

Plastic plumbing fixtures

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Plastic plumbing fixtures



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Preface

This is the second edition of CSA B45.5/IAPMO Z124, *Plastic plumbing fixtures*. It supersedes the previous edition published in 2011.

This Standard replaces

- a) CAN/CSA-B45.5-02, *Plastic plumbing fixtures*;
- b) IAPMO/ANSI Z124.1.2-2005, *Plastic Bathtub and Shower Units*;
- c) IAPMO/ANSI Z124.3-2005, *Plastic Lavatories*;
- d) IAPMO/ANSI Z124.4-2006, *Plastic Water Closet Bowls and Tanks*;
- e) IAPMO/ANSI Z124.6-2007, *Plastic Sinks*; and
- f) IAPMO/ANSI Z124.9-2004, *Plastic Urinal Fixtures*.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This Standard was prepared by the CSA/IAPMO Joint Harmonization Task Group on Plumbing Fixtures, under the jurisdiction of the CSA Technical Committee on Plumbing Fixtures and the IAPMO Plumbing Standards Committee. The CSA Technical Committee operates under the jurisdiction of the CSA Strategic Steering Committee on Construction and Civil Infrastructure. This Standard has been formally approved by the CSA Technical Committee and the IAPMO Plumbing Standards Committee. This Standard was approved as an American National Standard by the American National Standards Institute on January 10, 2017.

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- 3) This Standard was developed by consensus, which is defined as substantial agreement; consensus implies much more than a simple majority, but not necessarily unanimity. It is consistent with this definition that a member of the IAPMO Plumbing Standards Committee can be included in the Committee list and yet not be in full agreement with all sections of this Standard.
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Plastic plumbing fixtures

0 Introduction

Harmonization activities for plastic plumbing fixtures Standards were undertaken in 2005 by a Joint Harmonization Task Group (JHTG) on Plumbing Fixtures, in which CSA Group and IAPMO plumbing fixtures committees were equally represented. The responsibility for procedural matters and final approval of technical content was assumed by technical committees at higher levels within each SDO.

1 Scope

1.1

This Standard covers plastic plumbing fixtures and specifies requirements for materials, construction, performance, testing, and markings.

1.2

This Standard covers the following plumbing fixtures:

- a) bathtubs and combination tub/showers;
- b) lavatories;
- c) shower bases and shower stalls;
- d) sinks:
 - i) bar sinks;
 - ii) kitchen sinks;
 - iii) laundry sinks; and
 - iv) service sinks;
- e) urinals; and
- f) water closets.

1.3

In this Standard, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the Standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

1.4

SI units are the units of record in Canada. In this Standard, the inch/pound units are shown in parentheses. The values stated in each measurement system are equivalent in application; however, each system is to be used independently. Combining values from the two measurement systems can result in non-conformance with this Standard.

All references to gallons are to U.S. gallons.

For information on the conversion criteria used in this Standard, see Annex A.

2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

CSA Group

CAN/CSA-B651-12

Accessible design for the built environment

C22.2 No. 0.15-15

Adhesive labels

ASME (The American Society of Mechanical Engineers)/CSA Group

ASME A112.18.1-2012/CSA B125.1-12

Plumbing supply fittings

ASME A112.18.2-2015/CSA B125.2-15

Plumbing waste fittings

ASME A112.19.1-2013/CSA B45.2-13

Enamelled cast iron and enamelled steel plumbing fixtures

ASME A112.19.2-2013/CSA B45.1-13

Ceramic plumbing fixtures

ASME A112.19.3-2008/CSA B45.4-08

Stainless steel plumbing fixtures

ASME (The American Society of Mechanical Engineers)

A112.19.15-2012

Bathtubs/whirlpool bathtubs with pressure sealed doors

A112.19.19-2006 (R2011)

Vitreous china nonwater urinals

ASTM International (American Society for Testing and Materials)

C297/C297M-16

Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions

D883-12

Standard Terminology Relating to Plastics

D2244-15a

Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

D2565-99 (2008)

Standard Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications

G21-15

Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

ICC/ANSI (International Code Council/American National Standards Institute)

A117.1-2009

Accessible and Usable Buildings and Facilities

UL (Underwriters Laboratories)

969 (1995)

Standard for Marking and Labeling Systems

3 Definitions

The following definitions shall apply in this Standard:

Concealed tank — a water closet tank intended to be installed behind a wall.

Critical support area — that portion of the back, service, or non-service vertical wall located between 600 and 1200 mm (24 and 48 in) above the finished surface of the fixture floor.

Note: *The critical support area is that portion of the back, service, or non-service vertical wall in which grab bars provide the most beneficial support in the bathing area.*

Defect —

Blister — a hollow raised portion of the surface with a maximum dimension between 1 and 6 mm (0.04 and 0.25 in).

Chipped area — an area in which the surface material has been damaged to expose the substrate material.

Crack — a fracture in either the surface or the reinforcing material.

Moulding irregularity — a visible distortion related to forming.

Note: *Examples of moulding irregularities are dimples, domes, shorts, let-goes, and sink marks, as defined in ASTM D883.*

Pinhole — a hole in the surface whose largest dimension is less than 1.5 mm (0.06 in).

Pit — a small crater in the surface whose width and depth are approximately equal.

Spalling — the damage to a surface due to peeling, pop outs, or flake offs.

Speck — a particle of foreign matter that produces irregularities in the surface.

Fixture — a device that receives water, waste matter, or both and directs these substances into a drainage system.

Flexible (soft) construction — a combination of materials comprising a compressible centre faced on the bathing surface with a pliable, non-rigid top layer and a base layer made of rigid materials.

Flood level — the level at which water will overflow a fixture.

Grab bar — a rod or similar device that

- a) is installed in a fixture;
- b) is located wholly or partially in the critical support area;
- c) meets the applicable dimensional requirements of this Standard; and
- d) is designed to bear the loads specified in this Standard.

Grip rail — a bar, handle, or similar device

- a) integrated with a bathtub; and
- b) located on the rim or below the rim within the bathtub but not located wholly or partially in the critical support area.

Overflow — a conduit that is integral or attached to a fixture and whose function is to remove liquid from a fixture after the fixture has been filled past the desired level.

Service wall — the area of the shower stall or bathtub where supply fittings are intended to be installed.

Stain — a change from the original surface appearance, other than a reduction in gloss.

Standard dirt — a mixture of 20 parts carbon black (pigment grade), 20 parts iron black (i.e., iron oxide, black), 10 parts calcium stearate, 5 parts 30W motor oil, 1 part wetting agent (e.g., Rohm and Haas Triton X-100 or equivalent), and 44 parts water, measured by weight.

Standard liquid detergent — a mixture of 8.0% tetrapotassium pyrophosphate, 7.0% ethoxylated-alkyl-phenol, 8.0% sodiumxylenesulfonate, 1.5% butyl cellosolve, and 75.5% water, measured by volume.

Note: *The following commercial products are acceptable:*

- a) *tetrapotassium pyrophosphate: Monsanto TKPP;*
- b) *ethoxylated-alkyl-phenol: Monsanto Sterox NJ or Rohm & Haas Triton X-100;*
- c) *sodiumxylenesulfonate: Stepan Chemical Co. Stepan SXS; and*
- d) *butyl cellosolve: 2-butoxy ethanol.*

4 General requirements

4.1 General

4.1.1 Tolerances

Unless otherwise specified in this Standard, the tolerance on dimensions of 200 mm (8 in) and greater shall be $\pm 3\%$. The tolerance on dimensions less than 200 mm (8 in) shall be $\pm 5\%$.

In this Standard, dimensions specified as “minimum” or “maximum” shall not be reduced below the specified minimum or increased above the specified maximum by application of a tolerance. If a

dimensional range is specified and the word “minimum” or “maximum” does not appear, the upper and lower limits shall not be considered critical and the appropriate tolerance shall apply.

4.1.2 Surface finish

Fixture surfaces shall be free from defects to the extent specified in this Standard when inspected in accordance with Clause 5.4.

4.1.3 Coated parts

Coated parts other than those covered in Clause 4.3.1.2 shall comply with the applicable requirements of ASME A112.18.1/CSA B125.1.

4.1.4 Different materials

When a fixture is made of a combination of plastic and other materials covered under ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, or ASME A112.19.3/CSA B45.4, the other materials shall comply with the applicable requirements of ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, or ASME A112.19.3/CSA B45.4.

4.1.5 Accessible design fixtures

Fixtures designed to be accessible shall comply with the dimensional requirements specified in CAN/CSA-B651 or ICC/ANSI A117.1.

4.2 Waste fitting openings, drainage, and overflows

4.2.1 Openings and drainage

4.2.1.1

Fixtures shall

- a) have a waste fitting opening (outlet), the centre of which shall be located at the lowest point of the fixture; and
- b) drain to the waste outlet.

4.2.1.2

Except when proprietary (i.e., non-standard) waste fittings are provided by the manufacturer, the dimensions of waste outlets shall be as shown in Figure 1.

4.2.1.3

Factory-supplied waste fittings shall comply with ASME A112.18.2/CSA B125.2.

4.2.2 Overflows

4.2.2.1 Lavatories and sinks

4.2.2.1.1

Overflows in lavatories and sinks may be provided at the option of the manufacturer. When overflows are provided, their position in the fixture shall be at the option of the manufacturer and shall comply with the performance requirements in Clause 5.19.

4.2.2.1.2

When provided, overflows in sinks intended for dishwashing and food preparation (e.g., kitchen and bar sinks) shall not be concealed and shall be accessible for disassembly and cleaning after installation.

4.2.2.2 Bathtubs

Overflows in bathtubs may be provided at the option of the manufacturer. When overflows are provided, their dimension, location, and position in relation to the waste outlet in the fixture shall be as shown in Figure 7.

Variations in location, geometry, diameter, and angle of orientation of the overflow opening shall be acceptable when factory-provided waste and overflow fittings are used.

Note: *Local plumbing codes might require bathtub overflows.*

4.3 Lavatories and sinks

4.3.1 Openings and mounting surfaces for supply fittings

4.3.1.1

When provided, openings and mounting surfaces for lavatory and sink supply fittings shall be as shown in Figure 2, 3, 4, 5, or 6, as applicable, except when proprietary (i.e., non-standard) supply fittings are provided by the manufacturer.

4.3.1.2

Factory-supplied supply fittings shall comply with ASME A112.18.1/CSA B125.1.

4.3.1.3

Mounting surfaces for supply fittings that rely on an air gap for backflow protection shall be not more than 13 mm (0.5 in) below the flood level rim.

Note: *Care should be taken to ensure that the minimum air gap specified in ASME A112.18.1/CSA B125.1 or in the applicable plumbing code is not compromised when supply fittings are installed on fixtures with mounting surfaces below the flood level rim.*

4.4 Bathtubs and shower bases

4.4.1 Flanges

Bathtubs intended for installation against a wall shall incorporate a flange raised at least 8 mm (0.3 in) above the rim, as shown in Figure 7. Shower bases intended for installation against a wall shall incorporate a continuously raised flange at least 25 mm (1.0 in) above the threshold, as shown in Figure 8. The flange shall be

- a) integral with the bathtub or shower base;
- b) added to an island tub or shower base in the factory; or
- c) field-installed using a flange kit that complies with Clause 5.18 and includes all necessary parts and fasteners.

Bathtubs and shower bases using field-installed flanges shall be marked in accordance with Clause 6.3.

In addition, the bottom of any hole in the flange or corner treatment shall be not less than 8 mm (0.3 in) above the rim.

4.4.2 Slope to the waste outlet

Bathtubs and shower bases shall have a maximum slope of 4% to the waste outlet.

Note: There should be a minimum slope of 1% to the waste outlet.

4.4.3 Shower base thresholds

Except for accessible designs, when provided, shower base thresholds shall be at least 50 mm (2 in) above the top of the waste outlet, as shown in Figure 8.

4.4.4 Diameter, spacing, and grippable length of grab bars

Grab bars intended for residential and commercial installations shall have a

- a) diameter of between 22 and 40 mm (0.9 and 1.6 in) or an equivalent cross-sectional area;
- b) spacing of 38 mm (1.5 in) between the finished wall and the inside grippable surface of the grab bar; and
- c) minimum grippable length of
 - i) 228 mm (9.0 in), for bars mounted horizontally (see Figure 18(a)); and
 - ii) 152 mm (6.0 in), for bars mounted vertically (see Figure 18(b)).

4.4.5 Bathtubs with pressure sealed doors

Bathtubs with pressure sealed doors shall comply with ASME A112.19.15.

4.5 Water closets

4.5.1 General

In addition to the applicable requirements in this Standard, water closets and their flushing devices shall comply with the applicable requirements of ASME A112.19.2/CSA B45.1, except that the structural integrity tests for floor-mounted water closets shall be conducted in accordance with Clause 5.8.8.

4.5.2 Concealed tanks

Concealed tanks shall be required to comply only with the following tests:

- a) radii load test (Clause 5.9);
- b) water absorption test (Clause 5.25.4);
- c) inlet connection test (Clause 5.26); and
- d) deflection test (Clause 5.27).

4.6 Urinals

4.6.1

Urinals and their flushing devices shall comply with the applicable requirements of ASME A112.19.2/CSA B45.1.

4.6.2

In addition to complying with the applicable requirements of this Standard, non-water-consuming urinals shall comply with ASME A112.19.19.

5 Test requirements

5.1 General

For all structural tests, the specimens shall be installed in accordance with the manufacturer's instructions.

5.2 Stress tests for grab bars and grip rails

5.2.1 Load test for grab bars

5.2.1.1 Procedures

The load test for grab bars shall be conducted as follows:

- a) Over a period of 30 s, gradually apply a load of 1.3 kN (292 lbf) on the middle 90 mm (3.5 in) section of the specimen, as follows:
 - i) vertically downward, for grab bars mounted horizontally (i.e., grab bars installed at 45° or less from the horizontal); and
 - ii) pulling downward at an angle of $30 \pm 5^\circ$ from the wall, for grab bars mounted vertically (i.e., grab bars installed at more than 45° from the horizontal)
- b) Hold the load for $5 \text{ min} \pm 10 \text{ s}$;
- c) Following the removal of the load, subject the specimen to a water leakage test in accordance with Clause 5.18(c) except that the water spray shall be
 - i) aimed at the points where the specimen is mounted; and
 - ii) applied for 30 min after the load test is removed.

5.2.1.2 Performance

Grab bars shall not break or detach from the fixture. In addition,

- a) there shall be no leakage between the grab bar and the fixture;
- b) the fixture shall not show signs of cracking or other defects when inspected in accordance with Clause 5.4.1(d); and
- c) with the load removed, the grab bar shall not rotate within the fixture.

5.2.2 Rotation test for grip rails

5.2.2.1 Procedure

The rotation test for grip rails that rotate within the fixture shall be conducted as follows:

- a) Rotate the specimen along its long axis to a fixed position by applying a torque of not more than 5 N-m (44 lbf-in).
- b) Mark the surface of the specimen with a fine-tip marker.
- c) Locate a reference indicator at the mark.
- d) Rotate the specimen along its long axis to the maximum distance in the opposite direction from the reference indicator by applying a torque of not more than 5 N-m (44 lbf-in).
- e) Measure the angle of the rotation.
- f) Following removal of the load, subject the specimen to a water leakage test in accordance with Clause 5.18(c), except that the water spray shall be
 - i) aimed at the points where the specimen is mounted; and
 - ii) applied for 30 min after the load test is removed.

