ASME A112.18.1-2024/CSA B125.1:24

Plumbing supply fittings

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Plumbing supply fittings

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Preface

This is the fifth edition of ASME A112.18.1/CSA B125.1, *Plumbing supply fittings*. It supersedes the previous edition published in 2018, 2011, 2012, and 2005.

Together with ASME A112.18.2/CSA B125.2, CSA B125.3, and ASME A112.18.6/CSA B125.6, this Standard forms a series to cover plumbing fittings.

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

This Standard was prepared by the CSA Technical Committee on Plumbing Fittings and the ASME Standards Committee on Plumbing Materials and Equipment. The CSA Technical Committee operates under the jurisdiction of the CSA Strategic Steering Committee on Construction and Civil Infrastructure. This Standard has been formally approved by the ASME Standards Committee and the CSA Technical Committee.

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   c) *wording of the proposed change; and*
   d) *rationale for the change.*

ASME A112.18.1-2024/CSA B125.1:24
Plumbing supply fittings

1 Scope

1.1 Inclusions

This Standard covers plumbing supply fittings and accessories located between the supply stop and the terminal fitting, inclusive, as follows:

a) automatic compensating valves for individual wall-mounted showering systems;
b) bath and shower supply fittings;
c) bidet supply fittings;
d) clothes washer supply fittings;
e) commercial pre-rinse spray valves;
f) drinking fountain supply fittings;
g) humidifier supply stops;
h) kitchen, sink, and lavatory supply fittings;
i) laundry tub supply fittings;
j) lawn and sediment faucets;
k) low-pressure water dispensers;
l) metering and self-closing supply fittings;
m) shower heads and body sprays; and
n) supply stops.

1.2 Exclusions

This Standard does not cover

a) plumbing waste fittings, which are covered by ASME A112.18.2/CSA B125.2;
b) other devices (e.g., temperature-actuated in-line mixing valves), which are covered by CSA B125.3 or other Standards; and
c) flexible water connectors under continuous pressure, which are covered by ASME A112.18.6/CSA B125.6.

1.3 Exceptions

Except for push-fit fittings, this Standard does not cover pipes and tubes or pipe and tube fittings.

1.4 Terminology

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

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

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

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

1.5 Units

The values given in SI units are the units of record for the purposes of this Standard. The inch/pound units are shown in parentheses.

The values stated in each measurement system are equivalent in application; however, each system is to be used independently. Combining values from the two measurement systems can result in non-conformance with this Standard.

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

Note: *See Annex A for information on the conversion criteria used in this Standard.*

2 Reference publications

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

CSA Group

B64 Series:21
Backflow preventers and vacuum breakers

B125.3:22
Plumbing fittings

C22.2 No. 14-18
Industrial control equipment

C22.2 No. 24:21
Temperature-indicating and -regulating equipment

C22.2 No. 68-18
Motor-operated appliances (household and commercial)

C22.2 No. 94.2:20
Enclosures for electrical equipment, environmental considerations

C22.2 No. 250.0:21
Luminaires

C22.2 No. 250.13:22
Light emitting diode (LED) equipment for lighting applications

C22.2 No. 60065:16 (R2020)
Audio, video and similar electronic apparatus — Safety requirements

CAN/CSA-E60730-1:15
Automatic electrical controls — Part 1: General requirements

ASME (American Society of Mechanical Engineers)

A112.1.2-2012(R2022)
Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors)

A112.1.3-2000(R2019)
Air Gap Fittings for Use with Plumbing Fixtures, Appliances, and Appurtenances

A112.18.3-2002(R2022)
Performance Requirements for Backflow Devices and Systems in Plumbing Fixture Fittings

B1.20.1-2013(R2018)
Pipe Threads, General Purpose, Inch

B1.20.7-1991(R2018)
Hose Coupling Screw Threads (Inch)

B16.18-2021
Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2021
Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.26-2018
Cast Copper Alloy Fittings for Flared Copper Tubes

PTC 19.2-2010(R2020)
Pressure Measurement

PTC 19.5-2004(R2013)
Flow Measurement

ASME/CSA Group

ASME A112.18.2-2020/CSA B125.2:20
Plumbing waste fittings

ASME A112.18.6-2017/CSA B125.6:17 (R2021)
Flexible water connectors

ASSE International

1019-2011 (R2016)
Wall Hydrant with Backflow Protection and Freeze Resistance

1023-2020
Electrically Heated or Cooled Water Dispensers

1061-2020
Push-Fit Fittings

ASSE/ASME/CSA Group

ASSE 1016-2017/ASME A112.1016-2017/CSA B125.16:17 (R2021)
Performance requirements for automatic compensating valves for individual showers and tub/shower combinations

ASSE 1070-2020/ASME A112.1070-2020/CSA B125.70:20
Performance Requirements for Water Temperature Limiting Devices

ASTM International

B117-19
Standard Practice for Operating Salt Spray (Fog) Apparatus

B368-21
Standard Test Method for Copper-Accelerated Acetic Acid-Salt Spray (Fog) Testing (CASS Test)

B380-97(2023)
Standard Test Method for Corrosion Testing of Decorative Electrodeposited Coatings by the Corrodkote Procedure

B571-18
Standard Practice for Qualitative Adhesion Testing of Metallic Coatings

D968-22
Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

D3359-23
Standard Test Methods for Rating Adhesion by Tape Test

E29-22
Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

F2324-13(2019)
Standard Test Method for Prerinse Spray Valves

G85-19
Standard Practice for Modified Salt Spray (Fog) Testing

ISA (International Society of Automation)

ANSI/ISA-75.02.01-2008
Control Valve Capacity Test Procedures

MC96.1-1982
Temperature Measurement Thermocouples

ISO (International Organization for Standardization)

228-1:2000
Pipe threads where pressure-tight joints are not made on the threads — Part I: Dimensions, tolerances and designation

NSF International

NSF/ANSI 61-2022
Drinking Water System Components — Health Effects

NSF/ANSI/CAN 372-2022
Drinking Water System Components — Lead content

SAE International

J512:2022
Automotive Tube Fittings

ULSE Inc.

UL 50-15
Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 873-07
Temperature-Indicating and -Regulating Equipment

UL 1598-21
Luminaires

UL 1951-11
Electric Plumbing Accessories

UL 8750-15
Light Emitting Diode (LED) Equipment for Use in Lighting Products

UL 60065-15
Standard for Safety Audio, Video and Similar Electronic Apparatus — Safety Requirements

UL 60730-1-16
Automatic Electrical Controls — Part 1: General Requirements

3 Definitions and abbreviations

3.1 Definitions

The following definitions shall apply in this Standard:

Accessible — readily serviceable or readily replaceable.

Accessible design — a design approach for making devices accessible to persons with physical, sensory, or cognitive disabilities.

Note: *Accessible designs are also known as barrier-free designs.*

Accessory — a component that can, at the discretion of the user, be readily added, removed, or replaced and that, when removed, will not prevent the fitting from fulfilling its primary function.

Note: *Examples of accessories include aerators, hand-held shower assemblies, shower heads, and in-line flow controls.*

Air gap — the unobstructed vertical distance through air between the lowest point of a water supply outlet and the mounting deck of the fitting.

Automatic compensating valve — a water-mixing valve that is supplied with hot and cold water and provides a means of automatically maintaining the water temperature selected for an outlet.
Note: *Automatic compensating valves are used to reduce the risk of scalding and thermal shock.*

Backflow — a flowing back or reversal of the normal direction of flow.
Note: *Back siphonage and back pressure are types of backflow.*

Backflow prevention device — a mechanical device, whether used singly or in combination with other devices, that automatically prevents reversal of water flow in a water system due to back pressure or back siphonage.

Back pressure — pressure higher at the downstream or outlet end of a water system than at a point upstream.

Back siphonage — backflow caused by below-atmospheric pressure in the water system.

Body spray — a shower device for spraying water onto a bather other than from the overhead position.
Note: *An example is a device mounted on a wall below the bather's head that sprays water in an approximately horizontal direction and can be fixed or allowed to swivel on a ball joint.*

Commercial pre-rinse spray valve — a hand-held, self-closing fitting that is used to spray water on dishes, flatware, and other food service items for the purpose of removing food residue before cleaning.

Critical level (CL) — the lowest water level in a fitting at which back siphonage will not occur.

Cross-flow — the exchange of water from one supply to the other without water flowing through the mixing valve outlet(s).

Defect —

Blister — a dome-shaped defect resulting from loss of adhesion between layers or between one or more layers and the substrate.

Crack (as applied in coatings evaluation) —

a) a separation in a coating layer that extends down to the next layer or to the substrate in a coating that has lost its adhesion; or
b) any indication of a crack (e.g., white deposits or corrosion) that results from performance tests, allows penetration through a plating layer, and did not appear on the surface or part before performance testing.

Note: *Coating surface deformations that appear after performance testing (e.g., stretch marks, flow lines under the coating, or deformations caused by stress relieving of the substrate) and do not separate, peel, or come loose are not considered cracks.*

Pit — a small depression or cavity.

Surface defect — a pit, blister, crack, peeling, wrinkling, corrosion, or exposure of the substrate visible to the unaided eye at normal reading distance.
Note: *"Unaided eye" includes vision assisted by corrective lenses normally worn by the person inspecting a device for surface defects.*

Diverter — a device that is integral to a fitting or that functions as an accessory and is used to direct the flow of water from a primary outlet to one or more secondary outlets.

Faucet — a terminal fitting.

Lawn faucet — a faucet designed to be installed horizontally on the outside wall of a building with male or female IPS threads or copper solder connections on the inlet and hose threads on the outlet.

Notes:

1) *Lawn faucets can be frostproof.*
2) *The outlet is usually angled 45° from the horizontal. Lawn faucets include a flange that mounts flush with the wall.*

Sediment faucet — a horizontal faucet with male or female IPS threads on the inlet side and male hose threads at the outlet spout.

Notes:

1) *The outlet can be angled approximately perpendicularly to the inlet or angled outward.*
2) *Sediment faucets were formerly called boiler drains because they were originally designed to drain water from boilers and release any accumulated sediment. Today, they are also used in laundry rooms as hook-ups for washing machines.*

Self-closing faucet — a faucet that, once the valve is opened, automatically shuts off the flow of water by either mechanical or electronic means.

Metering faucet — a self-closing faucet that discharges water for a predetermined amount of time (i.e., cycle) or discharges a predetermined quantity of water before shutting off.

Fitting — a device that controls and guides the flow of water.

Note: *Fittings include faucets and valves.*

Combination fitting — a fitting with more than one supply inlet delivering water through a single spout.

Concealed fitting — a fitting with its body mounted beneath or behind a fixture, wall, or surface.

Deck-mounted fitting — a fitting that is mounted on top of a horizontal surface.

Exposed fitting — a fitting whose body is mounted above or in front of a fixture's deck or shelf.

Line fitting — a fitting that does not discharge to atmosphere.

Public lavatory fitting — a fitting intended to be installed in non-residential bathrooms that are exposed to walk-in traffic.

Supply fitting — a fitting that controls and guides the flow of water in a supply system.

Terminal fitting — a fitting with an open or atmospheric discharge.

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

Grasp — to firmly hold and seize an object by wrapping the fingers and thumb around it.

Low-pressure water dispenser — a terminal fitting located downstream of a pressure-reducing valve that dispenses drinking hot water above 71 °C (160 °F), cold water, or both at a pressure of 105 kPa (15 psi) or less.

Operating control — a part of a supply fitting or accessory that manually controls the temperature, direction, or flow rate of water or that closes and opens the water supply.

Outlet —

Primary outlet — the outlet from a supply fitting on the discharge side of a valve through which water will discharge unless diverted to a secondary outlet.

Secondary outlet — an outlet from a supply fitting on the discharge side of a valve, other than the primary outlet, through which water can be discharged.

Permanent mark/label — a mark or label that is intended to remain in place for the lifetime of the fitting under conditions of normal use.

Physical vapour deposition (PVD) — a family of coating processes in which the surface layer is formed by the deposition of individual atoms or molecules.
Note: *In PVD, a material is vaporized from a solid or liquid source, transported through a low-pressure gaseous or plasma environment, and condensed on a substrate surface.*

Potable water — water that is satisfactory for drinking and for culinary and domestic purposes.
Note: *Potable water meets the requirements of the health authority having jurisdiction.*

Pressure —

Flowing pressure — the pressure in the piping upstream of an open fitting or accessory.

Supply pressure — the static water pressure in the fitting supply piping.

Pressure envelope — the outside part of a supply fitting that withstands and contains the water pressure.

Push-fit fitting — a mechanical fitting that joins pipes or tubes and achieves a seal by pushing by hand the mating pipe or tube into the fitting.
Note: *The fitting can be removable or non-removable.*

Rigid waterway — a cross-section of a waterway that can transmit a bending load to the body of a fitting.

Seal — a component or other portion of a fitting that prevents water leakage.

Seat disc — a disc or washer that provides a watertight joint when compressed against the seat.

Service conditions 1 (SC-1) — the coated surfaces of concealed fittings and concealed parts of exposed fittings.

Service conditions 2 (SC-2) — the coated significant surfaces of exposed fittings and exposed parts of concealed fittings.

Shank — the rigid threaded portion of a supply fitting that extends below the mounting surface and has a means for connecting to the supply piping.

Shower head — an accessory to a supply fitting for spraying water onto a bather, typically from an overhead position.

Note: *Types of shower heads include fixed shower heads, hand-held showers, and rain showers.*

Hand-held shower — a shower head, connected to a flexible hose, that can be held or fixed in place for spraying water onto a bather.

