



Member of the FM Global Group

Approval Standard for Pressure Maintenance Devices

Class Number 1032

October 2019

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 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 Master Agreement, satisfactory performance in the field, successful re-examinations of equipment, materials, and services as appropriate, and surveillance 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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1 INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states Approval requirements for pressure maintenance devices (air/nitrogen) used in dry pipe and preaction type automatic sprinkler fire protection systems to automatically maintain, within pre-set limits, the air/nitrogen pressure within these systems.
- 1.1.2 Approval criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a follow-up program.

1.2 Scope

- 1.2.1 This standard encompasses the design and performance requirements for pressure maintenance devices (air/nitrogen) for use in dry pipe and preaction fire protection systems.
- 1.2.2 Approval Standards are intended to verify that the product described will meet stated conditions of performance, safety and quality useful to the ends of property conservation.

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 may also be considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of pressure maintenance devices (air/nitrogen) for use in dry pipe and preaction fire protection systems for the purpose of obtaining Approval. Pressure maintenance devices (air/nitrogen) for use in dry pipe and preaction fire protection systems having characteristics not anticipated by this standard may be FM Approved if performance equal, or superior, to that required by this standard is demonstrated, or if the intent of the standard is met. Alternatively, air pressure maintenance devices for use in dry pipe and preaction fire protection systems which meet all the requirements identified in this standard may not be FM Approved if other conditions that adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for Approval

Approval 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:
 - Suitability of the product;
 - Performance of the product as specified by the manufacturer and required by FM Approvals; and as far as practical,
 - Durability and reliability of the product.
- 1.4.2 An examination of the manufacturer's manufacturing facilities and audit of their quality control procedures shall be made to evaluate the manufacturer's ability to consistently produce the product that was examined and tested as part of the Approval project. The audit shall review the facility and in-place quality control procedures used in the manufacturing of the product. Typically, areas of review are incoming inspection, work in progress, production testing, final quality control, marking, calibration of equipment, shipping procedures, and document and drawing control. These

examinations are repeated periodically as part of FM Approvals' product follow-up program. (Refer to Section 5.2, Surveillance Audit.)

1.5 Basis for Continued Approval

1.5.1 Continued Approval is based upon:

- Production or availability of the product as currently FM Approved;
- The continued use of acceptable quality assurance procedures;
- Satisfactory field experience;
- Compliance with the terms stipulated in the Master Agreement;
- Satisfactory re-examination of production samples for continued conformity to requirements; and
- Satisfactory Surveillance Audits conducted as part of FM Approvals' Product Follow-up Program.

1.5.2 Also, as a condition of retaining Approval, manufacturers may not change an FM Approved product or service without prior written authorization by FM Approvals. (See Section 5.1.3 for additional details regarding changes).

1.6 Effective Date

The effective date of an Approval Standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products FM Approved under a previous edition shall comply with the new version by the effective date or forfeit Approval.

The effective date of this standard is October 1, 2019 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. Appendix A lists the selected units and conversions to SI units for measures appearing in this standard. Conversion of U.S. customary units is in accordance with the American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) / American Society for Testing Materials (ASTM) SI 10, *American National Standard for Metric Practice*.

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. For undated references, the latest edition of the referenced document (including any amendments) applies:

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

ANSI / American Society of Mechanical Engineers (ASME) B1.20.1, *Pipe Threads, General Purpose (Inch)*

International Organization for Standardization, ISO 17025, *General requirements for the competence of testing and calibration laboratories*

1.9 Definitions

For purposes of this standard, the following terms apply:

Accelerator

An accelerator is installed as part of the valve trim on a dry-pipe valve installed on the riser of a dry-pipe sprinkler system. It is used to reduce the time it takes a dry-pipe valve to open. It operates (trips) by sensing a significant and steady drop in system pressure (caused by the actuation of one or more sprinklers) which redirects system pressure to the intermediate chamber of the dry pipe valve reducing the pressure differential across the clapper of the dry-pipe valve allowing it open. Accelerators may be mechanical type or electric/electronic type.

