ASME A112.19.5-2005
(Revision of ASME A112.19.5-1999)

Trim for Water-Closet Bowls, Tanks, and Urinals

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Three Park Avenue • New York, NY 10016

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This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Interpretations are published on the ASME website under the Committee Pages at http://www.asme.org/codes/ as they are issued.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

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FOREWORD

In a letter dated April 8, 1965, the Plumbing Fixture Manufacturers Association requested the cooperation of the Office of Commodity Standards now the Office of Engineering Standards Services, National Institute of Standards and Technology (NIST) in the revision of Commercial Standard CS172-50, Brass Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards) and submitted a draft of the proposed revision prepared by the Standards Committee of that organization. The principal changes in the revision consisted of the standardization of the threads of such trim to comply with the latest requirements of Screw Thread Standards for Federal Services and American Standards Association Specification B1.1-1960, Screw Threads (R1974), and B2.1-1960, Pipe Threads (Except Dryseal) (R1968). The word "brass" was deleted from the title of the standard to provide latitude for the use of plastics for such trim.

A draft of the recommended revision was prepared by the Office of Commodity Standards and approved by a majority of the Standing Committee. Subsequently, the Office of Commodity Standards circulated the Recommended Revision of Commercial Standard CS172-50, Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards), TS-5677A, to the trade for comment and acceptance on January 21, 1966. Acceptances were received representing a satisfactory majority of the industry. The Office of Engineering Standards Services announced on September 26, 1966 that the Standard had been approved for publication and designated as Product Standard PS6-66 effective November 1, 1966. In 1977, American National Standard Committee A112, Panel 19, undertook to revise and update the Standard to reflect current industry practice. The new standard was approved as ANSI A112.19.5 on January 4, 1979. In accordance with NBS policy to avoid duplication of standardization activities by nationally recognized consensus standards-developing bodies, NBS withdrew PS6-66.

In 1996, The American Society of Mechanical Engineers (ASME) A112.19.5 Task Group began to revise the Standard to update it with current practice. The task group moved the requirements for the fill valve shank, locknut, and coupling nut from this Standard to the American Society of Sanitary Engineering (ASSE) 1002, Performance Requirements for Anti-Siphon Fill Valves (Ballcocks) for Gravity Water-Closet Flush Tanks. Also, the exterior dimensions for spud and flush valve locknuts and 2 in. coupling nuts were deleted from the Standard to facilitate the use of new materials; and performance requirements were added for assembling flush valves as an alternative to a thread and locknut.

In 2001, the A112 Project Team 19.5 began working with the toilet industry and automatic toilet tank cleaner suppliers to develop a test that would both set a standard durability test for tank trim and that would set limits on the chemicals used in automatic toilet tank cleaners. Two years of testing highlighted the difficulties in developing a test protocol that was reliable and repeatable. However, during this period, the Los Angeles Department of Water and Power Supplementary Purchase Specifications for Chemical Resistant Flapper Flush Valves was implemented, products were developed to meet this requirement, and the requirements were referenced in the Nonmandatory Appendex F of the 2004 revision of ASME A112.19.2, Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals. The Project Team also adopted this chemical durability requirement for this Standard.

A second issue arose during the development of the 2005 revision. People servicing toilet tank trims were having difficulty getting the appropriate replacement parts. In many cases, using the wrong replacement parts was increasing the water consumption significantly. The Project Team developed a comprehensive requirement for labeling OEM tanks and replacement tank trim parts to provide the information necessary to correctly select replacement parts for tanks.

The limit on the maximum outside diameter of the flush valve was removed to eliminate any confusion about the use of flush valves of different sizes to create different flow rates to toilet bowls.

Suggestions for improvement of this Standard are welcome. They should be sent to The American Society of Mechanical Engineers; Attn: Secretary, A112 Standards Committee; Three Park Avenue; New York, NY 10016-5990.

