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# **Examination Standard for Fire Pump Monitoring and Automated Testing**

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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 this standard is to present the criteria for examination 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 consistent and reliable product.

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## 1 INTRODUCTION

### 1.1 Purpose

- 1.1.1 This standard states testing and certification requirements for two products: fire pump monitoring systems and automated testing systems. These systems are used to detect and report fire pump system operations, anomalies, and performance trends. These separate systems can also be combined into a single system that meets all requirements of this standard.
- 1.1.2 Testing and certification criteria includes 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 describes the design and performance requirements for:
- fire pump monitoring systems that measure and collect information on fire pump systems for the purposes of detecting and reporting conditions during standby and operation of the fire pump;
  - automated fire pump testing systems which initiate, monitor, and collect information on fire pump churn (no flow) testing for the purposes of detecting and reporting conditions during operation of the fire pump. Automated fire pump testing systems shall meet test requirements and the intent of required inspection and testing in accordance with applicable jurisdictional requirements.
- 1.2.2 These systems shall not have any influence on the starting and running of the fire pump system in case of a fire protection water demand, including during pump testing.

### 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 fire pump monitoring systems and automatic fire pump churn test systems 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 may be conducted 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. 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 by the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agencies product surveillance program.

### 1.6 Effective Date

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

### 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 ANSI/IEEE/ASTM SI 10.

### 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/IEC 60529, *Degrees of Protection Provided by Enclosures (IP Code)*.

ANSI/UL 50E, *Enclosures for Electrical Equipment, Environmental Considerations*

ISO/IEC 17025, *General Requirements for the Competence of Testing and Calibration Laboratories*

FM Approvals Examination Standard 1042, *Vane-Type Waterflow Alarm Indicators*

FM Approvals Examination Standard 1044, *Fire Service Meters*

FM Approvals Examination Standard 1046, *Fire Pump Flowmeter Systems*

FM Approvals Examination Standard 1321/1323, *Controllers for Electric Motor Driven and Diesel Engine Driven Fire Pumps*

FM Approvals Examination Standard 3510, *Flow and Pressure Safety Switches*

FM Approvals Examination Standard 7710, *Low Water Level Limit Controls for Boilers*

FM Approvals Examination Standard 7745, *Controllers for Liquid Leak Detectors*

## 1.9 Terms and Definitions

For purposes of this standard, the following terms apply:

**Accepted** - This term refers to installations acceptable to the authority (AHJ) enforcing the applicable installation rules.

**Actuator** – an actuator is a device that receives an energy input and converts it into motion or force.

**AHJ:** Authority Having Jurisdiction. An organization office, or individual responsible for enforcing the requirements of a code standard, or for approving equipment, materials, installation, or procedure.

**Automated Testing System** - automatic system to carry out the weekly or monthly churn test including all sensors and actuators to cover the required inspection and testing in accordance with applicable jurisdictional requirements. The system consists of the following components:

- Control unit
- Sensors
- Actuators

**Battery** - A packaged collection of battery cells used as a supplemental power source.

**Circulation Relief Valve**- A valve on a fire pump designed to discharge a small amount of water to prevent overheating of the pump during no flow (“shutoff” or “churn”) conditions.

**Control unit** – processing unit measuring and monitoring functions and components, collecting data and alarms and processing the needed operations. The control unit consists of the following components:

- Central processing unit
- Input modules
- Output modules

**Diesel Engine** - A certified internal combustion engine in which the fuel is ignited entirely by the heat resulting from the compression of the air supplied for combustion. The oil-diesel engine, which operates on fuel injected after compression is practically completed, is the type usually used as a fire pump driver.

**Diesel Engine Fire Pump Controller** – A certified controller intended to control a diesel engine-driven fire pump.

**Electric Fire Pump Controller** - A certified controller intended to control an electric motor-driven fire pump.

**Electromagnetic Compatibility – EMC** – Ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

**Electromagnetic Immunity – EMI** - The ability of a device, equipment, or system to perform without degradation in the presence of an electromagnetic disturbance.

**Emission (electromagnetic)** - The term refers to the phenomenon by which electromagnetic energy emanates from a source.

