Examination Standard for Automatic Water Control Valves

Class Number 1020

December 2020

Foreword

This standard is intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of a this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product.

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1 INTRODUCTION

1.1 Purpose

1.1.1 This standard states testing and certification requirements for automatic water control valves.

1.1.2 Testing and certification criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

1.2.1 Automatic water control valves are most commonly used to control the flow of water to various fire protection sprinkler systems. They are used in sprinkler systems such as deluge, preaction, refrigerated area, and on-off multicycle sprinkler systems. Therefore, valves used for these applications must meet the requirements of this standard, as well as, at minimum, one of the following Examination Standards:

Sprinkler System	***Examination Standard Class***
Deluge	1011
Preaction	1012
Refrigerated Area	1013
On-Off Multicycle	1016

1.2.2 Although not addressed in this standard, automatic water control valves may be configured to control the flow to water spray systems, open and closed head foam water sprinkler systems and other special purpose systems. Certain designs of automatic water control valves are also utilized on the discharge of fire pumps for pressure relief, pressure reducing, and pump suction pressure regulating purposes.

1.3 Basis for Requirements

1.3.1 The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions and/or loss control specialists was also considered.

1.3.2 The requirements of this standard reflect tests and practices used to examine the design of automatic water control valves for the purpose of obtaining Certification. Transformer fluids having characteristics not anticipated by this standard may be certified if performance equal, or superior, to that required by this standard is demonstrated.

1.4 Basis for Certification

Certification is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

1.4.1 Examination and tests on production samples shall be performed to evaluate

- the suitability of the product;
- the performance of the product as specified by the manufacturer and required for certification; and as far as practical,
- the durability and reliability of the product.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be made to evaluate the manufacturer's ability to consistently produce the product which is examined and tested, and the marking procedures used to identify the product. Subsequent surveillance may be required by the certification agency in accordance with the certification scheme to ensure ongoing compliance.

1.5 Basis for Continued Certification

The basis for continual certification may include, but is not limited to, the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated by the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agencies product surveillance program.

1.6 Effective Date

The effective date of this certification standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this Standard is eighteen (18) months after the publication date of the standard for compliance with all requirements.

1.7 System of Units

Units of measurement used in this Standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI 10.

1.8 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the cited edition applies.

ASME B16.5 - 2003, Pipe Flanges and Flanged Fittings: NPS 1/2 through 24

ASTM D 471 - 2006, Standard Test Method for Rubber Property - Effect of Liquids

ASTM D 572 - 2004, Standard Test Method for Rubber - Deterioration by Heat and Oxygen

AWWA C606-06, AWWA Standard for Grooved and Shouldered Joints

FM Global Property Loss Prevention Data Sheets

IEEE/ASTM SI 10 - 2002, American National Standard for Use of the International System of Units (SI): The Modern Metric System

IEC 17025 - 2005, General Requirements for the Competence of Testing and Calibration Laboratories

NFPA 13 - 2007, Standard for the Installation of Sprinkler Systems

NFPA 15 - 2001, Standard for Water Spray Fixed Systems for Fire Protection

NFPA 16 - 2007, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems

1.9 Terms and Definitions

For purposes of this standard, the following terms apply:

Accepted
This term refers to installations acceptable to the authority enforcing the applicable installation rules. Acceptance is based upon an overall evaluation of the installation.. Acceptance is not a characteristic of a product. A product accepted for one installation may not be acceptable elsewhere.

Deluge System
A deluge system is a sprinkler system employing open sprinklers installed in the piping system. The system is connected to a water supply through an automatic water control valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.

Deluge sprinkler systems have open sprinklers and are used where it is desirable to discharge water through all of the system's sprinklers simultaneously. Prior to discharge there is no water in the sprinkler piping. The water supply is held back by an automatic water control valve which is operated manually or automatically by the actuation of a fire detection system. The fire detection system is required to be one of the following types: wet pilot sprinkler line, dry pilot sprinkler line, hydraulic rate-of-rise, pneumatic rate- of-rise or electric.

Preaction System
A sprinkler system employing automatic sprinklers attached to a piping system containing air that may or may not be under pressure, with a supplemental detection system installed in the same areas as the sprinklers. Actuation of the detection system opens an automatic water control valve that permits water to flow into the sprinkler piping system and to be discharged from any sprinklers that open.

Preaction systems are equipped with automatic sprinklers and are used where it is important to prevent the accidental discharge of water. These systems may also be used where an alarm is desired in advance of sprinkler operation or where it is desired to minimize the water delivery delay inherent in a standard dry- pipe system.

Rated Working Pressure
The maximum sustained pressure at or below which the valve shall operate trouble free. This pressure also sets the basis for the testing described in Section 4, Performance Requirements.

Refrigerated Area System
A hybrid preaction system that requires both a sprinkler and a heat-actuated device to operate before the water control valve opens and admits water into the sprinkler piping. It is intended for use in freezers with extremely low temperatures.

A refrigerated area sprinkler system affords fire protection in refrigerated rooms or buildings and includes special safeguards against accidental filling with water and subsequent freezing of the system. A fire detection system must actuate and one or more automatic sprinklers in the piping must operate before water will enter the sprinkler system. An alarm sounds if the detection system only is actuated while pneumatic pressure is maintained in the sprinkler piping. An alarm also sounds if the pneumatic pressure in the sprinkler piping is not properly maintained. In either case, water does not enter the system piping.

