Approval Standard for Dry Pipe Valves

Class Number 1021

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Foreword

The FM Approvals certification mark is intended to verify that the products and services described will meet FM Approvals' stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of Approval Standards is to present the criteria for FM Approval of various types of products and services, as guidance for FM Approvals personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for certification by FM Approvals shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Approval Standards strive to be performance-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Approval Standards:

a) must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and

b) must be readily identifiable.

Continuance of Approval and listing depends on compliance with the Approval Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on periodic follow-up audits of the manufacturing facility.

FM Approvals LLC reserves the right in its sole judgment to change or revise its standards, criteria, methods, or procedures.

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I INTRODUCTION

1.1 A dry pipe valve is installed in the water supply line to a dry pipe sprinkler system. The sprinkler piping downstream of the dry pipe valve contains air under pressure instead of water as in a wet system. When one or more sprinklers operate, air escapes, the dry pipe valve trips and water is admitted to the system.

1.2 FM Approval is based upon satisfactory examination and tests of production samples and inspection of manufacturing and quality control facilities. The following items are carefully evaluated in the course of an examination: functional suitability, operational reliability, adequacy of design and workmanship, uniformity and dependability of production, effectiveness of quality control and availability of replacement parts and service.

1.3 The requirements of this standard are intended as guidelines reflecting current FM Approval tests and practices. Items which do not precisely conform to these requirements may be approved if shown to perform as well as or superior to Approved items and to meet the intent of this standard. In the same way, items that do conform to each of these written requirements may not be approved if other considerations are felt to seriously affect the performance of the item.

II GENERAL DESCRIPTION

2.1 Description

2.1.1 The differential type dry pipe valve has either one or two hinged discs or clappers within a valve body. In the two clapper design, one is the water clapper, the other is the air clapper with a linkage assembly between them. The one clapper design utilizes one side of the clapper to contain the water supply while the other side contains pressurized air in the sprinkler piping. In both designs the ratio between the areas or lever arms of the air clapper and water clapper is about 6 to 1 so that the water supply can be contained by a relatively smaller air pressure. The space formed between the air and water clappers, or between the two seat rings in the single clapper design, is called the intermediate chamber. This chamber is vented to atmosphere through an automatic drain valve when the valve is in its normally shut or ‘‘set’’ position. This chamber allows any water or air leakage by the clapper(s) to be detected. When the valve operates or ‘‘trips’’, water enters this chamber, the automatic drain valve shuts and water flows to the alarms associated with the dry pipe system as well as into the sprinkler system piping.

2.1.2 The mechanical type dry pipe valve has one clapper which is held on its seat by a latch, either at the clapper or at some point in a lever system. When system air pressure is reduced to 5 to 30 psig (34.5 to 198 kPa) the latch is disengaged from the clapper by mechanical means and the valve operates similarly to the differential type. This type of dry pipe valve is more or less independent of system water pressure.

2.1.3 Some dry pipe valves may employ a combination of differential and mechanical design principles.

2.2 Markings

A corrosion resistant nameplate permanently fastened to the valve in a prominent position shall show: manufacturer’s or vendor’s name or trademark, rated working pressure, nominal valve size, distinctive model designation, year of manufacture and the symbol of FM Approval. All or part of this marking may be cast in raised letters on the valve body. If the valves are manufactured at more than one location, each valve shall be uniquely marked to indicate place of origin.

2.3 Sizes

Standard dry pipe valve sizes are: 2 in. (51 mm), 3 in. (76 mm), 4 in. (102 mm), 6 in. (152 mm) and 8 in. (203 mm). Other sizes may be Approved if there is a demonstrated need for them and they meet the requirements of this standard.

2.4 Rated Working Pressure

A dry pipe valve shall be designed for a minimum working pressure of 175 psig (1216 kPa).

2.5 End Connections

2.5.1 Valve bodies of 3 in. (76 mm) and larger sizes shall have flanged ends conforming to a recognized national standard for flanged fittings, such as ANSI B16.5. Two in. (51 mm) valve bodies may have flanged ends or threaded ends conforming to a recognized national standard for tapered pipe thread, such as ANSI B2.1. Other end connections may be Approved if there is a demonstrated need for them and these will be examined on a case-by-case basis.

2.5.2 Valves manufactured outside North America may be Approved with end connections conforming to National Standards recognized in the country of manufacture.

III DESIGN

3.1 General

3.1.1 Dry pipe valves often remain inactive for long periods of time yet they must be able and ready 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.

3.1.2 Valves shall be designed for an extended service life. Valves which meet the requirements of this standard are expected to perform reliably, under favorable conditions, for at least 75 years.

3.2 Operation

3.2.1 Dry pipe valve components shall operate positively, with no sluggishness or hang-ups, when tripped. Bumpers, stops or other means shall be provided to prevent damage to the clapper assembly or other valve parts when the clapper assembly comes to a stop after being tripped.

