



**ASME A112.19.2-2008/  
CSA B45.1-08**

# **Ceramic plumbing fixtures**



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# Preface

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

This Standard replaces

- (a) CAN/CSA-B45.1-02, *Ceramic Plumbing Fixtures*;
- (b) ASME A112.19.2-2003, *Vitreous China Plumbing Fixtures and Hydraulic requirements for Water Closets and Urinals*; and
- (c) ASME A112.19.9M-1991 (R2002), *Non-vitreous Ceramic Plumbing Fixtures*.

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 Water Management Products, Materials, and Systems. 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 August 1, 2008, and will be submitted to the Standards Council of Canada for approval as a National Standard of Canada.

August 2008

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# ASME A112.19.2-2008/CSA B45.1-08

## ***Ceramic plumbing fixtures***

### **0 Introduction**

#### **0.1**

This harmonized Standard was developed in response to an industry request for a Standard for evaluation of plumbing fixtures that would be acceptable for use in both Canada and the United States. Harmonized Standards for plumbing fixtures made of other materials are also available or under development.

#### **0.2**

The concept of harmonization for plumbing fixtures arose in the early 1990s, when a free trade agreement between Canada, Mexico, and the United States began to be discussed. Standards development organizations (SDOs) were at the forefront of these discussions and an opportunity soon arose for those SDOs involved in developing requirements for plumbing products to establish a process for harmonization. However, the effort to develop a trinational Standard stalled until 2001, when ASME and CSA decided to develop a binational Standard for plumbing fittings.

#### **0.3**

Harmonization activities for plumbing fixtures Standards were undertaken in 2004 by a Joint Harmonization Task Group (JHTG) on Plumbing Fixtures, in which the ASME and CSA plumbing fixtures committees were equally represented. The responsibility for procedural matters and final approval of technical content was assumed by technical committees at higher levels within each SDO.

### **1 Scope**

#### **1.1**

This Standard covers 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) laboratory sinks;
  - (ii) laundry sinks;
  - (iii) service sinks; and
  - (iv) 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 (Canadian Standards Association)**

CAN/CSA-B125.3-05

*Plumbing fittings*

CAN/CSA-B651-04

*Accessible design for the built environment*

CAN/CSA-B1800-06, *Thermoplastic nonpressure piping compendium*

CAN/CSA-B181.1-06

*Acrylonitrile-butadiene-styrene (ABS) drain, waste, and vent pipe and pipe fittings*

CAN/CSA-B181.2-06

*Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) drain, waste, and vent pipe and pipe fittings*

C22.2 No. 0.15-01 (R2006)

*Adhesive labels*

### **ASME (American Society of Mechanical Engineers)**

A112.6.1M-1997

*Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use*

A112.6.2-2001

*Framing-Affixed Supports for Off-the-Floor Water Closets with Concealed Tanks*

A112.19.5-2005

*Trim for Water-Closet Bowls, Tanks, and Urinals*

A112.19.12-2006

*Wall Mounted, Pedestal Mounted, Adjustable, Elevating, Tilting, and Pivoting Lavatory, Sink and Shampoo Bowl Carrier Systems and Drain Waste Systems*

A112.19.14-2006

*Six-Liter Water Closets Equipped with a Dual Flushing Device*

A112.19.19-2006

*Vitreous China Nonwater Urinals*

**ASME/CSA (American Society of Mechanical Engineers/Canadian Standards Association)**

ASME A112.18.1-2005/CAN/CSA-B125.1-05

*Plumbing supply fittings*

ASME A112.18.2-2005/CAN/CSA-B125.2-05

*Plumbing waste fittings*

**ASSE (American Society of Sanitary Engineering)**

1002-1999

*Performance Requirements for Anti-Siphon Fill Valves (Ballcocks) for Gravity Water Closet Flush Tanks*

1037-1986

*Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures*

**ASTM International (American Society for Testing and Materials)**

D 3311-06a

*Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns*

**IAPMO/ANSI (International Association of Plumbing and Mechanical Officials/American National Standards Institute)**

Z124.4-2006

*Plastic Water Closet Bowls and Tanks*

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

A117.1-2003

*Accessible and Usable Buildings and Facilities*

**UL (Underwriters Laboratories Inc.)**

969 (1995)

*Standard for Marking and Labeling Systems*

## **3 Definitions and abbreviations**

### **3.1 Definitions**

The following definitions 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 fixture 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).

**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 water closet 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/CAN/CSA-B125.1 and CAN/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 tank** — 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 flush tank 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.

**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 CAN/CSA-B125.3 and ASSE 1037).

**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 tank.

**Lavatory** — a washbowl or basin.

**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.



**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).

**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 between the weir and the trap dip or, 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 CAN/CSA-B125.3 or ASME A112.19.5).

**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.

**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.

**High-efficiency water closet (high-efficiency toilet)** — a water closet with an average water consumption of 4.8 Lpf (1.28 gpf) when tested in accordance with this Standard.

**Note:** *Dual-flush water closets with a maximum average water consumption of 4.8 Lpf (1.28 gpf) when tested in accordance with ASME A112.19.14 are also considered high-efficiency water closets.*



**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-saving water closet** — a water closet with an average water consumption greater than 6.0 Lpf (1.6 gpf) but not exceeding 13.2 Lpf (3.5 gpf) 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 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).

### 4.1.2 Tolerances

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

In this Standard, dimensions specified as “minimum” or “maximum” shall not be reduced below the specified minimum or increased above the specified maximum by application of a tolerance. If a dimensional range is specified and the word “minimum” or “maximum” does not appear, the upper and lower limits shall not be considered critical and the appropriate tolerance shall apply.

## 4.2 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:

(i) water closets:

- (1) the inside, back, and underside of the water closet 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 Waste fitting 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/CAN/CSA-B125.2.

### **4.3.2 Overflows**

#### **4.3.2.1 Provision and positioning**

Overflows in lavatories, sinks, and bidets 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.

#### **4.3.2.2 Cleaning**

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

## **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 ceramic plumbing fixtures**

### **4.5.1 Glazing**

The following surfaces of non-vitreous 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 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 not leak when tested in accordance with [Clause 6.9](#) and 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 CAN/CSA-B125.3 or ASME A112.19.5.

#### 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 1/2, 3/4, 1-1/4, or 1-1/2. Other spud dimensions shall be as specified in CAN/CSA-B125.3 or ASME A112.19.5.

### 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/CAN/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/CAN/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.

### 4.8.2 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 CAN/CSA-B125.3 or ASME A112.19.5.



## 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 continuously raised flange or bead at least 8 mm (0.3 in) above the rim. The raised 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](#). Fixtures using field-installed flanges shall be marked in accordance with [Clause 9.4](#) and shall include all necessary parts and fasteners.

## 4.10 Additional requirements for drinking fountains

### 4.10.1

Drinking fountains shall

- (a) include a supply fitting, which shall be at least 25 mm (1.0 in) above the flood level rim; and
- (b) comply with the dimensions shown in [Figure 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/CAN/CSA-B125.1, including the toxicity requirements.

## 4.11 Accessible design fixtures

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

# 5 Flushing devices

## 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 CAN/CSA-B125.3 or ASSE 1002 and a flush valve complying with CAN/CSA-B125.3 or ASME A112.19.5. 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, auxiliary spill openings 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.

## 5.3 Pressurized flushing devices

### 5.3.1 General

Pressurized flushing devices shall comply with CAN/CSA-B125.3 or ASSE 1037. 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, auxiliary spill openings 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 IAPMO/ANSI Z124.4.

## 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, the pump motor and its electronics shall be installed in a completely sealed chamber without the use of seals or O-rings.

### 5.5.2 Jet hose

When provided, a pump's jet hose shall be able to withstand a pressure of  $172 \pm 7$  kPa ( $25 \pm 1$  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 Absorption test

#### 6.1.1 General

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<sup>2</sup> (5.0 in<sup>2</sup>) 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 absorption test shall be conducted as follows:

- (a) Place the weighed fragments in distilled water at room temperature in a suitable vessel, 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, allow 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 by dividing the difference between the original weight of the dry fragment and the final weight, after immersion in the boiling water,  $W_f$ , by the original weight, and multiplying by 100, i.e.,

$$\% \text{ absorption} = [(W_f - W_o)/W_o] \times 100$$

where

$W_f$  = final weight of fragment after immersion in 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 fragment of a fixture with a glazed surface of approximately 3200 mm<sup>2</sup> (5.0 in<sup>2</sup>) and not more than 16 mm (0.63 in) thick.

### 6.2.2 Procedure

The crazing test shall be conducted as follows:

- Immerse the specimen in a solution of equal portions by weight of anhydrous calcium chloride and water.
- Maintain the solution at a temperature of  $110 \pm 3$  °C ( $230 \pm 5$  °F) for 90 min.
- Remove the specimen and immediately immerse it in an ice water bath at  $2.5 \pm 0.5$  °C ( $37 \pm 1$  °F) until chilled.
- Remove the specimen from the bath and immerse it for 12 h in a 1% solution of methylene blue dye at room temperature.
- 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 inspecting 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, the following shall be cause for rejection:

- defects that can affect use or serviceability, e.g., sharp and jagged edges, burrs, and cracks;
- 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.

If a feeler gauge of a thickness equal to the total warpage allowed in [Table 1](#) or [2](#), as applicable, will not slide under the specimen unless forced, the specimen shall be deemed to comply with the warpage requirements of [Table 1](#) or [2](#), as applicable.

If the specimen rocks on two opposite corners, the horizontal plane shall be determined by placing one feeler gauge, as thick as the total warpage allowed, under a corner that does not touch the flat and level surface and then forcing the specimen down on this gauge. If a second feeler gauge of the same thickness will not slide under the specimen at any other point, the specimen shall be deemed to comply with the warpage requirements of [Table 1](#) or [2](#), as applicable.

### 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 flange test

### 6.5.1 Procedure

The flange fixture seal test shall be conducted as follows:

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

### 6.5.2 Performance

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

## 6.6 Overflow test

### 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/CAN/CSA-B125.2.
- (b) Supply water to the specimen at the maximum flow rate specified in ASME A112.18.1/CAN/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 wall-mounted plumbing fixtures**

### **6.7.1 All wall-mounted fixtures**

#### **6.7.1.1 Set-up**

Wall-mounted 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 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 placed across the water closet seat and centred 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 lavatories**

A vertical load of 1.1 kN (250 lbf) shall be applied on the top surface on the front of the lavatory rim.

### **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 consist of a

- (a) 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; and



- (b) 76 mm (3.0 in) diameter load-distribution disc that is covered by 13 mm (0.5 in) thick sponge rubber or another suitable soft material between the disc and the surface being loaded and is capable of applying and removing a 1.3 kN (292 lbf) load at the centre of the specimen bottom.  
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) At the end of the period specified in Item (b), 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 100 kPa (15 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 bowl and through the trap. If required by the manufacturer, use a drain snake.
- (b) Rotate the auger five times for each test cycle.
- (c) Before each test cycle, adjust the water in the bowl to full trap seal depth.
- (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 7.9, and 8.3 to 8.6](#) are performed.

**Note:** A Macroscope 7 Model WH 3-6 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  $7 \pm 1$  °C ( $45 \pm 2$ °F).
- (b) Place the tank in a chamber with the following ambient temperature conditions:
  - (i) a dry bulb temperature of  $27 \pm 1$  °C ( $80 \pm 2$ °F);



- (ii) a wet bulb temperature of  $21 \pm 1$  °C ( $70 \pm 2$  °F);
- (iii) a relative humidity of  $63 \pm 3\%$ ; 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 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).

#### 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  $140 \pm 7$  kPa ( $20 \pm 1$  psi).
- (b) With stop valve 10 open, adjust valve 6 to establish a flow of  $11.4 \pm 1$  L/min ( $3.0 \pm 0.25$  gpm) at  $55 \pm 4$  kPa ( $8 \pm 0.5$  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)  $95 \pm 4$  L/min ( $25 \pm 1$  gpm) for flushometer valve water closets; and
  - (ii)  $133 \pm 4$  L/min ( $35 \pm 1$  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  $\pm 4$  L/min ( $\pm 1$  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.6](#). 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 Trap seal restoration test

### 7.3.1 Apparatus

The test apparatus shall be as specified in [Clause 7.2.1](#).

### 7.3.2 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.

### 7.3.3 Report

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

### 7.3.4 Performance

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

## 7.4 Water consumption test

### 7.4.1 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 7.3.2](#), omitting the addition of water to the bowl specified in [Clause 7.2.2\(e\)](#).

### 7.4.2 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.

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



### 7.4.3 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 7.3](#).

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](#).

### 7.4.4 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.

### 7.4.5 Performance

The average of the total flush volumes obtained in [Clause 7.4.3\(e\)](#) over the range of pressures specified in [Table 5](#) shall not exceed

- (a) 4.8 Lpf (1.28 gpf) for high-efficiency water closets;
- (b) 6.0 Lpf (1.6 gpf) for low-consumption water closets; and
- (c) 13.2 Lpf (3.5 gpf) for water-saving water closets.

## 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:  $65 \pm 1$  g ( $2.3 \pm 0.04$  oz);
  - (ii) diameter:  $4.2 \pm 0.4$  mm ( $0.16 \pm 0.02$  in);
  - (iii) thickness:  $2.7 \pm 0.3$  mm ( $0.11 \pm 0.01$  in); and
  - (iv) density:  $951 \pm 10$  kg/m<sup>3</sup> ( $59.4 \pm 0.6$  lb/ft<sup>3</sup>); and
- (b) 100 nylon balls with the following characteristics:
  - (i) weight:  $15.5 \pm 0.5$  g ( $0.545 \pm 0.015$  oz);
  - (ii) diameter:  $6.35 \pm 0.25$  mm ( $0.25 \pm 0.01$  in); and
  - (iii) density: of  $1170 \pm 20$  kg/m<sup>3</sup> ( $73 \pm 1$  lb/ft<sup>3</sup>).

### 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 in accordance with [Clause 7.3.2](#).

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 surface wash test shall be conducted as follows:

- Scrub the flushing surface of the test bowl clean with a mild liquid dishwashing detergent.
- Rinse and dry the flushing surface.
- 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](#).
- Trip the actuator, hold for a maximum of 1 s, and release.
- Observe the line during and after the flush.
- 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 (f) 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 Mixed media test

### 7.7.1 Test media

The test media shall consist of

- white synthetic open-cell polyurethane sponges measuring  $20 \times 20 \pm 1 \times 28 \pm 3$  mm ( $0.8 \times 0.8 \pm 0.04 \times 1.1 \pm 0.12$  in) and with a density of  $17.5 \pm 1.7$  kg/m<sup>3</sup> ( $1.1 \pm 0.1$  lb/ft<sup>3</sup>) when new and dry; and
- 15 lb Kraft anti-tarnish paper measuring  $190 \pm 6 \times 150 \pm 6$  mm ( $7.5 \pm 0.25 \times 6 \pm 0.25$  in), with 486 sheets to the ream.

### 7.7.2 Procedure

The mixed media test shall be conducted as follows:

- Condition 20 new sponges by soaking them in water for at least 10 min.
- Place the 20 sponges in the test bowl and squeeze them under water to remove air and to saturate them.
- Ensure that the test bowl has a full trap seal depth.



