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NATIONAL STANDARD

ANSI/CAN/UL 193:2024

STANDARD FOR SAFETY

Alarm Valves for Fire-Protection Service

ANSI/UL 193-2024

SCC FOREWORD

National Standard of Canada

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UL Standard for Safety for Alarm Valves for Fire-Protection Service, ANSI/CAN/UL 193

Twelfth Edition, Dated August 2, 2024

Summary of Topics

This New Twelfth Edition of ANSI/CAN/UL 193 dated August 2, 2024 is being issued as a new joint US/Canada Standard reflecting the latest ANSI and SCC approval dates and incorporating the proposal dated April 5, 2024.

The requirements are substantially in accordance with Proposal(s) on this subject dated April 5, 2024

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Preface

This is the Twelfth Edition of ANSI/CAN/UL 193, Standard for Alarm Valves for Fire-Protection Service.

ULSE is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL 193 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

This Twelfth Edition joint American National Standard and National Standard of Canada is based on, and now supersedes, the Eleventh Edition of UL 193 and the First Edition of ULC/ORD-C193-75.

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

This Edition of the Standard has been formally approved by the Technical Committee (TC) on Check, Dry Pipe, and Alarm Valves for Fire Protection Service, TC 260.

This list represents the TC 260 membership when the final text in this Standard was balloted. Since that time, changes in the membership may have occurred.

TC 260 Membership

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This Standard is intended to be used for conformity assessment.

The intended primary application of this Standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE

INTRODUCTION

1 Scope

1.1 These requirements cover alarm valves for use in automatic wet-pipe sprinkler systems for fire protection service. Alarm valves covered by these requirements are of either the variable- or constant-pressure type and are of the swing-check pattern. Ordinarily, variable-pressure alarm valves are acceptable for constant-pressure service without alteration; however, in some designs, that part of the device having to do with the delaying of alarms may be omitted.

1.2 Alarm valves covered by these requirements are intended for installation and use in accordance with the Standard for the Installation of Sprinkler Systems, NFPA 13.

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 Where values of measurement are specified in both SI and U.S. Customary units, it is the responsibility of the user of this Standard to determine the unit of measurement appropriate for the users needs.

4 Referenced Publications

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.

4.2 The following publications are referenced in this Standard:

ASME B16.1, *Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250*

ASME B16.5, *Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24, Metric/Inch Standard*

ASME B1.20.1, *Pipe Threads, General Purpose, Inch*

ASME B1.20.3, *Dryseal Pipe Threads, Inch*

ASTM A53/A53M, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*

ASTM A135/A135M, *Standard Specification for Electric-Resistance-Welded Steel Pipe*

ASTM A795/A795M, *Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use*

ASTM A307, *Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength*

ASTM A563, *Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric)*

ASTM E145, *Standard Specification for Gravity-Convection and Forced-Ventilation Ovens*

AWWA C207, *Steel Pipe Flanges for Waterworks Service – Sizes 4 In. Through 144 In. (100 mm Through 3600 mm)*

NFPA 13, *Installation of Sprinkler Systems*

UL 19, *Lined Fire Hose and Hose Assemblies*

UL 157, *Gaskets and Seals*

UL 258, *Shutoff Valves for Trim and Drain Purposes for Fire Protection*

UL 393, *Indicating Pressure Gauges for Fire Protection Service*

UL 753, *Alarm Accessories for Automatic Water-Supply Control Valves for Fire-Protection Service*

5 Glossary

5.1 For the purpose of this Standard, the following definitions apply.

5.2 NPS (NOMINAL PIPE SIZE) – A dimensionless designator for pipe sizes defined in standards including ASTM A53/A53M, ASTM A135/A135M, and ASTM A795/A795M. Used to replace terms such as "Nominal Diameter" and "Nominal Size."

5.3 READY CONDITION – The condition existing when:

a) An alarm valve is installed in a piping system that has been filled with water from an active water supply having a stable pressure; and

b) There is no water flow from any outlet on the system downstream from the alarm valve.

5.4 RETARDING FACTOR – The time in seconds that elapses while any specified rate-of-flow is being discharged from the system between the first passage of water through the alarm port of the valve and the completion of the action which is required of the mechanism to actuate the alarm devices. It does not include the time required to withdraw excess pressure from the riser above the valve, nor the delay incident to transmission of water through the piping from the alarm valve to water-motor gongs or other alarm apparatus that may be installed at some distance from the valve.

5.5 SENSITIVENESS – The minimum rate-of-flow from a system outlet, expressed in gallons per minute (gpm) (L/min) that will open the alarm valve, as indicated by continuous operation of both electrical and mechanical alarms.

