



Second Revision No. 37-NFPA 20-2017 [Global Comment]

Replace the term "torsional vibration damping type coupling" with "torsional coupling" in 7.5.1.6.4, 7.5.1.6.4.1, and 11.2.3.1.

Submitter Information Verification

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Submittal Date: Wed Sep 20 14:29:30 EDT 2017

Committee Statement

Committee Statement: The terminology is revised to be consistent with the new definition for torsional coupling.

Response Message:

**Second Revision No. 15-NFPA 20-2017 [Detail]**

Revise title of 11.2.7.2.1 to "Engine Batteries."

Submitter Information Verification

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Submittal Date: Wed Sep 20 09:13:43 EDT 2017

Committee Statement

Committee Statement: The title of this section has been revised to clarify that the subject batteries are used with engines and not some other application.

Response

Message:

**Second Revision No. 14-NFPA 20-2017 [New Section after 3.3.18]****3.3.19** Engine Battery.

A battery used to provide sufficient electrical energy to crank the engine to achieve engine start and the necessary energy for system controls.

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Submittal Date: Wed Sep 20 09:06:46 EDT 2017

Committee Statement

Committee Statement: This definition is added to coordinate with SR 15 and SR 16.

Response Message:

**Second Revision No. 39-NFPA 20-2017 [Section No. 3.3.45.3]****3.3.46.3 On-Site Standby Generator.**

A facility producing electric power on site as the alternate supply of ~~electrical~~ electric power. It differs from an on-site power production facility, in that it is not constantly producing power. [70:695.2]

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Submittal Date: Wed Sep 20 15:46:40 EDT 2017

Committee Statement

Committee Statement: This revision is to update the extract language.

Response Message:

**Second Revision No. 43-NFPA 20-2017 [Section No. 3.3.58]****3.3.59* Set Pressure.**

As applied to variable speed ~~pressure limiting control systems~~ pumps , the pressure that the variable speed pressure limiting control system is set to maintain.

A.3.3.59 Set Pressure.

Pressure is limited by controlling the speed of the fire pump. Once the fire pump reaches its rated speed, the discharge pressure will decrease from the set pressure as the flow rate increases and/or the power draw peaks.

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Submittal Date: Tue Oct 03 23:03:01 EDT 2017

Committee Statement

Committee Statement: This revision acknowledges available technology that was not previously addressed in this standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 19-NFPA 20-2017 [Section No. 3.3.67]****3.3.68*** Torsional Coupling.

A driveline component capable of transmitting torque having a very low spring constant along the axis of rotation to detune the driveline and move any damaging resonances safely below operating speed .

A.3.3.67 Torsional Coupling.

~~The effect of this component is to detune the driveline system and move any damaging resonances safely below operating speed.~~

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Submittal Date: Wed Sep 20 10:09:58 EDT 2017

Committee Statement

Committee Statement: The Technical Committee agrees that this language is more appropriate in the definition of Torsional Coupling than in the annex.

Response Message:

Public Comment No. 26-NFPA 20-2017 [Section No. 3.3.67]

**Second Revision No. 42-NFPA 20-2017 [Sections 3.3.75, 3.3.76]****3.3.76** Variable Speed Pressure Limiting Control Pumps and Controllers .**3.3.76.1** Self-Regulating Control.

The portion of a self-regulating variable speed fire pump unit that controls the pump speed and power.

3.3.76.2* Self-Regulating Variable Speed Fire Pump Unit.

A factory-built integrated fire pump unit consisting of pump, driver, and variable speed control unit, configured to maintain the set pressure until the maximum power draw is reached, while acting as a variable speed pressure limiting control and/or a variable speed suction limiting control.

A.3.3.76.2 Self-Regulating Variable Speed Fire Pump Unit.

The self-regulating variable speed fire pump unit has onboard factory embedded logic that enables it to know the suction pressure, discharge pressure, and power draw, and to calculate the flow and net pressures from that information, and then communicate the information. All accessories required to perform the discharge pressure limiting and net pressure limiting functions by pump speed regulation are integrated in the pump unit.

Each self-regulating variable speed fire pump unit should include a bypass that can operate in automatic mode and via a manual mechanical operator that can be used to bypass the variable frequency drive (VFD) in order to apply power directly to the motor.

3.3.76.3 Variable Speed Pressure Limiting Control.

A speed control system used to limit the total discharge pressure by reducing the pump driver speed from rated speed.

3.3.76.4 Variable Speed Pump.

A fire pump with variable speed pressure limiting control or a self-regulating variable speed fire pump unit.

3.3.76.5 Variable Speed Suction Limiting Control.

A speed control system used to maintain a minimum positive suction pressure at the pump inlet by reducing the pump driver speed while monitoring pressure in the suction piping through a sensing line.

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Submission Date: Tue Oct 03 22:51:20 EDT 2017

Committee Statement

Committee Statement: These new definitions acknowledge available technology that was not previously addressed in this standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 6-NFPA 20-2017 [Section No. 4.3.1]****4.3.1***

~~In the event of fire pump operation, Means shall be provided for qualified personnel shall respond to the fire pump location to determine that the fire pump is operating in a satisfactory manner during pump operation .~~

A.4.3.1

Determination of satisfactory operation can be made by either having a qualified person go to the pump room and monitor conditions in person, or having video, measurement, and sensor equipment installed in the pump room so that a qualified individual can determine satisfactory operation remotely.

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Submittal Date: Mon Sep 18 16:41:51 EDT 2017

Committee Statement

Committee Statement: This revision recognizes that video, measurement, and sensing technology currently exists that allows for pump operation to be monitored remotely by qualified personnel.
Response Message:

[Public Comment No. 6-NFPA 20-2017 \[Section No. 4.3.1\]](#)

[Public Comment No. 7-NFPA 20-2017 \[New Section after 4.3.1\]](#)



Second Revision No. 21-NFPA 20-2017 [Section No. 4.4]

4.4 Fire Pump Unit Performance.

4.4.1*

The fire pump unit, consisting of a pump, driver, and controller, shall perform in compliance with this standard as an entire unit when installed or when components have been replaced.

A.4.4.1

~~A single entity should be designated as having unit responsibility for the pump, driver, controller, transfer switch equipment, and accessories. *Unit responsibility* means the accountability to answer and resolve any and all problems regarding the installation, compatibility, performance, and acceptance of the equipment. Unit responsibility should not be construed to mean purchase of all components from a single supplier.~~

4.4.2

The complete fire pump unit shall be field acceptance tested for proper performance in accordance with the provisions of this standard. (See Section 14.2.)

4.4.3*

A single entity shall be designated as having responsibility for acceptable unit performance of the pump, driver, controller, and transfer switch equipment as required by this standard.

A.4.4.3

Unit responsibility means the accountability to answer and resolve any and all problems regarding the installation, compatibility, performance, and acceptance of the equipment. Unit responsibility should not be construed to mean purchase of all components from a single supplier.

4.4.4

~~The fire pump manufacturer shall be designated as having unit responsibility for the pump driver, controller, transfer switch equipment, and other accessories required by the listing agency.~~

4.4.4.1

~~The fire pump manufacturer shall be able to supply the necessary pump accessories to provide a complete pump installation.~~

4.4.4.2

~~The fire pump manufacturer shall be held accountable for the complete fire pump unit and satisfactory performance of the field acceptance test.~~

4.4.4.3*

~~The fire pump manufacturer shall not be held accountable for items supplied by others that affect the pump performance.~~

A.4.4.3.3

Examples of items supplied by others include, but are not limited to, incorrect piping and insufficient air intake for the pump room.

The fire pump manufacturer's accountability only includes proper operation and sizing of the pump and the accessories listed as follows:

- Listed pump
- Controller, electric motor, or diesel engine as appropriate
- Driver and accessories (including batteries)
- Flow meter or hose valve header and hose valves
- Suction and discharge pressure gauges and connections
- Pressure relief valve, when required, and waste cone, when required
- Automatic air release valve
- Eccentric suction reducer
- Concentric increaser
- Ball drip, when required
- Circulation relief valve, when required
- Baseplate for pump and driver
- Pressure recorder
- Rigid engine cooling water and flexible fuel lines
- Spare parts
- Instruction, operation, and maintenance manual

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
SR_21_-_Legislative_Text.docx	shows proper legislative text - For Staff Use	

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Submittal Date: Wed Sep 20 10:19:00 EDT 2017

Committee Statement

Committee Statement: This revisions removes the assignment of unit responsibility to the pump manufacturer, but maintains the requirement that a single entity be responsible for acceptable unit performance.

Response Message:

[Public Comment No. 28-NFPA 20-2017 \[Section No. 4.4.3 \[Excluding any Sub-Sections\]\]](#)

**Second Revision No. 24-NFPA 20-2017 [New Section after 4.5.1.4]****4.5.1.5***

For self-regulating variable speed fire pump units, two additional certified test curves showing the flow, net pressure, power, and speed shall be provided for each pump operating under the following conditions:

- (1) In self-regulating variable speed mode with the pump unit operating at constant discharge pressure, as measured by the discharge pressure transducer, through the design duty, and all flow rates from churn beyond 150 percent of rated flow until the maximum power draw is reached
- (2) In self-regulating variable speed mode with the pump unit operating at constant boost pressure through the design duty, and all flow rates from churn beyond 150 percent of rated flow until the maximum power draw is reached

A.4.5.1.5

This requires two additional certified test curves for each pump unit. The self-regulating mode (variable speed) test data shows the pressure/horsepower/speed on the Y axis and the flow on the X axis.

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Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 1-NFPA 20-2017 [Section No. 4.6.2.3.1]****4.6.2.3.1***

Where the maximum flow available from ~~a public or private service~~ the water supply main cannot provide a flow of 150 percent of the rated flow of the pump at the lowest permissible suction pressure, but the water supply can provide the greater of 100 percent of rated flow or the maximum flow demand of the fire protection system(s) at the lowest permissible suction pressure, the water supply shall be deemed to be adequate.

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Submittal Date: Tue Sep 12 22:53:03 EDT 2017

Committee Statement

Committee Statement: The change of the phrase "the water supply" to "a public or private service main" that occurred in the First Draft is confusing, as the term "water supply" is used two additional times in this section, as well as throughout Section 4.6.2. This revision ensures that the terminology is consistent throughout the section.

Response Message:

[Public Comment No. 11-NFPA 20-2017 \[Section No. 4.6.2.3.1\]](#)



Second Revision No. 25-NFPA 20-2017 [New Section after 4.7]

4.8 Self-Regulating Variable Speed Fire Pump Units.

4.8.1

Each variable speed self-regulating control unit shall maintain the factory-certified test data for variable speed operating conditions.

4.8.2

A self-regulating variable speed fire pump unit shall be factory assembled and listed as a unit.

4.8.3

Each self-regulating variable speed fire pump unit shall be provided with an across-the-line fire pump controller in accordance with Chapter 10 .

4.8.4

When alternate power is provided for the pump, an across-the-line combination fire pump controller/transfer switch designed and installed in accordance with Chapter 10 shall be provided.

4.8.5

As a minimum, each variable speed drive control unit shall be provided in a National Electrical Manufacturers Association (NEMA), Type 4, watertight enclosure with an ingress protection (IP) rating of IP66.

4.8.6

Each self-regulating variable speed fire pump unit shall be provided with a minimum of 5 percent line reactance on the input.

4.8.7

The current rating of the variable frequency drive (VFD) shall not be exceeded when operating in the motor service factor.

4.8.8

Self-regulating variable speed fire pump units shall monitor the suction pressure, discharge pressure, the power draw, and the calculated flow rate and provide a supervisory alarm signal to the controller whenever the results do not match the design curve of the unit.

4.8.9

Self-regulating variable speed fire pump units shall monitor the variable speed drive and provide a supervisory alarm signal to the controller whenever any of the following conditions occur:

- (1) Pump run
- (2) High temperature
- (3) Overcurrent
- (4) Overvoltage
- (5) Undervoltage
- (6) Ground fault
- (7) Phase loss
- (8)* Set pressure not met

A.4.8.9(8) _

The set pressure not met alarm signal would be sent whenever the discharge pressure is below the set pressure and the power draw is below the design maximum.

- (9) Overpressure
- (10) Bypass mode

4.8.9.1

Remote contacts that close to indicate an alarm shall be provided for connection to the controller.

4.8.10

A self-regulating variable speed fire pump unit shall have a visible display panel capable of showing, as a minimum, set pressure, maximum permissible power draw, all phase-to-phase voltages, all phase amperages, boost pressure, calculated rpm, calculated flow, alerts, and faults with an accuracy within ± 2 percent.

4.8.11

Suction and discharge transducers for self-regulating variable speed fire pump units shall be provided and protected from mechanical damage.

4.8.12

Self-regulating variable speed fire pump units shall capture and maintain all operating information for a minimum of 2 years.

4.8.13

A minimum clear working space in accordance with 110.26(A)(1) of *NFPA 70* shall be provided for the pump, variable speed driver, and self-regulating control unit.

4.8.14

The unit shall have no resonant first-order harmonic critical speed below 120 percent of maximum operating speed in either self-regulating or manual operator mode, whichever is greater.

4.8.15

Means shall be provided on each self-regulating variable speed fire pump unit to field adjust the set pressure.

4.8.15.1

The adjustment shall be secured by password protection or other equivalent means.

4.8.16*

When operating under no-flow conditions, each self-regulating variable speed fire pump unit shall operate at a speed that provides at least 25 percent of its rated pressure.

A.4.8.16

Under no-flow conditions, the jockey pump might maintain the pressure in the system above the set pressure, causing the variable speed control to slow down. This limits the minimum pump speed to approximately 50 percent of the rated speed.

4.8.17

Within 20 seconds after a demand to start, pumps shall supply and maintain a stable discharge pressure (± 10 percent) throughout the entire range of operation.

4.8.18

All motor-starting contactors shall comply with 10.4.5.1 .

4.8.19

An automatic bypass shall be provided in accordance with 10.10.3 and 10.10.4.2 .

4.8.20

An emergency-run mechanical control shall be provided in accordance with 10.5.3.2 .

4.8.21

Circuit protection shall be provided in the VFD path in accordance with 10.10.5 .

4.8.22

The assembly shall be marked with the short-circuit current rating.

4.8.23

Local control shall be in accordance with 10.10.7.1 and 10.10.7.2 .

4.8.24

The maximum operating frequency shall not exceed line frequency.

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Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 26-NFPA 20-2017 [Section No. 4.7.7.3]****4.7.7.3** Variable Speed ~~Pressure Limiting Control Pump~~ .**4.7.7.3.1**

Variable speed ~~pressure limiting control drivers pumps~~ , as defined in this standard, shall be acceptable to limit system pressure.

4.7.7.3.2*

The set pressure plus the maximum pressure variance of the ~~variable speed pressure limiting controlled systems~~ during variable speed operation and adjusted for elevation shall not exceed the pressure rating of any system component.

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Submittal Date: Wed Sep 20 13:38:51 EDT 2017

Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 5-NFPA 20-2017 [Section No. 4.10.3]****4.11.3**

The nameplate shall indicate the maximum pump horsepower demand required to power the pump at any flow, including all flows ~~less than or greater than~~ beyond 150 percent of the rated flow capacity.

Submitter Information Verification

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Submittal Date: Mon Sep 18 16:08:43 EDT 2017

Committee Statement

Committee Statement: This revision makes it clear that the HP requirement must include flows beyond 150 percent because the maximum HP could be above 150 percent.

Response Message:

[Public Comment No. 12-NFPA 20-2017 \[Section No. 4.10.3\]](#)

**Second Revision No. 27-NFPA 20-2017 [Section No. 4.12.1.1]****4.13.1.1***

Where an electric variable speed ~~pressure limiting controller pump~~ is installed, the automatic circulation relief valve shall ~~be set to a minimum of 5 psi (0.34 bar) below the operation set pressure~~ open at the minimum speed.

A.4.13.1.1

Under no-flow conditions, the jockey pump might maintain the pressure in the system above the set pressure, causing the variable speed control to slow down. However, there is still a need to discharge a small amount of water to cool the pump.

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Submittal Date: Wed Sep 20 13:41:04 EDT 2017

Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:



Second Revision No. 2-NFPA 20-2017 [Section No. 4.13.1.2]

4.14.1.2 Detached Outdoor Fire Pump Units.

4.14.1.2.1

Fire pump units that are in ~~detached buildings or enclosures shall be in accordance with 4.14.1.1.2 outdoors shall be located at least 50 ft (15.3 m) away from any buildings and other fire exposures .~~

4.14.1.2.2

Detached Outdoor installations shall be required to be provided with protection against possible interruption in accordance with 4.14.1.

4.14.1.2.3

~~Detached fire pump units shall be installed in a building or enclosure that meets or exceeds the requirements of 4.14.1 as well as the requirements of the locally adopted building code.~~

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Submittal Date: Mon Sep 18 13:40:15 EDT 2017

Committee Statement

Committee Statement: During the First Draft stage, there was insufficient technical substantiation provided to justify the elimination of outdoor fire pumps if properly rated for such installation and approved by the authority having jurisdiction. This revision reverses the change that was made at the First Draft.

Response Message:

[Public Comment No. 13-NFPA 20-2017 \[Section No. 4.13.1.2\]](#)

[Public Comment No. 29-NFPA 20-2017 \[Section No. 4.13.1.2.3\]](#)

**Second Revision No. 28-NFPA 20-2017 [Section No. 4.19.1.3]****4.20.1.3**

Where an electric variable speed ~~pressure limiting controller pump~~ or a diesel pressure limiting driver is installed, and the maximum total discharge head adjusted for elevation with the pump operating at shutoff and rated speed exceeds the pressure rating of the system components, a pressure relief valve shall be installed.

4.20.1.3.1

Where a an electric variable speed pump or diesel pressure limiting control driver is used, the pressure relief valve shall be set to a minimum of 10 psi (0.68 bar) above the set pressure of the variable speed pressure limiting control.

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Submittal Date: Wed Sep 20 13:44:10 EDT 2017

Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 4-NFPA 20-2017 [Section No. 5.6.1]****5.6.1 Water Supply Tanks for Very Tall Buildings.****5.6.1.1***

Where the primary supply source for a vertical fire protection zone is stored water within the building, each zone shall be supplied by a minimum of two tanks.

5.6.1.1.1

A water tank shall be permitted to be divided into compartments such that the compartments function as individual tanks.

5.6.1.1.2*

The total volume of all tanks or compartments supplying a vertical fire protection zone shall be sufficient for the full fire protection demand in that zone.

5.6.1.1.3

Each individual tank or compartment directly supplying a vertical fire protection zone shall be sized so that at least 50 percent of the fire protection demand is stored with any one compartment or tank out of service.

5.6.1.2

An automatic refill valve shall be provided for each tank or tank compartment.

5.6.1.3

A manual refill valve shall be provided for each tank or tank compartment.

5.6.1.4*

Each refill valve shall be sized and arranged to independently supply the system fire protection demand.

5.6.1.5

The refill rate shall be sustainable for the required water supply duration.

5.6.1.6*

The automatic and manual fill valve combination for each tank or tank compartment shall have its own connection to one of the following:

- (1) A standpipe riser for a zone that is supplied with not supplied from the tank served by the refill valve and is provided with a backup fire pump
- (2) An express riser from a primary water supply for a different vertical fire protection zone located above the refill valve A gravity feed express or standpipe riser for a zone that is not supplied from the tank served by the refill valve
- (3) A dedicated riser from a fire pump located below the refill valve
- (4) A reliable domestic riser sized to meet the requirements of 5.6.1.4

A.5.6.1.6

The refill valves can be connected to different risers on the same zone provided the standpipe is arranged so that no single failure will impair both standpipe risers. In a pumped standpipe zone this requires redundant pumps and the supply arranged with isolation valves so that at least one of the standpipe risers can remain in service with any single section isolated. For a gravity feed system this requires connections to two tanks (or tank compartments) and at least two express risers with interconnections arranged with isolation valves so that at least one of the standpipe risers can remain in service with any single section isolated.

5.6.1.6.1*

Each refill connection shall be made to a different riser.

5.6.1.6.2

The refill connections shall be interconnected.

5.6.1.6.2.1

When the refill valves are connected to different zones, check valves shall be installed in each standpipe connection to prevent cross flow between the different zones.

5.6.1.6.2.2

Isolation valves shall be provided on both sides of each check valve required by 5.6.1.6.2.1.

5.6.1.6.3

Isolation valves shall be provided between each interconnection.

5.6.1.6.4

When at least one of the tank valves is fed from below, the primary fill shall be from below.

5.6.1.6.4.1*

When the fill valves are connected to different zones, the isolation valve shall be permitted to be normally closed to assure that the primary refill is the first refill to operate.

A.5.6.1.6.4.1

When one refill valve is supplied from a pump located below the refill valve and another refill valve is supplied from a gravity fed riser, the gravity fed riser is likely to have higher pressure and will be the first refill source to operate unless a closed valve in the interconnection isolates the gravity pressure from one of the refill valves.

5.6.1.6.5*

Each tank shall be provided with an overflow sized for the maximum refill rate with a single automatic refill valve operating fully open.

A.5.6.1.6.5

An overflow designed with a large intake close to the top of the tank that tapers to the overflow pipe size will minimize the overflow depth that must be maintained at the top of the tank. The overflow can be designed using formulas for weirs.

5.6.1.6.6

The overflow shall be piped to a safe discharge location.

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Submittal Date: Mon Sep 18 14:05:07 EDT 2017

Committee Statement

Committee Statement: This revision provides additional clarity and guidelines for automatic tank refill valves. There will be pressure differentials whenever a combination of different refill options are used (i.e. gravity feed from the tank above and pump refill from below) that require check valves to prevent cross flow between the refill sources. In addition the higher pressure source (typically gravity feed) will supply the refill valve and it may be desirable to make the lower pressure source the primary refill option. Using the gravity feed as the primary refill could result in down-filling from the highest tank that then requires pump refill for the highest tank, resulting in unnecessary circulation of water between tanks. A normally closed valve in the cross connection will prevent this from happening.

Response Message:

**Second Revision No. 29-NFPA 20-2017 [New Section after 6.2.2.1]****6.2.2.2**

When operating below the rated speed in a self-regulating mode, a self-regulating variable speed fire pump unit shall maintain the discharge pressure within 5 percent of the set pressure.

6.2.2.3

When operating below the rated speed with a variable speed pump in suction control mode, a variable speed fire pump shall maintain the suction pressure at or above the lowest permissible suction pressure with an accuracy of $-0/+3$ psi ($-0/+0.2$ bar).

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Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 20-NFPA 20-2017 [Section No. 7.5.1.6.1.7]****7.5.1.6.1.7***

In addition to the requirements of 7.5.1.6.1.3, results shall include engine critical response, crankshaft stress, and crankshaft damper heat dissipation .

A.7.5.1.6.1.7

~~Examples include crankshaft stress and crankshaft damper heat dissipation.~~

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Committee Statement

Committee Statement: The Technical Committee agrees that this language is more appropriate in the body of the standard than in the annex.

Response Message:

Public Comment No. 25-NFPA 20-2017 [Section No. 7.5.1.6.1.7]

**Second Revision No. 22-NFPA 20-2017 [Section No. 8.1.5]****8.1.5* Pump Materials.**

Materials used in pump construction shall be selected based on the corrosion potential of the environment, fluids used, and operational conditions. (See ~~3.3.11~~ 3.3.12 for definition of corrosion-resistant materials.)

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Submittal Date: Wed Sep 20 10:42:18 EDT 2017

Committee Statement

Committee Statement: This revision corrects the cross-reference to the definition of corrosion-resistant material.

Response Message:

Public Comment No. 14-NFPA 20-2017 [Section No. 8.1.5]

**Second Revision No. 30-NFPA 20-2017 [Section No. 9.4.2]****9.4.2**

The requirements of 9.4.1 shall not apply to emergency-run mechanical starting, provided a successful start can be demonstrated on the standby generator system. (See 10.5.3.2 → control of the fire pump controller.

9.4.2.1*

The requirements of 9.4.1 shall apply to the emergency-run mechanical control of the self-regulating variable speed fire pump unit.

A.9.4.2.1

Operating the emergency-run mechanical control on the self-regulating variable speed fire pump unit can cause the voltage to drop below 85 percent on the fire pump controller and inhibit its operation.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

Organization: National Fire Protection Assoc

Street Address:

City:

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Submittal Date: Wed Sep 20 13:56:55 EDT 2017

Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 10-NFPA 20-2017 [Section No. 9.5.2.2]****9.5.2.2**

The following shall apply to the service factor:

- (1) The maximum service factor at which a motor shall be used is 1.15.
- (2) Where the motor is used with a variable speed pressure limiting controller, the service factor used shall ~~not be used.~~ be as marked on the motor, but in no case exceed 1.15.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Submittal Date: Tue Sep 19 11:08:05 EDT 2017

Committee Statement

Committee Statement: Fire pump motors listed for variable speed use are now provided with a marked service factor not exceeding 1.15. The revised wording permits this application and provides clarity for the requirements covering the use of a motor with a variable speed pressure limiting controller and the maximum allowable service factor for this application.

Response Message:

**Second Revision No. 31-NFPA 20-2017 [New Section after 10.3.4.3]****10.3.4.3.1**

Where a self-regulating variable speed fire pump unit is applied to the output of the controller, the accuracy of the fire pump controller meters shall not be required to be maintained, and the meters on the self-regulating variable speed fire pump unit shall be used.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Submittal Date: Wed Sep 20 13:59:29 EDT 2017

Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:



Second Revision No. 8-NFPA 20-2017 [New Section after 10.4.7.2.4]

10.4.7.2.5 Alternate Source Isolating Switch or Circuit Breaker Open.

Where two sources of power are supplied to meet the requirements of 9.3.2 , a signal shall be provided to indicate that the alternate source isolating switch or circuit breaker is open or tripped.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

Organization: National Fire Protection Assoc

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City:

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Submittal Date: Tue Sep 19 10:04:30 EDT 2017

Committee Statement

Committee Statement: This section is added because paragraph 10.8.3.12.2 permits the alternate source isolating switch or circuit breaker open alarm to be monitored, but does not require it. This should be required because an isolating switch or circuit breaker that is left open will prevent the fire pump from running on alternate power.

Response Message:

Public Comment No. 19-NFPA 20-2017 [New Section after 10.4.7.2]

**Second Revision No. 7-NFPA 20-2017 [Section No. 10.4.7.2.5]****10.4.7.2.6 Controller or System Trouble.**

A controller or system trouble alarm shall actuate whenever a ground-fault alarm signal, when provided (see 10.4.5.9), a pressure-sensing device alarm signal (see 10.5.2.1.3.1 and 10.5.2.1.3.2), a variable speed trouble signal, or a fail-to-start alarm signal (see 10.5.2.7.5), or a locked rotor overcurrent protection (see 10.6.9.1) occurs.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

Organization: National Fire Protection Assoc

Street Address:

City:

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Zip:

Submittal Date: Tue Sep 19 09:55:05 EDT 2017

Committee Statement

Committee Statement: This revision clarifies that the ground fault signal is only to be included when a ground fault signal is provided. Also, the locked rotor overcurrent protection required in 10.6.9.1 does not require an alarm, so this provision has been removed. The term "alarm" has been revised to "signal", as this is the appropriate terminology.

Response Message:

Public Comment No. 20-NFPA 20-2017 [Section No. 10.4.7.2.5]

**Second Revision No. 44-NFPA 20-2017 [Section No. 10.4.8]****10.4.8** Controller Contacts for Remote Indication.

Controllers shall be equipped with contacts (open or closed) to operate circuits for the conditions in 10.4.7.2.1 through 10.4.7.2.3 and 10.4.7.2.6 and when a controller is equipped with a transfer switch in accordance with 10.4.7.2.4 and 10.4.7.2.5 .

Submitter Information Verification

Submitter Full Name: Janna Shapiro

Organization: National Fire Protection Assoc

Street Address:

City:

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Zip:

Submittal Date: Mon Oct 30 13:26:43 EDT 2017

Committee Statement

Committee Statement: This revision is made to coordinate with FR #7 and FR #8.

Response Message:



Second Revision No. 32-NFPA 20-2017 [New Section after 10.10.1.3]

10.10.1.3.1

The current rating of the variable frequency drive (VFD) shall not be exceeded when operating in the motor service factor.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Street Address:

City:

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Zip:

Submittal Date: Wed Sep 20 14:02:07 EDT 2017

Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 33-NFPA 20-2017 [Section No. 10.10.3.5]****10.10.3.5**

When the manual selection means required in 10.10.7.3 is used to initiate a switchover from variable speed to bypass mode, if the pump is running in the variable speed mode and none of the conditions in 10.10.3 that require the controller to initiate the bypass operation exist, the controller shall be arranged to provide a restart delay to allow the motor to be de-energized before it is re-energized in the bypass mode. variable speed pressure limiting control is bypassed, automatic shutdown of the controller shall be as permitted by 10.5.4.2 .

Submitter Information Verification

Submitter Full Name: Janna Shapiro

Organization: National Fire Protection Assoc

Street Address:

City:

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Submittal Date: Wed Sep 20 14:04:08 EDT 2017

Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 16-NFPA 20-2017 [Section No. 11.2.7.2.1.2]****11.2.7.2.1.2***

Lead Flooded lead -acid batteries shall be furnished in a moist or dry charge condition with electrolyte liquid in a separate container. Valve-regulated lead-acid (VRLA) batteries shall be furnished in a completed, charged condition.

A.11.2.7.2.1.2

There are two different types of lead-acid batteries: vented (flooded) cells and valve-regulated lead-acid (VRLA) cells. The flooded cell has electrodes immersed in liquid electrolyte and allows the products of electrolysis and evaporation to escape freely into the atmosphere as they are generated. The VRLA cell, which is lower maintenance than the flooded type, is sealed, with the exception of a valve that opens to the atmosphere when the internal pressure in the cell exceeds atmospheric pressure by a pre-selected amount. The VRLA cell provides a means for recombination of internally generated oxygen and the suppression of hydrogen gas evolution to limit water consumption.

If batteries are going to be on-site for an extended period of time before being put into service, they should be of the flooded type in a dry charge condition. These batteries can then be wet down with electrolyte and charged just prior to use. VRLA batteries should only be brought to the site in a charged condition just prior to use.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

Organization: National Fire Protection Assoc

Street Address:

City:

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Zip:

Submittal Date: Wed Sep 20 09:16:25 EDT 2017

Committee Statement

Committee Statement: This standard has to date specifically specified dry charge batteries with separate electrolyte because of the typical extended time before the batteries are put into service when the pump set is commissioned. This was not intended to preclude low maintenance batteries, but to take advantage of the dry charge feature. Should low maintenance batteries have the necessary capacity to meet the performance requirements of the standard and the engine manufacturer's requirements without setting dormant on site for an extended period of time, this standard is open to their use. The annex material has been added to explain the differences between flooded and VRLA lead-acid batteries and their use.

Response Message:

[Public Comment No. 2-NFPA 20-2017 \[New Section after 3.3.32\]](#)

[Public Comment No. 1-NFPA 20-2017 \[Section No. 11.2.7.2.1.2\]](#)

**Second Revision No. 17-NFPA 20-2017 [Section No. 11.2.7.2.1.4]****11.2.7.2.1.4***

At 40°F (4°C), battery unit A shall have the capacity sufficient to maintain the cranking speed recommended by the engine manufacturer, ~~which is~~ during six consecutive cycles of 15 seconds of cranking and 15 seconds of rest.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

Organization: National Fire Protection Assoc

Street Address:

City:

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Submittal Date: Wed Sep 20 09:48:06 EDT 2017

Committee Statement

Committee Statement: As a result of the First Revision on this section, this editorial correction is necessary for the text to read correctly.

Response Message:

[Public Comment No. 22-NFPA 20-2017 \[Section No. 11.2.7.2.1.4\]](#)

**Second Revision No. 18-NFPA 20-2017 [Section No. 11.2.7.2.1.5]****11.2.7.2.1.5**

At 40°F (4°C), battery unit B shall have the capacity sufficient to maintain the cranking speed recommended by the engine manufacturer, ~~which is~~ during six consecutive cycles of 15 seconds of cranking and 15 seconds of rest.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Street Address:

City:

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Submittal Date: Wed Sep 20 10:02:17 EDT 2017

Committee Statement

Committee Statement: As a result of the First Revision on this section, this editorial correction is necessary for the text to read correctly.

Response Message:

[Public Comment No. 23-NFPA 20-2017 \[Section No. 11.2.7.2.1.5\]](#)

**Second Revision No. 11-NFPA 20-2017 [Section No. 11.2.7.2.5.3]****11.2.7.2.5.3**

The other method shall be an automatically controlled battery charger, in accordance with Section 12.6 , taking power from an ac power source.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

Organization: National Fire Protection Assoc

Street Address:

City:

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Submittal Date: Tue Sep 19 11:11:24 EDT 2017

Committee Statement

Committee Statement: During the first draft stage, the requirements on battery charging were moved from Chapter 12 to Chapter 11 where they are better located. Section 12.6 should be referenced for the battery charger requirements in their new location in 11.2.7.2.5.3.

Response Message:

**Second Revision No. 40-NFPA 20-2017 [Section No. 11.5.3.5]****11.5.3.5**

Exhaust systems equipped with spark-arresting mufflers shall be permitted to terminate in Division 2 locations as defined in Article 500 and Article 505 of NFPA 70. [37:8.2.3.3]

Submitter Information Verification

Submitter Full Name: Janna Shapiro

Organization: National Fire Protection Assoc

Street Address:

City:

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Submittal Date: Wed Sep 20 15:47:51 EDT 2017

Committee Statement

Committee Statement: This revision is to update the extract language.

Response Message:

**Second Revision No. 9-NFPA 20-2017 [Section No. 12.6]****12.6 Battery Chargers.**

The requirements for battery chargers shall be as follows:

- (1) Chargers shall be specifically listed for fire pump service and be part of the diesel fire pump controller.
- (2) Additional chargers also listed for fire pump service shall be permitted to be installed external to the diesel fire pump controller for added capacity or redundancy.
- (3) The rectifier shall be a semiconductor type.
- (4) The charger for a lead-acid battery shall be a type that automatically reduces the charging rate to less than 500 mA when the battery reaches a full charge condition.
- (5) The battery charger at its rated voltage shall be capable of delivering energy into a fully discharged battery in such a manner that it will not damage the battery.
- (6) The battery charger shall restore to the battery 100 percent of the battery's reserve capacity or ampere-hour rating within 24 hours.
- (7) The charger shall be marked with the reserve capacity or ampere-hour rating of the largest capacity battery that it can recharge in compliance with 12.6(4).
- (8) Means shall be provided on the exterior of the controller to read the voltage and charging current of each battery within an accuracy of ± 2 percent.
- (9) The charger shall be designed such that it will not be damaged or blow fuses during the cranking cycle of the engine when operated by an automatic or manual controller.
- (10) The charger shall automatically charge at the maximum rate whenever required by the state of charge of the battery.
- (11) The battery charger shall be arranged to indicate loss of current output on the load side of the direct current (dc) overcurrent protective device where not connected through a control panel. [See 12.4.1.4(2).]
- (12) The charger(s) shall remain in float mode or switch from equalize to float mode while the batteries are under the loads in 11.2.7.2.5.2.
- (13) ~~The charger(s) shall not inhibit the engine alternator from charging the batteries while the engine is running.~~ alternator shall be the primary means of charging when the engine is running.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Street Address:

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Submission Date: Tue Sep 19 10:55:08 EDT 2017

Committee Statement

Committee Statement: This revision ensures that the alternator is the primary means of charging because it recharges the batteries faster. It is required to recharge the battery in 30 minutes.