- (d) Crinkle a sheet of Kraft paper to form a ball approximately 25 mm (1.0 in) in diameter.
- (e) Repeat Item (d) to form eight paper balls for each test run.
- (f) Before each test run, hold each of the eight paper balls under water in a separate container until saturated.
- (g) One by one, place the eight saturated paper balls into the bowl so that they are distributed evenly among the sponges.
- (h) Trip the actuator, hold for a maximum of 1 s, and release.
- (i) After the flush cycle is completed, record the number of sponges and paper balls discharged (flushed out) from the water closet.
- (j) Repeat Item (h) to remove any remaining sponges and paper balls.

Items (b) to (j) complete one test run. These steps shall be repeated until four sets of data are obtained. The least favourable result shall be discarded and the three remaining results averaged. New sponges shall be used after four test runs.

### 7.7.3 Report

The number of sponges and paper balls flushed out from the water closet in each of the four test flushes shall be reported in a format similar to that of [Figure A.4](#).

### 7.7.4 Performance

Twenty-two mixed media (sponges and paper balls), averaged in accordance with [Clause 7.7.2](#), shall be flushed out of the water closet on the initial flush. The remaining media, if any, shall be flushed out on the second flush.

#### Notes:

- (1) A suggested supplier of sponges is FoamWorks Inc., P.O. Box 5208, Cleveland, Tennessee 37320, USA (tel. 423-559-0509).
- (2) A suggested supplier of Kraft paper is R.P. Andrews Paper Products, P.O. Box 60061, Northampton, Massachusetts 01062, USA (tel. 413-586-6442).

## 7.8 Drain line transport characterization test

### 7.8.1 Test medium

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

- (a) weight:  $298 \pm 10$  g ( $10.5 \pm 0.35$  oz);
- (b) diameter:  $19 \pm 0.4$  mm ( $0.75 \pm 0.015$  in); and
- (c) density:  $833 \pm 16$  kg/m<sup>3</sup> ( $52 \pm 1$  lb/ft<sup>3</sup>).

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

### 7.8.2 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 drain shall be extended up from the floor level 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.



### 7.8.3 Procedure

The drain line transport characterization test shall be conducted as follows:

- Prepare the test assembly in accordance with the applicable requirements of [Clause 7.1](#) (including the test pressures specified in [Clause 7.1.1\(d\)](#)).
- Place 100 balls in the water closet bowl.
- Trip the actuator, hold for a maximum of 1 s, and release.
- Record the distance travelled by each ball in accordance with [Clause 7.8.4](#).
- 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.

### 7.8.4 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:

- Record the number of balls in each of the eight distance categories specified in this Clause for each of the three test runs.
- Combine the test run results to determine the total number of balls in each of the eight distance categories.
- 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.5](#).
- Calculate the total carry of balls by adding the eight weighted carry distances.
- Calculate the average carry distance by dividing the total carry by the total number of balls ( $3 \times 100$  balls = 300 balls).

The test results shall be reported in a format similar to that of [Figure A.5](#). See [Figure A.6](#) for sample calculation data.

### 7.8.5 Performance

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

## 7.9 Overflow test for gravity flush tanks

### 7.9.1 Apparatus

The test apparatus shall be as shown in [Figure 11](#).

### 7.9.2 Procedure

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

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

### 7.9.3 Report

Report any leakage or water discharge outside the flush tank.

### 7.9.4 Performance

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



## 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.7 and A.8](#). 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  $38 \pm 2$  L/min ( $10 \pm 0.5$  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 350 and 550 kPa (50 and 80 psi), maintain the peak flow rate at  $\pm 4$  L/min ( $\pm 1$  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

The 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.7](#).



#### **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. A thoroughly clean container to mix 1 L of dye and a clean container to mix the control sample shall be used.

#### **8.5.2 Procedure**

The dye test shall be conducted as follows:

- (a) Add 5 g of the powder or dye to 1 L of water and mix the solution thoroughly.
- (b) Clean the test urinal, flush it once, and allow it to complete its flush cycle.
- (c) Add 30 mL of the dye solution to the water in the urinal well and mix it thoroughly.
- (d) Remove 10 mL of this solution from the urinal and add it to 1000 mL of clean water in a clean container (i.e., use a dilution ratio of 100:1). Set aside a sample of this solution in a test tube or comparator vial as the control sample 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 of the dye solution to the urinal and mix the solution.
- (g) Activate the flushing device and allow the urinal to complete its flush cycle.
- (h) Fill a test tube or comparator vial with the diluted solution from the urinal and compare it against the control sample.
- (i) Record the darkness of colour of the test sample relative to the control sample.

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

#### **8.5.4 Performance**

The colour of the test 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.8](#). 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](#) shall not exceed 1.9 Lpf (0.5 gpf) for high-efficiency urinals or 3.8 Lpf (1.0 gpf) for low-consumption urinals. This requirement shall be based on the average of the individual values from the three test sets.

## 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

Ceramic plumbing fixtures shall be marked with the manufacturer's name or registered trademark or, in the case of private labelling, the name of the customer for whom the fixture was manufactured. Additional markings shall be in accordance with [Clauses 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 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

### 9.2.1

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.

### 9.2.2

Fixtures that do not comply with one or more of the dimensional requirements of this Standard shall be marked with an "N" to indicate the non-standard nature of the fixture.

**Note:** This Clause is not intended to apply to fixtures that comply with none of the dimensional requirements of this Standard.



## 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) 13.2 Lpf (3.5 gpf) for water-saving water closets.

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 label 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 for ceramic plumbing fixtures shall be marked with the

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

### 9.5.2 Water closets and urinals

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 manufacturer's packaging and installation instructions and other literature shall be marked with 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, 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	$\leq 2600 \text{ mm}^2 (4.0 \text{ in}^2)$
	Pits, blisters, and pinholes	Total $\leq 5$
Water closet tank, water closet tank cover, or urinal	Bubbles, specks,* and spots	$\leq 5$ in one pottery square; total $\leq 10$
	Warpage	Not noticeably warped
	Surface finish	
	Wavy finish	$\leq 2600 \text{ mm}^2 (4.0 \text{ in}^2)$
	Pits, blisters, and pinholes	Total $\leq 5$
	Bubbles, specks,* and spots	$\leq 5$ in one pottery square; total $\leq 10$

\*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, 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 6.3 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.

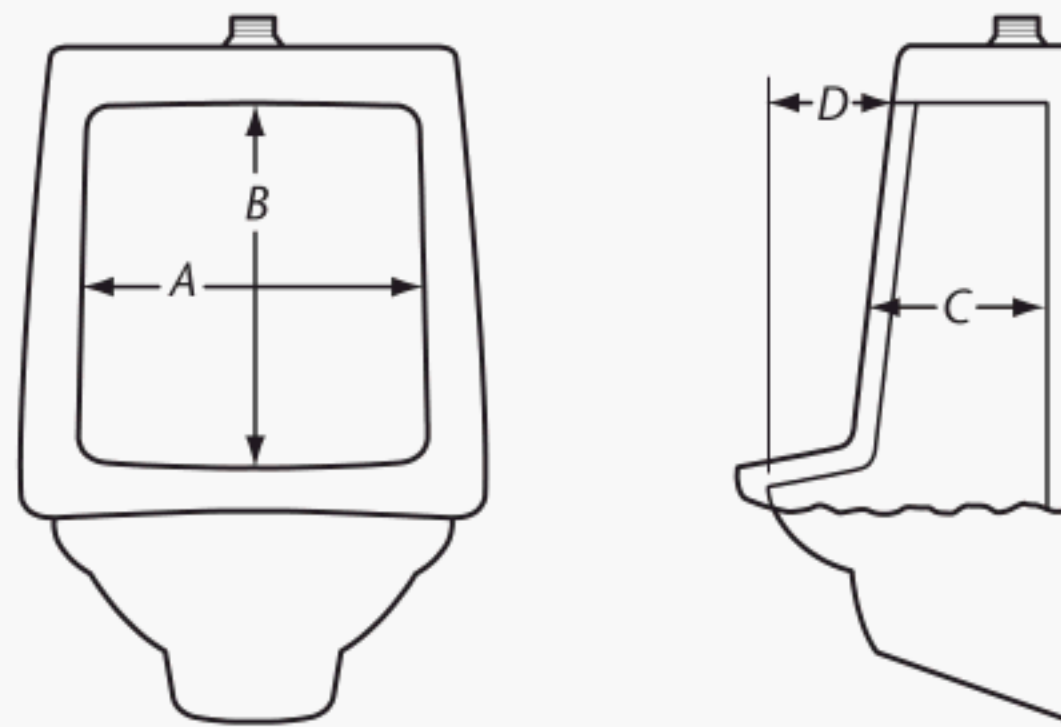
**Table 3**  
**Integral trap diameter requirements for urinals, mm (in)**  
 (See [Clause 4.7.1.](#))

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.](#))

Type of urinal	<i>A</i>	<i>B</i>	<i>C</i>		<i>D</i>	
	Interior width	Interior height	Interior depth		Projection	
			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, 7.4.3, 7.4.5, and 9.6.2.](#))

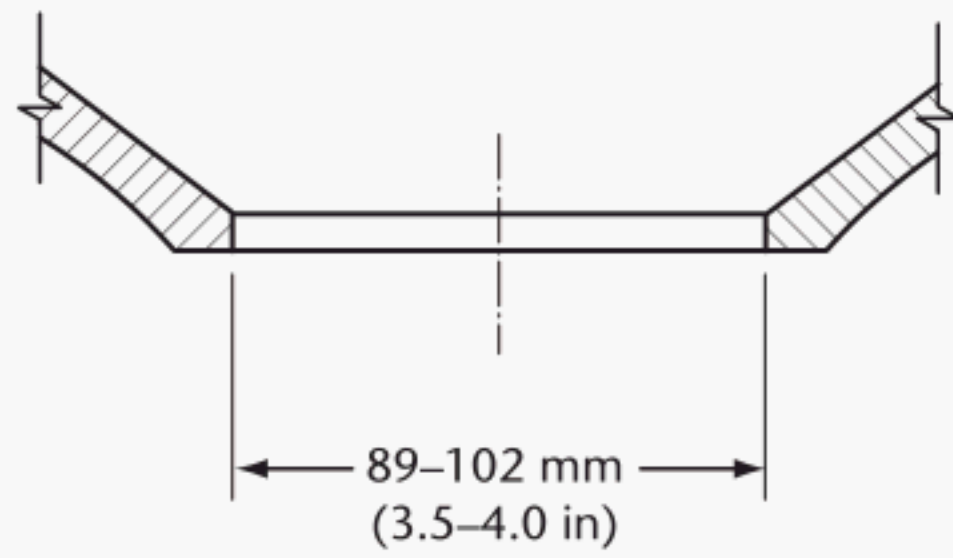
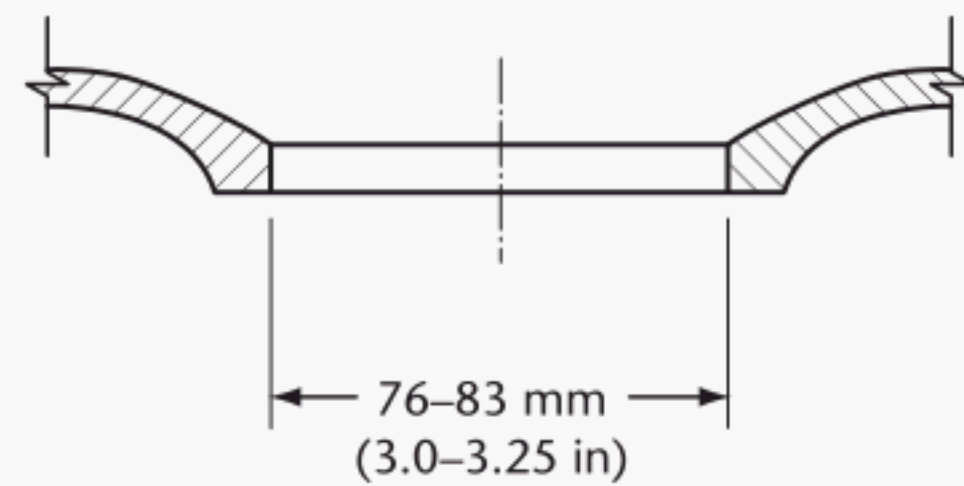
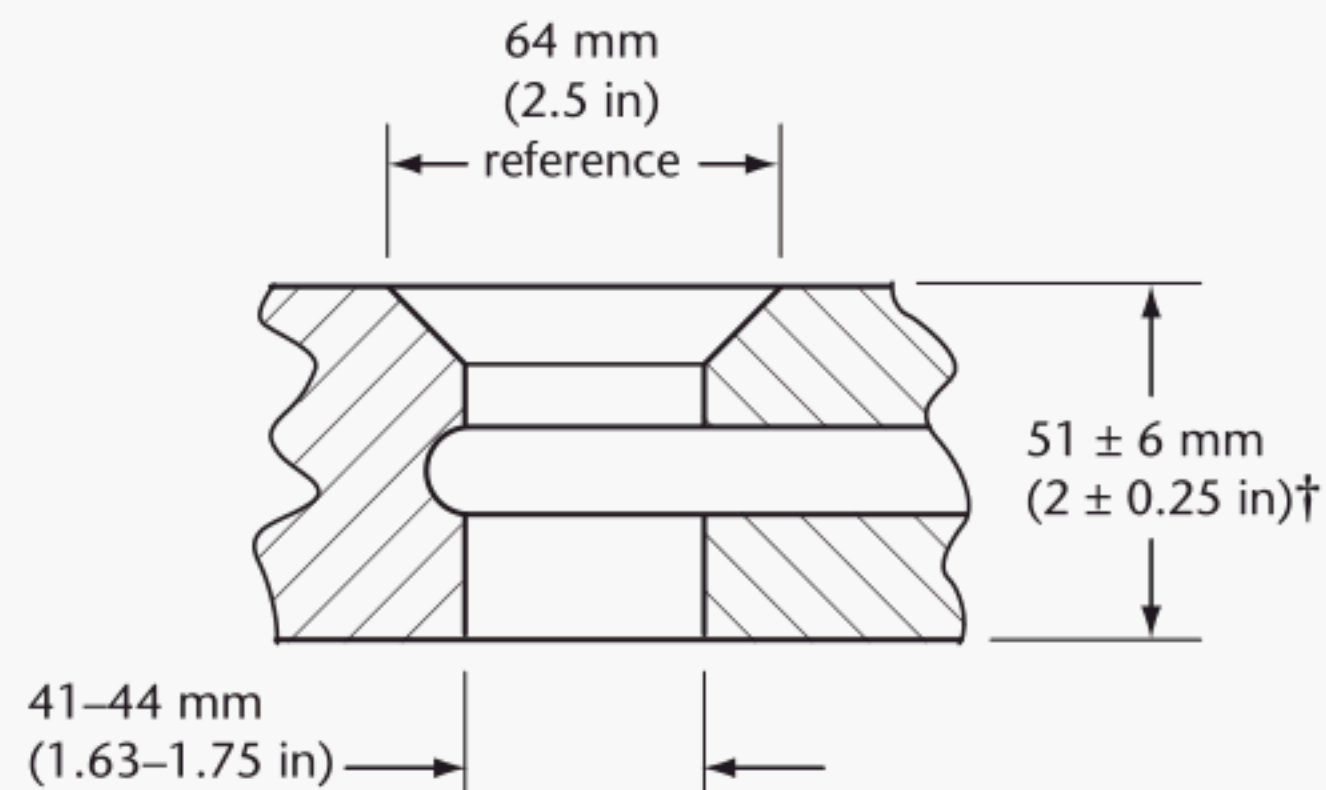
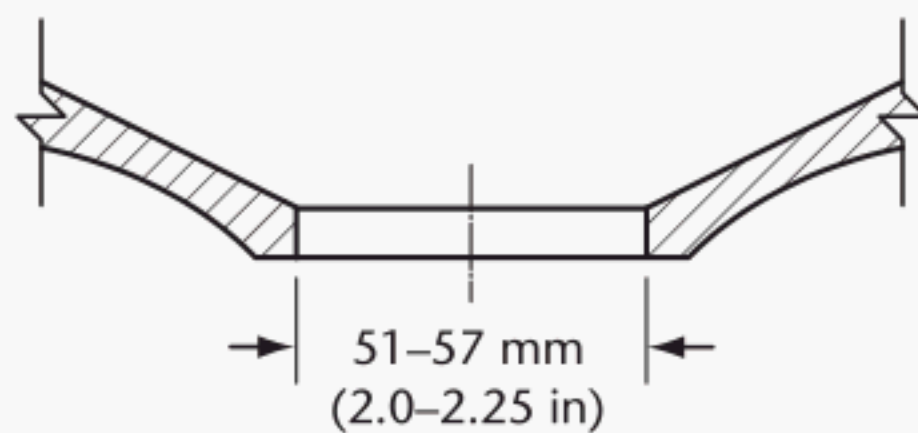
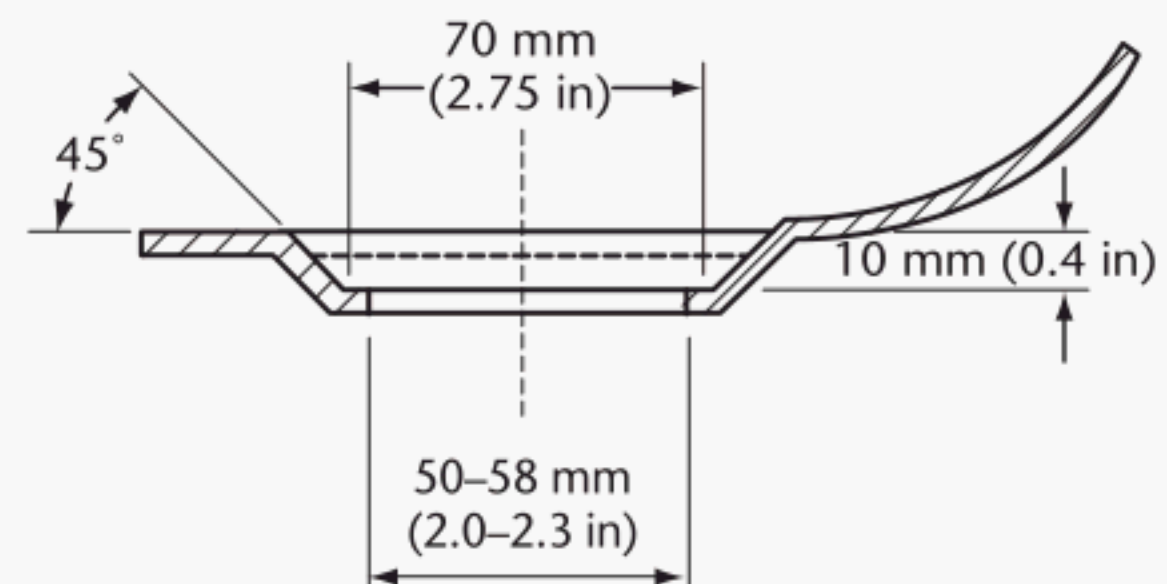
Test sequence (Note 1)	Clause	Test	Gravity flush tank, electro-hydraulic, and flushometer tank water closets	Flushometer valve water closets	
				Siphonic bowl	Blowout bowl
1	<a href="#">7.2</a>	Trap seal depth determination	140 (20)	240 (35)	310 (45)
2	<a href="#">7.3</a>	Trap seal restoration	140 (20)	240 (35)	310 (45)
3	<a href="#">7.4</a>	Water consumption	550 (80), 350 (50), and 140 (20)	550 (80), 240 (35), and 240 (35)	550 (80), 310 (45), and 310 (45)
4	<a href="#">7.5</a>	Granule and ball	140 (20)	240 (35)	310 (45)
5	<a href="#">7.6</a>	Surface wash	140 (20)	240 (35)	310 (45)
6	<a href="#">7.7</a>	Mixed media	140 (20)	240 (35)	310 (45)
7	<a href="#">7.8</a>	Drain line transport characterization	140 (20)	240 (35)	310 (45)
8	<a href="#">7.9</a>	Overflow for gravity tanks	550 (80)	—	—