5.6 SERVICE PRESSURE – The static pressure at the inlet to an alarm valve when the valve is in the ready condition.

5.7 SOLID SYSTEM – A system in which no air is present in the sprinkler piping.

5.8 WASTE OF WATER – The discharge of any water from the alarm port of an alarm valve that is in the ready condition.

CONSTRUCTION

6 General

6.1 Auxiliary components or attachments to alarm valves, such as water-motor-driven alarm gongs, pressure-operated switches, pressure gauges, trim and drain valves, and the like, are judged under the requirements for such devices or products and also with respect to their particular application. See UL 258, UL 393, and UL 753.

7 Sizes

7.1 Valves covered by these requirements include sizes 1 – 12 NPS, inclusive.

7.2 Valve sizes refer to the nominal diameter of the waterway through the inlet and outlet connections and to the NPS for which the connections are intended. The diameter of the waterway at the water seat ring of a valve may be reduced to less than that of the waterway at the inlet and outlet connections.

8 Working Pressures

8.1 An alarm valve shall be constructed for a minimum rated working pressure of 175 psig (1207 kPa).

9 Positions

9.1 An alarm valve may be constructed to operate when installed in only one specific position (horizontal only or vertical only) or it may be constructed to operate in both of these positions. See 32.2(e), for marking requirements.

10 Metallic Materials

10.1 The manufacturer shall identify the applicable ASTM or similar material specification for the metallic materials used in the bodies and covers of the alarm valve. The manufacturer shall provide documentation containing the physical property data to determine compliance with the minimum physical property requirements of the latest edition of the applicable ASTM or similar material specification as referenced by the manufacturer.

11 Bodies and Covers

11.1 A body and cover shall be made of a material having corrosion resistance at least equivalent to cast iron. If nonmetallic materials, for example, plastics, are used, they are to be subjected to a design study to evaluate their resistance to external fire exposure and thermal shock.

11.2 A casting shall not be plugged or filled but may be impregnated to remove porosity.

11.3 The dimensions of all flanges, flange pipe joints, and threaded body openings shall conform to the following standards, as applicable or to other national standards that apply where the valve is intended to be installed:

a) ASME B1.20.1;

b) ASME B1.20.3;

c) ASME B16.1 (Class 125 or higher); or

d) AWWA C207, for valves having a maximum rated working pressure of 175 psig (1207 kPa) and ASME B16.5, for valves having a maximum working pressure greater than 175 psig (1207 kPa).

11.4 Provision shall be made in a valve body for connection of all external fittings and attachments specified by NFPA 13.

11.5 The point of connection of the alarm piping shall be such that pressure sufficient to operate the alarm will be available at any velocity of flow through the valve of 1 – 20 feet per second (0.3 – 6.1 m/s), at service pressures of 20 psig (138 kPa) to the maximum rated working pressure. See 5.6.

11.6 A tapped opening in a valve body for a retarding chamber connection shall be at least 1/2 NPS, and at least 1/4 NPS for an opening used exclusively for a pressure gauge.

11.7 A tapped opening in a valve body for main drain connection shall be at least 3/4 NPS for up to 2 NPS valves, at least 1-1/4 NPS for 2-1/2 to 3-1/2 NPS valves, and 2 NPS for 4 NPS and larger valves.

11.8 Tapped openings provided for main drain piping shall be so located as to assist in carrying away sediment or foreign material likely to collect at the valve seat and to drain water from the system piping when the valve is installed in any intended position.

11.9 A body handhole opening shall be located on the side or on the top when the valve is installed in the intended position and sufficiently large to permit access to all working parts and allow the removal of the clapper assembly.

Exception: A valve is not required to be provided with a body handhole opening, when all of the following criteria are met:

a) The valve is designed to permit the clapper and all other internal parts to be removed and replaced;

b) A means is provided to allow removal and reinstallation of the valve, or serviceable portion of the valve, without disassembly of the sprinkler system piping; and

c) The means for valve or part removal and reinstallation is integral with the valve.

11.10 If a body handhole opening is provided, a cover plate shall be attached to the body of a valve using bolts and nuts, or bolts alone, or studs and nuts, with the removable parts having external drive surfaces, such as a square or hexagonal head.

11.11 Sizes of studs or bolts used will be an item of design review for all sizes of valves.

11.12 Bolts, nuts, and studs employed for the bolting of pressure-holding castings shall meet or exceed the applicable requirements in ASTM A307, and ASTM A563. Bolts shall be Grade A or Grade B, as specified in ASTM A307 and shall have a minimum tensile strength of 60,000 psi. Any bolts and studs other than those specified above shall have a minimum tensile strength of 60,000 psi. Any nuts other than those specified above shall have a minimum proof load stress of 60,000 psi.

