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Examination Standard for Fire Service Meters

Class Number 1044

May 2024

Foreword

This standard is intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product.

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1. INTRODUCTION

1.1 Purpose

1.1.1 This standard states testing and certification requirements for fire service meters for use in automatic fire protection systems. Meters addressed in this standard are used in aboveground installations as well as pits and vaults which may be below grade.

1.1.2 Testing and certification criteria may include performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

1.2.1 This standard encompasses the design and performance requirements for fire service meters intended for use where full registration metering devices on public water connections are required.

1.2.2 Other types and sizes, including metric sizes, of fire service meters may be certified if they meet the requirements and intent of this standard. Fire service meters of unusual design may be subjected to special tests to determine their suitability.

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 fire service meters for the purpose of obtaining certification.

1.4 Basis for Certification

Certification 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 for certification;
- the durability and reliability of the product.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be conducted to evaluate the manufacturer's ability to consistently produce the product, which is examined and tested, and the marking procedures used to identify the product. Subsequent surveillance may be required by the certification agency in accordance with the certification scheme to ensure ongoing compliance.

1.5 Basis for Continued Certification

The basis for continual certification may include the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;

- the continued use of acceptable quality assurance procedures;
- compliance with the terms stipulated by the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agency's product surveillance program.

1.6 Effective Date

The effective date of this examination standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this standard is eighteen (18) months after the publication date of the standard 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. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI 10.

Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection and are used in this standard.

1.8 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the cited edition applies:

ASME B1.20.1, *Pipe Threads, General Purpose, (Inch)*

AWWA C703, *Cold-Water Meters -- Fire Service Type*

FM 1045, *Waterflow Detector Check Valves*

FM 5551, *Strainers for use with Water Spray Systems*

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

ISO 7-1, *Pipe Threads Where Pressure-Tight Joints are made on the Threads- Part 1: Dimensions, Tolerances and Designation*

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. Acceptance is based upon an overall evaluation of the installation. Acceptance is not a characteristic of a product. It is installation specific. A product accepted for one installation may not be acceptable elsewhere.

Accuracy
The extent to which a given measurement agrees with the actual value for that measurement.

Electromagnetic (Mag Meters) Flowmeters
A volumetric flow meter with no moving parts, based on Faraday's Law of electromagnetic induction, which states that the voltage induced across any conductor as it moves at right angles through a magnetic field is proportional to the velocity of that conductor.

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 has been taken to refer to any style of pipe fitting covered in the scope of this Approval Standard with integral flanged end connections.

Grooved Coupling, Flexible
A grooved coupling is an assembly that is used to join two similar sized 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 different sized 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 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.

Rangeability
The ratio of the maximum flow to the minimum flow of the meter.

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.

Safe Maximum Operating Capacity
A specified maximum flow at which the meter is required to function safely.

Threaded End

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

Turbine-Type Flowmeters

A flow meter with turbine blades in the waterway. Water flowing around the blades results in the turbine rotating. The rotational speed of the turbine blades is proportional to the fluid velocity.

Type 1 Devices- Proportional Fire – Service Meter with Check Valve

A meter of the proportional type for measuring high flow rates, a bypass meter for measuring low flow rates and a check valve for diverting low flow rates through the bypass meter.

Type 2 Devices - Compound Fire – Service Meter Assembly and Strainer with Check Valve

A turbine type meter for measuring high flow rates, a bypass meter for measuring low flow rates, a strainer and a check valve for diverting low flow rates through the bypass meter.

Type 3 Devices - Turbine Fire – Service Meter and Strainer without Check Valve

A turbine type meter and strainer without a check valve and by-pass.

Type 4 Devices

Ultrasonic Transit-Time Flowmeters and Electromagnetic (Mag Meters) Flowmeters, (see definitions).