Response Message:

[Public Comment No. 18-NFPA 20-2017 \[Section No. 12.6\]](#)



Second Revision No. 12-NFPA 20-2017 [Section No. 14.1.1.1]

14.1.1.1

Suction piping shall be flushed at a flow rate not less than indicated in Table 14.1.1.1 or at the hydraulically calculated water demand rate of the system, whichever is greater.

Table 14.1.1.1 Minimum Flow Rates for Flushing Suction Piping

<u>Nominal Pipe Size (in.)</u>	<u>Flow rate (gpm)</u>	<u>Nominal Pipe Size (mm)</u>	<u>Flow Rate (L/min)</u>
<u>1</u>	<u>37</u>	<u>25</u>	<u>140</u>
<u>1½</u>	<u>85</u>	<u>38</u>	<u>345</u> <u>330</u>
<u>2</u>	<u>150</u>	<u>50</u>	<u>540</u> <u>570</u>
<u>2½</u>	<u>229</u>	<u>65</u>	<u>870</u>
<u>3</u>	<u>330</u>	<u>75</u>	<u>1,380</u> <u>1,250</u>
<u>3½</u>	<u>450</u>	<u>85</u>	<u>1,710</u>
<u>4</u>	<u>590</u>	<u>100</u>	<u>2,160</u> <u>2,240</u>
<u>5</u>	<u>920</u>	<u>125</u>	<u>3,490</u>
<u>6</u>	<u>1,360</u>	<u>150</u>	<u>4,850</u> <u>5,150</u>
<u>8</u>	<u>2,350</u>	<u>200</u>	<u>8,900</u>
<u>10</u>	<u>3,670</u>	<u>250</u>	<u>13,900</u>
<u>12</u>	<u>5,290</u>	<u>300</u>	<u>20,030</u> <u>20,100</u>
<u>14</u>	<u>7,200</u>	<u>350</u>	<u>27,300</u>
<u>16</u>	<u>9,400</u>	<u>400</u>	<u>35,600</u>

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Street Address:

City:

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Submittal Date: Tue Sep 19 11:27:58 EDT 2017

Committee Statement

Committee Statement: The table has been revised to include all potential pipe sizes that are allowed by the standard. Additionally, the revised flush rates are required to achieve a minimum of 15 fps as recommended by this standard. The conversion should be based on gpm to L/min rather than on calculating the velocity in a nominal pipe size.

Response Message:

**Second Revision No. 34-NFPA 20-2017 [Section No. 14.2.4]****14.2.4* Certified Pump Curve.****14.2.4.1**

A copy of the manufacturer's certified pump test curve shall be available for comparison with the results of the field acceptance test.

14.2.4.1.1

For water mist positive displacement pumping units, a copy of the manufacturer's certified shop test data for both variable speed and non-variable speed operation shall be available for comparison of the results of the field acceptance test.

14.2.4.1.2

For multistage multiport pumps, a copy of the manufacturer's certified shop test data for each discharge outlet shall be available for comparison with the results of the field acceptance test.

14.2.4.1.3

For self-regulating variable speed fire pump units, a copy of the manufacturer's test curves for self-regulating variable speed constant boost mode, self-regulating variable speed constant discharge mode, and bypass constant speed mode shall be available.

14.2.4.2

At all flow conditions, including those required to be tested in 14.2.6.3, the fire pump as installed shall equal the performance as indicated on the manufacturer's certified shop test curve within the accuracy limits of the test equipment.

14.2.4.2.1

For water mist positive displacement pumping units with variable speed features, the pump unit as installed shall equal the performance as indicated on the fire pump unit manufacturer's certified shop test data, with variable speed features deactivated within the accuracy limits of the test equipment.

14.2.4.2.2

For water mist positive displacement pumping units, the pump unit as installed shall equal the performance as indicated on the fire pump unit manufacturer's certified shop test data, with variable speed features activated within the accuracy limits of the test equipment.

14.2.4.2.3*

For self-regulating variable speed fire pump units, the unit as installed shall equal the performance as indicated on the fire pump unit manufacturer's certified self-regulating variable speed mode shop test data within the accuracy limits of the test equipment.

A.14.2.4.2.3

This requires comparing the discharge pressure and power draw for the flow against the curve provided by the pump supplier.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Submittal Date: Wed Sep 20 14:19:27 EDT 2017

Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 41-NFPA 20-2017 [Section No. 14.2.6.1.2.3]****14.2.6.1.2.3**

Fire pump controller voltage and current readings on controllers that are factory calibrated and adjusted to ~~±3 percent~~ ±2 percent shall be permitted to be used in lieu of calibrated volt/amp meters for the acceptance test.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Street Address:

City:

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Submittal Date: Thu Sep 21 08:47:42 EDT 2017

Committee Statement

Committee Statement: This revision is made to correlate with the First Revision that changed controller accuracy to 2 percent.

Response Message:

**Second Revision No. 35-NFPA 20-2017 [Section No. 14.2.6.4]****14.2.6.4** ~~Variable Speed Pressure Limiting Control Pumps .~~**14.2.6.4.1***

~~Pumps with variable speed pressure limiting control~~ Variable speed pumps shall be tested at no-flow, 25 percent, 50 percent, 75 percent, 100 percent, 125 percent, and 150 percent of rated load in the variable speed mode.

A.14.2.6.4.1

All seven points are required to verify the stability of the variable speed pump.

14.2.6.4.1.1

They Variable speed pumps shall also be tested at minimum, rated, and peak loads, with the fire pump operating at rated speed.

14.2.6.4.2

The fire protection system shall be isolated and the pressure relief valve closed for the rated speed tests required in 14.2.6.4.1.1.

14.2.6.4.3

The fire protection system shall be open and the relief valve set for the variable speed tests required in 14.2.6.4.1.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Street Address:

City:

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Submission Date: Wed Sep 20 14:21:57 EDT 2017

Committee Statement

Committee Statement: This revision recognizes available technology that was previously not addressed in the standard, but provides advantages for fire protection services.

Response Message:

**Second Revision No. 3-NFPA 20-2017 [Section No. A.4.13.1]****A.4.14.1**

A fire pump that is inoperative for any reason at any time constitutes an impairment to the fire protection system. It should be returned to service without delay.

Rain, intense heat from the sun, blown freezing rain, blowing sand or dust, flood, rodents, insects, and vandals are adverse conditions to equipment not installed in ~~a completely~~ an acceptable protective building or enclosure. At a minimum, equipment installed should be shielded by a roof or deck.

Submitter Information Verification

Submitter Full Name: Janna Shapiro

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Street Address:

City:

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Zip:

Submittal Date: Mon Sep 18 13:46:06 EDT 2017

Committee Statement

Committee Statement: During the First Draft stage, there was insufficient technical substantiation provided to justify the elimination of outdoor fire pumps if properly rated for such installation and approved by the authority having jurisdiction. This revision reverses the change that was made at the First Draft. The term "a completely" was changed to "an acceptable" because fire pumps might not need to be in a fully enclosed building to be adequately protected.

Response Message:

[Public Comment No. 16-NFPA 20-2017 \[Section No. A.4.13.1\]](#)

[Public Comment No. 30-NFPA 20-2017 \[Section No. A.4.13.1\]](#)



Second Revision No. 13-NFPA 20-2017 [Section No. A.14.1.3]

A.14.1.3

See Figure A.14.1.3(a) for a sample of a contractor's material and test certificate for fire pumps and Figure A.14.1.3(b) for a sample certificate for private fire service mains.

Figure A.14.1.3(a) Sample of Contractor's Material Test Certificate for Fire Pump Systems.

Contractor's Material and Test Certificate for Fire Pump Systems	
PROCEDURE: Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.	
A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.	
PROPERTY NAME	DATE
PROPERTY ADDRESS	
ACCEPTED BY APPROVING AUTHORITIES (NAMES)	
PLANS	ADDRESS
INSTALLATION CONFORMS TO ACCEPTED PLANS ☐ YES ☐ NO	
ALL EQUIPMENT USED IS APPROVED FOR FIRE SYSTEM SERVICE ☐ YES ☐ NO	
IF NO, STATE DEVIATIONS	
INSTRUCTIONS	HAS PERSON IN CHARGE OF FIRE PUMP EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF SYSTEM CONTROL VALVES AND CARE AND MAINTENANCE OF THIS NEW EQUIPMENT? ☐ YES ☐ NO
IF NO, EXPLAIN	
HAVE COPIES OF APPROPRIATE INSTRUCTIONS AND CARE AND MAINTENANCE CHARTS BEEN LEFT ON PREMISES? ☐ YES ☐ NO	
IF NO, EXPLAIN	
LOCATION	SUPPLIER'S BUILDING(S) (CAMPUS, WAREHOUSE, HIGH RISE)
EXPLAIN	
PUMP ROOM EQUIPMENT	IS THE PUMP ROOM EQUIPMENT PER THE PLANS AND SPECS? ☐ YES ☐ NO
IS THE FIRE PUMP PROPERLY MOUNTED AND ANCHORED TO THE FOUNDATION? ☐ YES ☐ NO	
IF NO, EXPLAIN	
IS THE FIRE PUMP BASE PROPERLY GROUTED? ☐ YES ☐ NO	
IF NO, EXPLAIN	
DOES THE PUMP ROOM HAVE THE PROPER FLOOR DRAINS? ☐ YES ☐ NO	
IF NO, EXPLAIN	
IS THE SUCTION AND DISCHARGE PIPING PROPERLY SUPPORTED? ☐ YES ☐ NO	
IS THE PUMP ROOM HEATED AND VENTILATED PER NFPA 20? ☐ YES ☐ NO	
PIPES AND FITTINGS	PIPE TYPES AND CLASS
PIPE CONFORMS TO _____ STANDARD ☐ YES ☐ NO	
FITTINGS CONFORM TO _____ STANDARD ☐ YES ☐ NO	
IF NO, EXPLAIN	
SUCTION AND DISCHARGE PIPING ANCHORED OR RESTRAINED? ☐ YES ☐ NO	
PRE-PACKAGED PUMP HOUSE	IS THIS A PACKAGE OR SKID MOUNTED PUMP? ☐ YES ☐ NO
IS THE PACKAGE/SKID PROPERLY ANCHORED TO A CONCRETE FOUNDATION? ☐ YES ☐ NO	
IF NO, EXPLAIN	
IS THE STRUCTURAL FOUNDATION FRAME FILLED WITH CONCRETE TO FORM A FINISHED FLOOR? ☐ YES ☐ NO	
IS THERE A FLOOR DRAIN INSTALLED? ☐ YES ☐ NO	
TEST DESCRIPTION	HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.8 bar) for 2 hours or 50 psi (3.4 bar) above static pressure in excess of 200 psi (13.8 bar) for 2 hours.
HYDROSTATIC TEST: ALL NEW PIPING HYDROSTATICALLY TESTED AT: _____ NO LEAKAGE ALLOWED	
PSI/BAR FOR _____ HOURS	
FLUSHING TESTS	FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burp bags at outlets such as hydrants and blowoffs. Flush at flows not less than 300 gpm (1476 L/min) for 4 in. pipe, 610 gpm (2309 L/min) for 5 in. pipe, 880 gpm (3331 L/min) for 6 in. pipe, 1560 gpm (5905 L/min) for 8 in. pipe, 2440 gpm (9235 L/min) for 10 in. pipe, and 3520 gpm (13,323 L/min) for 12 in. pipe. When supply cannot produce stipulated flow rates, obtain maximum available.

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(NFPA 20, 1 of 2)

FLUSHING TESTS (continued)	NEW PIPING FLUSHED ACCORDING TO _____ STANDARD ☐ YES ☐ NO
	BY (COMPANY) _____
	IF NO, EXPLAIN
	HOW FLUSHING FLOW WAS OBTAINED ☐ PUBLIC WATER ☐ TANK OR RESERVOIR ☐ OTHER (EXPLAIN) _____ THROUGH WHAT TYPE OPENING ☐ TEST HEADER ☐ OPEN PIPE
FIELD ACCEPTANCE TEST	LEADING FLUSHED ACCORDING TO _____ STANDARD ☐ YES ☐ NO
	BY (COMPANY) _____
	IF NO, EXPLAIN
	HOW FLUSHING FLOW WAS OBTAINED ☐ PUBLIC WATER ☐ TANK OR RESERVOIR ☐ OTHER (EXPLAIN) _____ THROUGH WHAT TYPE OPENING ☐ Y CONNECTION TO FLANGE & SPOGOT ☐ OPEN PIPE
FIELD ACCEPTANCE TEST	ALL EQUIPMENT APPROVED? ☐ YES ☐ NO
	ALL REQUIRED REPRESENTATIVES PRESENT FOR TEST ☐ YES ☐ NO
	AHJ AND OWNER'S REPRESENTATIVE PRESENT FOR TEST ☐ YES ☐ NO
	IF NO, EXPLAIN
	ALL ELECTRICAL WIRING COMPLETE AND PER NFPA 70 AND NFPA 20 ☐ YES ☐ NO
	IF NO, EXPLAIN
	CALIBRATE TEST EQUIPMENT USED ☐ YES ☐ NO
	CALIBRATION DATE _____
	FLOW TESTS
	PUMP DESIGN _____ GPM _____ PSI
	DOES THE PUMP MEET OR EXCEED THE CERTIFIED CURVE? ☐ YES ☐ NO
	PUMP TYPE ☐ HORIZONTAL ☐ VERTICAL TURBINE ☐ OTHER
PUMP MAKE _____ MODEL # _____ SERIAL # _____	
COMMENTS _____	
FIELD ACCEPTANCE TEST	ELECTRIC DRIVER OPERATIONAL TEST SATISFACTORY ☐ YES ☐ NO
	ELEC. DRIVER _____ MODEL # _____ SERIAL # _____ FLA _____
	VOLTAGE _____ VAC @ _____ HP _____ RPM _____
	ENGINE DRIVEN ☐ YES ☐ NO
	ENGINE MAKE _____ MODEL # _____ SERIAL # _____
	HP _____ RPM SPEED _____
	DIESEL DRIVER OPERATIONAL TEST SATISFACTORY? ☐ YES ☐ NO
	OTHER EXPLAIN _____
	CONTROLLER MAKE _____ MODEL # _____ SERIAL # _____
	VARIABLE SPEED PRESSURE LIMITING CONTROL ☐ YES ☐ NO
	TESTED AT MINIMUM, RATED, AND PEAK FLOW ☐ YES ☐ NO
	CONTROLLER TEST: ☐ YES ☐ NO
SIX AUTO STARTS ☐ YES ☐ NO	
SIX MANUAL STARTS ☐ YES ☐ NO	
PHASE REVERSAL TEST PERFORMED (ELECTRIC ONLY) ☐ YES ☐ NO	
ALTERNATE POWER SOURCE TESTED (ELECTRIC ONLY) ☐ YES ☐ NO	
ELECTRONIC FUEL MANAGEMENT (ECM) FUNCTION TEST PERFORMED (DIESEL ONLY) ☐ YES ☐ NO	
SYSTEM CONTROL VALVES LEFT WIDE OPEN ☐ YES ☐ NO	
IF NO, STATE REASON _____	
CONTROL VALVES	HOSE THREADS OF FIRE DEPARTMENT CONNECTIONS AND HYDRANTS INTERCHANGEABLE WITH THOSE OF FIRE DEPARTMENT ANSWERING ALARM ☐ YES ☐ NO
REMARKS	DATE LEFT IN SERVICE _____
ADDITIONAL COMMENTS:	
NAME OF INSTALLING CONTRACTOR _____	
SIGNATURES	TESTS WITNESSED BY _____
	FOR PROPERTY OWNER (SIGNED) _____ TITLE _____ DATE _____
FOR INSTALLING CONTRACTOR (SIGNED) _____ TITLE _____ DATE _____	
ADDITIONAL COMMENTS AND NOTES:	

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Figure A.14.1.3(b) Sample of Contractor's Material and Test Certificate for Private Fire Service Mains Feeding Fire Pump(s) .

Contractor's Material and Test Certificate for Private Fire Service Mains	
PROCEDURE Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.	
A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.	
PROPERTY NAME	DATE
PROPERTY ADDRESS	
PLANS	ACCEPTED BY APPROVING AUTHORITIES (NAMES)
	ADDRESS
	INSTALLATION CONFORMS TO ACCEPTED PLANS ☐ YES ☐ NO EQUIPMENT USED IS APPROVED ☐ YES ☐ NO IF NO, STATE DEVIATIONS
INSTRUCTIONS	HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF THIS NEW EQUIPMENT? ☐ YES ☐ NO IF NO, EXPLAIN
	HAVE COPIES OF APPROPRIATE INSTRUCTIONS AND CARE AND MAINTENANCE CHARTS BEEN LEFT ON PREMISES? ☐ YES ☐ NO IF NO, EXPLAIN
LOCATION	SUPPLIES BUILDINGS
PIPES AND JOINTS	PIPE TYPES AND CLASS TYPE JOINT
	PIPE CONFORMS TO STANDARD ☐ YES ☐ NO FITTINGS CONFORM TO STANDARD ☐ YES ☐ NO IF NO, EXPLAIN
	BURIED JOINTS NEEDING ANCHORAGE CLAMPED, STRAPPED, OR BLOCKED IN ACCORDANCE WITH STANDARD ☐ YES ☐ NO IF NO, EXPLAIN
TEST DESCRIPTION	FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blowoffs. Flush at flow not less than 380 gpm (1470 L/min) for 4 in. pipe, 610 gpm (2300 L/min) for 5 in. pipe, 880 gpm (3331 L/min) for 6 in. pipe, 1560 gpm (5905 L/min) for 8 in. pipe, 2440 gpm (9235 L/min) for 10 in. pipe, and 3520 gpm (13325 L/min) for 12 in. pipe. When supply cannot produce stipulated flow rates, obtain maximum available. HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.8 bar) for 2 hours or 50 psi (3.4 bar) above static pressure in excess of 150 psi (10.3 bar) for 2 hours. LEAKAGE: New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 gphr (1.89 L/hr) per 100 joints irrespective of pipe diameter. The amount of allowable leakage specified above can be increased by 1 ft or per inch valve diameter per hour (30 mL/25 mm/hr) for each metal seated valve isolating the test section. If dry barrel hydrants are tested with the main valve open, so the hydrants are under pressure, an additional 5 oz per minute (150 mL/min) leakage is permitted for each hydrant.
FLUSHING TESTS	NEW PIPING FLUSHED ACCORDING TO STANDARD ☐ YES ☐ NO BY (COMPANY) IF NO, EXPLAIN
	HOW FLUSHING FLOW WAS OBTAINED ☐ PUBLIC WATER ☐ TANK OR RESERVOIR ☐ FIRE PUMP THROUGH WHAT TYPE OPENING ☐ HYDRANT BUTT ☐ OPEN PIPE
	LEADS INS FLUSHED ACCORDING TO STANDARD ☐ YES ☐ NO BY (COMPANY) IF NO, EXPLAIN
FLUSHING TESTS	HOW FLUSHING FLOW WAS OBTAINED ☐ PUBLIC WATER ☐ TANK OR RESERVOIR ☐ FIRE PUMP THROUGH WHAT TYPE OPENING ☐ Y CONNECTION TO FLANGE & SPIGOT ☐ OPEN PIPE
	IF NO, EXPLAIN

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Contractor's Material and Test Certificate for Private Fire Service Mains Feeding Fire Pump(s)	
PROCEDURE Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.	
A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.	
PROPERTY NAME	DATE
PROPERTY ADDRESS	
PLANS	ACCEPTED BY APPROVING AUTHORITIES (NAMES)
	ADDRESS
	INSTALLATION CONFORMS TO ACCEPTED PLANS ☐ YES ☐ NO EQUIPMENT USED IS APPROVED ☐ YES ☐ NO IF NO, STATE DEVIATIONS
INSTRUCTIONS	HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF THIS NEW EQUIPMENT? ☐ YES ☐ NO IF NO, EXPLAIN
	HAVE COPIES OF APPROPRIATE INSTRUCTIONS AND CARE AND MAINTENANCE CHARTS BEEN LEFT ON PREMISES? ☐ YES ☐ NO IF NO, EXPLAIN
LOCATION	SUPPLIES BUILDINGS
PIPES AND JOINTS	PIPE TYPES AND CLASS TYPE JOINT
	PIPE CONFORMS TO STANDARD ☐ YES ☐ NO FITTINGS CONFORM TO STANDARD ☐ YES ☐ NO IF NO, EXPLAIN
	BURIED JOINTS NEEDING ANCHORAGE CLAMPED, STRAPPED, OR BLOCKED IN ACCORDANCE WITH STANDARD ☐ YES ☐ NO IF NO, EXPLAIN
TEST DESCRIPTION	FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blowoffs. Flush at flow not less than 37 gpm for 1 in. pipe (140 L/min for 25 mm pipe), 85 gpm for 1½ in. pipe (330 L/min for 38 mm pipe), 150 gpm for 2 in. pipe (570 L/min for 50 mm pipe), 229 gpm for 2½ in. pipe (870 L/min for 65 mm pipe), 330 gpm for 3 in. pipe (1250 L/min for 75 mm pipe), 450 gpm for 3½ in. pipe (1710 L/min for 85 mm pipe), 590 gpm for 4 in. pipe (2240 L/min for 100 mm pipe), 920 gpm for 5 in. pipe (3490 L/min for 125 mm pipe), 1360 gpm for 6 in. pipe (5150 L/min for 150 mm pipe), 2350 gpm for 8 in. pipe (8900 L/min for 200 mm pipe), 3670 gpm for 10 in. pipe (13,900 L/min for 250 mm pipe), 5290 gpm for 12 in. pipe (20,100 L/min for 300 mm pipe), 7200 gpm for 14 in. pipe (27,300 L/min for 350 mm pipe), and 9400 gpm for 16 in. pipe (35,600 L/min for 400 mm pipe). When supply cannot produce stipulated flow rates, comply with 14.1.1.3. HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.8 bar) for 2 hours or 50 psi (3.4 bar) above static pressure in excess of 150 psi (10.3 bar) for 2 hours. LEAKAGE: New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 gphr (1.89 L/hr) per 100 joints irrespective of pipe diameter. The amount of allowable leakage specified above can be increased by 1 ft or per inch valve diameter per hour (30 mL/25 mm/hr) for each metal seated valve isolating the test section. If dry barrel hydrants are tested with the main valve open, so the hydrants are under pressure, an additional 5 oz per minute (150 mL/min) leakage is permitted for each hydrant.

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HYDROSTATIC TEST	ALL NEW PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HOURS		BURIED JOINTS COVERED ☐ YES ☐ NO
LEAKAGE TEST	TOTAL AMOUNT OF LEAKAGE MEASURED _____ GALLONS		NO LEAKAGE ALLOWED FOR VISIBLE JOINTS HOURS
	ALLOWABLE LEAKAGE (BURIED) _____ GALLONS		NO LEAKAGE ALLOWED FOR VISIBLE JOINTS HOURS
HYDRANTS	NUMBER INSTALLED	TYPE AND MAKE	ALL OPERATE SATISFACTORILY ☐ YES ☐ NO
CONTROL VALVES	WATER CONTROL VALVES LEFT WIDE OPEN IF NO, STATE REASON _____		☐ YES ☐ NO
REMARKS	HOSE THREADS OF FIRE DEPARTMENT CONNECTIONS AND HYDRANTS INTERCHANGEABLE WITH THOSE OF FIRE DEPARTMENT ANSWERING ALARM ☐ YES ☐ NO		
	DATE LEFT IN SERVICE _____ ADDITIONAL COMMENTS: _____		
SIGNATURES	NAME OF INSTALLING CONTRACTOR _____		
	TESTS WITNESSED BY _____		
	FOR PROPERTY OWNER (SIGNED)	TITLE	DATE
	FOR INSTALLING CONTRACTOR (SIGNED)	TITLE	DATE
ADDITIONAL EXPLANATION AND NOTES _____			
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FLUSHING TESTS	NEW PIPING FLUSHED ACCORDING TO _____ STANDARD ☐ YES ☐ NO BY (COMPANY) IF NO, EXPLAIN _____		
	HOW FLUSHING FLOW WAS OBTAINED PUBLIC WATER ☐ TANK OR RESERVOIR ☐ FIRE PUMP	THROUGH WHAT TYPE OPENING ☐ HYDRANT BUTT ☐ OPEN PIPE	
	LEAD-INS FLUSHED ACCORDING TO _____ STANDARD ☐ YES ☐ NO BY (COMPANY) IF NO, EXPLAIN _____		
	HOW FLUSHING FLOW WAS OBTAINED PUBLIC WATER ☐ TANK OR RESERVOIR ☐ FIRE PUMP	THROUGH WHAT TYPE OPENING ☐ Y CONNECTION TO FLANGE & SPRIGOT ☐ OPEN PIPE	
HYDROSTATIC TEST	ALL NEW PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HOURS		BURIED JOINTS COVERED ☐ YES ☐ NO
LEAKAGE TEST	TOTAL AMOUNT OF LEAKAGE MEASURED _____ GALLONS		NO LEAKAGE ALLOWED FOR VISIBLE JOINTS HOURS
	ALLOWABLE LEAKAGE (BURIED) _____ GALLONS		NO LEAKAGE ALLOWED FOR VISIBLE JOINTS HOURS
HYDRANTS	NUMBER INSTALLED	TYPE AND MAKE	ALL OPERATE SATISFACTORILY ☐ YES ☐ NO
CONTROL VALVES	WATER CONTROL VALVES LEFT WIDE OPEN IF NO, STATE REASON _____		☐ YES ☐ NO
REMARKS	HOSE THREADS OF FIRE DEPARTMENT CONNECTIONS AND HYDRANTS INTERCHANGEABLE WITH THOSE OF FIRE DEPARTMENT ANSWERING ALARM ☐ YES ☐ NO		
	DATE LEFT IN SERVICE _____ ADDITIONAL COMMENTS: _____		
SIGNATURES	NAME OF INSTALLING CONTRACTOR _____		
	TESTS WITNESSED BY _____		
	FOR PROPERTY OWNER (SIGNED)	TITLE	DATE
	FOR INSTALLING CONTRACTOR (SIGNED)	TITLE	DATE
ADDITIONAL EXPLANATION AND NOTES _____			
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Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
SR_13_Figure_A.14.1.3_b_.docx	Revisions to Figure A.14.1.3(b)	

Submitter Information Verification

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Committee Statement

Committee Statement: The revision to the title makes it clear that this is not the standard underground piping test certificate used for NFPA 13 and NFPA 24 applications, but is unique to underground piping feeding one or more fire pumps. The recommended flush rate for underground piping feeding a fire pump is 15 fps. The change to the flushing flow rates is consistent with the revised rates in Table 14.1.1.1 (see SR

12) and to ensure that the recommended 15 fps would be achieved when flushing fire service mains.

Response

Message:

1. Revise title: Contractor's Material and Test Certificate for Private Fire Service Mains Feeding Fire Pump(s)
2. In the section titled "Test description", revise text after "FLUSHING:" to read as follows:

Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blowoffs. Flush at flow not less than 37 gpm for 1 in. pipe (140 L/min for 25 mm pipe), 85 gpm for 1½ in. pipe (330 L/min for 38 mm pipe), 150 gpm for 2 in. pipe (570 L/min for 50 mm pipe), 229 gpm for 2½ in. pipe (870 L/min for 65 mm pipe), 330 gpm for 3 in. pipe (1,250 L/min for 75 mm pipe), 450 gpm for 3½ in. pipe (1,710 L/min for 85 mm pipe), 590 gpm for 4 in. pipe (2,240 L/min for 100 mm pipe), 920 gpm for 5 in. pipe (3,490 L/min for 125 mm pipe) , 1,360 gpm for 6 in. pipe (5,150 L/min for 150 mm pipe), 2,350 gpm for 8 in. pipe (8,900 L/min for 200 mm pipe), 3,670 gpm for 10 in. pipe (13,900 L/min for 250 mm pipe), 5,290 gpm for 12 in. pipe (20,100 L/min for 300 mm pipe), 7,200 gpm for 14 in. pipe (27,300 L/min for 350 mm pipe), and 9,400 gpm for 16 in. pipe (35,600 L/min for 400 mm pipe). When supply cannot produce stipulated flow rates, comply with 14.1.1.3.



Second Revision No. 38-NFPA 20-2017 [Chapter C]

Annex C Fire Pump Controller Room Connectivity

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 Scope.

C.1.1

This annex covers considerations ~~relating related~~ to the data storage and data access of information related to fire pump controllers, including operation beyond the minimum controller data storage requirements. This storage can be managed by a stand-alone device (computer, tablet, or a device designed specifically for this application). Considerations in this annex include access methods, security considerations, accessible information, potential use of accessible information, long-term improvement in reliability, and standardization that allows the full potential of connectivity to be met.

C.1.2

Potential use of accessible information includes remote supervision, remote monitoring that could include specific components for failure forecasting/component replacement, and reliability analysis for owner, manufacturer, and NFPA or similar group for obtaining information only. No remote operation ~~per~~ or remote changing of any controller settings are to be permitted.

C.1.3

Connectivity is for remote monitoring and data gathering. It does not replace any of the alarm and signaling requirements of this standard.

C.1.4

The access can be local, such as a port (USB, RS-232, RS-485), or by remote access over any communication channel, such as phone line, Ethernet, Internet, ~~Local Network~~ local area network (LAN), or other.

C.1.5

This annex includes the following:

- (1) Possible controller access configurations (see Section C.3)
- (2) Security considerations (see Section C.4)
- (3) Some protection methods (see Section C.5)
- (4) Standardization issues (see Section C.6)

Standardization means standardization per se — that is, defining common data formats, and so forth, to allow access to a defined common set of data in any compliant controller. Controllers might also have proprietary data beyond the defined common set.

C.1.6

Remote or local access to fire pump controller stored data has been in existence for over 20 years; however, each manufacturer has used proprietary means for accessing (reading ~~or~~ downloading, or transferring) this data. There is a perceived need to extend these means to fire pump controllers in general, using some amount of commonality.

C.1.7

~~Although none of the clauses in Annex C are enforceable, the intention for future editions of this standard is to incorporate requirements into the main body of this standard. It is likely that the more technical aspects will remain in the annex or be deleted in the future.~~

C.2 General Definitions.

C.2.1 Access.

The ability to interrogate a controller in order to be able to read or download data. This can also include means of sending data or commands to a controller. Annex C addresses both local access and remote access.

C.2.2 Circuitry.

Electrical/electronic circuitry ~~which include~~ that includes microcontrollers and associated firmware.

C.2.3 Cloud.

The system of ~~internet~~ Internet -connected devices and services.

C.2.4 Connectivity.

The issues involved with communicating with (connecting to) fire pump controllers.

C.2.5 Encode.

Encrypt. This can be used to hide data, passwords, access information, and so forth.

C.2.6 Ethernet.

High-speed serial connection. Each Ethernet device has (should have) a unique Ethernet MAC (media access control) address. These are 4-8bit (12 hexadecimal digit) addresses such as: 00:A0:C9:14:C8:29.

C.2.7 Firmware.

A permanently stored processor program code (software); also called embedded program code.

C.2.8 Global System for Mobile Communication (GMS).

Cell phone technology.

C.2.9 HyperText Markup Language (HTML).

The standard markup language for handling text files over the World Wide Web.

C.2.10 Internet.

The global system of devices with routable IP addresses.

C.2.11 IP.

Internet protocol.

C.2.12 IP-4 (IPV4).

Internet version 4. Most of the extant internet is IP-4. LAN addresses are specific to IP-4. IP-4 uses 32-bit addresses (4×8) and has around 4.3 billion addresses.

C.2.13 IP-6 (IPV6).

The latest (next) ~~internet~~ Internet version. Most of the current ~~internet~~ Internet is IP-V. All IP-6 addresses are routable. IP-6 uses 128-bit addresses and provides many times more addresses than IP-4.

C.2.14 IT Department.

The company's information technology (computer) department.

C.2.15 Local Area Network (LAN).

A computer network that consists of either routable or nonroutable IP addresses.

C.2.16 Nonroutable.

An IP address reserved for LAN use. These are not visible outside the local network. Typical LAN addresses are: 10.x.y.z, 19D.2.168.x.y, and 17D.2.16/3D.2.x.y.

C.2.17 Private Area Network (PAN).

Short-range wireless networks such as: Bluetooth, ZigBee, infrared, and RFID.

C.2.18 Routable.

An IP address that is part of a routing table in a network (~~internet~~ Internet) router (or switch). These are visible to the outside world.

C.2.19 Routing.

The process of translating a device's IP address (usually a LAN address) into another IP address (usually a WAN or a routable address).

C.2.20 RS-232 (EIA-32).

A serial transmission electrical specification for two pieces of equipment.

C.2.21 RS-485 (EIA-45).

A serial transmission electrical specification ~~which that~~ is more advanced than RS-232 It allows connection to multiple pieces of equipment. Many serial protocols, such as ~~ModBus~~ Modbus , and so forth, run over RS-485 electrical networks.

C.2.22 Serial Port.

The electrical connection (electrical connector) to circuitry that provides and complies with a serial protocol.

C.2.23 Serial Protocol.

Data format used in various commercial data/ and/or control schemes involving multiple pieces of equipment, such as ~~ModBus~~ Modbus , LonWorks, BacNet, and CAN bus.

C.2.24 Transmission Control Protocol/Internet Protocol (TCP/IP).

The protocol used for most of the ~~internet~~ Internet including ~~web~~ Web pages.

C.2.25 USB Port.

The connection (connector) to circuitry that provides and complies with the Universal Serial Bus (USB) protocol. This is the same as USB connection on personal devices (computers and so forth).

C.2.26 User.

The person or entity who accesses or desires to access an a fire pump controller(s) FPC or FPCs [FPC(s)] .

C.2.27 Wide Area Network (WAN).

A network consisting of two or more locations under the control of a single entity (corporation or other entity). IP addresses must be routable in order to be visible from other locations.

C.3 Possible Configurations.**C.3.1 Standalone Controllers (FPCs) — Controllers Not Connected to a Network.****C.3.1.1**

These controllers have no permanent physical (wired) or wireless connection.

C.3.1.2

Standalone controllers are almost universal in modern controllers. Manual (user) intervention is required to access (read or download).

C.3.1.3

User connection can be any of several means, such as a ~~Serial Port~~ serial port or a ~~USB Port~~ port .

C.3.1.4

There are potential dangers (security hazards) to these access means. The dangers might be accidental (inadvertent) or malicious (willful) occurrences.

C.3.1.5

Potential damage could include corrupting the stored data or the access circuitry or firmware, either the data access means and/or the fire protection related firmware.

