



Member of the FM Global Group

Approval Standard for Flood Abatement Equipment

Class Number 2510

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Foreword

Approvals are 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 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 Approval shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing and/or applications shall ensure a consistently uniform and reliable product or service. Approval Standards strive to be performance-oriented and 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 Master 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 or service/application.

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 describes FM Approvals requirements for flood abatement equipment for use in riverine or rainfall related flood conditions.
- 1.1.2 FM Approvals criteria may include, but are not limited to, component and system testing performance 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 flood abatement equipment for use in controlling riverine or rainfall related flood conditions. Flood abatement equipment shall be FM Approved for specific flood protection applications which are designated and categorized by:

- Function (permanent, contingent, and emergency)
- Operation (automatic and manual)
- The intended use of protection (i.e., perimeter and opening barriers, flood abatement pumps and backwater valves)

- 1.2.2 This standard sets performance requirements for flood abatement equipment in the following product categories and associated class number:

<i>Class Number</i>	<i>Product Category</i>
2510	Opening Barriers
2511	Perimeter Barriers
2512	Backwater Valves
2513	Flood Abatement Pumps

- 1.2.3 Consultation with FM Global Property Loss Prevention Data Sheet 1-40 is required for installation of this equipment.
- 1.2.4 Flood waters can produce high hydrostatic or flood dynamic loading on a structure. Appropriate measures must be taken to ensure that an external wall structure (or similar) can withstand anticipated flood loading. Some wall construction assemblies often are able to withstand 3 ft (0.9 m) or less of flood loading without needing reinforcement or additional waterproofing.
- 1.2.5 Since each flood abatement system is unique in its operation and design, component testing shall be performed on a case-by-case basis. Upon request for a program, and receipt of appropriate system documentation, FM Approvals shall prepare a customized evaluation program for the specific flood abatement system. The test program shall verify the manufacturer's design calculations, stated performance requirements, as well as component functionality and reliability.
- 1.2.6 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 was also considered.

- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of flood abatement equipment for the purpose of obtaining FM Approval. Flood abatement equipment having characteristics not anticipated by this standard may be FM Approved if demonstrated performance is equal or superior to that required by this standard, or if the intent of the standard is met.

Alternatively, flood abatement equipment that has met 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. It is the sole discretion of FM Approvals whether Approval shall be granted.

1.4 Basis for Approval

- 1.4.1 Approval is based upon satisfactory evaluation of the product and the manufacturer. 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
 - The durability and reliability of the product
- 1.4.2 A satisfactory evaluation of the flood abatement equipment's "Design, Installation, Operation and Maintenance Manual" is required. The evaluation shall be performed to ensure that the document is accurate and complete.
- 1.4.3 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 quality control procedures used in the manufacturing of the product. Typical areas of review include; 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 as part of the 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:
- The suitability of the product
 - 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
 - Satisfactory Surveillance Audits conducted as part of FM Approvals product surveillance audit program
- 1.5.2 Also, as a condition of retaining Approval, manufacturers may not change a product or service without prior written authorization by FM Approvals.

1.6 Effective Date

The effective date of an Approval standard mandates that all products tested for Approval after that date shall satisfy the requirements of the 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 **Nov 1, 2013** for compliance with all requirements.

1.7 System of Units

Units of measurement used in this Approval 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 approximated. 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 and Materials (ASTM) SI 10-2010, *"American National Standard for Metric Practice."* Two units of measurement (liter and bar), outside of, but recognized by SI, are commonly used in the international scientific community and are used in this standard.

1.8 Applicable Documents

This standard is used in conjunction with the following standards, test methods, and practices as referenced in this standard.

ASME Publications

The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990 www.asme.org

ASME A112.14.1-, *Backwater Valves*

ASME Boiler and Pressure Vessel Code, Section VIII- Rules for Construction of Pressure Vessels, Division 1

ASTM Publications

American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

ASTM B117 - *Standard Practice for Operating Salt Spray (Fog) Apparatus*

ASTM D412 - *Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Elastomers - Tension*

ASTM D471 - *Standard Test Method for Rubber Property-Effect of Liquids*

ASTM D395 - *Standard Test Methods for Rubber Property - Compression Set*

ASTM D573 - *Standard Test Method for Rubber - Deterioration in an Air Oven*

ASTM D1242 - *Standard Test Method for Resistance of Plastic Materials to Abrasion*

ASTM D3273 - *Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber*

ASTM D5602 - *Standard Test Method for Static Puncture Resistance of Roofing Membrane Specimens*

ASTM D6382 - *Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material*

ASTM E290 - *Standard Test Methods for Bend Testing Of Material for Ductility*

ASTM G154 - *Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*

ASTM G155 - *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*

ASTM SI10 - *American National Standard for Use of the International System of Units (SI): The Modern Metric System*

