



Approval Standard for Positive Displacement Fire Pumps (Rotary Gear Type)

Class Number 1313

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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 periodic follow-up 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 states FM Approvals criteria for rotary gear type, positive displacement fire pumps that supply water and/or foam concentrates to water mist or foam fire protection systems. These pumps must be available for many years to operate reliably at rated capacities and pressures during emergency fire incidents, despite being idle for extended periods.
- 1.1.2 FM Approvals 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 encompasses the design and performance requirements for rotary gear type, positive displacement fire pumps for use in fire protection systems. Approval is limited to such pumps which have a rated pressure of a minimum of 40 psi (2.75 bar). In cases where metric size pumps are to be examined for Approval, test criteria comparable to the United States equivalent size shall be used.
- 1.2.2 Requirements for other types of fire pumps are detailed in the following Approval Standards:
- Class 1310 Multi-Stage, Multi-Outlet Type
 - Class 1311 Horizontal Split Case Centrifugal Type
 - Class 1312 Vertical Shaft Centrifugal Turbine Type
 - Class 1319 Horizontal End-Suction Centrifugal Type
 - Class 1370 Vertical Turbine Barrel Centrifugal Type
 - Class 1371 In-Line Centrifugal Type
- 1.2.3 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 rotary gear type, positive displacement fire pumps for the purpose of obtaining Approval. Such pumps 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, such pumps which meet all of the requirements identified in this standard may not be FM Approved if other conditions which adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for Approval

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

- 1.4.1 Examination and tests on production samples shall be performed to evaluate
- The suitability of the product
 - The performance of the product as specified by the manufacturer and required by FM Approvals; and as far as practical,

- The durability and reliability of the product.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures shall be made to evaluate the manufacturer's ability to produce the product which was examined and tested, and the marking procedures used to identify the product. These examinations are repeated as part of the FM Approvals product 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 Agreement;
- Satisfactory re-examination of production samples for continued conformity to requirements; and
- Satisfactory Surveillance Audits conducted as part of the 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 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 **March 1, 2018** for full 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, *American National Standard for Metric Practice*. Two units of measurement (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. For undated references, the latest edition of the referenced document (including any amendments) applies.

ANSI/IEEE/ASTM SI 10-2016, *American National Standard for Metric Practice*
FM Approval Standard 1359, *Trim Water Pressure Relief Valves, 1/4 through 2-1/2 in. Nominal Size*
FM Approval Standard 5560, *Water Mist Systems*
International Electro-technical Commission (IEC) 60034-1, *Rotating electrical machines - Part 1: Rating and performance*
National Electrical Manufacturers Association (NEMA) MG 1, *Motors and Generators*

1.9 Definitions

For purposes of this standard, the following terms apply:

Accepted

This term refers to installations acceptable to the authority enforcing the applicable installation rules. When this authority is FM Global, such locations are termed “FM Global Accepted.” Acceptance is based upon an overall evaluation of the installation. Factors other than the use of FM Approved equipment impact upon the decision to accept, or not to accept. Acceptance is not a characteristic of a product. A product accepted for one installation may not be acceptable elsewhere. (Contrast with FM Approved.)

Corrosion Resistant

Having resistance to corrosion equal to or exceeding that of bronze alloy having a minimum copper content of 80 percent, or be of Series 300 Stainless Steel construction. More specific corrosion resistance may be specified by referencing another material as the minimum corrosion benchmark.

Design Working Pressure

The maximum pressure for which a pump component is designed. This pressure is equal to or greater than the maximum pressure developed by the pump at maximum speed, prior to relief valve opening, plus the maximum suction pressure for the pump.

Efficiency

The ratio of the energy delivered by the pump to the energy supplied to the pump shaft (liquid power divided by applied power).

Fire Pump Alternate Manufacturing Location

A location that manufactures a complete pump to the design requirements of the Fire Pump Manufacturer (OEM) or modifies (i.e. trimming of a pump impeller) an OEM supplied (bare-shafted) fire pump.

The Fire Pump Alternate Manufacturing Location may be an alternate facility owned and operated by the OEM or a facility owned by others that performs the complete, or partial, manufacturing of the complete fire pump and/or package under direct control of the OEM.

Fire Pump Manufacturer

The manufacturer of the FM Approved fire pump, is also referred to as the Original Equipment Manufacturer (OEM) of the fire pump.

Fire Pump Package

An assembled fire pump, driver, controller and components, see Appendix D, necessary to provide a complete pump installation, as detailed in FM Global Property Loss Prevention Data Sheets.

