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ANSI/CAN/UL/ULC 312:2022

STANDARD FOR SAFETY

Check Valves for Fire-Protection Service

Approved American National Standard
ANSI

ANSI/UL 312-2022

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SCC FOREWORD

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UL Standard for Safety for Check Valves for Fire-Protection Service, ANSI/CAN/UL/ULC 312

Eleventh Edition, Dated June 2, 2022

Summary of Topics

This New Edition of ANSI/CAN/UL/ULC 312, Standard for Check Valves for Fire-Protection Service, dated June 2, 2022 has been issued to reflect the latest ANSI and SCC approval dates, and to incorporate the proposals dated September 30, 2019 and February 4, 2022.

The requirements are substantially in accordance with Proposal(s) on this subject dated September 30, 2019 and February 4, 2022.

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This ANSI/CAN/UL/ULC Safety Standard consists of the Eleventh Edition.

The most recent designation of ANSI/UL 312 as an American National Standard (ANSI) occurred on June 2, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This standard has been designated as a National Standard of Canada (NSC) on June 2, 2022.

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Preface

This is the Eleventh Edition of ANSI/CAN/UL/ULC 312, Standard for Check Valves for Fire-Protection Service.

UL is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO). ULC Standards is accredited by 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/ULC 312 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.

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 On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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This Edition of the Standard has been formally approved by the UL Standards Technical Panel (STP) on Check, Dry Pipe, And Alarm Valves For Fire Protection Service, STP 260.

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

STP 260 Membership

Name	Represent	Interest Category	Region
Ken Bush	Maryland State Fire Marshal's Office	AHJ/Regulator	USA
Virginia Charter	OSU	General Interest	USA
Jay Current	Ministry Of Solicitor General	Government	Ontario
Harish Dharamshi	HD Fire Protect PVT LTD	Producer	India
R. Fleming	National Fire Sprinkler Association Inc.	General Interest	USA
Corey Gall	Sprinkler Fitters UA Local 183	General Interest	USA
Theodore Harbour	Mueller Water Products	Producer	USA

STP 260 Membership Continued on Next Page

STP 260 Membership Continued

Name	Represent	Interest Category	Region
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Eldon Jackson	NIBCO Inc.	Producter	USA
Frank Kurz	Fire Technicians Network	Commercial / Industrial User	Canada
Maurice Pilette	Mechanical Designs LTD	General Interest	USA
Anthony Rago	Jensen Hughes	General Interest	Canada
Richard Ray	Cybor Fire Protection CO	Supply Chain	USA
Robert Roegner	North Carolina Department of Insurance	AHJ/Regulator	USA
Michael Savage	Marion County, FL	AHJ/Regulator	USA
Manuel Silva	Johnson Controls INC	Producer	USA
Robert Vincent	Shambaugh & Son INC	Supply Chain	USA
Jeffrey Zwirn	IDS Research Development Inc	General Interest	USA
Griff Edwards	Underwriters Laboratories Inc.	Project Manager – Non-voting	USA
Diane J. Haithcock	Underwriters Laboratories Inc.	Chair – Non-voting	USA

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Web site: ul.org

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 check valves of 1 NPS and larger, used in piping systems supplying water for fire protection service.

1.2 The check valves covered by these requirements are intended for installation and use in accordance with the Standards for:

a) Low-, Medium-, and High-Expansion Foam, NFPA 11;

b) Installation of Sprinkler Systems, NFPA 13;

c) Installation of Standpipe and Hose Systems, NFPA 14;

d) Water Spray Fixed Systems for Fire Protection, NFPA 15;

e) Installation of Foam-Water Sprinkler and Foam-Water Spray Systems, NFPA 16;

f) Installation of Stationary Pumps For Fire Protection, NFPA 20;

g) Water Tanks for Private Fire Protection, NFPA 22;

h) Installation of Private Fire Service Mains and Their Appurtenances, NFPA 24;

i) Water Mist Fire Protection Systems, NFPA 750; and

j) Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height, NFPA 13R.

1.3 Check valves covered by these requirements are intended for installation and use in accordance with, but not limited to the National Fire Code of Canada (NFC), and the National Building Code of Canada (NBC).

