



Member of the FM Global Group

Approval Standard for Spray Fire Shields

Class Number 4999

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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.

TABLE OF CONTENTS

1. INTRODUCTION	1
1.1 Purpose	1
1.2 Scope	1
1.3 Basis for Requirements	1
1.4 Basis for Approval	2
1.5 Basis for Continued Approval	2
1.6 Effective Date	2
1.7 System of Units	3
1.8 Applicable Documents	3
1.9 Definitions	3
2. GENERAL INFORMATION	4
2.1 Product Information	4
2.2 Approval Application Requirements	4
2.3 Requirements for Samples for Examination	4
3. GENERAL REQUIREMENTS	5
3.1 Review of Documentation	5
3.2 Physical or Structural Features	5
3.3 Markings	5
3.4 Manufacturer's Installation Instructions	5
3.5 Calibration	6
4. PERFORMANCE REQUIREMENTS	6
4.1 Spray Fire Shield Simulated Leak Test for Horizontal Piping	6
4.2 Spray Fire Shield Simulated Leak Test for Vertical Piping	6
4.3 Spray Fire Shield Fire Integrity Test	7
5. OPERATIONS REQUIREMENTS	7
5.1 Demonstrated Quality Control Program	8
5.2 Facilities and Procedures Audit (F&PA)	8
5.3 Installation Inspections	9
5.4 Manufacturer's Responsibilities	9
APPENDIX A: Units of Measurement	10
APPENDIX B: FM Approvals Certification Marks, Usage Guidelines	11
APPENDIX C: Spray Fire Shield Simulated Leak Test for Horizontal Piping	13
C-1 Introduction	13
C-2 Test Apparatus and Arrangement	13
C-3 Test Specimen	14
C-4 Test Procedure	14
C-5 Performance Requirements	15
APPENDIX D: Spray Fire Shield Simulated Leak Test for Vertical Piping	16
D-1 Introduction	16
D-2 Test Apparatus and Arrangement	16
D-3 Test Specimen	17
D-4 Test Procedure	17
D-5 Performance Requirements	17
APPENDIX E: Spray Fire Shield Fire Integrity Test	18
E-1 Introduction	18
E-2 Test Apparatus and Arrangement	18
E-3 Test Specimen	19
E-4 Test Procedure	19
E-5 Performance Requirements	20

1. INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states Approval requirements for Spray Fire Shields. Spray Fire Shields are used over mechanical joints in piping systems that carry flammable liquids. Their purpose is to prevent a spray fire from developing when a mechanical joint fails and as a consequence, develops a leak in the form of a highly pressured spray.
- 1.1.2 Past experience has shown that a number of fire losses have been caused by the failure of mechanical joints such as fittings and flanges. When this happens, a pressurized release of flammable fluid occurs which often results in a pressured spray fire. Such fires create a severe challenge because they can not be extinguished or controlled with conventional sprinkler systems. The intent of this standard is to evaluate products that can be installed as a shield or guard around a fitting such that if the fitting fails, the shield will disrupt or prevent the formation of a high pressure spray. This in turn will convert any resulting fires from a spray fire scenario to a 3D spill fire scenario which can be controlled by a properly designed sprinkler system.
- 1.1.3 Products that receive Approval recognition have been evaluated to provide assurance that they will perform their intended functions under expected conditions and prevent the formation of high pressure spray fires.
- 1.1.4 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 sets performance requirements for spray fire shields under simulated laboratory conditions that model the failure of a highly pressurized mechanical joint normally found in liquid piping systems. Such liquid piping systems are found in a variety of applications including, but not limited to, turbines and generators in power generation facilities and other flammable liquid operations such as hydraulic oil lines or liquid transfer piping.
- 1.2.2 The standard assesses the ability of a shield to convert a highly pressurized spray of fluid into a low pressure, low momentum flow under both normal operating conditions as well as under fire conditions such as that typically found within power generation facilities.
- 1.2.3 This standard is not intended to determine the suitability for all end use conditions of a product. Conditions under which spray fire shields are used vary widely. It is the responsibility of the manufacturer and building owner to determine the suitability of the products for the intended location.
- 1.2.4 This standard does not examine the spray fire shields ability to: contain leakage under normal conditions as identifying and fixing leaks is preferable to an undetected build-up of leaking fluid; perform its intended function when subjected to the long term effects of the galvanic reaction that results when the shield is installed on a liquid piping system made from a dissimilar metal.

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 FM Approvals and other organizations. The advice of manufacturers, users, trade associations and loss control specialists was also considered.

1.3.2 Meeting these requirements qualifies a product as an FM Approved spray fire shield. Requirements prohibit component substitution without prior authorization by FM Approvals.

1.3.3 The requirements of this standard reflect tests and practices used to examine characteristics of spray fire shields for the purpose of obtaining Approval. These requirements are intended primarily as guides and strict conformity is not always mandatory. Spray fire shields 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, spray fire shields that meet all the requirements identified in this standard may not be FM Approved if other conditions that adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for Approval

Approval is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

1.4.1 Examination and tests on production samples shall be performed to evaluate

- the suitability of the product;
- the performance of the product as specified by the manufacturer and required by FM Approvals; and as far as practical,
- the durability and reliability of the product.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures is made 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. These examinations may be repeated as part of FM Approvals' follow-up program.