5.2.2.2 Performance

Grip rails shall not rotate more than 22.5° or detach from the fixture. In addition,

- a) there shall be no leakage between the grip rails and the fixture; and
- b) the fixture shall not show signs of cracks or other defects when inspected in accordance with Clause 5.4.1(d).

5.3 Warpage tolerance test

5.3.1 Procedure

The specimen shall be placed on a flat and level surface to ascertain the amount of deviation from the horizontal plane at its edges.

A feeler gauge of a thickness equal to the total warpage allowed in Clause 5.3.2 shall not slide under the specimen unless forced. If the specimen rocks on two opposite corners, the horizontal plane shall be determined by placing one feeler gauge, as thick as the total warpage allowed, under a corner that does not touch the flat and level surface. This gauge is inserted by not more than 1/16 in. Forcing the specimen down on this gauge, a second feeler gauge of the same thickness shall not slide under the specimen at any other point.

5.3.2 Performance

When measured in accordance with Clause 5.3.1, the

- a) warpage at the edges of the fixture that set against a wall or floor, or into cabinets or countertops, shall not exceed 5 mm/m (0.06 in/ft);
- b) warpage at all other edges of the fixture shall not exceed 7.5 mm/m (0.09 in/ft); and
- c) total warpage of any linear dimension shall not exceed 16 mm (0.63 in).

Curves that are part of the design shall not be considered warpage.

5.4 Surface examination test

5.4.1 Procedure

The surface examination test shall be conducted as follows:

- a) Wash the specimen with a solution of standard liquid detergent and water, rinse with water, and dry.
Note: *To hasten drying during this test, surfaces can be wiped with a clean chamois leather or a clean, absorbent, lint-free material.*
- b) Rub the entire finished surface of the specimen with a sponge and a 50% solution of water and water-soluble black or blue-black ink. When inspecting coloured specimens, use a contrasting coloured ink.
- c) Rinse the ink immediately from the surface with water and dry the surface before examination.
- d) Examine the surface of the specimen for defects with the unaided eye from a distance of between 300 and 610 mm (1 and 2 ft) using a light source of partially diffused artificial light giving an illuminance on the surface of 1615 ± 540 lx (150 ± 50 foot-candles).

Note: *Unaided eye includes vision assisted by corrective lenses normally worn by the person examining the specimen.*

5.4.2 Performance

The specimen shall be free from cracks, chipped areas, and blisters. Other defects shall not exceed the maximums specified in Table 1.

5.5 Subsurface test

5.5.1 Procedure

The subsurface test shall be conducted on two different non-adjacent areas on the specimen as follows:

- a) Wash the specimen with a solution of standard liquid detergent and water, rinse with water, and dry.
- b) Abrade the specimen by rubbing the test areas with normal hand pressure for at least 25 cycles with 600-grit wet silicon carbide abrasive paper. Each test area shall be approximately 0.01 m² (16 in²).
- c) Following the abrasion, rinse the test areas with water and dry them.
- d) Apply 5 g (0.18 oz) of standard dirt to each area and rub the dirt with a dampened chamois and heavy thumb pressure in a circular motion for approximately 25 cycles.
- e) Allow the dirt to dry for at least 1 h.
- f) Wash the test areas by rubbing them with a clean, dampened chamois and standard liquid detergent.
- g) Examine the surface of the specimen in accordance with Clause 5.4.1(d).

5.5.2 Performance

There shall be no visible voids larger than 1.6 mm (0.063 in) in diameter below the original finish surface, and the maximum allowable number of voids smaller than 1.6 mm (0.063 in) for the two test areas shall be eight.

5.6 Waste fitting connection test

5.6.1 Procedure for bathtubs and shower bases

The waste fitting connection test for bathtubs and shower bases shall be conducted as follows:

- a) Wash the specimen with a solution of standard liquid detergent and water, rinse with water, and dry.
- b) Apply a 220 ± 4 N (50 ± 1 lbf) load using a 610 ± 6 mm (24 ± 0.25 in) lever arm connected to the waste fitting and extending horizontally as shown in Figure 9.
- c) Ensure that the load application does not exceed the test parameter by gradually applying the load over 5 to 10 s. Any combination of weight and lever arm may be used in lieu of the weight and lever arm specified in Item (b) as long as the bending moment is 136 N-m (100 ft-lb).
- d) Apply the load for 1 min and examine for cracks with load in place.
- e) Apply the load for 1 min in two additional radial locations which shall be approximately 180° apart. Examine for cracks with load in place.

5.6.2 Procedure for other fixtures

Fixtures other than bathtubs and shower bases shall be tested in accordance with Clause 5.6.1 except that a load of 110 ± 4 N (25 ± 1 lbf) shall be used.

5.6.3 Performance

There shall be no visible cracks in the bottom surface of the specimen.

5.7 Point impact load test

5.7.1 Procedures

5.7.1.1 General

The point impact load test shall be conducted using a steel ball with a diameter of 38 mm (1.5 in) and a weight of 2.20 ± 0.05 N (0.50 ± 0.01 lbf). The ball shall be free of gouges, deformations, and other surface defects.

5.7.1.2 Bathtubs and shower bases

The point impact load test for bathtubs and shower bases shall be conducted as follows:

- a) Wash the specimen with a solution of standard liquid detergent and water, rinse with water, and dry.
- b) Drop the steel ball specified in Clause 5.7.1.1 from a height of 900 mm (36 in) to strike six different locations, as follows:
 - i) three different locations on flat areas in the bottom of the specimen; and
 - ii) three different locations on the rim or threshold.
- c) Drop the steel ball from a height of 600 mm (24 in) to strike three different locations on radii in the bottom of the specimen. At least one strike shall be in a corner.

5.7.1.3 Sinks

The point impact load test for sinks shall be conducted as follows:

- a) Wash the specimen with a solution of standard liquid detergent and water, rinse with water, and dry.
- b) Drop the steel ball specified in Clause 5.7.1.1 from a height of 600 mm (24 in) to strike four different locations in each sink compartment, as follows:
 - i) two different locations on the flat area of the sink bottom; and
 - ii) two different locations on the convex rim radius.

Utility sinks without rolled rims shall be impacted only on the compartment bottom.

Additionally, sinks with tops or integral tops and drain boards shall be impacted on three different points on flat areas.

5.7.1.4 Lavatories

The point impact load test for lavatories shall be conducted as follows:

- a) Wash the specimen with a solution of standard liquid detergent and water, rinse with water, and dry.
- b) Drop the steel ball specified in Clause 5.7.1.1 three times from a height of 500 mm (20 in) to strike three different locations on flat areas on the top of the specimen.
- c) Drop the steel ball from a height of 500 mm (20 in) to strike three different locations inside the specimen bowl, as follows:
 - i) adjacent to the waste opening;
 - ii) 100 mm (4 in) from the drain; and
 - iii) on a sloping area of the specimen.

5.7.2 Performance

There shall be no cracks or chips in the surface of the specimen when examined in accordance with Items (b) to (d) of Clause 5.4.1.

5.8 Structural integrity tests

5.8.1 Load test for bathtub and shower seats

Note: The seat can be an integrally moulded part of the bathtub or shower base, or mechanically attached to the fixture.

5.8.1.1 Procedure

The load test for bathtub and shower seats shall be conducted as follows:

- a) Load the specimen with a 1335 ± 22 N (300 ± 5 lbf) test load applied to the centre of the seat using a 150 mm (6 in) diameter load-distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad.
- b) Leave the load in place for at least 2 min.

5.8.1.2 Performance

There shall be no cracks or other signs of failure in the surface of the seat or in the area around the seat when examined in accordance with Items (b) to (d) of Clause 5.4.1.

5.8.2 Load test for bathtub rims and bottoms and shower thresholds and bottoms

5.8.2.1 General

Bathtub rims and bottoms shall be tested in accordance with either Clause 5.8.2.2.1 or 5.8.2.2.2 and Clause 5.8.2.2.3. Shower thresholds and bottoms shall be tested in accordance with Clauses 5.8.2.2.1 and 5.8.2.2.3.

5.8.2.2 Procedures

5.8.2.2.1 Procedure for bathtub rims and bottoms and shower thresholds and bottoms

Note: See Clause 5.8.2.2.3 for secondary load testing.

The load test for bathtub rims and bottoms and shower thresholds and bottoms shall be conducted as follows:

- a) Preload the specimen with a 1335 ± 22 N (300 ± 5 lbf) test load applied to the centre of the bottom of the specimen using a 76 mm (3 in) diameter load-distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad.
- b) Leave the load in place for 2 to 3 min to allow for settlement of the test apparatus and initial slip in the fasteners.
- c) Remove the load.
- d) Ten to 15 min after removing the preload, reapply the test load for at least 2 min to the centre of the bottom of the specimen and, where applicable, midway between the ribs.
- e) Measure the deflection under the load with a deflectometer with a reading accuracy of at least 0.025 mm (0.001 in).
- f) Measure the residual deflection 10 ± 1 min after removal of the test load.

5.8.2.2.2 Alternative procedure for bathtub rims and bottoms

Note: See Clause 5.8.2.2.3 for secondary load testing.

5.8.2.2.2.1 Apparatus

The apparatus for the alternative load test for bathtub rims and bottoms shall be as follows (see Figure 10):

- a stand in which the specimen can be installed in accordance with the manufacturer's instructions, with a floor of particleboard at least 19 mm (0.75 in) thick or 16 mm (0.63 in) plywood supported on 2 × 6 in dimensional joists spaced 500 mm (20 in) on centres;
Note: *The intent of the test stand is to simulate a typical home floor.*
- a means of applying to and removing from the centre of the bottom of the specimen a 1335 ± 22 N (300 ± 5 lbf) test load;
- a padded load-distribution device in accordance with Figure 10(b); and
- a means of measuring deflections (e.g., dial indicators).

5.8.2.2.2.2 Procedure

The alternative load test for bathtub rims and bottoms shall be conducted as follows (see Figure 10):

- Apply a 1335 ± 22 N (300 ± 5 lbf) test load at the top of the loading device for 2 to 3 min.
- Remove the load and wait 10 to 15 min.
- Record the deflection with the load removed and set to zero all three gauges before recording any additional deflections.
Note: *Gauge A measures the deflection of the pad (soft) material, gauge B measures the deflection due to the test load, and gauge C measures the deflection of the test apparatus.*
- Apply the test load and record deflections after 1 to 2 min.
- Measure the residual deflection 10 ± 1 min after removal of the test load.
- Calculate the loaded and residual deflections using the following formula:

$$B - A - C = \text{Net deflection}$$

where

- A = deflection of the pad material (gauge A in Figure 10(b))
 B = deflection due to the test load (gauge B in Figure 10(b))
 C = deflection of the test apparatus (gauge C in Figure 10(a))

If lateral motion of the test apparatus causes tilting of the top loading plate, additional dial gauges shall be used to measure such deflections.

The averages of all dial indicator readings shall be used.

Alternative test apparatus that provide a rigid test stand may be used for conducting the test.

5.8.2.2.3 Secondary loads

5.8.2.2.3.1 Bathtub rims and bottoms

The test for secondary loads on bathtub rims and bottoms shall be conducted by applying a 1335 ± 22 N (300 ± 5 lbf) load for 1 to 2 min at two locations on the bottom of the specimen and at two locations on the rim, one at the midpoint and one near an end (see Figure 11) using a 76 mm (3 in) diameter load-distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad. The locations where

the loads are applied shall be different from those where the loads specified in Clauses 5.8.2.2.1 and 5.8.2.2.2 are applied.

Note: The purpose of these loads is to check for cracks only.

5.8.2.2.3.2 Shower thresholds and bottoms

The test for secondary loads on shower thresholds and bottoms shall be conducted by applying a 1335 ± 22 N (300 ± 5 lbf) load for 1 to 2 min at two locations on the bottom of the specimen and at two locations on the top of the threshold, one at the midpoint and one near an end (see Figure 12) using a 76 mm (3 in) diameter load-distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad. The locations where the loads are applied shall be different from those where the loads specified in Clause 5.8.2.2.1 are applied.

Note: The purpose of these loads is to check for cracks only.

5.8.2.3 Performance

There shall be no cracks in the surface of the specimen when examined in accordance with Items (b) to (d) of Clause 5.4.1.

In addition, for specimen bottoms,

- a) deflections under the test load shall not exceed 3.81 mm (0.150 in); and
- b) the maximum residual deflection 10 min after removal of the load shall not exceed 0.203 mm (0.008 in).

5.8.3 Area impact load test for bathtub and shower wall surrounds

5.8.3.1 Procedure

The area impact load test for bathtub and shower wall surrounds shall be conducted as follows:

- a) Place the specimen in the test apparatus.
- b) Suspend a 125 mm (5 in) diameter sandbag weighing 45 ± 5 N (10 ± 1 lbf) by a cable at a height of at least 2400 mm (8 ft) above the bottom of the specimen, using a suspension arm with a length of at least 1200 mm (4 ft).
- c) Ensure that when the sandbag is suspended and at rest, it just comes in contact with the point of impact, approximately 1200 mm (4 ft) above the bottom of the specimen.
- d) Impact the specimen twice at the following locations by raising the sandbag 840 mm (33 in) (measured vertically) above the rest position described in Item (c) along the arc of the suspension arm and then releasing it:
 - i) midpoint between framing members (studs) at approximately the centre of the wall; and
 - ii) midpoint between the intersection of adjacent walls and the first framing member (stud).

If the design of the specimen does not permit following the procedure specified in this Clause, the procedure may be modified, provided that the impact energy is equivalent.

5.8.3.2 Performance

There shall be no cracks in the surface of the specimen when examined in accordance with Items (b) to (d) of Clause 5.4.1.

5.8.4 Load test for bathtub and shower wall surrounds

5.8.4.1 Procedure

5.8.4.1.1

The load test for bathtub and shower wall surrounds shall be conducted as follows:

- a) Apply a 111 N (25 lbf) load to the specimen wall using a 76 mm (3 in) diameter load-distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad at the locations described in Clause 5.8.4.1.2.
- b) Leave the load in place for 1 min.
- c) Unload the specimen for 2 min.
- d) Repeat the steps in Items (a) to (c) ten times.

5.8.4.1.2

The loads for bathtub and shower wall surrounds shall be applied at the following locations:

- a) midpoint between framing members (studs) at the centre of the longest wall and approximately 1200 mm (4 ft) above the floor of the specimen;
- b) for bathtubs,
 - i) at a point halfway between the tub spout opening and shower head opening;
 - ii) directly in a vertical line with the tub spout and shower head; or
 - iii) directly in a vertical line with the tub spout; and
- c) for showers, at a point halfway between the shower head and the bottom of the specimen.

As an alternative to Items (a) to (c), the load may be applied midpoint between the intersection of adjacent walls and the first framing member (stud) at 1200 mm (4 ft) above the floor of the specimen.