Accepted

This term refers to installations acceptable to the authority enforcing the applicable installation rules. When the authority is FM Global, such locations are termed “FM Global Accepted.” Acceptance is based upon an overall evaluation of the installation. Factors other than the use of FM Approved equipment impact upon the decision to accept, or not to accept. Acceptance is not a characteristic of a product. It is installation specific. A product accepted for one installation may not be acceptable elsewhere. (Contrast with FM Approved.)

Automatic Sprinkler System

An integrated network of above-ground piping to which automatic sprinklers are attached. As a minimum, each sprinkler system is provided with at least one system control valve, system pressure gauge, system drain valve and a means of initiating alarm notification in the event of water movement through the system’s piping network. A sprinkler system is considered to provide adequate protection when it is connected to a reliable automatic water supply that can provide the flow, pressure and duration requirements for all occupancy hazards protected by the sprinkler system as required by the FM Global occupancy-specific data sheet.

Automatic Drain Valve

An automatic drain valve, also referred to as a ball drip check or velocity check valve, is used to ensure the intermediate chamber of a differential dry-pipe valve remains unpressurized while the valve is in the ready or set position. When the dry pipe valve trips the automatic drain valve trips allowing pressure to rise within the intermediate chamber.

Dry Pipe Automatic Sprinkler System

An automatic sprinkler system that is located downstream of a dry-pipe valve. It is filled with a pressurized gaseous medium (typically air or an inert gas such as nitrogen) for the purpose of maintaining the dry-pipe valve in the closed position. Upon sprinkler actuation, the pressure within the sprinkler system begins to drop until the pressure becomes too low to keep the dry-pipe valve closed. At this time the dry-pipe valve opens (trips) allowing water to fill the sprinkler system and discharge through any automatic sprinkler that has been actuated. A dry-pipe sprinkler system is typically used in areas where the presence of water within the sprinkler is not suitable. These systems are used when the ambient temperature of the protected area can drop below 40°F (4°C) or rise above 200°F (95°C).

Dry-Pipe Valve

An automatic water control valve, typically installed on the riser of a sprinkler system, which is specifically designed to use a pressurized gaseous medium (typically air or an inert gas such as nitrogen) to hold back water on the upstream side of the valve. The valve remains closed until the gas pressure on the downstream side of the valve drops, such as by automatic sprinkler operation, to a value too low to hold back the pressure of the water, thus opening the valve and allowing water to flow into and fill up the dry-pipe sprinkler system. Similar to an alarm check valve, it is designed to be equipped with a means of alarm

notification in the event water flows through it, but it is also equipped with a means of measuring the gas pressure within the sprinkler system. There are two types of dry-pipe valves available, a differential type valve and a mechanical type valve which are further described below.

Differential Type Dry-Pipe Valve

A dry pipe valve that is held in the closed position by a clapper that is characterized by a larger system (air/nitrogen) surface area than the surface area of the clapper in contact with water on the supply side of the valve. Normally these valves are designed with a pressure differential of between 5.0 and 6.5. As a result, in a valve with a differential of 5.0, a 20 psi (1.4 bar) system air/nitrogen pressure would be necessary to equalize a water supply pressure of 100 psi (6.9 bar). An additional 20 psi (1.4 bar) of system air/nitrogen pressure is typically supplied to ensure the valve will remain closed and avoid false trips. These valves employ an intermediate chamber which is normally vented to atmosphere so that the differential is maintained ensuring the valve remains closed. To hasten operation of the differential type dry-pipe valve an accelerator may be installed in the valve trim which, when activated, would redirect system air/nitrogen pressure into the intermediate chamber. This redirected pressure destroys the pressure differential of the valve, allowing it to trip sending water into the system piping.

Mechanical Type Dry-Pipe Valve

A dry pipe valve that is held in the closed position by a mechanical latch or piston. The operation of this type of valve is independent of water pressure and relies on an external device, a dry pilot actuator, provided as part of the valve trim. The dry pilot actuator functions similar to the differential valve described above. When the dry pilot actuator trips it vents the priming chamber of the mechanical type dry pipe valve allowing the aforementioned latch or piston to retract allowing the valve to trip sending water into the system piping.