On-Off Multicycle Sprinkler Systems

Multicycle sprinkler systems are certified automatic sprinklers and hydraulic controls capable of repeated on-off cycles appropriate to control the possible redevelopment of fire in the protected area. The cycling occurs as the result of fire detector operation which, acting as an electrical interlock, causes the main automatic water control valve to open and close. Fire detector actuation precedes sprinkler operation so water is discharged as from a conventional water system. Should the fire rekindle after its initial control, water again flows from the opened sprinklers. Manual control valve operation, in the event of detector impairment, is a required system capability. Sprinkler replacement after a fire does not cause impairment of protection

2 GENERAL INFORMATION

2.1 Product Information

2.1.1 Nominal sizes of automatic water control valves for fire protection service addressed in this standard are: nominal pipe sizes (NPS) 1-1/2, 2, 2½, 3, 4, 6 and 8 inches with a minimum rated working pressure of 175 psig (1215 kPa). Other pressure ratings and sizes, including metric sizes, shall be evaluated on a case-by-case basis.

2.1.2 In order to meet the intent of this standard, automatic water control valves must be examined on a model-by-model, type-by-type, manufacturer-by-manufacturer, and plant-by-plant basis. This is required because identical designs, fabricated using identical materials by different manufacturers, or even by different plants of the same manufacturer, have been shown to perform differently in testing. Sample automatic water control valves selected in conformance to this criterion shall satisfy all of the requirements of this standard.

2.2 Types

Current automatic water control valves are of two general designs:

2.2.1 Clapper Type

The clapper type valve utilizes a swing type clapper that is held closed on its seat by a mechanical latch which is held in the closed position by the force from a piston. The clapper type valve is illustrated in Figure C-1. Figure C-1 shows the valve in its ready or set position. Also illustrated are the sequence and the mechanisms for valve trip: the piston chamber water pressure is reduced by operation of a releasing device (a solenoid valve is shown in Figure C-1), the piston retracts, the clapper is unlatched and opens, and water flows to the sprinklers. The piston retracts because of a reduction in water pressure in the piston chamber. This pressure reduction results from the action of heat detectors and/or activated sprinklers opening trim release devices in the piston charge line. Figure C-1 shows an energized open solenoid valve (normally closed) which vents the pressure in the piston charge line. This solenoid valve release shown is one of many automatic control valve release mechanisms. A complete description of all the various release systems is detailed in the Examination Standards listed in Section 1.2.1 of this Standard. Figure C-1 shows a restrictor orifice between the water supply and the piston chamber. This is a common feature which ensures that the piston chamber pressure is fully vented by the release device(s), because the orifice limits the flow into the chamber to be less than the flow out of it.

2.2.2 Diaphragm Type

The diaphragm type utilizes an elastomeric flat or cylindrical (sleeve type) diaphragm that is held closed on the valve seat by the water supply pressure acting on the top of the flat diaphragm or on the outside of the sleeve type diaphragm. The flat diaphragm is illustrated in Figure C-2. The sleeve type diaphragm type is illustrated in Figure C-3. Figures C-2 and C-3 shows the valves in their ready or set position. Also illustrated are the sequence and the mechanisms for valve trip: diaphragm chamber water pressure is reduced by operation of a releasing device (a solenoid valve is shown in Figures C-2 and C-3), the diaphragm retracts, and water flows to the sprinklers. The diaphragm retracts because of a reduction in water pressure in the diaphragm chamber. This pressure reduction results from the action of heat detectors and/or activated sprinklers, which open trim components in the diaphragm charge line. Figures C-2 and C-3 show an energized open solenoid valve (normally closed) which vents the pressure in the diaphragm charge line. This solenoid valve release shown is one of many automatic control valve release systems. A complete description of all the various release systems is detailed in the Examination Standards listed in Section 1.2.1 of this Standard. Figures C-2 and C-3 also show a restrictor orifice between the water supply and the diaphragm chamber. This ensures that the diaphragm chamber pressure is fully vented because the orifice limits the flow into the chamber to be less than the flow out

of it.

2.2.3 Summary

In summary, the common designs of automatic water control valves trip when the water pressure in the piston or diaphragm chamber is reduced. This reduction of chamber pressure is controlled by the releasing mechanisms of the trim assemblies. These releasing mechanisms may be pneumatic, hydraulic, electrical or a combination of these releasing mechanisms. These releasing mechanisms and detailed operational testing requirements are contained in the Deluge, Preaction and Refrigerated Area Standard Class 1011/1012/1013, and the On-Off Multicycle Standard Class 1016.

2.3 Certification Application Requirements

The manufacturer shall provide the following preliminary information with any request for certification consideration:

- a complete list of all models, types, sizes, and options for the products or services being submitted for certification consideration;
- General assembly drawings, one complete set of manufacturing drawings, materials list(s), anticipated marking format, brochures, sales literature, specification sheets, and installation, operation and maintenance procedures; and
- the number and location of manufacturing facilities.

All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All documents shall be provided with English translation.

2.4 Requirements for Samples for Examination

2.4.1 Following authorization of a certification examination, the manufacturer shall submit samples for examination and testing based on the following:

- sample requirements to be determined by the certification agency

2.4.2 Requirements for samples may vary depending on design features, results of prior or similar testing, and results of any foregoing tests.

2.4.3 The manufacturer shall submit samples representative of production. Any decision to use data generated using prototypes is at the discretion of the certification agency.

2.4.4 It is manufacturer’s responsibility to provide any necessary test fixtures such as those which may be required to evaluate the automatic water control valves.

3 GENERAL REQUIREMENTS

3.1 Review of Documentation

3.1.1 During the initial investigation and prior to physical testing, the manufacturer's specifications, technical data sheets, and design details shall be reviewed to assess the ease and practicality of installation and use. The certification examination results may further define the limits of the final certification.

3.1.2 The manufacturer's dimensional specifications and/or dimensional drawings shall fully describe the product. All critical dimensions shall be indicated with the allowed upper and lower tolerance limits clearly shown.

