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Examination Standard for Alarm Check Valves

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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 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 alarm check valves that hydraulically activate a mechanical and/or electrical alarm when one or more sprinklers activate.

1.1.2 Testing and certification criteria may include performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

1.2.1 This standard encompasses the design and performance requirements for differential and pilot valve type alarm check valves. These valves are installed in wet sprinkler systems in either the vertical or horizontal orientation.

1.2.2 This standard was developed for alarm check valves in sizes: 1-1/2, 2, 2-1/2, 3, 4, 5, 6, and 8 in. nominal pipe size. Sizes refer to the nominal diameter of the pipeline to which the valve will be connected. In cases where metric sized alarm check valves are to be examined for certification, test criteria comparable to the equivalent or nearest nominal inch size shall be used.

1.2.3 Alarm check valves covered in this standard are supplied with either flanged, grooved, or flange x grooved inlet and outlet end connections.

1.2.4 Alarm check valves discussed in this standard may also be supplied with a retard chamber in order to minimize false alarms due to surges and fluctuations in water supply pressure.

1.2.5 Alarm check valves discussed in this standard are certified for a 175 psi (1205 kPa) minimum rated working pressure.

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 characteristics of alarm check valves for the purpose of obtaining certification.

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;
- the durability and reliability of the product.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be conducted 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 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;
- 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 agency's product surveillance program.

1.6 Effective Date

The effective date of this examination 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.

Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection and are used in this standard.

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:

ANSI/ASME B16.5 , *Pipe Flanges and Flanged Fittings*

ANSI/IEEE/ASTM SI 10, *American National Standard for Metric Practice*

ASTM D471, *Standard Test Method for Rubber Property - Effect of Liquids*

ASTM D572, *Standard Test Method for Rubber - Deterioration by Heat and Oxygen*

AWWA C606, *Joints, Grooved and Shouldered Type*

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. It is installation specific. A product accepted for one installation may not be acceptable elsewhere.

Alarm Device

This term refers to the device that activates as a result of the opening of the alarm check valve. Alarm devices include electrical pressure switches that send signals to the control panel, and mechanical devices such as water motor gongs.

Alarm Line

This term refers to the valve trim piping from the alarm check valve to the alarm device. The alarm line piping is fed from water from the alarm port and may pass through the retard chamber.

Alarm Port

This term refers to the passageway through the alarm check valve body from the seat ring to the alarm line.

Bypass Line

This term refers to the trim piping that channels water from the water supply to the downstream side of the alarm check valve.

Constant Pressure Service

This term refers to installations where the alarm check valve is fed from a static water supply such as a water tank.

Corrosion Resistant

Having resistance to corrosion equal to or exceeding that of a bronze alloy having a minimum copper content of 80 percent, or constructed of 300 or 400 Series Stainless Steel.

Drain Orifice

This term refers to the designed restriction in the valve trim piping used to regulate the draining of water from the alarm line. The drain orifice may be located prior to, or at the bottom of the retard chamber.

Drain Valve

This term refers to the auxiliary valve located adjacent to the alarm check valve used to drain all water from the sprinkler system for valve maintenance, or system repair.

End Connections

This term refers to the method of connecting components of a pipe system to the ends of the valve. Typical end connections for alarm check valves discussed in this standard are flanged and grooved ends.

Flanged End Valves

Valves having mating flanged ends per the dimensional values shown in ANSI/ASME B16.5. Flanges to other national or international standards shall be evaluated on a case-by-case basis.

Grooved End Valves

A grooved end valve is characterized by having grooved ends on the inlet and outlet ends of the valve

body such that the valve may be installed in the sprinkler system piping using certified grooved end couplings. For the purpose of this standard, grooves shall comply to the dimensional values shown in AWWA C606. Grooves to dimensions of other standards will be reviewed on a case-by-case basis.

Hand Hole Cover

A removable cover, which when removed, allows replacement of internal parts without having to remove the valve from the pipe line.

Horizontal Orientation

This term refers to installations where the alarm check valve is installed so that the clapper is in a near vertical position when closed. When installed in the horizontal orientation, the clapper shall be observed to fall towards the closed position when the waterflow stops.

Rated Working Pressure

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

Retard Chamber

A retard chamber is a pressure vessel that is fed from water flowing through the alarm port of the alarm check valve. The vessel is sized to minimize false alarms due to surges and fluctuations in water supply pressures found in variable pressure service.

Retard Orifice

This term refers to a designed restriction in the waterway feeding the retard chamber with water. The retard orifice shall be sized to allow the retard chamber to provide a 5 to 60 second delay before signaling the alarm. The retard orifice may or may not be part of the retard chamber itself.

Variable Pressure Service

This term refers to installations where the alarm check valve is supplied water from a water supply with varying water supply pressure. An example of variable pressure service installations are when the alarm check valve is fed off the municipal water main.

Vertical Orientation

This term refers to installations where the alarm check valve is installed so that the clapper is in a near horizontal position when closed. When installed in the vertical orientation, the clapper shall be observed to fall towards the closed position when the waterflow stops.