Rain shower — a shower head designed to be mounted directly over the bather with the spray face parallel to the floor.

Note: *The shower head can be mounted directly from the ceiling or on an extended shower arm.*

Significant surface — an exposed surface that, if blemished, spoils the appearance or affects the performance of a fitting.

Standard tools — tools that are normally carried by plumbers for installing and maintaining plumbing.

Note: *Examples include screwdrivers, key wrenches, flat-jawed wrenches, and pliers.*

Substrate — the base material and all layers of coating under the final coating.

Supply stop — a valve that is placed immediately upstream of a terminal fitting to shut off the water supply to the terminal fitting so that it can be serviced or replaced.

Valve — a fitting with a movable part that regulates the flow of water through one or more passages.

Cycling mixing valve — a supply fitting with a single handle that can rotate from the closed position, through cold to hot, and in the reverse direction back to the closed position.

Single-control mixing valve — a supply fitting with a single handle that turns water on and off and changes water volume and temperature.

Single-handle mixing valve — a supply fitting with a single handle for changing the discharge water temperature when the fitting is supplied with both hot and cold water.

Two-handle mixing valve — a supply fitting with separate hot and cold water control valves.

3.2 Abbreviations

The following abbreviations shall apply in this Standard:

CL — critical level
IPS — iron pipe size
NPS — nominal pipe size
NPSM — national pipe straight mechanical
NPT — national pipe tapered
PTC — performance test code
PVD — physical vapour deposition
SC-1 — service conditions 1
SC-2 — service conditions 2

4 Design requirements

4.1 Supply fittings

4.1.1 Rated pressure

4.1.1.1 General

Supply fittings shall be designed for a rated supply pressure of 690 kPa (100 psi).

4.1.1.2 Operation

Supply fittings shall be designed to function at a supply pressure between 140 and 860 kPa (20 and 125 psi).

4.1.2 Rated temperatures

4.1.2.1 General

Supply fittings shall be designed for rated supply temperatures from 5 °C to 71 °C (40 °F to 160 °F).

4.1.2.2 Operation

The hot water components of low-pressure water dispensers shall be designed for rated supply temperatures from 43 °C to 99 °C (110 °F to 210 °F).

4.1.3 Seating members

4.1.3.1 Replaceable seats

The following fittings shall have replaceable seats:

a) supply valves for bath and shower fittings, except concealed stops;
b) combination lavatory fittings;
c) combination kitchen sink fittings;
d) bidet fittings;
e) single lavatory faucets; and
f) exposed valve-type bath and shower fittings.

4.1.3.2 Seat disc arrangements

Seat disc arrangements shall

a) be replaceable; and
b) not vibrate in service.

When a threaded device is used to secure the disc, it shall remain secure after the disc has been removed and replaced five times.

4.1.3.3 Replaceable cartridge

In lieu of a replaceable seat, as required in Clauses 4.1.3.1 and 4.1.3.2, a replaceable cartridge that includes both seat and seal may be used.

4.1.3.4 Solenoid valve

The solenoid valve used to open and close the flow of water shall be replaceable.

4.2 Servicing

Supply fittings, excluding supply stops, shall be designed so that replacement of wearing parts can be accomplished

a) without removing the fitting from the supply system;
b) without removing the piping from the body;
c) without disturbing the finished wall; and
d) using standard tools or manufacturer-provided tools.

Swing spouts designed to use adjustable packing in the joint between the spout and the body shall be constructed so that the adjustments can be made without removing the spout.

4.3 Installation

A method of sealing between the fitting and the fixture to which it is fastened shall be provided.

4.4 Threaded connections

4.4.1 Pipe threads

Pipe threads shall comply with ASME B1.20.1.

4.4.2 Hose threads

Hose threads shall comply with ASME B1.20.7.

4.4.3 Aerators and other end point devices with standard threads

4.4.3.1 General

Aerators and other end point devices with standard threads shall be compatible with one of the following thread designations:

a) 13/16-27 UNS-2A, 3/4-27 UNS-2B, 15/16-27 UNS-2A, or 55/64-27 UNS-2B; or
b) M18X1-6g, M16X1-6H, M24X1-6g, M22X1-6H, or M28X1-6g.

4.4.3.2 Fittings with non-standard threads

Fittings with non-standard threads for aerators or other end point devices may be used.

4.4.4 Hand-held shower connection threads

Hand-held shower connection threads shall be 1/2-14 NPSM or ISO 228-G 1/2 B (see ISO 228-1).

4.4.5 Supply flare connections

The dimensions of supply flare connections shall be as specified in ASME B16.26.

4.4.6 Supply compression connections

The dimensions of supply compression connections shall be compatible with SAE J512.

4.4.7 Inlets and shanks

The dimensions for the inlets and shank lengths of 1/2-14 NPSM rigid shanks of deck-mounted lavatory and sink supply fittings designed to mate with a standard 1/2 NPSM coupling nut and tailpiece or 1/2 nominal size copper water tube shall be as shown in Figures 1 and 2.

Inlets and shanks may be designed to mate with other common connections.

Note: *Longer shank lengths are sometimes necessary on account of fitting orientations and countertop thickness or materials.*

4.4.8 Alternative end-threaded connections

Alternative end-threaded connections for flexible hoses and flexible components shall comply with the performance requirements of this Standard.

4.4.9 Shower head connection

Shower heads for installation on standard shower arms shall be capable of being connected to a 1/2 NPT male thread.

4.5 Connections other than threaded connections

4.5.1 Solder-joint sockets

The lengths and diameters of solder-joint sockets shall be as specified in ASME B16.18 or ASME B16.22 for connections to copper tubes. This requirement shall not apply to factory-assembled parts.

4.5.2 Push-fit fittings

Connections achieved by push-fit fittings, intended for use under continuous pressure, shall comply with ASSE 1061.

4.5.3 Alternative end connections

Alternative end connections for flexible hoses and flexible components shall comply with the performance requirements of this Standard.

4.5.4 Fittings with proprietary connections

Fittings with proprietary connections for aerators or other end point devices may be used.

4.6 Accessible designs

Operating controls intended for use in accessible designs shall

a) be automatically controlled; or
b) meet the following requirements:
   i) be operable with one hand;
   ii) not require tight grasping, pinching, or twisting of the wrist; and
   iii) require an operating force not greater than that specified in Clause 5.5.2.

4.7 Backflow prevention

Fittings shall be designed to protect the potable water supply from contamination due to backflow by a means that meets the applicable requirements of Clause 5.9.

Diverting and anti-siphoning devices incorporated into a fitting shall be removable for cleaning, repair, and replacement.

4.8 Cover plates and escutcheons

4.8.1 Cover plates

The cover plates of deck-mounted lavatory and sink supply fittings shall have the dimensions indicated in Figure 1 except as specified in Clause 4.8.2.

Note: *Refer to the appropriate plumbing fixture standards for the minimum mounting surface dimensions.*

4.8.2 Escutcheons

Concealed and deck-mounted supply fitting bodies or their escutcheons shall be capable of concealing a circular area with a diameter of not less than 44 mm (1.73 in).

4.9 Toxicity and lead content

4.9.1 Toxicity

Fittings covered by this Standard shall comply with the applicable requirements of NSF/ANSI 61.

4.9.2 Lead content for solders, fluxes, and metal alloys

Solders and fluxes in contact with potable water shall not exceed, by mass, 0.2% lead content. Metal alloys in contact with potable water shall not exceed 8% lead content.

4.9.3 Lead content for fittings

Fittings intended to convey or dispense water for human consumption through drinking or cooking shall not contain a weighted average lead content in excess of 0.25% when evaluated in accordance with the test method specified in NSF/ANSI 372.

4.10 Frost-proof faucets and hydrants

Frost-proof faucets and hydrants shall comply with the performance requirements of this Standard. Devices with integral backflow protection shall comply with CAN/CSA-B64 Series or ASSE 1019.

4.11 Shower heads and body sprays

4.11.1 General

When used as a component part of a shower head or body spray, the flow-restricting inserts shall be mechanically retained at the point of manufacture. For the purpose of this requirement, the term “mechanically retained” shall mean that a force of 36 N (8.0 lbf) or more is required to remove the flow-restricting insert. This requirement shall not apply to shower heads that would cause water to leak significantly from areas other than the spray face if the flow-restricting insert were removed.

4.11.2 High-efficiency shower heads

Note: *Water-conserving shower heads do not necessarily have to comply with the high-efficiency requirements specified in Clause 5.12 if they are not designated as high-efficiency shower heads.*

4.11.2.1 High-efficiency shower head with more than one mode

If the high-efficiency shower head has more than one mode, then

a) all modes shall comply with the maximum flow rate requirements specified in Clause 5.12.2.1;
b) all modes shall comply with the minimum flow rate requirements specified in Clause 5.12.2.2.1; and

c) at least one of the modes shall comply with the requirements specified in Clauses 5.12.2.2.2, 5.12.3, and 5.12.4 for high efficiency. The manufacturer shall indicate which mode is to be tested for high efficiency.

4.11.2.2 High-efficiency shower head marking requirements

See Clauses 6.1.2, 6.3.2, and 6.3.4 for additional marking requirements for high-efficiency shower heads.

4.12 Cross-flow

4.12.1 General

Except as otherwise allowed by Clause 4.12.2, a flow-control device shall not completely shut off the flow of water downstream of the primary shut-off valve when

a) fitted to a faucet or fitting; or
b) fitted to, or integral with, a shower head.

4.12.2 Check valves

Fittings that have either of the following shall have check valves installed in the fitting to prevent cross-flow:

a) integral flow-control devices downstream of the primary shut-off valves that completely shut off the flow of water; or
b) devices upstream of the primary shut-off valves that might allow cross-flow.

The check valves shall comply with Clause 5.3.3.

4.13 Fittings incorporating electrical features

4.13.1 General

4.13.1.1 Low-voltage circuits

Electrical power to low-voltage circuits involving a peak open-circuit potential of not more than 42.2 V shall be supplied by a

a) primary battery supply;
b) suitable Class 2 low-voltage transformer complying with the applicable CSA or UL electrical standards; or
c) combination of a transformer and fixed impedance that, as a unit, complies with the requirements for a Class 2 transformer specified in Item b).

4.13.1.2 Other than low-voltage circuits

Fittings incorporating electrical features other than low-voltage circuits shall comply with the applicable CSA or UL electrical standards.

Note: *These standards include the following:*

a) *for lighting products, CSA C22.2 No. 250.0 and CSA C22.2 No. 250.13 for Canada and UL 1598 or UL 8750 for the U.S.;*
b) *for audio or video products, CSA C22.2 No. 60065 for Canada and UL 60065 for the U.S.;*
c) *for controls, CSA C22.2 No. 24 or the applicable CSA E60730 Series standard for Canada and UL 873 or the applicable UL 60730 Series standard for the U.S.;*
d) *for electric plumbing products and accessories, CSA C22.2 No. 14 or CSA C22.2 No. 68 for Canada and UL 1951 for the U.S.; and*

e) *for parts intended for installation in wet locations, CSA C22.2 No. 94.2 for Canada or UL 50 for the U.S., for the appropriate degree of protection from ingress of moisture if applicable.*

4.13.2 Testing

When used with a plumbing fitting, electrical plumbing controls, including solenoid valves, shall
a) be considered components of the plumbing fitting;
b) be tested with the fitting; and
c) comply with Clause 5.6.

Replacement of a battery during the life cycle testing specified in Clause 5.6 shall not be considered a failure.

4.14 Materials

Coupling nuts, locknuts, and spout-holding nuts shall be made from
a) copper alloys with a minimum copper content of 56%;
b) stainless steel alloys of the 300 or 400 series;
c) plastics; or
d) materials that comply with Clause 5.11.

4.15 Automatic compensating valve temperature control

Automatic compensating valves shall comply with ASSE 1016/ASME A112.1016/CSA B125.16.

4.16 Lawn faucets

Lawn faucets (other than frost-proof lawn faucets) shall comply with Clause 5.10.

4.17 Flexible water connectors

Flexible water connectors intended for use under continuous pressure shall comply with ASME A112.18.6/CSA B125.6.

4.18 Commercial pre-rinse spray valves

Commercial pre-rinse spray valves shall comply with Clause 5.13.

4.19 Household hot water dispensers with storage electrical heating systems

Household hot water dispensers with storage electrical heating systems shall comply with ASSE 1023.

4.20 Integral water temperature limiting devices

Supply fittings with an integral water temperature limiting device, excluding shower fittings or fittings with only mechanical temperature limit stops, shall comply with the applicable requirements of ASSE 1070/ASME A112.1070/CSA B125.70.

5 Performance requirements and test procedures

5.1 General

5.1.1 Preconditioning

Before testing, specimens shall be conditioned at ambient laboratory conditions for not less than 12 h.

5.1.2 Installation for testing

For test purposes, specimens shall be installed in accordance with the manufacturer's instructions.

5.1.3 Test conditions

Unless otherwise specified in this Standard, tests shall be conducted at ambient laboratory conditions.

5.1.4 Order of tests

It shall not be necessary to conduct the tests in a particular order unless a sequence is specified in this Standard.

Note: *A summary of the applicable tests, by fitting type, is provided in Table B.1.*

5.2 Coatings

5.2.1 General

The fittings selected for testing shall be as received from the manufacturer and shall not have been subjected to any other test. The significant surfaces of the coated components shall be free of surface defects and uncoated areas, and shall not be stained.