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 user's 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 standards are referenced in this standard, and portions of these referenced standards may be essential for compliance.

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

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

ASME B16.1, *Gray Iron Pipe Flanges and Flanged Fittings*

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

ASTM A 53/A 53M, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*

ASTM A 135/A 135M, *Standard Specification for Electric-Resistance-Welded Steel Pipe*

ASTM A 795/A 795M, *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 and Studs, 60,000 Psi Tensile Strength*

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.*

AWWA C111/A21.11, *Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings*

AWWA C606, *Grooved and Shouldered Joints*

NFPA 11, *Low-, Medium-, and High-Expansion Foam*

NFPA 13, *Installation of Sprinkler Systems*

NFPA 14, *Installation of Standpipe and Hose Systems*

NFPA 15, *Water Spray Fixed Systems for Fire Protection*

NFPA 16, *Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*

NFPA 20, *Installation of Stationary Pumps For Fire Protection*

NFPA 22, *Water Tanks for Private Fire Protection*

NFPA 24, *Installation of Private Fire Service Mains and Their Appurtenances*

NFPA 750, *Water Mist Fire Protection Systems*

NFPA 13R, *Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height*

UL 157, *Gaskets and Seals*

5 Glossary

5.1 For the purposes of this standard, the following definitions apply.

5.2 CHECK VALVE – A self-acting device that is designed to allow fluid flow in one direction.

5.3 DETECTOR CHECK VALVE – A check valve equipped with a bypass around the valve to allow relatively small flows without operation of the valve. The bypass allows installation of a water meter to record a small usage of water.

5.4 NPS (NOMINAL PIPE SIZE) – A dimensionless designator for pipe sizes used to replace terms such as "nominal diameter" and "nominal size". Defined in standards including in the:

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

b) Standard Specification for Electric-Resistance-Welded Steel Pipe, ASTM A135/A135M; and

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

5.5 POPPET CHECK VALVE – A check valve incorporating a disc, clapper, or plug that moves uniformly away from or towards the valve seat.

5.6 SPLIT CLAPPER CHECK VALVE – A check valve incorporating a split-disc type clapper that pivots about a hinge pin located approximately in the center of the waterway.

5.7 SWING CHECK VALVE – A check valve incorporating a single clapper that rotates about a fixed location. These valves are manufactured with screwed, flanged, grooved pipe connections.

5.8 WAFER CHECK VALVE – A check valve having outside body and end connection dimensions that are less than the inside diameter of the bolt pattern of flanges of the same nominal pipe size. One set of flange studs long enough to span the valve is used to clamp the wafer check valve between its mating flanges.

CONSTRUCTION

6 General

6.1 Valve sizes refer to the nominal diameter of the waterway through the end connections and to the nominal pipe size for which the end connections are intended. The diameter of the waterway through the seat ring of a valve may be reduced below that of the waterway through the end connections.

7 Rated Pressures

7.1 A check valve of 12 NPS or smaller shall be constructed for a minimum rated pressure of 175 psig (1.2 MPa).

7.2 A check valve of a size larger than 12 NPS shall be constructed for a minimum rated pressure of 150 psig (1.0 MPa).

8 Metallic Materials

8.1 Metallic materials used in check valve samples submitted for investigation and test shall conform to the minimum physical property requirements of the latest edition of the applicable ASTM or equivalent material standard, as specified by the manufacturer.

9 Bodies and Covers

9.1 A body and cover shall be made of a material having strength and corrosion resistance at least equivalent to cast iron.

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

9.3 The dimensions of all flanged, threaded, grooved, shouldered and mechanical joint body end connections, and threaded and flanged 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) 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 Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250), ANSI/ASME B16.1 (Class 125 or higher).

d) Standard for Steel Pipe Flanges for Waterworks Service – Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm), ANSI/AWWA C207, for valves having a maximum rated pressure of 175 psig (1.2 MPa); and the Standard for Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard, ANSI/ASME B16.5, for valves having a maximum rated pressure greater than 175 psig.

e) Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings, ANSI/AWWA C111/A21.11.

f) Standard for Grooved and Shouldered Joints, ANSI/AWWA C606.

