



*Member of the FM Global Group*

# **Approval Standard for Sight Drains for Automatic Sprinkler Systems**

**Class Number 1056**

**December 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 sight drains for use in automatic sprinkler systems. They are used to allow visual verification that water is flowing through a pipe. Typical installations include main drain lines and in close proximity to inspector's test devices when discharge flow is not readily visible.
- 1.1.2 Approval criteria may include, but are not limited to, performance requirements, marking requirements, typical installations, 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 sight drains. In cases where metric sized products are to be examined for Approval, test criteria comparable to the equivalent or nearest nominal inch 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 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. The requirements of this standard reflect tests and practices used to examine characteristics of sight drains for the purpose of obtaining Approval. Sight drains 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, sight drains 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 Audit (F&PA) 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 Approvals 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 conducted as part of FM Approvals' Product Follow-up Program.

1.5.2 Also, as a condition of retaining Approval, manufacturers shall 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 **November 30, 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 measurements appearing in this standard. Conversion of U.S. customary units is in accordance with the Institute of Electrical and Electronics Engineers (IEEE)/ASTM International (ASTM) SI 10-02, *"Use of the International System of Units (SI): The Modern Metric System."*

## 1.8 Applicable Documents

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

- American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME) B1.20.1-1983 (R2006), *Pipe Threads, General Purpose (Inch)*
- ANSI/American Water Works Association (AWWA) C606-2006, *Grooved and Shouldered Joints*
- British Standards (BS) 21 - 2007, *Pipe Threads for Tubes and Fittings Where Pressure-Tight Joints Are Made On the Threads (Metric Dimensions)*
- British Standards / European Norm (BS EN) 10226-1 – 2004, *Pipe Threads Where Pressure Tight Joints Are Made on the Threads - Part 1: Taper External Threads and Parallel Internal Threads - Dimensions, Tolerances and Designation*
- 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*
- BS EN 10226-3 – 2005, *Pipe Threads Where Pressure-Tight Joints are Made on the Threads - Part 3: Verification By Means Of Limit Gauges*
- FM Global Property Loss Prevention Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*, March 2010
- FM Global Property Loss Prevention Data Sheet 3-7, *Fire Protection Pumps*, September 2010
- IEEE/ASTM SI 10 - 2002, *Use of the International System of Units (SI): The Modern Metric System*

International Organization for Standardization (ISO) 65 – 1981, *Carbon Steel Tube Suitable for Screwing in Accordance with ISO 7-1*  
 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 - 2006, *General Requirements for the Competence of Testing and Calibration Laboratories*  
 Japanese Industrial Standard (JIS) G3454 – 2007, *Carbon Steel Pipes for Pressure Service*

## 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. It is installation specific. A product accepted for one installation may not be acceptable elsewhere. (Contrast with FM Approved.)

### ***Cut Groove***

A groove that is machined in the outside diameter of a pipe, valve, or fitting near the end to allow joining by means of a gasketed grooved pipe coupling.

### ***End Connections***

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

### ***Flange Fittings***

The term flanged fittings refers to any style of pipe fitting covered in the scope of this Approval Standard with integral flanged end connections.

### ***FM Approvals Certification Marks***

The FM Approvals Certification Marks are detailed in Appendix B. Their use is mandatory on all units of FM Approved products. These registered marks cannot be used except as authorized by FM Approvals via the granting of Approval to a specific product.

### ***FM Approved***

This term refers to products FM Approved by FM Approvals. Such products are listed in the *Approval Guide*, an on-line resource of FM Approvals. See Appendix D for a sample listing. 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 prohibits the manufacturer from deviating from the as-FM Approved configuration of the product without review by and agreement of FM Approvals. Approval is product specific.

### ***Grooved Coupling, Flexible***

A grooved coupling is an assembly that is used to join grooved ends together. The flexible grooved coupling is characterized by its ability to allow for angular or rotational differences between the components being joined after assembly. These products may provide greater system reliability in situations involving excessive vibration, difficult alignment, or seismic activity. They may also provide greater system flexibility than historic use of rigid systems of flanged pipe and fittings.

***Grooved Coupling, Rigid***

A rigid grooved coupling is an assembly that is used to join two grooved ends together. The rigid grooved coupling is characterized by its prevention of rotation of the joined ends, and reduced tolerances for angular variations after assembly.

***Plain End Fittings***

Pipe couplings or other devices that are designed to work with pipe ends that have been cut perpendicular to its axis and incorporating no grooves or threads. The fitting is typically fastened to the pipe by mechanical means, such as a fastener.

