ASME A112.1.2-2012

(Revision of ASME A112.1.2-2004)

Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors)

AN AMERICAN NATIONAL STANDARD

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The American Society of Mechanical Engineers
Three Park Avenue • New York, NY • 10016 USA

Date of Issuance: April 9, 2012

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

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FOREWORD

The Sectional Committee on Minimum Requirements for Plumbing and Standardization of Plumbing Equipment, A40, realizing the need for regulations and devices to protect the purity of water supplies in buildings, organized a technical subcommittee on air gaps and backflow preventers in 1938. This subgroup completed a tentative draft of a proposed standard for air gaps for a meeting of Subcommittee 12 on January 20, 1939.

The draft proposal was considered and revised. Copies of this revised report were distributed to interested firms and individuals in industry for further criticism and comment. At the October meeting of the subcommittee, the comments received were carefully considered. The April 1940 draft, which followed shortly, was distributed to the members of Sectional Committee A40 for discussion. Certain changes were recommended, as well as the addition of two sections covering water inlets to tanks having overflows and drinking fountain bubblers. These were incorporated in the revised draft dated May 1940. Copies of this draft were distributed to the members of the sectional committee and to a group of more than 100 health supervisory officials, plumbing inspectors, state plumbing associations, and others. The received recommendations prompted another revision, which was reviewed by the members of Subcommittee 12. The changes and refinements made were incorporated, and a final revision dated July 1941 was approved by letter ballot vote of the sectional committee.

Following approval by the sectional committee and the sponsor organizations, the draft was transmitted to the American Standards Association (now known as the American National Standards Institute) for approval and designation as an American Standard. This designation was given in January 1942.

In 1958, the functions of Sectional Committee A40 pertaining to Standards for Plumbing Equipment were transferred to Standards Committee A112, and this Standard on Air Gaps in Plumbing Systems was assigned to Panel I. Panel I recommended the Standard's reaffirmation on April 18, 1972. Standards Committee A112 concurred in this recommendation on June 28, 1972. The American National Standards Institute approved this reaffirmation on January 23, 1973 and designated it A112.1.2-1973. The document was reaffirmed in 1989, revised in 1990, and revised again in 2004.

This Standard is based on the application of certain physical principles to the design of plumbing fixtures and other water-connected devices and their installation in plumbing systems. It has been prepared to avoid complicated measurements and tests, to determine proper air gaps by simple measurements to be made in the field, to provide an adequate margin of safety over laboratory tests, and to simplify inspections and the preparation of definite regulations. It also was prepared to prevent all types of backflow conditions where or when the insertion of a suitable air gap is appropriate.

This revision eliminates Nonmandatory Appendix A, which did not offer equivalent backflow protection to the requirements of this Standard.

It is recognized that, in some cases, the air gap is not practical and other types of backflow preventers would give adequate protection.

This Standard was developed with the intent that due consideration be given to the adoption of these provisions by model, state, and local codes.

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

This Standard was approved as an American National Standard on March 5, 2012.

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Standardization of Plumbing Materials and Equipment

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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
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the 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.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

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

The request for 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 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.

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. The A112 home page, http://go.asme.org/A112committee, contains information on future meeting dates and locations.

AIR GAPS IN PLUMBING SYSTEMS (FOR PLUMBING FIXTURES AND WATER-CONNECTED RECEPTORS)

1 GENERAL

1.1 Scope

This Standard identifies methods of providing protection against backsiphonage through means of an air gap and establishes physical requirements and methods of testing air gaps for plumbing fixtures and water receptors.

1.2 Units of Measurement

The values stated in either SI (Metric) or inch/pound units are to be regarded as the standard. 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 nonconformance with this Standard. All references to gallons are to U.S. gallons.

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.