C.3.2 Controllers (FPCs) Permanently Connected to a Network.**C.3.2.1 Private (Premise) Permanently Wired Methods.**

These might include: ~~Phone phone~~ modem, serial port or ~~USP~~ USB Port port , or Ethernet (see *IEEE 802.3, Standard for Ethernet*). The preferred protocol is Modbus. Other protocols can be used but no guidance is provided to standardize the register definitions for other protocols.

C.3.2.2 Public Accessible Connections (Wired or Wireless).

These might have a factory pre-assigned (default) LAN IP address or addresses, which is usually assigned by the premise owner's IT department.

C.3.2.3 Permanent Wireless Connections.

These can be WiFi (*see IEEE 802.11, Standard for Information Technology — Telecommunications and information exchange between systems Local and metropolitan area networks — Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*) (LAN or routable) or cellular (any of various services) (LAN).

C.4 Security Concerns.**C.4.1 General.**

Fire pump controllers (FPCs) are usually critical to life safety and property protection. Modern FPCs make use of internal embedded processors (microprocessors or microcontrollers). These are subject to damage or derangement if the program (program code) or data is damaged or compromised.

C.4.2 Accessing Data.

Plugging into the data access port (USP USB or other) via a computer (laptop, tablet, and so forth), smartphone, or a thumb drive (memory stick) could cause electrical damage or damage to data or software. Provisions should be made to prevent any such damage from preventing the fire pump from starting.

C.4.2.1

The device used to access the data might be damaged or have an infection (virus) ~~which~~ that could infect the fire pump controller. Inadvertent damage threats could include the following:

- (1) Accidental altering controller while connected to a laptop, cell phone, and so forth (remotely or locally)
- (2) Lightning hits (mainly induced surges from nearby hits)
- (3) Local (building) network (LANs) problems
- (4) Wide area (corporate) network (WAN) problems
- (5) Internet or "Cloud" problems

C.4.3 Malicious Intent.

All devices with a routable IP address are discovered within minutes of being connected to the ~~internet~~ Internet. Furthermore, connected (routable) devices are constantly being scanned.

C.4.4 Infections.**C.4.4.1**

Computers (laptops, tablets, and so forth) are frequently infected with viruses, key-loggers, ~~trojan~~ Trojan horses, and so forth, despite installed anti-virus software. Many of these allow the infected machine to be used for malicious intents.

C.4.4.2

Web pages are often infected. Web pages can be shut down, masquerade as another ~~web~~ Web page ("spoofing"), or used to gather data.

C.4.4.3

Web servers can also become infected and be forced to use hosted ~~web~~ Web page for malicious purposes.

C.4.5 Remote Control Hazards.**C.4.5.1**

Allowing remote starting and/or stopping a fire pump implies outside world access to the basic control software. This limits or negates the effectiveness of any firewalls.

C.4.5.2

Single installations: Disable PUMP starting, false starting (cause a fire alarm), false or reset weekly test time (cause a fire alarm), of a disabled controller.

C.4.5.3

Multiple installations: Simultaneous instances of any or all of [4.5.1 C.4.5.1](#) and [4.5.2 C.4.5.2](#) in order to hamper municipal services such as the local fire departments or the 911 centers.

C.4.6 External Threats to Fire Protection.

Corrupting a fire pump controller's data or software (firmware) is made easier if the attacker knows the controller software. Malicious access to controller firmware is often done by one or more of the following techniques:

- (1) Corruption of controller manufacturer's network via numerous attack schemes
- (2) Compromised employees or service personnel
- (3) Faux service personnel, vendors, and so forth
- (4) Access by employees' smartphones, laptops, or tablets
- (5) Direct or indirect via home connection
- (6) Key-loggers or other infections of manufacturers' computers

C.5 Risk Mitigation Methods.

Any single method can be, and are, compromised. The use of multiple methods of protection reduce the likelihood of successful attacks.

C.5.1 Risk Assessment.

This includes, at a minimum, both the likelihood and the frequency of an identified risk or hazard. See the risk assessment method of *NFPA 70*, Article 708, for an example.

C.5.2 Motivations for Attackers.

Some motivations include simple mischief or curiosity (hackers); desire to commit arson; business disruption; corporate blackmail; masking criminal activity; disrupting a COPS site or sites; reprisal (disgruntled employees or former ones); foreign enemies, including terrorists; disrupting critical services; and damaging a competitor's reputation.

C.5.3 Protection Against Threats.

Some means of protection include password protection (needs minimum requirements), encryption, software firewall, and hardware firewall (separate processors for data access versus fire pump controlling).

C.5.4 Passwords.

Passwords are easily compromised; however, more comprehensive ones take longer.

C.5.5 Encryption.

Various methods include HTTPS (SSL), RC5, and public-private key encryption. Anything less than 128-bit encryption methods are easily cracked in minutes by a determined attacker.

C.5.6 Alternate Access.

GMS can be more secure than wired or wireless TCP/IP connections.

C.5.7 Risk Mitigation.

Other methods of risk mitigation include the following:

- (1) Use of nonstandard ports (only limited help since encryption is vital)
- (2) Use of call-back for dial-up links
- (3) Limiting IP access to specific IP addresses(s) (white list)
- (4) Limiting access to specific MAC address(s)
- (5) Protecting controller software (source code)
- (6) Limiting the number of copies
- (7) Limiting access to software (source or object code)
- (8) Effective encryption of code

C.6 Standardization of Parameters.

C.6.1 Message Format.

Allowed local network types are RS-232, RS-485, and Ethernet (TCP/IP). The preferred protocol for the fire pump controller is Modbus. Other protocols can be used, but no guidance is provided to standardize the register definitions for other protocols.

C.6.2 Modbus Register Definitions.

See [Table C.8.2.9.1\(a\)](#), [Table C.8.2.9.1\(b\)](#), and [Table C.8.2.9.1\(c\)](#) [Table C.9.2.10.1\(a\)](#) through [Table C.9.2.10.1\(m\)](#) for register definitions.

C.7 Remote Control.

Remote starting and/or stopping is prohibited.

C.8 Data Recording/Reporting System(s) Configuration.

C.8.1 Data In the Fire Pump Controller.

C.8.1.1

[Modbus registers have been designated in Table C.9.2.10.1\(a\) through Table C.9.2.10.1\(m\) for electric and diesel fire pump controllers and jockey pump controller information. The information includes pump room device ID, controller manufacturer ID, time and date stamp of latest update, dynamic real-time data, controller settings, alarms, historical data, optional data for controller manufacturer configurable, and event log.](#)

C.8.1.2

[The fire pump controller may be provided with a read-only connection to the Internet or other network and information downloaded from the FPC.](#)

C.8.1.3

[Data registers may be provided in both electric and diesel FPCs for performance data in accordance with Table C.9.2.10.1\(k\) and Table C.9.2.10.1\(l\) .](#)

C.8.1.3.1

[The controller may be arranged to record and store the performance data with a time stamp for a given flow point when so initiated by the operator.](#)

C.8.1.4

[The data in Table C.9.2.10.1\(b\) through Table C.9.2.10.1\(d\) may be continuously monitored by the controller and time stamped and recorded in an event log using Modbus protocol in Table C.9.2.10.1\(e\) , Table C.9.2.10.1\(f\) , and Table C.9.2.10.1\(g\) . An event record should be triggered on the following:](#)

- (1) [Events listed in Table C.9.2.10.1\(h\) , Table C.9.2.10.1\(i\) , and Table C.9.2.10.1\(j\)](#)
- (2) [Voltage and currents exceeding \$\Delta\$ percent change during pump run with \$\Delta\$ adjustable up to 5 percent](#)
- (3) [Pressure every hour](#)
- (4) [Pressure value exceeding \$\Delta\$ percent change with \$\Delta\$ adjustable up to 5 percent](#)

C.8.1.4.1

[An Ethernet serial communications network using a standard Web-based, text file format \(HTML\) may be used in lieu of the Modbus protocol in Table C.9.2.10.1\(e\) , Table C.9.2.10.1\(f\) , and Table C.9.2.10.1\(g\) . The data in the text files should be delimited.](#)

C.8.1.5

[Data registers may be provided for diesel engines and other pump room devices in accordance with Table C.9.2.10.1\(m\) .](#)

C.8.2 Data Outside of Fire Pump Controller.

C.8.2.1

This annex provides guidelines for monitoring additional test and maintenance for the fire pump, fire pump controller, jockey pump, jockey pump controller, and for associated fire pump equipment (backflow preventers, check valves, pressure control valves, and so forth).

C.8.2.2

This annex anticipates that the additional monitoring and reporting will occur outside of the fire pump controller on a data recording/reporting device.

C.8.2.3

Any control functions in the data recording/reporting device should not have the potential for preventing the fire pump from operating.

C.9 Recommended Requirements.**C.9.1**

Separate access protocols should be used for the following access levels:

- (1) Read-only access to performance information — Level 1
- (2) Access for statistical analysis by independent body — Level 2a
- (3) Access for manufacturer analysis — fire pump — Level 2b
- (4) Access for manufacturer analysis — controller — Level 2c
- (5) Access for remote testing — Level 2d with alarm to be triggered if the pump is not restored to automatic mode within 8 hours

C.9.2 Information Recorded on Controller.**C.9.2.1**

All recorded information should be protected in accordance with C.9.1 and/or other appropriate security to limit access to appropriate entities.

C.9.2.2

The equipment information shown in Table C.9.2.2 should be recorded on the controller at the time of installation and made accessible in accordance with Table C.9.2.2.

Table C.9.2.2 Recommended Equipment Data

<u>Data Accessible to</u>							<u>Index</u>
<u>Data</u>	<u>Information Source</u>	<u>Supervision Monitoring</u>	<u>Performance Monitoring</u>	<u>Fire Pump Manufacturer</u>	<u>Controller Manufacturer</u>	<u>Diesel Engine Manufacturer</u>	<u>3rd Party Analysis</u>
Fire pump manufacturer	M		X	X	X	X	
Fire pump type	M		X	X	X	X	
Rated flow	M		X	X	X	X	
Rated pressure	M		X	X	X	X	
Rated speed	M		X	X	X	X	
Horsepower	M		X	X	X	X	
Factory test pressure	M		X	X	X	X	
Net churn pressure	M		X	X	X	X	
Net 150% percent pressure	M		X	X	X	X	
Pump start pressure	M		X	X	X	X	
Pump shutoff pressure	M		X	X	X	X	
Design suction pressure	M	X	X	X	X	X	
Design discharge pressure	M	X	X	X	X	X	
Electric motor manufacturer	M		X	X	X	X	
Electric motor type	M		X	X	X	X	
Electric motor serial number	M		X	X	X	X	
Electric motor model number	M		X	X	X	X	
Electric motor date in service	M		X	X	X	X	
Nominal system voltage	M		X	X	X	X	

<u>Data Accessible to</u>							<u>Index</u>
<u>Data</u>	<u>Information Source</u>	<u>Supervision Monitoring</u>	<u>Performance Monitoring</u>	<u>Fire Pump Manufacturer</u>	<u>Controller Manufacturer</u>	<u>Diesel Engine Manufacturer</u>	<u>3rd Party Inspection Station Analysis Station Address</u>
Electric motor horsepower	M		X	X	X	X	
Electric motor rated speed	M		X	X	X	X	
Motor rated FLA at the system nominal voltage	M		X	X	X	X	
Motor service factor	M		X	X	X	X	
Motor starting code	M		X	X	X	X	
Diesel engine manufacturer	M		X	X	X	X	
Diesel engine serial number	M		X	X	X	X	
Diesel engine model number	M		X	X	X	X	
Diesel engine date in service	M		X	X	X	X	
Diesel engine horsepower	M		X	X	X	X	
Diesel engine rated speed	M		X	X	X	X	
Controller manufacturer	M		X	X	X	X	
Controller type	M		X	X	X	X	
Controller serial number	M		X	X	X	X	
Controller model number	M		X	X	X	X	
Controller date in service	M		X	X	X	X	
Jockey pump manufacturer	M		X	X	X	X	
Jockey pump type	M		X	X	X	X	
Jockey pump serial number	M		X	X	X	X	

<u>Data Accessible to</u>							<u>Index</u>
<u>Data</u>	<u>Information</u>	<u>Supervision</u>	<u>Performance</u>	<u>Fire Pump</u>	<u>Controller</u>	<u>Diesel</u>	<u>3rd</u>
	<u>Source</u>	<u>Monitoring</u>	<u>Monitoring</u>	<u>Manufacturer</u>	<u>Manufacturer</u>	<u>Engine</u>	<u>Anal</u>
						<u>Manufacturer</u>	<u>Sta</u>
Jockey pump model number	M		X	X	X	X	
Jockey pump date in service	M		X	X	X	X	
Jockey pump horsepower	M		X	X	X	X	
Jockey pump start pressure	M		X	X	X	X	
Jockey pump shutoff pressure	M		X	X	X	X	
Jockey pump controller manufacturer	M		X	X	X	X	
Jockey pump controller manufacturer	M		X	X	X	X	
Jockey pump controller type	M		X	X	X	X	
Jockey pump controller serial number	M		X	X	X	X	
Jockey pump controller model number	M		X	X	X	X	
Jockey pump controller date in service	M		X	X	X	X	
Maximum system flow demand (at pump discharge flange)	M		X	X	X	X	
Maximum system pressure demand (at pump discharge flange)	M		X	X	X	X	

M: Requires manual input at time of installation or test.

C.9.2.3

The information shown in Table C.9.2.3 should be continuously monitored by the controller and time stamped -stamp recorded every 24 hours and whenever the value changes more than 5 percent from the previously recorded value.

Table C.9.2.3 Recommended Continuously Monitored Data

<u>Data Accessible to</u>						
<u>Data</u>	<u>Information Source</u>	<u>Supervision Monitoring</u>	<u>Performance Monitoring</u>	<u>Fire Pump Manufacturer</u>	<u>Diesel Engine Manufacturer</u>	<u>Controller Manufacturer</u>
Fire pump power status	M	X	X	X	X	X
Fire pump running status	M	X	X	X	X	X
Fire pump test running	M	X	X	X	X	X
Suction pressure	A	X	X	X	X	X
System pressure	A	X	X	X	X	X
Water temperature in pump casing	A	X	X	X	X	X
Room temperature	A	X	X	X	X	X
Pump started	A	X	X	X	X	X
Pressure at pump start	A	X	X	X	X	X
Type of start (automatic demand, automatic test, manual)	A	X	X	X	X	X
Pump shutdown	A	X	X	X	X	X
System pressure at pump shutdown shutdown	A	X	X	X	X	X
Type of shutdown (automatic demand, automatic test, manual)	A	X	X	X	X	X
Loss of power	A	X	X	X	X	X
Transfer of power	A	X	X	X	X	X
Fuel tank level (low)	A	X	X		X	
Fuel tank level percentage filled	A	X	X		X	
Fuel maintenance system status	A	X	X		X	

A: Controller should access and record data automatically.

M: Requires manual input at time of installation or test.

C.9.2.4

The test information shown in Table C.9.2.4 should be recorded with a time stamp, test identifier stamp, and data set identifier stamp on the controller at the time by pushing a test record button on the controller.

Table C.9.2.4 Recommended Test Performance Data

<u>Data Accessible to</u>							<u>Index</u>
<u>Time-Stamped Data Multiple Data Sets¹</u>	<u>Information Source</u>	<u>Supervision Monitoring</u>	<u>Performance Monitoring</u>	<u>Fire Pump Manufacturer</u>	<u>Controller Manufacturer</u>	<u>Diesel Engine Manufacturer</u>	<u>3rd Party Stamp and Signature</u>
<u>Test Data</u>							
Test date	A		X	X	X	X	
Test reference identifier	A		X	X	X	X	
Data set reference identifier	A		X	X	X	X	
Suction pressure	A		X	X	X	X	
System pressure	A		X	X	X	X	
Water temperature in pump casing	A		X	X	X	X	
Room temperature	A		X	X	X	X	
Pump started	A		X	X	X	X	
Pressure at pump start	A		X	X	X	X	
Type of start (automatic demand, automatic test, manual)	A		X	X	X	X	
Pump shutdown	A		X	X	X	X	
System pressure at pump shutdown	A		X	X	X	X	
Type of shutdown (automatic demand, automatic test, manual)	A		X	X	X	X	
Loss of power	A		X	X	X	X	
Transfer of power	A		X	X	X	X	
Test date	A		X	X	X	X	

<u>Time-Stamped Data Multiple Data Sets¹</u>	<u>Information Source</u>	<u>Data Accessible to</u>					<u>Index 3rd Time Stamp and File Name</u>
		<u>Supervision Monitoring</u>	<u>Performance Monitoring</u>	<u>Fire Pump Manufacturer</u>	<u>Controller Manufacturer</u>	<u>Diesel Engine Manufacturer</u>	
RPM	A		X	X	X	X	
Voltage phase A – B	A		X	X	X	X	
Voltage phase B – C	A		X	X	X	X	
Voltage phase C – C	A		X	X	X	X	
Amperage phase 1	A		X	X	X	X	
Amperage phase 2	A		X	X	X	X	
Amperage phase 3	A		X	X	X	X	
Suction pressure	A		X	X	X	X	
Discharge pressure	A		X	X	X	X	
Net pressure	A		X	X	X	X	
Minimum transducer pressure	A		X	X	X	X	
Nozzle 1 coefficient	M		X	X	X	X	
Nozzle 1 size	M		X	X	X	X	
Nozzle 1 pitot	M/A		X	X	X	X	
Nozzle 2 coefficient	M		X	X	X	X	
Nozzle 2 size	M		X	X	X	X	
Nozzle 2 pitot	M/A		X	X	X	X	
Nozzle 3 coefficient	M		X	X	X	X	
Nozzle 3 size	M		X	X	X	X	
Nozzle 3 pitot	M/A		X	X	X	X	
Nozzle 4 coefficient	M		X	X	X	X	
Nozzle 4 size	M		X	X	X	X	
Nozzle 4 pitot	M/A		X	X	X	X	
Nozzle 5 coefficient	M		X	X	X	X	
Nozzle 5 size	M		X	X	X	X	
Nozzle 5 pitot	M/A		X	X	X	X	
Nozzle 6 coefficient	M		X	X	X	X	

<u>Time-Stamped Data Multiple Data Sets¹</u>	<u>Data Accessible to</u>						<u>Index 3rd Time Stamp and File Status</u>
	<u>Information Source</u>	<u>Supervision Monitoring</u>	<u>Performance Monitoring</u>	<u>Fire Pump Manufacturer</u>	<u>Controller Manufacturer</u>	<u>Diesel Engine Manufacturer</u>	
Nozzle 6 size	M		X	X	X	X	
Nozzle 6 pitot	M/A		X	X	X	X	
Fuel tank level	A		X			X	
RPM	A		X	X	X	X	
<u>Analysis Data</u>							
Flow through pump	C		X	X	X	X	
RPM adjusted net pressure	C		X	X	X	X	
RPM adjusted flow	C		X	X	X	X	
Percentage of factory certified curve	C		X	X	X	X	
Hours on diesel engine or electric motor	A		X	X	X	X	
Maximum system flow demand (at pump discharge flange)	M		X	X	X	X	
Maximum system pressure demand (at pump discharge flange)	M		X	X	X	X	
Pump passed initial test	M		X	X	X	X	
Pump could supply maximum system demand	M		X	X	X	X	
Pump was significantly impaired	M		X	X	X	X	

<u>Time-Stamped Data Multiple Data Sets¹</u>	<u>Data Accessible to</u>					<u>Index 3rd Time Stamp and File Status</u>
	<u>Information Source</u>	<u>Supervision Monitoring</u>	<u>Performance Monitoring</u>	<u>Fire Pump Manufacturer</u>	<u>Controller Manufacturer</u>	<u>Diesel Engine Manufacturer</u>
Pump was partially impaired	<u>M</u>		<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
Pump passed after adjustments	<u>M</u>		<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
Failure mode	<u>M</u>		<u>X</u>	<u>X²</u>	<u>X³</u>	<u>X⁴</u>
Explanation of failure	<u>M</u>		<u>X</u>	<u>X²</u>	<u>X³</u>	<u>X⁴</u>
Part replaced (1)	<u>M</u>		<u>X</u>	<u>X²</u>	<u>X³</u>	<u>X⁴</u>
Part replaced (2)	<u>M</u>		<u>X</u>	<u>X²</u>	<u>X³</u>	<u>X⁴</u>
Part replaced (3)	<u>M</u>		<u>X</u>	<u>X²</u>	<u>X³</u>	<u>X⁴</u>
Part replaced (4)	<u>M</u>		<u>X</u>	<u>X²</u>	<u>X³</u>	<u>X⁴</u>
Description of maintenance, repair, and/or part replacement	<u>M</u>		<u>X</u>	<u>X²</u>	<u>X³</u>	<u>X⁴</u>
Routine maintenance or repair	<u>M</u>		<u>X</u>	<u>X²</u>	<u>X³</u>	<u>X⁴</u>
Date and time repair completed	<u>M</u>		<u>X</u>	<u>X²</u>	<u>X³</u>	<u>X⁴</u>

A: Controller Recording device should access and record data automatically.

C: Calculated result.

M: Requires manual input at time of installation or test.

M/A: Probably requires manual input at time of installation or test but may can be able to Record Automatically record automatically.

Note: ¹ A "record data now" button or input from a tablet or computer is needed to record each set and/or subset of performance data along with the test and data set identifier. It is recommended to provide a minimum of five 5 data sets for constant speed pumps and seven 7 data sets for variable speed pumps.

² For failure modes and parts replacement that involve the fire pump or motor.

³ For failure modes and parts replacement that involve the fire pump controller.

⁴ For failure modes and parts replacement that involve the diesel engine driver.

C.9.2.5

The performance information shown in Table C.9.2.5 should be time stamped, test identifier stamped, and data set identifier stamped, and recorded on the controller at the completion of any test and made accessible per Table C.9.2.5.

Table C.9.2.5 Recommended Performance Data

Time Stamped Data Multiple Data Sets	Information Source	Data Accessible to					
		Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer	Independent 3rd-party statistical analysis	Discharge Engine Manufacturer
Flow through pump	M/A	-	X	X	X	X	X
RPM adjusted net pressure	A	-	X	X	X	X	X
RPM adjusted flow	A	-	X	X	X	X	X
% of factory certified curve	A	-	X	X	X	X	X
Hours on diesel engine or electric motor	A	-	X	X	X	X	X
Maximum system flow demand (at pump discharge flange)	M	-	X	X	X	X	X
Maximum system pressure demand (at pump discharge flange)	M	-	X	X	X	X	X
Pump passed initial test	M	-	X	X	X	X	X
Pump could supply maximum system demand	M	-	X	X	X	X	X
Pump was significantly impaired	M	-	X	X	X	X	X
Pump was partially impaired	M	-	X	X	X	X	X
Pump passed after adjustments	M	-	X	X	X	X	X

Time Stamped Data Multiple Data-Sets	Information Source	Data Accessible to					
		Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer	Independent 3rd-party statistical analysis	Diesel Engine Manufacturer
Failure mode	M	-	X	X ^a	X ^b	X	X
Explanation of failure	M	-	X	X ^a	X ^b	X	X
Part replaced (1)	M	-	X	X ^a	X ^b	X	X
Part replaced (2)	M	-	X	X ^a	X ^b	X	X
Part replaced (3)	M	-	X	X ^a	X ^b	X	X
Part replaced (4)	M	-	X	X ^a	X ^b	X	X
Description of maintenance, repair, and/or part replacement	M	-	X	X ^a	X ^b	X	X
Routine maintenance or repair	M	-	X	X ^a	X ^b	X	X
Date & time repair completed	-	-	-	-	-	-	-

A: Controller should access and record data automatically.

M: Requires manual input at time of installation or test.

M/A: Probably requires manual input at time of installation or test but may be able to Record Automatically.

^a For failure modes and parts replacement that involve the fire pump or motor.

^b For failure modes and parts replacement that involve the fire pump controller.

^c For failure modes and parts replacement that involve the diesel engine driver.

Note: A "record data now button" or input from a tablet or computer is needed to record each set and/or subset of performance data along with the test and data set identifier. It is recommended to provide for a minimum of 5 data sets for constant speed pumps and 7 data sets for variable speed pumps.

C.9.2.5

The test information shown in Table C.9.2.5 should be recorded with a time stamp and maintenance/repair identifier on the controller at the time of the maintenance.

Table C.9.2.5 Recommended Maintenance Data

<u>Data Accessible to</u>						
<u>Data</u>	<u>Information Source</u>	<u>Supervision Monitoring</u>	<u>Performance Monitoring</u>	<u>Fire Pump Manufacturer</u>	<u>Controller Manufacturer</u>	<u>Diesel Engine Manufacturer</u>
Date of maintenance/repair	M		X	X	X	X
Maintenance/repair identifier	M		X	X	X	X
Pump could supply maximum system demand before maintenance/repair.	M		X	X	X	X
Pump was significantly impaired.	M		X	X	X	X
Pump was partially impaired.	M		X	X	X	X
Failure mode	M		X	X ^a 1	X ^b 2	X ^c 3
Explanation of failure	M		X	X ^a 1	X ^b 2	X ^c 3
Part replaced (1)	M		X	X ^a 1	X ^b 2	X ^c 3
Part replaced (2)	M		X	X ^a 1	X ^b 2	X ^c 3
Part replaced (3)	M		X	X ^a 1	X ^b 2	X ^c 3
Part replaced (4)	M		X	X ^a 1	X ^b 2	X ^c 3
Description of maintenance/repair	M		X	X ^a 1	X ^b 2	X ^c 3
Routine maintenance or repair	M		X	X ^a 1	X ^b 2	X ^c 3
Date & and time repair completed	M		X	X	X	X
Fuel tank level	A		X			X
Fuel maintenance system status	A		X			X

A: Controller Recording device should access and record data automatically.

M: Requires manual input at time of installation or test.

Note: A "record data now" button or input from a tablet or computer is needed to record each set and/or subset of performance data.

^a 1 For failure modes and parts replacement that involve the fire pump or motor.

^b 2 For failure modes and parts replacement that involve the fire pump controller.

^c 3 For failure modes and parts replacement that involve the diesel engine driver.

C.9.2.6

Stand-alone pump room data recording devices should be limited to one-way (download only) communication with the fire pump controller.

C.9.2.7

Stand-alone pump room data recording devices should not be directly collected to sensing devices that report to the controller (i.e., the same transducer should not report to both the controller and a data recording device).

C.9.2.8

As a recommended minimum, failure modes should be encoded (selectable on a pop-up menu) on the controller. The following failure modes are provided to improve standardization and help provide consistency in reporting:

- (1) Water supply inadequate
- (2) Electric power supply failure
- (3) Pipe, fitting, and/or valve failure
- (4) Controller failure
- (5) Pump running condition failure
- (6) Pump running operation failure
- (7) Relief valve failure
- (8) Diesel engine failure
- (9) Diesel engine system failure
- (10) Component failure (identify component)
- (11) Other (provide comment)

C.9.2.9

As a recommended minimum, the components should be encoded (selectable on a pop-up menu) on the controller. The following components list is provided to improve standardization and help provide consistency in reporting:

- (1) Impeller
- (2) Shaft
- (3) Bearings
- (4) Electric motor
- (5) Diesel engine
- (6) Batteries
- (7) Controller
- (8) Circuit board
- (9) Relief valve
- (10) Check valve
- (11) Control valve

C.9.2.10 Modbus Register Addresses.

C.9.2.10.1

Table C.9.2.10.1(a) through ~~Table C.9.2.10.1(d)~~ Table C.9.2.10.1(m) are recommended Modbus register usage for controllers.

Figure C.9.2.10.1 is an example of a pump room device identification.

Figure C.9.2.10.1 Example of a Pump Room Device Identification.

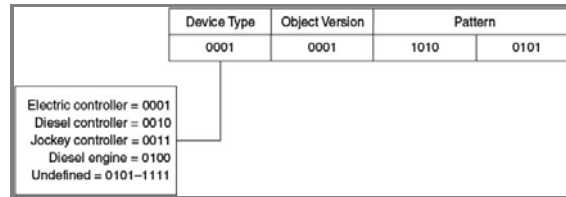


Table C.9.2.10.1(a) Pump Room Data Storage Structure

Device	Modbus Registers	Number of Registers	NFPA 20-2019 Table
Pump room data register assignments (42001–42999)			
Electric controller	42001–42280	280	Table C.9.2.10.1(b)
Diesel controller	42001–42280	280	Table C.9.2.10.1(c)
Undefined	42281–42290	10	
Jockey controller	42291–42420	130	Table C.9.2.10.1(d)
Undefined	42421–42430	10	
Electric event log	42431–42460	30	Table C.9.2.10.1(e)
Diesel event log	42431–42460	30	Table C.9.2.10.1(f)
Jockey event log	42461–42490	30	Table C.9.2.10.1(g)
Event log IDs			Tables C.9.2.10.1(h), (i), (j)
Undefined	42491–42500	10	
Pump performance curves	42501–42920	420	Table C.9.2.10.1(k)
Pump performance parameters			Table C.9.2.10.1(l)
Undefined	42921–42999	80	
Pump room data register assignments (43001–43999)			
Diesel engine	43001–43200	200	Table C.9.2.10.1(m)
Undefined	43201–43999	800	

Note: Electric and diesel controller data and event logs share the same registers.

Table C.9.2.10.1(b) Electric Fire Pump Controller

Modbus Register (42001–42290)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
		Pump Room Device					
42001		Pump room device ID			RO		See Note 2
42002–42010		Undefined			RO		
42011–42020		Manufacturer name			RO	ASCII Text	20 characters
42021–42030		Basic model			RO	ASCII Text	20 characters
42031–42040		Controller type			RO	ASCII Text	20 characters
42041–42050		Serial number			RO	ASCII Text	20 characters

<u>Modbus Register (42001–42290)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
<u>42051–42060</u>		<u>Software version</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
		<u>Time and Date Stamp</u>					
<u>42061–42064</u>		<u>Date and time</u>	<u>milliseconds</u>		<u>RO</u>	<u>64-bit binary number</u>	<u>See Note 3</u>
<u>42065–42070</u>		<u>Undefined</u>			<u>RO</u>		
		<u>Alarms</u>					
<u>42071</u>	<u>D0</u>	<u>AC power available</u>			<u>RO</u>	<u>Boolean</u>	<u>See Note 4</u>
	<u>D1</u>	<u>Audible alarm (common alarm)</u>			<u>RO</u>	<u>Bool</u>	
	<u>D2</u>	<u>Phase failure alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D3</u>	<u>Phase reversal alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D4</u>	<u>Motor running alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D5</u>	<u>Motor single phasing alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D6</u>	<u>Motor overload alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D7</u>	<u>Failure to start alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D8</u>	<u>Circuit breaker tripped alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D9</u>	<u>AC line under voltage alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D10</u>	<u>AC line over voltage alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D11</u>	<u>AC line under frequency alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D12</u>	<u>AC line over frequency alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D13</u>	<u>Low pump room temperature alarm</u>		<u>X</u>	<u>RO</u>	<u>Bool</u>	
	<u>D14</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D15</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
<u>42072</u>	<u>D0</u>	<u>Pressure start demand (low pressure)</u>			<u>RO</u>	<u>Bool</u>	
	<u>D1</u>	<u>Remote start demand</u>			<u>RO</u>	<u>Bool</u>	
	<u>D2</u>	<u>Deluge start demand</u>			<u>RO</u>	<u>Bool</u>	
	<u>D3</u>	<u>Weekly test start demand</u>			<u>RO</u>	<u>Bool</u>	

<u>Modbus Register (42001–42290)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
	D4	Local start pushbutton demand			RO	Bool	
	D5	Mechanical operator start demand (emergency run)			RO	Bool	
	D6	Lockout active (interlock)			RO	Bool	
	D7	Low discharge pressure alarm		X	RO	Bool	
	D8	Low suction pressure alarm		X	RO	Bool	
	D9	Low suction pressure shutdown active		X	RO	Bool	
	D10	System overpressure alarm			RO	Bool	
	D11	Pressure transducer fault			RO	Bool	
	D12	Pressure transducer test ok			RO	Bool	
	D13	Weekly/monthly test setup error			RO	Bool	
	D14	Weekly test demand active			RO	Bool	
	D15	Undefined			RO	Bool	
42073	D0	Transfer switch in normal position			RO	Bool	
	D1	Transfer switch in emergency position			RO	Bool	
	D2	Transfer switch normal power available		X	RO	Bool	
	D3	Transfer switch emergency power available		X	RO	Bool	
	D4	Emergency isolation switch open alarm			RO	Bool	
	D5	Generator engine start signal			RO	Bool	
	D6	Load shed active		X	RO	Bool	
	D7	Undefined			RO	Bool	
	D8	VFD ready			RO	Bool	
	D9	VFD failure alarm			RO	Bool	

<u>Modbus Register (42001–42290)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
	D10	VFD forward command active		X	RO	Bool	
	D11	VFD reverse command active		X	RO	Bool	
	D12	Controller in bypass, soft start/VFD only			RO	Bool	
	D13	Undefined			RO	Bool	
	D14	Undefined			RO	Bool	
	D15	Undefined			RO	Bool	
42074	D0	Minimum run timing active			RO	Bool	
	D1	Minimum run timer timed out			RO	Bool	
	D2	Sequential delay timing active			RO	Bool	
	D3	Acceleration delay timing active		X	RO	Bool	
	D4	High zone delay timing active		X	RO	Bool	
	D5	Restart delay timing active		X	RO	Bool	
	D6	Locked-rotor trip timing active		X	RO	Bool	
	D7	Load shed delay timing active		X	RO	Bool	
	D8	Undefined			RO	Bool	
	D9	Undefined			RO	Bool	
	D10	Undefined			RO	Bool	
	D11	Undefined			RO	Bool	
	D12	Undefined			RO	Bool	
	D13	Undefined			RO	Bool	
	D14	Undefined			RO	Bool	
	D15	Undefined			RO	Bool	
42075–42090		Undefined			RO		
		Dynamic Real-time Data					
42091		AC volts lines 1–2	V		RO	0–60000	0.1·Raw
42092		AC volts lines 2–3	V		RO	0–60000	0.1·Raw
42093		AC volts lines 3–1	V		RO	0–60000	0.1·Raw
42094		AC amps line 1	A		RO	0–50000	0.1·Raw
42095		AC amps line 2	A		RO	0–50000	0.1·Raw
42096		AC amps line 3	A		RO	0–50000	0.1·Raw
42097		Line frequency	Hz		RO	0–1000	0.1·Raw
42098–42100		Undefined					