***Rated Working Pressure***

This is the maximum sustained pressure at or below which the device shall operate trouble free for its entire design life. This value sets the basis for the testing described in Section 4.

***Threaded End***

Pipe couplings, valves or fittings which have been furnished with their ends threaded with internal or external pipe threads conforming to national or international standards for pipe threads for the nation of intended use (i.e. ANSI B1.20.1, ISO 7-1).

***Welded End***

Steel pipe furnished with ends which are characterized by having the ends cut perpendicular to its axis and finished with a pronounced bevel on each end to allow for butt welding. Valves and other devices found in piping systems can also be provided with welded end connections.

## **2. GENERAL INFORMATION**

### **2.1 Product Information**

- 2.1.1 The products outlined in Section 1.2 of this standard are for use in aboveground fire protection systems. Installations shall be in accordance with FM Global Property Loss Prevention Data Sheets and the manufacturer's installation instructions.
- 2.1.2 Sight drains show the operator that water is flowing to a drain when the outlet of the drain line is obscured from sight. They can also be used in and throughout a sprinkler system where visual verification of water flow is required.
- 2.1.3 In order to meet the intent of this standard, sight drains 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 been seen to perform differently in testing. Sample drains, selected in conformance to this criterion, shall satisfy all of the requirements of this standard.

## 2.2 Approval Application Requirements

- 2.2.1 To apply for an Approval examination, the manufacturer, or an authorized representative, 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,
- General assembly drawings, one complete set of manufacturing drawings, materials list(s), anticipated marking format, brochures, sales literature, specification sheets, installation, operation and maintenance procedures, and
- Number and location of manufacturing facilities 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.

## 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 any special test fixtures, which may be required to evaluate the sight drain.

# 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. All foreign language documents shall be provided with English translation.



### 3.2 Physical or Structural Features

- 3.2.1 Sight drains shall be designed for a minimum rated working pressure of 175 psi (1205 kPa). Sight drains with higher rated working pressures may be evaluated on a case-by-case basis.
- 3.2.2 Installation is limited to use in automatic sprinkler systems.
- 3.2.3 Nominal sizes of threads shall be between 1/2 and 2 inch NPT or equivalent. Threaded connections shall be in accordance with ANSI B1.20.1, BS21, ISO 7-1, or other recognized international standard.
- 3.2.4 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.
- 3.2.5 Sight drains 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.
- 3.2.6 Sight drains shall be designed with transparent windows to allow for the viewing of water flow through the drain. Other means of observing water flow will be evaluated on a case-by-case basis.

### 3.3 Materials

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

### 3.4 Markings

- 3.4.1 All FM Approved sight drains shall bear a 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 this Mark on any other product unless such product is covered by separate agreement with FM Approvals.
- 3.4.2 Each sight drain discussed in this standard shall be permanently marked with the following information:
  - Manufacturer's name or trademark;
  - Product model designation;
  - FM Approvals Certification Mark;
  - Nominal device size;
  - Year of manufacture
  - Manufacturing source code, if made at more than one location;
  - Rated working pressure;
- 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 be applied using die-stamping, forging, cast, roller embossing or electro-etching. Or any combination thereof.
- 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 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 with FM Approvals.

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 installation instructions shall be reviewed 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, 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 an ISO/IEC 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 Requirement

The sight drains shall conform to the manufacturer's drawings and specifications and to FM Approvals requirements.

#### 4.1.2 Test /Verification

A sample of each model sight drain 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 Hydrostatic Integrity

### 4.2.1 Requirement

All sight drains shall withstand exposure to hydrostatic pressure of two times the rated working pressure of the product. During and at the conclusion of the test, no fracture, permanent distortion, or functional impairment, including leakage, shall occur.

### 4.2.2 Test /Verification

Each size sight drain shall be subjected to a hydrostatic pressure test at 350 psi (2415 kPa) or two times its rated working pressure, whichever is higher, for five minutes. No failure, as described above, is allowed.

## 4.3 Visibility

### 4.3.1 Requirement

The sight drain shall clearly show water flow from a distance of 2 ft. (0.6 m) for all size sight drains, when viewed by an informed observer.

### 4.3.2 Test /Verification

A sample sight drain shall be placed indoors under a light source generating approximately 50 lumens/ft.<sup>2</sup> (538 lux). The sight drain shall be installed in a piping system and a turbulent water flow established through the device. At least four observers who have 20/20 vision (normal or corrected) shall stand 2 ft. (0.6 m) from the sight drain, and shall be able to observe water flow through the sight.

