



Member of the FM Global Group

Approval Standard for Quick Opening Devices (Accelerators, Exhausters) for Dry Pipe Valves

Class Number 1031

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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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1. INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states Approval requirements for quick opening devices (accelerators and exhausters) used with dry pipe valves in dry automatic sprinkler fire protection systems to hasten the operation of dry pipe valves when one or more sprinklers operate. These devices are also used on preaction sprinkler systems to hasten the operation of automatic water control valves. This standard addressed both mechanical and electronic devices.
- 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 quick opening devices (accelerators and exhausters) for use in dry automatic sprinkler 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 was also considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of Quick Opening Devices (Accelerators and Exhausters) for use in dry pipe automatic sprinkler 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, Quick Opening Devices (Accelerators and Exhausters) for use in dry pipe automatic sprinkler 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 initial Surveillance Audit shall be conducted 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 shall not change a product or service without prior authorization by FM Approvals.

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 August 1, 2019 for full compliance with all requirements.

1.7 System of Units

Units of measurements 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/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 water supply that can provide the flow, pressure and duration requirements for all occupancy hazards protected by the sprinkler system as required.

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 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 to open quicker than would be the case if venting was only accomplished through open sprinklers.

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.

Inspector's Test Connection

A device, or a manifold, consisting of one or two manual control valves, a section of sprinkler piping (allowing discharge to a safe location), and either one, two or four smooth bore corrosion-resistant orifices (no larger than the smallest orifice of any sprinkler installed on the sprinkler system to which the Inspector's Test Connection serves) depending on the method by which the sprinkler system was calculated for water delivery time. It is used to test the waterflow alarm mechanism provided with the sprinkler system and to determine the water delivery time to the device. When installed for the purpose of confirming waterflow alarm activation as well as determining water delivery time, it is installed at the hydraulically remote end of a sprinkler system.

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 automatic sprinkler 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 valve including those used with quick opening devices.

Rated Working Pressure

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

Wet Automatic Sprinkler System

An automatic sprinkler system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that the water discharges immediately from actuated sprinklers.

2. GENERAL INFORMATION

2.1 Product Information

- 2.1.1 Accelerators hasten the operation of differential dry pipe valves by reducing the differential pressure across the clapper. Antiflooding devices are used with mechanical accelerators to prevent foreign material from clogging internal orifices. The antiflooding device may be a separate component or an integral part of the mechanical accelerator.
- 2.1.2 Exhausters hasten the operation of dry pipe valve by aiding in venting dry pipe automatic sprinkler systems to atmosphere.
- 2.1.3 In order to meet the intent of this standard, all quick opening 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 quick opening devices, selected in conformance to this criterion, shall satisfy all of the requirements of this standard.

2.2 Approval Application Requirements

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

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 and one complete set of manufacturing drawings;
- Materials list(s) and material specifications;
- Anticipated marking format;
- Brochures, sales literature, specification sheets;
- Installation, operation and maintenance procedures; and
- The number and location of manufacturing facilities.

All documents shall be part of a controlled system and 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 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 dry pipe valves that are to be examined, product design features and results of prior testing. Any decision to use data generated utilizing prototypes is at the discretion of FM Approvals. 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 special test fixtures which may be required to evaluate the quick opening device(s).
- 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 Approval Limitation

Approval of accelerators will be limited for use with the specific dry pipe valve(s) requested by the manufacturer and used in the Approval testing. As such, Approval for use with multiple dry pipe valves shall require a complete test program for each dry pipe valve / accelerator combination.

3.2 Review of Documentation

- 3.2.1 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.
- 3.2.2 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.
- 3.2.3 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. All foreign language drawings shall be provided with an English translation.

3.3 Operation, Physical or Structural Features

- 3.3.1 Quick opening devices usually employ a two-chamber configuration with a diaphragm as the common boundary. Movement of the diaphragm effects movement of a clapper which holds dry pipe sprinkler system air/nitrogen pressure. A small orifice connects the two chambers. It is used for adjustment purposes and to equalize chamber pressures in dry pipe sprinkler systems that are not air-tight.

The device is in the set position when both chambers are in equilibrium. When one of more sprinklers operate, air/nitrogen is vented from the system side of the quick opening device. Since the equalizing orifice cannot compensate for the excessive air/nitrogen loss a pressure differential is created across the diaphragm which moves the clapper off its seat. The system air/nitrogen is vented to atmosphere or, as in a differential type dry pipe valve, redirected to the dry pipe valve intermediate chamber to destroy the pressure differential of the valve, allowing it to trip sending water into the system piping.