FM Global

FM Global, 75 Remittance Drive Suite #6182, Chicago, IL 60675-6182

FM Global Property Loss Prevention Data Sheet 1-40, Flood

International Standards Organization

International Standards Organization, , 1 rue de Varembe, Case Postale 56, CH-1211 Geneve 20, Switzerland

ISO 9001 - *Quality Systems - Model for quality assurance in design, development, production, installation, and servicing*

ISO 9002 - *Quality Systems - Model for quality assurance in production, installation, and servicing*

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

United States Army Corp of Engineers

United States Army Corp of Engineers (USACE), Engineering Research and Development Center (ERDC)

Standardized Testing Protocol for Evaluation of Expedient Floodfight Structures, June 27, 2010

United States Department of Transportation (D.O.T.)

United States Department of Transportation, Washington, DC

Code of Federal Regulations, Title 49, Transportation, Parts 171 through 180

1.9 Definitions

For purposes of this Standard, the following terms apply.

Accepted

This term refers to installations acceptable to the authority having jurisdiction and 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 the equipment. 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).

Automatic Flood Barrier

A permanent barrier that automatically deploys without the use of human interaction when flood conditions are detected. Types of automatic barriers include, but are not limited to, passive barriers (buoyancy driven horizontal or vertical) or active barriers (pneumatic or hydraulic activated by water sensors).

Backwater Valve

A device installed in building drainage systems utilizing a check valve to prevent backflow. Backwater valves are designed in either a normally open position or normally closed position.

Characteristic Curve

Graphic representation of the variation of the pump’s total head, efficiency and brake horsepower versus the pump’s capacity at a constant speed.

Combination Floor Drain and Backwater Valve

A floor drain incorporating an internal check member to prevent backflow.

Combination Horizontal Backwater Valve and Manual Gate Valve

A backwater valve designed to be installed in a horizontal drain line incorporating an internal check member and manual gate valve to prevent backflow.

Contingent Flood Barrier

A barrier that is pre-installed but is not permanently affixed to a structure. An example of a contingent barrier is a manual barrier which has pre-installed frame but the barrier itself is stored in a designated area other than the opening it’s designed to protect.

Deflection

The distance a flood barrier moves from its original location after or during a test.

Deployment Time

The amount of time required for setting up and/or operating a flood barrier.

Door Panels

Any panel, permanent or otherwise, which provides partial coverage of an exterior or interior door opening with the principle function of preventing flood waters into a structure.

Dry-Side

The side of the water basin protected by the flood barrier.

Emergency Flood Barrier

Any barrier that can be fitted, installed, or otherwise put in place in a relatively short period of time during a flood event.

Flood Abatement Pumps

A pump used for the removal of unwanted water. Types of flood abatement pumps include but are not limited to submersible (ex: a sump pump) and self-priming pumps. Flood abatement pumps shall be utilized in one of the following applications; as part of an open automatic barrier system, installed in a building and used for removal of unwanted water, and/or as a portable emergency device used for removal of unwanted water from a building.

Flood Doors

Any door, permanent or otherwise, which provides complete coverage of an exterior or interior door opening with the principle function of preventing flood waters into a structure.

FM Approvals Certification Mark

The FM Approvals Certification Mark is detailed in Appendix C. Its use is mandatory on all FM Approved systems. These registered marks cannot be used except as authorized by FM Approvals via the granting of Approval to a specific product. For flood abatement equipment systems, the FM Approvals Certification mark shall be placed on the system placard and not on individual components unless those components have undergone a separate evaluation to the applicable standards.

FM Approved

This term refers to products FM Approved by FM Approvals. Such products are listed in the Approval Guide, an online 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 contract 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.

Horizontal Backwater Valves

A backwater valve designed to be installed in a horizontal drain line incorporating an internal check member to prevent backflow.

Leakage Rate

The rate at which water moves past or through a flood barrier from the wet-side to the dry-side of the barrier, expressed as gallons per minute per foot length.

Major Repair

A repair made to a flood barrier during the performance testing that requires changes to barrier design by the manufacturer. Major repairs are only allowed at the discretion of FM Approvals, and may require re-testing or additional testing.

Manual Barrier

A barrier that requires human intervention to operate in the desired manner. Examples of a manual barrier include; an opening barrier which is stored in a designated area other than the opening it's designed to protect or a permanently installed opening barrier with hinges or pivots.

Maximum Load

Maximum radial hydraulic load on the impeller of a sump pump at any point on the performance curve based on a specific gravity of 1.0. This usually occurs at the point of maximum total discharge head.