5.8.4.2 Performance

With the load applied, deflection at any point shall not exceed 6.35 mm (0.25 in). For free-standing showers, the deflection at any point shall not exceed 25.4 mm (1.0 in).

5.8.5 Load test for unsupported bathtub areas

5.8.5.1 Procedure

The load test for unsupported bathtub areas shall be conducted as follows (see Figure 11):

- a) Apply a 45 ± 0.5 N (10 ± 0.1 lbf) load at the central point of all unsupported bathtub wall areas below the rim of the bathtub by means of a 25 mm (1 in) diameter steel rod rounded to a 13 mm (0.5 in) radius at the end in contact with the specimen.
- b) Measure the deflection opposite the applied load with a deflectometer or equivalent device with a reading accuracy of at least 0.025 mm (0.001 in).

5.8.5.2 Performance

There shall be no cracks in the surface of the specimen when examined in accordance with Items (b) to (d) of Clause 5.4.1. The deflection under the applied load shall not exceed 3.175 mm (0.125 in) at any load point.

5.8.6 Load test for sinks

5.8.6.1 Procedure

The load test for sinks shall be conducted as follows:

- Preload the specimen with an 890 ± 22 N (200 ± 5 lbf) load using a 76 mm (3 in) diameter load-distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad at the centre of the largest sink compartment and the largest integral top area, where applicable.
- Leave the load in place for 2 to 3 min to allow for settlement of the test apparatus and initial slip in the fasteners.
- Remove the load and wait 10 to 15 min.
- Apply the 890 ± 22 N (200 ± 5 lbf) test load for 5 min and then remove it.
- Measure the residual deflection 10 ± 1 min after removal of the test load with a deflectometer or equivalent device with a reading accuracy of at least 0.025 mm (0.001 in).

5.8.6.2 Performance

There shall be no cracks in the surface of the specimen when examined in accordance with Items (b) to (d) of Clause 5.4.1. The maximum residual deflection after removal of the load shall not exceed 0.254 mm (0.010 in).

5.8.7 Load test for lavatories with integral tops and for wall-hung lavatories

5.8.7.1 Procedure

The load test for lavatories with integral tops and for wall-hung lavatories shall be conducted as follows:

- Preload the specimen with a 1335 ± 22 N (300 ± 5 lbf) test load applied at the locations shown in Figure 13 using a 200 mm (8 in) diameter load-distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad. The locations shall be not more than 380 mm (15 in) in from the rim of the lavatory bowl.
- Leave the load in place for 2 to 3 min to allow for settlement of the test apparatus and initial slip in the fasteners.
- Remove the load and wait 10 to 15 min.
- Apply the test load for 1 to 2 min.
- Measure the residual deflection 10 ± 1 min after removal of the load with a deflectometer or equivalent device with a reading accuracy of at least 0.025 mm (0.001 in). The deflection shall be measured on a horizontal portion of the outlet or on a horizontal portion of the drain if one is mounted during the test.

5.8.7.2 Performance

There shall be no cracks in the surface of the specimen when examined in accordance with Items (b) to (d) of Clause 5.4.1. The maximum residual deflection after removal of the load shall not exceed 0.254 mm (0.010 in).

5.8.8 Load test for floor-mounted water closet bowl rims

5.8.8.1 Apparatus

The test apparatus shall be set up as follows:

- Use two steel channels, 75 mm (3 in) in depth and approximately 610 mm (2 ft) long, placed back to back and spaced 75 mm (3 in) apart (see Figure 14).
- Weld a 6 mm (0.25 in) thick steel plate of the appropriate size to the top flanges of the channels.

- c) Place the channels across the bowl rim, centred at a distance of 254 mm (10 in) for round bowls and 305 mm (12 in) for elongated bowls, measured normal to the centreline across the seat bolt holes.
- d) To simulate bumpers, place rubber disks approximately 32 × 10 mm (1.25 × 0.38 in) at four positions as shown in Figure 14 between the channels and rim.
- e) Fill the bowl to the normal level with water before applying the load.

5.8.8.2 Procedure

The load test for floor-mounted water closet bowl rims shall be conducted as follows:

- a) Apply a load of 1335 ± 22 N (300 ± 5 lbf), including the weight of the channels and plate described in Items (a) and (b) of Clause 5.8.8.1, on the specimen.
- b) Leave the load in place for 60 ± 5 min.
- c) Measure the deflection of the bowl rim at the points shown in Figure 14 with an instrument having an accuracy of 0.025 mm (0.001 in).
- d) Inspect the specimen for visible damage while the load is in place.
- e) Remove the load.
- f) Measure the residual deflection of the bowl rim 60 ± 5 min after removal of the load.

5.8.8.3 Performance

When the surface of the specimen is examined in accordance with Items (b) to (d) of Clause 5.4.1, there shall be no

- a) visible cracks;
- b) water leakage when the load is in place or after removal of the load; and
- c) visible distortion of the specimen after removal of the load.

Rim deflection with the load in place shall not exceed 2.54 mm (0.10 in) and residual deflection after load removal shall not exceed 1.3 mm (0.05 in).

5.8.9 Load test for water closet tank lids

5.8.9.1 Procedure

The load test for water closet tank lids shall be conducted as follows (see Figure 15):

- a) Mount the tank with its lid on a matching bowl or suitable test fixture.
- b) Using a 75 mm (3 in) diameter steel weight distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad, apply a load of 445 ± 22 N (100 ± 5 lbf) to the top of the lid along the lengthwise centreline at
 - i) the midpoint of the lid; and
 - ii) a quarter point from one end.
- c) Leave the load in place for 2 ± 0.5 min.
- d) Observe the specimen for visible damage while the load is in place.
- e) Remove the load.

5.8.9.2 Performance

When the specimen is examined in accordance with Items (b) to (d) of Clause 5.4.1, there shall be no

- a) visible cracks;
- b) water leakage either when the load is in place or after removal of the load; and
- c) visible distortion of the specimen after removal of the load.

5.9 Radii load test for water closets, urinals, bathtubs, and showers

5.9.1 Procedure

The outside radii of finished surfaces shall be tested with a 13 mm (0.5 in) diameter nylon rod applying a load of approximately 45 N (10 lbf) at an angle tangent to the radius.

5.9.2 Performance

When the surface of the specimen is examined in accordance with Items (b) to (d) of Clause 5.4.1, it shall show no cracks, chips, or voids.

5.10 Colourfastness test

5.10.1 Specimen

The specimen shall comprise two samples taken from the same area of the plastic plumbing fixture. One sample (the test sample) shall be tested for 200 h in accordance with ASTM D2565. The other sample (the control sample) shall be stored away from any light source at a temperature of 23 ± 5 °C (73 ± 9 °F).

5.10.2 Conditions

The conditions for the colourfastness test shall be as follows:

- The black panel temperature shall be maintained at 63 ± 5 °C (145 ± 9 °F).
- Humidity need not be controlled.
- The irradiance of the xenon arc lightbulb shall be maintained at 0.35 ± 0.02 W/m² at 340 nm for the duration of the test.
- The light filters surrounding the xenon arc lightbulb shall be borosilicate glass.

5.10.3 Procedure

5.10.3.1 Exposure procedures

The test sample shall be subjected to the following exposure procedures:

- Subject the test sample to conditions specified in Clause 5.10.2 for 200 h in accordance with ASTM D2565.
- At the conclusion of the 200 h test period, store the test sample away from any light source at a temperature of 23 ± 5 °C (73 ± 9 °F) for not less than 72 h.
- Clause 5.10.3.2 shall be used to evaluate the colourfastness. Clause 5.10.3.3 shall be used if the results of Clause 5.10.3.2 are uncertain.

5.10.3.2 Non-instrumented evaluation

Non-instrumented evaluation shall be conducted as follows:

- The test sample shall be examined with the unaided eye from a distance of between 300 and 610 mm (1 and 2 ft) for significant change in colour or surface texture when compared with the control sample using the light source as specified in Clause 5.4.1(d).
- The samples shall be placed next to each other while completing the examination.
- The test sample shall comply with the performance requirements in Clause 5.10.4.1.

5.10.3.3 Instrumented evaluation

Instrumented evaluation shall be conducted as follows:

- Colour readings shall be taken on the test sample before and after accelerated aging with the reading instrument set to read at an illumination of D65, a CIE 10° observer with the specular

component excluded, and using the CIELAB colour scale. The location on the sample where the readings are taken, as well as the orientation of the sample in relation to the reading instrument, shall be noted. The same sample location and orientation shall be used for both measurements.

- b) A minimum of three delta E readings shall be taken and averaged.
- c) The test sample shall comply with the performance requirements in Clause 5.10.4.2.

5.10.4 Performance

5.10.4.1 Non-instrumented performance

The following shall apply for non-instrumented performance:

- a) There shall be no significant change in colour and surface texture between the test and control samples. A significant change in colour shall be defined as an observable colour difference when the samples are placed next to each other and examined using the conditions specified in Clause 5.10.3.2(a).
- b) If the sample fails to pass the test, two more samples shall be tested and both shall pass.

5.10.4.2 Instrumented performance

The following shall apply for instrumented performance:

- a) The average colour difference of the test sample before and after the exposure procedures specified in Clause 5.10.3 shall be not more than 2 delta E units.
- b) If the sample fails to pass the test, two more samples shall be tested and both shall pass.

5.11 Stain resistance test

5.11.1 Procedure

The stain resistance test shall be conducted as follows:

- a) Cut the specimen(s) from the inside or bottom of the plastic plumbing fixture (below the rim).
- b) Condition the specimen(s) by wet-rubbing them with an abrasive powder consisting of 60 g (2.1 oz) of trisodium phosphate and 2700 g (95.2 oz) of 160-mesh pottery flint or ground quartz and cheesecloth for at least 20 cycles.
- c) Apply two drops of each of the following liquid reagents and a similar amount of the solid reagents to the test specimen(s):
 - i) black crayon;
 - ii) black liquid shoe polish;
 - iii) blue washable ink;
 - iv) lipstick* of contrasting colour;
 - v) hair dye† of contrasting colour;
 - vi) iodine solution (1% alcohol solution); and
 - vii) gentian violet solution (2% aqueous solution).

* Avon lipstick is acceptable

† Miss Clairol hair dye is acceptable.

- d) In addition to the reagents listed in Item (c), apply two drops of each of the following reagents to sinks:
 - i) beet juice*;
 - ii) grape juice†; and
 - iii) liquid from a wet tea bag‡.

* Juice from Del Monte sliced beets (not pickled) is acceptable.

† Welch's 100% Pure Grape Juice (purple) is acceptable.

‡ A Lipton's tea bag (orange pekoe or pekoe cut black tea) is acceptable.

- e) Leave one of the two reagent drops specified in Items (c) and (d) uncovered and cover the other drop with a watch glass to prevent evaporation and to ensure contact with the specimen(s).
- f) Allow the specimen(s) to remain for 16 h at a temperature of 23 ± 2 °C (73 ± 4 °F) and a relative humidity of $50 \pm 5\%$.
- g) Remove the excess reagents by blotting lightly with a paper towel.
- h) Clean and examine the specimen(s) for stains (i.e., changes in surface color or texture compared to the untested surface) in accordance with Clause 5.4.1(d), immediately after the conclusion of the 16 h period.
- i) Give each stain (covered and uncovered) a rating in accordance with Clause 5.11.2.

5.11.2 Rating

5.11.2.1

The specimen(s) shall be washed with water and cheesecloth or a soft bristle brush for 20 scrub cycles using normal hand pressure, and dried by blotting.

Specimens not staining at this point shall receive a rating of 1: non-staining.

5.11.2.2

Stains present after initial washing with water shall be washed with alcohol (commercial rubbing alcohol) or naphtha (lighter fluid) using cheesecloth or a soft bristle brush for 20 scrub cycles with normal hand pressure. The specimen(s) shall then be washed with water and dried by blotting.

Specimens not staining at this point shall receive a rating of 2: removable by alcohol or naphtha.

5.11.2.3

Stains present after the cleanings specified in Clauses 5.11.2.1 and 5.11.2.2 shall be scrubbed in accordance with Clause 5.11.1(b) for 20 cycles only. The specimen(s) shall then be washed with water and dried by blotting. Reduction of gloss due to scrubbing shall not constitute staining.

Specimens whose stain is removed by abrasive powder shall have a rating of 3: removable by first application of household scouring powder.

Note: The abrasive powder composition is specified in Clause 5.11.1(b).

5.11.2.4

Stains present after the cleanings specified in Clauses 5.11.2.1 to 5.11.2.3 shall be scrubbed in accordance with Clause 5.11.1(b) for an additional 40 cycles. The specimen(s) shall then be washed with water and dried by blotting. Reduction of gloss due to scrubbing shall not constitute staining.

Specimens whose stain is removed by this additional cleaning shall have a rating of 4: removable by two abrasive powder scrubblings.

Note: The abrasive powder composition is specified in Clause 5.11.1(b).

5.11.2.5

Specimens with stains remaining after the cleanings specified in Clauses 5.11.2.1 to 5.11.2.4 shall have a rating of 5 and shall be tested to determine the depth of staining as follows:

- a) Cut through the affected area and sand lightly with 400-grit sandpaper until the stain is removed.
- b) Measure depth to the nearest 0.025 mm (0.001 in).

5.11.3 Performance

The maximum stain resistance rating shall be the sum of the individual stain ratings for each of the covered and uncovered stain areas and shall not exceed 50, except for sinks, where it shall not exceed 64. The maximum allowable thickness of material removed to eliminate a stain shall be 0.127 mm (0.005 in).

5.12 Cleanability and wear tests

5.12.1 Wear test

5.12.1.1 Specimens

5.12.1.1.1

Three flat test specimens shall be cut from the inside of the fixture, one from the front or back, one from the end, and one from the bottom (below the rim of the threshold), and trimmed to a dimension of approximately 90 × 90 mm (3.5 × 3.5 in).

If the specimens have insufficient rigidity, they shall then be bonded to 11-gauge stainless steel plates of the same dimension using a suitable adhesive and sanded to the dimensions of the backing plates.

Note: To salvage the stainless steel plates, a water-resistant contact adhesive should be used.

5.12.1.1.2

When relatively flat specimens cannot be obtained within the fixture areas described in Clause 5.12.1.1.1, the specimens may be taken from other areas of the fixture.

When such specimens are used, a cross-section of the bottom of the fixture shall be cut and edge-sanded to establish the surface material thickness, if any. The test specimens shall be at least as thick as the surface material of the bottom cross-section.

5.12.1.1.3

When the fixture has no flat areas from which to obtain specimens, the manufacturer shall supply coupons prepared with the same materials and in the same manner as the fixture itself.

When coupons are used, a cross-section of the bottom of the fixture shall be cut and edge-sanded to establish the surface material thickness, if any. The coupons shall be at least as thick as the surface material of the bottom cross-section.

5.12.1.2 Test equipment

5.12.1.2.1

Each brush shall consist of a 40 × 90 mm (1.5 × 3.5 in) block containing 59 hog bristles placed in alternate rows that are staggered, five and four bristles each, resulting in nine lanes of bristles in the direction of brush travel. Each brush shall also contain 54 No. 40 (drill-size) holes through the block, adjacent to each bristle, to feed the abrasive slurry to each bristle area. Brush bristles shall not be allowed to wear to a length of less than 13 mm (0.5 in). The total dry weight of each brush and its carrier shall be 10.8 ± 0.1 N (38.3 ± 0.35 oz).