Ultrasonic Transit-Time Flowmeters

A volumetric flow meter with no moving parts, which measures the difference of the transit time of ultrasonic pulses. Ultrasonic transit-time meters requires particulates, bubbles or turbulence in the flow.

Welded End

Steel pipe furnished with ends characterized by having the ends cut perpendicular to its axis and finished with a pronounced bevel on each end to allow for buttwelding.

2. GENERAL INFORMATION

2.1 Product Information

2.1.1 The products outlined in Section 1.2 of this standard are for use when required by local waterworks as full registration metering devices on public water connections to private fire protection systems.

2.1.2 In order to meet the intent of this standard, fire service meters shall be examined on a model-by-model, type-by-type, manufacturer-by-manufacturer, and plant-by-plant basis. This is predicated on the basis that identical designs, fabricated using identical materials by different manufacturers, or, even by different plants of the same manufacturer, have sometimes been shown to perform differently in testing. Sample fire service meters selected in conformance to this criterion shall satisfy all of the requirements of this standard.

2.2 Certification Application Requirements

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

- a complete list of all models, types, sizes, and options for the products or services being submitted for certification consideration,
- general assembly drawings, one complete set of manufacturing drawings, materials list(s) (e.g., ASTM A 48, Class 40A, Gray Iron Casting), anticipated marking format, brochures, sales literature, specification sheets, installation, operation and maintenance procedures,
- the number and location(s) 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

2.3.1 Following authorization of certification examination, the manufacturer shall submit samples for examination and testing based on the following:

Sample requirements to be determined by the certification agency.

2.3.2 Requirements for samples may vary depending on design features, results of prior or similar testing, and results of any foregoing tests.

2.3.3 The manufacturer shall submit samples representative of production.

2.3.4 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the fire service meters.

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 certification investigation.

3.2 Physical or Structural Features

3.2.1 Fire service meters shall be designed for a minimum rated working pressure of 175 psi (1205 kPa).

3.2.2 Nominal sizes of fire service meters are 2, 3, 4, 6, 8, 10 and 12 inch NPS. Other sizes may be evaluated on a case by case basis.

3.2.3 Fire service meters discussed in this standard are characterized in three different types as defined below and discussed in AWWA Standard C703 as well as ultrasonic transit-time flowmeters and electromagnetic (mag meters) flowmeters. Other types of fire service meters may be evaluated on a case by case basis.

- Type 1 Devices – Proportional Fire – Service Meter with Check Valve
- Type 2 Devices – Compound Fire – Service Meter Assembly and Strainer with Check Valve
- Type 3 Devices – Turbine Fire – Service Meter and Strainer without Check Valve
- Type 4 Devices - Ultrasonic Transit-Time and Electromagnetic (Mag Meters) Flowmeters

3.2.4 Fire service meters of the turbine meter type shall be provided with strainers with a 175 psi (1205 kPa) minimum rated working pressure. Strainers may be standalone devices or incorporated into an integral assembly which includes the meter and detector check valve, if applicable. Standalone meters shall be certified. (See FM 5551, Strainers for Use with Water Spray Systems)

3.2.5 Integral strainers must also meet the requirements of FM 5551, Strainers for Use with Water Spray Systems. Major requirements include that the filter strainer shall be of corrosion resistant material which shall be designed to entrap material 3/8 in. (10 mm) and larger, the strainer shall be designed to permit removal of the filter for replacement or repairs without removing the strainer from the line, and a flushing outlet with shutoff valve shall be provided with each strainer.

3.2.6 Detector check valves, if applicable, may be standalone devices or incorporated into an integral assembly which includes the meter and strainer, if applicable. Standalone detector check valves shall be certified. (See FM 1045, Waterflow Detector Check Valves).

3.2.7 Integral detector check valves also must also meet the requirements of FM 1045, Waterflow Detector Check Valves. Major requirements include a clearance examination, spring cycle testing, bonding adequacy and water absorption testing on rubber sealing components as well as a differential cracking pressure examination.

