



**Approval Standard  
for  
Air Release Valves  
1/2 Inch Through 1 Inch  
Nominal Size**

**Class Number 1344**

**January 2010**

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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 FM Approvals criteria for air release valves for use in wet pipe sprinkler systems, or with horizontal split case pumps.

1.1.2 Approval criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit assurance procedures, and a follow-up program.

### 1.2 Scope

1.2.1 This standard encompasses the design and performance requirements for 1/2 inch through 1 inch nominal size air release valves. In cases where metric sized products are to be examined for Approval, test criteria comparable to the equivalent or nearest nominal size shall be used.

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 air release valves for the purpose of obtaining FM Approval. Air release valves 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. Conversely, air release valves which meet all of the requirements identified in this Standard may not be FM Approved if other conditions which 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:

- The suitability of the product
- The performance of the product as specified by the manufacturer and required by FM Approvals; and as far as practical,
- The durability and reliability of the product.

1.4.2 An initial facilities and procedures (F&PA) 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 the FM Approval product follow-up program. (Refer to Section 5.2, Facility and Procedures 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 Facilities and Procedures Audits (F&PAs) 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. (Refer to Section 5.1.3 for further 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 **December 31, 2010** 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 10-02, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*.

## 1.8 Applicable Documents

The following standards, test methods, and practices are referenced in this standard or are beneficial in understanding this standard:

- ANSI/ASME B16.42 (1998), *Ductile Iron Pipe Flanges and Flanged Fittings*  
ANSI/American Water Works Association (AWWA) C512 (2007), *Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service*  
ANSI/AWWA C550 (2005), *Protective Interior Coatings for Valves and Hydrants*  
ANSI/IEEE/ASTM SI 10 (2002), *American National Standard for Use of the International System of Units (SI): The Modern Metric System*  
ASME B16.1 (2005), *Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800*  
ASME B16.5 (2009), *Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard*  
ASME B1.20.1-1983 (R2006), *Pipe Threads, General Purpose (Inch)*  
ASTM A48/A48M-03 (2008), *Standard Specification for Gray Iron Castings*  
ASTM A126-04 (2004), *Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings*  
ASTM A307-07b (2007), *Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength*  
ASTM A536-84 (2009), *Standard Specification for Ductile Iron Castings*  
AWWA M51 (2001), *Air Release, Air/Vacuum Valves & Combination Air Valves, First Edition*

British Standards Institution, BS EN 10226-2 (2005), *Pipe threads where pressure tight joints are made on the threads. Taper external threads and taper internal threads. Dimensions, tolerances and designation*  
FM Global Property Loss Prevention Data Sheet 2-8N (Feb. 2008), *Installation of Sprinkler Systems*  
FM Global Property Loss Prevention Data Sheet 3-7 (June 2009), *Fire Protection Pumps*  
International Organization for Standardization (ISO) 7-1 (1994), *Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation*  
ISO 7-2 (2000), *Pipe threads where pressure-tight joints are made on the threads - Part 2: Verification by means of limit gauges*  
ISO/International Electrotechnical Commission (IEC) 17025 (2005), *General Requirements for the Competence of Testing and Calibration Laboratories*  
National Sanitation Foundation (NSF)/ANSI 61 (2008), *Drinking Water System Components -- Health Effects*

## 1.9 Definitions

For purposes of this standard, the following terms apply:

### ***Accepted***

This term refers to installations acceptable to the authority enforcing the applicable installation rules. 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 whether to accept the product. Acceptance is not a characteristic of a product. A product accepted for one installation may not be acceptable elsewhere. (Contrast with FM Approved.)

### ***Air Flow Rate***

The quantity of air, expressed in standard cubic feet per minute (cubic meters per minute), passing through an orifice.

### ***Air Release Valve***

A hydromechanical device designed to automatically release to the atmosphere small pockets of air as they accumulate at local high points along a pipeline when the pipeline or piping system is full and operating under pressure.

### ***End Connections***

The term “End Connections” refers to the method of connecting components of a pipe system to the valve. Typical end connections in a fire protection service are cut groove, rolled groove, threaded, plain end, and welded end.

