UL 1739

STANDARD FOR SAFETY

Pilot-Operated Pressure-Control Valves for Fire-Protection Service

UL Standard for Safety for Pilot-Operated Pressure-Control Valves for Fire-Protection Service, UL 1739

Sixth Edition, Dated April 28, 2017

Summary of Topics

This revision of ANSI/UL 1739 dated February 28, 2024 includes an update to the Operation Test; 19.5, 19.8, and 19.9.

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated January 5, 2024.

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Standard for Pilot-Operated Pressure-Control Valves for Fire-Protection Service

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Sixth Edition

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This ANSI/UL Standard for Safety consists of the Sixth Edition including revisions through February 28, 2024.

The most recent designation of ANSI/UL 1739 as an American National Standard (ANSI) occurred on February 28, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in ULSE's Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover pilot-operated pressure-control valves intended to reduce the water pressure in the supply piping for standpipe systems, or sprinkler systems, or both.

1.2 The valves covered by these requirements are intended for use in:

a) Standpipe systems installed in accordance with the Standard for Installation of Standpipe and Hose Systems, NFPA 14; or

b) Sprinkler systems installed in accordance with the Standard for Installation of Sprinkler Systems, NFPA 13.

1.3 The valves covered by these requirements are intended to be inspected, tested, and maintained in accordance with the Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, NFPA 25.

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.

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.

5 Glossary

5.1 For the purpose of these requirements, the following definitions apply.

5.2 MAIN VALVE – The part of the valve assembly that controls the flow of water.

5.3 NPS (NOMINAL PIPE SIZE) – A dimensionless designator for pipe sizes defined in standards including ASTM A53, ASTM A135 and ASTM A795 used to replace terms such as "Nominal Diameter" and "Nominal Size".

5.4 PILOT OPERATED PRESSURE-CONTROL VALVE – A valve intended to reduce the downstream water pressure to a specified value under both flowing (residual) and nonflowing (static) conditions.

5.5 PILOT VALVE – The part of the valve assembly that controls the operation of the main valve.

5.6 RATED INLET PRESSURE – The maximum inlet pressure at which the valve is intended to be subjected from the water supply system.

5.7 REFERENCED SETTING(S) – A location(s) for setting the valve as referenced in the manufacturer's installation and operating instructions and for which performance information is provided.

5.8 RESIDUAL PRESSURE – Pressure acting on a point in the system under flowing conditions.

5.9 STATIC PRESSURE – Pressure acting on a point in the system under no (zero) flow conditions.

CONSTRUCTION

6 Sizes

6.1 As used in these requirements, valve sizes refer to NPS (Nominal Pipe Size) for which the end connections are intended. The diameter of the waterway through the seat of a valve may be reduced to less than the designated NPS.

6.2 A pilot operated pressure control valve shall be constructed for use with 1 NPS.

7 Rated Inlet Pressure

7.1 A valve shall be constructed for use at a rated inlet pressure of at least 175 psig (1.21 MPa).

8 Outlet Pressure Settings

8.1 A valve shall be constructed to incorporate a reference setting or settings to provide a static outlet pressure not exceeding 175 psig (1.21 MPa).

Exception: The 175 psig (1.21 MPa) maximum does not apply to a valve intended for applications that require higher outlet pressures provided that manufacturer's instructions indicate that the pressure rating of the components installed downstream of the valve shall not be exceeded.

9 Bodies and Bonnets

9.1 A cast valve body of the globe or angle pattern shall be smooth and free from porosity, scale, lumps, cracks, blisters, sand holes, or other defects that may impair intended operation. A casting shall not be plugged or filled, but may be impregnated to remove porosity.

9.2 The dimensions of a flange, flange pipe joint, and threaded body opening shall comply with the following requirements, as applicable:

a) Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1;

b) Standard for Dryseal Pipe Threads (Inch) – ANSI/ASME B1.20.3;

c) Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800 – ANSI/ASME B16.1 (Class 125 or higher); and

d) Standard for Valves-Flanged, Threaded, and Welding End – ANSI/ASME B16.34.

9.3 The bolting of a pressure-holding casting shall be such that the maximum stress on any bolt will not exceed one-fourth the elastic limit of the material. The load on the bolts is to be computed on the basis of the maximum set pressure of the valve. The area of application of pressure is to be calculated as follows:

a) If a full face gasket is used, the area of force application is that area extending out to a line defined by the inner edge of the bolts.

b) If an "O" ring seal or ring gasket is used, the area of force application is that area extending out to the center line of the "O" ring or gasket.