5.2.2 Corrosion (all substrates and coatings)

5.2.2.1 Performance requirements

After undergoing the applicable test specified in Clause 5.2.2.2.1, coatings shall not show more than one surface defect in any 650 mm^2 (1.0 in^2) area of the significant surface or up to three surface defects on a 25 mm (1 in) length of parting line. The surface defects shall be not larger than 0.8 mm (0.03 in) in any dimension.

If widely scattered surface defects are observed after testing (as occasionally occurs), such defects shall not significantly deface or adversely affect the function of the coated part.

5.2.2.2 Test procedure

5.2.2.2.1 Corrosion tests

The coated parts shall comply with the performance requirements of Clause 5.2.2.1 after being subjected to one of the following corrosion tests:

a) ASTM G85 (Annex A1 — acetic acid): the test duration shall be 8 h for service conditions 1 (SC-1) and 24 h for service conditions 2 (SC-2).
b) ASTM B117 (neutral salt): this test shall be applicable to SC-2 devices and have a duration of 24 h.
c) ASTM B368 (CASS): this test shall be applicable to SC-2 devices and have a duration of 4 h.
d) ASTM B380 (Corrodkote): this test shall be applicable to SC-2 devices and have a duration of 4 h.

Note: *If more than one test method is specified, the manufacturer can specify which method is to be used. SC-1 and SC-2 are defined in Clause 3.1.*

5.2.2.2.2 Pass criteria for SC-1

An SC-1 specimen that passes the SC-2 test shall be considered to have met the requirements of Clause 5.2.2.2.1.

5.2.3 Adhesion

5.2.3.1 Performance requirements

The coating and the separate layers of multi-layer coatings shall be sufficiently adherent to each other and to the base material to comply with one of the adhesion tests specified in Clause 5.2.3.2, 5.2.3.3, or 5.2.3.4, as applicable.

5.2.3.2 Electrodeposited and PVD coatings on metals

Specimens shall be tested in accordance and comply with one of the following adhesion tests specified in ASTM B571:

a) Section 4 (burnish test);
b) Section 7 (file test);
c) Section 8 (grind-saw test); or
d) Section 9 (heat-quench test).

5.2.3.3 Electrodeposited and PVD coatings on plastics

5.2.3.3.1 Performance requirements

Fittings or component parts of fittings that have electrodeposited coatings on plastic bases, including those with additional organic coatings, shall comply with the following requirements when tested in accordance with Clause 5.2.3.3.2:

a) No surface defects shall be present on significant surfaces.
b) Non-significant surfaces, gates, and parting lines may have minor cracks not longer than 6 mm (0.25 in) provided there is no loss of adhesion between the base material and the coating.
c) Blisters not exceeding 6 mm^2 (0.01 in^2) in area shall be acceptable within 6 mm (0.25 in) of an injection point. If an injection point is within 6 mm (0.25 in) of a significant surface, then Item a) shall apply.
d) Warpage shall be considered acceptable only where it does not affect the performance of the fitting or component.

The adhesion of organic coatings shall be evaluated following the procedure specified in Clause 5.2.3.4 and shall not be evaluated during the test specified in Clause 5.2.3.3.2.

5.2.3.3.2 Thermal cycling procedure

Before the thermal cycling test begins, the fittings or component parts of fittings shall be examined and surface imperfections (e.g., small mould imperfections) shall be noted. These surface imperfections shall not be considered failures after the thermal cycling test unless they develop into surface defects.

Under dry conditions, the specimens shall be subjected consecutively to four complete cycles of temperatures, with each complete cycle consisting of the following steps in the following order:

a) –40 ± 2 °C (–40 ± 4 °F) for 20 min to 1 h;
b) 20 ± 5 °C (68 ± 9 °F) for a minimum of 20 min;
c) 75 ± 2 °C (167 ± 4 °F) for 20 min to 1 h; and
d) 20 ± 5 °C (68 ± 9 °F) for a minimum of 20 min.

The temperatures specified in Items a) to d) shall be measured within 50 mm (2 in) of the centre of the location of the specimens. Temperature ramping may be used for achieving the temperatures specified in Items a) to d). For the steps specified in Items a) and c), the temperature ramping time (if any) plus

the time during which the specimen is at the specified temperature (a minimum of 20 min) shall not exceed 1 h.

During testing, there shall be free circulation of air around the specimens and most of their surface area shall not be in contact with other specimens or the holding container.

5.2.3.4 Organic coatings

The adhesion of organic coatings shall be tested in accordance with Method A of ASTM D3359. The organic coating shall have an adhesion rating of 3A or better.

5.2.4 Decorative organic coatings

5.2.4.1 Performance requirements

In addition to complying with the adhesion testing specified in Clause 5.2.3.4, decorative organic coatings shall show no surface defects when they are tested in accordance with Clauses 5.2.4.2 and 5.2.4.3, and their finish shall not erode in such a way that the surface directly beneath the organic coating is exposed when they are tested in accordance with Clause 5.2.4.4.

5.2.4.2 Water degradation

Specimens shall be immersed in distilled water maintained at 38 ± 1 °C (100 ± 2 °F) for 24 ± 0.5 h in a corrosion-proof container and then removed and examined.

5.2.4.3 Soap and cleaner effects

Two drops (0.10 mL total) of each of the following solutions shall be applied to the organic coating (preferably on a flat surface) and allowed to remain there for 16 h:

a) ammonium hydroxide (6N);
b) sodium hydroxide (6N);
c) methanol (100%); and
d) surfactant (100% polyethylene oxyethanol).

At the end of the 16 h period, the excess liquid shall be removed by rinsing with water, and the coating shall be dried and examined.

Note: *Non-ionic surfactants complying with Item d) include GAF Igepal CO, GAF Igepal CA, and Shell Triton X-100.*

5.2.4.4 Abrasion resistance

Specimens shall be tested in accordance with Method A of ASTM D968 using 12 L (3.2 gal) of silica sand on a relatively flat surface of the specimen.

5.3 Pressure and temperature

5.3.1 Static and dynamic seals

5.3.1.1 Failure criteria

Seals of plumbing supply fittings and accessories, except those of automatic compensating valves (see Clause 4.15), shall not leak or otherwise fail when tested in accordance with Clauses 5.3.1.2 to 5.3.1.4.

5.3.1.2 Procedure with the valve closed

The specimen shall be tested in accordance with Clause 5.3.1.4, after which it shall be subjected to the supply pressures specified in Clause 5.3.1.4, for 5 min each, with the valve closed.

5.3.1.3 Procedure with the outlet(s) blocked

The specimen shall be tested in accordance with Clause 5.3.1.4, after which it shall be subjected to the supply pressures specified in Clause 5.3.1.4, for 5 min each, with the outlet(s) blocked.

Where the outlet(s) is difficult to block, the flowing pressure shall be increased to the pressures specified in Clause 5.3.1.4 for 5 min each. The joints of the fittings shall be checked for leakages.

5.3.1.4 Test temperatures and pressures

5.3.1.4.1 General

The test shall be conducted in an ambient environment of 20 ± 5 °C (68 ± 9 °F). The specimen shall be brought to equilibrium test temperatures by running water through it.

5.3.1.4.2 Test temperature and pressure ranges

The test temperatures and pressures shall be as follows:

a) 140 ± 14 kPa and 10 ± 6 °C (20 ± 2 psi and 50 ± 10 °F);
b) 860 ± 14 kPa and 10 ± 6 °C (125 ± 2 psi and 50 ± 10 °F);
c) 140 ± 14 kPa and 66 ± 6 °C (20 ± 2 psi and 150 ± 10 °F); and
d) 860 ± 14 kPa and 66 ± 6 °C (125 ± 2 psi and 150 ± 10 °F).

Devices intended only for cold water applications shall be tested in accordance with Items a) and b) only.

5.3.2 Burst pressure

5.3.2.1 Failure criteria

Fittings shall withstand a hydrostatic burst pressure test at the pressures specified in Clause 5.3.2.2 or 5.3.2.3 without permanent distortion or failure of the pressure envelope.

5.3.2.2 Terminal fittings

Terminal fittings shall withstand a hydrostatic pressure of 3450 kPa (500 psi) for 1 min. The pressure shall be applied to the inlet with the valve(s) closed. Fittings may be of the pressure-relieving type provided the relief occurs at a pressure above 1030 kPa (150 psi) and the relief discharge is into a plumbing fixture.

5.3.2.3 Line fittings

Line fittings shall withstand a hydrostatic pressure of 3450 kPa (500 psi) for 1 min. The pressure shall be applied to the inlet with the outlet blocked and the valve open.

5.3.3 Cross-flow check valves

Note: *See Clause 4.12 for additional cross-flow requirements.*

5.3.3.1 Performance requirements

When tested in accordance with Clauses 5.3.3.2 and 5.3.3.3, cross-flow check valves shall not leak more than 35 mL/min (0.01 gpm) out of one supply inlet when the opposite supply inlet is pressurized. This test shall be run before and after the life cycle test specified in Clause 5.6.

5.3.3.2 Set-up

Fittings with integral flow-control devices downstream of the primary shut-off valves that completely shut off the flow of water shall be tested with the primary shut-off valves open and all outlets blocked.

Fittings with devices upstream of the primary shut-off valves that might allow cross-flow shall be tested with the primary shut-off valves closed.

5.3.3.3 Test procedure

The cross-flow check valve leak test shall be conducted as follows:

a) Pressurize one supply inlet to 35 kPa (5 psi) with water at 10 ± 6 °C (50 ± 10 °F) for 1 min with the primary shut-off valves open and all outlets blocked.
b) Observe the opposite supply inlet for leakage.
c) Repeat Items a) and b) for the opposite supply inlet.

5.3.4 Hose assemblies

5.3.4.1 Failure criteria

Hose assemblies shall not fail or leak when tested in accordance with Clauses 5.3.4.2 and 5.3.4.3.

5.3.4.2 Torque

The threaded connections of hose assemblies shall be tested as specified in Clause 5.3.1.3 with the threaded connections tightened to

a) the torque required to affect the seal; and
b) 150% of the torque required by Item a).

5.3.4.3 Burst pressure

Hose assemblies shall be tested at a hydrostatic pressure of 690 kPa (100 psi) for 1 h followed by a burst pressure test of 2000 kPa (290 psi) for 1 min using water at 10 ± 6 °C (50 ± 10 °F).

5.3.5 Ball joints

Shower head and body spray ball joints shall not leak in any position more than 35 mL/min (0.01 gpm) measured over 5 min when tested at a flowing pressure of 345 ± 35 kPa (50 ± 5 psi) and a temperature of 38 ± 6 °C (100 ± 10 °F).

5.3.6 Diverters

5.3.6.1 Bath and shower

5.3.6.1.1 Leakage rate

When tested in accordance with Clause 5.3.6.1.2, the rate of the leakage from a primary outlet when flow is through the secondary outlet shall not exceed 400 mL/min (0.1 gpm).

5.3.6.1.2 Measurement parameters

Bath and shower diverters shall be tested for rate of leakage at 69 kPa (10 psi) flowing pressure, measured between the diverter and the secondary outlet at 300 mm (12 in) from the diverter, with water at 38 ± 6 °C (100 ± 10 °F). Measurements shall be taken for 5 min, beginning 1 min after the diverter is activated.

5.3.6.2 Kitchen and lavatory

5.3.6.2.1 Leakage rate

When tested in accordance with Clause 5.3.6.2.2, the rate of leakage out of the spout of kitchen and lavatory side spray diverters shall not exceed 400 mL/min (0.1 gpm).

5.3.6.2.2 Measurement parameters

Kitchen and lavatory side spray diverters shall be tested for rate of leakage out of the spout at 140 ± 7 kPa (20 ± 1 psi) and 690 ± 7 kPa (100 ± 1 psi) flowing pressure with water diverted to the side spray, using water at 10 ± 6 °C (50 ± 10 °F) and 38 ± 6 °C (100 ± 10 °F). Measurements shall be taken for 5 min, beginning 1 min after the diverter is activated.

5.3.7 Aerators and other end point devices

Aerators and other end point devices shall maintain their installed position without leakage, stripping of threads, or loosening when tested for 5 min with water flowing at the pressures and temperatures specified in Items b) and d) of Clause 5.3.1.4.2.

Note: *Other end point devices include stream straighteners, laminar flow devices, barb fittings, and point-of-use filters.*

5.3.8 Low-pressure water dispensers

5.3.8.1 Failure criteria

Seals of low-pressure water dispensers shall not leak or otherwise fail when tested in accordance with Clause 5.3.8.2. This test shall be conducted after the life cycle test in Clause 5.6.

5.3.8.2 Test procedure

The specimen shall be brought to equilibrium test temperatures by running water through it at the manufacturer's rated temperature and pressure. The valve shall be closed and subjected to 1.5 times the manufacturer's rated pressure for 5 min.

5.4 Flow rate

5.4.1 Supply fittings

Fittings and accessories shall meet the minimum and maximum flow rate requirements specified in Table 1 at the temperatures and flowing pressures specified in Clause 5.4.2.3. These requirements shall be met before and after the life cycle tests specified in Clause 5.6.

5.4.2 Test procedure

5.4.2.1 Specimen

The specimen shall

a) be thoroughly flushed before the flow rate is measured;
b) be connected to a smooth-interior pipe or tubing with a length equal to at least 20 times the inside diameter of the inlet(s) of the specimen;
c) have a pipe or tubing of the length specified in Item b) connected to the outlet of the specimen if the specimen does not discharge to the atmosphere;
d) be connected to a pipe or tubing of the same nominal size as the specimen connections;
e) have its standard accessories installed, when tested for compliance with the maximum flow rates and the minimum flow rates for high-efficiency devices specified in Table 1; and
f) have its standard accessories removed, when tested for compliance with the minimum flow rates specified in Table 1.