3.1.3 All documents pertaining to the product materials, dimensions, processing, and marking shall be controlled by the manufacturer's Quality Assurance procedures, and shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level.

3.2 Physical or Structural Features

3.2.1 Common sizes for deluge, preaction, refrigerated area, and on-off multicycle valves are: 1-1/2, 2, 2-1/2, 3, 4, 6, and 8 inches nominal pipe size (NPS).

3.2.2 All automatic water control valves shall have a minimum rated working pressure of 175 psi (1215 kPa).

3.2.3 Valve bodies of 3 in. (76.2 mm) and larger shall have flanged ends conforming to a recognized national or international standard for flanges and flanged fittings, such as ASME B16.5, *Pipe Flanges and Flanged Fittings NPS 1/2 through 24*. Flanged by grooved ends, or grooved by grooved ends are also acceptable in sizes 3 inches and larger. Smaller valves may have flanged, threaded, or grooved ends conforming to a recognized national or international standard such as ANSI/AWWA C606-06, AWWA Standard for Grooved and Shouldered Joints. Other end connections may be certified if there is a demonstrated need for them, and these will be examined on a case-by-case basis.

3.2.4 Valves manufactured or for use outside North America may be certified with end connections conforming to recognized national or international standards.

3.3 Design Requirements

3.3.1 Water control valves may remain inactive for long periods of time, yet they must be ready and able to operate positively and reliably at any moment. Overall design should be uncomplicated, and construction should be simple and rugged with appropriately generous dimensions and clearances. An example of this design approach is the piston or plunger assembly in a clapper type valve, frequently a fabric reinforced rolling rubber diaphragm, which is shown in Figure C-1. The generous clearance on the piston periphery and the rolling low friction movement of the diaphragm is far superior in these applications than the piston with the radial seal also shown in Figure C-1. Radial Seals shall not be considered for certification. The rolling rubber diaphragm is a good example of the desired seal. However, each seal design submitted for certification is examined on a case-by-case basis.

3.3.2 Water control valves and releasing devices shall be designed so that all movements of lever systems, diaphragms, valves and switches are positive and repeatable. The releasing device shall be capable of providing the energy necessary to trip the valve under all conditions of system water pressure up to the rated working pressure.

3.3.3 Valves may be designed for manual or automatic resetting. Automatic resetting, if provided, is accomplished by mechanical or hydraulic means external to the main valve, without removing the cover faceplate, if provided. Valves without faceplates will be evaluated on a case-by-case basis.

3.4 Operation

3.4.1 Water control valves shall be designed to operate at all water supply pressures, from a minimum of 20 psi (140 kPa) to the maximum rated working pressure of the valve.

3.4.2 Water control valves which are operated by a reduction in water supply pressure in the piston or diaphragm chamber, shall operate (trip) at a positive gauge pressure greater than 5 psi (35 kPa). A check valve shall be installed in the water supply pressure line leading to the chamber in order to prevent accidental valve trip if the water supply pressure momentarily drops below the trip point pressure.

3.4.3 All water control valves shall have means incorporated in their design for manual tripping of the valve at the valve location, such as a manual pull station.

3.5 Markings

3.5.1 The following shall be cast onto the valve body in raised letters:

- The manufacturer's name or logo;
- The valve model number;
- Nominal valve size (inches/millimeters);
- An arrow indicating the direction of flow;
- The foundry and casting date code; and,
- Rated working pressure, psi (kPa)

3.5.2 Alternatively, a corrosion resistant nameplate, positively fastened to the valve body or faceplate cover, for example with drive screws, may contain the same information. A combination of both may be used. If the valves are manufactured at more than one location, each valve shall be uniquely marked to indicate place of origin.

3.5.3 Additionally, a metal nameplate, attached to the body or hand hole cover with drive screws, must also be attached to the trimmed valve to indicate the systems as following:

- The manufacturers' logo;
- Model Number and "Deluge or Preaction", "Single or Double Interlock" Valve;
- The certification agency's mark of conformity.

3.5.4 Valve users should be advised in the manufacturer's installation instructions if horizontal installation is required. The installation instructions (shipped with the valve) shall contain detailed descriptions of the valve installation and operation in the horizontal orientation.

3.5.5 For specific marking information, refer to the various release systems as detailed in the other relevant Examination Standards listed in Section 1.2.1 of this standard.

3.6 Materials and Construction

3.6.1 All materials used in automatic water control valves shall be suitable for the intended purpose. Valve parts which could affect the operation of the valve if they became corroded or are subject to tuberculation shall be constructed of corrosion resistant materials. This includes such parts as clapper arm and latch hinge pins and their bushings. The mating sealing components, such as metal seat rings in contact with rubber sealing surfaces and diaphragms, shall be constructed of materials which will not adhere to each other over time. Adhesion testing involving long term contact under pressure between the seal and seat in various environments may be necessary. Refer to the Deluge, Preaction and Refrigerated Area

Standard Class 1011/1012/1013, and the On- Off Multicycle Standard 1016. Certain designs involving dynamic seals are not considered for certification. A radial O-ring seal design in the piston of a clapper type valve shall not be considered for certification. Valve body coatings may be tested for durability, particularly if the coatings are subjected to mechanical wear or water erosion.

3.7 Environment

3.7.1 The automatic water control valves shall be designed to operate in a temperature environment of between 40 ºF to 125 ºF (4 ºC to 52 ºC). The manufacturer's Installation, Maintenance, and Operation Instructions shall include wording to the effect: "The valves must be located in an indoor environment above 40 ºF (4 °C), which is not subject to weather, freezing temperatures, or physical damage".