### ***Flanged End Valves***

Valves having mating flanged ends per the dimensional values shown in ASME B16.5, *Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard*. Flanges meeting other national or international standards may be evaluated on a case-by-case basis.

### ***FM Approved***

This term refers to products FM Approved by FM Approvals. Such products are listed in the Approval Guide, an online resource of FM Approvals, see Appendix D. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned a Master Agreement to FM Approvals. These forms obligate the manufacturer to allow re-examination of the product and audit of facilities and procedures at FM Approval’s discretion. It further requires the manufacture not to deviate from the as-FM Approved configurations of the product without review by and agreement of FM Approvals.

### ***Orifice***

This term refers to the opening in the valve outlet where air is expelled.

***Rated Working Pressure***

This is the maximum sustained pressure at or below which the valve shall operate trouble free. This also sets the basis for the testing described in Section 4, Performance Requirements. The minimum pressure rating considered for FM Approval is 175 psi (1205 kPa).

***Threaded End***

Air release valves which have been furnished with its ends threaded with internal or external pipe threads conforming to national or international standards for pipe threads for the nation of intended use (e.g., ASME B1.20.1, ISO 7-1).

**2. GENERAL INFORMATION****2.1 Product Information**

- 2.1.1 Air release valves permit trapped air to be released from sprinkler piping without losing water pressure. They are used on wet pipe sprinkler systems, on casings of horizontal split case pumps, and other applications.
- 2.1.2 In order to meet the intent of this standard, air release valves shall 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 using identical materials by different manufacturers, or, even by different plants of the same manufacturer, have sometimes been shown to perform differently in testing. Sample valves, selected in conformance to this criterion, shall satisfy all of the requirements of this standard.

**2.2 Approved Application Requirements**

- 2.2.1 To apply for an Approval examination, the manufacturer, or an authorized representative, shall submit a request to:

Group Manager – Hydraulics  
FM Approvals  
Hydraulics Laboratory  
743A Reynolds Road  
West Glocester, RI 02814 U.S.A.

- 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 drawing, material list(s), anticipated marking format, brochures, sales literature, specification sheets, installation, operation and maintenance procedures, and
  - Number and location of manufacturing facilities making the products submitted for Approval.
- 2.2.3 All the above referenced documents 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 documents shall be provided with English translation at the time of submittal.

### 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 shall be determined by FM Approvals following review of the preliminary information. Sample requirements may vary depending on design features, results of prior testing, and results of the foregoing tests. It is the manufacturer's responsibility to submit samples representative of production. Any decision to use data generated utilizing prototypes is at the discretion of FM Approvals. The manufacturer shall provide any special test fixtures which may be required to evaluate the air release valve.

## 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 dimensional drawings shall fully describe the product. All critical dimensions shall be indicated with the allowed upper and lower tolerance limits clearly shown.
- 3.1.3 All documents pertaining to the product materials, dimensions, processing, and marking shall be controlled by the manufacturer's Quality Assurance procedures, and shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level.

### 3.2 Physical or Structural Features

- 3.2.1 Air release valves shall be designed for a minimum rated working pressure of 175 psi (1205 kPa). Valves with higher rated working pressures will be evaluated on a case-by-case basis.
- 3.2.2 Installation is limited to use in wet pipe sprinkler systems, or on casings of horizontal split case pumps.
- 3.2.3 The inlets of the air release valves shall be 1/2, 3/4, or 1 inch NPT or equivalent and the outlets of the air release valves shall be a minimum of 1/2 inch NPT or equivalent.
- 3.2.4 Body and Cover
- 3.2.4.1 The material of construction for bodies and covers shall be of gray cast iron (ASTM A126, Class B, or ASTM A48, Class 35) or ductile iron (ASTM A536, Grade 65-45-12) and shall have flanged or threaded connections. Other materials may be accepted on a case-by-case evaluation.
- 3.2.4.2 Cover Bolting. Where used, bolting materials shall equal or exceed the minimum physical strength requirements of ASTM A307.
- 3.2.5 Valve Connections
- 3.2.5.1 Internal threaded connections shall be in accordance with ASME B1.20.1, BS EN 10226-2, ISO 7/1, or other recognized international standards.
- 3.2.5.2 Flanged-end dimensions and drilling for cast-iron bodies and covers shall conform to ASME B16.1, Class 125 or Class 250. Flanged-end dimensions and drilling for ductile-iron bodies and covers shall conform to ANSI/ASME B16.42, Class 150 or Class 300.

