JOINT CANADA-UNITED STATES
NATIONAL STANDARD

ANSI/CAN/UL 260:2023

STANDARD FOR SAFETY

Dry Pipe and Deluge Valves for Fire-Protection Service

ANSI/UL 260-2023

SCC FOREWORD

National Standard of Canada

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UL Standard for Safety for Dry Pipe and Deluge Valves for Fire-Protection Service, ANSI/CAN/UL 260

Eighth Edition, Dated October 31, 2023

Summary of Topics

This new Eighth Edition of ANSI/CAN/UL 260, Standard for Dry Pipe and Deluge Valves for Fire-Protection Service, dated October 31, 2023 includes clarification of products covered by the Scope and additional revisions throughout.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated May 12, 2023.

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Standard for Dry Pipe and Deluge Valves for Fire-Protection Service

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Sixth Edition – May, 1994
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Eighth Edition

October 31, 2023

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

The most recent designation of ANSI/UL 260 as an American National Standard (ANSI) occurred on October 31, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface, and SCC Foreword.

This standard has been designated as a National Standard of Canada (NSC) on October 31, 2023.

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Preface (UL)

This is the Eighth Edition of the ANSI/CAN/UL 260, Standard for Dry Pipe and Deluge 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 260 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 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.

This Edition of the Standard has been formally approved by the Technical Committee (TC) for 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

Name	Representing	Interest Category	Region
Diantao Bai	Tianjin Fire Research Institute Of MEM Shenzhen Inter Safety Technology CO LTD	Testing & Stds Org	China
Ken Bush	Office of the Maryland State Fire Marshal	AHJ/Regulator	USA
Virginia Charter	Oklahoma State University	General Interest	USA
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Corey Gall	Sprinkler Fitters UA Local 183	General Interest	USA
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TC 260 Membership Continued on Next Page

TC 260 Membership Continued

Name	Representing	Interest Category	Region
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Jeffrey Zwirn	IDS Research Development Inc	General Interest	USA

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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 valve equipment intended for installation in piping systems to supply water automatically to dry pipe, deluge, and pre-action sprinkler systems for fire-protection service.

1.2 Valves covered by these requirements may be a differential type, latched-clapper type, or a combination of these types.

1.3 The valves covered by these requirements are intended for installation and use in accordance with the following standards:

a) Standard for Low-, Medium-, and High-Expansion Foam, NFPA 11.

b) Standard for the Installation of Sprinkler Systems, NFPA 13.

c) Standard for the Installation of Standpipe and Hose Systems, NFPA 14.

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

e) Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems, NFPA 16

1.4 This standard does not cover low-differential dry pipe valves or valves with differentials outside of the requirement specified for differential dry pipe valves.

2 Components

2.1 Auxiliary components or attachments to valves, such as water-motor-driven alarm gongs, electric circuit closers, pressure-operated switches, pressure gauges, trim and drain valves, and the like, shall comply with the requirements for such devices or products and also with respect to the particular application. See UL 753, UL 393, and UL 258. Also see 2.2 – 2.5.

2.2 Except as indicated in 2.3, a component of a product covered by this standard shall comply with the requirements for that component.

2.3 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.

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

2.5 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 publications are referenced in this Standard:

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: Class 25, 125, and 250*

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

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 3,600 mm)*

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*

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 ALARM DEVICE – A mechanical or electrical device to sound an alarm on operation of the valve.

5.3 AUTOMATIC DRAIN VALVE – A valve connected in the open position to the intermediate chamber of a dry pipe valve so as to drain water from the chamber and vent the chamber to atmosphere when the valve is in the set position, and limits water flow from the chamber after the valve is tripped.

5.4 CLAPPER – That portion of a valve mechanism on which air pressure or water pressure, or both, act and which opens to allow water to flow through the valve when operated.

5.5 DELUGE VALVE – An automatic water-supply control valve that is intended to be operated by:

a) Mechanical, electrical, hydraulic, pneumatic, or a thermal fire detection system installed in the same area as sprinklers;

b) Manual means; or

c) A combination of these methods.

A deluge valve is intended to admit water into:

d) A piping system having open sprinklers (deluge systems); or

e) A piping system with closed sprinklers (pre-action systems).

5.6 DIFFERENTIAL – The ratio of system water supply pressure to system air pressure, expressed as gauge pressures measured at the trip point.

5.7 DIFFERENTIAL DRY PIPE VALVE – A dry pipe valve having an air clapper of larger area relative to the area of the water clapper with the two separated by an intermediate chamber maintained at atmospheric pressure.

5.8 DRY PIPE VALVE – An automatic sprinkler water-supply control valve constructed so that air pressure in a system of piping will retain water pressure and flow until the air pressure in the system is released by actuation of an automatic sprinkler, manual release, or other similar devices causing automatic operation of the valve and allowing water into the system.

5.9 INTERMEDIATE CHAMBER – That portion of a differential dry pipe valve which separates the air and/or water clapper seating surfaces and that is at atmospheric pressure when the valve is in the set position.

5.10 LATCH, ANTI-RESEAT – A latch mechanism provided in a differential dry pipe valve designed to prevent the clapper from returning to its set position after operation.

5.11 LATCHED-CLAPPER TYPE VALVE – A valve in which a mechanism acts to produce a force which is multiplied through a series of levers, links, or latches to maintain the water clapper in the closed position. Such a valve is sometimes referred to as a mechanical type.

5.12 LEAK POINT – The system air pressure and service water pressure at which water begins to emit from the intermediate chamber drain during the tripping sequence of a valve.

5.13 NPS (NOMINAL PIPE SIZE) -– A dimensionless designator for pipe sizes defined in standards including 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 and ASTM A795/A795M, Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use. Used to replace terms such as "Nominal Diameter" and "Nominal Size."

5.14 PILOT SPRINKLER – An automatic sprinkler connected to an air or water line, which in turn is connected to a deluge, pre-action, or other water-supply control valve; when actuated, the sprinkler will cause the valve to operate.

5.15 PRIMING CONNECTION – A port provided in the valve body to allow water to enter above the clapper when the valve is in the set position.

5.16 SET POSITION – The position of a valve clapper and other operating parts with system pressure and system air pressure applied when the valve is ready for operation.

