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Performance Requirements for

Pressurized Flushing Devices for Plumbing Fixtures



An American National Standard

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Preface

This is the first edition of ASSE 1037/ASME A112.1037/CSA B125.37, *Performance requirements for pressurized flushing devices for plumbing fixtures*. It supersedes the previous edition of ASSE 1037, published in 1990 and CSA B125.3, published in 2012.

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

This Standard was prepared by the ASSE/ASME/CSA Harmonization Task Group on Plumbing Fittings, under the jurisdiction of the ASME A112 Standards Committee on Plumbing Materials and Equipment, the ASSE Product Standards Committee, and the CSA Technical Committee on Plumbing Fittings. 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 on Plumbing Materials and Equipment, the ASSE Product Standards Committee, and the CSA Technical Committee on Plumbing Fittings. This Standard was approved as an American National Standard by the American National Standards Institute on January 21, 2015.

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Performance requirements for pressurized flushing devices for plumbing fixtures

Section I

1 Scope

1.1

This Standard covers pressurized flushing devices (PFDs) intended to flush water closets, urinals, and other plumbing fixtures and specifies requirements for materials, design, methods of operation, test methods, and markings.

1.2

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 sections do not include requirements or alternative requirements; the purpose of a note accompanying a section 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.

1.3

SI units are the units of record in Canada. In this Standard the inch/pound units are shown in parentheses.

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

Section II

2 Reference publications and definitions

2.1 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.

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

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

Plumbing supply fittings

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

Ceramic plumbing fixtures

ASME (The American Society of Mechanical Engineers)

A112.18.3-2002 (R2012)

Performance requirements for backflow protection devices and systems in plumbing fixture fittings

A112.19.14-2006 (R2011)

Six-liter water closets equipped with a dual flushing device

B1.1-2008

Unified Inch Screw Threads (UN & UNR Thread Form)

B1.20.1-2013

Pipe Threads, General Purpose (Inch)

B16.18-2012

Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2013

Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASSE (ASSE International Chapter of IAPMO, LLC.)

1001-2008

Performance Requirements for Atmospheric Type Vacuum Breakers

Plumbing Dictionary Sixth Edition — 2007

CSA Group

B64 Series-11

Backflow preventers and vacuum breakers

B64.1.1-11

Atmospheric vacuum breakers (AVB)

SAE International (Society of Automotive Engineers)

J512 (1997)

Automotive Tube Fittings

2.2 Definitions

In addition to the definitions in the reference publications, the following definitions shall apply in this Standard:

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

Backflow — a flowing back or reversal of the normal direction of flow.

Note: *Back siphonage and back pressure are types of backflow.*

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

Pressurized flushing device — a device that utilizes the water supply pressure to flush plumbing fixtures.

Non-tank type PFD (Flushometer valve) — a pressurized flushing device that is attached to a pressurized water supply pipe that, when actuated, opens the pipe for direct flow of water into the fixture at a rate and in a quantity that enables proper operation of the fixture. The valve then gradually closes to provide trap reseal in the fixture and avoid water hammer.

Tank type PFD (Flushometer tank) — a pressurized flushing device in a pressurized water supply pipe but integrated within an accumulator vessel affixed and adjacent to the fixture inlet to cause an effective enlargement of the supply line. The discharge directs the flow of water into the fixture at a rate and in a quantity that enables proper operation of the fixture. The valve then gradually closes to provide trap reseal in the fixture and avoid water hammer.

Primary control — the standard means by which the PFD is activated as designated by the manufacturer.

Secondary control — an alternative means by which the PFD is activated as designated by the manufacturer.

Section III

3 Design and general requirements

3.1 Pressures

PFDs shall be designed to function at a supply pressure between 140 and 860 kPa (20 and 125 psi). In addition, PFDs shall comply with [Clause 4.2](#).

3.2 Temperatures

PFDs shall be designed to function with water temperature between 4 °C and 30 °C (40°F and 85°F).

3.3 Backflow prevention

PFDs incorporating backflow preventers shall comply with the requirements of [Clause 4.3](#) or [4.4](#). When a backflow preventer is not incorporated in the PFD, installation instructions shall identify the specific types of backflow prevention required.

3.4 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 22N (5 lbf)

3.5 Control stop

If the manufacturer provides a control stop with the PFD, it shall be considered part of the PFD.

