TBS/GTDC4(6328) P3 – Blow Moulded polyolefin containers — Specification (Part 3: Closed head containers over 60 litres, up to and including 250 litres capacity)
1 Scope
This standard (Part 3) specifies tolerances on dimensions, performance requirements and methods of sampling and tests for free standing blow moulded containers, made from polyolefin, with capacities over 60 litres up to and including 250 litres and having an internal neck diameter not exceeding 75 mm.

This standard does not cover containers specifically intended for products classified as dangerous goods.

2 Normative references
The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- IS 2798: 1998 Methods of test for plastic containers (first revision)
- IS 8747:1977 Method of test for environmental stress crack resistance of blow moulded polyethylene containers

3 Terms and definitions
For the purpose of this document, the following terms and definitions shall apply;

3.1 Blow Moulded Container
A container formed from a parison of heat softened thermoplastics material by the application of pressure which forces it against the inside walls of a blow mould.

3.2 Brimful Capacity
The volume of liquid held by the container when filled to the point of overflowing while standing on a level with all closures removed (see Figure 1)

3.3 Container Effective Plan Dimensions
The effective dimensions of the container in a stack or block

3.4 Container Height to Neck or Bung Face for Filling Purposes
The height to the highest point of the neck or bung housing face of the empty container (see Figure 1)

3.5 Container Overall Height
The height of the finished empty container at its highest point, excluding the closure (see Figure 1)

3.6 Container Overall Plan Dimensions
The maximum value of each plan dimension of the container

3.7 Effective Height in Stack
Where the container has interstacking features, the effective height in stack or an empty container, is from its base, to the base of the container immediately above it

3.8 External Neck Diameter
The external diameter of the neck, excluding thread and/ or prominences, measured as the mean of two perpendicular diameters avoiding the part line
3.9 Gross Capacity
The total enclosed volume of the container including any space which may not be capable of being filled.

3.10 Mould Parting Line
A line on the container corresponding to a parting joint of the blow mould.

3.11 Neck Height
The perpendicular distance from the highest point of the plane including the neck face to the nearest point of the finished container shoulder along a line passing through:

a) in the case of screw threaded necks, the outermost edge of the thread; a feature below the thread of greater diameter than the thread is considered as a part of the container’s shoulder;

b) in the case of plain cylindrical and internally threaded necks, the outermost diameter point excluding flash; and

c) in the case of neck having a bead and thread, or bead only, the outermost point of the bead

NOTE: A bead is separated from the container by a region of diameter smaller than that of the bead.

3.12 Neck or Bung Housing Face
The uppermost surface of the housing

3.13 Nominal or Net Capacity
The volume of liquid which the container is intended to hold (see Figure 1)

3.14 Thread Diameter
The diameter of the neck thread measured as the mean of two perpendicular diameters, avoiding the parting line
4 Capacity

A recommended range of nominal capacities for stock containers for liquid products, together with the corresponding minimum brimful capacities, is given in Table 1. When the container is filled to nominal capacity, the liquid level shall be below the bottom of the closure neck, with the container standing level on its base. Capacities shall not be measured within 48 h of production. The water used shall be at a temperature of $27 \pm 2^\circ$C.

Table 1- Recommended Nominal Capacities / Brimful Capacities

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Nominal Capacity (litres)</th>
<th>Minimum Brimful Capacity (litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>60</td>
<td>63</td>
</tr>
<tr>
<td>2.</td>
<td>75</td>
<td>78</td>
</tr>
<tr>
<td>3.</td>
<td>100</td>
<td>102.5</td>
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<tr>
<td>4.</td>
<td>125</td>
<td>128</td>
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<tr>
<td>5.</td>
<td>150</td>
<td>154</td>
</tr>
<tr>
<td>6.</td>
<td>200</td>
<td>205</td>
</tr>
<tr>
<td>7.</td>
<td>225</td>
<td>230</td>
</tr>
<tr>
<td>8.</td>
<td>250</td>
<td>256</td>
</tr>
</tbody>
</table>
6 Tolerances and dimensions

The tolerances and dimensions specified refer to finished empty containers. Dimensions of filled containers may show differences. All measuring equipment shall be capable of measuring to an accuracy of 10 percent of the acceptable tolerance.

