



The American Society of  
Mechanical Engineers

A N A M E R I C A N N A T I O N A L S T A N D A R D

# DUAL FLUSH DEVICES FOR WATER CLOSETS

**ASME A112.19.10-2003**  
(Revision of ASME A112.19.10-1994)

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# FOREWORD

The purpose of this Standard is to establish a nationally recognized standard for dual flush devices to achieve volumetric water saving performance for water closets. This Standard provides guidance to manufacturers, distributors, purchasers, and jurisdiction officials, specifiers, or water utility planners for water conservation, to promote better understanding between suppliers and users, and to furnish a basis for fair competition in furnishing such products to meet the principal demands of the trade.

This Standard includes a series of tests for dual flush devices for modification of the flush volume from installed water closets and newly manufactured water closets that use 3.5 gal per flush or a greater volume, to reduce water consumption, that may apply such control options to provide two distinctive modes of operation. The devices considered to be covered in this Standard are those required to provide at least a 30% reduction in water consumption in the reduced flush mode and still meet the required performance levels of the Standard.

The reduction in water closet flush volume discharges that may be made by a variety of techniques, other than one or another single motion selector actuation and leaving the unit, are not covered by this Standard. Other active or passive techniques, or methods not covered, include, but are not restricted to: installation of dams; displacement volume containers; cylindrical or other shaped water barrier containment elements; and hand-held observer, evaluator, and/or controls for termination of the flush.

The tests specified in this Standard for the removal of liquid wastes and toilet tissues, or other comparable waste loads, are derived from industry experience, from field unit installations, independent laboratory evaluations by the methods included herein, and research studies. The endeavor accounts for service requirements that are necessary for the sanitary protection provided by water closets and water conservation achievable through the installation of these devices. The tests presented are from demonstrated applications by competent laboratory personnel and from other standards applications giving results of suitable reproducibility for the purposes intended.

This revision of the 1994 edition has changed the performance requirements to provide for an acceptable amount of leakage. In addition, soft metric conversion of the U.S. customary units has been added and a number of minor editorial errors have been corrected.

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

This Standard was approved as an American National Standard on February 26, 2003.

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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 that 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.

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# DUAL FLUSH DEVICES FOR WATER CLOSETS

## 1 GENERAL

### 1.1 Scope

This Standard covers physical and performance requirements and test methods pertaining to dual flush devices that are installed within water closet tanks which use 3.5 gpf (13.2 Lpf) or greater volume, to reduce total volumetric water consumption.

### 1.2 Units of Measurement

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

In this Standard, gallons per flush is abbreviated gpf and liters per flush is abbreviated Lpf.

### 1.3 References

The following documents form a part of this Standard to the extent specified herein. Unless otherwise specified, the latest edition shall apply.

ASME A112.19.2M, Vitreous China Plumbing Fixtures  
ASME A112.19.6, Hydraulic Performance Requirements for Water Closets and Urinals

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

### 1.4 Definitions

*cycle time*: the time beginning at the instant the flush release device is operated, and ending at the instant the water supply valve is completely shut off and the water stops flowing.

*dual flush device*: a mechanism for control of water closet discharge that provides the user with two options for selective operation with either a normal fill volume or a reduced volume of water from the tank. The dual flush devices are considered to be those which are capable of providing at least 30% reduction in water consumption. Only activation by selection of one option by the user, and a release of the actuation selector, without requiring further action or holding by the user, shall be required. User involvement devices that require further action or holding of the selector control to participate in the process of maintaining the selected operation mode and flush (single-option flush modifying devices or rapid closure devices) are not covered in this Standard.

*flapper valve*: see *flush valve*.

*flow pressure*: the pressure in the water supply pipe at the fixture fitting, valve, or water inlet while the fitting valve or water outlet is flowing.

*flush tank (gravity type)*: a device that stores a specified quantity of water. When actuated, it discharges the quantity of water, plus some through-flow from the potable water supply or other acceptable water source for the water closet sanitary service, into the water closet bowl or urinal by gravity. It is often a container for a measured quantity of water, fitted with an inlet valve (ball cock) and a flush valve, and is either wall-hung or close-coupled (with closet bowl).

*flush valve*: a special form of valve located at the bottom of a flush tank used to control the discharge of water from the tank into a water closet or urinal.

*sanitary*: reasonably acceptable appearance and not necessarily microbiologically clean.

*water closet*: a plumbing fixture having a water-containing receptor that receives liquid and solid body waste and, upon actuation, conveys the waste through an exposed integral trap seal into a gravity drainage system.