3.2.8 End connections shall be male threaded, female threaded, flanged, or grooved end connections, and shall conform to a nationally or internationally recognized standard. Other types of end connections may be evaluated on a case-by-case basis. Fire service meters with threaded end connections shall be provided with a section to serve as a wrench grip.

3.2.9 Devices 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.

3.2.10 Replaceable internal parts shall be readily accessible by use of normally available hand tools. Parts lists and instruction shall be easily understood by an informed observer.

3.3 Materials

All materials used in these devices shall be suitable for the intended application. Device parts exposed to water shall be constructed of corrosion resistant materials. Particular consideration shall be given to turbines, turbine spindles, and main casings. These and any other materials used in fire service meters shall have physical properties necessary to render them suitable for their intended use. When unusual materials are used, special tests may be necessary to verify their suitability.

3.4 Markings

3.4.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the following information:

- name and address of the manufacturer or marking traceable to the manufacturer;
- date of manufacture or code traceable to date of manufacture or lot identification;
- model number, size, rated working pressure, directional flow arrow, etc., as appropriate.

When hazard warnings are needed, the markings should be universally recognizable.

3.4.2 Markings shall be cast or forged in raised characters or die stamped on the device body.

3.4.3 A corrosion resistant metal nameplate bearing the same information as stated above shall be considered acceptable if permanently fastened to the device body.

3.4.4 Other methods of applying permanent markings will be evaluated on a case by case basis.

3.4.5 Each required marking shall be legible and durable and applied in any of, or combination of, the above methods with the exception of the directional flow arrow which must be applied as stated in Section 3.4.2 or 3.4.3.

3.4.6 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.

3.4.7 The certification agency's mark of conformity shall be displayed visibly and permanently on the product and/or packaging as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.

3.5 Manufacturer's Installation and Operation Instructions

3.6.1 The manufacturer shall

- prepare instructions for the installation, maintenance, and operation of the product;
- provide facilities for repair of the product and supply replacement parts; and
- provide services to ensure proper installation, inspection, or maintenance for products where it is not reasonable to expect the average user to be able to provide the installation, inspection, or maintenance.

3.6 Calibration

3.6.1 Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was

performed against working standards whose calibration is certified and traceable to an acceptable reference standard and certified by an ISO/IEC 17025 accredited calibration laboratory. The test equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.

3.6.2 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 the equipment.

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3.7 Tolerances

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

4. PERFORMANCE REQUIREMENTS

4.1 Examination

4.1.1 Requirements

The fire service meters shall conform to the manufacturer's drawings and specifications and to certification requirements.

4.1.2 Test/Verification

A sample shall be examined and compared to drawings and specifications. It shall be verified that the samples conform to the physical and structural requirements described in Section 3, General Requirements, and the manufacturer's drawings. The manufacturer's installation instructions shall be reviewed for completeness and ease of understanding.

4.2 Flow Accuracy

4.2.1 Requirements

Prior to conducting the flow accuracy tests described below a fire service meter assembly of each size, shall be subjected to a hydrostatic test pressure of 350 psi (2415 kPa) or two times the rated working pressure, whichever is greater, for a duration of five minutes. There shall be no visible leakage as a result of this test.

4.2.1.1 Type 1 Meter Requirements (Proportional Fire – Service Meter with Check Valve)

Meters shall register not less than 97 percent and not more than 103 percent of the water that actually passes through the meter at any flow rate within the normal test flow rate limits shown in Table 4.2.1.1 below, with the exception of changeover between the bypass meter and the main meter, where the accuracy in this flow range shall not be less than 85 percent. The difference in the flow rate from the beginning to the end of the changeover shall not exceed the changeover flow range shown below.

