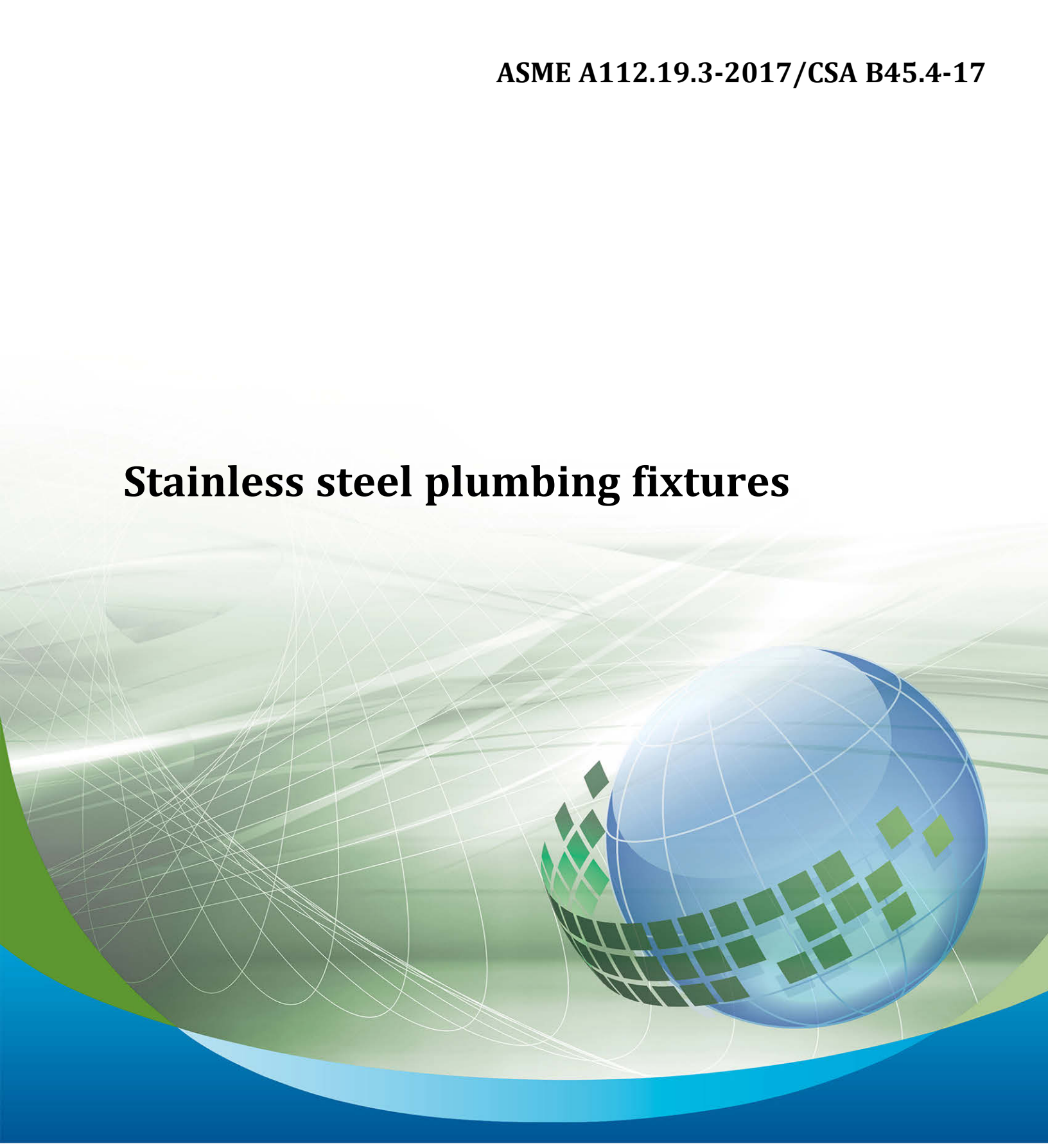
ASME A112.19.3-2017/CSA B45.4-17

Stainless steel plumbing fixtures



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Stainless steel plumbing fixtures

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Contents

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Preface

This is the second edition of ASME A112.19.3/CSA B45.4, *Stainless steel plumbing fixtures*. It supersedes the previous edition published in 2008.

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

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

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ASME A112.19.3-2017/CSA B45.4-17
Stainless steel plumbing fixtures

1 Scope

1.1

This Standard covers plumbing fixtures made of stainless steel alloys and specifies requirements for materials, construction, performance, testing, and markings.

Note: *The term "corrosion-resisting steel" is also applied to stainless steel.*

1.2

This Standard covers the following plumbing fixtures:

a) bathtubs;
b) bidets;
c) drinking fountains and water coolers;
d) lavatories;
e) shower bases;
f) sinks:
    i) kitchen and bar sinks;
    ii) laboratory sinks;
    iii) laundry sinks;
    iv) service sinks; and
    v) utility sinks;
    vi) urinals; and
    vii) 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 yard/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.