Exhauster

An exhauster is typically installed as part of the valve trim on the dry-pipe valve installed on the riser of a dry-pipe sprinkler system. Larger exhausters may also be installed in system piping. Regardless of its installation location, it is used to reduce the time it takes a dry-pipe valve to open. It operates (trips) by sensing a significant and steady drop in system pressure (caused by the actuation of one or more sprinklers) which vents system air/nitrogen pressure to atmosphere. This venting speeds the pressure decay of the sprinkler system reducing the pressure differential across the clapper of the dry-pipe valve allowing it open quicker than would be the case if venting was only accomplished through open sprinklers.

End Connections

The means by which components of a sprinkler system are connected to the sprinkler fitting or piping. Typical end connections for pressure maintenance devices are threaded.

FM Approvals Certification Marks

The use of the FM Approvals Certification Mark is mandatory on all FM Approved products. These registered marks cannot be used except as authorized by FM Approvals via the granting of Approval to a specific product.

FM Approved

This term refers to products FM Approved by FM Approvals. Such products are listed in the *Approval Guide*, an on-line resource of FM Approvals. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned a Master Agreement to FM Approvals. This form obligates the manufacturer to allow re-examination of the product and audit of facilities and procedures at FM Approvals' discretion. It further requires the manufacturer not to deviate from the as-FM Approved configuration of the product without review by and agreement of FM Approvals. Approval is product and site specific.

Intermediate Chamber

A portion of a differential dry pipe valve which is open to atmosphere during normal operation. It remains open to atmosphere by use of an automatic drain valve when the valve is in its normally shut or “set” position. When supplied with system air/nitrogen through the activation of an accelerator, the automatic drain valve closes, allowing pressure in the intermediate chamber to rise and destroy the differential of the differential dry pipe valve, allowing it to trip sending water into the system piping.

Pressure Maintenance Device

A pneumatic/nitrogen pressure maintenance device used to automatically maintain the correct pneumatic/nitrogen pressure in a dry pipe sprinkler system, preaction system, or in dry pilot lines. When installed in these systems, this device eliminates the need for manual filling to overcome small leaks or temperature changes. Pressure maintenance devices do not interfere with the operation of a dry pipe or deluge valve including those used with quick opening devices.

Precision System, Single-Interlock

A sprinkler system employing automatic sprinklers attached to a piping system containing supervisory pressure with a supplemental detection system installed in the same areas as the sprinklers. Actuation of the detection system signals a fire alarm control system which opens the automatic water control valve which permits water to flow into the sprinkler piping system and to be discharged from any sprinklers that are open.

Single-Interlock Precision systems 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.

Precision System, Double-Interlock (Also referred to as a Refrigerated Area System)

A sprinkler system employing automatic sprinklers in the system piping which contains supervisory pressure. Installed in the area of the system sprinklers are detectors/releasing devices, which are either electric heat (or smoke) detectors or pneumatic release detectors such as a fixed temperature sprinkler head in a dry pilot line. This arrangement requires two independent detector/releasing activations in order to trip the automatic water control valve and flow water into the sprinkler piping. This system provides an additional safeguard against accidental water discharge than that of Single-Interlock Precision Systems. The system is also referred to as a ***Refrigerated Area System*** because they are predominately installed in refrigerated areas where the accidental charging of the distribution lines with water could have detrimental effects on the installation.

In contrast, the Single-Interlock Precision System would fill the system piping with water upon one detector activation only. This would result in frozen sprinklers heads and piping without an activated sprinkler. The sprinkler system would have to be dismantled, resulting in a prolonged time without fire protection.

However, these double-interlock systems are also employed in sensitive non-freezer applications where the accidental water discharge would cause damage and production downtime of expensive equipment, such as found in semi-conductor manufacturing.

Pressure Regulator

A control valve used to automatically reduce and maintain outlet pressure below that of a source inlet pressure.

Pressure Switch

A switch that closes an electrical contact when a desired pressure has been observed at its inlet. The switch may make contact either on pressure rise or decrease.

Rated Working Pressure

This is the maximum sustained pressure at or below which the air pressure maintenance device shall operate trouble free. This also sets the basis for the testing described in Section 4, Performance Requirements. The minimum pressure rating considered for FM Approval is 175 psi (12.06 bar).