**Enclosure** - A surrounding case constructed to provide a degree of protection against incidental contact with the enclosed equipment, and to provide a degree of protection against specified environmental conditions.

**Fire Pump** - Pump dedicated to delivering a specified rate of water flow at a specified pressure to the fire extinguishing system of a premises.

**Fire Pump Churn Test** – A test start and run of the fire pump without water flowing. Typically conducted weekly or monthly for a period of 10 to 30 minutes.

**Fire Pump Controller** – Generic term for a Diesel Engine Fire Pump Controller or an Electric Fire Pump Controller used to start the fire pump. (see FM Standard 1321/1323)

**Fire Pump Monitoring System** - monitoring system monitors the operation of the Fire Pump System and records data for performance trending and or further analysis.

**Fire Pump Unit** - An assembled unit consisting of a fire pump, driver, controller, and accessories.

**Fail safe** – A system ensuring in the event of a fault due to the characteristics of its components and their integration the system will always go to a safe status.

**Pressure Activated** - Starting of the pump driver is initiated by detecting a reduction in water pressure in the sprinkler system piping.

**Redundancy** - System design principle that introduces duplicate components to provide fault tolerance if a component fails.

**Remote Location** – Term used to define where data is sent after being collected.

**Sensor** -A sensor is a device that detects and responds to some type of input from the physical environment such as light, heat, motion, moisture, or pressure and converts this input into an electrical output.

**Type-Tested Device** - A device conforming to an established type, comprised of elements (components, devices, equipment) combined and rated as a unit, replicating the constructional and performance features of the typical device which has been verified previously to be in accordance with a designated standard.

## 2 GENERAL INFORMATION

### 2.1 Product Information

- 2.1.1 A fire pump monitoring system is intended to continuously monitor the entire fire pump system. The system shall provide means to detect system trouble conditions, performance trends and initiate appropriate signals or alarms for the purpose of summoning qualified personnel to conduct an investigation and initiate repairs.
- 2.1.2 An automated fire pump testing system is intended to automatically initiate the periodic (weekly/monthly) no flow run test and comprehensively monitor the pump performance during the churn test. The system shall provide means to detect system upsets, terminate testing, and initiate an alarm to prevent damage to the fire pump unit.
- 2.1.3 These systems shall not have any negative influence on the water supply in case of a water demand of the fire pump system including during pump testing.

### 2.2 Certification Application Requirements

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

- a complete list of all models, types, sizes, and options for the products being submitted for certification consideration.
- general assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, piping and electrical schematics, nameplate format, brochures, sales literature, spec. sheets, installation, operation, and maintenance procedures, software etc.
- 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 a certification examination, the manufacturer shall submit samples for examination and testing based on the following:
- sample requirements are to be determined by the certification agency
- 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 the certification agency.

### 3 GENERAL REQUIREMENTS

#### 3.1 Product Information

- 3.1.1 Where the manufacturer makes any claims in the instruction manual regarding special features of construction or performance specifications that exceed the requirements detailed in this standard, all such claims shall be verified, and the test procedures carried out as stated in each clause and shall be extended or supplemented to verify the claimed performance.

#### 3.2 Review of Documentation

- 3.2.1 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 certification examination results may further define the limits of the final certification.
- 3.2.2 The manufacturer's dimensional specifications and/or designs shall fully describe the product. All critical dimensions shall be shown with allowed upper and lower tolerance limits clearly defined.
- 3.2.3 All documents pertaining to product materials, dimensions, processing, and marking shall be controlled by the manufacturer's quality assurance procedures, and shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All foreign language drawings shall be provided with English translation.