5.12.1.2.2

The abrasive slurry shall consist of 3 L (0.66 gal) of water, 15 g (0.5 oz) of sodium carboxymethyl cellulose, 60 g (2.1 oz) of trisodium phosphate, and 2700 g (95.2 oz) of 160-mesh pottery flint or ground quartz, contained in a 200 × 300 mm (8 × 12 in) (diameter × height) battery jar or equivalent, with cover, that will accept tubes and a motor-driven stirring apparatus to maintain particulate matter in suspension. NPS-1/8 or equivalent tubes shall be extended from the battery jar through a vinyl metering pump or equivalent to each of the brush holders on the scrub tester and from there to each feedhole.

Note: A Sigmamotor model TM-10 metering pump® was used in preparing this test method.

5.12.1.3 Procedure

5.12.1.3.1

The flow rate of the slurry through each tube shall be between 3.0 and 3.5 mL/min (0.10 and 0.12 fl-oz/min). To check the flow rate, the pump shall be run until no further bubbles are visible in the tubing. Next, each tube shall be placed in a separate graduated cylinder and the pump shall be run for 10 min. Anti-foam shall be added and warm water made to flow on the outside of the cylinders to break any foam that could be present on the slurry. The level in each cylinder shall be 30 to 35 mL (1.0 to 1.2 fl-oz) at the end of the 10 min period.

5.12.1.3.2

The specimens shall be scrubbed for the number of cycles specified in Table 2. Brushes shall be switched at 25, 50, and 75% of the full term according to Table 3. At each switch of brushes it shall be ensured that the feedholes are not obstructed and excess slurry shall be washed from the specimen trays.

5.12.1.3.3

On completion of the total cycles, all specimens shall be removed, rinsed in water, dried, and measured for cleanability in accordance with Clause 5.12.2 and for reduction in surface material. The remaining slurry shall not be reused.

5.12.2 Cleanability test

5.12.2.1

The white-light reflectance readings for each specimen shall be the average of three individual readings approximately 13 mm (0.5 in) apart and shall be measured using an instrument with a maximum aperture of 25 mm (1 in).

5.12.2.2

The white-light reflectance of specimens that have been tested in accordance with Clause 5.12.1 shall be R_1 .

5.12.2.3

Ten grams (0.35 oz) of standard dirt shall be applied to each area scrubbed in accordance with Clause 5.12.1.3.2 with a dampened chamois under heavy thumb pressure in a circular motion for 25 cycles. After the first area has dried for 1 h, the areas shall be rubbed with a clean, dampened chamois and standard liquid detergent until it appears that no further dirt is being removed, then rinsed in water and allowed to dry.

5.12.2.4

After the procedure specified in Clause 5.12.2.3 is conducted, the white-light reflectance shall be determined again for each specimen in accordance with Clause 5.12.2.1 and shall be R_2 .

The average absolute percentage loss in white-light reflectance for each specimen shall be calculated as follows:

$$\left(\frac{R_1 - R_2}{R_1} \right) \times 100 \not\geq 5 \%$$

5.12.2.5

If the average absolute percentage loss of white-light reflectance is greater than 2%, the specimens shall be given an additional rubbing with a clean, dampened chamois and the abrasive slurry specified in Clause 5.12.1.2.2 for approximately 50 cycles, rinsed in warm water, and allowed to dry. The white-light reflectance shall be determined again for each specimen in accordance with Clause 5.12.2.1 and shall be R_3 .

The new average absolute percentage loss in white-light reflectance for each specimen shall be calculated as follows:

$$\left(\frac{R_1 - R_2}{R_1} \right) \times 100 \not\geq 2 \%$$

5.12.3 Performance

Each specimen shall withstand the number of scrub cycles specified in Table 2 without wear-through of the surface material in the middle third of the specimen surface (see Figure 16) when tested in accordance with Clause 5.12.1.

In addition, when tested in accordance with Clause 5.12.2, each specimen shall not lose more than 5% white-light reflectance after being cleaned with liquid cleanser and not more than 2% white-light reflectance after an additional cleaning with abrasive cleaner.

5.13 Ignitability test

5.13.1 General

The ignitability test shall

- a) be conducted only on the unexposed service walls of bathtubs and shower stalls (see Figure 17);
- b) not apply to fixtures intended for use in RVs; and
- c) not apply around shower and bathtub waste openings.

5.13.2 Procedure

5.13.2.1

Five test specimens, each approximately 300 × 300 mm (12 × 12 in), shall be cut from the service wall. If a sufficient area is not available, test specimens may be cut from prepared sheets made using the same process and techniques and from the same materials as the fixture itself.

5.13.2.2

The ignitability test shall be conducted in a draft-free laboratory hood that allows removal of products of combustion immediately after each test is conducted.

5.13.2.3

The specimens shall be mounted in the hood in a vertical position. The burner of a propane torch shall be adjusted to provide a blue flame, the visible portion of which shall be 25 mm (1 in) long.

Note: A Bernzomatic® Master Torch consisting of a TX-9 propane cylinder and a TX-2 or a JT 680 utility burner unit is acceptable.

5.13.2.4

The ignitability test shall be conducted as follows:

- a) Position the burner so that the flame is inclined upward at a 45° angle and the tip of the blue portion of the flame touches the centre of the unfinished side of the specimen.
- b) After 30 s, withdraw the burner at least 450 mm (18 in) from the specimen and record the burning period (i.e., when no evidence of flame or progressive glow is seen).
- c) One minute after no evidence of flame or progressive glow is seen, apply the burner again to the same portion of the specimen for an additional 30 s.
- d) Remove and extinguish the burner and again record the burning period.

5.13.3 Performance

If, when ignited, all five specimens cease to burn within 30 s after removal of the burner, the fixture or material shall be deemed to have complied with the ignitability requirement.

If any one of the five specimens fails the test, five additional specimens shall be tested. If, when ignited, the five additional specimens cease to burn within 30 s after removal of the burner, the fixture or material shall be deemed to have complied with the ignitability requirement.

Burning shall be allowed beyond 30 s only if it takes place along the upper edge of the specimen.

5.14 Cigarette test

5.14.1 Procedure

The cigarette test shall be conducted as follows:

- a) Use three specimens of approximately 150 × 150 mm (6 × 6 in).
- b) Select packages of three popular brands of cigarettes and light three cigarettes, one from each freshly opened package.
- c) Place the cigarettes on the specimens with the lit end 25 mm (1 in) from the specimen edge.
- d) Allow the cigarettes to burn for 2 min ± 2 s.

Note: If the cigarette self-extinguishes in less than 2 min, the cigarette should be re-lit until the 2 min ± 2 s test period is completed.

- a) Remove the cigarettes and allow the burned areas to cool.
- b) Wipe the burned areas with a clean cheesecloth or a soft bristle brush.
- c) If a visible stain remains, sand the stained area with 400-grit wet or dry sandpaper and water until the stain is removed.

5.14.2 Performance

There shall be no ignition or progressive glow of the specimen surface during or after contact with the lighted cigarettes. Any resulting damage shall not impair the serviceability of the fixture and shall be easily repairable using abrasive and polishing compounds to approximate the original finish.

5.15 Chemical resistance test

5.15.1 Specimens

The specimen(s) shall

- a) have an untextured surface where possible;
- b) be cut from the inside or bottom of the fixture (below the rim), or from the apron; and
- c) be conditioned as specified in Clause 5.4.1(a).

When relatively flat specimens cannot be obtained directly from the fixture, the manufacturer shall supply coupons prepared with the same materials and in the same manner as the fixture itself.

5.15.2 Procedure

The chemical resistance test shall be conducted as follows:

- a) Apply two drops of each of the following reagents to the surface finish:

- i) naphtha*;
- ii) ethyl alcohol;
- iii) amyl acetate;
- iv) 1% ammonium hydroxide;
- v) citric acid, 10% water solution;
- vi) urea, 6.0% water solution;
- vii) hydrogen peroxide, 3% water solution;
- viii) sodium hypochlorite 6% solution†;
- ix) toluene;
- x) ethyl acetate;
- xi) lye, 1% to 2% water solution‡; and
- xii) acetone.

* Varnish makers' and painter's naphtha are acceptable.

† Clorox® is acceptable.

‡ Drano® is acceptable.

- b) Leave one of the two reagent drops specified in Item (a) uncovered and cover the other drop with a watch glass to prevent evaporation and to ensure full contact with the specimen(s).
- c) Allow the reagents to remain in contact with the specimen(s) for 16 h.
- d) At the end of the 16 h period remove the watch glass and the excess reagent.
- e) Keep the specimen(s) for 24 h at a temperature of 23 ± 2 °C (74.3 ± 3.6 °F) and a relative humidity of $50 \pm 5\%$.
- f) Examine the specimen(s) in accordance with Clause 5.4.1(d).

5.15.3 Performance

The surface finish shall be unaffected by the reagents except for superficial changes removable by sanding with 400-grit wet or dry sandpaper and water. Damage resulting from the test shall not impair the serviceability of the fixture and shall be easily repairable using abrasive and polishing compounds to approximate the original finish.

5.16 Thermal shock resistance test

5.16.1 Specimen

The specimen shall be a complete fixture.

If conducting the test on a complete fixture is not practical or possible, it may be conducted using a specimen cut from the bottom of large fixtures around the area where water usually impinges. Alternatively, the manufacturer may supply a specially prepared specimen that will prevent water from contacting the cut edges and the back.

5.16.2 Procedure

The thermal shock resistance test shall be conducted as follows:

- a) Impinge on the specimen surface, where water will normally strike, hot water at the temperature specified in Table 4 for 1.5 min and at a rate of 3.78 ± 0.80 L/min (1.0 ± 0.2 gpm).
- b) Allow the water to drain for 30 s.
- c) Immediately after the 30 s, impinge, at the same point, cold water at the temperature specified in Table 4 for 1.5 min at a rate of 3.78 ± 0.80 L/min (1.0 ± 0.2 gpm).
- d) Allow water to drain for 30 s.
- e) Steps (a) to (d) constitute one cycle. Continue the test for the number of cycles specified in Table 4.

5.16.3 Performance

Examine the specimen for cracking and crazing in accordance with Clause 5.4.1(d). There shall be no cracking, crazing, blistering or spalling, or delamination.

5.17 Water resistance test for bathtubs and showers

5.17.1 Specimens

Three test specimens shall be used for the water resistance test for bathtubs and showers as follows:

- a) One specimen shall be taken from the wall surround area and the other two specimens from two different areas of the bathtub below the overflow, or two different areas of the shower below the threshold.
- b) If there are no wall surrounds, all three specimens shall be from different areas of the bathtub or shower, including one specimen from the bottom.
- c) If the specimens differ in appearance or surface texture, control specimens shall be cut from areas immediately adjacent to each test specimen. If the specimens are the same in appearance and surface texture, only one control specimen shall be required.

5.17.2 Procedure

The water resistance test for bathtubs and showers shall be conducted as follows:

- a) Condition the surfaces of the specimens, including the control specimen(s), by wet-rubbing with an abrasive powder consisting of 60 g (2.1 oz) of trisodium phosphate and 2700 g (95.2 oz) of 160-mesh pottery flint or ground quartz and cheesecloth for at least 20 cycles using normal hand pressure. Rinse the surfaces with water.
- b) Place the specimens against the portholes of a suitable non-reactive vessel (see Figures B.1 and B.2) using silicone rubber gaskets between the vessel and the specimens. Cover any unused portholes with a non-reactive material. The portholes shall have a minimum area of 3900 mm² (6 in²) each.

- c) Apply distilled water at 65 ± 1 °C (150 ± 2 °F) for 100 ± 0.5 h to the specimens, ensuring that the test face of the specimen is submerged.

5.17.3 Performance

Examine the specimen first for colour change and then for cracking and crazing in accordance with Clause 5.4.1(d). There shall be no cracking, crazing, blistering or spalling, delamination, or permanent colour change of the specimens.

Final evaluations for colour change shall be performed between 72 and 108 h after testing. When the result is in doubt, an examination shall be conducted in accordance with ASTM D2244. The average colour difference between the test and control specimens shall be not more than ± 2 Delta E units.

Discolouration that can be removed by abrading the surface to a maximum depth of 0.125 mm (0.005 in) and repolishing in accordance with the manufacturer's care and maintenance instructions shall be acceptable.

5.18 Field-installed tiling-flange seal test

5.18.1 Procedure

The tiling-flange seal test shall be conducted as follows:

- a) Set up and load the specimen in accordance with Clause 5.8.1.1.
- b) Maintain the load for the full duration of the test.
- c) Apply a continuous water spray to the flange seal at the joint with the fixture as follows:
 - i) using a 30° full jet spray nozzle;
 - ii) for 30 min;
 - iii) from a distance of 1.2 m (4 ft) from the face of the spray nozzle;
 - iv) at an angle of 45°;
 - v) at a flow rate of 11.4 L/min (3.0 gpm); and
 - vi) at a temperature of 40 ± 5 °C (104 ± 9 °F).
- d) Inspect the specimen for water transmission through the joint to the back of the flange.

Note: Full Jet®, narrow angle 30° series, part No. 1/2 GG 3030, manufactured by Spraying Systems Co., North Avenue at Schmale Road, P.O. Box 7900, Wheaton, IL, 60189, has been used for this test.

5.18.2 Performance

There shall be no water leakage through the flange and fixture joint.

5.19 Overflow test (lavatories and sinks)

5.19.1 Procedure

The overflow test shall be conducted as follows:

- a) Install the specimen using a waste fitting that complies with ASME A112.18.2/CSA B125.2.
- b) Supply water to the specimen at a rate of 5.7 L/min (1.5 gpm). If the specimen is a laundry or utility sink, the rate of water supply to the major compartment shall be at least 15 L/min (4 gpm) and to the minor compartment (if any) at least 9 L/min (2.4 gpm).
- c) Block the waste outlet.
- d) Measure the elapsed time from the onset of water flowing into the overflow opening until the water begins to flow over the flood level of the specimen.

5.19.2 Performance

The specimen shall drain at least 5 min from the onset of water flowing into the overflow opening, without overflowing its flood level rim.

5.20 Knife drop test (for kitchen and bar sinks only)

5.20.1 Procedure

A steel knife shall be dropped, tip down, from a height of 600 mm (24 in) to strike two different points of the bottom of each compartment.

The knife shall

- a) have a mass of 28 g (1 oz);
- b) be 1.27 ± 0.13 mm (0.050 ± 0.005 in) thick;
- c) have a rounded tip with a 6.4 ± 0.4 mm (0.25 ± 0.016 in) radius; and
- d) have its edge ground to 0.635 ± 0.051 mm (0.025 ± 0.002 in).

5.20.2 Performance

Examine the specimen for cracking and fractures in accordance with Clause 5.4.1(d). The specimen shall not show any cracks or fractures.

Any damage shall not extend through the surface finish. If the damage can be restored to approximate the original finish by using abrasives and polishing compounds, it shall not be deemed a failure.