Table 4.2.1.1 Type 1 Meter Operating Requirements

Nominal Device Size		***Normal Flow and Test Range Limits***		***Changeover Flow Range***	
in.	***(mm)***	***gal/min***	***(L/min)***	***gal/min***	***(L/min)***
2	(50)	5 - 200	(19 - 755)	30	(115)
3	(80)	5 - 400	(19 - 1515)	40	(150)
4	(100)	5 - 700	(19 - 2650)	60	(225)
6	(150)	8 - 1600	(30 - 6055)	130	(490)
8	(200)	10 - 2800	(38 – 10 600)	210	(795)
10	(250)	15 - 4400	(57 – 16 655)	300	(1135)
12	(305)	20 - 5500	(75 - 20 820)	350	(1325)

4.2.1.2 Type 2 Meter Requirements (Compound Fire – Service Meter Assembly and Strainer with Check Valve)

Meters shall register not less than 98.5 percent and not more than 101.5 percent of the water that actually passes through the meter at any flow rate within the normal test flow rate limits shown in Table 4.2.1.2 below, with the exception of changeover between the bypass meter and the main

meter, where the accuracy in this flow range shall not be less than 85 percent. The difference in the flow rate from the beginning to the end of the changeover shall not exceed the changeover flow spreads shown below.

Table 4.2.1.2 Type 2 Meter Operating Requirements

Nominal Device Size		***Normal Flow and Test Range Limits***		***Changeover Flow Range***	
in.	***(mm)***	***gal/min***	***(L/min)***	***gal/min***	***(L/min)***
2	(50)	2 - 160	(8 - 605)	15	(55)
3	(80)	2 - 350	(8 - 1325)	30	(115)
4	(100)	4 - 700	(15 - 2650)	40	(150)
6	(150)	5 - 1600	(20 - 6055)	90	(340)
8	(200)	8 - 2800	(30 - 10 600)	150	(565)
10	(250)	8 - 4400	(30 - 16 655)	200	(755)
12	(305)	12 - 5500	(45 - 20 820)	250	(945)

4.2.1.3 Type 3 Meter Requirements (Turbine Fire – Service Meter and Strainer without Check Valve)

Meters shall register not less than 98.5 percent and not more than 101.5 percent of the water that actually passes through the meter at any flow rate within the normal test flow rate limits shown in Table 4.2.1.3 below.

Table 4.2.1.3 Type 3 Meter Operating Requirements

Nominal Device Size		***Normal Flow and Test Range Limits***	
in.	***(mm)***	***gal/min***	***(L/min)***
2	(50)	5 - 160	(20 - 605)
3	(80)	5 - 350	(20 - 1325)
4	(100)	5 - 700	(20 - 2650)
6	(150)	30 - 1600	(115 - 6055)
8	(200)	35 - 2800	(135 - 10 600)
10	(250)	55 - 4400	(210 - 16 655)
12	(305)	80 - 5500	(305 - 20 820)

4.2.1.4 Type 4 Meter Requirements [Ultrasonic Transit-Time Flowmeters and Electromagnetic (Mag Meters) Flowmeters]

Meters shall register not less than 98.5 percent and not more than 101.5 percent of the water that actually passes through the meter at any flow rate within the normal test flow rate limits shown in Table 4.2.1.4 below.

Table 4.2.1.4 Type 4 Meters Operating Requirements

Nominal Device Size		***Normal Flow and Test Range Limits***	
in.	***(mm)***	***gal/min***	***(L/min)***
2	(50)	4 - 160	(15 - 605)
3	(80)	5 - 350	(20 - 1325)
4	(100)	5 - 700	(20 - 2650)
6	(150)	20 - 1600	(75 - 6055)
8	(200)	35 - 2800	(130 - 10 600)
10	(250)	55 - 4400	(210 - 16 655)
12	(305)	85 - 5500	(320 - 20 820)

4.2.2 Test/Verification

Sample fire service meter assemblies shall be subjected to a hydrostatic test pressure of 350 psi (2415 kPa) or two times the rated working pressure, whichever is greater, for a duration of five minutes, with no visual body or gasket leakage. Each meter shall then be tested for accuracy by comparing the registered flow on the meter to a calibrated standard. If the manufacturer's stated normal flow rate and/or accuracy exceeds the limits stated above the meter shall be tested for the manufacturers stated accuracy at the manufacturer's stated minimum and maximum flows rates. A minimum of 4 data points shall be taken for 2, 3 and 4 inch devices and 6 data points for 6, 8, 10 and 12 inch devices.