5.17 SYSTEM AIR PRESSURE – The static air pressure in the system piping when the valve is in the set condition.

5.18 SYSTEM PRESSURE – The static water pressure at the main outlet of a valve when the valve is in the set condition.

5.19 TRIP POINT – That system air pressure and service water pressure at which the valve clapper begins to move away from the set position to allow water to flow into the system.

5.20 TRIPPING DEVICE – A device for operating a dry pipe or deluge valve, initiated by a fire detection system or by manual means.

5.21 VALVE GAG – Any supplementary means which prevents normal operation.

5.22 WATER COLUMNING – A condition occurring in a dry, deluge, or pre-action fire suppression system where water accumulates downstream of the clapper of a system control valve, preventing the control valve from operating.

5.23 WATER-MOTOR OPERATED ALARM – A mechanical alarm device (operated by energy or water flow) attached to a dry pipe, pre-action, or deluge valve and supplied with water from the intermediate chamber or discharge side of the valve, to sound an alarm on operation of the valve.

5.24 WET PILOT SPRINKLER LINE – A hydraulic detection and actuation piping system equipped with heat responsive devices, commonly automatic sprinklers which when subjected to heat from a fire, operate to release water pressure from the piping system causing the automatic operation of a deluge valve.

CONSTRUCTION

6 Sizes

6.1 Valves covered by these requirements include sizes 1 – 16 NPS, inclusive.

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

7 Rated Pressure

7.1 A valve shall be constructed for a minimum rated pressure of 175 psig (1206 kPa).

8 Metallic Materials

8.1 Metallic materials used in dry pipe and deluge valve samples submitted for investigation and test shall conform to the minimum physical property requirements of the latest edition of the applicable ASTM or similar material specification as referenced by the manufacturer.

9 Operating Mechanisms

9.1 Differential type dry pipe valves

9.1.1 A differential dry pipe valve shall have a differential within the range of 4.5:1 and 11:1 for all service pressures from 20 psig (138 kPa) to the maximum rated pressure. The difference between the maximum and minimum values of the differential, as determined during tests of any individual valve, shall not exceed 3.5.

9.2 Latched-clapper type dry pipe valves

9.2.1 The minimum system air pressure at which a latched-clapper type dry pipe valve will trip shall be at a value to provide for positive operation under any condition. The minimum air pressure causing the valve to trip shall be 15 psig (103 kPa) at 150 psig (1034 kPa) service pressure.

9.2.2 A latched-clapper dry pipe valve shall be either:

a) Constructed to reduce the likelihood of water leakage from the water side of the valve to the air side when in the set position; or

b) Provided with a positive means of venting any leakage of water from the space above the clapper.

9.3 Deluge valves

9.3.1 A deluge valve shall be operable by automatic and manual means. The valve shall be arranged for attachment of both types of operating means.

9.3.2 An automatic operating means of the electric type shall be constructed for operation from both a primary and a secondary source of electric energy.

10 Bodies and Covers

10.1 The body and cover of a valve shall be made of material having corrosion resistance at least equivalent to cast iron. If nonmetallic materials are used, they are to be judged on the basis of their ability to resist external fire exposure and thermal shock.

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

10.3 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 B1.20.3;

b) ASME B1.20.1;

c) ASME B16.1;

d) AWWA C207 or ASME B16.5, for valves having a maximum rated pressure greater than 175 psig (1206 kPa); and

e) AWWA C606.

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

10.5 The point of connection of alarm piping to a valve shall be such that pressure sufficient to operate alarms is available at any flow rate through the valve from 1 to 20 feet per second (0.3 – 6 m/s), with a residual pressure at the valve of 15 psig (103 kPa).

10.6 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.

10.7 A tapped opening provided for main drain piping shall be located on the water-supply side of the valve clapper. An additional tapped opening for system drain piping shall be provided on the system side of the clapper.

10.8 A body handhole opening shall be provided and shall be sufficiently large to permit access to all working parts and to 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 operating 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.

10.9 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.

10.10 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.

10.11 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.

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

10.12 A handhole cover plate weighing more than 30 pounds (13.6 kg) shall have an attached chain, or the equivalent, in turn secured to the body casting, or arranged for attachment to an end flange bolt, as assistance in handling the plate when being removed or reassembled.

11 Valve Mechanisms

11.1 General

11.1.1 An internal operating part whose removal may become necessary shall be readily accessible, removable, and replaceable without damage.

11.1.2 The construction of a valve part which is disassembled in field servicing shall be such that it cannot be improperly reassembled.

11.1.3 A valve mechanism shall be constructed to provide freedom of movement of operating parts. Examples of required valve clearances and references to specific sections of this document illustrated in Annex B.

11.1.4 A part that bears against, rotates within, or slides on stationary parts, and that must be free to move during valve operation, shall be either made of corrosion-resistant material, such as bronze, brass, chrome-plated bronze, monel metal, and other suitable non-metallic material. The parts, if made of materials lacking corrosion-resistant properties, shall be fitted with bushings, inserts, or other parts made of corrosion-resistant materials named above at those points where freedom of motion is required.

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

11.1.6 A clapper arm shall be made of bronze or equally corrosion-resistant materials or, if made of ferrous materials, shall be equipped with bronze bushings or bushings of equivalent corrosion-resistant material at the point where it engages a hinge pin or other moving part.

11.2 Clapper supports

11.2.1 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.

11.2.2 A clapper arm shall be supported by a hinge pin(s) made of bronze or other equally corrosion-resistant material. The hinge pin(s) shall be constructed to withstand 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 rate of 15 feet per second (4.5 m/s). Bronze hinge pins not less than 3/8-inch (9.5-mm) diameter for valves of 3 NPS or less, and not less than 7/16-inch (11-mm) in diameter for valves of 3-1/2 NPS or larger, meet the intent of this requirement and are acceptable.

11.2.3 A bearing shall minimize the possibility that corrosive action will cause parts to bind or seize.

11.2.4 Each hinge-pin support bearing and clapper-arm bearing shall have a length equal to or exceeding 70 percent 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.

11.2.5 A valve mechanism shall not employ any parts which become disengaged or dislodged during the operation of the valve.

11.2.6 A valve clapper assembly shall include no features which provide a path for leakage of water from the supply side of valves to the system side. As an example, a tapped opening on the underside of a clapper to receive a screw or bolt holding a retaining ring for a valve facing in position shall terminate within the clapper metal.