Maximum Power

The greatest speed-corrected power required to drive a flood abatement pump at rated speed and at any point along its characteristic curve, and through the pumps total run out condition.

Minor Repair

A small repair made to a flood barrier during the performance testing. A repair will constitute as a "minor repair" only if; (1) the repair can be easily replicated by the end user, and (2) the Design, Installation, Operation, and Maintenance Manual instructs how to conduct the repair. If a minor repair becomes part of the deployment procedure in the Design, Installation, Operation, and Maintenance Manual, it will no longer be considered a repair.

Nationally Recognized Testing Laboratory (NRTL)

A laboratory which is listed and recognized by the United States Department of Labor, Occupational Safety & Health Administration's (OSHA) Directorate of Science, Technology, and Medicine program. The program recognizes private sector organizations as NRTL's, and recognition signifies that an organization has met the necessary qualifications specified in the regulations for the Program. The NRTL determines that specific equipment and materials ("products") meet consensus-based standards of safety to provide the assurance, required by OSHA, that these products are safe for use in the U.S. workplace.

Normally Closed Backwater Valve

A backwater valve designed in such a manner that when installed, the swing check remains closed until flow causes it to open.

Normally Open Backwater Valve

A backwater valve designed in such a manner as not to interfere with the movement of the air in the drainage system. When installed, the swing check hangs in a normally open position.

Opening Barrier

Any device capable of preventing flood water from passing through an opening in a structure. Opening barriers are permanent or contingent and operate as automatic or manual.

Overtopping

The action of water flowing over the top of a perimeter flood barrier.

Pedestal Sump Pump

A sump pump that is comprised of; a pumping element in a sump, pit, or a low point, and a motor mounted on a column or pedestal extended vertically above the pumping element. The motor would not be exposed to the water in the sump, pit, or low point.

Perimeter Barrier

A temporary emergency structure which, when deployed, is intended to protect an area surrounding an occupancy from riverine flood conditions.

Permanent Barrier

A barrier that is pre-installed and permanently affixed to a structure.

Rated Capacity

Rate at which water is delivered, in gal./min. (L/min), at rated pressure and rated speed.

Rated Pressure

Pressure in pounds per square inch - psi (kilopascals -kPa) developed by the pump when operating at rated capacity.

Riverine Flood Conditions

Flooding of or produced by a river causing both water and sediments to be transported onto a flood plain.

River-Side

The side of the basin that imposes the flood water, also referred to as the wet-side.

Seal

The location on a barrier where the product meets the ground or wall of the basin to prevent water from moving from the wet-side of the basin to the dry-side. A seal can also be made between different components or sections of the flood barrier.

Self-Priming Pump

A pump which will clear its passages of air if it becomes air bound and resume delivery of the pumpage without outside attention.

Shutoff Pressure

The net pressure in psi (kPa) developed by a flood abatement pump at rated speed with zero flow.

Structural Opening

Any penetration where water can flow such as doors, windows, air bricks/vent bricks, portals, Garage entrance/loading dock entrance, etc.

Submersible Sump Pump

A sump pump that consists of both the pumping element and motor submerged in the sump, pit, or low point of a building. Both the pumping element and the motor are exposed to water.

Submersible Pump

A pump that consists of both the pumping element and the motor in a protective housing which allows the system to run properly when submerged in a liquid.

Sump Pump

A pump powered by an electric motor used for the removal of ground water drainage from a sump, pit or low point in a foundation. Types of sump pumps include, but are not limited to, pedestal and submersible.

Terminal Backwater Valve

A backwater valve designed to be installed at the discharge end of a horizontal drain line incorporating a check member to prevent backflow.

Total Discharge Head

The gauge reading in psi (kPa) at the discharge of a sump pump, referred to the pump centerline, plus the velocity head at the point of gauge attachment.

Total Suction Head

The condition when the suction pressure is above atmospheric. The total suction head is the algebraic sum of the gauge reading in psi (kPa) at a flood abatement pump suction nozzle, referred to the pump centerline, plus the velocity head at the point of gauge attachment. Also called “positive suction pressure”.

Total Head

The algebraic difference between the total discharge head and the total suction head. Where suction head exists, total head equals total discharge head minus total suction head.

Vertical or 90-Deg Backwater Valve

A backwater valve designed to be installed in vertical piping, such as downstream from a P-trap or a holding tank.

2. GENERAL INFORMATION

2.1 Product Information

2.1.1 Flood abatement equipment is designated and categorized by function (permanent, contingent, and emergency) and operation (automatic and manual). FM Approvals defines protection with the following flood abatement equipment.

- Temporary perimeter flood barriers
- Opening flood barriers
- Backwater valves
- Flood abatement pumps

2.1.2 In order to meet the intent of this standard, Flood Abatement Equipment 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 in identical materials by different manufacturers have been seen to perform differently in testing. Sample Flood Abatement Equipment, selected in conformance to this criterion, shall satisfy all of the requirements of this standard.

