



**CSA
Group**

ASME A112.19.5-2017/CSA B45.15-17

Flush valves and spuds for water closets, urinals, and tanks



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ASME A112.19.5-2017/CSA B45.15-17 May 2017

Title: *Flush valves and spuds for water closets, urinals, and tanks*

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



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*Published in May 2017 by CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3
1-800-463-6727 • 416-747-4044*

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The 2017 edition of this Standard is being issued with an automatic addenda subscription service. The use of addenda allows revisions made in response to public review comments or committee actions to be published as necessary.

Published in May 2017 by
CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard
Toronto, Ontario, Canada
M9W 1R3
1-800-463-6727 or 416-747-4044
Visit the CSA Group Online Store at
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ISBN 978-1-4883-0469-9

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Preface

This is the second edition of ASME A112.19.5/CSA B45.15, *Flush valves and spuds for water closets, urinals, and tanks*. It supersedes the previous edition published in 2011.

This edition includes the following changes:

- a) addition of 3/4 spud size in Table 2;
- b) update to markings and packaging requirements;
- c) update to chemical resistance test procedure requirements; and
- d) update to the minimum effective thread length dimension.

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

This Standard was prepared by the ASME/CSA Joint Harmonization Task Group on Plumbing Fixtures, under the jurisdiction of the ASME Standards Committee on Plumbing Materials and Equipment and the CSA Technical Committee on Plumbing Fixtures. The CSA Technical Committee operates under the jurisdiction of the CSA Strategic Steering Committee on Construction and Civil Infrastructure. This Standard has been formally approved by the ASME Standards Committee and the CSA Technical Committee. This Standard was approved as an American National Standard by the American National Standards Institute on May 23, 2017.

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ASME A112.19.5-2017/CSA B45.15-17

Flush valves and spuds for water closets, urinals, and tanks

1 Scope

1.1

This Standard covers spuds and flush valves for water closet bowls, tanks, and urinals.

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 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 (nonmandatory) 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.

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

2 Reference publications

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

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

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

Ceramic plumbing fixtures

ASME (The American Society of Mechanical Engineers)

B1.20.1-2013

Pipe Threads, General Purpose, Inch

3 Definitions and abbreviations

3.1 Definitions

The following definitions shall apply in this Standard:

Flush valve — a valve located in a flush tank and used to flush a fixture by discharging water into the fixture.

Early closure flush valve — a valve in which the flush valve seal is adjustable to control the water level.

Note: *Usually, early closure flush valves are dependent on either a time delay or the distance that the water level drops to control the level at which the flush valve closes.*

Flush valve body — a fitting that contains a flush valve seat and a means of mounting to a fixture.

Note: *The means for mounting the body can be threaded or non-threaded, and can be with or without an overflow.*

Flush valve seal — a component of the flush valve that mates against the flush valve seat to prevent leakage when the flush valve is closed.

Note: *Flappers are a type of flush valve seal.*

Flush valve seat — the sealing surface of the flush valve body which, when mated with the flush valve seal, prevents leakage through the flush valve into the fixture.

Mounting seal — a seal between the flush valve body and the fixture.

Spud — a fitting used to connect a flushometer valve to a water closet or urinal.

Note: *Spuds are illustrated in Tables 1 and 2.*

3.2 Abbreviations

The following abbreviations shall apply in this Standard:

NPS — nominal pipe size

NPSM — National Pipe Straight Mechanical

PVC — polyvinylchloride

4 Design requirements

4.1 Rated temperatures

Flush valves and spuds shall be designed for rated supply temperatures between 5 and 43 °C (40 and 110 °F).

4.2 Threads

Pipe threads shall comply with ASME B1.20.1.

4.3 Overflow tubes

The inside diameter of the overflow tube for flush valves intended to be sold as replacement parts shall be a minimum of 23.4 mm (0.92 in).

4.4 Spud dimensions

Threaded spuds shall comply with the dimensions specified in Tables 1 and 2.

Note: Alternate dimensions may be used provided that compatibility is maintained with mating components.

5 Performance requirements and test methods

5.1 General

5.1.1 Preconditioning

Before testing, specimens shall be conditioned at ambient laboratory conditions for a minimum of 12 h.

5.1.2 Installation for testing

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

5.1.3 Flush valve assembly

5.1.3.1 Threaded

Threaded flush valves intended to be assembled to the fixture using a flush valve nut shall be tested in accordance with Clauses 5.3 and 5.4.

5.1.3.2 Non-threaded

Flush valves assembled to water closets by means other than threads shall be tested in accordance with Clause 5.4.