5.21 Skillet drop test (for kitchen sinks only)

5.21.1 Procedure

A 270 mm (10.5 in) diameter cast iron skillet weighing 20 ± 0.4 N (4.5 ± 0.1 lbf) shall be held with the handle up and dropped on two points between the drain and side wall from a height of 300 mm (12 in) in each compartment, approximately 90° apart.

5.21.2 Performance

The specimen shall be examined for cracking and fractures in accordance with Items (b) to (d) of Clause 5.4.1 and shall not show any cracks or fractures.

5.22 Vibration test (for kitchen sinks only)

5.22.1 General

The vibration test shall be conducted only on kitchen sink compartments with a 90 mm (3.5 in) diameter or larger waste outlet.

5.22.2 Procedure

The vibration test shall be conducted as follows:

- a) Add a 15 g (0.53 oz) mass to one of the blades or the disk of a food waste grinder to create an imbalance.
- b) Locate the mass at a distance of 57 ± 3 mm (2.25 ± 0.13 in) so that the plane of rotation of the mass is 156 ± 6 mm (6.13 ± 0.25 in) below the underside of the outer rim and the centre of gravity is 210 ± 6 mm (8.25 ± 0.25 in) below the underside of the outer rim of a 114 mm (4.5 in) diameter mounting flange.

- c) Ensure that the overall weight of the grinder is 84 ± 2 N (19 ± 0.5 lbf).
- d) Assemble the grinder and attach it to the sink in such a way that the electrical and waste connections do not restrict the motion of the grinder.
- e) Operate the grinder at 1725 ± 3 rpm.
- f) Flow cold water through the grinder at a rate of at least 3.8 L/min (1 gpm).
- g) Turn the grinder on for 30 s and off for 1 min to complete one cycle.
- h) Subject the specimen to 1000 cycles.

Note: An In-Sinkerator Model No. Badger 5XP or equivalent is acceptable.

5.22.3 Performance

The specimen shall be examined for cracking and fractures in accordance with Items (b) to (d) of Clause 5.4.1 and shall not show any cracks or fractures.

5.23 Heated pan test (for kitchen sinks only)

5.23.1 Procedure

The heated pan test shall be conducted only on kitchen sinks, as follows:

- a) Mark a test area of 254 ± 25 mm (10 ± 1 in) in diameter on the bottom of each compartment of the specimen.
- b) Locate the test area to provide maximum contact with a flat surface.
- c) Heat a 6 ± 1 mm (0.25 ± 0.04 in) thick aluminum disk with a diameter of 150 ± 6 mm (6 ± 0.25 in) for 15 ± 0.5 min in an oven at 185 ± 5 °C (365 ± 10 °F).
- d) Place the aluminum disk on the test area for 10 ± 0.5 min.
- e) Remove the aluminum disk.
- f) Repeat Items (c) to (e) twice (for a total of three times) on the test area.
- g) Leave the sink at room ambient temperature for 4 h.

5.23.2 Performance

The specimen shall be examined for surface deterioration such as cracking, crazing, blistering, discoloration, or other surface defects in accordance with Clause 5.4.1(d). There shall be no cracking, crazing, blistering, discoloration, or other surface defects.

Damage resulting from the test, including slight melting of the surface that can be repaired using abrasive and polishing compounds in accordance with the manufacturer's care and maintenance instructions, shall be acceptable, provided that it does not impair the function of the sink.

When the result is in doubt, an examination shall be conducted in accordance with ASTM D2244. The average colour difference between the test and control specimens shall be not more than ± 2 Delta E units.

5.24 Hot wax test (for kitchen sinks only)

5.24.1 General

The hot wax test shall be conducted on each sink compartment with the waste outlet open and repeated with the outlet blocked.

5.24.2 Procedure

The hot wax test shall be conducted as follows:

- a) Pour 300 ± 50 ml (10 ± 1 oz) of bath wax at a temperature of 185 ± 5 °C (365 ± 10 °F) onto the bottom of the specimen at the farthest point from the waste outlet for 5 ± 1 s.
- b) Leave the specimen at ambient temperature for 30 ± 5 min.
- c) Remove the wax from the specimen.

Note: Fisher Scientific Co. B-219 Bath Wax is acceptable.

5.24.3 Performance

The specimen shall be examined for surface deterioration such as cracking, crazing, blistering, discoloration, or other surface defects. There shall be no cracking, crazing, blistering, discoloration, or other surface defects.

Damage resulting from the test, including slight melting of the surface that can be repaired using abrasive and polishing compounds in accordance with the manufacturer's care and maintenance instructions, shall be acceptable, provided that it does not impair the function of the sink.

When the result is in doubt, an examination shall be conducted in accordance with ASTM D2244. The average colour difference between the test and control specimens shall be not more than ± 2 Delta E units.

5.25 Tests for flexible (soft) construction fixtures

5.25.1 Resistance to fungi and bacteria growth

Resistance to fungi and bacteria growth shall be determined in accordance with ASTM G21.

5.25.2 Puncture resistance test

5.25.2.1 Procedure

The puncture resistance test shall be conducted as follows:

- a) Randomly distribute 24 common drywall nails over the centremost 300×300 mm (12×12 in) area on the bottom of the fixture.
- b) Place a 300×300 mm (12×12 in) piece of plywood, 25 mm (1 in) thick, over the nails.
- c) Apply a load of 650 N (146 lbf) for 1 min.
- d) Examine the test area in accordance with Clause 5.25.2.2.
- e) Drop a No. 2 Phillips screwdriver weighing 0.9 to 1 N (0.20 to 0.22 lbf) from a height of 1500 mm (60 in) to strike a flat area on the bottom of the specimen perpendicularly.

Note: The 1500 mm (60 in) is measured from tip of the screwdriver.

- f) Examine the impact location in accordance with Clause 5.25.2.2.
- g) Repeat Items (e) and (f) three times.

5.25.2.2 Examination

Following the procedure specified in Clause 5.25.2.1, the specimen shall be examined as follows:

- a) Fill the specimen with water.
- b) Apply pressure to the areas where puncturing is suspected.
- c) Note air bubbles ejected if a puncture is present.
- d) Empty the specimen.
- e) Apply pressure near any puncture previously detected.

- f) Note any water or water and air mixture expelled from the puncture site.

5.25.2.3 Performance

The surface of the specimen shall not be punctured. Any resulting depressions on the surface shall disappear within 24 h.

5.25.3 Bonding test

5.25.3.1 Procedure

Five specimens, each 25 × 25 mm (1.0 × 1.0 in), shall be tested in accordance with ASTM C297/C297M at a crosshead rate of 0.5 mm/min (0.02 in/min). The average value shall be recorded.

5.25.3.2 Performance

The bond strength between the surface finish and the reinforcement substructure shall be a minimum average of 28 kPa (4 psi). All specimens tested shall exhibit failure in the reinforcement, not in the interface between the surface finish and the reinforcement.

5.25.4 Water absorption test

5.25.4.1 Procedure

The water absorption test shall be conducted as follows:

- a) Cut three specimens in accordance with Clause 5.17.1.
- b) Cover any exposed edges with a non-reactive sealant.
- c) Condition the specimens for 24 h in an oven at 50 ± 3 °C (122 ± 5 °F), cool them in a desiccator to ambient laboratory temperature, and weigh them as soon as they reach ambient temperature.
- d) Completely immerse the specimens in distilled water at 23 ± 1 °C (73 ± 2 °F) for 24 h.
- e) Remove the specimens from the water one at a time and wipe off the surface water with a dry cloth.
- f) Weigh the specimens within 30 s of removal from the water.
- g) Calculate the percentage increase in mass to the nearest 0.01%.

5.25.4.2 Performance

No specimen shall absorb water in excess of 0.5% by mass.

5.26 Inlet connection test

5.26.1 Procedure

The inlet connection test shall be conducted only on water closet tanks which have the water supply shank below the tank water level, as follows:

- a) Connect a 150 mm (6 in) galvanized nipple with a 9.5 mm (0.375 in) inside diameter to the water inlet shank as illustrated in Figure 19 (i.e., the pivot arm).
- b) Fill the tank with water to the manufacturer's recommended maximum level with water at ambient temperature.
- c) Apply a load on the pivot arm with a 6.8 ± 0.5 kg (15 ± 1 lb) mass as illustrated in Figure 18.
- d) Maintain the load in place for approximately 2 min.
- e) Inspect the tank for visible damage and leakage while the load is in place.
- f) Rotate the pivot to two other positions (e.g., 120° and 240° from the original position).
- g) Repeat the steps in Items (c) to (e) in each of those positions.

- h) Remove the load.
- i) Inspect for damage in accordance with the procedure specified in Clause 5.4.

5.26.2 Performance

The following shall apply at the end of the test:

- a) There shall be no visible cracks or water leakage either when the load is in place or after removal of the load.
- b) There shall be no permanent distortion after removal of the load.

5.27 Deflection test

5.27.1

The deflection test for water closet tanks shall be conducted as follows:

- a) Install the tank on a matching water closet bowl or suitable test fixture.
- b) Install deflection gauges on the sides, front, back, and bottom of the tank. The side, front, and back gauges shall be positioned 13 mm (0.5 in) below the water level, centered along the tank. The bottom gauges shall be equally spaced. All gauges shall be positioned away from reinforcing ribs, when present. See Figure 20.
- c) Fill the tank to the manufacturer's recommended maximum level with water at ambient temperature.
- d) Measure and record the deflections.
- e) Add the two side deflections, the front and back deflections, and the two bottom deflections.

5.27.2 Performance

The sums of the deflections shall not exceed

- a) 1.5 mm (0.06 in) for the sides of the tank;
- b) 4.6 mm (0.18 in) for the front and back of the tank; and
- c) 1.0 mm (0.04 in) for the bottom of the tank.

In addition, each individual deflection shall not exceed 75% of the values specified in Items (a) to (c).

6 Markings

6.1 General

6.1.1

Plastic plumbing fixtures shall be marked with the manufacturer's name or registered trademark or, in the case of private labelling, the name of the customer for whom the fixture was manufactured. Additional markings shall be in accordance with Clauses 6.3 and 6.4, as applicable.

6.1.2

Markings shall be permanent, legible, and visible after installation.

6.1.3

Acceptable means of applying permanent markings shall include etching, mechanical stamping, stamping with a permanent (non-water-soluble) ink, and moulding in.

Adhesive labels that comply with CSA C22.2 No. 0.15 or UL 969 shall also be considered permanent when placed on a surface that is not normally submerged in water. The exposure conditions specified in Clause 7.1 of UL 969 shall apply.

6.1.4

In Canada, warnings and cautionary and safety markings, including those found in user manuals, shall be in English and French.

6.2 Non-standard fixtures

6.2.1

Fixtures that require proprietary (i.e., non-standard) components, e.g., supply or waste fittings, shall indicate, in the packaging or the accompanying literature, that such components are provided by the manufacturer and shall identify the proper replacement parts.

6.2.2

Fixtures that do not comply with one or more of the dimensional requirements of this Standard and of Clause 5.13.1(b) shall be marked “RV”.

6.3 Field-installed flanges

Bathtub and shower bases that use field-installed flanges shall have a non-permanent label stating “Do not install this fixture against a wall unless the appropriate flange is first installed”*.

** The equivalent French wording is “Ne pas fixer cet appareil au mur à moins que la bride appropriée n’ait été préalablement installée”.*

6.4 Packaging

Packaging for plastic plumbing fixtures shall be marked with the

- a) manufacturer’s name or registered trademark or, in the case of private labelling, the name of the customer for whom the fixture was manufactured; and
- b) model number.

6.5 Installation instructions

6.5.1

The manufacturer shall provide installation instructions with water closets (except for flushometer valve water closets). For close-coupled water closets, installation instructions shall be provided with the bowl or tank.

6.5.2

Flange kits for installation in the field shall include installation instructions.

Table 1
Surface test requirements*
 (See Clause 5.4.2.)

Defect	Size*	Maximum number allowed		
		In any 76 mm (3 in) diameter area	In each compartment and its rim	For every 300 mm (1 ft) in the integral top of a fixture
Blister	—	0	0	0
Chipped area	—	0	0	0
Crack	—	0	0	0
Moulding irregularity	—	1	8	4
Pinhole	≥ 0.4–0.8 mm (0.016–0.03 in)	4	8	4
Pit	< 0.4 mm (0.016 in)	8	16	6
Speck				
Small	≥ 0.4–0.8 mm (0.016–0.03 in)	4	8	4
Medium	≥ 0.8–1.6 mm (0.03–0.06 in)	2	4	2
Large	≥ 1.6 mm (0.06 in)	0	0	0
Surface porosity	—	0	0	0

* Applicable only to visible surfaces.

Table 2
Scrub cycles
 (See Clauses 5.12.1.3.2 and 5.12.3.)

Fixture	Cycles
Bathtub	10 000
Laundry sink	10 000
Lavatory	12 000
Shower stall and receptor	7 600
Sink	20 000
Water closet and urinal	10 000

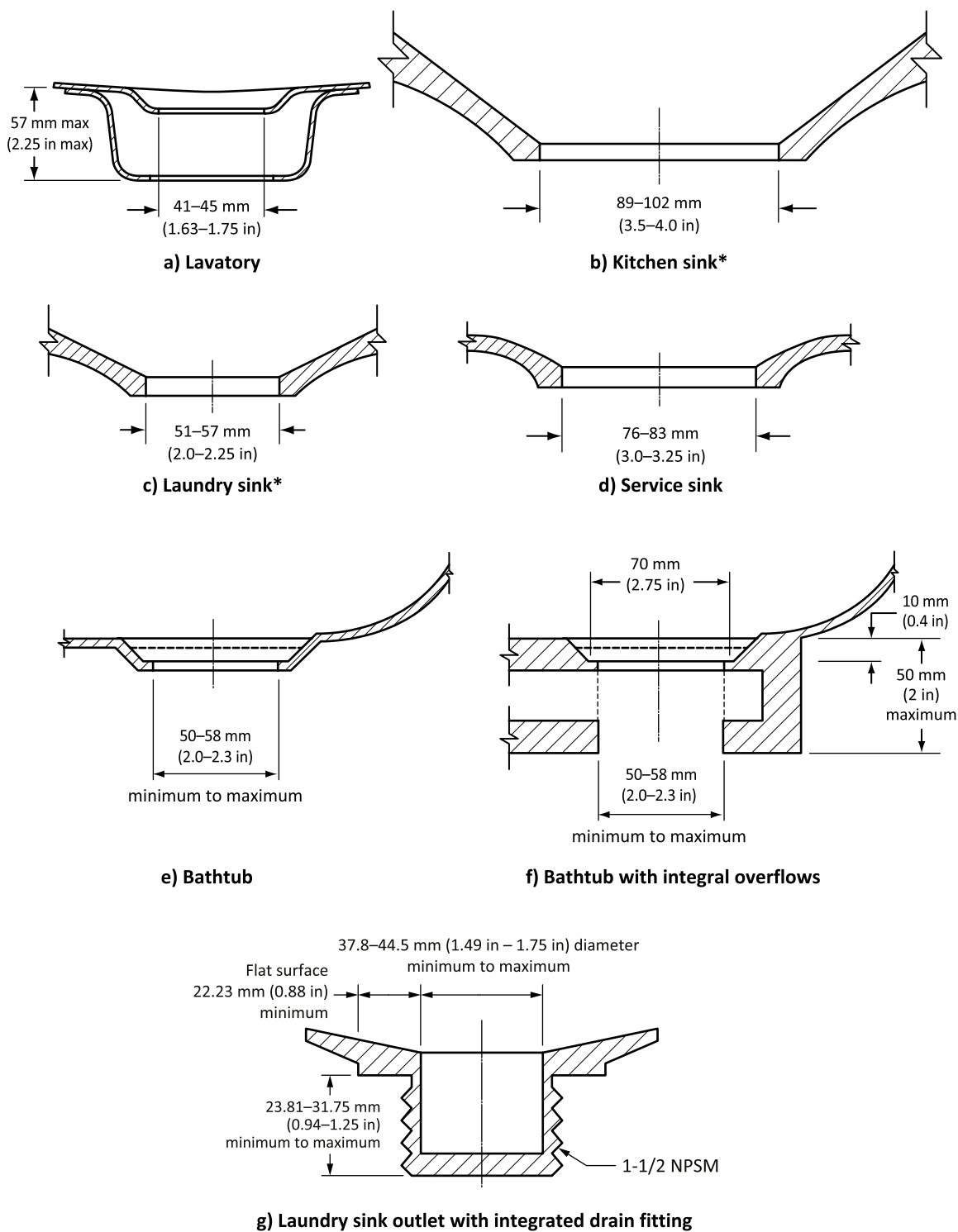
Table 3
Brush switching schedule for scrub test
 (See Clause 5.12.1.3.2.)