<u>Modbus Register (42001–42290)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
<u>42101</u>		Pump discharge pressure (system pressure)	psi/bar/kPa		RO	0–6000	0.1·Raw
<u>42102</u>		Suction pressure	psi/bar/kPa	X	RO	0–6000	0.1·Raw
<u>42103</u>		Net pressure = system – suction	psi/bar/kPa	X	RO	0–6000	0.1·Raw
<u>42104</u>		System pressure at pump shutdown	psi/bar/kPa		RO	0–10000	0.1·Raw
<u>42105</u>		Flow	gpm/L/min	X	RO	0–50000	
<u>42106</u>		Motor speed	rpm	X	RO	0–4000	
<u>42107</u>		VFD motor speed	Hz	X	RO	0–1000	0.1·Raw
<u>42108–42110</u>		Undefined					
<u>42111</u>		Water temperature, pump casing	°F/°C	X	RO	0–1000	0.1·Raw
<u>42112</u>		Pump room temperature	°F/°C	X	RO	0–1000	0.1·Raw
<u>42113–42114</u>		Storage tank level	gal	X	RO	0–10,000,0000	
<u>42115–42130</u>		Undefined					
		Controller Settings					
<u>42131</u>		Pressure start	psi/bar/kPa		RO	0–600	
<u>42132</u>		Pressure stop	psi/bar/kPa		RO	0–600	
<u>42133</u>		Manual stop only			RO	0 = Automatic, 1 = Manual stop only	
<u>42134</u>		Minimum run timer (running period timer)	sec		RO	0–6000	
<u>42135</u>		Sequential timer	sec		RO	0–6000	
<u>42136</u>		Weekly test timer, day	day		RO	0–6, Sunday = 0	
<u>42137</u>		Weekly test timer, hr	hr			0–23	
<u>42138</u>		Weekly test timer, min	min			0–59	
<u>42139</u>		Pressure units			RO	0 = psi, 1 = bar, 2 = kPa	
<u>42140</u>		Flow units		X	RO	0 = gpm, 1 = L/min	
<u>42141</u>		Temperature units		X	RO	0 = °F, 1 = °C	
<u>42142–42150</u>		Undefined					
		Historical Data					
<u>42151</u>		Maximum starting current line A	A	X	RO	0–30000	0.1·Raw
<u>42152</u>		Maximum starting current line B	A	X	RO	0–30000	0.1·Raw

<u>Modbus Register (42001–42290)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
42153		Maximum starting current line C	A	X	RO	0–30000	0.1·Raw
42154		Maximum run current line A	A	X	RO	0–50000	0.1·Raw
42155		Maximum run current line B	A	X	RO	0–50000	0.1·Raw
42156		Maximum run current line C	A	X	RO	0–50000	0.1·Raw
42157		Minimum ac volts idle lines 1–2	V	X	RO	0–1000	
42158		Minimum ac volts idle lines 2–3	V	X	RO	0–1000	
42159		Minimum ac volts idle lines 3–1	V	X	RO	0–1000	
42160		Maximum ac volts idle lines 1–2	V	X	RO	0–1000	
42161		Maximum ac volts idle lines 2–3	V	X	RO	0–1000	
42162		Maximum ac volts idle lines 3–1	V	X	RO	0–1000	
42163		Minimum ac volts starting lines 1–2	V	X	RO	0–60000	0.1·Raw
42164		Minimum ac volts starting lines 2–3	V	X	RO	0–60000	0.1·Raw
42165		Minimum ac volts starting lines 3–1	V	X	RO	0–60000	0.1·Raw
42166		Minimum ac volts running lines 1–2	V	X	RO	0–60000	0.1·Raw
42167		Minimum ac volts running lines 2–3	V	X	RO	0–60000	0.1·Raw
42168		Minimum ac volts running lines 3–1	V	X	RO	0–60000	0.1·Raw
42169		Maximum ac volts running lines 1–2	V	X	RO	0–60000	0.1·Raw
42170		Maximum ac volts running lines 2–3	V	X	RO	0–60000	0.1·Raw
42171		Maximum ac volts running lines 3–1	V	X	RO	0–60000	0.1·Raw
42172		Minimum frequency	Hz	X	RO	0–1000	0.1·Raw
42173		Maximum frequency	Hz	X	RO	0–1000	0.1·Raw
42174		Last locked rotor ac amps line 1	A	X	RO	0–50000	
42175		Last locked rotor ac amps line 2	A	X	RO	0–50000	
42176		Last locked rotor ac amps line 3	A	X	RO	0–50000	
42177–42178		Undefined					

<u>Modbus Register (42001–42290)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
42179		Minimum system pressure	psi/bar/kPa	X	RO	0–6000	0.1·Raw
42180		Maximum system pressure	psi/bar/kPa	X	RO	0–6000	0.1·Raw
42181		Counter, number of starts			RO	0–10000	
42182		Counter, number of calls to start			RO	0–10000	
42183		Total run time, hours	hr		RO	0–59999	
42184		Total run time, minutes	min		RO	0–59	
42185		Total run time, seconds	sec		RO	0–59	
42186		Pump last run time, minutes	min		RO	0–59	
42187		Pump last run time, seconds	sec		RO	0–59	
42188		Total controller power on time, hours	hr		RO	0–59999	
42189		Total controller power on time, minutes	min		RO	0–59	
42190		Total controller power on time, seconds	sec		RO	0–59	
42191		Hours since last run	hr		RO	0–59999	
42192		Hours since last solenoid drain valve test	hr		RO	0–59999	
42193–42196		Last pump start, date and time	milliseconds		RO	64-bit binary number	See Note 3
42197–42202		Last phase failure, date and time	milliseconds		RO	64-bit binary number	See Note 3
42203–42206		Last phase reversal, date and time	milliseconds		RO	64-bit binary number	See Note 3
42207–42210		Last locked rotor trip, date and time	milliseconds		RO	64-bit binary number	See Note 3
42211–42230		Undefined					
42231–42280		Manufacturer specific				50 registers	
42281–42290		Undefined					

Notes:

(1) A register value of FFFFH indicates data are not available.

(2) See Figure C.9.2.10.1 for an example of pump room device identification.

(3) Date and time stamp uses 64-bit Unix time stamp (Epoch) per ISO 8601, *Data Elements and Interchange Formats — Information Interchange — Representation of Dates and Times*. For example, 2017-09-12T14:00:00.0001 is a date and time stamp.

Table C.9.2.10.1(c) Diesel Fire Pump Controller

<u>Modbus Register (42001–42280)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
		<u>Pump Room Device</u>					
42001		Pump room device ID			RO		See Note 2
42002–42010		Undefined			RO		
42011–42020		Manufacturer name			RO	ASCII Text	20 characters
42021–42030		Basic model			RO	ASCII Text	20 characters
42031–42040		Controller type			RO	ASCII Text	20 characters
42041–42050		Serial number			RO	ASCII Text	20 characters
42051–42060		Software version			RO	ASCII Text	20 characters
		<u>Time and Date Stamp</u>					
42061–42064		Date and time	milliseconds		RO	64-bit binary number	See Note 3
42065–42070		Undefined			RO		
		<u>Alarms</u>					
42071	D0	AC power fail alarm			RO	Boolean	
	D1	Audible alarm (common)			RO	Bool	
	D2	Control switch in auto			RO	Bool	
	D3	Control switch in manual			RO	Bool	
	D4	Engine running			RO	Bool	
	D5	Crank on battery #1 active			RO	Bool	
	D6	Crank on battery #2 active			RO	Bool	
	D7	Crank resting active			RO	Bool	
	D8	Failure-to-start alarm			RO	Bool	
	D9	System trouble #1 alarm			RO	Bool	
	D10	System trouble #2 alarm			RO	Bool	
	D11	AC power fail start alarm			RO	Bool	

<u>Modbus Register</u> <u>(42001–42280)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional</u> <u>(X)</u>	<u>Write</u>	<u>Range (See</u> <u>Note 1)</u>	<u>Scaling</u> <u>and</u> <u>Notes</u>
	D12	Start contactor #1 fail alarm			RO	Bool	
	D13	Start contactor #2 fail alarm			RO	Bool	
	D14	Pump trouble group alarm			RO	Bool	
	D15	Undefined			RO	Bool	
42072	D0	Pressure start demand (low pressure)			RO	Bool	
	D1	Remote start demand			RO	Bool	
	D2	Deluge start demand			RO	Bool	
	D3	Weekly test start demand			RO	Bool	
	D4	Lockout active (interlock)			RO	Bool	
	D5	Low discharge pressure alarm			RO	Bool	
	D6	Low suction pressure alarm			RO	Bool	
	D7	Low suction pressure shutdown active			RO	Bool	
	D8	System overpressure alarm			RO	Bool	
	D9	Pressure transducer fault			RO	Bool	
	D10	Pressure transducer test OK			RO	Bool	
	D11	Weekly/monthly test setup error			RO	Bool	
	D12	Weekly test demand active			RO	Bool	
	D13	Undefined			RO	Bool	
	D14	Undefined			RO	Bool	
	D15	Undefined			RO	Bool	
42073	D0	Battery #1 OK			RO	Bool	
	D1	Battery #2 OK			RO	Bool	
	D2	Battery #1 failure alarm			RO	Bool	
	D3	Battery #2 failure alarm			RO	Bool	
	D4	Charger #1 fail alarm			RO	Bool	
	D5	Charger #2 fail alarm			RO	Bool	

<u>Modbus Register (42001–42280)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
	D6	Battery #1 in equalize		X	RO	Bool	
	D7	Battery #2 in equalize		X	RO	Bool	
	D8	Battery #1 over voltage alarm			RO	Bool	
	D9	Battery #2 over voltage alarm			RO	Bool	
	D10	Undefined			RO	Bool	
	D11	Undefined			RO	Bool	
	D12	Undefined			RO	Bool	
	D13	Undefined			RO	Bool	
	D14	Undefined			RO	Bool	
	D15	Undefined			RO	Bool	
42074	D0	Overspeed alarm			RO	Bool	
	D1	High engine coolant water temp alarm			RO	Bool	
	D2	Low oil pressure alarm			RO	Bool	
	D3	Low pump room temperature alarm		X	RO	Bool	
	D4	High reservoir level alarm		X	RO	Bool	
	D5	Low reservoir level alarm		X	RO	Bool	
	D6	Fuel tank level low alarm			RO	Bool	
	D7	Fuel tank level high alarm		X	RO	Bool	
	D8	Fuel tank spill alarm			RO	Bool	
	D9	Fuel maintenance needed			RO	Bool	
	D10	Relief valve open			RO	Bool	
	D11	Low air pressure alarm (air-starting engines)			RO	Bool	
	D12	Undefined			RO	Bool	
	D13	Undefined			RO	Bool	
	D14	Undefined			RO	Bool	
	D15	Undefined			RO	Bool	
42075	D0	Electronic control module switch (ECMS) engine terminal 301			RO	Bool	

<u>Modbus Register</u> <u>(42001–42280)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional</u> <u>(X)</u>	<u>Write</u>	<u>Range (See</u> <u>Note 1)</u>	<u>Scaling</u> <u>and</u> <u>Notes</u>
	D1	Fuel injection malfunction (FIM) engine terminal 302			RO	Bool	
	D2	Electronic control module warning (ECMW) engine terminal 303			RO	Bool	
	D3	Electronic control module failure (ECMF) engine terminal 304			RO	Bool	
	D4	Low suction pressure engine option (LSP) engine terminal 305			RO	Bool	
	D5	High raw water temperature (HRT) engine terminal 310			RO	Bool	
	D6	Low raw water flow (LRF) engine terminal 311			RO	Bool	
	D7	Low engine temperature (LET) engine terminal 312			RO	Bool	
	D8	Undefined			RO	Bool	
	D9	Undefined			RO	Bool	
	D10	Undefined			RO	Bool	
	D11	Undefined			RO	Bool	
	D12	Undefined			RO	Bool	
	D13	Undefined			RO	Bool	
	D14	Undefined			RO	Bool	
	D15	Undefined			RO	Bool	
42076	D0	Minimum run timing active			RO	Bool	
	D1	Minimum run timed out			RO	Bool	
	D2	Sequence delay timing active			RO	Bool	
	D3	High zone delay timing active		X	RO	Bool	
	D4	Power fail start delay timing active		X	RO	Bool	
	D5	Undefined			RO	Bool	
	D6	Undefined			RO	Bool	
	D7	Undefined			RO	Bool	

<u>Modbus Register (42001–42280)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
	D8	Undefined			RO	Bool	
	D9	Undefined			RO	Bool	
	D10	Undefined			RO	Bool	
	D11	Undefined			RO	Bool	
	D12	Undefined			RO	Bool	
	D13	Undefined			RO	Bool	
	D14	Undefined			RO	Bool	
	D15	Undefined			RO	Bool	
42077–42090		Undefined					
		Dynamic Real-Time Data					
42091		Battery #1 volts	V		RO	0–5000	0.01·Raw
42092		Battery #2 volts	V		RO	0–5000	0.01·Raw
42093		Charger 1 ac power input	V		RO	0–3000	
42094		Battery #1 amps	A		RO	0–5000	0.01·Raw
42095		Battery #2 amps	A		RO	0–5000	0.01·Raw
42096		Charger 2 ac power input	V		RO	0–3000	
40097–42100		Undefined					
42101		Pump discharge pressure (system pressure)	psi/bar/kPa		RO	0–6000	0.1·Raw
42102		Suction pressure	psi/bar/kPa	X	RO	0–6000	0.1·Raw
42103		Net pressure = system – suction	psi/bar/kPa	X	RO	0–6000	0.1·Raw
42104		System pressure at pump shutdown	psi/bar/kPa		RO	0–1000	0.1·Raw
42105		Flow	gpm/L/min	X		0–50000	
42106		Engine speed	rpm	X		0–4000	
42107–42110		Undefined					
42111		Water temperature, pump casing	°F/°C	X	RO	0–1000	0.1·Raw
42112		Pump room temperature	°F/°C	X	RO	0–1000	0.1·Raw
42113–42114		Storage tank level	gal	X	RO	0–10,000,000	
42115		Fuel tank level	gal	X	RO	0–2000	
42116–42130		Undefined					
		Controller Settings					
42131		Pressure start	psi/bar/kPa		RO	0–600	
42132		Pressure stop	psi/bar/kPa		RO	0–600	
42133		Manual stop only			RO	0 = Automatic, 1 = Manual stop only	

<u>Modbus Register (42001–42280)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
42134		Minimum run timer (running period timer)	sec		RO	0–6000	
42135		Sequential timer	sec		RO	0–6000	
42136		Weekly test timer, day	day		RO	0–6, Sunday = 0	
42137		Weekly test timer, hr	hr			0–23	
42138		Weekly test timer, min	min			0–59	
42139		Pressure units			RO	0 = psi, 1 = bar, 2 = kPa	
42140		Flow units		X	RO	0 = gpm, 1 = L/min	
42141		Temperature units		X	RO	0 = °F, 1 = °C	
42142–42150		Undefined					
		Historical Data					
42151		Minimum battery #1 voltage	V		RO	0–5000	0.01·Raw
42152		Minimum battery #2 voltage	V		RO	0–5000	0.01·Raw
42153		Maximum battery #1 voltage	V		RO	0–5000	0.01·Raw
42154		Maximum battery #2 voltage	V		RO	0–5000	0.01·Raw
42155		Minimum battery #1 amps	A		RO	0–1500	0.1·Raw
42156		Minimum battery #2 amps	A		RO	0–1500	0.1·Raw
42157		Maximum battery #1 amps	A		RO	0–1500	0.1·Raw
42158		Maximum battery #2 amps	A		RO	0–1500	0.1·Raw
42159–42178		Undefined					
42179		Minimum system pressure	psi/bar/kPa		RO	0–6000	0.1·Raw
42180		Maximum system pressure	psi/bar/kPa		RO	0–6000	0.1·Raw
42181		Counter, number of starts			RO	0–10000	
42182		Counter, number of calls to start			RO	0–10000	
42183		Total run time, hr	hr		RO	0–59999	
42184		Total run time, min	min		RO	0–59	
42185		Total run time, sec	sec		RO	0–59	
42186		Pump last run time, min	min		RO	0–59	

<u>Modbus Register (42001–42280)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
42187		Pump last run time, sec	sec		RO	0–59	
42188		Total controller power on time, hr	hr		RO	0–59999	
42189		Total controller power on time, min	min		RO	0–59	
42190		Total controller power on time, sec	sec		RO	0–59	
42191		Hours since last run	hr		RO	0–59999	
42192		Hours since last solenoid drain valve test	hr		RO	0–59999	
42193–42196		Last engine start, date and time	milliseconds		RO	64-bit binary number	See Note 3
42197–42200		Last engine overspeed, date and time	milliseconds		RO	64-bit binary number	See Note 3
42201–42204		Last charger failure, date and time	milliseconds		RO	64-bit binary number	See Note 3
42205–42208		Last battery trouble, date and time	milliseconds		RO	64-bit binary number	See Note 3
42209–42212		Last low fuel level, date and time	milliseconds		RO	64-bit binary number	See Note 3
42213–42216		Last engine high temperature, date and time	milliseconds		RO	64-bit binary number	See Note 3
42217–42220		Last engine low pressure, date and time	milliseconds		RO	64-bit binary number	See Note 3
42221–42230		Undefined					
42231–42280		Manufacturer specific				50 registers	
42281–42290		Undefined					

Notes:

(1) A register value of FFFFH indicates data are not available.

(2) See Figure C.9.2.10.1 for an example of pump room device identification.

(3) Date and time stamp uses 64-bit Unix time stamp (Epoch) per ISO 8601, *Data Elements and Interchange Formats — Information Interchange — Representation of Dates and Times*. For example, 2017-09-12T14:00:00.0001 is a date and time stamp.

Table C.9.2.10.1(d) Jockey Pump Controller

<u>Modbus Register (42291–42430)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
		Pump Room Device					

<u>Modbus Register (42291–42430)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
<u>42291</u>		<u>Pump room device ID</u>			<u>RO</u>		<u>See Note 2</u>
<u>42292–42300</u>		<u>Undefined</u>			<u>RO</u>		
<u>42301–42310</u>		<u>Manufacturer name</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
<u>42351–42320</u>		<u>Basic model</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
<u>42361–42330</u>		<u>Controller type</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
<u>42371–42340</u>		<u>Serial number</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
<u>42381–42350</u>		<u>Software version</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
		<u>Time and Date Stamp</u>					
<u>42351–42354</u>		<u>Date and time</u>	<u>milliseconds</u>		<u>RO</u>	<u>64-bit binary number</u>	<u>See Note 3</u>
<u>42355–42360</u>		<u>Undefined</u>					
		<u>Alarms</u>					
<u>42361</u>	<u>D0</u>	<u>Power available</u>			<u>RO</u>	<u>Boolean</u>	
	<u>D1</u>	<u>Pump running</u>			<u>RO</u>	<u>Bool</u>	
	<u>D2</u>	<u>Failure-to-start alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D3</u>	<u>Common alarm</u>			<u>RO</u>	<u>Bool</u>	
	<u>D4</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D5</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D6</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D7</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D8</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D9</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D10</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D11</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D12</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D13</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D14</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
	<u>D15</u>	<u>Undefined</u>			<u>RO</u>	<u>Bool</u>	
<u>42362–42370</u>		<u>Undefined</u>					
		<u>Dynamic Real- Time Data</u>					
<u>42371</u>		<u>Pump discharge pressure (system pressure)</u>	<u>psi/bar/kPa</u>		<u>RO</u>	<u>0–6000</u>	<u>0.1·Raw</u>
<u>42372–42380</u>		<u>Undefined</u>					
		<u>Controller Settings</u>					

Modbus Register (42291–42430)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
42381		Pressure start	psi/bar/kPa		RO	0–600	
42382		Pressure stop	psi/bar/kPa		RO	0–600	
42383		Main switch in auto			RO	1 = Switch in AUTO	
42384		Main switch in manual			RO	1 = Switch in MANUAL	
42385		Main switch in off			RO	1 = Switch in OFF	
42386		Pressure units			RO	0 = psi, 1 = bar, 2 = kPa	
42387–42390		Undefined					
		Historical Data					
42391		Counter, number of starts			RO	0–10000	
42392		Total jockey run time, hr	hr		RO	0–59999	
42393		Total jockey run time, min	min		RO	0–59	
42394–42400		Undefined					
42401–42420		Manufacturer specific				20 registers	
42421–42430		Undefined					

Notes:

(1) A register value of FFFFH indicates data are not available.

(2) See Figure C.9.2.10.1 for an example of pump room device identification.

(3) Date and time stamp uses 64-bit Unix time stamp (Epoch) per ISO 8601, *Data Elements and Interchange Formats — Information Interchange — Representation of Dates and Times*. For example, 2017-09-12T14:00:00.0001 is a date and time stamp.

Table C.9.2.10.1(e) Event Log Data Access — Electric Controller

Modbus Register (42431–42460)	Description	Units	Write	Range	Scaling and Notes
42431	Rewind event log oldest		RO		Read register to rewind
42432	Rewind event log 1 day ago		RO		Read register to rewind
42433	Rewind event log 7 days ago		RO		Read register to rewind
42434	Rewind event log 30 days ago		RO		Read register to rewind
42435	Rewind event log 60 days ago		RO		Read register to rewind
42436	Rewind event log 90 days ago		RO		Read register to rewind
42437–42440	Undefined				
42441–42443	Date and time stamp	milliseconds	RO	64-bit binary number	See Note 2

<u>Modbus Register (42431–42460)</u>	<u>Description</u>	<u>Units</u>	<u>Write</u>	<u>Range</u>	<u>Scaling and Notes</u>
42444	Event ID		RO	1–250	See ID Table C.9.2.10.1(h) Event ID = 0 is EOF
42445	Event value1	psi/bar/kPa	RO	0–6000	0.1·Raw
42446	Flags, event value1				
42447–42450	Undefined				
42451–42460	Manufacturer configurable			10 registers	

Notes:

(1) A register value of FFFFH indicates data are not available.

(2) See Figure C.9.2.10.1 for an example of pump room device identification.

(3) Date and time stamp uses 64-bit Unix time stamp (Epoch) per ISO 8601, *Data Elements and Interchange Formats — Information Interchange — Representation of Dates and Times*. For example, 2017-09-12T14:00:00.0001 is a date and time stamp.

Table C.9.2.10.1(f) Event Log Data Access — Diesel Controller

<u>Modbus Register (42431–42460)</u>	<u>Description</u>	<u>Units</u>	<u>Write</u>	<u>Range</u>	<u>Scaling and Notes</u>
42431	Rewind event log oldest		RO		Read register to rewind
42432	Rewind event log 1 day ago		RO		Read register to rewind
42433	Rewind event log 7 days ago		RO		Read register to rewind
42434	Rewind event log 30 days ago		RO		Read register to rewind
42435	Rewind event log 60 days ago		RO		Read register to rewind
42436	Rewind event log 90 days ago		RO		Read register to rewind
42437–42440	Undefined				
42441–42443	Date and time stamp	milliseconds	RO	64-bit binary number	See Note 2
42444	Event ID		RO	1–250	See ID Table C.9.2.10.1(i) Event ID = 0 is EOF
42445	Event value1	psi/bar/kPa	RO	0–6000	0.1·Raw
42446	Flags, event value1				
42447–42450	Undefined				
42451–42460	Manufacturer configurable			10 registers	

Notes:

(1) A register value of FFFFH indicates data are not available.

(2) See Figure C.9.2.10.1 for an example of pump room device identification.

(3) Date and time stamp uses 64-bit Unix time stamp (Epoch) per ISO 8601, *Data Elements and Interchange Formats — Information Interchange — Representation of Dates and Times*. For example, 2017-09-12T14:00:00.0001 is a date and time stamp.

Table C.9.2.10.1(g) Event Log Data Access — Jockey Controller

<u>Modbus Register (42461–42490)</u>	<u>Description</u>	<u>Units</u>	<u>Write</u>	<u>Range</u>	<u>Scaling and Notes</u>
<u>42461</u>	<u>Rewind event log oldest</u>		<u>RO</u>		<u>Read register to rewind</u>
<u>42462</u>	<u>Rewind event log 1 day ago</u>		<u>RO</u>		<u>Read register to rewind</u>
<u>42463</u>	<u>Rewind event log 7 days ago</u>		<u>RO</u>		<u>Read register to rewind</u>
<u>42464</u>	<u>Rewind event log 30 days ago</u>		<u>RO</u>		<u>Read register to rewind</u>
<u>42465</u>	<u>Rewind event log 60 days ago</u>		<u>RO</u>		<u>Read register to rewind</u>
<u>42466</u>	<u>Rewind event log 90 days ago</u>		<u>RO</u>		<u>Read register to rewind</u>
<u>42467–42470</u>	<u>Undefined</u>				
<u>42471–42473</u>	<u>Date and time stamp</u>	<u>milliseconds</u>	<u>RO</u>	<u>64-bit binary number</u>	<u>See Note 2</u>
<u>42474</u>	<u>Event ID</u>		<u>RO</u>	<u>1–250</u>	<u>See ID Table C.9.2.10.1(j) Event ID = 0 is EOF</u>
<u>42475</u>	<u>Event value1</u>	<u>psi/bar/kPa</u>	<u>RO</u>	<u>0–6000</u>	<u>0.1·Raw</u>
<u>42476</u>	<u>Flags, event value1</u>				
<u>42477–42480</u>	<u>Undefined</u>				
<u>42481–42490</u>	<u>Manufacturer configurable</u>			<u>10 registers</u>	
<u>42491–42500</u>	<u>Undefined</u>				

Notes:

(1) A register value of FFFFH indicates data are not available.

(2) See Figure C.9.2.10.1 for an example of pump room device identification.

(3) Date and time stamp uses 64-bit Unix time stamp (Epoch) per ISO 8601, *Data Elements and Interchange Formats — Information Interchange — Representation of Dates and Times*. For example, 2017-09-12T14:00:00.0001 is a date and time stamp.

Table C.9.2.10.1(h) Electric Event Messages

<u>ID</u>	<u>Event Message</u>
<u>1</u>	<u>Pump Running</u>
<u>2</u>	<u>Pump Stopped</u>
<u>3</u>	<u>Fail to Start</u>
<u>4</u>	<u>Fail to Start Noted</u>
<u>5</u>	<u>Call to Start</u>
<u>6</u>	<u>Locked Rotor Trip</u>
<u>7</u>	<u>Rotor Trip Clear</u>
<u>8</u>	<u>Over Voltage</u>
<u>9</u>	<u>Over Frequency</u>
<u>10</u>	<u>Under Voltage</u>
<u>11</u>	<u>Under Frequency</u>
<u>12</u>	<u>Voltage Imbalance</u>

<u>ID</u>	<u>Event Message</u>
<u>13</u>	<u>Phase Failure</u>
<u>14</u>	<u>Phase Reversal</u>
<u>15</u>	<u>Current >320% FLA</u>
<u>16</u>	<u>Motor Overload</u>
<u>17</u>	<u>Nominal Voltage</u>
<u>18</u>	<u>Voltage Balanced</u>
<u>19</u>	<u>Nominal Frequency</u>
<u>20</u>	<u>Phase Nominal</u>
<u>21</u>	<u>Phase Sequence</u>
<u>22</u>	<u>Nominal Current</u>
<u>23</u>	<u>Motor Normal</u>
<u>24</u>	<u>Interlock On</u>
<u>25</u>	<u>Interlock Off</u>
<u>26</u>	<u>Deluge Open</u>
<u>27</u>	<u>Deluge Closed</u>
<u>28</u>	<u>Low Pressure</u>
<u>29</u>	<u>Normal Pressure</u>
<u>30</u>	<u>Manual Stop Button</u>
<u>31</u>	<u>Manual Stop Released</u>
<u>32</u>	<u>Power Transferred</u>
<u>33</u>	<u>Power Re-Transferred</u>
<u>34</u>	<u>Control Voltage OK</u>
<u>35</u>	<u>No Control Voltage</u>
<u>36</u>	<u>Load Disconnect</u>
<u>37</u>	<u>Load Reconnect</u>
<u>38</u>	<u>Local Start Input</u>
<u>39</u>	<u>Local Start Clear</u>
<u>40</u>	<u>Remote Start Input</u>
<u>41</u>	<u>Remote Start Clear</u>
<u>42</u>	<u>Emergency Run On</u>
<u>43</u>	<u>Emergency Run Off</u>
<u>44</u>	<u>Emergency Isolation Switch On</u>
<u>45</u>	<u>Emergency Isolation Switch Off</u>
<u>46</u>	<u>Soft Start Over Temp Bypass</u>
<u>47</u>	<u>Soft Start Over Temp Normal</u>
<u>48</u>	<u>Motor Start Checked</u>
<u>49</u>	<u>Pressure Fail</u>
<u>50</u>	<u>Pressure in Range</u>
<u>51</u>	<u>Pressure Log</u>
<u>52</u>	<u>Pressure Log Run</u>
<u>53</u>	<u>Database Clear</u>
<u>54</u>	<u>System Reset</u>
<u>55</u>	<u>Data Log Cleared</u>
<u>56</u>	<u>Low Suction Pressure</u>

<u>ID</u>	<u>Event Message</u>
<u>57</u>	<u>Suction Pressure OK</u>
<u>58</u>	<u>Reservoir Low</u>
<u>59</u>	<u>Reservoir OK</u>
<u>60</u>	<u>Low Pump Room Temp</u>
<u>61</u>	<u>Pump Room Temp OK</u>
<u>62</u>	<u>Pump Room Trouble</u>
<u>63</u>	<u>Pump Room Normal</u>
<u>64</u>	<u>Min Start Volts</u>
<u>65</u>	<u>Max Start Current</u>
<u>66</u>	<u>Load Shed</u>
<u>67</u>	<u>Load Restored</u>
<u>68</u>	<u>Weekly Test Running</u>
<u>69</u>	<u>Weekly Test Done</u>
<u>70</u>	<u>Parameters Reset</u>
<u>71</u>	<u>Passwords Reset</u>
<u>72</u>	<u>Low Suction Level</u>
<u>73</u>	<u>Suction Level OK</u>
<u>74</u>	<u>Automatic Start</u>
<u>75</u>	<u>Automatic Start Clear</u>
<u>76</u>	<u>Calibration Error</u>
<u>77</u>	<u>Calibration Error Cleared</u>
<u>78</u>	<u>Test In Progress</u>
<u>79</u>	<u>Test Completed</u>
<u>80</u>	<u>Jockey Pump Running</u>
<u>81</u>	<u>Jockey Pump Off</u>
<u>82</u>	<u>Jockey Pump Trouble</u>
<u>83</u>	<u>Jockey Pump OK</u>
<u>84</u>	<u>Emergency Stop</u>
<u>85</u>	<u>Emergency Stop Released</u>
<u>86</u>	<u>VFD Bypass</u>
<u>87</u>	<u>VFD Active</u>
<u>88</u>	<u>VFD Failure</u>
<u>89</u>	<u>VFD Failure Clear</u>
<u>90</u>	<u>System Overpressure</u>
<u>91</u>	<u>System Pressure OK</u>
<u>92</u>	<u>Weekly Test Due</u>
<u>93</u>	<u>Weekly Test Due Clear</u>
<u>94</u>	<u>Softstarter Fault</u>
<u>95</u>	<u>Softstarter Ok</u>
<u>96</u>	<u>VFD Ready</u>
<u>97</u>	<u>VFD Not Ready</u>
<u>98</u>	<u>Shunt Trip Normal</u>
<u>99</u>	<u>Shunt Trip Emergency</u>
<u>100</u>	<u>Flow Meter On</u>

<u>ID</u>	<u>Event Message</u>
101	Flow Meter Off
102	Auto Start Input
103	Auto Start Input Off
104	Pressure Delta
105	Test Pushbutton Start
106	Test Failed
107	Test Override
108	Manual Stop Enabled
109	Manual Stop Disabled
110	Manual Pushbutton Start
111	Duty Pump
112	Standby Pump
113	Unit Available
114	Unit Not Available
115	Shutdown Activated
116	Shutdown Released
117	Relief Valve Open
118	Relief Valve Closed
119	Manual Test Input
120	Manual Test Clear
121	VFD Sleep (Power Off)
122	VFD Wakeup (Power On)
123–250	Undefined

Table C.9.2.10.1(i) Diesel Event Messages

<u>ID</u>	<u>Event Message</u>
1	Engine Running
2	Engine Stopped
3	Fail to Start
4	Fail to Start Noted
5	Call to Start
6	Interlock On
7	Interlock Off
8	Deluge Open
9	Deluge Closed
10	Low Pressure
11	Normal Pressure
12	Manual Stop Button
13	Manual Stop Released
14	Remote Start Run
15	Remote Start Term
16	Pressure Fail
17	Pressure in Range
18	Pressure Log

<u>ID</u>	<u>Event Message</u>
19	Pressure Log Run
20	System Reset
21	Low Suction Pressure
22	Suction Pressure Clear
23	Pump Room Trouble
24	Pump Room Normal
25	Weekly Test Running
26	Weekly Test Done
27	Parameters Reset
28	Passwords Reset
29	Flow Meter On
30	Flow Meter Clear
31	Fuel Spill Input
32	Fuel Spill Clear
33	Engine Over Speed
34	Engine Over Speed Clear
35	Engine Temp High
36	Engine Temp High OK
37	Oil Pressure Low
38	Oil Pressure Low OK
39	Fuel Level Low
40	Fuel Level Low OK
41	Fuel Level High
42	Fuel Level High OK
43	Low Pump Room Temp
44	Pump Room Temp OK
45	Reservoir High
46	Reservoir High Clear
47	Reservoir Low
48	Reservoir Low Clear
49	Relief Valve Open
50	Relief Valve Closed
51	Charger 1 Fail
52	Charger 1 Recovered
53	Charger 2 Fail
54	Charger 2 Recovered
55	Battery 1 Trouble
56	Battery 1 Clear
57	Battery 2 Trouble
58	Battery 2 Clear
59	Crank 1 Button
60	Crank 1 Button Clear
61	Crank 2 Button
62	Crank 2 Button Clear

<u>ID</u>	<u>Event Message</u>
<u>63</u>	<u>Calibration Error</u>
<u>64</u>	<u>Calibration Error Cleared</u>
<u>65</u>	<u>No Control Voltage</u>
<u>66</u>	<u>Control Voltage OK</u>
<u>67</u>	<u>Missing Battery</u>
<u>68</u>	<u>Missing Battery OK</u>
<u>69</u>	<u>AC Power Lost</u>
<u>70</u>	<u>AC Power Restored</u>
<u>71</u>	<u>Test In Progress</u>
<u>72</u>	<u>Test Completed</u>
<u>73</u>	<u>Automatic Start</u>
<u>74</u>	<u>Automatic Start Clear</u>
<u>75</u>	<u>Low Suction Level</u>
<u>76</u>	<u>Suction Level OK</u>
<u>77</u>	<u>Main Switch Off</u>
<u>78</u>	<u>Main Switch Auto</u>
<u>79</u>	<u>Main Switch Manual</u>
<u>80</u>	<u>Jockey Pump Running</u>
<u>81</u>	<u>Jockey Pump Off</u>
<u>82</u>	<u>Jockey Pump Trouble</u>
<u>83</u>	<u>Jockey Pump OK</u>
<u>84</u>	<u>Battery 1 Out</u>
<u>85</u>	<u>Battery 1 Out Off</u>
<u>86</u>	<u>Battery 2 Out</u>
<u>87</u>	<u>Battery 2 Out Off</u>
<u>88</u>	<u>Charger 1 Out</u>
<u>89</u>	<u>Charger 1 Out Off</u>
<u>90</u>	<u>Charger 2 Out</u>
<u>91</u>	<u>Charger 2 Out Off</u>
<u>92</u>	<u>Weekly Test Due</u>
<u>93</u>	<u>Weekly Test Due Clear</u>
<u>94</u>	<u>System Overpressure</u>
<u>95</u>	<u>System Pressure OK</u>
<u>96</u>	<u>Fuel Injector Fail</u>
<u>97</u>	<u>Fuel Injector OK</u>
<u>98</u>	<u>Coil Continuity 1 Fail</u>
<u>99</u>	<u>Coil Continuity 2 Fail</u>
<u>100</u>	<u>AC Power Loss Start</u>
<u>101</u>	<u>AC Voltage High</u>
<u>102</u>	<u>AC Voltage Normal</u>
<u>103</u>	<u>AC Voltage Low</u>
<u>104</u>	<u>AC Power Loss Delay</u>
<u>105</u>	<u>Fuel Valve Relay Status</u>
<u>106</u>	<u>Low Pressure Sensor</u>