9.4 A wafer check valve shall be constructed to fit between flanges made in accordance with the requirements for Class 125 or higher flanges in the American National Standard for Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250), ANSI/ASME B16.1.

9.5 Check valves shall be constructed to be field serviced. A check valve weighing more than 60 pounds (27 kg) shall be provided with an access cover, lifting lug, or an eyebolt to facilitate servicing.

Exception: Check valves in sizes 2-1/2 NPS and smaller may be constructed without having provisions for field servicing.

9.6 The load on any bolt shall not exceed the minimum tensile strength specified in Table II of the Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength, ASTM A307, when

the valve is at the test pressure specified in 21.1. The area of the application of pressure is to be calculated as follows:

a) To an area defined by a line contacting the inner portion of the bolt holes when a full-face gasket is used, or

b) To the centerline of the "O" ring or gasket, when an "O" ring or gasket is used.

10 Valve Mechanisms

10.1 Internal working parts that are removed during intended maintenance shall be removable without damaging the valve and without requiring the use of special tools.

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

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

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

b) Be fitted with bushings, inserts, or other parts made of the corrosion-resistant materials specified in (a) at those points where freedom of motion is required.

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

10.5 An internal spring used in a check valve shall be made of material having corrosion resistance equivalent to phosphor bronze and shall be capable of at least 50,000 cycles of intended operation. See Cycling Test, Section 16.

10.6 All parts within the valve shall be secured so that the parts cannot separate in use.

11 Clapper Supports

11.1 A clapper arm shall be:

a) Made of bronze or equivalently corrosion-resistant material; or

b) Fitted with a bushing(s) made of bronze or other corrosion-resistant material where moving parts can be expected to be in contact with other parts.

11.2 A clapper arm bushing or hinge pin bearing shall project a sufficient distance to maintain not less than 1/8 in (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 equivalently corrosion-resistant material and shall be long enough to extend inside the walls of cast iron bodies to provide an end-bearing surface.

11.3 A clapper arm shall be supported by a hinge pin(s) made of bronze or equivalently corrosion-resistant material; or another equivalent method. The clapper support shall be constructed to resist the impact effect on it 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 ft per second (4.6 m/s). Bronze hinge pins not less than 3/8 in (9.5 mm) in diameter for valves of 3 NPS or less, and not less than 7/16 in (11.1 mm) in diameter for valves of 3-1/2 to 14 NPS complies with this requirement.

11.4 When a hinge pin is used a bearing shall be constructed to reduce the risk of corrosive action causing parts to bind or seize.

11.5 The length of a hinge pin support bearing or a clapper arm bearing consisting of a material having strength and corrosion resistance equivalent to cast iron shall be equal to or greater than 70 % of the diameter of the hinge pin, but not less than 5/16 in (7.9 mm). A clapper arm bearing made of material having strength and corrosion resistance equivalent to Series 300 stainless steel shall have a minimum length of 0.165 in (4.2 mm). Equivalency is to be determined by means of comparative corrosion tests, depending upon material type. When a hinge pin is not used, the clapper support shall comply with the requirements of 11.3.

12 Clapper Stops

12.1 When a valve is fully open, the point of contact between the valve body and clapper shall be located so that impact or the reaction of the water will not tend to damage, twist, or bend the parts.

12.2 If a clapper stop is located on a hand-hole cover of the body, the cover shall be constructed and arranged so that it cannot be attached to the body in any position other than its intended position.

13 Seats

13.1 The seating surfaces of a valve shall be constructed to resist leakage. See Leakage Test, Section 20.

13.2 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 in (3.2 mm) wider than the surface of the body seat ring.

13.3 A seating surface that is contacted by a resilient material shall be made of metallic material having corrosion resistance at least equivalent to brass, bronze, ni-resist iron, or ductile iron having a nickel plating at least 0.003 in (0.08 mm) thick; or nonmetallic material complying with the requirements specified in Nonmetallic Materials Test, Section 17.

13.4 A seating surface that is contacted by a 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 18.

13.5 A rubber seat shall be clamped, mechanically secured, bonded, or vulcanized to the valve body or disc.

13.6 The seating surface of a clapper having a flat resilient facing shall overhang the surface of the seat ring on the inside by not less than 1/4 in (6.4 mm) and on the outside by not less than 1/8 in (3.2 mm).