11.2.7 The construction of and hinging of the moving parts of a valve shall be such that the parts do not damage a clapper facing or seat ring by striking them during valve setting or during operation of the valve.

11.2.8 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 equally corrosion-resistant material and shall be long enough to extend inside the walls of cast-iron bodies to provide an end bearing surface.

11.2.9 If a side plug is not used to support a hinge pin, bearings formed in cast iron or other materials that have equivalent corrosive properties shall be equipped with bronze or equally corrosion-resistant bushing material over the bearing surface of the hinge pin.

12 Anti-Reseat Latches

12.1 Anti-reseat latches are required on all valves that are susceptible to collecting water above the clapper (water column) or are undrainable from above the clapper after operation.

12.2 A latch and a latch spring shall be made of bronze or other equally corrosion-resistant material.

12.3 A latch-operating spring shall be of such construction and material that its function is not impaired by intended stress. The spring shall be retained and arranged to prevent abrasion, binding, buckling, or other interference with its free movement.

12.4 A latch shall be constructed to reduce the risk of its becoming sluggish in action or inoperative due to corrosion or deposits of sediment or other foreign matter.

12.5 The valve construction shall be such that, during operation, a clapper assembly will unseat and move to the wide-open position or to some intermediate position determined by the rate of water flow through the valve. A clapper assembly shall not, under any condition, including reverse flow, return automatically to the set position following stoppage of upward flow of water, and a latch shall be provided, where necessary, to accomplish this.

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 does not tend to twist or bend the parts.

13.2 If a clapper latch or stop is located on the cover of the body, the cover shall be constructed so that it cannot be attached to the body in any position other than its intended position.

14 Clapper Rings and Seat Rings

14.1 A metal-to-metal valve-seating surface shall be of bronze or other equally corrosion-resistant material and shall have sufficient width of surface contact to withstand compression stresses and resist damage due to pipe scale or foreign matter carried by the water.

14.2 The face of a metal clapper ring shall have dimensions such that all ferrous-metal parts of the clapper are 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 raised not less than 1/8 inch (3.2 mm) above adjacent portions of the body castings.

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 appropriate for this purpose.

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 24.

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

14.7 A screw or other part used to hold a clapper facing clamping ring in place shall be of bronze or equivalent material and large enough for adequate strength and ease of assembly and disassembly with ordinary tools.

15 Clearances

15.1 Clearances shall be provided between working parts, and between working and stationary parts, so that corrosion or deposits of foreign matter within an assembly do not render a valve sluggish in action or inoperative.

15.2 The clearance between a clapper or a part attached thereto and the inside walls of iron body castings in every position of the clapper, except wide open, shall be not less than 1/2 inch (12.7 mm). This clearance shall be not less than 1/4 inch (6.4 mm) for a bronze-bodied valve.

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

15.4 The clearances between hinge pins and their bearings shall be not less than 0.005 inch (0.13 mm), see Figure B1.2.

15.5 End clearance shall be provided between a clapper arm bearing and its cooperating side bearing surfaces.

16 Drain Components

16.1 Drain components that are not subject to water supply or system pressures are permitted to be made from non-metallic pipe, tubing and fittings.

17 Valve Settings

17.1 A valve shall not be difficult to set properly, and setting the valve shall not require the services of more than one person.

17.2 The construction of a valve shall be such that only tools normally employed by the trade are required in the setting operation.

17.3 A cover enclosing any external valve mechanism shall be designed and located so that it does not interfere with the setting of the valve or inspection of its parts.

17.4 Provision shall be made in the construction of a valve so that a valve cannot be placed in the set position and pressures established at the valve seats without closure of all service openings through which water could flow upon valve operation.

17.5 The valve shall be examined to determine that it is impossible, to return the valve to the set position unless all of the major internal parts have been properly positioned and assembled within the valve.

18 Valve Gags

18.1 The process of setting any valve shall not involve use of a temporary gag even though the gag is automatically released when the valve is completely set.

18.2 A valve shall be constructed to resist gagging. Openings which would normally 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 plate shall be located in a manner that reduces the risk of such insertion.

19 Valve Trim Accessories

19.1 The valve shall be provided with the necessary trim accessories, such as shutoff valves, drains, and fittings.

20 Intermediate Chamber Automatic Drain Valves

20.1 An automatic drain valve shall be provided for differential dry pipe valves and valves incorporating normally vented intermediate chambers. A drain valve may be located within the intermediate chamber for closure by gravity when the clapper mechanism lifts, or it may be an externally assembled flow- or velocity-type drain valve.

21 Priming Water

21.1 A valve requiring priming water to seal the air seat shall be provided with means for priming and a means to prevent overfilling.

PERFORMANCE

22 General

22.1 Representative samples of each size and type of dry pipe and deluge valve together with auxiliary devices shall 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 and chemical tests.

23 Nonmetallic Materials Tests

23.1 General

23.1.1 A plastic or other nonmetallic part, other than elastomeric parts such as clapper facings and "O" rings, shall comply with the requirements of 23.2.1 – 23.2.4.

23.1.2 Elastomeric parts, except gaskets, of each size and type used in the various assemblies shall comply with the requirements of 23.3.1 and 23.3.2.

23.2 Plastic parts

23.2.1 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 normal operation test of 27.6; reseating test of 27.7; and Deformation Test, Section 28.

23.2.2 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 hours before conducting any test or dimensional check. Prior to any tests, elastomeric parts complying with 23.3.1 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.

23.2.3 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.

23.2.4 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 normal operation test of 27.6; reseating test of 27.7; and Deformation Test, Section 28.

23.3 Elastomeric parts (except gaskets)

23.3.1 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 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 considered to be 60 °C (140 °F).

23.3.2 UL 157 provides for the testing of either finished elastomeric parts or sheet or slab material. Sheet or slab material shall 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.

24 Adhesion Test for Resilient Seat Material

24.1 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) – (e); 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 24.1. The bolt holes of the test fixture shall have a diameter of 3/8 inch. 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 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 24.2;

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

l is the 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 24.2.

b) The amount of compression required to achieve the force, *Fc*, in (a) is to be measured, in millimeters, to the nearest 2 mm (.078 inches).

