ASME A112.19.2-2018/CSA B45.1-18

Ceramic plumbing fixtures

ASME
SETTING THE STANDARD

CSA Group

REVISED OCTOBER 2018

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Revision History

ASME A112.19.2-2018/CSA B45.1-18, Ceramic plumbing fixtures

Errata — October 2018	Revision symbol (in margin)
Preface Clause 7.9.2.2.3 Figure 3	Δ

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Ceramic plumbing fixtures

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Δ Preface

This is the third edition of ASME A112.19.2/CSA B45.1, *Ceramic plumbing fixtures*.

It supersedes the previous edition published in 2013.

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 has been 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 June 15, 2018.

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ASME A112.19.2-2018/CSA B45.1-18
Ceramic plumbing fixtures

1 Scope

1.1

This Standard covers vitreous and non-vitreous china plumbing fixtures and specifies requirements for materials, construction, performance, testing, and markings. This Standard's performance requirements and test procedures apply to all types of water closets and urinals that discharge into gravity drainage systems in permanent buildings and structures, independent of occupancy.

1.2

This Standard covers the following plumbing fixtures:

a) bathtubs;
b) bidets;
c) drinking fountains;
d) fixtures for institutional applications;
e) lavatories;
f) shower bases;
g) sinks:
    i) bar sinks;
    ii) clinic sinks;
    iii) kitchen sinks;
    iv) laboratory sinks;
    v) laundry sinks;
    vi) service sinks; and
    vii) utility sinks;
h) urinals; and
i) 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; "may" is used to express an option or that which is permissible within the limits of the standard; and "can" is used to express possibility or capability.

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.

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

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

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

CAN/CSA-B181.1-15
Acrylonitrile-butadiene-styrene (ABS) drain, waste, and vent pipe and pipe fittings

CAN/CSA-B181.2-15
Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) drain, waste, and vent pipe and pipe fittings

B651-12 (R2017)
Accessible design for the built environment

C22.2 No. 0.15-15
Adhesive labels

CSA Group/IAPMO (International Association of Plumbing and Mechanical Officials)

CSA B45.5-17/IAPMO Z124.4-2017
Plastic plumbing fixtures

ASME International (American Society of Mechanical Engineers)

A112.6.1M-1997 (R 2017)
Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use

A112.6.2-2017
Framing-Affixed Supports (Carriers) for Off-the-Floor Plumbing Fixtures

A112.19.12-2014
Wall Mounted, Pedestal Mounted, Adjustable, Elevating, Tilting, and Pivoting Lavatory, Sink and Shampoo Bowl Carrier Systems and Drain Waste Systems

A112.19.14-2013
Six-Liter Water Closets Equipped with a Dual Flushing Device

A112.19.19-2016
Vitreous China Nonwater Urinals

ASME International (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 A112.19.5-2017/CSA B45.15-17
Flush valves and spuds for water closets, urinals, and tanks

ASSE (American Society of Sanitary Engineering)/ASME International (American Society of Mechanical Engineers)/CSA Group
ASSE 1002-2015/ASME A112.1002-2015/CSA B125.12-15
Anti-Siphon Fill Valves for Water Closet Tanks

ASSE 1037-2015/ASME A112.1037-2015/CSA B125.37-15
Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures

ASTM International
D 3311-17
Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns

ICC/ANSI (International Code Council/American National Standards Institute)
A117.1-2017
Accessible and Usable Buildings and Facilities

UL (Underwriters Laboratories Inc.)
969-17
Standard for Marking and Labeling Systems

3 Definitions and abbreviations

3.1 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.

Anti-siphon fill valve — a valve that is used to supply water to a flush tank and has, on its discharge side, an air gap, integral mechanical backflow preventer, or vacuum breaker. It is operated by a float or similar device.

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

Blowout action — a means of flushing a water closet whereby a jet of water directed at the bowl outlet opening pushes the bowl contents into the upleg, over the weir, and into the gravity drainage system.

Blowout bowl — a non-siphonic water closet bowl with an integral flushing rim, a trap at the rear of the bowl, and a visible or concealed jet that operates with a blowout action.

China

Non-vitreous china — ceramic material in which porosity results in a water absorption of between 0.5 and 15.0% of the original weight of the dry specimen (see Clause 6.1).

Vitreous china — ceramic material fired at a high temperature to form a non-porous body with a maximum water absorption of 0.5% of the original weight of the dry specimen (see Clause 6.1).

Critical level (CL) — the highest water level of a supply fitting at which back siphonage will not occur.

Defect

Blister (large) — a hollow raised portion of the glazed surface of a fixture with a dimension greater than 3 mm (0.13 in).

Bubble — a raised portion of the glazed surface of a fixture or a sand speck whose largest dimension is less than 1 mm (0.04 in).

Crack — a fracture in the glaze or the body of a fixture, but not a dunt or a craze.

Craze (crazing) — fine cracks in the surface finish.

Discoloration — a coloured spot with a dimension greater than 6 mm (0.25 in) or specks or spots in sufficient number that a change in colour is produced.

Dull or eggshell finish — a dead, flat, slightly matted, undeveloped glaze or semi-glazed finish with numerous very fine pinholes.
Note: *Dull or eggshell finish is not to be confused with a satin or matte finish used for decorative purposes.*

Dunt — a hairline fracture extending through the body of a fixture and caused by strains during manufacturing.

Exposed body — an unglazed portion of a fixture with a dimension of 2 mm (0.08 in) or greater.

Fire check — a fine shallow crack in the body of a fixture that is not covered with glaze.

Pinhole — a hole in the glazed surface of a fixture whose largest dimension is 2 mm (0.08 in) or less.

Pit — a hole in the glazed surface of a fixture with a dimension greater than 2 mm (0.08 in).

Speck — an area of contrasting colour whose largest dimension is between 0.3 and 1 mm (0.01 and 0.04 in).

Spot — an area of contrasting colour whose largest dimension is greater than 1 mm (0.04 in) but less than 3 mm (0.13 in).

Warpage — a defect in a fixture resulting in a concave or convex gap between the fixture and the adjacent wall or floor.

Wavy finish — a defect in a finish that results in numerous irregular or mottled runs in the glaze.

Fill time — the time from the instant the flush valve of a flush tank closes until the instant the fill valve is completely shut off.

Finish — the texture and condition of a surface (excluding colour).

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.

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

Flush cycle — the complete operating sequence of a water closet or urinal in emptying its contents, cleaning its inside surfaces, and refilling the water seal.

Flushing device — a device for delivering water into a water closet bowl or urinal.

Flush valve — a valve for discharging water from a flush tank into a water closet bowl or urinal.

Pressurized flushing device — a flushing device that is employed in non-gravity flushing systems and uses the water supply to create a pressurized discharge to flush fixtures.
Note: *Flushometer tanks, flushometer valves, and electronically controlled pressurized devices are examples of pressurized flushing devices (see CSA B125.3 and ASSE 1037/ASME A112.1037/CSA B125.37).*

Flushometer tank — a flushing device that effectively enlarges the water supply pipe immediately before the water closet bowl or urinal by being integrated within an accumulator vessel affixed and adjacent to the fixture inlet.

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 delivery of water at a sufficient rate for proper operation.*

Flushing surface — a surface that is visible after installation and is wetted during operation of a water closet or urinal.

Glaze — a smooth, impermeable, glass-like ceramic coating.

Gravity flush tank water closet — a water closet designed to flush the bowl with water supplied by gravity only.

Integral — a cast or formed part of a fixture, e.g., a trap, seat, or flush tank.

Lavatory — a washbowl or basin.

Thin-wall lavatory — a washbowl or basin having a wall thickness less than 6 mm (0.25 in.)

Low-profile tank — a tank on a water closet that employs a flushing device that is below the flood level of the water closet bowl.

Pottery square — a square opening 51 mm (2.0 in) on each side cut into a sheet of flexible material and used to count the number of defects in the opening (see Tables 1 and 2).

Pressure —

Flowing pressure — the pressure in a water supply pipe at the inlet to an open valve.

Static pressure — the pressure in a water supply pipe at the inlet of a closed valve.

Reverse draft moulding — the area behind the leading edge of the side wall lip on both sides of the shield.

Rim — the unobstructed open edge of a plumbing fixture.

Sanitary — an aesthetic condition of cleanliness (not the state of being microbiologically clean).

Siphonic action — the movement of water through a flushing fixture by creating a siphon to remove waste material.

Siphonic bowl — a water closet bowl that has an integral flushing rim, a trap at the front or rear, and a floor or wall outlet, and operates with a siphonic action (with or without a jet).

Spreader — the top section of a urinal that delivers water through rim holes down the back wall of the urinal.

Spud — a fitting used to connect a flushing device to a water closet or urinal.

Trap — a fitting, device, or integral portion of a fixture that provides a liquid seal that prevents the back passage of sewer gas without affecting the flow of wastewater.

Trap dip — the highest internal surface of the lowest part of a trap (see Figure 13).

Trap seal depth — the vertical distance
a) between the weir and the trap dip; or
b) if applicable, between the weir and the trap dip or the top edge of a jet opening, whichever is higher.

Trim — parts made of materials other than china that are normally supplied with a fixture, e.g., spuds, wall hangers, and flush valves (but not including fittings) (see CSA B125.3 or ASME A112.19.5/CSA B45.15).

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

High-efficiency urinal — a urinal with an average water consumption of 1.9 Lpf (0.5 gpf) or less when tested in accordance with this Standard.

Low-consumption urinal — a urinal with an average water consumption of 3.8 Lpf (1.0 gpf) or less when tested in accordance with this Standard.

Non-water-consuming urinal — a urinal that conveys liquid body waste through a trap seal into a gravity drainage system without the use of water.

Urinal lip — the section in the bottom of a urinal that keeps the water from flowing out of the urinal when flushed.

Urinal shield — the sides of the urinal that project from the wall that help keep the individual's privacy while using the urinal.

Visible surface — a surface of a fixture that is readily visible to an observer in a normal standing position after the fixture is installed.

Visible after installation — a surface that remains visible (not necessarily from a normal standing position) after the fixture is installed.

Warpage — a defect in a fixture resulting in a concave or convex gap between the fixture and the adjacent wall or floor.

Washdown (washout) bowl — a water closet bowl that has an integral flushing rim and a floor or wall outlet and primarily operates with a non-siphonic action.

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.

Dual-flush water closet — a water closet incorporating a feature that allows the user to flush the water closet with either a reduced or a full volume of water.

Electro-hydraulic water closet — a water closet with a non-mechanical trap seal incorporating an electric motor and controller to facilitate flushing.

Gravity water closet — a vessel that stores a predetermined quantity of water and includes a flushing device to discharge water (plus some through-flow from the water supply line) into a water closet bowl or urinal.

Note: *A common type of gravity water closet is a wall-hung vessel or a vessel close-coupled with the water closet bowl that is fitted with a fill valve and flush valve.*

High-efficiency water closet (high-efficiency toilet) — either one of the following:

a) a single-flush water closet with an average water consumption of 4.8 Lpf (1.28 gpf) or less when tested in accordance with this Standard; or
b) a dual-flush water closet with an effective flush volume defined as the composite, average flush volume of two reduced flushes and one full flush when tested in accordance with this Standard and ASME A112.19.14.

Low-consumption water closet — a water closet with an average water consumption of 6.0 Lpf (1.6 gpf) or less when tested in accordance with this Standard.

Water surface — the surface of the still water in the well of a water closet or urinal when the trap is filled to the weir.

Weir — the lowest internal surface of the highest part of a trap (see Figure 13).

Well — a pocket that is open at the top and formed inside a water closet bowl or urinal at the entrance to the trap.

3.2 Abbreviations

The following abbreviations shall apply in this Standard:

CL — critical level
gpf — gallons per flush
Lpf — litres per flush

4 General requirements

4.1 Dimensions and tolerances

4.1.1 Thickness

The ceramic material in plumbing fixtures shall be at least 6 mm (0.25 in) thick throughout (exclusive of glaze), except as noted in Clause 4.8.1.4.