5.2 Life cycle test

5.2.1 Performance requirements

During and after the test, flush valves shall

- a) continue to function as they did at the beginning of the test;
- b) show no signs of leakage; and
- c) not develop any defects that might adversely affect their functionality or serviceability.

5.2.2 Test method

The life cycle test shall be conducted as follows:

- a) Install the specimen with a minimum sustained water head of 150 mm (6.0 in) at 21 ± 5 °C (70 ± 10 °F).
- b) Operate the specimen and allow it to return to its closed position for 150 000 cycles, with water at ambient temperature and returned to a minimum of 150 mm (6.0 in) head after each cycle.

5.3 Thread torque test

5.3.1 Performance requirements

The flush valve and flush valve nut shall withstand a torque of 14 N•m (10 lbf-ft) without jumping the threads or showing any sign of visible damage.

5.3.2 Test method

The thread torque test shall be conducted as follows:

- a) Using the matching flush valve nut, assemble the flush valve to a smooth 13 mm (0.5 in) thick aluminum plate with a hole bored through it. Ensure that the hole in the aluminum plate is 1 to 5 mm (0.04 to 0.20 in) larger than the outside diameter of the flush valve thread.
- b) Tighten the flush valve nut to a torque of 14 N•m (10 lbf-ft).
- c) Wait 1 min and disassemble the flush valve and flush valve nut.
- d) Examine for signs of damage or jumped threads.

5.4 Fixture and flush valve joint leak test

5.4.1 Performance requirement

The joint between the fixture and the flush valve (i.e., the flush valve mounting seal) shall not leak. Leakage through the flush valve seal opening shall not be considered a failure.

5.4.2 Test method

The fixture and flush valve joint leak test shall be conducted as follows:

- a) Assemble the flush valve into a hole in the bottom of a container that is at least 500 mm (20 in) deep from the bottom to the lowest spill point. The hole in the bottom of the container shall be 1 to 5 mm (0.04 to 0.20 in) larger than the outside diameter of the flush valve thread or in accordance with the manufacturer's instructions in the case of non-threaded connections.
- b) Fill the container with water at 21 ± 5 °C (70 ± 10 °F) to a height of 500 mm (20 in) measured from the container bottom.
- c) Wait 10 min.
- d) Inspect for leaks between the flush valve and the container.

5.5 Leak rate and accelerated chemical resistance tests

5.5.1 General

The flush valve seal shall be tested with a flush valve for the leak rate test. The tests shall be conducted in the following order:

- a) leak rate test (see Clause 5.5.3.2); and
- b) accelerated chemical resistance test (see Clause 5.5.3.3).

5.5.2 Performance requirement

Leakage through the flush valve seal during the initial leak rate test period and after the accelerated chemical resistance test shall not exceed 0.25 mL/h.

5.5.3 Test methods

5.5.3.1 Apparatus

The test apparatus for the leak rate and accelerated chemical resistance tests shall consist of an NPS-8 clear PVC pipe attached to a piece of 6.4 mm (0.25 in) PVC flat stock. The joint between the pipe and the flat stock shall be completely sealed. The flat stock shall have a hole bored through it that is 1 to 5 mm (0.04 to 0.20 in) larger than the outside diameter of the flush valve thread or attachment mechanism. The flush valve shall be assembled into the hole in the flat stock. The clear PVC pipe shall be marked with a fill line 178 ± 1.5 mm (7 ± 0.06 in) above the lowest point of the flush valve seat. Leakage from the flush valve seal shall be collected and measured.

Note: An alternative test apparatus may be used if the conditions of this Clause are met.

5.5.3.2 Leak rate test procedure

The leak rate test shall be conducted as follows:

- a) Fill the test apparatus with water at 21 ± 5 °C (70 ± 10 °F) to the specified fill line.
- b) Lift the flush valve seal and flush the test apparatus.
Note: This procedure will allow the flush valve seal to be wetted and seal properly.
- c) Repeat Items a) and b) two more times, for a total of three fill-flush cycles.
- d) Fill the test apparatus to the fill line. Allow the flush valve seal to seat properly by leaving the test setup undisturbed for 24 ± 1 h.
- e) At the end of the 24 ± 1 h period specified in Item d), drain any water from the beaker, refill the apparatus with water to the fill line, and start the test. Conduct the test for $1 \text{ h} \pm 2 \text{ min}$.
- f) At the conclusion of the test, remove the test apparatus from the graduated beaker.
- g) Inspect the beaker for any water that might have leaked past the flush valve seal.
- h) Measure the water collected in the beaker and calculate the leak rate.