4.3 Durability (24 hr flow test)

4.3.1 Requirements

The fire service meter assemblies shall be flow tested for a total of 24 hours at a flow equal to the safe maximum operating capacity shown below in Table 4.3 or to the manufacturer's safe maximum operating capacity, whichever is greater.

Table 4.3 Durability Flow Requirements

Nominal Device Size		***Safe Maximum Operating Capacities***	
in.	***(mm)***	***gal/min***	***(L/min)***
2	(50)	160	(605)
3	(80)	350 (Type 2 & 3) 400 (Type 1)	(1325) (1515)
4	(100)	700	(2650)
6	(150)	1600	(6055)
8	(200)	2800	(10 600)
10	(250)	4400	(16 655)
12	(305)	5500	(20 820)

4.3.2 Tests/Verification

Each size meter shall be tested at the flows shown in Table 4.3 or to the manufacturer's safe maximum operating capacity, whichever is greater, for a period of 24 hours. Subsequently, each meter shall then be tested for accuracy by comparing the registered flow on the meter to a calibrated standard. A minimum of 4 data points shall be taken for 3 and 4 inch devices and 6 data points for 6, 8, and 10 inch devices. The accuracy of the meter at the conclusion of the 24 hour test shall be ± 3% of actual flow.

4.4 Friction Loss

4.4.1 Requirement

Tests shall be conducted to determine the friction loss through each meter size at various flow rates including the safe maximum operating capacity shown below or to the manufacturer's safe maximum operating capacity, whichever is greater. Friction loss through the meter shall not exceed the losses stated in Table 4.4.2.

Table 4.4.1 Friction Loss Flow Requirements

Nominal Device Size		***Safe Maximum Operating Capacities***	
in.	***(mm)***	***gal/min***	***(L/min)***
2	(50)	160	(605)
3	(80)	350 (Type 2 & 3)	(1325)

Nominal Device Size		*Safe Maximum Operating Capacities*	
		400 (Type 1)	(1515)
4	(100)	700	(2650)
6	(150)	1600	(6055)
8	(200)	2800	(10 600)
10	(250)	4400	(16 655)
12	(305)	5500	(20 820)

4.4.2 Test/Verification

A sample fire service meter shall be installed between two Schedule 40 test pipes of the same nominal diameter as the fire service meter and equipped with piezometer rings. The pressure loss between the piezometer rings shall be measured at a minimum of five flow rates including those listed in Table 4.4.1 to determine the total friction loss of the fire service meter assembly and test piping. The friction loss of the test piping, without the fire service meter assembly installed, shall then be measured at the same flow rates and deducted from the total friction loss with the device installed in the flow line previously measured. The net friction loss across the fire service meter shall not exceed the losses stated in Table 4.4.2.

Table 4.4.2 Friction Loss Requirements

Meter Type	*Friction Loss*	
	psi	*(kPa)*
Type 1 Meter - Proportional Fire - Service Meter with Check Valve	4	(30)
Type 2 Meter - Compound Fire - Service Meter Assembly and Strainer with Check Valve	12	(85)
Type 3 Meter - Turbine Fire – Service Meter and Strainer without Check Valve	11	(75)
Type 4 Meter - Ultrasonic Transit-Time Flowmeters and Electromagnetic (Mag Meters) Flowmeters	4	(30)

4.5 Hydrostatic Strength

4.5.1 Requirements

Fire service assemblies shall withstand a hydrostatic pressure of four times the rated working pressure without rupture, cracking or permanent distortion.