3.8 Serviceability and Parts Removal

3.8.1 Automatic water control valves shall be designed so that all parts are uniquely oriented to minimize the possibility of improper assembly. All internal parts shall be easily removable for inspection, cleaning, repair or replacement without removing the valve from the system piping. Certain water control valves may be certified even when required to be removed from the system piping for maintenance if the intent of the Standard is met. Specifically, if the valve assembly has design features which facilitate ease of removal, and this is verified by testing, it may be certified.

3.8.2 The valve shall be constructed so that it can be reset after valve trip by a single person using standard tools.

3.8.3 All valve installation and maintenance manuals must contain safety warnings requiring depressurization and draining of all piping before any maintenance is attempted.

3.8.4 An integral drain shall be provided below the valve seat such that the sprinkler system, after valve trip, is able to be drained *completely* of water without opening the faceplate cover, if so equipped. This is intended to eliminate any pool of water above the valve seat which may evaporate and form ice plugs in a refrigerated area and may also contribute to corrosion.

3.9 Instructions and Trim Equipment

3.9.1 The manufacturer shall provide complete installation, maintenance, operating and troubleshooting instructions for the automatic water control valve and all its component parts. Valve resetting procedures and verification of such shall be completely detailed.

3.9.2 The manufacturer shall provide all necessary trim, including equipment, fittings, and piping, to perform the following:

- Automatically drain to atmosphere any water leakage past the water seat. After valve operation, the automatic drain mechanism may either close or constantly drain through an orifice.
- Automatically operate an electric or hydraulic alarm, or both, when the valve operates.
- Allow checking of the water supply flow after the valve operates.
- Permit manual drainage of the system after the valve operates.

The drain line shall be located on the supply side of the clapper and shall be sized as follows:

Nominal Valve Size, in.	*Drain Size*	
	in.	*(mm)*
1-1/2	¾	(20)
2	¾	(20)
2-1/2	1-1/4	(32)
3	1-1/4	(32)
4	2	(50)
6	2	(50)
8	2	(50)

- Permit manual isolation of the alarms after operation or for repairs, and manual testing of the alarm(s) without tripping the valve.
- Give a visual indication of the water supply pressure.

3.9.3 Certified equipment (such as pressure gauges, valves, and pressure switches) shall be used as trim components wherever applicable.

3.10 Clearances

3.10.1 Ample clearances shall be provided between all moving and stationary parts so that corrosion or deposits such as tuberculation will not interfere with proper operation of the valve.

3.10.2 To assure ample clearance, the following minimum dimensions shall be maintained (refer to Figure C-4):

- 3/4 in. (20 mm) between valve body and clapper assembly in all positions from closed to wide open.
- 1/2 in. (13 mm) between valve body and clapper hub or hubs of any intermediate levers.
- 1/16 in. (1.6 mm) minimum play between clapper hinge pin bearings or bushings and the clapper arm dimension.
- 1/8 in. (3 mm) minimum projection of hinge pin bushings or clapper arm bushings beyond the supporting material.

3.10.3 The above clearances may differ for valves which use special materials, coatings or finishes. Examination of these valves will be on a case-by-case basis.

3.11 Calibration

3.11.1 Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified and traceable to an acceptable reference standard and certified by an ISO/IEC 17025 accredited calibration laboratory. The test equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.

3.11.2 When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of thus equipment.

4 PERFORMANCE REQUIREMENTS

The valve manufacturer shall determine the sequence of testing.

4.1 Examination

4.1.1 The automatic water control valves shall conform to the manufacturer's drawings and specifications and to the certification agency requirements.

4.1.2 A sample shall be examined and compared to drawings and specifications. It shall be verified that the sample conforms to the requirements described in Section 3, General Requirements.

4.2 Operational Tests

4.2.1 Automatic water control valve systems shall be tripped by operating all of the relevant releasing means at various water supply pressures from 20 psi (140 kPa) to the rated working pressure of the valve. The valves shall operate smoothly, consistently, and repeatedly. For detailed operational testing requirements refer to Deluge, Preaction and Refrigerated Area Standard Class 1011/1012/1013, and On-Off Multicycle Standard 1016.

Special emphasis will be given to the installation and operating instructions provided by the manufacturer. The possibilities of malfunction due to maladjustment of parts or improper installation will be investigated.

Special tests will be developed, as necessary, to evaluate the operation of automatic water control valves having special or unusual releasing mechanisms.

4.2.2 Automatic water control valve systems shall be set up by following the installation instructions provided by the manufacturer. The automatic water control valve shall be tripped by operating all of the relevant releasing means at various water supply pressures from 20 psi (140 kPa) to the rated working pressure of the valve. The valves shall operate smoothly, consistently, and repeatedly. Each operational test shall be repeated 3 times at each water supply pressure in order to demonstrate consistent operation.

Detailed operational testing requirements are contained in the Deluge, Preaction and Refrigerated Area Standard Class 1011/1012/1013, and On-Off Multicycle Standard 1016.

Automatic water control valves used in sprinkler systems such as deluge, preaction, refrigerated area, and on-off multi-cycle sprinkler systems must meet the requirements of this Standard, and also the following Examination Standards:

Sprinkler System	***Examination Standard Class***
Deluge	1011
Preaction	1012
Refrigerated Area	1013
On-Off Multicycle	1016

4.3 Friction Loss

4.3.1 The construction of the valve shall be such that obstruction to the passage of water through the valve body is minimal. With the clapper or diaphragm in the full open position, the loss in water pressure through the valve shall not exceed 5.0 psi (35 kPa) at a flow producing a velocity of 17 ft/sec (5 m/sec) in Schedule 40 steel pipe of the same nominal diameter as the valve, as shown in Table 4.3.