- 3.2.6 The orifice of the air release valves shall be no larger than 5/32 inch or equivalent.
- 3.2.7 Other types and sizes of end connection may be evaluated on a case-by-case basis, provided such ends are compatible with the requirements of FM Global Loss Prevention Data Sheets.
- 3.2.8 Workmanship and Painting
- 3.2.8.1 Air release valves submitted for testing shall be true production samples and shall be free of sharp edges, burrs, or other imperfections which might injure the installer or interfere with proper assembly of the unit.
- 3.2.8.2 Internal Protective Coating. If an internal protective coating is applied, all wetted parts – except machined or bearing surfaces, and corrosion-resistant components – shall be coated in accordance with ANSI/AWWA C550.
- 3.2.8.3 External Surfaces. Exterior surfaces of each valve shall be coated with the manufacturer's standard primer.

### 3.3 Materials

All materials used in these valves shall be suitable for the intended application. Valve parts exposed to water shall be constructed of corrosion resistant materials. Particular consideration shall be given to the float, mechanical linkage and the orifice. These and any other materials used in air release valves shall have physical properties necessary to render them suitable for their intended use. 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 All FM Approved air release valves shall bear the FM Approvals Certification Mark (see Appendix B.) The FM Approvals Certification Mark shall be displayed visibly and permanently on the product. The manufacturer shall not use these marks on any other product unless such product is covered by a separate agreement with FM Approvals.
- 3.4.2 Each air release valve discussed in this standard shall be permanently marked with the following information:
- Manufacturer's name or trademark;
  - Inlet and outlet nominal size;
  - Model designation;
  - Rated Working Pressure;
  - The FM Approvals Certification Mark
- 3.4.3 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.
- 3.4.4 Each required marking listed in Section 3.4.2 shall be legible and durable and applied by, or any combination of, die-stamping, forging, roller embossing or electro-etching.
- 3.4.5 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the product as FM Approved. The FM Approvals Certification Mark (see Appendix B) shall be displayed visibly and permanently on the product. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.
- 3.4.6 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 complete installation instructions with each assembly, where necessary, including any special dimension requirements. The installation instructions shall outline in detail the field procedures for installing, testing, and repairing the units. The installation instructions shall employ normal tools of the trade. Instructions shall be provided in each shipping container, as appropriate. The manual shall be reviewed by FM Approvals for completeness and ease of comprehension.

### 3.6 Calibration

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

The calibration of recently purchased 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 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 recalibrated.

### 3.7 Tolerances

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

## 4. PERFORMANCE REQUIREMENTS

### 4.1 Examination

#### 4.1.1 Requirement

The air release valves shall conform to the manufacturer's drawings and specifications and to FM Approval requirements

#### 4.1.2 Test/Verification

A sample of each model valve submitted for Approval 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 Seat Leakage

#### 4.2.1 Requirements

All air release valves shall be leak tight when hydrostatically tested at pressures of 20 psi (140 kPa) and its rated working pressure for five minutes at each pressure.

#### 4.2.2 Test/Verification

With the outlet open to atmosphere, the inlet of each size valve shall be hydrostatically tested at 20 psi (140 kPa) and its rated working pressure for five minutes at each pressure. No leakage shall be allowed.

### 4.3 Hydrostatic Integrity

#### 4.3.1 Requirements

All air release valves shall withstand exposure to hydrostatic pressure of four times the rated working pressure of the product for five minutes. During and at the conclusion of the test, no fracture, rupturing or permanent distortion shall occur.

#### 4.3.2 Test/Verification

Each size valve shall be subjected to a hydrostatic pressure test at 700 psi (4825 kPa) or four times its rated working pressure, whichever is higher, for five minutes. No failure, as described above, shall be allowed.