4.5.2 Test/Verification

Fire service meter assemblies of each size shall be subjected to a hydrostatic test pressure of 700 psi (4825 kPa) or four times the rated working pressure, whichever is greater, for a duration of five minutes. There shall be no visible rupture, cracking, or permanent distortion to the fire service meter assemblies as a result of this test.

5. MANUFACTURER'S REQUIREMENTS

5.1 Demonstrated Quality Control Program

5.1.1 A quality assurance program is required to assure that subsequent products produced by the manufacturer shall present the same quality and reliability as the specific products examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests, and is documented in the certification report.
- Continued conformance to this standard is verified by the certifier's surveillance program.
- Quality of performance is determined by field performance and by periodic re-examination and testing.

5.1.2 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-conforming materials.

5.1.3 Documentation/Manual

There should be an authoritative collection of procedures/policies. It should 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.

5.1.4 Records

There should be an authoritative collection of procedures/policies. It should 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.

5.1.5 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 certification report, may be required to be reported to, and authorized by the certification agency prior to implementation for production.

Records of all revisions to all certified products shall be maintained.

5.2 Surveillance Audit Program

5.2.1 An audit of the manufacturing facility may be part of the certification agency's surveillance requirements to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to ensure a uniform product consistent with that which was tested and certified.

5.2.2 Certified products or services shall be produced or provided at, or provided from, location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location prior to disclosure to the certification agency.

5.3 Product Modification

The manufacturer shall notify the certification agency of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

5.4 Manufacturing and Production Tests

5.4.1 Test Requirement No. 1 - *Body Leakage*

The manufacturer shall test 100 percent of production meters for body leakage to twice the rated working pressure. The pressure shall be held for a minimum of 30 seconds with no evidence of body leakage or distortion.

5.4.2 Test Requirement No. 1 - *Accuracy*

The manufacturer shall test 100 percent of production meters for accuracy, ensuring that they meet the accuracy requirements of this standard, before shipment.

6. BIBLIOGRAPHY

BS EN 10242, *Threaded Pipe Fittings in Malleable Cast Iron*

ISO 17025, *General Requirements for the Competence of Testing and Calibration Laboratories*

FM 1140, *Quick Opening Valves 1/4 inch through 2 inch Nominal Size*

APPENDIX A: Tolerance

Unless otherwise stated, the following tolerances shall apply:

Angle:	± 2°
Frequency (Hz):	± 5 percent of value
Length:	± 2 percent of value
Volume:	± 5 percent of value
Volume Per Unit Area:	± 5 percent of value
Pressure:	+ 5 percent of value - 0 percent of value
Temperature:	± 4°F (2°C)
Flow	± 2 percent of value
Time:	+ 5/–0 seconds +0.1/–0 minutes

Unless stated otherwise, all tests shall be carried out at a room (ambient) temperature of 68 ± 9°F (20 ± 5°C).

APPENDIX B: Sample Listings

Fire Service Meters

Where local waterworks authorities require the installation of full registration metering devices on public water connections to private fire protection systems, meters especially designed for fire protection service should be used. Unless otherwise noted in the listing, these meters have a 175 psi (1205 kPa) rated working pressure.

Model TPH

Model Number	*Nominal Pipe Size, in.*	*By-Pass Size, in.*	*Max. Working Pressure, psi (kPa)*	*Remarks*
TPH-2	3	3⁄4	175 (1205)	a
	4	1	175 (1205)	a
	6, 8, 10	2	175 (1205)	a
TPH-3	3	n/a	175 (1205)	b
	4	n/a	175 (1205)	b
	6, 8, 10	n/a	175 (1205)	b

Remarks
a. Certified as a Type 2 Fire Service Meter (with Waterflow Detector Check Valve)
b. Certified as a Type 3 Fire Service Meter (without Waterflow Detector Check Valve)