<u>ID</u>	<u>Event Message</u>
107	Auto Start Input
108	Auto Start Input Off
109	Pressure Delta
110	Cranking 1
111	Cranking 2
112	Mode Off Off
113	Mode Auto Off
114	Mode Manual Off
115	Jockey Pump Running
116	Jockey Pump Off
117	Jockey Pump Trouble
118	Jockey Pump OK
119	Battery 1 Out
120	Battery 1 Out Off
121	Battery 2 Out
122	Battery 2 Out Off
123	Charger 1 Out
124	Charger 1 Out Off
125	Charger 2 Out
126	Charger 2 Out Off
127	Weekly Test Due
128	Weekly Test Due Clear
129	System Overpressure
130	System Pressure OK
131	Fuel Injector Fail
132	Fuel Injector OK
133	Primary Fail Start
134	Primary Fail Clear
135	Primary Interrupt
136	Primary Interrupt Cleared
137	Coil Continuity 1 Fail
138	Coil Continuity 2 Fail
139	AC Power Loss Start
140	AC Voltage High
141	AC Voltage Normal
142	AC Voltage Low
143	Secondary Crank
144	Secondary Crank Off
145	AC Power Loss Delay
146	Fuel Valve Relay Status
147	Low Pressure Sensor
148	Auto Start Input
149	Auto Start Input Off
150	Pressure Delta

<u>ID</u>	<u>Event Message</u>
<u>151</u>	Cranking 1
<u>152</u>	Cranking 2
<u>153</u>	Test Button
<u>154</u>	Test Failed
<u>155</u>	Test Override
<u>156</u>	Auto Shutdown Disabled
<u>157</u>	Auto Shutdown Enabled
<u>158</u>	Duty Pump
<u>159</u>	Standby Pump
<u>160</u>	Unit Available
<u>161</u>	Unit Not Available
<u>162</u>	Dump Valve On
<u>163</u>	Dump Valve Off
<u>164</u>	Shutdown Activated
<u>165</u>	Shutdown Released
<u>166</u>	Manual Test Input
<u>167</u>	Manual Test Clear
<u>168</u>	Term 301, ECMS
<u>169</u>	Term 301, ECMS Clear
<u>170</u>	Term 302, FIM
<u>171</u>	Term 302, FIM Clear
<u>172</u>	Term 303, ECMW
<u>173</u>	Term 303, ECMW Clear
<u>174</u>	Term 304, ECMF
<u>175</u>	Term 304, ECMF Clear
<u>176</u>	Term 305, LSP
<u>177</u>	Term 305, LSP Clear
<u>178</u>	Term 310, HRT
<u>179</u>	Term 310, HRT Clear
<u>180</u>	Term 311, LRF
<u>181</u>	Term 311, LRF Clear
<u>182</u>	Term 312, LET
<u>183</u>	Term 312, LET Clear
<u>184–250</u>	Undefined

Table C.9.2.10.1(j) Jockey Event Messages

<u>ID</u>	<u>Event Message</u>
<u>1</u>	Pump Running
<u>2</u>	Pump Stopped
<u>3</u>	Fail to Start
<u>4</u>	Fail to Start Noted
<u>5</u>	Call to Start
<u>6</u>	Phase Failure
<u>7</u>	Phase Reversal

<u>ID</u>	<u>Event Message</u>
<u>8</u>	<u>Motor Overload</u>
<u>9</u>	<u>Motor Normal</u>
<u>10</u>	<u>Low Pressure</u>
<u>11</u>	<u>Normal Pressure</u>
<u>12</u>	<u>Pressure Fail</u>
<u>13</u>	<u>Pressure in Range</u>
<u>14</u>	<u>Pressure Log</u>
<u>15</u>	<u>Pressure Log Run</u>
<u>16</u>	<u>System Reset</u>
<u>17</u>	<u>Parameters Reset</u>
<u>18</u>	<u>Passwords Reset</u>
<u>19</u>	<u>Automatic Start</u>
<u>20</u>	<u>Automatic Start Clear</u>
<u>21</u>	<u>Main Switch Off</u>
<u>22</u>	<u>Main Switch Auto</u>
<u>23</u>	<u>Main Switch Manual</u>
<u>24</u>	<u>System Overpressure</u>
<u>25</u>	<u>System Pressure OK</u>
<u>26</u>	<u>Auto Start Input Off</u>
<u>27</u>	<u>Pressure Delta</u>
<u>28</u>	<u>Mode Off Off</u>
<u>29</u>	<u>Mode Auto Off</u>
<u>30</u>	<u>Mode Manual Off</u>
<u>31–250</u>	<u>Undefined</u>

Table C.9.2.10.1(k) Performance Data (Modbus Registers 42501–42920)

	<u>Address Offset</u>	<u>+0</u>	<u>+1</u>	<u>+2</u>	<u>+3</u>	<u>+4</u>	<u>+5</u>	<u>+6</u>	<u>+7</u>	<u>+8</u>	<u>+9</u>	<u>+10</u>
-	<u>Data Description</u>	<u>Year</u>	<u>Mo</u>	<u>Day</u>	<u>Hr</u>	<u>Min</u>	<u>Sec</u>	<u>Flow Point %</u>	<u>Measured Flow</u>	<u>System Pressure</u>	<u>Suction Pressure</u>	<u>Sys- Press</u>
	<u>Starting Address</u>	-	-									
<u>Present Data Table</u>	<u>42501</u>	<u>42501</u>						<u>0</u>				
	<u>42521</u>	<u>42521</u>						<u>25</u>				
	<u>42541</u>	<u>42541</u>						<u>50</u>				
	<u>42561</u>	<u>42561</u>						<u>75</u>				
	<u>42581</u>	<u>42581</u>						<u>100</u>				
	<u>42601</u>	<u>42601</u>						<u>125</u>				
	<u>42621</u>	<u>42621</u>						<u>150</u>				
<u>Previous Data Table</u>												
	<u>42641</u>	<u>42641</u>						<u>0</u>				
	<u>42661</u>	<u>42661</u>						<u>25</u>				
	<u>42681</u>	<u>42681</u>						<u>50</u>				
	<u>42701</u>	<u>42701</u>						<u>75</u>				

	<u>Address Offset</u>	<u>+0</u>	<u>+1</u>	<u>+2</u>	<u>+3</u>	<u>+4</u>	<u>+5</u>	<u>+6</u>	<u>+7</u>	<u>+8</u>	<u>+9</u>	<u>+10</u>
-	<u>Data Description</u>	<u>Year</u>	<u>Mo</u>	<u>Day</u>	<u>Hr</u>	<u>Min</u>	<u>Sec</u>	<u>Flow Point %</u>	<u>Measured Flow</u>	<u>System Pressure</u>	<u>Suction Pressure</u>	<u>Sys- Press</u>
	<u>Starting Address</u>	-	-									
	<u>42721</u>	<u>42721</u>						<u>100</u>				
	<u>42741</u>	<u>42741</u>						<u>125</u>				
	<u>42761</u>	<u>42761</u>						<u>150</u>				
Acceptance Data Table	<u>42781</u>	<u>42781</u>						<u>0</u>				
	<u>42801</u>	<u>42801</u>						<u>25</u>				
	<u>42821</u>	<u>42821</u>						<u>50</u>				
	<u>42841</u>	<u>42841</u>						<u>75</u>				
	<u>42861</u>	<u>42861</u>						<u>100</u>				
	<u>42881</u>	<u>42881</u>						<u>125</u>				
	<u>42901</u>	<u>42901</u>						<u>150</u>				

Notes:

(1) The controller should be arranged to record and store the data for a given flow point when so initiated by the operator.

(2) Data are organized into tables of 7 records containing 18 fields with date and time as the key field. Date and time fields are organized per ISO.

Table C.9.2.10.1(I) Pump Curve Parameters

<u>Offset</u>	<u>Data Description</u>	<u>Range</u>	<u>Units</u>	<u>Write</u>	<u>Scale</u>
<u>+0</u>	<u>Year</u>	<u>1700–3000</u>	<u>yr</u>	<u>RO</u>	
<u>+1</u>	<u>Month</u>	<u>1–12</u>	<u>mo</u>	<u>RO</u>	
<u>+2</u>	<u>Day</u>	<u>1–31</u>	<u>day</u>	<u>RO</u>	
<u>+3</u>	<u>Hour</u>	<u>0–23</u>	<u>hr</u>	<u>RO</u>	
<u>+4</u>	<u>Minute</u>	<u>0–59</u>	<u>min</u>	<u>RO</u>	
<u>+5</u>	<u>Second</u>	<u>0–59</u>	<u>sec</u>	<u>RO</u>	
<u>+6</u>	<u>Percent flow point</u>	<u>0–150</u>	<u>%</u>	<u>RO</u>	
<u>+7</u>	<u>Measured flow</u>	<u>0–50,000</u>	<u>gpm/L/min</u>	<u>RO</u>	
<u>+8</u>	<u>Suction pressure</u>	<u>0–6000</u>	<u>psi/bar/kPa</u>	<u>RO</u>	<u>0.1·Raw</u>
<u>+9</u>	<u>Sys-suc pressure*</u>	<u>0–6000</u>	<u>psi/bar/kPa</u>	<u>RO</u>	<u>0.1·Raw</u>
<u>+10</u>	<u>System pressure</u>	<u>0–6000</u>	<u>psi/bar/kPa</u>	<u>RO</u>	<u>0.1·Raw</u>
<u>+11</u>	<u>RPM</u>	<u>0–5000</u>	<u>rpm</u>	<u>RO</u>	
<u>+12</u>	<u>Amps L1</u>	<u>0–60,000</u>	<u>A</u>	<u>RO</u>	<u>0.1·Raw</u>
<u>+13</u>	<u>Amps L2</u>	<u>0–60,000</u>	<u>A</u>	<u>RO</u>	<u>0.1·Raw</u>
<u>+14</u>	<u>Amps L3</u>	<u>0–60,000</u>	<u>A</u>	<u>RO</u>	<u>0.1·Raw</u>
<u>+15</u>	<u>Volts L1–L2</u>	<u>0–50,000</u>	<u>V</u>	<u>RO</u>	<u>0.1·Raw</u>
<u>+16</u>	<u>Volts L2–L3</u>	<u>0–50,000</u>	<u>V</u>	<u>RO</u>	<u>0.1·Raw</u>
<u>+17</u>	<u>Volts L3–L1</u>	<u>0–50,000</u>	<u>V</u>	<u>RO</u>	<u>0.1·Raw</u>
<u>+18</u>	<u>Table units</u>		<u>0 = psi, 1 = bar, 2 = kPa</u>	<u>RO</u>	
<u>+19</u>	<u>Table units</u>		<u>0 = gpm, 1 = L/min</u>	<u>RO</u>	

*Net pressure calculation.

Table C.9.2.10.1(m) Diesel Engines and Other Pump Room Devices

<u>Modbus Register (43001–43999)</u>	<u>Bit</u>	<u>Description</u>	<u>Units</u>	<u>Optional (X)</u>	<u>Write</u>	<u>Range (See Note 1)</u>	<u>Scaling and Notes</u>
		<u>Pump Room Device</u>					
<u>43001</u>		<u>Pump room device ID</u>			<u>RO</u>		<u>See Note 2</u>
<u>43002–43010</u>		<u>Undefined</u>			<u>RO</u>		
<u>43011–43020</u>		<u>Manufacturer name</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
<u>43021–43030</u>		<u>Basic model</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
<u>43031–43040</u>		<u>Equipment type</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
<u>43041–43050</u>		<u>Serial number</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
<u>43051–43060</u>		<u>Software version</u>			<u>RO</u>	<u>ASCII Text</u>	<u>20 characters</u>
		<u>Time and Date Stamp</u>					
<u>43061–43064</u>		<u>Date and time</u>	<u>milliseconds</u>		<u>RO</u>	<u>64-bit binary number</u>	<u>See Note 3</u>
<u>43065–43070</u>		<u>Undefined</u>			<u>RO</u>		
		<u>Diesel Engine Data</u>					
<u>43071</u>		<u>Pressure units</u>			<u>RO</u>	<u>0 = psi, 1 = bar, 2 = kPa</u>	
<u>43072</u>		<u>Temperature units</u>			<u>RO</u>	<u>0 = °F, 1 = °C</u>	
<u>43073–43080</u>		<u>Undefined</u>					
<u>43081</u>		<u>Engine coolant temperature</u>	<u>°F/°C</u>		<u>RO</u>	<u>0–300</u>	
<u>43082</u>		<u>Engine oil pressure</u>	<u>psi/bar/kPa</u>		<u>RO</u>	<u>0–150</u>	
<u>43083</u>		<u>Engine speed</u>	<u>rpm</u>		<u>RO</u>	<u>0–4000</u>	
<u>43084</u>		<u>Total engine hours</u>	<u>hr</u>		<u>RO</u>	<u>0–59999</u>	
<u>43085–43100</u>		<u>Undefined</u>					
<u>43101–43199</u>		<u>Manufacturer specific</u>				<u>100 registers</u>	
<u>43200–43999</u>		<u>Undefined</u>					

Notes:

(1) A register value of FFFFH indicates data are not available.

(2) See Figure C.9.2.10.1 for an example of pump room device identification.

(3) Date and time stamp uses 64-bit Unix time stamp (Epoch) per ISO 8601, *Data Elements and Interchange Formats — Information Interchange — Representation of Dates and Times*. For example, 2017-09-12T14:00:00.0001 is a date and time stamp.

Table C.9.2.10.1(a) Recommended Standardized Electric Motor Controller Modbus Register Definitions

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42001	ac-volts L1-L2	NA	xxxxx	D
42002	ac-volts L2-L3	NA	xxxxx	D
42003	ac-volts L1-L3	NA	xxxxx	D
42004	ac-amps L1	NA	xxxxx	D
42005	ac-amps L2	NA	xxxxx	D
42006	ac-amps L3	NA	xxxxx	D
42007	System pressure (psi or bar)	NA	xxxx.x or xxx.xx*	D
42008	Suction pressure (psi or bar)	NA	xxxx.x or xxx.xx*	D
42009	VFD speed (HZ)	NA	xxxxx	D
42010	Aux input #1, 0–100%	NA	xxxxx	D
42011	Aux input #2, 0–100%	NA	xxxxx	D
Modbus Register Description Alarm On State				
42012	Alarm register #1	NA		D
	Minimum run delay timing high	NA	bit-0	D
	Accelerate delay timing high	NA	bit-1	D
	High zone delay timing high	NA	bit-2	D
	Sequence delay timing high	NA	bit-3	D
	Load shed active high	NA	bit-4	D
	Low discharge pressure alarm high	NA	bit-5	D
	Low suction alarm high	NA	bit-6	D
	Low suction shutdown active high	NA	bit-7	D
	System over pressure alarm high	NA	bit-8	D
	Restart delay timing high	NA	bit-9	D
	Weekly test demand active high	NA	bit-10	D
	Failure to start alarm high	NA	bit-11	D
	Lockout active high	NA	bit-12	D
	VFD ready high	NA	bit-13	D
	VFD forward command active high	NA	bit-14	D
	VFD reverse command active high	NA	bit-15	D
42013	Alarm register #2	NA		D
	Pressure start demand high	NA	bit-0	D
	Remote start demand high	NA	bit-1	D
	Deluge start demand high	NA	bit-2	D
	Weekly test start demand high	NA	bit-3	D
	Local start PB demand high	NA	bit-4	D
	Manual operator start demand high	NA	bit-5	D
	Audible alarm high	NA	bit-6	D
	Weekly/monthly test setup error high	NA	bit-7	D
	Minimum run timed out high	NA	bit-8	D
	Load shed delay timing high	NA	bit-9	D
	Mod SP1/2 power OK high	NA	bit-10	D
	Mod SP1/2 power loss start high	NA	bit-11	D
	Pressure transducer fault high	NA	bit-12	D

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42014	Pressure transducer test OK-high	NA	bit-13	D
	VFD failure-high	NA	bit-14	D
	Controller in bypass mode, soft start/VFD only-high	NA	bit-15	D
	Alarm register #3	NA		D
	Timed trip timing-high	NA	bit-0	D
	Motor running-high	NA	bit-1	D
	Motor overload alarm-high	NA	bit-2	D
	Motor single phasing alarm-high	NA	bit-3	D
	Phase reversal alarm-high	NA	bit-4	D
	ac voltage low alarm-high	NA	bit-5	D
	Phase smart protection lockout-high	NA	bit-6	D
	Transfer switch in normal position-high	NA	bit-7	D
	Transfer switch in alternate power position high	NA	bit-8	D
	ac power available-high	NA	bit-9	D
	Transfer switch normal power available-high	NA	bit-10	D
	Transfer switch alternate power available-high	NA	bit-11	D
	Emergency CB open-high	NA	bit-12	D
	CB tripped-high	NA	bit-13	D
	Engine start signal-low	NA	bit-14	D
	Unused	NA	bit-15	D
42015	Alarm register #4	NA		D
	Pump trouble #1 input-high	NA	bit-0	D
	Pump trouble #2 input-high	NA	bit-1	D
	Pump trouble #3 input-high	NA	bit-2	D
	Pump trouble #4 input-high	NA	bit-3	D
	Pump trouble #5 input-high	NA	bit-4	D
	Pump trouble #6 input-high	NA	bit-5	D
	Pump trouble #7 input-high	NA	bit-6	D
	Pump trouble #8 input-high	NA	bit-7	D
	Pump trouble group alarm-high	NA	bit-8	D
	Unused	NA	bit-9-15	D
	Other Information	NA		D
42016	Start count	NA	xxxxx	D
42017	Run time hours	NA	xxxx.x	D
42018	Hours since last run	NA	xxxx.x	D
42019	Hours since last DVS test	NA	xxxx.x	D
42020-42029	Unused	NA		
Pump Curve Data				
	Present Data	% Flow		
42030	Measured flow (gpm or L/min)	0	xxxxx	S
42031	Year (4-digit)	0	xxxxx	S
42032	Month 1-12	0	xxxxx	S
42033	Day 1-31	0	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
			xxxx.x or xxx.xx *	
42034	SYS—SUCTION pressure (psi or bar)	0	xxx.xx *	S
42035	rpm	0	xxxxx	S
			xxxx.x or xxx.xx *	
42036	Suction pressure (psi or bar)	0	xxx.xx *	S
			xxxx.x or xxx.xx *	
42037	System pressure (psi or bar)	0	xxx.xx *	S
42038	Amps L1	0	xxxxx	S
42039	Amps L2	0	xxxxx	S
42040	Amps L3	0	xxxxx	S
42041	Volts L1-L2	0	xxxxx	S
42042	Volts L2-L3	0	xxxxx	S
42043	Volts L1-L3	0	xxxxx	S
42044	Measured flow (gpm or L/min)	25	xxxxx	S
42045	Year (4-digit)	25	xxxxx	S
42046	Month 1–12	25	xxxxx	S
42047	Day 1–31	25	xxxxx	S
			xxxx.x or xxx.xx *	
42048	SYS—SUCTION pressure (psi or bar)	25	xxx.xx *	S
42049	rpm	25	xxxxx	S
			xxxx.x or xxx.xx *	
42050	Suction pressure (psi or bar)	25	xxx.xx *	S
			xxxx.x or xxx.xx *	
42051	System pressure (psi or bar)	25	xxx.xx *	S
42052	Amps L1	25	xxxxx	S
42053	Amps L2	25	xxxxx	S
42054	Amps L3	25	xxxxx	S
42055	Volts L1-L2	25	xxxxx	S
42056	Volts L2-L3	25	xxxxx	S
42057	Volts L1-L3	25	xxxxx	S
42058	Measured flow (gpm or L/min)	50	xxxxx	S
42059	Year (4-digit)	50	xxxxx	S
42060	Month 1–12	50	xxxxx	S
42061	Day 1–31	50	xxxxx	S
			xxxx.x or xxx.xx *	
42062	SYS—SUCTION pressure (psi or bar)	50	xxx.xx *	S
42063	rpm	50	xxxxx	S
			xxxx.x or xxx.xx *	
42064	Suction pressure (psi or bar)	50	xxx.xx *	S
			xxxx.x or xxx.xx *	
42065	System pressure (psi or bar)	50	xxx.xx *	S
42066	Amps L1	50	xxxxx	S
42067	Amps L2	50	xxxxx	S
42068	Amps L3	50	xxxxx	S
42069	Volts L1-L2	50	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42070	Volts L2-L3	50	xxxxx	S
42071	Volts L1-L3	50	xxxxx	S
42072	Measured flow (gpm or L/min)	75	xxxxx	S
42073	Year (4-digit)	75	xxxxx	S
42074	Month 1-12	75	xxxxx	S
42075	Day 1-31	75	xxxxx	S
			xxxx.x or	
42076	SYS—SUCTION pressure (psi or bar)	75	xxx.xx *	S
42077	rpm	75	xxxxx	S
			xxxx.x or	
42078	Suction pressure (psi or bar)	75	xxx.xx *	S
			xxxx.x or	
42079	System pressure (psi or bar)	75	xxx.xx *	S
42080	Amps L1	75	xxxxx	S
42081	Amps L2	75	xxxxx	S
42082	Amps L3	75	xxxxx	S
42083	Volts L1-L2	75	xxxxx	S
42084	Volts L2-L3	75	xxxxx	S
42085	Volts L1-L3	75	xxxxx	S
42086	Measured flow (gpm or L/min)	100	xxxxx	S
42087	Year (4-digit)	100	xxxxx	S
42088	Month 1-12	100	xxxxx	S
42089	Day 1-31	100	xxxxx	S
			xxxx.x or	
42090	SYS—SUCTION pressure (psi or bar)	100	xxx.xx *	S
42091	rpm	100	xxxxx	S
			xxxx.x or	
42092	Suction pressure (psi or bar)	100	xxx.xx *	S
			xxxx.x or	
42093	System pressure (psi or bar)	100	xxx.xx *	S
42094	Amps L1	100	xxxxx	S
42095	Amps L2	100	xxxxx	S
42096	Amps L3	100	xxxxx	S
42097	Volts L1-L2	100	xxxxx	S
42098	Volts L2-L3	100	xxxxx	S
42099	Volts L1-L3	100	xxxxx	S
42100	Measured flow (gpm or L/min)	125	xxxxx	S
42101	Year (4-digit)	125	xxxxx	S
42102	Month 1-12	125	xxxxx	S
42103	Day 1-31	125	xxxxx	S
			xxxx.x or	
42104	SYS—SUCTION pressure (psi or bar)	125	xxx.xx *	S
42105	rpm	125	xxxxx	S
			xxxx.x or	
42106	Suction pressure (psi or bar)	125	xxx.xx *	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
			xxxx.x or xxx.xx *	
42107	System pressure (psi or bar)	125	xxx.xx *	S
42108	Amps L1	125	xxxxx	S
42109	Amps L2	125	xxxxx	S
42110	Amps L3	125	xxxxx	S
42111	Volts L1-L2	125	xxxxx	S
42112	Volts L2-L3	125	xxxxx	S
42113	Volts L1-L3	125	xxxxx	S
42114	Measured flow (gpm or L/min)	150	xxxxx	S
42115	Year (4-digit)	150	xxxxx	S
42116	Month 1-12	150	xxxxx	S
42117	Day 1-31	150	xxxxx	S
			xxxx.x or xxx.xx *	
42118	SYS—SUCTION pressure (psi or bar)	150	xxx.xx *	S
42119	rpm	150	xxxxx	S
			xxxx.x or xxx.xx *	
42120	Suction pressure (psi or bar)	150	xxx.xx *	S
			xxxx.x or xxx.xx *	
42121	System pressure (psi or bar)	150	xxx.xx *	S
42122	Amps L1	150	xxxxx	S
42123	Amps L2	150	xxxxx	S
42124	Amps L3	150	xxxxx	S
42125	Volts L1-L2	150	xxxxx	S
42126	Volts L2-L3	150	xxxxx	S
42127	Volts L1-L3	150	xxxxx	S
	Previous Data	%Flow		
42128	Measured flow (gpm or L/min)	0	xxxxx	S
42129	Year (4-digit)	0	xxxxx	S
42130	Month 1-12	0	xxxxx	S
42131	Day 1-31	0	xxxxx	S
			xxxx.x or xxx.xx *	
42132	SYS—SUCTION pressure (psi or bar)	0	xxx.xx *	S
42133	rpm	0	xxxxx	S
			xxxx.x or xxx.xx *	
42134	Suction pressure (psi or bar)	0	xxx.xx *	S
			xxxx.x or xxx.xx *	
42135	System pressure (psi or bar)	0	xxx.xx *	S
42136	Amps L1	0	xxxxx	S
42137	Amps L2	0	xxxxx	S
42138	Amps L3	0	xxxxx	S
42139	Volts L1-L2	0	xxxxx	S
42140	Volts L2-L3	0	xxxxx	S
42141	Volts L1-L3	0	xxxxx	S
42142	Measured flow (gpm or L/min)	25	xxxxx	S
42143	Year (4-digit)	25	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42144	Month 1–12	25	xxxxx	S
42145	Day 1–31	25	xxxxx	S
			xxxx.x or	
42146	SYS—SUCTION Pressure (psi or bar)	25	xxx.xx *	S
42147	rpm	25	xxxxx	S
			xxxx.x or	
42148	Suction pressure (psi or bar)	25	xxx.xx *	S
			xxxx.x or	
42149	System pressure (psi or bar)	25	xxx.xx *	S
42150	Amps L1	25	xxxxx	S
42151	Amps L2	25	xxxxx	S
42152	Amps L3	25	xxxxx	S
42153	Volts L1-L2	25	xxxxx	S
42154	Volts L2-L3	25	xxxxx	S
42155	Volts L1-L3	25	xxxxx	S
42156	Measured flow (gpm or L/min)	50	xxxxx	S
42157	Year (4-digit)	50	xxxxx	S
42158	Month 1–12	50	xxxxx	S
42159	Day 1–31	50	xxxxx	S
			xxxx.x or	
42160	SYS—SUCTION pressure (psi or bar)	50	xxx.xx *	S
42161	rpm	50	xxxxx	S
			xxxx.x or	
42162	Suction pressure (psi or bar)	50	xxx.xx *	S
			xxxx.x or	
42163	System pressure (psi or bar)	50	xxx.xx *	S
42164	Amps L1	50	xxxxx	S
42165	Amps L2	50	xxxxx	S
42166	Amps L3	50	xxxxx	S
42167	Volts L1-L2	50	xxxxx	S
42168	Volts L2-L3	50	xxxxx	S
42169	Volts L1-L3	50	xxxxx	S
42170	Measured flow (gpm or L/min)	75	xxxxx	S
42171	Year (4-digit)	75	xxxxx	S
42172	Month 1–12	75	xxxxx	S
42173	Day 1–31	75	xxxxx	S
			xxxx.x or	
42174	SYS—SUCTION pressure (psi or bar)	75	xxx.xx *	S
42175	rpm	75	xxxxx	S
			xxxx.x or	
42176	Suction pressure (psi or bar)	75	xxx.xx *	S
			xxxx.x or	
42177	System pressure (psi or bar)	75	xxx.xx *	S
42178	Amps L1	75	xxxxx	S
42179	Amps L2	75	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42180	Amps L3	75	xxxxx	S
42181	Volts L1-L2	75	xxxxx	S
42182	Volts L2-L3	75	xxxxx	S
42183	Volts L1-L3	75	xxxxx	S
42184	Measured flow (gpm or L/min)	100	xxxxx	S
42185	Year (4-digit)	100	xxxxx	S
42186	Month 1-12	100	xxxxx	S
42187	Day 1-31	100	xxxxx	S
42188	SYS—SUCTION pressure (psi or bar)	100	xxxx.x or xxx.xx [*]	S
42189	rpm	100	xxxxx	S
42190	Suction pressure (psi or bar)	100	xxxx.x or xxx.xx [*]	S
42191	System pressure (psi or bar)	100	xxxx.x or xxx.xx [*]	S
42192	Amps L1	100	xxxxx	S
42193	Amps L2	100	xxxxx	S
42194	Amps L3	100	xxxxx	S
42195	Volts L1-L2	100	xxxxx	S
42196	Volts L2-L3	100	xxxxx	S
42197	Volts L1-L3	100	xxxxx	S
42198	Measured flow — (gpm or L/min)	125	xxxxx	S
42199	Year (4-digit)	125	xxxxx	S
42200	Month 1-12	125	xxxxx	S
42201	Day 1-31	125	xxxxx	S
42202	SYS—SUCTION pressure (psi or bar)	125	xxxx.x or xxx.xx [*]	S
42203	rpm	125	xxxxx	S
42204	Suction pressure (psi or bar)	125	xxxx.x or xxx.xx [*]	S
42205	System pressure (psi or bar)	125	xxxx.x or xxx.xx [*]	S
42206	Amps L1	125	xxxxx	S
42207	Amps L2	125	xxxxx	S
42208	Amps L3	125	xxxxx	S
42209	Volts L1-L2	125	xxxxx	S
42210	Volts L2-L3	125	xxxxx	S
42211	Volts L1-L3	125	xxxxx	S
42212	Measured flow (gpm or L/min)	150	xxxxx	S
42213	Year (4-digit)	150	xxxxx	S
42214	Month 1-12	150	xxxxx	S
42215	Day 1-31	150	xxxxx	S
42216	SYS—SUCTION pressure (psi or bar)	150	xxxx.x or xxx.xx [*]	S
42217	rpm	150	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42218	Suction pressure (psi or bar)	150	xxxx.x or xxx.xx [*]	S
42219	System pressure (psi or bar)	150	xxxx.x or xxx.xx [*]	S
42220	Amps L1	150	xxxxx	S
42221	Amps L2	150	xxxxx	S
42222	Amps L3	150	xxxxx	S
42223	Volts L1-L2	150	xxxxx	S
42224	Volts L2-L3	150	xxxxx	S
42225	Volts L1-L3	150	xxxxx	S
Acceptance Data		% Flow		
42226	Measured flow (gpm or L/min)	0	xxxxx	P
42227	Year (4-digit)	0	xxxxx	P
42228	Month 1-12	0	xxxxx	P
42229	Day 1-31	0	xxxxx	P
42230	SYS—SUCTION pressure (psi or bar)	0	xxxx.x or xxx.xx [*]	P
42231	rpm	0	xxxxx	P
42232	Suction pressure (psi or bar)	0	xxxx.x or xxx.xx [*]	P
42233	System pressure (psi or bar)	0	xxxx.x or xxx.xx [*]	P
42234	Amps L1	0	xxxxx	P
42235	Amps L2	0	xxxxx	P
42236	Amps L3	0	xxxxx	P
42237	Volts L1-L2	0	xxxxx	P
42238	Volts L2-L3	0	xxxxx	P
42239	Volts L1-L3	0	xxxxx	P
42240	Measured flow (gpm or L/min)	25	xxxxx	P
42241	Year (4-digit)	25	xxxxx	P
42242	Month 1-12	25	xxxxx	P
42243	Day 1-31	25	xxxxx	P
42244	SYS—SUCTION pressure (psi or bar)	25	xxxx.x or xxx.xx [*]	P
42245	rpm	25	xxxxx	P
42246	Suction pressure (psi or bar)	25	xxxx.x or xxx.xx [*]	P
42247	System pressure (psi or bar)	25	xxxx.x or xxx.xx [*]	P
42248	Amps L1	25	xxxxx	P
42249	Amps L2	25	xxxxx	P
42250	Amps L3	25	xxxxx	P

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42251	Volts L1-L2	25	xxxxx	P
42252	Volts L2-L3	25	xxxxx	P
42253	Volts L1-L3	25	xxxxx	P
42254	Measured flow (gpm or L/min)	50	xxxxx	P
42255	Year (4-digit)	50	xxxxx	P
42256	Month 1-12	50	xxxxx	P
42257	Day 1-31	50	xxxxx	P
			xxxx.x or xxx.xx *	
42258	SYS—SUCT pressure (psi or bar)	50	xxx.xx *	P
42259	rpm	50	xxxxx	P
			xxxx.x or xxx.xx *	
42260	Suction pressure (psi or bar)	50	xxx.xx *	P
			xxxx.x or xxx.xx *	
42261	System pressure (psi or bar)	50	xxx.xx *	P
42262	Amps L1	50	xxxxx	P
42263	Amps L2	50	xxxxx	P
42264	Amps L3	50	xxxxx	P
42265	Volts L1-L2	50	xxxxx	P
42266	Volts L2-L3	50	xxxxx	P
42267	Volts L1-L3	50	xxxxx	P
42268	Measured flow (gpm or L/min)	75	xxxxx	P
42269	Year (4-digit)	75	xxxxx	P
42270	Month 1-12	75	xxxxx	P
42271	Day 1-31	75	xxxxx	P
			xxxx.x or xxx.xx *	
42272	SYS—SUCT pressure (psi or bar)	75	xxx.xx *	P
42273	RPM	75	xxxxx	P
			xxxx.x or xxx.xx *	
42274	Suction pressure (psi or bar)	75	xxx.xx *	P
			xxxx.x or xxx.xx *	
42275	System pressure (psi or bar)	75	xxx.xx *	P
42276	Amps L1	75	xxxxx	P
42277	Amps L2	75	xxxxx	P
42278	Amps L3	75	xxxxx	P
42279	Volts L1-L2	75	xxxxx	P
42280	Volts L2-L3	75	xxxxx	P
42281	Volts L1-L3	75	xxxxx	P
42282	Measured flow (gpm or L/min)	100	xxxxx	P
42283	Year (4-digit)	100	xxxxx	P
42284	Month 1-12	100	xxxxx	P
42285	Day 1-31	100	xxxxx	P
			xxxx.x or xxx.xx *	
42286	SYS—SUCT pressure (psi or bar)	100	xxx.xx *	P
42287	rpm	100	xxxxx	P

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42288	Suction pressure (psi or bar)	100	xxxx.x or xxx.xx *	P
42289	System pressure (psi or bar)	100	xxxx.x or xxx.xx *	P
42290	Amps L1	100	xxxxx	P
42291	Amps L2	100	xxxxx	P
42292	Amps L3	100	xxxxx	P
42293	Volts L1	100	xxxxx	P
42294	Volts L2	100	xxxxx	P
42295	Volts L3	100	xxxxx	P
42296	Measured flow (gpm or L/min)	125	xxxxx	P
42297	Year (4-digit)	125	xxxxx	P
42298	Month 1-12	125	xxxxx	P
42299	Day 1-31	125	xxxxx	P
42300	SYS — SUCT pressure (psi or bar)	125	xxxx.x or xxx.xx *	P
42301	rpm	125	xxxxx	P
42302	Suction pressure (psi or bar)	125	xxxx.x or xxx.xx *	P
42303	System pressure (psi or bar)	125	xxxx.x or xxx.xx *	P
42304	Amps L1	125	xxxxx	P
42305	Amps L2	125	xxxxx	P
42306	Amps L3	125	xxxxx	P
42307	Volts L1-L2	125	xxxxx	P
42308	Volts L2-L3	125	xxxxx	P
42309	Volts L1-L3	125	xxxxx	P
42310	Measured flow (gpm or L/min)	150	xxxxx	P
42311	Year (4-digit)	150	xxxxx	P
42312	Month 1-12	150	xxxxx	P
42313	Day 1-31	150	xxxxx	P
42314	SYS — SUCT pressure (psi or bar)	150	xxxx.x or xxx.xx *	P
42315	rpm	150	xxxxx	P
42316	Suction pressure (psi or bar)	150	xxxx.x or xxx.xx *	P
42317	System pressure (psi or bar)	150	xxxx.x or xxx.xx *	P
42318	Amps L1	150	xxxxx	P
42319	Amps L2	150	xxxxx	P
42320	Amps L3	150	xxxxx	P
42321	Volts L1-L2	150	xxxxx	P
42322	Volts L2-L3	150	xxxxx	P
42323	Volts L1-L3	150	xxxxx	P
Jockey Pump Operation				

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42500	Last jockey pump monitoring reset date (year)	NA	xxxxx	S
42501	Last jockey pump monitoring reset date (month)	NA	xxxxx	S
42502	Last jockey pump monitoring reset date (day)	NA	xxxxx	S
42503	Last jockey pump monitoring reset time (hr)	NA	xxxxx	S
42504	Last jockey pump monitoring reset time (min)	NA	xxxxx	S
42505	Last jockey pump monitoring reset time (sec)	NA	xxxxx	S
42506	Total number of starts (since reset)	NA	xxxxx	S
42507	Total jockey pump run time (min. since last reset)	NA	xxxxx	S
42508	Jockey pump start pressure (most recent)	NA	xxxxx	S
42509	Jockey pump stop pressure	NA	xxxxx	S
42510	Most recent run time (sec)	NA	xxxxx	S

NA: Not applicable. P: Permanent. S: Static. D: Dynamic

*One decimal place assumed if psi and two decimal places assumed if bar.