#### 3.3 Required Features - General

- 3.3.1 The equipment within the scope of this standard shall be able to withstand the normal environmental conditions encountered in manufacturing, storage, and the installation environment for which it is designed.
- 3.3.2 The equipment within the scope of this standard shall be able to operate reliably according to the maintenance cycle of the original manufacturer.
- 3.3.3 The system components shall be capable of withstanding ambient temperature ranges of +39°F (+4°C) to +120°F (+50°C) for indoor applications and be able to operate normally at temperature ranges outside of this range if otherwise specified by the manufacturer.
- 3.3.4 Electrical components shall conform to the applicable national and international electrical codes.
- 3.3.5 Electromagnetic Compatibility (EMC) immunity environment A for use in commercial, industrial, or business environment shall ensure reliable operation of fire pump equipment that are within the vicinity of the systems in the scope of this standard and IEC CISPR 11 and IEC 61000-4-(2 thru 13),
- 3.3.6 The intended mounting methods of field installed systems, devices, or sensors shall be compatible with the monitored equipment, shall not compromise functionality in any way and shall be suitable for the intended environment. The mounting methods of field installed systems, devices, or sensors shall be identified in the operating instructions.
- 3.3.7 The system enclosure shall have an environmental rating that is suitable for the application. Minimum enclosure ratings shall be per ANSI / IEC 60529 ingress protection rating of IP 31 or Type 2 as defined in ANSI/UL 50E.
- 3.3.8 The control unit enclosure shall provide the means to prevent unauthorized access such as a lock, or tamper resistant screws, etc.

- 3.3.9 The enclosures are intended for outdoor use do require to have corrosion protection as defined in ANSI/UL 50E.
- 3.3.10 Battery powered sensors shall have a battery life of one year or more. Battery life shall be calculated based on normal operation with no alarms present.
- 3.3.11 Battery powered sensors shall produce a low battery indication. The sensor shall continue to operate for 7 days under the low battery indication. At the end of 7 days the sensor shall be capable of generating a correct signal as normally measured by that sensor. The system shall generate a fault signal if battery sensors produce a low battery and/or when depleted.
- 3.3.12 All control units shall have provisions for grounding all non-current-carrying metal parts that are exposed or that are located in a position to be contacted by persons during normal operation or adjustment of the equipment and that are capable of becoming energized. A terminal intended for connection of an equipment grounding conductor shall be plainly identified with one of the symbols.
- 3.3.13 Controllers shall be provided with a terminal or an equivalent means for connecting an equipment grounding conductor.
- 3.3.14 All systems shall provide a means for reporting the history of all data recorded based on either Sections 3.4 for Fire Pump Monitoring Systems or 3.5 for Fire Pump Automated Testing Systems.

#### **3.4 Required Features – Fire Pump Monitoring Systems**

Fire pump monitoring systems shall measure and record the points listed in Sections 3.4.2 through 3.4.4 for the purposes of detecting and reporting fire pump system failures and performance trends. Additional monitoring points can be incorporated into the fire pump monitoring system at the manufacturer's discretion.

- 3.4.1 The fire pump monitoring system shall be equipped with a supplemental power source, such as a battery, which shall be capable of continuous system operation for a period of at least 24 hours, including 1 hour of maximum load (e.g., continuous alarm, lights, etc.) without replacement or recharge of power source.
- 3.4.2 Minimum Monitoring Points – All Pumps
  - a. Fire pump controller A/C power failure.
  - b. Fire pump running.
  - c. Fire pump fails to start.
  - d. Fire pump suction and discharge pressures.
  - e. Pump room temperature.
  - f. Fire protection water supply tank level.
- 3.4.3 Minimum Monitoring Points – Electric Motor Driven Pumps Only
  - a. Loss of phase (power not available) on the line side of the motor contactor.
  - b. Phase reversal on the line side of the contactor.
  - c. Controller connected to alternate source. If provided.
  - d. Emergency isolating switch (CB) open.
- 3.4.4 Minimum Monitoring Points – Diesel Engine Driven Pumps Only
  - a. Fire pump controller not set to automatic start.
  - b. Engine low oil pressure when running (LLP – Low Lubricant Pressure).
  - c. Engine high cooling water temperature when running (HET - High Engine Temperature).
  - d. Low engine coolant flow (CRWCLS - Clogged Raw Water Coolant).
  - e. General/common fire pump controller trouble signal.
  - f. Engine battery health, failure or disconnected.

- g. Engine shutdown due to overspeed (OSS -Overspeed Switch).
- h. Low engine fuel level.