**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 water-saving 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
<a href="#">8.4</a>	Surface wash	175 (25)
<a href="#">8.5</a>	Dye	175 (25)
<a href="#">8.6</a>	Water consumption	175 (25) and 550 (80)

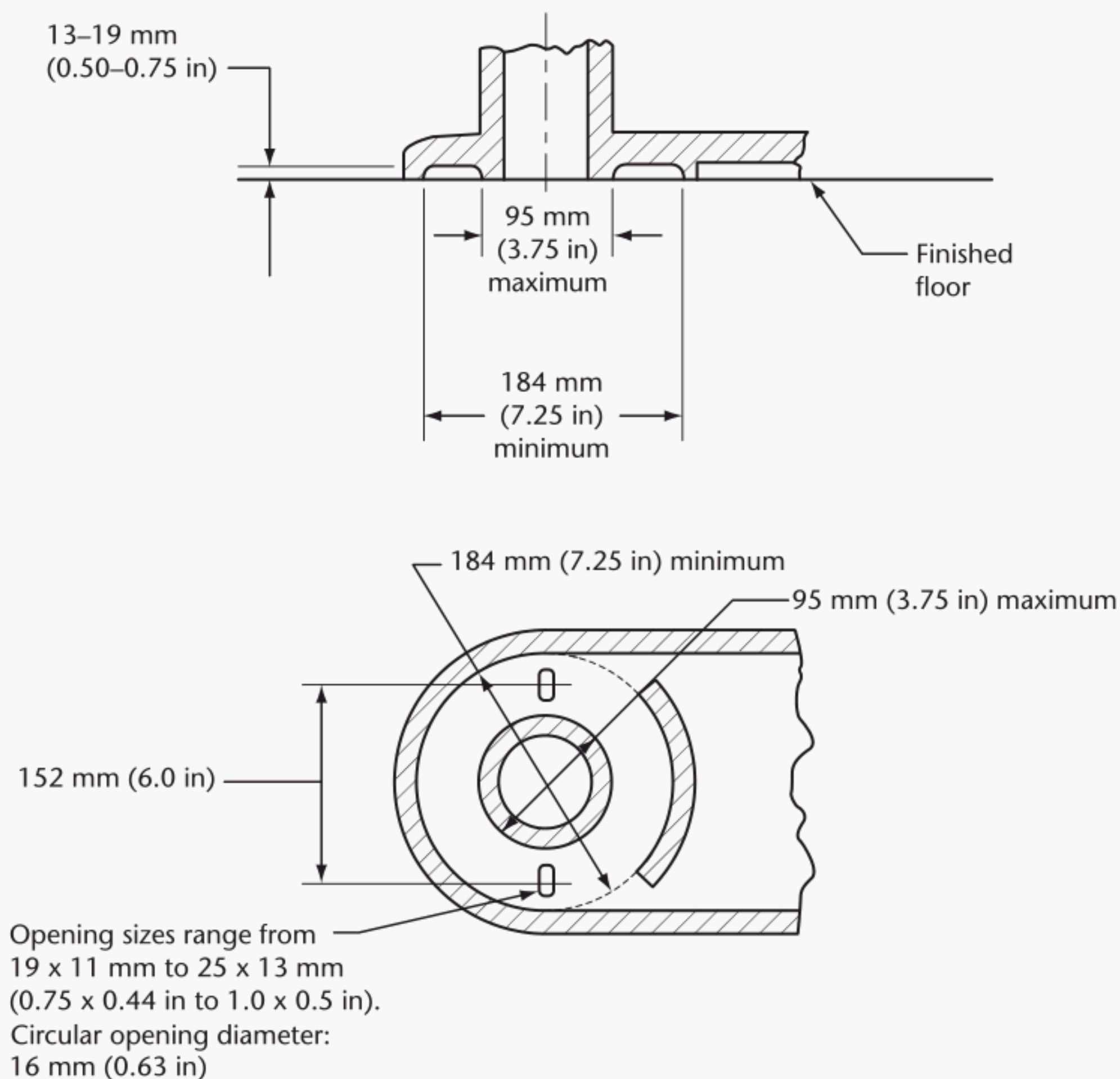
**(a) Sink\*****(b) Service sink****(c) Lavatory and bidet****(d) Laundry sink\*****(e) Bathtub**

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

†Dimension applies only to lavatories with overflow.

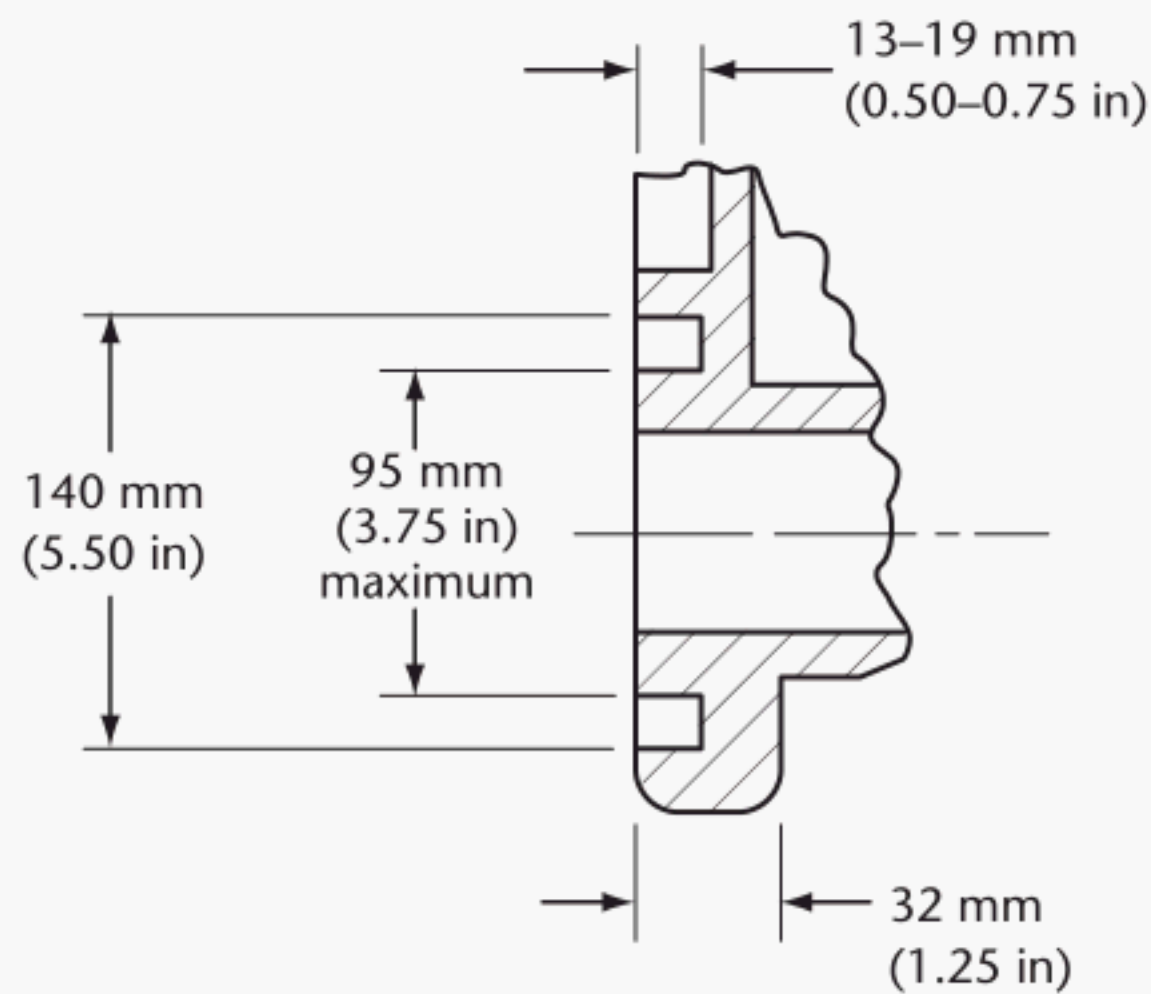
**Figure 1**  
**Waste outlet dimensions**  
(See [Clause 4.3.1.2.](#))



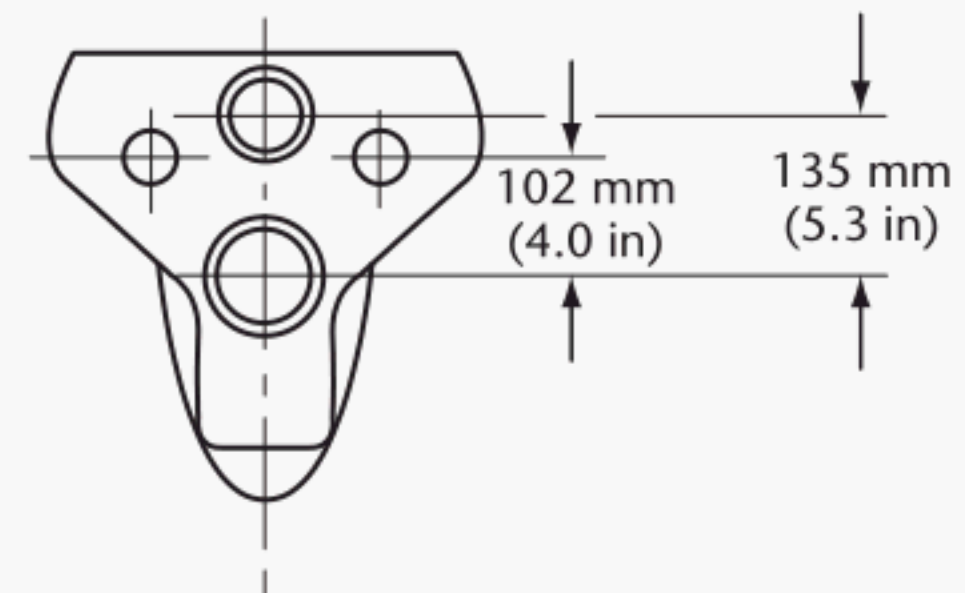


**Note:** This Figure is not intended to restrict the design of the water closet bowl base, provided that dimensions critical to interchangeability are maintained.