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 in (b) is achieved.

d) The clamped fixture is 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 assembly is to be removed from the water, (a) – (c) are to be repeated, and the assembly reimmersed in the water.

e) Following 90 days of immersion, the fixture clamping means is to be removed and the fixture left undisturbed for 1 hour. The fixture is 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, and 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 24.2.

Figure 24.1

Test Fixture for Section of Facing Material

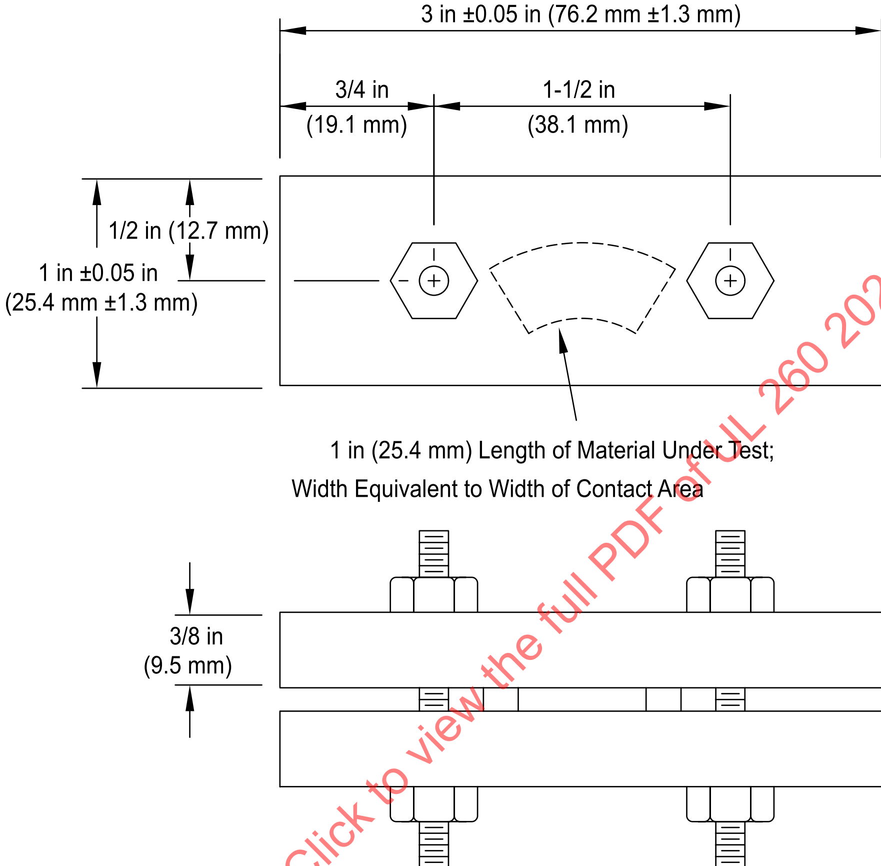

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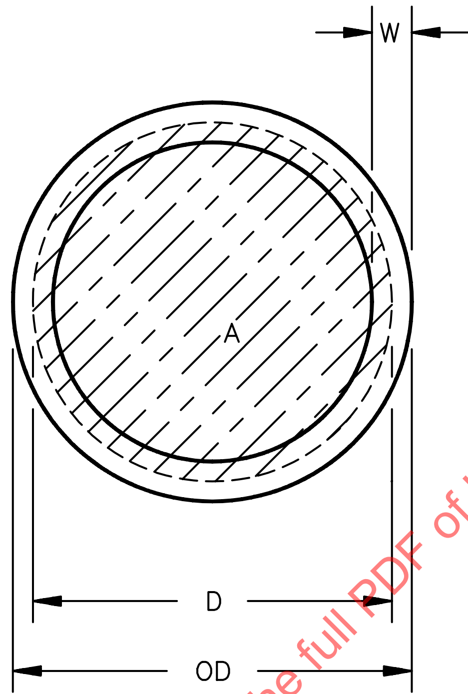
Figure 24.2

Dimensions of Resilient Facing Material



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25 Installation Assembly Test

25.1 A valve shall be constructed to permit installation using tools ordinarily employed by pipe fitters. Outside attachments and accessory equipment shall be capable of being securely attached without difficulty.

25.2 At least one size of a given type, design, or class of valve, equipped with appropriate trim, is to be installed in the position recommended by the manufacturer's installation instructions above a gate valve of similar size in a hydraulic system arranged for conducting the following tests. If the manufacturer's instructions call for installation in more than one position, the test installation is to be that presenting the most difficulties in handling and assembling the valve in the piping. The various fittings and attachments necessary for testing purposes are to be connected as part of this test.

26 Servicing Test for Valves Without Handhole Openings

26.1 A valve that does not incorporate a handhole opening, when tested as specified in 26.2 and 26.3, shall be serviceable, including being able to be removed from the system piping and having its clapper and end seals replaced, using ordinary hand tools in conjunction with any integral means provided with the valve.

26.2 A valve, attached at both ends to appropriately-sized 6-inch long pipe spools, is to be placed in a tension-compression testing machine. The valve assembly is to be subjected to a compression force applied along the longitudinal axis of the pipe spools and of a magnitude equivalent to the weight of the valve plus the additional compression force specified in Table 26.1 corresponding to the size of the pipe used with the valve.

Table 26.1
Additional Valve Compression Force

Valve NPS	Pounds-force	(N)
2	153	(680)
2-1/2	236	(1050)
3	323	(1437)
4	489	(2175)
6	944	(4199)
8	1507	(6703)
10	2237	(9950)
12	3069	(13647)
14	4036	(17948)
16	5132	(22822)

26.3 Following compression, the valve, or serviceable portion of the valve, as appropriate, and end seals are to be removed from the pipe spools while under the compression load by the use of ordinary hand tools along with any integral means provided with the valve. The seals are to be replaced and the valve or valve portion, as appropriate, is then to be reinstalled between the pipe spools by the use of ordinary hand tools along with any integral means provided with the valve.

27 Operation Tests

27.1 General valve types

27.1.1 An assembled dry pipe or deluge valve and its parts shall, when tested with wide-open water-supply valves, operate over a range of water-supply pressures from 5 psig (34.5 kPa) to the maximum rated working pressure and have adequate strength to withstand the stresses imposed.

27.1.2 A clapper assembly, when in intermediate (partly open) positions, on latches, or otherwise, shall be free to move from these positions toward more open positions if the flow rate is increased.