3.4.5 Response Time – at intervals not exceeding the following:

- a. Record the measured value or status of all monitored points a minimum of once per hour.
- b. Output a signal to a remote location within 60 seconds if a monitored point status change or value goes outside the required range.

### 3.5 Required Features – Fire Pump Automated Testing Systems

#### 3.5.1 General

3.5.1.1 The automated test shall not be initiated, and the system shall generate a visual and audible notification if any of the following conditions are present:

- a. The pump to driver coupling guard is not in place.
- b. Manual stop engaged during pre-warning time.
- c. The pump is already running.
- d. There is a fire pump controller trouble condition or alarm.
- e. Fire pump room water/flooding is detected.
- f. Pump room temperature is below +39°F (+4°C) or above +120°F (50°C)
- g. The driver and pump are out of alignment or have not had an alignment check in the last 12 months.
- h. The fire protection water supply tank (where provided) is below minimum capacity.

3.5.1.2 A prewarning visual and audible warning signal will be generated within the pump room for a minimum of 60 seconds prior to starting the pump. Optionally, a pump room occupancy sensor can be used to prevent the starting of the pump.

3.5.1.3 Pump starting shall be initiated via system pressure drop and the pump shall be allowed to run in a churn (no-flow) condition for a minimum of 10 minutes (electric) or 30 minutes (diesel).

3.5.1.4 If any of the following conditions are detected the test will be terminated and generate a visual and audible notification:

- a. Pump case or packing gland is overheating.
- b. Lack of water flow through the pump circulation relief valve (electric and radiator-cooled diesels only).
- c. Pump room temperature greater than 120°F (50°C).
- d. Fire pump controller signals a trouble or alarm signal.
- e. Fire pump room water/flooding is detected.
- f. Pushing the stop button on the fire pump controller or diesel engine panel.

3.5.2 The automated fire pump testing system shall be equipped with an output contact providing a signal in case of power failure or use of a supplemental power source.

#### 3.5.3 Electric Motor Driven Pumps

No additional requirements beyond those in Sections 3.5.1 and 3.5.2.

### 3.5.4 Diesel Engine Driven Pumps

3.5.4.1 Pump starting shall not occur and the system shall generate a visual and audible notification if any of the following conditions are present:

- a. Engine oil level below minimum.
- b. Low Engine battery voltage.\*
- c. Engine ECM failure signal.\*
- d. Engine fuel tank below minimum level.

3.5.4.2 If any of the following conditions are detected the test will be terminated and the system will generate a visual and audible notification:

- a. Diesel engine overheating.\*
- b. No flow through the cooling loop Alarm (CRWCLS Clogged Raw Water Coolant).\*
- c. Engine low oil pressure.\*
- d. Engine fuel level below minimum.
- e. Excessive pump/engine vibration.

\* These can be obtained from the fire pump controller abnormal conditions signal when provided.

### 3.6 Cyber Security

3.6.1 For systems that are to be connected to the internet to facilitate communications and reporting, the following cyber security and software/firmware measures are required:

- a. The system shall not use any unauthenticated FTP SSL or TSL services.
- b. The system shall have no unused open ports.
- c. The system shall be deployed and operated behind a network firewall.
- d. The system shall not have any embedded code that may try to establish communication, provide unauthorized access, or send data to an unknown entity via internet.

### 3.7 Markings

3.7.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the following information:

- a. Name and address of the manufacturer or marking traceable to the manufacturer.
- b. Date of manufacture or code traceable to date of manufacture or lot identification.
- c. Model number, size, rating, capacity, operation voltage, ambient operating temperature range, etc., as appropriate.
- d. Enclosure type rating or IEC IP Code.
- e. All field wire terminals shall be clearly identified.

When hazard warnings are needed, the markings should be universally recognizable.

3.7.2 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.

3.7.3 The certification agency's mark of conformity shall be displayed visibly and permanently on the product as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.

3.7.4 All markings shall be legible and durable.

### 3.8 Manufacturer's Installation and Operation Instructions

3.8.1 The manufacturer shall:

- prepare instructions for the installation, maintenance, and operation of the product;
- provide facilities for repair of the product and supply replacement parts, if applicable; and
- provide services to ensure proper installation, inspection, and maintenance for the 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.