If the accessories are supplied separately, they shall be tested as separate devices using commercially available pipe or tubing.

The test set-up shall be as shown in Figure 3.

5.4.2.2 Flow rate

Other flow rate test conditions shall be as follows:

a) the upstream pressure tap(s) and downstream pressure tap (if required) shall be located as shown in Figure 3;
b) pressure tap size and configuration shall comply with ASME PTC 19.2 or ANSI/ISA-75.02;
c) if a fluid meter is used to measure flow rate, the installation shall be as specified in ASME PTC 19.5; and
d) if the time/volume method is used, the container shall be of sufficient size to hold the collected water for at least 1 min.

5.4.2.3 Procedure

5.4.2.3.1 Settings

Fittings shall be tested at the maximum flow setting, if adjustable, with both hot and cold water valves fully open on combination fittings.

The flow rate test shall be conducted with water between 5 °C and 71 °C (40 °F and 160 °F) in accordance with the intended end use of the fitting and under the following conditions:

a) for minimum flow: at 140 ± 7 kPa (20 ± 1 psi) at the inlet when water is flowing;
b) for maximum flow for faucets: at 410 ± 7 kPa (60 ± 1 psi) at the inlet when water is flowing;
c) for maximum flow for low-pressure water dispensers: at 105 ± 7 kPa (15 ± 1 psi) at the inlet when water is flowing; and
d) for commercial pre-rinse spray valves: in accordance with Clause 5.13.3.

5.4.2.3.2 Flow rate tests for shower heads and body sprays

Flow rate tests for shower heads and body sprays shall be conducted with water at 38 ± 6 °C (100 ± 10 °F) and the flow maintained for at least 1 min. The flow rate test for

a) maximum flow for shower heads and body sprays in all operating modes shall be conducted at 550 ± 14 kPa (80 ± 2 psi);

b) minimum flow for shower heads shall be conducted at 310 ± 14 kPa (45 ± 2 psi). If the shower head has more than one mode, the minimum flow rate shall be determined at a flowing pressure of 310 ± 7 kPa (45 ± 1 psi) in all modes. Pause or trickle modes designed to flow at less than 1.9 L/min (0.5 gpm) at 550 kPa (80 psi) shall be excluded from the minimum flow requirements; and
Note: *The intent of Item b) is to aid in the selection of an appropriate automatic compensating valve.*

c) high-efficiency shower heads shall be conducted in accordance with Clause 5.12.2.

5.5 Operating requirements

5.5.1 General

Except for accessible designs and tub-to-shower and tub spout diverters, the torque or force required to open, operate, and close a manually activated valve or operating control shall not exceed the applicable operating torque or linear force specified in Table 2 when the manually operated valve or operating control is tested at the temperatures and pressures specified in Clause 5.3.1.4.

5.5.2 Accessible design devices

Accessible design devices shall be tested in accordance with Clause 5.3.1.4.1. Before and after the life cycle test, the linear force required to open, operate, and close a manually activated valve or operating control shall not exceed

a) 22 N (5 lbf) when tested at
   i) 140 ± 14 kPa and 10 ± 6 °C (20 ± 2 psi and 50 ± 10 °F);
   ii) 550 ± 14 kPa and 10 ± 6 °C (80 ± 2 psi and 50 ± 10 °F);
   iii) 140 ± 14 kPa and 66 ± 6 °C (20 ± 2 psi and 150 ± 10 °F); and
   iv) 550 ± 14 kPa and 66 ± 6 °C (80 ± 2 psi and 150 ± 10 °F); and
b) 45 N (10 lbf) when tested in accordance with Items b) and d) of Clause 5.3.1.4.2.

5.5.3 Low-pressure water dispensers

Low-pressure water dispensers shall be tested at a flowing pressure of 140 ± 14 kPa (20 ± 2 psi) with water at 10 ± 6 °C (50 ± 10 °F) for cold water only applications or with water at 99 + 0, –6 °C (210 + 0, –10 °F) for hot water only applications. Devices intended to dispense cold and hot water shall be tested at both water temperatures. Operating controls shall not require a moving force greater than 45 N (10 lbf) or 22 N (5 lbf) for accessible designs.

5.5.4 Swing spouts

Swing spouts, including those with pullout spouts, shall be tested at a flowing pressure of 860 ± 14 kPa (125 ± 2 psi) with water at 10 ± 6 °C (50 ± 10 °F). The force required to turn the spouts shall not exceed 45 N (10 lbf) measured at the end of the spout.

5.5.5 Shower heads and body sprays

At a flowing pressure of 860 ± 14 kPa (125 ± 2 psi) with water at 38 ± 6 °C (100 ± 10 °F), shower head and body spray ball joints shall not require a moving force greater than 45 N (10 lbf) at the farthest point from the ball joint.

5.6 Life cycle

5.6.1 Performance requirements

5.6.1.1 General

5.6.1.1.1 Requirements

Fittings incorporating moving parts or parts subject to wear shall be tested in accordance with Clauses 5.6.2 and 5.6.3 for the number of cycles specified in Table 3 except for automatic compensating valves (see Clause 4.15).

5.6.1.1.2 Test specimens

The specimens shall be installed in accordance with the manufacturer's instructions.

During and after the test, the specimens shall continue to function as they did at the beginning of the test and shall not develop defects that could adversely affect their functionality or serviceability.

5.6.1.1.3 Additional requirements

In addition to the requirements specified in Clauses 5.6.1.1.1 and 5.6.1.1.2, valves, swing spouts, shower heads, body sprays, diverters, aerators, and other end point devices shall comply with the applicable requirements specified in Clauses 5.6.1.2 to 5.6.1.6 after the life cycle test specified in Clause 5.6.2.

5.6.1.2 Valves or controls

Manually activated valves or controls

a) shall open, operate, and close with a torque or force that does not exceed 120% of that specified in Table 2 when tested in accordance with Clause 5.5 (except for accessible design valves, which shall not exceed the force specified in Clause 5.5.2); and
b) may have the packing nut tightened once during the test to stop leakage along the stem.

5.6.1.3 Swing spouts

5.6.1.3.1 General

Except for those with pullout spouts, swing spouts

a) shall not leak at the spout joint when tested in accordance with Clause 5.3.1.3;
b) may have the spout nut tightened once during the test to stop leakage; and
c) shall not require a turning force greater than 45 N (10 lbf) at the end of the spout when the flowing pressure is 860 kPa (125 psi) and the water temperature is 10 ± 6 °C (50 ± 10 °F).

5.6.1.3.2 Swing spouts with pullout spouts

Swing spouts with pullout spouts shall not require a turning force greater than 45 N (10 lbf) at the end of the spout.

5.6.1.4 Shower heads and body sprays

Shower heads and body sprays

a) shall not leak more than 35 mL/min (0.01 gpm) at the ball joint in any position when tested in accordance with Clause 5.3.5;

b) may have the ball joint packing nut tightened once during the test to reduce leakage; and
c) shall not require a moving force greater than 45 N (10 lbf) at the farthest point from the ball joint when the flowing pressure is 860 ± 14 kPa (125 ± 2 psi) and the water temperature is 38 ± 6 °C (100 ± 10 °F).

5.6.1.5 Diverters

5.6.1.5.1 General

Diverters shall
a) operate with a torque or force that does not exceed 120% of the torque or force specified in Table 2 when tested in accordance with Clause 5.5 (except for tub-to-shower and tub spout diverters);
b) if they are bath or shower diverters, not leak more than 800 mL/min (0.2 gpm) from a primary outlet when flow is through the secondary outlet when tested in accordance with Clause 5.3.6.1.2; and
c) if they are kitchen or lavatory side spray diverters, not leak more than 800 mL/min (0.2 gpm) out of the spout when tested in accordance with Clause 5.3.6.2.2.

5.6.1.5.2 Additional requirements

In addition to the requirements specified in Clause 5.6.1.5.1, a bath and shower automatic reset diverter shall be considered to have failed this test if it does not remain functional and reset itself to the tub position.

5.6.1.6 Aerators and other end point devices

Aerators and other end point devices shall comply with the performance requirements specified in Clause 5.3.7.

5.6.2 Test procedures

5.6.2.1 Set-up

The specimen shall be positioned so that the life cycle test apparatus can operate the specimen through its normal operating range without imposing forces inconsistent with its normal operation. The specimen shall be installed as it would be in its intended application.

5.6.2.2 General parameters

5.6.2.2.1 Speed

The speed of the life cycle test apparatus shall be adjusted to 1500 ± 150 cycles of operation per hour unless otherwise specified in this Standard or by the manufacturer.

5.6.2.2.2 Pressure and temperature

Water at a flowing pressure of 345 ± 35 kPa (50 ± 5 psi) and a supply pressure of 550 kPa (80 psi) maximum (valve closed) shall be supplied to the specimen throughout the test.

Hot water shall be at 66 ± 6 °C (150 ± 10 °F) and cold water shall be at 10 ± 6 °C (50 ± 10 °F).

5.6.2.2.3 Flow rate

For devices that flow in excess of 15 L/min (4.0 gpm) at 345 ± 35 kPa (50 ± 5 psi) flowing pressure, the outlet may be restricted to a flow rate of not less than 15 L/min (4.0 gpm) during the test.

5.6.2.2.4 Cold or hot water only applications

Fittings or valves in fittings that are intended to be used only with cold water shall be tested only with cold water.

Fittings or valves in fittings that are intended to be used only with hot water shall be tested to the temperature cycles specified in Clause 5.6.2.3.

5.6.2.3 Cycling

Unless otherwise specified in this Standard, fittings shall be temperature-cycled by supplying hot water to both supplies and then supplying cold water to both supplies every 1000 volume-control cycles (closed-open-closed).

Note: *The test specified in this Clause may be started with cold water and then switched to hot water as long as the specified sequences are maintained.*

5.6.2.4 Test loads

The test apparatus shall apply a torque or force sufficient to operate the specimen throughout the test but not exceeding 120% of the applicable torque or force specified in Table 2.

5.6.3 Fittings and other control devices

5.6.3.1 Mixing valves

Notes:

1) *The tests specified in this Clause may be started in the cold position and then switched to the hot position as long as the specified sequences are maintained.*
2) *The temperature cycle from the hot open to the cold open and back to the hot open position is counted as one cycle.*

5.6.3.1.1 Fittings with a rotary action valves

For fittings with a rotary action valve, the apparatus shall be adjusted to turn the valve and any associated handle mechanism from the fully closed position to a position between 37% and 75% of the fully open position, but not exceeding 360°. This test shall simulate the intended operating motion of the fitting without making contact with the end stops, except as agreed to by the manufacturer.

5.6.3.1.2 Single-control mixing valves or mixing valves with separate controls

For single-control mixing valves or mixing valves with separate volume and temperature controls, the apparatus shall be adjusted to operate the valve as follows:

a) For the volume cycle, the volume control shall be moved from the fully closed position to 80% (minimum) of the fully open position, without making contact with the end stops, and back to the fully closed position.
b) For the temperature cycle, the temperature control shall be moved a minimum of 80% of the range between the full hot position to the full cold position and back to the full hot position, without making contact with the end stops, except as agreed to by the manufacturer.
c) The total number of cycles specified in Table 3 shall be calculated by adding together the following:
   i) the total volume control cycles (open-closed-open) in the hot position;

ii) the total volume control cycles (open-closed-open) in the cold position; and
iii) the total number of temperature control cycles (full open hot position to full open cold position and back to full open hot position).

The sequence shall be seven open-closed-open cycles in the hot position, then a switch to the cold position, then seven open-closed-open cycles in the cold position, and then a switch back from the cold position to the hot position, for a total of 15 cycles.

For single-control mixing valves, hot and cold water shall be supplied alternately to both supplies and then switched every 1000 cycles.

5.6.3.1.3 Single-handle cycling mixing valve

For single-handle cycling mixing valves of the cycling type, the apparatus shall be adjusted to operate the specimen from closed to 80% (minimum) of the range between the cold position and the hot position, and back to closed, without making contact with the end stops except as agreed to by the manufacturer.

5.6.3.1.4 Two-handle mixing valves

For two-handle mixing valves, the hot and cold water valves shall be opened and closed simultaneously.

5.6.3.2 Metering and self-closing faucets

5.6.3.2.1 Metering faucets

Metering faucets shall close before reactivation of the next cycle. Adjustable metering faucets shall be set to run for approximately 5 s after actuation. Non-adjustable metering faucets shall be operated at their maximum run duration.

5.6.3.2.2 Self-closing faucets

Self-closing faucets, not including metering, shall be opened to the applicable extent specified in Clause 5.6.3.1.2 and allowed to close at a rate specified by the manufacturer.

5.6.3.3 Other devices

5.6.3.3.1 Devices to be tested with the highest flow rate

The following devices shall be tested at a flowing pressure of 345 ± 35 kPa (50 ± 5 psi) flowing through the device outlet with the highest flow rate, with their standard accessories installed:
a) bidet diverters;
b) multi-function aerators;
c) shampoo diverters;
d) shower head adjustment mechanisms;
e) shower head flow or function controls; and
f) side spray flow or function controls.

5.6.3.3.2 Devices to be tested at a specified flow rate

The following devices shall be tested at a flowing pressure of 345 ± 35 kPa (50 ± 5 psi) at 9.5 ± 0.4 L/min (2.5 ± 0.1 gpm) through a fixed outlet or with their standard accessories installed, when installed at a maximum distance of 2.0 m (78 in) from the outlet of the diverter:
a) in-line flow-control devices in showers;

b) shower-to-shower diverters;
c) tub spout diverters; and
d) tub-to-shower diverters.