ASSE/ANSI 1002, Water-Closet Flush Tank Ball Cocks[1]

Publisher: American Society of Sanitary Engineering (ASSE), 901 Canterbury Road, Westlake, OH 44145 (www.asse-plumbing.org)

CSA B125.3, Plumbing Fittings

Publisher: Canadian Standards Association (CSA), 5060 Spectrum Way, Mississauga, Ontario L4W 5N6, Canada (www.csa.ca)

1.4 Definitions

air gap: a vertical distance through the atmosphere between the lowest potable water outlet and the highest level of the source of fluid contamination.

air gap, critical: the air gap that will prevent backsiphonage under laboratory conditions, with still water, wide-open control valve, and a vacuum of at least 635 mm Hg (25 in. Hg).

air gap, minimum required: an air gap greater than the critical air gap by a factor of safety to cover service conditions. The air gap required to prevent backsiphonage through a water supply opening (faucet or valve), under the action of atmospheric pressure and a vacuum in the water supply system, depends principally on

(a) the size of the effective opening

(b) the distance between the end of the supply fitting outlet (spout) pipe and a nearby wall

The minimum required air gap shall be measured vertically from the lowest point of the faucet, spout, or supply pipe to the flood-level rim of the fixture or receptor (see Figs. 1 and 2).

backflow: the flow of water or other liquids into the distributing pipes of a potable supply of water from any source or sources other than the intended source. Backsiphonage and backpressure are types of backflow.

backflow connection or condition: any arrangement whereby backflow can occur.

backflow prevention device: a device or assembly (combination of devices) designed to prevent backflow.

critical level: the level at which backsiphonage will not occur, including any required factor of safety.

critical level mark: the manufacturer's designated critical level.

effective opening: the smallest cross-sectional area in a faucet, device, or a supply pipe through which water flows to an outlet. If two or more lines supply one outlet, the effective opening shall be the sum of the cross-sectional areas of the individual lines or the area of the outlet, whichever is smaller.

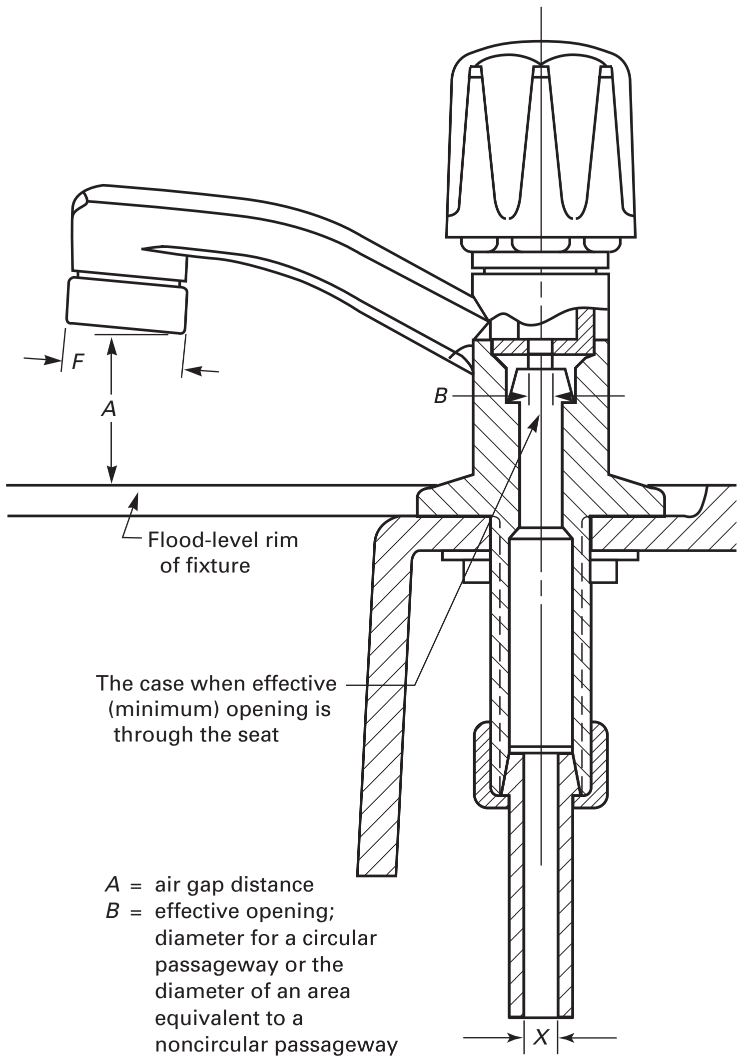
NOTE: To illustrate the practical use of the term "effective opening," refer to Fig. 1. With ordinary plumbing supply fittings, the minimum cross-sectional area usually occurs at the seat of the control valve, *B*; but, in other cases, it may be at the point of discharge (spout) or at the inlet to the control valve, *X*.