### 3.9 Calibration

3.9.1 Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified and traceable to an acceptable reference standard and certified by an ISO/IEC 17025 accredited calibration laboratory. The test equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.

3.9.2 When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of this equipment.

## 4 PERFORMANCE TESTING REQUIREMENTS

### 4.1 General Requirements (All Systems)

#### 4.1.1 Temperature Range

- 4.1.1.1 All system components shall operate within the temperature range of +39°F (+4°C) to +120°F (+50°C). Equipment submitted for examination with a wider operational temperature range will be examined at the limits stated by the manufacturer during testing.
- 4.1.1.2 The system shall be loaded (or conditioned for a minimum of one hour within an environmental chamber), to attain a steady-state temperature of +120°F (+50°C). Operating tests shall be conducted at 85 percent and 110 percent of the rated supply voltage. The system responses, sequences, signals and alarms shall operate correctly as intended and as specified in Section 3 and Section 4 of this standard.
- 4.1.1.3 The system shall be loaded (or conditioned for a minimum of one hour), to attain a steady-state temperature of +39°F (+4°C). Operating tests shall be conducted at 85 percent and 110 percent of the rated supply voltage. The system responses, sequences, signals and alarms shall operate correctly as intended and as specified in Section 3 and Section 4 of this standard.

#### 4.1.2 Voltage Range

- 4.1.2.1 The system shall produce no trouble signal or false detection and detection time shall comply with Sections 3.4, 3.5, and 3.6 when operated between 85% and 110% of rated input voltage. If an absolute voltage range, beyond the 85% and 110% of nominal, is specified by the manufacturer, the unit will be tested at the extremes of the range.

#### 4.1.3 Dielectric Strength

- 4.1.3.1 The system shall be capable of withstanding a high potential between input/output terminals and ground, for one minute without arcing or breakdown.
- 4.1.3.2 For an operating voltage of 30Vac (42.42Vdc) or less, a potential of 500Vac (707Vdc) shall be applied between input/output terminals and enclosure ground for one minute.
- 4.1.3.3 For an operating voltage greater than 30Vac (42.42Vdc), a potential of 1000Vac + twice the rated voltage shall be applied between input/output terminals and enclosure ground for one minute.

#### 4.1.4 Extraneous Transients

- 4.1.4.1 No false signal will be generated when the system is subjected to transients and voltage dips from sources which are described below. One powered sample of the system will be subjected to transients described below at a distance of 24 inches:
  - a. Radio frequency transmissions with radiation power levels equivalent to 5 Watts at 24 inches (0.6 m) in the 27 MHz, 150-174 MHz, 450-467 MHz, 850-870 MHz, and 900-920 MHz bands.
  - b. A sequential arc (Jacob's ladder) generated between two 15 in. (0.4 m) long, No. 14 AWG (2.1 mm) solid copper conductors attached rigidly in a vertical position to the output terminals of an oil burner ignition transformer or gas tube transformer rated 120 volts, 60 hertz primary; 10,000 volts, 60 hertz, 23 mA secondary. The two wires are to be formed in a taper, starting with a 1/8 in. (3.2 mm) separation at the bottom (adjacent to terminals) and extending to 1.25 in (32 mm) at the top.

- c. Operation of an electric drill rated 120 V, 60 Hz, 2.5 A.
- d. Operation of a soldering gun rated 120 V, 60 Hz, 2.5 A.
- e. Operation of a 6 in (150 mm) diameter solenoid-type vibrating bell with no arc suppression and rated 24 V dc.

4.1.4.2 The system will produce no false detection or trouble signal in the presence of these extraneous transients, and it will respond satisfactorily to a baseline test in the presence of the extraneous transients.