4.1.2 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.

4.2 Glazing

Glaze shall be thoroughly fused to the body of the plumbing fixture.

All exposed surfaces shall be glazed, except for

a) surfaces that are intended to come into contact with walls or floors; and
b) the following surfaces of
    i) water closets:
        1) the inside, back, and underside of the flush tank;
        2) the underside of the tank lid;
        3) the underside of the flushing rim;
        4) a section of the flushing surface not to exceed 6 mm (0.25 in) below the flushing rim;
        5) all surfaces of the trap not visible after installation; and
        6) the back and underside of the pedestal;
    ii) lavatories:
        1) the backs of lavatories set away from walls;
        2) the backs of overflows;
        3) the undersides of outlet bosses;
        4) the undersides of drop-in lavatories; and
        5) the backs of lavatory legs and pedestals; and
    iii) bidets:
        1) the underside of the flushing rim;
        2) a section of the flushing surface not to exceed 6 mm (0.25 in) below the flushing rim; and
        3) the back and underside of the pedestal.

In other fixtures, the surfaces where the fixture is supported in the kiln may remain unglazed, as long as such surfaces are not visible after installation.

Note: *See Clause 4.5.1 for additional glazing requirements applicable to non-vitreous ceramic plumbing fixtures.*

4.3 Waste fitting openings, drainage, and overflows

4.3.1 Openings and drainage

4.3.1.1

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.

4.3.1.2

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.

4.3.1.3

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

4.3.2 Overflows

4.3.2.1 Lavatories, sinks, and bidets

4.3.2.1.1

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.

4.3.2.1.2

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.

4.3.2.1.3

Overflows shall comply with Clause 6.6.

4.3.2.2 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 8.

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.*

4.4 Off-the-floor plumbing fixture supports

Fixture supports, when required, shall comply with ASME A112.6.1, ASME A112.6.2, or ASME A112.19.12, as applicable.

4.5 Non-vitreous china plumbing fixtures

4.5.1 Glazing

The following surfaces of non-vitreous china fixtures shall be glazed:

a) surfaces that will be continuously subjected to standing water when the fixture is in use;
b) exposed surfaces, except as specified in Clause 4.2; and
c) the back and underside of water closet tanks and the underside of lids.

4.5.2 Integral traps

Non-vitreous china fixtures shall not have integral traps.

4.6 Additional requirements for water closets

4.6.1 Outlet dimensions

Outlets shall have the dimensions shown in

a) Figure 2 (for floor-mounted bottom-outlet water closets); or
b) Figure 3 (for rear-outlet and rear-spigot-outlet water closets).

4.6.2 Non-standard outlets

Outlets that require connections other than a closet flange and ring shall

a) not leak when tested in accordance with Clause 6.9; and
b) shall allow for field repair or replacement.

4.6.3 Bolt hole spacing

Bolt holes for wall-mounted water closet bowls shall be spaced as shown in Figure 4.

4.6.4 Roughing-in details

Water closet outlets shall rough-in at 254, 305, or 356 mm (10.0, 12.0, or 14.0 in), or as specified in the manufacturer's installation instructions.

Note: *See Figure 5.*

4.6.5 Seat-mounting holes

Except when proprietary (i.e., non-standard) seats are supplied by the manufacturer, water closet seat-mounting holes shall be as shown in Figure 5.

4.6.6 Rim profiles

Except when proprietary (i.e., non-standard) seats are supplied by the manufacturer, adult water closet bowl rim profiles for round and elongated bowls shall be as shown in Figure 6.

4.6.7 Water surface dimensions

Water closet bowls shall have a minimum water surface dimension of 125 × 100 mm (5 × 4 in) when measured on a flat and level surface.

4.6.8 Trap diameter

Water closet bowl traps shall have a diameter that allows a solid ball with a minimum diameter of 38 mm (1.5 in) to pass.

4.6.9 Spuds

4.6.9.1

The standard nominal size for spuds on water closet bowls shall be as follows:

a) 1-1/4 or 1-1/2 for water closet bowls operated by flushometer valves; and
b) 1-1/4, 1-1/2, or 2 for water closet bowls operated by wall-mounted flush tanks.

Other spud dimensions shall be as specified in CSA B125.3 or ASME A112.19.5/CSA B45.15.

4.6.9.2

Top spuds shall be located as shown in Figure 5 a).

4.6.10 Rim heights

Water closet bowls shall have the following rim heights:

a) adult water closets shall have a minimum rim height of 343 mm (13.5 in);
b) juvenile water closets shall have a rim height between 267 and 343 mm (10.5 and 13.5 in); and
c) children's water closets shall have a rim height between 241 and 267 mm (9.5 and 10.5 in).

4.7 Additional requirements for urinals

4.7.1 Integral trap diameter

Integral traps on urinals shall have a diameter that will allow a solid ball with the applicable minimum diameter specified in Table 3 to pass.

4.7.2 Dimensions

The minimum dimensions for urinals shall be as specified in Table 4.

4.7.3 Spuds

For urinals operated by flushometer valves, the standard nominal spud size shall be 3/4, 1-1/4, or 1-1/2. Other spud dimensions shall be as specified in ASME A112.19.5/CSA B45.15.

4.7.4 Materials and construction

The materials and construction of urinals shall comply with the applicable requirements of this Standard.

4.7.5 Non-water-consuming urinals

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

4.8 Additional requirements for lavatories, sinks, and bidets

4.8.1 Openings and mounting surfaces for supply fittings

4.8.1.1

When provided, openings and mounting surfaces for lavatory, sink, and bidet supply fittings shall be as shown in Figure 7, except when proprietary (i.e., non-standard) supply fittings are provided by the manufacturer.

4.8.1.2

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

4.8.1.3

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.*

4.8.1.4

When the thickness along the exterior edge of a lavatory is less than 6 mm (0.25 in), the load tests in Clause 6.7.3 shall be performed. The thickness shall not be less than 3 mm (0.12 in) along any point at the edge and the thickness shall return to a minimum of 6 mm (0.25 in) within a distance of 75 mm (3 in) from the nearby edge.

4.8.2 Wall-mounted commercial lavatories and sinks

Wall-mounted lavatories and sinks intended for commercial applications shall be provided with openings for fasteners that have the support dimensions specified in ASME A112.6.1.

4.8.3 Spuds for clinic sinks

The standard nominal size for spuds for clinic sinks operated by flushometer valves shall be 1-1/2. Other spud dimensions shall be as specified in CSA B125.3 or ASME A112.19.5/CSA B45.15.

4.9 Additional requirements for bathtubs and shower bases

4.9.1 Minimum dimensions for bathtubs

The minimum dimensions for bathtubs shall be as shown in Figure 8.

4.9.2 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.*

4.9.3 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 6.5 and includes all necessary parts and fasteners.

Fixtures using field-installed flanges shall be marked in accordance with Clause 9.4.

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

4.10 Additional requirements for drinking fountains

4.10.1

Drinking fountains shall

a) include a supply fitting, which shall have a discharge outlet at least 25 mm (1.0 in) above the flood level rim; and

b) comply with the dimensions shown in Figure 9.

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

4.10.2

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

Note: *ASME A112.18.1/CSA B125.1 includes toxicity and lead content requirements.*

4.11 Accessible design fixtures

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

5 Flushing devices used with fixtures

5.1 General

5.1.1

Flushing devices shall deliver water at a sufficient rate and quantity to permit water closets and urinals to comply with the hydraulic performance requirements of this Standard. Gravity flush tanks, pressurized flushing devices, and other flushing methods may be used.

5.1.2

Air gaps, vacuum breakers, or other backflow preventers shall be installed above the overflow or flood level of the fixture. Alternatively, spill openings to the outside of the flush tank shall be provided as required by Clause 5.2.4 or 5.3.2.

5.2 Gravity flush tanks

5.2.1 General

Gravity flush tanks for water closets and urinals shall include an anti-siphon fill valve complying with CSA B125.3 or ASSE 1002/ASME A112.1002/CSA B125.12 and a flush valve complying with CSA B125.3 or ASME A112.19.5/CSA B45.15. Gravity flush tanks shall have provisions for overflow.

5.2.2 Fill valve opening diameter and location

The fill valve opening shall have the diameter shown in Figure 10, but may be located on either side of the flush tank.

5.2.3 Critical level

The critical level (CL) mark on the fill valve shall be at least 25 mm (1.0 in) above the flush tank overflow.

5.2.4 Low-profile gravity tanks

When the critical level of the fill valve in low-profile gravity tank water closets is below the flood level of the bowl rim, an auxiliary spill opening(s) shall be provided to ensure that the water in the tank will drain to the floor if the overflow is clogged or the trap is blocked. The size and position of these openings shall be such that with the fill valve at the full open position and the water pressure at maximum, no water shall rise to the critical level of the fill valve.

5.2.5 Water closet fill valve

The water closet fill valve shall be the pilot valve type only or, alternatively, the fill valve shall meet the performance requirements of the fill valve test protocol in Clauses 7.10 and 7.11.

5.2.6 Water closet tank capacity

Any barrier, bucket, dam, displacement device, or similar fixture used in a water closet tank to affect flush volume shall be tamper-resistant and permanently affixed to the tank. Any device that can be tampered with or removed such that the water closet can be made to flush with greater than the maximum flush volumes specified in Clauses 7.12 and 7.13 shall be deemed noncompliant.

5.3 Pressurized flushing devices

5.3.1 General

Pressurized flushing devices shall comply with CSA B125.3 or ASSE 1037/ASME A112.1037/CSA B125.37. The critical level of the lowest anti-siphon device in a flushometer-valve-activated water closet shall be at least 25 mm (1.0 in) above the flood level of the water closet bowl rim.

5.3.2 Low-profile tanks with pressurized flushing devices

When the critical level of the pressurized flushing device in low-profile tank water closets is below the flood level of the bowl rim, an auxiliary spill opening(s) shall be provided to ensure that the water in the tank will drain to the floor if the overflow is clogged or the trap is blocked. The size and position of these openings shall be such that with the pressurized flushing device at the full open position and the water pressure at maximum, no water shall rise to the critical level of the pressurized flushing device.

5.4 Plastic water closet tanks

Plastic water closet tanks intended for use with vitreous china bowls shall comply with CSA B45.5/IAPMO Z124.

5.5 Electrical components of electro-hydraulic water closets

5.5.1 Pump motor and impeller

The pump motor and impeller coupling of electro-hydraulic water closets shall be non-mechanical and seamless. When located below the flood level of the water closet bowl, the pump motor and its electronics shall be installed in a completely sealed chamber without the use of seals, gaskets, or O-rings.

5.5.2 Jet hose

When provided, a pump's jet hose shall be able to withstand a pressure of 172 ± 7 kPa (25 ± 1 psi) for 60 min.

5.5.3 Electrical supply cords

Electrical supply cords shall

a) be between 0.9 and 1.8 m (3 and 6 ft) long;
b) be permanently attached; and
c) have an attachment plug for connection to the branch-circuit supply.

The opening where the electrical supply cord exits the water closet shall be smooth and rounded. Alternatively, the opening may have a grommet.

5.5.4 Wiring harnesses and electrical controls

Wiring harnesses and electrical controls that are not enclosed in the pump housing shall be located above the flood level of the water closet tank.

5.6 Dual-flush water closets

Dual-flush water closets shall comply with ASME A112.19.14.

6 Tests — Materials, finishes, structural integrity, and seals

Note: *See Clauses 7 and 8 for further tests.*

6.1 Water absorption test

6.1.1 Test specimen

The test specimen shall consist of three fragments of china taken from a fixture. Each fragment shall have been in contact with the kiln furniture at some point on its surface. Specimens taken from the same day's scrapped production may be used, at the option of the manufacturer, to avoid destroying a finished fixture. Each fragment shall have approximately 3200 mm^2 (5.0 in^2) of unglazed surface area and be not more than 16 mm (0.63 in) thick.