5.5.3.3 Accelerated chemical resistance test procedure

The accelerated chemical resistance test shall be conducted on two new test specimens with two different bowl cleaner solutions (each specimen to be tested with one cleaner only), as follows:

- a) Prepare master solutions of two different chlorine-based bowl cleaners* at 2000 ± 100 ppm of total chlorine by dissolving and mixing with distilled or deionized water† in a clean glass or plastic container. Chlorine concentration (ppm) shall be measured and the measurement rounded to the nearest whole number. Equipment capable of yielding such accuracy is deemed suitable. Label one container with solution as “Master Solution A” and the second as “Master Solution B”. Analyze each solution upon preparation and at each solution change [see Item d)] and record the concentration each time. Maintain the concentration between 2000 ± 200 ppm. If the analyses indicate that the concentrations of the solutions have changed to be outside of this range, discard the solutions and prepare new ones from the same cleaner.

* Clorox Bleach® and 2000 Flushes Bleach® tablet forms are acceptable and may be ground to a powder for dissolving in the solution. If either product is discontinued, the tests may be conducted using an available bowl cleaner. The discontinued product should be reported to the ASME and CSA technical committees.

† Distilled and deionized water have a substantial amount of impurities removed. If another alternative exists to the same effect, it too shall be deemed permissible.

- b) Prepare two test vessels for the testing of the flush valve seals. The test vessels shall have a lid and be large enough to totally contain the seal without applying stress to it. The first test vessel shall be labeled “Test Vessel A”. The second test vessel shall be labeled “Test Vessel B”. Insert one valve seal test specimen into each glass test vessel such that the sealing surface of the test specimen is not under physical stress. Add “Solution A” to the test vessel labeled “Test Vessel A” so as to completely cover the test specimen with solution and fill the vessel as completely as possible. A lid

shall be placed on the vessel as a means to reduce fume exposure and outgassing. Add “Solution B” to the test vessel labeled “Test Vessel B” so as to completely cover the test specimen and fill the vessel as completely as possible. A lid shall be placed on this vessel as well.

- c) Place “Test Vessel A” and “Test Vessel B” in a convection oven or other device capable of maintaining a temperature of 40 ± 3 °C (104 ± 5 °F) for 28 days.
- d) On weekdays, replace the solution in each test vessel with new solution from the same Master Solution every 24 h (± 1 h). After replacing and analyzing the solution in each test vessel, return the test vessels to the oven. On weekends, maintain the test vessels with solution and test samples at 40 ± 3 °C (104 ± 5 °F) without changing the test solutions.
- e) Within 1 h of the end of the 28-day test period, subject the specimen to the leak rate test specified in Clause 5.5.3.2.

6 Markings

6.1 Manufacturer’s name or trademark

6.1.1

Flush valves shall be marked with the manufacturer’s name or registered trademark or, in the case of private labelling, with the name of the customer for whom the flush valve was manufactured.

6.1.2

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

Note: Replacing flush valve seals can change the water closet water consumption. Therefore, manufacturers of water closets should provide adequate information about replacement flush valves. See Clause 9.3 of ASME A112.19.2/CSA B45.1.