elevation: the air gap–related term applied to drinking fountain nozzles.

flood-level rim: the top edge of the receptor from which water will flow out of the receptor (an overflow opening is not considered a flood-level rim).

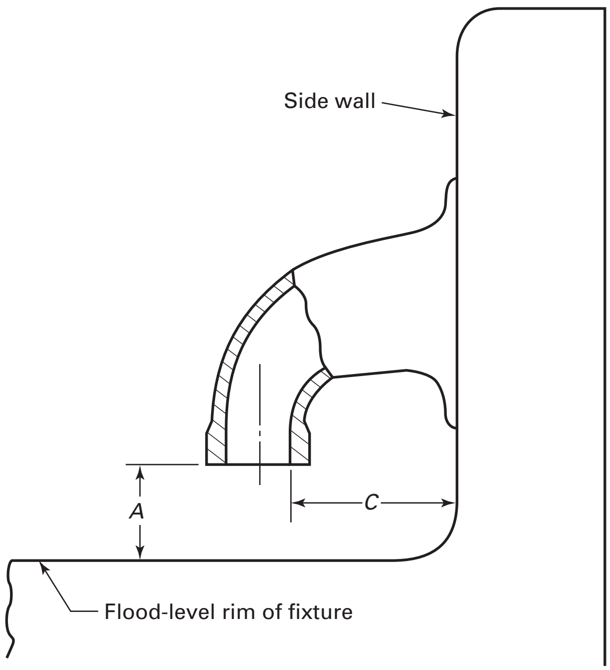
[1] May also be obtained from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.

Fig. 1 Example of Air Gap and Effective Opening



A = air gap distance
B = effective opening; diameter for a circular passageway or the diameter of an area equivalent to a noncircular passageway
F = diameter of water supply discharge
X = inside diameter of the supply pipe, control valve inlet

Fig. 2 Example of Near-Wall Influence on Air Gap



A = air gap distance
C = ≥3× the effective opening

NOTE: The definition of "flood-level rim" is based on a fixture or receptor with reasonably level edges. It is recognized that certain fixtures or receptors may be provided with uneven edges. In such cases, the equivalent of flood-level rim shall be considered as the maximum water elevation possible with full flow of water from all water-supplied pipes discharging into the fixture or receptor. Obviously, in such cases, the flood-level rim or its equivalent is not capable of simple measurement in the field.

free area: the area created between a near wall and the faucet or fitting when the distance between the wall and the outlet of the faucet or device is three times the diameter of the effective opening for a single wall or a distance four times the diameter of the effective opening for two intersecting walls.

2 REQUIREMENTS

2.1 Minimum Required Air Gap for General Use

The following requirements of minimum required air gaps shall apply to plumbing fixtures in general use. It is recognized that the actual water level in a receptor may rise higher than the flood-level rim and a factor of safety has been applied to compensate for this higher level.

(a) The minimum required air gap shall be twice the diameter of the effective opening, but in no case less than the values specified in Table 1 or in conformance with the performance requirements of paras. 2.4.1 and 2.4.2.