10 Materials

10.1 A part that bears against, rotates within, or slides on stationary parts, and that moves during valve operation, shall be either:

a) Made of corrosion-resistant material; or

b) Fitted with bushings, inserts, or other parts made of corrosion-resistant material at those points where freedom of motion is required.

10.2 An interior bolt or screw shall be made of bronze or other material having at least equivalent resistance to corrosion.

10.3 An internal spring shall be made of material having corrosion resistance at least equivalent to that of phosphor bronze and shall be resistant to stress corrosion.

10.4 A seat ring shall be made of brass, bronze, or a material having at least equivalent resistance to corrosion and shall be held in place by screw threads, cold swaging, or the equivalent.

11 Body-Seat Rings

11.1 A body-seat ring shall have a smooth, machined surface capable of complying with the Seat Leakage Test specified in 20.2.

11.2 A seat ring of an iron-bodied valve shall be made of a material having corrosion resistance equivalent to brass or bronze and shall be held in place by screw threads, cold swaging, or the equivalent.

12 Valve Mechanisms

12.1 An internal working part that is removed during intended maintenance shall be removable without damaging the valve. The removal shall require the use of ordinary tools only, such as pipe wrenches, flat-blade or cross-point screwdrivers, pliers, and the like.

12.2 A part that is disassembled in field servicing shall be of a construction that will permit its accurate reassembly.

12.3 A part within the valve shall be secured to resist separation during intended use.

12.4 If an orifice with a diameter less than 3/16 inch (4.8 mm) is used in the trim or operation of a valve, a screen or strainer with corrosion resistance equivalent to brass shall be provided. The total area of the openings in the screen or strainer shall be not less than 20 times the cross-sectional area of the opening that the screen or strainer is intended to protect. The largest dimension of the screen or strainer openings shall not exceed 1/32 inch (0.8 mm) less than the diameter of the protected orifice. The strainer shall be constructed such that the screen is capable of being cleaned without removing the strainer from the pilot piping.

12.5 The pilot trim line used in a pressure control valve shall not incorporate a manual shutoff valve that could affect the proper operation of the valve unless the shutoff valve has provisions to be locked in the open position.

13 Clearances

13.1 Clearances shall be provided between working parts and between working and stationary parts so that corrosion or deposits of foreign matter within an assembly will not result in impaired operation of the valve.

13.2 The clearance between a valve disc or a part attached thereto and the inside walls of an iron body casting shall not be less than 1/2 inch (12.7 mm) for every position of the disc except fully open. This clearance shall not be less than 1/4 inch (6.4 mm) for valves having bodies of bronze or equivalently corrosion-resistant material.

14 Valve Adjustment

14.1 A valve shall be provided with a means such as a fastening nut to secure the intended setting.

PERFORMANCE

15 General

15.1 Representative samples of each size valve shall be subjected to the tests described in Sections 16 – 22. Additional samples of parts constructed of nonmetallic materials, such as rubber seal rings, are to be used for the Elastomeric Parts (Except Gaskets) Test, Section 17.

16 10-Day Moist Ammonia Air Stress Cracking Test

16.1 After being subjected to the conditions described in 16.2 – 16.4, 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 Leakage Test, Section 20, and the Strength of Body Test, Section 21, if there is evidence of cracking.

16.2 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 16.1. Pipe sealing tape or pipe compound are not to be used on the threads.

Table 16.1
Torque on pipe connections

Nominal pipe size NPS	Torque, pound-inch
1	1200
1-1/4	1450
1-1/2	1550
2	1650
2-1/2	1750
3	1800
4	1900

16.3 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.

16.4 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).

17 Elastomeric Parts (Except Gaskets) Test

17.1 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.

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 UL 157. The maximum service temperature used to determine the oven time and temperature for oven aging is 60°C (140°F).

17.2 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.

18 Spring Test

18.1 A spring used in a valve mechanism shall operate as intended when tested for 50,000 cycles of operation at a rate of not more than 6 cycles per minute. Each cycle of operation is to consist of a compression of the spring to its minimum intended operating length (maximum compression during operation) and an extension back to its original length.