27.1.3 Valves having a diaphragm type sealing assembly, when, after tripped into operating mode, still in close position, shall be free to move to open position when the system pressure is increased. The sealing assembly shall allow water to be admitted into the system at service pressure not higher than 20 psig (138 kPa).

27.1.4 Under reverse-flow conditions, the clapper assemblies of all valves shall be prevented (by latches or otherwise) from moving toward their seats.

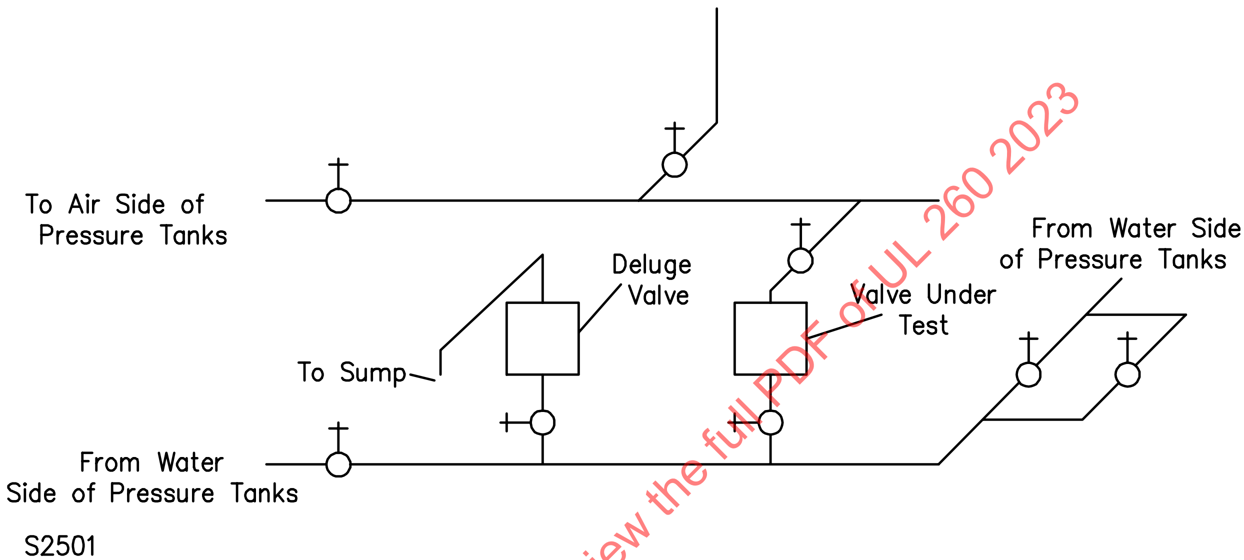
27.1.5 To prevent water columning, a clapper assembly, when in the intermediate position established by the flow of water at a supply pressure of 5 psig (34.5 kPa), shall prevent the establishment of a differential pressure across the valve or be provided with a latching mechanism to hold the clapper assembly away from the body seat ring.

27.1.6 A valve provided with an anti-reseat latch mechanism shall, when tested with an active water supply valve wide open, operate so as to move the clapper assembly to an open position. Under full-flow conditions the clapper assembly shall be wide open, and following stoppage of flow shall remain wide open or be retained by the anti-reseat latch mechanism at a position sufficiently open to prevent damage to the assembly under conditions of high-velocity reverse flow.

27.1.7 The various tests for operation of a valve are to be conducted with the valve installed as recommended in the manufacturer's installation instructions in a system of full-size piping having a water supply sufficient to maintain the required service pressure at the various rates of flow for the duration of each test. The discharge is to be piped to a system of approximately 500-gallon (1.9 m^3) capacity. Such a system is shown in Figure 27.1.

Figure 27.1

Reseating Test



27.2 Differential type dry pipe valves

27.2.1 A valve operating on a differential pressure shall operate promptly after reduction of air pressure in the system above the valve to the normal leak point.

27.2.2 The difference between the leak and trip air pressures shall not exceed 3 psig (20.7 kPa).

27.2.3 A differential-type valve shall operate within the average working differentials specified in 9.1 and 9.2.

27.3 Latched-clapper type dry pipe valves

27.3.1 A latched-clapper dry pipe valve shall provide for positive operation under any setting condition when the system air pressure is at the minimum value recommended by the manufacturer's installation instructions.

27.3.2 The air pressure at the trip point of a latched-clapper valve shall be constant or show an upward trend as the water service pressure is increased.

27.4 Alarm devices

27.4.1 The point of connection of alarm piping to a valve shall be determined by a supplementary operation test in accordance with 10.5.

27.5 Supplementary tripping devices

27.5.1 A valve constructed to operate in response to the action of a manual or automatic tripping device, or combination thereof, shall operate promptly and positively as the result of such action.

27.5.2 Manual or automatic tripping devices, or combinations thereof, shall demonstrate repeatedly the ability to operate in a reliable manner and to transmit the tripping action to the valve within the range of response for which the device is designed.

27.6 Normal

27.6.1 A valve is to be subjected to a series of operation tests at water service pressures including at least those of 5, 10, 15, and 20 psig (34, 69, 103, and 138 kPa), intermediate pressures in 10 psig (69 kPa) increments between 30 and 150 psig (207 and 1034 kPa), and at 155, 160, 165, and 175 psig (1069, 1103, 1138, and 1206 kPa).

27.6.2 A valve having a maximum rated working pressure higher than 175 psig (1206 kPa), in addition to being tested at the pressures specified in 27.6.4, is to be tested at service pressures greater than 175 psig (1206 kPa) in increments of 25 psig (172 kPa), up to and including the maximum rated working pressure to the valve.

27.6.3 In preparation for each test, clapper seats and seat rings and any other operating parts are to be cleaned. The main clapper member is then to be properly seated and the valve placed in the set position. The cover plate is to be bolted in place.

27.6.4 If a dry pipe valve is to be tested, the proper priming water level is to be established, and the system air pressure is to be established at the valve and in the system test piping. The exact air pressure in the system piping, the pressure at which the valve leaked, and the pressure at which it tripped are to be recorded. The exact water service pressure effective on the water seat of the valve is to be recorded for each test. From this data, the differential of the valve is to be computed. Subsequently, observations are to be made of the position of the valve clapper member with relation to its anti-reseat latching mechanism after each operation.