(b) These minimum requirements may not apply to certain unusual conditions. When a receptor receives water from two or more outlets of different sizes, air gaps for all water supply openings shall be at least equal to that required for the largest opening.

2.2 Water Closet Tanks

Requirements for backsiphonage protection in gravity water closet tanks shall be in accordance with ASSE/ANSI 1002 or CSA B125.3.

2.3 Minimum Elevation of Drinking Fountain Nozzles[2]

Drinking fountain nozzles, including those that may at times extend through a water surface and with an orifice diameter not greater than an 11-mm (0.440-in.) or 97-mm^2 (0.150-in.^{2}) area, shall be placed so that the lower edge of the nozzle orifice is at an elevation not less than 19 mm (0.75 in.) above the flood-level rim of the fixture or receptor.

The 19-mm (0.75-in.) elevation shall also apply to nozzles with more than one orifice, providing that the sum of the areas of all orifices shall not exceed the area of a circle 11 mm (0.440 in.) in diameter.

Should the cross-sectional area of a single-nozzle orifice or the sum of the cross sections of the orifices, in case there is more than one, be greater than that of a circle 11 mm (0.440 in.) in diameter, the elevation shall not be less than *H* in the following formula:

$$H = \frac{d}{0.440} \times 0.75 \text{ in.}$$

$$H = \frac{d}{11} \times 19 \text{ mm}$$

where

d = the diameter of a circle equal in cross-sectional area to that of the nozzle orifice or orifices

2.4 Determination of Minimum Air Gaps for Plumbing Fixture Supply Fittings Not Meeting the Minimum Air Gap Requirements of Table 1

2.4.1 Determination of Critical Air Gap. The following is the procedure for the determination of minimum air gaps for plumbing systems:

(a) Install the faucet or device, with all checking members removed or held fully open, in its normally installed position in a container [approximately 380 mm (15 in.) × 250 mm (10 in.) × 150 mm (6 in.) deep]. The outlet of the faucet or device shall have at least a free area of four times its effective opening between the container and the outlet. The mounting surface of the faucet or

[2] The term "elevation" is used instead of air gap for nozzles because some nozzles may be assembled without an air gap, as defined in this Standard.

Table 1 Minimum Air Gaps for Generally Used Plumbing Fixtures

Fixtures	Minimum Air Gaps		
	When Not Affected by Near Wall [Note (1)]	When Affected by Near Wall [Note (2)]	When Affected by Two Adjacent Walls
Lavatories with effective openings not greater than 12 mm (0.5 in.) in diameter	25 mm (1.0 in.)	38 mm (1.5 in.)	50 mm (2.0 in.)
Sinks, laundry trays, and gooseneck bath faucets with effective openings not greater than 19 mm (0.75 in.) in diameter	38 mm (1.5 in.)	57 mm (2.25 in.)	76 mm (3.0 in.)
Over-rim bath fillers with effective openings not greater than 25 mm (1.0 in.) in diameter	50 mm (2.0 in.)	76 mm (3.0 in.)	102 mm (4.0 in.)
Effective openings greater than 25 mm (1.0 in.)	2× effective opening	3× effective opening	4× effective opening

NOTES:
(1) Side walls, ribs, or similar obstructions do not affect the air gaps when spaced from the inside edge of the spout opening a distance greater than three times the diameter of the effective opening for a single wall or a distance greater than four times the diameter of the effective opening for two intersecting walls (see Figs. 2 and 3).
(2) Vertical walls, ribs, or similar obstructions extending from the water surface to or above the horizontal plane of the spout opening require greater air gaps when spaced closer to the nearest inside edge of the spout opening than specified in Note (1). The effect of three or more such vertical walls or ribs has not been determined. In such cases, the air gap shall be measured from the top of the walls.

device shall be level with the water surface in the container.

(b) Connect the inlet(s) of the faucet or device to a vacuum source. The vacuum shall be measured at the inlet of the faucet or device.

(c) A means to change the water level in the container relative to the outlet of the faucet or device shall be provided.