5.6.3.3.3 Tub-to-shower and tub-spout diverters

For tub-to-shower diverters and tub-spout diverters, the specimen shall be mechanically activated to deliver full flow through the outlet. The flow of water shall be shut off by a bath or shower supply fitting or control valve installed upstream of the specimen. Diverters shall be reset to the tub position mechanically except for automatic diverters, which are intended to reset themselves to the tub position. The test apparatus for automatic diverters may relieve the shower head flowing pressure while simultaneously shutting off the supply valve to accelerate the life cycle test.

5.6.3.3.4 Complete cycle

One complete cycle for a device shall consist of switching the device from one position to the other and back to the original position. In the case of devices with multiple adjustable positions, one complete cycle shall consist of switching from one extreme position, through all the intermediate positions, to the other extreme position and back to the original position.

5.6.3.3.5 Shower head and body spray complete cycle

For shower head and body spray ball joints, one complete cycle shall consist of moving the device horizontally from an initial full-side position to the opposite full-side position and back to the initial-side position without making contact with surfaces at the extreme ends of the path.

5.6.3.4 Swing spouts

The life cycle test for swing spouts shall be conducted as follows:
a) Mount the specimen on the life cycle test apparatus with the axis about which the spout turns mounted vertically and in line with the axis of the drive spindle.
b) Fit the forked end of the drive adapter loosely over the spout and allow the spout tip to freely move vertically.
c) Attach a weight with a mass of 0.18 kg (0.40 lb) to the spout outlet connection.
d) Adjust the apparatus to turn the spout through an equal arc on each side of the centre through 90% of the total path and not more than 90°.
e) Establish and maintain sufficient force to rotate the spout throughout the test, but do not exceed 45 N (10 lbf) applied at the end of the spout.
f) Alternate cold and hot water every 1000 cycles, starting with cold.

The hot and cold water temperatures and the water pressures shall be those specified in Clause 5.6.2.2.2.

5.6.3.5 Shower hoses, pullout spout hoses, and side spray hoses

5.6.3.5.1 Tension lifecycle test

Hoses shall be subjected to a 67 N (15 lbf) tension test for 10 000 cycles, with the force applied gradually at the end of the hose connector.

5.6.3.5.2 Axial load test

The end connections of hoses shall not pull out when an axial force is applied and increased to 334 N (75 lbf) by extending the hose at a rate not faster than 127 cm/min (50 in/min) and then maintained for 15 s.

5.6.3.5.3 Mandrel and pressure integrity test

Following completion of the test specified in Clause 5.6.3.5.2, the hose shall be bent for one complete turn around a mandrel 50 mm (2.0 in) in diameter. The end connections of the hose shall then be pulled until a force of 67 N (15 lbf) is applied or until the hose comes fully into contact with the mandrel, whichever occurs first. The hose and the end connections shall not leak when tested in accordance with Clause 5.3.1.3.

5.7 Resistance to installation loading

5.7.1 Bending strength

5.7.1.1 Performance requirements

The specimen shall not break or crack when tested in accordance with Clause 5.7.1.2. This requirement shall not apply to waterways through a solder joint.

5.7.1.2 Test procedure

The specimen shall be rigidly mounted. A perpendicular force shall be applied to a rigid waterway on the pressure side of a terminal supply fitting or on both sides of a non-terminal supply fitting. The perpendicular force and location to apply the perpendicular force shall be as specified in Figure 4. Sustain the force for a minimum of 10 s.

5.7.2 Thread torque

5.7.2.1 Metal NPT supply connections

5.7.2.1.1 General

Metal NPT supply connections shall be capable of withstanding stresses imposed on pipe-thread supply connections due to the turning effects exerted by assembling to piping or tubing of the torque load specified in Table 4.

5.7.2.1.2 Performance requirements

The specimen shall comply with Clause 5.3.2.1 when tested in accordance with Clause 5.7.2.1.3.

5.7.2.1.3 Test procedure

A thread sealant type may be used if specified in manufacturer's installation instructions. The specimen shall be rigidly mounted. A fitting with mating pipe thread shall be attached to the threaded connection to allow the torque wrench to engage. Each pipe section is then to be tightened to the applicable torque specified in Table 4. The torque shall be applied with a torque wrench that has a maximum allowable inaccuracy of 3% of the full-scale reading.

5.7.2.2 Threaded connections intended to seal water

5.7.2.2.1 General

Threaded connections intended to seal water shall not crack, strip, or leak due to the turning effects exerted by assembling to piping, tubing, or proprietary connections.

5.7.2.2.2 Performance requirements

The specimen's threaded connections intended to seal water shall not crack, strip, or leak when tested in accordance with Clause 5.7.2.2.3.

5.7.2.2.3 Test procedure

The test shall be conducted as follows:

a) Tighten the threaded connections to a torque to affect the seal or the torque specified by the manufacturer. Increase to 150% of the torque.
b) Test according to Clause 5.3.1.4.2 a).
c) Hold for 5 min. Check for leakage.
d) Repeat Steps b) to c) for Clause 5.3.1.4.2 b) to d).

Devices intended only for cold water applications shall be tested in accordance with Items a) and b) only.

5.7.2.3 Factory-assembled connections

Clauses 5.7.2.1 to 5.7.2.2 shall not apply to factory-assembled connections.

5.8 Resistance to use loading

5.8.1 Operating controls

5.8.1.1 Water supply close or open controls

Operating controls that close or open the water supply shall withstand a torque or force, applied in the manner required to close or open the valve, that is three times greater than that specified in Table 2. Fracture of the handle or stem shall constitute failure.

5.8.1.2 Wall-mounted bath or shower operating controls

Wall-mounted bath or shower operating controls that can be grasped shall not pull off when subjected to an axial force of 445 N (100 lbf).

5.8.1.3 Other controls

Operating controls other than those specified in Clause 5.8.1.2 shall not pull off when subjected to an axial force of 45 N (10 lbf).

5.8.2 Maintenance of installed position

Hand-held showers provided with a lug or other device to hang the hand-held shower shall

a) be installed in their mounted position; and
b) have a force of 67 N (15 lbf) applied at the centre of the hand grip for 1 min.

There shall be no damage that would prevent the hand-held shower from being re-hung in its intended position.

5.8.3 Swing spout strength

5.8.3.1 Performance requirements

When tested in accordance with Clause 5.8.3.2, swing spouts shall withstand a mass of 6.4 kg (14 lb) attached at the spout outlet, and the angle at the spout outlet shall not change by more than 15°.

This test shall not apply to pullout spouts.

5.8.3.2 Test procedure

The swing spout strength test shall be conducted as follows:

a) Mount the faucet in accordance with the manufacturer's instructions.
b) Measure the spout outlet angle from the vertical.
c) Suspend the mass from the centreline of the spout outlet for 3 min and then remove it.
d) After 30 min, measure the spout outlet angle.

5.9 Backflow prevention

5.9.1 General

Fittings shall be tested in accordance with the applicable tests specified in Clauses 5.9.2 and 5.9.3 and then retested within 48 to 96 h of completing all applicable life cycle tests specified in Clause 5.6.

5.9.2 Fittings with plain outlets

5.9.2.1 Air gaps

Fittings with plain outlets shall be protected by an air gap in accordance with ASME A112.1.2 or ASME A112.1.3. For deck-mounted fittings, the air gap shall be measured as the vertical distance from the plane of the mounting surface of the fitting to the lowest point of the outlet. Where the fittings incorporate threads to accept an aerator or similar device, this measurement shall be taken with the aerator or similar device installed (see Figure 1).

A critical level mark on the fittings may be used as an alternative to the air gap. The critical level shall be confirmed by the test method specified in Clause 5.9.2.2.

5.9.2.2 Test procedure

5.9.2.2.1 Test specimen set-up

The specimen shall be set up as follows:

a) Remove all checking members or open them fully.
b) Install the specimen as recommended by the manufacturer by mounting it over a container measuring approximately 380 × 250 × 150 mm (15 × 10 × 6 in). Ensure the mounting surface is plumb or level with the water surface in the container.
c) Allow the outlet of the specimen to have a free area at least four times the area of its effective opening between the container and the outlet.

5.9.2.2.2 Procedure

The critical air gap test for fittings with plain outlets shall be conducted as follows:

a) Connect the inlet(s) of the specimen to a vacuum source.
b) Measure the vacuum at the inlet(s) of the specimen.
c) Provide a means to change the water level in the container relative to the outlet of the specimen.
d) Start the test with the water level at the mounting surface level.
e) With the specimen fully open from the inlet(s) to the place of discharge to the atmosphere, apply a vacuum of 85 kPa (12 psi) to the inlet(s).
f) Hold for 1 min. Back siphonage at this time shall be a cause for rejection.
g) Slowly bring the water level closer to the discharge outlet until the level at which back siphonage occurs is reached.
h) At the level specified in Item g), measure and record the distance between the lowest point of the outlet of the specimen and the water surface.
i) Return the specimen to atmospheric pressure.
j) Starting with the water level higher than where back siphonage occurred, apply a vacuum of 85 kPa (12 psi) to the inlet(s).
k) Slowly lower the water level until back siphonage ceases.
l) Maintain the vacuum for 1 min to ensure water is not being drawn into the discharge outlet.
m) At the level specified in Item k), measure and record the distance between the lowest point of the outlet of the specimen and the water surface.

The greater of the distances determined in Items h) and m) shall be the critical air gap of the fitting.

The critical air gap test shall be repeated twice to confirm the critical air gap measurement.

The critical level mark on the fittings (see Clause 5.9.2.1) shall be at or below the critical air gap determined by this test.

Note: *85 kPa (12 psi) is equivalent to 638 mm (25 in) of mercury.*

5.9.3 Fittings with submersible outlets

5.9.3.1 General

Fittings where the outlets are submersible shall

a) have a backflow prevention device(s) that complies with the applicable requirements of the CAN/CSA-B64 Series or ASME A112.18.3; or
b) comply with the applicable requirements specified in Clause 5.9.3.2 or 5.9.3.3.

5.9.3.2 Single-outlet fittings with a submersible outlet

5.9.3.2.1 General

Single-outlet fittings with a submersible outlet shall comply with Clause 5.9.3.2.2 and have an atmospheric vent between two check valves. The atmospheric vent shall be located downstream of the last control valve, and the critical level of the device shall be at least 25 mm (1 in) above the plane of the mounting surface of the fitting.

5.9.3.2.2 Test to determine the presence of hidden check valves

5.9.3.2.2.1 General

Fittings incorporating check valves shall be tested in accordance with Clause 5.9.3.2.2.4.

When the test is performed as specified in Clause 5.9.3.2.2.4, water shall be drawn into the sight tube, demonstrating that all check valves are fouled open and that there are no hidden check valves.

5.9.3.2.2.2 Settings

The procedure for testing the settings shall be as follows:

a) Connect a sight tube in a leak-proof manner to the outlet of the specimen.
b) Seal all atmospheric vents.
c) Foul all check valves open.
d) Install the specimen in accordance with Clause 5.9.3.2.2.3.
e) Conduct the test in accordance with Clause 5.9.3.2.2.4.
f) Once water is drawn into the sight tube, terminate the test.

5.9.3.2.2.3 Mounting

The specimen shall be mounted in its normal operating position in accordance with the manufacturer's instructions and using the test set-up shown in Figure 5. The inlet pipe(s) shall be connected collectively to

a) a water supply that can deliver water through the specimen at normal flow;
b) a vacuum system that can maintain a 0 to 85 kPa (0 to 12 psi) vacuum; and
c) the atmosphere.

The coloured-water reservoir shown in Figure 5 shall be located below the mounting surface level of the specimen. The coloured water in the reservoir shall be at the mounting surface level.

The terminal end of the sight tube shall be immersed 13 mm (0.5 in) below the mounting surface level of the coloured water in the reservoir. The sight tube shall be transparent and have an inside diameter of 13 ± 1.5 mm (1/2 ± 1/16 in).

5.9.3.2.2.4 Test procedure

The test to determine the presence of hidden check valves in single-outlet fittings with a submersible outlet shall be conducted as follows (see Figure 5):

a) Mount the specimen in accordance with Clause 5.9.3.2.2.3.
b) Open Valve 3.
c) Apply and hold a vacuum of 85 kPa (12 psi) for 5 min.
d) Close Valve 3, gradually open Valve 2, and allow the pressure on the supply side of the specimen device to gradually return to atmospheric.
e) Close Valve 2 and gradually open Valve 3.
f) Gradually raise the vacuum test load from 0 to 85 kPa (0 to 12 psi) and then gradually reduce it to 0 kPa (0 psi).
g) Create a surge effect by quickly opening and closing Valves 2 and 3 at least five times. During the test, the applied vacuum load shall start at 0 kPa (0 psi), be increased to 85 kPa (12 psi), and then be decreased to 0 kPa (0 psi).

Note: *85 kPa (12 psi) is equivalent to 638 mm (25 in) of mercury.*

5.9.3.2.3 Check valve leakage

5.9.3.2.3.1 General

Fittings incorporating check valves shall be tested in accordance with Clauses 5.9.3.2.3.3 and 5.9.3.2.3.4 to determine their resistance to leakage.

5.9.3.2.3.2 Performance requirements

There shall be no drop in the pressure applied to the outlet within the 5 min period of the test specified in Clause 5.9.3.2.3.6.