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

For information on the unit 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

B125.3-12
Plumbing fittings

B651-12
Accessible design for the built environment

C22.2 No. 0.15-15
Adhesive labels

ASME (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 A112.19.2-2013/CSA B45.1-13
Ceramic plumbing fixtures

ASTM International (American Society for Testing and Materials)

A240/A240M-16
Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

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

A117.1-2009
Accessible and Usable Buildings and Facilities

UL (Underwriters Laboratories Inc.)

969 (1995)
Standard for Marking and Labeling Systems

3 Definitions

The following definitions shall apply in this Standard:

Air gap — the unobstructed vertical distance, through the open atmosphere, between the lowest opening of a water supply and the flood level of the fixture.

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Bidet — a fixture with a hot and cold water supply intended for genital and perineal hygiene.

Defect —

Blemish — a dent, depression, or raised portion on the visible stainless steel surface of a fixture.

Crack — a fracture in the surface or substrate material of a fixture.

Die mark — a visible scoring of the stainless steel surface of a fixture.

Pinhole — a hole in the stainless steel surface of a fixture whose largest dimension is 1.5 mm (0.06 in) or less.

Wrinkle — a corrugation in the stainless steel surface of a fixture that is visible or can be felt.

Fitting — a device that controls and guides the flow of water.
Note: *See ASME A112.18.1/CSA B125.1 and CSA B125.3 for definitions of specific types of fittings.*

Fixture — a device that receives water, waste matter, or both and directs these substances into a drainage system.
Note: *See ASME A112.19.2/CSA B45.1 for definitions of specific types of fixtures.*

Flange —
a) the flat area on the front or sides of a compartment in a sink or lavatory; or
b) the raised vertical section for retaining water in a tub or shower base.

Flat-rim sink (rim-back sink) — a single- or double-compartment sink with flanges on all sides but no back ledge (ledge-back).

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

Flushometer valve — a flushing device attached to a pressurized water supply pipe that, when actuated, opens the pipe for direct flow into the fixture at a rate and in a quantity that enables proper operation of the fixture. The valve then gradually closes to provide trap reseal in the fixture and avoid water hammer.
Note: *The pipe to which the flushometer valve is connected should be large enough to enable it to deliver water at a sufficient rate of flow for flushing.*

Horizontal surface — a surface forming an angle with the horizontal of less than 45°.

Integral rim — a mounting rim that is an integrally formed part of a sink flange and has clamp-down devices for attaching the sink to the countertop.

Lavatory — a washbowl or basin.

Ledge — the flat area of a sink or lavatory on which supply fittings are normally mounted.

Ledge-back sink — a single- or double-compartment sink with a ledge along the back that has openings for mounting supply fittings.

Mirror finish — a highly reflective finish with no visible polishing lines.

Rim — the unobstructed open edge of a fixture.

Satin finish — a surface with a soft sheen consisting of fine, regular polish lines in a uniform pattern.

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Urinal — a fixture that receives only liquid body waste and conveys the waste through a trap into a drainage system.

Vertical surface — a surface forming an angle with the horizontal of 45 to 90°.

Water closet — a fixture with a water-containing receptor that receives liquid and solid body waste and on actuation conveys the waste through an exposed integral trap into a drainage system.

4 General requirements

4.1 Materials

With the exception of laboratory sinks, which shall be made of type 316 stainless steel alloy, stainless steel plumbing fixtures shall be made of type 201, 202, 301, 302, 304, 316, or 430 stainless steel alloys.

Note: *These stainless steel alloy types are specified in ASTM A240/A240M.*

4.2 Stainless steel thickness

4.2.1 Lavatories and sinks

4.2.1.1 General

The thickness of stainless steel sheet for lavatories and kitchen, bar, laboratory, laundry, and utility sinks shall comply with Clause 4.2.1.2 (before drawing) or 4.2.1.3 (after drawing).

4.2.1.2 Before drawing

The minimum thickness shall be based on bowl depth as specified in Table 1.

4.2.1.3 After drawing

The minimum thickness after fabrication shall be as follows:

a) vertical surfaces: 0.559 mm (0.022 in);
b) corners: 0.508 mm (0.020 in); and
c) horizontal surfaces: 0.635 mm (0.025 in).

For Items a) and b), the thickness shall be determined by taking the average of six measurements of surface or corner thickness. For Item c), thickness shall be determined by taking the average of three measurements from the bottom of the fixture and three from the flat surfaces of the flange.

4.2.2 Other fixtures

The thickness of stainless steel sheet for fixtures not specified in Clause 4.2.1.1 shall be determined in accordance with Clause 4.2.1.3.

4.3 Tolerances

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

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4.4 Waste fitting openings, drainage, and overflows

4.4.1 Waste fitting openings and drainage

4.4.1.1

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.

4.4.1.2

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.

4.4.1.3

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

4.4.2 Overflows

4.4.2.1 Lavatories, sinks, and bidets

4.4.2.1.1

Overflows may be provided at the option of the manufacturer. When overflows are provided, the manner in which they are positioned shall be at the option of the manufacturer.

4.4.2.1.2

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.

4.4.2.1.3 Performance

Overflows shall comply with Clause 5.4.

4.4.2.2 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: *Some plumbing codes require bathtub overflows.*

4.5 Additional requirements for water closets

Water closets and their flushing devices shall comply with the applicable requirements of ASME A112.19.2/CSA B45.1, except that the

a) structural integrity test shall be conducted in accordance with Clause 5.5.1; and
b) minimum thickness requirements for vitreous china shall not apply.