This revision was approved as an American National Standard on November 29, 2005.

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, A112 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Proposing Revisions. Revisions are made periodically to this Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the edition, the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal including any pertinent documentation. When appropriate, proposals should be submitted using the A112 Project Initiation Request form.

Interpretations. Upon request, the Committee will render an interpretation of any requirement of their Standards. Interpretations can only be rendered in response to a written request sent to the Secretary of the A112 Standards Committee.

The request for an interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings, which are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The A112 Standards Committee schedules meetings as needed, which are open to the public. Persons wishing to attend any meeting should contact the secretary of the A112 Standards Committee.

TRIM FOR WATER-CLOSET BOWLS, TANKS, AND URINALS

1 GENERAL

1.1 Scope

This Standard establishes criteria for those items of trim for water-closet bowls, tanks, and urinals known as spuds, locknuts for spuds, flush valves, and flush elbows. Requirements for fill valves (ballcocks) are defined in ANSI/ASSE 1002.

This Standard does not address the compatibility of materials. Nothing stated herein shall preclude the production of special design flush valves with unique nonstandard features for use in low-consumption plumbing fixtures.

1.2 Units of Measurement

Values are generally stated in U.S. Customary units and International System of Units (SI). U.S. Customary units shall be considered as the standard.

1.3 Reference Standards

The following documents form a part of this Standard to the extent specified herein. The latest issue shall apply.

ANSI/ASSE 1002, Performance Requirements for Anti-Siphon Fill Valves (Ballcocks) for Gravity Water Closet Flush Tanks

Publisher: American Society of Sanitary Engineering (ASSE), 901 Canterbury Road, Westlake, OH 44145

ASME A112.19.2, Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals

ASME B1.20.1, Pipe Threads, General Purpose (Inch)

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

ASTM F 409, Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings

Publisher: American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

1.4 Definitions

flush valve flapper: an elastomeric flush valve component that combines in one piece a pair of lever arms, a valve seat sealing surface, and sometimes a float.

flush valve seal: a flush valve component, typically elastomeric that serves as the flush valve sealing component. A flush valve flapper is one type of flush valve seal.

2 DESIGN REQUIREMENTS

Thread dimensions shall be as given in Tables 1 and 2. The information provided in Nonmandatory Appendix A is the result of a series of calculations that are specified in ASME B1.20.1. Dimensions for regular and reducing spuds shall be as shown in Tables 1 and 2.

Standard flush valves for gravity flush tanks shall conform to the dimensions of Fig. 1. The I.D. requirement in Fig. 1 is only applicable to aftermarket flush valves. For water-closet tank manufacturers, the Overflow Test for Gravity Tank requirement of ASME A112.19.2 shall apply.

Flush elbows shall conform to the dimensions in Fig. 2.

3 PERFORMANCE REQUIREMENTS

3.1 Dimensional Criteria for Spuds

Dimensions for spuds shall be as shown in Tables 1 and 2. Thread dimensions shall be 2–11.5 NPSM-1, $1\frac{1}{2}$–11.5 NPSM-1, $1\frac{1}{4}$–11.5 NPSM-1, and $\frac{3}{4}$–14 NPSM-1 in accordance with ASME B1.20.1. (All thread dimensions are Class 1.) Thread dimensions shall be inspected using ring and plug gages.

3.2 Flush Valve — Means of Assembly

3.2.1 Threaded Attachment. If a flush valve is threaded and is intended to be assembled to the fixture using a flush valve nut, either

(a) the threads shall be 2-11.5 NPSM Class 1 in accordance with ASME B1.20.1. They shall be inspected using ring and plug gages, or

(b) the flush valve and flush valve nut shall use an alternate thread configuration which shall be capable of being tightened to 10 lbf-ft (14 N·m) of torque, when tested in accordance with para. 4.1.