*water savings*: the amount of flush volume water reduction in gallons or percentage when comparing consumption with and without a dual flush device for a water closet.

*water surface*: the surface of the still water in the water closet bowl when filled to the trap weir.

## 2 GENERAL REQUIREMENTS

### 2.1 Functional Operation

When designed for installation in a gravity-type flush tank, the dual flush device shall fit within the tank punching without interference with other operating parts, except for the specific design requirements for modification of the function and operation, with free movement of all parts. Inserts and attachments within the tank shall not restrict the movement or operation of all parts, except for specific limits purposely intended by the design and operating needs of the device(s). The user shall be required to activate the function by actuation of the selector control or handle and release; the selected flush mode shall be completed without requiring further action or holding by the user.



## 2.2 Durability

The product shall meet the performance requirements of the cycle test in para. 3.2. Materials that are immersed in or exposed to water in the tank shall conform to requirements for longevity and resistance to corrosion, adsorption, and dimensional stability.

## 2.3 Hydraulic Performance

Separate dual flush devices installed in water closet tanks shall meet the hydraulic performance tests in para. 3.3 when tested on two of three different selected sample product water closets submitted for tests or provided by the testing laboratory. If failure of any of the tests occurs, the third water closet and a new dual flush assembly shall be tested. Any added failures of either assembly and/or performance failure of the water closet shall be cause for rejection of the device. Label restrictions on the installation of the device(s) to any single or group of manufacturers' water closets shall be specified on a distinctive color caution label on the package or instructions by the manufacturer, producer, or provider of the device(s) in the event of demonstrated failures for those models.

## 3 TESTING

### 3.1 Functional Operation Test

**3.1.1 Dual Flush Device Test Method.** The dual flush device shall be installed and adjusted in accordance with the manufacturer's installation instructions in the water closet tank(s) with volume of 3.5 gpf (13.2 Lpf) or greater selected for test (of the three water closet product samples provided). The dual flush handle or other actuation selector shall be independently operated to evaluate freedom of parts to move when the fixture is empty and normally filled, unless intrinsic design of the device requires constraints related to its functional performance.

**3.1.2 Performance Requirement.** Parts shall not bind or seize when operated. Settings according to the manufacturer's instructions should not cause leakage.

### 3.2 Cycle Testing

#### 3.2.1 Cycle Testing of the Flush Valve Assembly

**3.2.1.1 Test Method.** Install the flush valve in a tank that contains a steady water supply and controls the water level to a maximum height of  $7 \pm \frac{1}{4}$  in. (178  $\pm$  6 mm), or as marked on the fixture tank if less, above the flush valve seat. Place a volume of water in the tank to the same water level height above the flush valve seat. Allow to stand for  $60 \pm 3$  min and observe any leakage of water from the flush valve outlet. No leakage shall be observed. Conduct cycle testing by opening and closing the flush valve assembly for 75,000 continuous cycles. Tank walls may be dammed for accelerated tests

if the device and all associated hardware are immersed to represent actual installation conditions with the hydraulic head maintained.

The full displacement of operating requirements for each mode of the open-close test cycles shall be to complete the full extent of the motion of parts to their normal functional stop locations. The entire drain and refill modes need not be completed if the full displacement of the operating parts is achieved. The control mechanism shall be cycled in both modes of operation for the normal-flush and reduced-flush volume discharges with 5:1 actuations as the ratio for the lower to larger flush discharge; i.e., five consecutive reduced flushes and one normal flush.

Upon completion of the cycling period, remove any dams and water from the tank. Place a volume of water in the tank to the previous water level height above the flush valve seat. Allow to stand for  $60 \pm 3$  min and observe any leakage of water from the flush valve outlet.

**3.2.1.2 Performance Requirement.** Not more than 2% of the total measured volume of water in the tank shall leak from the flush valve outlet after the cycling is completed and the unit is allowed to stand for  $60 \pm 3$  min.

**3.2.1.3 Cycle Testing of the Flapper Valve.** The test method and performance requirement of the flush valve assembly shall be conducted for devices that include a flapper valve as part of dual flush system equipment and assembly for installations (see paras. 3.2.1.1 and 3.2.1.2).