### 4.4 Strength of Parts

#### 4.4.1 Requirements

All air release valves shall withstand exposure to hydrostatic pressure of two times the rated working pressure of the product. The inner components of the valve shall not fracture, leak, distort or have any functional impairment as a result of the test.

#### 4.4.2 Test/Verification

Each size valve shall be subjected to a hydrostatic pressure of 350 psi (2415 kPa) or two times its rated working pressure, whichever is higher, for five minutes. At the conclusion of the test, the inner components shall be inspected to ensure that they did not fracture, leak, or distort, and that there is no functional impairment of the valve as a result of the test.

## 4.5 Venting Capabilities

### 4.5.1 Requirements

The valve shall be capable of venting air when pressurized with water at any setting between 20 psi (140 kPa) and the rated working pressure.

### 4.5.2 Test/Verification

The valve shall be set in the vertical position with air and water connections into the body, see figures in Appendix C. The air release valve shall be filled with water making sure there are no air pockets inside the valve. With the body full of water, the air release valve shall be hydrostatically pressurize to pressures of 20 psi (140 kPa), 50 psi (345 kPa), 100 psi (690 kPa) and the air release valves rated working pressure. Once the intended hydrostatic internal pressure is reached, air shall be introduced into the body at pressures that are 10 psi (70 kPa) greater than that of the water pressure, it shall be verify that the air is vented through the valve.

## 4.6 Cycle Test

### 4.6.1 Requirements

Air release valves shall be capable of 1500 cycles of normal operation without excessive wear, damage or failure of any valve component.

### 4.6.2 Test/Verification

Sample air release valves shall be cycled 1500 times, at a rate not exceeding 6 cycles per minute, through its full range of motion. The valve shall be installed in the vertical position with air and water connections into the body, see figures in Appendix C. The air release valve shall be filled with water making sure there are no air pockets inside the valve. With the body full of water, pressurize the air release valve to two times its rated working pressure, 175 psi (1205 kPa) minimum, for a duration of 5 minutes. Upon the completion of the pressure test, the valve will be subjected to hydrostatic pressure equal to its rated working pressure for the duration of the cycle test. The test valve shall then be subjected to 1,500 cycles of air pressure ranging from zero pressure to 185 psi (1275 kPa). The test equipment shall be equipped with a means of counting the pressure cycles. It shall be verified that the air is vented through the valve after each cycle. After the completion of the cycle test, the valve shall be disassembled. Parts shall be visibly examined for signs of excessive wear, damage or failure. This test, or a portion thereof, may be waived at the option of the examining engineer if the design and calculation review are satisfactory.

## 4.7 Additional Tests

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

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 shall be required to assure that subsequent air release valves produced by the manufacturer, at an authorized location, shall demonstrate the same quality and reliability as the specific valves examined. Design quality, conformance to design, and performance are the areas of primary concern. Design quality is determined during the 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 Facilities and Procedures Audit (F&PA). 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 discrepant materials.

In order to assure adequate traceability of materials and products, the manufacturer shall maintain records of all quality control tests performed, and their results, for a minimum period of two years from the date of manufacture of the valve.

5.1.2 Documentation/ Manual

The manufacturer shall provide FM Approvals with 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 shall allow no unauthorized changes to the product. Changes 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 797, FM Approved Product/Specification-Tested Revision Request Form. 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. The table is not all-inclusive. As mentioned above, modifications that fit this category shall be documented by means of a letter stating the change, and requesting an Approval examination.

<b><i>Modification</i></b>	<b><i>Description/Example</i></b>
Increase of Pressure Rating	The product was originally FM Approved for 175 psi (1205 kPa), and now is to be evaluated to 300 psi (2070 kPa).
Additional or Relocation of the Manufacturing Location	The product was originally FM Approved at 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 Flanged Assembly.
Change to Critical Dimensions	Modifications that would depart from the national or international standards that are used in the manufacturing of the products 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 in the valve 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 797.