2.2 Approval Application Requirements

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

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

The manufacturer shall provide the following preliminary information that gives a full description of the construction of the flood abatement equipment. All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level.

Test programs will be scheduled only upon receipt of all material listed herein. All foreign language documents shall be provided with English translation.

- 2.2.1 Marketing/Ordering Literature - Showing general specifications and functions of the system.
- 2.2.2 Model Number Breakdown - A specification or drawing showing all system variations and options to be examined.
- 2.2.3 The Design, Installation, Operation, and Maintenance Manual.
- 2.2.4 Quality Control Procedures - Document(s) detailing routine testing and final inspection procedures: receiving inspection; in-process inspection; final inspection, and calibration of measuring and testing equipment used. In addition, procedures must detail the system acceptance testing once the flood abatement equipment system is installed.
- 2.2.5 Documentation Control Specification - Proposed method of controlling critical documents which may be identified in the Documentation Section of the Approval Report. These drawings shall be listed in the report issued at the conclusion of the Approval Program. FM Approvals shall be notified of changes to these documents via Form 797, "Approved Product/Specification-Tested Revision Report or Address/ Main Contact Change Report".
- 2.2.6 Production Drawings - The following drawings shall be provided:
 - Electrical schematic(s)
 - Final assembly drawings and parts lists sufficient to detail primary components (all), operator controls, and their locations
 - Complete set of mechanical drawings for all machined parts
 - Complete part specifications (including manufacturer's model numbers, size, ratings, etc.) for all purchased parts
 - Specification sheets for all parts/components
 - Drawings showing all construction details
 - Product label drawing(s) showing all required marking information. The label drawing shall show the proposed label location on the equipment and artwork showing the manufacturer's name, address, model and serial numbers, equipment ratings, warning markings, and the FM Approval Certification Mark, (see Appendix C).
- 2.2.7 The number and location of manufacturing facilities.

2.3 Requirements for Samples for Examination

Sample requirements are to be determined by FM Approvals following review of the preliminary information. Sample requirements may vary depending on design features and/or the results of any testing. It is the manufacturer's responsibility to submit samples representative of production. Any decision to use data generated utilizing prototype components or prototype systems is at the sole discretion of FM Approvals.

3. GENERAL REQUIREMENTS

3.1 Review of Documentation

During the initial investigation and prior to 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 system and its components shall be capable of being used within the limits of the Approval investigation.

3.2 Physical or Structural Construction Features

3.2.1 Opening and Temporary Perimeter Barriers

- 3.2.1.1 Air / Nitrogen / other gas cylinder(s) for pressurized seal systems shall meet the applicable requirements of either the ASME Boiler and Pressure Vessel Code, Section VIII or Code of Federal Regulations, Title 49, Transportation, Parts 171 through 180; or equivalent national standard of the country of use, reference section 4.9.
- 3.2.1.2 All materials used in flood abatement equipment shall be suitable for the intended application. Flood abatement equipment shall be constructed of corrosion resistant materials. When unusual materials are used, additional testing may be necessary to verify their suitability.
- 3.2.1.3 Certain elastomeric materials, particularly those that contain bituminous or asphaltic compounds, are subject to material degradation due to biological attack. This type of degradation is long-term and would not necessarily affect the elastomeric barrier material during a single flood deployment, but could cause substantial degradation over extended storage times. Therefore, these materials shall only be accepted for use at the sole discretion of FM Approvals.
- 3.2.1.4 Manually operated caps and valves, and mechanisms, must have a securing, locking, and/or supervising component.
- 3.2.1.5 The design of automatic opening barriers shall be such that major debris that could impact the barrier's functionality is prevented from entering the system. Other debris shall be able to be flushed from the system during periodic maintenance.
- 3.2.1.6 Automatic opening barriers shall be capable of manual deployment.
- 3.2.1.7 Automatic opening barriers shall be evaluated for reliability when any component is exposed to an outside load condition (i.e. vehicular, personnel traffic, etc.) while in the open position. The manufacturer shall provide a complete analysis which illustrates the product's ability to withstand any anticipated load conditions over the expected life of the barrier. The analysis shall include at a minimum; maximum deflection under load, permanent deflection based on simulated live loads, and a failure analysis of the deployment equipment. The analysis shall be reviewed for accuracy and completeness by FM Approvals.

3.2.2 Backwater Valves

- 3.2.2.1 A backwater valve shall comply with the minimum dimensional requirements indicated in Tables 1 through 3 and the corresponding figures. Either flange or hub and spigot type ends are acceptable.