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4.6 Additional requirements for urinals

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

a) structural integrity test shall be conducted in accordance with Clause 5.5.3; and
b) minimum thickness requirements for vitreous china shall not apply.

4.7 Additional requirements for lavatories, sinks, and bidets

4.7.1 Openings and mounting surfaces for supply fittings

4.7.1.1

When provided, openings and mounting surfaces for lavatory, sink, and bidet supply fittings shall be as shown in Figures 2 to 6, except when proprietary (i.e., non-standard) supply fittings are provided by the manufacturer.

4.7.1.2

Factory-supplied lavatory, sink, and bidet supply fittings shall comply with ASME A112.18.1/CSA B125.1.

4.7.1.3

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.*

4.7.2 Laundry or utility sink capacity

The minimum capacity of at least one compartment of a laundry or utility sink shall be 60 L (15.9 gal).

4.8 Additional requirements for bathtubs and shower bases

4.8.1 Minimum dimensions for bathtubs

The minimum dimensions for bathtubs shall be as shown in Figure 7.

4.8.2 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.*

4.8.3 Flanges

Bathtubs and shower bases intended for installation against a wall shall incorporate a flange raised at least 8 mm (0.3 in) above the rim. 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 5.3 and includes all necessary parts and fasteners.

Fixtures using field-installed flanges shall be marked in accordance with Clause 6.4.

Note: *Flanges are also referred to as beads.*

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4.9 Additional requirements for drinking fountains

4.9.1

Drinking fountains shall

a) include a supply fitting, which shall be at least 25 mm (1.0 in) above the flood level rim; and
b) comply with the dimensions shown in Figure 8.

Note: *Drinking fountain supply fittings are also known as drinking fountain bubblers.*

4.9.2

Factory-supplied drinking fountain supply fittings shall comply with ASME A112.18.1/CSA B125.1, including the toxicity requirements.

4.10 Accessible design fixtures

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

5 Tests

5.1 Surface examination

5.1.1 Procedure

Visible surfaces shall be examined for defects by the unaided eye under ordinary light at a distance of approximately 610 mm (2 ft).

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

5.1.2 Performance

Visible surfaces shall be free of blemishes, cracks, die marks, pinholes, and wrinkles. Surface details that are part of the design shall not be cause for rejection.

5.2 Warpage test

5.2.1 Procedure

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

A feeler gauge of a thickness equal to the total warpage allowed in Clause 5.2.2 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.

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5.2.2 Performance

When measured in accordance with Clause 5.2.1, the

a) warpage at edges of the fixture that are set against the 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.

Warpage that is eliminated when the fixture is installed in accordance with the manufacturer's instructions shall not be considered a cause for failure.

5.3 Field-installed flange test

5.3.1 Procedure

The flange fixture seal test shall be conducted as follows:

a) Install the flange in accordance with the manufacturer's instructions.
b) Expose the flange seal at the joint with the fixture to a continuous water spray for 15 to 20 min. Use a shower spray with a flow rate of 9.0 ± 0.5 L/min (2.38 ± 0.13 gpm) and a water temperature of 38 ± 3 °C (100 ± 5 °F).
c) Inspect the specimen for water leakage through the joint to the back of the flange.

5.3.2 Performance

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

5.4 Overflow test (lavatories, sinks, and bidets)

5.4.1 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 and keep the specimen levelled in a stand.
b) Supply water to the specimen at the maximum flow rate specified in ASME A112.18.1/CSA B125.1 for flow rate testing of a supply fitting appropriate for the specimen. 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) Close the waste outlet.
d) Measure the elapsed time from the onset of water flowing into the overflow opening until the water begins to overflow the flood level rim of the specimen.

5.4.2 Performance

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

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5.5 Structural integrity tests

5.5.1 Water closets

5.5.1.1 Procedure

The structural integrity test for water closets shall be conducted as follows:

a) Install the specimen in accordance with the manufacturer's instructions.
b) Cover the bowl with a loose piece of plywood 19 mm (0.75 in) thick.
c) Apply a static load centred over the bowl and gradually increase the load to 2.2 kN (500 lbf).
d) Maintain the load for at least 2 min.
e) Remove the load.
f) Visually inspect the specimen 5 min after removal of the load.

5.5.1.2 Performance

There shall be no structural damage or other forms of failure, e.g., tearing of the stainless steel or separation of weld joints.

5.5.2 Lavatories and sinks

5.5.2.1 Apparatus

The apparatus for the structural integrity test for lavatories and sinks shall consist of a

a) loading device capable of applying a 1.3 kN (292 lbf) load without shock to the centre of the bottom of the specimen; and

   Note: *Calibrated weights or a suitable mechanical or hydraulic load applicator may be used.*

b) 76 mm (3.0 in) diameter load-distribution disc that is covered by 13 mm (0.5 in) thick sponge rubber or another suitable soft material between the disc and the surface being loaded and is capable of applying and removing a 1.3 kN (292 lbf) load at the centre of the fixture bottom.