2. GENERAL INFORMATION**2.1 Product Information**

2.1.1 Pressure maintenance devices are used to control and maintain the required air/nitrogen pressure necessary to keep the differential dry pipe valve closed in a dry pipe sprinkler system. The air or nitrogen pressure in a dry pipe sprinkler system is normally supplied by an air compressor or nitrogen cylinders (with pressure regulator) or nitrogen generators. The compressed air/nitrogen is automatically maintained by the pressure maintenance device which contains a pressure sensing element and flow control valve which regulates air/nitrogen flow into the dry pipe or preaction sprinkler system. The pressure sensing element is the control medium that maintains the air pressure within predetermined limits. The flow control valve permits air to pass from the supply source to the sprinkler system upon receipt of a signal from the sensing element. Per NFPA 13, a pressure maintenance device is required where the air compressor supplying the dry pipe system has a capacity equal to or greater than 5.5 ft³/min (160 L/min) at 10 psi (0.7 bar).

2.1.2 In order to meet the intent of this standard, all pressure maintenance devices 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 manufacturer or, even by different plants of the same manufacturer, have been seen to perform differently in testing. Sample pressure maintenance devices, selected in conformance to this criterion, shall satisfy all of the requirements of this standard.

2.2 Approval Application Requirements

2.2.1 To apply for an Approval examination, the manufacturer, or an authorized representative, should submit a request to information@fmaprovals.com.

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

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

2.2.3 Foreign language documents shall be provided with English translation.

2.3 Requirements for Samples for Examination

2.3.1 Following set-up and authorization of an Approval examination, the manufacturer shall submit samples for examination and testing. Sample requirements are to be determined by FM Approvals

following review of the preliminary information. Sample requirements may vary depending on the size range of the pressure maintenance devices that are to be examined, product design features and results of prior testing. The manufacturer's test facilities may be used for testing. If testing is performed at the FM Approvals Hydraulics Laboratory, it is the manufacturer's responsibility to provide any necessary test fixtures. Any manufacturer supplied test fixtures shall be returned to the manufacturer at their request.

- 2.3.2 It is the manufacturer's responsibility to submit samples representative of production. Any decision to use data generated using prototypes is at the discretion of FM Approvals. The manufacturer shall provide any necessary test fixtures, such as those which may be required to evaluate the pressure maintenance devices.
- 2.3.3 If there are failures encountered during the examination, FM Approvals will provide the manufacturer with information regarding what testing will need to be repeated and any additional sample requirements.

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 Approval 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 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. Foreign language documents shall be provided with English translation.

3.2 Physical or Structural Features

- 3.2.1 The pressure maintenance device shall be designed for a minimum rated working pressure of 175 psi (12.06 bar).
- 3.2.2 Pressure maintenance devices consist of a pressure sensing element, either a pressure regulator or pressure switch. The pressure regulator reduces higher pressure air/nitrogen to a level required by the dry pipe or preaction sprinkler system while the pressure switch will activate (and deactivate) an air compressor within predetermined limits to provide pressurized air to these systems.
- 3.2.3 The inlet of the pressure maintenance device shall be supplied with a threaded end connection. This connection shall conform to a recognized national or international standard, such as ANSI/ASME B1.20.1, *Pipe Threads, General Purpose (Inch)*.
- 3.2.4 Pressure maintenance devices shall include the following components:

- A by-pass line which allows air/nitrogen to be introduced to the sprinkler system piping during initial pressurization with no pressure regulation.
- A suitable strainer shall be provided to protect the small opening(s) in the air pressure maintenance device.
- A check valve furnished to protect the regulator from water entry once dry pipe or deluge valve has tripped.
- Shut off valve(s) to isolate the pressure maintenance device for repairs, etc.

3.3 Materials

All materials used in the construction of the pressure maintenance device shall be suitable for the intended application. Parts exposed to water shall be constructed of corrosion resistant materials. Materials shall be compatible with other sprinkler system components. When unusual materials are used, special tests may be necessary to verify their suitability. All components shall withstand the normal abuse of shipping, handling, and installation.