3.6 Connections to water supply and fixtures

Tapered pipe threads shall conform to ASME B1.20.1. Straight threads shall conform to ASME B1.1. Dimensions of solder-joint connections shall conform to ASME B16.18 or ASME B16.22. Compression connections shall be compatible with SAE J512.

3.6.1 Inlet connections

Inlet supply connections shall be as specified by the PFD manufacturer.

3.6.2 Outlet connections

Outlet connections shall provide pressure-tight connections to the fixture to which it is assembled, as specified in ASME A112.19.2/CSA B45.1.

3.7 Coatings

Coatings shall comply with the applicable requirements of ASME A112.18.1/CSA B125.1.

3.8 PFDs incorporating electrical features

3.8.1 General

PFDs incorporating electric features shall comply with the applicable requirements of ASME A112.18.1/CSA B125.1.

3.8.2 Testing

When used with a PFD, electrical plumbing controls, including solenoid valves, shall

- (a) be considered components of the PFD;
- (b) be tested with the PFD; and
- (c) comply with [Clause 4.7](#).

Replacement of a battery during any of the testing required by this section shall not be considered a failure of the PFD.

Section IV

4 Performance requirements and test methods

4.1 General

4.1.1 Preconditioning

Before testing, specimens shall be conditioned at ambient laboratory conditions for at least 12 h.

4.1.2 Installation for testing

For test purposes, specimens shall be installed in accordance with the manufacturer's instructions. All intervals between discharges shall be sufficient so as to allow the PFD to complete its flushing cycle.

4.1.3 Test conditions

All tests shall be conducted using water temperatures between 4 °C and 30 °C (40°F and 85°F), unless otherwise specified in this test procedure.

4.1.4 Order of tests

Tests shall be conducted on the same specimen, in the order listed in this Standard.

4.2 Pressure test

4.2.1 Purpose

The purpose of this test is to determine if the PFD operates across its required pressure range.

4.2.2 Procedure

The pressure test shall be conducted as follows:

- (a) Install the test specimen on a test stand with the PFD discharging to atmosphere.
- (b) Operate the PFD (i.e., allow it to complete its flushing cycle) at a static pressure of 140 ± 14 kPa (20 ± 2 psi).
- (c) Repeat Item (b) at a static pressure of 860 ± 14 kPa (125 ± 2 psi).
- (d) Subject the PFD to a static pressure of 140 ± 14 kPa (20 ± 2 psi).
- (e) Hold for 5 min.
- (f) Repeat Item (b) at a static pressure of 860 ± 14 kPa (125 ± 2 psi).
- (g) Observe for leakage.

4.2.3 Performance criteria

Failure to complete the flushing cycle or any leakage shall result in a rejection of the PFD.

4.3 Back siphonage test — Non-tank type PFDs

4.3.1 Purpose

The purpose of this test is to ensure that the PFD incorporates a means to protect against back siphonage except as specified in [Clause 3.3](#).

4.3.2 Procedure

Non-tank type PFDs shall comply with the back siphonage performance requirements in ASME A112.18.3, ASSE 1001, or CSA B64.1.1.

4.3.3 Performance criteria

Failure to comply with the applicable back siphonage requirements of the applicable standards specified in [Clause 4.3.2](#) shall result in a rejection of the PFD.

4.4 Backflow test — Tank type PFDs

4.4.1 Purpose

The purpose of this test is to ensure that the PFD incorporates a means to protect against back siphonage and backpressure.

4.4.2 Procedure

The backflow test for tank type PFDs shall be conducted as follows:

- (a) Install the test specimen in accordance with [Figure 1](#).
- (b) Foul all checking members with a 0.8 mm (0.032 in) diameter 100% copper wire formed to the sealing surface of the check being tested and in the proper location for the type of valve construction, as illustrated in [Figure 2](#), [3](#), or [4](#).
- (c) Add a dye solution to the tank.
- (d) Pressurize the tank to the manufacturer's recommended working pressure to establish the normal water level in the PFD tank.
- (e) Apply a vacuum of 85 kPa (12 psi) and maintained for at least 1 min.
- (f) Slowly apply a vacuum (not less than 5 s) from 0 kPa to 85 kPa (0 psi to 12 psi)
- (g) Slowly reduce the vacuum from 85 kPa to 0 kPa (12 psi to 0 psi).
- (h) Create a surge effect by quickly (less than 1 s) opening and closing a quick-acting valve. During this step, the vacuum shall range between 85 kPa and 0 kPa (12 psi and 0 psi).