Table 4.3. - Friction Loss Flows, 17 ft/sec (5 m/sec)

Valve Size		***Flow***	
in.	***(mm)***	***gal/min***	***(L/min)***
1-1/2	(40)	106	(400)
2	(50)	179	(680)
2-1/2	(65)	255	(965)
3	(80)	391	(1480)
4	(100)	675	(2555)
6	(150)	1530	(5790)
8	(205)	2650	(10 030)

4.3.2 A sample valve shall be installed between two Schedule 40 test pipes of the same nominal diameter as the valve and equipped with piezometer rings. The pressure loss between the piezometer rings shall be measured for the corresponding flow rates listed in Table 4.3 to determine the total friction loss of the valve and test piping. The friction loss in the test piping, without the valve installed, is then measured at the same flow rates and deducted from the total friction loss previously measured. The net friction loss across the valve shall not exceed 5.0 psi (35 kPa).

4.4 Body Hydrostatic Strength

4.4.1 The valve body assembly shall withstand a hydrostatic pressure of 700 psi (4825 kPa) or four times the rated working pressure, whichever is greater, without rupture, cracking or permanent distortion.

4.4.2 With the clapper or diaphragm in the partially open position, valve bodies of each valve size and end connection style shall be subjected to a hydrostatic test pressure of 700 psi (4825 kPa) or four times the rated working pressure, whichever is greater, for a duration of five minutes. For the clapper type valves, the clapper shall be open, off the seat in order to subject the entire body assembly to the hydrostatic pressure. For the diaphragm type valves, the hydrostatic pressure must be applied to the top and bottom of the diaphragm. There shall be no visible rupture, cracking, or permanent distortion to the valve body as a result of this test.

4.5 Clapper Strength

4.5.1 For the clapper type valves, the outlet side of the clapper shall withstand a hydrostatic pressure of 350 psi (2415 kPa) or two times the rated working pressure, whichever is greater, without damage or functional impairment.

4.5.2 With the clapper closed, on the seat and the valve inlet open to atmosphere, the clapper of each valve size shall be subjected to a hydrostatic test pressure of 350 psi (2415 kPa) or two times the rated working pressure, whichever is greater, applied to the outlet side of the clapper for a duration of five minutes. Examination shall demonstrate that there is no damage or functional impairment as a result of this test.

4.6 Diaphragm Strength

4.6.1 All diaphragm type valves, as well as all actuators and trim components which utilize diaphragms, shall withstand a differential pressure of 350 psi (2415 kPa) or two times the rated working pressure, whichever is greater, without diaphragm damage or functional impairment.

4.6.2 Diaphragms of each size shall be subjected to a differential test pressure of 350 psi (2415 kPa) or two times the rated working pressure, whichever is greater. The differential pressure shall be applied across the diaphragm in the direction which normally applies the closing force in the device. The test duration shall be five minutes. For example, referring to Figure C-2, two times the rated working pressure would be applied to the top of the diaphragm with the valve inlet open to atmosphere. As another example, referring to Figure C-1, the pressure would be applied to the piston chamber with the opposite side of the piston not pressurized, but with the piston rod restrained against the latch. Examination shall demonstrate that there is no diaphragm damage or functional impairment as a result of this test.

4.7 Bonding Adequacy

4.7.1 For resilient seated valves, rubber facings shall remain securely bonded or fastened to the disc base material.

4.7.2 A representative size valve shall be subjected to a flow rate producing a velocity of 30 ft/sec (9 m/sec) in Schedule 40 steel pipe of the same nominal diameter as the valve. The test duration shall be 90 minutes. Following this test, there shall be no apparent separation of the rubber from the base material or substrate or any other type of failure, such as blistering, peeling, flaking, delaminating, or evidence of loosening from the base material or of any hardware used to secure the rubber facing.

Table 4.7.2 - Bonding Adequacy Flows

Nominal Valve Size, in.	***Flow, gal/min (L/min) at Velocity of 30 ft/sec (9 m/sec)***	
1-1/2	190	(720)
2	315	(1190)
2-1/2	450	(1705)
3	690	(2610)
4	1190	(4505)
6	2700	(10 220)
8	4680	(17 715)

4.8 Water Absorption

4.8.1 For resilient seated valves, water absorption of the rubber facings shall not result in an increase greater than 1.5 percent of the original thickness or weight.

4.8.2 A specimen of the valve rubber facing supplied by the manufacturer shall be maintained in water at a temperature of 212 °F (100 °C) for 6 hours to measure the comparative ability of the rubber to withstand the effect of water in accordance with ASTM D 471, *Standard Test Method for Rubber Property - Effect of Liquids*. At the end of this period, an increase in the thickness or weight of the sample shall not be greater than 1.5 percent of the original thickness or weight.

4.9 Aging

4.9.1 For resilient seated valves, aging shall not promote cracking of the rubber facings.

4.9.2 A specimen of the valve rubber facing, approximately 1 x 3 inches (25 x 75 mm) by 1/8 in. (3 mm) thick, supplied by the valve manufacturer, shall be subjected to an accelerated aging test in accordance with ASTM D 572, *Standard Test Method for Rubber - Deterioration by Heat and Oxygen*. The test duration shall be 96 hours. After the test the specimen shall be examined for resilience. No cracking shall occur when the sample is bent double, (i.e. bent 180E).

4.10 Additional Tests

Additional tests may be required, at the disecretion of the certification agency, depending on the design features and results of any foregoing tests.

5 OPERATIONS REQUIREMENTS

5.1 Demonstrated Quality Control Program

5.1.1 A quality assurance program is required to assure that subsequent automatic water control valves produced by the manufacturer shall present the same quality and reliability as the specific valves examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests and may be documented in the certification report.
- Continued conformance to this standard is verified by the certifier's surveillance Audit.
- Quality of performance is determined by field performance and by periodic re-examination and testing.