#### 4.1.5 Surge Transient Tests

4.1.5.1 Protection against line surge transients will be a requirement for each submitted system. One powered sample of the system will be subjected to transient waveforms having peak levels of 100, 500, 1000, 1500, and 2400 V dc, as delivered into a 200-ohm load. This requirement applies to all field wiring terminals that have a possibility of being subjected to line-induced voltage (i.e., initiating device circuits, power circuits, and remote/auxiliary connections). Wireless connections are excluded from this requirement.

#### 4.1.6 Electromagnetic Compatibility (EMC)

4.1.6.1 Emission tests are required to verify compliance with environment B. This environment relates to low-voltage public networks such as domestic/residential, commercial, and light industrial locations/installations.

4.1.6.2 EMC emission and immunity tests shall be carried out in accordance with the test described in FM Standard 1321/1323 Section 5.18 based on the manufacturer's documentation and existing type testing and approvals.

#### 4.1.7 Enclosure

4.1.7.1 Products evaluated in this standard shall have an environmental rating that's suitable for the application. Enclosure environmental testing shall be conducted to verify the minimum enclosure ratings per ANSI / IEC 60529 ingress protection rating of IP 31 or Type 2 as defined in ANSI/UL 50E. The sensing components, telemetry components and power related components shall be protected from the environment. It's not a requirement that all these components be housed in the same enclosure.

#### 4.1.8 Sensors and Actuators

4.1.8.1 Electrical sensors may be either contact or non-contact type and wired or wireless.

4.1.8.2 Contact type sensors shall be protected from accumulation or damage from debris in order to maintain functionality. Sensors intended for continuous immersion shall be designed with a minimum ingress protection of IP68 as defined in ANSI / IEC 60529 or Type 6P as defined in ANSI/UL 50E.

4.1.8.3 Non-contact sensors shall not be influenced by wind, rain, dust in their measurements. Minimum ingress protection shall be IP31 as defined in ANSI / IEC 60529 or Type 2 as defined in ANSI/UL 50E.

4.1.8.4 Sensor enclosure housing to be used outdoors shall provide outdoor corrosion protection defined in ANSI/UL 50E.

4.1.8.5 Pressure switches and transducers shall meet the requirements of Section 5.9 of FM Standard 1321/1323.

- 4.1.8.6 Level sensors shall meet the requirements of Sections 4.5 and 4.6 of FM Standard 7710.
- 4.1.8.7 Leak detectors shall meet the requirements of Section 4.3 of FM Standard 7745.
- 4.1.8.8 Water flow meters shall meet the requirements of FM Standard 1044 or 1046.
- 4.1.8.9 Water flow switches shall meet the requirements of FM Standard 1042 or 3510.

## 4.2 Fire Pump Monitoring Systems

A fire pump unit shall be equipped with all sensors of the fire pump monitoring system under test in accordance with the manufacturer's manual.

### 4.2.1 Minimum Monitoring Point Verification – All Pumps

- a. The system's capability of measuring or receiving the inputs from the monitoring points listed in Section 3.4.2 will be verified.

### 4.2.2 Minimum Monitoring Point Verification – Electric Motor Driven Fire Pumps

- a. The system's capability of measuring or receiving the inputs from the monitoring points listed in Section 3.4.3 will be verified.

### 4.2.3 Minimum Monitoring Point Verification - Diesel Motor Driven Fire Pumps

- a. The system's capability of measuring or receiving the inputs from the monitoring points listed in Section 3.4.4 will be verified.

### 4.2.4 Response time

- a. The time required for the system to record all monitoring points listed in Section 3.4 shall be verified to be 1 hour or less.
- b. The time required for the system to output a signal to a remote location for all monitoring points listed section 3.4 shall be measured and cannot exceed 60 seconds when the monitored point status changes or its value is outside the required range.

### 4.2.5 Supplemental Power Source

The monitoring supplemental power source's (battery's) ability to support the following conditions will be verified:

- a. Continuous operation for 24 hours.
- b. Following 24 hours of operation, 1 hour of maximum system power demand as required in clause 3.4.1.
- c. The battery charger shall be arranged to detect the loss of current flow on the load terminals, detect a damaged battery, and detect a missing or disconnected battery.
- d. The battery charger must be of sufficiently robust electronic and material construction to operate in the same environment (rated temperature range) as the fire pump controller [i.e. +39°F (+4°C) to +120°F (+50°C)].