#### 3.2.2 Cycle Testing of Flush Handle Assembly

**3.2.2.1 Test Method.** Suspend a  $1.5 \pm 0.1$  oz weight from the flush handle assembly, suitably arranged to load all handle, selector, or actuation levers. Flush the handle for 75,000 cycles. The length of the cycle shall be at the fullest extent of motion for the lower and normal flush procedure, and shall be sequenced at a 5:1 ratio for the lower to larger flush discharge operations. If two handles are utilized in the design, sequence the actuations for flushing action at the 5:1 ratio. The cycle shall be to the normal limit of motion of the handle and its attachments within the water closet tank for each of the operating modes for the total number of cycles for the test. The cycle test time and a pause for *rest* state need to be established for each device in order to avoid unusual dynamic responses not ordinarily experienced in actual usage.

Upon completion of the test cycle, inspect the mechanism for deformations, interference, and deterioration; ink with a contrasting dye and visually inspect for signs of cracking. If the handle(s), selector, and/or control was tested as per para. 3.2.1.1, the mechanism inspection shall be performed at the completion of that procedure.



**3.2.2.2 Performance Requirement.** Any signs of cracking, permanent distortion, elongation, breakage of any links and attachments, or dimensional changes due to wear, swelling, or absorption of water shall be cause for rejection to the extent function and/or performance is altered.

### 3.2.3 Cycle Testing of Complete Unit

**3.2.3.1 Test Method for Dual Flush Device.** A complete dual flush device shall be installed in a flush tank equipped with a fill valve that is adjusted to a level at a height as marked on the fixture tank, or to a minimum of  $7 \pm \frac{1}{4}$  in. ( $178 \pm 6$  mm) above the flush valve seat. Place a volume of water in the tank to the same water level height above the flush valve seat. Flush (operate) the assembly for 25,000 cycles with sequence cycles of reduced and full flushes, in the ratio of 5:1 for low to normal flush volume. The length of the flush cycle shall not be less than 90 sec or sufficient to drain and fill the tank. After 25,000 cycles, remove all the tank water. Refill the tank to the previous water level height above the flush valve seat. Allow to stand  $60 \pm 3$  min and determine if there is any leakage of water from the flush valve outlet. If the test has been accomplished in conducting this procedure (see paras. 3.2.1 or 3.2.2), then para. 3.2.3.1 need not be separately performed, but the performance requirement must be satisfied (see para. 3.2.3.2).

**3.2.3.2 Performance Requirement.** Not more than 0.5% of the total measured volume of water in the tank shall leak from the flush valve outlet after  $60 \pm 3$  min.

## 3.3 Hydraulic Performance

Water closets with new devices installed shall be tested in accordance with the procedures and requirements of ASME A112.19.2M and ASME A112.19.6, as described in the following sections. All tests in ASME A112.19.6 shall be performed with the dual flush devices and mechanisms installed in accordance with the manufacturer's instructions and as noted in para. 2.3.

**3.3.1 Dual Flush Mechanism, Short or Reduced Volume Flush — Washing of Flushing Surface (Rim Wash).** See para. 7.1.4.1, ink test, of ASME A112.19.6. When conducting the test for rim wash, add the following:

(a) set the dual flush mechanism for water volume at a minimum of 30% savings of water closet rated consumption,<sup>1</sup> in accordance with the manufacturer's instructions for achieving satisfactory performance;

(b) follow the test media, procedures, report, and performance requirements of ASME A112.19.6.

<sup>1</sup> If normal rated consumption is unknown, the water closet tank shall be filled to the waterline mark and flushed to collect and measure the discharged volume. The test shall be repeated three times and the average determined to be the rated normal consumption of the water closet.

**3.3.2 Removal of Waste Liquids (Water Change).** See para. 7.1.5.1, dye tests, of ASME A112.19.6.

(a) *Test Method.* When conducting the test for removal of waste liquids for water dilution ratio, add the following:

(1) set the dual flush mechanism for a minimum of 30% savings of water closet rated consumption, in accordance with the manufacturer's instructions for achieving satisfactory performance.

(2) tests shall be repeated three successive times only with the reduced volume flushes and with the dye solution added for each test, without other added refill of the bowl. After the third reduced flush, and without additional bowl refill and with the dye solution added, flush one conventional long duration discharge.

(3) follow the test method, procedure, report, and performance requirement of ASME A112.19.6.

(4) record the results of each test separately.

(b) *Performance Requirement.* A dilution ratio of at least 100:1 shall be obtained in each flush at the reduced water consumption of the dual flush operation, and the dilution ratio of at least 100:1 shall be obtained with the long conventional flush. Failure to perform at the established levels shall be cause for rejection.