11.13 The load on any bolt, excluding bolts used for trim components, exclusive of the force to compress the gasket, shall not exceed the minimum tensile strength of the specified material when the valve is pressurized to four times the rated pressure. The area of the application of pressure is to be calculated as follows:

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

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

11.14 A handhole cover plate shall be constructed so that it cannot be installed in such a manner as to impair the operation of the valve.

12 Valve Mechanisms

12.1 General

12.1.1 A valve part that is constructed to be disassembled during field servicing shall be such that it cannot be reassembled in an unintended manner.

12.1.2 There shall be no waste of water when the valve is in a ready condition. See 5.3, 5.8, and 26.1.6.

12.1.3 A valve mechanism shall provide freedom of movement of operating parts.

12.1.4 The clapper assembly shall be hung in the interior of the valve body so that the clapper assembly will move toward the seat by gravity and seal as intended when no water is flowing. For valves intended for horizontal installation, the use of springs to affect intended seating is acceptable.

12.1.5 A spring used in an alarm valve shall be made of a material having corrosion resistance at least equivalent to phosphor bronze and shall be capable of complying with the requirements outlined in 21.1 and 21.2.

12.1.6 A part that bears against, rotates within, or slides on stationary parts, and that must be free to move during valve operation, shall:

a) Be made of corrosion-resistant material, such as bronze, brass, chrome-plated bronze, monel metal, and the like; or

b) If made of materials lacking corrosion-resistant properties, be fitted with bushings, inserts, or other parts made of the corrosion-resistant materials mentioned above, at those points where freedom of motion is required.

12.1.7 Any interior bolt or screw shall be made of bronze or other equally or more corrosion-resistant material.

12.2 Clapper supports

12.2.1 Clapper-arm bushings or hinge-pin bearings shall project a sufficient distance to maintain not less than 1/8-inch (3.2-mm) clearance between ferrous-metal parts. If a side plug is used to support a hinge pin, holes in the plugs shall be drilled concentric with the screw threads. A bearing plug shall be made of bronze or other corrosion-resistant material and shall be long enough to extend inside walls of cast-iron bodies to provide an end-bearing surface.

12.2.2 A clapper arm shall be supported by a hinge pin(s) made of bronze or other corrosion-resistant material. The hinge pin(s) shall resist the impact effect caused by a surge of water on the closed clapper. For purposes of this determination, the water surge is assumed to be flowing at a velocity of 15 feet per second (4.6 m/s). Bronze hinge pins not less than 3/8 inch (9.5 mm) in diameter for valves of 3 NPS or less, and not less than 7/16 inch (11.1 mm) in diameter for valves of 3-1/2 NPS or larger, are considered to be in conformance with this requirement.

12.2.3 A bearing shall be constructed to reduce the risk of corrosive action causing parts to bind or cement together.

12.2.4 The hinging of the moving parts of a valve shall be such that the parts will not damage a clapper facing or seat ring during valve operation.

12.2.5 Hinge-pin support bearings and clapper-arm bearings shall each have a length that equals or exceeds 70 % of the diameter of the hinge pin, but not less than 5/16 inch (7.9 mm). A clapper-arm bearing made of material having strength and corrosion resistance equivalent to a Series 300 stainless steel shall have a minimum length of 0.165 inch (4.2 mm). Equivalence is to be determined by means of comparative corrosion tests, depending upon material type.

13 Clapper Stops

13.1 When fully open, the clapper shall bear against a definite stop, the point of contact being so located that impact or the reaction of the water will not tend to twist or bend the parts.

13.2 The clapper arm and clapper combination shall reduce the risk of the clapper tipping and catching under the seat ring in case the connection between the clapper and its arm becomes badly worn.

14 Clapper Rings and Seat Rings

14.1 A metal-to-metal valve-seating surface shall be of bronze or equally or more corrosion-resistant material and shall have sufficient width of surface contact to withstand compression stresses and damage due to pipe scale or foreign matter carried by the water. The seating surface of a metal clapper ring shall be at least 1/8 inch (3.2 mm) wider than the surface of the body seat ring.

14.2 The face of a metal clapper ring shall have dimensions such that all ferrous-metal parts of the clapper will be at least 1/8 inch (3.2 mm) away from the metal of the body or body seat ring.

14.3 The face of a metal seat ring in the body shall be at least 1/8 inch (3.2 mm) above adjacent portions of the body casting.

14.4 A metal ring on which seating surfaces are formed may be threaded, dove-tailed, swaged, or pressed in place, or may be an integral part of a valve body or clapper if the metal is acceptable for this purpose. See 14.1.

14.5 A metal seat or valve ring contacted by a clapper facing made of rubber or other resilient material shall be made of, or faced with, a material to which the clapper facing will not adhere. See Adhesion Test for Resilient Seat Materials, Section 23.