18.2 A sample valve into which the cycled spring has been assembled then is to be subjected to at least three point checks from the data generated during the Operation Test, Section 19, and the values obtained shall not differ by more than 10 percent from those obtained with as-received samples.

19 Operation Test

19.1 When tested as described in 19.3 – 19.8, a valve shall operate without malfunction and shall perform in accordance with the manufacturer's specifications throughout the:

a) Rated inlet pressure range;

b) Rated outlet pressure range;

c) Flow range of the valve during the test, and

d) Control the downstream pressure when the valve is closed abruptly in accordance with 19.8 and 19.9.

19.2 A single sample is to be used for the operation tests defined in 19.3 – 19.9. As a result of the tests, the valve shall show no malfunction or deterioration of performance.

19.3 A valve incorporating an adjustable speed control device shall operate within time and pressure requirements specified in 19.5 and 19.8 when adjusted to its slowest operating position.

19.4 The inlet of a sample valve is to be connected to a piezometer to which a pressure gauge is attached and to a water supply that provides the rated inlet pressure and maximum flow required. The downstream side of the sample is to be fitted with a piezometer equipped with a pressure gauge, piping, and a valve to control the water flow through the sample.

19.5 The sample is to be adjusted to a referenced setting yielding the lowest outlet pressure indicated in the installation instructions. The inlet pressure then is to be increased to the minimum inlet pressure recommended by the manufacturer, and the outlet pressure and flow is to be recorded. The inlet pressure then is to be increased in 50 psig (345 kPa) increments or less up to the maximum rated inlet pressure, and the outlet pressure and flow is to be recorded at each increment. Also, at each increment, the shutoff valve at the end of the test line that controls the water flow through the sample is to be adjusted to obtain a no (zero) flow condition and other intermediate flow rates up to the maximum rated flow. This procedure then is to be repeated at settings representative of the inlet and outlet ranges recommended by the manufacturer. The recorded outlet pressures at each increment and all flowing conditions shall be within ±10 percent of the referenced outlet setting pressure. Except for the no (zero) flow condition, the time for the valve to return within ±10 percent of the outlet pressure referenced in the manufacturer's instructions shall not exceed 5 seconds. After one minute at the no (zero) flow condition, the valve outlet pressure shall not exceed 15 psig or 10 %, whichever is greater, above the referenced outlet setting pressure. See test procedures 1 and 2 in Table 19.1 for a description of test conditions.

Table 19.1
Operation test conditions

Test no.	Test description	Valve outlet pressure setting(s)	Valve inlet pressure setting(s)	Flow(s)
1	Varying inlet pressure and constant system flow demand	Minimum and maximum	Minimum to maximum in 50 psi (345 kPa) increments	Zero and maximum rated or attainable at each inlet pressure
2	Constant inlet pressure and varying system flow demand	Minimum/Maximum and at least 2 intermediate settings	Minimum to maximum in 50 psi (345 kPa) or less increments	Zero and maximum rated or attainable, and at least 5 intermediate flows at each inlet pressure

Table 19.1 Continued on Next Page

Table 19.1 Continued

Test no.	Test description	Valve outlet pressure setting(s)	Valve inlet pressure setting(s)	Flow(s)
3	Inlet pressure below intended outlet pressure	Minimum and maximum	1) Inlet pressure 10 psi (68.9 kPa) less than minimum. 2) Inlet pressure 10 psi (68.9 kPa) less than maximum outlet valve setting. And 3) Inlet pressure as low as 50 psi (34.5 kPa) at maximum outlet pressure.	Zero and maximum rated or attainable and at least 5 intermediate flows at each inlet pressure
4	Maximum outlet pressure developed under shutoff conditions	Maximum	Maximum	See 19.8 and 19.9

19.6 The pressures recorded in 19.5 at the inlet and outlet of the valves shall be adjusted for losses due to friction in the piping when these losses exceed 1 psi.

19.7 To determine the performance characteristics of the valve when the inlet pressure is below the intended outlet pressure, the test procedure described in 19.5 is to be conducted with the valve adjusted to the referenced settings yielding the lowest and highest outlet pressures and with inlet pressures as low as 50 psig (345 kPa) up to the intended outlet pressure of the valve. See test procedure 3 in Table 19.1 for a description of test conditions.