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

4.4.3 Performance criteria

Any coloured water in the sight glass during the tests specified in [Clause 4.4.2](#) shall result in a rejection of the PFD.

4.5 Hydraulic performance tests

4.5.1 Purpose

The purpose of this test is to determine the PFD's hydraulic performance.

4.5.2 Procedure

The hydraulic performance test shall be conducted

- (a) in accordance with the applicable performance tests specified in ASME A112.19.2/CSA B45.1, for single-flush PFDs;
- (b) in accordance with the applicable performance tests specified in ASME A112.19.14, for dual-flush PFDs;
- (c) using three fixtures;
 - (i) complying with ASME A112.19.2/CSA B45.1; and
 - (ii) manufactured by different manufacturers; and
- (d) following the sequence specified in [Table 1](#) for each type of PFD, depending on the fixture on which it is intended to be installed.

4.5.3 Performance criteria

Failure to comply with the performance requirements of ASME A112.19.2/CSA B45.1 or, for dual flush function PFDs, ASME A112.19.14, shall result in a rejection of the PFD.

Table 1
Sequence for hydraulic performance tests
 (See [Clause 4.5.2.](#))

Water closet PFDs	Urinal PFDs	Dual flush PFDs	
		Full flush mode	Reduced flush mode
Trap seal depth determination	Trap seal depth determination	Trap seal depth determination	Trap seal restoration
Water consumption	Surface wash	Water consumption	Reduced flush volume
Granule and ball	Dye	Granule and ball	Dye
Surface wash	Water consumption	Surface wash	Toilet paper
Mixed media		Mixed media	
Drain line transport characterization		Drain line transport characterization	

4.6 Operating requirements

4.6.1 Purpose

The purpose of this test is to determine the torque or force required to open, operate, and close a manually activated primary control.

4.6.2 Procedure

The operating (torque) test shall be conducted in an ambient environment of 20 ± 5 °C (68 ± 9 °F), as follows:

- (a) Install the test specimen on a test stand with the PFD discharging to atmosphere.
- (b) Bring the test specimen to equilibrium test temperatures by running water through it.
- (c) Determine the torque or force to operate a manually activated operating control by testing with water running as follows:
 - (i) 140 ± 14 kPa and 15 ± 6 °C (20 ± 2 psi and 59 ± 10 °F); and
 - (ii) 550 ± 14 kPa and 15 ± 6 °C (80 ± 2 psi and 59 ± 10 °F).

4.6.3 Performance criteria

4.6.3.1

For primary controls of non-accessible design PFDs, the linear force shall not exceed 90 N (20 lbf).

4.6.3.2

For primary controls of accessible design PFDs, the linear force shall not exceed 22 N (5 lbf).

4.7 Life cycle test

4.7.1 Purpose

The purpose of this test is to determine if there is any deterioration in the performance of the PFD through the life cycle testing.

4.7.2 Procedure

4.7.2.1 Test set-up

The PFD for the life cycle test shall be set up as follows:

- (a) Install the test specimen on a test stand with the PFD discharging to atmosphere.
- (b) Connect the PFD to a 172 ± 14 kPa (25 ± 2 psi) flowing supply pressure at 15 ± 6 °C (59 ± 10 °F).
- (c) Flush the PFD at least five times to hydraulically balance it.
- (d) Once hydraulically balanced, flush the PFD five consecutive times.
- (e) Measure the volume of each flush.
- (f) Average the five flush volumes and record the average flush volume of the PFD. For dual flush PFDs, measure and average the flush volumes for five full flushes then measure and average the flush volumes for five reduced flushes.

4.7.2.2 Procedure for PFDs with a primary control only

The life cycle test for PFDs with a primary control only shall be conducted as follows:

- (a) Subject the PFD 250,000 cycles of operation.
- (b) After every 25,000 cycles,
 - (i) record the average flush volume of three consecutive flushes; and
 - (ii) observe the PFD for leakage .
- (c) For dual flush PFDs, use the following cycling sequence:
 - (i) 25,000 cycles in full-flush mode;
 - (ii) 100,000 cycles in reduced-flush mode;
 - (iii) 25,000 cycles in full-flush mode; and
 - (iv) 100,000 cycles in reduced-flush mode.
- (d) Compare the average flush volumes at each stage with the average discharge volumes recorded in accordance with [Clause 4.7.2.1\(f\)](#).