14.6 A rubber ring shall be held in place by rings or other fasteners made of bronze or equally corrosive resistant material.

14.7 A screw or other part used to hold a clapper facing clamping ring in place shall be of bronze or equally corrosive-resistant material.

15 Nonmetallic Materials

15.1 A plastic or other nonmetallic part, other than rubber parts such as clapper facings and "O" rings, shall comply with the requirements of 22.2.1.1 and 22.2.2.1.

15.2 Elastomeric parts, except gaskets, of each size and type used in the various assemblies shall comply with the requirements of 22.3.1 and 22.3.2.

16 Clearances

16.1 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 render a valve sluggish in action or inoperative.

16.2 The clearance between a clapper or a part attached thereto and the inside walls of body castings in every position of the clapper except the fully open position shall be at least 1/2 inch (12.7 mm) for an iron casting and at least 1/4 inch (6.4 mm) for a bronze casting.

16.3 There shall be clearances to the body casting or other body parts of not less than 1/2 inch (12.7 mm) around the hubs of a clapper arm.

16.4 A diametrical clearance of not less than 1/4 inch (6.4 mm) shall be provided to prevent contact between inner edges of a seat ring and metal parts of a clapper assembly, such as rubber ring retainers, when the valve is in the closed position.

16.5 The clearance between hinge pins and their bearings shall not be less than 0.005 inch (0.127 mm).

16.6 End clearance shall be provided between a clapper-arm bearing and its cooperating side bearing surface.

17 Auxiliary Checks

17.1 Auxiliary checks are either bypass or alarm port types. An auxiliary check shall be so located that deposits or sediment will not tend to accumulate on the clapper or seat ring to an extent sufficient to interfere with intended operation.

17.2 An auxiliary check of the swing-check type shall comply with the applicable requirements relating to main-valve parts.

17.3 An auxiliary check of the vertical-rising type shall be provided with guides or an appropriate housing which will serve as a guide, so as to prevent the check from sticking in the open position.

17.4 An auxiliary check shall have sufficient play between it and its supporting members so that the check can seat as intended.

17.5 If an auxiliary check is supported on, or its housing is a part of, the main valve, the auxiliary check shall be allowed sufficient play so that after seating it will not have a tendency to hold the main clapper off its seat.

17.6 An auxiliary check valve housing shall be provided with a through opening that will permit system pressure to assist in holding the check on its seat.

17.7 An auxiliary check valve of the vertical-rising type shall be provided with a spring as an aid to seating.

18 Retarding Chambers

18.1 The body of a retarding chamber shall be made of a material having corrosion resistance at least equivalent to cast iron.

18.2 The pressure retaining parts of a retarding chamber shall withstand, without rupture, a hydrostatic pressure of twice the maximum rated working pressure applied for 1 minute.

18.3 If a screen is employed in the piping between an alarm valve and a retarding chamber, it shall be made of corrosion-resistant material and shall be accessible for cleaning and replacement.

18.4 The largest dimension of the screen openings shall not exceed 1/16 inch (1.6 mm) less than the diameter of the smallest orifice to be protected by the screen. The total area of the openings in the screen shall be not less than 20 times the cross-sectional area of the opening which the screen is designed to protect.

18.5 A retarding chamber shall include means for its support. If piping is to be used for this support, the pipe sizes to be used and the maximum lengths of pipe so used shall be stated on the instruction charts provided with the alarm valve. See 33.4.

18.6 A tapped opening of not less than 3/4-inch pipe size shall be provided in a retarding chamber for connection of alarm devices.

19 Valve Gags

19.1 A valve shall prevent gagging of the valve. Openings which are intended to be plugged but which could be used for the insertion of rods or sticks or other similar objects which would gag the valve without requiring the removal of the cover or faceplate shall not be used.

PERFORMANCE

20 General

20.1 Representative samples of each size alarm valve, together with appropriate auxiliary devices for test, are to be furnished and subjected to the tests described in these requirements. Test bars of metal used in castings and additional samples of parts constructed of nonmetallic materials, such as valve-seat discs, are required for physical tests.

21 Spring Cycling Test

21.1 A spring used in a valve mechanism shall operate as intended for 50,000 cycles.

21.2 A sample valve of any type employing a spring is to be connected to a hydraulic cylinder and subjected to 50,000 cycles of intended operation. For clapper springs, the clapper is to be rotated off of the seat to a 45° angle and slowly returned to the closed position. For internal bypass springs, the bypass is to be operated from the fully open position to the closed position.

22 Nonmetallic Materials Tests

22.1 General

22.1.1 A plastic or other nonmetallic part, other than rubber parts such as clapper facings and “O” rings, shall comply with the requirements of 22.2.1.1 and 22.2.2.1.