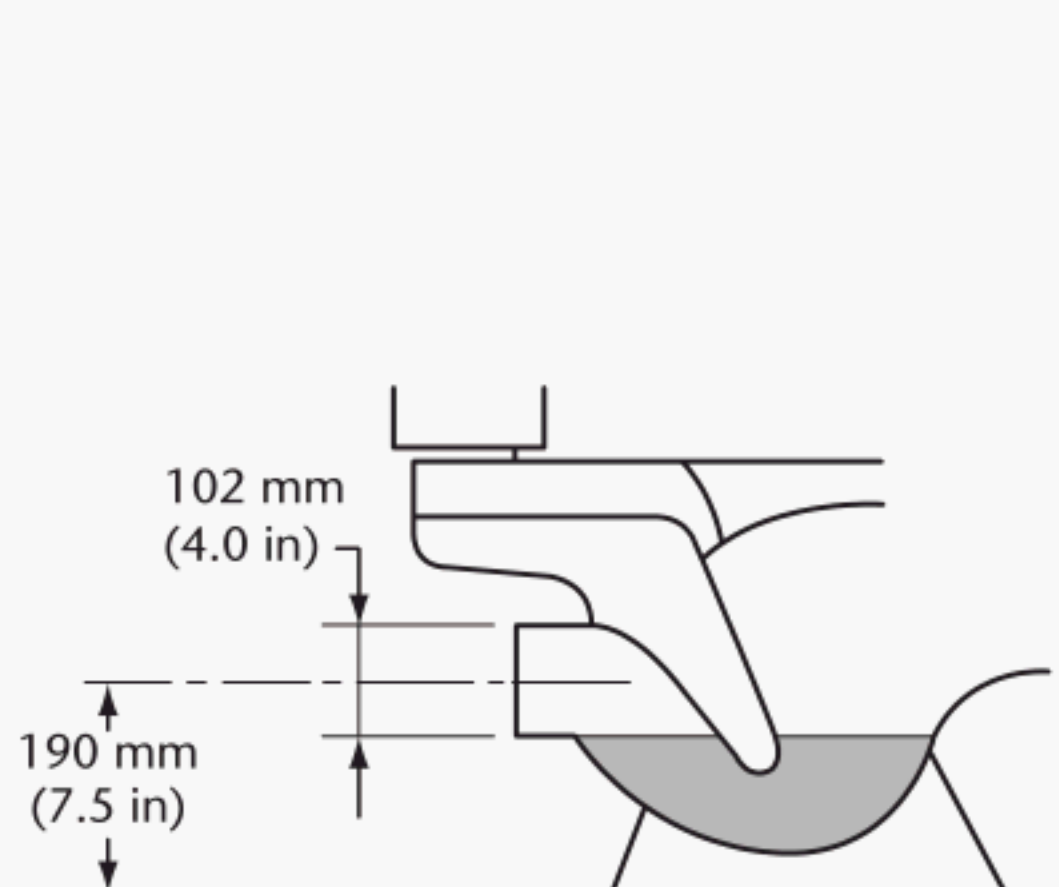
**Figure 2**  
**Outlet dimensions for floor-mounted bottom-outlet water closets**  
(See [Clause 4.6.1.](#))



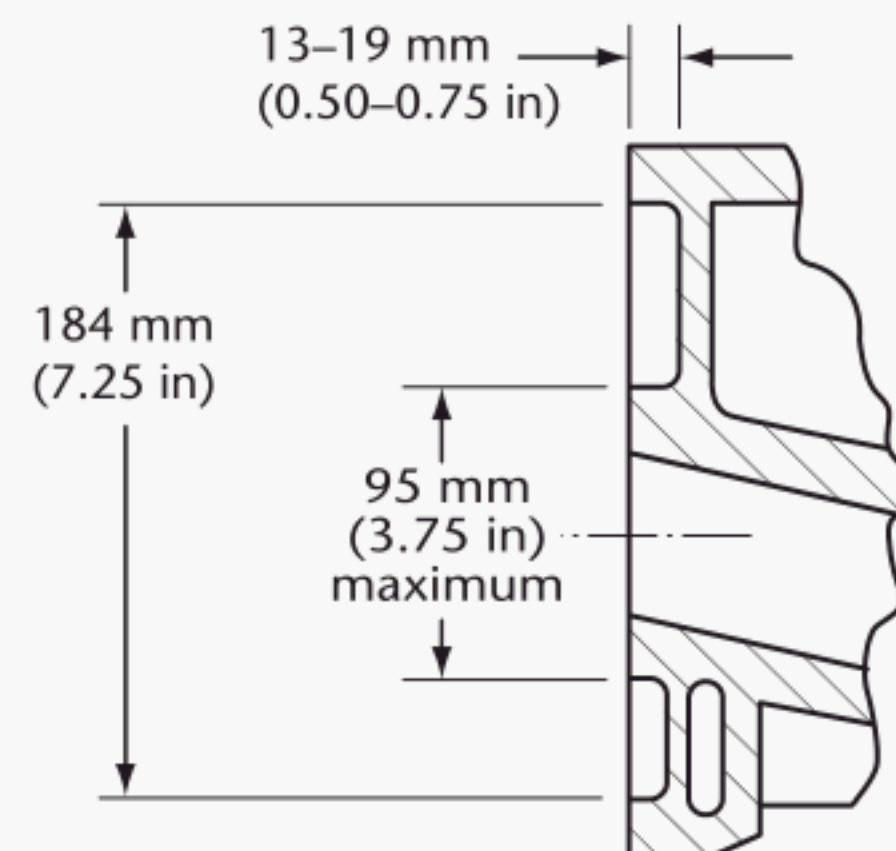
**(a) Wall-mounted rear-outlet water closet bowl**



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



**(c) Floor-mounted rear-spigot-outlet water closet bowl**

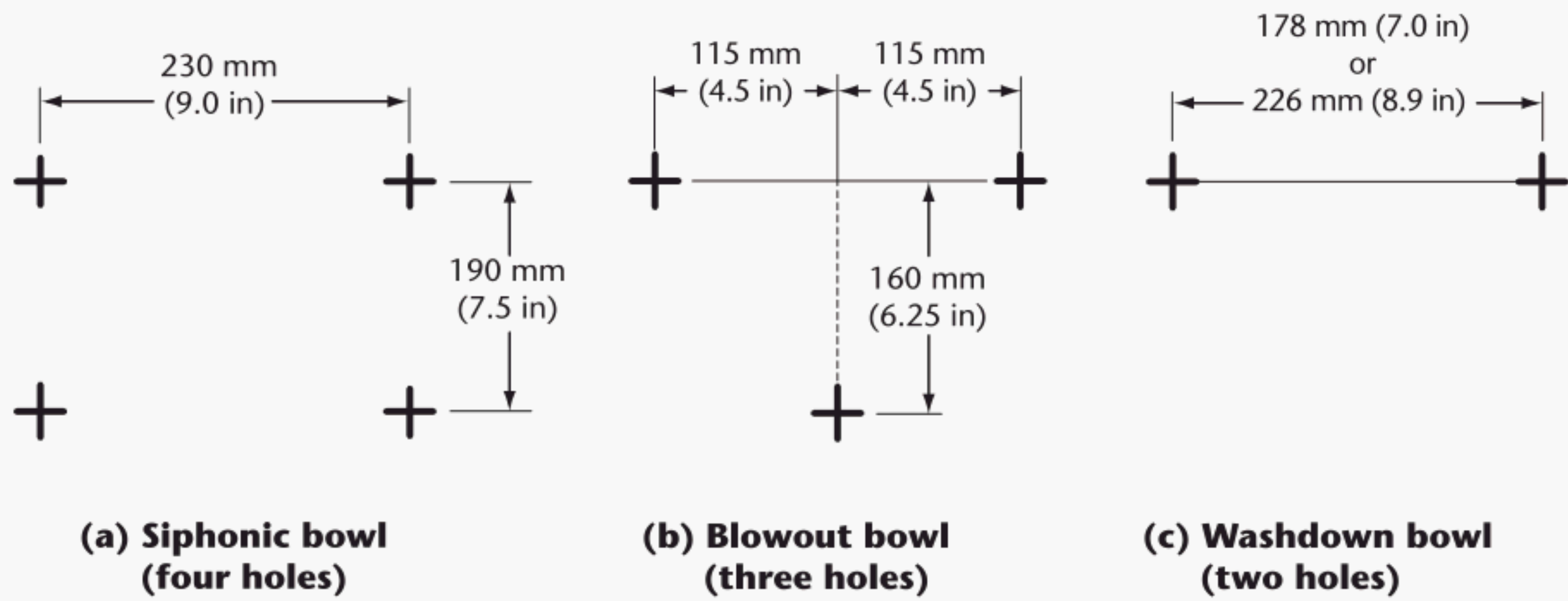


**(d) Floor-mounted rear-outlet water closet bowl**

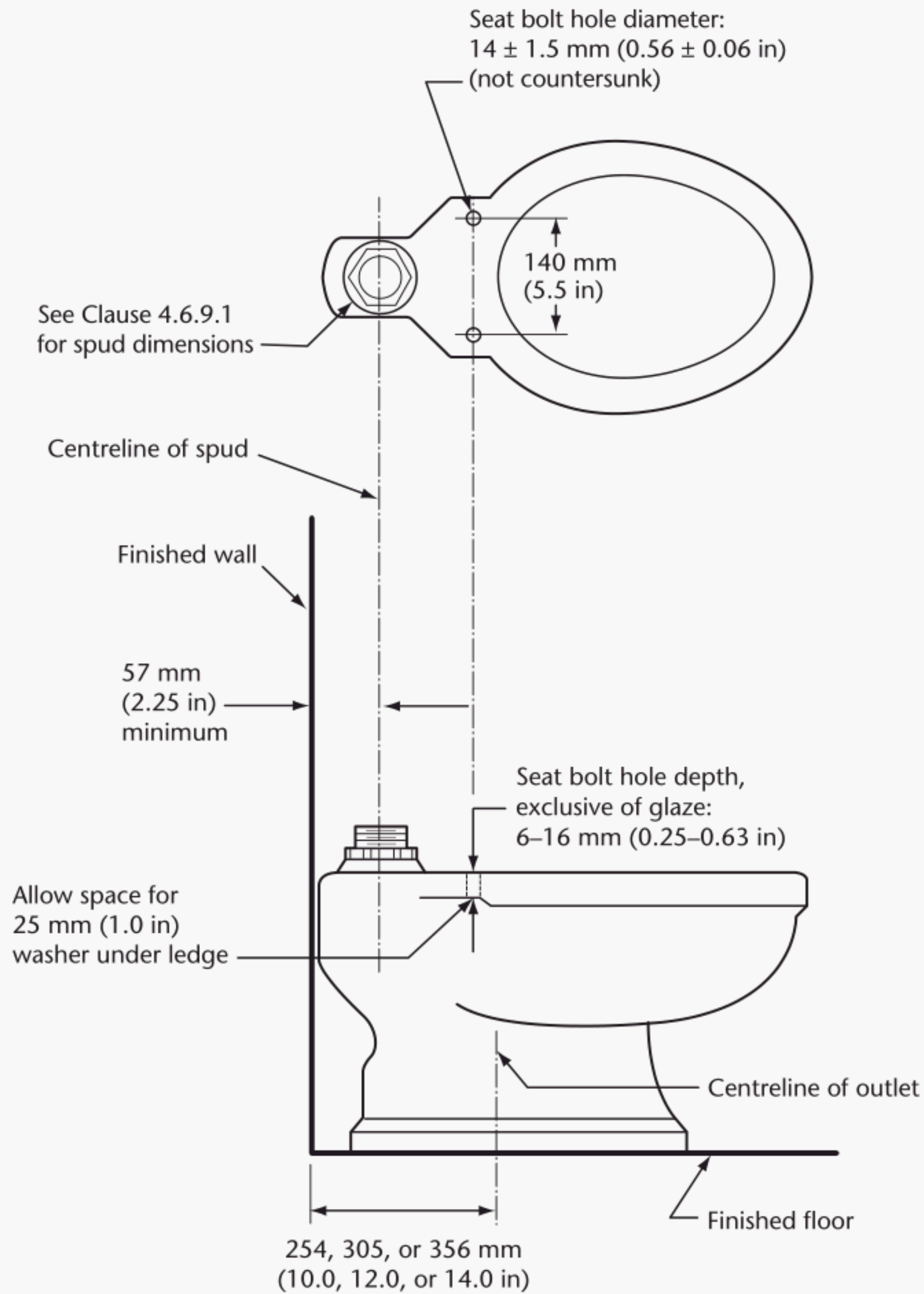
**Figure 3**  
**Outlet dimensions for rear-outlet and rear-spigot-outlet water closet bowls**

(See [Clause 4.6.1.](#))





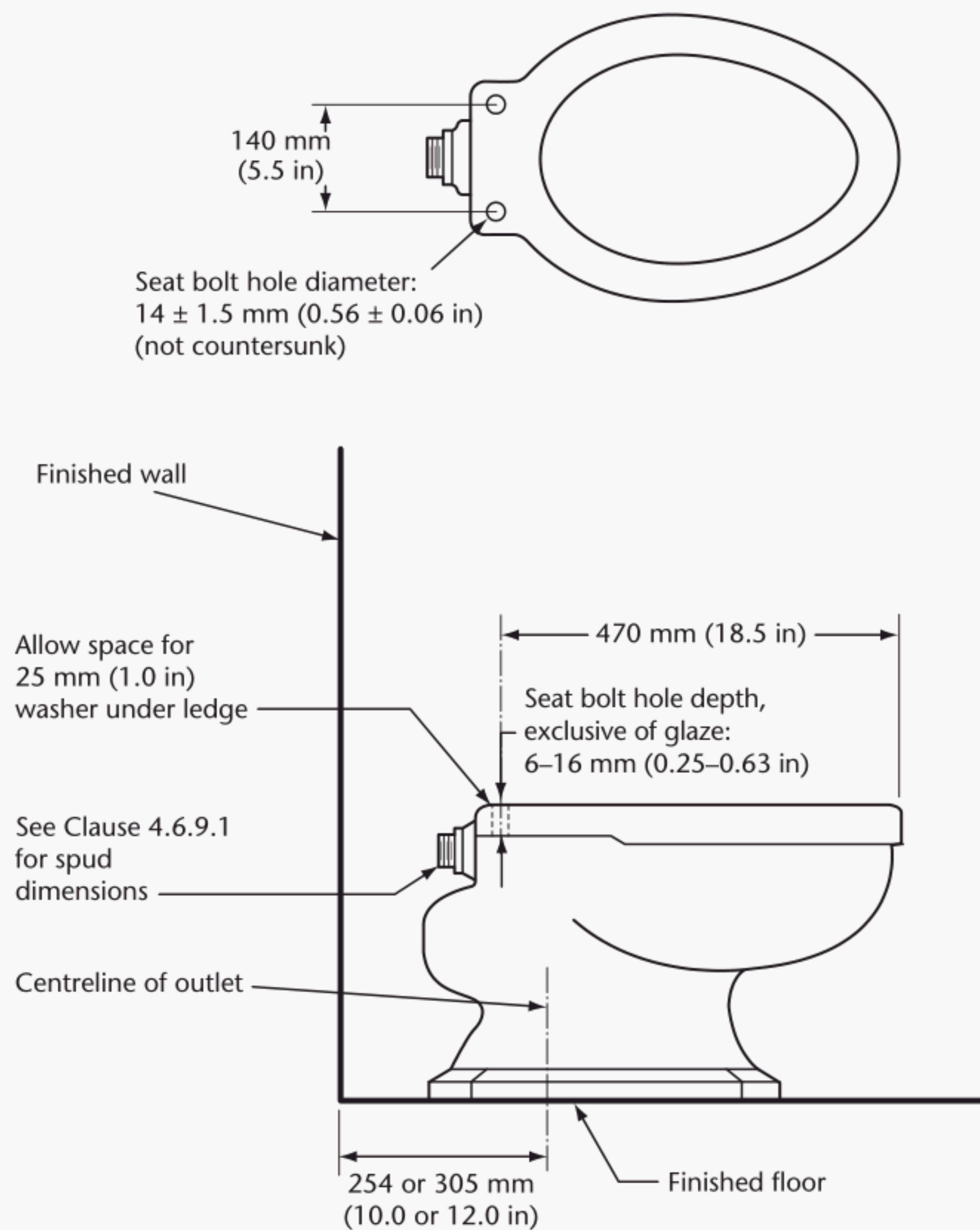
**Figure 4**  
**Bolt hole spacing for wall-mounted water closet bowls**  
(See [Clause 4.6.3.](#))

**(a) Top spud floor-outlet water closet**

**Figure 5**  
**Roughing-in and seat bolt hole dimensions for water closets**  
 (See [Clauses 4.6.4](#), [4.6.5](#), and [4.6.9.2](#).)