6.2 Packaging

6.2.1

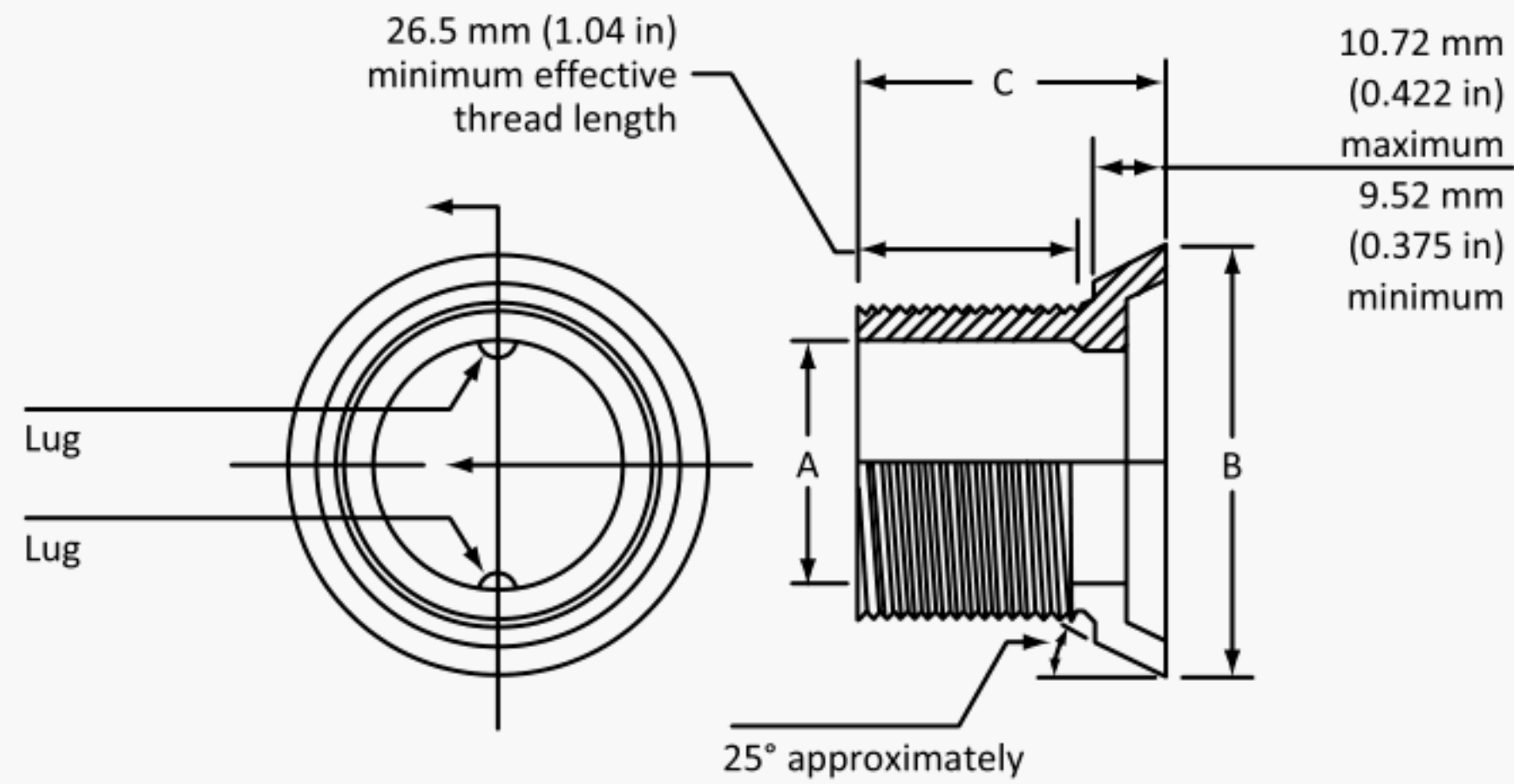
Packaging for replacement flush valves and flush valve seals shall be marked with the following:

- a) the manufacturer’s name or registered trademark or, in the case of private labeling, the name of the customer for whom the flush valve or flush valve seal was manufactured;
- b) the model part number(s) and identification of the manufacturer(s) of the flush valve(s) or flush valve seal(s) it is intended to replace; and
- c) where an intended design is a general or universal replacement product for flush valves or flush valve seals, package marking shall indicate this to satisfy the requirements of Item b).

