



Approval Standard for Water Flow Detector Testers 1 in. Through 8 in. Nominal Size

Class Number 1043

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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 water flow detector testers for use in wet pipe sprinkler systems, for both new installations, and for retro-fit applications.
- 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 inch through 8 inch nominal size water flow detector testers. 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 This standard encompasses both traditional mechanical type water flow detector testers (where the water flow detectors are tested by the passage of water past the vane), and electrical style (where the water flow past the water flow detector is electrically simulated).
- 1.2.3 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 water flow detector testers for the purpose of obtaining FM Approval. Water flow detector testers 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, water flow detector testers 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, 2011** 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 / American Water Works Association (AWWA) C606 (2006) – *Grooved and Shouldered Joints*
ANSI/IEEE/ASTM SI 10 (2002), *American National Standard for Use of the International System of Units (SI): The Modern Metric System*
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)*
British Standards Institution, BS EN 10226-2 (2006), *Pipe threads where pressure tight joints are made on the threads - Part 2. Taper, external threads and taper internal threads - Dimensions, tolerances and designation*
FM Global Property Loss Prevention Data Sheet 2-0 (March 2010), *Installation Guidelines for Automatic Sprinklers*
FM Global Property Loss Prevention Data Sheet 3-7 (May 2010), *Fire Protection Pumps*
International Organization for Standardization (ISO) 7-1 (2007), *Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation*
ISO/International Electrotechnical Commission (IEC) 17025 (2005), *General Requirements for the Competence of Testing and Calibration Laboratories*

National Electrical Manufacturer's Association (NEMA) MG-1-2009, *Motors and Generators*
National Sanitation Foundation (NSF)/ANSI 61 (2010), *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.)

End Connections

The term "End Connections" refers to the method of connecting components of a pipe system to one another. Typical end connections in a fire protection service are cut groove, rolled groove, cast groove, threaded, flanged, plain end, and welded end.

Flanged End

This term refers to piping components 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 Approvals Certification Marks

The FM Approvals Certification Marks are detailed in Appendix B. Their use is mandatory on all units of FM Approved water flow detector testers. 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 online resource of FM Approvals, see Appendix C. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned a Master Agreement to FM Approvals. The Master Agreement obligates 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. Approval is product specific.

Grooved End

This term refers to a style of end connection that is characterized by having a groove located near the free end of the piping component allowing joining to other grooved end products via the use of grooved end couplings. Dimensions for these connections may vary slightly due to the method used to impart the groove to the product (i.e. cut groove where the groove is machined, roll groove where the groove is mechanically formed using a grooving machine, or cast groove where the groove is simply cast on the part during casting process) but in all cases tend to follow the dimensions of ANSI / American Water Works Association (AWWA) C606 – *Grooved and Shouldered Joints*.

Mechanical Tee

A mechanical tee is a fitting that provides a connection to a pipe line in the place of a tee. The pipe is pre-drilled per the manufacturer's instructed hole size, and the "saddle" is placed over the hole so that the mechanical tee gasket encircles the hole. The fitting has a second piece that loops around the pipe and allows for the "saddle" to be drawn tight against the pipe surface. Approval of these fittings is limited to fittings having a minimum of one pipe size reduction as the branch outlet. Equal size outlets are not permitted. Typical end connections for these fittings are threaded and grooved end.

Rated Working Pressure

This is the maximum sustained pressure at or below which the water flow detector tester 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

Water flow detector testers 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, EN 10226-2, ISO 7-1).

Water Flow Detector

This term refers to a device that incorporates a switch that is activated when prolonged water flow interacts with a paddle that is inserted into the pipeline. The device is fastened to the pipe by means of a U-Bolt wrapping around the pipe outside diameter and through a saddle housing. The saddle housing also has a gasket that prevents the water supply pressure from escaping, and atmospheric pressure from entering the sprinkler piping.

2. GENERAL INFORMATION

2.1 Product Information

- 2.1.1 Water flow detector testers permit the testing of in-line water flow detectors used in sprinkler piping without the need for the discharge of the water that is used for the test. They are used on wet pipe sprinkler systems in new installations and may also be designed for retro-fit applications.
- 2.1.2 In order to meet the intent of this standard, water flow detector testers shall be examined on a model-by-model, type-by-type, manufacturer-by-manufacture, 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, wiring diagrams, 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 – Mechanical Style

- 3.2.1 Water flow detector testers are available in two basic configurations: new installation; and retro-fit installation style. All water flow detector testers discussed in this standard shall be designed for a minimum rated working pressure of 175 psi (1205 kPa). Products with higher rated working pressures will be evaluated on a case-by-case basis.
- 3.2.2 New installation style is characterized by having a manifold body of the same size as the run piping with porting for the installation of the water flow detector and trim loop piping. A flow arrow shall be on the manifold body indicating flow direction for the proper installation of the water flow detector and loop piping.
- 3.2.3 The retro-fit style is characterized by having two mechanical tees that are to be installed in the sprinkler piping directly. The retro-fit installation style shall be installed so that the existing water flow detector is approximately centered between the mechanical tees.
- 3.2.4 Installation is limited to use in wet pipe sprinkler systems and may be installed in horizontal and vertical orientations.
- 3.2.5 The trim loop piping shall be a minimum of 3/4 inch NPS.

