



Approval Standard for Expansion Chambers

Class Number 1364

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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 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 requirements for expansion chambers for use in wet pipe sprinkler systems that utilize water or antifreeze solutions.
- 1.1.2 Approval criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a follow-up program.

1.2 Scope

- 1.2.1 This standard applies to any component intended for use in sprinkler system piping to reduce pressure changes from temperature cycling in sprinkler systems, or to account for thermal expansion or pressure changes in anti-freeze systems. These expansion chambers are referred to as thermal expansion chambers.
- 1.2.2 The standard applies to any component (with the exception of anti-waterhammer check valves) intended for use in sprinkler system piping to reduce pressure surges from fire pump start-ups. These expansion chambers are sometimes referred to as surge suppressors or surge arrestors.

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 expansion chambers for the purpose of obtaining Approval. Expansion chambers 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, expansion chambers 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 A first audit shall be conducted to evaluate the manufacturer's ability to consistently produce the product that was examined and tested as part of the Approval project. The audit shall review the facility and in-place quality control procedures used in the manufacturing of the product. Typically, areas of review are incoming inspection, work in progress, production testing, final quality control, marking, calibration of equipment, shipping procedures, and document and drawing control. These audits are repeated periodically for as long as the product remains FM Approved, as part of FM Approvals' Surveillance Audit 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 Approval's product 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 authorization by FM Approvals. (Refer to section 5.1.4 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 else forfeit Approval.

The effective date of this Standard is **One Year from Issue Date** 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 Institute of Electrical and Electronics Engineers (IEEE)/American Society for Testing Materials (ASTM) SI 10-2010, *American National Standard for Metric Practice*.

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 Applicable Documents

The following standards, test methods, and practices are referenced in this standard:

American National Standards Institute (ANSI) B16.5 - 1996, *Pipe Flanges & Flanged Fittings*
ANSI/American Water Works Association (AWWA) C-606- 2011, *Grooved and Shouldered Joints*
American Society of Mechanical Engineers (ASME) B1.20.1 - 1983 (R2006), *Pipe Threads, General Purpose, (Inch)*
ASME Boiler & Pressure Vessel Code - 2010, Section VIII Division 1 – *Rules for Construction of Pressure Vessels*
FM Global Property Loss Prevention Data Sheet 2-0 - April 2011, *Installation Guidelines for Automatic Sprinklers*
IEEE/ASTM SI 10-2010, *American National Standard for Metric Practice*
ISO 17025 - 2005, *General Requirements for the Competence of Testing and Calibration Laboratories*
NFPA 13, 2010 edition, *Standard for the Installation of Sprinkler Systems*
U.S. Department of Transportation (DOT) Title 49, Code of Federal Regulations (CFR), *Hazardous Materials Regulations of the Department of Transportation*

1.9 Definitions

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.)

Bladder

This term is used to describe the rubber chamber located inside an expansion chamber that is pre-charged with gas to act as a shock absorber to liquid expanding or surging within a closed loop sprinkler system.

Expansion Chamber

This is a generic term used throughout this Approval Standard to describe either thermal expansion chambers or surge suppressors. See below detailed definitions of *Thermal Expansion Chambers* and *Surge Suppressors*.

End Connections

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

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 C. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned a Master Agreement to FM Approvals. This form obligates the manufacturer to allow re-examination of the product and surveillance audits at FM Approvals discretion. It further requires the manufacturer not to deviate from the as-FM Approved configuration of the product without review by and agreement of FM Approvals. Approval is product specific.

Pre-Charge Pressure

This term is used to describe the initial gas charge of the bladder before the fluid system pressure is introduced. The pre-charge pressure supplied by the manufacturer and contained in the expansion chamber bladder of a newly constructed expansion chamber is referred to as the “factory” pre-charge pressure.

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.

Surge Suppressor

Surge suppressors (also referred to as surge arresters or dampers), similar in construction to thermal expansion chambers, are used to moderate the potentially destructive effects of pressure surges or water hammer due to pump starting and stopping and valve opening and closing. They are employed when an anti-waterhammer check valve, alone, proves inadequate to control the problem, but should always be used in conjunction with such a valve.

Thermal Expansion Chamber

Thermal expansion chambers are used in automatic sprinkler systems to control the effects of thermal expansion on system pressure that can occur due to fluid temperature changes. These hydropneumatic pressure vessels provide additional space in the system to accommodate the expanded volume of solution when temperature increases. They contain a pre-charged bladder (containing nitrogen or dry air, typically) that is compressed as the system pressure increases creating the space for the increased volume of fluid.

2. GENERAL INFORMATION

2.1 Product Information

- 2.1.1 Expansion chambers are typically composed of two major parts: a steel pressure vessel shell and an internal rubber bladder that is pre-charged by the manufacturer typically with either dry air or nitrogen.
- 2.1.2 Expansion chambers for use in anti-freeze systems shall be tested for compatibility with both pure ethylene glycol and water, and pure propylene glycol and water only. Any other anti-freeze mixture will be the subject of a special evaluation.

2.2 Approval Application Requirements

- 2.2.1 To apply for an Approval examination the manufacturer, or its authorized representative, should submit a request to

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

- 2.2.2 The manufacturer shall provide the following preliminary information with any request for Approval consideration:
- A complete list of all models, types, sizes, and options for the products or services being submitted for Approval consideration;
 - General assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, piping and electrical schematics, nameplate format, brochures, sales literature, spec. sheets, installation, operation and maintenance procedures, and
 - The number and location of manufacturing facilities.
- 2.2.3 All the above referenced documents shall be controlled by the manufacture's Quality Assurance procedures, and shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and/or 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 an Approval examination, the manufacturer shall submit samples for examination and testing. Sample requirements to be determined by FM Approvals following review of the preliminary information.
- 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. Any decision to use data generated using prototypes is at the discretion of FM Approvals.
- 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 expansion chambers discussed in this standard.