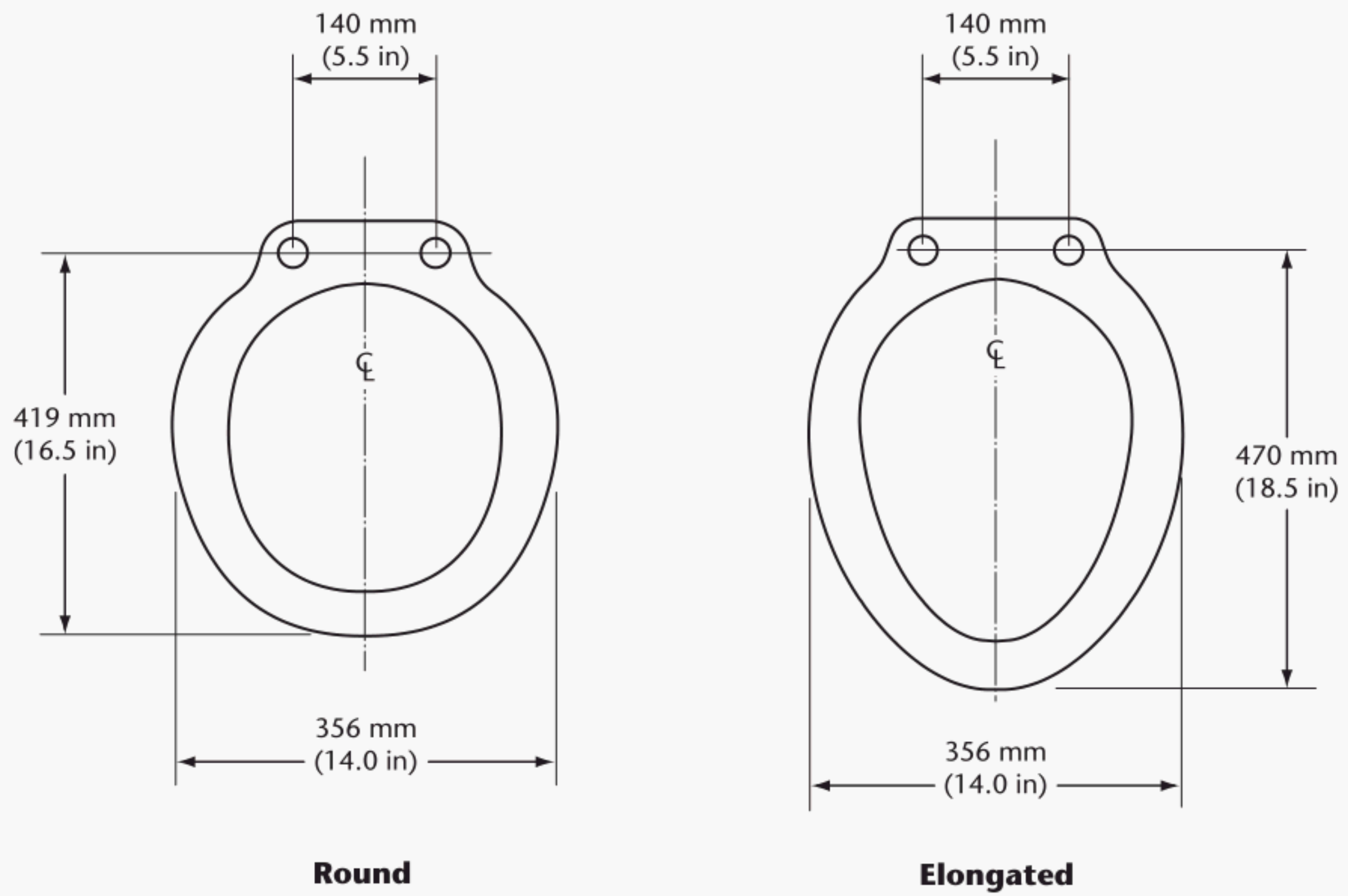
(Continued)





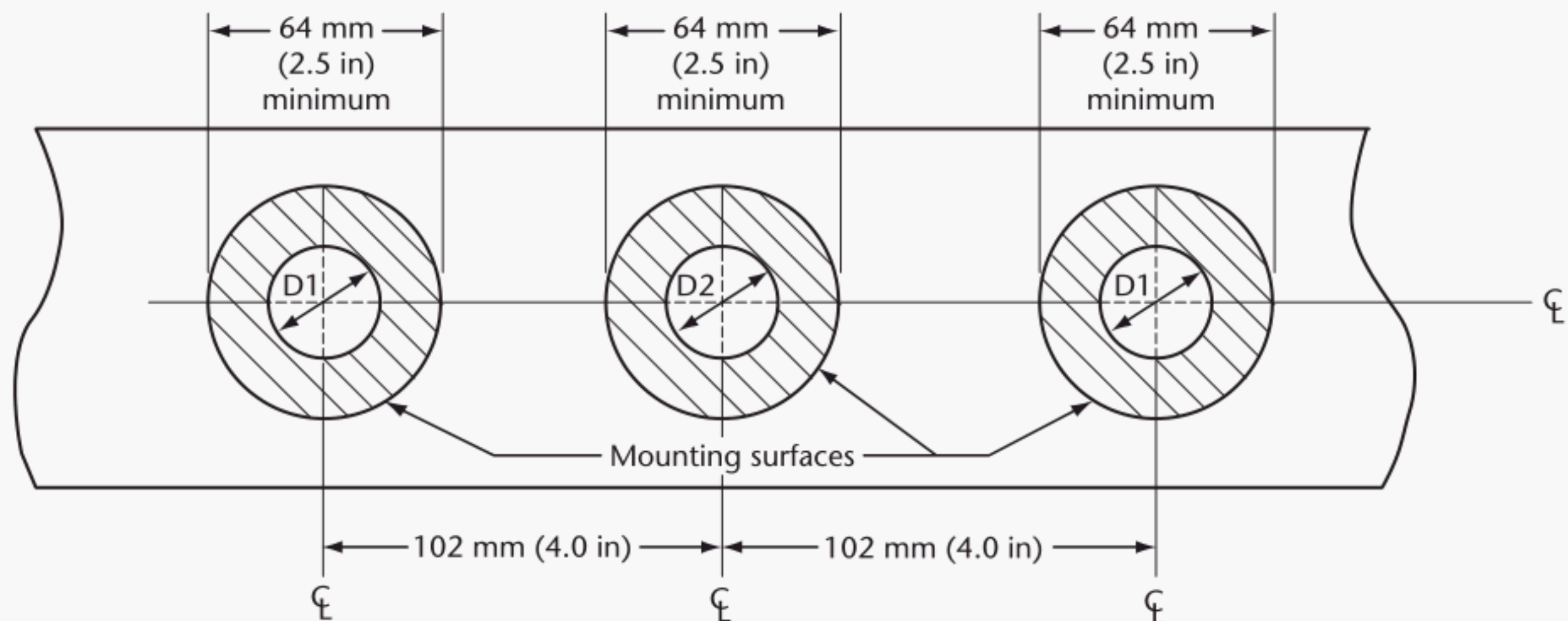
**(b) Back spud floor-outlet water closet**