Cycle interval	Lane number			
	1	2	3	4
0–25% brush numbers	1	2	3	4
25–50% brush numbers	4	1	2	3
50–75% brush numbers	3	4	1	2
75–100% brush numbers	2	3	4	1

Table 4
Thermal shock resistance test
 (See Clause 5.16.2.)

Fixture	Cycles	Temperature, °C (°F)	
		Hot water	Cold water
Bathtub and shower base	250	66 ± 2 (150 ± 4)	10 ± 2 (50 ± 4)
Kitchen sink	250	88 ± 2 (190 ± 4)	21 ± 2 (70 ± 4)
Lavatory or bar, laundry, service, or utility sink	500	66 ± 2 (150 ± 4)	10 ± 2 (50 ± 4)

Figure 1
Waste outlets dimensions
 (See Clause 4.2.1.2.)



* Waste outlets for bar and laundry sinks may have a diameter of 51 to 57 mm (2.0 to 2.25 in) or 89 to 102 mm (3.5 to 4.0 in).

Figure 2
Opening and mounting surface dimensions for standard 200 mm (8 in) deck fittings
 (See Clause 4.3.1.1.)

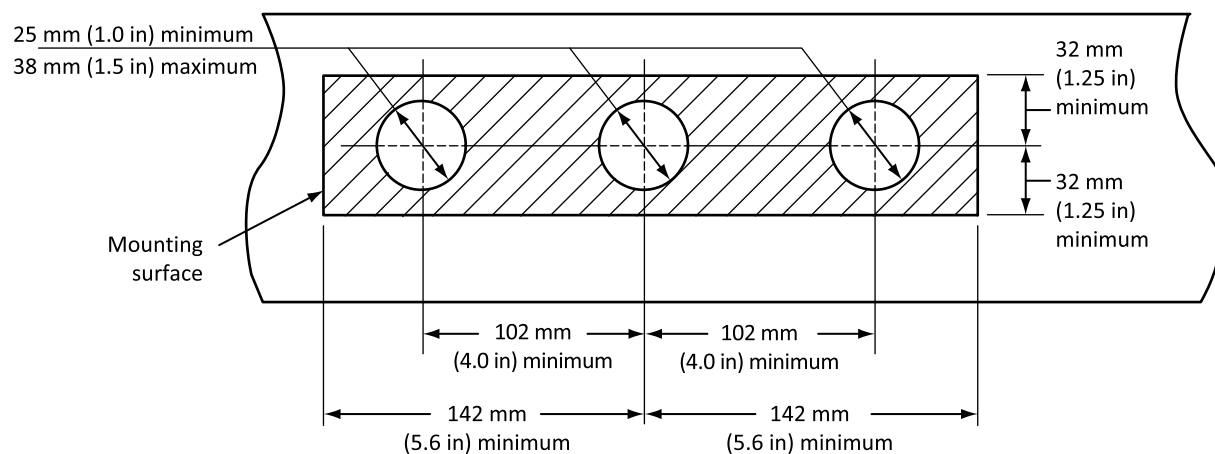
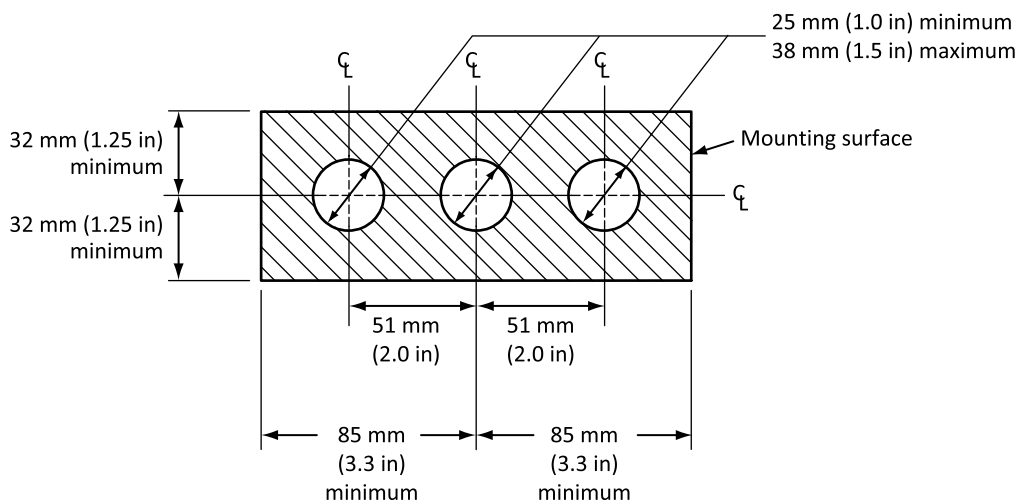


Figure 3
Opening and mounting surface dimensions for standard 200 mm (8 in) combination fittings
 (See Clause 4.3.1.1.)



Notes:

- 1) D1: 32 to 38 mm (1.25 to 1.5 in).
- 2) D2: 25 to 38 mm (1.0 to 1.5 in).
- 3) The dimensions in Notes (1) and (2) are minimums and maximums, i.e., tolerances do not apply.
- 4) The openings need not be in a straight line.

Figure 4
Opening and mounting surface dimensions for standard 100 mm (4 in) centre-set fittings

(See Clause 4.3.1.1.)

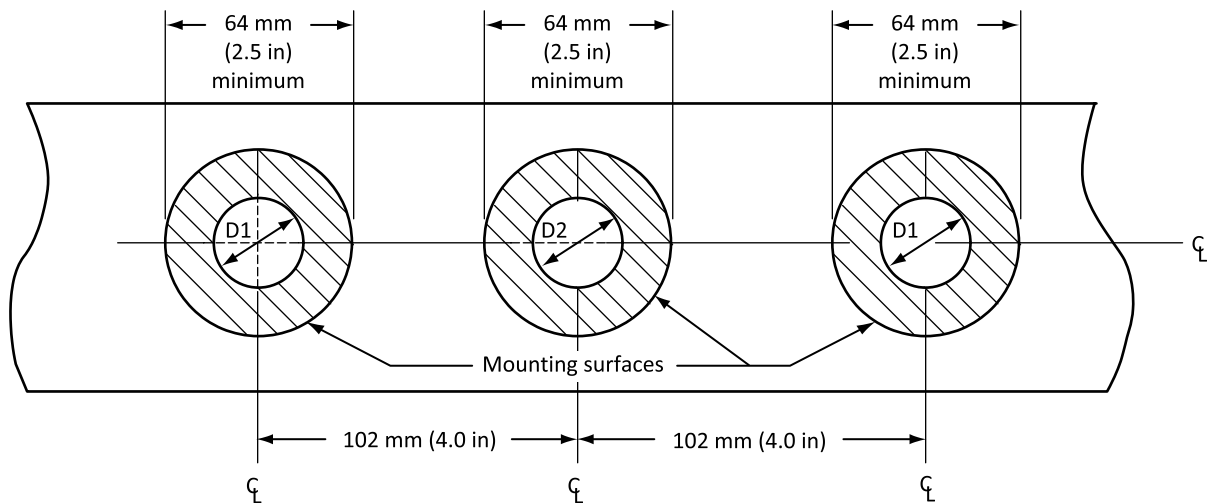
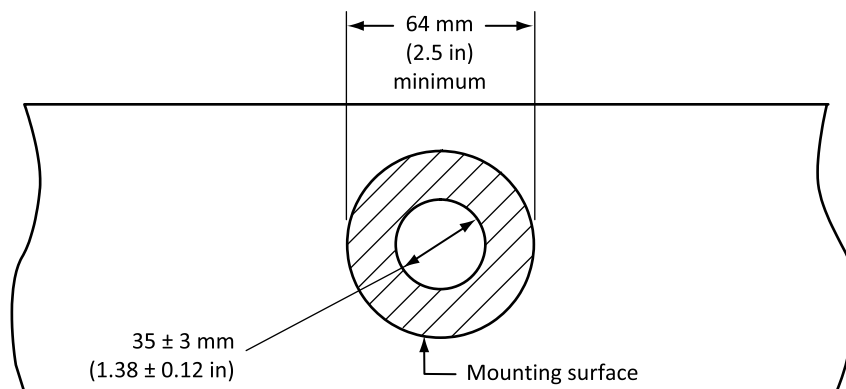


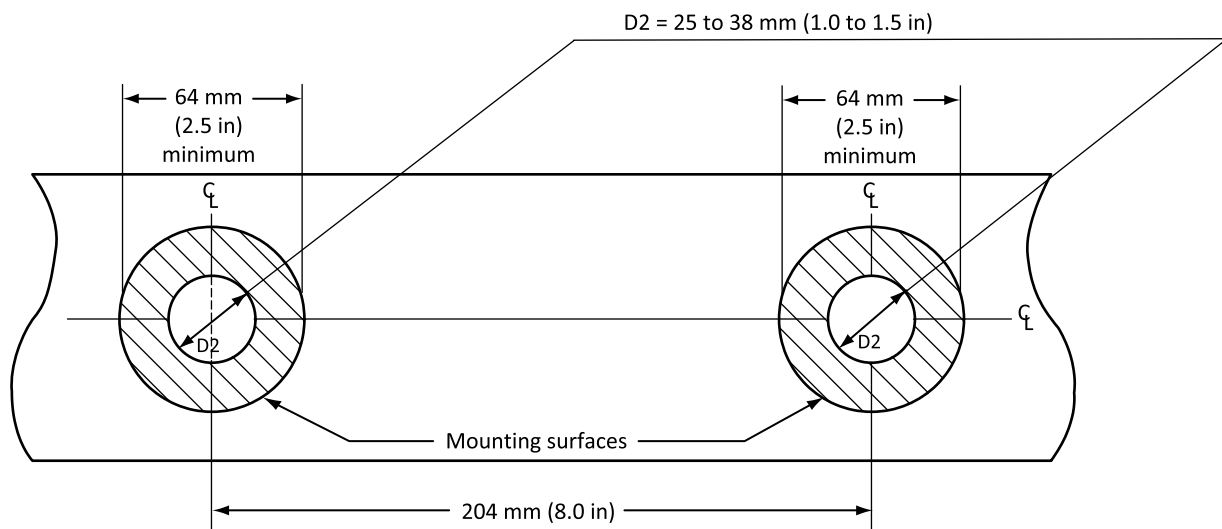
Figure 5
Opening and mounting surface dimensions for standard 200 mm (8 in) combination fittings

(See Clause 4.3.1.1.)



Note: The dimensions for D2 are minimum and maximum, i.e., tolerances do not apply.

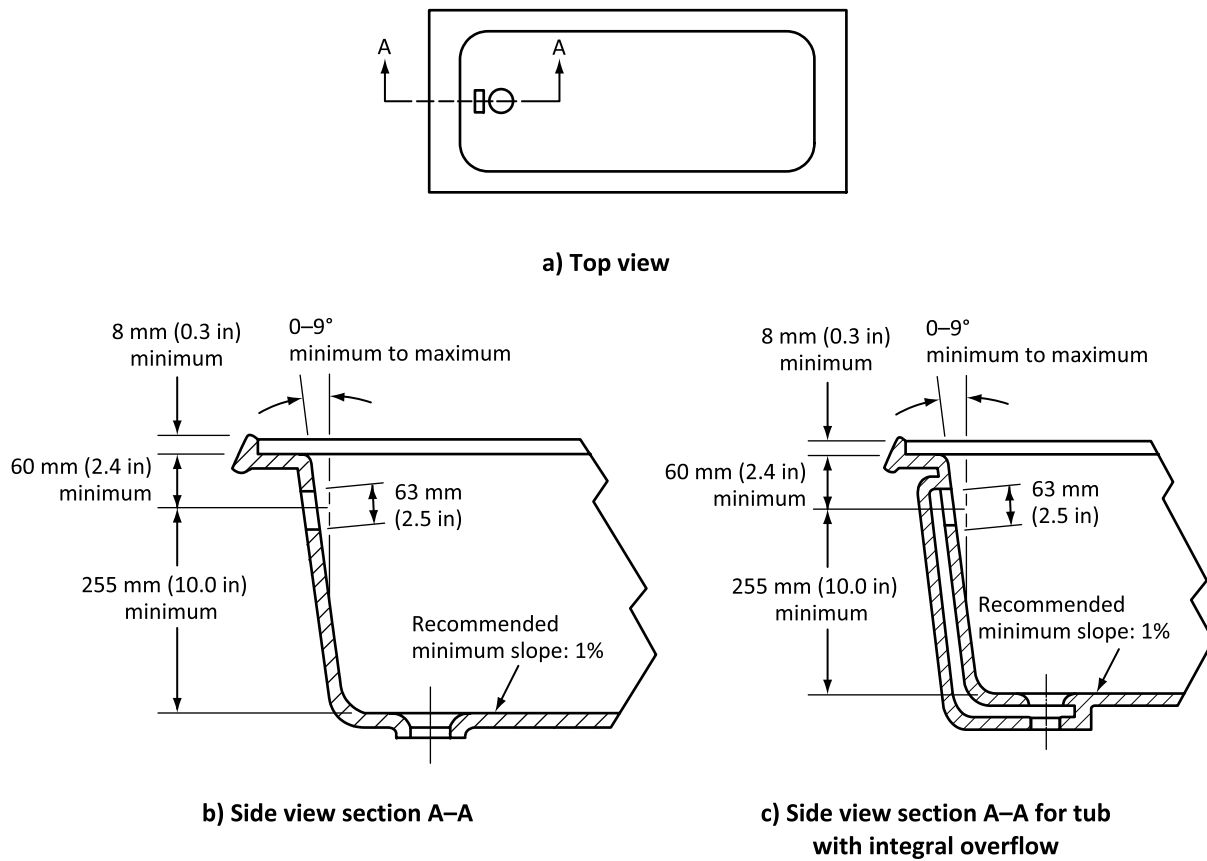
Figure 6
Opening and mounting surface dimensions for single-mount supply fittings
 (See Clause 4.3.1.1.)