2. GENERAL INFORMATION

2.1 Product Information

2.1.1 Alarm check valves typically consist of an assembly of the following components: body, spring, disc/clapper, seat ring, seal facing, lifting lug, hand hole cover, clapper spring, and hinge pin.

2.1.2 Alarm check valves are supplied with trim piping that create the alarm, bypass, and drain lines that provide for proper operation of the valve. The trim piping typically consists of pipe fittings and nipples, retard chamber, retard orifice, drain orifice, drain valve, inlet and outlet pressure gauges, and pressure switch (for electrical alarm signaling).

2.1.3 Alarm check valves discussed in this standard are for use in wet sprinkler systems.

2.1.4 In order to meet the intent of this standard, alarm check valves must be examined on a model-by-model, type-by-type, manufacturer-by manufacturer, and plant-by-plant basis. This is predicated on the basis that identical designs, fabricated in identical materials by different manufacturers or, even by different plants of the same manufacturer, have been seen to perform differently in testing. Sample valves, selected in conformance to this criterion, shall satisfy all of the requirements of this standard.

2.2 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, complete set of manufacturing drawings, materials list, anticipated marking format, piping and electrical schematics, nameplate format, brochures, sales literature, spec. sheets, 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 foreign language documents shall be provided with English translation.

2.3 Requirements for Samples for Examination

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

- Sample requirements to be determined by the certification agency.

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

2.3.3 The manufacturer shall submit samples representative of production.

2.3.4 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the alarm check 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 product shall be capable of being used within the limits of the certification investigation.

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

3.2 Physical or Structural Features

3.2.1 Valves shall be designed for a minimum rated working pressure of 175 psi (1205 kPa).

3.2.2 End connections shall be flanged, grooved, or flanged x grooved and shall conform to a nationally or internationally recognized standard. Other types of end connections shall be evaluated on a case-by-case basis.

3.2.3 Alarm check valves shall be supplied with a hand hole large enough to permit the removal of all internal working parts without removal of the valve body from the sprinkler system.

3.2.4 The interior of the valve body shall preferably have a straight waterway. The area of the waterway at any point within the valve body shall not be less than 60 percent of the nominal area of the pipe to which the valve is connected.

3.2.5 The valve body shall have a drain connection so that it will serve to drain all water from the system piping with the alarm valve installed in either the horizontal or vertical orientation. The drain size for valves less than 4inch NPS shall be 1-1/4 inch NPS. For alarm check valves 4 inch NPS and larger, the drain size shall be 2 inch NPS.

3.2.6 Placement of a test and drain valve in lieu of the typically supplied style of drain valve does not replace the need for an inspector's test connection at the most remote location of the sprinkler system. The test and drain valve shall not be used in lieu of the inspector's test connection for the testing of the entire wet piping system. The test and drain valve shall only be used to exercise the clapper and check the mechanical alarm (water motor gong). All alarm check valves with this option shall have a note in their installation, operation, and maintenance instructions.

3.2.7 The alarm check valve body shall be supplied with two 1/4 inch NPS pipe connections for pressure gauges. There shall be one pipe connection below, and one above the clapper.

3.2.8 The clapper with arm shall be designed so that it will close when no water is flowing through the valve.

3.2.9 The clapper and arm shall be designed so that they cannot separate in use. Clearance allowances for the clapper and arm have been shown in Appendix C.

3.2.10 If the clapper arm is made of iron, bushings shall be provided in the hub of the clapper arm where the hinge pin passes through it.

3.2.11 The face of the body seat ring shall be at least 1/8 inch (3.2 mm) higher than the surrounding metal into which it is placed. The seat ring shall be a minimum of 1/4 inch (6.3 mm) in width.

3.2.12 Metal clapper facings (finished seating surface) shall have a minimum width of 1/4 inch (6.3 mm).

3.2.13 Rubber clapper facings shall be clamped at least 1/2 inch (12.7 mm) from ~~at~~ the inner edge of the seat ring. The rubber clapper facing shall extend a minimum of 1/8 inch (3.2 mm) over the outside of the seat ring and shall be backed up across the full width by a finished surface on the clapper. The clamping ring shall come to a stop against a shoulder on the clapper to prevent distortion of the rubber.

3.2.14 Valves having a single hinge pin side plug shall provide hinge pins which have tapped holes at each end for ease of removal.

3.2.15 Clapper parts shall be assembled in such a manner that they will not separate in reasonable cycling pressure service.

3.2.16 Valves that employ springs to aid in closing the valve shall be capable of 50,000 cycles of full travel without damage to or failure of the spring.

3.2.17 Valves submitted for testing shall be true production samples and shall be free of sharp edges, burrs, or other imperfections which might injure the installer or interfere with proper assembly of the unit. Any decision to use data generated using prototypes is at the discretion of the certification agency.

3.2.18 Where screens are provided at the inlet to the retard chamber, the diameter of the holes in the screen shall be 1/16 inch (1.6 mm) less than the diameter of the smallest orifice to be protected by the screen. The total area of the openings in the screen should be a minimum of 20 times the cross sectional area of the orifice that the screen is designed to protect.