Table C.9.2.10.1(c) Recommended Standardized Diesel Controller Modbus Register Definitions

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42001	Battery #1 volts	NA	Xxxxx*	D
42002	Battery #2 volts	NA	Xxxxx*	D
42003	Unused	NA	D	
42004	Battery #1 amps	NA	Xxxxx*	D
42005	Battery #2 amps	NA	Xxxxx*	D
42006	Unused	NA	D	
42007	System pressure (psi or bar)	NA	xxxx.x or xxx.xx†	D
42008	Suction pressure (psi or bar)	NA	xxxx.x or xxx.xx†	D
42009	Unused	NA	D	
42010	Aux. Input #1 user defined	NA	xxxxx	D
42011	Aux. Input #2 user defined	NA	xxxxx	D
Modbus Register Description				
Alarm on State		NA		
42012	Alarm register #1	NA	D	
	Minimum run delay timing high	NA	bit-0	D
	Power fail start delay timing high	NA	bit-1	D
	High zone delay timing high	NA	bit-2	D
	Sequence delay timing high	NA	bit-3	D
	Engine running high	NA	bit-4	D
	High water temp alarm high	NA	bit-5	D
	Low suction alarm high	NA	bit-6	D
	Low suction shutdown active high	NA	bit-7	D
	System over pressure alarm high	NA	bit-8	D
	Overspeed alarm high	NA	bit-9	D
	Weekly test demand active high	NA	bit-10	D

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42013	Failure-to-start-alarm-high	NA	bit-11	D
	Lockout active-high	NA	bit-12	D
	Crank-on-battery-#1-high	NA	bit-13	D
	Crank-on-battery-#2-high	NA	bit-14	D
	Resting-high	NA	bit-15	D
	Alarm-register-#2	NA	D	
	Pressure-start-demand-high	NA	bit-0	D
	Remote-start-demand-high	NA	bit-1	D
	Deluge-start-demand-high	NA	bit-2	D
	Weekly-test-start-demand-high	NA	bit-3	D
	Start-contactor-#1-fail-high	NA	bit-4	D
	Start-contactor-#2-fail-high	NA	bit-5	D
	Audible-alarm-high	NA	bit-6	D
	Weekly/monthly-test-setup-error-high	NA	bit-7	D
	Minimum-run-timed-out-high	NA	bit-8	D
	Pump-demand-high	NA	bit-9	D
	Control-switch-in-auto-high	NA	bit-10	D
	Control-switch-in-manual-high	NA	bit-11	D
	Pressure-transducer-fault-high	NA	bit-12	D
	Pressure-transducer-test-OK-high	NA	bit-13	D
42014	ac-power-fail-start-high	NA	bit-14	D
	Low-discharge-pressure-alarm-high	NA	bit-15	D
	Alarm-register-#3	NA	D	
	Battery-#1-failure-alarm-high	NA	bit-0	D
	Battery-#2-failure-alarm-high	NA	bit-1	D
	Pump-trouble-group-alarm-high	NA	bit-2	D
	System-trouble-#1-alarm-high	NA	bit-3	D
	ac-power-fail-alarm-high	NA	bit-4	D
	Battery-#1-over-voltage-alarm-high	NA	bit-5	D
	Battery-#2-over-voltage-alarm-high	NA	bit-6	D
	Term-301, ECMS-high	NA	bit-7	D
	Term-302, FIM-high	NA	bit-8	D
	Term-303, ECMW-high	NA	bit-9	D
	Term-304, ECMF-high	NA	bit-10	D
	Term-310, RWHIT-high	NA	bit-11	D
	Term-311, CRWCLS-high	NA	bit-12	D
	Term-312, LET-high	NA	bit-13	D
	Low-oil-pressure-alarm-high	NA	bit-14	D
	Unused	NA	bit-15	D
42015	Alarm-register-#4	NA	D	
	Pump-trouble-#1-input-high	NA	bit-0	D
	Pump-trouble-#2-input-high	NA	bit-1	D
	Pump-trouble-#3-input-high	NA	bit-2	D
	Pump-trouble-#4-input-high	NA	bit-3	D

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
	Pump trouble #5 input high	NA	bit-4	D
	Pump trouble #6 input high	NA	bit-5	D
	Pump trouble #7 input high	NA	bit-6	D
	Pump trouble #8 input high	NA	bit-7	D
	Battery #1 in-equalize high	NA	bit-8	D
	Battery #2 in-equalize high	NA	bit-9	D
	Battery #1 OK high	NA	bit-10	D
	Battery #2 OK high	NA	bit-11	D
	Charger #1 fail alarm high	NA	bit-12	D
	Charger #2 fail alarm high	NA	bit-13	D
	System trouble #2 alarm high	NA	bit-14	D
	Unused	NA	bit-15	D
Other Information	NA	D		
42016	Start count	NA	xxxxx	D
42017	Run-time hours	NA	xxxxx	D
42018	Hours since last run	NA	xxxx.x*	D
42019	Hours since last DVS test	NA	xxxx.x*	D
42020-42029	Unused	NA		
Pump Curve Data				
<u>Present Data</u>	<u>% Flow</u>			
42030	Measured flow (gpm or L/min)	0	xxxxx	S
42031	Year (4-digit)	0	xxxxx	S
42032	Month 1-12	0	xxxxx	S
42033	Day 1-31	0	xxxxx	S
42034	SYS — SUCT pressure (psi or bar)	0	xxxx.x or xxx.xx†	S
42035	RPM	0	xxxxx	S
42036	Suction pressure (psi or bar)	0	xxxx.x or xxx.xx†	S
42037	System pressure (psi or bar)	0	xxxx.x or xxx.xx†	S
42038	Amps battery 1	0	xxxxx	S
42039	Amps battery 2	0	xxxxx	S
42040	Volts battery 1	0	xxxxx	S
42041	Volts battery 2	0	xxxxx	S
42042	Unused	0	xxxxx	S
42043	Unused	0	xxxxx	S
42044	Measured flow (gpm or L/min)	25	xxxxx	S
42045	Year (4-digit)	25	xxxxx	S
42046	Month 1-12	25	xxxxx	S
42047	Day 1-31	25	xxxxx	S
42048	SYS — SUCT pressure (psi or bar)	25	xxxx.x or xxx.xx†	S
42049	rpm	25	xxxxx	S
42050	Suction pressure (psi or bar)	25	xxxx.x or xxx.xx†	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42051	System pressure (psi or bar)	25	xxxx.x or xxx.xx†	S
42052	Amps battery 1	25	xxxxx	S
42053	Amps battery 2	25	xxxxx	S
42054	Volts battery 1	25	xxxxx	S
42055	Volts battery 2	25	xxxxx	S
42056	Unused	25	xxxxx	S
42057	Unused	25	xxxxx	S
42058	Measured flow (gpm or L/min)	50	xxxxx	S
42059	Year (4-digit)	50	xxxxx	S
42060	Month 1–12	50	xxxxx	S
42061	Day 1–31	50	xxxxx	S
42062	SYS – SUCT pressure (psi or bar)	50	xxxx.x or xxx.xx†	S
42063	rpm	50	xxxxx	S
42064	Suction pressure (psi or bar)	50	xxxx.x or xxx.xx†	S
42065	System pressure (psi or bar)	50	xxxx.x or xxx.xx†	S
42066	Amps battery 1	50	xxxxx	S
42067	Amps battery 2	50	xxxxx	S
42068	Volts battery 1	50	xxxxx	S
42069	Volts battery 2	50	xxxxx	S
42070	Unused	50	xxxxx	S
42071	Unused	50	xxxxx	S
42072	Measured flow (gpm or L/min)	75	xxxxx	S
42073	Year (4-digit)	75	xxxxx	S
42074	Month 1–12	75	xxxxx	S
42075	Day 1–31	75	xxxxx	S
42076	SYS – SUCT pressure (psi or bar)	75	xxxx.x or xxx.xx†	S
42077	rpm	75	xxxxx	S
42078	Suction pressure (psi or bar)	75	xxxx.x or xxx.xx†	S
42079	System Pressure (psi or bar)	75	xxxx.x or xxx.xx†	S
42080	Amps battery 1	75	xxxxx	S
42081	Amps battery 2	75	xxxxx	S
42082	Volts battery 1	75	xxxxx	S
42083	Volts battery 2	75	xxxxx	S
42084	Unused	75	xxxxx	S
42085	Unused	75	xxxxx	S
42086	Measured flow (gpm or L/min)	100	xxxxx	S
42087	Year (4-digit)	100	xxxxx	S
42088	Month 1–12	100	xxxxx	S
42089	Day 1–31	100	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42090	SYS — SUCT pressure (psi or bar)	100	xxxx.x or xxx.xx†	S
42091	rpm	100	xxxxx	S
42092	Suction pressure (psi or bar)	100	xxxx.x or xxx.xx†	S
42093	System pressure (psi or bar)	100	xxxx.x or xxx.xx†	S
42094	Amps battery 1	100	xxxxx	S
42095	Amps battery 2	100	xxxxx	S
42096	Volts battery 1	100	xxxxx	S
42097	Volts battery 2	100	xxxxx	S
42098	Unused	100	xxxxx	S
42099	Unused	100	xxxxx	S
42100	Measured flow (gpm or L/min)	125	xxxxx	S
42101	Year (4-digit)	125	xxxxx	S
42102	Month 1–12	125	xxxxx	S
42103	Day 1–31	125	xxxxx	S
42104	SYS — SUCT pressure (psi or bar)	125	xxxx.x or xxx.xx†	S
42105	rpm	125	xxxxx	S
42106	Suction pressure (psi or bar)	125	xxxx.x or xxx.xx†	S
42107	System pressure (psi or bar)	125	xxxx.x or xxx.xx†	S
42108	Amps battery 1	125	xxxxx	S
42109	Amps battery 2	125	xxxxx	S
42110	Volts battery 1	125	xxxxx	S
42111	Volts battery 2	125	xxxxx	S
42112	Unused	125	xxxxx	S
42113	Unused	125	xxxxx	S
42114	Measured flow (gpm or L/min)	150	xxxxx	S
42115	Year (4-digit)	150	xxxxx	S
42116	Month 1–12	150	xxxxx	S
42117	Day 1–31	150	xxxxx	S
42118	SYS — SUCT pressure (psi or bar)	150	xxxx.x or xxx.xx†	S
42119	rpm	150	xxxxx	S
42120	Suction pressure (psi or bar)	150	xxxx.x or xxx.xx†	S
42121	System pressure (psi or bar)	150	xxxx.x or xxx.xx†	S
42122	Amps battery 1	150	xxxxx	S
42123	Amps battery 2	150	xxxxx	S
42124	Volts battery 1	150	xxxxx	S
42125	Volts battery 2	150	xxxxx	S
42126	Unused	150	xxxxx	S
42127	Unused	150	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
Previous Data	%FLOW			
42128	Measured flow (gpm or L/min)	0	xxxxx	S
42129	Year (4-digit)	0	xxxxx	S
42130	Month 1–12	0	xxxxx	S
42131	Day 1–31	0	xxxxx	S
42132	SYS — SUCT pressure (psi or bar)	0	xxxx.x or xxx.xx†	S
42133	rpm	0	xxxxx	S
42134	Suction pressure (psi or bar)	0	xxxx.x or xxx.xx†	S
42135	System pressure (psi or bar)	0	xxxx.x or xxx.xx†	S
42136	Amps battery 1	0	xxxxx	S
42137	Amps battery 2	0	xxxxx	S
42138	Volts battery 1	0	xxxxx	S
42139	Volts battery 2	0	xxxxx	S
42140	Unused	0	xxxxx	S
42141	Unused	0	xxxxx	S
42142	Measured flow (gpm or L/min)	25	xxxxx	S
42143	Year (4-digit)	25	xxxxx	S
42144	Month 1–12	25	xxxxx	S
42145	Day 1–31	25	xxxxx	S
42146	SYS — SUCT pressure (psi or bar)	25	xxxx.x or xxx.xx†	S
42147	rpm	25	xxxxx	S
42148	Suction pressure (psi or bar)	25	xxxx.x or xxx.xx†	S
42149	System pressure (psi or bar)	25	xxxx.x or xxx.xx†	S
42150	Amps battery 1	25	xxxxx	S
42151	Amps battery 2	25	xxxxx	S
42152	Volts battery 1	25	xxxxx	S
42153	Volts battery 2	25	xxxxx	S
42154	Unused	25	xxxxx	S
42155	Unused	25	xxxxx	S
42156	Measured flow (gpm or L/min)	50	xxxxx	S
42157	Year (4-digit)	50	xxxxx	S
42158	Month 1–12	50	xxxxx	S
42159	Day 1–31	50	xxxxx	S
42160	SYS — SUCT pressure (psi or bar)	50	xxxx.x or xxx.xx†	S
42161	rpm	50	xxxxx	S
42162	Suction pressure (psi or bar)	50	xxxx.x or xxx.xx†	S
42163	System pressure (psi or bar)	50	xxxx.x or xxx.xx†	S
42164	Amps battery 1	50	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42165	Amps battery 2	50	xxxxx	S
42166	Volts battery 1	50	xxxxx	S
42167	Volts battery 2	50	xxxxx	S
42168	Unused	50	xxxxx	S
42169	Unused	50	xxxxx	S
42170	Measured flow (gpm or L/min)	75	xxxxx	S
42171	Year (4-digit)	75	xxxxx	S
42172	Month 1–12	75	xxxxx	S
42173	Day 1–31	75	xxxxx	S
42174	SYS – SUCT pressure (psi or bar)	75	xxxx.x or xxx.xx†	S
42175	rpm	75	xxxxx	S
42176	Suction pressure (psi or bar)	75	xxxx.x or xxx.xx†	S
42177	System pressure (psi or bar)	75	xxxx.x or xxx.xx†	S
42178	Amps battery 1	75	xxxxx	S
42179	Amps battery 2	75	xxxxx	S
42180	Volts battery 1	75	xxxxx	S
42181	Volts battery 2	75	xxxxx	S
42182	Unused	75	xxxxx	S
42183	Unused	75	xxxxx	S
42184	Measured flow (gpm or L/min)	100	xxxxx	S
42185	Year (4-digit)	100	xxxxx	S
42186	Month 1–12	100	xxxxx	S
42187	Day 1–31	100	xxxxx	S
42188	SYS – SUCT pressure (psi or bar)	100	xxxx.x or xxx.xx†	S
42189	rpm	100	xxxxx	S
42190	Suction pressure (psi or bar)	100	xxxx.x or xxx.xx†	S
42191	System pressure (psi or bar)	100	xxxx.x or xxx.xx†	S
42192	Amps battery 1	100	xxxxx	S
42193	Amps battery 2	100	xxxxx	S
42194	Volts battery 1	100	xxxxx	S
42195	Volts battery 2	100	xxxxx	S
42196	Unused	100	xxxxx	S
42197	Unused	100	xxxxx	S
42198	Measured flow (gpm or L/min)	125	xxxxx	S
42199	Year (4-digit)	125	xxxxx	S
42200	Month 1–12	125	xxxxx	S
42201	Day 1–31	125	xxxxx	S
42202	SYS – SUCT pressure (psi or bar)	125	xxxx.x or xxx.xx†	S
42203	rpm	125	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42204	Suction pressure (psi or bar)	125	xxxx.x or xxx.xx†	S
42205	System pressure (psi or bar)	125	xxxx.x or xxx.xx†	S
42206	Amps battery 1	125	xxxxx	S
42207	Amps battery 2	125	xxxxx	S
42208	Volts battery 1	125	xxxxx	S
42209	Volts battery 2	125	xxxxx	S
42210	Unused	125	xxxxx	S
42211	Unused	125	xxxxx	S
42212	Measured flow (gpm or L/min)	150	xxxxx	S
42213	Year (4-digit)	150	xxxxx	S
42214	Month 1–12	150	xxxxx	S
42215	Day 1–31	150	xxxxx	S
42216	SYS — SUCT pressure (psi or bar)	150	xxxx.x or xxx.xx†	S
42217	rpm	150	xxxxx	S
42218	Suction pressure (psi or bar)	150	xxxx.x or xxx.xx†	S
42219	System pressure (psi or bar)	150	xxxx.x or xxx.xx†	S
42220	Amps battery 1	150	xxxxx	S
42221	Amps battery 2	150	xxxxx	S
42222	Volts battery 1	150	xxxxx	S
42223	Volts battery 2	150	xxxxx	S
42224	Unused	150	xxxxx	S
42225	Unused	150	xxxxx	S
Acceptance Data		% FLOW		
42226	Measured flow (gpm or L/min)	0	xxxxx	P
42227	Year (4-digit)	0	xxxxx	P
42228	Month 1–12	0	xxxxx	P
42229	Day 1–31	0	xxxxx	P
42230	SYS — SUCT pressure (psi or bar)	0	xxxx.x or xxx.xx†	P
42231	rpm	0	xxxxx	P
42232	Suction pressure (psi or bar)	0	xxxx.x or xxx.xx†	P
42233	System pressure (psi or bar)	0	xxxx.x or xxx.xx†	P
42234	Amps battery 1	0	xxxxx	P
42235	Amps battery 2	0	xxxxx	P
42236	Volts battery 1	0	xxxxx	P
42237	Volts battery 2	0	xxxxx	P
42238	Unused	0	xxxxx	P
42239	Unused	0	xxxxx	P
42240	Measured flow (gpm or L/min)	25	xxxxx	P

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42241	Year (4-digit)	25	xxxxx	P
42242	Month 1–12	25	xxxxx	P
42243	Day 1–31	25	xxxxx	P
42244	SYS — SUCT pressure (psi or bar)	25	xxxx.x or xxx.xx†	P
42245	rpm	25	xxxxx	P
42246	Suction pressure (psi or bar)	25	xxxx.x or xxx.xx†	P
42247	System pressure (psi or bar)	25	xxxx.x or xxx.xx†	P
42248	Amps battery 1	25	xxxxx	P
42249	Amps battery 2	25	xxxxx	P
42250	Volts battery 1	25	xxxxx	P
42251	Volts battery 2	25	xxxxx	P
42252	Unused	25	xxxxx	P
42253	Unused	25	xxxxx	P
42254	Measured flow (gpm or L/min)	50	xxxxx	P
42255	Year (4-digit)	50	xxxxx	P
42256	Month 1–12	50	xxxxx	P
42257	Day 1–31	50	xxxxx	P
42258	SYS — SUCT pressure (psi or bar)	50	xxxx.x or xxx.xx†	P
42259	rpm	50	xxxxx	P
42260	Suction pressure (psi or bar)	50	xxxx.x or xxx.xx†	P
42261	System pressure (psi or bar)	50	xxxx.x or xxx.xx†	P
42262	Amps battery 1	50	xxxxx	P
42263	Amps battery 2	50	xxxxx	P
42264	Volts battery 1	50	xxxxx	P
42265	Volts battery 2	50	xxxxx	P
42266	Unused	50	xxxxx	P
42267	Unused	50	xxxxx	P
42268	Measured flow (gpm or L/min)	75	xxxxx	P
42269	Year (4-digit)	75	xxxxx	P
42270	Month 1–12	75	xxxxx	P
42271	Day 1–31	75	xxxxx	P
42272	SYS — SUCT pressure (psi or bar)	75	xxxx.x or xxx.xx†	P
42273	rpm	75	xxxxx	P
42274	Suction pressure (psi or bar)	75	xxxx.x or xxx.xx†	P
42275	System pressure (psi or bar)	75	xxxx.x or xxx.xx†	P
42276	Amps battery 1	75	xxxxx	P
42277	Amps battery 2	75	xxxxx	P
42278	Volts battery 1	75	xxxxx	P

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42279	Volts battery 2	75	xxxxx	P
42280	Unused	75	xxxxx	P
42281	Unused	75	xxxxx	P
42282	Measured flow (gpm or L/min)	100	xxxxx	P
42283	Year (4-digit)	100	xxxxx	P
42284	Month 1–12	100	xxxxx	P
42285	Day 1–31	100	xxxxx	P
42286	SYS – SUCT pressure (psi or bar)	100	xxxx.x or xxx.xx†	P
42287	rpm	100	xxxxx	P
42288	Suction pressure (psi or bar)	100	xxxx.x or xxx.xx†	P
42289	System pressure (psi or bar)	100	xxxx.x or xxx.xx†	P
42290	Amps battery 1	100	xxxxx	P
42291	Amps battery 2	100	xxxxx	P
42292	Volts battery 1	100	xxxxx	P
42293	Volts battery 2	100	xxxxx	P
42294	Unused	100	xxxxx	P
42295	Unused	100	xxxxx	P
42296	Measured flow (gpm or L/min)	125	xxxxx	P
42297	Year (4-digit)	125	xxxxx	P
42298	Month 1–12	125	xxxxx	P
42299	Day 1–31	125	xxxxx	P
42300	SYS – SUCT pressure (psi or bar)	125	xxxx.x or xxx.xx†	P
42301	rpm	125	xxxxx	P
42302	Suction pressure (psi or bar)	125	xxxx.x or xxx.xx†	P
42303	System pressure (psi or bar)	125	xxxx.x or xxx.xx†	P
42304	Amps battery 1	125	xxxxx	P
42305	Amps battery 2	125	xxxxx	P
42306	Volts battery 1	125	xxxxx	P
42307	Volts battery 2	125	xxxxx	P
42308	Unused	125	xxxxx	P
42309	Unused	125	xxxxx	P
42310	Measured flow (gpm or L/min)	150	xxxxx	P
42311	Year (4-digit)	150	xxxxx	P
42312	Month 1–12	150	xxxxx	P
42313	Day 1–31	150	xxxxx	P
42314	SYS – SUCT pressure (psi or bar)	150	xxxx.x or xxx.xx†	P
42315	rpm	150	xxxxx	P
42316	Suction pressure (psi or bar)	150	xxxx.x or xxx.xx†	P

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
42317	System pressure (psi or bar)	150	xxxx.x or xxx.xx†	P
42318	Amps battery 1	150	xxxxx	P
42319	Amps battery 2	150	xxxxx	P
42320	Volts battery 1	150	xxxxx	P
42321	Volts battery 2	150	xxxxx	P
42322	Unused	150	xxxxx	P
42323	Unused	150	xxxxx	P
Jockey Pump Operation				
42500	Last jockey pump monitoring reset date (year)	NA	xxxxx	S
42501	Last jockey pump monitoring reset date (month)	NA	xxxxx	S
42502	Last jockey pump monitoring reset date (day)	NA	xxxxx	S
42503	Last jockey pump monitoring reset time (hr)	NA	xxxxx	S
42504	Last jockey pump monitoring reset time (min)	NA	xxxxx	S
42505	Last jockey pump monitoring reset time (sec)	NA	xxxxx	S
42506	Total number of starts (since reset)	NA	xxxxx	S
42507	Total jockey pump run time (minutes since last reset)	NA	xxxxx	S
42508	Jockey pump start pressure (most recent)	NA	xxxxx	S
42509	Jockey pump stop pressure	NA	xxxxx	S
42510	Most recent run time (sec)	NA	xxxxx	S

NA: Not applicable. P: Permanent. S: Static. D: Dynamic

*One decimal place assumed for battery voltage, amperes, and hours.

†One decimal place assumed if psi and two decimal place assumed if bar.

Table C.9.2.10.1(d) Recommended Additional Standardized Controller Modbus Register Definitions

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
Basic Information (should be supplied by the fire pump package integrator)				
43001	Recording units	NA	Xxxxx ^a	P
43002-43021	Fire pump type	NA	String(40)	P
43022	Rated flow	NA	xxxxx	P
43023	Rated pressure	NA	xxxxx	P
43024	Rated speed	NA	xxxxx	P
43025	Rated horsepower	NA	xxxxx	P
43026	Factory test pressure	NA	xxxxx	P
43027	Design net churn pressure	NA	xxxxx	P
43028	Design net 150% pressure	NA	xxxxx	P
43029	Pump start pressure	NA	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
43030	Pump-reset pressure	NA	xxxxx	S
43031	Design suction pressure	NA	xxxxx	S
43032	Design discharge pressure	NA	xxxxx	S
43101-43120	Electric motor manufacturer	NA	String(40)	P
43121-43140	Electric motor type	NA	String(40)	P
43141-43160	Electric motor serial number	NA	String(40)	P
43161-43180	Electric motor model number	NA	String(40)	P
43181-43183	Electric motor date in service	NA	xxxxx	P
43184	Nominal system voltage	NA	xxxxx	P
43185	Electric motor rated horsepower	NA	xxxxx	P
43186	Electric motor rated speed	NA	xxxxx	P
43187	Motor rated FLA at the system nominal voltage	NA	xxxxx	P
43188	Motor service factor	NA	x.xxxx ^b	P
43189	Motor starting code	NA	ASCII	P
43190	Name plate full load amps	NA	xxxxx	P
43251-43270	Diesel engine manufacturer	NA	String(40)	P
43271-43290	Diesel engine serial number	NA	String(40)	P
43291-43310	Diesel engine model number	NA	String(40)	P
43311-43313	Diesel engine date in service	NA	xxxxx	P
43314	Diesel engine rated horsepower	NA	xxxxx	P
43315	Diesel engine rated speed	NA	xxxxx	P
43351-43370	Controller manufacturer	NA	String(40)	P
43371-43390	Controller type	NA	String(40)	P
43391-43410	Controller serial number	NA	String(40)	P
43411-43430	Controller model number	NA	String(40)	P
43431-43433	Controller date in service	NA	xxxxx	P
43501-43520	Jockey pump manufacturer	NA	String(40)	P
43521-43540	Jockey pump type	NA	String(40)	P
43541-43560	Jockey pump serial number	NA	String(40)	P
43561-43580	Jockey pump model number	NA	String(40)	P
43581-43583	Jockey pump date in service	NA	xxxxx	S
43584	Jockey pump horsepower	NA	xxxxx	P
43585	Jockey pump start pressure	NA	xxxxx	S
43586	Jockey pump reset pressure	NA	xxxxx	S
43651-43670	Jockey pump controller manufacturer	NA	String(40)	P
43671-43690	Jockey pump controller type	NA	String(40)	P
43691-43710	Jockey pump controller serial number	NA	String(40)	P
43711-43730	Jockey pump controller model number	NA	String(40)	P
43731-43733	Jockey pump controller date in service	NA	xxxxx	P
43801	Maximum system flow demand (at pump discharge flange)	NA	xxxxx	P
43802	Maximum system pressure demand (at pump discharge flange)	NA	xxxx.x or xxx.xx ^e	P
	Continuously Monitored Data	NA		

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
43851	Fire pump power status	NA	xxxxx	D
43852	Fire pump running status	NA	xxxxx	D
43853	Fire pump test running	NA	xxxxx	D
			xxxx.x or	
43854	Suction Pressure (psi or bar)	NA	xxx.xx ^G	D
			xxxx.x or	
43855	System pressure (psi or bar)	NA	xxx.xx ^G	D
			xxxx.x or	
43856	Pump discharge pressure (psi or bar)	NA	xxx.xx ^G	D
43857	Water temperature in pump casing	NA	xxxxx	D
43858	Room temperature	NA	xxxxx	D
43859-43861	Last pump start date	NA	xxxxx	S
43862-43864	Last pump start time	NA	xxxxx	S
			xxxx.x or	
43865	Pressure at pump start	NA	xxx.xx ^G	S
43866-43871	Type of start (1-automatic demand, 2-automatic test, 3-manual)	NA	xxxxx	S
43872-43874	Last pump shutdown date	NA	xxxxx	S
43875-43877	Last pump shutdown time	NA		
			xxxx.x or	
43878	System pressure at pump shutdown	NA	xxx.xx ^G	S
43879	Type of shutdown (1-automatic demand, 2-automatic test, 3-manual, 4-overspeed, 5-other trouble)	NA	xxxxx	S
43880	Loss of power	NA	xxxxx	S
43881	Transfer of power	NA	xxxxx	S
43901	Fuel tank level (0-above $\frac{2}{3}$, 1-below $\frac{2}{3}$)	NA	xxxxx	S
43902	Fuel tank level (% full)	NA	xxx.xx ^d	
43903	Fuel maintenance system status	NA	xxxxx	S
	Nonflow Test Data Sets — 10 sets	NA		
43951-43953	Last nonflow monitoring reset date (day-month-year)	NA	xxxxx	S
43954-43956	Last nonflow monitoring reset time (hour(s)-minutes-seconds)	NA	xxxxx	
43957	Total number of nonflow tests during monitored period	NA	xxxxx	S
43958	Total pump test run time during monitored period (minutes)	NA	xxxxx	S
43959-43988	Nonflow test date start (day-month-year)	NA	xxxxx	S
43989-44018	Nonflow test time start (hr-min-sec)	NA	xxxxx	S
44019-44048	Nonflow test date end (day-month-year)	NA	xxxxx	S
44049-44078	Nonflow test time end (hr-min-sec)	NA	xxxxx	S
44079-44088	Nonflow test reference identifier	NA	xxxxx	S
44089-44098	Nonflow test data set reference identifier	NA	xxxxx	S
			xxxx.x or	
44099-44108	Nonflow test suction pressure (psi or bar)	NA	xxx.xx ^G	S
			xxxx.x or	
44109-44118	Nonflow test system pressure (psi or bar)	NA	xxx.xx ^G	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
44119-44128	Nonflow test pump discharge pressure (psi or bar)	NA	xxxx.x or xxx.xx ^G	S
44129-44138	Nonflow test net pressure (psi or bar)	NA	xxxx.x or xxx.xx ^G	S
44139-44148	Nonflow test water temperature in pump casing	NA	xxxxx	S
44149-44158	Nonflow test room temperature	NA	xxxxx	S
44159-44188	Nonflow test pump start date (day-month-year)	NA	xxxxx	S
44189-44218	Nonflow test pump start time (hr-min-sec)	NA	xxxxx	S
44219-44228	Nonflow test pressure at pump start	NA	xxxx.x or xxx.xx ^G	S
44229-44238	Nonflow test minimum transducer pressure	NA	xxxx.x or xxx.xx ^G	S
44239-44248	Nonflow test type of start (1-automatic demand, 2-automatic test, 3-manual)	NA	xxxxx	S
44249-44278	Nonflow test pump shutdown time	NA	xxxxx	S
44279-44288	Nonflow test system pressure at pump shutdown	NA	xxxx.x or xxx.xx ^G	S
44289-44298	Nonflow test type of shutdown (1-automatic demand, 2-automatic test, 3-manual, 4-overspeed, 5-other trouble)	NA	xxxxx	S
44299-44308	Nonflow test rpm	NA	xxxxx	S
44309-44318	Non-flow test voltage phase A-B	NA	xxxxx	S
44319-44328	Nonflow test voltage phase B-C	NA	xxxxx	S
44329-44338	Nonflow test voltage phase C-A	NA	xxxxx	S
44339-44348	Nonflow test amperage phase 1	NA	xxxxx	S
44349-44358	Nonflow test amperage phase 2	NA	xxxxx	S
44359-44368	Nonflow test amperage phase 3	NA	xxxxx	S
Acceptance Test Data Set – Permanent – 0%, 25%, 50%, 75%, 100%, 125%, & 150%		NA		
44601-44603	Test date acceptance test (day month year)	NA	xxxxx	P
44604	Test reference identifier acceptance test	NA	xxxxx	P
44605-44611	Data set reference identifier acceptance test	Yes	xxxxx	P
44612-44618	Suction pressure acceptance test	Yes	xxxx.x or xxx.xx ^G	P
44619-44625	System pressure acceptance test	Yes	xxxx.x or xxx.xx ^G	P
44626-44632	Discharge pressure acceptance test	Yes	xxxx.x or xxx.xx ^G	P
44633-44639	Net pressure	Yes	xxxx.x or xxx.xx ^G	P
44661-44667	Water temperature in pump casing acceptance test	Yes	xxxxx	P
44668-44674	Room temperature acceptance test	Yes	xxxxx	P
44675-44677	Initial pump start date acceptance test	NA	xxxxx	P
44678-44680	Initial pump start time acceptance test	NA	xxxxx	P
44681-44683	Final pump stop date acceptance test	NA	xxxxx	P
44684-44686	Final pump stop time acceptance test	NA	xxxxx	P