Note: These diagrams are not intended to restrict design.

(for kitchen sinks only)

Figure 7
Bathtub overflow
 (See Clause 4.2.2.2.)



Note: These diagrams are not intended to restrict design. Alternate sizes and shapes shall be considered acceptable.

Figure 8
Shower base thresholds
 (See Clauses 4.4.1 and 4.4.3.)

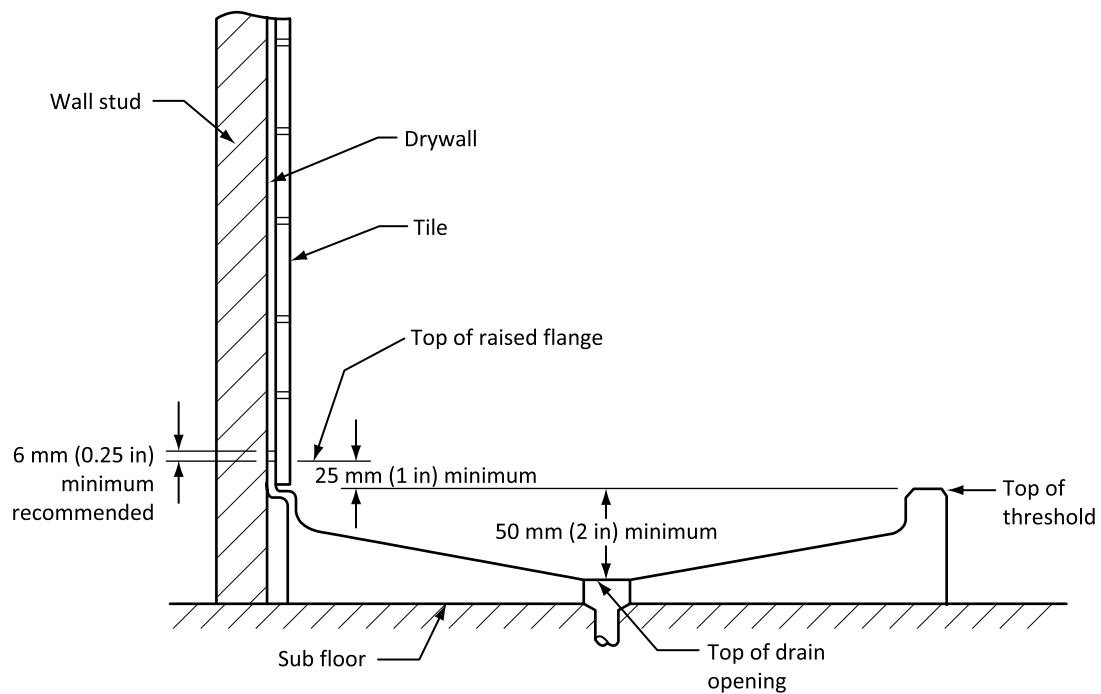


Figure 9
Waste fitting connection test
 (See Clause 5.6.1.)

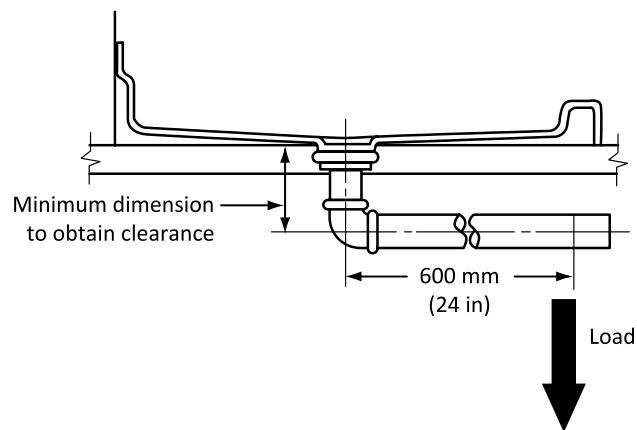
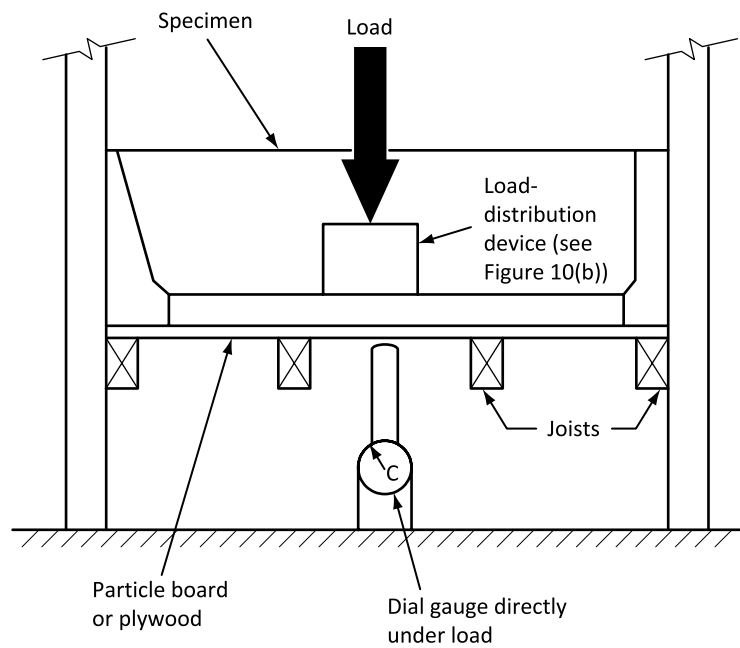
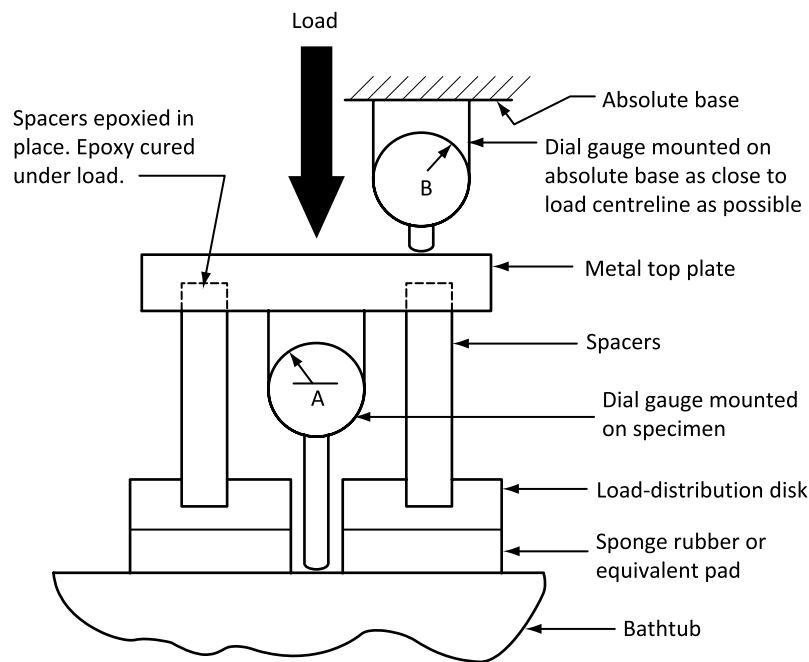


Figure 10
Alternative load test for bathtub rims and bottoms
 (See Clause 5.8.2.2.2.)



a) Test set-up



b) Load-distribution device

Figure 11
Test for secondary loads on bathtub rims and bottoms and load test for unsupported bathtub areas
(See Clauses 5.8.2.2.3.1 and 5.8.5.1.)

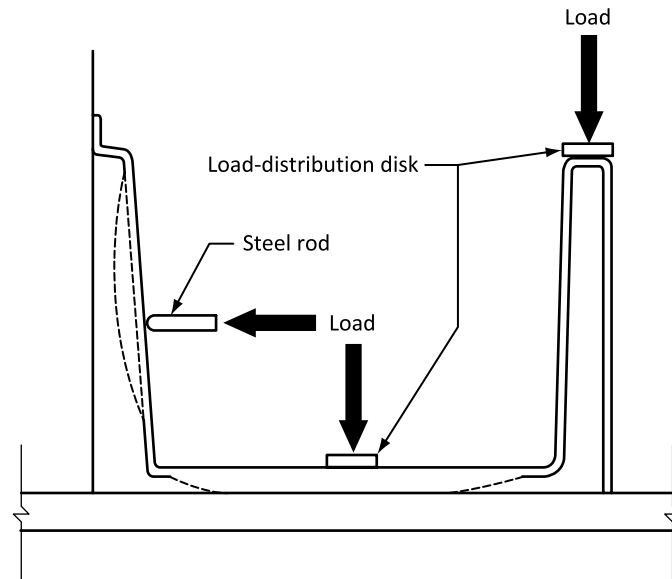


Figure 12
Test for secondary loads on shower thresholds and bottoms
(See Clause 5.8.2.2.3.2.)

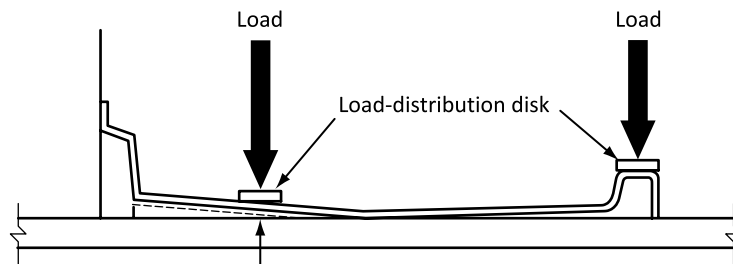


Figure 13
Load test for lavatories with integral tops and for wall-hung lavatories
 (See Clause 5.8.7.1.)

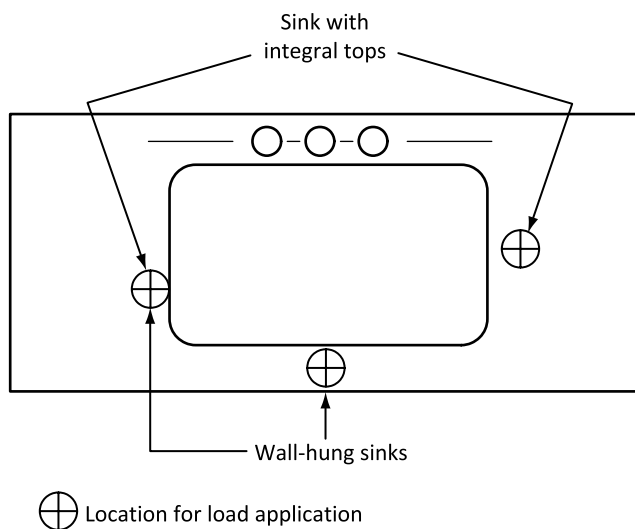


Figure 14
Load test for floor-mounted water closet bowl rims
 (See Clause 5.8.8.)

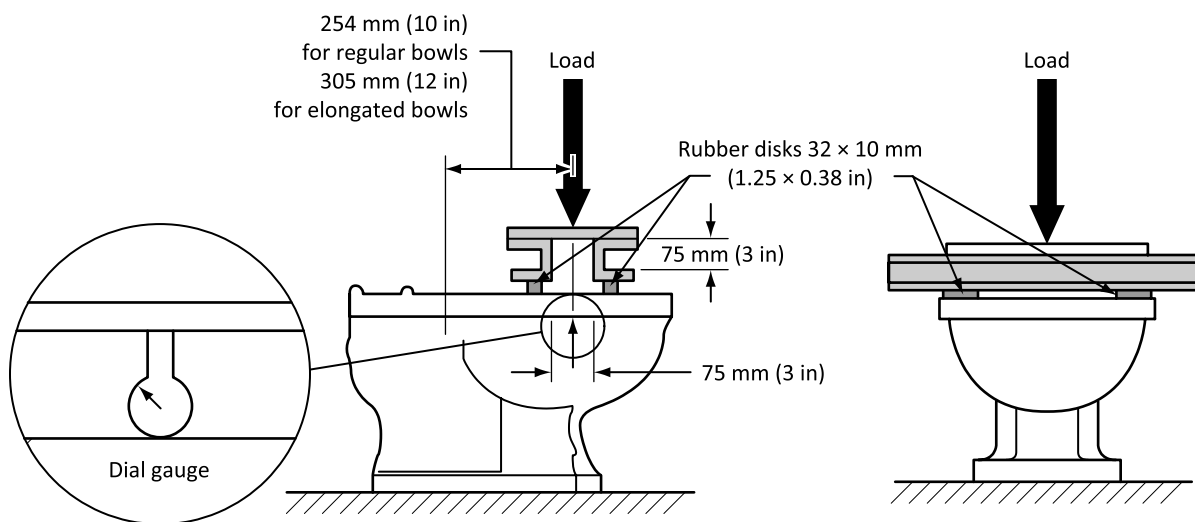


Figure 15
Load test for water closet tank lids
(See Clause 5.8.9.1.)

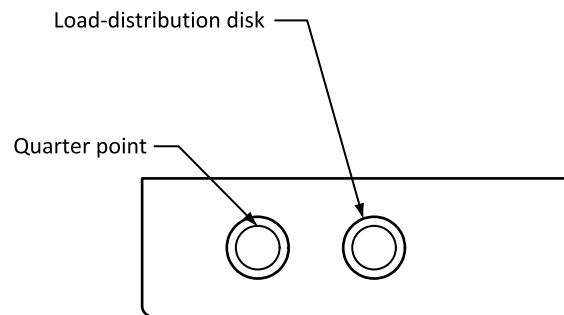


Figure 16
Wear test specimen
(See Clause 5.12.3.)

