



UL 668

STANDARD FOR SAFETY

Hose Valves for Fire-Protection Service

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UL Standard for Safety for Hose Valves for Fire-Protection Service, UL 668

Tenth Edition, Dated April 28, 2004

Summary of Topics

This revision to ANSI/UL 668 was issued to incorporate the following changes:

To allow for grooved inlets and alternative thread types where the valve is used in areas specifying different threading

The revised requirements are substantially in accordance with Proposal(s) on this subject dated May 27, 2016.

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INTRODUCTION

1 Scope

1.1 These requirements cover angle-pattern and straightway-pattern hose valves intended for use on standpipes, fire pumps, and hydrants supplying water for fire protection service.

1.2 Requirements for the installation of hose valves include the Standards of the National Fire Protection Association for the Installation of Sprinkler Systems, NFPA 13; for Standpipe, Private Hydrants, and Hose Systems, NFPA 14; for Installation of Stationary Fire Pumps for Fire Protection, NFPA 20; and for Installation of Private Fire Service Mains and Their Appurtenances, NFPA 24.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.2 A component is not required to comply with a specific requirement that

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

CONSTRUCTION

5 Sizes

5.1 Hose valves covered by these requirements include the following patterns and opening sizes as designated in nominal inches (see Table 5.1):

- a) Angle (90-Degree) Pattern – For use on standpipes having inlet and outlet openings of the same size or with the inlet larger than the outlet. Openings are to be of the 1, 1-1/2, 2-1/2, or 3 inch nominal size;
- b) Angle (90- and 120-Degree) Pattern – For use on wet-pipe sprinkler equipment having 1 inch nominal inlets and 1-1/2 inch nominal outlets;
- c) Straightway Pattern – For use on fire pumps and hydrants having inlet and outlet openings of the same nominal 2-1/2 inch size; and
- d) Straightway Pattern – For use on standpipes having inlet and outlet openings of the same size or with the inlet larger than the outlet. Openings are to be of the 1, 1-1/2, 2-1/2, or 3 inch nominal size.

Table 5.1
Nominal pipe size dimensions

Nominal size	Outside diameter	
	Inches	(mm)
1	1.315	(33.40)
1-1/2	1.900	(48.26)
2-1/2	2.875	(73.03)
3	3.500	(88.90)

6 Working Pressure

6.1 A hose valve shall be constructed for a minimum working pressure of 175 psi (1.21 MPa).

7 Materials

7.1 A hose valve intended for use on standpipes and fire pumps shall be made entirely of brass or bronze, or other material having equivalent corrosion resistant properties, except for the handwheel (see 7.3) and for the valve seal (see 17.6) of an angle pattern valve.

7.2 A straightway pattern hose valve intended for use on hydrants, and for assembly thereto by bolting the valve to the outside of the hydrant barrel at the hose outlets, shall be permitted to have a cast iron body and a bonnet intended to be bolted together. The remaining valve parts shall be made of brass, bronze, or other material having equivalent corrosion resistant properties, except for the handwheel.

7.3 A handwheel shall be made of material equivalent in strength to malleable iron.

8 Castings

8.1 A casting shall be smooth, free from scale, lumps, cracks, blisters, sand holes, and defects that impairs its intended use. A casting shall not be plugged or filled; however, impregnation to remove porosity is permissible.

9 Direction to Open

9.1 A hose valve shall open by turning the handwheel to the left (counterclockwise) as viewed from the top, except when specifically ordered otherwise to fit existing equipment.

10 Metallic Seat Rings

10.1 The seat ring shall be made of brass, bronze, or other equivalent corrosion resistant material.

11 Inlets and Attachment Means

11.1 A hose valve intended for use on a fire pump and a standpipe shall be fitted at the inlet end with one of the following:

- a) Female pipe threads complying with ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch);
- b) Grooved ends complying with the ANSI/AWWA C606, Standard for Grooved and Shouldered Joints;
- c) Female pipe threads complying with a national standard that applies where the valve is intended to be installed;
- d) Female screw threads complying with the Standard for Fire Hose Connections, NFPA 1963; or
- e) Female screw threads to fit existing equipment complying with the specification where the valve is intended to be installed.