3.4 Markings

3.4.1 Each pressure maintenance device discussed in this Standard, shall be permanently marked with the following information:

- Manufacturer's name or trademark
- Model designation
- Air flow directional arrow
- FM Approvals Certification Mark

3.4.2 Any additional pertinent marking information required by a national or international standard to which the product is manufactured shall be permanently marked on the outside surface of each assembly.

3.4.3 All markings shall be legible and durable throughout the useful life of the product.

3.5 Manufacturer's Installation and Operation Instructions

The manufacturer shall provide installation instructions which provide details necessary to properly install, operate, and maintain the pressure maintenance device. These instructions shall be submitted to FM Approvals prior to the examination of these devices.

3.6 Calibration

Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of its stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment shall be submitted to FM Approvals for its records. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified as traceable to the National Institute of Standards and Technology (NIST) or traceable to other acceptable reference standards and certified by an ISO 17025 "General Requirements for the Competence of Testing and Calibration Laboratories" 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 accreditation certificate as an ISO 17025 calibration laboratory is required for FM Approvals' records.

The calibration of new equipment is also required. Documentation indicating either the date of purchase or date of shipment, equipment description, and model and serial number is required for identification. The period from the time the equipment was put into service to the date of testing must be within an interval that does not require the equipment to be calibrated as determined on the basis of the parameters mentioned above.

3.7 Tolerances

Tolerances on units of measure shall be as described in Appendix A, unless otherwise specified.

4. PERFORMANCE REQUIREMENTS

4.1 Examination

4.1.1 Requirement

The pressure maintenance devices shall conform to the manufacturer's drawings and specifications and to FM Approval requirements.

4.1.2 Test/Verification

A sample pressure maintenance device shall be examined and compared to the manufacturer's 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 Pressure Control

4.2.1 Requirement

The pressure maintenance device shall be designed so that it will be capable of adjustment to maintain an air/nitrogen pressure in the range of 15 - 75 psi (1.03 – 5.17 bar) or an operating range determined by the manufacturer.

4.2.2.1 Test/Verification – Pressure Switch

A pressure switch type pressure sensing element shall be tested at 15, 35, 55 and 75 psi (1.05, 2.4, 3.8 and 5.15 bar). The pressure switch shall operate within +/- 5% of its nominal pressure setting. The pressure switch shall have an operating differential of 2 - 8 psi (0.14 – 0.55 bar), meaning it shall transmit a signal to close at a pressure 2 - 8 psi (0.14 – 0.55 bar) greater than the pressure at which it transmits a signal to open.

4.2.2.2 Test/Verification – Pressure Regulator

A pressure regulator type pressure sensing element shall be tested at set pressures of 15, 35, 55 and 75 psi (1.05, 2.4, 3.8 and 5.15 bar). After setting the pressure regulator to each of the required set pressure settings, rapidly subject the outlet of the device to atmospheric pressure by opening a downstream ball valve. Allow discharge to atmosphere for a period of no less than five seconds, which results in a minimum pressure decay of 50% of the original pressure setting. After closing the ball valve, allow the regulator to stabilize discharge pressure (no change in measured discharge pressure for 30 secs.). Pressure regulator shall restore discharge pressure to within +/- 2% of its original pressure setting.

4.3 Flow Control

4.3.1 Requirement

The pressure maintenance device shall be designed that such that its flow rate does not exceed that available through a 1/16 in. (1.6 mm) diameter orifice at 100 psi (6.90 bar) pressure discharging to atmosphere.

4.3.2 Test/Verification

To evaluate design adequacy, tests will be made to determine the time required to drop the air pressure 5 psi (0.35 bar) from various initial pressures in a closed system of approximately 375 gallons (1420 liters). In each test the air shall discharge to atmosphere. The time to drop the pressure through the pressure maintenance device shall be equal to or greater than the time required to drop the pressure through the 1/16 inch (1.6 mm) orifice.

4.4 Backflow Prevention Device

4.4.1 Requirement

The backflow preventative device, provided to prevent the flow of air from the sprinkler system to the air supply source in the event of air supply failure, shall not leak at or below 75 psi (5.15 bar).

4.4.2 Test/Verification

With the inlet open to atmosphere, the downstream side of the backflow prevention device shall be pneumatically tested at 15, 35, 55 and 75 psi (1.05, 2.4, 3.8 and 5.15 bar). The test shall be conducted for a duration of five minutes at each pressure. No leakage is allowed.

