



Member of the FM Global Group

Approval Standard for Monitor Assembly

Class Number 1421

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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 criteria for monitor assemblies that deliver and distribute water for fire protection purposes. These assemblies must operate reliably for many years at rated capacities and pressures during emergency fire incidents, despite being idle for extended periods.
- 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 monitor assemblies for use in fire protection systems. Approval is limited to industrial applications. In cases where metric sized monitor assemblies are to be examined for Approval, test criteria comparable to the United States equivalent 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 was also considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of monitor assemblies for the purpose of obtaining Approval. Monitor assemblies 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, monitor assemblies that meet all of 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
- 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 examination of the manufacturing facilities and audit of quality control procedures shall be made to evaluate the manufacturer's ability to produce the product which was examined and tested, and the marking procedures used to identify the product. These examinations are repeated as part of FM Approvals product follow-up program.

1.5 Basis for Continued Approval

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.

Also, as a condition of retaining Approval, manufacturers may 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 April 30, 2008 for full 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 Institute of Electrical and Electronics Engineers (IEEE)/American Society for Testing Materials (ASTM) SI 10-2002, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*. One unit of measurement (Liter), outside of, but recognized by SI, is commonly used in international fire protection and is used in this standard.

1.8 Applicable Documents

The latest versions of the following standards, test methods, and practices are referenced in this standard:

- ANSI B16.5 - 2003, *Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/ Inch Standard*
- ANSI B1.20.1 - 1983, *Pipe Threads, General Purpose (Inch)*
- ANSI/American Water Works Association (AWWA), C606 - 2004, *Grooved and Shouldered Joints*
- FM Approvals' Approval Standard 5130 - April 2007, *Foam Extinguishing Systems*
- FM Global Property Loss Prevention Data Sheets
- IEEE/ASTM SI 10-2002, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*
- National Fire Protection Association (NFPA) 15 - 2007, *Standard for Water Spray Fixed Systems For Fire Protection*
- NFPA 24 - 2007, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*
- NFPA 25 - 2002, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*
- NFPA 1963 - 2003, *Standard for Fire Hose Connections*
- NFPA 1964 - 2003, *Standard for Spray Nozzles*

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 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.)

Corrosion Resistant

Having resistance to corrosion equal to or exceeding that of bronze alloy having a minimum copper content of 80 percent, or constructed of Series 300 Stainless Steel.

Design Working Pressure

The maximum pressure at which a monitor assembly is designed to operate.

FM Approvals Certification Mark

The FM Approvals Certification Marks are detailed in Appendix B. Their use is mandatory on all units of FM Approved monitor assemblies. 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, a publication of FM Approvals, issued annually, or one of the supplements. 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.

Monitor

A water discharge device upon which a fire fighting nozzle may be mounted, that has a base which may be secured to absorb reaction forces, and that that is adjustable to direct discharge through a range of vertical and horizontal angles. FM Approved monitors are specially designed with large clear waterways to give a powerful, far-reaching stream for the protection of pulpwood piles, lumber yards, or other locations where a large amount of water must be instantly available without the delay of laying hose lines.

Underwriters Playpipe

A large bore, straight stream fire hose nozzle. Before the introduction of spray nozzles, playpipes were the only nozzles used with 2-1/2 in. (65 mm) fire hose for industrial fire fighting. Playpipes are now primarily used as water measuring devices during water testing. One type has a 30 in. (760 mm) barrel and is known as the standard Underwriters playpipe with a 1-3/4 in. (45 mm) nozzle tip and an alternate attachable 1-1/8 in. (30 mm) nozzle tip. The other type has a 15 in. (380 mm) barrel and is known as the short playpipe. The detachable tip for the barrel has a 1-1/8 in. (30 mm) orifice. Swivel handles provide a good handgrip for two persons. The short playpipe, when used for fire fighting, usually has a detachable 1 in. (25 mm) shutoff tip.

2. GENERAL INFORMATION

2.1 Product Information

- 2.1.1 Monitor assemblies covered by this standard include those designed for 100 gal/min through 5000 gal/min (380 L/min through 18 925 L/min) or larger capacities. Monitor assemblies designed for rated capacities greater than 5000 gal/min (18 925 L/min) shall be evaluated on a case-by-case basis.
- 2.1.2 In order to meet the intent of this standard, monitor assemblies 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 manufacturers or, even by different plants of the same manufacturer, have been seen to perform differently in testing. Sample monitor assemblies, 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:

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

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

- A complete list of all models, types, sizes, and options for the products or services being submitted for Approval consideration;
- General assembly drawings, one complete set of manufacturing drawings, materials list(s) and material specifications (such as ASTM A48 CL 40 - Cast Iron), anticipated marking format, brochures, sales literature, specification sheets, installation, operation and maintenance procedures; and,
- The number and location of manufacturing facilities.