5.5.2.2 Procedure

The structural integrity test for lavatories and sinks shall be conducted as follows:

a) Mount the specimen (including a waste fitting) in a wood frame in accordance with the manufacturer's instructions.
b) Apply a 1.3 kN (292 lbf) load to the bottom of the specimen at the centre of the maximum span, hold for 2 min, and then remove the load. If the waste outlet is located at the centre of the bottom of the specimen, apply the load over the centre of the waste outlet.
c) Ten minutes after removal of the load, apply a 1.3 kN (292 lbf) load for 1 min to the centre of the bottom of the specimen. If the waste outlet is at the centre of the bottom of the specimen, apply the load halfway between the centre of the waste outlet and the wall or threshold. Do not apply the load over a rib or other support on the underside of the specimen.
d) Inspect the specimen for damage.

5.5.2.3 Performance

There shall be no structural damage or other forms of failure, e.g., tearing of the stainless steel or separation of weld joints.

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5.5.3 Wall-mounted urinals

5.5.3.1 Procedure

The structural integrity test for wall-mounted urinals shall be conducted as follows:

a) Install the specimen in accordance with the manufacturer's instructions.
b) Apply a 0.22 kN (50 lbf) vertical load on the top surface at the front of the rim.
c) Maintain the load for at least 2 min.
d) Remove the load.
e) Visually inspect the specimen 5 min after removal of the load.

5.5.3.2 Performance

There shall be no structural damage or other forms of failure, e.g., tearing of the stainless steel or separation of welds or joints.

5.5.4 Bathtubs and shower bases

5.5.4.1 Apparatus

The apparatus for testing the structural integrity of bathtubs and shower bases shall be as follows:

a) three micrometer dial gauges graduated to 0.03 mm (0.001 in);
b) a loading device capable of applying a 1.3 kN (292 lbf) load without shock to the centre of the specimen bottom; and

   Note: *Calibrated weights or a suitable mechanical or hydraulic load applicator may be used.*

c) a 130 × 250 mm (5 × 10 in) pad to distribute the load over a 32 500 mm^2 (50.0 in^2) area. The pad shall consist of a sheet of sponge rubber 19 mm (0.75 in) thick (Shore A durometer of 8 to 14), topped with a plate of plywood or stiffer material having a minimum thickness of 19 mm (0.75 in). The thickness of this plate shall be such that there is not more than 0.25 mm (0.01 in) deflection of the ends when the load is applied.

5.5.4.2 Set-up

The specimen shall be mounted in a wood frame simulating normal installation, as follows:

a) The frame shall allow for clearance under the specimen for the dial gauges.
b) The manufacturer's installation instructions shall be used for spacing the 2 × 4 dimensional lumber of the frame and for fastening the specimen to the frame. If such instructions are not available, the specimen shall be fastened along the flange to each stud of the frame by 38 mm (1.5 in) long No. 6 steel wood screws using 10 mm (0.38 in) steel washers. The spacing of the studs in the frame shall be not greater than 406 mm (16 in) between centres.
c) The top of the frame shall be at least 305 mm (12 in) higher than the top of the installed specimen.
d) If legs or other component parts of the specimen are within 3 mm (0.13 in) of the floor line after installation, rigid vertical support shall be provided.
e) If the front apron of the specimen is not touching the test frame, the apron shall be supported in a continuous bed of plaster of Paris.

5.5.4.3 Procedure

The structural integrity test for bathtubs and shower bases shall be conducted as follows:

a) Maintain the temperature of the test area and specimen at 24 ± 6 °C (75 ± 10 °F).
b) Inspect the finished surface of the specimen for cracks and other defects. Note all defects and damage.

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c) Centre the distribution pad over the horizontal centrelines of the specimen waste outlet with the 254 mm (10 in) dimension along the length of the waste outlet. Determine the waste outlet centrelines by using the average length and width of the waste outlet.
d) Place the three micrometer dial gauges on a rigid base beneath the longitudinal centreline of the waste outlet, with one gauge directly beneath the centre of the distribution pad and the other two within 51 mm (2.0 in) of each end of the bottom of the waste outlet.
e) Ensure that the areas where the tips of the gauges bear on the specimen are sufficiently flat and smooth that a small lateral movement of the specimen will not change the gauge reading by more than 0.03 mm (0.001 in).
f) Prepare the bearing areas by grinding the undersurface or by rigidly fastening a small, flat, level plate to the specimen.
g) If the waste outlet of the specimen interferes with the placement of the gauges, insert a standard spud into the waste outlet and use the flat surface on the spud for gauge bearing.
h) Preload the specimen by applying a load of 1.3 kN (292 lbf) on the centre of the distribution pad for 5 min. Remove the load and take the initial dial gauge readings.
i) Reload the specimen using the 1.3 kN (292 lbf) load and take gauge readings immediately following the load application and again 5 min later.
j) Remove the load and take gauge readings immediately following removal and again 10 min later.
k) Calculate the average deflection of the specimen and supports by averaging the deflections measured by the two end gauges.
l) Calculate the centre deflection (at the waste outlet) by subtracting the average deflection calculated in Item k) from the deflection measured by the centre gauge.
m) After removal of the load, inspect the surface of the specimen for cracks in accordance with Clause 5.1. Note any other damage resulting from the testing.