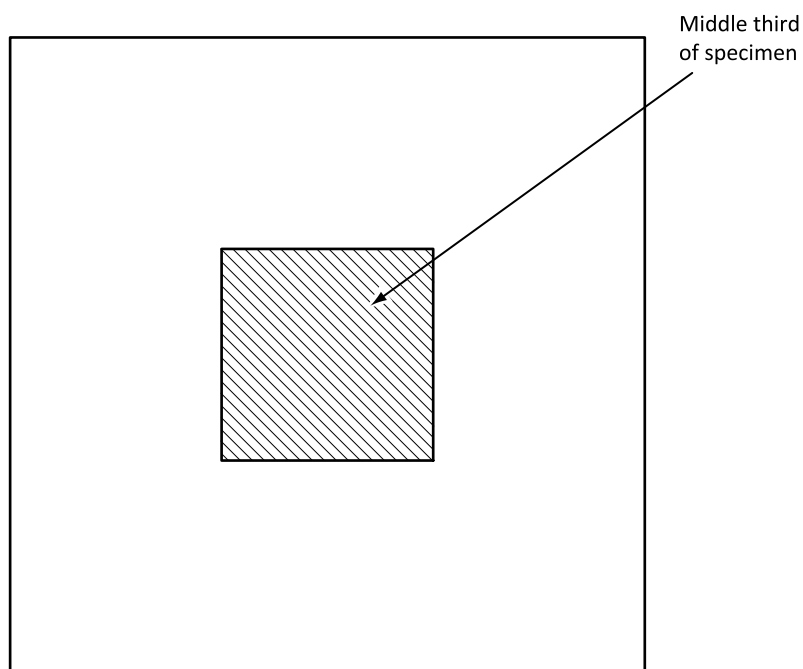
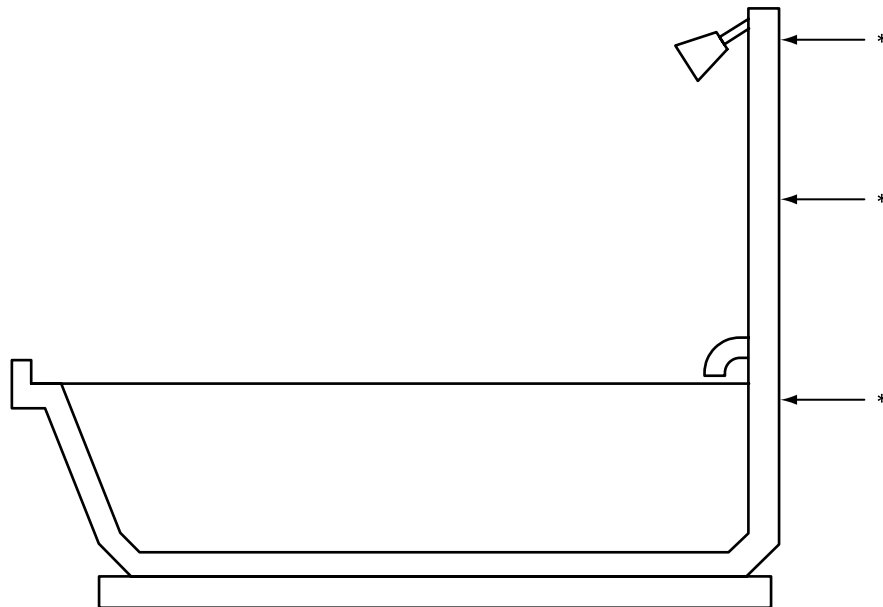
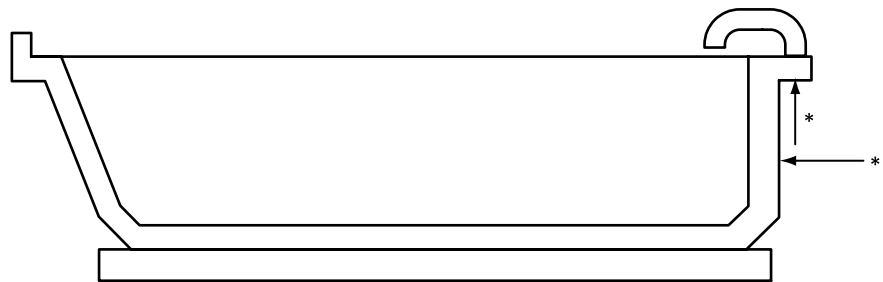


Figure 17
Ignitability test
(See Clause 5.13.1.)



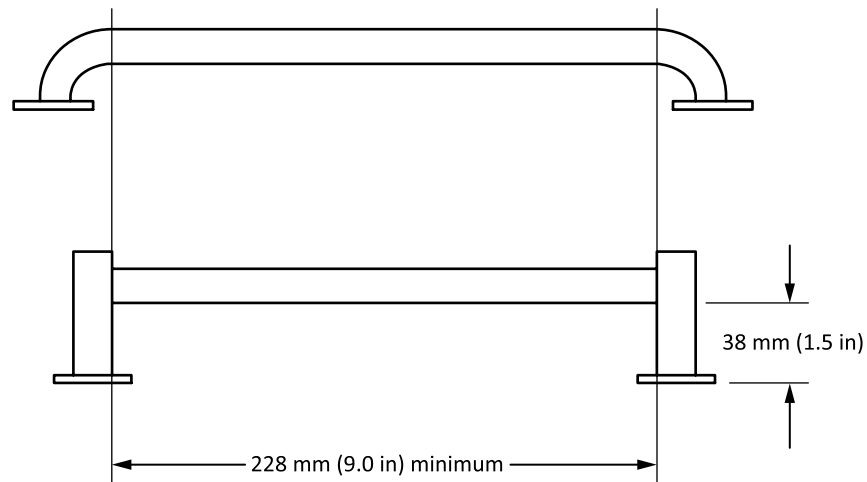
Combination tub/shower and shower



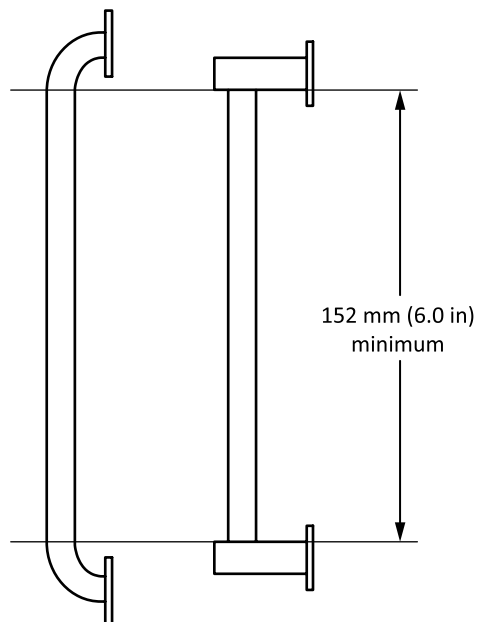
Bathtub

*Areas to be tested.

Figure 18
Grippable length for grab bars
(See Clause 4.4.4.)



a) Horizontal



b) Vertical

Figure 19
Inlet connection test for water closet tanks
 (See Clause 5.26.1)

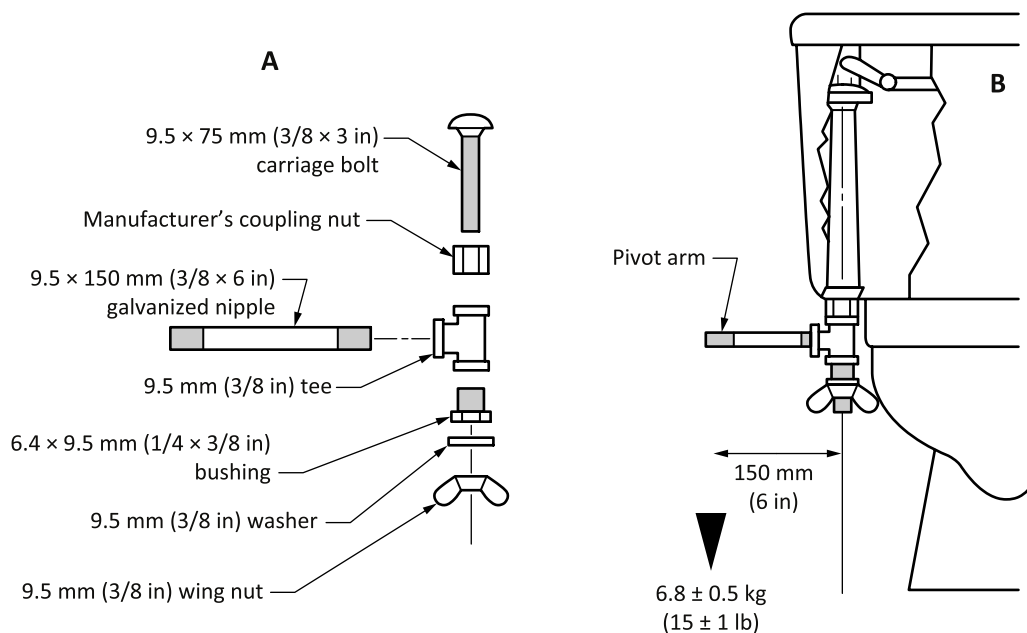
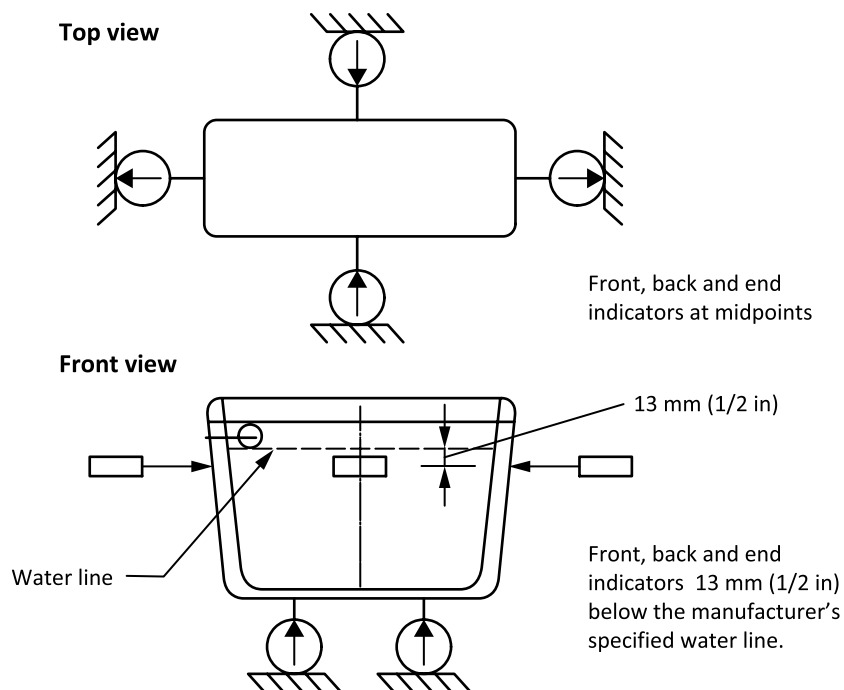


Figure 20
Hydrostatic load test for water closet tanks
 (See Clause 5.27.1)



Annex A (informative)

Unit conversion and rounding criteria

Note: *This Annex is not a mandatory part of this Standard.*

A.1 Conversion

The following conversion rules are used in this Standard:

- a) Zeros to the left of the first non-zero digit are not significant.
- b) If the number is greater than 1, all zeros to the right of the decimal point are significant.
- c) In multiplication and division, the original number with the smallest number of significant digits determines the number of significant digits in the product or quotient.
- d) If an exact constant is used (e.g., 3 ft = 1 yd), it does not affect the number of significant digits in the calculated value.
- e) If inexact constants are used (e.g., = 3.1416), the constant with at least one more significant digit than the smallest number of significant digits in the original data is used.

A.2 Rounding

The following rounding rules are used in this Standard:

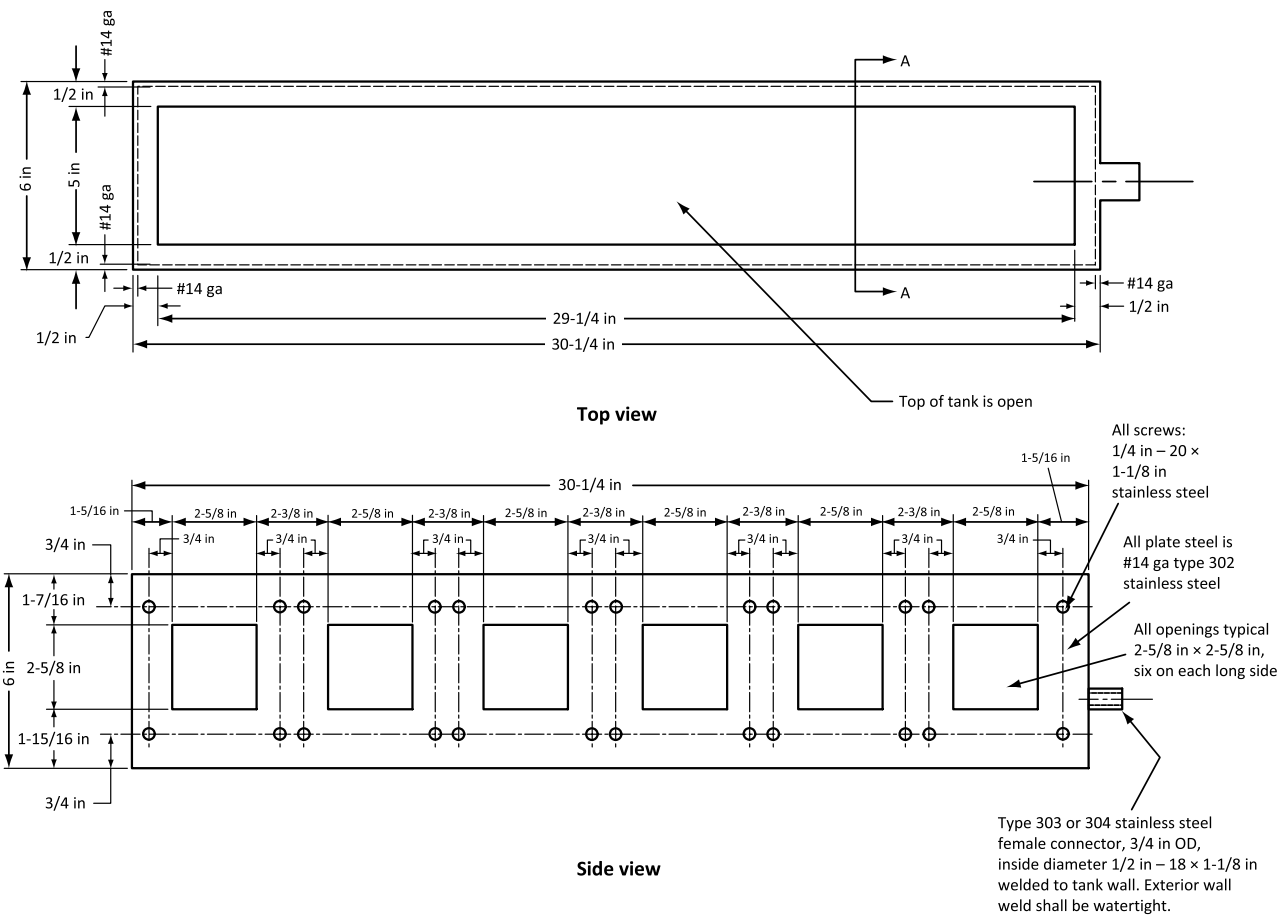
- a) The digits that follow the last significant digit are dropped if the first digit is less than 5.
- b) If the first digit dropped is greater than 5, the preceding digit is increased by 1.
- c) If the first digit dropped is 5 and there are non-zero digits following the 5, the preceding digit is increased by 1.
- d) If the first digit dropped is 5 and there are only zeros following the 5, the digit is rounded to the even number (e.g., for three significant digits, 1.655000 becomes 1.66, 1.625000 becomes 1.62).
- e) For maximums and minimums, rounding is performed within the range of the maximum and minimum values in a way that does not violate the original limits.

Annex B (normative)

Water resistance test tank

Note: This Annex is a mandatory part of this Standard.

Figure B.1
Water resistance test tank
(See Clause 5.17.2.)



Note: For metric conversion, 1 in = 25.4 mm.

Figure B.2
Water resistance test tank — Details
 (See Clause 5.17.2.)