3.2.2 Latches or other devices shall be provided to prevent the dry pipe valve from reseating automatically after being tripped. The clapper shall remain above the seat to allow system drainage until manually reset.

3.2.3 It shall not be possible to render the valve inoperative by any external mechanical device(s).

3.2.4 Valves shall be designed so that component parts do not strike clapper rings or seat rings during tripping or resetting operations.

3.3 Orientation and Parts Removal

Dry pipe valves shall be designed so that all parts are uniquely oriented to minimize the possibility of improper assembly. All parts shall be easily removed for inspection, cleaning, repair or replacement without injury to the machined surfaces of the clapper and seat rings. Valve parts shall be able to be removed with standard tools.

3.4 Serviceability

Dry pipe valves shall be reasonably easy to set or reset after tripping by one person using standard tools. The body handhole cover(s) shall be designed to fit on the body in only one orientation if the position of the handhole cover(s) can affect the operation of the valve. The handhole(s) shall be large enough to permit normal maintenance, repairs and resetting.

3.5 Materials

All materials used in dry pipe valves shall be suitable for the intended purpose. All valve parts which could affect the operation of the valve if they become corroded or tuberculated shall be constructed of corrosion resistant materials. Metal seat rings which come into contact with rubber seating rings shall be constructed of material which will not naturally stick to rubber.

3.6 Friction Loss

The loss in water pressure across the valve shall not exceed 5 psi (34.5 kPa) at the flow rates listed below:

Valve Size in. (mm)	*Flow gpm (m^3/min.)*
2 (51)	150 (0.43)
3 (76)	400 (1.51)
4 (102)	750 (2.84)
6 (152)	1500 (4.30)
8 (203)	3000 (11.35)

3.7 Performance

3.7.1 Differential type dry pipe valves shall have a ratio of system water pressure to air pressure when the valve operates (trips) of between 5 and 6.5 at all water pressures from 20 psig (138 kPa) to the rated working pressure.

3.7.2 Mechanical type dry pipe valves shall operate at air pressures between 5 psig (34.5 kPa) and 30 psig (198 kPa) for all water pressures from 20 psig (138 kPa) to the rated working pressure.

3.8 Clearances

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

3.8.2 The following minimum dimensions shall be maintained:

⅛ in. (3 mm) between seat rings and metal parts of clapper assemblies such as metal retaining rings.

¾ in. (19 mm) between valve body and clapper assembly in all positions from closed to wide open.

½ in. (13 mm) between valve body and clapper hubs or hubs of any intermediate levers.

1/32 in. (1 mm) between hinge pins and bearings.

1/16 in. (2 mm) between face of metal clapper seat ring and clapper (for clappers with metal seat rings).

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

3.9 Trim Equipment

3.9.1 Dry pipe valves shall be supplied with auxiliary equipment which is necessary for operation of the system, or which may be necessary or desirable for a particular installation. This equipment includes pipes, fittings, valves, gages, alarms and switches. Exhausters and accelerators are auxiliary devices used to decrease the time of operation of the system. Necessary openings in the dry pipe valve must be provided for auxiliary equipment.

3.9.2 The air supply line shall be ¾ in. (19 mm) NPS and located on the air side of the valve above any priming connections.

3.9.3 A drain line shall be provided on the water side of the valve, sized as follows:

2 in. (51 mm) valves	¾ in. (19 mm) NPS
3 in. (76 mm) valves	1¼ in. (28 mm) NPS
4, 66 & 8 in. (102, 152 & 203 mm) valves	2 in. (51mm) NPS

3.9.4 A ¾ in. (19 mm) NPS minimum fitting shall be provided for possible installation of an automatic sprinkler within the dry pipe valve enclosure. (This may be piped to the priming connection.)

3.9.5 If priming water is needed to seal the air seat, provisions for adding it shall consist of the following: a ¾ in. (19 mm) NPS connection on the air side of the dry pipe, a shut-off valve, and a cup to prevent direct connection of a priming water supply line to the priming water line.

3.9.6 If priming water is used, a connection shall be provided so that proper priming water level can be determined.

3.10 Intermediate Chamber

3.10.1 The intermediate chamber of a dry pipe valve shall have an automatic drain valve for venting to atmosphere any water leakage by the clapper(s). The drain valve shall have a means to check the position of the clapper or ball portion of the valve to ensure that it is operating properly. A drain valve may be one of several types and may be located either inside or outside the chamber. One type located within the chamber closes mechanically when the clapper is raised. Other types located outside the chamber are called velocity drain valves, and close when a flow of water enters the chamber. Velocity drain valves shall shut at flow rates of between 2 and 10 gpm (7.6 and 37.9 dm^3/min.).

3.10.2 Dry pipe valves which do not have intermediate chambers shall have some means to detect the presence of water if it rises approximately one foot above the valve clapper.