All documents 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

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 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 all equipment to perform the tests. All monitor tests shall be conducted utilizing a FM Approved Underwriters playpipe with suitable diameter orifice tip.

3. GENERAL REQUIREMENTS

3.1 Review of Documentation

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 Physical or Structural Features

- 3.2.1 Monitor assemblies shall be designed for a minimum rated working pressure of 175 psi (1205 kPa). Monitor assemblies with higher rated working pressures will be evaluated on a case-by-case basis.
- 3.2.2 Typical inlet and outlet end connections shall be male threaded, female threaded, flanged, grooved, or fire hose thread or Storz type end connections, and shall conform to a nationally or internationally recognized standard as listed in Paragraph 1.8, or equivalent. Other types of end connections shall be evaluated on a case-by-case basis. End connections with threaded end connections shall be provided with a section to serve as a wrench grip. If a special wrench is required, it shall be supplied with the monitor.
- 3.2.3 Monitors assemblies submitted for testing shall be 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, or with full water flow.

3.3 Materials

All materials used in these monitor assemblies shall be suitable for the intended application. At a minimum, all parts exposed to water shall be constructed of corrosion resistant materials. When unusual materials are used, special tests may be necessary to verify their suitability.

3.4 Markings

- 3.4.1 Each monitor assembly shall be permanently marked on its external surface with the following information:
- Manufacturer's name or trademark;
 - Nominal size;
 - Rated working pressure;
 - Model designation; and
 - FM Approvals Certification Mark, (see Appendix B).
- 3.4.2 Monitor assemblies that are produced at more than one location shall be identified as the product of a particular location.
- 3.4.3 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the product as FM Approved. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.
- 3.4.4 The FM Approvals Certification Mark (see Appendix B) shall be displayed visibly and permanently on the product. The manufacturer shall not use this Mark on any other product unless such product is covered by separate report or agreement with FM Approvals.
- 3.4.5 All markings shall be legible and durable.

3.5 Manufacturer's Installation and Operation Instructions

Maintenance, operation and installation instructions, including any special dimension requirements, shall be furnished by the manufacturer. Instructions shall be provided with each monitor assembly.

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, indicating 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 a ISO 17025 calibration laboratory. The test equipment must 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 calibrated as determined on the basis of the parameters mentioned above.

3.7 Tolerances

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

4. PERFORMANCE REQUIREMENTS

4.1 Examination

4.1.1 Requirements

The monitor assembly shall conform to all the manufacturer's specifications and to FM Approvals requirements.

4.1.2 Test/Verification

Appropriate samples shall be examined and compared to the specifications. It shall be verified that the sample conforms to the physical and structural requirements described in Section 3, General Requirements.

4.2 Hydrostatic Proof-Pressure

4.2.1 Requirement

Monitors assemblies shall not leak at twice the rated pressure and shall not rupture, crack, or exhibit permanent distortion at four times the rated pressure.

4.2.2 Test/Verification

The monitor assembly shall be hydrostatically pressurized to 350 psi (2415kPa), or twice its rated pressure, whichever is greater, and held at that pressure for a period of one minute. No visible leakage shall occur.

The monitor assembly shall be hydrostatically pressurized to 700 psi (4825 kPa), or four times its rated pressure, whichever is higher, and held at that pressure for a period of five minutes. No ruptures, noticeable distortions, or other failure that would impair function shall occur.

4.3 Operation and Freedom of Movement

4.3.1 Requirement

The monitor assembly shall operate freely, with no binding, in both the horizontal and vertical planes while hydrostatically pressurized to 175 psi (1205 kPa), or the manufacturer's maximum specified rated pressure, whichever is greater. The monitor assembly shall operate freely with no binding, in both the horizontal and vertical planes while under flowing conditions of 100 psi (690 kPa) inlet pressure. The mechanism shall maintain the monitor in its set position.

4.3.2 Test/Verification

The assembly's nozzle connection shall be suitably plugged. The monitor assembly shall then be hydrostatically pressurized to 175 psi (1205 kPa), or the manufacturer's specified maximum pressure, whichever is greater. While at this pressure, the monitor assembly shall be operated over both its full range of horizontal and vertical movements.

The monitor assembly shall then be operated, over both its full range of horizontal and vertical movement while under flowing conditions of 100 psi (690 kPa) pressure.

Full range of movement shall be available under both test conditions.

4.4 Pressure Verses Flow Rate

4.4.1 Requirements

The pressure differential between the inlet and the outlet of the monitor shall be recorded at various flow rates.