22.1.2 Elastomeric parts, except gaskets, of each size and type used in the various assemblies shall comply with the requirements of 22.3.1 and 22.3.2.

22.2 Plastic parts

22.2.1 Air-oven aging

22.2.1.1 Three complete valve assemblies including plastic components or three samples of each plastic component utilized in the valve assembly shall not show signs of warping, creeping, cracking or other deterioration that may preclude the intended operation of the valve following air-oven aging for 180 days at 121 °C (250 °F). Valve assemblies utilizing plastic components exhibiting signs of deterioration as a result of the test exposure shall demonstrate acceptable performance when subjected to both the Operational Tests, Section 26, and the Leakage Test, Section 29. Plastic components exhibiting signs of deterioration as a result of the test exposure shall be installed in a complete valve assembly and shall demonstrate acceptable performance when subjected to the Operational Tests, Section 26, and the Leakage Test, Section 29.

22.2.1.2 Complete valve assemblies, including the plastic components, and sample plastic components to be aged are to be supported in a full-draft, circulating-air oven that has been preheated at full draft to 121 ±1 °C (250 ±1.8 °F). Elastomeric facings or “O” rings may be included or excluded at the manufacturer’s option. The manner of support is to be such that the samples are prevented from touching one another or the sides of the oven. The samples are to be aged for 180 days at full draft and then allowed to cool in air at 23 ±2 °C (73.4 ±3.6 °F) for at least 24 hours before conducting any test or dimensional check. Prior to any tests, elastomeric parts complying with 22.3.1 are to be installed, if not included in the aging test. As used in this test, the term “full draft” refers to the air flow over the samples in the oven with the air inlet and outlets fully open. The oven used for accelerated aging is to be Type IIA as specified in ASTM E145.

22.2.1.3 If a plastic material cannot withstand the temperature indicated without softening, distortion, or deterioration, an air-oven aging test at a lower temperature, minimum 87 °C (189 °F), for a longer period of time may be used.

22.2.2 Water immersion

22.2.2.1 Three complete valve assemblies, including the plastic components or three samples of each plastic component utilized in the valve assembly shall not show signs of warping, creeping, cracking or other deterioration that may preclude the intended operation of the valve following immersion in tap water at 87 ±2 °C (189 ±3.6 °F) for 180 days. Valve assemblies utilizing plastic components exhibiting signs of deterioration as a result of the test exposure shall demonstrate acceptable performance when subjected to the Operational Tests, Section 26, and the Leakage Test, Section 29. Plastic components exhibiting signs of deterioration as a result of the test exposure shall be installed in a complete valve assembly and shall demonstrate acceptable performance when subjected to the Operational Tests, Section 26, and the Leakage Test, Section 29.

22.3 Elastomeric parts (except gaskets)

22.3.1 An elastomeric part used to provide a seal shall have the following properties when tested as specified in 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 %;

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 %; or a minimum tensile strength of 2200 psi (15.2 Mpa) and a minimum ultimate elongation of 100 %; 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 UL 157. The maximum service temperature used to determine the oven time and temperature for oven aging is considered to be 60 °C (140 °F).

22.3.2 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.

23 Adhesion Test for Resilient Seat Material

23.1 Conformance with the requirements of 14.5 is to be determined by tinning of the metal seat or by immersion in tap water of a compression test fixture capable of use as specified in (a) – (h), and consisting of a full circular seat or valve ring with a full section of resilient clapper facing material held together with a bridging construction; or capable of accommodating a full section of resilient clapper facing material placed between full sections of equal length of the seat or valve ring and clapper facing; or capable of accommodating a 1 inch (25.4 mm) long section, measured along the central arc, of resilient clapper facing material placed between plates of the same material as the seats or valve rings and clapper facings, similar to that shown in Figure 23.1. The bolt holes of the test fixture shall have a diameter of 3/8 inch (9.53 mm). The bolt and nut material shall be corrosion resistant. The tests are to be conducted as follows:

a) The clapper facing material is to be placed in the compression test fixture and the fixture compressed in a tension-compression machine until a load, *Fc*, is developed according to the following formula:

$$Fc = \frac{Dpl}{4}$$

where:

Fc is the test load, in pounds (N × 0.225), rounded to the nearest larger whole number;

D is the diameter, in inches (mm × 0.04), measured along the sectional center line of the resilient valve seat material. This diameter is equal to the outer diameter of the seat material minus the width of the material, see Figure 23.2;

p is the pressure rating of the valve, in psig (kPa × 0.145); and

l is the length, in inches (mm x 0.04), of the sample of resilient valve seat material under test. If the sample is a complete circular sample, this length is the circumference defined by diameter, *D*, see Figure 23.2.