6.1.2 Specimen preparation

The specimen shall be prepared as follows:

a) Dry the china fragments to a constant weight at 110 ± 5 °C (230 ± 9°F).
b) Store the fragments in a desiccator until they cool to room temperature.
c) After the fragments reach room temperature, weigh each on a balance to an accuracy of 0.01 g. This shall be W_o.

6.1.3 Procedure

The water absorption test shall be conducted as follows:

a) Place the weighed fragments in distilled water at room temperature in a suitable container, supported so that they are not in contact with the bottom of the container.
b) Boil the fragments for 2 h. After boiling is completed, leave the fragments to remain in the water for 18 h (for a total of 20 h).
c) After the fragments have remained in the water for 20 h, dry each fragment with a damp towel to remove excess water and reweigh to an accuracy of 0.01 g. This shall be W_f .

6.1.4 Report

The absorption shall be reported as a percentage of the original weight of the dry specimen, W_o. The percentage for each fragment shall be obtained a follows:

% absorption = $[(W_f - W_o)/W_o] \times 100$
where
W_f = final weight of fragment after immersion in the boiling water, g
W_o = original weight of dry fragment, g

6.1.5 Performance
The average absorption of the three fragments shall not exceed 0.5% for vitreous china and 15% for non-vitreous china.

6.2 Crazing test

6.2.1 Test specimen
The test specimen shall be a glazed surface of approximately 3200 mm² (5.0 in²) and not more than 16 mm (0.63 in) thick.

6.2.2 Procedure
The crazing test shall be conducted as follows:
a) Prepare three baths as follows:
   i) a solution of equal portions by weight of anhydrous calcium chloride and water at 110 ± 3 °C (230 ± 5°F);
   ii) ice water at 2.5 ± 0.5 °C (37 ± 1°F); and
   iii) a solution of 1% methylene blue dye at room temperature.
b) Immerse the specimen in the anhydrous calcium chloride solution for 90 min.
c) Maintain the solution at a temperature of 110 ± 3 °C (230 ± 5°F).
d) Remove the specimen and immediately immerse it in the ice water bath unit chilled.
e) Remove the specimen from the ice water bath and immerse it for 12 h in the methylene blue dye solution.
f) Remove the specimen and examine it for craze lines, as indicated by penetration of the blue dye.

6.2.3 Performance
There shall be no crazing.

6.3 Surface examination

6.3.1 Procedure
Surface finishes shall be examined for defects by the unaided eye approximately 610 mm (2 ft) directly above the rim while the specimen is rocked to each side and backward to an angle of approximately 45°. The light source used to examine surface finishes shall be partially diffused daylight supplemented, if necessary, with diffused artificial light, giving an illuminance on the surface of a minimum of 1100 lx (102 foot-candles).

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

6.3.2 Evaluation

6.3.2.1
Water closet bowls, tanks, and urinals shall be evaluated in accordance with Clause 6.3.2.3 and Table 1. Defects that exceed the maximums specified in Table 1 shall be cause for rejection of the fixture.

6.3.2.2

Lavatories and drinking fountains shall be evaluated in accordance with Clause 6.3.2.3 and Table 2, except for pedestals and legs, which shall be evaluated in accordance with Clause 6.3.2.3 and Table 1. Defects that exceed the maximums specified in Table 1 or 2 shall be cause for rejection of the fixture.

6.3.2.3

For all fixtures, in addition to the defects specified in Clause 6.3.2.2, any one of the following shall be cause for rejection:

a) defects that can affect use or serviceability, e.g., sharp and jagged edges, burrs, and cracks;
b) crazes;
c) dunts;
d) surface discoloration;
e) dull or eggshell finish (unless part of the decorative treatment);
f) exposed body;
g) fire checks;
h) large blisters; and
i) projections.

6.3.3 Performance

Surface finishes shall be free from defects that could affect the intended purpose of a fixture.

6.3.4 Other fixtures

Fixtures not specified in Clause 6.3.2 shall be evaluated in accordance with Clause 6.3.2.1.

6.4 Warpage test

6.4.1 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 Table 1 or 2, as applicable, shall not slide under the specimen unless forced.

If the specimen rocks on two opposite corners, the horizontal plane shall be determined by inserting a feeler gauge, as thick as the total warpage allowed, under a corner that does not touch the flat and level surface. The feeler gauge shall be inserted not more than 1.6 mm (0.063 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.

6.4.2 Performance

Fixtures shall comply with the warpage requirements specified in Table 1 or 2, as applicable, when tested in accordance with Clause 6.4.1.

6.5 Field-installed tiling-flange seal test

6.5.1 Procedure

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

a) Set up the specimen in accordance with the manufacturer's instructions.

b) 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).
c) 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.*

6.5.2 Performance

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

6.6 Overflow test (lavatories, sinks, and bidets)

6.6.1 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 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 flow over the flood level of the specimen.

6.6.2 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.

6.7 Structural integrity tests for all wall-mounted plumbing fixtures and thin-wall lavatories

6.7.1 All wall-mounted fixtures and thin-wall lavatories

6.7.1.1 Set-up

Fixtures shall be firmly affixed to a solid test stand in accordance with the manufacturer's installation instructions. Supporting devices shall remain exposed for the duration of the test. If the manufacturer provides a support device with the fixture, that device shall be employed for the test.

6.7.1.2 Performance

Fixtures and their supporting devices shall withstand the test load for 10 min without failure or visible structural damage.

6.7.2 Wall-mounted water closets

6.7.2.1 Load

A load of 2.2 kN (500 lbf), including the weight of the channels and plate, shall be applied to the water closet bowl using the channel and plate assembly specified in Clause 6.7.2.2.

6.7.2.2 Apparatus

Two steel channels, size 3U × 4.1 and approximately 610 mm (2 ft) long, shall be placed back to back and spaced 76 mm (3.0 in) apart. A 6 mm (0.25 in) steel plate shall be fillet welded to the top flange of the channels. The channels shall be centred across the water closet rim at a distance, measured from the centreline of the seat bolts, of 254 mm (10 in) for round front bowls and 305 mm (12 in) for elongated bowls. If the water closet is intended for use with a seat, a plastic seat with bumpers shall be fastened to the bowl.

6.7.3 Wall-mounted and thin-wall lavatories

6.7.3.1 Wall-mounted lavatories

A vertical load of 1.1 kN (250 lbf) shall be applied on the top surface on the front of the lavatory rim using a 76 mm (3 in) diameter load-distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad.

6.7.3.2 Thin-wall lavatories

The load tests shall be conducted using a 76 mm (3 in) diameter load distribution disk resting on a 13 mm (0.5 in) thick sponge rubber or equivalent pad, as follows:

a) A vertical load of 500 N (112 lbf) shall be applied along the centre of the top surface of the lavatory rim.
b) A horizontal load of 300 N (67 lbf) shall be applied along the top front edge of the lavatory rim against the lavatory.

6.7.4 Wall-mounted urinals

A vertical load of 0.22 kN (50 lbf) shall be applied on the top surface on the front of the urinal rim.

6.8 Structural integrity test for bathtubs, shower bases, and non-vitreous service sinks

6.8.1 Apparatus

The apparatus for the structural integrity test for bathtubs, shower bases, and non-vitreous service sinks shall

a) consist of a
   i) test stand in which the specimen can be installed in the manner specified by the manufacturer. The test stand shall have a floor of particleboard at least 19 mm (0.75 in) thick or plywood at least 16 mm (0.63 in) thick supported on 2 × 6 dimensional joists spaced 500 mm (20 in) between centres to simulate a typical home floor;
   ii) 76 mm (3.0 in) diameter load-distribution disc; and
   iii) 13 mm (0.5 in) thick sponge rubber or another suitable soft material placed between the disc and the surface being loaded;
b) be capable of applying and removing the test load.

Alternative apparatus constructions that result in a suitable rigid test stand may be used.

6.8.2 Procedure

The structural integrity test for bathtubs, shower bases, and non-vitreous service sinks shall be conducted as follows:

a) Install the specimen (including a waste fitting) in the test apparatus in accordance with the manufacturer's instructions.
b) Apply a 1.3 kN (292 lbf) load to the centre of the bottom of the specimen and hold for 2 min. 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) After the 2 min period, apply the load for 1 min at each of the following locations:
   i) at two other bottom locations between the waste outlet and the walls;
   ii) at two locations on the rim or threshold;
   iii) at the midpoint and near one end; and
   iv) on the centre of the seat (if provided).
d) Inspect the specimen for damage.

6.8.3 Performance

There shall be no failure or visible structural damage.

6.9 Joint seal test

Joints shall be made in accordance with the manufacturer's instructions and subjected to a hydrostatic pressure of 34.5 ± 3.4 kPa (5 ± 0.5 psi) for 15 min. There shall be no evidence of leakage.

6.10 Auger test

6.10.1 Procedure

When materials other than vitreous or non-vitreous china are used in a water closet bowl trap, the following test shall be conducted:

a) Insert a manual closet auger into the water closet trap. If required by the manufacturer, use a drain snake.
b) Before each test cycle, adjust the water in the bowl to full trap seal depth.
c) Rotate the auger five times for each test cycle.
d) Perform a total of 100 cycles by removing, reinserting, and rotating the auger for each cycle.

The auger test shall be performed before any of the hydraulic performance tests specified in Clauses 6.6,7.3 to 7.8, and 8.3 to 8.6 are performed.

Note: *A Macro WHE3-6 w/WH34 or equivalent may be used to conduct this test.*

6.10.2 Performance

With the bowl and trap filled to the full trap seal depth, there shall be no water leakage, other than trap outlet spillage, after removal of the auger.

6.11 Condensation-free (insulated) tank test

6.11.1 Procedure

The condensation-free (insulated) tank test shall be conducted as follows:

a) Fill the tank to the waterline and adjust the water temperature to 7 ± 1 °C (45 ± 2°F).

b) Place the tank in a chamber with the following ambient temperature conditions:
   i) a dry bulb temperature of 27 ± 1 °C (80 ± 2°F);
   ii) a wet bulb temperature of 21 ± 1 °C (70 ± 2°F);
   iii) a relative humidity of 63 ± 3%; and
   iv) a maximum air velocity of 0.254 m/s (50 ft/min) on any point of the exterior tank surface.

6.11.2 Performance

A tank shall be considered condensation free if, after 3 h, no condensation on the tank exterior is observed before the tank is removed from the chamber.

7 Water closet tests

Note: *Many products are available for performing these tests. Specific manufacturers are mentioned as examples and mention of them does not constitute an endorsement.*

7.1 General

7.1.1 All tests

The following requirements shall apply to all water closet tests:

a) The pressure- and flow-measuring apparatus employed for testing and the configuration of the water supply system shall be as shown in
   i) Figure 11 for gravity and flushometer tank water closets; and
   ii) Figure 12 for flushometer valve water closets.
b) The water supply system shall be standardized in accordance with Clause 7.1.5.1 or 7.1.5.2, as applicable.
c) The temperature of the water shall be 18 to 27 °C (65 to 80°F).
d) Water closets shall be tested at the test pressures specified in Table 5 or at the manufacturer's recommended minimum pressure. A test pressure greater than 550 kPa (80 psi) shall not be used.
e) The specimen shall be placed on a flat and level or plumb surface, with the outlet and trap clear.
f) The specimen shall discharge to atmosphere.

Tests shall be conducted in the sequence specified in Table 5.

7.1.2 Gravity flush tank water closets

At each test pressure specified in Table 5 for gravity flush tank water closet tests, the water level in the tank and the fill time shall be adjusted in accordance with the manufacturer's instructions and specifications. Water closets that require higher minimum supply pressures shall be adjusted in accordance with the manufacturer's instructions. In the absence of manufacturer instructions and specifications, the fill valve shall remain set as received from the manufacturer.