4.7.2.3 Procedure for PFDs with an optional secondary control

When the PFD is equipped with a secondary control, the secondary control shall be subjected to 2,500 cycles of operation upon the completion of the test specified in [Clause 4.7.2.2](#). At the end of the 2,500 cycles, the average flush volume of three consecutive flushes shall be recorded.

4.7.2.4 Subsequent tests

Upon completion of the test specified in [Clause 4.7.2.2](#) and, when applicable, in [Clause 4.7.2.3](#), the following tests shall be conducted again:

- (a) Pressure test, for all PFDs ([Clause 4.2](#));
- (b) Back siphonage test, for non-tank type PFDs ([Clause 4.3](#));
- (c) Backflow test, for tank type PFDs ([Clause 4.4](#)); and
- (d) Operating requirements test, for the PFD ([Clause 4.6](#)).

4.7.3 Performance criteria

Sticking, chattering, or leaking during or at the conclusion of the life cycle test shall result in a rejection of the PFD.

For flush volumes

- (a) greater than 2 L (0.5 gal), the average flush volume at each recorded stage varying by more than 10% shall result in a rejection of the device; and
- (b) 2 L (0.5 gal) or less, the average flush volume at each recorded stage shall not vary by more than 20%.

Failure to meet the criteria specified in [Clauses 4.2, 4.3, 4.4, and 4.6](#) at the completion of the life cycle test shall result in rejection of the PFD.

4.8 Integral control stop life cycle test

4.8.1 Purpose

The purpose of this test is to ensure that optional integral control stops are operable for a specified minimum number of cycles.

4.8.2 Procedure

The life cycle test for integral control stops for PFDs shall be conducted as follows:

- (a) Install the test specimen on a test stand with the PFD discharging to atmosphere.
- (b) Position the integral control stop in the closed position.
- (c) Pressurize the control stop to 860 ± 35 kPa (125 ± 5 psi).
- (d) Check for leaks:
- (e) Reduce the pressure 415 ± 20 kPa (60 ± 3 psi).
- (f) Operate the control stop for 500 cycles, as follows:
 - (i) One complete cycle shall be operating the control stop from the fully closed position to at least 80% of the fully open position, without making contact with the end stops, and back to the fully closed position.
 - (ii) The rate of opening and closing the control stop should not exceed 250 cycles per hour to effectively simulate its manual operation.
- (g) Upon completion of the 500 cycles of operation,
 - (i) close the control stop;
 - (ii) pressurize the control stop to 860 ± 35 kPa (125 ± 5 psi);
 - (iii) maintain the pressure for 5 min; and
 - (iv) check for leaks.

4.8.3 Performance criteria

Any sign of leakage from the control stop shall result in a rejection of the PFD.

4.9 Hydrostatic pressure test for non-tank type PFDs

4.9.1 Purpose

The purpose of the hydrostatic pressure test for non-tank type PFDs is to determine if the PFD is capable of withstanding a hydrostatic test pressure of 3,450 kPa (500 psi).

4.9.2 Procedure

The hydrostatic pressure test for non-tank type PFDs shall be conducted as follows:

- (a) Close the PFD.
- (b) Pressurize the PFD to a hydrostatic pressure of $3,450 \pm 35$ kPa (500 ± 5 psi) through the inlet. Maintain the pressure for 1 min.

4.9.3 Performance criteria

Any leakage shall result in a rejection of the PFD.

4.10 Hydrostatic pressure test for tank type PFDs

4.10.1 Purpose

The purpose of the hydrostatic pressure test for tank type PFDs is to determine if the PFD is capable of withstanding a hydrostatic test pressure of 3,450 kPa (500 psi) or two times the minimum relief valve opening pressure, but in no case less than 550 kPa (80 psi).

4.10.2 Procedure

The hydrostatic pressure test for tank type PFDs shall be conducted as follows:

- (a) Remove or deactivate for PFDs that incorporate such devices.
- (b) Increase the pressure at the inlet by increments of 7 kPa (1 psi) per second, from 0 kPa (0 psi) until the relief valve is discharging at a flow rate of at least 5 mL/min (0.17 oz/min).
- (c) Record the pressure in Item (b) and name it as the minimum relief valve opening pressure.
- (d) Block the outlet of the relief valve.
- (e) Pressurize the PFD to a hydrostatic pressure of two times the minimum relief valve opening pressure, but not less than 550 kPa (80 psi).
- (f) Maintain the pressure for 5 min.
- (g) For PFDs without a relief valve, slowly increase the pressure to $3,450 \pm 35$ kPa (500 ± 5 psi).
- (h) Maintain the pressure for 1 min.

