



*Member of the FM Global Group*

# **Approval Standard for Fire Department Connections**

**Class Number 1530**

**November 2016**

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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 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, successful re-examinations of equipment, materials, and services as appropriate, and surveillance 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 Fire Department Connections which are used to provide a means to pump water into a sprinkler system, or standpipe, from a public hydrant or other water supply.
- 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 surveillance audit program.

### 1.2 Scope

- 1.2.1 This standard encompasses the design and performance requirements for fire department connections.
- 1.2.2 Approval Standards are intended to verify that the product described will meet stated conditions of performance, safety and quality useful to the ends of property conservation.

### 1.3 Basis for Requirements

- 1.3.1 The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions and/or loss control specialists may also be considered.
- 1.3.2 The requirements of this Standard reflect tests and practices used to examine characteristics of fire department connections for the purpose of obtaining Approval. Fire department connections 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, fire department connections 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 examination of the manufacturing facilities and audit of quality control procedures is made 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, Surveillance Audit Program)

## 1.5 Basis for Continued Approval

### 1.5.1 Continued Approval is based upon:

- Production or availability of the product as currently FM Approved;
- The continued use of acceptable quality assurance procedures;
- Satisfactory field experience;
- Compliance with the terms stipulated in the Master Agreement;
- Satisfactory re-examination of production samples for continued conformity to requirements; and
- Satisfactory Surveillance Audits conducted as part of FM Approvals' surveillance audit 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 **February 28, 2017** 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 10-2010, "*American National Standard for Metric Practice.*"

## 1.8 Applicable Documents

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 - 2013, *Pipe Threads, General Purpose (Inch)*

ANSI / ASME B1.20.3 - 2013, *Dryseal Pipe Threads (Inch)*

ANSI / ASME B1.20.7 - 2013, *Hose Coupling Screw Threads*

ANSI / IEEE / ASTM SI 10 - 2010, *American National Standard for Metric Practice*

ANSI / American Water Works Association (AWWA) C606 – 2015, *Grooved and Shoulder Joints*

FM Global Property Loss Prevention Data Sheet 2-0 – January 2014, *Installation Guidelines for Automatic Sprinklers*

FM Global Property Loss Prevention Data Sheets

International Organization for Standardization (ISO) / International Electrotechnical Commission (IEC)  
17025-2005, *General Requirements for the Competence of Testing and Calibration Laboratories*

National Fire Protection Association (NFPA) 13 - 2016, Standard for the Installation of Sprinkler Systems

NFPA 14 - 2016, Standard for the Installation of Standpipe and Hose Systems

NFPA 15 - 2012, Standard for Water Spray Fixed Systems for Fire Protection

NFPA 25 - 2014, Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems

NFPA 1962 - 2013, Standard for the Care, Use, Inspection, Service Testing, and Replacement of Fire Hose, Couplings, Nozzles, and Fire Hose Appliances

NFPA 1963 - 2014, Standard for Fire Hose Connections

## 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.)

### *End Connections*

The means by which components of a sprinkler system are connected to the sprinkler fitting or piping. Typical end connections are grooved and threaded.

### *FM Approved*

This term refers to products FM Approved by FM Approvals. Such products are listed in the Approval Guide, an on-line resource of FM Approvals. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned a Master Agreement to FM Approvals. This form obligate the manufacturer to allow re-examination of the product and surveillance audits at FM Approval’s 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.

### *FM Approvals Certification Mark*

Product markings, applied by the manufacturer, that identify the product as FM Approved. Their use is mandatory on all units of FM Approved fire department connections. These registered marks cannot be used except as authorized by FM Approvals via the granting of Approval to a specific product.

### *Rated Working Pressure*

This is the maximum sustained pressure at or below which the fire department connections 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).

### *Standpipe*

This term refers to the piping within a building that provides water supply to the hose connections, hose stations, as well as sprinkler systems (on combined systems). Standpipes are classified as either “Automatic” or “Manual”, where the difference is whether or not the standpipe is connected to a water supply. If connected to a water supply on continuous basis, and all that is required to get water at the hose valve is to open the hose valve, then the system is regarded as “Automatic”. For Standpipe systems that receive primary water supply from the fire department connection at the exterior wall of the building, this is regarded as “Manual”. Secondary Classifications for standpipes are “Dry” or “Wet” which is a reference to the normal condition within the actual standpipe. Standpipe systems are further classified as vertical when supplying water to hose connections floor to floor, and horizontal when supplying water to hose connections on the same floor.