3.11 Auxiliary Equipment

3.11.1 Dry pipe valves shall have the capability of operating various Approved, audible alarm devices, such as water motor gongs (FM Approval Standard Class No. 1050) and pressure switches (FM Approval Standard Class No. 3132). The valve shall also have the ability to test these alarm devices without tripping the valve or allowing water into the system piping.

3.11.2 Valve shall be equipped with Approved gages (FM Approval Standard Class No. 2311) to indicate air pressure and water supply pressure.

3.11.3 Air Pressure Maintenance Devices are used to maintain dry pipe system air pressure within pre-set limits and are examined in accordance with FM Approval Standard Class No. 1032.

3.11.4 Quick-Opening Devices, Accelerators and Exhausters, are used to increase the speed of operation of dry pipe valves and are examined in accordance with FM Approval Standard Class No. 1031.

IV TESTS — DRY PIPE VALVES

4.1 Operational Tests

A sample valve will be installed in a vertical riser. The valve will be set with air pressure above and water below, with the water control valve at least 1/3 open. The valve will be tripped at various water supply pressures from 20 psig (138 kPa) to the rated working pressure by slowly reducing the system air pressure above the valve. Normally each valve will be operated at least three times at each supply pressure increment (approximately 20 psig or 138 kPa). All operations must fall within the specifications of Paragraph 3.7.

4.2 Friction Loss

A sample valve will be installed between two flanged test pipes of the same nominal diameter as the valve and equipped with piezometer rings. The head loss between the piezometers will be measured for sufficient flows to determine the valve head loss characteristics. The head loss shall be in accordance with Paragraph 3.6.

4.3 Strength of Clapper Latch

In some situations a dry pipe valve may experience a reverse flow through the valve. To test the strength of the clapper latch, a sample valve will be subject to a reverse flow of approximately 2000 gpm (7.57 m^3/min.) for 5 minutes with the clapper on the wide open latch. The valve shall remain open during the test and no permanent distortion or function impairment shall occur.

4.4 Strength of Clapper

To further the strength of the clapper assembly, a sample valve will be tripped with air below the valve instead of water. The valve will be set with approximately 100 psig (690 kPa) air above and below the valve with a supply volume below the valve of approximately 375 gals. (1.4 m^3). The valve will be tripped by rapidly releasing the air pressure above the valve through a 2 in. (51 mm) drain valve. No damage to any valve parts shall result from this test and the valve shall operate satisfactorily after the test.

4.5 Hydrostatic Test

With the clapper assembly removed, a sample valve will be subjected to a hydrostatic test of 700 psig (4.8 M Pa) or 4 times the rated working pressure, whichever is greater, for 5 minutes. No leakage or permanent distortion shall result from this test.

V TESTS — RUBBER FACINGS

5.1 General

Rubber facing utilized in many dry pipe valves play a critical role in the reliable operation of the valve especially after extended periods of time. These rubber parts (natural or synthetic) will be the subject of a special examination as deemed necessary by FM Approvals and will include the below listed tests.

5.2 Water Absorption

A sample of the valve facing will be maintained in water at a temperature of 212°F (373°C) for 6 hours. At the end of this period, the increase in weight of the sample shall not exceed 1.5% of the original weight and the increase in thickness shall not exceed 1.5% of the original thickness.

5.3 Hardness

A sample facing will be tested for hardness. A value of 50 to 70 based on the Shore durometer ‘‘A’’ scale will be acceptable.

5.4 Aging

A sample facing will be subject to an accelerated aging test in accordance with ASTM D572 (Accelerated Aging of Vulcanized Rubber by the Oxygen-Pressure Method). After the test the sample will be examined for resilience; no cracking shall occur when the sample is bent double.

5.5 Adhesion

5.5.1 Due to the reaction between sulfur and copper, rubber products that contain sulfur may stick to valves with bronze seating surfaces. This situation will generally be limited to natural rubber facings; however, some synthetic rubber products may be sulfur cured. Testing will not be necessary if seating surfaces are made from materials that do not contain copper or if seating surfaces are tinned or coated with a suitable material.

5.5.2 If it is suspected that this situation may occur, the valve will be tested as follows:

— the clapper with rubber facing will be set on its seating surface with a pressure of 50 psig (340 kPa).

— the valve will be maintained in an environment of approximately 150°F (338°K) for 30 days.

— at the end of this period the clapper shall be able to be lifted off its seat by hand.

APPENDIX

APPROVAL MARKS

REPRODUCTION ART: FM Approval Marks

For use on nameplates, in literature, advertisements, packaging and other graphics.

1) The FM Approvals diamond mark is acceptable to FM Approvals as an Approval mark when used with the word ‘‘Approved.’’

2) The FM Approval logomark has no minimum size requirement, but should always be large enough to be readily identifiable.

3) Color should be black on a light background or a reverse may be used on a dark background.

For Cast-On Marks

4) Where reproduction of the mark described above is impossible because of production restrictions, a modified version of the diamond is suggested. Minimum size specifications are the same as for printed marks. Use of the word ‘‘Approved’’ with this mark is optional.

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