4.5 Strength of Parts

4.5.1 Requirement

All parts of the pressure maintenance devices which may in the course of operation be subjected to water pressure, shall withstand hydrostatic pressure of 350 psi (24.13 bar) or two times the rated working pressure, whichever is greater, without rupture, cracking or permanent distortion.

4.5.2 Test/Verification

The pressure maintenance device shall be able to withstand a hydrostatic pressure of 350 psi (24.13 bar) or two 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 pressure maintenance device as a result of this test.

4.6 Durability

4.6.1 Requirement

The pressure maintenance device shall be designed to operate reliably without excessive maintenance throughout a reasonable service life.

4.6.2 Test/ Verification

To evaluate the design, a sample device will be subjected to an endurance test of 10,000 operations with the device adjusted to maintain a pressure of 28 to 30 psi (1.93 – 2.07 bar). There shall be no mechanical failure nor any appreciable change in the operating characteristics as a result of this test.

4.7 Additional Tests

Additional tests may be required, depending on design features, results of any tests, material application, or to verify the integrity and reliability of the pressure maintenance device, at the discretion of FM Approvals.

Unexplainable failures shall not be permitted. A re-test shall only be acceptable at the discretion of FM Approvals and with adequate technical justification of the conditions and reasons for failure.

5. OPERATIONS REQUIREMENTS

A quality control program is required to assure that subsequent air pressure maintenance devices produced by the manufacturer at an authorized location, shall present the same quality and reliability as the specific air pressure maintenance devices examined. Design quality, conformance to design, and performance are the areas of primary concern. Design quality is determined during the Approval examination and tests, and is covered in the Approval Report. Conformance to design is verified by control of quality and is covered in the Surveillance Audit Program. Quality of performance is determined by field performance and by periodic re-examination and testing.

5.1 Demonstrated Quality Control Program

5.1.1 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
- Handling and disposition of non-conformance materials.
- In order to assure adequate traceability of materials and products, the manufacturer shall maintain records of all quality control tests performed, for a minimum period of two years from the date of manufacture.

5.1.2 Documentation/Manual

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

5.1.3 Drawing and Change Control

The manufacturer shall establish a system of product configuration control that does not allow unauthorized changes to the product. Revisions to critical documents, identified in the Approval Report, must be reported to, and authorized by, FM Approvals prior to implementation for production. The manufacturer shall assign an appropriate person or group to be responsible for, and require that, proposed changes to FM Approved or Listed products be reported to FM Approvals before implementation. The manufacturer shall notify FM Approvals of changes in the product or of persons responsible for keeping FM Approvals advised by means of FM Approvals Form 619, *FM Approved Product/Specification-Tested Revision Report or Address/Main Contact Change Report*. Records of all revisions to all FM Approved products shall be maintained.

5.1.3.1 The table below has been included as a guide to manufacturers of what is considered to be a significant change to FM Approvals. As mentioned above, modifications that fit this category shall be documented by means of a letter stating the change and requesting a quotation for an Approval examination.

Modification	Description/Example
Addition or Relocation of the Manufacturing Location	The product was originally FM Approved in location A, and now is desired to be made in locations A and B, or only in location B.
Increase in Pressure Rating	The product was originally FM Approved for 175 psi (12.06 bar), and now is to be evaluated to 300 psi (20.70 bar.)
Changes to Critical Dimensions	Modifications that would depart from the national or international standards that are used in the manufacturing of the product as originally FM Approved.
	Modifications that would have an effect on the use of the product with standardized fittings/couplings.
	Modifications that would have an effect on the ability of the product to maintain the same performance as the originally Approved product. An example of this would be a significant reduction of wall thickness on the body.

5.1.3.2 The table below has been included as a guide to manufacturers of modifications that are commonly submitted on FM Approvals Form 619, *FM Approved Product/Specification-Tested Revision Report or Address/Main Contact Change Report*.