5.9.3.2.3.3 Upstream check valves

The check valve leakage test for single-outlet fittings with a submersible outlet shall be conducted as follows:

a) Block open or remove all check valves except the upstream check valve.
b) Install the specimen in accordance with Clause 5.9.3.2.3.5.
c) Conduct the test in accordance with Clause 5.9.3.2.3.6.

5.9.3.2.3.4 Downstream check valves

The check valve leakage test for single-outlet fittings with a submersible outlet shall be conducted as follows:

a) Block open or remove all check valves except the downstream check valve.
b) Install the specimen in accordance with Clause 5.9.3.2.3.5.
c) Conduct the test in accordance with Clause 5.9.3.2.3.6.

5.9.3.2.3.5 Test set-up

The specimen shall be set up as follows:

a) Mount the specimen in its normal operating position, in accordance with the manufacturer's instructions and using the test set-up shown in Figure 6.
b) Connect the inlet pipe(s) collectively to a water supply that can deliver water through the specimen at normal flow and to the atmosphere.
c) Connect a pressurized water supply, as shown in Figure 6, to the specimen outlet in a leak-proof manner.

5.9.3.2.3.6 Test procedure

The check valve leakage test shall be conducted as follows (see Figure 6):

a) Mount the specimen in accordance with Clause 5.9.3.2.3.5.
b) Seal all atmospheric vents.
c) Open Valve 1 and purge the air from the system.
d) Close Valve 1.
e) Open Valve 2 to reduce the water pressure on the inlet side to 0.
f) Gradually raise the outlet pressure to 1.4 kPa (0.2 psi).
g) Isolate the pressure source for 5 min.
h) Increase the outlet pressure to 35 kPa (5 psi).
i) Isolate the pressure source for 5 min.

5.9.3.2.4 Adequacy of the atmospheric vent

5.9.3.2.4.1 General

For fittings incorporating an atmospheric vent, the adequacy of the atmospheric vent shall be verified by performing the test specified in Clause 5.9.3.2.4.3.

5.9.3.2.4.2 Performance requirements

The maximum allowable rise in water level in the sight tube shall be to within ±25 mm (±1.0 in) of the critical level of the device when the test is performed as specified in Clause 5.9.3.2.4.3.

Note: *The location of the critical level of the device may be determined in accordance with Clause 16 of ASME A112.18.3.*

5.9.3.2.4.3 Test procedure

The test for verifying the adequacy of the atmospheric vent shall be conducted as follows:

a) Connect a sight tube in a leak-proof manner to the outlet of the specimen.
b) Foul all check valves with a 0.81 mm (0.032 in) wire.
c) Leave the atmospheric vents open.
d) Install the specimen in accordance with Clause 5.9.3.2.2.3.
e) Conduct the test in accordance with Clause 5.9.3.2.2.4.

5.9.3.3 Back siphonage prevention in side spray diverters

5.9.3.3.1 General

Fittings incorporating a side spray diverter shall comply with the performance requirements of Clause 5.9.3.3.2 when tested in accordance with Clause 5.9.3.3.3.

5.9.3.3.2 Performance requirements

During testing in accordance with Clause 5.9.3.3.3, water shall not rise in the sight tube except for an upward bowing of the meniscus of not more than 3 mm (0.12 in).

5.9.3.3.3 Test procedure

The test shall be conducted as follows (see Figure 5):

a) Remove the spray head.
b) Connect a sight tube in a leak-proof manner to the spray hose outlet of the specimen.
c) Install the specimen in accordance with Clause 5.9.3.2.2.3.
d) Open Valve 1.
e) Flush the specimen with water for 5 min.
f) Close Valve 1.
g) Open Valve 2 to the atmosphere and allow water to drain from the device and from the hose.
h) Conduct the test in accordance with Clause 5.9.3.2.2.4.

5.9.3.4 Service sink faucets

Service sink faucets shall be designed to prevent re-installation of the spout directly onto the faucet body with the backflow prevention device removed, when the faucet has a backflow prevention device that

a) is not cast in the body of the faucet;

b) has an inlet in line with its outlet; and
c) has a disassembly torque of less than 81 N·m (60 lbf·ft).

5.10 Drainage test for lawn faucets

5.10.1 Performance requirements

When tested in accordance with Clause 5.10.2, lawn faucets shall drain at least 50% of the volume of the inlet shank and pipe.

5.10.2 Test procedure

Lawn faucets shall be tested as follows:
a) Connect the faucet to a 1.2 m (48 in) length of standard-weight pipe of the same nominal diameter as the inlet of the faucet.
b) Install the assembly (faucet and pipe) with a downward slope of 1% toward the faucet.
c) Close the faucet, fill the assembly with water, and measure the amount of water required to fill the assembly.
d) Open the faucet and allow the assembly to drain for 5 min, collecting the water that drains.
e) Measure the amount of water drained.

5.11 Alternative materials test

5.11.1 Performance requirements

Coupling nuts, locknuts, and spout-holding nuts shall not be adversely affected when tested in accordance with Clause 5.11.2. Fittings shall be capable of being disassembled and reassembled and continue to comply with Clause 5.3.1.

5.11.2 Test procedure

5.11.2.1 Test specimen

The specimen shall
a) be a complete fitting;
b) be mounted in its intended operating position; and
c) have its parts tightened to the maximum torque as specified by the manufacturer.

5.11.2.2 Procedure

The specimen shall be tested in accordance with ASTM B117 (neutral salt) for 96 h. After exposure, it shall be left to dry for a minimum of 24 h at ambient laboratory conditions. The specimen shall then be disassembled and reassembled using standard tools.

5.12 High-efficiency shower heads

5.12.1 General

High-efficiency shower heads shall comply with Clauses 5.12.2 to 5.12.4.

If the shower head has more than one mode, then the manufacturer shall specify the mode or modes that are intended to comply with the high-efficiency requirements.

The flow rate tests shall be conducted with water at 38 ± 6 °C (100 ± 10 °F) and the flow maintained for at least 1 min.

5.12.2 Flow rate

5.12.2.1 Maximum

The maximum flow rate for high-efficiency shower heads in all operating modes shall be

a) specified by the manufacturer but in no case shall be more than 7.6 L/min (2.0 gpm) at each test pressure;
b) verified through testing at flowing pressures of 140, 310, and 550 ± 7 kPa (20, 45, and 80 ± 1 psi); and
c) used for determining the minimum flow rates in accordance with Clause 5.12.2.2.2.

5.12.2.2 Minimum

5.12.2.2.1 Shower heads with more than one mode

If the shower head has more than one mode, the minimum flow rate shall be determined at a flowing pressure of 310 ± 7 kPa (45 ± 1 psi) in all modes.

Pause or trickle modes designed to flow at less than 1.9 L/min (0.5 gpm) at 550 kPa (80 psi) shall be excluded from the minimum flow requirements.

Note: *The intent of this Clause is to aid in the selection of an appropriate automatic compensating valve.*

5.12.2.2.2 General

The minimum flow rate for the manufacturer's specified mode or modes shall be determined through testing and shall be not less than

a) 60% of the maximum flow rate specified in Clause 5.12.2.1 when tested at a flowing pressure of 140 ± 7 kPa (20 ± 1 psi); and
b) 75% of the maximum flow rate specified in Clause 5.12.2.1 when tested at flowing pressures of 310 ± 7 kPa (45 ± 1 psi) and 550 ± 7 kPa (80 ± 1 psi).

5.12.3 Spray force

5.12.3.1 Performance requirement

When tested in accordance with Clause 5.12.3.2, the minimum spray force for

a) high-efficiency shower heads and hand-held showers shall be not less than 0.56 N (2.0 ozf) at a flowing pressure of 140 ± 7 kPa (20 ± 1 psi) at the inlet. The specimen shall be deemed to exceed the minimum spray force requirement when the force-balance fixture rotates past 0.0 ± 0.1°; and
b) high-efficiency rain showers shall be not less than 0.40 N (1.4 ozf) at a flowing pressure of 140 ± 7 kPa (20 ± 1 psi) at the inlet. The specimen shall be deemed to exceed the minimum spray force requirement when the force-balance fixture rotates past 0.0 ± 0.1°.

5.12.3.2 Set-up

The specimen shall

a) be thoroughly flushed before measuring the spray force;
b) be connected to a smooth-interior pipe or tube with a length equal to at least 20 times the inside diameter of the inlet(s) of the specimen;
c) be connected to a pipe or tubing of the same nominal size as the specimen connections;

d) have its standard components installed; and
e) be tested with an apparatus that utilizes a force balance fixture, as illustrated in Figures 7A, 7B, and 8 in accordance with Clauses 5.12.3.3 to 5.12.3.5.

5.12.3.3 Spray force-balance test apparatus

The force-balance test apparatus shall have a means for measuring the rotation from the horizontal or for determining the point of balance, or both, and shall be calibrated as follows:

a) ensure the force balance fixture is dry prior to calibration;
b) establish the zero angle position when the target is at 45 ± 1° to the horizontal and the force-balance fixture is balanced;
c) position a force gauge to be in contact perpendicularly with the centre of the target, as illustrated in Figure 9 a);
d) zero the force gauge;
e) for high-efficiency shower heads and hand-held showers, place counterweights on the force-balance fixture so that it balances the applicable force specified in Clause 5.12.3.1 applied at the centre and perpendicular to the target, while maintaining the 0.0 ± 0.1° position, as shown in Figure 9 b);
f) for high-efficiency rain showers, place counterweights on the force-balance fixture so that it balances the applicable force specified in Clause 5.12.3.1 applied at the centre and perpendicular to the target, while maintaining the 0.0 ± 0.1°, as shown in Figure 9 c); and
g) remove the force gauge from the force-balance fixture.

The final angle position shall be a non-zero value, calibrated to the applicable force specified in Clause 5.12.3.1.

5.12.3.4 Additional test conditions

Additional test conditions shall be as follows:

a) the upstream pressure gauge shall be located 200 ± 50 mm (8 ± 2 in) upstream of the specimen inlet;
b) the pressure gauge size and configuration shall comply with ASME PTC 19.2 or ANSI/ISA-75.02;
c) if a fluid meter is used to measure the flow rate, the installation shall be in accordance with ASME PTC 19.5;
d) the water temperature shall be 38 ± 6 °C (100 ± 10 °F) and maintained for at least 1 min; and
e) the flowing pressure shall be 140 ± 7 kPa (20 ± 1 psi) at the inlet.

5.12.3.5 Test procedure

The test procedure shall be as follows:

a) ensure the force balance fixture is dry prior to testing;
b) for shower heads and hand-held showers, mount the specimen so the force target surface and shower head faceplate are parallel, and the centre of the force target and the centre of the shower head are aligned and 455 ± 5 mm (18 ± 0.25 in) apart, measured before the water flow is initiated;
c) for rain showers, mount the specimen directly above the force target so that the centre of the rain shower aligns directly over the centre of the force target at 45° to the target and is parallel to the floor. The centre of the rain shower to the centre of the force target should be 455 ± 5 mm (18 ± 0.25 in) apart (see Figure 7B), measured before the water flow is initiated;
d) once the water flow has been initiated, adjust the specimen using only the standard components so that the centre of the spray pattern aligns with the centre of the force target;
e) maintain water flow for at least 1 min; and

f) verify that the spray force meets the performance requirement specified in Clause 5.12.3.1.

If the centre of the spray pattern cannot hit the centre of the force target, then the specimen shall be deemed to have not met the spray force performance requirement.

5.12.4 Spray coverage

5.12.4.1 Performance criteria

The maximum volume of water collected in the 50 and 100 mm (2 and 4 in) rings shall not exceed 75% of the total volume of water collected, and the total combined minimum volume of water collected in the 50, 100, and 150 mm (2, 4, and 6 in) rings shall be not less than 25% of the total volume of water collected.

5.12.4.2 Set-up

The specimen shall

a) be thoroughly flushed before measuring the spray coverage;
b) be connected to a smooth-interior pipe or tube with a length equal to at least 20 times the inside diameter of the inlet(s) of the specimen;
c) be connected to a pipe or tubing of the same nominal size as the specimen connections;
d) have its standard components installed; and
e) be tested with an annular ring test apparatus as illustrated in Figures 10 to 12.

5.12.4.3 Test apparatus

The test apparatus annular rings shall have a dimensional tolerance of ±1.5 mm (±0.06 in). Material for the test apparatus should be 0.75 mm (0.03 in) thick Type 304 stainless steel.

5.12.4.4 Other test conditions

Other test conditions shall be as follows:

a) the upstream pressure tap shall be located 200 ± 50 mm (8 ± 2 in) upstream of the specimen inlet;
b) the pressure tap size and configuration shall comply with ASME PTC 19.2 or ANSI/ISA-75.02;
c) if a fluid meter is used to measure the flow rate, the installation shall be in accordance with ASME PTC 19.5;
d) if the volume/time method is used for the flow rate measurement, the container shall be of sufficient size to hold water collected for at least 1 min;
e) the water temperature shall be 38 ± 6 °C (100 ± 10 °F) and shall be maintained for at least 1 min; and
f) the flowing pressure shall be 310 ± 7 kPa (45 ± 1 psi) at the inlet.