5.1.2 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- existence of corporate quality assurance guidelines;
- incoming quality assurance, including testing;
- in-process quality assurance, including testing;
- final inspection and tests;
- equipment calibration;
- drawings, operating manuals, and specific test procedure change control;
- packaging and shipping; and
- handling and disposition of non-conforming materials.

5.1.3 Documentation/Manual

There should be an authoritative collection of procedures/policies. It should provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system should require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

5.1.4 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture.

5.1.5 Drawing and Change Control

- The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents, identified in the certification report, may be required to be reported to, and authorized by the certification agency prior to implementation for production.
- Records of all revisions to all certified products shall be maintained.

5.2 Surveillance Audit

5.2.1 An audit of the manufacturing facility may be part of the certification agency's surveillance requirements to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to ensure a uniform product consistent with that which was tested and certified.

5.2.2 Certified products or services shall be produced or provided at, or provided from, location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location prior to disclosure to the certification agency.

5.3 Manufacturer's Responsibilities

5.3.1 The manufacturer shall notify the certification agency of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

5.4 Manufacturing and Production Tests

5.4.1 Test Requirement No. 1 – Seat Leakage Test

The manufacturer shall test 100 percent of production automatic water control valves at the rated working pressure for seat leakage. The test pressure shall be applied on the seat of a closed valve for a minimum of 15 seconds. Leakage shall not exceed 0.017 oz. (0.5 cm^3) for metal-seated valves; zero leakage is required for resilient-seated valves.

5.4.2 Test Requirement No. 2 – Hydrostatic Test

The manufacturer shall hydrostatically test 100 percent of production automatic water control valves for body leakage at twice the rated working pressure. The pressure shall be held for a minimum of 1 minute. No evidence of body leakage or distortion shall be permitted

5.4.3 Test Requirement No. 3 – Operation Test

The manufacturer shall perform an operation test on 100 percent of production automatic water control valves following the above seat leakage and hydrostatic test. All valves shall be operated without evidence of sticking or binding.

APPENDIX A:

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APPENDIX B:

