



Approval Standard for Centrifugal Fire Pumps (Vertical Shaft, Turbine Type)

Class Number 1312

January 2018

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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.

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1. INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states FM Approval criteria for vertical shaft, turbine type, centrifugal fire pumps which supply water to fire protection systems. These pumps must have an extended service life, throughout which they must be capable of operating reliably at rated capacities and pressures during emergency fire incidents, despite being idle for extended periods.
- 1.1.2 FM 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 encompasses the design and performance requirements for vertical shaft, turbine type, centrifugal fire pumps for use in fire protection systems. Approval is limited to vertical shaft, turbine type, centrifugal fire pumps which have a minimum rated pressure of 40 psi (275 kPa). In cases where metric sized vertical shaft, turbine type, centrifugal fire 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 centrifugal fire pumps are detailed in the following FM Approval Standards:

<i>Class</i>	<i>Centrifugal Fire Pump Type</i>
1310	Multi Stage, Multi Outlet
1311	Horizontal, Split-Case Type
1319	Horizontal, End-Suction Type
1370	Vertical Turbine Barrel Type
1371	In-Line Type

- 1.2.3 Requirements for other major components in the pump package are detailed in the following Approval Standards:

<i>Class</i>	<i>Equipment</i>
1046	Fire Pump Flowmeter Systems
1321/1323	Controllers for Electric Motor Driven and Diesel Engine Driven Fire Pumps
1333	Diesel Engine Fire Pump Drivers
1336	Fire Pump Couplings and Flexible Connecting Shafts for Fire Protection Service
1359	Trim Water Pressure Relief Valves
2311	Pressure Gauges for Fire Protection Systems

- 1.2.4 FM 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 vertical shaft, turbine type, centrifugal fire pumps for the purpose of obtaining FM Approval. Vertical shaft, turbine type, centrifugal fire pumps having characteristics not anticipated by this Standard may be Approved if performance equal, or superior, to that required by this Standard is demonstrated, or if the intent of the Standard is met. Alternatively, vertical shaft, turbine type, centrifugal fire 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 FM Approval

FM 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 consistently produce the product which was examined and tested, and the marking procedures used to identify the product. These examinations are repeated as part of 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 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 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. (Refer to Section 5.1.3 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 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 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 10-2016, *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*
American Water Works Association (AWWA) E103, *Horizontal and Vertical Line-Shaft Pumps*
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 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 Approved equipment impact upon the decision to accept, or not to accept. 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 Approved.)

Bowl Assembly

The actual pumping component which develops the necessary pressure and flow rate. The pump assembly may consist of one or more stages, or bowl assemblies.

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.

Column Pipe

The pipe which suspends the pump bowl assembly from the head assembly and serves as a conductor for the water from the pump bowl assembly to the discharge head.

Corrosion Resistant

Having resistance to corrosion equal to or exceeding that of bronze alloy having a minimum copper content of 80 percent, or being of Series 300 Stainless Steel construction.

Datum

The elevation of the surface from which the pump head or baseplate is supported.

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 shut off or churn conditions with the largest impeller, the most stages available, and at maximum speed.

Discharge Head

A part of the pump assembly which supports the driver, pump, and column; aligns the driver and pump; seals the pumped water from atmosphere; and changes the vertical flow to a horizontal direction.

Efficiency

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

Enclosed Impeller

An impeller in which the pumped liquid is confined by the sidewalls (shrouds) and vanes of the impeller. All impellers supplied in accordance with this Approval Standard shall be of this type.

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 Mark

The FM Approvals Certification Mark is detailed in Appendix B. Their use is mandatory on all units of FM Approved split-case pumps. 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 Approved by FM Approvals. Such products are listed in the FM Approval Guide, issued annually, or one of the supplements. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned an Approval Agreement to FM Approvals. This agreement obligates the manufacturer to allow re-examination of the product and audit of facilities and procedures at FM Approvals discretion. It further requires the manufacturer not to deviate from the as-Approved configuration of the product without review by and agreement of FM Approvals. Approval is product specific.

Hollow Shaft

Pertains to the hollow drive shaft of electric motors or right angle gear drives. The hollow drive shaft is designed to accept the solid line shaft. This design facilitates impeller adjustment within the bowl assembly and the installation of a non-reverse ratchet into the motor or gear drive.

Line Shaft

A shaft which transmits the power from the driver to the pump shaft. Line shafts can be either of the open, water lubricated, or enclosed, oil lubricated, type.

Maximum Power

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

Minimum Submergence

The minimum depth of water required for proper pump operation, as specified by the manufacturer.

Multiple Stage Pumps

Vertical shaft, turbine type, centrifugal fire pumps with more than one impeller and bowl on the same shaft. The number of stages is determined by the number of impellers.

Non-reverse Ratchet

A mechanism installed as an integral part of the hollow shaft electric motor or hollow shaft right angle gear drive to prevent reverse rotation of the pump driver assembly.

Oil Lubricated Pump

A design in which the shaft is enclosed in a tube and the shaft bearings are lubricated by oil.

Overall Length

The length from the datum to the bottom of the strainer.

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.

Setting

The nominal vertical distance in feet (meters) from the datum to the column pipe connection at the bowl assembly.

Shutoff or Churn Pressure

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

Single Stage Pump

A pump in which the total head is developed by one impeller/bowl assembly.

Total Discharge Head

The gauge reading in psi (kPa) at the discharge of the pump, measured at the pump centerline, plus the velocity head at the point of gauge attachment, plus the elevation difference between the discharge gauge centerline and the sump water level.