5.12.4.5 Test procedure

The test procedure shall be as follows:

a) mount the specimen so that its faceplate is horizontal and parallel with the top surface of the annular rings;
b) position the annular rings underneath the specimen so the centreline of the faceplate and the centre ring are in vertical alignment and the top of the annular gauge is 455 ± 5 mm (18 ± 0.25 in) from the faceplate (see Figure 12);
c) cover the top of the annular rings and adjust the flowing pressure until stabilized;
d) remove the cover and allow the water to flow through the specimen and into the annular rings for at least 1 min;

e) record the measured flow rate and, using a stopwatch, the time to the nearest second;
f) collect, measure, and record the volume of water in each annular ring and determine the total volume collected in all of the rings;
g) calculate and record the percentage collected in each ring relative to the total recorded volume collected; and
h) if the total volume collected varies by more than ±5% of the total volume calculated from the recorded flow rate and time, repeat the procedure.

5.13 Commercial pre-rinse spray valves

5.13.1 General

Commercial pre-rinse spray valves shall comply with Clauses 5.13.2 and 5.13.3.

5.13.2 Spray force

The spray force of commercial pre-rinse spray valves shall be determined through testing in accordance with Clauses 5.13.2.2 to 5.13.2.4.

5.13.2.1 Performance requirement

When tested in accordance with Clauses 5.13.2.2 to 5.13.2.4, the spray force for commercial pre-rinse spray valves shall be not less than 1.1 N (4.0 ozf).

5.13.2.2 Test specimens

Three representative production samples shall be selected for performance testing.

5.13.2.3 Test apparatus

The test apparatus shall comply with the requirements in ASTM F2324 and shall be set-up in accordance with Section 9 of ASTM F2324.

5.13.2.4 Test procedure

The spray force shall be determined in accordance with Section 10 of ASTM F2324, disregarding any reference to Annex A1 of ASTM F2324.

5.13.3 Flow rate

The maximum flow rate for commercial pre-rinse spray valves shall be specified by the manufacturer and verified through testing in accordance with the procedures specified in ASTM F2324, excluding Annex A1.

When the spray force of the commercial pre-rinse spray valve determined in accordance with Clause 5.13.2 is

a) more than 2.2 N (8.0 ozf), the maximum flow rate shall not exceed 4.85 L/min (1.28 gpm);
b) more than 1.4 N (5.0 ozf) but equal to or less than 2.2 N (8.0 ozf), the maximum flow rate shall not exceed 4.54 L/min (1.20 gpm); and
c) equal to or less than 1.4 N (5.0 ozf), the maximum flow rate shall not exceed 3.79 L/min (1.00 gpm).

6 Markings, packaging, and installation instructions

6.1 General

6.1.1 Marking requirements

Products complying with this Standard shall be marked with

a) the manufacturer's recognized name, trademark, or other mark; or
b) in the case of private labelling, the name, trademark, or other mark of the customer for whom the fitting was manufactured.

Markings shall be accomplished by use of a permanent mark or by placing a permanent label on the product.

Markings shall be located in such a way that they are visible after installation.

6.1.2 Shower head markings

Shower heads and hand-held showers shall be marked with the manufacturer's specified maximum flow rate, expressed in L/min and gpm, verified in accordance with Clause 5.4.2.3.2 a) or 5.12.2.1 (high-efficiency).

6.1.3 Kitchen, lavatory, and metering faucet markings

Kitchen, lavatory, and metering faucets shall be marked with the manufacturer's specified maximum flow rate, expressed in L/min and gpm or L/cycle and gpc, verified in accordance with Clause 5.4.2.3.1 b).

6.2 Temperature identification

The following bath and shower mixing valves shall have their temperature control settings identified alphabetically, numerically, or graphically:

a) single-handle valves; and
b) single-control valves.

Note: *"Graphically" includes colour.*

6.3 Packaging

6.3.1 General

Packaging shall be marked with

a) the manufacturer's recognized name, trademark, or other mark as well as the model number; or
b) in the case of private labelling, the name, trademark, or other mark of the customer for whom the fitting was manufactured as well as the model number.

6.3.2 Shower heads packaging

Packaging for shower heads shall be marked with the manufacturer's specified maximum flow rate verified in accordance with Clause 5.4.2.3.2 a) or 5.12.2.1 (high-efficiency), and either Item a) or b), as follows:

a) the manufacturer's specified minimum flow rate at 310 ± 7 kPa (45 ± 1 psi) verified in accordance with Clause 5.4.2.3.2 b) or 5.12.2.2.1 (high-efficiency) [e.g., minimum 5.7 L/min (1.5 gpm) at 45 psi]; or

b) the statement “For use with automatic compensating valves rated at xxx L/min (yyy gpm) or less”, where “xxx L/min (yyy gpm)” is the manufacturer’s specified minimum flow rate verified in accordance with Clause 5.4.2.3.2 b) or 5.12.2.2.1 (high-efficiency).

6.3.3 Kitchen, lavatory, and metering faucets packaging

Packaging for kitchen, lavatory, and metering faucets shall be marked with the manufacturer’s specified maximum flow rate, in L/min and gpm or L/cycle and gpc, verified in accordance with Clause 5.4.2.3.1 b).

6.3.4 High-efficiency shower heads and body sprays packaging

High-efficiency shower heads and body sprays shall not be packaged, marked, or provided with instructions directing the user to an alternative water-use setting that would override the maximum flow rate specified in Clause 5.12.2.1. Instructions related to the maintenance of the devices, including changing or cleaning shower head components, shall direct the user on how to return the device to its intended maximum flow rate.

6.4 Commercial pre-rinse spray valves

6.4.1 Marking requirements

Commercial pre-rinse spray valves shall be marked with the manufacturer’s specified maximum flow rate determined in accordance with Clause 5.13.3 and expressed in L/min (gpm).

6.4.2 Packaging

Packaging or other included literature for commercial pre-rinse spray valves shall be marked with the
a) manufacturer’s maximum flow rate determined in accordance with Clause 5.13.3; and
b) minimum spray force determined in accordance with Clause 5.13.2.

6.4.3 Instructions

Commercial pre-rinse spray valves shall not be packaged, marked, or provided with instructions directing the user to an alternative water-use setting that would override the maximum flow rate specified in Clause 5.13.3. Instructions related to the maintenance of the devices, including changing or cleaning pre-rinse components, shall direct the user on how to return the device to its intended maximum flow rate.

Table 1
Minimum and maximum flow rates
(See Clauses 5.4.1 and 5.4.2.1.)

Fitting or accessory	Minimum, L/min (gpm)	Maximum, L/min (gpm)
Bathtub	9.0 (2.4)	—
Bidet	5.7 (1.5)	—
Commercial pre-rinse spray valve	—	See Clause 5.13.3
Laundry tub	15 (4.0)	—
Laundry tub – Low flow	3.0 (0.8)	15 (4.0)
Lavatory (other than public lavatory or metering)	—	8.3 (2.2)
High-efficiency lavatory faucet	3.0 (0.8)	5.7 (1.5)
Lawn or sediment faucet	15 (4.0)	—
Low-pressure water dispenser		5.7 (1.5)
Metering	—	1.0 L/cycle (0.25 gal/cycle)
Public lavatory (other than metering)	—	1.9 (0.5)
Service sink	15 (4.0)	—
Shower head*	—	9.5 (2.5)
High-efficiency shower head	See Clause 5.12.2.2	7.6 (2.0)
Sink	—	8.3 (2.2)
Supply stop†		
3/8 in (pipe)	21 (5.5)	—
3/8 in (compression)	15 (4.0)	—
1/2 in (pipe)	36 (9.5)	—
1/2 in (compression)	21 (5.5)	—

***** *Includes hand-held showers, rain showers, and body sprays. Safety shower heads shall be exempt from the maximum flow rate requirements specified in this Table.*

† *Supply stop sizing shall be based on the nominal size for the outlet indicated in the manufacturer's literature.*

Note: *For purposes of determining compliance with these specifications, an observed or calculated value shall be rounded "to the nearest unit" in the last right-hand digit used in expressing the specification limit in accordance with the Rounding Method of ASTM E29.*

Table 2
Operating requirements
(See Clauses 5.5.1, 5.6.1.2, 5.6.1.5.1, 5.6.2.4, and 5.8.1.1.)

Operating control	Linear force, N (lbf)	Operating torque, N•m (lbf•in)
Accessible design	See Clause 5.5.2	—
All other operating controls*	45 (10)	1.7 (15)
Supply stop		
NPS-1/2 and smaller	67 (15)	1.7 (15)
Larger than NPS-1/2	110 (25)	2.8 (25)

***** *For self-closing valves, the specified torques and forces apply only to the opening operation of the valves.*

Table 3
Life cycle test
(See Clauses 5.6.1.1.1 and 5.6.3.1.2.)

Fitting	Cycles
Bath or shower fitting*	250 000
Bidet fitting	50 000
Body spray or shower head adjusting mechanism (flow or function control)	10 000
Body spray or shower head ball joint	10 000
Diverter (tub-to-shower, shower-to-shower, tub spout, bidet, shampoo, shower-to-body spray, or in-line flow control device)	15 000
Laundry tub fitting	250 000
Lavatory or sink fitting*	500 000
Lawn or sediment faucet or hydrant	150 000
Low-pressure water dispenser	22 000
Low-pressure water dispenser swing spout	10 000
Commercial pre-rinse spray valve	250 000
Metering faucet*	150 000
Self-closing faucet*	150 000
Side spray assembly, including the diverter (pullout spout handpiece function control or multi-function aerator)	10 000
Supply stop†	2000
Swing spout	50 000

***** *Includes electronic fittings.*

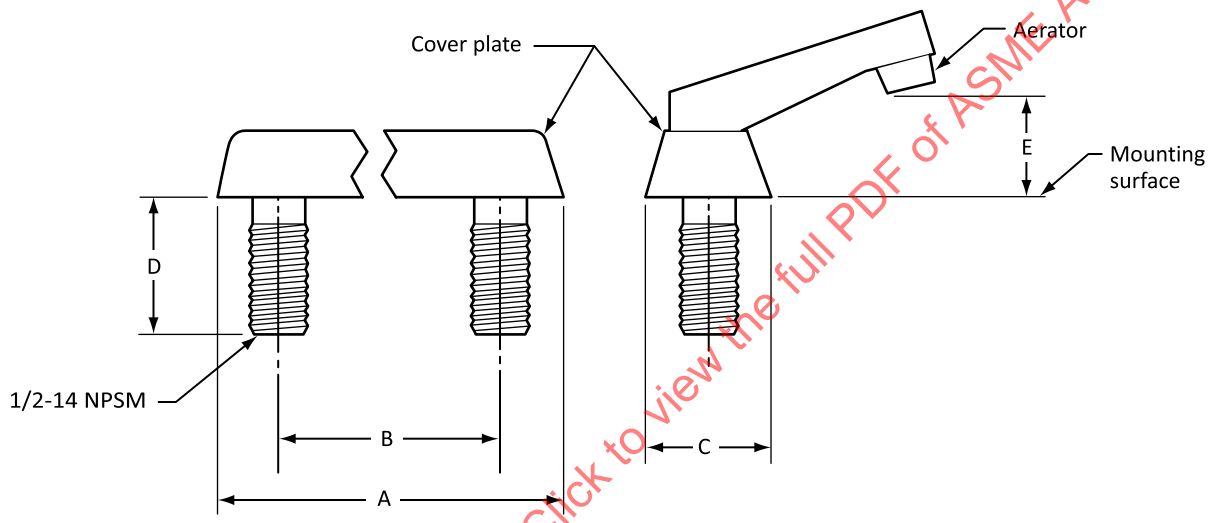
† *Supply stops integral with automatic compensating valves are not subject to the life cycle test.*

Table 4
Thread torque strength
(See Clauses 5.7.2.1 and 5.7.2.1.2.)

Thread size	Torque, N•m (lbf•ft)
3/8 NPT	43 (32)
1/2 NPT	61 (45)
3/4 NPT	88 (65)
1 NPT	129 (95)

Note: *The thread-assembling torque requirements apply only to metal NPT supply connections.*

Figure 1
Deck-mounted lavatory and sink supply fittings
(See Clauses 4.4.7, 4.8.1, and 5.9.2.1.)



Type of fitting	A maximum	B	C minimum	D minimum	E air gap
100 (4) centre set	170 mm (6.75 in)	102 mm ± 2 mm (4.00 in ± 0.08 in)	44 mm (1.73 in)	44.5 mm (1.75 in)	See Clause 5.9.2.1
200 (8) deck fitting	285 mm (11.25 in)	204 mm ± 2 mm (8.00 in ± 0.08 in)	44 mm (1.73 in)	44.5 mm (1.75 in)	See Clause 5.9.2.1
Single lavatory faucet	—	—	44 mm (1.73 in)	44.5 mm (1.75 in)	See Clause 5.9.2.1

Figure 2 a)
Dimensions for 1/2-14 NPSM shanks — Shank with coupling nut and tailpiece connection
(See Clause 4.4.7.)

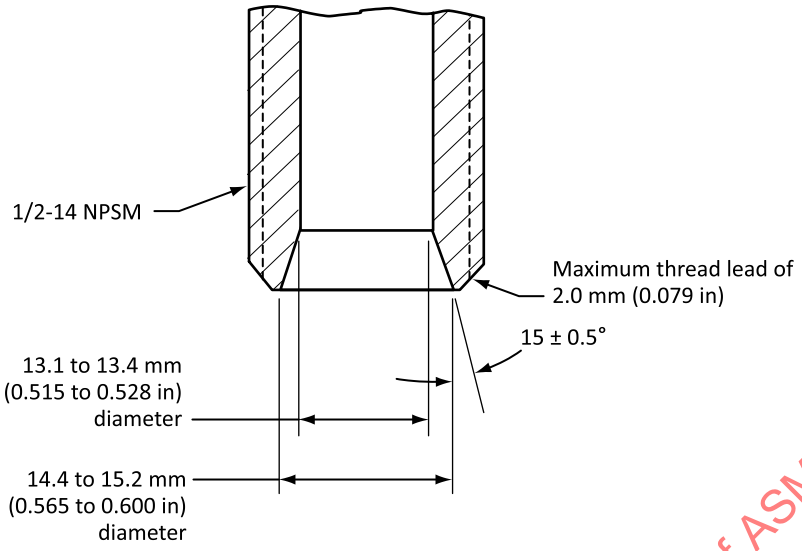


Figure 2 b)
Dimensions for 1/2-14 NPSM shanks — Shank with 1/2 nominal size copper water tube connection
(See Clause 4.4.7.)