(d) Start the test with the water level at the mounting surface of the faucet or device.

(e) With the faucet or device fully open from its inlet(s) to point of discharge to atmosphere, apply a vacuum of 635 mm Hg (25 in. Hg) to the inlet(s). Backsiphonage at this time is cause for rejection.

(f) The water level shall slowly be brought closer to the discharge outlet of the faucet or device until the level at which backsiphonage occurs. At this point, record the water level. The distance between the water level and the lowest point on the discharge outlet of the faucet or device shall be measured and recorded.

(g) Return the faucet or device to atmospheric conditions.

(h) Starting with the water level higher than where backsiphonage occurred, apply a vacuum to the inlet(s) of 635 mm Hg (25 in. Hg). Slowly lower the water level until the backsiphonage stops. Maintain the vacuum for another 1 min to be sure no more water is being drawn into the discharge outlet of the faucet or device. At this point, record the water level. The distance from the water level and the lowest point on the discharge outlet of the faucet or device shall be measured and recorded.

(i) The larger of the two distances measured and recorded shall be considered the critical air gap of the faucet or fitting.

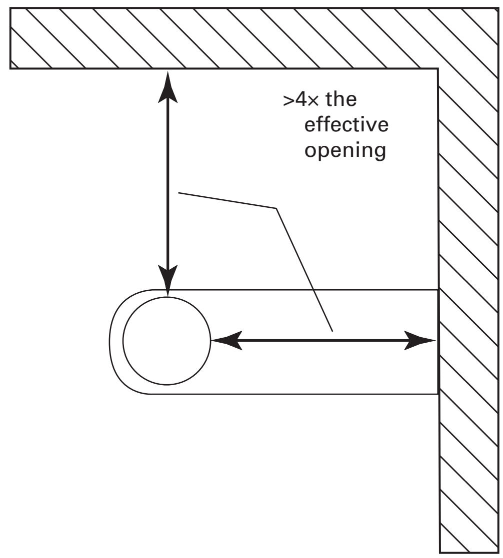
(j) Repeat this test for another two sequences to confirm the measured and recorded critical air gap.

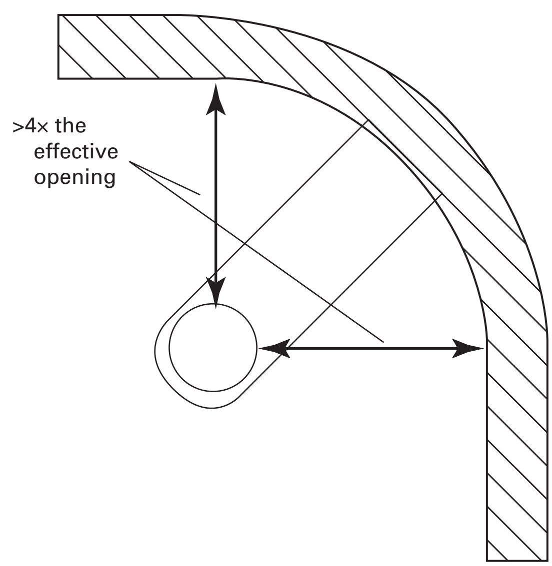
(k) For faucets and devices with a critical level mark, confirm that the mark is at a level that is at or above the highest water level recorded in determining the critical air gap.

NOTE: Faucets or devices that can be installed and have a near-wall effect [see Table 1, Notes (1) and (2)] shall be tested with the discharge outlet of the faucet or device against one wall of the test container.

2.4.2 Backsiphonage. With the water level at the critical level mark on the faucet or device or at the mandatory levels of Table 1 when the faucet or device has no mark, apply a vacuum of 635 mm Hg (25 in. Hg) to the inlet(s) of the faucet or device. Any indication of water at the inlet(s) shall be cause for rejection.

Fig. 3 Example of Near-Wall Influences on Air Gap: Top View





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