Adjustments to the components inside the tank shall not be made once the water level and fill time adjustments have been made for the water consumption test pressure of 140 kPa (20 psi).

All remaining tests shall be performed at a pressure of 140 kPa (20 psi) (or the higher minimum operating pressure specified by the manufacturer).

The test methods and performance requirements specified in Clauses 7.12 and 7.13 shall apply to high-efficiency gravity tank toilets only.

7.1.3 Flushometer tank, electro-hydraulic, or other pressurized flushing device water closets

At each test pressure specified in Table 5 for flushometer tank, electro-hydraulic, or other pressurized flushing device water closets, the tank components shall be adjusted in accordance with the manufacturer's instructions and specifications. In the absence of such instructions and specifications, the tank components shall remain as received from the manufacturer.

7.1.4 Flushometer valve water closets

At each pressure specified in Table 5 for flushometer valve water closets, the supply stop shall be adjusted in accordance with the manufacturer's instructions and specifications. In the absence of such instructions and specifications, the stop shall be adjusted as specified in Clause 7.1.5.2 b).

7.1.5 Procedures for standardizing the water supply system

Note: *The purpose of these mandatory standardization procedures is to establish the system capacity at the minimum test pressure and to simulate typical field installation conditions under easily repeatable test laboratory conditions.*

7.1.5.1

Note: *See Figure 11.*

The procedure for standardizing the water supply system for testing gravity flush tank close-coupled water closets and flushometer tank one-piece and close-coupled water closets shall be as follows:

a) Adjust pressure regulator 4 to provide a static pressure of 140 ± 7 kPa (20 ± 1 psi).
b) With stop valve 10 open, adjust valve 6 to establish a flow of 11.4 ± 1 L/min (3.0 ± 0.25 gpm) at 55 ± 4 kPa (8 ± 0.5 psi) flowing pressure measured at gauge 7.
c) Keep valve 8 fully open, except when it is used to shut off the flow completely.
d) Remove stop valve 10 and install the specimen.

7.1.5.2

Note: *See Figure 12.*

The procedure for standardizing the water supply system for testing flushometer valve water closets shall be as follows:

a) Set the static pressure at gauge 7 by adjusting pressure regulator 4 to
   i) 240 kPa (35 psi) for flushometer valve water closets; and
   ii) 310 kPa (45 psi) for blowout bowls.
b) Attach the flushometer valve, with matching supply stop in the fully open position, at the discharge end of the water supply system and leave the flushometer valve discharge outlet open to the atmosphere.
c) Activate the flushometer valve and establish a peak flow rate, by adjusting valve 8, of
   i) 95 ± 4 L/min (25 ± 1 gpm) for flushometer valve water closets; and
   ii) 133 ± 4 L/min (35 ± 1 gpm) for blowout bowls.
   If the flushometer valve specified by the manufacturer is not capable of attaining the applicable minimum flow rate, adjust the flushometer to its fully open position.
d) Connect the flushometer valve to the test bowl.
e) Record the peak flowing pressure at gauge 10 and the peak flow rate through the flushometer valve while it is attached to the bowl. While conducting water consumption testing at 350 and 550 kPa (50 and 80 psi), maintain the peak flow rate at ± 4 L/min (± 1 gpm) by adjusting valve 9 as necessary.

7.1.6 Test medium

If a test requires a test medium, the medium shall be placed in the water closet bowl and the flushing device activated as specified in the applicable test procedure clause of this Standard. The specimen shall discharge into a receiving vessel or drainage system. The medium remaining in the bowl, if any, and that discharged into the receiving vessel or drainage system shall be observed. If necessary, the specimen shall be flushed again to remove the remaining medium from the bowl or trap before each test run.

7.1.7 Reports

Test results shall be evaluated and reported in accordance with the procedures specified for each test. Suggested formats for reporting test results are shown in Figures A.1 to A.5. Alternative formats for accurately reporting test data shall also be acceptable.

7.2 Trap seal depth determination test

Note: *See Figure 13.*

7.2.1 Apparatus

Figure 13 shows an acceptable apparatus for determining trap seal depth. Another apparatus, e.g., a steel tape measure or a steel rule with a perpendicular horizontal element secured to one end, may also be used.

7.2.2 Procedure

The trap seal depth determination test shall be conducted as follows:

a) Lower the probe until the horizontal element is resting against the trap dip.
b) Record the corresponding scale value as h_1.
c) Disengage the horizontal element from the probe.
d) Elevate the probe completely out of the water.
e) Confirm that the specimen is at full trap seal depth by slowly pouring water into the well until a slight overflow is detected dripping from the bowl outlet.
f) When the dripping ceases, adjust the probe so that its point is exactly at the water surface.
g) Record the corresponding scale value as h_2.
h) Calculate the full trap seal depth, H_f, by subtracting h_1 from h_2 ($H_f = h_2 - h_1$).

7.2.3 Report

The full trap seal depth, H_f, shall be reported.

7.2.4 Performance

The full trap seal depth, H_f, shall be at least 51 mm (2.0 in).

7.3 Water consumption test

7.3.1 General

Full trap seal restoration shall be indicated by overflow out of the water closet outlet after the main flush discharge. Such overflow shall be a sufficient indication of trap seal restoration. If no overflow is observed, the water consumption test shall be interrupted and the residual trap seal depth, H_r, shall be measured in accordance with Clause 7.4.2, omitting the addition of water to the bowl specified in Clause 7.2.2 e).

7.3.2 Apparatus

Flush volumes shall be measured with

a) a receiving vessel, calibrated by volume in increments not exceeding 0.25 L (0.07 gal);
b) a load cell with a readout in increments not exceeding 0.25 L (0.07 gal); or
c) any other apparatus capable of measuring volumes to within 0.25 L (0.07 gal).

A stopwatch or electric timer graduated in increments not exceeding 0.1 s shall be used to measure time.

7.3.3 Procedure

The water consumption test shall be conducted as follows:

a) Record the static pressure (see Table 5).
b) Trip the actuator and hold for a maximum of 1 s while simultaneously starting the stopwatch or timer.
c) Record the volume received in the vessel (main flush volume) when the main flush is completed, i.e., when the trailing flow that occurs at the end of the main discharge ceases.
d) Record the total flush volume after cessation of flow of the excess trap refill water (afterflow) subsequent to the first observation.
e) Round down the total flush volume to the nearest 0.25 L (0.07 gal).
f) If there is no evidence of afterflow, measure and record the residual trap seal depth, H_r, in accordance with Clause 7.4.

Items a) to f) complete one test run. These steps shall be repeated until three sets of data are obtained for each test pressure specified in Table 5.

7.3.4 Report

Static pressure, main and total flush volume, afterflow (if any), and cycle time shall be reported in a format similar to that of Figure A.1. The report shall also indicate whether the trap seal was restored. If the trap seal was not restored, the residual trap seal depth, H_r, shall be reported.

7.3.5 Performance

The average of the total flush volumes obtained in Clause 7.3.3 e) over the range of pressures specified in Table 5 shall not exceed

a) 4.8 Lpf (1.28 gpf) for single-flush high-efficiency water closets;
b) 6.0 Lpf (1.6 gpf) for the full flush volume mode of dual-flush high-efficiency water closets; and
c) 6.0 Lpf (1.6 gpf) for low-consumption water closets.

7.4 Trap seal restoration test

7.4.1 Apparatus

The test apparatus shall be as specified in Clause 7.2.1.

7.4.2 Procedure

The trap seal restoration test shall be conducted as follows:

a) Flush the water closet.
b) Allow the water closet to complete its flush cycle.
c) Adjust the probe after each flush cycle so that the point is exactly at the water surface.
d) Record the corresponding scale value as h_3.

e) Calculate the residual trap seal depth, H_r, by subtracting h_1 from h_3 ($H_r = h_3 - h_1$).

Repeat Items a) to e) to obtain ten sets of measurements.

7.4.3 Report

The residual trap seal depth, H_r, shall be reported for each flush.

7.4.4 Performance

A residual trap seal depth, H_r, of at least 51 mm (2.0 in) shall be restored after all ten flushes.

7.5 Granule and ball test

7.5.1 Test media

The test media shall consist of the following:

a) approximately 2500 cylindrical high-density polyethylene (HDPE) granules with the following characteristics:
   i) weight: 65 ± 1 g (2.3 ± 0.04 oz);
   ii) diameter: approximately 4.0 mm (0.16 in);
   iii) thickness: approximately 2.6 mm (0.10 in); and
   iv) density: 951 ± 10 kg/m^3 (59.4 ± 0.6 lb/ft^3); and
b) 100 nylon balls with the following characteristics:
   i) weight: 15.5 ± 0.5 g (0.545 ± 0.015 oz);
   ii) diameter: 6.35 ± 0.25 mm (0.25 ± 0.01 in); and
   iii) density: of 1170 ± 20 kg/m^3 (73 ± 1 lb/ft^3).

7.5.2 Procedure

The granule and ball test shall be conducted as follows:

a) Add the granules and flush the water closet once before beginning the test to condition the granules.
b) Add the test media to the water in the bowl.
c) Allow the balls to settle to the bottom of the well.
d) Trip the actuator, hold for a maximum of 1 s, and release.
e) Count the granules and balls visible in the bowl after completion of the flush.
f) Measure and record the residual trap seal depth, H_r, in accordance with Clause 7.4.2.

Items b) to f) complete one test run. These steps shall be repeated until three sets of data are obtained.

Notes:

1) *A suggested supplier of granules is Geberit Manufacturing, Inc., P.O. Box 2008, 1100 Boone Drive, Michigan City, Indiana 46360, USA (tel. 219-879-4466).*
2) *A suggested supplier of nylon balls is Precision Plastic Ball Co., 10125 Pacific Avenue, Franklin Park, Illinois 60131, USA (tel. 847-678-2255).*

7.5.3 Report

The number of granules and balls in the bowl after flushing shall be reported in a format similar to that of Figure A.2. The report shall indicate whether the full trap seal was restored. If the full trap seal was not restored, the residual trap seal depth, H_r, shall be reported.

7.5.4 Performance

Not more than 125 granules (5% of the original number) and not more than five balls (5% of the original number) shall be visible in the bowl after each flush.

7.6 Surface wash test

7.6.1 Test medium

The test medium shall be an ink line applied using a wet-erase fine-point transparency marker. The colour of the ink shall contrast with that of the test bowl.

7.6.2 Procedure

The flushing surface of the test bowl shall be flushed clean with a mild liquid dishwashing detergent. The test shall be conducted as follows:

a) Rinse and dry the flushing surface.
b) Draw a continuous horizontal ink line around the circumference of the flushing surface, approximately 25 mm (1.0 in) below the rim jets, with the marker specified in Clause 7.6.1.
c) Trip the actuator, hold for a maximum of 1 s, and release.
d) Observe the line during and after the flush.
e) When the flush cycle is complete, measure and record the length and position of any ink line segments remaining on the flushing surface.

Items a) to e) complete one test run. These steps shall be repeated until three sets of data are obtained.

7.6.3 Report

The lengths and locations of any ink line segments remaining on the flushing surface after each flush shall be reported in a format similar to that of Figure A.3.

7.6.4 Performance

The total length of the ink line segments remaining on the flushing surface after each flush shall not exceed 51 mm (2.0 in) when averaged over three test runs. No individual segment shall be longer than 13 mm (0.5 in).

7.7 Drain line transport characterization test

7.7.1 Test medium

The test medium shall consist of 100 polypropylene balls with the following characteristics:

a) weight: 3.0 ± 0.2 g (0.105 ± 0.007 oz); and
b) diameter: 19 ± 0.4 mm (0.75 ± 0.02 in).