5.5.4.4 Performance

5.5.4.4.1
Bathtubs shall show no damage to inner or outer surfaces as a result of testing. Cracking shall be considered damage to the inner surface. Cracking or separation of reinforcing members shall be considered damage to the outer surface.

5.5.4.4.2
Centre deflection 5 min after the load specified in Clause 5.5.4.3 is applied shall be not greater than 3.18 mm (0.125 in). The residual centre deflection 10 min after the load is removed shall be not greater than 0.08 mm (0.003 in).

6 Markings, packaging, and installation instructions and other literature

6.1 General

6.1.1
Stainless steel 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 6.2 and 6.3, as applicable.

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6.1.2
Markings shall be permanent, legible, and visible after installation.

6.1.3
Acceptable means of applying permanent markings shall include firing on, etching, sand blasting, mechanical stamping, stamping with a permanent (non-water soluble) ink, and casting in.

Adhesive labels that comply with CAN/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.

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

6.3 Additional markings for water closets and urinals
Additional markings for water closets and urinals shall be in accordance with Clause 9.3 of ASME A112.19.2/CSA B45.1.

6.4 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».*

6.5 Packaging and installation instructions and other literature

6.5.1 General
The manufacturer's packaging and literature, including installation instructions for recommended minimum operating pressures for water closets and urinals, shall comply with Clauses 9.5 and 9.6 of ASME A112.19.2/CSA B45.1.

6.5.2 Packaging

6.5.2.1
Packaging for stainless steel 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.

6.5.2.2
Packaging for water closets and urinals shall be marked with the average water consumption in accordance with Clause 9.3.2 of ASME A112.19.2/CSA B45.1.

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6.5.3 Installation instructions

6.5.3.1

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.

6.5.3.2

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

Table 1
Thickness of stainless steel sheet, mm (in)
(See Clause 4.2.1.2.)

Bowl depth	Minimum thickness
≤ 165 (6.5)	0.66 (0.026)
> 165 (6.5) and ≤ 190 (7.5)	0.73 (0.029)
> 190 (7.5) and ≤ 254 (10.0)	0.81 (0.032)
> 254 (10.0)	1.17 (0.046)

Notes:

1) *The minimum metal thickness specified in this Table is the decimal thickness before drawing or forming.*
2) *Bowl depth shall be determined as follows:*
   a) *Place a straightedge across the topmost surface of the rim.*
   b) *Measure the bowl depth at a right angle from the straightedge to the bottom of the lavatory or sink, as close as possible to, but not in, the waste outlet depression.*

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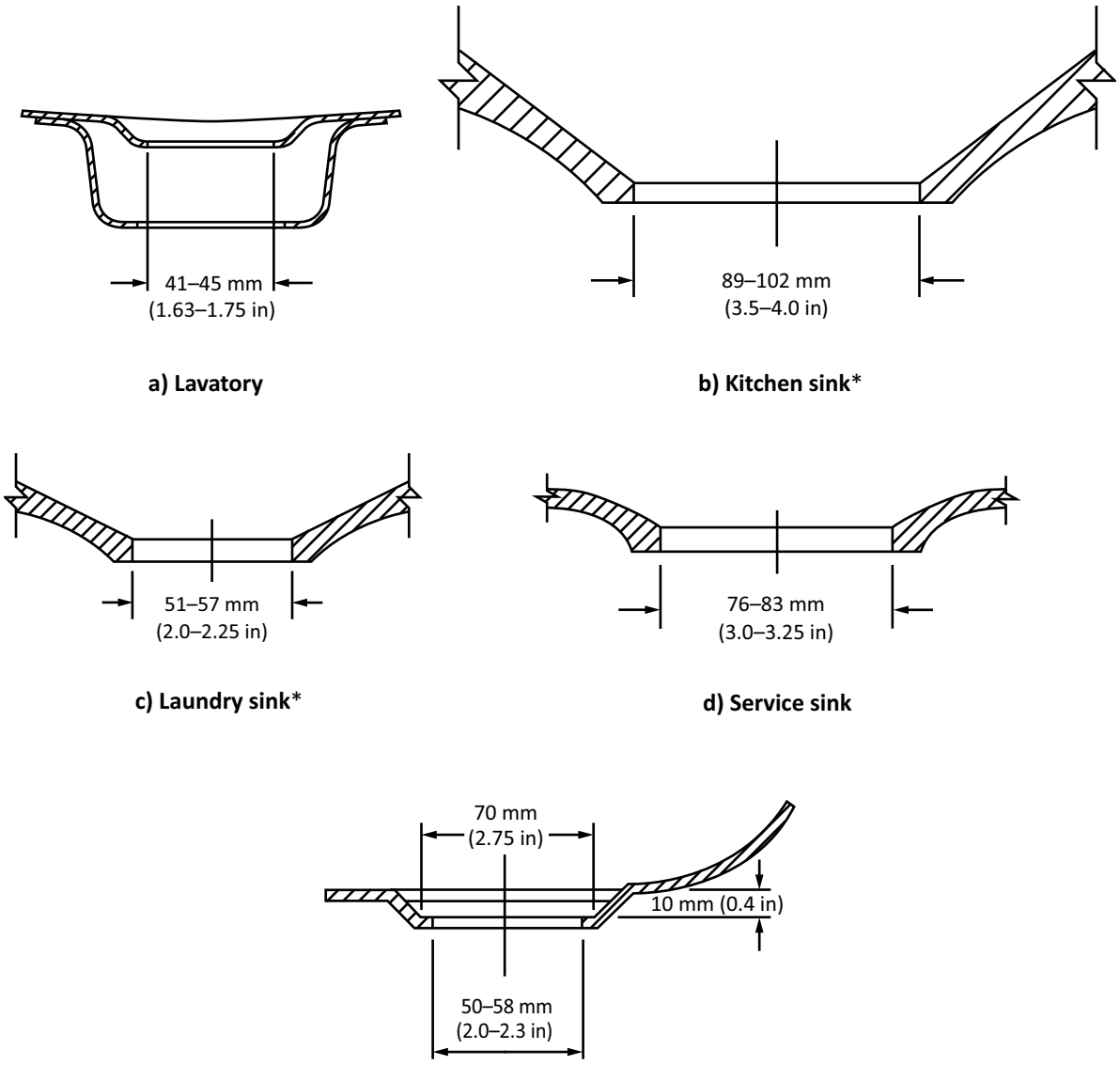
Figure 1
Waste outlet dimensions
(See Clause 4.4.1.2.)