3.2.19 The retard chamber shall have suitable supports for mounting. The piping ordinarily used in retard chamber connections must not be used as the sole means of support for the retard chamber.

3.2.20 The retard chamber shall be supplied with 3/4 inch NPS piping connections to the alarm devices.

A manually operated control valve shall be installed in the line between the alarm valve and the retard chamber. The valve, when wide open, shall have a waterway at least equal to the nominal waterway area of the pipe to which it is connected. The valve position shall be readily apparent by visual examination (open or closed).

3.3 Clearances

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

3.3.2 To assure ample clearance, the following minimum dimensions shall be maintained:

- The clearances between the periphery of the clapper and the inside of the body in every position of the clapper from “closed” to “full open” shall be at least 3/4 inch (19 mm). For valves incorporating corrosion resistant clappers and bodies, the clearance requirement shall be 3/8 inch (10 mm). See Figure C-1 in Appendix C.

- There shall be a clearance of at least 1/2 inch (13 mm) between the hub of the clapper arm and the inside of the body. For valves incorporating corrosion resistant clappers and bodies, the clearance requirements shall be 3/8 inch (10 mm). See Figure C-2 in Appendix C.

- The width of the hub on the clapper arm shall be at least 1/8 inch (3 mm) less than the minimum distance between the hinge pin bearings. See Figure C-3 in Appendix C.

- There shall be a diametrical clearance of at least 0.015 in. (0.4 mm) between the outside

diameter of the hinge pin and the inside diameter of the hole in the hinge pin bearing. See Figure C-3 in Appendix C.

- There shall be a minimum 1/8 inch (3 mm) projection of hinge pin bushings beyond the supporting material. See Figure C-3 in Appendix C.

- No allowance or reduction in tolerances are allowed for coatings applied to iron components.

3.4 Materials

All materials used in these valves shall be suitable for the intended application. Particular consideration shall be given to the corrosion resistance of the materials used as contact surfaces between rotating or moving and stationary parts. When unusual materials are used, special tests may be necessary to verify their suitability.

3.5 Markings

3.5.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the following information:

- name and address of the manufacturer or marking traceable to the manufacturer;
- date of manufacture or code traceable to date of manufacture or lot identification ;
- model designation; nominal valve size; rated working pressure; directional flow arrow; etc., as appropriate.

When hazard warnings are needed, the markings should be universally recognizable.

3.5.2 Marking**s** shall be cast or forged in raised characters or die stamped on the valve body. All letters and symbols shall be large enough to be read by a person with normal vision standing 3 ft (0.9 m) away.

3.5.2.1 A corrosion resistant metal nameplate bearing the same information as stated above shall be considered acceptable if permanently fastened to the valve body or cover.

3.5.2.2 Other methods of applying permanent markings will be evaluated on a case-by-case basis.

3.5.3 Each required marking listed in Section 3.5.1 shall be legible and durable and applied in any of, or combination of, the above methods with the exception of the directional flow arrow which must be applied as stated in Section 3.5.2.

3.5.4 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify certification agency’s mark of conformity.

3.5.5 The certification agency’s mark of conformity shall be displayed visibly and permanently on the product and/or packaging as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.

3.6 Manufacturer's Installation and Operation Instructions

3.6.1 The manufacturer shall:

- prepare instructions for the installation, maintenance, and operation of the product;
- provide facilities for repair of the product and supply replacement parts; and
- provide services to ensure proper installation, inspection, or maintenance for products where it is not reasonable to expect the average user to be able to provide the installation, inspection, or maintenance.

3.7 Calibration

3.7.1 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.

3.7.2 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 the equipment.

4. PERFORMANCE REQUIREMENTS

4.1 Examination

4.1.1 Requirement

The alarm check valves shall conform to the manufacturer's drawings and specifications and to certification requirements.

4.1.2 Test/Verification

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

4.2 Clapper Strength

4.2.1 Requirements

The valve clapper shall withstand exposure to hydrostatic pressure of two times the rated working pressure. During and at the conclusion of the test, no fracture, ~~or~~ permanent distortion or functional impairment shall occur. After this test the valve shall be fully operable and shall comply with the leakage requirements in either Section 4.3 (Resilient Seat Leakage) or Section 4.4 (Metal-To-Metal Seat Leakage), as applicable.

4.2.2 Tests/Verification

A hydrostatic pressure of two times the rated working pressure shall be applied to the outlet side of the valve with the inlet of the valve open to atmosphere. The test pressure shall be held for five minutes. During and at the conclusion of the test, no fracture, permanent distortion or functional impairment shall occur. Full compliance with Section 4.3 (Resilient Seat Leakage) or Section 4.4 (Metal-To-Metal Seat Leakage) is required after the clapper strength test.

4.3 Resilient Seat (Reverse Flow) Leakage

4.3.1 Requirement

Resilient seated valves shall be leak tight when subjected to hydrostatic test pressures applied to the outlet side of the valve ranging from 30 psi (205 kPa) to the rated working pressure.