11.1.1 When the inlet end is fitted with female screw threads, the threads are permitted to be integral with the valve body or located within a coupling that is able to swivel with respect to the body.

11.2 A hydrant hose valve shall be constructed to attach to hydrant barrels by use of two 3/4 inch (19.1 mm) tap bolts, spaced horizontally 5-5/8 inches (143 mm) on centers or by use of a flange complying with a national standard that applies where the valve is to be installed.

12 Outlet Nipples and Threads

12.1 A hose valve outlet shall be threaded in accordance with Standard for Fire Hose Connections, NFPA 1963, unless otherwise specifically ordered to fit existing equipment or to comply with a specification where the valve is intended to be installed. The outlet end shall be provided with at least four full threads.

12.2 The outer end of external (male) and internal (female) threads other than taper pipe threads ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch) shall be terminated by the "Higbee Cut" to facilitate coupling and to avoid crossing and mutilation of thread.

12.3 A hose nipple shall be made of brass, bronze, or other equivalent corrosion resistant material.

13 Hose Outlet Caps

13.1 A hose outlet cap shall be provided for a straightway pattern hose valve intended for use on hydrants.

13.2 A hose outlet cap shall be made of cast iron or equivalent corrosion resistant material.

13.3 A cap gasket complying with the dimensional specifications in the Standard for Fire Hose Connections, NFPA 1963, shall be provided with each hose outlet cap.

13.4 The cap nut on a hydrant hose valve shall have dimensions corresponding to those of the operating nuts on hydrants on which the hose valve is to be installed.

13.5 A gasket recess complying with the dimensional specifications in the Standard for Fire Hose Connections, NFPA 1963, shall be provided in the cap at the inner end of the threads.

13.6 A hose outlet cap shall be constructed to accommodate a swivel attachment for the chain used to secure the cap to a hydrant or hose valve on which it is used.

14 Valve Stems

14.1 Stem threads shall be Acme, modified Acme, half V, or square type.

14.2 The assembly of the stem and its attached parts shall be such that the parts cannot separate in use. See Hydraulic Operation Test, Section 22, and Mechanical Strength Test, Section 25.

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15 Stuffing Boxes and Seals

15.1 A valve shall include a stuffing box, or other means for sealing, so that there shall be no leakage at the valve stem. The bearing surface provided in a stuffing box gland or seal retainer for the stem shall be made of material having corrosion resistance equivalent to brass or bronze.

15.2 A stuffing box shall include a gland or follower with a packing nut. There shall be no threads within the stuffing box.

15.3 The stuffing box shall be of a width to contain packing so that there is no leakage around the stem and shall have the space required for entrance of packing removal tools.

15.4 The stuffing box bottom and the end of the gland shall be beveled.

15.5 A valve shall be constructed to permit repacking of the stuffing box or replacement of at least one seal ring when the valve is fully open and under rated working pressure. A stem seal using formed rubber rings shall include at least two rings and stem seals using "O" rings shall include at least one ring.

15.6 In a cast iron valve, the entire stuffing box shall be made of brass or bronze, and the stem opening through the bonnet shall be brass or bronze bushed.

16 Handwheels

16.1 The outside diameter of a handwheel shall be not less than that specified in Table 16.1 for any given valve inlet size and pressure.

Table 16.1
Minimum handwheel diameter

Nominal pipe size of valve inlet, inches	Diameter of handwheel for working pressures			
	175 psi (1.21 MPa)		300 psi (2.07 MPa)	
	Inches	(mm)	Inches	(mm)
1	2-5/8	(66.8)	3	(76.2)
1-1/4	3	(76.2)	3-1/4	(82.6)
1-1/2	3-1/4	(82.6)	3-1/2	(88.9)
2	3-1/2	(88.9)	4-3/8	(111.1)
2-1/2	4-3/8	(111.1)	5	(127.0)
3	6	(152.4)	7	(177.8)