b) Alternate calculations may be used for other designs of alarm valves to determine the proper test load, *Fc*, and tensile force required to separate the test material from the seat or ring material of the test fixture;

c) The amount of compression required to achieve the force, *Fc*, in (a) is to be measured, in millimeters, to the nearest 2 mm;

d) The compression test fixture is to be removed from the tension-compression machine, and the fixture compressed by its clamping means until the compression measured in (c) is achieved;

e) The sample assembly shall be visually examined to ensure the following:

1) The entire surface of the test material is in contact with the mating surfaces of the test fixture;

2) The test material is not in contact with either of the two bolts of the test fixture; and

3) The test material is fully contained within the test fixture and not extruding outside the dimensions of the test fixture plates.

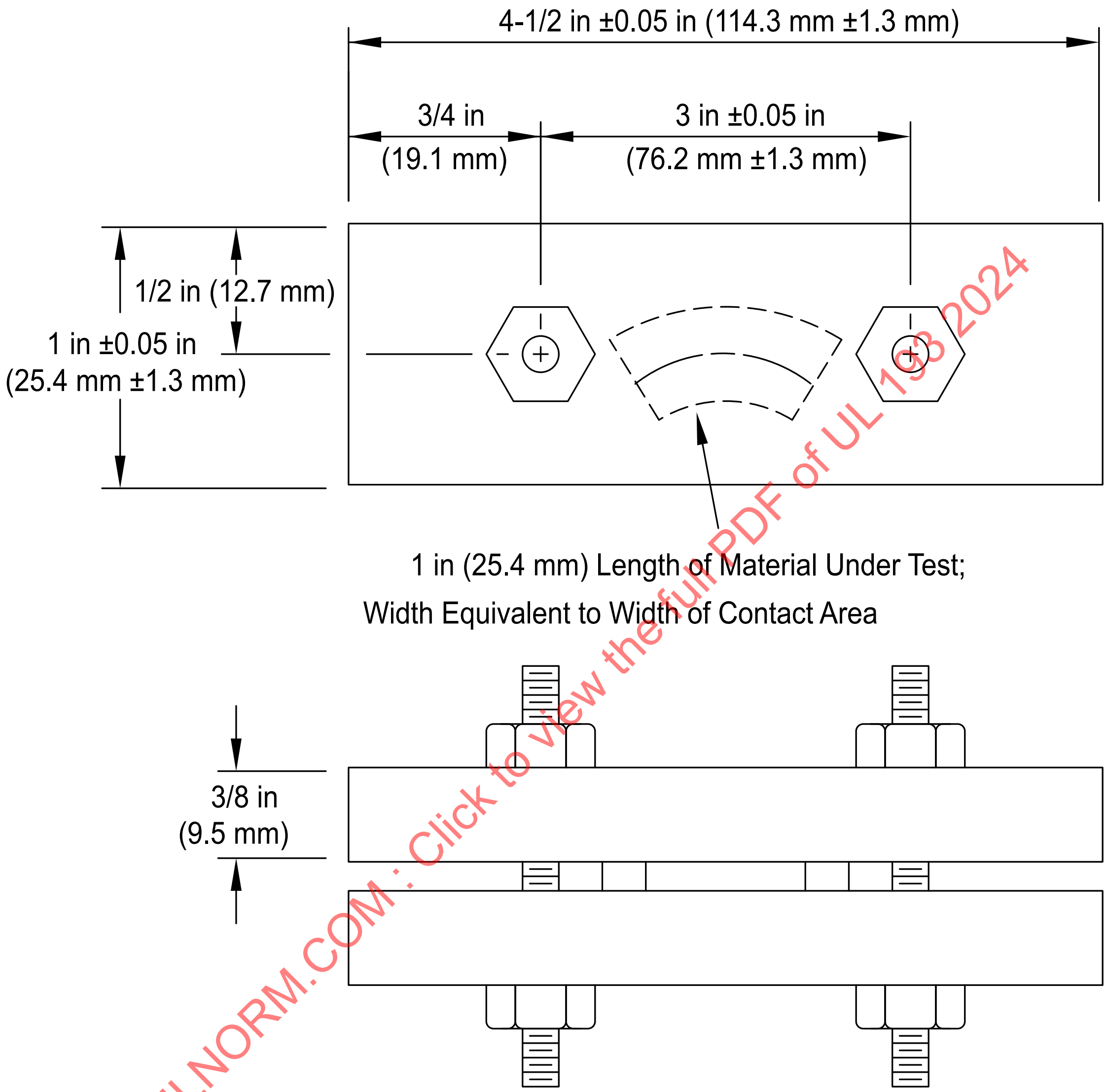
f) A total of three sample assemblies shall be constructed as specified in (a) – (e) above;