3.2.2 Nonthreaded Attachment. If a flush valve is to be assembled to the flush tank by any means other than a threaded attachment, it shall withstand a pull-out force of 60 lbf (267 N) when tested in accordance with para. 4.2.

Flush valves assembled to one-piece water closets by other means shall only be subjected to the leak test.

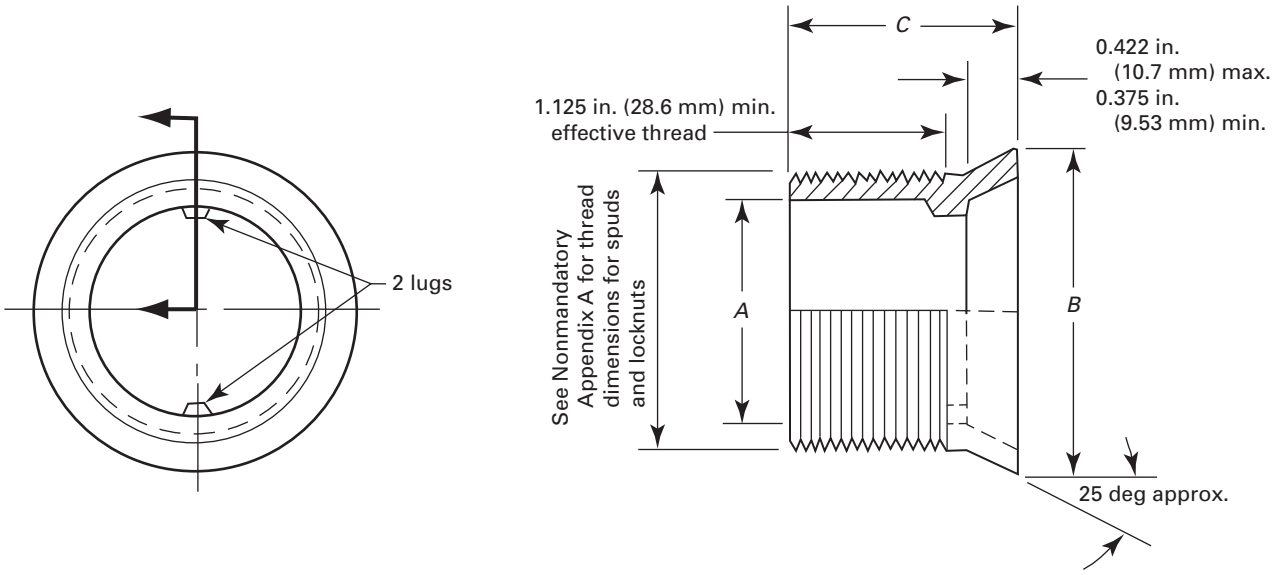


Table 1 Dimensions of Regular Spuds

Nominal Spud Size	*A*, in. (mm)		*B*, in. (mm)		*C*, in. (mm)
	Max.	Min.	Max.	Min.	(Nominal)
2	2.06 (52.3)	2.03 (51.6)	2.72 (69.1)	2.62 (66.5)	1.75 (44.5)
$1\frac{1}{2}$	1.59 (40.4)	1.53 (38.9)	2.25 (57.2)	2.16 (54.9)	1.62 (41.1)
$1\frac{1}{4}$	1.31 (33.3)	1.28 (32.5)	2.00 (50.8)	1.93 (49.0)	1.62 (41.1)

3.3 Flush Valve to Flush Tank Seal

The joint between the fixture and flush valve shall not leak when tested in accordance with para. 4.3.

3.4 Flush Valve Seals — Chemical Durability

If a flush valve has a flush valve seal or flush valve flapper, the seal or flapper shall comply with the leak test requirements when tested in accordance with para. 4.4.

4 TEST PROCEDURES

4.1 Flush Valve Assembly — Alternate Thread Torque Test

4.1.1 Criteria. The flush valve and flush valve nut with an alternative thread shall withstand a torque of 10 lbf-ft (14 N·m).