## **2. GENERAL INFORMATION**

### **2.1 Product Information**

- 2.1.1 Fire department connections provide a means to pump water into a Sprinkler system, or standpipe, from a public hydrant or other water supply.
- 2.1.2 In order to meet the intent of this standard, fire department connections 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 fire department connections, 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 [information@fmapprovals.com](mailto:information@fmapprovals.com).
- 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 drawings, materials list(s), anticipated marking format, brochures, sales literature, specification sheets, installation, operation and maintenance procedures, and
  - Number and location of manufacturing facilities.
- 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 or revision level

### **2.3 Requirements for Samples for Examination**

- 2.3.1 Sample Requirements are to be determined by FM Approvals following review of the preliminary information used in the preparation of the examination proposal. Sample requirements may vary depending on size range of the product under consideration, design features, results of prior testing, and results of any foregoing tests. Following the authorization of the examination proposal, the manufacturer shall submit samples for examination and testing using the shipping guidance information included with the proposal letter.
- 2.3.2 The manufacturer shall submit samples representative of production. Any decision to use data generated using prototypes is at the discretion of FM Approvals.
- 2.3.3 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the fire department connections.
- 2.3.4 If failures are encountered during the examination testing, FM Approvals will provide the manufacturer with information regarding what testing will need to be repeated and any additional sample requirements.

## **3. GENERAL REQUIREMENTS**

### **3.1 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 The fire department connections shall be designed for a minimum rated working pressure of 175 psi (1205 kPa).
- 3.2.2 Fire department connections shall have a single 4 inch (100 mm) or two 2-1/2 inch (63 mm) female hose inlets with swivels and a 4 inch IPS minimum outlet. Each inlet shall be provided with a suitable washer and conform to NFPA Standard 1963, "Standard for Fire Hose Connections". The hose inlets may be attached to the body or may be part of an adapter; the swivels shall have spanner lugs.

- 3.2.3 The body shall be straight, or have a 45 or 90 degree angle.
- 3.2.4 The inlets shall be arranged so that the hose can be conveniently attached to or removed from one inlet while the other is in service.
- 3.2.5 Waterways shall be at least 2-1/2 inch I.D. from inlet to outlet. A 2-1/2 inch diameter sphere will be placed into each inlet. The sphere must pass freely through the body.
- 3.2.6 Either a single or dual clapper arrangement is Approvable.
- 3.2.7 The clearances between the periphery of the clapper and the inside of iron-bodies shall be at least 1/4 inch in every position of the clapper from closed to full open.
- 3.2.8 The seat ring shall be raised 1/8 inch minimum above the body to allow for proper seating of the clapper.
- 3.2.9 A hose plug which can be readily removed or broken shall be provided on each inlet to protect the hose threads and to prevent the entrance of foreign material.

### 3.3 Materials

All materials used in these fire department connections 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 Each fire department connection discussed in this Standard, shall be permanently marked with the following information:
- Manufacturer's name or trademark
  - The type of system it supplies on top of the body such as "AUTO. SPKR.", "OPEN SPKR.", or "STAND-PIPE"
  - Model designation
  - FM Approvals Certification Mark
- 3.4.2 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.
- 3.4.3 Each fire department connection shall be supplied with a corrosion resistant wall plate. The plate shall be marked in cast raised letters with the words "FIRE DEPT. CONNECTION" and the type of system which is supplied in the following manner:

AUTOMATIC SPRINKLERS  
FIRE DEPT. CONNECTION  
Or  
STANDPIPE  
FIRE DEPT. CONNECTION  
Or  
OPEN SPRINKLERS  
FIRE DEPT. CONNECTION

- 3.4.4 Each required marking listed in Section 3.4.1 shall be legible and durable and applied in any of, or any combination of casting, die stamping, forging, roller embossing or electro-etching.
- 3.4.5 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the product as FM Approved. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.
- 3.4.6 All markings shall be legible and durable throughout the useful life of the product.

### **3.5 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 new test equipment shall be clearly identified by label or sticker showing the date of initial calibration and the next due date. When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of this equipment.

### **3.6 Tolerances**

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

## **4. PERFORMANCE REQUIREMENTS**

### **4.1 Examination**

#### **4.1.1 Requirement**

The fire department connections shall conform to the manufacturer's drawings and specifications and to FM Approval requirements.

#### **4.1.2 Test/Verification**

A sample fire department connection 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 Strength Test

##### 4.2.1 Requirement

The fire department connection body shall withstand hydrostatic strength testing without sustaining cracking or permanent deformation.

##### 4.2.2 Test/Verification

The fire department connection body shall be able to withstand a hydrostatic pressure of 700 psi (4830 kPa) or four times the rated working pressure, whichever is greater, for five minutes.