g) The three sample assemblies are to be immersed for 90 days in tap water maintained at a temperature of 87 ±2 °C (189 ±4 °F). Following 30 and 60 days of immersion, the sample assemblies are to be removed from the water, (a) – (e) are to be repeated, and the assemblies shall be reimmersed in the water; and

h) Following 90 days of immersion, the fixture clamping means is to be removed from each sample and left undisturbed for 1 hour. The fixture assemblies are then to be secured to the jaws of the tension-compression testing machine. With the jaws separating at the rate of 0.1 inch (2.5 mm) per minute, the tensile force required to separate the resilient clapper facing from the seat or ring material is to be determined for each of the three samples. The average tensile force of the three samples shall not exceed the force equivalent to a 5 psig (34.5 kPa) differential acting over the area, A, defined by the diameter, D, see Figure 23.2.

Figure 23.1

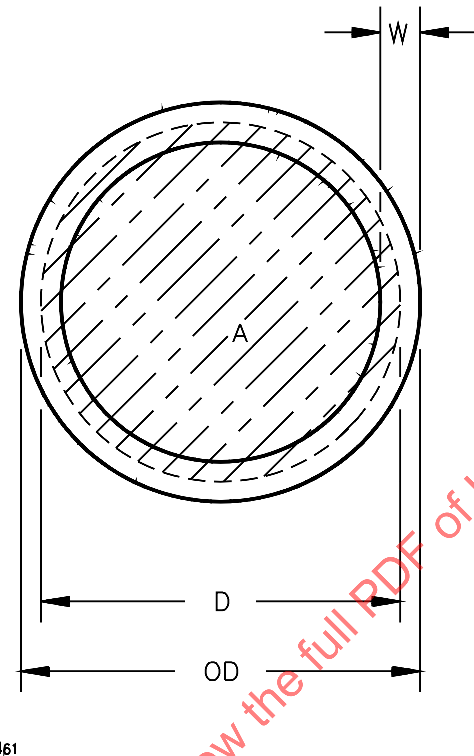
Test Fixture for Section of Facing Material



s2460d

Figure 23.2

Dimensions of Resilient Facing Materials



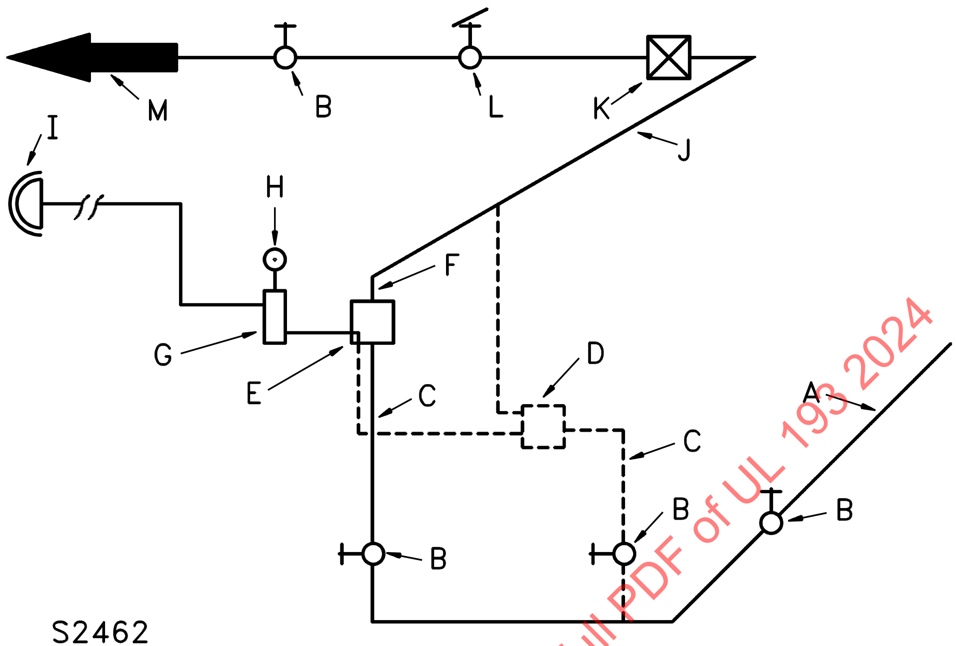
24 Installation Assembly Test

24.1 An alarm valve shall be capable of being installed by means of tools ordinarily employed by pipe fitters. Outside attachments and accessory equipment shall be capable of being securely attached without difficulty.

24.2 At least one size of a given type, design, or class of an alarm valve assembly is to be installed in a hydraulic system and trimmed in accordance with the manufacturer's installation instructions. The valve is to be equipped with its attachments and trim. See Figure 24.1.