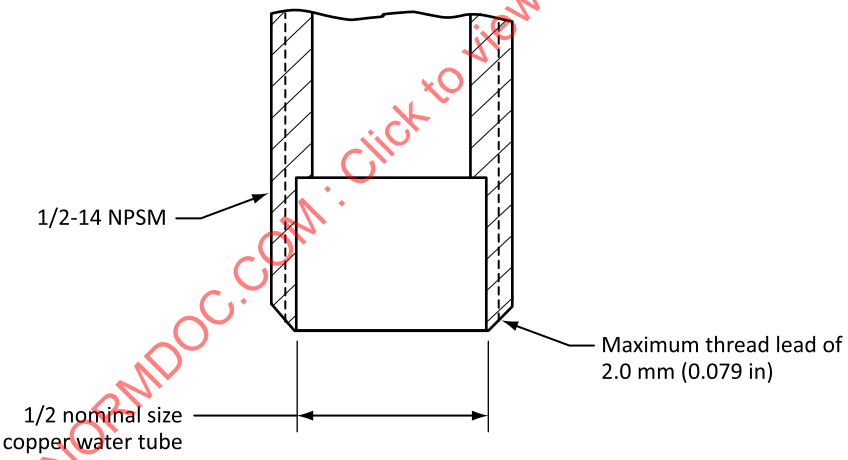


Figure 3
Discharge capacity test schematics
(See Clauses 5.4.2.1 and 5.4.2.2.)

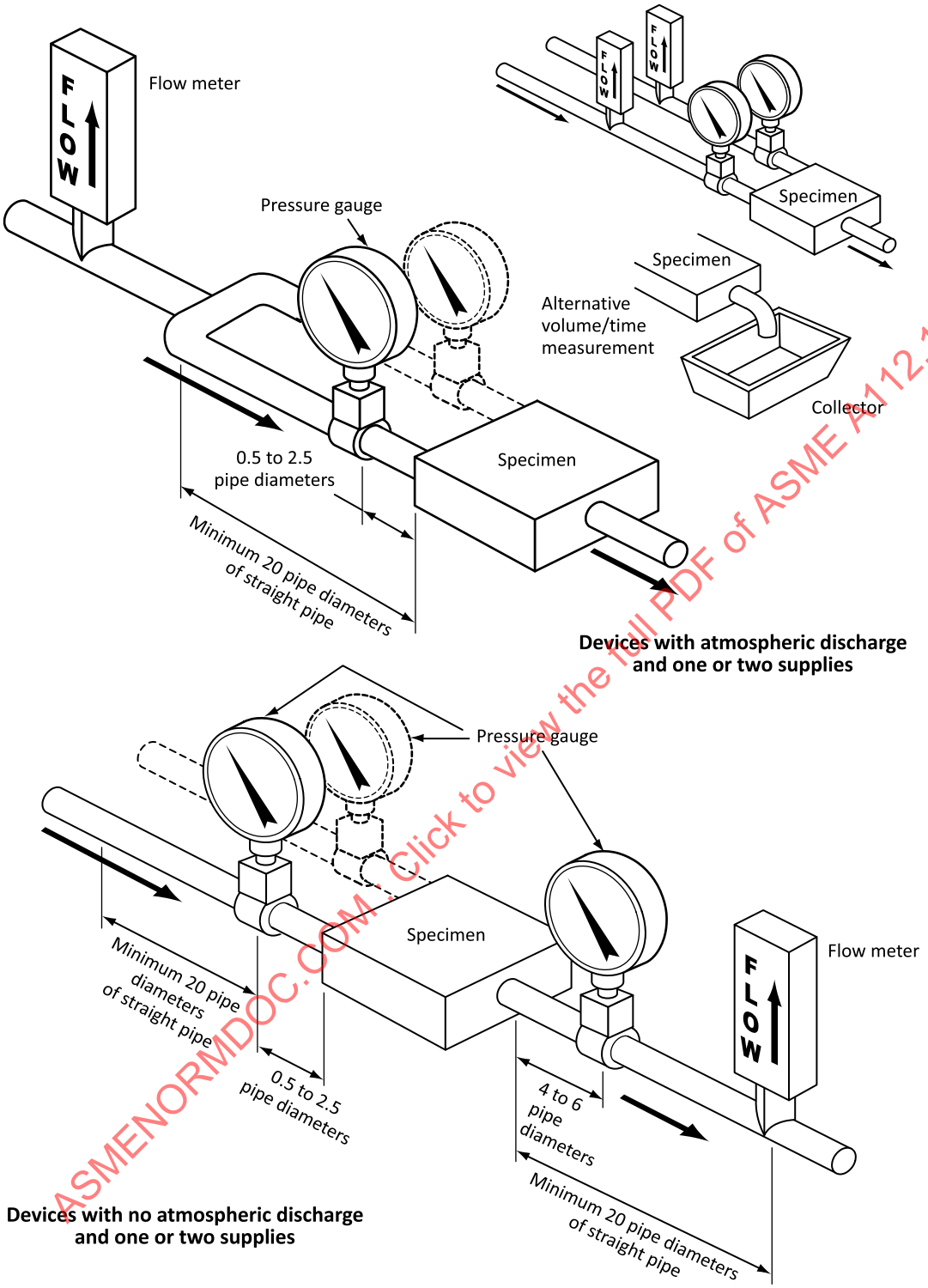
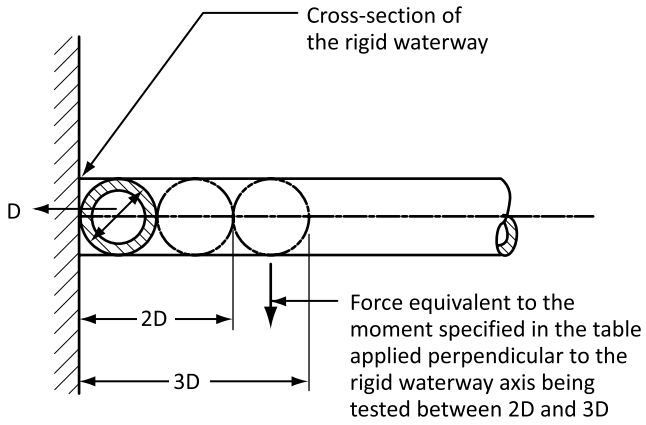


Figure 4
Bending moment on supply fittings
(See Clause 5.7.1.2.)



Fitting size	Bending moment Metal waterway component N•m (ft•lbf)	Bending moment Plastic waterway component N•m (ft•lbf)
NPS-3/8	40 (30)	40 (30)
NPS-1/2	60 (44)	40 (30)
NPS-3/4	80 (60)	40 (30)
NPS-1	100 (74)	40 (30)

Figure 5
Set-up for back siphonage and hidden check valve test
(See Clauses 5.9.3.2.2.3, 5.9.3.2.2.4, and 5.9.3.3.3.)

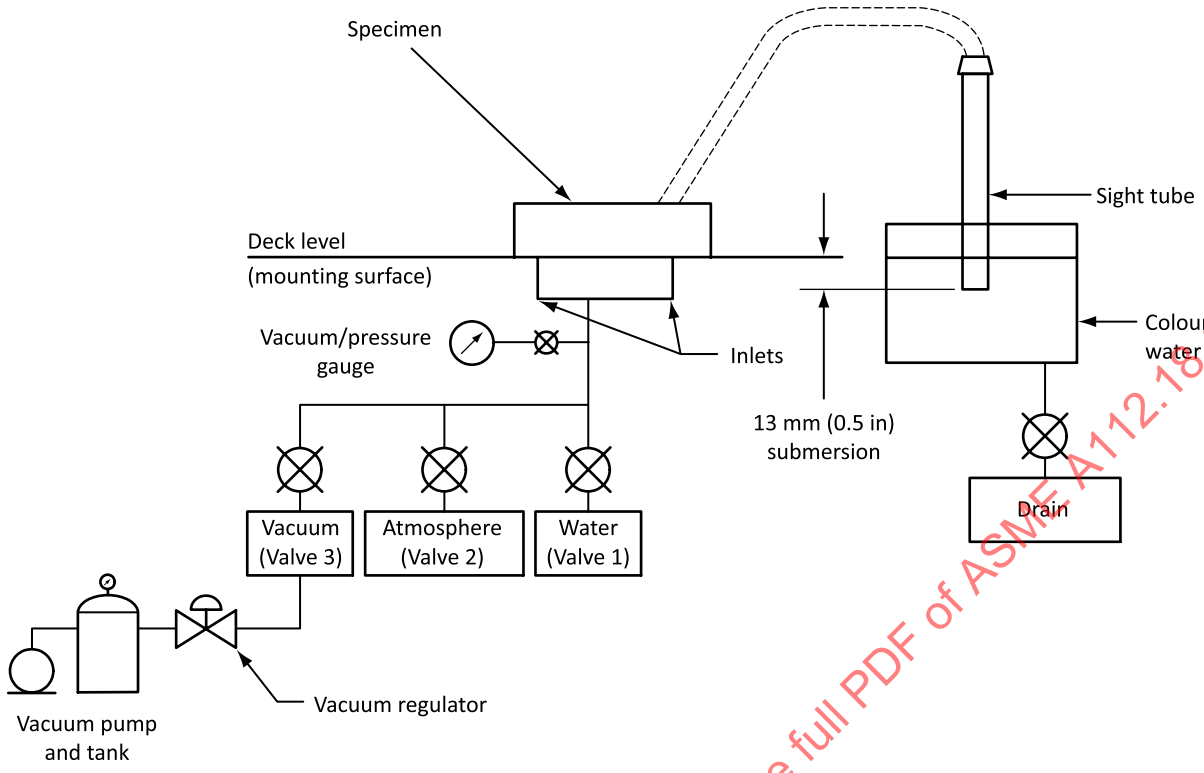


Figure 6
Set-up for check valve leakage test
(See Clauses 5.9.3.2.3.5 and 5.9.3.2.3.6.)

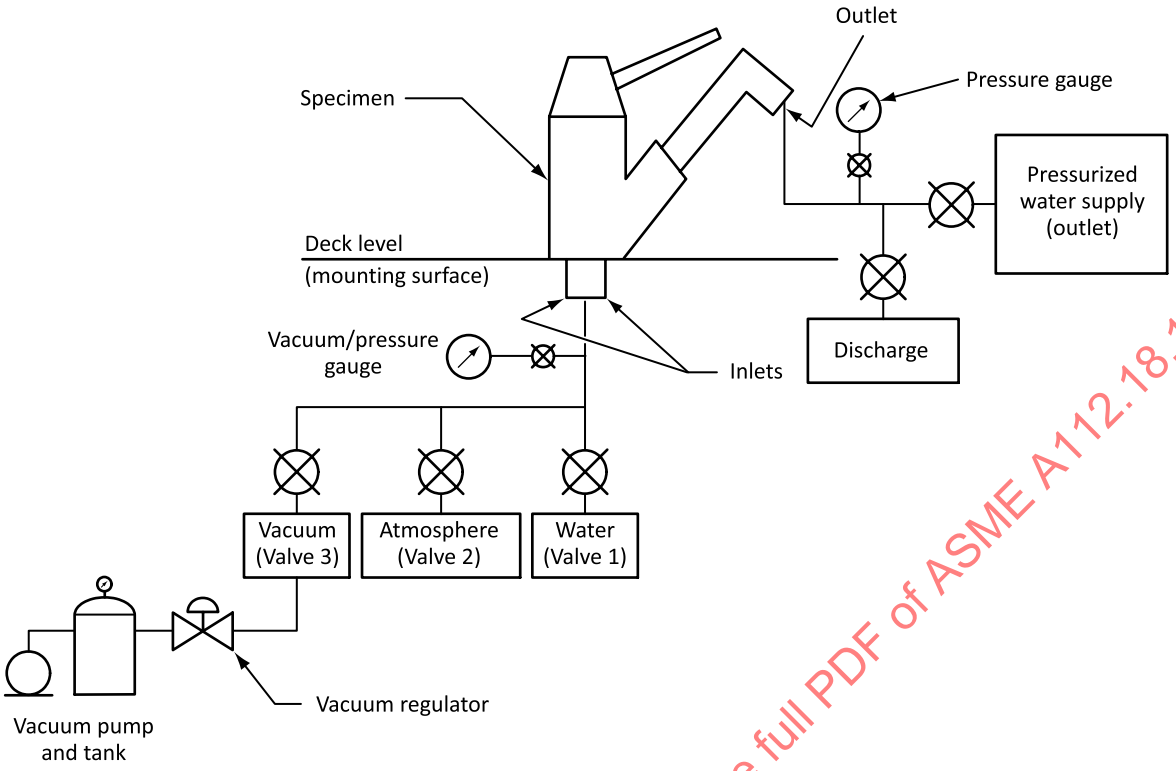


Figure 7A
Shower head and hand-held shower spray force-balance test apparatus
(See Clause 5.12.3.2.)