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
44687-44716	Pump start dates acceptance test (record up to 10)	NA	xxxxx	P
44717-44746	Pump start times acceptance test (record up to 10)	NA	xxxxx	P
44747-44776	Pump stop dates acceptance test (record up to 10)	NA	xxxxx	P
44777-44806	Pump stop times acceptance test (record up to 10)	NA	xxxxx	P
			xxxx.x or	
44821-44841	Pressure at pump start acceptance test	NA	xxx.xx ^G	P
44842-44848	Type of start acceptance test (1-automatic demand, 2-automatic test, 3-manual)	NA	xxxxx	P
44849-44855	Minimum transducer pressure at startup acceptance test	NA	xxxxx	P
44856	Number of start and stops during acceptance test	NA	xxxxx	P
44857-44859	Final pump shutdown time acceptance test	NA	xxxxx	P
			xxxx.x or	
44860	System pressure at final pump shutdown	NA	xxx.xx ^G	P
44861	Type of shutdown (1-automatic demand, 2-automatic test, 3-manual, 4-overspeed, 5-other trouble)	NA	xxxxx	P
44881-44901	Loss of power (for transfer) date (day-month-year)	NA	xxxxx	P
44902-44922	Loss of power (for transfer) time (hr-min-sec)	NA	xxxxx	P
44923-44943	Transfer of power date (day-month-year)	NA	xxxxx	P
44944-44964	Transfer of power time (hr-min-sec)	NA	xxxxx	P
44965-44985	Day power restored to normal (day-month-year)	NA	xxxxx	P
44986-45006	Time power restored to normal (hr-min-sec)	NA	xxxxx	P
45007-45027	Date readings recorded (day-month-year)	NA	xxxxx	P
45028-45048	Time readings recorded (hr-min-sec)	NA	xxxxx	P
45061-45067	rpm	Yes	xxxxx	P
45068-45074	Voltage phase A-B acceptance test	Yes	xxxxx	P
45075-45081	Voltage phase B-C acceptance test	Yes	xxxxx	P
45082-45088	Voltage phase C-A acceptance test	Yes	xxxxx	P
45089-45095	Amperage phase 1 acceptance test	Yes	xxxxx	P
45096-45102	Amperage phase 2 acceptance test	Yes	xxxxx	P
45103-45109	Amperage phase 3 acceptance test	Yes	xxxxx	P
45151-45170	Nozzle coefficient acceptance test, up to 20 per test	NA	x.xxxx ^b	P
45171-45190	Nozzle size acceptance test, up to 20 per test (in. or cm)	NA	xx.xxx ^e	P
			xxxx.x or	
45191-45330	Nozzle pitot pressure acceptance test, up to 20 per test	Yes	xxx.xx ^G	P
45361-45367	Fuel tank level acceptance test (0-above $\frac{2}{3}$, 1-below $\frac{2}{3}$)	Yes	xxxxx	P
45368-45374	Fuel tank level acceptance test (% full)	Yes	xxxxx	P
45375-45381	Flow through pump acceptance test	Yes	xxxxx	P
			xxxx.x or	
45382-45388	rpm-adjusted net pressure acceptance test	Yes	xxx.xx ^G	P
45389-45395	rpm-adjusted flow acceptance test (gpm or L/min)	Yes	xxxxx	P
45396-45402	% of factory certified curve acceptance test	Yes	xxxxx	P
45421-45422	Hours on diesel engine or electric motor at start of acceptance test	NA	xxxxxxxx.xx ^d	P

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
45423-45424	Hours on diesel engine or electric motor at conclusion of acceptance test	NA	xxxxxxxx.xx ^d	P
45425	Pump passed initial acceptance test	NA	Y/N	P
45426	Pump could supply maximum system demand acceptance test (1-Yes, 2-No, 3-Demand not known)	NA	xxxxx	P
45427	Pump was significantly impaired acceptance test	NA	Y/N	P
45428	Pump was partially impaired acceptance test	NA	Y/N	P
45429	Pump passed after adjustments acceptance test	NA	Y/N	P
45430	Failure mode acceptance test (See standardize list)	NA	xxxxx	P
45431-45470	Explanation of failure acceptance test	NA	String(80)	P
	Fire Pump Operation	NA	xxxxx	S
45501-45503	Last fire pump monitoring reset date	NA	xxxxx	S
45504-45506	Last fire pump monitoring reset time	NA		
45507-45566	Fire pump start date and time (last 10 times)	NA	xxxxx	S
45567-45626	Fire pump stop date and time (last 10 times)	NA	xxxxx	S
45627	Fire pump start pressure (most recent)	NA	xxxxx	S
45628	Fire pump stop pressure (most recent)	NA	xxxxx	S
45629	Stop automatic or manual (most recent)	NA	xxxxx	S
45630	Total number of starts since reset	NA	xxxxx	S
45631-45632	Total run time since reset (minutes)	NA	xxxxx	S
45661-45810	Date loss of electrical power with switch in on position since last reset (50 sets)	NA	xxxxx	S
45811-45960	Time loss of electrical power with switch in on position since last reset (50 sets)	NA	xxxxx	S
45961-46110	Date power restored after loss of power with switch in on position since last reset (50 sets)	NA	xxxxx	S
46111-46260	Time power restored after loss of power with switch in on position since last reset (50 sets)	NA	xxxxx	S
46261-46410	Date power switch turned off (50 sets)	NA	xxxxx	S
46411-46560	Time power switch turned off (50 sets)	NA	xxxxx	S
46561-46710	Date power switch turned back on (50 sets)	NA	xxxxx	S
46711-46860	Time power switch turned back on (50 sets)	NA	xxxxx	S
Current Performance Test Data Set – Permanent – 0%, 25%, 50%, 75%, 100%, 125%, & 150%				
47001-47003	Test date current performance test (day month year)	NA	xxxxx	S
47004	Test reference identifier current performance test	NA	xxxxx	S
47005-47011	Data set reference identifier current performance test	Yes	xxxxx	S
			xxxx.x or	
47012-47018	Suction pressure current performance test	Yes	xxx.xx ^e	S
			xxxx.x or	
47019-47025	System pressure current performance test	Yes	xxx.xx ^e	S
			xxxx.x or	
47026-47032	Discharge pressure current performance test	YES	xxx.xx ^e	S
			xxxx.x or	
47033-47039	Net pressure	YES	xxx.xx ^e	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
47061-47067	Water temperature in pump casing current performance test	YES	xxxxx	S
47068-47074	Room temperature current performance test	YES	xxxxx	S
47075-47077	Initial pump start date current performance test	NA	xxxxx	S
47078-47080	Initial pump start time current performance test	NA	xxxxx	S
47081-47083	Final pump stop date current performance test	NA	xxxxx	S
47084-47086	Final pump stop time current performance test	NA	xxxxx	S
47087-47116	Pump start dates current performance test (record up to 10)	NA	xxxxx	S
47117-47146	Pump start times current performance test (record up to 10)	NA	xxxxx	S
47147-47176	Pump stop dates current performance test (record up to 10)	NA	xxxxx	S
47177-47206	Pump stop times current performance test (record up to 10)	NA	xxxxx	S
47221-47241	Pressure at pump start current performance test	NA	xxxx.x or xxx.xx ^G	S
47242-47248	Type of start current performance test (1-automatic demand, 2-automatic test, 3-manual) (up to 7 startups)	NA	xxxxx	S
47249-47255	Minimum transducer pressure at startup current performance test (up to 7 startups)	NA	xxxxx	S
47256	Number of start and stops during current performance test	NA	xxxxx	S
47257-47259	Final pump shutdown time current performance test	NA	xxxxx	S
47260	System pressure at final pump shutdown	NA	xxxx.x or xxx.xx ^G	S
47261	Type of shutdown (1-automatic demand, 2-automatic test, 3-manual, 4-overspeed, 5-other trouble)	NA	xxxxx	S
47281-47301	Loss of power (for transfer or shutdown, up to 7) date (day month year)	NA	xxxxx	
47302-47322	Loss of power (for transfer or shutdown, up to 7) time (hr min sec)	NA	xxxxx	S
47323-47343	Transfer of power date, up to 7 (day month year)	NA	xxxxx	
47344-47364	Transfer of power time, up to 7 (hr min sec)	NA	xxxxx	S
47365-47385	Day power restored to normal, up to 7 (day month year)	NA	xxxxx	
47386-47406	Time power restored to normal, up to 7 (hr min sec)	NA	xxxxx	
47407-47427	Date readings recorded (day month year)	Yes	xxxxx	S
47428-47448	Time readings recorded (hr min sec)	Yes	xxxxx	S
47461-47467	rpm	Yes	xxxxx	S
47468-47474	Voltage phase A-B current performance test	Yes	xxxxx	S
47475-47481	Voltage phase B-C current performance test	Yes	xxxxx	S
47482-47488	Voltage phase C-A current performance test	Yes	xxxxx	S
47489-47495	Amperage phase 1, current performance test	Yes	xxxxx	S
47496-47502	Amperage phase 2, current performance test	Yes	xxxxx	S
47503-47509	Amperage Phase 3, current performance test	Yes	xxxxx	S
47551-47570	Nozzle coefficient current performance test, up to 20 per test	NA	x.xxxx ^b	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
47571-47590	Nozzle size current performance test, up to 20 per test (inch or cm)	NA	xx.xxx ^e	S
47591-47730	Nozzle pitot pressure current performance test, up to 20 per test	Yes	xxxx.x or xxx.xx ^e	S
47761-47767	Fuel tank level current performance test (0-above $\frac{2}{3}$; 1-below $\frac{2}{3}$)	Yes	xxxxx	S
47768-47774	Fuel tank level current performance test (% full)	Yes	xxxxx	S
47775-47781	Flow through pump current performance test	Yes	xxxxx	S
47782-47788	rpm-adjusted net pressure current performance test	Yes	xxxx.x or xxx.xx ^e	S
47789-47795	rpm-adjusted flow current performance test (gpm or L/min)	Yes	xxxxx	S
47796-47802	% of factory certified curve current performance test	Yes	xxxxx	S
47821-47822	Hours on diesel engine or electric motor at start of current performance test	NA	xxxxxxxx.xx ^d	S
47823-47824	Hours on diesel engine or electric motor at conclusion of current performance test	NA	xxxxxxxx.xx ^d	S
47825	Pump passed initial current performance test	NA	Y/N	S
47826	Pump could supply maximum system demand current performance test (1-Yes, 2-No, 3-Demand not known)	NA	xxxxx	S
47827	Pump was significantly impaired current performance test	NA	Y/N	S
47828	Pump was partially impaired current performance test	NA	Y/N	S
47829	Pump passed after adjustments current performance test	NA	Y/N	S
47830	Failure mode current performance test (see standardize list)	NA	xxxxx	S
47831-47870	Explanation of failure current performance test	NA	String(80)	S
Previous Performance Test Data Set – Static – 0%, 25%, 50%, 75%, 100%, 125%, & 150%		NA		
48001-48003	Test date previous performance test (day month year)	NA	xxxxx	S
48004	Test reference identifier previous performance test	NA	xxxxx	S
48005-48011	Data set reference identifier previous performance test	Yes	xxxxx	S
48012-48018	Suction pressure previous performance test	Yes	xxxx.x or xxx.xx ^e	S
48019-48025	System pressure previous performance test	Yes	xxxx.x or xxx.xx ^e	S
48026-48032	Discharge pressure previous performance test	Yes	xxxx.x or xxx.xx ^e	S
48033-48039	Net pressure	Yes	xxx.xx ^e	S
48061-48067	Water temperature in pump casing previous performance test	Yes	xxxxx	S
48068-48074	Room temperature previous performance test	Yes	xxxxx	S
48075-48077	Initial pump start date previous performance test	NA	xxxxx	S
48078-48080	Initial pump start time previous performance test	NA	xxxxx	S
48081-48083	Final pump stop date previous performance test	NA	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
48084-48086	Final pump stop time previous performance test	NA	xxxxx	S
48087-48116	Pump start dates previous performance test (record up to 10)	NA	xxxxx	S
48117-48146	Pump start times previous performance test (record up to 10)	NA	xxxxx	S
48147-48176	Pump stop dates previous performance test (record up to 10)	NA	xxxxx	S
48177-48206	Pump stop times previous performance test (record up to 10)	NA	xxxxx	S
48221-48241	Pressure at pump start previous performance test	NA	xxxx.x or xxx.xx ⁶	S
48242-48248	Type of start previous performance test, up to 7 (1-automatic demand, 2-automatic test, 3-manual)	NA	xxxxx	S
48249-48255	Minimum transducer pressure at startup previous performance test, up to 7	NA	xxxxx	S
48256	Number of start and stops during previous performance test	NA	xxxxx	S
48257-48259	Final pump shutdown time previous performance test	NA	xxxxx	S
48260	System pressure at final pump shutdown	NA	xxxx.x or xxx.xx ⁶	S
48261	Type of shutdown (1-automatic demand, 2-automatic test, 3-manual, 4-overspeed, 5-other trouble)	NA	xxxxx	S
48281-48301	Loss of power (for transfer or shutdown, up to 7) date (day month year)	NA	xxxxx	S
48302-48322	Loss of power (for transfer or shutdown, up to 7) time (hr min sec)	NA	xxxxx	S
48323-48343	Transfer of power date, up to 7 (day month year)	NA	xxxxx	S
48344-48364	Transfer of power time, up to 7 (hr min sec)	NA	xxxxx	S
48365-48385	Day power restored to normal, up to 7 (day month year)	NA	xxxxx	S
48386-48406	Time power restored to normal, up to 7 (hr min sec)	NA	xxxxx	S
48407-48427	Date readings recorded (day month year)	Yes	xxxxx	S
48428-48448	Time readings recorded (hr min sec)	Yes	xxxxx	S
48461-48467	rpm	Yes	xxxxx	S
48468-48474	Voltage Phase A-B, previous performance test	Yes	xxxxx	S
48475-48481	Voltage Phase B-C, previous performance test	Yes	xxxxx	S
48482-48488	Voltage Phase C-A, previous performance test	Yes	xxxxx	S
48489-48495	Amperage Phase 1, previous performance test	Yes	xxxxx	S
48496-48502	Amperage Phase 2, previous performance test	Yes	xxxxx	S
48503-48509	Amperage Phase 3, previous performance test	Yes	xxxxx	S
48551-48570	Nozzle coefficient previous performance test, up to 20 per test	NA	x.xxxx ^b	S
48571-48590	Nozzle size previous performance test, up to 20 per test (in. or cm)	NA	xx.xxx3	S
48591-48730	Nozzle pitot pressure previous performance test, up to 20 per test	Yes	xxxx.x or xxx.xx ⁶	S
48761-48767	Fuel tank level, previous performance test (0-above $\frac{2}{3}$, 1-below $\frac{2}{3}$)	Yes	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
48768-48774	Fuel tank level, previous performance test (% full)	Yes	xxxxx	S
48775-48781	Flow through pump, previous performance test	Yes	xxxxx	S
			xxxx.x or	
48782-48788	rpm-adjusted net pressure, previous performance test	Yes	xxx.xx ^e	S
48789-48795	rpm-adjusted flow, previous performance test (gpm or L/min)	Yes	xxxxx	S
48796-48802	% of factory-certified curve, previous performance test	Yes	xxxxx	S
48821-48822	Hours on diesel engine or electric motor at start of previous performance test	NA	xxxxxxxx.xx ^d	S
48823-48824	Hours on diesel engine or electric motor at conclusion of previous performance test	NA	xxxxxxxx.xx ^d	S
48825	Pump passed initial previous performance test	NA	Y/N	S
48826	Pump could supply maximum system demand previous performance test (1-Yes, 2-No, 3-Demand not known)	NA	xxxxx	S
48827	Pump was significantly impaired previous performance test	NA	Y/N	S
48828	Pump was partially impaired previous performance test	NA	Y/N	S
48829	Pump passed after adjustments previous performance test	NA	Y/N	S
48830	Failure mode previous performance test (see standardize list)	NA	xxxxx	S
48831-48870	Explanation of failure previous performance test	NA	String(80)	S
Repair Maintenance Data (20 sets)				S
48901-48903	Date of maintenance/repair	NA	xxxxx	S
48904	Maintenance/repair identifier	NA	xxxxx	S
48905	Routine maintenance or repair	NA	Y/N	S
48906	Pump out of service during maintenance/repair	NA	Y/N	S
48907-48909	Date pump out of service (day-month-year)	NA	xxxxx	S
48910-48912	Time pump out of service (hour-min-sec)	NA	xxxxx	S
48913-48915	Date pump restored to service (day-month-year)	NA	xxxxx	S
48916-48918	Time pump restored to service (hour-min-sec)	NA	xxxxx	S
48919-48921	Date pump maintenance/repair completed	NA	xxxxx	S
48922-48941	Part replaced (1)	NA	String(40)	S
48942-48981	Description of maintenance, repair, and/or Part 1 replacement	NA	String(80)	S
48982-49001	Part replaced (2)	NA	String(40)	S
49002-49041	Description of maintenance, repair, and/or Part 2 replacement	NA	String(80)	S
49042-49061	Part replaced (3)	NA	String(40)	S
49062-49101	Description of maintenance, repair, and/or Part 3 replacement	NA	String(80)	S
49102-49121	Part replaced (4)	NA	String(40)	S
49122-49161	Description of maintenance, repair, and/or Part 4 replacement	NA	String(80)	S
49162-49201	Routine maintenance or repair	NA	String(40)	S
49202-49204	Date repair completed	NA	xxxxx	S

<u>Modbus Register</u>	<u>Registry Use</u>	<u>Flow (%)</u>	<u>Format</u>	<u>Data Type</u>
49205	Fuel tank level current performance test (0-above $\frac{2}{3}$, 1-below $\frac{2}{3}$)	NA	xxxxx	S
49206	Fuel tank level current performance test (% full)	NA	xxxxx	S
49207	Fuel maintenance system status	NA	xxxxx	S
49208-49300	Unused	NA		S
49301-56900	19 additional repair maintenance data sets	NA	See 48901-49207	S

NA: Not applicable. P: Permanent. S: Static. D: Dynamic

^a A value of 0 is psi, gpm, in., and °F; a value of 1 is bar, L/min, cm, and °C.

^b Four decimal places assumed.

^c One decimal place assumed if psi, two decimal places assumed if bar.

^d Two decimal places assumed.

^e Three decimal places assumed.

C.9.2.10.2

Table C.9.2.10.1(d) Table C.9.2.10.1(c) includes information that is beyond the current functionality of fire pump controllers but is important for evaluating the reliability of fire pump systems and components. The proposed Modbus register usage in this table is preliminary and can be modified by NEMA and input from fire pump controller manufacturers. If it is determined that the information in Table C.9.2.10.1(d) Table C.9.2.10.1(c) is beyond what should be included in a fire pump controller, a standalone stand-alone device could be developed to handle the information in this table. The data in Table C.9.2.10.1(d) Table C.9.2.10.1(c) can be stored locally, remotely, or both.

C.9.2.11 Data Recording Formats.

C.9.2.11.1

The data formats shown in [Table C.9.2.11.1](#) are used in [Table C.9.2.11.2](#), [Table C.9.2.11.3](#), and [Table C.9.2.11.4](#).

Table C.9.2.11.1 Data Formats

<u>Reference Name</u>	<u>Format</u>	<u>Possible Values</u>			
Bit	-	0 or 1			
Byte	8 bits	0–256			
Character (char)	1 byte	0–256 interpreted as letters, numbers, or symbols using ASCII convention			
Integer (int)	2 bytes	0–65,534 (A decimal place can be assumed in interpreting.) When using an assumed decimal place for a number where the first digit can exceed 5, the number is limited to 4 digits.			
Number (num)	5 bytes	Byte	Value	Number	Power of 10
		1st byte	0	Positive	Positive
			1	Positive	Negative
			2	Negative	Positive
			3	Negative	Negative
		2nd–4th bytes	0–16,777,216	-	-
		5th byte	0–255 (10 ^{n})	-	-
String	Multi bytes as specified, e.g., string(80) is 80 bytes	Any letters, numbers, or symbols represented in the ASCII convention			
Date	8 characters	xxxx (year), xx (month), xx (day)			
Time	3 bytes	n hours (0–24), n minutes (0–60), n seconds (0–60)			

C.9.2.11.2

Table C.9.2.11.2 provides a record format that is common for most equipment and is referenced in the tables that provide formatting for associated fire pump equipment.

Table C.9.2.11.2 Common Equipment Data

<u>Category</u>	<u>Item</u>	<u>Format</u>	<u>Possible Values</u>
-	Manufacturer (develop list)	String(48)	Alphanumeric
	Model number	String(48)	Alphanumeric
	Size	String(48)	Alphanumeric
	Serial number	String(48)	Alphanumeric
	Year manufactured	4 Character	xxxx (year)
	Device/component identifier tag	String(48)	Alphanumeric

C.9.2.11.3

Table C.9.2.11.3 provides a format for basic information for electric fire pumps, controllers, and jockey pumps.

Table C.9.2.11.3 Recommended Standardized Format for Basic Fire Pump Information and Operation

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Type of record</u>	String(48)	FIRE PUMP (FP) RECORD	-
<u>Facility name</u>	String(96)	Alphanumeric	-
<u>Location — GPS coordinates (longitude)</u>	Number	-180° to +180°	-
<u>Location — GPS coordinates (latitude)</u>	Number	-90° to +90°	-
<u>Location — GPS coordinates (elevation)</u>	Number	ft or m	-
<u>Location adjusted for privacy — GPS coordinates (longitude)</u>	Number	-180° to +180°	-
<u>Location adjusted for privacy — GPS coordinates (latitude)</u>	Number	-900° to +90°	-
<u>Location adjusted for privacy — GPS coordinates (elevation)</u>	Number	ft or m	-
<u>Reporting units pressure</u>	Character	(1) psi (2) bar (3) pascals (4) other	-
<u>Reporting units flow</u>	Character	(1) gpm (2) L/min (3) L/sec (4) m ³ /min (5) ft ³ /min (6) other	-
<u>Type of inspection or test</u>	Character	(I) Inspection (T) Test (M) Maintenance (R) Repair	-
<u>Start of item record marker for item</u>	String(16)	RECORD START	-
<u>Unit type identifier (develop list)</u>	String(48)	Alphanumeric	-
<u>Passed, failed, or passed but needs attention</u>	Character	(P) Passed (F) Failed (A) Passed but needs attention	-
<u>Passed visual inspection</u>	Character	(Y) Yes (N) No (A) Not applicable	-
<u>Maintenance required</u>	Number	Number ≥ 0	-
<u>Maintenance done</u>	Character	(1) Not applicable (2) Completed (3) Ordered but not completed (4) Not ordered	-

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>End of item record marker</u>	String(16)	RECORD END	-
<u>End of ITM (all components reported)</u>	String(48)	END OF INSPECTION, TEST, AND MAINTENANCE REPORT	-
<u>Basic information (should be supplied by the fire pump package integrator)</u>	-	-	-
<u>Start fire pump info</u>	String(16)	START BASIC FP	-
<u>Fire pump type</u>	String(40)	-	P
<u>Rated flow</u>	Number	≥0	P
<u>Rated pressure</u>	Number	≥0	P
<u>Rated speed</u>	Number	≥0	P
<u>Rated horsepower</u>	Number	≥0	P
<u>Factory test pressure</u>	Number	≥0	P
<u>Design net churn pressure</u>	Number	≥0	P
<u>Design net 150% pressure</u>	Number	≥0	P
<u>Pump start pressure</u>	Number	≥0	S
<u>Pump reset pressure</u>	Number	≥0	S
<u>Design suction pressure</u>	Number	≥0	S
<u>Design discharge pressure</u>	Number	≥0	S
<u>Maximum system flow demand (at pump discharge flange)</u>	Number	≥0	P
<u>Maximum system pressure demand (at pump discharge flange)</u>	Number	≥0	P
<u>End fire pump info</u>	-	END BASIC FP	-
<u>Start fire pump motor</u>	-	START FP MOTOR	-
<u>Electric motor manufacturer</u>	String(40)	Alphanumeric	P
<u>Electric motor type</u>	String(40)	Alphanumeric	P
<u>Electric motor serial number</u>	String(40)	Alphanumeric	P
<u>Electric motor model number</u>	String(40)	Alphanumeric	P
<u>Electric motor date in service</u>	Date	Date	P
<u>Nominal system voltage</u>	Number	≥0	P
<u>Electric motor rated horsepower</u>	Number	≥0	P
<u>Electric motor rated speed</u>	Number	≥0	P
<u>Motor rated FLA at the system nominal voltage</u>	Number	≥0	P
<u>Motor service factor</u>	Number	≥0	P
<u>Motor starting code</u>	Character	-	P
<u>Nameplate full load amps</u>	Number	≥0	P
<u>End fire pump motor</u>	-	END FP MOTOR	-
<u>Start diesel engine</u>	-	START DIESEL ENG	-
<u>Diesel engine manufacturer</u>	String(40)	Alphanumeric	P
<u>Diesel engine serial number</u>	String(40)	Alphanumeric	P
<u>Diesel engine model number</u>	String(40)	Alphanumeric	P
<u>Diesel engine date in service</u>	Date	Date	P

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Diesel engine rated horsepower</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Diesel engine rated speed</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>End diesel engine</u>	-	END DIESEL ENG	-
<u>Start FP controller</u>	-	START FP CONTROL	-
<u>Controller manufacturer</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Controller type</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Controller serial number</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Controller model number</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Controller date in service</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>End FP controller</u>	-	END FP CONTROL	-
<u>Start jockey pump</u>	-	START JOCKEY	-
<u>Jockey pump manufacturer</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Jockey pump type</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Jockey pump serial number</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Jockey pump model number</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Jockey pump date in service</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Jockey pump horsepower</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Jockey pump start pressure</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Jockey pump reset pressure</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Jockey pump controller manufacturer</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Start jockey pump</u>	-	END JOCKEY	-
<u>Start jockey pump controller</u>	-	START JP CONTROL	-
<u>Jockey pump controller type</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Jockey pump controller serial number</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Jockey pump controller model number</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>Jockey pump controller date in service</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>End jockey pump</u>	-	END JP CONTROL	-
<u>Start fire pump status</u>	-	START FP STATUS	-
<u>From controller</u>	-	-	-
<u>AC volts lines 1–2</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>AC volts lines 2–3</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>AC volts lines 3–1</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>AC amps line 1</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>AC amps line 2</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>AC amps line 3</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>Battery #1 volts</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Battery #2 volts</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>UNUSED</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Battery #1 amps</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Battery #2 amps</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>UNUSED</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>System pressure (psi or bar)</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Suction pressure (psi or bar)</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>VFD speed (Hz)</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>Aux input #1, 0–100%</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>Aux input #2, 0–100%</u>	<u>Number</u>	<u>Number ≥0</u>	<u>D</u>
<u>DESCRIPTION ALARM ON STATE</u>	-	-	-
<u>From controller alarm register #1</u>	-	-	-
<u>Minimum run delay timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Accelerate delay timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>High zone delay timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Sequence delay timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Load shed active high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Power fail start delay timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>High zone delay timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Sequence delay timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Engine running high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>High water temp alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Low discharge pressure alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Low suction alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Low suction shutdown active high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>System overpressure alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Restart delay timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Weekly test demand active high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Failure-to-start alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Lockout active high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Crank on battery #1 high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Crank on battery #2 high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Resting high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Alarm register #2</u>	<u>Character</u>	<u>Y or N</u>	-
<u>VFD ready high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>VFD forward command active high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>VFD reverse command active high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Alarm register #2</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pressure start demand high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Remote start demand high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Deluge start demand high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Weekly test start demand high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Local start PB demand high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Manual operator start demand high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Audible alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Weekly/monthly test setup error high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Minimum run timed out high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Load shed delay timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Mod SP 1/2 power OK high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Mod SP 1/2 power loss start high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Start contactor #1 fail high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Start contactor #2 fail high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Audible alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Weekly/monthly test setup error high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Minimum run timed out high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Pump demand high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Control switch in auto high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Control switch in manual high</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Pressure transducer fault high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pressure transducer test OK high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>VFD failure high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Controller in bypass mode, soft start/VFD only high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Alarm register #3</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Timed trip timing high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Motor running high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Motor overload alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Motor single phasing alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Phase reversal alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>AC voltage low alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Phase smart protection lockout high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Transfer switch in normal position high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Transfer switch in emergency position high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>AC power available high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>AC power fail start high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Low discharge pressure alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Alarm register #3</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Battery #1 failure alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Battery #2 failure alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble group alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>System trouble #1 alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>AC power fail alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Battery #1 overvoltage alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Battery #2 overvoltage alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Term 301, ECMS high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Term 302, FIM high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Term 303, ECMW high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Term 304, ECMF high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Term 310, RWHIT high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Term 311, CRWCLS high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Term 312, LET high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Low oil pressure alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Transfer switch normal power available high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Transfer switch emergency power available high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Emergency CB open high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>CB tripped high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Engine start signal low</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>UNUSED</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Alarm register #4</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble #1 input high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble #2 input high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble #3 input high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble #4 input high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble #5 input high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble #6 input high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble #7 input high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble #8 input high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Pump trouble group alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Thru bit-15 UNUSED</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Battery #1 in equalize high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Battery #2 in equalize high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Battery #1 OK high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Battery #2 OK high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Charger #1 fail alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>Charger #2 fail alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>System trouble #2 alarm high</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>UNUSED</u>	<u>Character</u>	<u>Y or N</u>	<u>D</u>
<u>OTHER INFO</u>	-	-	-
<u>Start count</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Run time hours</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Hours since last run</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Hours since last DVS test</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Fire pump power status</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Fire pump running status</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Fire pump test running</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Suction pressure (psi or bar)</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>System pressure (psi or bar)</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Pump discharge pressure (psi or bar)</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Water temperature in pump casing</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Room temperature</u>	<u>Number</u>	<u>≥0</u>	<u>D</u>
<u>Last pump start date</u>	<u>Date</u>	<u>Date</u>	<u>S</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Last pump start time</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Pressure at pump start</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Type of start (1-automatic demand, 2-automatic test, 3-manual)</u>	<u>Integer</u>	(1) <u>Automatic demand</u> (2) <u>Automatic test</u> (3) <u>Manual</u>	<u>S</u>
<u>Last pump shutdown date</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Last pump shutdown time</u>	<u>Time</u>	<u>Time</u>	-
<u>System pressure at pump shutdown</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Type of shutdown (1-automatic demand, 2-automatic test, 3-manual, 4-overspeed, 5-other trouble)</u>	<u>Integer</u>	(1) <u>Automatic demand</u> (2) <u>Automatic test</u> (3) <u>Manual</u> (4) <u>Overspeed</u> (5) <u>Other</u>	<u>S</u>
<u>Loss of power</u>	-	-	<u>S</u>
<u>Transfer of power</u>	-	-	<u>S</u>
<u>Fuel tank level</u>	<u>Integer</u>	(0) <u>Above $\frac{2}{3}$</u> (1) <u>Below $\frac{2}{3}$</u>	<u>S</u>
<u>Fuel tank level (% full)</u>	<u>Number</u>	≥ 0	-
<u>Fuel maintenance system status</u>	<u>Character</u>	(A) <u>Active</u> (O) <u>Turned off</u> (N) <u>Not functioning properly</u>	<u>S</u>
<u>End pump status</u>	-	<u>END PUMP STATUS</u>	<u>S</u>
<u>Start non-flow (NF) test</u>	-	<u>START NF TEST</u>	<u>S</u>
<u>Non-Flow Test Data Sets – 10 sets</u>	-	-	-
<u>Last non-flow monitoring reset date</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Last non-flow monitoring reset time</u>	<u>Time</u>	<u>Time</u>	-
<u>Total number of non-flow test during monitored period</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Total pump test run time during monitored period (minutes)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test start date</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Non-flow test start time</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Non-flow test end date</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Non-flow test end time</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Non-flow test reference identifier</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test data set reference identifier</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test suction pressure (psi or bar)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test system pressure (psi or bar)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test pump discharge pressure (psi or bar)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test net pressure (psi or bar)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test water temperature in pump casing</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test room temperature</u>	<u>Number</u>	≥ 0	<u>S</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Non-flow test pump start date</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Non-flow test pump start time</u>	<u>Time</u>	<u>Time</u>	<u>-</u>
<u>Non-flow test pressure at pump start</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test minimum transducer pressure</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test type of start</u>	<u>Integer</u>	(1) <u>Automatic demand</u> (2) <u>Automatic test</u> (3) <u>Manual</u>	<u>S</u>
<u>Non-flow test pump shutdown</u>	<u>Date</u>	<u>Date</u>	<u>-</u>
<u>Non-flow test pump shutdown time</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Non-flow test system pressure at pump shutdown</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test type of shutdown</u>	<u>Integer</u>	(1) <u>Automatic demand</u> (2) <u>Automatic test</u> (3) <u>Manual</u> (4) <u>Overspeed</u> (5) <u>Other trouble</u>	<u>S</u>
<u>Non-flow test rpm</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test voltage phase A-B</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test voltage phase B-C</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test voltage phase C-A</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test amperage phase 1</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test amperage phase 2</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Non-flow test amperage phase 3</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>End non-flow test</u>	<u>-</u>	<u>END NF TEST</u>	<u>-</u>
<u>Start acceptance test</u>	<u>-</u>	<u>START ACCPT TEST</u>	<u>-</u>
<u>Acceptance Test Data Set – Permanent – 0%, 25%, 50%, 75%, 100%, 125%, and 150%</u>	<u>-</u>	<u>-</u>	<u>-</u>
<u>Test date acceptance test (day month year)</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>Test reference identifier acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Data set reference identifier acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Suction pressure acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>System pressure acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Discharge pressure acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Net pressure</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Water temperature in pump casing acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Room temperature acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Initial pump start date acceptance test</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>Initial pump start time acceptance test</u>	<u>Time</u>	<u>Time</u>	<u>P</u>
<u>Final pump stop date acceptance test</u>	<u>Date</u>	<u>Date</u>	<u>P</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Final pump stop time acceptance test</u>	<u>Time</u>	<u>Time</u>	<u>P</u>
<u>Pump start dates acceptance test (record up to 10)</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>Pump start times acceptance test (record up to 10)</u>	<u>Time</u>	<u>Time</u>	<u>P</u>
<u>Pump stop dates acceptance test (record up to 10)</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>Pump stop times acceptance test (record up to 10)</u>	<u>Time</u>	<u>Time</u>	<u>P</u>
<u>Pressure at pump start acceptance test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Type of start acceptance test</u>	<u>Integer</u>	(1) <u>Automatic demand</u> (2) <u>Automatic test</u> (3) <u>Manual</u>	<u>P</u>
<u>Minimum transducer pressure at startup acceptance test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Number of start and stops during acceptance test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Final pump shutdown time acceptance test</u>	<u>Time</u>	<u>Time</u>	<u>P</u>
<u>System pressure at final pump shutdown</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Type of shutdown</u>	<u>Integer</u>	(1) <u>Automatic demand</u> (2) <u>Automatic test</u> (3) <u>Manual</u> (4) <u>Overspeed</u> (5) <u>Other trouble</u>	<u>P</u>
<u>Loss of power (for transfer) date</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>Loss of power (for transfer) time</u>	<u>Time</u>	<u>Time</u>	<u>P</u>
<u>Transfer of power date</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>Transfer of power time</u>	<u>Time</u>	<u>Time</u>	<u>P</u>
<u>Date power restored to normal</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>Time power restored to normal (hr min sec)</u>	<u>Time</u>	<u>Time</u>	<u>P</u>
<u>Date readings recorded</u>	<u>Date</u>	<u>Date</u>	<u>P</u>
<u>Time readings recorded</u>	<u>Time</u>	<u>Time</u>	<u>P</u>
<u>RPM</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Voltage phase A–B acceptance test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Voltage phase B–C acceptance test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Voltage phase C–A acceptance test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Amperage phase 1 acceptance test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Amperage phase 2 acceptance test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Amperage phase 3 acceptance test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>
<u>Battery 1 amperage</u>	-	-	-
<u>Battery 2 amperage</u>	-	-	-
<u>Nozzle coefficient acceptance test, up to 20 per test</u>	<u>Number</u>	<u>≥0</u>	<u>P</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Nozzle size acceptance test, up to 20 per test (in. or cm)</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Nozzle pitot pressure acceptance test, up to 20 per test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Fuel tank level acceptance test (0-above $\frac{2}{3}$, 1-below $\frac{2}{3}$)</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Fuel tank level acceptance test (% full)</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Flow through pump acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>RPM adjusted net pressure acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>RPM adjusted flow acceptance test (gpm or L/min)</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>% of factory certified curve acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Hours on diesel engine or electric motor at start of acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Hours on diesel engine or electric motor at conclusion of acceptance test</u>	<u>Number</u>	≥ 0	<u>P</u>
<u>Pump passed initial acceptance test</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Pump could supply maximum system demand acceptance test</u>	<u>Integer</u>	(1) Yes (2) No (3) Demand not known	<u>P</u>
<u>Pump was significantly impaired acceptance test</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Pump was partially impaired acceptance test</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Pump passed after adjustments acceptance test</u>	<u>Character</u>	<u>Y or N</u>	<u>P</u>
<u>Failure mode acceptance test (see standardized list)</u>	<u>Number</u>	<u>Integer ≥ 0</u>	<u>P</u>
<u>Explanation of failure acceptance test</u>	<u>String(80)</u>	<u>Alphanumeric</u>	<u>P</u>
<u>End acceptance test</u>	-	<u>END ACCPT TEST</u>	-
<u>Start performance test</u>	-	<u>START PERF TEST</u>	-
<u>Current Performance Test Data Set – Permanent – 0%, 25%, 50%, 75%, 100%, 125%, and 150%</u>	-	-	-
<u>Start data set</u>	-	<u>START TEST DS</u>	-
<u>Test subset number</u>	-	-	-
<u>Test date current performance test</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Test reference identifier current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Data set reference identifier current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Suction pressure current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>System pressure current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Discharge pressure current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Net pressure</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Water temperature in pump casing current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Room temperature current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Initial pump start date current performance test</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Initial pump start time current performance test</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Final pump stop date current performance test</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Final pump stop time current performance test</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Pump start dates current performance test (record up to 10)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Pump start times current performance test (record up to 10)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Pump stop dates current performance test (record up to 10)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Pump stop times current performance test (record up to 10)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Pressure at pump start current performance test</u>	xxxx.x or xxx.xx ⁶	-	<u>S</u>
<u>Type of start current performance test</u>	<u>Integer</u>	(1) Automatic demand (2) Automatic test (3) Manual	<u>S</u>
<u>Minimum transducer pressure at startup current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Number of start and stops during current performance test</u>	<u>Number</u>	<u>Integer</u> ≥ 0	<u>S</u>
<u>Final pump shutdown time current performance test</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>System pressure at final pump shutdown</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Type of shutdown</u>	<u>Integer</u>	(1) Automatic demand (2) Automatic test (3) Manual (4) Overspeed (5) Other trouble	<u>S</u>
<u>Loss of power (for transfer) date</u>	<u>Date</u>	<u>Date</u>	-
<u>Loss of power (for transfer) time</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Transfer of power date</u>	<u>Date</u>	<u>Date</u>	-
<u>Transfer of power time</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Day power restored to normal</u>	<u>Date</u>	<u>Date</u>	-
<u>Time power restored to normal</u>	<u>Time</u>	<u>Time</u>	-