<b><i>Modification</i></b>	<b><i>Description/Example</i></b>
Change in Company Contact information	Company Name, Company Contact and Title, Phone Number, Fax Number, Email Address, Company Office Address
Updating of Drawings	The Form 797 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
Updating of Documentation	Creation of New or Revisions to sales literature, Installation Instructions, Grooving Dimensions, Quality Manual, etc.

5.1.3.3 In instances where the modification is difficult to categorize, manufacturers are encouraged to contact FM Approvals to discuss the nature of the change, and to inquire about how to send the information to FM Approvals. The examples shown in Section 5.1.3 are based on common examples of modifications as they relate to the manufacture of the product.

## 5.2 Facilities and Procedures Audit (F&PA)

- 5.2.1 An audit of the manufacturing facility is part of the Approval investigation to verify implementation of the quality control program. Its purpose is to ensure that the manufacturer's equipment, procedures, and quality program are maintained to produce a consistently uniform and reliable product. Initial inspections of facilities already producing similar FM Approved products may be waived at the discretion of FM Approvals.
- 5.2.2 Unannounced follow-up inspections shall be conducted at least annually by FM Approvals, or its designate, to determine continued compliance. More frequent audits may be required by FM Approvals.
- 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.

## 5.3 Manufacturer's Responsibilities

- 5.3.1 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.
- 5.3.2 Where all or part of the quality control has been subcontracted, the manufacturer shall, at a minimum, conduct sufficient oversight audits to verify the continued application of the required controls.

## 5.4 Manufacturing and Production Tests

### 5.4.1 Test requirement No. 1 – *Leakage*

The manufacturer shall test 100 percent of production air release valves for leakage at the rated working pressure. The test pressure shall be applied for a minimum of 1 minute with no leakage allowed.

### 5.4.2 Test requirement No. 2 – *Body Hydrostatic*

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

**APPENDIX A: Units of Measurement**

**FLOW:** gal/min - “gallons per minute”; (L/min - “liters per minute”)  
 $L/min = gal/min \times 3.785$

**FORCE:** lb - “pounds”; (N - “Newtons”)  
 $N = lb \times 4.4482$

**LENGTH:** in. - “inches”; (mm - “millimeters”)  
 $mm = in. \times 25.4$

ft - “feet”; (m - “meters”)  
 $m = ft \times 0.3048$

**PRESSURE:** psi - “pounds per square inch”; (kPa - “kilopascals”)  
 $kPa = psi \times 6.895$

bar - “bar”; (kPa - “kilopascals”)  
 $bar = kPa \times 0.01$   
 $bar = psi \times 0.06895$

**VELOCITY:** ft/s - “feet per second”; (m/s - “meters/second”)  
 $m/s = ft/s \times 0.3048$

**VOLUME:** gal - “gallons”; (L - “liter”)  
 $L = gal \times 3.785$

L - “liter”; ( $dm^3$  - “cubic decimeters”)  
 $L = 1 dm^3$

## APPENDIX B: FM Approvals Certification Marks

FM Approvals certification marks are to be used only in conjunction with products or services that have been FM Approved by FM Approvals and in adherence with usage guidelines.



**FM APPROVED mark:**

Authorized by FM Approvals as a certification mark for any product that has been FM Approved. There is no minimum size requirement for the mark, but it must be large enough to be readily identifiable. The mark should be produced in black on a light background, or in reverse on a dark background.



**FM APPROVED mark with "C" only:**

Authorized by FM Approvals as a certification mark for any product that has been evaluated by FM Approvals in accordance with Canadian codes and standards. There is no minimum size requirement for the mark, but it must be large enough to be readily identifiable. The mark should be produced in black on a light background, or in reverse on a dark background.



**FM APPROVED mark with "C" and "US":**

Authorized by FM Approvals as a certification mark for any product that has been evaluated by FM Approvals in accordance with US and Canadian codes and standards. There is no minimum size requirement for the mark, but it must be large enough to be readily identifiable. The mark should be produced in black on a light background, or in reverse on a dark background.



**Cast-On FM APPROVALS marks:**

Where reproduction of the FM APPROVED mark described above is impossible because of production restrictions, use these modified versions of the FM APPROVED mark. There is no minimum size requirement for the mark, but it must be large enough to be readily identifiable.