a) Lavatory

b) Kitchen sink*

c) Laundry sink*

d) Service sink

e) Bathtub

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

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Figure 2
Opening and mounting surface dimensions for standard 200 mm (8 in) deck fittings
(See Clause 4.7.1.1.)

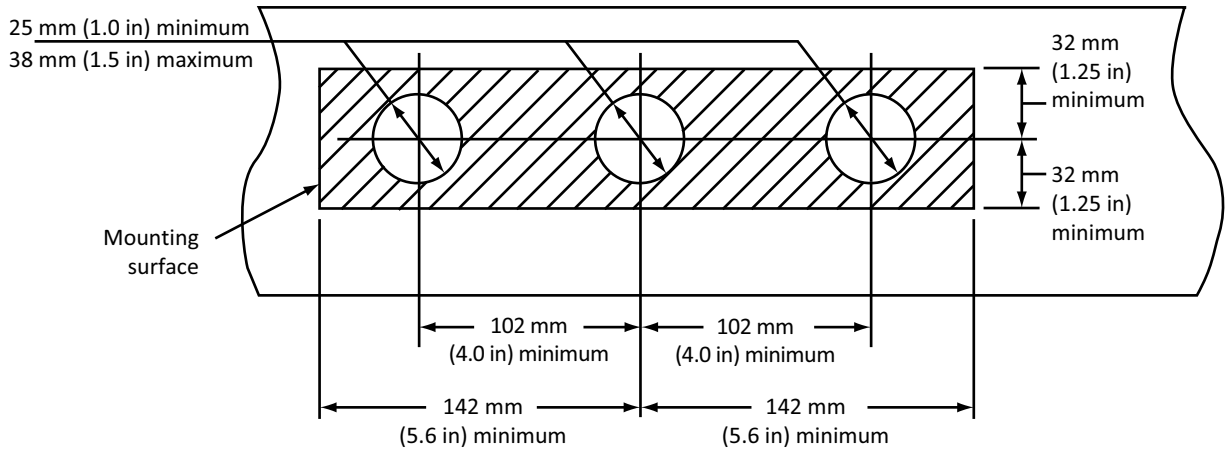

Figure 3
Opening and mounting surface dimensions for standard 200 mm (8 in) combination fittings
(See Clause 4.7.1.1.)