Figure 24.1

Sensitiveness Test Installation



A – Water supply to the test system.

B – Control valves and their sizes correspond to the piping in which they are installed.

C – Pipe, 4 inch with 2-1/2- by 4-inch reducers for 2-1/2 NPS valves, 4 inch with 3- by 4-inch reducers for 3 NPS valves, 4 inch for 4 NPS valves, 6 inch for 6 NPS valves and 6 inch with 8- by 6-inch reducers for 8 NPS valves. An elbow of the same size as the valve under test is to be used for tests of valves in the horizontal position. Other system pipe sizes may be permitted where appropriate pressures and flows can be provided.

D – Valve under test mounted in a horizontal position.

E – Valve under test mounted in a vertical position.

F – Reducer, 2-1/2- by 1-1/2-inch for 2-1/2 NPS valves, 3- by 1-1/2-inch for 3 NPS valves, 4- by 1-1/2-inch for a 4 NPS valve, 6- by 4- by 1-1/2-inch for 6 NPS valves and 8- by 6- by 4- by 1-1/2-inch for 8 NPS valve. An elbow of the same size as the valve under test is used for tests in the horizontal position. Other system reducer sizes may be permitted where appropriate pressures and flows can be provided.

G – Manufacturer's retard chamber.

H – The manufacturer's pressure switch is used to determine when electrical alarms are transmitted and is located in the special fitting atop the retarding chamber.

I – The manufacturer's water-motor alarm gong is to be located 6 feet (1.8 m) above the valve under test and is connected to it through 75 feet (22.9 m) of 3/4-inch pipe.

J – Flexible hose and couplings conforming to the requirements of UL 19. The hose is to have a length of 15 feet ±6 inches (3.6 ±0.2 m) between the couplings and have a nominal inside diameter of 1-1/2 inches (38.1 mm).

K – Magnetic Flow meter, 1-1/2-inch size with minimum graduations of at least 1/2 gpm (2 L/min) and a minimum range of 2 – 30 gpm (7.5 – 115 L/min).

L – Control valve, quick-opening type.

M – Weigh barrel and scale for calibration of the flow meter, if necessary.

25 Positiveness of Response and Transmission Test

25.1 A valve shall actuate mechanical and electrical alarm devices at all rates of water flow in excess of the minimum rating required to actuate alarms, as well as at any velocity of flow through the valve of 1 – 20 feet per second (0.3 – 6.1 m/s).

25.2 A valve shall be equally operative without special adjustment at all service pressures up to and including the rated working pressure. The positive of response and transmission test shall be conducted at pressure ranges as described in 26.1.1 (a) or (b) as applicable.

25.3 A valve shall discontinue alarms when the flow is stopped.

25.4 A valve shall transmit successive alarms without requiring manual resetting.

25.5 A valve shall supply water at 5 psig (34.5 kPa) at the inlet to water-motor gongs located as described in 24.2.

25.6 A valve shall supply water at 5 psig (34.5 kPa) to electric alarms located as close as possible to the outlet of the retard chamber.

26 Operational Tests

26.1 Sensitiveness

26.1.1 The sensitiveness of a valve shall be within the range of water flows of 4 – 20 gpm (15 – 76 L/min) for any service pressure of:

a) 20 – 100 psig (138 – 690 kPa) and at the rated pressure for a valve having a maximum rated working pressure of 175 psig (1207 kPa); or

b) 20 psig (138 kPa) to the maximum rated working pressure of a valve, minus 75 psig (517 kPa) and at the rated working pressure, for a valve having a rated working pressure greater than 175 psig (1207 kPa).

26.1.2 The ratio of the service pressure to system pressure shall not exceed 1.15:1 for the service pressures indicated in 26.1.1. The operating differential of a valve shall not exceed 13 psig (90 kPa) at the maximum rated working pressure of the valve, minus 75 psig (517 kPa).

26.1.3 Fully mechanical alarms such as water motor gongs shall be actuated within 5 minutes after onset of flow through the alarm valve when the flow rate through the valve is at any level above the minimum as determined in the tests specified in 26.1.1.

26.1.4 An electrical pressure switch or other electrical alarm initiating device shall be actuated within 90 seconds after onset of flow through the alarm valve when the flow rate through the valve is at any level above the minimum as determined in the tests specified in 26.1.1.

26.1.5 No alarm, either mechanical or electrical, shall be given at a flow rate through the valve of less than 4 gpm (15 L/min).

26.1.6 The sample valve including the retard chamber where provided, as shown in Figure 24.1, is to be subjected to a series of operation tests at various service pressures and using various rates of water flow from the test system to determine compliance with 26.1.1. At each service pressure used in these tests, observations are to be made to determine the minimum flow rate to cause continuous electrical and mechanical alarm.