4.4.2 Tests/Verification

The pressure differential between the inlet and the outlet of the monitor shall be measured for flow rates from 100 to 5000 gal/min (380 to 18,925 L/min) or as appropriate for the minimum and maximum flow capacity range of the monitor assembly. Appropriately sized nozzles, as required to achieve the specified range of flows, shall be attached to the monitor. The nozzles may be changed to achieve the specified flow rates, as needed. Monitor inlet and outlet pressures and flow rates, as well as nozzle selections for each flow rate shall be recorded. The manufacturer's specified values shall be within the range achieved in test.

4.5 Weatherability

4.5.1 Requirements

The monitor assembly shall operate freely, with no binding, in both the horizontal and vertical planes and shall show no significant deformation, blistering, or fracture, following exposure to a simulated rain and freezing conditions with a low temperature of -40 F (-40 C) for a period of 24 hours. After completion of

the weatherability exposure test, if deemed necessary after visual inspection, deterioration of the performance characteristics shall be evaluated, including the use of any or all of the tests detailed in Section 4.2 (Hydrostatic Proof-Pressure), Section 4.3 (Operation and Freedom of Movement), and Section 4.4 (Pressure Verses Flow Rate). Failure to exhibit normal operation as a result of freezing shall be deemed a failure.

4.5.2 Tests/Verification

A monitor assembly shall be subjected to a water spray at a rate of 0.6 in./min (15 mm/min), or full immersion bath, for an elapsed time of 5 minutes to observe the collection of water, if any, within the assembly. This is to simulate exposure to a heavy rainstorm. The inlet and nozzle connections shall be suitably plugged to prevent water from entering the flow path of the assembly. The monitor assembly shall then be conditioned in a freezer set at -40°F (-40°C) for a minimum period of 24 hours. Upon removal from the conditioning chamber the unpressurized monitor assembly shall be allowed to return to room temperature and then shall be tested for proper function of the adjustments and controls. Then the monitor assembly shall be visually examined and, if deemed necessary, the monitor assembly shall be subjected to the post-tests as detailed in Section 4.5.1.

4.6 High Temperature Exposure

4.6.1 Requirements

A dry monitor assembly shall operate freely, with no binding, in both the horizontal and vertical planes and shall show no significant deformation, blistering, or fracture following exposure to a high temperature of 135°F (57°C) for a period of 24 hours. After completion of the high temperature exposure test, if deemed necessary after visual inspection, deterioration of the performance characteristics shall be evaluated, including the use of any or all of the tests detailed in Section 4.2 (Hydrostatic Proof-Pressure), Section 4.3 (Operation and Freedom of Movement), and Section 4.4 (Pressure Verses Flow Rate).

4.6.2 Tests/Verification

The monitor assembly shall be conditioned in an oven or furnace set at 135°F (57°C) for a period of 24 hours. Immediately upon removal from the conditioning chamber, the unpressurized monitor assembly shall be tested for proper function of the adjustments and controls. Then the monitor assembly shall be visually examined and, if deemed necessary, the monitor assembly shall be subjected to the post-tests as detailed in Section 4.6.1.

4.7 Durability

4.7.1 Requirements

A dry monitor assembly shall operate freely, with no binding, in both the horizontal and vertical planes and shall show no significant damage after 500 cycles of operation throughout its full range of motion. After completion of the 500 cycles of operation, if deemed necessary after visual inspection, deterioration of the performance characteristics shall be evaluated, including the use of any or all of the tests detailed in Section 4.2 (Hydrostatic Proof-Pressure), Section 4.3 (Operation and Freedom of Movement), and Section 4.4 (Pressure Verses Flow Rate).

4.7.2 Tests/Verification

The monitor assembly shall be mounted in its normal operating position and cycled through its full range of motion in both the vertical and horizontal planes while unpressurized. Cycling shall be at the normal operating speed of the adjustments while operated by their normal means, either manual or powered. The cycling shall be conducted in an environment maintained between at 68, +/- 18°F (20, +/- 10°C). Upon conclusion of the cycling, the unpressurized monitor assembly shall be tested for proper function of the

adjustments and controls. Then the monitor assembly shall be visually examined and, if deemed necessary, the monitor assembly shall be subjected to the post-tests as detailed in Section 4.7.1.

4.8 Corrosion - Salt Spray

4.8.1 Requirements

In order to evaluate the resistance to corrosion of the assembly, such as might be experienced by dissimilar materials in contact over long periods of time; the monitor assembly shall withstand a timed exposure to a salt spray atmosphere.

When tested as detailed in Section 4.8.2, visual evidence of severe deterioration or impending failure of any component shall constitute failure. Following exposure, all of the samples shall be subjected to the Hydrostatic Proof-Pressure evaluation of Section 4.2, with no failure.