6.2.2

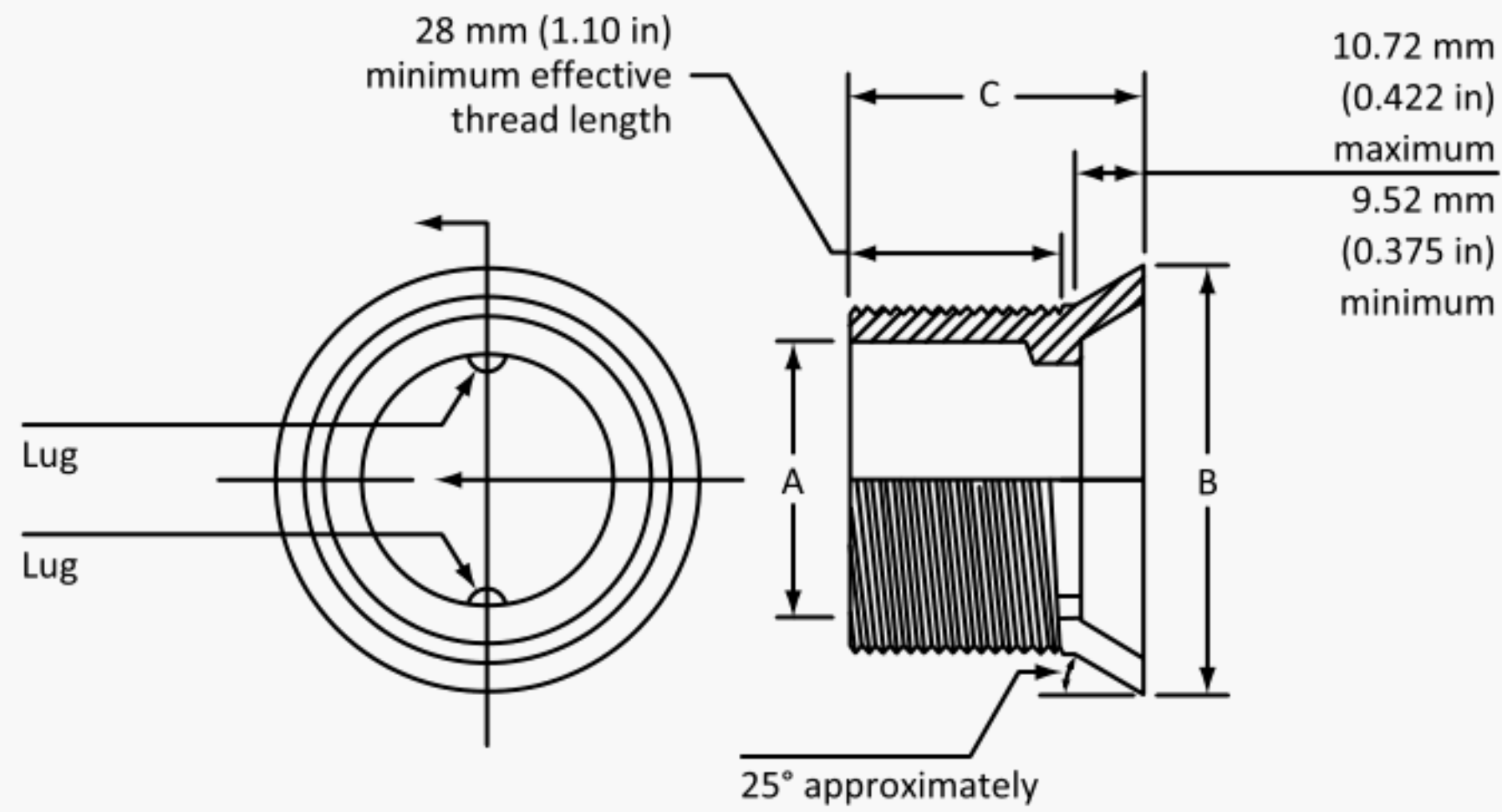
Adjustable replacement flush valves and flush valve seals shall include installation instructions required to maintain the original flush volume of the toilet(s) for which they are intended to be installed.

Table 1
Dimensions of reducing water closet and urinal spuds
(See Clauses 3.1 and 4.4.)



Nominal spud size	External thread designation, NPSM	A		B		C
		Maximum, mm (in)	Minimum, mm (in)	Maximum, mm (in)	Minimum, mm (in)	Nominal, mm (in)
1 × 3/4	3/4–14	20.6 (0.81)	19.8 (0.78)	40.0 (1.57)	38.0 (1.50)	38.0 (1.50)
1-1/4 × 3/4	3/4–14	20.6 (0.81)	19.8 (0.78)	51.0 (2.00)	49.0 (1.93)	38.0 (1.50)
1-1/2 × 1-1/4	1-1/4–11-1/2	35.0 (1.38)	32.5 (1.28)	57.0 (2.25)	55.0 (2.16)	40.0 (1.57)
2 × 1-1/4	1-1/4–11-1/2	35.0 (1.38)	32.5 (1.28)	69.0 (2.72)	67.0 (2.64)	40.0 (1.57)
2 × 1-1/2	1-1/2–11-1/2	40.0 (1.57)	38.9 (1.53)	69.0 (2.72)	67.0 (2.64)	40.0 (1.57)

Table 2
Dimensions of regular water closet and urinal spuds
 (See Clauses 3.1 and 4.4.)



Nominal spud size	External thread designation, NPSM	A		B		C
		Maximum, mm (in)	Minimum, mm (in)	Maximum, mm (in)	Minimum, mm (in)	Nominal, mm (in)
3/4	3/4-14	20.6 (0.81)	19.8 (0.78)	40.0 (1.57)	38.0 (1.50)	40.5 (1.59)
1-1/4	1-1/4-11-1/2	33.3 (1.31)	32.5 (1.28)	51.0 (2.00)	49.0 (1.93)	40.0 (1.57)
1-1/2	1-1/2-11-1/2	40.0 (1.57)	38.9 (1.53)	57.0 (2.25)	55.0 (2.16)	40.0 (1.57)
2	2-11-1/2	52.3 (2.06)	51.6 (2.03)	69.0 (2.72)	66.0 (2.60)	45.0 (1.77)

Annex A (informative)

Unit conversion and rounding criteria

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

A.1 Conversion

The following conversion rules are used in this Standard:

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

A.2 Rounding

The following rounding rules are used in this Standard:

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



I S B N 978-0-7918-7175-1



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