27.6.5 Supplementary operation tests of dry pipe valves are also to be conducted under full-flow conditions and shall comply with the requirements of 10.5.

27.6.6 When a deluge valve is being tested, the clapper latching mechanism is to be placed in the set position. The main water-supply valve is then to be opened wide, and the valve is to be operated using supplemental and manual tripping devices. The pressures on tripping mechanisms are to be recorded before test and at the trip point when these devices are used. The water service pressure is to be recorded and observations made after the test of the position of the valve clapper member with relation to its anti-reseat mechanism.

27.7 Reseating test

27.7.1 When tested as specified in 27.7.1 – 27.7.5, the latch and clapper of a valve shall not be damaged, as evidenced by careful examination of the latch and clapper.

27.7.2 The test valve is to be installed above a gate valve in the system piping in its normal installation position as shown in Figure 27.1. The valve is to be supplied with water from a header on which a second 6-inch automatic water-supply control valve (dry pipe or deluge) is installed and arranged to discharge to a sump through a 6-inch pipe opening. Water is to be supplied to the header through a series of valves. The discharge from the valve under test is to be connected to a piping system having approximately 500-gallon (1.9 m^3) capacity.

27.7.3 The clapper of the test valve is to be manually opened to the widest operating position found in the operating tests and latched in this position, and the cover plate is to be bolted in place. Water is to be admitted into the valve body and system piping to a level sufficient so that there is water on the system side of the valve. Air is to be pumped into the overhead piping to the values shown in Table 27.1, and the gate valve controlling the test valve is to be opened. Water is then to be allowed to flow through the test valve into the overhead piping, trapping the air previously admitted, simulating a system in the tripped condition.

Table 27.1
Reseating Tests

Test No.[a]	Service pressure Psig	Service pressure (kPa)	Initial air pressure Psig	Initial air pressure (kPa)	Supply valve position
1	100	(689)	60	(345)	2-inch supply valve open
2	100	(689)	100	(689)	2-inch supply valve open
3	100	(689)	100	(689)	All supply valves closed
4	150	(1034)	100	(689)	All supply valves closed
5	150	(1034)	125	(862)	All supply valves closed
6	175	(1207)	125	(862)	All supply valves closed
7	200	(1379)	150	(1034)	All supply valves closed
8	225	(1551)	150	(1034)	All supply valves closed
9	250	(1724)	150	(1034)	All supply valves closed

[a] All valves are to be subjected to test Nos. 1 – 6; valves having higher rated service pressures are also to be subjected to Test Nos. 7 – 9, as applicable, to correlate the valve's maximum rated pressure with the test service pressure.

27.7.4 The water-supply pressure is then to be adjusted to the values shown in Table 27.1 and the supply valves at the entrance to the header adjusted in accordance with Table 27.1.

27.7.5 The adjacent automatic water-supply control (dry pipe or deluge) valve is then to be tripped at each condition listed in Table 27.1 causing reverse flow of water and entrapped system air through the valve under test. The test valve is then to be opened and the clapper and latch carefully examined for damage.

27.8 Wet pilot sprinkler line limitations tests

27.8.1 The operating characteristics of a deluge valve are to be determined with relation to the maximum height at which wet sprinklers are to be placed above the valve.

27.8.2 The manufacturer's installation instructions shall provide pilot piping system limitations for a range of service-water pressures between 20 psig (138 kPa) and the rated pressure and in accordance with the formulas and examples shown in Annex A. In determining the pilot line limitations, the actuator trip point pressure as measured during the testing described in 27.6, is to be divided by 1.5 before applying the formulas.

Exception: A manufacturer's calculation method which yields a more restrictive pilot piping system limitation may be used.

28 Deformation Test

28.1 Valves with mechanical latching mechanisms

28.1.1 A valve in which the clapper is held in the set position by means of hold-down latches, a bearing post against which a clapper bears, or other method of mechanically applying force to the clapper, shall:

a) Not deform;

b) Operate normally; and

c) Not leak water past the valve seat after being subjected for 2 hours to a water-service pressure of twice the maximum rated pressure applied to the valve clapper in the set position.

28.1.2 The valve is to be installed on a test fixture and the clapper member placed in the set position. A service pressure of twice the maximum rated pressure is to be established on the supply side of the valve, and this pressure is to be maintained for 2 hours. Observations are to be made to note any sign of leakage.

28.1.3 At the conclusion of the application of pressure, the parts of the valve are to be examined for any signs of damage or deformation. The valve is then to be subjected to operation tests at varying service pressures.

28.1.4 Weepage of water past a metal-to-metal valve seat that does not exceed 1 fluid ounce (30 ml) per hour per inch of nominal valve size is considered acceptable.

28.2 Valves without mechanical latching mechanisms

28.2.1 A valve not incorporating a latching mechanism (see 9.2) shall not deform and not leak water past the valve seat when subjected, for a period of 2 hours, to a hydrostatic pressure of twice the rated pressure exerted on the system side of the valve clapper.

28.2.2 The system side of the valve is to be fitted with appropriate fittings and filled with water so as to exclude all air. A hydrostatic pressure equal to twice the rated pressure is to be applied and maintained for 2 hours.

28.2.3 Observations are to be made for leakage, and at the conclusion of the application of pressure, the parts of the valve are to be examined for any signs of damage or distortion. The valve shall then be subjected to operation tests at varying service pressures. See 27.6.1 – 27.6.6.

29 Hydraulic Friction Loss Test

29.1 Head losses due to hydraulic friction shall not exceed 3 psi (21 kPa) at a flow velocity of 15 feet per second (4.57 m/s) based upon the open area in Schedule 40 pipe of the same nominal size as the valve. For valves without a constant flow path geometry, an additional test is to be conducted at 20 psi (138 kPa) inlet pressure.

Exception: Head losses due to hydraulic friction may exceed 3 psi (20.7 kPa) at a flow rate of 15 feet per second (4.6 m/s) in the full size pipe connection to the valve, if the device is marked to indicate that it is to be used only in hydraulically calculated systems. See 34.4 for marking requirements.

29.2 The sample valve is to be installed in its intended position in a test piping system. This test line is to be equipped with a calibrated nozzle setup or other means by which selected rates of flow can be established. A differential 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 measured. Selected flow rates are to be established and the loss-of-head through the valve plus the loss through the piping between piezometers for each rate of flow is to be determined.