**Figure 5 (Concluded)**



**Figure 6**  
**Water closet bowl rim profiles**  
(See [Clause 4.6.6.](#))

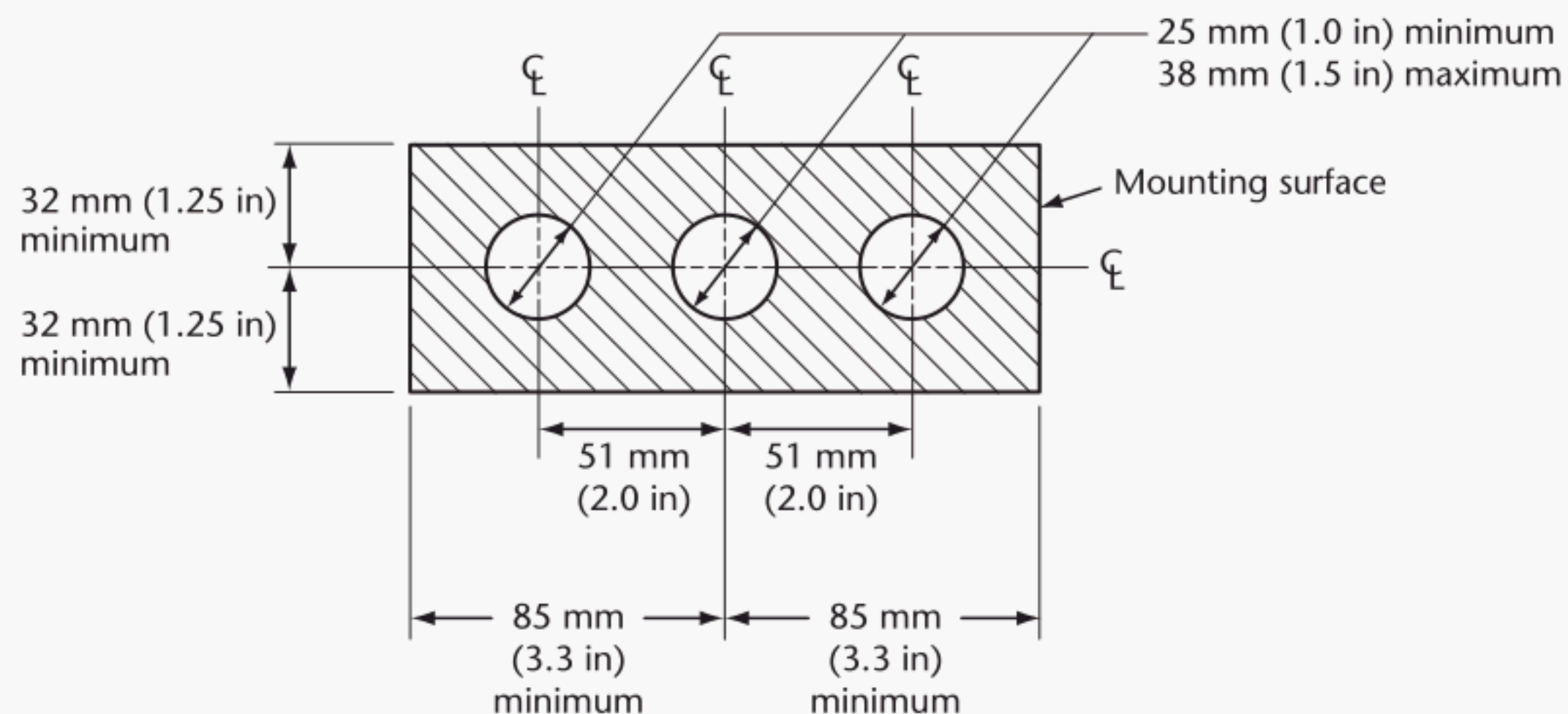




**Notes:**

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

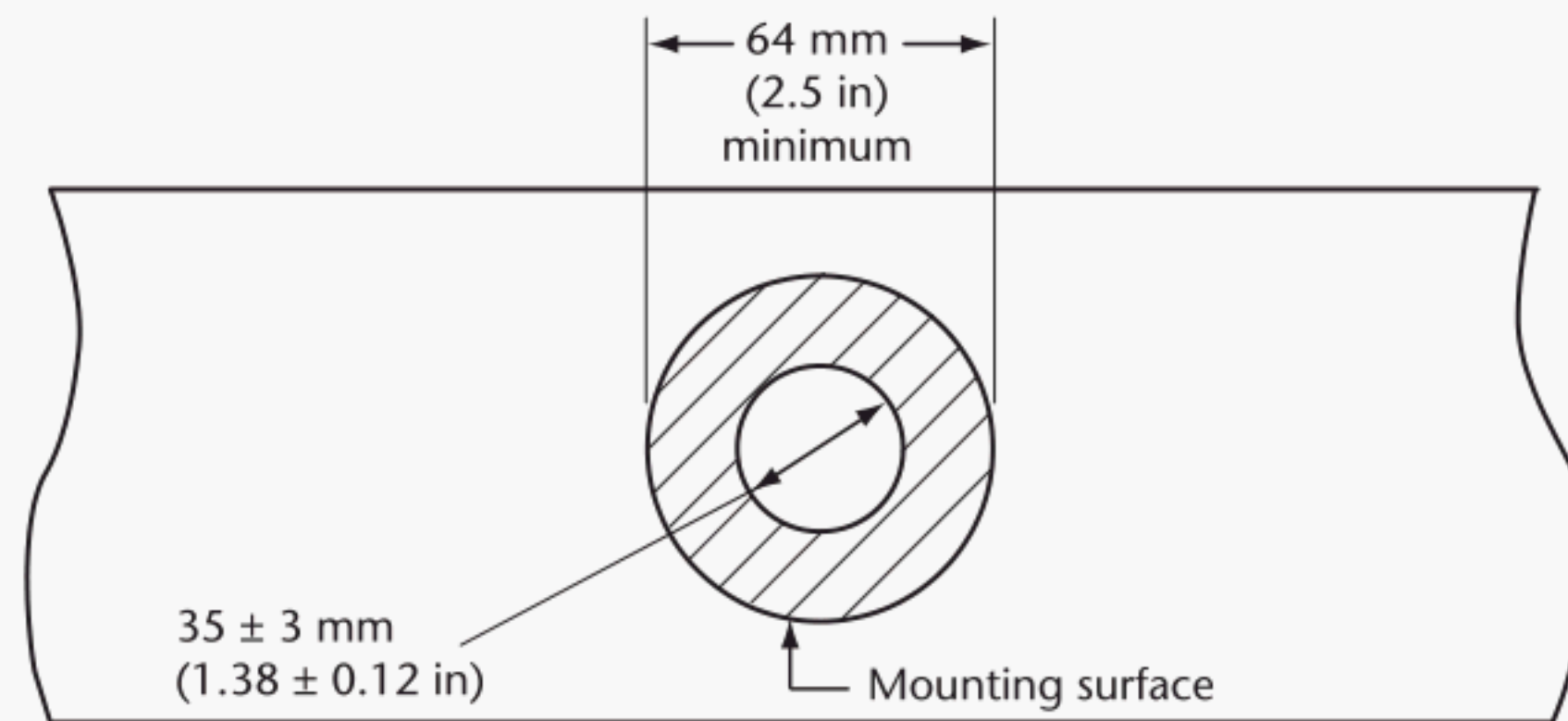
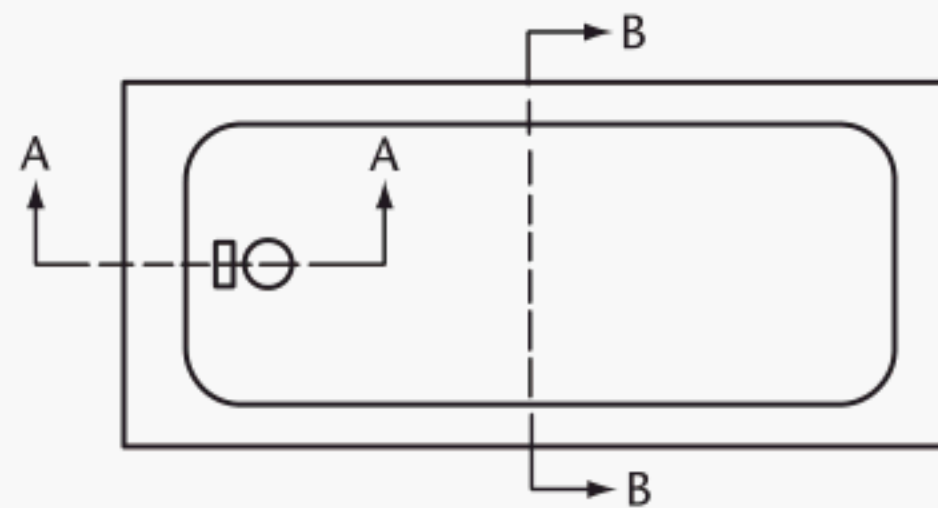
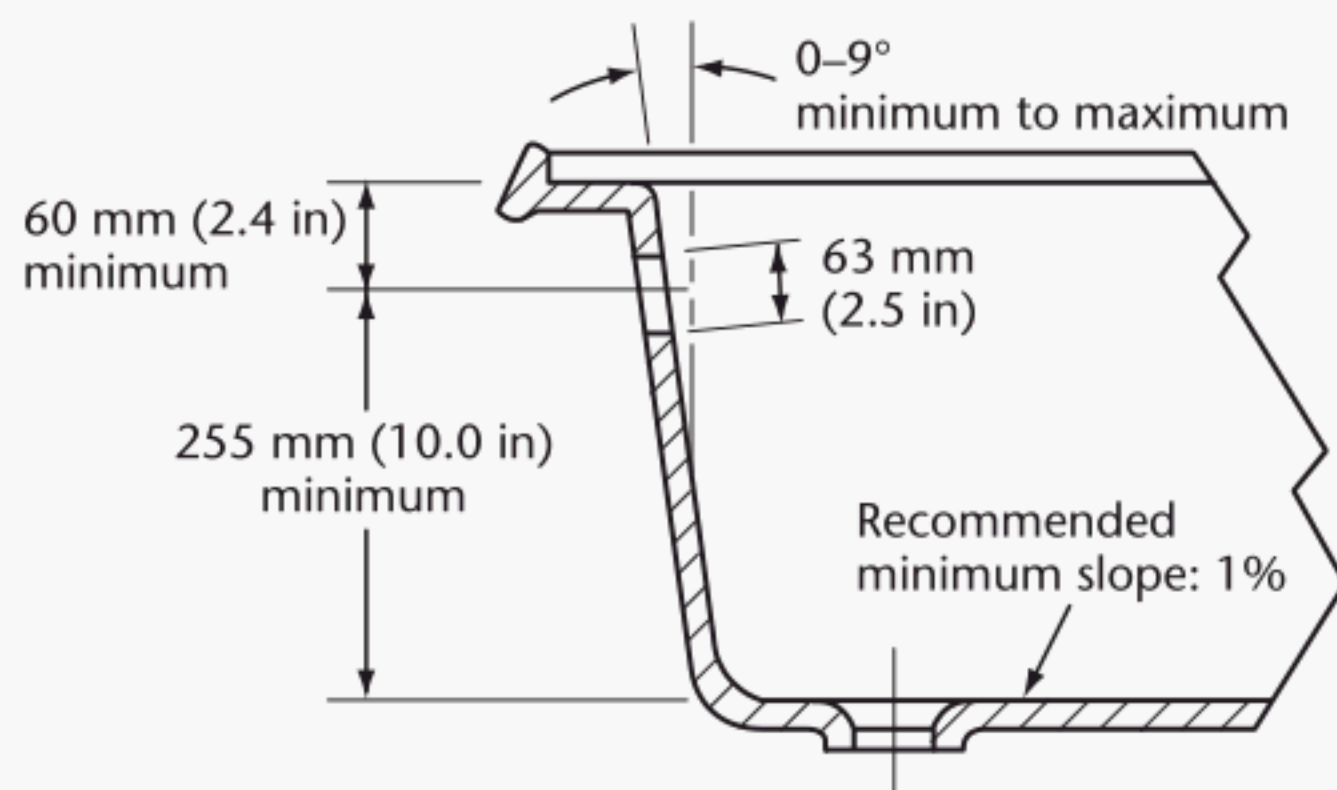
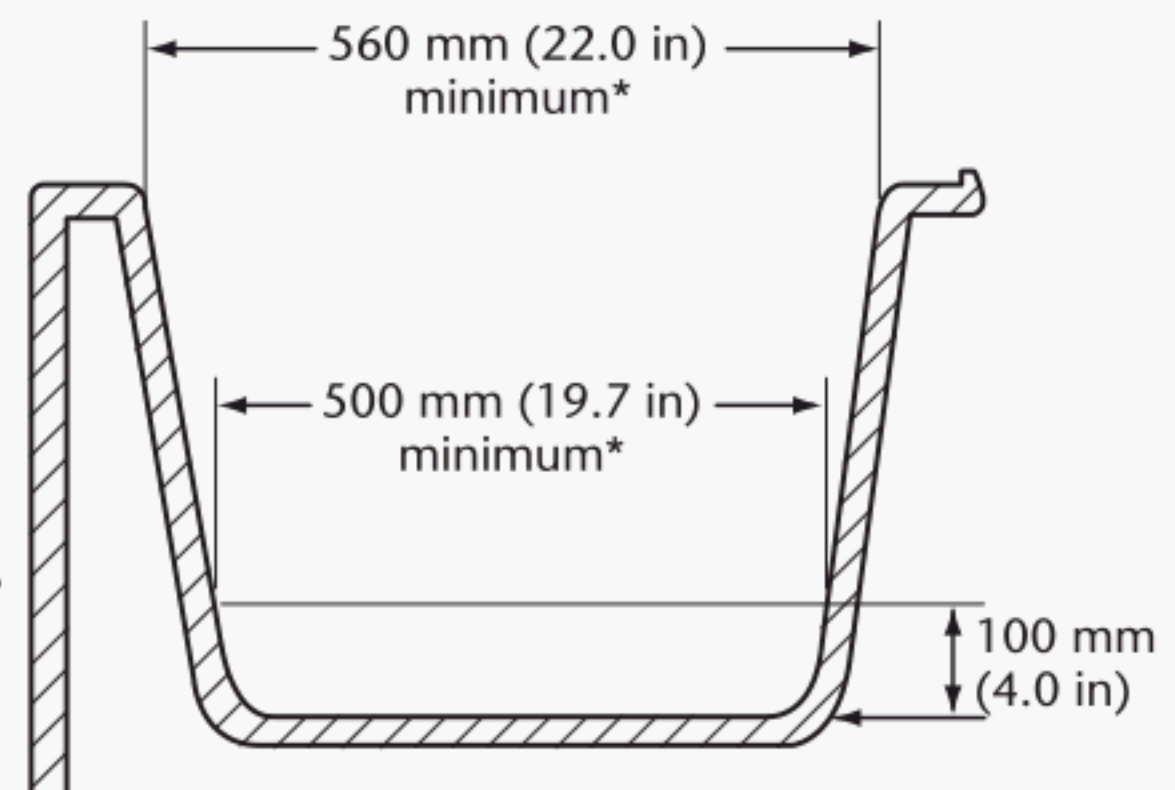
**(a) Standard 200 mm (8 in) combination fittings**



**(b) Standard 100 mm (4 in) centre-set fittings**

**Figure 7**  
**Supply fitting opening and mounting surface dimensions**  
(See [Clause 4.8.1.1.](#))

(Continued)

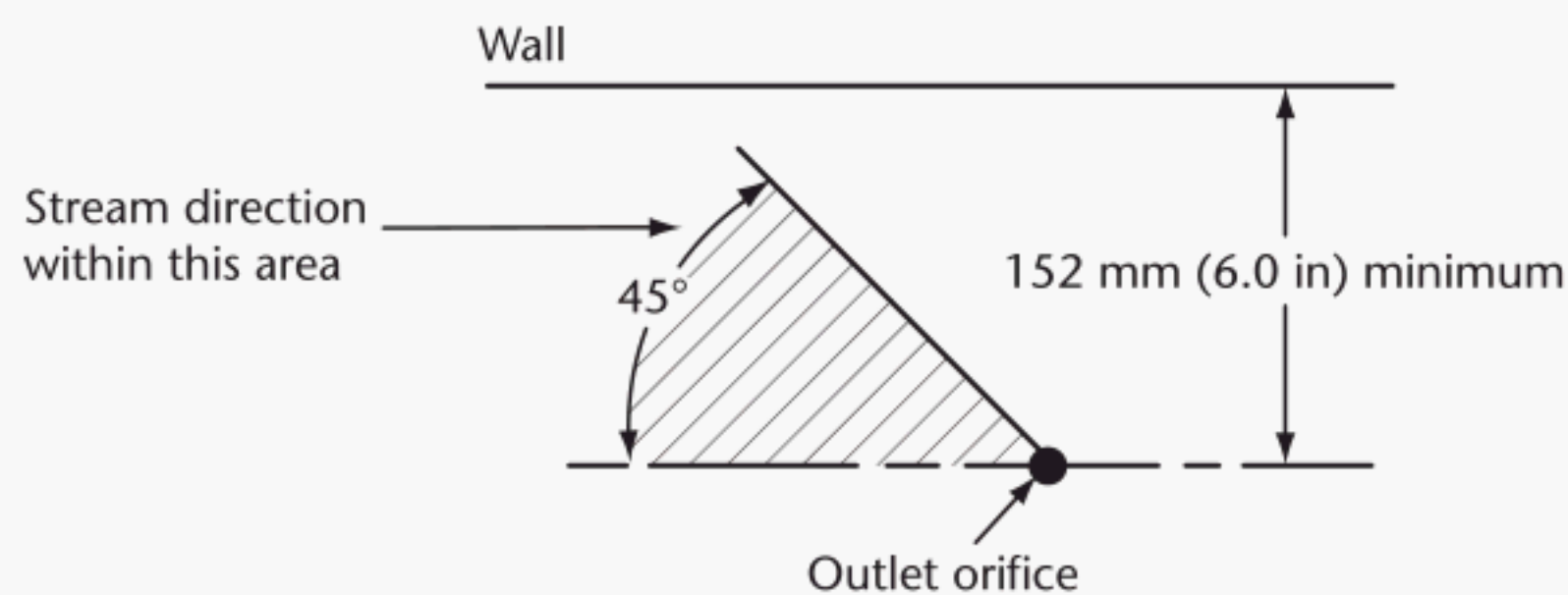
**(c) Single-mount supply fittings****Figure 7 (Concluded)****(a) Top view****(b) Side view section A-A****(c) Side view section B-B**

\*Minimum width at widest point in plan.

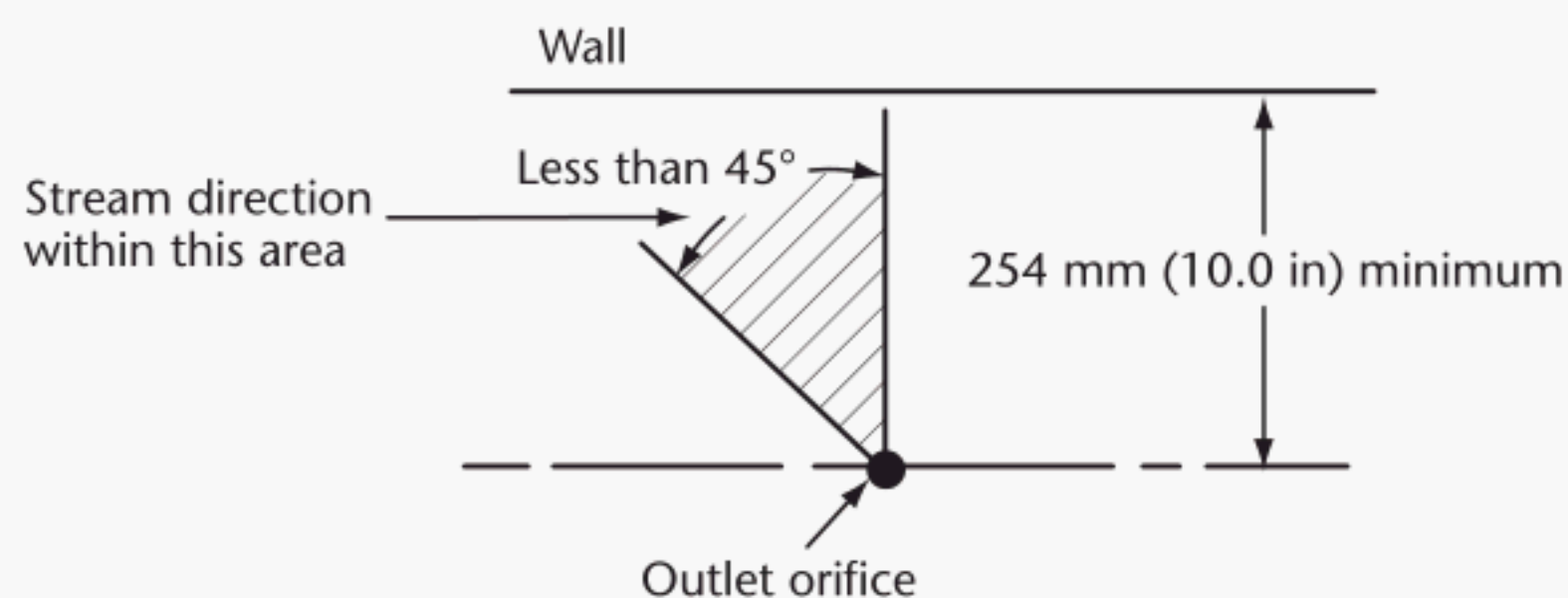
**Note:** These diagrams are not intended to restrict design. Alternative sizes and shapes shall be considered acceptable.