16.2 A handwheel rim shall have a rounded surface and shall be free from sharp projections.

16.3 The handwheel shall be marked as specified in 27.3.

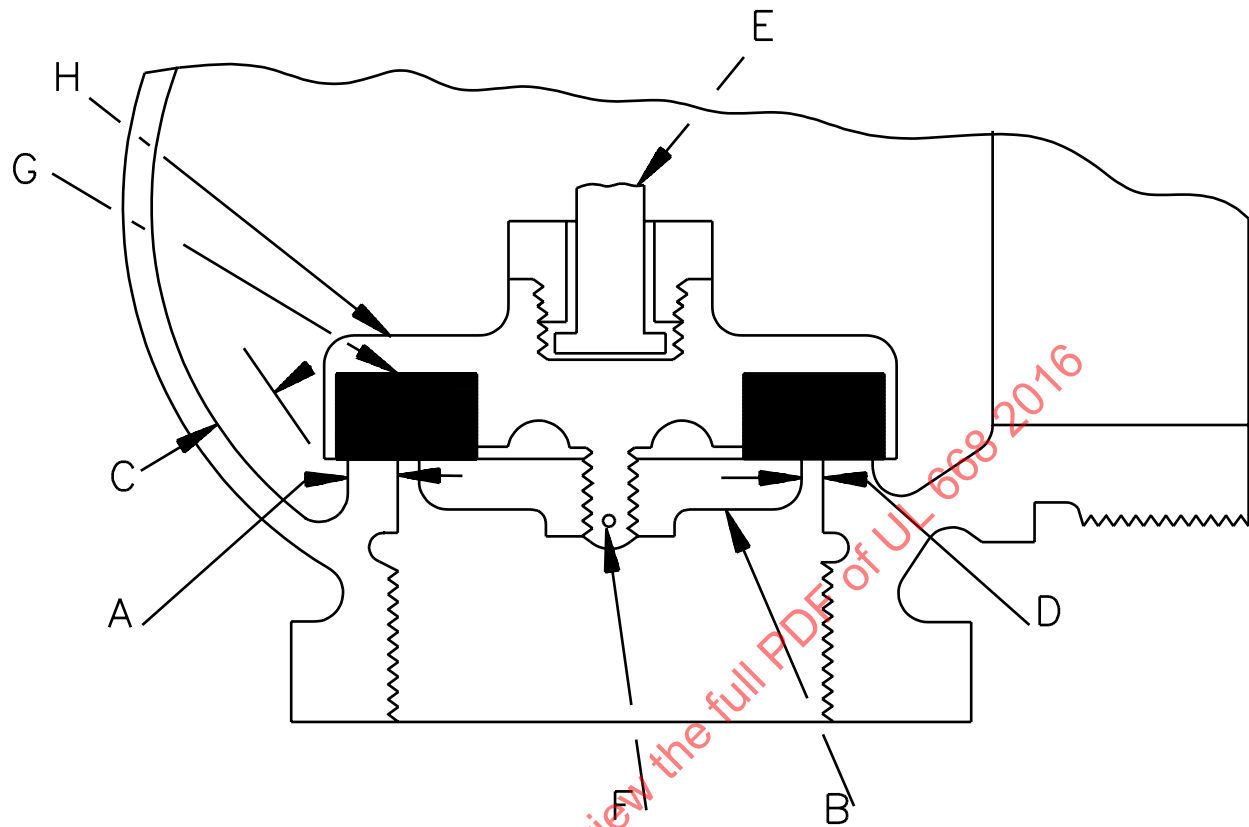
17 Angle Pattern Valves

17.1 The seat ring of an angle pattern valve, when finished, shall not extend into the valve interior beyond the near side of the outlet opening.

17.2 The seat ring width of an angle pattern valve (Figure 17.1(A)) shall be as specified in Table 17.1.

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Figure 17.1
Angle pattern valve seat details



S2545A

Angle Pattern Valve Seat Details

A – Seat width.

B – Nut or clamping ring for Resilient Seat Seal.

C – Clearance between the edge of the Resilient Seat Seal holder and the inside of the body.