13.7 The diameter of the cross section of an "O" ring used as a seating surface shall be at least 1/4 in (6.4 mm) less in width than the width of its mating seating surface.

13.8 A rubber seat bonded to or encasing the clapper shall be designed to withstand separation, tearing, or permanent distortion. See Disbondment Test, Section 19.

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

13.10 A flat resilient clapper facing shall be clamped in place with a solid clamping ring having an outside diameter at least 1 in (25.4 mm) greater than the diameter of the circle circumscribing the stud(s) used to secure the ring at its inner edge of the centerline of the bolt circle if bolts are used. A clapper in contact with a flat resilient clapper facing shall have a finished surface. The clamping ring shall be bronze or equivalently corrosion-resistant material. The clamping ring shall be constructed and arranged so that it does not interfere with the valve seat and shall come to a stop against a shoulder. After assembly of the facing and clamping ring on the check, the assembly shall be pinned or locked in position.

13.11 An "O" ring facing shall be recessed or similarly restrained for at least two-thirds of its cross sectional area. With the clapper in the closed position, the "O" ring shall be centered on the seating surface.

13.12 A screw or other part used to hold a clapper facing clamping ring in place shall be bronze or equivalently corrosion-resistant material.

14 Clearances

14.1 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 cause a valve to be sluggish in action or not to operate as intended. Examples of required valve clearances and references to specific sections of this document are illustrated in Annex A.

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

14.3 A diametrical clearance of not less than 1/4 in (6.4 mm) shall be provided so that there is no 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.

14.4 The clearance between hinge pins and their bearings shall be not less than 0.005 in (0.13 mm).

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

14.6 The clearance between the clapper in a wafer check valve installed in accordance with the manufacturer's specifications and the inside wall of Schedule 40 steel pipe of the same nominal pipe size as the valve shall be not less than 3/8 in (9.5 mm) in any clapper position except fully open.

PERFORMANCE

15 General

15.1 Representative samples of each size check valve shall be subjected to the tests described in Sections 16 – 23. 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.

16 Cycling Test

16.1 Valves using a spring or equivalent force producing member for operation in a valve mechanism shall operate as intended, and without fracture of the spring or the force producing member, for 50,000 cycles of operation when tested in accordance with 16.2 – 16.3.

Exception: Valves having a hinge pin and no return spring are not required to be evaluated.

16.2 A representative size valve assembly shall be placed in the horizontal position. For swing, split clapper and wafer type check valves, the valve clapper is to be cycled by rotating the clapper from the seated position to 45° and then returning the clapper to the seated position by applying a force to the clapper. For poppet type valves, the disc clapper or plug shall be moved from the seat a distance of 50 % of the maximum design distance and then returned to the seated position by applying a force to the clapper.

16.3 The valve is to be subjected to 50,000 cycles of operation at a rate not exceeding 6 cycles per minute.

17 Nonmetallic Materials Test

17.1 General

17.1.1 A plastic or other nonmetallic part, other than elastomeric parts such as clapper facings and "O" rings, shall comply with the requirements of 17.2.1 – 17.2.4.

17.1.2 Elastomeric parts, except gaskets, of each size and type used in the various assemblies shall comply with the requirements in 17.3.1 and 17.3.2.

17.2 Plastic parts

17.2.1 Following air-oven aging for 180 days at 121 °C (250 °F), there shall be no warping, creeping, or other signs of deterioration of a plastic component that may preclude the intended operation of the valve. There shall be no cracking of any plastic component. A valve with aged plastic components shall demonstrate acceptable performance when subjected to the Leakage Test, Section 20.

17.2.2 A complete valve assembly, including the plastic parts, 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 h before conducting any test or dimensional check. Prior to any tests, elastomeric parts complying with 17.3.1 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 the Standard Specification for Gravity-Convection and Forced-Ventilation Ovens, ASTM E145.

17.2.3 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.