Appendix B is intentionally blank

APPENDIX C: Figures

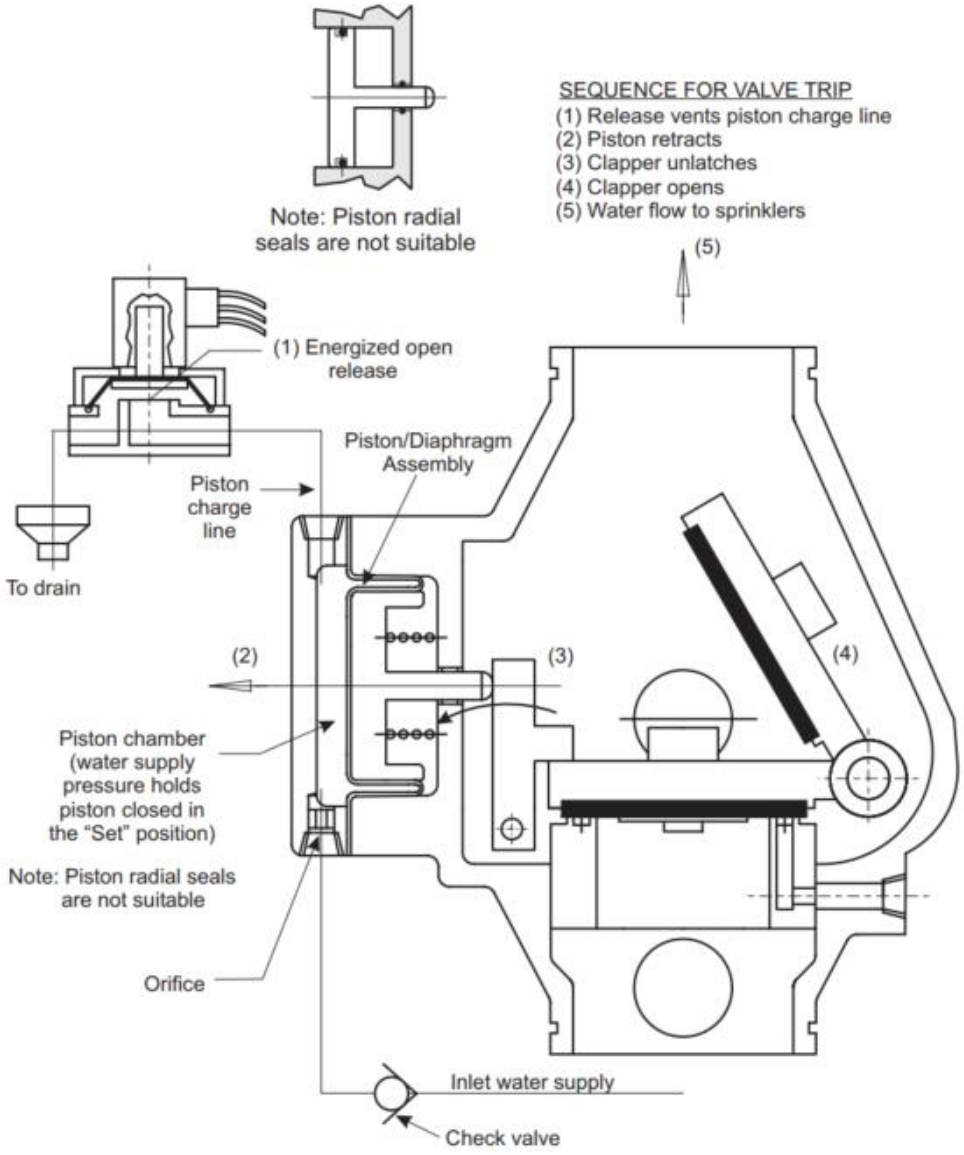

Figure C-1: Clapper Type Valve Assembly

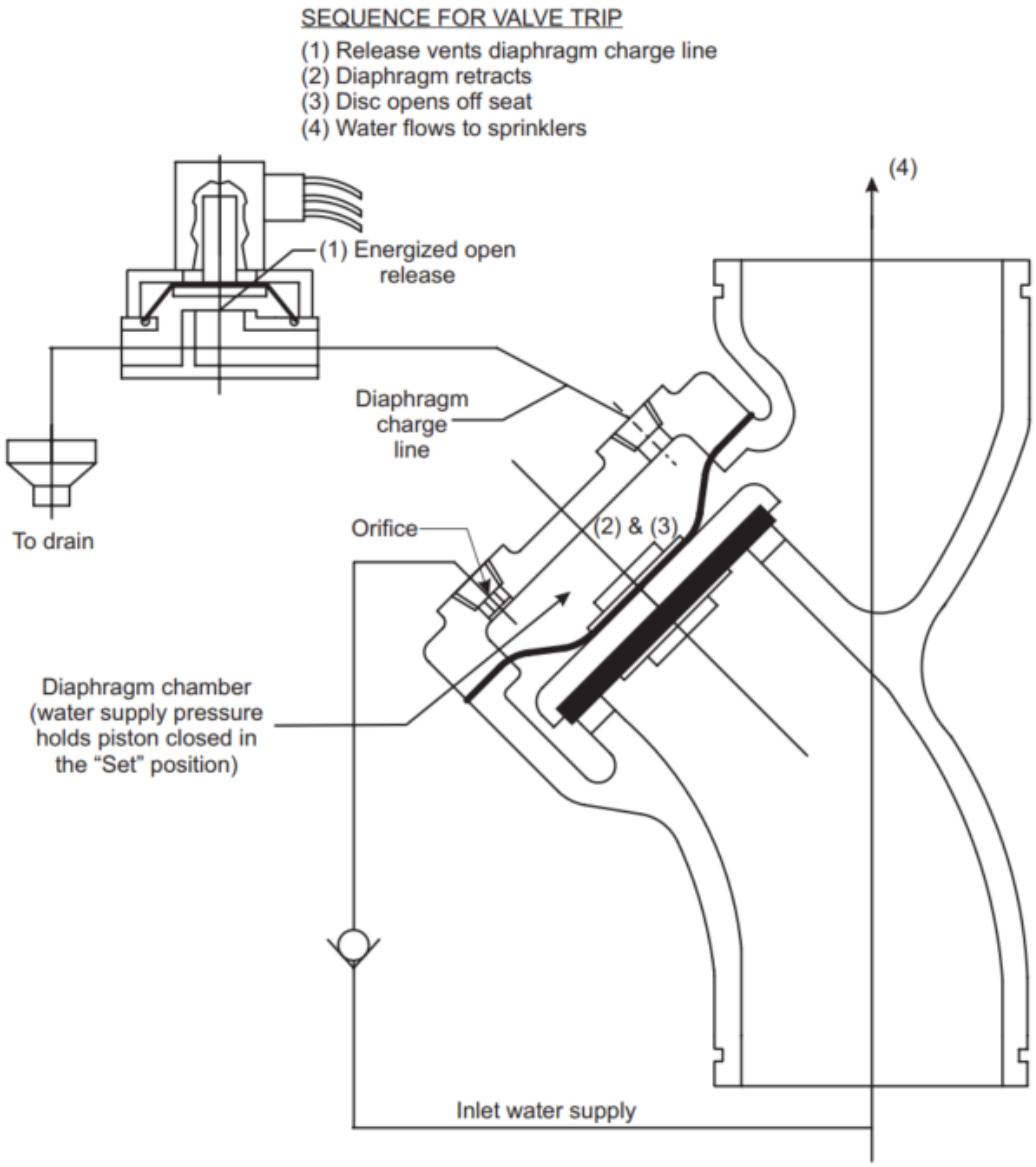