- 3.3.2 The quick opening device shall have a minimum rated working pressure of 175 psi (12 bar).
- 3.3.3 Quick opening devices shall trip the dry pipe valve to which it is being evaluated with within 30 seconds after the operation of one or more sprinklers at system pressures encountered throughout the range of water supply pressures from 20 psi (0.50 bar) to 175 psi (12 bar), or the dry pipe valve's rated working pressure if greater.
- 3.3.4 Quick opening devices shall remain functional when exposed to air/nitrogen and water pressures up to the rated working pressure of the dry pipe valve it is being evaluated with.
- 3.3.5 The anti-flooding component of a mechanical type quick opening device shall not allow water or foreign matter to enter the accelerator nor shall it interfere with the devices normal operation.
- 3.3.6 The anti-flooding component of a mechanical type quick opening device shall be designed to permit quick cleaning and maintenance without the use of special tools.
- 3.3.7 Provisions shall be made in the dry pipe valve trim for isolating mechanical type quick opening devices in order that repairs can be made without affecting sprinkler system performance.
- 3.3.8 Orifices shall be protected from clogging.
- 3.3.9 A pressure gauge shall be provided to sense upper chamber pressure in mechanical type accelerators to facilitate the detection of a clogged pressure equalizing device.
- 3.3.10 All materials used shall be suitable for their intended application. Components susceptible to malfunction due to corrosion shall be constructed of materials with at least the corrosion resistance equal to a bronze alloy with a minimum 80% copper content.
- 3.3.11 Quick opening devices shall be provided with threaded NPT connections. These connections shall be designed in accordance with ANSI/ASME B1.20.1. Alternatively, quick opening devices intended for sale outside the United States may be supplied with pipe threads conforming to the relevant recognized national standard that will provide compatibility with that nation's automatic sprinkler system components.

3.4 Markings

- 3.4.1 All FM Approved quick opening devices shall bear at least the following minimum markings:
- Manufacturer's name, code or trademark
 - Model designation
 - Rated working pressure
 - Specific source code, indicating location of manufacture (if more than one)
 - Date of manufacture code
 - FM Approvals Certification Mark

3.4.2 The device inlet and outlet shall clearly be identified either with text or arrow showing direction of flow.

3.4.3 All markings shall be legible 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 system. These instructions shall be submitted to FM Approvals prior to the examination of a system.

3.6 Calibration

3.6.1 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.

3.6.2 The calibration of new equipment is also required. Documentation indicating either the date of purchase or date of shipment, equipment description, model and serial number is required for identification. The new test equipment shall be clearly identified by label or sticker showing the date of initial calibration and the next due date.

3.6.3 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.

3.7 Tolerances

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

4. PERFORMANCE REQUIREMENTS

4.1 Examination

4.1.1 Requirement

The quick opening devices shall conform to the manufacturer's drawings and specifications and to FM Approvals requirements.

4.1.2 Evaluation

A sample device 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 Operation

4.2.1 Requirement

The time required to trip the dry pipe valve after sprinkler activation shall be less than 30 seconds at all water

pressures. The pressure in the system shall be reduced by opening a sprinkler, or equivalent, which provides a pressure decay of from 20 psi (1.4 bar) to 10 psi (0.70 bar) over a period of one minute.

4.2.2 Test/Verification

Testing shall be conducted on each size dry pipe valves submitted for Approval. Water supply pressures shall be varied from 20 psi (1.4 bar) to 175 psi (12 bar) or the system maximum working pressure, whichever is greater. Select a restriction which will reduce the system air/nitrogen pressure from 20 psi (1.4 bar) to 10 psi (0.70 bar) over a period of one minute. This rate of decay is equal to the rate of decay in a 750 gallon (2.85 cubic meters) system when opening a standard K5.6 sprinkler. The system air/nitrogen pressure at each water supply pressure shall be in accordance with the manufacturer's instructions. Alternatively, a trip ratio of 5:1 will be assumed. Based on this trip ratio, determine the system air/nitrogen pressure at the trip point for each supply water supply pressure and add 20 psi (1.4 bar). The system air/nitrogen pressure must not exceed the water supply pressure. The time required to trip the dry pipe valve after sprinkler activation shall be measured. To ensure that the accelerator provides sufficient air velocity to adequately close the automatic drain valve, these components shall be tested as a unit.