Note: *A suggested supplier of polypropylene balls is Precision Plastic Ball Co., 10125 Pacific Avenue, Franklin Park, Illinois 60131, USA (tel: 847-678-2255).*

7.7.2 Apparatus

Figure 14 shows an acceptable assembly for the test. The assembly shall have an NPS-4 rigid plastic or glass pipe that

a) is at least 18 m (60 ft) long;
b) is connected directly to an NPS-4 plastic one-quarter bend in accordance with CAN/CSA-B181.1, CAN/CSA-B181.2, or ASTM D 3311, or has a borosilicate (Pyrex® or Kimax®) glass NPS-4 90° elbow

connected by a hubless coupling or solvent-cemented joint, as applicable, connected directly to the floor flange of the specimen;
c) runs from the water closet and provides a straight run with a 2% slope; and
d) is vented with an NPS-1-1/2 pipe located between 0.3 and 3.0 m (1 and 10 ft) from the specimen.

For back-outlet water closets, the pipe shall be extended up from the floor using fittings complying with CAN/CSA-B181.1 or CAN/CSA-B181.2. NPS-4 plastic DWV piping and a sanitary tee shall be used to ensure that the water closet outlet is at the manufacturer's recommended height above the floor.

7.7.3 Procedure

The drain line transport characterization test shall be conducted as follows:
a) Prepare the test assembly in accordance with the applicable requirements of Clause 7.1 [including the test pressures specified in Clause 7.1.1d)].
b) Place 100 balls in the water closet bowl.
c) Trip the actuator, hold for a maximum of 1 s, and release.
d) Record the distance travelled by each ball in accordance with Clause 7.7.4.
e) Remove all balls from the test assembly.

Items b) to e) complete one test run. These steps shall be repeated until three sets of data are obtained.

7.7.4 Report

An overall measure of performance shall be determined by recording the location of the balls after flushing within one of eight categories that represent various distances of travel down the drain line. These categories shall include one for balls that remain in the bowl or trap, one for balls that exceed the 18 m (60 ft) length of pipe, and one for each 3 m (10 ft) increment of pipe [e.g., 0 to 3 m (0 to 10 ft) and 3 to 6 m (10 to 20 ft)].

Test results shall be reported as follows:
a) Record the number of balls in each of the eight distance categories specified in this Clause for each of the three test runs.
b) Combine the test run results to determine the total number of balls in each of the eight distance categories.
c) Calculate the weighted carry distance by multiplying the total number of balls in each category by the "average distance travelled" corresponding to that category. The "average distance travelled" for each category shall be 0, 1.5 m (5 ft), 4.5 m (15 ft), 7.5 m (25 ft), 10.5 m (35 ft), 13.5 m (45 ft), 16.5 m (55 ft), and 18 m (60 ft), respectively. See Figure A.4.
d) Calculate the total carry of balls by adding the eight weighted carry distances.
e) Calculate the average carry distance by dividing the total carry by the total number of balls (3 × 100 balls = 300 balls).

The test results shall be reported in a format similar to that of Figure A.4. See Figure A.5 for sample calculation data.

7.7.5 Performance

The average carry distance (total carry of all balls divided by 300) shall be at least 12.2 m (40 ft).

7.8 Overflow test for gravity flush tanks

7.8.1 Apparatus

The test apparatus shall be as shown in Figure 11.

7.8.2 Procedure

The overflow test for gravity flush tanks shall be conducted as follows:

a) Adjust the static pressure to 550 kPa (80 psi).
b) Open the water supply valve (valve 8 in Figure 11).
c) Set the fill valve to the fully open position and allow the water to flow for 5 min.

7.8.3 Report

Report any leakage or water discharge outside the flush tank.

7.8.4 Performance

Leakage or water escaping from the flush tank shall constitute failure.

7.9 Waste extraction test

7.9.1 Apparatus

The test apparatus shall be a drop guide placed across the top of the toilet bowl, with the centreline of a 50 mm (2 in) diameter opening 150 mm (6 in) in front of the centre of the seat post holes, equidistant from each hole. The drop guide

a) may be made of plastic or other rigid material;
b) shall be no more than 12 mm (0.5 in) thick; and
c) shall be of sufficient length to span the top of the toilet bowl.

7.9.2 Test media

7.9.2.1 General

The test media shall consist of seven soybean paste cylinders and four loosely crumpled balls of toilet paper.

7.9.2.2 Soybean paste cylinders

7.9.2.2.1

The seven soybean paste cylinders shall have

a) a nominal content of 34.9% water, 33.1% soybean, 18.5% rice, 12.2% salt, and 1.6% ethyl alcohol by weight;

Note: *Total percentages exceed 100% due to rounding.*

b) a density of 1.15 ± 0.10 g/mL (i.e., density greater than that of water);
c) a mass of 50 ± 4 g per cylinder;
d) a length of 100 ± 13 mm (4 ± 0.5 in);
e) a diameter of 25 ± 6 mm (1 ± 0.25 in); and
f) a combined mass of 350 ± 10 g.

Note: *A suggested supplier of soybean paste is Gauley Associates Ltd., 1 Davidson Drive, Acton, ON L7J 0A4, Canada. Tel: 519-853-4057.*

7.9.2.2.2

The soybean paste cylinders may be either uncased or cased. Cased cylinders

a) shall be encased with non-lubricated latex condoms;
b) shall be tied with a polymeric cord 1.0 mm (0.04 in) in diameter that will not crack or harden with time; and
c) should be stored in airtight containers and refrigerated when not in use with a damp sponge placed in the bottom of the container to prevent the test cylinders from drying.

Notes:

1) *A suggested supplier of latex condoms is LifeStyles® brand, purchased from Ansell Healthcare Products LLC, Dothan, AL 36303 USA.*
2) *A suggested supplier of the cord is Stretch Magic Bead & Jewelry Cord, Pepperell Braiding Company, P.O. Box 1487, Peperell, MA 01463, Tel. 800-343-8114.*

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7.9.2.2.3

During testing, the soybean paste cylinders shall be between 18 and 27 °C (65 and 80 °F). Cased cylinders that have been stored in a refrigerator shall be acclimatized by flushing each cylinder at least three times prior to conducting testing.

7.9.2.2.4

Cased soybean paste cylinders shall be discarded after being subjected to 100 flushes. Soybean paste cylinders that are damaged in any way shall not be used. Soybean paste cylinders may contain small volumes of air; however, cylinders that float shall not be used.

7.9.2.3 Toilet paper balls

7.9.2.3.1

Each ball of toilet paper shall

a) be loosely crumpled;
b) be comprised of six squares of untreated, single ply toilet paper, each measuring 114 × 114 mm (4.5 × 4.5 in) or having an equivalent surface area; and
c) measure 51 to 76 mm (2 to 3 in) in diameter.

7.9.2.3.2

The single-ply toilet paper shall comply with the absorption and wet tensile strength tests specified in Clauses 7.9.2.3.3 and 7.9.2.3.4.

7.9.2.3.3 Absorption test for the toilet paper

7.9.2.3.3.1

The absorption test for the toilet paper shall be conducted as follows:

a) Wrap a six-sheet strip of the toilet paper snugly around a piece of 51 mm (2 in) Schedule 40 PVC pipe.
b) Slide the toilet paper off the pipe.
c) Grasp the tube of paper halfway down its length and turn it inside out and down over itself. This shall result in a ball approximately 50 mm (2 in) in diameter.
d) Drop the ball into a pan of water.

7.9.2.3.3.2

The paper ball shall sink below the surface in less than 3 s.

7.9.2.3.4 Wet tensile strength test for the toilet paper

7.9.2.3.4.1

The wet tensile strength test for the toilet paper shall be conducted as follows:

a) Use a 51 mm (2 in) Schedule 40 PVC coupling and union nut as a frame to hold the toilet paper.
b) Place one sheet of toilet paper on the coupling nut and slide the union nut over the coupling.
c) Invert the frame and submerge the toilet paper in water for 5 s.
d) Remove the frame from the water and return it to the upright position.
e) Place an 8 mm (0.32 in) diameter steel ball weighing 2 g ± 0.1 g in the centre of the wet sheet of toilet paper.

7.9.2.3.4.2

The toilet paper sheet shall support the steel ball without any evidence of tearing.

7.9.3 Procedure

The waste extraction test shall be conducted as follows:

a) Set the static water supply pressure to 350 kPa ± 14 kPa (50 ± 2 psi).
b) Adjust the tank water level to the level specified in the manufacturer's instructions (i.e., set to waterline) where applicable.
c) Flush at least three times prior to beginning testing.
d) Set the inlet water temperature between 18 and 27 °C (65 and 80 °F).
e) Readjust the tank water level to the proper level if required.
f) Freely drop the seven soybean paste cylinders in a vertical orientation through the opening in the drop guide into the bowl.
g) Immediately remove the drop guide and freely and randomly drop the four balls of crumpled toilet paper over the centre of the bowl sump.
h) Wait 10 ± 1 s and then flush the bowl.
i) Record the test as "pass" or "fail". The test shall be recorded as a "fail" if any test media remains in the bowl or trap, or if a trap seal of at least 50 mm (2 in) is not restored.
j) Flush the bowl again to clear the bowl and trapway and fully restore the trap seal.
k) Repeat the steps in items e) to j) four times, for a total of five test runs.

7.9.4 Performance and report

The specimen shall be deemed to have failed the test if any test media remains in the bowl or trap in more than one test run, or if a trap seal of at least 50 mm (2 in) is not restored in more than one test run.

The test report shall indicate if all test media was flushed out on at least four of the five test runs and whether or not the trap seal was restored.

7.9.5 Performance

Water closet model performance shall be identified as either a "pass" or "fail", depending upon whether it can successfully and completely clear all test media from the fixture in a single flush in at least four of five attempts. Tests where the toilet sample clogs, plugs, or fails to restore a minimum of a 50 mm (2 in) trap seal following each flushing test shall be deemed a failed test. The flush performance

criteria shall apply to single-flush toilets, and to the full flush option of dual-flush toilets in accordance with ASME A112.19.14.

7.10 Consistent water level test

7.10.1 Procedure

The consistent water level test shall be conducted on non-pilot valves only, as follows:

a) Install the fill valve in the water closet tank provided, install the tank on a leveled test stand, and adjust the water level per the manufacturer's recommendation at an inlet water pressure of 140 ± 14 kPa (20 ± 2 psi) or at the manufacturer's recommended minimum pressure as noted in the product literature and product packaging.
b) Flush the tank to verify and mark the water level after completed refill.
c) Increase the inlet water pressure to 410 ± 14 kPa (60 ± 2 psi).
d) Flush the tank.
e) Measure any difference in water level after completed refill.
f) Repeat the steps in Items a) to e) utilizing 550 ± 14 kPa (80 ± 2 psi) inlet water pressure.

7.10.2 Performance

The fill valve shall shut off at the same water level ± 12 mm (± 0.5 in) for all three inlet water pressures. In addition, water shall not enter the overflow tube or flow out of the tank at any of the three tested inlet pressures.

7.11 Fill valve shutoff integrity test with increased water pressure

7.11.1 Procedure

The fill valve shutoff integrity test shall be conducted on non-pilot valves only, as follows:

a) Install the fill valve in a water closet tank and adjust the water level per the manufacturer's recommendation at an inlet water pressure of 140 ± 14 kPa (20 ± 2 psi) or at the manufacturer's recommended minimum pressure as noted in the product literature and product packaging.
b) Flush the tank to verify and mark the water level after completed refill.
c) Increase the inlet pressure to the fill valve from 140 kPa (20 psi) (or recommended minimum pressure) to 410 kPa (60 psi), then to 550 kPa (80 psi) at a rate of less than 69 kPa (10 psi) per second.

7.11.2 Performance

The water level shall remain at the initial mark of ± 12 mm (± 0.5 in). In addition, water shall not enter the overflow tube or flow out of the tank.