4.1.2 Test Method. Assemble the flush valve to a smooth 0.5 in. (13 mm) thick aluminum plate with a hole bored through it that measures 0.040 in. to 0.200 in. (1 mm to 5 mm) larger than the outer diameter of the flush valve threads using the matching flush valve nut. Tighten the flush valve nut to a torque of 10 lbf-ft (14 N·m). Wait 1 min and disassemble the flush valve and flush valve nut and examine for signs of damage.

4.1.3 Performance Requirement. The flush valve and the flush valve nut shall not have jumped threads nor shall they show signs of damage when disassembled.

4.2 Flush Valve Assembly — Nonthreaded Assembly Test

4.2.1 Criteria. The flush valve shall withstand a pull-out force of 60 lbf (267 N).

4.2.2 Test Method. Assemble the flush valve in an appropriate fixture and mount the fixture normally. A 60 lbf (267 N) vertical force shall be applied to the flush valve and held for 1 min.

4.2.3 Performance Requirement. The flush valve shall not pull loose from the fixture nor shall it show signs of damage.

4.3 Flush Valve Assembly — Leak Test

4.3.1 Criteria. The joint between the fixture and the flush valve shall not leak.

4.3.2 Test Method. Assemble the flush valve into a hole in the floor of a container that is at least 21 in. (534 mm) tall from the floor to the lowest spill point. The hole in the floor of the container shall measure 0.040 in. to 0.200 in. (1 mm to 5 mm) larger than the outer diameter of the flush valve threads. Fill the container with water to a height of 21 in. (534 mm) measured from the container floor. Wait for 10 min and inspect for leaks between the flush valve and the container.