Modification	Description/Example
Change in Company Contact Information	Name, Title, Phone Number, Fax Number, Email Address, Company Office Address, Company Name
Updating of Drawings	FM Approved Product Revision Request Form is used to notify FM Approvals in the event of: minor dimensional changes to non-critical features, minor changes in notes, location of title block, re-creation of the same drawing on CAD, etc.
Changes in Markings	Please describe what changes are to be made and include a drawing of the proposed marking.
Changes in Materials of a component	Where new material is either superior, or comparable to material used in original Approval

<i>Modification</i>	<i>Description/Example</i>
Updating of Documentation	Creation of New or Revisions to Sales literature, Installation Instructions, Grooving Dimensions, Quality Manual, etc.

5.1.3.3 For the instances where the modification is difficult to categorize, manufacturers are encouraged to contact FM Approvals to discuss the nature of the change and inquire about how to send the information to FM Approvals. The examples shown in Sections 5.1.3.1 and 5.1.3.2 are based on common examples of modifications as they relate to the manufacture of the product.

5.2 Surveillance Audit Program

5.2.1 An audit of the manufacturing facility is part of the Approval investigation to verify implementation of the quality control program. The surveillance audit shall ensure that the appropriate controls are in place to verify that the product bearing the FM Approval Mark conforms to the specified requirements. Although the structure defined in ISO 9001 “Quality Management Systems - Requirements” may be applied, the focus of surveillance audits is principally the FM Approved or Listed product. Initial inspections of facilities already producing similar FM Approved products may be waived at the discretion of FM Approvals.

5.2.2 Surveillance audits shall be conducted by FM Approvals, or its representatives, at least annually at each location that manufactures the product, and/or applies the FM Approval Mark as listed in the final Approval Report to confirm continued compliance. The frequency of, and time needed to complete, the surveillance audit is dependent on the product class, product complexity, jurisdictional requirements, FM Approvals accreditation requirements, and findings.

5.2.3 The manufacturer shall manufacture the product or service only at the location(s) audited by FM Approvals and as specified in the Approval Report. Manufacture of products bearing the FM Approval Mark is not permitted at any other locations without prior written authorization by FM Approvals.

5.2.4 In the event that all or part of the quality inspection is subcontracted, the manufacturer shall provide FM Approvals with documentation outlining the nature of the inspection, frequency, test details, and pass / fail criteria that was provided to the subcontracted company, and documentation that they have received and implemented these procedures.

5.3 Installation Inspections

Field inspections may be conducted to review an installation. The inspections are conducted to assess ease of application, and conformance to written specifications. When more than one application technique is used, one or all may be inspected at the discretion of FM Approvals.

5.4 Manufacturer’s Responsibilities

The manufacturer shall notify FM Approvals of changes in product construction, design, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation of such changes.

5.5 Manufacturing and Production Tests5.5.1 Test Requirement No. 1 – *Body Leakage Test*

The manufacturer shall perform body leakage testing on 100 percent of production pressure maintenance devices. Body leakage testing shall be run at a test pressure equal to the rated working pressure for a minimum of 30 seconds with no evidence of body leakage or distortion.

APPENDIX A: TOLERANCES

Unless otherwise stated, the following tolerances shall apply:

Mass	± 2 percent of value
Length	± 2 percent of value
Pressure	± 2 psi (0.14 bar)
Temperature	$\pm 4^{\circ}\text{F}$ (2°C)
Time	+ 5/-0 seconds +0.1/-0 minutes

Unless stated otherwise, all tests shall be carried out at a room (ambient) temperature of $68 \pm 9^{\circ}\text{F}$ ($20 \pm 5^{\circ}\text{C}$).

APPENDIX B: SAMPLE LISTING

Pressure Maintenance Devices, Dry Pipe Systems

These pressure maintenance devices automatically maintain a predetermined air or nitrogen pressure in dry pipe sprinkler systems. Some devices may be used with a noncontinuous air supply which is capable of initially filling the system. Other systems require a continuous air or nitrogen supply. Unless noted otherwise in the listing, these pressure maintenance devices have a pressure rating of 175 psi (12.05 bar).

Models TB-12 and TC-82

Models TC-82 and TB-12

Model	Type	Rated Working Pressure, psi (bar)	Remarks
TB-12	Air/Nitrogen	175 (12)	
TC-82	Air	175 (12)	