6.1 Container height to Neck Face

The tolerance on container height to neck face shall be ±1 percent compared to the nominal value. The height shall be measured with accordance with method described in Annex A.

6.2 Container Overall Height

The tolerance on container overall shall be ±1 percent, whichever is greater. The height shall be measured in accordance with the method described in Annex B.1.

6.3 Container Overall Plan Dimensions

The tolerance on container overall plan dimensions shall be ±1 percent. The plan dimensions shall be measured in accordance with the method described in Annex B.1.

6.4 Neck Height

The tolerance on neck height shall be ±2.0 percent. The neck height shall be measured in accordance with the method described in Annex B.3.

6.5 Thread Diameters

The length of thread in contact between cap and neck shall be a minimum of 1 turn. The major and minor thread diameters shall each be measured in accordance with the method described in Annex B.4. The tolerance on thread diameters shall be as agreed to between the purchaser and the supplier depending on the intended usage.

7 Performance requirements

7.1 Drop Impact Strength

The container when subjected to the drop test by the method described in Annex C shall show no sign of rupture or leakage from the walls of the container. Slight deshaping of the body shall not render the container unacceptable in the test.

7.2 Top Load Resistance

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 when tested in accordance with the method described Annex D.

7.3 Environmental Stress-Crack Resistance

The containers when tested in accordance with method I of IS 8747 shall show no evidence of stress cracking or leakage after being kept in the oven for 48 h.

7.4 Ink Adhesion of Printed Containers

The printed matter on the containers when tested in accordance with the method described Annex E shall be still legible.

7.5 Product Resistance of Printed Containers

The printed matter on the containers when tested in accordance with the method described in Annex F shall be still legible.
7.6 Test for Compatibility

The containers shall be tested for determination of compatibility for an intended purpose as per the method described in Annex G.

8 Handle Strength

The handles and the containers shall remain intact and undamaged when tested in accordance with the method described in Annex H.

9 Closures

The closure shall be of a material as resistant to the product as is the container itself and shall correspond to the type and form of the container so as to ensure a good and leak proof fit when tested in accordance with the method described in Annex I. Thread closures shall be tightened to a torque as agreed to between the purchaser and the supplier.

10 Sampling

10.1 The container shall be type tested for the requirements given in clause 7.1 and 7.2. Any change in design, material or capacity makes it necessary for the new containers to be tested in accordance with all the tests specified. The tests given in clause 7.4 and 7.5 are applicable only to printed containers.

10.3 The frequency of sampling and the number of samples are deemed to be a matter of agreement between the purchaser and the supplier. Nevertheless, the sample size given in the test methods namely, drop impact strength, top load resistance and handle strength shall be used as these are the minimum necessary to obtain meaningful test results regardless of the batch size under consideration.

11 Marking

The containers shall be legibly and indelibly marked with the following information

a) Manufacturer's name, initials or trade-mark.

b) Nominal capacity of the container in ml or litres.

c) Batch No. and year of manufacture.

d) Recyclable/non-recyclable symbol.

e) Plastic identification code.
ANNEX A
(Clause 6.2)
MEASUREMENT OF CONTAINER HEIGHT TO NECK FACE
A1. Ascertain the container height to neck face by placing the empty container on a flat surface and measuring to the highest point on the neck face using a micrometer height gauge. The measurement shall be to an accuracy of 0.05 mm.

ANNEX B
(Clause 6.3,6.4,6.5,6.6)
MEASUREMENT OF DIMENSIONS
B1 Overall Height
B1.1 Apparatus
B1.1.1 Micrometre height gauge
B1.2 Procedure
Place the container on a surface plate and measure to the highest point on the container using a micrometre 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).
B1.3 Calculation
The height is recorded as the mean of the two readings. The accuracy of measurement shall be 0.1 mm.
B2 Diameter
B2.1 Apparatus
B2.1.1 Vernier micrometer or circumference gauge
B2.2 Procedure
The container diameter shall be ascertained by either of the micrometer or circumference gauge method.
B2.2.1 Micrometer method
By using a Vernier or micrometer, 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.
B2.2.2 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.