4.3.2 Test/Verification

With the inlet side open to atmosphere, the outlet side of each size valve shall be subjected to hydrostatic pressures of 30, 100 and 175 psi (205, 690 and 1205 kPa) and at the rated working pressure if in excess of 175 psi (1205 kPa). The test pressures shall each be held for five minutes, with no leakage allowed.

4.4 Metal-To-Metal Seat Leakage

4.4.1 Requirement

Metal-to-metal seated valve leakage shall not exceed 1 fluid ounce/hr (30 ml/hr) per inch of nominal valve size when subjected to downstream hydrostatic test pressures ranging from 30 psi (205 kPa) to the rated working pressure.

4.4.2 Test/Verification

With the inlet side open to atmosphere, the outlet side of each valve shall be subjected to hydrostatic pressures of 30, 100 and 175 psi (205, 690 and 1205 kPa) and at the rated working pressure if in excess of 175 psi (1205 kPa). The test pressures shall each be held for five minutes. Slight leakage, not in excess of 1 fluid ounce/hr (30 ml/hr) per inch of nominal valve size, is allowed.

4.5 Hydrostatic Strength – Alarm Check Valve

4.5.1 Requirement

Valve bodies shall withstand a hydrostatic pressure of four times the rated working pressure without rupture, cracking or permanent distortion.

4.5.2 Test/Verification

With the clapper or disc 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. There shall be no visible rupture, cracking, or permanent distortion to the valve body as a result of this test.

4.6 Hydrostatic Strength – Trim Piping

4.6.1 Requirement

Alarm check valve trim piping shall withstand a hydrostatic pressure of twice times the rated working pressure without rupture, cracking or permanent distortion.

4.6.2 Test/Verification

This test may be conducted including the alarm check valve body or just using the trim piping. In either case, the items under test shall be filled with water making sure to remove all internal air. The component shall then be subjected to a hydrostatic test pressure of twice the rated working pressure for a duration of five minutes. The minimum test pressure for this test shall be 350 psi (2415 kPa). There shall be no visible rupture, cracking, or permanent distortion to any component of the trim piping as a result of this test.

4.7 Friction Loss Determination

4.7.1 Requirement

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 disc in the full open position, the loss in pressure through the valve shall not exceed 5.0 psi (35 kPa) at a flow producing a velocity of 20 ft/s (6.1 m/s) in Schedule 40 steel pipe of the same nominal diameter as the valve.

4.7.2 Tests/Verification

Tests shall be conducted to show that the friction loss through each nominal size valve does not exceed 5.0 psi (35 kPa) at the flow rates shown in Table 4.6.2. These flows have been calculated based on a fluid velocity of 20 ft/sec (6.1 m/s) in Schedule 40 steel sprinkler pipe. This test may be waived at the examining engineer's option if drawing and calculation reviews of manufacturer's flow data are satisfactory. For valves corresponding to metric sizes, the manufacturer shall indicate the metric pipe to be used in the evaluation.

Table 4.6.2. - Friction Loss Flows

Nominal Valve Size, in.	*Flow, gal/min (L/min) at Velocity of 20 ft/sec (6.1 m/sec)*	
1-1/2	125	(475)
2	210	(795)
2-1/2	300	(1135)
3	460	(1740)
4	795	(3010)
5	1245	(4715)
6	1800	(6815)
8	3120	(11 810)

4.8 Cycle Test

4.8.1 Requirements

Alarm check valves which employ springs on the clapper shall be capable of 50,000 cycles of normal operation without excessive wear, damage or failure of any valve component.

4.8.2 Tests/Verification

A sample valve of each size shall be cycled 50,000 times, at a rate not exceeding 6 cycles per minute, through its full range of travel in a static air environment. This test shall be conducted at atmospheric (0 psi, 0 kPa) conditions. After the completion of the cycling test, the valve shall be disassembled. Parts shall be visibly examined for signs of excessive wear, damage or failure. This test, or a portion thereof, may be waived at the option of the examining engineer if design and calculation reviews are satisfactory.

4.9 Bonding Adequacy

4.9.1 Requirement

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

4.9.2 Test/Verification

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 for 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 4.8.2 - 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	(1695)
3	690	(2615)
4	1190	(4505)
5	1870	(7080)
6	2700	(10 225)
8	4680	(17 705)

4.10 Water Absorption

4.10.1 Requirement

For resilient seated valves, water absorption of the rubber facings shall not exceed 1.5 percent of the original thickness or weight.

4.10.2 Test/Verification

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 rubber to withstand the effect of water in accordance with ASTM D471, “Standard Test Method for Rubber Property - Effect of Liquids.” At the end of this period, a change in the thickness or weight of the sample shall not exceed 1.5 percent of the original thickness or weight.

4.11 Aging

4.11.1 Requirement

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

4.11.2 Test/Verification

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 D572, “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. bend radius of 180º).

4.12 Minimum Operational Flow Test

4.12.1 Requirement

Samples of each size of alarm check valve under evaluation shall be installed into a piping system in order to determine the minimum flow rate required to cause alarm signaling. This test shall be performed for supply pressures ranging from 20 psi (135 kPa) through the rated working pressure. Under no circumstances shall the operational flow be less than 4 gpm (15 L/min). This test shall be performed for vertical and horizontal orientations as applicable.