4.3.3 Performance Requirement. No water shall leak from the joint between the flush valve and the container.

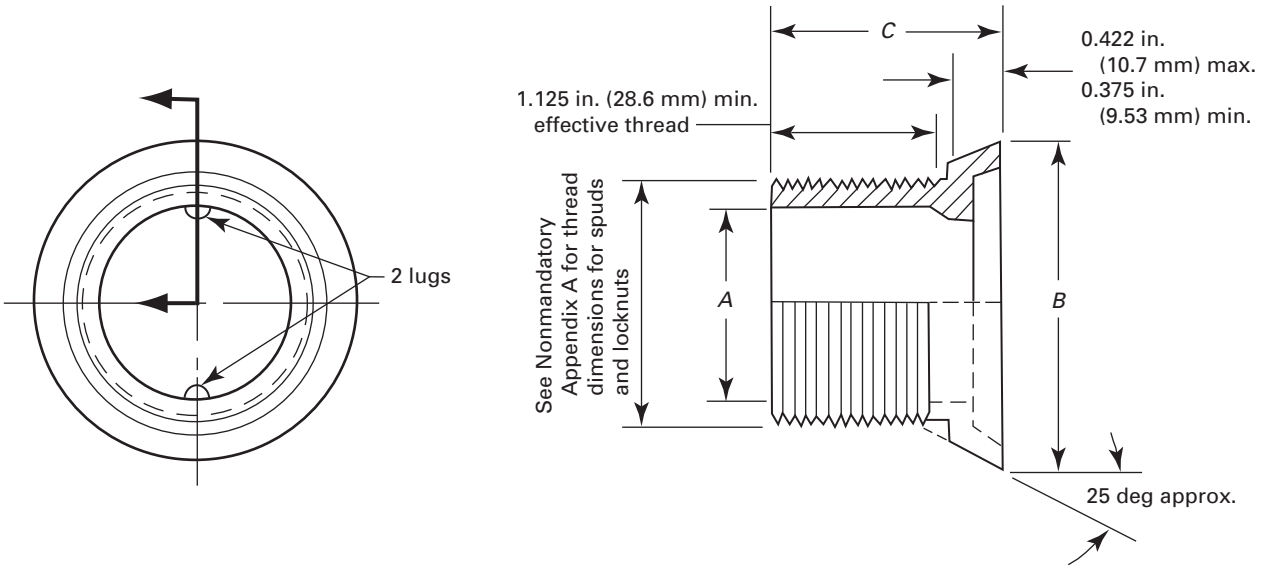


Table 2 Dimensions of Reducing Spuds

Nominal Reducing Spud Size [Note (1)]	*A*, in. (mm)		*B*, in. (mm)		*C*, in. (mm) (Nominal)
	Max.	Min.	Max.	Min.	
2 × 1½	1.58 (40.1)	1.53 (38.9)	2.72 (69.1)	2.62 (66.5)	1.62 (41.1)
2 × 1¼	1.38 (35.1)	1.28 (32.5)	2.72 (69.1)	2.62 (66.5)	1.62 (41.1)
1½ × 1¼	1.38 (35.1)	1.28 (32.5)	2.25 (57.2)	2.16 (54.9)	1.62 (41.1)
1¼ × ¾	0.81 (20.6)	0.78 (19.8)	2.00 (50.8)	1.93 (49.0)	1.50 (38.1)
1 × ¾	0.81 (20.6)	0.78 (19.8)	1.57 (39.9)	1.50 (38.1)	1.50 (38.1)

NOTE:
(1) The smaller dimension is the thread size (nominal).

Leakage through the flapper opening shall be disregarded.

4.4 Flush Valve Seals — Chemical Durability Test

4.4.1 Criteria. When tested according to paras. 4.4.2.1 and 4.4.2.2, leakage from the flush valve seal must meet the performance requirement in para. 4.4.3, following both the first and second leak rate test.

4.4.2 Test Method. The flush valve seal shall be tested with a flush valve. First run the leak rate test, run the accelerated test, and then conclude by running the leak rate test.

4.4.2.1 Leak Rate Test

(a) Apparatus. The test apparatus consists of an 8 in. (203 mm) diameter clear PVC pipe attached to a piece of 0.25 in. (6.4 mm) minimum PVC flat stock and appropriately sealed. The flat stock shall have a hole bored through it that measures 0.040 in. to 0.200 in. (1 mm to 5 mm) larger than the outer diameter of the flush valve threads or attachment mechanism. The valve seat shall be assembled into the hole in the flat stock of the test apparatus. The clear PVC pipe shall be marked with a fill line that measures 7 in. ± 0.06 in. (178 mm ± 1.5 mm) above the valve seat. The apparatus shall then be placed on top of a 3 L graduated beaker for the purpose of accurately monitoring and measuring any leaks.

NOTE: An alternate set of apparatus is permitted if it will enable the tester to provide the required environment for the test.

