested temperature of (50 ± 2) ºC.

13 TEST FOR INK ADHESION OF PRINTED CONTAINERS

13.1 Procedure

Apply two strips of 25 mm wide transparent pressure sensitive tape or cello tape to the printed area of container; one piece down the length of the container and the other round the circumference.

Press the tape firmly on to the container and leave it for 15 s.

Remove the tape by pulling slowly at about 1 cm/s from one end at about 90° to the container surface.

There shall be no significant removal of the print from the surface of the container and the print shall be legible to the naked eye after the test.

14 TEST FOR PRODUCT RESISTANCE OF PRINTED CONTAINERS

14.1 Procedure

Leave the containers to stand for at least 24 h after printing.

Smear the containers, or representative section cut-out from the printed area, with the product at (40 ±2) °C and leave it for 1 h.

Wash the container or its representative section with cold water.

Rub each container or representative section firmly with hard paper tissue ten times.

There shall be no significant removal of the print from the surface of the container and the print shall be legible to the naked eye after the test.