#### 4.3 Clapper Leakage Test

##### 4.3.1 Requirement

The clapper(s) shall prevent excessive leakage when subjected to a water pressure at 125% of the rated working pressure.

##### 4.3.2 Test/ Verification

The clapper(s) will be subjected to 125% of the rated working pressure for 5 minutes. Total water leakage shall not exceed one (1) pint.

#### 4.4 Clapper Strength Test

##### 4.4.1 Requirement

The clapper(s) shall not crack or deform when subjected to twice the rated working pressure.

##### 4.4.2 Test/ Verification

Clapper(s) shall have adequate strength to resist a water pressure of two times the rated working pressure for five minutes. There shall be no failure or permanent distortion of the clapper(s) as a result of this test.

#### 4.5 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 fire department connections, 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 fire department connections produced by the manufacturer at an authorized location, shall present the same quality and reliability as the specific fire department connections examined. Design quality, conformance to design, and performance are the areas of primary concern. Design quality is determined during the Approval examination and tests, and is covered in the Approval Report. Conformance to design is verified by control of quality and is covered in the Surveillance Audit Program. Quality of performance is determined by field performance and by periodic re-examination and testing.

### 5.1 Demonstrated Quality Control Program

5.1.1 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- Existence of corporate quality assurance guidelines
- Incoming quality assurance, including testing
- In-process quality assurance, including testing
- Final inspection and tests
- Equipment calibration
- Drawing and change control
- Packaging and shipping
- Handling and disposition of non-conformance materials.
- In order to assure adequate traceability of materials and products, the manufacturer shall maintain records of all quality control tests performed, for a minimum period of two years from the date of manufacture.

5.1.2 Documentation/Manual

There shall exist an authoritative collection of procedures and policies. Such documentation shall provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system shall require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

5.1.3 Drawing and Change Control

The manufacturer shall establish a system of product configuration control that does not allow unauthorized changes to the product. Revisions to critical documents, identified in the Approval Report, must be reported to, and authorized by, FM Approvals prior to implementation for production. The manufacturer shall assign an appropriate person or group to be responsible for, and require that, proposed changes to FM Approved or Listed products be reported to FM Approvals before implementation. The manufacturer shall notify FM Approvals of changes in the product or of persons responsible for keeping FM Approvals advised by means of FM Approvals Form 619, *FM Approved Product/Specification-Tested Revision Report or Address/Main Contact Change Report*. Records of all revisions to all FM Approved products shall be maintained.

5.1.3.1 The table below has been included as a guide to manufacturers of what is considered to be a significant change to FM Approvals. As mentioned above, modifications that fit this category shall be documented by means of a letter stating the change, and requesting a quotation for an Approval examination.

<i>Modification</i>	<i>Description/Example</i>
Addition or Relocation of the Manufacturing Location	The product was originally FM Approved in location A, and now is desired to be made in locations A and B, or only in location B.
Increase in Pressure Rating	The product was originally FM Approved for 175 psi (1205 kPa), and now is to be evaluated to 300 psi (2070 kPa.)
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 on the body.

5.1.3.2 The table below has been included as a guide to manufacturers of modifications that are commonly submitted by the manufacturer to notify FM Approvals of changes in the product or of persons responsible for keeping FM Approvals advised by means of FM Approvals Form 619, *FM Approved Product/Specification-Tested Revision Report or Address/Main Contact Change Report*.

<i>Modification</i>	<i>Description/Example</i>
Change in Company Contact Information	Name, Title, Phone Number, Fax Number, Email Address, Company Office Address, Company Name
Updating of Drawings	FM Approved Product Revision Request Form is used to notify FM Approvals in the event of: minor dimensional changes to non-critical features, minor changes in notes, location of title block, re-creation of the same drawing on CAD, etc.
Changes in Markings	Please describe what changes are to be made and include a drawing of the proposed marking.
Changes in Materials of 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 For the instances where the modification is difficult to categorize, manufacturers are encouraged to contact FM Approvals to discuss the nature of the change, and inquire about how to send the information to FM Approvals. The examples shown in Sections 5.1.3.1 and 5.1.3.2 are based on common examples of modifications as they relate to the manufacture of the product.