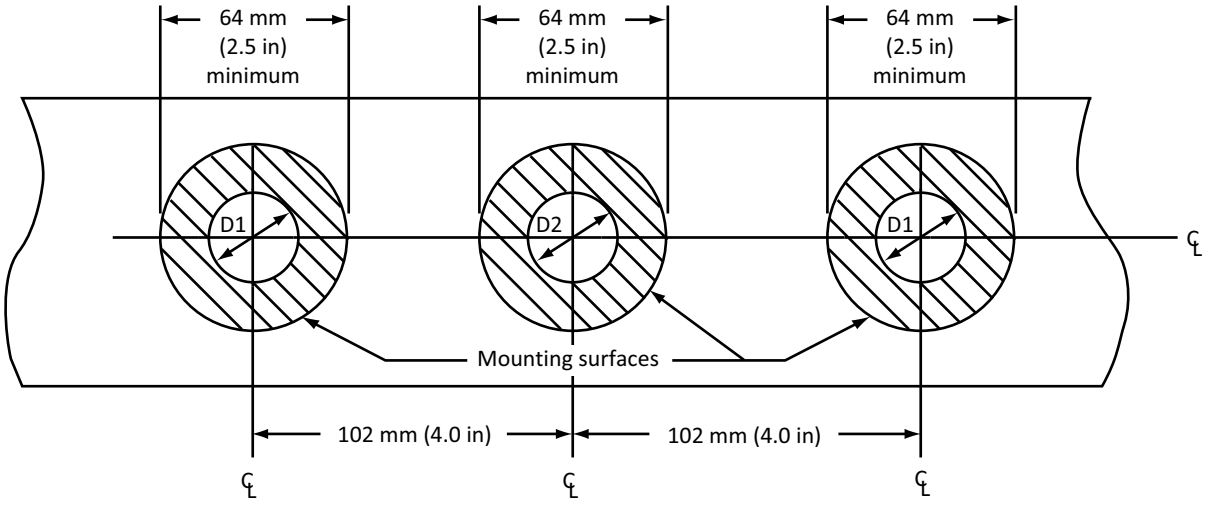

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Figure 4
Opening and mounting surface dimensions
for standard 100 mm (4 in) centre-set fittings
(See Clause 4.7.1.1.)

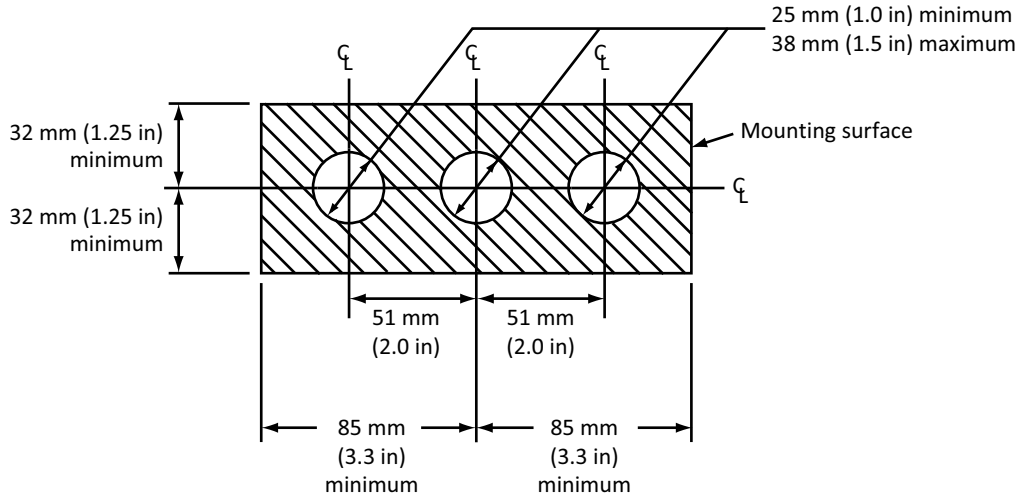

Figure 5
Opening and mounting surface dimensions
for standard 200 mm (8 in) combination fittings
(See Clause 4.7.1.1.)

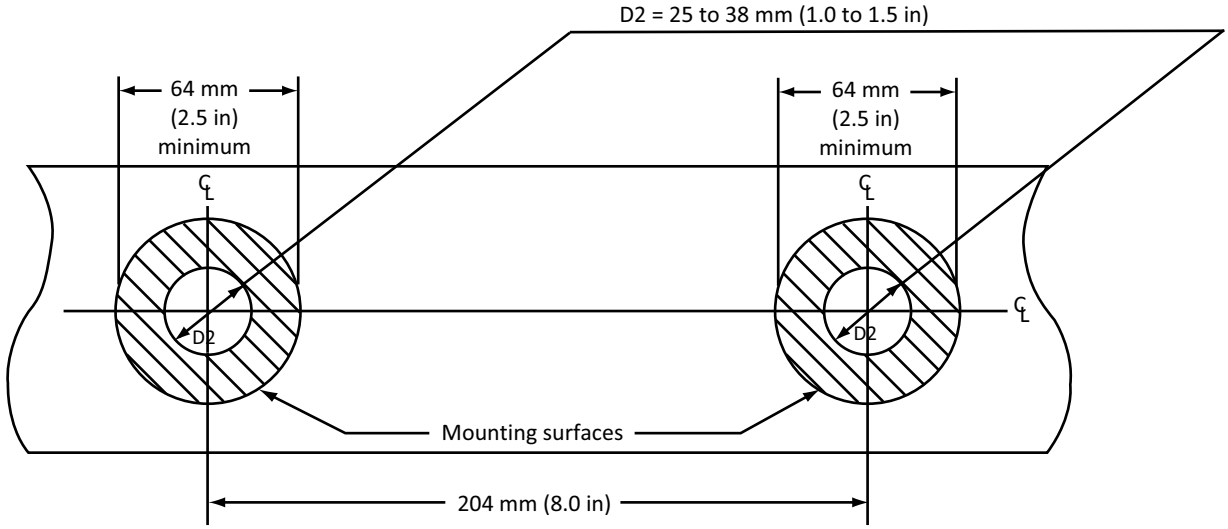

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Figure 6
Opening and mounting surface dimensions for single-mount supply fittings
(See Clause 4.7.1.1.)