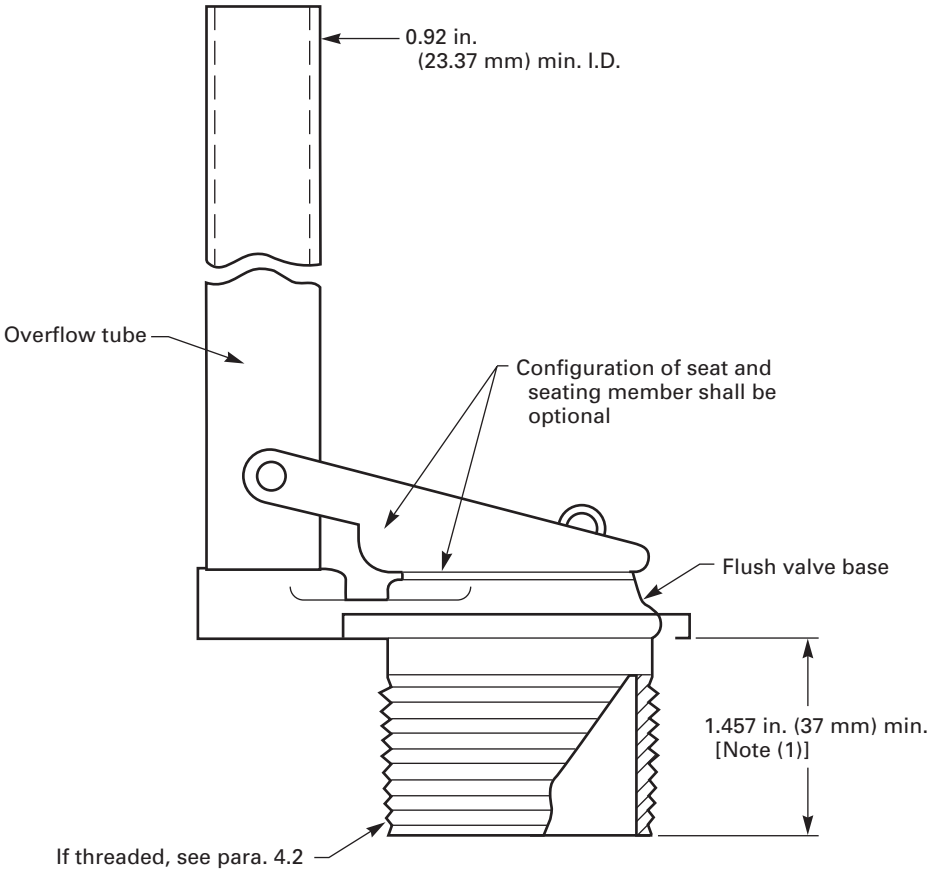
(b) Procedure

(1) Fill the test apparatus with tap water to the specified fill line. The temperature of the tap water used for this testing shall be maintained between 61°F and 80°F (16°C and 27°C).

(2) Lift the flush valve seal and flush the test apparatus. Fill and repeat twice. This allows the flush valve seal to be wetted and to find its seal.

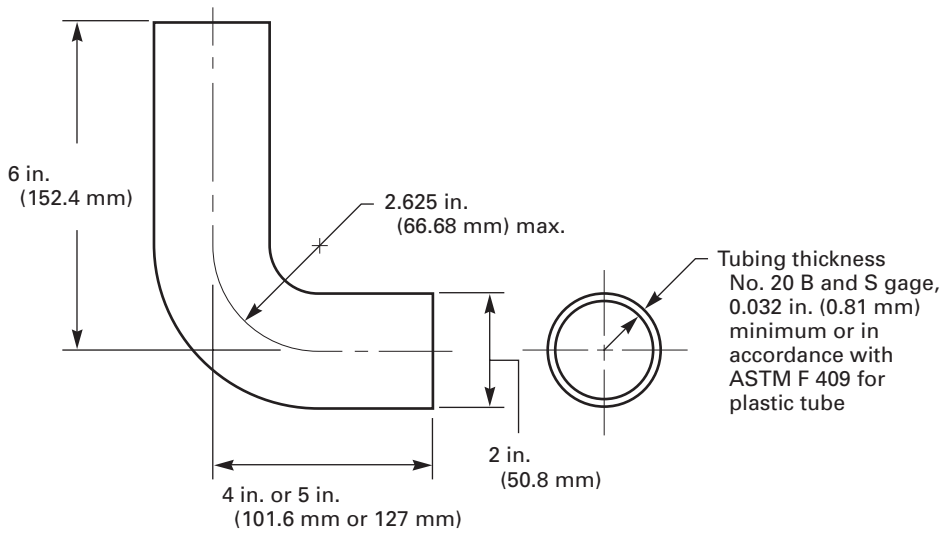
(3) Once again fill the test apparatus to the fill line. Allow the flapper to seat properly by leaving the setup undisturbed for 24 hr ± 1 hr.

(4) At the end of the 24 hr period, drain any water from the beaker, refill water in the tank to the fill line, and start the test. Test shall run for 1 hr ± 2 min.