7.12 Adjustability test for tank-type gravity water closets with original equipment

7.12.1 Procedure

The adjustability test for tank-type water closets with original equipment shall be conducted as specified in Clause 7.3 with the following modifications:

a) The water closet shall be installed on a leveled test stand and all adjustable tank trim components (any field adjustment features in the tank that might increase the water closet flush volume) shall be adjusted to the maximum water use setting, while taking care not to damage or alter the parts.
b) The water level in the tank shall be set to 6 ± 2 mm (0.25 ± 0.06 in) below the top of the overflow tube. Where the tank utilizes an internal containment vessel and does not possess an overflow

tube, the vessel shall be filled to a level 6 ± 2 mm (0.25 ± 0.06 in) below the top rim of the vessel or to the manufacturer's designated water line, whichever is higher.

c) The static pressure of the water supply shall be adjusted to 550 ± 14 kPa (80 ± 2 psi).
d) The water closet shall be flushed, maintaining the activator in the flushing position for not more than one second, the water being drained into a container.
e) After the flush cycle is complete, the total flush volume shall be observed and recorded.
f) This procedure shall be repeated until five sets of data are obtained.
g) The static pressure of the water supply shall be adjusted to 140 ± 14 kPa (20 ± 2 psi) or to the manufacturer's recommended minimum pressure, as noted in the product literature and product packaging, and Items d) to f) shall be repeated.
h) For dual-flush water closet fixtures, this test shall be conducted at both full flush and reduced flush modes.

7.12.2 Report

The five individual flush volumes and the average of the five runs shall be reported for each of the two static water supply pressures specified.

7.12.3 Performance

The average total flush volume for five test runs for each of the two static water supply pressures shall not exceed the following:

a) for single-flush fixtures: 6.4 L (1.68 gal) per flush; and
b) for dual-flush fixtures:
   i) reduced flush ("short flush") mode – 5.3 L (1.40 gal) per flush; and
   ii) full flush mode – 7.6 L (2.00 gal) per flush.

The volume of water may be determined visually using a graduated container or by weight calculated as a unit to volume unit.

7.13 Adjustability test for tank-type gravity water closets with aftermarket closure seals

7.13.1 Procedure

The adjustability test for tank-type gravity water closets with aftermarket closure seals shall be conducted as specified in Clause 7.3, with the following modifications:

a) The water closet shall be installed on a leveled test stand and all adjustable tank trim components (any field adjustment features in the tank that might increase the water closet flush volume) shall be adjusted for maximum water use, while taking care not to damage or alter the parts.
b) The original equipment flush valve seal shall be removed and replaced with a standard (buoyant) aftermarket seal/flapper for that water closet where possible. For any ongoing surveillance testing, the same model replacement flush valve seal shall be used as was used during the initial product testing and certification.
c) In the case of a standard configuration 2 in flush valve, a non-adjustable Fluidmaster Bullseye Super flapper (part no. 501) or a Coast Foundry Ultra Blue flapper shall be used.
d) In the case of a standard configuration 3 in flush valve, an adjustable Lavelle Korky model 3060 or Fluidmaster model 5403 flapper shall be used. The flapper shall be adjusted in accordance with the flapper manufacturer's instructions to provide the rated flush volume of the water closet.
e) In the case of non-standard flush valves, one or more replacement seals available at hardware, plumbing supply, and building supply stores or from the manufacturer or other recognized source shall be used.

f) The water level in the tank shall be set to 6 ± 2 mm (0.25 ± 0.06 in) below the top of the overflow tube. Where the tank utilizes an internal containment vessel and does not possess an overflow tube, the vessel shall be filled to a level 6 ± 2 mm (0.25 ± 0.06 in) below the top rim of the vessel or to the manufacturer's designated water line, whichever is higher.
g) The static pressure of the water supply shall be adjusted to 550 ± 14 kPa (80 ± 2 psi).
h) The water closet shall be flushed maintaining the activator in the flushing position for a period of one second maximum, with the water being drained into a container.
i) After the flush cycle is complete, the total flush volume shall be observed and recorded.
j) This procedure shall be repeated until five sets of data are obtained.
k) The static pressure of the water supply shall be adjusted to 140 ± 14 kPa (20 ± 2 psi) or to the manufacturer's recommended minimum pressure as noted in the product literature and product packaging, and Items h) to k) shall be repeated.
l) For dual-flush water closet fixtures, this test shall be conducted at both flush modes (full flush and reduced flush).

7.13.2 Report

The five individual flush volumes and the average of the five runs shall be reported for each of the two static water supply pressures specified.

7.13.3 Performance

The average total flush volume for five test runs for each of the two static water supply pressures shall not exceed the following:

a) for single-flush fixtures: 6.4 L (1.68 gal) per flush; and
b) for dual-flush fixtures:
   i) reduced flush ("short flush") mode – 5.3 L (1.40 gal) per flush; and
   ii) full flush mode – 7.6 L (2.00 gal) per flush.

The volume of water may be determined visually using a graduated container or by weight calculated as a unit to volume unit.

8 Urinal tests

8.1 General

8.1.1

The test methods and performance requirements specified in Clauses 8.2 to 8.6 shall apply to water-consuming urinals. The test methods and performance requirements specified in Clause 8.7 shall apply only to non-water-consuming urinals.

8.1.2

Urinals shall be tested at the test pressures specified in Table 6 or at the manufacturer's recommended minimum pressure. However, a test pressure greater than 550 kPa (80 psi) shall not be used.

8.1.3

Test results shall be evaluated and reported in accordance with the procedures specified for each test. Suggested formats for reporting test results are shown in Figures A.6 and A.7. Alternative formats for accurately reporting data shall also be acceptable.

8.2 Test apparatus and general instructions

8.2.1

Note: *See Figure 12.*

The procedure for standardizing the water supply system for testing flushometer valve urinals shall be as follows:

a) Set the static pressure at gauge 7 by adjusting pressure regulator 4 to 170 kPa (25 psi).
b) Attach the flushometer valve, with matching supply stop in the fully open position, at the discharge end of the water supply system and leave the flushometer valve discharge outlet open to the atmosphere.
c) Activate the flushometer valve and establish a peak flow rate, by adjusting valve 8, of 38 ± 2 L/min (10 ± 0.5 gpm). If the flushometer valve specified by the manufacturer is not capable of attaining the minimum flow rate, adjust the flushometer to its fully open position.
d) Connect the flushometer valve to the test urinal.
e) Record the peak flowing pressure at gauge 10 and the peak flow rate through the flushometer valve while it is attached to the urinal. While conducting water consumption testing at 175 and 550 kPa (25 and 80 psi), maintain the peak flow rate at ± 4 L/min (± 1 gpm) by adjusting valve 9 as necessary.

The temperature of the water shall be 18 to 27 °C (65 to 80 °F).

8.2.2

The urinal shall be plumb, the trap and outlet shall be clear, and, if applicable, the urinal shall be filled to the weir level before each test run. The urinal shall discharge to atmosphere.

8.2.3

At the applicable test pressure(s) specified in Table 6, the supply stop shall be adjusted in accordance with the manufacturer's instructions and specifications. In the absence of such instructions and specifications, the stop shall be adjusted as specified in Clause 8.2.1 b).

8.2.4

The flushing device shall be activated in a normal manner.

8.2.5

Test results shall be evaluated and reported in accordance with the applicable procedures specified in Clauses 8.3 to 8.6.

8.3 Trap seal depth determination test

Note: *See Figure 13. Although Figure 13 depicts a water closet, it is also applicable to urinals.*

8.3.1 Apparatus

Figure 13 shows an acceptable apparatus for determining trap seal depth. Another apparatus, e.g., a steel tape measure or a steel rule with a perpendicular horizontal element secured to one end, may also be used.

8.3.2 Procedure

The trap seal depth determination test shall be conducted as follows:

a) Lower the probe until the horizontal element is resting against the trap dip.

b) Record the corresponding scale value as h_1.
c) Disengage the horizontal element from the probe.
d) Elevate the probe completely out of the water.
e) Confirm that the urinal is at full trap seal depth by slowly pouring water into the well until a slight overflow is detected dripping from the urinal outlet.
f) When the dripping ceases, adjust the probe so that its point is exactly at the water surface.
g) Record the corresponding scale value as h_2.
h) Calculate the full trap seal depth, H_f, by subtracting h_1 from h_2 ($H_f = h_2 - h_1$).

8.3.3 Report

The full trap seal depth, H_f, shall be reported.

8.3.4 Performance

The full trap seal depth, H_f, shall be at least 51 mm (2.0 in).

8.4 Surface wash test

8.4.1 Test medium

The test medium shall be an ink line applied using a wet-erase fine-point transparency marker. The colour of the ink shall contrast with that of the urinal.

8.4.2 Procedure

The surface wash test shall be conducted as follows:
a) Scrub the flushing surface of the urinal clean with a mild liquid dishwashing detergent.
b) Rinse and dry the flushing surface.
c) On the back wall of the urinal, draw a continuous horizontal ink line at one-third the distance measured from below the lowest point of the flushing rim to the top of the water surface. This line shall extend to 50% of the distance along the interior sidewall. Where the interior sidewall is not defined by a reverse draft moulding, a reference line shall be drawn from the front of the spreader down to the top rear of the urinal lip to the point where it merges with the shield.
d) Activate the flushing device.
e) When the trap refill cycle is complete, measure and record the length of any ink line segments remaining on the flushing surface.

Items a) to e) complete one test run. These steps shall be repeated until three sets of data are obtained.

8.4.3 Report

The lengths and locations of any ink line segments remaining on the flushing surface after each flush shall be reported in a format similar to that of Figure A.6.

8.4.4 Performance

The total length of the ink line segments remaining on the flushing surface after each flush shall not exceed 25 mm (1.0 in) when averaged over three test runs. No individual segment shall be longer than 13 mm (0.5 in).

8.5 Dye test

8.5.1 Test medium and apparatus

The dye test medium shall be 5 g of methylene blue powder or brilliant polar blue dye. Two clean containers to mix the test and control solutions shall be used.

8.5.2 Procedure

The dye test shall be conducted as follows:

a) Dissolve 5 g (0.18 oz) of methylene blue powder or brilliant polar blue dye in 1 L (34 fl-oz) of water and mix the solution thoroughly in a clean container. This shall be the test solution.
b) Clean the urinal, flush it once, and allow it to complete its flush cycle.
c) Add 30 mL (1.0 fl-oz) of the test solution to the water in the urinal well and mix it thoroughly.
d) Remove 10 mL (0.3 fl-oz) of the test solution and water mix from the urinal well and dissolve it in 1000 mL (34 fl-oz), or 170 mL (5.7 fl-oz) for high-efficiency urinals, of clean water in the control solution container (i.e., use a dilution ratio of 100:1, or 17:1 for high-efficiency urinals). This shall be the control solution. Set aside a sample of the control solution in a test tube or comparator vial for all three test runs.
e) Flush the urinal and clean it to ensure that all traces of the dye have been removed.
f) Add 30 mL (1.0 fl-oz) of the test solution to the water in the urinal well and mix thoroughly.
g) Flush the urinal again and allow it to complete its flush cycle.
h) Fill a test tube or the comparator vial with water from the urinal well (i.e., the diluted solution) and compare it against the control solution.
i) Record the colour of the diluted solution sample relative to the control solution (i.e., lighter than, darker than, or the same).

Items e) to i) complete one test run. These steps shall be repeated until three sets of data are obtained.

8.5.3 Report

The colour of the diluted solution sample shall be compared to the colour of the control solution. The test report shall indicate whether the diluted solution sample is lighter than, darker than, or the same colour as the control solution.

8.5.4 Performance

The colour of the diluted solution sample shall be lighter than or equal to that of the control sample.

8.6 Water consumption test

8.6.1 Apparatus

A receiving vessel, calibrated by volume in increments not exceeding 0.25 L (0.07 gal) or placed on a load cell with a readout in increments not exceeding 0.25 L (0.07 gal), or any other apparatus capable of measuring volumes to within 0.25 L (0.07 gal) shall be used.