#### 4.2.6 Cybersecurity

- a. The different implemented access levels shall be tested in accordance with 3.6.
- b. It shall be proven that any access to the Central Processing Unit software by interfaces like USB, external devices or network connection will not be possible except with manufacturer's access in accordance with 3.6.

### 4.3 Examination of the Automated Fire Pump Testing Systems

A fire pump unit shall be equipped with all sensors and actuators of the automated fire pump testing system under test in accordance with the manufacturer's manual.

#### 4.3.1 Temperature Range

- 4.3.1.1 All system components shall operate within the temperature range of +39°F (+4°C) to +120°F (+50°C). Equipment submitted for examination with a wider operational temperature range will be examined at the limits stated by the manufacturer during testing.
- 4.3.1.2 The system shall be loaded (or conditioned for a minimum of one hour within an environmental chamber), to attain a steady-state temperature of +120°F (+50°C). Operating tests shall be conducted at 85 percent and 110 percent of the rated supply voltage. The system responses, sequences, signals and alarms shall operate correctly as intended and as specified in Section 3 and Section 4 of this standard.
- 4.3.1.3 The system shall be loaded (or conditioned for a minimum of one hour), to attain a steady-state temperature of +39°F (+4°C). Operating tests shall be conducted at 85 percent and 110 percent of the rated supply voltage. The system responses, sequences, signals and alarms shall operate correctly as intended and as specified in Section 3 and Section 4 of this standard.

#### 4.3.2 Function Testing

- 4.3.2.1 The system's ability to provide pump start prewarning visual and acoustical indicators for a period of not less than 60 seconds prior to initiating pump starting shall be verified. In addition, the function of a remote prewarning signal capable of powering a remote visual indicator for the duration of the test shall be confirmed. The functional testing of the test termination can be also carried out by simulating the inputs at the terminals of the control unit.
- 4.3.2.2 The system's ability to prevent the automatic churn test under the conditions listed in Section 3.5.1.1 will be verified. The churn test will not be initiated, and a trouble signal will be generated.
- 4.3.2.3 The system's ability to initiate pump starting via system pressure drop and monitor the pump in a churn (no-flow) condition for a minimum of 10 minutes (electric) or 30 minutes (diesel) shall be verified.
- 4.3.2.4 The system's ability to terminate the automatic churn test immediately under the conditions listed in Section 3.5.1.4 will be verified. The churn test will be terminated, and a trouble alarm will be generated. All components used to terminate the test will be verified.
- 4.3.2.5 Additional system functions beyond those listed in Section 3.5 and performance claims in the manufacturer's system documentation and literature shall be verified.
- 4.3.2.6 The system will determine if maintenance data is verified before operation; and if the maintenance data is not correctly confirmed the automatic test shall not start.

- 4.3.2.7 The system's ability to detect and report trouble signals will be verified by injecting system failures.
- 4.3.2.8 The system's ability to function properly during a power outage. During standby the external power shall be switched off. A power failure indication shall be provided. If a supplemental power source is provided, it shall be tested in accordance with 4.5.2. Switching from primary to supplemental power shall have no influence on the fire pump operation.
- 4.3.2.9 The system's ability to detect waterflow while the churn test is running. During the test the sensor will be activated, which detects the fire protection system water demand. The test procedure will be terminated, and no stop signal shall be sent. This test shall be carried out with the software independent means activated and deactivated.

#### 4.3.3 Cyber Security

- 4.3.3.1 The different implemented access levels shall be tested in accordance with 3.6.
- 4.3.3.2 It shall be proven that any access to the Central Processing Unit software by interfaces like USB, external devices or network connection will not be possible except with manufacturer's access in accordance with 3.6.

## 5 OPERATIONS REQUIREMENTS

### 5.1 Demonstrated Quality Control Program

5.1.1 A quality assurance program is required to assure that subsequent products produced by the manufacturer shall present the same quality and reliability as the specific products examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests and may be documented in the certification report.
- Continued conformance to this standard is verified by the certifier's surveillance program.
- Quality of performance is determined by field performance and by periodic re-examination and testing.