## 5.2 Surveillance Audit Program

- 5.2.1 An audit of the manufacturing facility is part of the Approval investigation to verify implementation of the quality control program. The surveillance audit shall ensure that the appropriate controls are in place to verify that the product bearing the FM Approval Mark conforms to the specified requirements. Although the structure defined in ISO 9001 “Quality Management Systems - Requirements” may be applied, the focus of surveillance audits is principally the FM Approved or Listed product. Initial inspections of facilities already producing similar FM Approved products may be waived at the discretion of FM Approvals.
- 5.2.2 Surveillance audits shall be conducted by FM Approvals, or its representatives, at least annually at each location that manufactures the product, and/or applies the FM Approval Mark as listed in the final Approval Report to confirm continued compliance. The frequency of, and time needed to complete, the surveillance audit is dependent on the product class, product complexity, jurisdictional requirements, FM Approvals accreditation requirements, and findings.
- 5.2.3 The manufacturer shall manufacture the product or service only at the location(s) audited by FM Approvals and as specified in the Approval Report. Manufacture of products bearing the FM Approval Mark is not permitted at any other locations without prior written authorization by FM Approvals.
- 5.2.4 In the event that all or part of the quality inspection is subcontracted, the manufacturer shall provide FM Approvals with documentation outlining the nature of the inspection, frequency, test details, and pass / fail criteria that was provided to the subcontracted company, and documentation that they have received and implemented these procedures.

### **5.3 Installation Inspections**

Field inspections may be conducted to review an installation. The inspections are conducted to assess ease of application, and conformance to written specifications. When more than one application technique is used, one or all may be inspected at the discretion of FM Approvals.

### **5.4 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.

### **5.5 Manufacturing and Production Tests**

#### **5.5.1 Test Requirement No. 1 – *Hydrostatic Test***

The manufacturer shall perform hydrostatic pressure testing on 100 percent of production fire department connections. The fire department connection shall be subjected to twice the rated working pressure for a minimum of 1 minute. There should be no evidence of body leakage or deformation.

#### **5.5.2 Test Requirement No. 1 – *Clapper Leakage Test***

The manufacturer shall perform Clapper leakage testing on 100 percent of production fire department connections. Clapper Leakage testing shall be run at a test pressure equal to the rated working pressure for a minimum duration of 1 minute.

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**APPENDIX A: UNITS OF MEASUREMENT**

<b>AREA:</b>	ft <sup>2</sup> – “square feet”; (m <sup>2</sup> – “square meters”) m <sup>2</sup> = ft <sup>2</sup> x 0.0929
<b>FLOW:</b>	Gal/min – “gallons per minute; (L/min- “liters per minute”) L/min = gal/min x 3.785 L/sec = gal/min x 0.06309
<b>LENGTH:</b>	in. - “inches”; (mm - “millimeters”) mm = in. x 25.4 ft - “feet”; (m - “meters”) m = ft x 0.3048
<b>MASS:</b>	lb - “pounds”; (kg - “kilograms”) kg = lb x 0.454
<b>PRESSURE:</b>	psi - “pounds per square inch”; (kPa - “kilopascals”, Bar) kPa = psi x 6.895 bar = psi x 0.0689
<b>TEMPERATURE:</b>	°F - “degrees Fahrenheit”; (°C - “degrees Celsius”) °C = (°F - 32) x 0.556

**APPENDIX B: TOLERANCE**

Unless otherwise stated, the following tolerances shall apply:

<b>Mass</b>	$\pm 2$ percent of value
<b>Length</b>	$\pm 2$ percent of value
<b>Pressure</b>	$\pm 2$ psi (14 kPa)
<b>Temperature</b>	$\pm 4^{\circ}\text{F}$ ( $2^{\circ}\text{C}$ )
<b>Time</b>	+ 5/-0 seconds
	+0.1/-0 minutes

## APPENDIX C: SAMPLE LISTING

### Fire Service Connections

A fire service pumper connection, located outside buildings, permits the fire service to pump water into a sprinkler system from a nearby public hydrant or reservoir. Water supplied at high pressure will aid automatic sprinklers to control a fire. The connection may also be used to supply building standpipes.

FM Approved connections are made of bronze and consist of two inlet couplings threaded for standard fire hose and siamesed into an outlet pipe connection. A check valve is provided in each inlet so that either connection may be used separately. The connections are available in straight, 45° or 90° patterns. Unless otherwise noted in the listing, these connections have 175 psi (1205 kPa) rated working pressure.

### Models A, B, C, D

<i>Model No.</i>	<i>Component Description</i>	<i>Nominal Size, Inlets x Outlet, in.</i>	<i>Rated Working Pressure, psi (kPa)</i>
A	Straightaway Single Clapper	2 1/2 x 2 1/2 x 4	175 (1205)
B	Straightaway Double Clapper	2 1/2 x 2 1/2 x 4	175 (1205)
C	45 degree angle Body Double Clapper	2 1/2 x 2 1/2 x 4	175 (1205)
D	90 degree angle Body Double Clapper	2 1/2 x 2 1/2 x 4	175 (1205)