*Downloadable art and other FM Approvals resources are available by visiting our Web site at [www.fmaprovals.com](http://www.fmaprovals.com)*

## FM Approvals Certification Marks

### Usage Guidelines

- All FM Approvals certification marks are the sole property of FM Approvals LLC (“FM Approvals”) and are registered or the subject of applications for registration in the United States and many other countries. They are for use only according to these guidelines.
- FM Approvals certification marks may be used only on FM Approved products and related product packaging, in advertising material, catalogs and news releases. Use of FM Approvals certification marks on such material is not a substitute for use of the complete FM Approvals certification mark on FM Approved products and/or product packaging.
- No FM Approvals certification mark or aspect thereof may be incorporated as part of a business name, Internet domain name, or brand name/trademark for products/product lines. This includes both design aspects (the FM Approvals “diamond,” etc.) and word aspects (“FM,” “Approved,” etc.). The use of any FM Approvals certification mark as a trademark is strictly prohibited.
- The Approval Standard number or class number may not be incorporated as part of a business name, Internet domain name, or brand name/trademark for products/product lines. For example, a company may not say “ABC Company’s 4100 Fire Door is FM Approved”; the proper terminology is, “ABC Company’s Fire Door is FM Approved per Approval Standard 4100.”
- FM Approvals certification marks, except for the FM Approvals Quality System Registration mark, may not be used on business stationery/cards/signage because this could mischaracterize the relationship with FM Approvals. Additionally, these items should not reference any FM Approvals certification mark.
- Products or services may not be marketed under any mark or name similar to “FM Global,” “FM Approvals” or any of the FM Approvals certification marks. Further, products or services may not be marketed to imply a relationship beyond the scope of any Approval made by FM Approvals.
- When an FM Approvals certification mark is used in advertising material or on product packaging, all material must reflect the specific circumstances under which the product was FM Approved. The material must clearly differentiate between products that are FM Approved and those that are not, and may not, in any way, imply a more substantial relationship with FM Approvals.
- A company may not reference the intent to submit a product for Approval or the expectation that a company will have a certain product FM Approved in the future. For example, a company may not state, “Approval by FM Approvals pending” or “Approval by FM Approvals applied for.”
- FM Approvals certification marks should not be preceded or followed by a qualifier that indicates a degree of certification or acceptability. For example, “exceeds,” “first” or “only” may not be used to qualify any FM Approvals certification mark.
- Only original artwork issued by FM Approvals should be used. The FM Approvals certification marks should not be altered in any way other than to resize the artwork proportionately. Unacceptable uses of the marks include, but are not limited to, adding/deleting wording or artwork, reducing the artwork to an illegible size, animation or distortion.
- The text of the FM Approvals certification marks may not be translated into any language other than English.
- FM Approvals certification marks must appear in a size and location that is readily identifiable, but less prominent than the name of the owner of the certification or the manufacturer/seller/distributor of the certified products.

