



Examination Standard for Centrifugal Fire Pumps (Multi-Stage, Multi-Outlet Type)

Class Number 1310

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Foreword

This standard is 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 standards is to present the criteria for certification of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistently uniform and reliable product.

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1 INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states testing and certification requirements for multi-stage, multi-outlet type centrifugal fire pumps that supply water to 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 Testing and certification criteria may include performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

- 1.2.1 This standard encompasses the design and performance requirements for multi-stage, multi-outlet type centrifugal fire pumps for use in fire protection systems. Certification is limited to pumps which have a rated pressure of at least 40 psi (275 kPa). In cases where metric sized centrifugal fire pumps are to be examined for certification, 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 examination standards:

<i>Class</i>	<i>Pump Type</i>
1311	Horizontal Split Case Type
1312	Vertical Shaft Turbine 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 certification 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	Flexible Fire Pump Couplings and Flexible Connecting Shafts for Fire Protection
1359	Trim Water Pressure Relief Valves
2311	Pressure Gauges for Fire Protection Systems

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 multi-stage, multi-outlet type centrifugal fire pumps for the purpose of obtaining certification.

1.4 Basis for Certification

Certification 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 for certification;
- 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. Subsequent surveillance may be required by the certification agency in accordance with the certification scheme to ensure ongoing compliance.

1.5 Basis for Continued Certification

The basis for continual certification may include the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- the continued use of acceptable quality assurance procedures;
- compliance with the terms stipulated in the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agency's product surveillance program.

1.6 Effective Date

The effective date of this examination standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this standard is eighteen (18) months after the publication date of the standard 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. 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.

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.

ANSI/IEEE/ASTM SI 10, *American National Standard for Metric Practice*
API Standard 682, *Pumps—Shaft Sealing Systems for Centrifugal and Rotary Pumps*
IEC 60034-1, *Rotating electrical machines - Part 1: Rating and performance*
NEMA MG 1, *Motors and Generators*

1.9 Terms and 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. Acceptance is based upon an overall evaluation of the installation. Acceptance is not a characteristic of a product. A product accepted for one installation may not be acceptable elsewhere.

Axial Split-Case Centrifugal Fire Pump

A pump with the shaft in a horizontal position, with a housing which is split in a horizontal plane through the shaft centerline for easy maintenance and in which the pressure is developed by the action of centrifugal force. The term horizontal split-case is also used.

Corrosion Resistant

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

Discharge Casing

The discharge casing is one of several casings, including suction casings and stage casings, of a multi-stage multi-outlet type centrifugal pump. The discharge casing is used to direct fluid out of the pump and the discharge outlet may be positioned horizontally or vertically at 90 degrees to the shaft centerline in a number of defined directions.

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 available, the maximum number of stages, operating at the maximum speed 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).

Enclosed Impeller

An impeller in which the pumped liquid is confined by the sidewalls (shrouds) and vanes of the impeller.

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 certified 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.

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

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 pumps total run out condition. This is determined under conditions of increasing positive suction head.

Mechanical Seals

A sealing device which forms a running seal between the rotating and stationary components. They may be used in place of compression (soft) packing. All mechanical seals are constructed of three basic sets of parts:

- A set of primary seal faces: one rotary and one stationary
- A set of secondary seals known as shaft packings and insert mountings such as O-rings, wedges and V-rings
- Mechanical seal hardware including gland rings, collars, compression rings, pins, springs and bellows

The primary seal is achieved by two very flat, lapped faces perpendicular to the shaft. The rubbing contact between these two flat mating surfaces minimizes leakage. One face is held stationary in a housing and the other face is fixed to, and rotates with, the shaft. Dissimilar materials are usually used for the stationary insert and the rotating seal ring face in order to prevent adhesion of the two faces.

Cartridge Seal Type

This type of mechanical seal is a completely self-contained unit (including stationary and rotating seal faces, gland sleeve, mating ring, etc.) which is pre-assembled and preset before installation. The cartridge mechanical seal is a complete seal assembly which is manufactured, assembled and calibrated by the mechanical seal manufacturer.

Component Type

This type of mechanical seal is assembled from the individual components directly onto the shaft. The components usually consist of a rotating unit with a mating face which is in contact with a

stationary unit. The rotating unit seals in two places, at the interface between the rotating face and stationary and between the shaft and the seal body. The stationary unit seals against the pump body.

Split Seal Type

This type of mechanical seal has its primary sealing elements and other components split. The seal can be mounted on a pump with out removing the impeller.

Multiple Stage Pumps

Centrifugal fire pumps with more than one impeller on the same shaft. The number of stages is determined by the number of impellers.

Multiple Stage, Multiple Outlet Pumps

Centrifugal fire pumps with more than one impeller on the same shaft and more than one discharge outlet. The number of stages is determined by the number of impellers. For the purposes of FM Approval these pumps are limited to a maximum of 3 discharge outlets.

Radial Split-Case Centrifugal Fire Pumps

Radial split-case centrifugal fire pumps are pumps with the shaft in a horizontal position, with housings which are split in a plane perpendicular to the axis of rotation. The term vertically split is also used.

Rated Capacity

Capacity in gallons per minute - gal/min (liter/min - L/min), at rated pressure and speed.

Rated Pressure

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

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.

Stage Casing

The stage casing is one of several casings, including suction casings and discharge casings, of a multi-stage multi-outlet type centrifugal pump. The stage casing is used to direct fluid into and out of the pump impellers. Typically, a multi-stage multi-outlet pump will include several stage casings.

Stuffing Box Packing

Typically, an arrangement consisting of rings of packing, a lantern ring for the injection of a lubricating and/or flushing liquid, and a gland to hold the packing and maintain the desired compression for a proper seal. The function of packing is to control leakage it is not intended to eliminate it completely. The packing is lubricated by the pumped liquid. The lantern ring is supplied for situations where the stuffing box pressure is below atmospheric pressure, to inject lubrication into the stuffing box by the use of a bypass line from the pump discharge to the lantern ring connection.

Suction Casing

The suction casing is the first of several casings, including stage casings and discharge casings, of a multi-stage multi-outlet type centrifugal pump. The suction inlet may be positioned inline with the pump shaft, or with the suction inlet oriented 90 degrees to the pump shaft in a number of defined directions.

Total Discharge Head

The gauge reading in psi (kPa) at the discharge flange of the 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 the pump suction flange, referred to the pump centerline, and the velocity head at the point of gauge attachment. Also called “positive suction pressure.”

Total Suction Lift

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

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

Vertical Mounted Multi- Stage, Multi-Outlet Centrifugal Fire Pump

A multi-stage, multi-outlet centrifugal pump with the shaft in a vertical position, in which the pressure is developed by the action of centrifugal force.