NOTE:
(1) The minimum shall be permitted to vary for close-coupled tanks.

Fig. 1 Standard Flush Valve for Gravity Flush Tanks



GENERAL NOTE: A locknut and washer assembly within the elbow shall be permitted.

Fig. 2 Flush Elbows

(5) At the conclusion of the test, remove the test apparatus from the graduated beaker and inspect the beaker for any water that may have leaked past the flush valve seal. Measure the water collected in the graduated beaker. Report the leak rate as "xx mL/h."

4.4.2.2 Accelerated Test

(a) Apparatus. Use the same test setup specified in para. 4.4.2.1. Two drop-in bowl cleaners will be used, Clorox Bleach and 2000 Flushes Bleach. Separate tests shall be conducted on separate flush valve seal samples using both bowl cleaners. If either product is discontinued, run the tests using the available product and report the discontinued product to ASME. To increase test accuracy, two samples of each flush valve seal shall be tested with each stock solution.

(1) Concentrated stock solutions shall be made using each bowl cleaner. The concentration shall be at 2,000 ppm of total chlorine in a tap water solution.

(2) Each stock solution shall be analyzed initially upon preparation and at each solution change, at which time the concentration level shall be recorded. In the event that an analysis indicates that the concentration of the stock solution has changed by more than 10% from that prepared in accordance with the above procedure, the solution shall be discarded and a new stock solution prepared.

(3) The flush valve seal shall be attached to the test apparatus from para. 4.4.2.1. No more than one flush valve seal per test apparatus shall be allowed.

(4) The stock solution shall be added to the test vessel and filled to the fill line. The test apparatus containing the stock solution and the flush valve seal shall then be placed in a mechanically convected oven or other device capable of maintaining a test temperature of 104°F ± 5°F (40°C ± 3°C) for 28 days.

(5) The solution in the test apparatus shall be changed once a day with fresh stock solution.

(6) At the end of the 28 day test period, and within 1 hr, the flush valve seal shall be subjected to the leak test specified in para. 4.4.2.1.

4.4.3 Performance Requirement. Leakage through the valve during both the initial leak rate test period and after the accelerated test shall not exceed 0.25 mL/h.

5 IDENTIFICATION

5.1 Required Labels

5.1.1 Water-closet tanks shall have labels that comply with para. 5.2 and either para. 5.3 or 5.4.

NOTE: These requirements are intended to be included in the next revision of ASME A112.19.2.

5.1.2 Replacement flush valves shall have labels that comply with paras. 5.2 and 5.5.

5.1.3 Replacement flush valve flappers shall have labels that comply with para. 5.5.

5.2 Flush Valve Marking — Manufacturer's Name or Trademark

Flush valves shall be marked with the manufacturer's name or registered trademark, or, in case of private labeling, of the customer for whom the unit was manufactured. This mark shall be legible, readily identified, and permanently affixed.

5.3 Service

All water-closet tanks shall have a permanent, legible label with the telephone number for a service department that can inform a caller of the correct replacement components for the water-closet tank and the source of those components. The suggested language for the label is, "To service tank components, call xxx-xxx-xxxx" (where the x's represent the service telephone number). The label shall also include the manufacturer's part number of the flush valve seal.

5.4 Marking Replaceable Components of Flush Valves Installed as Original Equipment in Water-Closet Tanks

When flush valve seals and flappers are replaced, it could change the water-closet tank water consumption. Therefore, it is necessary for manufacturers of water-closet tanks to provide service information about installed flush valves. Every water-closet tank shall be permanently marked or permanently labeled with the appropriate information in para. 5.4.1, 5.4.2, or 5.4.3.

5.4.1 Standard Flush Valve Flappers. All water-closet tanks fitted with a 2 in. flush valve utilizing a standard, buoyant flapper flush valve seal shall have a label that reads, "Use Only Standard 2 in. Replacement Flapper."