5.1.2 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- existence of corporate quality assurance guidelines.
- incoming quality assurance, including testing.
- In-process quality assurance, including testing.
- final inspection and tests.
- equipment calibration.
- drawing and change control.
- packaging and shipping.
- handling and disposition of non-conforming materials.

#### 5.1.3 Documentation/Manual

There should be an authoritative collection of procedures/policies. It should provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system should require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

#### 5.1.4 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture.

#### 5.1.5 Drawing and Change Control

- The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents or software, identified in the certification report, may be required to be reported to, and authorized by the certification agency prior to implementation for production.
- Records of all revisions to all certified products shall be maintained.

### 5.2 Surveillance Audit

5.2.1 An audit of the manufacturing facility may be part of the certification agencies surveillance requirements to verify implementation of the quality assurance program. Its purpose is to determine that the

manufacturer's equipment, procedures, and quality program are maintained to ensure a uniform product consistent with that which was tested and certified.

- 5.2.2 Certified products or services shall be produced or provided at, or provided from, location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location prior to disclosure to the certification agency.

### **5.3 Manufacturer's Responsibilities**

- 5.3.1 The manufacturer shall notify the certification agency of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

### **5.4 Manufacturing and Production Tests**

- 5.4.1 The manufacturer shall test 100% of production of the main control board and user interface (where applicable) for normal operation. This test may be completed during production or after final assembly of the whole unit. The manufacturer shall have a written controlled procedure outlining the details and acceptance criteria for this production test.

## 6 BIBLIOGRAPHY

FM Global Property Loss Prevention Data Sheet 2-81, *Fire Protection System Inspection, Testing and Maintenance*, April 2019; Interim Revision October 2021

FM Global Property Loss Prevention Data Sheet 3-7, *Fire Protection Pumps*, April 2021; Interim Revision October 2021

FM Approvals Examination Standard 1321/1323, *Controllers for Electric Motor Driven and Diesel Engine Driven Fire*, February 2018

FM Approvals Examination Standard 1333, *Diesel Engine Fire Pump Drivers*, April 2022

FM Approvals Examination Standard 3010, *Fire Alarm Signaling Systems*, September 2021

National Fire Protection Association (NFPA) 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2022

National Fire Protection Association (NFPA) 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2023

International Electrotechnical Commission (IEC) CISPR 11 *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

International Electrotechnical Commission (IEC) 61000-4-2, *Electromagnetic Compatibility (EMC) – Part 4-2: Testing and Measurement Techniques – Electrostatic Discharge Immunity Test*

International Electrotechnical Commission (IEC) 61000-4-3, *Electromagnetic Compatibility (EMC) – Part 4-3: Testing and Measurement Techniques – Radiated, Radio-Frequency, Electromagnetic Field Immunity Test*

International Electrotechnical Commission (IEC) 61000-4-4, *Electromagnetic Compatibility (EMC) – Part 4-4: Testing and Measurement Techniques – Electrical Fast Transient/Burst Immunity Test*

International Electrotechnical Commission (IEC) 61000-4-5, *Electromagnetic Compatibility (EMC) – Part 4-5: Testing and Measurement Techniques – Surge Immunity Test*

International Electrotechnical Commission (IEC) 61000-4-6, *Electromagnetic Compatibility (EMC) – Part 4-6: Testing and Measurement Techniques – Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields*

International Electrotechnical Commission (IEC) 61000-4-8, *Electromagnetic Compatibility (EMC) – Part 4-8: Testing and Measurement Techniques – Power Frequency Magnetic Field Immunity Test*

International Electrotechnical Commission (IEC) 61000-4-11 (2004), *Electromagnetic Compatibility (EMC) – Part 4-11: Testing and Measurement Techniques – Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests*

International Electrotechnical Commission (IEC) 61000-4-13, *Electromagnetic Compatibility (EMC) – Part 4-13: Testing and Measurement Techniques – Harmonics and Interharmonics Including Mains Signalling at A.C. Power Ports, Low Frequency Immunity Tests*