4.3 Clogging

4.3.1 Requirement

Mechanical quick opening devices shall be adequately protected from clogging due to foreign material or debris found within sprinkler system piping. The intent of the requirement is to ensure that anti-flooding devices prevent potential debris from passing through them into the mechanical quick opening device where small orifices are incorporated in the design and may be subject to clogging.

4.3.2 Test/Verification

4.3.2.1 One tablespoon of organic matter, approximately the size and shape of sunflower seeds, will be placed in the accelerators inlet piping to simulate loosened debris within an automatic sprinkler system making its way through the quick opening device during the operation of the dry pipe valve.

4.3.2.2 The procedure discussed above shall be repeated using two tablespoons of wooden toothpick segments. The segments used shall be made by cutting a standard round toothpick, approximately 0.1 inch (2.5 mm) in diameter into approximately 0.13 inch (3.3 mm) lengths.

4.3.2.3 Each test will be repeated three times. The above debris shall not pass through the anti-flooding device in all cases.

4.4 Ease of Cleaning

4.4.1 Requirement

Mechanical quick opening devices shall be serviceable using standard tools of the trade (i.e. no special tools). The intent of the requirement is to ensure anti-flooding devices can be cleaned in a reasonable period of time using standard tools of the trade.

4.4.2 Test/Verification

The evaluation shall be conducted by measuring the time required to clean the anti-flooding device of the material captured by the testing described in Section 4.3 – Clogging. A cleaning time of 20 minutes or less is consider satisfactory.

4.5 Diaphragm Strength

4.5.1 Requirement

Devices with diaphragms shall withstand a differential hydrostatic pressure of 350 psi (24.15 bar) or two times the rated working pressure, whichever is greater, across the diaphragm for 5 minutes. No diaphragm damage or functional impairment shall result from this test. Following this test the quick opening device shall be fully operational.

4.5.2 Test/Verification

A differential pressure of 350 psi (24.15 bar) or two times the rated working pressure, whichever is greater, shall be applied to the outlet side of the device with the inlet open to atmosphere. The test pressure shall be held for five minutes. During and at the conclusion of the test, no leakage, fracture, permanent distortion or functional impairment shall occur.

4.6 Hydrostatic Strength

4.6.1 The devices shall withstand a hydrostatic pressure of 700 psi (48.25 bar) or four times the rated working pressure, whichever is greater, without functional impairment, rupture, cracking or permanent distortion.

4.6.2 Test/Verification

The entire device shall be subject to a hydrostatic pressure of 700 psi (48.25 bar) or four times the rated working pressure, whichever is greater for a period of five minutes. During and at the conclusion of the test, no functional impairment, rupture, cracking or permanent distortion shall occur.

4.7 Additional Tests

At the discretion of FM Approvals additional tests may be required, depending on design features, results of any tests, material application, or to verify the integrity and reliability of the quick opening devices.

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

5. OPERATIONS REQUIREMENTS

A Quality Control Program is required to assure that quick opening devices produced by the manufacturer at an authorized location shall present the same quality and reliability as the specific quick opening 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 performances 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.

| <i>Modification</i> | <i>Description/Example</i> |
|--|---|
| 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. |
| Change in Manufacturing Process | Change from Threaded Assembly to Rolled Groove End Connections |
| 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. |

| <i>Modification</i> | <i>Description/Example</i> |
|---------------------|---|
| | 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 in the pressure containing components of the device. |

- 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*.

| <i>Modification</i> | <i>Description/Example</i> |
|---------------------------------------|---|
| 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 Component | Where new material is either superior, or comparable to material used in original Approval |
| 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 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.

5.4 Manufacturing and Production Tests

5.4.1 Test Requirement No. 1 – *Body Leakage*

The manufacturer shall test 100 percent of production quick opening devices for body leakage to twice the rated working pressure. The pressure shall be held 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:

| | |
|-------------|---|
| Length | ± 2 percent of value |
| Volume | ± 5 percent of value |
| Pressure | ± 5 psi (0.35 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**ACCELERATORS AND EXHAUSTERS**

An accelerator or exhauster used in combination with a dry pipe valve, causes the valve to trip quickly upon sprinkler operation. These devices operate when loss of system air pressure exceeds a predetermined rate. Unless otherwise noted in the listing, these accelerators and exhausters have a rated working pressure of 175 psi (12 bar).

ABC Co, 123 Streets Ave, City, ST 33303

| Accelerator Model | Approved for use with the following dry pipe valves: | Rated working pressure, psi (bar) |
|--------------------------|---|--|
| Model MAZ | Model PJZ, Sizes 4 and 6 inch NPS | 175 (12) |