B.3 Measurement of Neck Height

B.3.1 Apparatus
B.3.1.1 Micrometer depth gauge

B.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.

B.3.3 Calculation
Record the neck height as the mean of the two readings taken at right angles at the neck face.

B.4 Measurement of Neck and Thread Diameters

B.4.1 Apparatus
B.4.1.1 Micrometer or Vernier, giving an accuracy of measurement of 0.02 mm.

B.4.2 Procedure
B.4.2.1 Measure the neck with a vernier or micrometer as follows:
   a) Close to but avoiding the part line; and
   b) At 90° to the position specified at (a).

B.4.3 Calculation
The diameter is recorded as the mean of the two diameters at right angles.

B.5 Measurement of Wall Thickness

B.5.1 Apparatus
B.5.1.1 Micrometer or screw gauge, fitted with ball point tips or dial calliper gauge fitted with spherical anvils giving an accuracy of measurement of 0.02 mm.

B.5.2 Procedure
The container wall thickness shall be ascertained by either of the methods indicated below.

B.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.

B.5.2.2 Dial calliper gauge method
Measure the wall thickness with the help of dial calliper 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.
ANNEX C
(Clause 7.2)
DROP IMPACT TEST

C.1 Principle

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

C.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;

c) Provides a solid surface of concrete to absorb all shock without deflection.

C.3 Drop Height

Unless specified otherwise in the container standard, the drop height of the filled containers up to 5 kg or 5 litres capacity shall be 1.4 m, for containers of 5 kg up to 20 kg is 1.2 m and for containers of 20 kg to 60 kg shall be 1 m and 100 kg to 250 kg shall be 0.4 m to 0.5 m.

C.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.

C.5 Procedure

C.5.1 Fill each containers 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).

C.5.2 Close each container with its usual closure with the inner seal heat sealed to its mouth. 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.

C.5.3 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.

C.5.4 The containers shall not rupture nor shall 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.

C.6 Test at 0°C

C.6.1. 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 to 0°C and stored at that range for at least 4 h.
C.6.2 The containers shall be subjected to drop test as per the procedure specified at C.5.

ANNEX D
(Clause 7.3)
STACK LOAD TEST

D.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.

D.2 Sample Size

Four containers shall be used for each single test.

D.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 x 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.

ANNEX E
(Clause 7.4)
TEST FOR INK ADHESION OF PRINTED CONTAINERS

E.1 Procedure

E.1.1 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.

E.1.2 Press the tape firmly on to the container and leave it for 15 seconds.

E.1.3 Remove the tape by pulling slowly at about 1 cm/s from one end at about 90° to the container surface.

E.1.4 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.
ANNEX G
(Clause 7.9)

TEST FOR COMPATIBILITY

G.1 General

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

G.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, dour 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 I.4.2.

G.3 Test Specimens

G.3.1 Material

Three test pieces of approximately 15 cm X 15 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.

G.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 I.4.2

G.4 Procedure

G.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 I.3.1.

G.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 ± PC 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.

G.5 Test Result and Interpretation

G.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.

G.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.

G.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°C.

ANNEX H

HANDLE PULL TEST
(clause 8)

H.1 General
Two methods are prescribed, namely Method A and Method B.

H.2 Sample Size

Three containers shall be used for each single test.

H.3 Method A

H.3.1 Apparatus
A suitable device to hold the container firmly in inverted position near the shoulder.

H.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. Keep for 24 h and examine for any damage to the handle or the hinges.

H.4 Method B

H.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 300 mm 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.
ANNEX I

(Claused 7.1)

CLOSURE LEAKAGE

I.1 Procedure

I.1.1 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 minutes. The container shall be examined for any leakage which would be evident from any visible stains on the blotting paper.

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

I.2 Vibration Table

I.2.1 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 I.2.2.

I.2.2 Procedure

I.2.2.1 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.

I.2.2.2 Place the test container in the predetermined attitude on the vibration table (see I.2), 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).

I.2.2.3 Operate the table between 3.4 and 6 Hz for the predetermined period to give a peak acceleration in the range of 0.5 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 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.

I.2.2.4 At the end of the test period, the closure shall show no indication of leakage.