### 3.3.3 Toilet Paper Test for Waste Removal

(a) *Test Method.*<sup>2</sup> Test media and procedure follow ASME A112.19.6, para. A2.3.1, with the following changed actions:

(1) a test load of 20 sheets of two-ply toilet paper, with each doubled sheet detached from each other, or 40 detached sheets of single-ply paper, shall be added to the bowl (not in balls). The sheets shall be randomly distributed over the water surface before flushing and without wiping flushing surface (leaving any residual sheets or parts thereon).

(2) flush the water closet with the reduced flush volume.

(3) record whether any test media remains in the well and observe the adequacy of siphonic action with removal of test load.

(4) tests shall be repeated three successive times with new paper loads, only with the reduced volume flushes with new load of toilet tissues; do not remove residuals of toilet paper that are not extracted. The three (total) lowered volume flushes are conducted without added refill of the bowl or removal of residual test media.

(5) without removal of residual toilet tissue and no additional bowl refill, add a new load of 40 two-ply individual sheets, or 80 single-ply sheets, of toilet paper scattered over the water surface, and flush one conventional long duration discharge.

<sup>2</sup> If interfold (pack-type) paper is used, the number of sheets is the same as the sheets of roll-type paper. The absorption time for the interfold paper is determined in the same manner as for the roll-type paper after first cutting the interfold sheets where folded, then placing the two sheets on the surface of the water.

(6) record the results of each test separately.

(b) *Performance Requirement.* All residual paper shall be removed from the well (not visible) in

(1) any two of the three reduced volume flushes and

(2) all residual and new paper load added in the following single conventional long flush

Failure to perform both (1) and (2) above shall be cause for rejection.

### 3.3.4 Water Consumption and Trap Seal Restoration

#### 3.3.4.1 Reduced Water Flush Volume

(a) *Test Method.* Test method follows para. 7.1.6.1, water consumption test, of ASME A112.19.6, with the following changed action: set the dual flush mechanism for 30% savings of water closet rated consumption, in accordance with the manufacturer's instructions for achieving satisfactory performance.

(b) *Performance Requirements.* Average water consumption (total flush volume), with the reduced volume flush derived with the dual flush mechanism (installed and set according to manufacturer's instructions) actuation for the lower water consumption over the range of test pressures specified, shall represent at least 30% reduction of the rated consumption of the water closet. The reduction in water consumption volume shall not be less than 30% at any test pressure, based upon average values from the three-run test sets.

#### 3.3.4.2 Trap Seal Restoration

(a) *Test Method.* Test method follows ASME A112.19.6, paras. 7.1.6.2 and 7.1.6.3, with the following changed action: set the dual flush mechanism for a minimum 30% savings of water closet rated consumption, in accordance with the manufacturer's instructions for achieving satisfactory performance.

Tests shall be repeated three successive times only with the reduced volume flushes, without added refill of the bowl. The trap seal refill shall be for full reseal to within  $\frac{1}{2}$  in. (13 mm) for each repeated test; if trap seal depth failure with the three consecutive reduced flushes occurs, perform seven additional tests and record data. The trap seal depth shall not be less than  $\frac{1}{2}$

in. (13 mm) of full trap seal in six out of the total of ten tests.

For water closets that normally have  $2\frac{1}{2}$  in. (64 mm) seal, full reseal shall be realized in the first three tests and, if not demonstrated, then seven additional reduced flushes shall be repeated, after the initial three, and a total of six low successive flushes with full refill shall be demonstrated. The trap seal depth shall not fall below  $2\frac{1}{2}$  in. (64 mm), to within  $\frac{1}{4}$  in. (6 mm), in any one of the tests. Without additional bowl refill, flush one conventional long duration full discharge and observe the siphonic action and measure trap seal. Record the results of each test separately.

(b) *Performance Requirements.* For each set of tests, at each of the pressures, the data for the average trap seal depth in the bowl for acceptable performance shall not be reduced by

(1) more than a total of  $\frac{1}{2}$  in. (13 mm), based on the sequence of three successive reduced flush operations; or from the additional seven tests, for a total of ten tests, more than an average from six tests of  $\frac{1}{4}$  in. (6 mm) below the required trap seal

(2) more than a total of  $\frac{1}{4}$  in. (6 mm) below the required trap seal with the long conventional flush and with preservation of siphonic action

For closets with normal  $2\frac{1}{2}$  in. (64 mm) trap seal, the first three tests shall demonstrate full reseal and, if not shown, six of the seven additional tests shall be full reseal and have no more than  $\frac{1}{4}$  in. (6 mm) loss in any one of those tests.

Trap seal replenishment may not be sufficient with controlled reduced volume discharges due to shorter refill times and other control strategies. Insufficient trap seal depth can reduce protection intended and may cause loss of siphonic action. Failure to meet the trap seal requirements shall be cause for rejection.