4.12.2 Test/Verification

Samples of each size of alarm check valve under evaluation shall be installed into a piping system in order to determine the minimum flow rate required to cause alarm signaling. Upstream of the alarm check valve shall be a control valve that can isolate the valve under test from the water supply. The outlet of the alarm check valve shall discharge flow through a throttling and shut-off valve continuing on to a calibrated flow meter. The alarm line shall be fitted with a mechanical and/or electrical alarm device for verification of alarm signal. The alarm check valve may be supplied with a retard chamber at the manufacturer's option.

The test piping shall be filled with water making sure to remove all trapped air from the system. The throttling valve adjacent to the flow meter and the main drain valve adjacent to the alarm check valve shall be in the closed position. The water supply control valve shall be opened slowly causing the seating of the clapper of the alarm check valve. The manual control valve between the alarm check valve and the retard chamber shall be in the open position. The test piping shall be visually inspected for leakage in any of the piping connections; any leaks shall be stopped prior to testing. To perform the test, the throttling valve located upstream of the flow meter shall be opened slowly causing water to flow through the alarm valve via the bypass line. Flow shall be increased until the flow meter is reading slightly less than 4 gpm (15 L/min) and start a timing device. If at the end of 180 seconds the alarm valve has not operated, the test may be stopped. If the valve is observed to operate at a flow rate under 4 gpm (15 L/min) the valve has not met the requirement. (Refer to Appendix D for an example of the test arrangement.)

4.13 Sensitivity Test

4.13.1 Requirement

Samples of each size of alarm check valve under evaluation shall be installed into a piping system in order to determine the minimum flow rate required to cause repeatable alarm signaling. This test shall be performed for supply pressures ranging from 20 psi (135 kPa) through the rated working pressure. Under no circumstances shall the operational flow be under 4 gpm (15 L/min) nor over 20 gpm (75 L/min) throughout the range of water supply pressure. This test shall be performed for vertical and horizontal orientations as applicable.

4.13.1 Test/Verification

Samples of each size of alarm check valve under evaluation shall be installed into a piping system in order to determine the minimum flow rate required to cause repeatable alarm signaling. This test shall be conducted using the same test piping as described in Section 4.11.2, Minimum Operational Flow Test. The following test shall be performed for supply pressures ranging from 20 psi (135 kPa) through the rated working pressure.

The test piping shall be filled with water making sure to remove all trapped air from the system. The throttling valve adjacent to the flow meter and the main drain valve adjacent to the alarm check valve shall be in the closed position. The water supply control valve shall be opened slowly causing the

seating of the clapper of the alarm check valve. The manual control valve between the alarm check valve and the retard chamber shall be in the open position. The test piping shall be visually inspected for leakage in any of the piping connections; any leaks shall be stopped prior to testing. To perform the test, the throttling valve located upstream of the flow meter shall be opened slowly causing water to flow through the alarm valve via the bypass line. Flow shall be increased until the alarm valve is observed to open causing the mechanical and/or electrical alarm device to signal. The flow rate shall be recorded.

The manual control valve between the alarm check valve and the retard chamber, and the water supply valve shall be closed, and the retard chamber shall be allowed to drain completely. Once the retard chamber has drained, the water supply valve can be slowly opened. The alarm check valve should reset automatically into the closed position. The test system shall be allowed to settle prior to the next step.

Simultaneously, the manual control valve between the alarm check valve and the retard chamber shall be opened, and a timing device shall be started. The time to activation for the alarm device shall be recorded. The recorded activation time shall fall between 5 and 60 seconds. The intent of this test is to determine the minimum flow rate that will result in repeatable activation of the alarm device within the allowed response time limits. It may be necessary to adjust the throttling valve between tests. This test shall be repeated for a total of three recordings per increment of water supply pressure. (Refer to Appendix D for an example of the test arrangement.)

5. MANUFACTURER'S REQUIREMENTS

5.1 Demonstrated Quality Control Program

5.1.1 A quality assurance program is required to assure that subsequent products produced by the manufacturer shall present the same quality and reliability as the specific products 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 program.
- 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;
- drawing and 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

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.

5.1.5 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 Product Modification

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*

The manufacturer shall test 100 percent of production valves for seat leakage to the rated working pressure. The pressure shall be held for a minimum of 15 seconds. If there is no visible leakage after 15 seconds, then the test may be considered acceptable. For metal seated valves, only, if there is leakage visible during the 15 second test, then the test duration shall be extended to a minimum of 1 minute so that the leakage rate can be determined. If the metal seated valve is observed to have leakage in excess of 1 fluid ounce/hr (30 ml/hr) the valve is considered to have failed the test. Resilient-seated valves of any sizes shall have no visible leakage.

Following the seat leakage test, all valves shall be opened through their full range with no evidence of sticking or binding.

5.4.2 *Test Requirement No. 2 - Body Leakage*

The manufacturer shall test 100 percent of production valves for body leakage to twice the rated working pressure. The pressure shall be held for a minimum of 1 minute with no evidence of body leakage or distortion.