1.5 Basis for Continued Approval

Continued Approval is based upon:

- production or availability of the product as currently FM Approved;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the Approval report and Master Agreement
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory Facilities and Procedures Audits (F&PAs) conducted as part of FM Approvals' product follow-up program.

Also, as a condition of retaining Approval, manufacturers may not change a product or service without prior authorization by FM Approvals.

1.6 Effective Date

The effective date of an Approval standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products that were 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 January 1, 2007 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 10-02, *Standard for Use of the International System of Units (SI): The Modern Metric System*.

1.8 Applicable Documents

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

American Society for Testing and Materials (ASTM) International

ASTM E 1529-00, *Standard Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies*

ASTM SI 10-02, *Standard for Use of the International System of Units (SI): The Modern Metric System*

American Society of Mechanical Engineers (ASME)

ASME B 16.5-2003, *Pipe Flanges and Flanged Fittings: NPS ½ Through 24*.

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FM Global Property Loss Prevention Data Sheet 7-32, *Flammable Liquid Operations* (September 2000)

FM Global Property Loss Prevention Data Sheet 7-99, *Heat Transfer by Organic and Synthetic Fluids*

FM Global Property Loss Prevention Data Sheet 7-101, *Fire Protection for Steam Turbines and Electric Generators*

1.9 Definitions

For purposes of this standard, the following terms apply:

Liquid Piping System – a piping system that conveys pressured liquids. These systems may convey liquids such as, but not limited to, lube oil, mineral oil, hydraulic fluid and refrigerants.

Mechanical Joint – a method of joining lengths of pipe, valves, expansion joints, fittings or other similar items to one another by means of flanged ends that are bolted together. Placed between the flanges is a gasket such that when the fasteners joining the sections together are tightened, a pressure resistant seal is developed.

Pool Fire – a fire caused by the ignition of liquids. These types of fires are commonly found in open tanks or in diked areas. The heat release rate for this type of fire is dependent on the liquid being burned and the exposed surface area of the liquid pool.

Spray Fire – a fire caused by the ignition of liquids resulting from leaks under pressure. The spray is easily ignited and will burn nearly as fast as it is released producing heat release rates much greater than a pool fire. The duration of the fire depends on the fuel supply available and how quickly it can be shut off.

2. GENERAL INFORMATION

2.1 Product Information

2.1.1 The use of spray fire shields to prevent highly pressured jets of fluid is a critical component in the overall effectiveness of controlling a fire using a conventional sprinkler system. Fires resulting from highly pressured sprays of liquids can not be controlled or extinguished by conventional sprinkler systems. When a mechanical joint fails such that it results in a highly pressurized spray of liquid, the presence of the spray shield turns the pressured spray into a low pressure, low momentum flow of liquid which can be controlled or extinguished by a conventional sprinkler system.

2.1.2 Spray fire shields are normally fabricated from galvanized or stainless steel but can be fabricated from other materials, if these other materials successfully meet all the test criteria contained in this standard. They can be fabricated for a range of pipe diameters and operating pressures.

2.2 Approval Application Requirements

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

Materials Director
FM Approvals
1151 Boston-Providence Turnpike
PO Box 9102
Norwood, MA 02062
U.S.A.

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

- A complete list of all models, types, sizes, and options for the products or services being submitted for Approval consideration;
- general assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, installation and any maintenance procedures;
- the number and location of manufacturing facilities. All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All 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 based on the following:

- Minimum and maximum diameter pipe systems for which Approval is desired
- Maximum design operating pressure for the liquid operating system to which it will be attached
- Minimum thickness of materials for the various combinations of size and pressure ratings, if applicable.

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 At the sole discretion of FM Approvals, spray shields for pipe diameters other than the minimum and maximum noted above shall need to be tested.

3. GENERAL REQUIREMENTS

3.1 Review of Documentation

During the initial investigation and prior to physical testing, the manufacturer's specifications and details shall be reviewed to assess the ease and practicality of installation and use. The Approval investigation shall define the limits of the Approval.

3.2 Physical or Structural Features

Physical and structural features, including but not limited to material type, grade and thickness, shall be shown on controlled detailed drawings.

3.3 Markings

- 3.3.1 The packaging and the spray shield itself shall bear the manufacturer's name, product trade name, design pressure rating for which it is Approved and the Approval mark of FM Approvals (see Appendix B).
- 3.3.2 Labels or markings denoting Approval shall be applied by the manufacturer only within and on the premises of manufacturing locations that are under the FM Approvals Facilities and Procedures Audit Program.
- 3.3.3 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the product as FM Approved. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.
- 3.3.4 The Approval Mark (see Appendix B) shall be displayed visibly and permanently on the product and/or packaging as appropriate. The manufacturer shall not use this Mark on any other product unless such product is covered by a separate report.
- 3.3.5 All markings shall be legible and durable.

3.4 Manufacturer's Installation Instructions

The manufacturer shall provide the user with

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