## 4 LABELING

The requirement for label information that shall be attached, or printed on packaging, is to include the statement "Tested in accordance with ASME A112.19.10-2003, which specifies that the reduced flush mode be set at 30% water savings for all laboratory test modes."



# NONMANDATORY APPENDIX A

## OPTIONAL TEST FOR DETERMINATION OF PERFORMANCE AT MAXIMUM WATER SAVINGS

### A1 MINIMUM WATER CONSUMPTION

(a) *Test Requirements.* Test requirements in ASME A112.19.10 are based upon demonstrated minimum of 30% water savings performance. A dual flush device with potential for greater water savings may be evaluated by those test methods. It shall be required that a constant setting to maintain the same water reduction in all tests, according to manufacturer's instructions, be applied for all tests that depend on water consumption. The procedures of para. 3.3 may be applied for test evaluations of devices to demonstrate satisfactory performance with dual flush equipment set for maximum water savings that may be claimed for an installation of such devices.

(b) *Performance Requirements.* The average water consumption shall be specified from the test results for the maximum water savings. Acceptability of performance will rely on satisfactory results from all parts of paras. 3.3.1 through 3.3.4. Water usage for each test procedure shall be measured and recorded for each pressure setting of the water supply delivery system after conducting the particular test procedure and without readjustment of the device. The water flush volumes, at each pressure, shall be within  $\pm 2.5\%$  and the mean within  $\pm 3\%$  of the minimum and maximum values for all pressures tested.

**Table A1 Suggested Format for Reporting  
Observations/Data of Cycle Testing of Flush Valve  
Assembly**

Paragraph	Test	Leakage [Note (1)]	
		Yes	No
3.2.1.1	After 60 $\pm$ 3 min (before cycle test)		
3.2.2.1	After 75,000 continuous cycles		

**NOTE:**

(1) As indicated by occurrence of water dripping from bottom (exit) of flush valve.

### A2 REPORTING FORMAT

Optional formats for reporting data from the laboratory testing are provided to assist in presentation of test results.

(a) Refer to Table A1 for reporting observations and/or data of cycle testing of flush valve assembly.

(b) Refer to Table A2 for reporting observations and/or data of cycle testing of flush handle assembly.

(c) Refer to para. 3.3.1 for reporting washing of flushing surface. Use Table A-3, Suggested Format for Reporting Results of Ink Test, from ASME A112.19.6.

(d) Refer to para. 3.3.2 for reporting removal of waste liquids. Use Table A-4, Suggested Format for Reporting Results of Dye Test on Water Closets or Urinals, from ASME A112.19.6.

(e) Refer to para. 3.3.3 and Table A3 for reporting paper test for waste removal.

(f) Refer to para. 3.3.4 for reporting water consumption and trap seal restoration. Use Table A-5, Suggested Format for Reporting Results of Flush Volume and Cycle Time Test on Water Closets, from ASME A112.19.6. Refer to para. 3.3.4.2 and Table A4 for reporting trap seal restoration.

**Table A2 Suggested Format for Reporting  
Observations/Data of Cycle Testing of Flush  
Handle Assembly**

Paragraph	Test	Damage Function/ Performance	
		Yes	No
3.2.2.1	After 75,000 continuous cycles		



**Table A3 Suggested Format for Reporting Results of Paper Test for Waste Removal**

Test Run No.	Condition [Note (1)]	All Paper Removed From Bowl in Initial Flush	
		Yes	No
1	Reduced flush volume		
2	Reduced flush volume		
3	Reduced flush volume		
4	Full flush volume		

## NOTE:

(1) No added refill to bowl or removal of test media *in all test runs*.

**Table A4 Suggested Format for Reporting Results of Trap Seal Restoration Test**

Test Run No.	Condition [Note (1)]	All Paper Removed From Bowl in Initial Flush [Notes (2), (3)]	
		Yes	No [Note (4)]
1	Reduced flush volume		
2	Reduced flush volume		
3	Reduced flush volume		
4	Reduced flush volume		
5	Reduced flush volume		
6	Reduced flush volume		
7	Reduced flush volume		
8	Reduced flush volume		
9	Reduced flush volume		
10	Reduced flush volume		

## NOTES:

- (1) No added refill to bowl or removal of test media *in all test runs*.  
 (2) As indicated by the occurrence of afterflow.  
 (3) Conduct tests at 20, 50, and 80 psi (138, 345, and 552 kPa) static pressures.  
 (4) Distance measured to full reseal level.