17.2.4 Following immersion in tap water at 87 ±2 °C (189 ±3.6 °F) for 180 days, there shall be no warping, creeping, or other signs of deterioration of a plastic component that may preclude the intended operation of the valve. There shall be no cracking of any plastic component. Valves with aged components shall demonstrate acceptable performance when subjected to the Leakage Test, Section 20.

17.3 Elastomeric parts (except gaskets)

17.3.1 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 %.

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 %.

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).

17.3.2 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 in (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 Adhesion Test for Resilient Seat Materials

18.1 Compliance with the requirements specified in 13.4 is to be determined by either tinning of the metal seat or by subjecting a representative seat assembly to a compressive load while immersed in tap water as described in 18.2 and 18.3, and being capable of separating the seat assembly as described in 18.3(e).

18.2 The assembly to be immersed in tap water shall consist of a compression test fixture capable of use as specified in 18.3 (a) – (e), and consisting of:

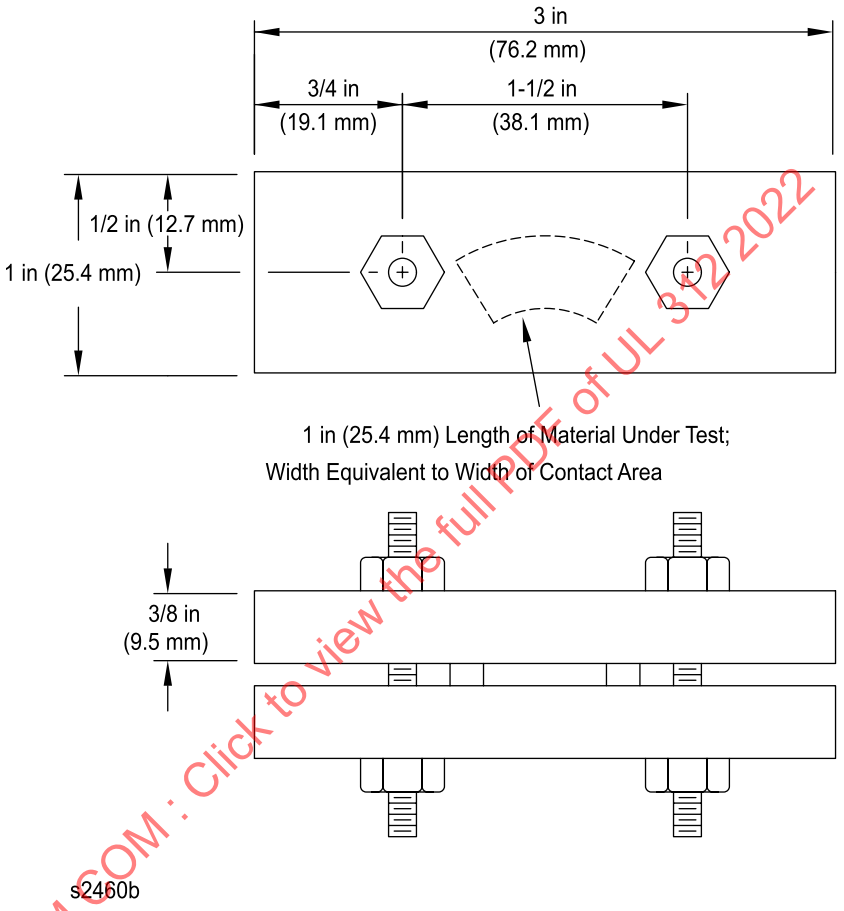
a) A full circular seat;

b) Valve ring with a full circular section of resilient clapper facing material held together with a bridging construction; or

c) Consisting of a section of a circular seat or valve ring with a comparable section of a resilient clapper facing material of the same circumferential length as the seat. In this case these sections are to be placed within a test fixture with a bridging construction; or capable of accommodating a 1 in (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. An example of this assembly is illustrated in Figure 18.1.

Figure 18.1

Test Fixture for Section of Facing Material



18.3 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 formula:

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

where:

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

D = Diameter, in inches (mm × 0.04), measured along the sectional centerline of the resilient valve seat material. This diameter is equal to the outer diameter (OD) of the seat material minus the width (W) of the material, see Figure 18.2;

p = Pressure rating of the valve, in psig (MPa ×145); and

l = Length, in inches (mm × 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 18.2.

b) The amount of compression required to achieve the force, *Fc*, specified in 18.3(a) is to be measured, in millimeters, to the nearest 2 mm.