4.10.3 Performance criteria

Any leakage through the PFD's body shall result in a rejection of the PFD.

Section V

5 Markings, packaging, and installation instructions

5.1 Markings

PFDs complying with this Standard shall be marked with

- (a) the manufacturer's name, trademark, or other mark or, in the case of private labeling, the name, trademark, or other mark of the customer for whom the PFD was manufactured;
- (b) a line and the letters "CL"* to indicate the critical level on PFDs with vacuum breakers (i.e., air inlet ports) intended for installation in potable water systems. as determine in [Clause 4.3.2](#)

*The equivalent French wording is "NC".

- (c) identification of flush mode options shall be depicted on the actuator of manually activated dual flush function PFDs. This identification shall be either by graphic display or lettering, or shall be intuitively apparent.

5.2 Water consumption

All PFDs complying with this Standard shall be marked to identify their average water consumption in litres per flush (Lpf) and gallons per flush (gpf) as determined in [Clause 4.5](#).

5.3 Visibility of markings

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

5.4 Packaging

Packaging shall be marked with the

- (a) manufacturer's name, trademark, or other mark or, in the case of private labeling, the name, trademark, or other mark of the customer for whom the PFD was manufactured; and
- (b) model name or series number, and water consumption in litres per flush (Lpf) and gallons per flush (gpf).

5.5 Installation instructions

The manufacturer shall provide installation instructions with PFDs. See [Clause 3.3 Backflow Prevention](#) for additional requirements for instructions.

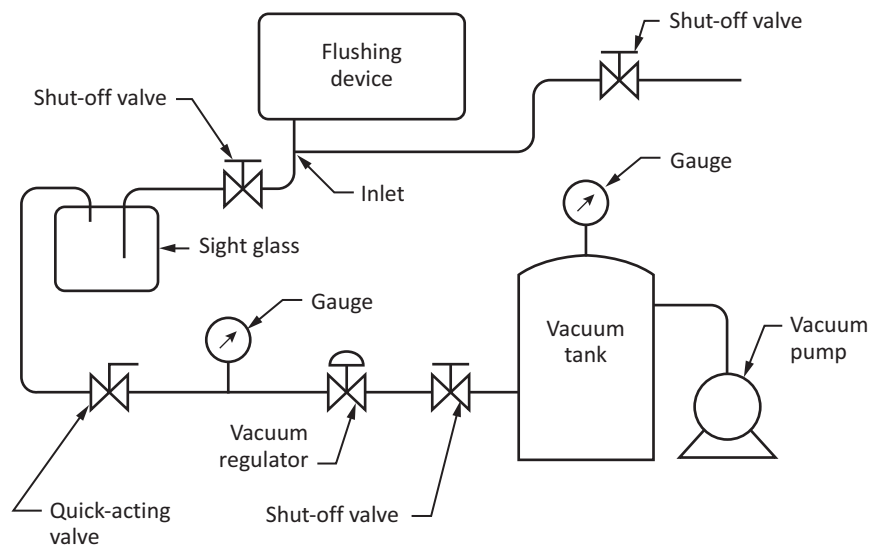
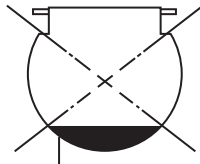


Figure 1
Backflow test set up for tank type PFDs
(See [Clause 4.4.2](#).)

Swing check



Test wire to be placed across the seat at this point

Figure 2
Swing check
(See [Clause 4.4.2.](#))

**Poppet type check
Nozzle type body**

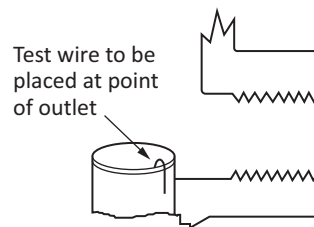


Figure 3
Poppet type check nozzle type body
(See [Clause 4.4.2.](#))

**Poppet type
Flat or level seat body**

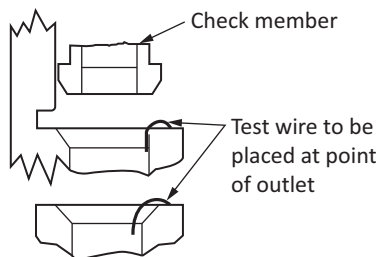


Figure 4
Poppet type flat or level seat body
(See [Clause 4.4.2.](#))



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