**Figure 8**  
**Dimensions for bathtubs**  
(See [Clause 4.9.1.](#))



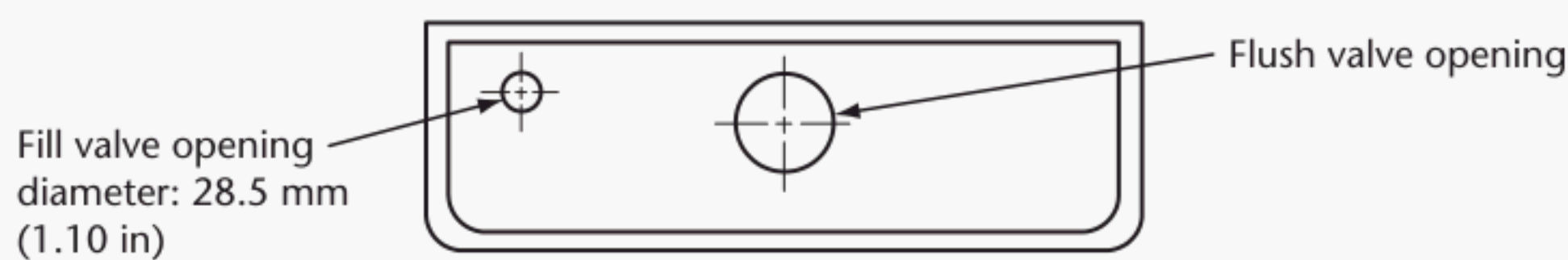


**(a) Stream generally parallel with wall**

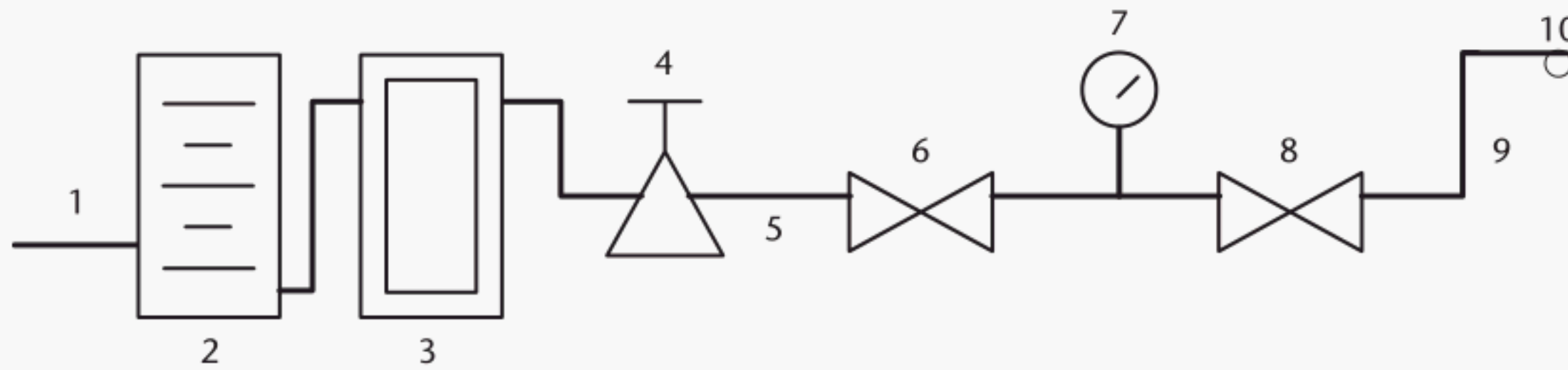
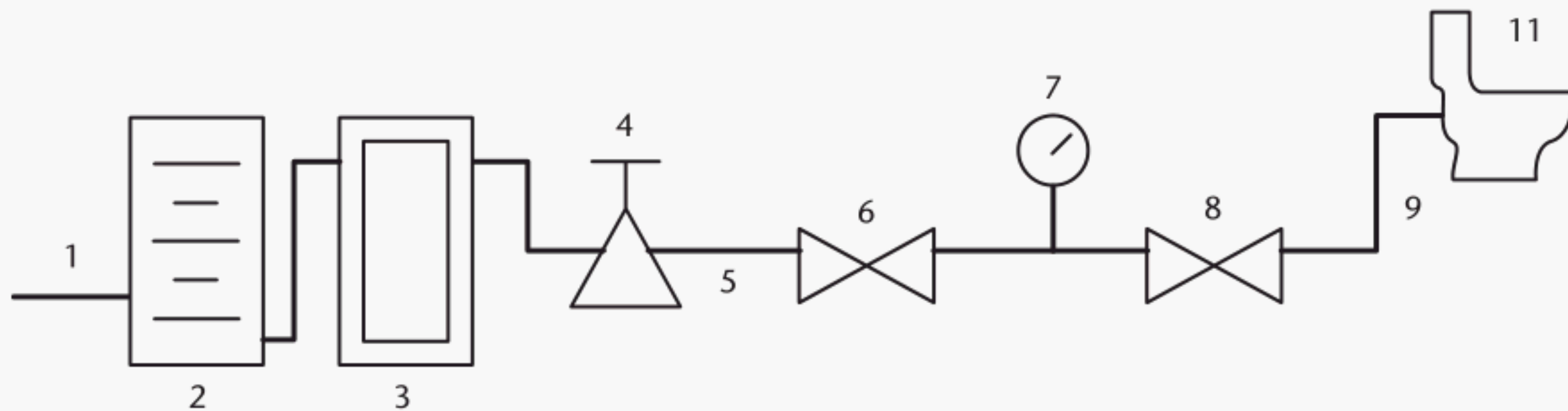


**(b) Stream generally toward wall**

**Figure 9**  
**Clearance for drinking fountains**  
 (See [Clause 4.10.1.](#))



**Figure 10**  
**Gravity flush tank valve openings**  
 (See [Clause 5.2.2.](#))

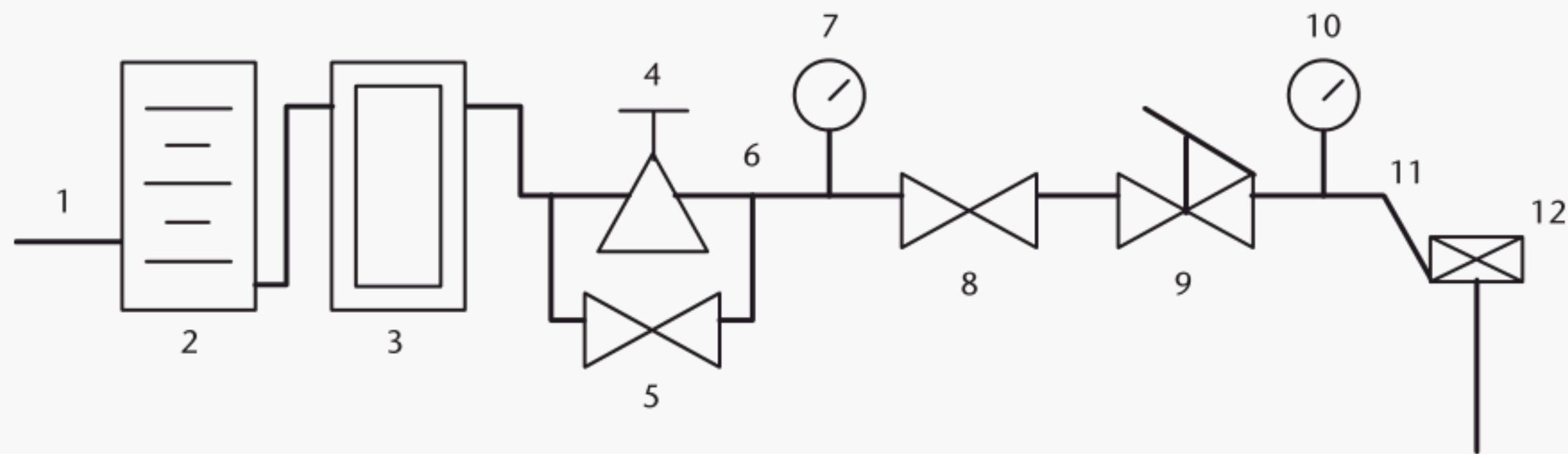
**(a) Water supply shown ready for standardization****(b) Water supply shown ready for water closet test****Notes:**

- (1)** 1 = water supply pipe. Water for testing shall be clean. A minimum supply static pressure of 860 kPa (125 psi) shall be provided.
- (2)** 2 = filter. A filter shall be used to remove particles and contaminants from the water to prevent interference with the operation of the water supply system or the water closet under test.
- (3)** 3 = flow meter. The flow meter shall cover a 0 to 38 L/min (0 to 10 gpm) range and have an accuracy of 2% full scale. Variable area and turbine meters may be used.
- (4)** 4 = pressure regulator. The pressure-reducing valve (regulator) shall cover a 140 to 550 kPa (20 to 80 psi) range and have a capacity not less than 38 L/min (10 gpm) at a falloff pressure of 35 kPa (5 psi). Watts Regulator Co., Model 223, NPS-3/4 has been found acceptable for water closet testing.
- (5)** 5 = supply piping. A minimum NPS-3/4 pipe or tubing shall be used.
- (6)** 6 = valve. The control valve shall be a commercially available NPS-3/4 globe valve or equivalent to facilitate throttling.
- (7)** 7 = pressure gauge. The pressure gauge shall have a range of 0 to 690 kPa (0 to 100 psi) and have 10 kPa (1 psi) divisions. Accuracy shall not be less than 2% full scale.
- (8)** 8 = ball or gate valve. This valve shall be used for on-off control (minimum NPS-3/4).
- (9)** 9 = flexible hose. The flexible hose shall connect the standardized supply to the water closet. The hose shall be NPS-5/8 inside diameter minimum.
- (10)** 10 = stop valve. The stop valve simulating a fill valve shall be NPS-3/8. Brass Craft Model R-15 has been found acceptable for water closet testing.
- (11)** 11 = specimen. The specimen shall be tested with tank and fill valve installed.
- (12)** Many devices are available for performing the tests covered by this Figure. Specific manufacturers are identified in Notes (4) and (10) as examples only and reference to them does not constitute an endorsement.

**Figure 11**  
**Standardization of water supply system for testing gravity**  
**and flushometer tank water closets**

(See [Clauses 7.1.1](#), [7.1.5.1](#), [7.9.1](#), and [7.9.2](#).)



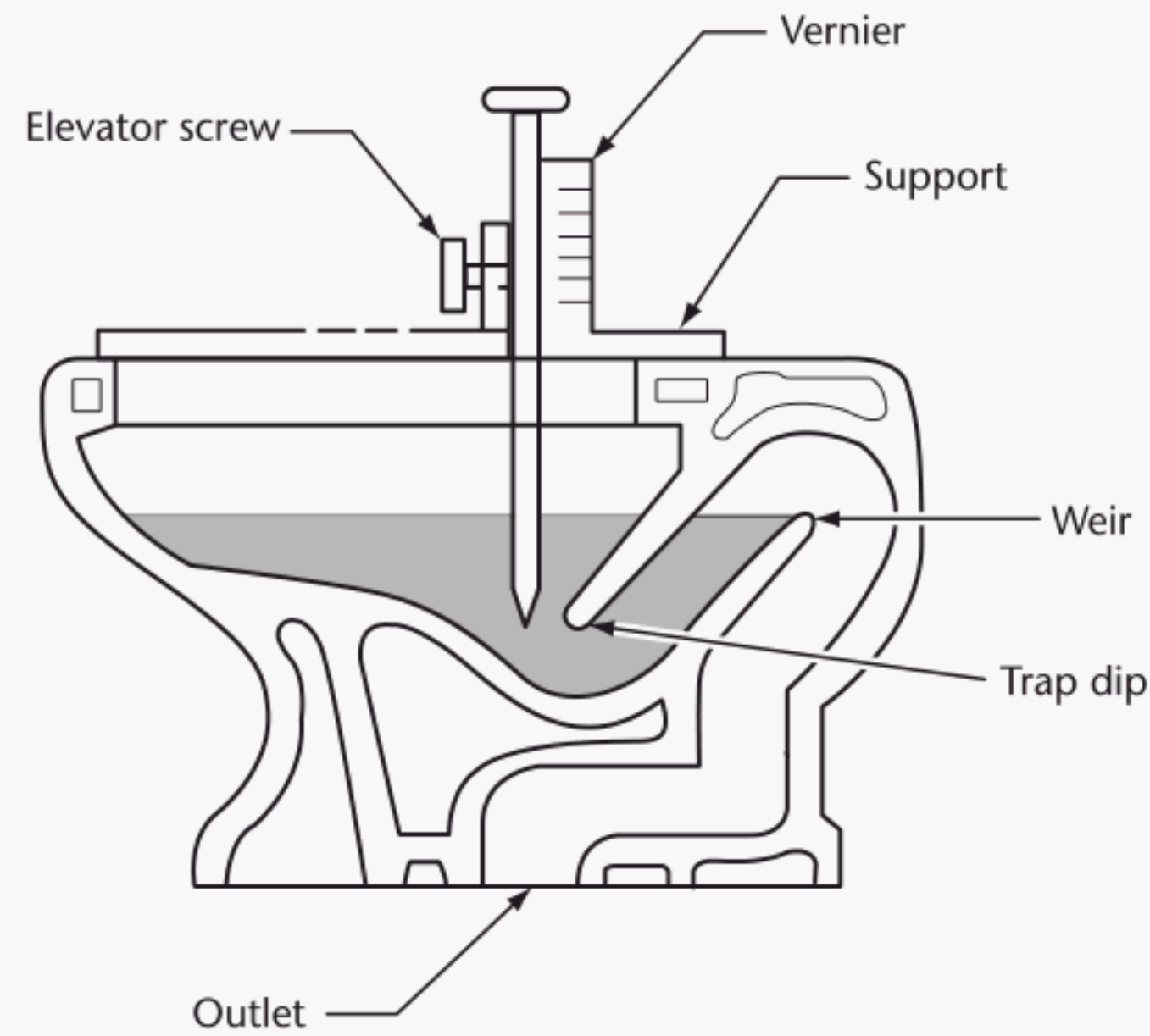
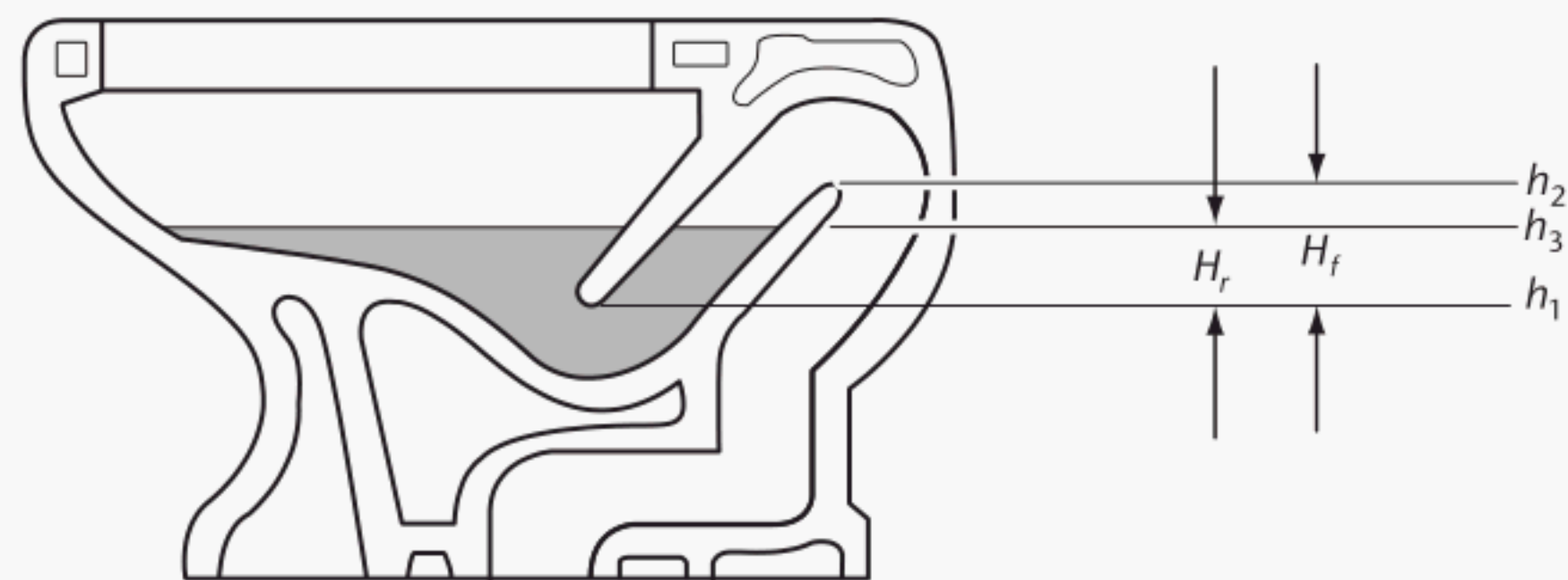