29.3 The sample valve is then 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 valve is then to be determined by subtracting the losses over the piping alone from the losses over the piping and valve.

30 Body Leakage Test

30.1 An assembled valve shall withstand, without evidence of leakage, an internal hydrostatic pressure of two times the rated working pressure of the valve applied for 1 minute.

30.2 During the test, the valve clappers are to be blocked open to impress the test pressure on all parts of the assembly.

31 Strength of Body Test

31.1 An assembled valve shall withstand, without rupture, an internal hydrostatic pressure of four times the maximum rated pressure for 5 minutes. During this test, the valve clappers are to be blocked open to impress the test pressure on all parts of the assembly subjected to the rated pressure may be substituted.

31.2 The hydrostatic 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 a large area may be reinforced. Other materials capable of withstanding the pressure may be substituted.

32 Automatic Drain Valves

32.1 Flow- or velocity-type drain valves employed for normally venting intermediate chambers of valves shall, following closure, remain closed during system drainage until the pressure effective at the clapper or ball becomes less than 2 psig (13.8 kPa). The valves shall open at a pressure between 0.5 and 2.0 psig (3.5 and 13.8 kPa). These valves shall incorporate provisions for manually determining that the intermediate chamber of a dry pipe valve is open to the atmosphere.

32.2 Flow- or velocity-type drain valves shall be provided with a means of manually opening the drain valve when the valve is under pressure.

MANUFACTURING AND PRODUCTION TESTS

33 General

33.1 The manufacturer shall provide the necessary production control, inspection, and tests. The program shall include at least the following:

a) The manufacturer shall check each dry pipe valve of the differential type for leakage past the air and water seat. With the clapper in the closed position, the valve body is to be filled with water above the air seat. Pressure is to be applied at a rate not exceeding 10 psig (69 kPa) in 30 seconds until a pressure of 10 psig (69 kPa) above the trip point is reached, and this pressure is to be maintained for 3 minutes. The water service pressure is to be not less than 25 psig (172 kPa). During the application of pressure, the valve is to be checked for leakage at the intermediate chamber drain. At any of the test pressures, the valve shall not show leakage in excess of 0.1 fluid ounce (3 ml) per minute.

b) The manufacturer shall check each deluge valve for leakage past the water seat. With the valve in the set position, service pressure is to be applied to the inlet side and held for 3 minutes. The valve shall not show leakage in excess of 0.1 fluid ounce per minute at a service pressure of not less than 25 psig (172 kPa).

c) The manufacturer shall conduct an operation test on each dry pipe or deluge valve at a service pressure of at least 25 psig (172 kPa) and not exceeding 100 psig (690 kPa). On differential valve, the working differential shall comply with the requirements in 9.1 and 9.2. All valves shall operate positively, and all valves shall latch in the open position.

d) The manufacturer shall check each dry pipe and deluge valve for body leakage with the clapper in the open position. A hydrostatic test conducted at twice-rated pressure shall disclose no leakage through the body or at joints, deformation, cracks, or other evidence of weakness. Castings shall be smooth, free of scale, lumps, cracks, blisters, sand holes, and defects of any nature which could make them unfit for the use for which they are intended. A casting shall not be plugged or filled; however, impregnation to remove porosity is permissible.

MARKING

34 General

34.1 A dry pipe or deluge valve shall be marked with all of the following:

a) Name or trademark of the manufacturer or private labeler.

b) Nominal 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 3 months of a calendar year may be marked with the following year as the date of manufacture. A valve produced in the first 6 months of a calendar year may be marked with the previous year as the date of manufacture.

f) Position of installation, if the valve is intended to be installed only in the horizontal position. If the valve is designed to operate in the vertical and horizontal positions, the marking is not required.

34.2 Except as specified in 34.6, markings required by 34.1 (a) – (d) and (f) shall be letters and figures that are at least 1/4 inch (6.4 mm) high for a 3 NPS or smaller valve and 3/8 inch (9.5 mm) high for a valve larger than 3 NPS. Markings shall be raised not less than 0.030 inch (0.76 mm) above or recessed not less than 0.050 inch (1.3 mm) below the surface of the body or cover.

34.3 Except as indicated in 34.6, the marking required by 34.1(e) shall be cast in characters sized in accordance with 34.2 or stamped on a flat space provided for the purpose, using figures of the height specified in 34.2.

34.4 Except as indicated in 34.6, the marking required by 29.1 shall be included on the valve body casting to form a permanent part of the assembly and shall include the observed friction loss stated as equivalent feet-of-pipe of a size equal to that of the valve, using s of the height specified in 34.2.

34.5 If a manufacturer produces valve assemblies at more than one factory, each individual assembly shall have a distinctive marking to identify it as the product of a particular factory.

34.6 The markings required by 34.1 (a) – (e) and by 34.4 may be placed on an etched or stamped metal nameplate permanently mounted on the valve or cover plate using letters a minimum of 3/16 inch (4.8 mm) high and 0.005 inch (0.13 mm) deep.

INSTRUCTIONS

35 Installation Instructions and Trim Drawings

35.1 Installation instructions shall be provided with each valve assembly. The instructions shall include:

a) An illustration showing the valve trim as specified by NFPA 13,

b) Pilot characteristics (as determined in 27.8),

c) Cross-section assembly views to explain the valve operation. The valve trim drawing shall specify the type of accessories (that is, shutoff valves, drains, fittings, and the like) for use as trim, and

d) Minimum operating pressure, when the service pressure required to flow water into the system exceeds 5 psi (34.47 kPa).

e) Where a valve exceeds the 3 psi hydraulic friction loss requirement in Section 29, the manufacturer shall indicate in the installation instructions that the device is to be used only in hydraulically calculated systems. The instructions shall include the observed friction loss from testing stated as equivalent feet-of-pipe of a size equal to that of the valve.

35.2 The instructions shall include directions for care and maintenance and shall detail the method for setting the valve. The instructions shall include the following statement or equivalent: "Where difficulty in performance is experienced, the manufacturer or the authorized representative shall be contacted if any field adjustment is to be made."