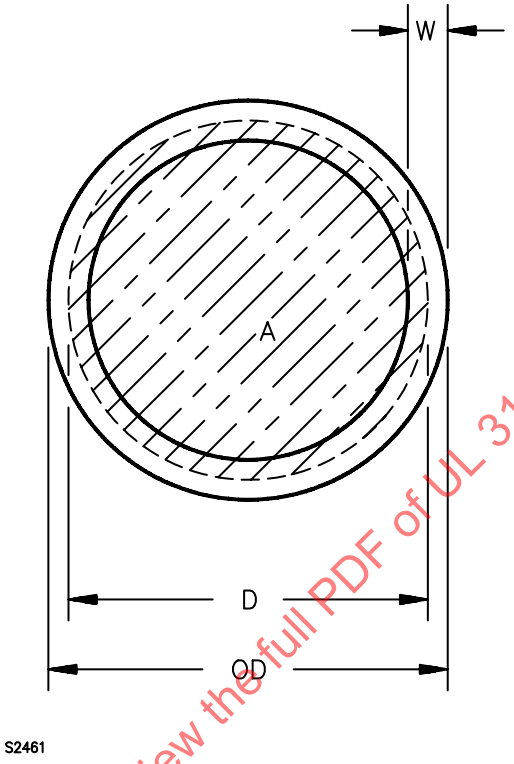
c) The compression fixture is to be removed from the tension-compression machine, and the fixture compressed by its clamping means until the compression measured as specified in 18.3(b) is achieved.

d) The clamped compression fixture assembly is to be immersed for 90 days in tap water maintained at a temperature of 87 ±2 °C (189 ±3.6 °F). After 30 and 60 days of immersion, the assembly is to be removed from the water, the compression methods specified in 18.3 (a) – (c) are to be repeated, and the assembly reimmersed in the water.

e) After 90 days of immersion, the fixture clamping means is to be removed and the fixture left undisturbed for 1 h. The fixture then is to be secured to the jaws of the tension-compression testing machine to preclude the introduction of shear forces during the remainder of this test. With the jaws separating at the rate of 0.1 in (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, and shall not exceed the force equivalent to a 5 psi (34 kPa) differential acting over the area A, defined by the diameter D, see Figure 18.2.

Figure 18.2

Dimensions of Resilient Facing Material



19 Disbondment Test

19.1 A rubber seat bonded to or encasing the clapper shall withstand separation, tearing, or permanent distortion when subjected to the waterflow described in 19.2.

19.2 A representative size valve, is to be subjected to a waterflow velocity of 25 ft per second (4.6 m/s) for 1 h. Following the waterflow, the valve is to be visually examined for separation, tearing, or permanent distortion of the resilient material from the base metal.

19.3 The flow at 25 ft per second (4.6 m/s), as required in 19.2, is based upon the open area in the Schedule 40 pipe of the same nominal pipe size as the valve.

20 Leakage Test

20.1 A check valve shall withstand for 1 minute, without leakage at joints or at the valve seat, an internal hydrostatic pressure of two times the rated pressure of the valve. Slight weeping of water at the valve seat is acceptable for metal-to-metal seats. Leakage past clappers with, or in contact with, resilient seats is not acceptable.

20.2 For the purposes of this test, "slight weeping" is defined as leakage not exceeding 1 fluid ounce per h (0.008 mL/sec) per in (25.4 mm) of nominal valve size.

20.3 A check valve with a resilient facing shall withstand for 16 h, without leakage at the valve seat, an internal hydrostatic pressure equivalent to the head of a column of water 5 ft (1.5 m) high retained within the downstream portion of the valve body. No leakage shall occur as evidenced by wetting of paper placed

beneath the valve assembly. This test is to be conducted with the valve in both the horizontal and vertical position if intended for such use.

21 Strength of Body Test

21.1 An assembled valve shall withstand, without rupture, an internal hydrostatic test pressure of four times the rated pressure applied for 5 minutes. During this test the valve clapper is to be blocked open to impress the test pressure on all parts of the valve assembly subject to rated pressure.