19.8 After conducting the tests described in 19.5, a valve with a rated inlet pressure greater than 175 psi (1210 kPa) is to be adjusted to a referenced setting yielding the highest outlet pressure. The valve is then to be subjected to the rated inlet pressure while the valve is flowing approximately one-half the maximum flow recommended by the manufacturer. The shutoff valve at the end of the test line is to be closed from the partially open position so as to achieve a no (zero) flow condition within 15 seconds after starting to close the shutoff valve. The recorded outlet pressure shall not exceed 175 psig (1210 kPa) or 10 % over the outlet pressure setting, whichever is greater. See test procedure 4 in Table 19.1 for a description of test conditions.

19.9 After being subjected to the test described in 19.8, a valve having a nominal diameter of less than 6 NPS and having a rated inlet pressure greater than 250 psig (1723 kPa) is to be adjusted to yield the highest outlet pressure recommended by the manufacturer. The valve is then to be subjected to the rated inlet pressure while the valve is flowing 250 gallons per minute (946 L/m). The shut-off valve on the end of a 50-foot (15.2-m) length of 2-1/2-inch (64-mm) rubber-lined hose is to be closed from the open position so as to achieve a no (zero) flow condition within 2 seconds from starting to close the valve. The recorded outlet pressure shall not exceed 250 psig (1723 kPa) or 50 psig (345 kPa) above the highest outlet pressure recommended by the manufacturer, whichever is greater.

20 Leakage Tests

20.1 General

20.1.1 When tested as described in 20.2 and 20.3, a valve shall withstand an internal hydrostatic pressure of both rated and twice the rated pressure of the valve for 1 minute, without leakage at joints, through the bodies and bonnets of the main valve and pilot valve, or the valve seat.

Exception: For valves having designs where pressure on the valve outlet is required to maintain the valve in the closed position, there shall be no leakage across the valve seat exceeding 1 psi when the valve is

subjected to the test method in 19.5 and under the following valve settings and conditions for a period of 1 minute:

a) No (zero) flow condition,

b) The maximum inlet pressure, and

c) Minimum outlet pressure.

20.2 Seat leakage test

20.2.1 The inlet of a sample of the valve is to be connected to a hydrostatic pressure source. The seating faces of the sample are to be wiped clean, after which the inlet of the sample is to be closed, pressurized to the rated pressure, and the valve seats examined for leakage. The inlet of the sample then is to be pressurized to twice the rated pressure, maintained at that pressure for 1 minute, and the valve seats examined for leakage during and after pressurization.

20.3 Body leakage test

20.3.1 After completion of the test specified in 20.2.1, the outlet of the sample is to be closed by a cap or the equivalent. The sample then is to be partially opened to allow pressurization of the entire valve body, including the bonnet joint and sealing device, to the rated pressure, and examined for leakage. The sample then is to be pressurized to twice the rated pressure, maintained at that pressure for 1 minute, and examined for leakage during and after pressurization.

21 Strength of Body Test

21.1 A valve, including trim, shall withstand for 5 minutes, without rupture, an internal hydrostatic pressure of four times the rated pressure.

21.2 During this test, the valve is to be partially open; except that, if testing with the valve partially open is impractical, two tests shall be conducted; first with the inlet pressurized, and then with the outlet pressurized.

21.3 This test is not to be considered a test for gaskets or seals. A gasket used with a casting or other part having a large area may be reinforced. Other materials that will withstand the pressure may be substituted for the gaskets and seals provided with the valve.

22 One-Year Static Leakage Test

22.1 A valve shall:

a) Withstand for 1 year, without leakage from the outlet, an inlet pressure equal to 25 psig (170 kPa) less than the rated pressure, and

b) After the 1 year exposure, the valve shall not have values that differ by more than 10 percent from those obtained with the as-received valve when subjected to the Operation Test, Section 19.

22.2 A sample of the valve is to be filled with water in both the outlet and inlet sides and a pipe plug and pressure gauges are to be attached.

22.3 The inlet side of the sample then is to be pressurized to a pressure equal to 25 psig (170 kPa) less than the rated pressure and the outlet side pressure set at the minimum recommended by the manufacturer. After the 1 year period, the sample is to be subjected to at least three flow rates that had been conducted on the as received sample during the Operation Test, Section 19.