ANNEX A (informative) – METHOD OF CALCULATION FOR WET PILOT LINE LENGTH

A1 General

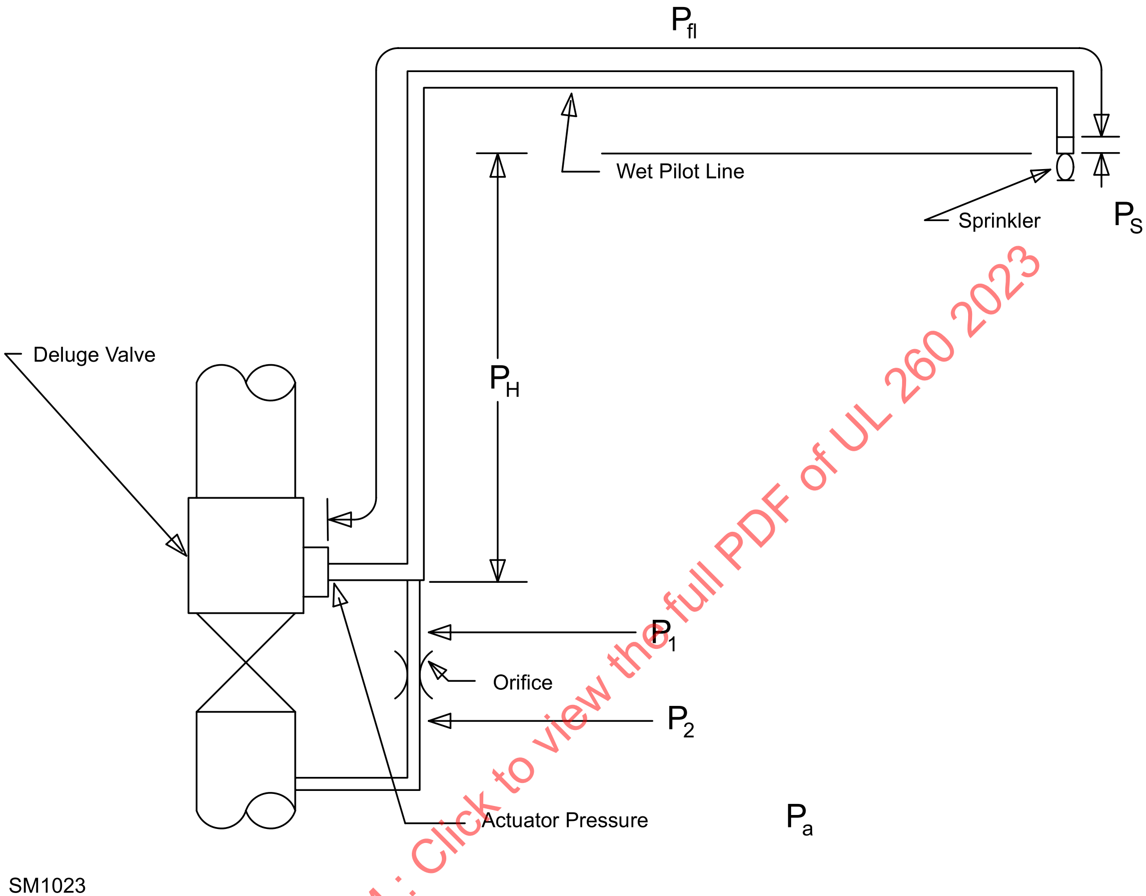
A1.1 Many deluge valves for use with wet pilot lines use a diaphragm actuator or hydraulic cylinder to generate a force to hold the valve closed. When the water pressure in the actuator is reduced to a specific value, the valve will open.

A1.2 A simple hydraulic circuit is shown below and equation (1) is given that describes the actuator pressure at the valve trip point in terms of the height of the pilot line (P_h), the friction loss for the total length of the pilot line (P_{fl}), and the pressure drop at the remote sprinkler (P_s), which upon actuation relieves the wet pilot line pressure.

A1.3 The pressure and water flow in the wet pilot line are controlled by an orifice placed in the valve trim close to the actuator. At the valve trip point, the actuator pressure can be measured and the flow through this orifice can be calculated for any given value of water supply pressure at the orifice inlet and valve trip pressure at the orifice outlet.

Figure A.1

Typical Deluge System With Wet Pilot Line



$$P_a = P_h + P_{fl} + P_s \quad (Equation\ 1)$$

$$P_{fl} = P_a - (P_h + P_s) \quad (Equation\ 2)$$

in which:

P_a is the adjusted actuator trip point pressure (actuator trip pressure divided by 1.5 as specified in 27.8.2) in psi;

P_h is the maximum height at any point along the wet pilot line in equivalent pressure in psi;

P_{fl} is the friction loss, in psi, for the entire length of wet pilot line to the remote sprinkler; and

P_s is the pressure drop, in psi, across the remote sprinkler relieving the pressure in the wet pilot line.

A1.4 The equation for sharp-edged orifice is:

$$Q = 29.8(K)(d^2)\sqrt{\Delta P}$$

in which:

Q is the flow through the orifice in gallons per minute;

K is the orifice coefficient (0.61 for square-edged orifice);

d is the diameter of the orifice in inches;

ΔP is $P_2 - P_1$, the pressure drop across the orifice in psi;

P_2 is the supply pressure in psi; and

P_1 is the trip point for a given supply pressure in psi.

A1.5 If the length of the pilot line from the orifice to the actuator is negligible,

$$P_1 = P_a$$

The pressure drop across the remote pilot line sprinkler, with a flow through it of Q calculated above, is then determined:

$$P_s = (Q)^2 / (K')^2$$

in which:

P_s is the pressure drop across the sprinkler orifice in psi;

Q is the flow rate through the sharp-edge orifice in gallons per minute; and

K' is the sprinkler K-factor.

A1.6 Assuming a given height for a wet pilot line, the friction loss in psi (P_{fl}) can be determined from equation (2):

$$P_{fl} = P_a - (P_h + P_s) \quad \text{(Equation 2)}$$

A1.7 For a flow of Q through the wet pilot line at the trip point pressure, the friction loss (P) in psi/ft can be determined from the Hazen-Williams formula:

$$P = \frac{4.52 \times Q^{1.85}}{C^{1.85} \times D^{4.87}}$$

in which:

P is the pipe friction loss per foot of length (psi/ft);

Q is the flow rate through the orifice in gallons per minute;

D is the pipe I.D. in inches; and

C is the roughness coefficient (use 120 as the value for pilot piping).