6. BIBLIOGRAPHY

ANSI/ASME B1.20.1, *Pipe Threads, General Purpose (Inch)* and Redesignation of AMSE/ANSI B2.1

ISO/IEC 17025, *General Requirements for the Competence of Testing and Calibration Laboratories*.

APPENDIX A:

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APPENDIX B:

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APPENDIX C: DRAWINGS

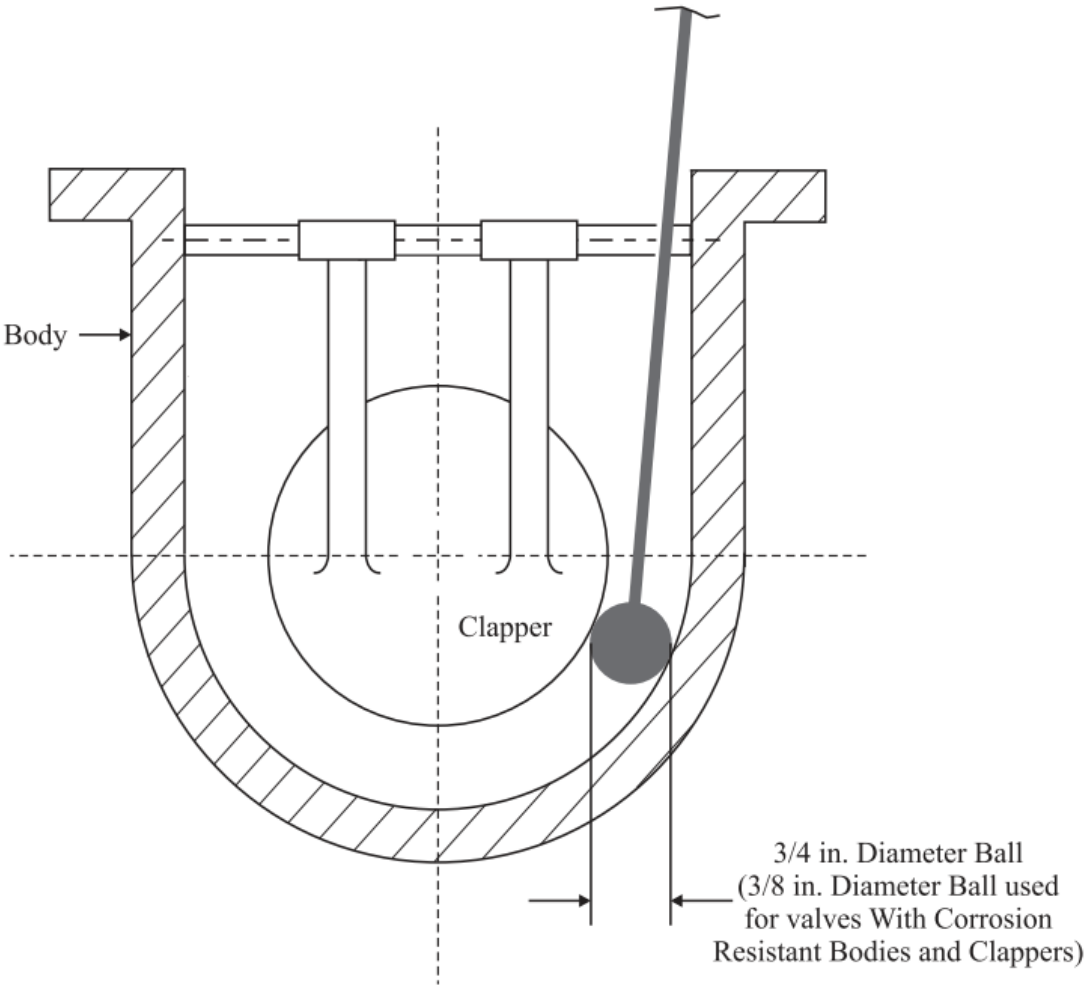