- 3.2.6 The circulation pump used to generate the water flow used during the test shall be sized to deliver 20 gpm to 30 gpm (75 L/min to 115 L/min), and must be able to be mounted in horizontal or vertical orientations. The electric motor used to drive the recirculation pump shall have an enclosure rated for occasional water spray. Wiring connections are to be made per the provided wiring diagram. The recirculation pump shall be able to withstand the hydrostatic pressure test described in Section 4.3 or it shall be able to be suitably isolated during this test.
- 3.2.7 The inlet and outlet valves shall be marked to indicate the valve position. In the event that the inlet and outlet valves are not interchangeable, they shall be marked for their proper installation location.
- 3.2.8 Water flow detector testers 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.
- 3.2.9 The manufacturer shall identify all options for internal and external coatings, and materials of construction for major components in order for each option to be represented in the examination.

3.3 Physical or Structural Features – Electrical Style

- 3.3.1 This section has been added as a place holder in the event that some of the currently available water flow detectors build in a capacity for testing either internally or via another means.
- 3.3.2 As applicable, the construction requirements for the base water flow detector would still apply for this construction variation.
- 3.3.3 In the event that this option is submitted for FM Approval evaluation, the tests outlined in this standard would be applied to the test program as appropriate. In addition, other features or characteristics may be subject to additional testing as needed in order to validate their function.

3.4 Materials

All materials used in these water flow detector testers shall be suitable for the intended application. Components exposed to water shall be constructed of corrosion resistant materials. Particular consideration shall be given to the manifold body, inlet and outlet valves, recirculation pump casing, and the loop pipe fittings. These and any other materials used in water flow detector testers 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.

3.5 Markings

- 3.5.1 All FM Approved water flow detector testers 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.
- 3.5.2 Each water flow detector tester 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;
 - Flow direction
 - The FM Approvals certification mark

- 3.5.3 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.
- 3.5.4 Each required marking listed in Section 3.4.2 shall be legible and durable and applied by, or any combination of, casting, forging, roller embossing or electro-etching.
- 3.5.5 All markings shall be legible and durable throughout the useful life of the product.

3.6 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.

3.7 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.

3.8 Tolerances

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

4. PERFORMANCE REQUIREMENTS

4.1 Examination

4.1.1 Requirement

The water flow detector testers 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 Leakage

4.2.1 Requirements

All water flow detector testers shall be leak tight when hydrostatically tested at twice the rated working pressure of the device for five minutes. During and at the conclusion of this test, there shall be no observed leakage from any piping connection, or component as a result of this test.

4.2.2 Test/Verification

With the ends of the manifold body (or sample run pipe) closed off, the sample shall be filled with water making sure to remove all internal air, and then subjected to an internal hydrostatic pressure of 350 psi (2415 kPa), or twice the rated working pressure, whichever is higher, for five minutes without observed leakage.

4.3 Hydrostatic Integrity

4.3.1 Requirements

All water flow detector testers 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 as a result of this test.

4.3.2 Test/Verification

Each size water flow detector tester 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 Operational Test

4.4.1 Requirements

Water flow detector testers shall be operated to ensure functionality of all components at 30 psi (205 kPa) and the rated working pressure.

4.4.2 Test/Verification

Each size water flow detector shall be filled with water and operated to ensure that the recirculation pump flows enough water to activate the water flow detector. Verification shall be made at 30 psi (205 kPa) and the rated working pressure 175 psi (1205 kPa) or greater. At the conclusion of the test, the inner components shall be inspected to ensure that they did not dislodge, leak, or distort, and that there is no functional impairment of the device as a result of the test.

4.5 Electrical Test – Voltage Variation

4.5.1 Requirements

Operation of the water flow detector tester will be verified as the input voltage to the recirculation pump motor is varied from 90 percent to 110 percent of rated voltage. The device shall operate properly under these conditions.