21.2 The strength of body test is an internal hydrostatic pressure test for strength of body castings, flanges, covers, and the like, is not considered a test for gaskets or seals. Gaskets used with castings or parts having large areas may be reinforced. Other materials that can withstand the pressure may be substituted for regularly used gaskets and seals.

22 Hydraulic Friction Loss Test

22.1 Head losses due to hydraulic friction shall not exceed 3 psi (21 kPa) at a flow rate that corresponds to a velocity of 15 ft per second (4.6 m/s).

22.2 The flow at 15 ft per second (4.6 m/s) is based upon the open flow area in Schedule 40 steel pipe of the same nominal pipe size as the valve.

22.3 The sample check valve is to be installed in its intended position in a test piping system. This test line is to be equipped with calibrated nozzles or equivalent means by which selected rates of flow can be established. A differential pressure gauge is to be connected to piezometer fittings located upstream and downstream from the test valve by means of which the loss-of-head between the two piezometer fittings is to be measured. Selected flow rates are to be established and the loss-of-head over the valve plus that over the piping between piezometers for each rate of flow is to be calculated from the differential pressure measurements.

22.4 The sample valve then is to be removed from the test piping and the loss-of-head for test piping located between the piezometer fittings is to be determined for the same rates of flow. The loss-of-head for the check valve then is to be determined by subtracting the losses over the piping alone from the losses over the piping and valve.

23 Detector Check Valve Differential Test

23.1 A detector check valve shall operate while being subjected to under a differential pressure of not less than 42 in of water (10.4 kPa) and not more than 84 in of water (20.9 kPa).

23.2 For the purposes of this test, the operating differential is defined as the pressure between the inlet and outlet of the valve at which leakage past the valve seat occurs.

MANUFACTURING AND PRODUCTION TESTS

24 General

24.1 The manufacturer shall provide the necessary production control, inspection, and tests.

24.2 The program shall include at least factory testing of each valve for body and seat leakage. Each test is to be conducted at twice the rated pressure, and the pressure is to be held as long as necessary to determine acceptability, but in no case less than 15 s. There shall be no leakage through the body or cover, no distortion, and no more than a slight weeping (see 20.2) past the clapper for metal-to-metal

seats. Leakage past clappers with, or in contact with, resilient seats is not acceptable. Other test arrangements may be considered and accepted if found to achieve the results contemplated.

MARKING

25 General

25.1 A check valve shall be marked with the following:

a) Name or identifying symbol of the manufacturer or private labeler.

b) Nominal pipe size of valve.

c) Distinctive model number, catalog designation, or the equivalent.

d) Rated pressure.

e) Year of manufacture. A valve produced in the last three months of a calendar year may be marked with the following year as the date of manufacture. A valve produced in the first six months of a calendar year may be marked with the previous year as the date of manufacture.

f) Arrow showing direction of flow.

g) Intended position of installation, such as "Horizontal" or "Vertical"; except that, if the valve may be installed in either position, the marking of the position is not required.

25.2 The markings specified in 25.1 (a) – (e) and (g) shall be included on the body or cover casting using one of the following methods:

a) Cast letters and figures at least 3/8 in (9.5 mm) high and raised at least 0.030 in (0.8 mm) above or recessed at least 0.050 in (1.3 mm) below the surface of the body or cover.

b) Placed on an etched or stamped corrosion resistant metal nameplate permanently mounted on the valve body or cover plate using letters at least 3/32 in (2.4 mm) high and at least 0.005 in (0.13 mm) deep.

Exception: The marking specified in 25.1(e) may be stamped on a flat space provided for the purpose in lieu of the marking methods specified in 25.2 (a) and (b). The letter height shall be as specified in 25.2(a).

25.3 The marking specified in 25.1(f) shall be included on the body casting in the form of a cast figure. As an alternative, if the access cover can be attached to the valve body in only one orientation, the marking may be placed on the cover.

25.4 If a manufacturer produces valves at more than one factory, each valve shall have a distinctive marking by which the valve may be identified as the product of a particular factory.