**Notes:**

- (1) 1 = water supply pipe. Water for testing shall be clean. A minimum static supply pressure of 860 kPa (125 psi) shall be provided.
- (2) 2 = filter. A filter shall be used to remove particles and contaminants from the water to prevent interference with the operation of the water supply system or the water closet under test.
- (3) 3 = flow meter. The flow meter shall cover the range 0 to 227 L/min (0 to 60 gpm) and have an accuracy of 2% full scale. Variable area and turbine meters shall be permitted.
- (4) 4 = pressure regulator. The pressure-reducing valve shall cover a 140 to 550 kPa (20 to 80 psi) range and have a capacity not less than 189 L/min (50 gpm) at a falloff pressure of 49 kPa (5 psi). An NPS-2 regulator bushed down to NPS-1-1/2 has been found satisfactory for achieving these flow rates. Some NPS-1-1/2 regulators do not allow for high flow rates on account of internal design or construction restrictions. A second regulator to provide a controlled inlet pressure should be used.
- (5) 5, 8, and 9 = valves. The control valves shall be commercially available full bore NPS-1-1/2 globe valves or equivalent to facilitate throttling (8), quick shut-off (9), and bypass (5) of the regulator.
- (6) 6 = supply piping. A minimum NPS-1-1/2 diameter pipe or tubing shall be used.
- (7) 7 and 10 = pressure gauges. The pressure gauges shall have a range of 0 to 690 kPa (0 to 100 psi) and have 10 kPa (1 psi) divisions. Accuracy shall not be less than 2% full scale.
- (8) 11 = flexible hose. The flexible hose shall connect the standardized supply to the flushometer valve. The hose shall be NPS-1-1/4 inside diameter and shall not be more than 3 m (10 ft) long.
- (9) 12 = flushometer valve. The flushometer valve shall be supplied with a matching supply stop. The manufacturer or the test laboratory shall supply the flushometer valve for testing, at the option of the manufacturer. All flushometer valves used for testing shall comply with CAN/CSA-B125.3 or ASSE 1037.

**Figure 12**  
**Standardization of water supply system for testing**  
**flushometer valve water closets and urinals**

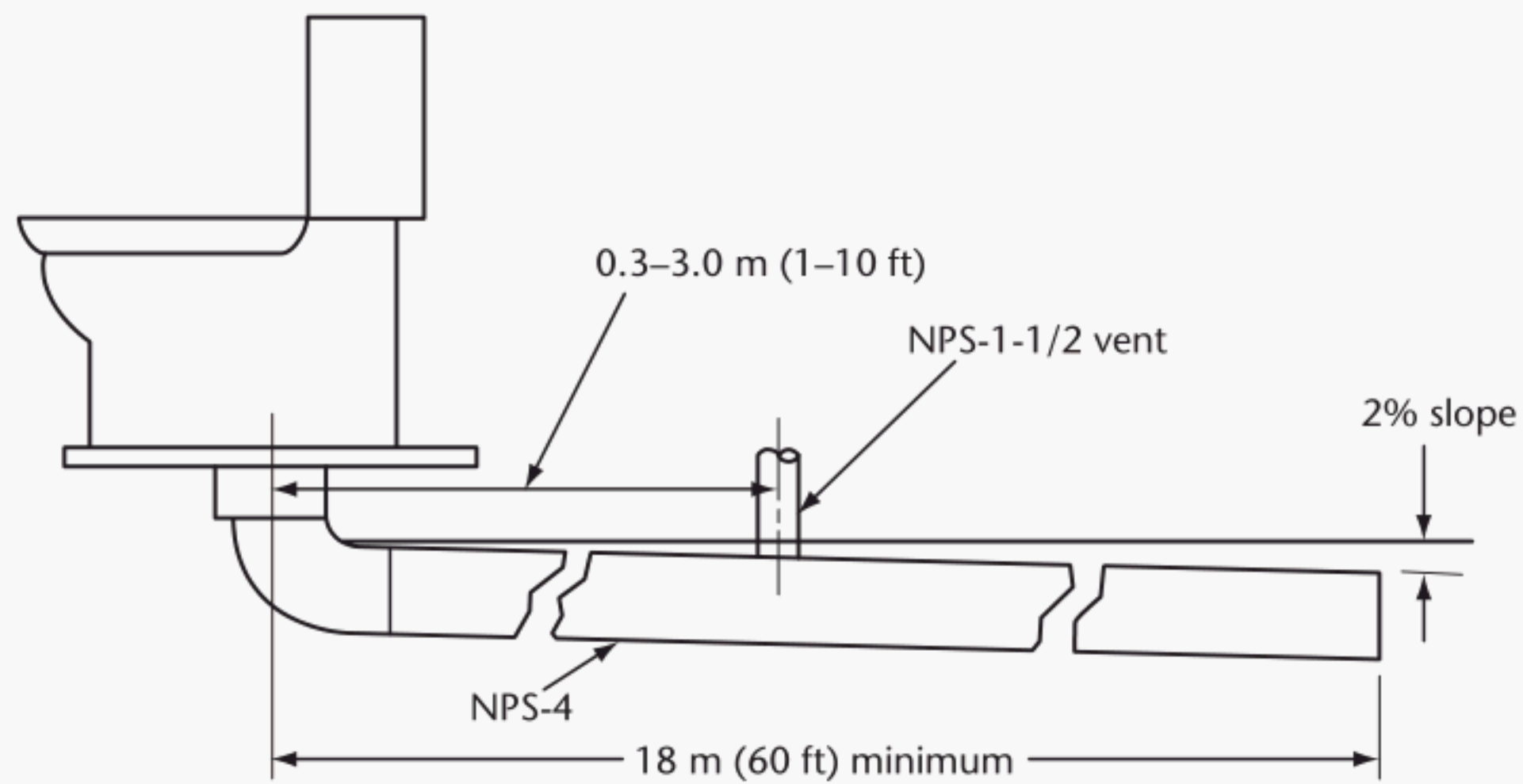
(See [Clauses 7.1.1](#), [7.1.5.2](#), and [8.2.1](#).)

**(a) Suggested apparatus****(b) Required measurements**

**Note:** Diagram (a) shows a full trap seal and diagram (b) shows a partially depleted trap seal.

**Figure 13**  
**Suggested apparatus and required measurements for**  
**the trap seal depth determination test**  
 (See [Clauses 3, 7.2, 7.2.1, 8.3, and 8.3.1.](#))





**Figure 14**  
**Suggested drain line transport characterization test assembly**  
(See [Clause 7.8.2.](#))

## Annex A (informative)

### Suggested formats for reporting test results

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

Static pressure, kPa (psi)	Run no.	Flush volume, L (gal)			Cycle time, s	Trap seal restored? (yes/no)	Residual trap seal depth, $H_r$ , mm (in)*
		Main flush	Total flush	Afterflow (total flush minus main flush)			
	1						
	2						
	3						
	Average total flush volume, L (gal)				Average cycle time, s		
	1						
	2						
	3						
	Average total flush volume, L (gal)				Average cycle time, s		
	1						
	2						
	3						
	Average total flush volume, L (gal)				Average cycle time, s		

\*Record residual trap seal depth only if trap seal not restored. See [Clause 7.3](#).

**Figure A.1**  
**Suggested format for reporting results of the water consumption test for water closets**  
(See [Clauses 7.1.7](#) and [7.4.4](#).)

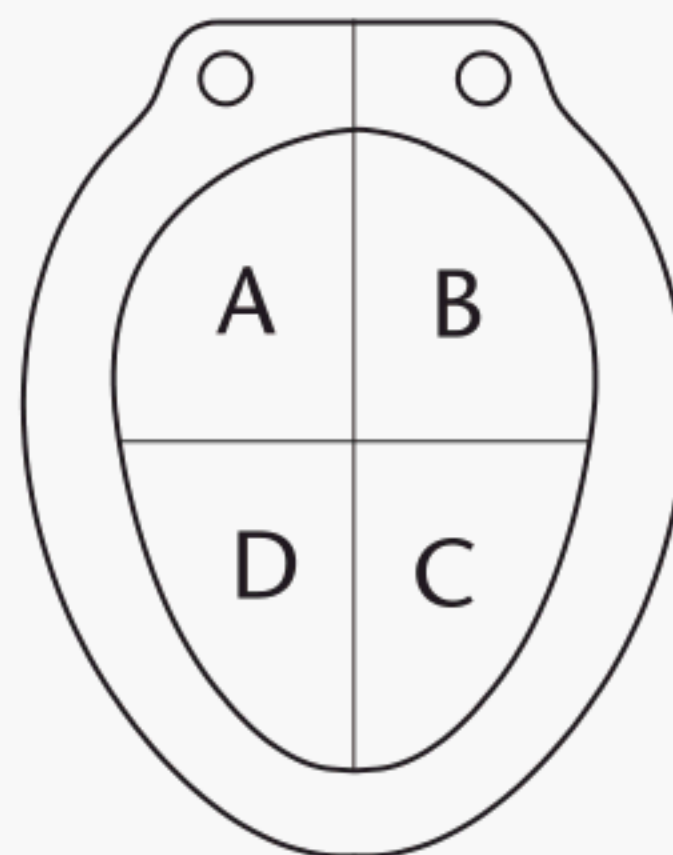
Run no.	Number of granules in bowl after flushing	Number of balls in bowl after flushing	Trap seal restored? (yes/no)	Residual trap seal depth, $H_r$ , mm (in)*
1				
2				
3				

\*Record residual trap seal depth only if trap seal not restored. See [Clause 7.3](#).

**Figure A.2**  
**Suggested format for reporting results of the granule and ball test**  
(See [Clauses 7.1.7](#) and [7.5.3](#).)



Run no.	Number of ink line segments remaining on the flushing surface	Number of segments in each quadrant	Length of each segment, mm (in)	Combined length of segments, mm (in)
1		A		
		B		
		C		
		D		
2		A		
		B		
		C		
		D		
3		A		
		B		
		C		
		D		
Longest segment, mm (in)				
Average combined length, mm (in)				



**Quadrants**

**Figure A.3**  
**Suggested format for reporting results of the**  
**surface wash test for water closets**  
 (See [Clauses 7.1.7](#) and [7.6.3.](#))

Run no.	Initial flush				Second flush			
	Number flushed out			Trap seal restored? (yes/no)	Number flushed out			Trap seal restored? (yes/no)
	Sponges	Paper balls	Total		Sponges	Paper balls	Total	
1								
2								
3								
4								

**Figure A.4**  
**Suggested format for reporting results of the mixed media test**  
 (See [Clauses 7.1.7](#) and [7.7.3](#).)

Travel distance, m (ft)	Number of balls			Total balls (three runs)	Average distance travelled, m (ft)	Weighted carry distance (total balls × average distance travelled), m (ft)
	First run	Second run	Third run			
In bowl or trap					0 (0)	
< 3 (< 10)					1.5 (5)	
3–6 (10–20)					4.5 (15)	
6–9 (20–30)					7.5 (25)	
9–12 (30–40)					10.5 (35)	
12–15 (40–50)					13.5 (45)	
15–18 (50–60)					16.5 (55)	
> 18 (> 60)					18.0 (60)	
Total	100	100	100	300	—	
Average carry distance per ball (total carry distance/300)						

**Figure A.5**  
**Suggested format for reporting results of the  
 drain line transport characterization test**  
 (See [Clauses 7.1.7](#) and [7.8.4](#).)



Travel distance, m (ft)	Number of balls			Total balls (three runs)	Average distance travelled, m (ft)	Weighted carry distance (total balls × average distance travelled), m (ft)
	First run	Second run	Third run			
In bowl or trap	5	2	7	14	0 (0)	0 (0)
< 3 (< 10)	14	22	15	51	1.5 (5)	76.5 (255)
3–6 (10–20)	8	9	6	23	4.5 (15)	103.5 (345)
6–9 (20–30)	5	2	4	11	7.5 (25)	82.5 (275)
9–12 (30–40)	2	0	3	5	10.5 (35)	52.5 (175)
12–15 (40–50)	5	8	2	15	13.5 (45)	202.5 (675)
15–18 (50–60)	9	12	7	28	16.5 (55)	462.0 (1 540)
> 18 (> 60)	52	45	56	153	18.0 (60)	2 754 (9 180)
Total	100	100	100	300	—	3 733.5 (12 445)

Average carry distance per ball (total carry distance/300): 3 733.5 m/300 = 12.5 m (12 445 ft/300 = 41.5 ft)

**Figure A.6**  
**Sample calculation for the drain line transport characterization test**  
(See [Clauses 7.1.7](#) and [7.8.4](#).)

Run no.	Number of ink line segments remaining on the flushing surface	Length of each segment, mm (in)	Combined length of segments, mm (in)
1			
2			
3			
Average combined length, mm (in)			

**Figure A.7**  
**Suggested format for reporting results of  
the surface wash test for urinals**  
(See [Clauses 8.1.3](#) and [8.4.3](#).)

Static pressure, kPa (psi)	Run no.	Flush volume, L (gal)			Trap seal restored? (yes/no)
		Main flush	Total flush	Afterflow (total flush minus main flush)	
	1				
	2				
	3				
	Average total flush volume, L (gal)				
	1				
	2				
	3				
	Average total flush volume, L (gal)				

**Figure A.8**  
**Suggested format for reporting results of**  
**the water consumption test for urinals**  
 (See [Clauses 8.1.3](#) and [8.6.3](#).)



## *Annex B (informative)*

# **Unit conversion criteria**

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

### **B.1 Conversion rules**

The following conversion rules are used in this Standard:

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

### **B.2 Rounding rules**

The following rounding rules are used in this Standard:

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

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