D – Clearance between inside of the seat and the nut or clamping ring for the Resilient Seat Seal.

E – Valve stem.

F – Locking pin for Retainer Nut or Clamping Ring.

G – Resilient Seat Seal.

H – Holder for Resilient Seat Seal.

Table 17.1
Minimum seat-ring width

Nominal pipe size of valve inlet inches	Width of seat	
	Inch	(mm)
1	1/8	(3.2)
1-1/4	1/8	(3.2)
1-1/2	3/16	(4.8)
2	7/32	(5.6)
2-1/2	1/4	(6.4)
3	3/8	(9.5)

17.3 The lift of a valve, that is, the distance between the seat ring and the valve seat seal with the valve fully open, shall be not less than as specified in Table 17.2.

Table 17.2
Minimum valve lift

Nominal pipe size of valve inlet inches	Lift of valve	
	Inch	(mm)
1	3/4	(19.1)
1-1/4	7/8	(22.2)
1-1/2	1	(25.4)
2	1-3/8	(34.9)
2-1/2	1-3/4	(44.5)
3	2	(50.8)

17.4 The seat seal holder shall be free to turn on its stem so that the seal is capable of seating without any rotary or scraping action.

17.5 The means for securing a locknut used to secure a seal holder to its stem shall give securement equivalent to that provided by the use of a pin as shown in Figure 17.1.

17.6 A resilient seat seal shall be made of a nonmetallic material firmly secured and assembled so that it is easily replaced. The seal holder shall enclose the outer edge of the seal for its entire thickness, as shown in Figure 17.1. The valve seal, seal holder, and seal clamping ring shall have dimensions so that the seal face overhangs the body seat ring both inside and outside.

17.7 The clearance specified in Figure 17.1(C), between the edge of the seal holder and the inside of the body, shall be not less than that specified in Table 17.3.

Table 17.3
Minimum clearance between seal holder and inside of body

Nominal pipe size of valve inlet, inches	Clearance between disc holder and body	
	Inch	(mm)
1	1/8	(3.2)
1-1/4	3/16	(4.8)
1-1/2	3/16	(4.8)
2	1/4	(6.4)
2-1/2	1/4	(6.4)
3	5/16	(7.9)

17.8 The clearance specified in Figure 17.1(D), between the inside of the seat and the seal nut or clamping ring, shall be not less than 1/16 inch (1.6 mm).

17.9 The seal retainer nut or clamping ring shall be pinned in place or restrained from movement by a locking feature.

18 Straightway Pattern Valves

18.1 A straightway pattern valve consists of either the nonrising-stem or the rising-stem construction.

18.2 A straightway pattern valve, when fully open, shall have a straight through unobstructed waterway with a circular cross section, whose area at any point shall be not less than the cross-sectional area of the waterway of the size of pipe with which the valve is intended to be used.

18.3 The gate of straightway pattern valve shall be of the solid-wedge, split-wedge, or parallel-seat type.

18.4 A straightway pattern valve shall have guides for the gate cast integral with the body.

18.5 A valve that seats tightly with the gate in one position only shall have integrally cast guides of unequal widths, or other equivalent means, to provide for intended assembly.

18.6 A valve for use on hydrants shall be permitted to have a gate with a single seating face and with guides cast in the body.

18.7 A valve body shall have a boss formed on the underside at the outlet end that is capable of being drilled to receive a drip cock.

PERFORMANCE

19 General

19.1 Representative samples of each size hose valve shall be subjected to the tests specified in Sections 19 – 25. Test bars of metal used in castings and additional samples of parts constructed of nonmetallic materials, such as rubber seal rings, are to be required for physical tests.

20 10-Day Moist Ammonia Air Stress Cracking Test

20.1 After being subjected to the conditions described in 20.2 – 20.4, a brass part containing more than 15 percent zinc when examined using 25X magnification shall:

- a) Show no evidence of cracking; or
- b) Comply with the Hydraulic Operation Test, in Section 22, and the Leakage Test, Section 23 if there is evidence of cracking.

Exception: Cracking complies with (a) when the cracking does not impact the ability of the product to comply with the requirements of this Standard.