## 4.4 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 sight drains, at the discretion of FM Approvals.

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

## 5. OPERATIONS REQUIREMENTS

A quality control program is required to assure that subsequent sight drains produced by the manufacturer at an authorized location, shall demonstrate the same quality and reliability as the specific drains 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 non-conforming 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.

#### 5.1.2 Documentation/Manual

The manufacturer shall maintain 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 Report or Address/Main Contact Change Report*. Records of all revisions to FM Approved products shall be maintained.

- 5.1.3.1 The table below has been included as a guide to manufacturers of what is considered to be a significant change to FM Approvals. As mentioned above, modifications that fit this category shall be documented by means of a letter stating the change, and requesting 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).
Addition or Relocation of the Manufacturing Location	The product was originally FM Approved in location A, and now is desired to be made in locations A and B, or only in location B.
Change in Manufacturing Process	Change from Threaded Assembly to Groove End Connections
Changes to Critical Dimensions	Modifications that would depart from the national or international standards that are used in the manufacturing of the product as originally FM Approved.
	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 drain 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	Name, Title, Phone Number, Fax Number, Email Address, Company Office Address, Company Name
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 the 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 Sections 5.1.3.1 and 5.1.3.2 are based on common examples of modifications as they relate to the manufacture of the product.

## **5.2 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 products may be waived at the discretion of FM Approvals.
- 5.2.2 These audits shall be conducted periodically, but at least annually, by FM Approvals or its representatives or more frequently depending on jurisdictional requirements. At issue of this standard the Occupational and Safety Health Administration (OSHA) of the United States Department of Labor requires audits of manufacturing sites producing products for use in hazardous locations during each quarter the product is manufactured.
- 5.2.3 The client shall manufacture the FM Approved 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.
- 5.2.4 In the event that all or part of the quality inspection is subcontracted, the manufacturer shall provide FM Approvals with documentation outlining the nature of the inspection, frequency, test details, and pass/fail criteria that was provided to the subcontracted company, and documentation that they have received and implemented these procedures.

## **5.3 Manufacturer's Responsibilities**

- 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**

The manufacturer shall test 100 percent of production sight drains hydrostatically for body leakage and integrity to the rated working pressure. The pressure shall be held for a minimum of 5 seconds with no evidence of body leakage, cracking or distortion.

**APPENDIX A: Units of Measurement**

<b>FLOW:</b>	gal./min. - “gallons per minute”; (L/min - “liter per minute”) $L/min = gal./min. \times 3.7854$
<b>LENGTH:</b>	in. - “inches”; (mm - “millimeters”) $mm = in. \times 25.4$ ft. - “feet”; (m - “meters”) $m = ft. \times 0.3048$
<b>LIQUID</b>	oz. - “ounces”; (mL - “milliliters”) $mL = oz. \times 29.573$
<b>MASS:</b>	lb - “pounds”; (kg - “kilograms”) $kg = lb \times 0.454$
<b>PRESSURE:</b>	psi - “pounds per square inch”; (kPa - “kilopascals”) $kPa = psi \times 6.895$
<b>TEMPERATURE:</b>	$^{\circ}F$ - “degrees Fahrenheit”; ( $^{\circ}C$ - “degrees Celsius”) $^{\circ}C = (^{\circ}F - 32) \times 0.556$
<b>TORQUE or MOMENT:</b>	lb·ft. - “pound-feet”; (N·m - “newton-meter”) $N \cdot m = lb \cdot ft. \times 1.356$

## APPENDIX B: FM Approvals Certification Marks

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.



### 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](http://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: 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

**Pressure:**  $\pm 5$  psi (35 kPa)

**Time:**  $+5/-0$  seconds

$+0.1/-0$  minutes

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

## APPENDIX D: Sample Listing

### SIGHT DRAINS

A sight drain is designed to visually show that water is flowing in the drain piping of an automatic sprinkler system. They can be used in other applications in an automatic sprinkler system where visual verification of water flow is required. Unless otherwise noted in the listing, these sight drains have 175 psi (1205 kPa) rated working pressure.

**CPH Mfg Inc, 2 Colin Lane, Charlton, MA 01507**

<i>Product Designation</i>	<i>Connection Size, NPT inches</i>
CPH 33	1/2
CPH 34	3/4
CPH 35	1
CPH 36	1-1/4
CPH 37	1-1/2