Figure C-2: Diaphragm Type Valve Assembly

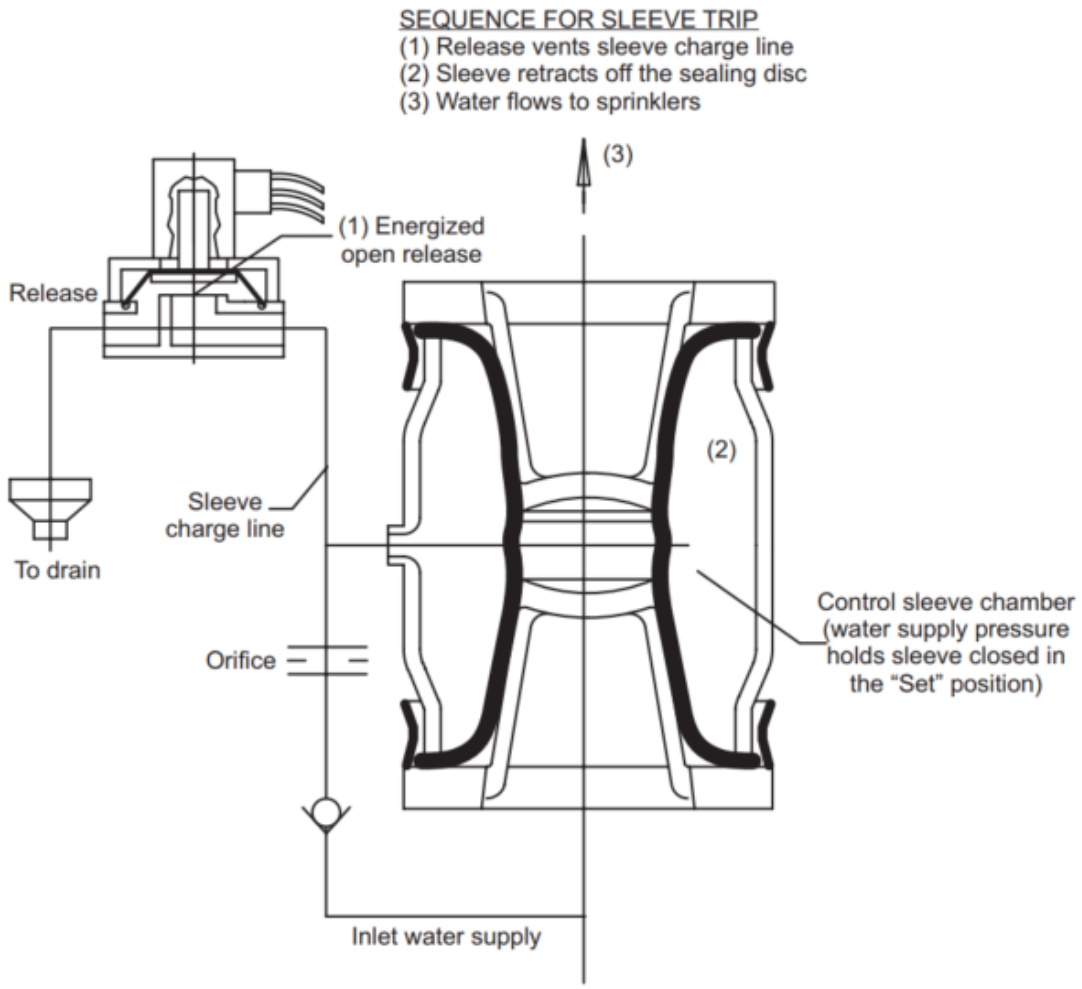

Figure C-3: Sleeve Type Valve Assembly

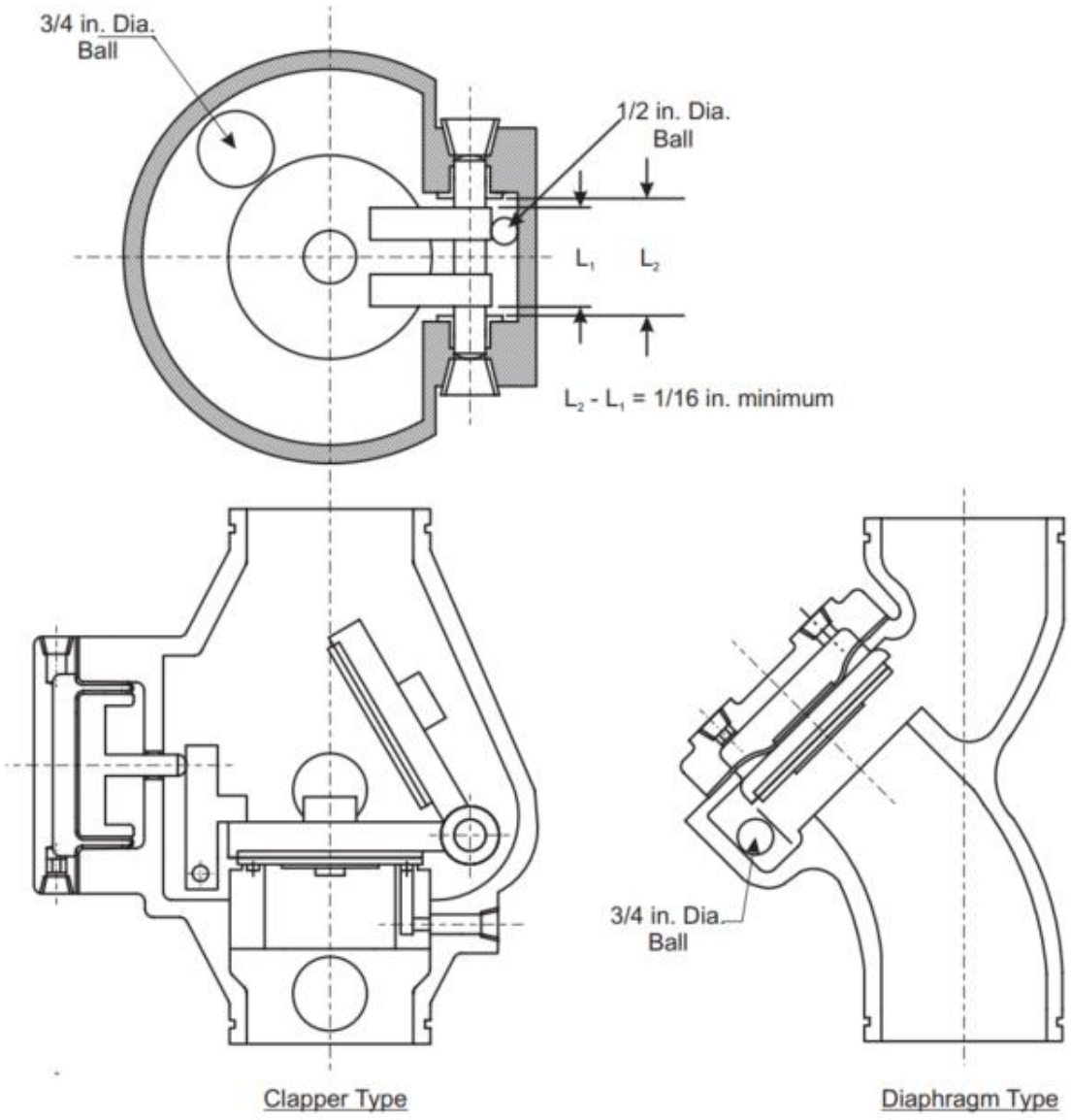

Figure C-4: Clearance Illutrations