8.6.2 Procedure

The water consumption test shall be conducted as follows:

a) Record the static pressure (see Table 6).
b) Activate the flushing device.
c) Record the volume received in the vessel (main flush volume) when the main flush is completed, i.e., when the trailing flow that occurs at the end of the main discharge ceases.

d) Record the total flush volume after cessation of flow of the excess trap seal restoration (afterflow) subsequent to the first observation.
e) Round down the total flush volume to the nearest 0.25 L (0.07 gal).
f) The amount of excess trap refill (afterflow) shall be determined by subtracting the main flush volume from the total flush volume.

Items a) to f) complete one test run. These steps shall be repeated until three sets of data are obtained for both test pressures specified in Table 6.

8.6.3 Report

Static pressure, main and total flush volume, and afterflow (if any) shall be reported in a format similar to that of Figure A.7. The report shall also indicate whether the trap seal was restored.

8.6.4 Performance

The average water consumption of urinals over the two pressures specified in Table 6, based on the average of the individual values from the three test sets, shall not exceed 1.9 Lpf (0.5 gpf) for high-efficiency urinals or 3.8 Lpf (1.0 gpf) for low-consumption urinals.

8.7 Tests for non-water-consuming urinals

Non-water-consuming urinals shall be tested in accordance with ASME A112.19.19.

9 Markings, packaging, and installation instructions and other literature

9.1 General

9.1.1

Plumbing fixtures complying with this Standard 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 9.2 to 9.5, as applicable.

9.1.2

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

9.1.3

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

9.2 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.

9.3 Additional markings for water closets and urinals

9.3.1 Close-coupled water closets

The model number shall be marked on both the bowl and the tank of close-coupled water closets.

9.3.2 Water consumption

Water closets and urinals shall be marked to identify their average water consumption, expressed in litres and gallons per flush, as follows:

a) 1.9 Lpf (0.5 gpf) or the actual tested water consumption, if lower, for high-efficiency urinals;
b) 3.8 Lpf (1.0 gpf) or the actual tested water consumption, if lower, for low-consumption urinals;
c) 4.8 Lpf (1.28 gpf) or the actual tested water consumption, if lower, for high-efficiency water closets;
d) 6.0 Lpf (1.6 gpf) or the actual tested water consumption, if lower, for low-consumption water closets; and
e) Flushometer bowls, urinals, and bowls for close-coupled toilets shall be marked accordingly as indicated in Items (a) to (d). When also tested to be used with tanks or valves with lower consumption levels, the option of including a dual consumption marking or a consumption range may be used.

The litre or gallon value may be stated first, at the manufacturer's option.

9.3.3 Water level mark in gravity flush tank water closets

Gravity flush tanks shall be marked with a water level mark or with the information necessary to determine the water level in the tank needed to deliver the intended flush volume. This mark shall be applied to the ceramic body of the tank, the tank liner, or the flush valve overflow tube.

The vertical distance between the water level mark and the lowest point of the tank overflow channel shall not exceed 38 mm (1.5 in).

9.3.4 Water closet tank repair parts

Water closet tanks shall have a mark in accordance with Clauses 9.1.2 and 9.1.3 indicating at least the following:

a) the telephone number of a service department from which end-users can obtain replacement parts;
b) the serial or part number of the flush valve seal; and
c) information on procuring replacement parts for maintaining the original flush volume.

9.4 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".*

9.5 Packaging

9.5.1 General

Packaging 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.

9.5.2 Water closets and urinals

In addition to the requirements in Clause 9.5.1, packaging for water closets and urinals shall be marked with the average water consumption in accordance with Clause 9.3.2.

9.6 Installation instructions and other literature

9.6.1 General

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.

9.6.2 Water closets

If the manufacturer's recommended minimum pressure is greater than the applicable value specified in Table 5, the packaging and installation instructions and other literature shall specify the recommended minimum pressure.

9.6.3 Urinals

If the manufacturer's recommended minimum pressure is greater than the applicable value specified in Table 6, the manufacturer's packaging and installation instructions and other literature shall be marked with the recommended minimum pressure.

9.6.4 Field-installed flange kits

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

Table 1
Permitted defects in water closets and urinals
(See Clauses 3.1, 6.3.2.1, 6.3.2.2, 6.4.1, and 6.4.2.)

Location	Defect	Maximum permitted
Water closet bowl	Warpage	
	Foot/wall, bow, or arch	3.0 mm (0.13 in)
	Rocker	1.5 mm (0.06 in)
	Top — both directions	21 mm/m (0.25 in/ft)
	Surface finish	
	Wavy finish	2600 mm^2 (4.0 in^2)
	Pits, blisters, and pinholes	Total 5
	Bubbles, specks,* and spots	5 in one pottery square; total 10
Water closet tank, water closet tank lid, or urinal	Warpage	Not noticeably warped
	Surface finish	

(Continued)

Table 1 (Concluded)

Location	Defect	Maximum permitted
	Wavy finish	2600 mm² (4.0 in²)
	Pits, blisters, and pinholes	Total 5
	Bubbles, specks,* and spots	5 in one pottery square; total 10

** Specks less than 0.3 mm (0.01 in) in their maximum dimension shall not be counted unless numerous enough to form a discoloration.*

Table 2
Permitted defects in lavatories and drinking fountains
(See Clauses 3.1, 6.3.2.2, 6.4.1, and 6.4.2.)

Location	Defect	Maximum permitted
—	Warpage	Warpage of flat slab out of horizontal plane shall not exceed 21 mm/m (0.25 in/ft) on all sizes Warpage on backs of lavatories that are attached to the wall shall not exceed 3 mm (0.13 in)
	Warpage of self-rimming lavatories	3 mm (0.13 in) at any point
Service space and top of slab	Spots, blisters, and pinholes	≤ 1 in one pottery square; total ≤ 2
Inside of bowl and front of apron	Bubbles and specks*	≤ 1 in one pottery square; total ≤ 4
Face of integral back and side	Spots, blisters, and pinholes	Not more than 1 on back or on either side; total ≤ 3

** Specks less than 0.3 mm (0.01 in) in their maximum dimension shall not be counted unless numerous enough to form a discoloration.*

Table 3
Integral trap diameter requirements for urinals, mm (in)
(See Clause 4.7.1.)

Type of urinal	Minimum diameter of ball
Stall	—
Blowout	19 (0.75)
Siphon jet	23 (0.88)
Washout	23 (0.88)

Table 4
Minimum dimensions for urinals, mm (in)
(See Clause 4.7.2.)

	A	B	C		D	
			Interior depth		Projection	
Type of urinal	Interior width	Interior height	Without shields	With shields	Regular	Extended lip
Wall-mounted	216 (8.5)	191 (7.5)	76 (3.0)	178 (7.0)	152 (6.0)	203 (8.0)
Stall	305 (12.0)	813 (32.0)	76 (3.0)	178 (7.0)	152 (6.0)	203 (8.0)

Note: *Interior width and interior depth shall be measured halfway between the top and bottom of the interior opening.*

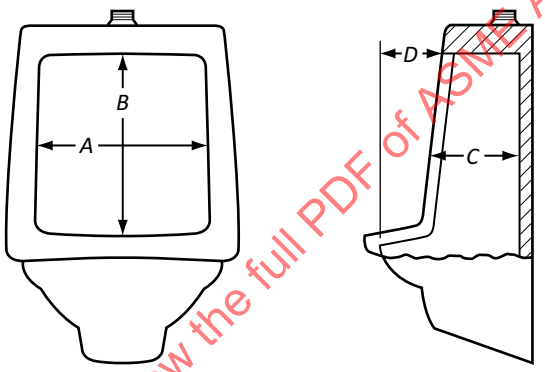


Table 5
Static test pressures for water closets, kPa (psi)
(See Clauses 7.1.1 – 7.1.4, 7.3.3, 7.3.5, and 9.6.2.)

Test sequence (Note 1)	Clause	Test	Gravity flush tank, electro-hydraulic, and flushometer tank water closets	Flushometer valve water closets	
				Siphonic bowl	Blowout bowl
1	7.2	Trap seal depth determination	140 (20)	240 (35)	310 (45)
2	7.4	Trap seal restoration	140 (20)	240 (35)	310 (45)
3	7.3	Water consumption	550 (80), 350 (50), and 140 (20)	550 (80) and 240 (35)	550 (80) and 310 (45)
4	7.5	Granule and ball	140 (20)	240 (35)	310 (45)
5	7.6	Surface wash	140 (20)	240 (35)	310 (45)
6	7.7	Drain line transport characterization	140 (20)	240 (35)	310 (45)
7	7.8	Overflow for gravity flush tanks	550 (80)	—	—
8	7.9	Waste extraction test	350 (50)	350 (50)	350 (50)
9	7.10	Consistent water level	140 (20) 410 (60), and 550 (80)	—	—
10	7.11	Fill valve shut-off integrity	140 (20), and 550 (80)	—	—

(Continued)

Table 5 (Concluded)

Test sequence (Note 1)	Clause	Test	Gravity flush tank, electro-hydraulic, and flushometer tank water closets	Flushometer valve water closets	
				Siphonic bowl	Blowout bowl
11	7.12*	Adjustability test with original equipment	140 (20), and 550 (80)	—	—
12	7.13*	Adjustability test with after-market seals	140 (20), and 550 (80)	—	—

* *Applicable to HETs only.*

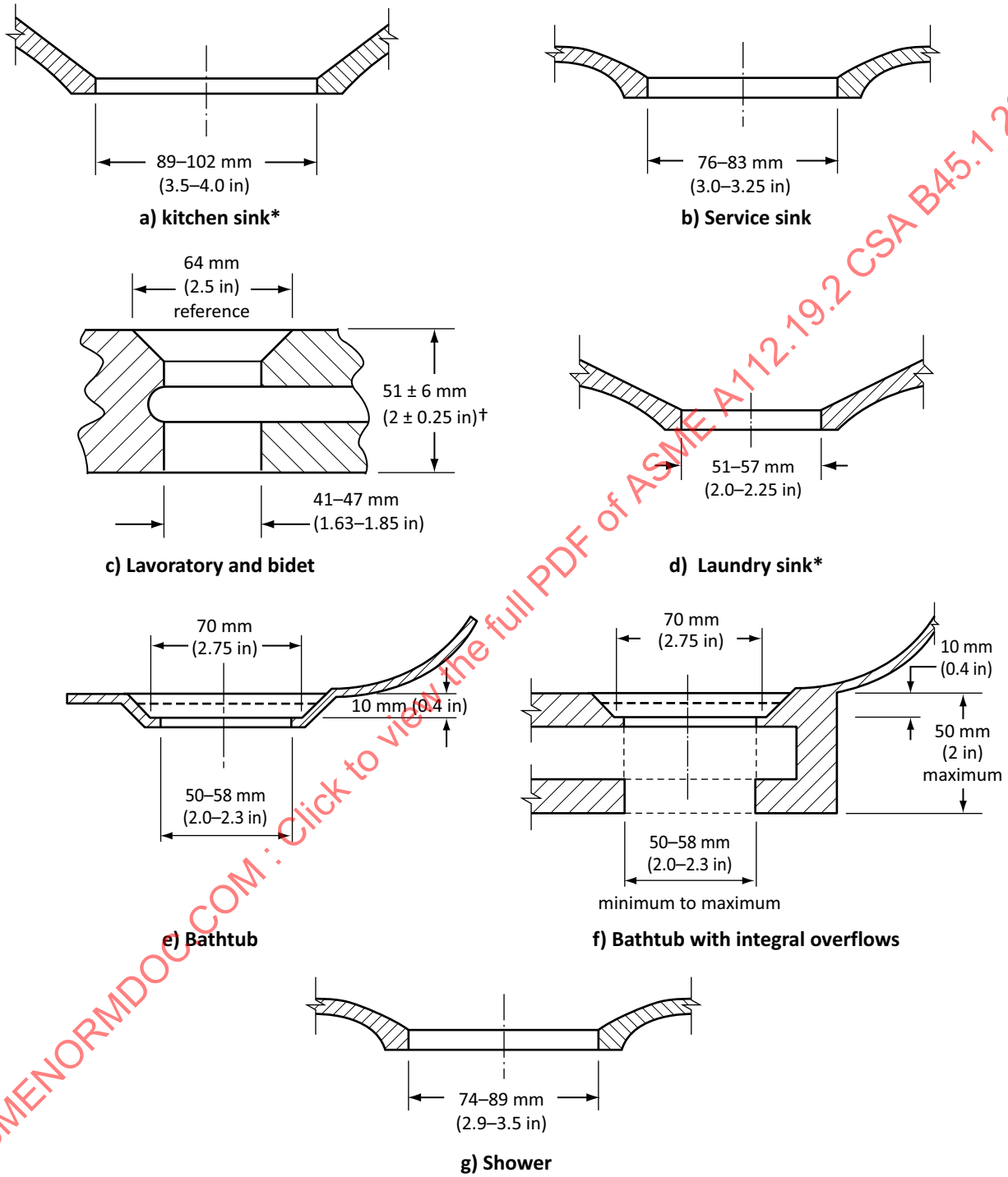
Notes:

1) *Tests shall be performed in the sequence specified in this Table.*
2) *Adjustments to tank trim components shall be permitted only when changes to test pressures are indicated. No adjustments shall be allowed between tests employing like pressures.*
3) *For water closets with alternative materials in the trap, the auger test of Clause 6.10 shall be conducted before the tests in this Table.*
4) *Where a higher minimum operating pressure is specified for a fixture by a manufacturer, the specified pressure shall be substituted for the minimum test pressure specified in this Table. The manufacturer's specified operating pressure shall be indicated in its product literature and on its product packaging.*
5) *Gravity flush tank and flushometer tank water closet types include siphonic, pressure-assist (other than flushometer valve models), and washout bowl.*
6) *The manufacturer's safe-operating pressure recommendations shall be followed for all water closets. The maximum static water pressure shall be not more than* 550 kPa *(80 psi) and shall be not less than*
   a) *140 kPa (20 psi) for low-consumption gravity flush tank and flushometer tank water closets;*
   b) *240 kPa (35 psi) for low-consumption flushometer-valve-activated water closets; and*
   c) *310 kPa (45 psi) for blowout flushometer-valve-activated water closets.*
7) *Pressures higher than 550 kPa (80 psi) are considered unsafe.*

Table 6
Static test pressures for urinals, kPa (psi)
(See Clauses 8.1.2, 8.2.3, 8.6.2, 8.6.4, and 9.6.3.)

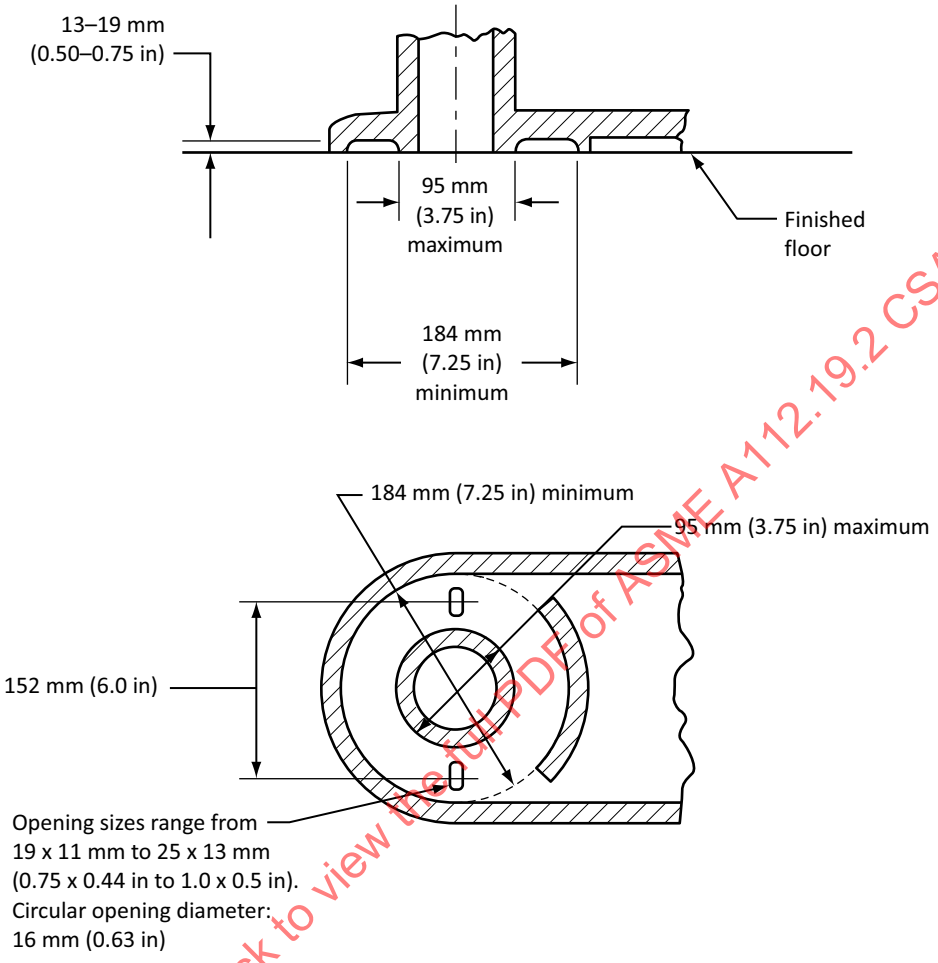
Clause	Test	Pressure
8.4	Surface wash	175 (25)
8.5	Dye	175 (25)
8.6	Water consumption	175 (25) and 550 (80)

Figure 1
Waste outlet dimensions
(See Clause 4.3.1.2.)



* *Waste outlets for bar 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).*
† *Dimension applies only to lavatories with overflow.*

Figure 2
Outlet dimensions for floor-mounted bottom-outlet water closets
(See Clause 4.6.1.)

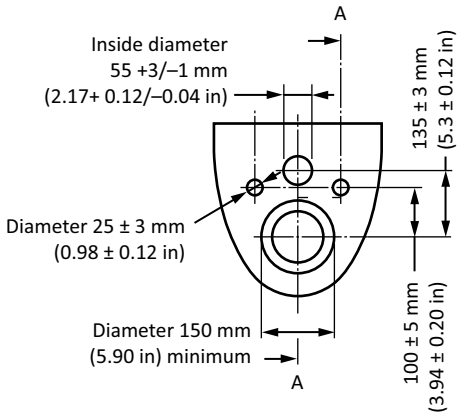


Note: *This Figure is not intended to restrict the design of the water closet bowl base, provided that dimensions critical to interchangeability are maintained.*

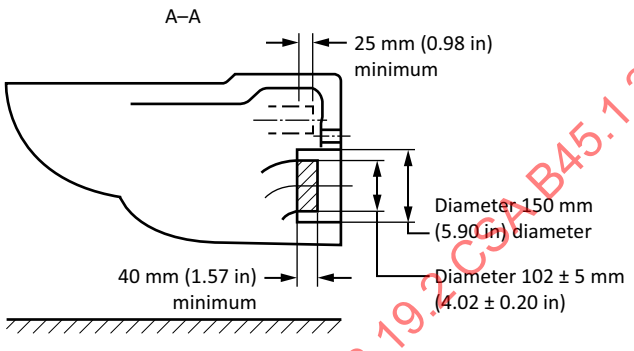
Δ

Figure 3
Outlet dimensions for rear-outlet and rear-spigot-outlet water closet bowls

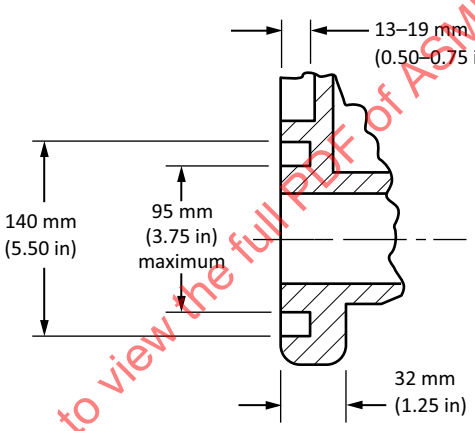
(See Clause 4.6.1.)



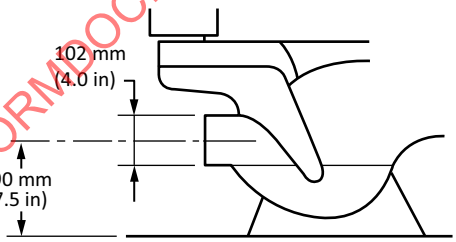
a) **Wall-mounted rear-outlet washdown water closet bowl**



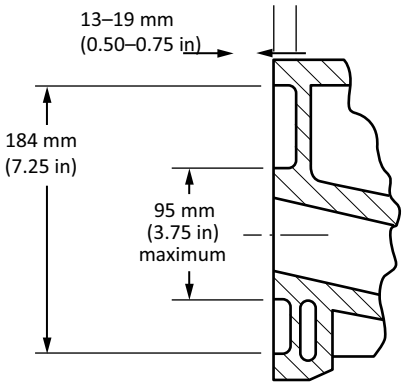
b) **Wall-mounted rear-outlet washdown water closet bowl**



c) **Wall-mounted rear-outlet non-washdown water closet bowl**

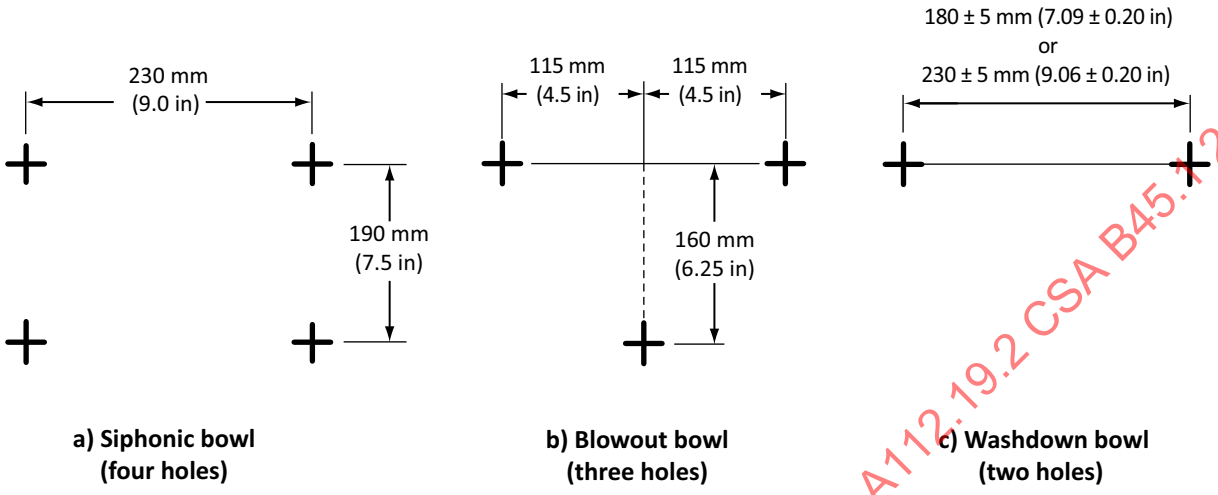


d) **Floor-mounted rear-spigot-outlet water closet bowl**



e) **Floor-mounted rear-outlet water closet bowl**

Figure 4
Bolt hole spacing for wall-mounted water closet bowls
(See Clause 4.6.3.)



a) Siphonic bowl (four holes)

b) Blowout bowl (three holes)

c) Washdown bowl (two holes)