4.8.2 Tests/Verification

The monitor assembly, with provision for sealing the inlet and outlet connections, shall be exposed to salt spray (fog) as specified by the latest version of the Standard for Salt Spray (Fog) Testing, ASTM B117. The salt solution shall consist of 20 percent by weight of common salt (sodium chloride) dissolved in demineralized water.

The samples shall be exposed to a salt spray (fog) for a continuous period of 10 days. Each monitor assembly shall be mounted in its intended installation position.

Following the exposure to the salt fog, the samples shall be removed from the test chamber and permitted to air dry for a two to four day drying period. Following this test, samples shall be subjected to the tests detailed in Section 4.3, Operation and Freedom of Movement.

4.9 Foam Monitors

Monitors used for the discharge of fire fighting foam shall meet all requirements of this standard and shall also be evaluated per the applicable sections of Approval Standard 5130, Foam Extinguishing Systems.

4.10 Additional Tests

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

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

5. OPERATIONS REQUIREMENTS

A quality control program is required to assure that subsequent monitor assemblies produced by the manufacturer at an authorized location shall present the same quality and reliability as the specific monitor assemblies 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; and,
- 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 should be 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 should 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, *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. To facilitate the Approval of significant changes, 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>
Change in pressure:	<ul style="list-style-type: none"> The product was originally FM Approved at 175 psi (1205 kPa) and now is to be evaluated at 250 psi (1725 kPa)
Addition or relocation of the manufacturing location:	<ul style="list-style-type: none"> The product was originally FM Approved when made in location A, and now it is desired to make the same product in locations A and B, or in Location B only.
Changes to Critical Dimensions:	<ul style="list-style-type: none"> Modifications that would have an effect on the ability of the product to maintain the same performance as the originally FM Approved product.

5.1.3.2 The table below has been included as a guide to manufacturers of modifications which may be submitted on FM Approvals Form 797.

<i>Modification</i>	<i>Description/Example</i>
Change in Company Contact Information:	<ul style="list-style-type: none"> Contact Name, Title, Phone Number, FAX Number, Office Address, Company Name
Updating of Drawings:	<ul style="list-style-type: none"> Minor dimensional changes, or note changes, Re-creation of old drawing on CAD
Change in material or marking:	<ul style="list-style-type: none"> Where new material is superior, or to show proposed new marking

5.1.3.3 For the instances where the modification is difficult to categorize, manufacturers are encouraged to contact FM Approvals and to discuss the nature of the proposed change, and 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 ductile iron pipe and fittings, flexible fittings and couplings.

5.1.3.4 FM Approvals, at its sole discretion, shall determine when additional testing is necessary to validate proposed changes.

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 determine that the manufacturer's equipment, procedures, and quality program are maintained to insure a consistently uniform and reliable product. Initial inspections of facilities already producing similar 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 client 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 Approvals Certification Mark is not permitted at any other locations without prior written authorization by FM Approvals.

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 - *Hydrostatic Test*

The manufacturer shall test 100 percent of production monitor assemblies for body leakage to 500 psi (3450 kPa). The pressure shall be held for a minimum of one minute with no ruptures, leakage or noticeable distortions.

5.4.2 Test Requirement No. 2 - *Operational and Freedom of Movement Test*

The manufacturer shall test 100 percent of production monitor assemblies for operational and freedom of movement as detailed in Section 4.3.2. The monitor assembly shall operate freely, with no binding, in both the horizontal and vertical planes while hydrostatically pressurized to 500 psi (3450 kPa).

APPENDIX A: Units of Measurement

FLOW:	gal/min – "gallons per minute"; (L/min – "liters per minute") L/min = gal/min x 3.785
LENGTH:	in. – "inches"; (mm - "millimeters") mm = in. x 25.4 ft – "feet"; (m - "meters") m = ft x 0.3048
PRESSURE:	psi – "pounds per square inch"; (kPa – "kilopascals") kPa = psi x 6.895 inHg – "inches of mercury" psi = inHg x 0.491 bar – "bar"; (kPa - "kilopascals") bar = kPa x 0.01 bar = psi x 0.06895
TEMPERATURE:	°F – "degrees Fahrenheit"; (°C – "degrees Celsius") °C = (°F -32) x 0.556
WATER DEPOSITION:	in/min – "inches per minute" (mm/min – "millimeters per minute") mm/min = 25.4 x in/min

APPENDIX B: FM Approvals Certification Mark

FM Approvals certifications 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.



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.



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.

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: Tolerances

Unless otherwise stated, the following tolerances shall apply:

Angle:	$\pm 2^\circ$
Length:	± 2 percent of value
Volume:	± 5 percent of value
Volume Per Unit Area:	± 5 percent of value
Pressure:	± 5 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 $68 \pm 9^\circ\text{F}$ ($20 \pm 5^\circ\text{C}$).



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