4.5.2 Test/Verification

The water flow detector tester shall be filled with water and vented of all internal air. The electrical leads from the recirculation pump motor shall be connected to a power supply and the unit shall be observed for operation as the input power is varied from 90 percent to 110 percent of the electrical nameplate rating. Verification of operation shall be made with water supply pressures of 30 psi (205 kPa) and the rated working pressure. At all points within this range, the unit shall be observed to operate properly.

4.6 Electrical Test - Environmental

4.6.1 Requirements

Water flow detector testers shall be tested for performance for indoor applications only. This testing will expose the water flow detector tester to the following environments for 24 hours at each setting. After the exposure conditioning the assembly will be checked for proper operation.

Table 4.6.1 – *Environmental Conditioning Settings*

<i>Environmental Condition</i>	<i>Parameters</i>
Cold	32°F (0°C)
Hot	120°F (50°C)
Humid	100°F (38°C) at 90 percent humidity

4.6.2 Test/Verification

Samples of water flow detector testers shall be placed in an environmental chamber and exposed to each of the conditions outlined in Table 4.6.1 for a period of 24 hours. After the conclusion of each exposure time, the sample will be checked for proper operation.

4.7 Electrical Test – Dielectric

4.7.1 Requirements

The recirculation pump motor shall withstand, for a time period of one minute, high potential applied between the terminals and the pump enclosure, and between the terminals and the terminal enclosure. During this test, there shall be no signs of arcing or breakdown.

4.7.2 Test/Verification

A voltage of 1500 volts shall be applied between the terminals and the pump enclosure, and between the terminals and the terminal enclosure. The voltage shall be applied in each test for a duration of 1 minute. During the dielectric test there shall be no signs of arcing or breakdown.

4.8 Electrical Test – Bonding Resistance

4.8.1 Requirement

The resistance measured between the grounding screw and/or terminal and various locations shall be less than 1 ohm.

4.8.2 Test/Verification

Using an ohmmeter, the resistance measured between the grounding screw and/or terminal and various locations on the water flow detector tester shall be measured.

4.9 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 water flow detector testers.

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 water flow detector testers 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 water flow detector tester.

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.

<i>Modification</i>	<i>Description/Example</i>
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.

<i>Modification</i>	<i>Description/Example</i>
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 water flow detector testers 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 water flow detector testers 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.fmapprovals.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: Sample Listings

WATER FLOW DETECTOR TESTERS

When energized, the water flow detector tester supplies circulating water around a vane type water flow detector, causing vane motion to be transmitted to an alarm-actuating switch after the predetermined time delay has occurred. These devices are suitable for use with FM Approved vane detectors in 2 through 8 in. nominal sizes. No sprinkler system water has to be sent to a drain with this system.

Unless otherwise specified, these testers 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>Nominal Pipe Size, in (DN)</i>	<i>Rated Working Pressure, psi (kPa)</i>	<i>Remarks</i>
Model A – Original Installation	1 (DN25)	175 (1205)	a, b, c, d, e
	1-1/4 (DN32)	175 (1205)	a, b, c, d, e
	1-1/2 (DN40)	175 (1205)	a, b, c, d, e
	2 (DN50)	175 (1205)	a, b, c, d, e
	2-1/2 (DN65)	175 (1205)	a, b, c, d, e
	3 (DN80)	175 (1205)	a, b, c, d, e
	4 (DN100)	175 (1205)	a, b, c, d, e
	5 (DN125)	175 (1205)	a, b, c, d, e
	6 (DN150)	175 (1205)	a, b, c, d, e
	8 (DN150)	175 (1205)	a, b, e
Model B – Retrofit Installation	1-1/4 (DN32)	175 (1205)	e
	1-1/2 (DN40)	175 (1205)	e
	2 (DN50)	175 (1205)	e
	2-1/2 (DN65)	175 (1205)	e
	3 (DN80)	175 (1205)	e
	4 (DN100)	175 (1205)	e
	5 (DN125)	175 (1205)	e
	6 (DN150)	175 (1205)	e
	8 (DN150)	175 (1205)	e

Notes:

- Approved as supplied in ASTM A795, Schedule 10 piping configuration.
- Approved as supplied in ASTM A795, Schedule 40 piping configuration.
- Approved as supplied in EN 10255, Heavy piping configuration.
- Approved as supplied in EN 10255, Medium piping configuration.
- Device requires either 120 V ac and 240V ac power.

APPENDIX D: Tolerances

Unless otherwise stated, the following tolerances shall apply:

Angle: $\pm 2^\circ$

Frequency (Hz): ± 5 percent of value

Length: ± 2 percent of value

Volume: ± 5 percent of value

Volume Per Unit Area: ± 5 percent of value

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

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 $68 \pm 9^\circ\text{F}$ ($20 \pm 5^\circ\text{C}$).