Figure C-1. Periphery of the Clapper and the Inside of the Body Clearances

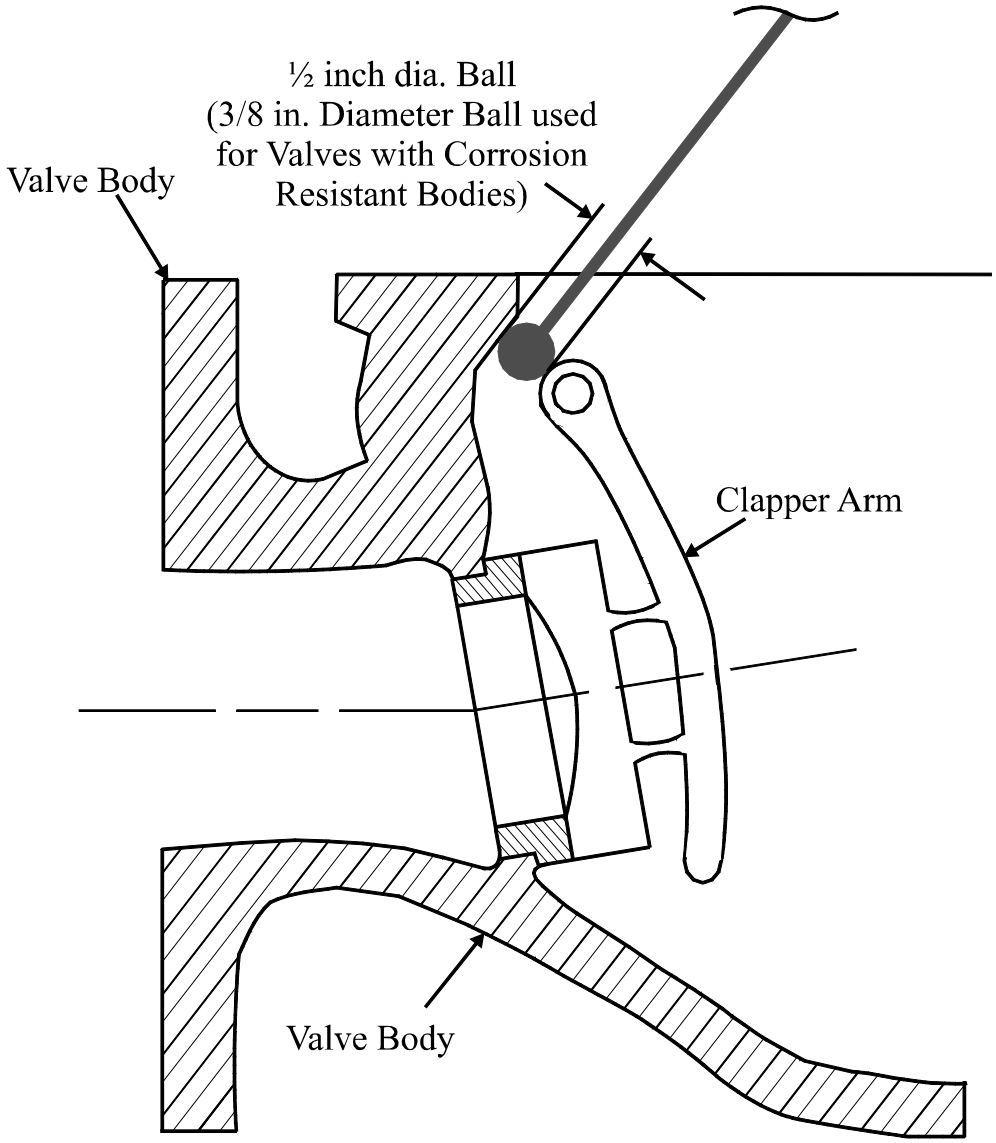


Figure C-2. Hub of the Clapper Arm and Inside of the Body Clearances

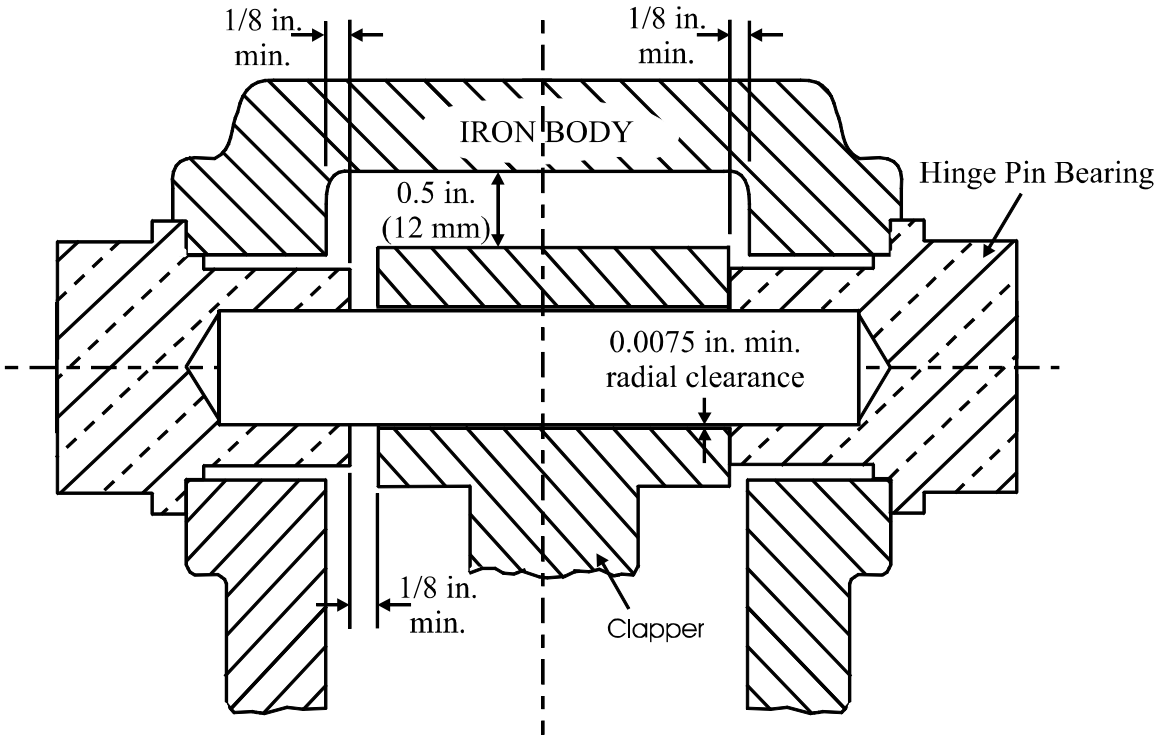
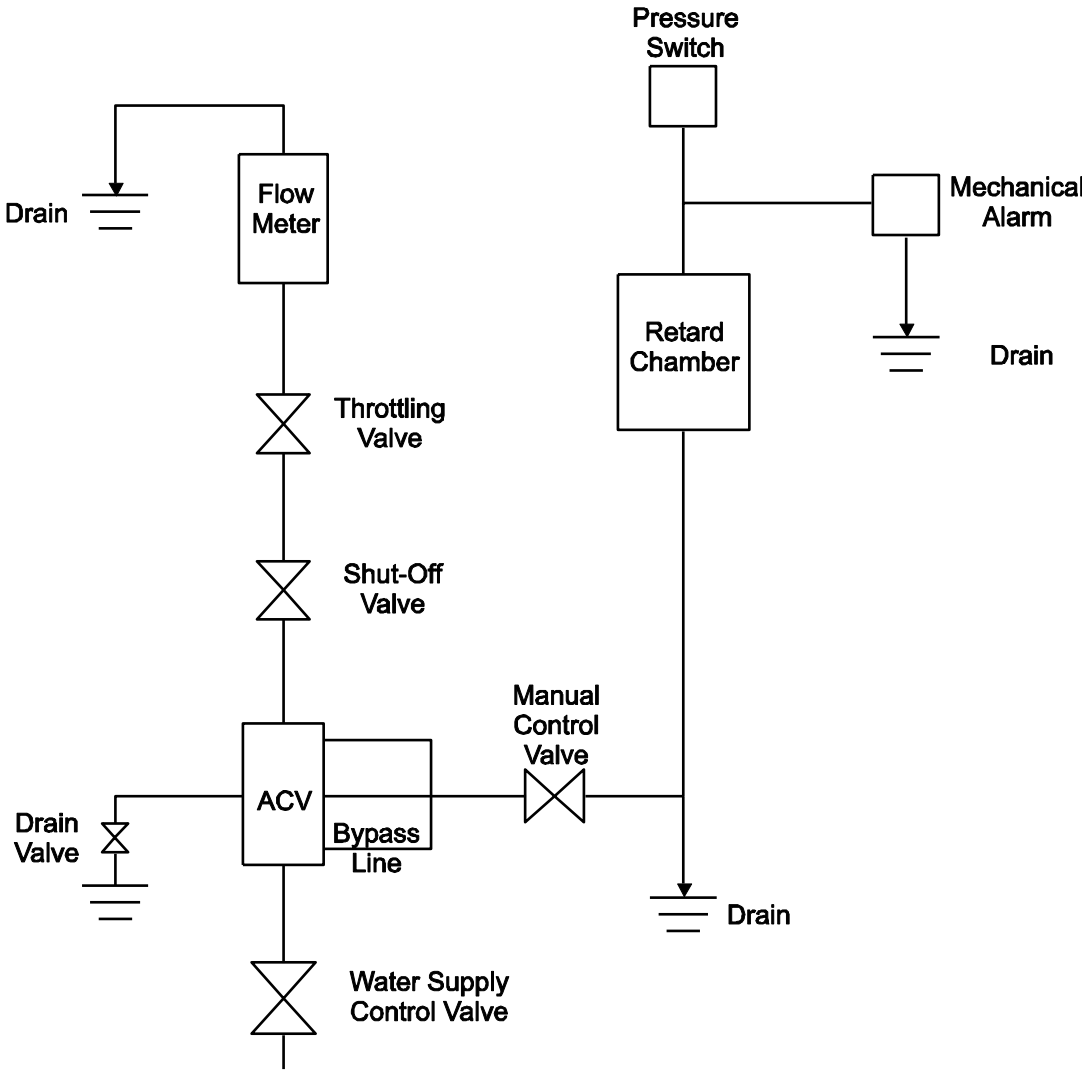


Figure C-3. Hinge Pin Clearances

APPENDIX D: TEST SET-UP DIAGRAM



APPENDIX E: SAMPLE LISTING

ABC Inc 123 Approvals Dr, Any City, Anywhere

Product Description	End Connections Inlet x Outlet	Nominal Pip Size, in.	Max. Rated Working Pressure, psi (kPa)	Remarks
Model ABC	Flange x Flange	4, 6, 8	175 (1205)	a
	Flange x Groove	4, 6	175 (1205)	a, b
	Groove x Groove	4, 6, 8	300 (2070)	a

Remarks:

a. For use with certified retard chamber model XYZ.
b. For vertical installations only.