Fire Pump Packager

The Fire Pump Manufacturer can delegate, through a legal agreement, the function of assembling the fire pump package to a third party known as the fire pump packager. Alternatively, or in addition to, a Fire Pump Packager may package or just distribute complete private labeled fire pump packages.

The Fire Pump Packager may be a facility owned and operated by the Fire Pump Manufacturer or a facility owned by others that performs the assembly of the complete fire pump package under direct control of the OEM.

Fire Pump Private Labeler

A company, other than the Fire Pump Manufacturer (OEM), that has a legal agreement with the OEM whereby the pump is manufactured and labeled by the OEM in the name of the Private Labeler.

In order to enter into a Fire Pump Private Label agreement, a Fire Pump Private Labeler must be one of the following entities:

- Fire Pump Manufacturer
- Fire Pump Alternate Manufacturer
- Fire Pump Packager

FM Approvals Certification Marks

The FM Approvals Certification Marks are detailed in Appendix C, and 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 clean agent extinguishing systems, the FM Approvals Certification Marks 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, issued annually, or its supplements. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned a Master Agreement to FM Approvals. These forms obligate the manufacturer to allow re-examination of the product and audit of facilities and procedures at FM Approval's discretion. It further requires the manufacturer not to deviate from the as-FM Approved configuration of the product without review by and agreement of FM Approvals.

Maximum Power

The greatest speed-corrected power required to drive the pump at rated speed and at maximum flow.

Net Positive Inlet Pressure Available (NPIPA)

The total of the inlet and barometric pressure minus the vapor pressure of the liquid at the inlet temperature. This value must be equal to or greater than the net positive inlet pressure required (NPIPR) as established by the pump manufacturer for the speed, pressure and fluid characteristics which exist.

Net Positive Inlet Pressure Required (NPIPR)

The pressure required above liquid vapor pressure, to fill each pumping chamber or cavity while open to the inlet chamber.

Pump Rotor

A gear in which the pumped liquid is confined by the sidewalls of the pump housing and gear tooth void open area.

Rated Capacity

Fluid volume moved per unit time - gal/min (L/min), at rated pressure and speed.

Rated Pressure

Pressure - psi (bar) developed by the pump when operating at rated capacity.

Relief Valve

A pressure-operated valve which is used to limit the pressure of the system to which it is connected by venting fluid at a rate greater than the replacement rate.

Rotary Gear, Positive Displacement Fire Pump

A pump with shafts normally in a horizontal position, incorporating meshing gears in a housing and in which the pressure is developed by the transportation of fluid around the interior perimeter of the housing confined between gear teeth and the housing walls.

Total Differential Pressure

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. Where suction lift exists, total head equals total discharge head plus total suction lift.

Total Discharge Head

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

Total Suction Head

The pressure condition at the inlet of an operating pump when the suction pressure is above atmospheric. The total suction head is the algebraic sum of the gauge reading in psi (bar) at the pump suction nozzle, referred to the pump centerline, and the velocity head at the point of gauge attachment. Also called "positive suction pressure."

Total Suction Lift

The pressure condition at the inlet of an operating pump when suction pressure is below atmospheric. The total suction lift is the algebraic sum of the gauge reading in psi (bar) at the suction nozzle of the pump, referred to the pump centerline, and the velocity head at the point of gauge attachment.

Unloader Valve

A relief valve set at a lower pressure than the main relief valve and that vents its discharge back to the suction side of the pump. Unloader valves are used in water mist systems to limit pump flow to that demanded by the downstream system. The intent is that the unloader valve limits flow and that the relief valve limits maximum pressure of the system. A single valve cannot perform both functions as the unloader valve relieving pressure will change in response to suction pressure changes.

Water Mist

A water spray, for which the D_v 0.99, for the flow weighted cumulative volumetric distribution of water droplets, is less than 1,000 microns at the minimum design operating pressure of the water mist nozzle.

Water Mist System

A distribution system connected to a water supply that is equipped with one or more nozzles capable of delivering water mist intended to control, suppress, or extinguish fires.

2. GENERAL INFORMATION

2.1 Product Information

- 2.1.1 Pumps within the scope of this standard include those designed for flow capacities based upon the minimum and maximum operating speeds for their designs.
- 2.1.2 Pumps shall have a minimum rated pressure of a minimum of 40 psi (2.75 bar).
- 2.1.3 To meet the intent of this standard, pumps must be examined on a model-by-model, type-by-type, manufacturer-by-manufacturer, and plant-by-plant basis. This is predicated on the basis that identical designs, fabricated in identical materials by different manufacturers or, even by different plants of the same manufacturer, have been seen to perform differently in testing. Sample pumps, selected in conformance to this criterion, shall satisfy all of the requirements of this standard.