20.2 Each test sample is to be subjected to the physical stresses normally imposed on or within a part as the result of assembly with other components. Such stresses are to be applied to the sample prior to and maintained during the test. Samples with threads, intended to be used for installing the product in the field, are to have the threads engaged and tightened to the torque specified in Table 20.1. Teflon tape or pipe compound are not to be used on the threads.

Table 20.1
Torque requirements for pipe connections

Nominal pipe size, inches ^a	Torque	
	Pound-inches	(Newton-meters)
1	1200	(135.6)
1-1/4	1450	(163.8)
1-1/2	1550	(175.1)
2	1650	(186.4)
2-1/2	1750	(197.7)
3	1800	(203.4)

^a Dimensions as specified in ANSI/ASME B1.20.1.

20.3 Three samples are to be degreased and then continuously exposed in a set position for ten days to a moist ammonia-air mixture maintained in a glass chamber approximately 12 by 12 by 12 inches (305 by 305 by 305 mm) having a glass cover.

20.4 Approximately 600 ml of aqueous ammonia having a specific gravity of 0.94 is to be maintained at the bottom of the glass chamber below the samples. The samples are to be positioned 1-1/2 in. (38.1 mm) above the aqueous ammonia solution and supported by an inert tray. The moist ammonia-air mixture in the chamber is to be maintained at atmospheric pressure and at a temperature of 93°F (34°C).

21 Elastomeric Parts Test

21.1 An elastomeric part used to provide a seal shall have the following properties when tested as specified in the Standard for Gaskets and Seals, UL 157:

- a) For silicone rubber (having poly-organo-siloxane as its constituent characteristic), a minimum tensile strength of 500 psi (3.4 MPa) and a minimum ultimate elongation of 100 percent;
- b) For natural rubber and synthetic rubber other than silicone rubber, a minimum tensile strength of 1500 psi (10.3 MPa) and minimum ultimate elongation of 150 percent; or a minimum tensile strength of 2200 psi (15.2 MPa) and a minimum ultimate elongation of 100 percent; and
- c) Those properties relating to maximum tensile set; minimum tensile strength and elongation after oven aging; and hardness after oven aging, all as specified in the Standard for Gaskets and Seals, UL 157. The maximum service temperature used to determine the oven time and temperature for oven aging is identified as being 60°C.

21.2 The Standard for Gaskets and Seals, UL 157, provides for the testing of either finished elastomeric parts or sheet or slab material. Sheet or slab material is to be tested when the elastomeric parts are O-rings having diameters of less than 1 inch (25.4 mm). The material tested is to be the same as that used in the product, regardless of whether finished elastomeric parts or sheet or slab material is tested.

22 Hydraulic Operation Test

22.1 A valve shall withstand, without malfunction of any part, a flow at pressures up to its rated working pressure.

22.2 The sample for this test is to be connected to a piezometer to which a pressure gauge has been attached, and to a water supply providing the rated working pressure at full flow. The downstream side of the hose valve is to be fitted with adapters, a piping arrangement constructed to represent either 50 feet (15.2 m) of 1-1/2 inch (38.1 mm) fire hose and a 1/2 inch (12.7 mm) nozzle for a nominal 1 or 1-1/2 inch valve, or 50 feet of 2-1/2 inch (63.5 mm) fire hose and a 1 inch (25.4 mm) nozzle for a nominal 2-1/2 inch valve.

22.3 The hose valve is to be closed and the inlet pressure at the piezometer is to be increased to 50 psi (345 kPa). The hose valve then is to be opened to the fully opened position while the flowing pressure is maintained at 50 psi. The valve then is to be closed, the pressure increased to 100 psi (689 kPa) and the valve opened while the inlet pressure is held constant. This process is to be repeated in 50 psi increments until the rated working pressure is attained. The sample is then to be subjected to the Leakage Test, Section 23 and Strength of Body Test, Section 24.

22.4 During the test specified in 22.3 measurements are to be made of the operating torque required to close the valve to the point only where flow is stopped, to fully close it, to open it to the point where leakage begins, and to fully open it. These values shall not exceed the maximum operating torque values specified in Table 22.1.