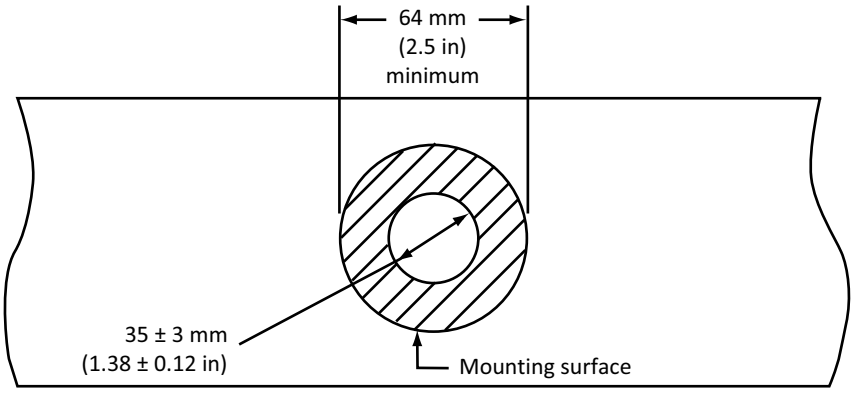
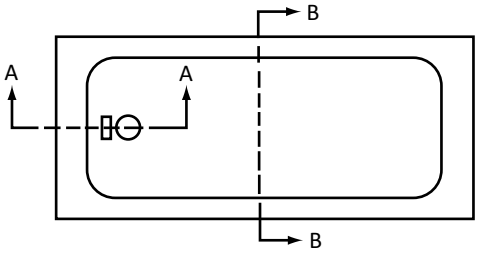
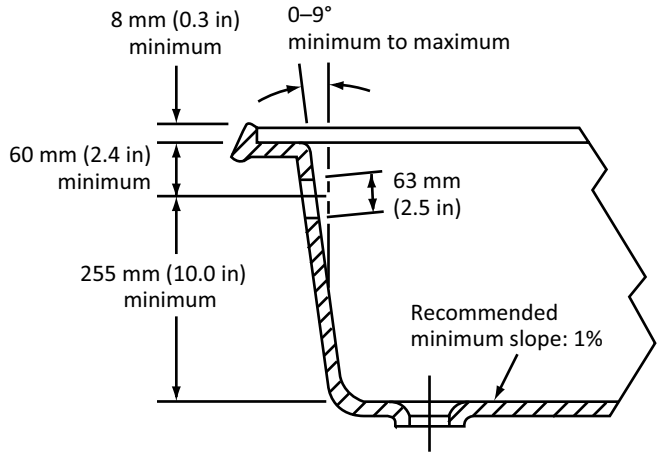


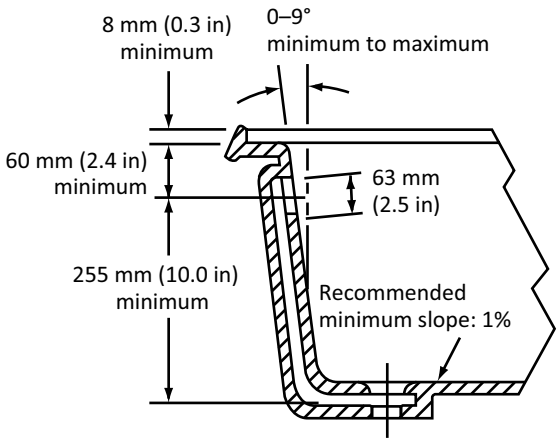
Figure 7
Dimensions for bathtubs
(See Clauses 4.4.2.2 and 4.8.1.)



a) Top view



b) Side view section A–A



c) Side view section A–A for tub with integral overflow

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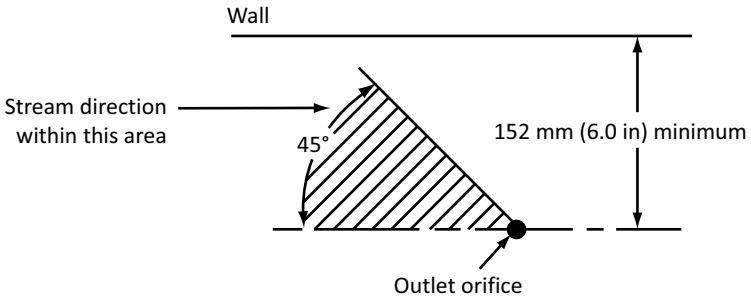
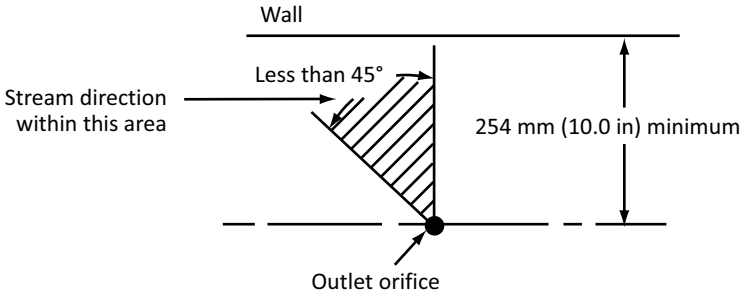
Figure 8
Clearance for drinking fountains
(See Clause 4.9.1.)



a) Stream generally parallel with wall



b) Stream generally toward wall

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Annex A (informative)
Unit conversion criteria

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

A.1 Conversion rules

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., π = 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 rules

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.

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