5.4.2 Early Closure Flush Valves With Adjustable Flappers. All water-closet tanks fitted with a 2 in. flush valve utilizing an early closure flush valve seal, in which the flush valve seal is adjustable to control the closing water level in the tank, shall have a label as stated in para. 5.4.2.1.

5.4.2.1 Early Closure Time and Distance Numbers. Two early closure numbers (as defined in para. 5.4.2.1.1) shall be marked on the label. The label shall read, "Use only EC-Txx or EC-Dyy Replacement Flush Valve Seals," where the xx's and yy's represent the early closure time and distance numbers.

5.4.2.1.1 Early Closure Numbers. Early closure flush valves in which the flush valve seal is adjustable to control the closing water level are dependent on either a time delay or a distance that the water level drops to control the point at which the flush valve closes. To maintain toilet performance and consumption, it is critical that replacement parts for this type of early closure

flush valve match either the time or distance characteristics. To facilitate this, the following two early closure numbers are required for each water-closet tank with an early closure flush valve.

(a) Early Closure Time Number. The time from when the water-closet tank is flushed until the flush valve closes, is defined as the early closure time number. The early closure time number shall be represented as EC-Txx, where the xx represents the time (in seconds) to one decimal place. For example, an early closure time of 1.7 sec would result in an early closure time number of EC-T17. Likewise an early closure time of 2 sec would result in an early closure time number of EC-T20.

(b) Early Closure Distance Number. The distance from waterline to water level at flush valve closure is the early closure distance number. This shall be represented as EC-Dyy, where the yy represents the distance (in inches) to one decimal place. For example, an early closure distance of 3.7 in. would result in and early closure distance number of EC-D37.

5.4.3 Other Flush Valve Seals. Water-closet tanks fitted with all other types of flush valves shall have a label that reads, "Use MMM NNN Replacement Seal." In this case, MMM represents the manufacturer's name or trademark and NNN represents the model or part number of the replaceable seal.

5.5 Replacement Flush Valve or Flush Valve Seal Package Marking

The consumer packaging for all replacement flush valves or flush valve seals shall be marked on the outside with one of the following, as appropriate:

(a) the words "Standard 2 in. Replacement Flapper" (para. 5.4.1)

(b) the "EC" (Early Closure) numbers that the flush valve flapper replaces (para. 5.4.2)

(c) the manufacturer's name/trademark and model/part number (para. 5.4.3)

NONMANDATORY APPENDIX A
THREAD DIMENSIONS (CLASS 1)

Table A-1 below is the result of a series of calculations specified in ASME B1.20.1.

Table A-1 Thread Dimensions (Class 1)

External Threads					
Nominal Shank Size	External Thread Designation	Major Diameter, in.		Pitch Diameter, in.	
		Max.	Min.	Max.	Min.
3/4	3/4–14 NPSM-1	1.034	1.0185	0.9873	0.9794
1 1/4	1 1/4–11.5 NPSM-1	1.638	1.6225	1.5816	1.5725
1 1/2	1 1/2–11.5 NPSM-1	1.877	1.8615	1.8205	1.8113
2	2–11.5 NPSM-1 [Note (1)]	2.351	2.3355	2.2944	2.285
Internal Threads					
Nominal Size	External Thread Designation	Minor Diameter, in.		Pitch Diameter, in.	
		Max.	Min.	Max.	Min.
3/4	3/4–14 NPSM-1	0.974	0.958	0.9992	0.9889
1 1/4	1 1/4–11.5 NPSM-1	1.564	1.546	1.5952	1.5834
1 1/2	1 1/2–11.5 NPSM-1	1.803	1.785	1.8343	1.8223
2	2–11.5 NPSM-1	2.277	2.259	2.3085	2.2963

NOTE:

(1) National Pipe and Straight Thread for Mechanical Joints or American Standard for Straight Thread for Mechanical Joints.

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