Table 22.1
Maximum operating torque

Diameter of handwheel		Maximum operating torque	
Inches	(mm)	Pound-inches	(Newton · meters)
2-5/8	(66.8)	42	(4.75)
3	(76.2)	54	(6.10)
3-1/4	(82.6)	66	(7.46)
3-1/2	(88.9)	72	(8.14)
4	(101.6)	120	(13.56)
4-3/8	(111.1)	162	(18.31)
5	(127.0)	222	(25.09)
6	(152.4)	324	(36.61)
7	(177.8)	420	(47.46)

23 Leakage Tests

23.1 General

23.1.1 A valve shall withstand, without leakage at joints, at the valve seat, or at the stuffing box or seal provided for the stem, an internal hydrostatic pressure of twice the rated working pressure of the valve applied for 1 minute except as specified in 23.2.2.

23.2 Seat leakage

23.2.1 The inlet of each valve is to be connected to a water supply. The seating faces of the valve are to be wiped clean, after which the valve is to be closed, pressurized to rated working pressure, examined for leakage, and then pressurized to twice rated working pressure, as specified in 23.1.1.

23.2.2 Straightway pattern valves having metal-to-metal seats and provisions for attachment to hydrants only, shall show no leakage through body or bonnet and only a slight weeping past the seats. Slight weeping is defined as leakage not exceeding 1 fluid ounce (0.03 L) per hour per inch (25.4 mm) of nominal valve size.

23.3 Body leakage

23.3.1 After completion of the valve seat leakage test specified in 23.2.1 and 23.2.2, the outlet of the valve is to be closed by a cap or the equivalent, and the valve is to be partially opened to allow pressurization of the entire valve body to rated working pressure, including the bonnet joint and up to the stuffing box or sealing device, examined for leakage, and then pressurized to twice rated working pressure as specified in 23.1.1.

23.3.2 For the test specified in 23.3.1, the valve shall not be fully opened because the purpose of the test is then partially defeated, since the construction shall provide tight closure along the stem so that the stuffing box is capable of being repacked, or the stem sealing device replaced, with the pressure applied while the valve is fully open.

23.4 Repacking test

23.4.1 After completion of the tests specified in 23.1.1 – 23.3.2, the valve is to be fully opened, and the packing in the stuffing box or at least one ring of any sealing device is to be removed.

23.4.2 With the valve in the fully open position and under rated working pressure for 1 minute, leakage through the unpacked stuffing box or altered stem sealing device shall not interfere with the replacement of the packing or sealing device.

23.5 Body and stem leakage

23.5.1 After the tests at rated working pressure specified in 23.4.1 and 23.4.2, the stuffing box is to be repacked or any stem sealing device is to be replaced. The valve is to be partially opened, and the test pressure is to be increased to twice the rated working pressure and held at that pressure for 1 minute.

23.5.2 During the test specified in 23.5.1, there shall be no weeping or leakage through the castings, or signs of structural weakness. Slight leakage at the valve stem not exceeding 2 fluid ounces (0.06 L) per hour is permitted.

24 Strength of Body Test

24.1 An assembled valve that is partially opened shall withstand for 1 minute without rupture an internal hydrostatic test pressure of five times the rated working pressure.

24.2 Because this test is not identified as a test for gaskets or seals, leakage at joints is permitted.

25 Mechanical Strength Test

25.1 Internal and external valve parts

25.1.1 A valve assembly shall withstand, without malfunction of any internal or external valve part which would affect the operability or strength of the valve, such as a handwheel, stem assembly, and seat seal, a torque applied at the handwheel as specified in 25.1.2.

25.1.2 A sample of the valve is to be secured in a vise or supported in an equivalent manner. The test torque is to be applied through the handwheel and measured from the center of the handwheel by a torque wrench or equivalent device. The torque value specified in Table 25.1 is to be applied to the sample valve with the valve:

- a) In the closed position in the direction tending to further close the valve; and
- b) In the open position in the direction tending to further open the valve.