APPENDIX C: Figures

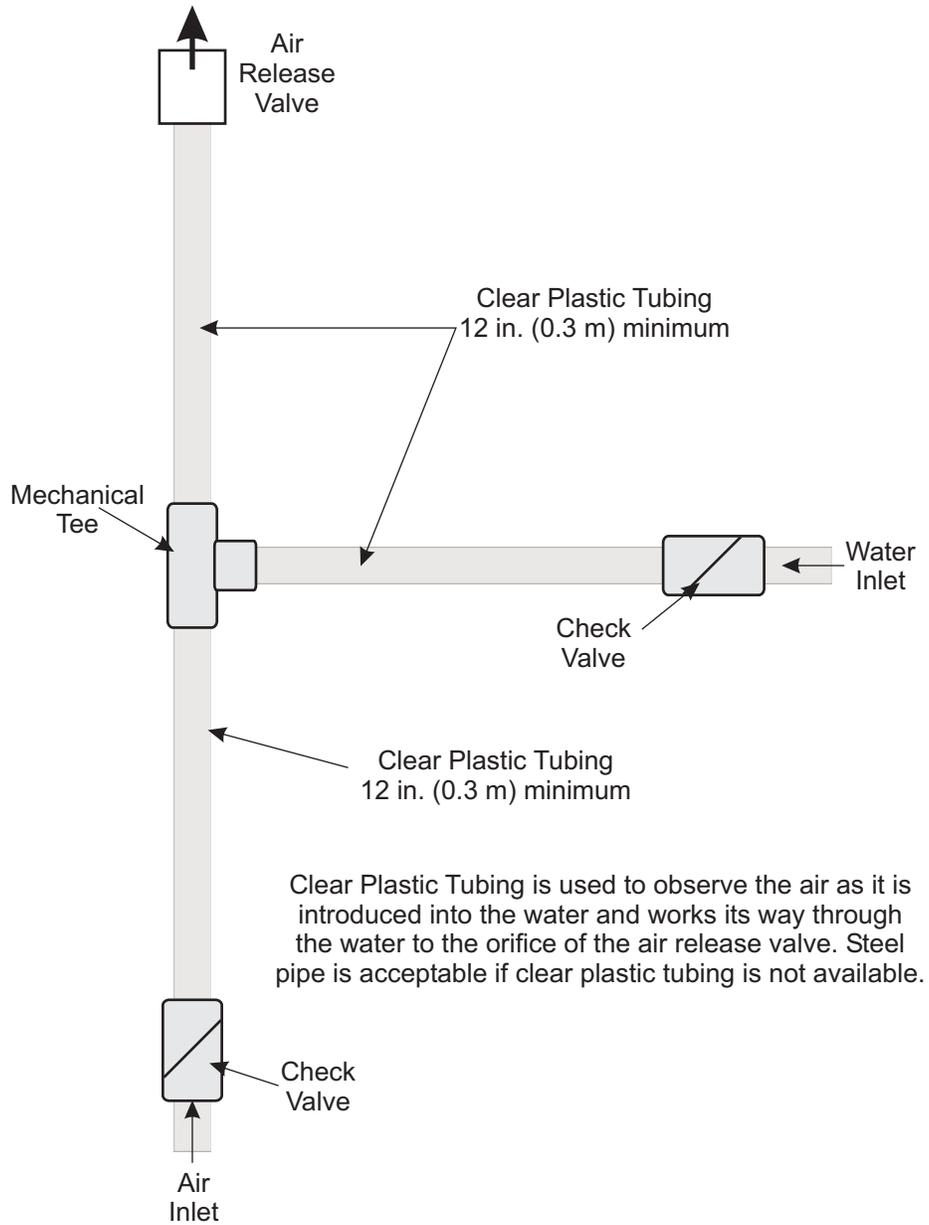


Figure C-1 Test Apparatus (Check Valves) - Preferred

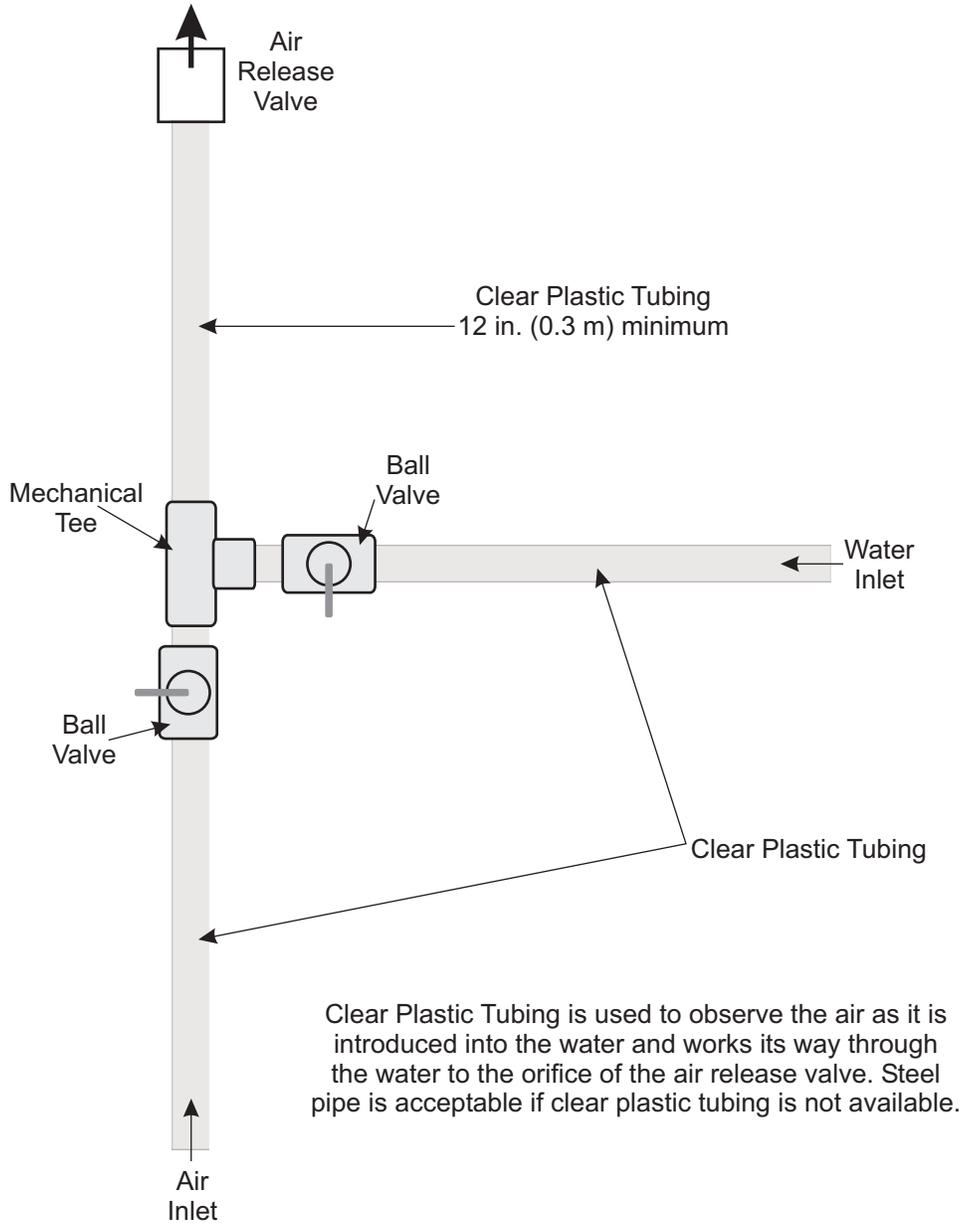


Figure C-2 Test Apparatus (Ball Valves)

## APPENDIX D: Sample Listings

### AIR RELEASE VALVES

An air release valve is designed to automatically vent the trapped air from a wet pipe sprinkler system or a horizontal split-case pump which is automatically controlled. Unless otherwise noted in the listing, these valves have a 175 psi (1205 kPa) rated working pressure.

ABC Co., Inc, 4321 E West Ave, West Glocester RI 02814

<i>Product Designation</i>	<i>Connection Size, in (mm)</i>	<i>Orifice Diameter, in. (mm)</i>
100.05	½, (13)	3/32, (2)
100.07	¾, (19)	3/32, (2)
100.10	1, (25)	3/32, (2)
120.05	½, (13)	1/16, (1.5)
120.07	¾, (19)	1/16, (1.5)
120.10	1, (25)	1/16, (1.5)
140.05	½, (13)	5/32, (4)

All models are for use with wet pipe sprinkler systems and horizontal split-case pumps.

## APPENDIX E: Tolerances

Unless otherwise stated, the following tolerances shall apply:

**Angle:**  $\pm 2^\circ$

**Frequency (Hz):**  $\pm 5$  percent of value

**Length:**  $\pm 2$  percent of value

**Volume:**  $\pm 5$  percent of value

**Volume Per Unit Area:**  $\pm 5$  percent of value

**Pressure:** + 5 percent of value  
- 0 percent of value

**Temperature:**  $\pm 4^\circ\text{F}$  ( $2^\circ\text{C}$ )

**Time:** + 5/-0 seconds  
+0.1/-0 minutes

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



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