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Date readings recorded</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Time readings recorded</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>RPM</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Voltage phase A-B current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Voltage phase B-C current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Voltage phase C-A current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Amperage phase 1 current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Amperage phase 2 current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Amperage phase 3 current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Battery 1 amperage</u>	-	-	-
<u>Battery 2 amperage</u>	-	-	-
<u>Nozzle coefficient current performance test, up to 20 per test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Nozzle size current performance test, up to 20 per test (in. or cm)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Nozzle pitot pressure current performance test, up to 20 per test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Fuel tank level current performance test (0-above $\frac{2}{3}$, 1-below $\frac{2}{3}$)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Fuel tank level current performance test (% full)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Flow through pump current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Rpm adjusted net pressure current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Rpm adjusted flow current performance test (gpm or L/min)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>% of factory certified curve current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Hours on diesel engine or electric motor at start of current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Hours on diesel engine or electric motor at conclusion of current performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Pump passed initial current performance test</u>	<u>Character</u>	<u>Y or N</u>	<u>S</u>
<u>Pump could supply maximum system demand current performance test</u>	xxxxx	(1) Yes (2) No (3) Demand not known	<u>S</u>
<u>Pump was significantly impaired current performance test</u>	<u>Character</u>	<u>Y or N</u>	<u>S</u>
<u>Pump was partially impaired current performance test</u>	<u>Character</u>	<u>Y or N</u>	<u>S</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Pump passed after adjustments current performance test</u>	<u>Character</u>	<u>Y or N</u>	<u>S</u>
<u>Failure mode current performance test (see standardize list)</u>	<u>Number</u>	<u>Integer ≥0</u>	<u>S</u>
<u>Explanation of failure current performance test</u>	<u>String(80)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>End performance test data set</u>	-	<u>END TEST DS</u>	-
<u>End performance test</u>	-	<u>END FP PERF</u>	-
<u>Start previous performance</u>	-	<u>START PREV PERF</u>	-
<u>Start previous performance data set</u>	-	<u>Start PP DS</u>	-
<u>Previous Performance Test Data Set – Static – 0%, 25%, 50%, 75%, 100%, 125%, and 150%</u>	-	-	-
<u>Test date previous performance test</u>	<u>Date</u>	<u>Time</u>	<u>S</u>
<u>Test reference identifier previous performance test</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Data set reference identifier previous performance test</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Suction pressure previous performance test</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>System pressure previous performance test</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Discharge pressure previous performance test</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Net pressure</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Water temperature in pump casing previous performance test</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Room temperature previous performance test</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Initial pump start date previous performance test</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Initial pump start time previous performance test</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Final pump stop date previous performance test</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Final pump stop time previous performance test</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Pump start dates previous performance test (record up to 10)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Pump start times previous performance test (record up to 10)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Pump stop dates previous performance test (record up to 10)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Pump stop times previous performance test (record up to 10)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Pressure at pump start previous performance test</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Type of start previous performance test</u>	<u>Integer</u>	(1) Automatic demand (2) Automatic test (3) Manual	<u>S</u>
<u>Minimum transducer pressure at startup previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Number of start and stops during previous performance test</u>	<u>Number</u>	<u>Integer</u> ≥ 0	<u>S</u>
<u>Final pump shutdown time previous performance test</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>System pressure at final pump shutdown</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Type of shutdown</u>	<u>Integer</u>	(1) Automatic demand (2) Automatic test (3) Manual (4) Overspeed (5) Other trouble	<u>S</u>
<u>Loss of power (for transfer) date</u>	<u>Date</u>	<u>Date</u>	-
<u>Loss of power (for transfer) time</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Transfer of power date</u>	<u>Date</u>	<u>Date</u>	-
<u>Transfer of power time</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Day power restored to normal</u>	<u>Date</u>	<u>Date</u>	-
<u>Time power restored to normal</u>	<u>Time</u>	<u>Time</u>	-
<u>Date readings recorded</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Time readings recorded</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>RPM</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Voltage phase A-B previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Voltage phase B-C previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Voltage phase C-A previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Amperage phase 1 previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Amperage phase 2 previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Amperage phase 3 previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Battery 1 amperage</u>	-	-	-
<u>Battery 2 amperage</u>	-	-	-
<u>Nozzle coefficient previous performance test, up to 20 per test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Nozzle size previous performance test, up to 20 per test (in. or cm)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Nozzle pitot pressure previous performance test, up to 20 per test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Fuel tank level previous performance test</u>	<u>Integer</u>	(0) Above $\frac{2}{3}$ (1) Below $\frac{2}{3}$	<u>S</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Fuel tank level previous performance test (% full)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Flow through pump previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Rpm adjusted net pressure previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Rpm adjusted flow previous performance test (gpm or L/min)</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>% of factory certified curve previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Hours on diesel engine or electric motor at start of previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Hours on diesel engine or electric motor at conclusion of previous performance test</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Pump passed initial previous performance test</u>	<u>Character</u>	<u>Y or N</u>	<u>S</u>
<u>Pump could supply maximum system demand previous performance test</u>	xxxxx	(1) Yes (2) No (3) Demand not known	<u>S</u>
<u>Pump was significantly impaired previous performance test</u>	<u>Character</u>	<u>Y or N</u>	<u>S</u>
<u>Pump was partially impaired previous performance test</u>	<u>Character</u>	<u>Y or N</u>	<u>S</u>
<u>Pump passed after adjustments previous performance test</u>	<u>Character</u>	<u>Y or N</u>	<u>S</u>
<u>Failure mode previous performance test (see standardized list)</u>	<u>Number</u>	<u>Integer ≥ 0</u>	<u>S</u>
<u>Explanation of failure previous performance test</u>	<u>String(80)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>End test data subset</u>	-	<u>END PP DS</u>	-
<u>End performance test</u>	-	<u>END PREV TEST</u>	-
<u>Start repair record</u>	-	<u>START REPAIR</u>	-
<u>Repair Maintenance Data (20 sets)</u>	-	-	<u>S</u>
<u>Start repair data subset</u>	-	<u>START REPAIR DS</u>	-
<u>Date of maintenance/repair</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Maintenance/repair identifier</u>	<u>Number</u>	≥ 0	<u>S</u>
<u>Repair preventative or result of failure</u>	<u>Character</u>	(P) Preventative (F) Failure	<u>S</u>
<u>Failure mode</u>	<u>Integer</u>	<u>Develop List</u>	-
<u>Pump out of service during maintenance/repair</u>	<u>Character</u>	<u>Y or N</u>	<u>S</u>
<u>Date pump out of service (day month year)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Time pump out of service (hour min sec)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Date pump restored to service (day month year)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Time pump restored to service (hour min sec)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Date pump maintenance/repair completed</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Part replaced (1)</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>Description of maintenance, repair, and/or part 1 replacement</u>	<u>String(80)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>Part replaced (2)</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>Description of maintenance, repair, and/or part 2 replacement</u>	<u>String(80)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>Part replaced (3)</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>Description of maintenance, repair, and/or part 3 replacement</u>	<u>String(80)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>Part replaced (4)</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>Description of maintenance, repair, and/or part 4 replacement</u>	<u>String(80)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>Routine maintenance or repair</u>	<u>String(40)</u>	<u>Alphanumeric</u>	<u>S</u>
<u>Date repair completed</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Fuel tank level current performance test</u>	<u>Integer</u>	(0) Above $\frac{2}{3}$ (1) Below $\frac{2}{3}$	<u>S</u>
<u>Fuel tank level current performance test (% full)</u>	<u>Number</u>	<u>>0</u>	<u>S</u>
<u>Fuel maintenance system status</u>	<u>String(3)</u>	<u>ON, OFF, IMP (impaired)</u>	<u>S</u>
<u>Unused</u>	-	-	<u>S</u>
<u>19 additional repair maintenance data sets</u>	-	-	<u>S</u>
<u>End repair data subset</u>	-	<u>END REPAIR DS</u>	-
<u>End repair record</u>	-	<u>END REPAIR</u>	-
<u>Start jockey operation</u>	-	<u>START JP OPER</u>	-
<u>Jockey Pump Operation</u>	-	-	<u>S</u>
<u>Last jockey pump monitoring reset date</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Last jockey pump monitoring reset time</u>	<u>Time</u>	<u>Time</u>	-
<u>Total number of starts (since reset)</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Total jockey pump run time (minutes since last reset)</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Jockey pump start pressure (most recent)</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Jockey pump stop pressure</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Most recent run time (seconds)</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>End jockey operation</u>	-	<u>END JP OPER</u>	-
<u>Start FP operation</u>	-	<u>START FP OPER</u>	-
<u>Fire Pump Operation</u>	<u>xxxxx</u>	-	<u>S</u>
<u>Last fire pump monitoring reset date</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Last fire pump monitoring reset time</u>	<u>Time</u>	<u>Time</u>	-
<u>Fire pump start date and time (last 10 times)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>

<u>Data</u>	<u>Format</u>	<u>Possible Values</u>	<u>Permanent, Static, Dynamic</u>
<u>Fire pump stop date and time (last 10 times)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Fire pump start pressure (most recent)</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Fire pump stop pressure (most recent)</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Stop automatic or manual (most recent)</u>	<u>Character</u>	(A) Automatic (M) Manual	<u>S</u>
<u>Total number of starts since reset</u>	<u>Number</u>	<u>Integer ≥0</u>	<u>S</u>
<u>Total run time since reset (minutes)</u>	<u>Number</u>	<u>≥0</u>	<u>S</u>
<u>Date loss of electrical power with switch in on position since last reset (50 sets)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Time loss of electrical power with switch in on position since last reset (50 sets)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Date power restored after loss of power with switch in on position since last reset (50 sets)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Time power restored after loss of power with switch in on position since last reset (50 sets)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Date power switch turned off (50 sets)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Time power switch turned off (50 sets)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>Date power switch turned back on (50 sets)</u>	<u>Date</u>	<u>Date</u>	<u>S</u>
<u>Time power switch turned back on (50 sets)</u>	<u>Time</u>	<u>Time</u>	<u>S</u>
<u>End Fire Pump Operation</u>	-	<u>END FP OPER</u>	-

C.9.2.11.4

Table C.9.2.11.4 provides a format for the repair of associated fire pump equipment.

Table C.9.2.11.4 Equipment Repair Data Record Layout for Associated Equipment

<u>Category</u>	<u>Item</u>	<u>Format</u>	<u>Possible Values</u>
<u>Equipment repair data</u>	<u>Type of record</u>	<u>String(48)</u>	<u>REPAIR</u>
	<u>Facility name</u>	<u>String(96)</u>	<u>Alphanumeric</u>
	<u>Location — GPS coordinates (longitude)</u>	<u>Number</u>	<u>–180° to +180°</u>
	<u>Location — GPS coordinates (latitude)</u>	<u>Number</u>	<u>–90° to +90°</u>
	<u>Location — GPS coordinates (elevation)</u>	<u>Number</u>	<u>ft or m</u>
	<u>Location adjusted for privacy — GPS coordinates (longitude)</u>	<u>Number</u>	<u>–180° to +180°</u>
	<u>Location adjusted for privacy — GPS coordinates (latitude)</u>	<u>Number</u>	<u>–90° to +90°</u>
	<u>Location adjusted for privacy — GPS coordinates (elevation)</u>	<u>Number</u>	<u>ft or m</u>
	<u>Repair date</u>	<u>Date</u>	<u>Year/month/date</u>
	<u>Common data</u>	<u>See Table C.9.2.11.2 Common Equipment Data</u>	
	<u>Repair preventative or result of failure</u>	<u>Character</u>	<u>(P) Preventative</u> <u>(F) Failure</u>
	<u>Failure mode (develop list)</u>	<u>5 character</u>	<u>Correspond to list</u>
	<u>Failure impaired fire protection system</u>	<u>Character</u>	<u>(I) Impaired</u> <u>(P) Partially functional</u> <u>(N) Not impaired</u>
	<u>Repair code (develop list)</u>	<u>5 character</u>	<u>Correspond to list</u>
	<u>Component replaced (develop list)</u>	<u>5 character</u>	<u>Correspond to list</u>
	<u>Repair description</u>	<u>String(96)</u>	<u>Alphanumeric</u>
	<u>Component replacement date</u>	<u>Date</u>	<u>Year/month/date</u>
	<u>End of repair record</u>	<u>String(48)</u>	<u>END OF REPAIR</u>

C.9.2.11.5

Table C.9.2.11.5 provides a format for the inspection, test, and maintenance of associated fire pump equipment. Where the format conflicts with NFPA 25, the format in NFPA 25 takes precedence.

Table C.9.2.11.5 Inspection, Test, and Maintenance Record Layout for Associated Equipment

Category	Item Format	Format	Possible Values
Basic information	Type of Record	String(48)	INSPECTION, TEST, AND MAINTENANCE
	Facility Name	String(96)	Alphanumeric
	Location — GPS coordinates (longitude)	Number	–180° to +180°
	Location — GPS coordinates (latitude)	Number	–90° to +90°
	Location — GPS coordinates (elevation)	Number	ft or m
	Location adjusted for privacy — GPS coordinates (longitude)	Number	–180° to +180°
	Location adjusted for privacy — GPS coordinates (latitude)	Number	–90° to +90°
	Location adjusted for privacy — GPS coordinates (elevation)	Number	ft or m
	Reporting units pressure	Character	(1) psi (2) bar (3) pascals (4) other
	Reporting units flow	Character	(1) gpm (2) L/min (3) L/sec (4) m ³ /min (5) ft ³ /min (6) other
Item inspected, tested, maintained or repaired — repeat for each item inspected, tested, maintained, or repaired	Type of inspection or test	Character	(I) Inspection (T) Test (M) Maintenance (R) Repair
	Start of item record marker for item	String(16)	RECORD START
	Unit type identifier (develop list)	String(48)	Alphanumeric
	Passed, failed, passed but needs attention	Character	(P) Passed (F) Failed (A) Passed but needs attention
	Item and sub-items from Table C.9.2.11.6 Item Information	See Table C.9.2.11.6 Item Information	

<u>Category</u>	<u>Item Format</u>	<u>Format</u>	<u>Possible Values</u>
	<u>Passed visual inspection</u>	<u>Character</u>	(Y) Yes (N) No (A) Not applicable
	<u>Maintenance required</u>	<u>Number</u>	Number ≥0
	<u>Maintenance done</u>	<u>Character</u>	(1) Not applicable (2) Completed (3) Ordered but not completed (4) Not ordered
	<u>End of item record marker</u>	<u>String(16)</u>	RECORD END
<u>End of ITM record</u>	<u>End of ITM (all components reported)</u>	<u>String(48)</u>	END OF INSPECTION, TEST, AND MAINTENANCE REPORT

C.9.2.11.6

Table C.9.2.11.6 contains what information should be recorded for each piece of associated equipment.

Table C.9.2.11.6 Item Information

Item	Item Component	Format	Possible Values
Alarm device	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Operated satisfactorily	Character	(Y) Yes
			(N) No
			(3) N.A.
Backflow preventer	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Type		(1) DC
			(2) DDC
			(3) RPZ
			(4) RPZDC
			(5) Air gap
			(6) Check valve
			(7) Single check DC
			(8) Other
	Non-flow upstream pressure	Number	2 decimal places
	Non-flow intermediate chamber pressure	Number	2 decimal places
	Non-flow downstream pressure	Number	2 decimal places
	ITC flow upstream pressure	Number	2 decimal places
	ITC flow intermediate chamber pressure	Number	2 decimal places
Balancing valve diaphragm	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Operated satisfactorily	Character	(Y) Yes
			(N) No
			(3) N.A.
Balancing valve diaphragm	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Operated satisfactorily	Character	(Y) Yes
			(N) No
			(3) N.A.
Ball drip (automatic-type) drain valves	Common data	See Table C.9.2.10.2 Common Equipment Data	

<u>Item</u>	<u>Item Component</u>	<u>Format</u>	<u>Possible Values</u>
<u>Bladder tank</u>	<u>Operated satisfactorily</u>	Character	(Y) Yes (N) No (3) N.A.
	<u>Common data</u>	See Table C.9.2.11.2 Common Equipment Data	
	<u>Fill level OK</u>	Character	(Y) Yes (N) No (3) N.A.
	<u>Operated satisfactorily (Y-Yes, N-No, 3-N.A.)</u>	Character	(Y) Yes (N) No (3) N.A.
	<u>Comment if needed</u>	String (80)	Alphanumeric
<u>Check valve(s)</u>	<u>Common data</u>	See Table C.9.2.11.2 Common Equipment Data	
	<u>Type</u>	Character	(1) Flanged swing (2) Grooved swing (3) Spring-loaded flanged swing (4) Spring-loaded grooved swing (5) Spring-loaded duo-wafer (6) Spring-loaded duo-grooved (7) Spring-loaded duo-flanged (8) Other
	<u>Prevents backflow</u>	Character	(Y) Yes (N) No (3) Not verified
	<u>Non-flow upstream pressure</u>	Number	Number ≥0
	<u>Non-flow downstream pressure</u>	Number	Number ≥0
	<u>Demand test flow rate</u>	Number	Number ≥0
	<u>Demand flow upstream pressure</u>	Number	Number ≥0
	<u>Demand flow downstream pressure</u>	Number	Number ≥0
	<u>Unit type identifier</u>	String(48)	Alphanumeric
	<u>Where installed</u>	Character	(1) On fire pump discharge (2) Loop piped back to suction
	<u>Operated satisfactorily</u>	Character	(Y) Yes (N) No (3) N.A.

<u>Item</u>	<u>Item Component</u>	<u>Format</u>	<u>Possible Values</u>
<u>Control valve(s)</u>	<u>Common data</u>	See Table C.9.2.11.2 Common Equipment Data	
	<u>Type of valve</u>	Character	(1) OS&Y (2) Butterfly (3) Ball (4) NRS gate (5) Post indicator gate (6) Post indicator butterfly (7) Wall indicator gate (8) Wall indicator butterfly (9) Other
	<u>Nominal valve size (in. or cm)</u>	Number	Number ≥0
	<u>Original position of valve</u>	Character	(1) Normally open valve open (2) Normally open closed (3) Normally closed valve closed (4) Normally closed valve open (5) Valve partially closed
	<u>Stops flow of water when closed</u>	Character	(1) Yes (2) Minor leakage (3) No (4) Not tested for flow
	<u>Obstructs flow of water when open</u>	Character	(Y) Yes (N) No (3) Not tested for flow
	<u>Operated satisfactorily</u>	Character	(Y) Yes (N) No (3) N.A.
	<u>See backflow prevention devices</u>	-	-
	<u>Detector check valve</u>	-	-
	<u>Adequate heat</u>	Character	(Y) Yes (N) No
<u>Fire department connection</u>	<u>Connection supplies</u>	Character	(1) Sprinkler (2) Standpipe (3) Standpipe and sprinkler (4) Other
	<u>Connection flushed</u>	Character	(Y) Yes (N) No
	<u>Connection tested</u>	Character	(Y) Yes (N) No

<u>Item</u>	<u>Item Component</u>	<u>Format</u>	<u>Possible Values</u>
	<u>System passed</u>	<u>Character</u>	(Y) Yes (N) No
<u>Fire pumps</u>	<u>Common data</u>		See Table C.9.2.11.2 Common Equipment Data
<u>Fittings — except rubber gasketed</u>	<u>Indication of leakage present</u>	<u>Character</u>	(1) No (2) Minor (3) Significant
<u>Fittings (rubber-gasketed)</u>	<u>Indication of leakage present</u>	<u>Character</u>	(1) No (2) Minor (3) Significant
<u>Foam concentrate</u>	<u>Manufacturer</u>	<u>String(48)</u>	<u>Alphanumeric</u>
	<u>Type</u>	<u>String(48)</u>	<u>Alphanumeric</u>
	<u>Adequate quantity</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Samples submitted for testing</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Samples tested satisfactory</u>	<u>Character</u>	(Y) Yes (N) No
<u>Foam concentrate strainer(s)</u>	<u>Strainer clear initial</u>	<u>Character</u>	(Y) Yes (N) No
<u>Foam concentrate tank</u>	<u>Tank full</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Protective coating (mineral oil) on top of foam concentrate OK</u>	<u>Character</u>	Y-Yes N-No
<u>Foam-water solution</u>	<u>Foam percentage</u>	<u>Number</u>	<u>Number ≥0</u>
	<u>Solution passed</u>	<u>Character</u>	(Y) Yes (N) No
<u>Gauges</u>	<u>Gauge on</u>	<u>Character</u>	(1) System side wet pipe system (2) Supply side wet pipe system (3) Air side dry pipe system (4) Supply side dry pipe system (5) Air side preaction system (6) Supply side preaction system (7) Fire pump suction (8) Fire pump discharge (9) Water mist system (10) Pressure tank (11) Water storage tank (12) Other

<u>Item</u>	<u>Item Component</u>	<u>Format</u>	<u>Possible Values</u>
<u>General information sign</u>	<u>Gauges reading correctly</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Required signs provided</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Signs readable & correct</u>	<u>Character</u>	(Y) Yes (N) No
<u>Gravity tanks</u>	<u>Water level OK</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Adequate heat provided</u>	<u>Character</u>	(Y) Yes (N) No
<u>Hangers/pipe supports</u>	<u>Passed visual inspection</u>	<u>Character</u>	(Y) Yes (N) No
<u>Hydraulic design information sign/hydraulic placards</u>	<u>Required signs/placards provided</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Signs readable & correct</u>	<u>Character</u>	(Y) Yes (N) No
<u>Identification signs</u>	<u>Required signs/placards provided</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Signs readable & correct</u>	<u>Character</u>	(Y) Yes (N) No
<u>Information sign</u>	<u>Required signs/placards provided</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Signs readable & correct</u>	<u>Character</u>	(Y) Yes (N) No
<u>Inspector's test connection</u>	<u>Flowed without obstruction</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Activated alarm</u>	<u>Character</u>	(Y) Yes (N) No
<u>Mainline strainers</u>	<u>Strainer without excessive debris and damage</u>	<u>Character</u>	(Y) Yes (N) No
<u>Manual actuation device(s)</u>	<u>Passed test</u>	<u>Character</u>	(Y) Yes (N) No
<u>Mist system compressed gas cylinder</u>	<u>Cylinders full</u>	<u>Character</u>	(Y) Yes (N) No
<u>Mist system control equipment</u>	<u>Passed test</u>	<u>Character</u>	(Y) Yes (N) No
<u>Mist system plant air, compressors, and receivers</u>	<u>Operated satisfactorily</u>	<u>Character</u>	(Y) Yes (N) No
<u>Mist system pneumatic valves, cylinder valves, and master release valves</u>	<u>Passed test</u>	<u>Character</u>	(Y) Yes (N) No
<u>Mist system standby pump</u>	<u>Passed test</u>	<u>Character</u>	(Y) Yes (N) No
<u>Mist system water storage cylinder (additive storage cylinder)</u>	<u>Passed test</u>	<u>Character</u>	(Y) Yes (N) No

<u>Item</u>	<u>Item Component</u>	<u>Format</u>	<u>Possible Values</u>
<u>Mist system water storage cylinder (high pressure)</u>	<u>Passed test</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Mist system water storage cylinder (high pressure) filters on refill connection</u>	<u>Passed test</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Mist system water storage cylinder (high pressure) support frame/restraints</u>	<u>Passed visual inspection</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Mist system water storage cylinder (high pressure) vent plugs at refilling</u>	<u>Operated satisfactorily</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Mist system water storage cylinder (high pressure) water level (load cells)</u>	<u>Passed test</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Mist system water storage tank</u>	<u>Tank full without leaks</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Mist system water storage tank all valves, appurtenances</u>	<u>Passed test</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Mist system water storage tank sight glass valves (confirm open)</u>	<u>Operated satisfactorily</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Mist system water storage tank water level (supervised)</u>	<u>Passed test</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Pipe (above ground)</u>	<u>Type of system</u>	<u>Character</u>	<u>(1) Wet pipe sprinkler</u> <u>(2) Dry pipe sprinkler</u> <u>(3) Preaction</u> <u>(4) Deluge</u> <u>(5) Water mist</u> <u>(6) Other</u>
	<u>Environment</u>	<u>Character</u>	<u>(1) Indoors heated</u> <u>(2) Indoors unheated</u> <u>(3) Covered exposed to exterior atmosphere</u> <u>(4) Covered exposed to exterior salt air</u> <u>(5) Exposed exterior</u> <u>(6) Exposed exterior salt air</u> <u>(7) Hostile chemical</u> <u>(8) Other</u>
	<u>Free of leads and excessive corrosion</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Fittings (above ground)</u>	<u>Type of system</u>	<u>Character</u>	<u>(1) Wet pipe sprinkler</u> <u>(2) Dry pipe sprinkler</u> <u>(3) Preaction</u> <u>(4) Deluge</u> <u>(5) Water mist</u> <u>(6) Other</u>

<u>Item</u>	<u>Item Component</u>	<u>Format</u>	<u>Possible Values</u>
	<u>Environment</u>	<u>Character</u>	(1) Indoors heated (2) Indoors unheated (3) Covered exposed to exterior atmosphere (4) Covered exposed to exterior salt air (5) Exposed exterior (6) Exposed exterior salt air (7) Hostile chemical (8) Other
	<u>Free of leaks and excessive corrosion</u>	<u>Character</u>	(Y) Yes (N) No
<u>Pipe and fittings (underground)</u>	<u>Environment</u>	<u>Character</u>	(1) Sandy soil (2) Clay soil (3) Corrosive soil (4) Other
	<u>Unit type identifier</u>	<u>String(48)</u>	<u>Alphanumeric</u>
	<u>Type of pipe</u>	<u>Character</u>	(1) Ductile iron (2) Steel (3) CPVC (4) Polyethylene (5) Other
	<u>Pipe encasement</u>	<u>Character</u>	(1) Polyethylene wrap (2) Culvert (3) None
	<u>Water supply source</u>	<u>Character</u>	(1) From municipal system (2) From water storage tank (3) From pond, lake, river, etc. (4) Other
	<u>Free of excessive leakage</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Excessive friction loss</u>	<u>Character</u>	(Y) Yes (N) No
<u>Pipe stands</u>	<u>Passed visual inspection</u>	<u>Character</u>	(Y) Yes (N) No
<u>Post indicator and wall indicator valves</u>	<u>Opened and closed</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Stopped flow of water when closed</u>	<u>Character</u>	(Y) Yes (N) No (3) Not verified
<u>High flow pressure relief valve (fire pump, etc)</u>	<u>Common data</u>	<u>See Table C.9.2.11.2 Common Equipment Data</u>	

<u>Item</u>	<u>Item Component</u>	<u>Format</u>	<u>Possible Values</u>
	<u>Type</u>	<u>Character</u>	(1) Pilot operated (2) Spring loaded (3) Other
	<u>Discharge to</u>	<u>Character</u>	(1) Atmosphere (2) Tank (3) Fire pump suction (4) Other
	<u>Relief pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Shut off pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Functioning properly</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Common data</u>	See Table C.9.2.11.2 Common Equipment Data	
<u>Pressure-reducing valve</u>	<u>Type</u>	<u>Character</u>	(1) Pilot operated (2) Spring loaded (3) Other
	<u>Installation with other pressure-reducing valves</u>	<u>Character</u>	(1) Stand alone (2) Series upstream (3) Series downstream (4) Parallel with smaller (5) Parallel with larger (6) Parallel same size (7) Combination series and parallel (8) Other
	<u>Static inlet pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Static outlet pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Residual low flow inlet pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Residual low flow outlet pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Residual low flow inlet pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Residual low flow outlet pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Functioning properly</u>	<u>Character</u>	(Y) Yes (N) No
	<u>Common data</u>	See Table C.9.2.11.2 Common Equipment Data	
<u>Pump suction control valve</u>	<u>Type</u>	<u>Character</u>	(1) Pilot operated (2) Spring loaded (3) Other
	<u>Set suction pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Static inlet pressure</u>	<u>Number</u>	Number ≥ 0
	<u>Static outlet pressure</u>	<u>Number</u>	Number ≥ 0

<u>Item</u>	<u>Item Component</u>	<u>Format</u>	<u>Possible Values</u>
	<u>Inlet pressure @ 100% rated pump capacity</u>	<u>Number</u>	<u>Number ≥ 0</u>
	<u>Outlet pressure @ 100% rated pump capacity</u>	<u>Number</u>	<u>Number ≥ 0</u>
	<u>Inlet pressure @ 150% rated pump capacity</u>	<u>Number</u>	<u>Number ≥ 0</u>
	<u>Outlet pressure @ 150% rated pump capacity</u>	<u>Number</u>	<u>Number ≥ 0</u>
	<u>Functioning properly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Reduced-pressure detectors</u>	<u>Common data</u>	<u>See Table C.9.2.11.2 Common Equipment Data</u>	
	<u>Functioning properly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Retainer glands</u>	<u>No visible leakage or damage</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Sight glass</u>	<u>No visible leakage or damage</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Suction tanks</u>	<u>Tank full</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Supervisory device</u>	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Supports</u>	<u>Correctly installed</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>System pressure-regulating devices</u>	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Tank alarm and supervisory component, enclosure temperature</u>	<u>Connected to constantly monitored location</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Tank alarm and supervisory component, high and low water level</u>	<u>Connected to constantly monitored location</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Tank alarm and supervisory component, low water temperature alarms</u>	<u>Connected to constantly monitored location</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Tank alarm and supervisory component, temperature alarms</u>	<u>Connected to constantly monitored location</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Tank alarm and supervisory component, valve supervision</u>	<u>Connected to constantly monitored location</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>

<u>Item</u>	<u>Item Component</u>	<u>Format</u>	<u>Possible Values</u>
<u>Tank alarm and supervisory component, water level alarms</u>	<u>Connected to constantly monitored location</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Tank alarm and supervisory component, water temperature</u>	<u>Connected to constantly monitored location</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Tank catwalks and ladders</u>	<u>Passed visual inspection</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
<u>Tank check valves</u>	<u>Functioned correctly</u>	<u>Character</u>	<u>(Y) Yes</u> <u>(N) No</u>
			<u>(3) Not verified</u>

C.9.2.11.7

All recorded information should be protected in accordance with appropriate security to limit access to appropriate entities.

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
Table_C9.2.10.1_a_.docx	For Staff Use
Tables_C92.10.1_b_through_d_and_m_.docx	For Staff Use
Tables_C9.2.10.1_e_through_j_.docx	For Staff Use
Tables_C9.2.10.1_k_and_l_.docx	For Staff Use
Tables_C.9.2.2_through_C.9.2.5_and_C.9.2.11.1_through_C.9.2.11.6.docx	For Staff Use

Submitter Information Verification

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City:
State:
Zip:
Submittal Date: Wed Sep 20 14:35:13 EDT 2017

Committee Statement

Committee Statement: Significant modifications were needed to the existing annex to make data formatting more universal.
Response Message: