



Public Input No. 19-NFPA 20-2019 [Global Input]

NFPA 20 – 2022 Edition

Chapter 15 Working Plans

New Section

1.1. Working Plan Symbols

1.1.1 Symbols used on working plans shall comply with the fire pump and sprinkler symbols of NFPA 170 - 2018 Edition Chapter 7 including Tables 7.2, 7.5, 7.6.1.1, 7.6.1.2, 7.6.1.3, 7.6.1.4, 7.6.2, 7.6.3, 7.7, 7.8 and 7.9 for fire pump fittings, piping, valves and fire pump related devices and apparatuses as listed for fire sprinkler systems in accordance with this standard.

Additional Proposed Changes

File Name	Description	Approved
NFPA_170_2021_Fire_Pump_Changes.docx	Proposed Changes to 2021 edition of NFPA 170	

Statement of Problem and Substantiation for Public Input

Often plan reviewers are faced with different symbols on every drawing that cause long and tedious reviews of drawings just figuring out what symbols mean. the 2018 Edition of NFPA 170 was updated with the goal to alleviate randomness of symbols. Since the 1980's these symbols had not been edited or updated. The Standard was revamped with the help of AutoSprink, HydraCAD and SprinkCAD to get a consistent library of symbols. There is still room for interpretation of special items but standardizing the common symbols will make design, review and installation a faster efficient process with standardization, after-all this is why we create standards. In future editions these sections will be expanded in 2021 and updated to address specific types of fire pumps, special devices and new products as released.

Submitter Information Verification

Submitter Full Name: William Smith

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Affiliation: NFPA 170 Primary Technical Committee member

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Submittal Date: Fri Jan 25 16:40:25 EST 2019

Committee:

Committee Statement

Resolution: Proposed language is limiting and doesn't belong in chapter 1, it is unclear if it's proposed to add symbols in NFPA 170.

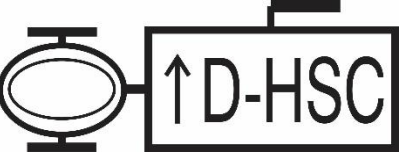
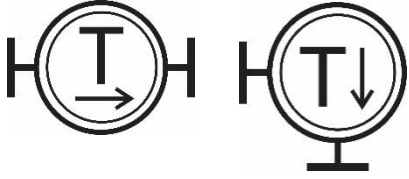
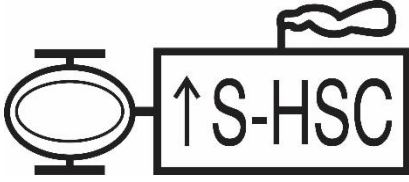
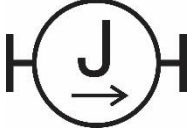
NFPA 170 2018 - 7.2

Remove:

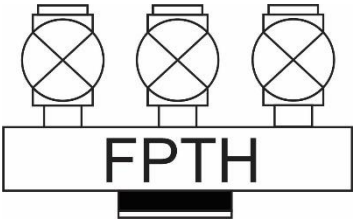
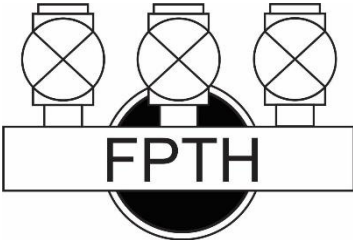
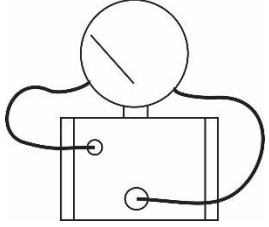
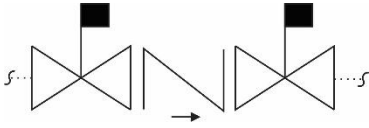
Symbol for Fire pump With Driver, Freestanding Test header, Wall-mounted test header

	connection	
	Fire pump with driver	Specify driver type and rated capacity
	Freestanding test header	Freestanding; specify number and sizes of outlets
	Wall-mounted test header	Wall; specify number and sizes of outlets
	Sprinkler detection	

Add: Table 7.6.1.5 Fire Pump Type Symbols

	Vertical In-Line Pump (VIP)	Specify PSI, GPM & Flow Direction
	Horizontal Split Case – Electric	Specify rotation, PSI, GPM & Flow Direction
	Horizontal Split Case – Diesel	Specify rotation, PSI, GPM & Flow Direction
	Vertical Turbine Pump	Specify PSI, GPM & Flow Direction
	Steam Turbine Drive Pump	Specify PSI, GPM & Flow Direction
	Jockey Pump	Specify PSI, GPM & Flow Direction

Add: Table 7.6.1.6 Fire Pump Device Symbols

	Eccentric Reducer	One side of the reducer maintains flat elevation to the reduced size. Indicate sizes.
	Concentric Reducer	Reducer is conical to the center of the reduced size. Indicate sizes.
	Wall Mounted Test Header	Mounts to a Wall. Indicate number of hose connections, sizes and GPM output for Fire Pump.
	Free Standing Test Header	Mounts to a free-standing flange. Indicate number of hose connections, sizes and GPM output for Fire Pump.
	Suction Control Valve	Modulates the maintain the pump discharge in relation to the suction head available. Indicate size.
	Fire Meter	Grooved Fire Meter for Flow Testing of Fire Pumps. Indicate size.
	Bypass – Consists of 2 Butterfly valves and 1 Check Valve (see Table 7.2 for individual components.)	Fire Pump City Bypass. Indicate sizes and direction.

	Fire Pump Control Panel	Panel that Controls Fire Pump Operation.
	Jockey Pump Control Panel	Panel that Controls Jockey Pump Operation.
	Transfer Switch Panel	Panel that Controls Transfer of Fire Pump Power to alternate source.

Modify Chapter 7

Add: Table 7.6.1.5 Fire Pump Type Symbols – Supplementary Symbols shall be as given in Table 7.6.1.5

Add: Table 7.6.1.6 Fire Pump Device Symbols – Supplementary Symbols shall be as given in Table 7.6.1.6

Chapter 7 Symbols for Use in Water Supply, Extinguishing, and Sprinkler System Drawings and Insurance Diagrams

7.1* Introduction.

7.1.1 This chapter presents symbols that shall be used in drawings and diagrams.

7.1.2* Symbol Presentation.

7.1.2.1* **Symbol Shapes.** The shape of symbols shall be as illustrated in Sections 7.2 through 7.7.

7.1.2.2 **Screened Lines.** Screened lines in the chapter shall not be considered part of the symbol but shall be used to represent the piping, wiring, or mounting surface associated with the symbol.

7.1.2.3 **Symbol Scale.** All scales for symbols on any one drawing shall be the same relative size.

7.1.2.4* **Symbol Orientation.** Symbols shall be oriented to the walls, piping, electrical lines, and so forth, to which they are attached.

7.2* **Water Supply and Distribution Symbols.** Water supply and distribution symbols shall be as given in Table 7.2.

7.3 Reserved.

7.4 **Symbols Related to Means of Egress.** Symbols related to means of egress shall be as given in Table 7.4.

7.5 **Indicating Appliances.** Symbols for indicating appliances shall be as given in Table 7.5.

7.6* Symbols for Fire Extinguishing Systems.

7.6.1 Various Types of Fire Extinguishing Systems.

7.6.1.1 **Water-Based Systems.** Symbols for water-based systems shall be as given in Table 7.6.1.1.

7.6.1.2 **Dry Chemical Systems.** Symbols for dry chemical systems shall be as given in Table 7.6.1.2.

7.6.1.3 **Systems Utilizing a Gaseous Medium.** Symbols for systems utilizing a gaseous medium shall be as given in Table 7.6.1.3.

7.6.1.4 **Supplementary Symbols.** Supplementary symbols shall be as given in Table 7.6.1.4.

7.6.2 **Symbols for Fire Sprinklers.** Symbols for fire sprinklers shall be as given in Table 7.6.2.

7.6.2.1* For sprinklers shown in Table 7.6.2, the temperature rating of the sprinkler and other characteristics shall be shown via legends or noted on drawings where a limited number of an individual type of sprinkler is called for by the design.

7.6.3* **Symbols for Piping, Valves, Control Devices, and Hangers.** Symbols for piping, valves, control devices, and hangers shall be as given in Table 7.6.3.

7.7 **Symbols for Portable Fire Extinguishers.** Symbols for portable fire extinguishers shall be as given in Table 7.7.

7.8 **Symbols for Fire-Fighting Equipment.** Symbols for fire-fighting equipment shall be as given in Table 7.8.

7.9* **Miscellaneous Symbols.** Miscellaneous symbols shall be as given in Table 7.9.



Public Input No. 41-NFPA 20-2019 [Global Input]

Remove the terms “Standard for” or “Subject” from in front of all UL standards referenced in NFPA 20.

Statement of Problem and Substantiation for Public Input

The terms are redundant and unnecessary. All references to UL are standards.

Submitter Information Verification

Submitter Full Name: Kelly Nicoletto

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Submission Date: Wed Jun 12 16:49:08 EDT 2019

Committee:

Committee Statement

Resolution: [FR-1-NFPA 20-2019](#)

Statement: The terms are redundant and unnecessary. All references to UL are standards.



Public Input No. 42-NFPA 20-2019 [Global Input]

Remove ANSI from in front of all UL standards referenced in NFPA 20.

Statement of Problem and Substantiation for Public Input

Many years ago, UL preferred the ANSI/UL reference because there was a transition of traditional UL standards towards an ANSI standards development process.

Now, years later, a large majority of UL Standards are ANSI approved and follow the ANSI development and maintenance process. However, sometimes readers are confused because they don't understand the standards are actually UL standards, not developed by ANSI. There are many other references to standards promulgated by other standards development organizations where they are considered ANSI approved but do not include ANSI in the reference.

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Submittal Date: Wed Jun 12 16:51:43 EDT 2019

Committee:

Committee Statement

Resolution: FR-2-NFPA 20-2019

Statement: Many years ago, UL preferred the ANSI/UL reference because there was a transition of traditional UL standards towards an ANSI standards development process.

Now, years later, a large majority of UL Standards are ANSI approved and follow the ANSI development and maintenance process. However, sometimes readers are confused because they don't understand the standards are actually UL standards, not developed by ANSI. There are many other references to standards promulgated by other standards development organizations where they are considered ANSI approved but do not include ANSI in the reference.



Public Input No. 84-NFPA 20-2019 [Global Input]

Type your content here ...

Replace the term "variable frequency drive" with the term "adjustable speed drive" in every instance where the term "variable frequency drive" appears.

Statement of Problem and Substantiation for Public Input

The correct term is "Adjustable Speed Drive" as defined in NFPA 70.

Submitter Information Verification

Submitter Full Name: Megan Hayes

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Submittal Date: Tue Jun 25 08:57:53 EDT 2019

Committee:

Committee Statement

Resolution: [FR-3-NFPA 20-2019](#)

Statement: The term "Variable Speed Drive" should be replaced with "Adjustable Speed Drive" as this is the more appropriate term to define these types of drivers. The change aligns with the term defined in NFPA 70.



Public Input No. 89-NFPA 20-2019 [Global Input]

- Change "maximum power draw" to "maximum pump break horsepower" throughout this Standard.

Statement of Problem and Substantiation for Public Input

The terminology "maximum power draw" is currently used in section 3.3.76.2, 4.5.1.5 (1), and 4.5.1.5 (2) but is not defined in the standard. By changing this to "maximum pump break horsepower" the standard will now be referring to a defined criteria, see section 3.3.38, that can be understood and met.

Submitter Information Verification

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Submittal Date: Wed Jun 26 15:08:11 EDT 2019

Committee:

Committee Statement

Resolution: [FR-4-NFPA 20-2019](#)

Statement: "Maximum pump brake horsepower" is the correct term to be used instead of maximum power draw.



Public Input No. 2-NFPA 20-2018 [Section No. 2.3]

2.3 Other Publications.

2.3.1 AGMA Publications.

American Gear Manufacturers Association, 1001 N. Fairfax Street, Suite 500, Alexandria, VA 22314-1587.

ANSI/AGMA 2011-B14, *Cylindrical Wormgearing Tolerance and Inspection Methods*, 2014.

2.3.2 ANSI Publications.

American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI B11.19, *Performance Requirements for Safeguarding*, 2010.

2.3.3 ASCE Publications.

American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400.

ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*, 2010 201 6.

2.3.4 ASME Publications.

ASME International, Two Park Avenue, New York, NY 10016-5990.

Boiler and Pressure Vessel Code, 2015 201 7.

2.3.5 – ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM SI10, Standard for the Use of the International System of Units (SI): The Modern Metric System, 2016.

2.3.6 AWS Publications.

American Welding Society, 8669 NW 36 Street, Suite 130, Miami, FL 33166-6672.

AWS D1.1/D1.1M, *Structural Welding Code — Steel*, 2015.

2.3. 6 7 HI Publications.

Hydraulic Institute, 6 Campus Drive, First Floor North, Parsippany, NJ 07054-4406.

ANSI/HI 1.4, *Rotodynamic Centrifugal Pumps for Manuals Describing Installation, Operation and Maintenance*, 2014.

ANSI/HI 3.6, *Rotary Pump Tests*, 2016.

2.3. 7 8 IEEE Publications.

IEEE, Three Park Avenue, 17th Floor, New York, NY 10016-5997.

~~IEEE/ASTM SI10, *Standard for Use of the International System of Units (SI): The Modern Metric System*, 2010.~~

ANSI/IEEE C62.1, *IEEE Standard for Gapped Silicon-Carbide Surge Arresters for AC Power Circuits*, 1989. **(Withdrawn)**

ANSI/IEEE C62.11, *IEEE Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1 kV)*, 2012.

ANSI/IEEE C62.41, *IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits*, 1991. **(Superseded by IEEE 62.41.1 and IEEE 62.41.2)**

ANSI /IEEE C62.41.1, Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits, 2002, reaffirmed 2008.

ANSI/IEEE C62.41. 2 , Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits, 2002, Corrigendum 1, 2012 .

2.3.89 ISO Publications.

International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

ISO 15540, *Fire Resistance of Non-Metallic Hose Assemblies and Non-Metallic Compensators — Test Methods*, 2nd edition, 2016.

2.3.910 NEMA Publications.

National Electrical Manufacturers Association, 1300 North 17th Street, Suite 900, Arlington, VA 22209.

NEMA MG-1, *Motors and Generators*, 2014, **Supplement 1, 2017**.

2.3.4011 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*, 2013 **2006, revised 2014**.

ANSI/UL 508, *Standard for Industrial Control Equipment*, 2013 **2018**.

ANSI/UL 1449, *Standard for Surge Protective Devices*, 2016 **2014, revised 2018**.

2.3.4412 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

Statement of Problem and Substantiation for Public Input

Referenced current national consensus standard editions.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3-NFPA 20-2018 [Chapter E]	

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk

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Submittal Date: Mon Oct 29 21:27:44 EDT 2018

Committee: FIM-AAA

Committee Statement

Resolution: FR-85-NFPA 20-2019

Statement: References updated to latest published editions.

**Public Input No. 43-NFPA 20-2019 [Section No. 2.3.10]****2.3.10** UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*, -2013 2006, revised 2014 .

ANSI/UL 508, *Standard for Industrial Control Equipment*, -2013 2016 .

ANSI/UL 1449, *Standard for Surge Protective Devices*, 2016.

UL 1489 Fire Resistant Pipe Protection Systems Carrying Combustible Liquids, 2016.

Statement of Problem and Substantiation for Public Input

: Update the publishing dates for each of the UL standards listed to reflect the most up to date edition and UL 1489 is proposed for 11.4.4.1 and therefore if resolved to a FR should be included in chapter 2.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 44-NFPA 20-2019 [Section No. E.2.2]	
Public Input No. 45-NFPA 20-2019 [Section No. E.1.2.7]	

Submitter Information Verification

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Submittal Date: Wed Jun 12 16:53:58 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-85-NFPA 20-2019](#)

Statement: References updated to latest published editions.



Public Input No. 50-NFPA 20-2019 [Section No. 2.3.10]

2.3.10 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 142, Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids, 2013.

ANSI/UL 218, Standard for Fire Pump Controllers, 2018

ANSI/UL 508, Standard for Industrial Control Equipment, 2013.

ANSI/UL 1004-5, Standard for Fire Pump Motors, 2014

ANSI/UL 1008, Standard for Transfer Switch Equipment, 2011, revised 2015

ANSI/UL 1449, Standard for Surge Protective Devices, 2016.

ANSI/UL 1247, Standard for Diesel Engines for Driving Stationary Fire Pumps, 2014

Statement of Problem and Substantiation for Public Input

The proposed additions reference the diesel engine and fire pump controller standards since these, in addition to UL 508, contain many relevant construction and test requirements.

Submitter Information Verification

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Submittal Date: Mon Jun 24 09:05:08 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-85-NFPA 20-2019](#)

Statement: References updated to latest published editions.



Public Input No. 51-NFPA 20-2019 [New Section after 3.3]

TITLE OF NEW CONTENT -- 3.3xx- Adjustable Speed Drive

Type your content here ...

Power conversion equipment that provides a means of adjusting the speed of an electric motor. [70: Art. 100]

Statement of Problem and Substantiation for Public Input

The definition for Adjustable Speed Drive is extracted from NFPA 70.

Submitter Information Verification

Submitter Full Name: Megan Hayes

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Submittal Date: Mon Jun 24 09:11:25 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-87-NFPA 20-2019

Statement: The definition for Adjustable Speed Drive is used in the document in lieu of "Variable Frequency Drive" as per FR-3. The definition is extracted from NFPA 70.



Public Input No. 52-NFPA 20-2019 [New Section after 3.3]

TITLE OF NEW CONTENT-- 3.3x - Automation

Type your content here ...

Performing a function without the necessity of human intervention. [70: Art. 100]

3.3x - Nonautomatic

Requiring human intervention to perform a function. [70: Art. 100]

Statement of Problem and Substantiation for Public Input

The proposed definitions adopt those for automatic and nonautomatic presently in NEC Article 100.

Submitter Information Verification

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Submittal Date: Mon Jun 24 09:20:40 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-89-NFPA 20-2019

Statement: Term "Non Automatic" is added into chapter 3 as it is currently used throughout the standard but is not defined in the document. The definition is extracted from NFPA 70 article 100.

**Public Input No. 99-NFPA 20-2019 [Section No. 3.3.5]****3.3.5 Automated Inspection and Testing.**

The performance of inspections and tests at a distance from the system or component being inspected or tested through the use of electronic devices or equipment installed for the purpose.

3.3.5.1 Automated Test System

Is an automation solution that enables full routine testing of the fire pump system without manual intervention by a site operator, and the automation solution is provided as part of a packaged fire pump assembly automated test system, including sensors, cameras, automated control valves, data acquisition system, data storage system, and cloud storage system. The test is manually activated (locally or remotely) by qualified personnel and after the test, the system is confirmed by local or remote qualified personnel, to be confirmed as being in 'back in fire fighting' service mode.

Statement of Problem and Substantiation for Public Input

Automated testing bring several benefits to the objectives of reliability in fire pump systems:

1. The automated run sequences ensure that the test is properly executed without over-looking any activities.
2. The automated data collection ensures accurate readings and transposition of the data, versus manual recording and processing that can lead to incorrect data being entered in the wrong field, or over-looked.
3. The collected data can automatically be reviewed for range of acceptance tolerance bands without the risk of human error.
4. At the completion of testing the automated process controls can reset the system settings, (valve positions, communications links, sensor inputs, etc.) back to the active duty mode as opposed to the risk of being left in the wrong position.
5. Remote automated testing of diesel fire pumps sets while the operator is in the building provide greater health safety for the operator while ensuring that the operator is close at hand to in the event of issues and can do an emergency manual shut-down if there is the potential of catastrophic failure.
6. Remote at distance automated testing of electric fire pump sets with Camera's and complete positioning sensors ensures that everything the operator could do on site can be repeated.
7. The extra cost of automated devices, sensors, cameras, data logging equipment and diagnostic software is made up for by much more economical monthly test costs that achieve a better result.

In summary, with improved testing quality and frequency the availability / reliability of the fire safety systems are improved. Automated test systems support this improvement in reliability and lowers the per unit "inspection / test" cost to the owner and NET-NET the owner experiences a lower cost after 2 years, with the benefits of improved fire safety.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 100-NFPA 20-2019 [Section No. 4.35]	

Submitter Information Verification

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Submittal Date: Wed Jun 26 15:44:16 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: Related PI 100 was also rejected by the committee so the term is not included in the document.



Public Input No. 90-NFPA 20-2019 [Section No. 3.3.12]

3.3.12 Corrosion-Resistant Material.

Materials such as brass, copper, Monel[®], stainless steel, or other equivalent corrosion-resistant materials.

3.3.12.1 E-Coating

E-Coatings are a Metallurgically bonded corrosion resistant process that can be used on the interior and exterior surfaces of the fire pumps, to help retain their hydraulic performance, over a longer period.

Statement of Problem and Substantiation for Public Input

Added definition of 'E-Coating' to support an proposed addition in 6.2.1.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 101-NFPA 20-2019 [New Section after 4.4.3]	

Submitter Information Verification

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Submittal Date: Wed Jun 26 15:11:40 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: Coating can possibly come off and clog diesel engine water by-pass strainers and sprinkler heads.
The listing laboratories have product specific requirements for corrosion resistance.



Public Input No. 91-NFPA 20-2019 [Section No. 3.3.38]

3.3.38 Maximum Pump Brake Horsepower.

The maximum brake horsepower required to drive the pump at rated speed for any flow up to 175% of rated flow . The pump manufacturer determines this by shop test under expected suction and discharge conditions. Actual field conditions can vary from shop conditions.

Statement of Problem and Substantiation for Public Input

This change will clarify and provide specific measurable criteria for pump testing that is reasonable.

As the flow through a pump increases the boost pressure provided by that pump decreases. By the time a pump reaches 175% of its rated flow there will be much less pressure provided than is required to be useful for most fire systems.

When going beyond 175% of rated flow to prevent the pump from cavitating a much higher suction pressure will be required than can be found in the vast majority of the fire pump installations around the world.

By setting a specific flow rate that will be used to determine the required power rating of the pump driver all fire pump manufacturers will be on an even playing field when it comes to peak power testing. With today's requirement of testing until a peak power is achieved there is the opportunity for pump manufacturers to incorrectly test their pumps. This will most often happen if the manufacturer does not or cannot maintain a high enough suction pressure to prevent the pump from cavitating. When simply looking at the test results it can appear that a pump reached it's peak power when in fact it simply started to cavitate.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 92-NFPA 20-2019 [Section No. 4.7.6]	
Public Input No. 93-NFPA 20-2019 [Section No. 4.11.3]	
Public Input No. 94-NFPA 20-2019 [Section No. 9.5.2.1]	
Public Input No. 95-NFPA 20-2019 [Section No. 11.2.2.7]	

Submitter Information Verification

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Submittal Date: Wed Jun 26 15:13:43 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: The standard currently requires non-overloading over the entire pump curve. The proposed language can cause the controller and the motor to overload. Many pumps can perform past 175% rated flow.



Public Input No. 97-NFPA 20-2019 [Section No. 3.3.46]

3.3.46 Power.

3.3.46.1 Alternate Power.

A power source that is independent of the primary power supply.

3.3.46.2 On-Site Power Production Facility.

An on-site normal supply of electric power that is expected to be constantly producing power.

3.3.46.3 On-Site Standby Generator.

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

3.3.46.4 Standby Power.

An alternate power source that is normally inactive but becomes active whenever the primary power is lost.

3.3.46.4 On-Site Standby Battery Based Energy Storage Unit

An alternate power source in the form of a battery based energy storage unit comprising: prefabricated assembly of battery technology - battery charge and dis-charge technology - and unit power controller technology, that has sufficient on-board controls and automation to reserve the necessary energy for fire fighting duty requirements.

Statement of Problem and Substantiation for Public Input

Historically, standby diesel /NG generators, diesel driven pumps, or alternate power feeds from separate supply grids have been the acceptable means to ensure the required availability of the fire sprinkler system. Over the past 15 years modern energy battery based storage units have become common place and are a proven, predictable and reliable source of electrical power.

In densely populated urban areas there are forces that steer decision makers away from installing more grid capacity for alternate grid sources, and also steer decision makers away from engine driven generators

A proven and popular choice for alternate / emergency power applications has become new battery technology that fuels modern energy storage units. This enables all of the higher reliability elements of an electrically driven fire pump system with an energy source that allows the implementation of life safety systems that are consistent with the urban noise, environmental, space, access, and reliability expectations.

Although modern energy storage units have a higher first cost relative to diesel engine driven pump options, or back-up diesel generators, the life cycle maintenance and repair costs are a small fraction of the engine and generator options.

This public input enables the availability of a more reliable alternate / stand-by power solution than those currently available. It meets the challenges in urban areas that other options cannot, and has a lower life-cycle cost than all currently approved options.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 88-NFPA 20-2019 [Section No. 9.3.4]	PI No 88 draws on this definition in 3.3.46

Submitter Information Verification

Submitter Full Name: peter thomsen

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Submittal Date: Wed Jun 26 15:30:21 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [CI-19-NFPA 20-2019](#)

Statement: The committee doesn't have sufficient information to determine the adequacy of the proposed text. Committee decided to create a committee input to solicit additional information on the subject of effectively using the energy storage systems as an alternate source of power.

The committee wants to evaluate the concerns pertaining to alternate sources of power as currently addressed by the standard and those that might be specific to energy storage systems in this application.



Public Input No. 39-NFPA 20-2019 [Section No. 3.3.78]

3.3.78 Vertical Fire Protection Zone.

A vertical zone within a high-rise building that is supplied from a fire pump(s) and/or water storage tank(s) with a riser that is separate from the standpipe system .

Statement of Problem and Substantiation for Public Input

High rise building construction is regulated by several codes and standards. A zone is described in many ways from the International Building Code (IBC), NFPA 13, NFPA 14, and NFPA 20. This public input starts to attempt to correlate the terminology of what a vertical zone is across all the codes and standards.

This PI adds in text to the vertical fire protection zone definition that apply solely to fire sprinkler systems. The change to this definition is useful for the application of NFPA 20 Section 5.6, in NFPA 13 (see PIs 404, 444, 486) and the IBC.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 38-NFPA 20-2019 [Section No. 5.6.1.1]	
Public Input No. 40-NFPA 20-2019 [Section No. 3.3.78]	

Submitter Information Verification

Submitter Full Name: Jeffrey Hugo

Organization: National Fire Sprinkler Associ

Affiliation: On behalf of NFSA Engineering and Standards (E&S) committee.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jun 06 18:56:39 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-8-NFPA 20-2019](#)

Statement: Building standpipes are incorporated into the definition of vertical fire protection zone to address PI's 38, 39, and 40.

**Public Input No. 40-NFPA 20-2019 [Section No. 3.3.78]****3.3.78 Vertical Fire Protection Standpipe System Zone.**

A vertical zone within a subdivision of a standpipe system limited or determined by the pressure limitations of the system components within a high-rise building that is supplied from a fire pump(s) and/or water storage tank(s).

-

Statement of Problem and Substantiation for Public Input

High rise building construction is regulated by several codes and standards. A zone is described in many ways from the International Building Code (IBC), NFPA 13, NFPA 14, and NFPA 20. This public input starts to attempt to correlate the terminology of what a vertical zone is across all the codes and standards.

This PI adds in text to the vertical fire protection zone definition to apply to fire sprinkler systems and a new definition from NFPA 14 for vertical standpipe system zone. Both terms are useful for the application of NFPA 20 in Section 5.6.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 39-NFPA 20-2019 [Section No. 3.3.78]	
Public Input No. 38-NFPA 20-2019 [Section No. 5.6.1.1]	

Submitter Information Verification

Submitter Full Name: Jeffrey Hugo
Organization: National Fire Sprinkler Associ
Affiliation: On behalf of NFSA Engineering and Standards (E&S) committee
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 06 19:06:33 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: By incorporating building standpipes into the definition of vertical fire protection zone this accomplishes the intent of PI's 38, 39, and 40.

**Public Input No. 101-NFPA 20-2019 [New Section after 4.4.3]****4.4.4**

Fire pumps are permitted to use e-coatings on internal and external surfaces. E-coatings can only be considered when they are of the metallurgically bonded type and have the record of coating process, with a quality control procedure that documents the components, materials and process parameters. All other coatings are not permitted in the hydraulic path of the pump.

Statement of Problem and Substantiation for Public Input

Justification - E-Coatings are a proven technology that preserves the hydraulic performance of a centrifugal pump, and at the same time does not subject the fluid to any new sources of debris, as other lesser coatings might cause, due to flaking.

E-coating costs for pump manufacturers are equal to costs without e-coating treatment, so there is no additional cost to the customer. The customer will save costs over the life of the system, as the life of the pump volute will be extended, ensuring intended pump performance is maintained.

The net effect of the above means that customers will have a longer lasting, better performing fire pumps with e-coatings at no increase to first costs.

Related Public Inputs for This Document

Related Input	Relationship
<u>Public Input No. 90-NFPA 20-2019 [Section No. 3.3.12]</u>	Definition to support this new section and 6.2 & 6.2.1
<u>Public Input No. 98-NFPA 20-2019 [New Section after 6.2]</u>	Supported by 3.3.12 & and this section.

Submitter Information Verification

Submitter Full Name: Joanne Schneider
Organization: Armstrong Fluid Technology
Street Address:
City:
State:
Zip:
Submission Date: Wed Jun 26 15:57:58 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: Coating can possibly come off and clog diesel engine water by-pass strainers and sprinkler heads. The listing laboratories have product specific requirements for corrosion resistance.



Public Input No. 33-NFPA 20-2019 [New Section after 4.6.2.1]

4.6.2.1.1 Where mechanical seals are used as fire pump shaft seals, only clean water that is free of debris and particles shall be supplied to the fire pump.

A.4.6.2.1.1 Fire pumps with mechanical seals should be restricted to those applications where only clean water is pumped. Debris and particles may adversely affect the performance of mechanical seals and cause the seal to fail its intended function. Water supplies should not be from a source that allows for particles, such as sand and debris, to enter the water such as open tanks and open bodies of water, e.g., retention ponds, lakes or rivers. Also, the pump should operate with positive pressure conditions at the pump inlet at all times.

Statement of Problem and Substantiation for Public Input

Some fire pumps are being fitted with mechanical seals to prevent leakage from the pump shaft. The performance of these mechanical seals can be adversely impacted by debris, sand and other particles in the water supply. Only clean sources of water shall be used in applications where mechanical seals are utilized in fire pumps.

Submitter Information Verification

Submitter Full Name: Ilan Cohn

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Thu Apr 11 11:43:47 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: Clean water can't be guaranteed for fire pump service. Any new construction or modification to the water source lines can introduce debris. As currently written it is difficult to enforce this requirement, parameters defining water quality would be needed.



Public Input No. 92-NFPA 20-2019 [Section No. 4.7.6]

4.7.6*

The driver shall be selected in accordance with 9.5.2 (electric motors), 11.2.2 (diesel engines), or 13.1.2 (steam turbines) to provide the required power to operate the pump at rated speed and maximum pump load under any flow condition up to 175% of rated flow .

Statement of Problem and Substantiation for Public Input

This change will clarify and provide specific measurable criteria for pump testing that is reasonable.

As the flow through a pump increases the boost pressure provided by that pump decreases. By the time a pump reaches 175% of its rated flow there will be much less pressure provided than is required to be useful for most fire systems.

When going beyond 175% of rated flow to prevent the pump from cavitating a much higher suction pressure will be required than can be found in the vast majority of the fire pump installations around the world.

By setting a specific flow rate that will be used to determine the required power rating of the pump driver all fire pump manufacturers will be on an even playing field when it comes to peak power testing. With today's requirement of testing until a peak power is achieved there is the opportunity for pump manufacturers to incorrectly test their pumps. This will most often happen if the manufacturer does not or cannot maintain a high enough suction pressure to prevent the pump from cavitating. When simply looking at the test results it can appear that a pump reached it's peak power when in fact it simply started to cavitate.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 91-NFPA 20-2019 [Section No. 3.3.38]	This change reflects the proposed change to the definition of maximum pump brake horsepower.
Public Input No. 93-NFPA 20-2019 [Section No. 4.11.3]	
Public Input No. 94-NFPA 20-2019 [Section No. 9.5.2.1]	
Public Input No. 95-NFPA 20-2019 [Section No. 11.2.2.7]	

Submitter Information Verification

Submitter Full Name: Steven Baird
Organization: Armstrong Fluid Technology
Street Address:
City:
State:
Zip:
Submission Date: Wed Jun 26 15:19:35 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: The standard currently requires non-overloading over the entire pump curve. The proposed language can cause the controller and the motor to overload. Many pumps can perform past 175% rated flow.



Public Input No. 53-NFPA 20-2019 [Section No. 4.8.7]

4.8.7

The output current rating of the variable frequency adjustable speed drive (VFD) ASD) as marked on the nameplate of the controller shall not be exceeded when operating in the motor service factor at the maximum pump horsepower in accordance with 4.11.3.

Statement of Problem and Substantiation for Public Input

The proposed revision clarifies that the service factor amps are not always at the full 1.15 service factor.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

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City:

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Submittal Date: Mon Jun 24 09:26:34 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-9-NFPA 20-2019](#)

Statement: This change clarifies that the service factor amps are not always at the full 1.15 service factor.

**Public Input No. 93-NFPA 20-2019 [Section No. 4.11.3]****4.11.3**

The nameplate shall indicate the maximum pump horsepower demand required to power the pump at any flow ,including flows beyond 150 percent of the rated capacity up to 175% of rated flow .

Statement of Problem and Substantiation for Public Input

This change will clarify and provide specific measurable criteria for pump testing that is reasonable. As the flow through a pump increases the boost pressure provided by that pump decreases. By the time a pump reaches 175% of its rated flow there will be much less pressure provided than is required to be useful for most fire systems. When going beyond 175% of rated flow to prevent the pump from cavitating a much higher suction pressure will be required than can be found in the vast majority of the fire pump installations around the world. By setting a specific flow rate that will be used to determine the required power rating of the pump driver all fire pump manufacturers will be on an even playing field when it comes to peak power testing. With today's requirement of testing until a peak power is achieved there is the opportunity for pump manufacturers to incorrectly test their pumps. This will most often happen if the manufacturer does not or cannot maintain a high enough suction pressure to prevent the pump from cavitating. When simply looking at the test results it can appear that a pump reached it's peak power when in fact it simply started to cavitate.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 91-NFPA 20-2019 [Section No. 3.3.38]	This change reflects the proposed change to the definition of maximum pump brake horsepower.
Public Input No. 92-NFPA 20-2019 [Section No. 4.7.6]	This change reflects the proposed change to the definition of maximum pump brake horsepower.
Public Input No. 94-NFPA 20-2019 [Section No. 9.5.2.1]	
Public Input No. 95-NFPA 20-2019 [Section No. 11.2.2.7]	

Submitter Information Verification

Submitter Full Name: Steven Baird
Organization: Armstrong Fluid Technology
Street Address:
City:
State:
Zip:
Submission Date: Wed Jun 26 15:21:56 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: The standard currently requires non-overloading over the entire pump curve. The proposed language can cause the controller and the motor to overload. Many pumps can perform past 175% rated flow.



Public Input No. 18-NFPA 20-2019 [New Section after 4.14.1.1.4]

Fire Pump Room Location

The current section 4.14.1.1.4 requires that the location of and access to the fire pump room shall be preplanned with the fire department.

The new change I recommend is to require that location to be preplanned but with further addressing of other requirements. E.g. when the preplanned location is to be underground - then the following must be maintained for the safety of firefighters & ITM personnel or even the equipment safety itself; -

- 1) The access must be made so easy "no monkey ladders".
- 2) The depth of the room "how deep is the room" - there must be no vertical travel.
- 3) Proper Drainage.
- 4) Submersible pump that activates upon the activation of float switch. The activation of such a pump shall initiate a supervisory signal "abviously no one would like to have the fire pump merged into water".
- 5) Ventilation and natural ventilation could be another issue that NFPA has to consider for underground locations.

Statement of Problem and Substantiation for Public Input

1st problem is the safety of firefighter and emergency respondents for locations underground if vertical ladders are used.

2nd Endangering the safety and lives of ITM personnel.

3rd Any heavy leakage and without proper drainage system could lead to submerged into water "short circuit of controller".

I don't have solid papers and proofs to show here but I was in charge of two issues/accidents where fire pump rooms were underground, and there was no proper drainage for both cases. The water has reached the bottom of the controller shorting out the 3 phases leading to entire trip of electrical system! The issue was that the submersible pump has failed and there was no monitoring for that failure. This accident cost around 200,000 \$ for repair. The other issue was for a hospital. There was huge leakage on the fire pump suction. Drainage and submersible pump has failed. The water shorted out the controller and the main transformer circuit tripped and the entire hospital was out except for those loads connected to emergency generators!

Submitter Information Verification

Submitter Full Name: Faris Al Zahrani

Organization: Jubail Industrial College

Affiliation: Jubail Industrial College

Street Address:

City:

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Zip:

Submittal Date: Fri Jan 18 14:49:45 EST 2019

Committee: FIM-AAA

Committee Statement

Resolution: Room construction should be consistent with the applicable building code. The proposal will limit vertical access to the fire pump which may be necessary. Requirement for drainage is existing in the body of the standard (chapter 4).

**Public Input No. 10-NFPA 20-2018 [Section No. 4.16.3.2]****4.16.3.2***

The requirements of 4.16.3.1 shall not apply where the supply is a suction tank with its base- water level after supplying the most demanding system for the required duration is at or above the same elevation as the centerline of the fire pump, and the gauge pressure at the pump suction flange shall be permitted to drop to -3 psi- does not drop below -3 psi (-0.2 bar) at 150 percent of rated flow with the- when the tank is at it's lowest water level- after the maximum system demand and duration have been supplied .

Statement of Problem and Substantiation for Public Input

When introduced the wording of this section correlated the tank base and pump room floor elevations. In 2013 the annex material was revised to indicate that the main concern was the water level vs pump elevation. The body of the standard was not revised to match and as currently written could be erroneously interpreted to require the tank base be elevated above the fire pump itself. Ultimately for the purpose of hydraulics and pump suction pressures the elevation of the pump room floor and the water storage tank base are irrelevant, particularly since the vortex plate must be located a minimum of 6" above the tank base and the fire pump is typically at least 8" off the pump room floor plus the distance from the base to center-line of the suction flange. The primary factors to be considered are the elevation of the water in the storage tank after the fire flow x duration of the most demanding system has been met and the elevation of the pump itself. I believe the submitted change is more in line with the intent outlined in the annex edits and is a more reasonable metric by which to assess the relative elevations. Any added mathematic complexity would be required to calculate the tank water elevation and ultimately the pump inlet flange pressure regardless.

Submitter Information Verification

Submitter Full Name: MIKE MOREY

Organization: Shambaugh and Son LP

Street Address:

City:

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Zip:

Submission Date: Wed Dec 12 09:06:08 EST 2018

Committee: FIM-AAA

Committee Statement

Resolution: FR-10-NFPA 20-2019

Statement: The intent of the section is to require the water level to be at or above the centerline of the fire pump after fire flow duration of the most demanding system has been met regardless of the water tank base elevation.



Public Input No. 28-NFPA 20-2019 [Section No. 4.20.6]

4.20.6 Discharge Piping.

4.20.6.1

Except as permitted in 4.20.6.2, the relief valve discharge pipe shall be of a size not less than that given in Section 4.28.

4.20.6.1.1 If the pipe employs more than one elbow, the next larger pipe size shall be used.

4.20.6.2

The discharge pipe shall be permitted to be sized hydraulically to discharge sufficient water to prevent the pump discharge pressure, adjusted for elevation, from exceeding the pressure rating of the system components.

4.20.6.2.1 –

~~If the pipe employs more than one elbow, the next larger pipe size shall be used.~~

4.20.6.3

Relief valve discharge piping returning water back to the supply source, such as an aboveground storage tank, shall be run independently and not be combined with the discharge from other relief valves.

4.20.6.4

Relief valve discharge piping from a single fire pump returning water back to the supply source shall be permitted to be combined with fire pump test piping downstream of any control valve in a manner that complies with 4.20.6, 4.22.2, and 4.22.3.

4.20.6.5

The discharge piping from multiple relief valves shall not be combined with fire pump test piping.

4.20.6.6

Isolation of the test header piping from the pressure relief valve discharge shall be possible.

Statement of Problem and Substantiation for Public Input

Current section 4.20.6.2.1 applies to section 4.20.6.1, not 4.20.6.2

Submitter Information Verification

Submitter Full Name: Gayle Pennel

Organization: JENSEN HUGHES

Street Address:

City:

State:

Zip:

Submission Date: Tue Mar 26 18:19:34 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: Language is existing and doesn't need to be relocated. The existing text is adequate.



Public Input No. 27-NFPA 20-2019 [Section No. 4.20.7.1]

4.20.7.1

Where the pump driver is an electric motor, a stream turbine, or a radiator cooled diesel engine, and the pressure relief valve discharge has been piped back to suction, a circulation relief valve sized in accordance with 4.13.1.7 and 4.20.7 and discharged to atmosphere shall be provided downstream of the pressure relief valve. The circulating relief valve shall actuate below the opening set point of the pressure relief valve to ensure cooling of the pump during churn operation.

Statement of Problem and Substantiation for Public Input

The circulation relief valve required in this section is not needed for a heat exchange cooled diesel engine as water is already discharging through the heat exchanger.

Submitter Information Verification

Submitter Full Name: Gayle Pennel

Organization: JENSEN HUGHES

Street Address:

City:

State:

Zip:

Submittal Date: Tue Mar 26 18:11:19 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: The paragraph written in standard is sufficient. Furthermore section 4.20.7.2 addresses the case where the pump is driven by a diesel engine with a heat exchanger.



Public Input No. 96-NFPA 20-2019 [New Section after 4.21.2.4]

4.21.2.4.1

Up to 3 self regulating variable speed fire pump units can be operated in series as part of a series fire pump unit, only when provided as a packaged fire pump assembly.

Statement of Problem and Substantiation for Public Input

The gaining popularity of taller buildings has resulted in the creation of more complex multistage multiport pump designs that offer a small footprint, however have design complexity, high repair and maintenance costs, and if not in service result in no sprinkler service to the whole building.

The use of single stage pumps connected in series permits the generation of boost pressures appropriate for today's very tall building designs, while enabling a more simple, easier to maintain design of these pumps relative to multistage multiport pumps.

The use of variable speed pump operation in fire systems enables further installation and design advantages that improve design options, reduce installed costs, and allow greater configuration flexibility. Extending the number of variable speed pumps allowed in series from 2 to 3 pumps, just for the SRVSFPU design, will improve feasibility of the entire systems, will reduce the challenges with high pressure outlet from the multistage multiport designs and provide simple more reliable service processes that in turn make the fire system more reliable, and therefore more effective.

Submitter Information Verification

Submitter Full Name: Steven Baird

Organization: Armstrong Fluid Technology

Street Address:

City:

State:

Zip:

Submission Date: Wed Jun 26 15:29:40 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: The complexity of the installation, particularly on the fire pump controller's feedback stability, hasn't been sufficiently addressed, evaluated, and technically justified.

**Public Input No. 34-NFPA 20-2019 [Section No. 4.22.2.10.1]****4.22.2.10.1 –**

~~The alternate means of measuring flow shall be located downstream of and in series with the flow meter.~~

Statement of Problem and Substantiation for Public Input

As written, it suggests the flow be measured through the flow meter while discharging water out the test header. This diminishes the value of, and even negates the requirement for an "alternate" means of measuring flow as is the intent of this section. The primary and alternate flow measuring devices are not intended to be used to test one another. Both are used to evaluate the performance of the pump. With regard to the test header, it is used to evaluate the performance of the pump and the suction supply. The flow meter gauge is to be calibrated by returning it to the manufacturer for a certified calibration, or by a qualified gauge calibration specialist, not by comparing the flow meter gauge to pitot readings through the test header. Pitot gauges also require calibration by qualified personnel and have the opportunity to be inaccurate just as the flow meter gauge. Thus calibration of both the flow meter gauge and the pitot gauge must be kept independent and separate.

Also, throttling the flow with the hose valves while monitoring flow through the flow meter goes against the recommendations of the flow meter manufacturer's instructions. Flow meter manufacturers require the throttling be done with the throttle valve, which they also require to be a butterfly valve, on the flow meter piping arrangement. Additionally, Annex Figure A.4.22.1.3(b) needs to be revised to show the appropriate arrangement which should show the test header being installed either upstream or downstream of the flow meter, but in either case, as an independent means of measuring flow.

Submitter Information Verification

Submitter Full Name: Tony Spencer

Organization: Patterson Pump Company

Affiliation: Patterson Pump Company

Street Address:

City:

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Zip:

Submittal Date: Mon Apr 22 11:05:17 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: The intent of the placement of the hose header is to validate the accuracy of the flow meter reading and this requirement should be retained in the standard.

**Public Input No. 20-NFPA 20-2019 [Section No. 4.22.3.4 [Excluding any Sub-Sections]]**

The pipe size shall be in accordance with one of the following methods:

- (1) Where the pipe between the hose valve header and the connection to the pump discharge pipe is over 15 ft (4.5 m) in length, the next larger pipe size than that required by 4.22.3.1.3 shall be used.
- (2) Where the pipe between the hose valve header and the connection to the pump discharge pipe contains more than 4 fittings that create a change in direction, the next larger pipe size than that required by 4.22.3.1.3 shall be used.
- (3)* This pipe shall be permitted to be sized by hydraulic calculations that match the actual test configuration and that include the required pitot pressure and friction loss for the total length of pipe and fire hose plus equivalent lengths of fittings, control valve, and hose valves, plus elevation loss, from the pump discharge flange to the discharge outlets.

Statement of Problem and Substantiation for Public Input

The friction loss created by directional fittings can easily exceed that of long pipe lengths in the test header (A single elbow being 18+ feet). Typical test header installs have 2-4 fittings (Tee/elbow at the discharge, elbow after the shutoff valve and potentially a single or double elbow to offset the pipe to a specific point on the wall). I have calculated numerous test header installs over 15' and have yet to find one that fails to perform with the specified pipe size, but the presence of excessive fittings seems as much or more a concern than the presence of excessive pipe length in most layouts I have analyzed. Additionally, while relatively low in likelihood, as written the standard would effectively reward the practice of replacing actual pipe length with fittings to reduce below the 15' barrier. I considered proposing a change to equivalent length alone, but the variations by pipe size and the more real world applicability and ease of analysis seemed to make this solution preferable.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 21-NFPA 20-2019 [Section No. A.4.22.3.4(2)]	

Submitter Information Verification

Submitter Full Name: MIKE MOREY
Organization: Shambaugh and Son LP
Street Address:
City:
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Submittal Date: Fri Feb 01 12:09:37 EST 2019
Committee: FIM-AAA

Committee Statement

Resolution: [FR-11-NFPA 20-2019](#)
Statement: Bullet two added to address the friction loss created by directional fittings as it can exceed friction loss due to long pipe lengths in the test header. Corrected the referenced table number.



Public Input No. 29-NFPA 20-2019 [Section No. 4.32.4.3]

4.32.4.3 5

There shall be two inspection test valves attached to the pressure sensing line that shall consist of a tee, a valve, a second tee with the branch plugged, and a second valve. *[See Figure A.4.32(a) and Figure A.4.32(b).]*

Statement of Problem and Substantiation for Public Input

This section should not be a subsection of the "Check Valves or Ground-Face Unions" as it does not apply and should be placed as a separate paragraph either before or after this section.

Submitter Information Verification

Submitter Full Name: Stephen Jaskolka
Organization: The Dupont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Mar 28 11:15:24 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: FR-12-NFPA 20-2019

Statement: The section number is updated in order to separate from section 4.32.4 as the section does not apply to Check Valves or Ground Face Unions.



Public Input No. 100-NFPA 20-2019 [Section No. 4.35]

4.35 Automated Inspection, Testing, and Distance Monitoring of Devices, Meters, and Equipment.

4.35.1 *

Devices, meters, and equipment utilized to perform automated inspection and testing procedures that are subjected to system pressure, where provided, shall be listed.

4.35.2 *

Devices, meters, and equipment utilized to perform distance monitoring of system or component status that are subjected to system pressure, where provided, shall be listed.

4.35.3 Fire Pump Automated Test Systems

4.35.3.1 A fire pump automated test system can only be provided as part of a Packaged Fire Pump Assembly as described in 4.31.

4.35.3.2 The fire pump automated test system shall be factory tested and listed as a unit.

4.35.3.3 The fire pump automated test system can only be utilized on electric motor driven fire pump systems and diesel engine driven fire pump systems.

4.35.3.4 Electric motor driven fire pump systems can be tested in an automated fashion without a local operator, through a remote operator process that includes a web-camera view of the fire pump room. A remote operator is an operator that is not in the same building as the fire pump system.

4.35.3.5 Diesel engine driven fire pump systems cannot be tested in an automated fashion by a remote operator.

4.35.3.6 When diesel engine driven fire pump systems are automatically tested there shall be qualified personnel on site witnessing the test either;

i directly while being physically in the pump room, or

ii the operator can be directly outside of the pump room and witness the test through a web-camera along with full instrumentation display on their live connected remote dashboard.

4.35.3.7 When automated testing is performed, the results of all required test data shall be collected automatically through electronic means and stored.

4.35.3.8 Electronic test data shall be stored on the automated test control system local memory, and also shall be collected remotely if the operator is remote (on a storage medium), and shall also be automatically sent to a cloud storage site managed by the automated test system manufacturer.

4.35.3.9 Remote connectivity of the automated test system shall be provided by the automated test system manufacturer to include remote camera capability, and connectivity to cloud storage.

4.35.3.10 The accountability to assess and communicate performance results is that of the qualified personnel as described in 4.3.4.2.

4.35.3.11 The cloud data is owned by the building owner.

4.35.3.12 Any and all automated testing is activated by qualified personnel, either local or remote. Once the testing is completed the operator shall confirm that the packaged fire pump assembly is returned to normal 'ready' mode, and the valve positions are captured by the test cycle and stored as part of the test data set. Valve positions shall be confirmed by position sensors on the valve stem, handle or valve actuator drive mechanism.

Statement of Problem and Substantiation for Public Input

Automated testing bring several benefits to the objectives of reliability in fire pump systems:

1. The automated run sequences ensure that the test is properly executed without over-looking any activities.
2. The automated data collection ensures accurate readings and transposition of the data, versus manual recording and processing that can lead to incorrect data being entered in the wrong field, or over-looked.
3. The collected data can automatically be reviewed for range of acceptance tolerance bands without the risk of human error.
4. At the completion of testing the automated process controls can reset the system settings, (valve positions, communications links, sensor inputs, etc.) back to the active duty mode as opposed to the risk of being left in the wrong position.
5. Remote automated testing of diesel fire pumps sets while the operator is in the building provide greater health safety for the operator while ensuring that the operator is close at hand to in the event of issues and can do an emergency manual shut-down if there is the potential of catastrophic failure.
6. Remote at distance automated testing of electric fire pump sets with Camera's and complete positioning sensors ensures that everything the operator could do on site can be repeated.
7. The extra cost of automated devices, sensors, cameras, data logging equipment and diagnostic software is made up for by much more economical monthly test costs that achieve a better result.

In summary, with improved testing quality and frequency the availability / reliability of the fire safety systems are improved. Automated test systems support this improvement in reliability and lowers the per unit "inspection / test" cost to the owner and NET-NET the owner experiences a lower cost after 2 years, with the benefits of improved fire safety.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 99-NFPA 20-2019 [Section No. 3.3.5]	This PI relates to PI No 99 that provides a definition

Submitter Information Verification

Submitter Full Name: peter thomsen
Organization: s a armstrong
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 26 15:50:56 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: Proposed language does not add any value to the existing text. Furthermore it doesn't allow diesel pumps to be tested as currently allowed by NFPA 20.



Public Input No. 38-NFPA 20-2019 [Section No. 5.6.1.1]

5.6.1.1*

Where the primary supply source for a vertical fire protection zone or a vertical standpipe system 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 or a vertical standpipe system 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 or a vertical standpipe system 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.

Statement of Problem and Substantiation for Public Input

High rise building construction is regulated by several codes and standards. A zone is described in many ways from the International Building Code (IBC), NFPA 13, NFPA 14, and NFPA 20. This public input starts to attempt to correlate the terminology of what a vertical zone is across all the codes and standards.

This PI adds to the text of Section 5.6 the new vertical standpipe system zone (see related PIs) term to provide some clarity and correlation among NFPA 13, NFPA 14 and the IBC.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 39-NFPA 20-2019 [Section No. 3.3.78]	
Public Input No. 40-NFPA 20-2019 [Section No. 3.3.78]	

Submitter Information Verification

Submitter Full Name: Jeffrey Hugo

Organization: National Fire Sprinkler Associ

Affiliation: On behalf of NFSA Engineering and Standards (E&S) committee

Street Address:

City:

State:

Zip:

Submission Date: Thu Jun 06 18:52:48 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: Incorporating building standpipes into the definition of vertical fire protection zone accomplishes the intent of PI's 38, 39, and 40.



Public Input No. 4-NFPA 20-2018 [Chapter 6 [Title Only]]

Centrifugal Pumps Other Than Vertical Shaft Turbine Type

Statement of Problem and Substantiation for Public Input

Vertical shaft turbine type pumps are also centrifugal pumps. Renaming Chapter 6 as proposed is intended to differentiate the centrifugal pumps covered by Chapter 6 from those covered by Chapter 7.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 5-NFPA 20-2018 [Section No. 6.1.1]	
Public Input No. 8-NFPA 20-2018 [New Section after 6.1.1.3]	
Public Input No. 9-NFPA 20-2018 [Chapter 7 [Title Only]]	

Submitter Information Verification

Submitter Full Name: Brian Fox
Organization: Enercon Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Dec 04 17:03:38 EST 2018
Committee: FIM-AAA

Committee Statement

Resolution: Chapter 6 adequately describes and addresses the differences between vertical turbine pumps and other types of centrifugal pumps.



Public Input No. 5-NFPA 20-2018 [Section No. 6.1.1]

6.1.1 * Types: Application

6.1.1.1

~~Centrifugal pumps shall be of~~ This chapter applies to centrifugal pumps of the overhung impeller design and the impeller between bearings design.

6.1.1.2

The overhung impeller design shall be close coupled or separately coupled single- or two-stage end-suction-type *[see Figure A.6.1.1(a) and Figure A.6.1.1(b)]* or in-line-type *[see Figure A.6.1.1(c) through Figure A.6.1.1(e)]* pumps.

6.1.1.3

The impeller between bearings design shall be separately coupled single-stage or multistage axial (horizontal) split-case-type *[see Figure A.6.1.1(f)]* or radial (vertical) split-case-type *[see Figure A.6.1.1(g)]* pumps.

Statement of Problem and Substantiation for Public Input

The current wording seems to limit centrifugal pumps to the two types identified. However, pumps covered in Chapter 7 are also centrifugal pumps. Proposed change resolves potential confusion regarding the centrifugal pumps addressed in Chapter 6 versus the centrifugal pumps addressed by Chapter 7.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4-NFPA 20-2018 [Chapter 6 [Title Only]]	Clarification of Chapter 6 vs Chapter 7 Centrifugal Pumps
Public Input No. 8-NFPA 20-2018 [New Section after 6.1.1.3]	

Submitter Information Verification

Submitter Full Name: Brian Fox
Organization: Enercon Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Dec 04 17:22:43 EST 2018
Committee: FIM-AAA

Committee Statement

Resolution: [FR-94-NFPA 20-2019](#)

Statement: Change resolves potential confusion regarding the centrifugal pumps addressed in Chapter 6 versus the centrifugal pumps addressed by Chapter 7.

 Section 6.1.2 requirements are relocated and rephrased to clarify that the requirement only applies to centrifugal pumps addressed in Chapter 6.

**Public Input No. 8-NFPA 20-2018 [New Section after 6.1.1.3]****6.1.1.4**

Centrifugal pumps addressed in this chapter shall not be used where a static suction lift is required.

Statement of Problem and Substantiation for Public Input

Change re-locates the requirement in Section 6.1.2 and re-words to clarify that the requirement only applies to centrifugal pumps addressed in Chapter 6.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4-NFPA 20-2018 [Chapter 6 [Title Only]]	Clarification of Chapter 6 vs Chapter 7 Centrifugal Pumps
Public Input No. 5-NFPA 20-2018 [Section No. 6.1.1]	Clarification of Chapter 6 vs Chapter 7 Centrifugal Pumps
Public Input No. 6-NFPA 20-2018 [Section No. 6.1.2]	

Submitter Information Verification

Submitter Full Name: Brian Fox
Organization: Enercon Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Dec 04 18:08:31 EST 2018
Committee: FIM-AAA

Committee Statement

Resolution: [FR-94-NFPA 20-2019](#)

Statement: Change resolves potential confusion regarding the centrifugal pumps addressed in Chapter 6 versus the centrifugal pumps addressed by Chapter 7.

Section 6.1.2 requirements are relocated and rephrased to clarify that the requirement only applies to centrifugal pumps addressed in Chapter 6.



Public Input No. 6-NFPA 20-2018 [Section No. 6.1.2]

6.1.2 * – Application.

~~Centrifugal pumps shall not be used where a static suction lift is required.~~

Statement of Problem and Substantiation for Public Input

Section 6.1.2, as written, is confusing because centrifugal pumps addressed in Chapter 7 are used where a static suction lift is required. See proposed new Section 6.1.1.4.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 8-NFPA 20-2018 [New Section after 6.1.1.3]	Relocate 6.1.2 to new 6.1.1.4.

Submitter Information Verification

Submitter Full Name: Brian Fox
Organization: Enercon Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Dec 04 17:52:21 EST 2018
Committee: FIM-AAA

Committee Statement

Resolution: [FR-94-NFPA 20-2019](#)

Statement: Change resolves potential confusion regarding the centrifugal pumps addressed in Chapter 6 versus the centrifugal pumps addressed by Chapter 7.

Section 6.1.2 requirements are relocated and rephrased to clarify that the requirement only applies to centrifugal pumps addressed in Chapter 6.



Public Input No. 98-NFPA 20-2019 [New Section after 6.2]

6.2 Coatings and Finishes

6.2.1 No coatings shall be permitted on the interior surfaces of the pump casing and adapter unless conditions of 6.2.1.1 are met.

6.2.1.1 E-Coatings that use a metallurgically bonded corrosion resistant process that can be used on the interior and exterior surfaces of the fire pumps.

Statement of Problem and Substantiation for Public Input

Justification - E-Coatings are a proven technology that preserves the hydraulic performance of a centrifugal pump, and at the same time does not subject the fluid to any new sources of debris, as other lesser coatings might cause, due to flaking.

E-coating costs for pump manufacturers are equal to costs without e-coating treatment, so there is no additional cost to the customer. The customer will save costs over the life of the system, as the life of the pump volute will be extended, ensuring intended pump performance is maintained.

The net effect of the above means that customers will have a longer lasting, better performing fire pumps with e-coatings at no increase to first costs.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 101-NFPA 20-2019 [New Section after 4.4.3]	

Submitter Information Verification

Submitter Full Name: Joanne Schneider
Organization: Armstrong Fluid Technology
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 26 15:31:28 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: Coating can possibly come off and clog diesel engine water by-pass strainers and sprinkler heads. The listing laboratories have product specific requirements for corrosion resistance.



Public Input No. 1-NFPA 20-2018 [New Section after 6.5.2]

6.5.3 Mass Elastic System

6.5.3.1* For a separately coupled-type pumps driven by a diesel engine, a torsional coupling shall be used and mounted on the engine side of the flexible coupling or flexible connecting shaft.

A.6.5.3.1

Torsional couplings are very useful at moving harmful stresses out of the operating speed ranges of these pump systems. However, if the stiffness or damping characteristic of the coupling is not selected correctly it can actually make the system torsional activity worse at operating speed.

6.5.3.1.1* For drive systems that include a diesel engine, a torsional coupling, and a horizontal shaft pump, the pump manufacturer shall provide at minimum a 2-mass torsional frequency calculation indicating that the speed at which engine firing frequency excites the system resonance is at minimum 30% below rated pump operating speed.

6.5.3.1.1.1* The torsional frequency calculation specified in 6.5.3.1.1 shall include the mass elastic characteristics for a wetted pump with the specific impeller(s) trim, the torsional coupling, flexible coupling or flexible connecting shaft, and the engine.

A.6.5.3.1.1.1

TWO MASS MODEL HORIZONTAL SHAFT PUMP WITH FLYWHEEL MOUNTED TORSIONAL COUPLING

When using a torsional coupling which has a torsional spring rate much less than the torsional spring rate of the flexible connecting shaft and pump shaft, the system should be considered as two lumped inertias (M1, M2) connected by a spring (K) as per Figure 1.

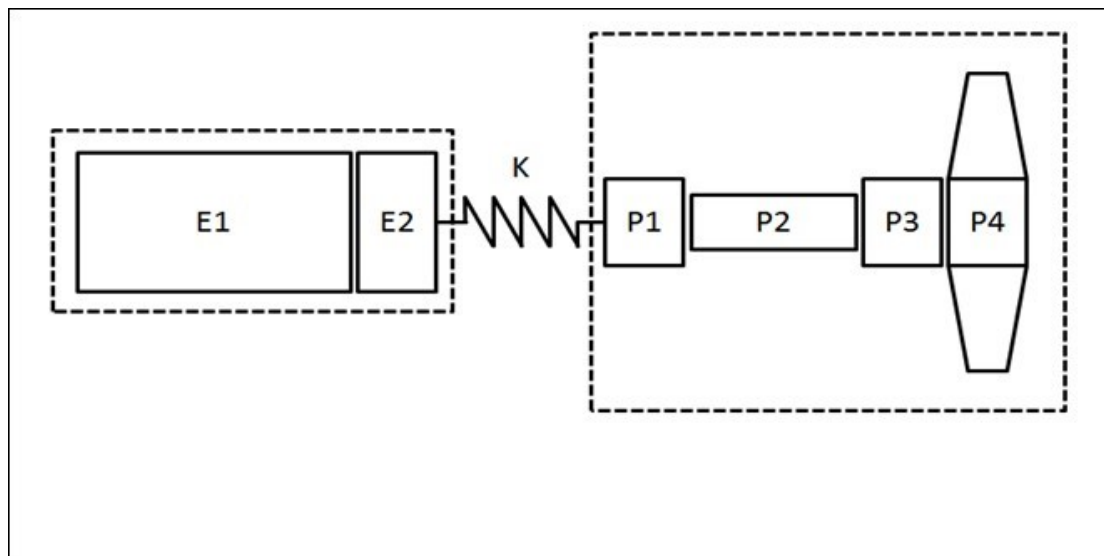


Figure A.6.5.3.1.1 lumped inertia definition (HSC or ES with torsional coupling)

where:

E1 - total inertia of engine and flywheel (kgm^2)

E2 - torsional coupling primary inertia (kgm^2)

P1 - torsional coupling secondary inertia (kgm^2)

P2 - flexible connecting shaft total inertia (kgm^2) - if present

P3 - inertia of companion flange (kgm^2) - if present

P4 - wetted inertia of pump impeller (kgm^2)

K - dynamic torsional stiffness of torsional coupling element (Nm/rad)

6.5.3.1.2* When the calculations required in 6.5.3.1.1 indicate that critical speeds are found to fall within 30% above or within 30% below of pump rated speed, then a further detailed set of forced response calculations are required of the components indicating there are no damaging vibratory stresses or torques within the pump shaft, coupling or flexible connecting shaft, engine crankshaft stress or excessive crankshaft damper heat dissipation.

A.6.5.3.1.2

The calculated forced response results should be compared against manufacturers' recommended limits for each component. For torsional couplings this comparison would include vibratory torque and heat dissipation if the spring element is a viscoelastic material.

6.5.3.1.2.1* The torsional analysis specified in 6.5.3.1.2 shall include the mass elastic characteristics required in 6.5.3.1.1.1 plus;

(a) the excitation characteristics of the specific engine and rating

(b) a fully flexible lumped parameter model having multiple elements along the length of the engine crankshaft, the horizontal shafting, and pump impeller

(c) include the effect of engine misfire

A.6.5.3.1.2.1

As a result of the influence of emission laws engine combustion processes have changed considerably over the years. The cylinder and injection pressures of modern diesel engines are very different than older engines. Therefore when doing the calculations of 6.5.3.1.2 it is desirable to have specific engine manufacturer and rating excitation data. Older hand books that provide diesel engine excitation data are typically inadequate for these calculations.

This is often referred to as a multi-mass analysis.

6.5.3.1.3 For a system defined in 6.5.3.1 that use a variable speed diesel driver the operating speed for the analytical speeds shall be define as a minimum of 30% above pump rated speed and 30% below the lowest possible speed of the variable speed driver.

6.5.3.1.4 The torsional coupling required in par. 6.5.3.1 shall be permitted to be omitted when the system or an identical sample system, with same specific impeller trim, has been tested from 0 to 150% flow at the pressures on the flow curve for the pump shaft peak to peak vibratory torque stress has been measured and the following conditions are met;

a) peak to peak stresses shall be measured at all speeds from 25% above pump rated speed to 25% below pump rated speed or 25% below the lowest possible speed of a variable speed system and there are no stresses greater than 75% of the calculated stress capability of each of the components in the system.

b) all vibratory torque measurements shall have remained positive .

Additional Proposed Changes

File Name	Description	Approved
NFPA_20-PC27.pdf	NFPA_20-PC27	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. 27 of the (A2018) Second Draft Report for NFPA 20 and per the Regs. at 4.4.8.3.1.

Torsional failures of horizontal pump systems typically resulting in broken pump shafts have been happening too often the last few years. There is no obvious smoking gun at this time, therefore I am proposing a solution equal to the requirements in chapter 7 for Vertical Turbine pumps that been developed over a number of NFPA 20 revision cycles.

Submitter Information Verification

Submitter Full Name: TC on FIM-AAA

Organization: NFPA

Street Address:

City:

State:

Zip:

Submittal Date: Fri Jul 27 09:10:53 EDT 2018

Committee:

Committee Statement

Resolution: There is insufficient information to require torsional couplings in all diesel engine installations.



Public Comment No. 27-NFPA 20-2017 [New Section after 6.5.2]

6.5.3 Mass Elastic System

6.5.3.1* _____ For a separately coupled-type pumps driven by a diesel engine, a torsional coupling shall be used and mounted on the engine side of the flexible coupling or flexible connecting shaft.

A.6.5.3.1 _____

Torsional couplings are very useful at moving harmful stresses out of the operating speed ranges of these pump systems. However, if the stiffness or damping characteristic of the coupling is not selected correctly it can actually make the system torsional activity worse at operating speed.

6.5.3.1.1* _____ For drive systems that include a diesel engine, a torsional coupling, and a horizontal shaft pump, the pump manufacturer shall provide at minimum a 2-mass torsional frequency calculation indicating that the speed at which engine firing frequency excites the system resonance is at minimum 30% below rated pump operating speed.

6.5.3.1.1.1* _____ The torsional frequency calculation specified in 6.5.3.1.1 shall include the mass elastic characteristics for a wetted pump with the specific impeller(s) trim, the torsional coupling, flexible coupling or flexible connecting shaft, and the engine.

A.6.5.3.1.1.1 1

TWO MASS MODEL HORIZONTAL SHAFT PUMP WITH FLYWHEEL MOUNTED TORSIONAL COUPLING

When using a torsional coupling which has a torsional spring rate much less than the torsional spring rate of the flexible connecting shaft and pump shaft, the system should be considered as two lumped inertias (M1, M2) connected by a spring (K) as per Figure 1.

Figure _____ A.6.5.3.1.1 lumped inertia definition (HSC or ES with torsional coupling)

where:

E1 _____ - total inertia of engine and flywheel (kgm^2)

$M1 = E1 + E2$ $M2 = P1 + P2$ $E2$ _____ - torsional coupling primary inertia (kgm^2)
 $+ P3 + P4$ $P1$ _____ - torsional coupling secondary inertia (kgm^2)
 $P2$ _____ - flexible connecting shaft total inertia (kgm^2) – if

present

$P3$ _____ - inertia of companion flange (kgm^2) – if *present*

$P4$ _____ - wetted inertia of pump impeller (kgm^2)

K _____ - dynamic torsional stiffness of torsional coupling element (Nm/rad)

6.5.3.1.2* _____ When the calculations required in 6.5.3.1.1 indicate that critical speeds are found to fall within 30% above or within 30% below of pump rated speed, then a further detailed set of forced response calculations are required of the components indicating there are no damaging vibratory stresses or torques within the pump shaft, coupling or flexible connecting shaft, engine crankshaft stress or excessive crankshaft damper heat dissipation.

A.6.5.3.1.2

The calculated forced response results should be compared against manufacturers' recommended limits for each component. For torsional couplings this comparison would include vibratory torque and heat dissipation if the spring element is a viscoelastic material.

6.5.3.1.2.1* _____ The torsional analysis specified in 6.5.3.1.2 shall include the mass elastic characteristics required in 6.5.3.1.1.1 plus;

(a) the excitation characteristics of the specific engine and rating

(b) a fully flexible lumped parameter model having multiple elements along the length of the engine crankshaft, the horizontal shafting, and pump impeller

(c) include the effect of engine misfire

A.6.5.3.1.2.1 _____

As a result of the influence of emission laws engine combustion processes have changed considerably over the years. The cylinder and injection pressures of modern diesel engines are very different than older engines. Therefore when doing the calculations of 6.5.3.1.2 it is desirable to have specific engine manufacturer and rating excitation data. Older hand books that provide diesel engine excitation data are typically inadequate for these calculations.

This is often referred to as a multi-mass analysis.

6.5.3.1.3 _____ For a system defined in 6.5.3.1 that use a variable speed diesel driver the operating speed for the analytical speeds shall be define as a minimum of 30% above pump rated speed and 30% below the lowest possible speed of the variable speed driver.

6.5.3.1.4 _____ The torsional coupling required in par. 6.5.3.1 shall be permitted to be omitted when the system or an identical sample system, with same specific impeller trim, has been tested from 0 to 150% flow at the pressures on the flow curve for the pump shaft peak to peak vibratory torque stress has been measured and the following conditions are met;

a) peak to peak stresses shall be measured at all speeds from 25% above pump rated speed to 25% below pump rated speed or 25% below the lowest possible speed of a variable speed system and there are no stresses greater than 75% of the calculated stress capability of each of the components in the system.

b) all vibratory torque measurements shall have remained positive .

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Whitney_NFPA_20_PC_27_Attachment_with_Figure.pdf	Attachment has figure included as did not upload on Terra.	✓

Statement of Problem and Substantiation for Public Comment

Torsional failures of horizontal pump systems typically resulting in broken pump shafts have been happening too often

the last few years. There is no obvious smoking gun at this time, therefore I am proposing a solution equal to the requirements in chapter 7 for Vertical Turbine pumps that been developed over a number of NFPA 20 revision cycles.

Related Item

- PI-195

Submitter Information Verification

Submitter Full Name: John Whitney

Organization: Clarke Fire Protection Product

Street Address:

City:

State:

Zip:

Submittal Date: Tue May 09 18:09:13 EDT 2017

Committee Statement

Committee Action: Rejected but held

Resolution: This is a complicated topic that needs further study to determine if torsional couplings are required for all diesel drive engines.

Copyright Assignment

I, John Whitney, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am John Whitney, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Baio, Debbie

From: Whitney, John
Sent: Wednesday, May 10, 2017 4:33 PM
To: Baio, Debbie
Subject: NFPA 20 Comments

Deb,

Please see below Substantiations for my Comments that are in TerraView;

PC 22 Problem and Substantiation

This is editorial as a result of changes made during Proposals so text will read correctly.

PC 23 Problem and Substantiation

This is editorial as a result of changes made during Proposals so text will read correctly.

PC 24 Problem and Substantiation

Somehow during the Proposal change “three” was changed to “six” inadvertently. This is to correct it back to three.

PC 25 Problem and Substantiation

This language was a part of the original Proposals but did make it into TerraView text.

PC 26 Problem and Substantiation

I believe this information is more appropriate in definition than in the Annex. Delete A.3.3.67 if this Comment is accepted.

PC 22 Problem and Substantiation

This is editorial as a result of changes made during Proposals.

PC 27 Deb, I had submitted PI 195 which was Resolved. Since that was a new par. I do not know how to I would like to submit the following Comment to PI 195 that I can paste in. Could you paste it for me?

6.5.3 Mass Elastic System

6.5.3.1* For a separately coupled-type pumps driven by a diesel engine, a torsional coupling shall be used and mounted on the engine side of the flexible coupling or flexible connecting shaft.

A.6.5.3.1

Torsional couplings are very useful at moving harmful stresses out of the operating speed ranges of these pump systems. However, if the stiffness or damping characteristic of the coupling is not selected correctly it can actually make the system torsional activity worse at operating speed.

6.5.3.1.1* For drive systems that include a diesel engine, a torsional coupling, and a horizontal shaft pump, the pump manufacturer shall provide at minimum a 2-mass torsional frequency calculation indicating that the speed at which engine firing frequency excites the system resonance is at minimum 30% below rated pump operating speed.

6.5.3.1.1.1* The torsional frequency calculation specified in 6.5.3.1.1 shall include the mass elastic characteristics for a wetted pump with the specific impeller(s) trim, the torsional coupling, flexible coupling or flexible connecting shaft, and the engine.

A.6.5.3.1.1.1

TWO MASS MODEL HORIZONTAL SHAFT PUMP WITH FLYWHEEL MOUNTED TORSIONAL COUPLING

When using a torsional coupling which has a torsional spring rate much less than the torsional spring rate of the flexible connecting shaft and pump shaft, the system should be considered as two lumped inertias ($M1$, $M2$) connected by a spring (K) as per Figure 1.

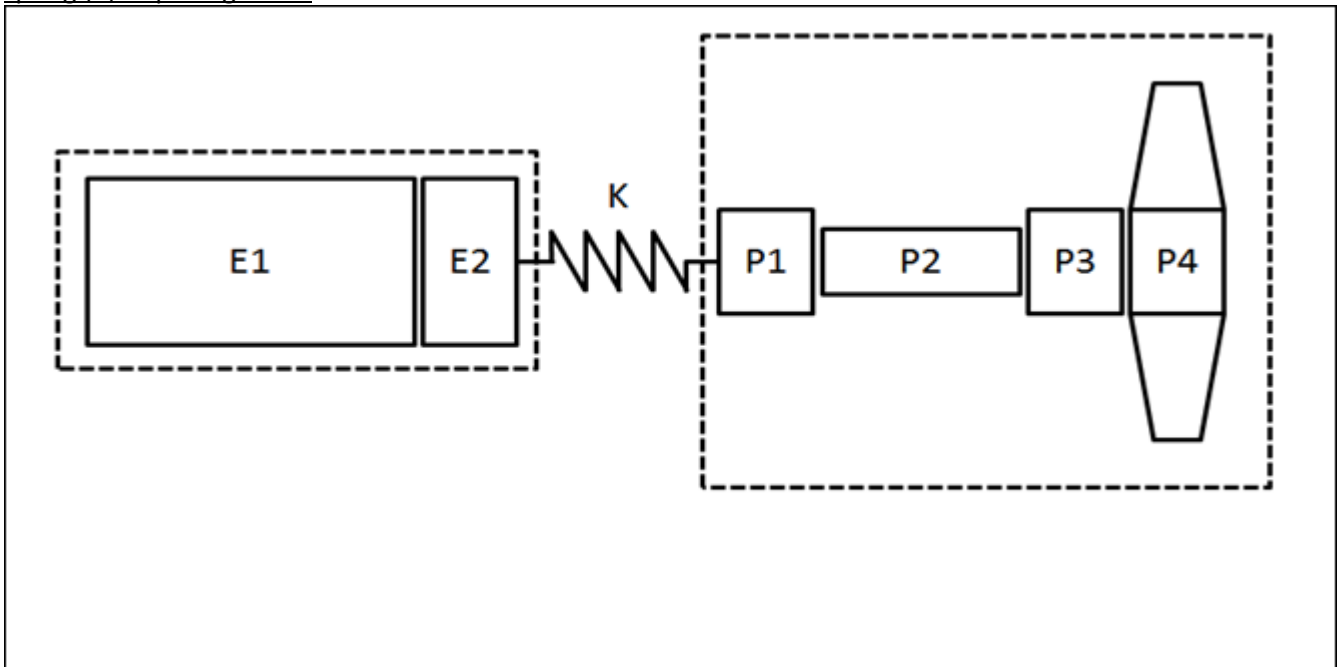


Figure A.6.5.3.1.1 lumped inertia definition (HSC or ES with torsional coupling)

where:

<u>E1</u>	- total inertia of engine and flywheel (kgm^2)	
<u>E2</u>	- torsional coupling primary inertia (kgm^2)	
<u>P1</u>	- torsional coupling secondary inertia (kgm^2)	
<u>P2</u>	- flexible connecting shaft total inertia (kgm^2) – <i>if present</i>	
<u>P3</u>	- inertia of companion flange (kgm^2) – <i>if present</i>	
<u>P4</u>	- wetted inertia of pump impeller (kgm^2)	
<u>K</u>	- dynamic torsional stiffness of torsional coupling element (Nm/rad)	$M1 = E1 + E2$ $M2 = P1 + P2 + P3 + P4$

6.5.3.1.2* When the calculations required in 6.5.3.1.1 indicate that critical speed above or within 30% below of pump rated speed, then a further detailed set of forced response calculations are required of the components indicating there are no damaging vibratory stresses or torques within the pump shaft, coupling or flexible connecting shaft, engine crankshaft stress or excessive crankshaft damper heat dissipation.

A.6.5.3.1.2

The calculated forced response results should be compared against manufacturers' recommended limits for each component. For torsional couplings this comparison would include vibratory torque and heat dissipation if the spring element is a viscoelastic material.

6.5.3.1.2.1* The torsional analysis specified in 6.5.3.1.2 shall include the mass elastic characteristics required in 6.5.3.1.1.1 plus;

- (a) the excitation characteristics of the specific engine and rating
- (b) a fully flexible lumped parameter model having multiple elements along the length of the engine crankshaft, the horizontal shafting, and pump impeller
- (c) include the effect of engine misfire

A.6.5.3.1.2.1

As a result of the influence of emission laws engine combustion processes have changed considerably over the years. The cylinder and injection pressures of modern diesel engines are very different than older engines. Therefore when doing the calculations of 6.5.3.1.2 it is desirable to have specific engine manufacturer and rating excitation data. Older hand books that provide diesel engine excitation data are typically inadequate for these calculations.

This is often referred to as a multi-mass analysis.

6.5.3.1.3 For a system defined in 6.5.3.1 that use a variable speed diesel driver the operating speed for the analytical speeds shall be define as a minimum of 30% above pump rated speed and 30% below the lowest possible speed of the variable speed driver.

6.5.3.1.4 The torsional coupling required in par. 6.5.3.1 shall be permitted to be omitted when the system or an identical sample system, with same specific impeller trim, has been tested from 0 to 150% flow at the pressures on the flow curve for the pump shaft peak to peak vibratory torque stress has been measured and the following conditions are met;

- a) peak to peak stresses shall be measured at all speeds from 25% above pump rated speed to 25% below pump rated speed or 25% below the lowest possible speed of a variable speed system and there are no stresses greater than 75% of the calculated stress capability of each of the components in the system,
- b) all vibratory torque measurements shall have remained positive .

Problem and Substantiation

Torsional failures of horizontal pump systems typically resulting in broken pump shafts have been happening too often the last few years. There is no obvious smoking gun at this time, therefore I am proposing a solution equal to the requirements in chapter 7 for Vertical Turbine pumps that been developed over a number NFPA 20 revision cycles.

**Public Input No. 9-NFPA 20-2018 [Chapter 7 [Title Only]]**

Vertical Shaft Turbine–Type Centrifugal Pumps

Statement of Problem and Substantiation for Public Input

Vertical shaft turbine pumps are a type of centrifugal pump. Section 4.20 is entitled Relief Valves for Centrifugal Pumps. This proposed title change clarifies that the requirements of Section 4.20 apply to pumps covered by Chapter 7.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4-NFPA 20-2018 [Chapter 6 [Title Only]]	Title Change

Submitter Information Verification

Submitter Full Name: Brian Fox
Organization: Enercon Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Dec 04 18:24:08 EST 2018
Committee: FIM-AAA

Committee Statement

Resolution: Current text adequately addresses the difference between the two types of pumps. Maintain consistency with chapter 6.



Public Input No. 110-NFPA 20-2019 [Section No. 8.4.4]

8.4.4

The pump controller shall manage the performance of all pumps and drivers to provide continuous and smooth operation without intermittent pump cycling or discharge pressure varying by more than plus or minus 10 percent during pump sequencing after rated pressure has been achieved.

Statement of Problem and Substantiation for Public Input

This requirement needs clarity. it is not clear if "varying by more than 10 percent" is both a plus and minus tolerance. The requirement is revised assuming it is both.

Submitter Information Verification

Submitter Full Name: John Kovacik

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Wed Jun 26 23:46:59 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-64-NFPA 20-2019

Statement: Modified section to provide consistency with chapter 10 and clarified intent by adding time restriction and providing a definitive range for pressure variance.



Public Input No. 105-NFPA 20-2019 [New Section after 9.2.3.4]

TITLE OF NEW CONTENT

New Section to follow 9.2.3.4.2 An instantaneous trip circuit breaker shall be permitted in lieu of the overcurrent device specified in 9.2.3.4 provided it is part of an assembly listed for fire pump service and complies with 9.2.3.4.

Statement of Problem and Substantiation for Public Input

Section 10.8.2.2(3) permits the use of an instantaneous trip circuit breaker in lieu of the overcurrent devices specified in 10.8.2.2(2) provided it is part of a transfer switch assembly listed for fire pump service and complies with 9.2.3.4.1. Based on this permission it should also be allowed to be used in lieu of the overcurrent device specified in 9.2.3.4 provided it is part of an assembly listed for fire pump service and complies with 9.2.3.4.

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 26 22:02:19 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: FR-16-NFPA 20-2019

Statement: Section 10.8.2.2(3) permits the use of an instantaneous trip circuit breaker in lieu of the overcurrent devices specified in 10.8.2.2(2) provided it is part of a transfer switch assembly listed for fire pump service and complies with 9.2.3.4.1. Based on this permission, the section is modified to allow instantaneous trip circuit breaker to be used in lieu of the overcurrent device specified in 9.2.3.4 provided it is part of an assembly listed for fire pump service and complies with 9.2.3.4.



Public Input No. 107-NFPA 20-2019 [Section No. 9.2.3.4.1]

9.2.3.4.1

Alternatively, compliance with 9.2.3.4 shall be based on an assembly listed for fire pump service that complies with the following:

- (1) The overcurrent protection device shall not open within 2 minutes at 600 percent full-load current.
- (2) The overcurrent protection device shall not open with a restart transient of 24 times the full-load current.
- (3) The overcurrent protection device shall not open within 10 minutes at 300 percent full-load current.
- (4) The trip point for circuit breakers shall not be field adjustable.
- (5) It shall be identified as being "Suitable for use as Service Equipment."
- (6) Where used as service equipment, the disconnecting means shall be marked "Service Disconnect."

Statement of Problem and Substantiation for Public Input

Regarding new item (5), this assembly will be used as service equipment in most installations and should be suitably rated.

Regarding new item (6), Section 230.70(B) of the National Electrical Code requires the following "Each service disconnect shall be permanently marked to identify it as a service disconnect." This is not the same as a marking "Suitable for Use as Service Equipment" or "Fire Pump Disconnecting Means".

Submitter Information Verification

Submitter Full Name: John Kovacic

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Wed Jun 26 22:44:33 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-17-NFPA 20-2019](#)

Statement: Added item (5), The assembly used as service equipment should be suitably rated.

Added item (6) to align with National Electrical Code as Section 230.70(B) of the NEC requires each service disconnect to be permanently marked as "Service Disconnect" to identify it as such. "Suitable for Use as Service Equipment" or "Fire Pump Disconnecting Means" is not the same as "Service Disconnect".



Public Input No. 109-NFPA 20-2019 [New Section after 9.3.4]

TITLE OF NEW CONTENT

Add new Section 9.3.4.1 For fire pump installations using the arrangement in 9.2.2(1), 9.2.2(2), 9.2.2(3), or 9.2.2(5) for the alternate source of power, no more than one disconnecting means and associated overcurrent protection device shall be installed in the power supply to the fire pump controller in accordance with 9.2.3.

Statement of Problem and Substantiation for Public Input

No more than one disconnecting means and associated overcurrent protection device should be permitted in the alternate power supply to the fire pump controller as is allowed for the normal power supply to the fire pump controller.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 108-NFPA 20-2019 [New Section after 10.8.2.1.3]	New Section after 10.8.2.1.3 references new Section after 9.3.4.
Public Input No. 108-NFPA 20-2019 [New Section after 10.8.2.1.3]	

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 26 23:21:24 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: [FR-18-NFPA 20-2019](#)

Statement: No more than one disconnecting means and associated overcurrent protection device should be permitted in the alternate power supply to the fire pump controller as is allowed for the normal power supply to the fire pump controller.

Re-number subsequent sections.



Public Input No. 88-NFPA 20-2019 [Section No. 9.3.4]

9.3.4

Where provided, the alternate source of power shall be supplied from one of the following sources:

- (1) A generator installed in accordance with Section 9.6
- (2) One of the sources identified in 9.2.2(1), 9.2.2(2), 9.2.2(3), or 9.2.2(5) where the power is provided independent of the normal source of power
- (3) A battery based energy storage unit compliant to NFPA70 and NFPA855 requirements, with a solid state power converter unit to provide the rated peak power requirements of the fire pump. The battery based energy storage unit shall be a pre-fabricated assembly to include remote monitoring, remaining kWh of capacity at the rated peak power, and able to receive ongoing charge from an external power supply. The battery charging source of supply can be the primary power supply for the fire pump.
- (4) Where the battery based energy storage unit is also used for other purposes, such as peak shaving, it shall have a listed controller that activates a transfer switch to dedicate remaining energy to fire-fighting duty when:
 - (5) The remaining energy in the battery (kwh) becomes less than 150% of the required energy for the time duration that the fire fighting system must operate under standby power by code, standard, or jurisdiction
 - (6) The fire pump has been activated in response to the fire controller.
- (7) No other critical life safety systems can be run from the battery based energy storage unit that is meant to provide an alternate power source for the fire pump system.

Statement of Problem and Substantiation for Public Input

Historically, standby diesel /NG generators, diesel driven pumps, or alternate power feeds from separate supply grids have been the acceptable means to ensure the required availability of the fire sprinkler system. Over the past 15 years modern energy battery based storage units have become common place and are a proven, predictable and reliable source of electrical power.

In densely populated urban areas there are forces that steer decision makers away from installing more grid capacity for alternate grid sources, and also steer decision makers away from engine driven generators

A proven and popular choice for alternate / emergency power applications has become new battery technology that fuels modern energy storage units. This enables all of the higher reliability elements of an electrically driven fire pump system with an energy source that allows the implementation of life safety systems that are consistent with the urban noise, environmental, space, access, and reliability expectations.

Although modern energy storage units have a higher first cost relative to diesel engine driven pump options, or back-up diesel generators, the life cycle maintenance and repair costs are a small fraction of the engine and generator options.

This public input enables the availability of a more reliable alternate / stand-by power solution than those currently available. It meets the challenges in urban areas that other options cannot, and has a lower life-cycle cost than all currently approved options.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 97-NFPA 20-2019 [Section No. 3.3.46]	

Submitter Information Verification

Submitter Full Name: peter thomsen

Organization: s a armstrong

Committee Statement

City:

Resolution: CI-19-NFPA 20-2019

State:

Statement: The committee doesn't have sufficient information to determine the adequacy of the proposed text.

Zip:

Committee: Committee decided to create a committee input to solicit additional information on the subject of

Submittal Date: Wed Jun 26 14:58:14 EDT 2019
Effectively using the energy storage systems as an alternate source of power.

Committee: FIM-AAA

The committee wants to evaluate the concerns pertaining to alternate sources of power as currently addressed by the standard and those that might be specific to energy storage systems in this application.



Public Input No. 54-NFPA 20-2019 [Section No. 9.5.1.5]

9.5.1.5*

The corresponding values of locked rotor current for motors rated at other voltages shall be determined by multiplying the values shown by ~~the ratio of 460 V to the rated voltage~~ in Table 9.5.1.1(a) by the ratio of 230V to the voltage rating of the motor .

Statement of Problem and Substantiation for Public Input

The proposed change is a correction to match Table 9.5.1.1(a).

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 09:31:04 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-92-NFPA 20-2019](#)

Statement: The modification is a correction of text to match Table 9.5.1.1(a).



Public Input No. 55-NFPA 20-2019 [Section No. 9.5.1.6]

9.5.1.6

Code letters of motors for all other voltages shall conform with those shown for ~~460 V~~ 230 V in Table 9.5.1.1(a).

Statement of Problem and Substantiation for Public Input

The proposed change is a correction to match Table 9.5.1.1(a)

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 09:33:15 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-21-NFPA 20-2019](#)

Statement: The modification is a correction of text to match Table 9.5.1.1(a).

**Public Input No. 94-NFPA 20-2019 [Section No. 9.5.2.1]****9.5.2.1**

The motor capacity in horsepower shall be such that the maximum motor current in any phase under any condition of pump load up to 175% of rated flow and voltage unbalance shall not exceed the motor-rated full-load current multiplied by the service factor.

Statement of Problem and Substantiation for Public Input

This change will clarify and provide specific measurable criteria for pump testing that is reasonable. As the flow through a pump increases the boost pressure provided by that pump decreases. By the time a pump reaches 175% of its rated flow there will be much less pressure provided than is required to be useful for most fire systems. When going beyond 175% of rated flow to prevent the pump from cavitating a much higher suction pressure will be required than can be found in the vast majority of the fire pump installations around the world. By setting a specific flow rate that will be used to determine the required power rating of the pump driver all fire pump manufacturers will be on an even playing field when it comes to peak power testing. With today's requirement of testing until a peak power is achieved there is the opportunity for pump manufacturers to incorrectly test their pumps. This will most often happen if the manufacturer does not or cannot maintain a high enough suction pressure to prevent the pump from cavitating. When simply looking at the test results it can appear that a pump reached it's peak power when in fact it simply started to cavitate.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 91-NFPA 20-2019 [Section No. 3.3.38]	This change reflects the proposed change to the definition of maximum pump brake horsepower.
Public Input No. 92-NFPA 20-2019 [Section No. 4.7.6]	This change reflects the proposed change to the definition of maximum pump brake horsepower.
Public Input No. 93-NFPA 20-2019 [Section No. 4.11.3]	This change reflects the proposed change to the definition of maximum pump brake horsepower.
Public Input No. 95-NFPA 20-2019 [Section No. 11.2.2.7]	

Submitter Information Verification

Submitter Full Name: Steven Baird
Organization: Armstrong Fluid Technology
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 26 15:24:07 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: The standard currently requires non-overloading over the entire pump curve. The proposed language can cause the controller and the motor to overload. Many pumps can perform past 175% rated flow.



Public Input No. 56-NFPA 20-2019 [Section No. 10.1.2.4]

10.1.2.4 Service Equipment Listing.

All controllers and transfer ~~switches~~ equipment assemblies shall be listed as “suitable for use as service equipment” where so used.

Statement of Problem and Substantiation for Public Input

The main purpose of a service equipment is, as defined in UL 846A:

3.6 SERVICE EQUIPMENT – Equipment, usually consisting of a circuit breaker, switch, or fuses, and related accessories, located near the point of entrance of supply conductors to a building or other structure and intended to constitute the main control and means of cutoff of the supply.

In the case of an Arrangement I transfer switch assembly, both an isolating switch and a circuit breaker (OCP) are required upstream from the transfer switch mechanism for the emergency source, mainly to cut the power coming directly from a second utility or a generator. Hence the emergency side on the transfer switch must be suitable for service equipment when so used. It is the same for Arrangement II, except that the service equipment components (IS and CB on both power sources) can be installed in a separated box but nonetheless, it is required.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 09:35:54 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-22-NFPA 20-2019

Statement: The main purpose of a service equipment is, as defined in UL 846A:

3.6 SERVICE EQUIPMENT – Equipment, usually consisting of a circuit breaker, switch, or fuses, and related accessories, located near the point of entrance of supply conductors to a building or other structure and intended to constitute the main control and means of cutoff of the supply.

In the case of an Arrangement I transfer switch assembly, both an isolating switch and a circuit breaker (OCP) are required upstream from the transfer switch mechanism for the emergency source, mainly to cut the power coming directly from a second utility or a generator. Hence the emergency side on the transfer switch must be suitable for service equipment when so used. It is the same for Arrangement II, except that the service equipment components (IS and CB on both power sources) can be installed in a separated box but nonetheless, it is required.

**Public Input No. 49-NFPA 20-2019 [Section No. 10.3.4.5.1]****10.3.4.5.1**

A fire pump controller shall not be used as a junction box for any purpose (see *Section 9.7*), including the following:

- (1) To supply other equipment
- (2) To splice incoming or outgoing wires
- (3) To connect external surge suppression
- (4) As a raceway

Statement of Problem and Substantiation for Public Input

Overall, the fire pump controller should not be used as a raceway either. Here is one example why this practice should not be allowed. Jockey pump controllers are being mounted on the side of fire pump controllers with a hole between the two cabinets. The input wires to the jockey controller are then being run into the fire pump controller and then through the hole to the jockey pump controller. To eliminate the possibility of the jockey pump controller supply conductors causing a fault in the fire pump controller due to spliced, skinned, pinched wires and the like, the fire pump controller should not be used as a raceway.

Submitter Information Verification

Submitter Full Name: William Stelter

Organization: Master Control Systems, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jun 20 12:05:19 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-23-NFPA 20-2019

Statement: The fire pump controller should not be used as a raceway.

**Public Input No. 57-NFPA 20-2019 [Section No. 10.3.4.5.3]****10.3.4.5.3**

Except as provided in 4.21.2.2(1) and 10.9.4, lockout, remote shutdown or interlock to prevent normal operation shall not be permitted unless approved by the authority having jurisdiction.

Statement of Problem and Substantiation for Public Input

The term lockout is used in 10.9.4. The proposed addition provides guidance for the AHJ if a lockout or interlock is allowed.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 09:38:26 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-24-NFPA 20-2019](#)

Statement: Added lockout to allow lockout if approved by AHJ as the term in used in 10.9.4.

New annex adds guidance for the AHJ if a lockout or interlock is allowed as per
10.3.4.5.3.



Public Input No. 58-NFPA 20-2019 [New Section after 10.3.7.4]

TITLE OF NEW CONTENT -- 10.3.7.4.1

Type your content here ..

The installation and operating instructions of the manufacturer shall be provided with the fire pump controller or be accessible electronically.

10.3.7.4.2

The installation instructions of the manufacturer, as a minimum, shall be provided with the fire pump controller.

Statement of Problem and Substantiation for Public Input

The trend in most every part of society is to go paperless to help the environment. Industry experience is that instruction manuals provided inside the controller oftentimes do not stay there. In cases where many people are in charge of the fire pump system, they may not have the opportunity to consult the manual because someone has taken it or it was simply stolen. Those in charge of the fire pump system are already obliged to visit the controller manufacturer's website and download the manual or request it from the manufacturer's after-sale service department. Instruction manuals can consist of 100 or more pages and this number of pages times the amount of controllers sold in a year results in a huge amount of printed paper. The standard should provide the flexibility to allow the fire pump controller manufacturer to offer the instruction manual through electronic means.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 09:41:12 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: The proposal language is confusing as currently written and conflicts with what's currently prescribed in the standard.

**Public Input No. 59-NFPA 20-2019 [Section No. 10.4.4]****10.4.4 Locked Rotor Overcurrent Protection.**

The only other overcurrent protective device that shall be required and permitted between the isolating switch and the fire pump motor shall be located within the fire pump controller and shall possess the following characteristics:

- (1) For a squirrel-cage or wound-rotor induction motor, the device shall be of the time-delay type having tripping times as follows:
 - (2) Between 8 seconds and

20 seconds
 - (a) 12 seconds at locked rotor current
 - (b) Three minutes at a minimum of 300 percent of motor full-load current
- (3) For a direct-current motor, the device shall be as follows:
 - (4) Of the instantaneous type
 - (5) Calibrated and set at a minimum of 400 percent of motor full-load current
- (6) There shall be visual means or markings clearly indicated on the device that proper settings have been made.
- (7) * It shall be possible to reset the device for operation immediately after tripping, with the tripping characteristics thereafter remaining unchanged.
- (8) Tripping shall be accomplished by opening the circuit breaker, which shall be of the external manual reset type.

Additional Proposed Changes

File Name	Description	Approved
NEMA_Public_Input_2022_10.4.4_1_a_.pdf	10.4.4(1)(a) -- on made change to this line - changed to "12 seconds" only	

Statement of Problem and Substantiation for Public Input

The proposed revision aligns with UL 1004-5 for listed fire pump motors.

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: Nema
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 24 09:46:11 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: FR-25-NFPA 20-2019

Statement: Section modified to align with UL 1004-5 for listed fire pump motors.

NFPA Public Input Form

NOTE: All Public Input must be received by 5:00 pm EST/EDST on the published Public Input Closing Date.

For further information on the standards-making process, please contact the Codes and Standards Administration at 617-984-7249 or visit www.nfpa.org/codes.

For technical assistance, please call NFPA at 1-800-344-3555

FOR OFFICE USE ONLY

Log #: _____

Date Rec'd: _____

Date _____ Name Megan Hayes Tel. No. _____

Company National Electrical Manufacturers Association (NEMA) Email _____

Street Address 1300 North 17th Street, Suite 900 City Rosslyn State VA Zip 22209

Please indicate organization represented (if any) NEMA

1. (a) Title of NFPA Standard Standard for the Installation of Stationary Pumps for Fire Protection NFPA No. & Year 20-2019

(b) Section/Paragraph 10.4.4(1)(a)

2. Public Input Recommends (check one): ☐ new text ☒ revised text ☐ deleted text

3. Proposed Text of Public Input (include proposed new or revised wording, or identification of wording to be deleted): [Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).]

10.4.4(1)(a) between 8 seconds and ~~1220~~ seconds at locked rotor current

4. Statement of Problem and Substantiation for Public Input: (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Public Input, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

The proposed revision aligns with UL 1004-5 for listed fire pump motors.

5. Copyright Assignment

(a) ☒ I am the author of the text or other material (such as illustrations, graphs) proposed in the Public Input.

(b) ☐ Some or all of the text or other material proposed in this Public Input was not authored by me. Its source is as follows: (please identify which material and provide complete information on its source)

I hereby grant and assign to the NFPA all and full rights in copyright in this Public Input (including both the Proposed Text and the Statement of Problem and Substantiation). I understand that I acquire no rights in any publication of NFPA in which this Public Input in this or another similar or analogous form is used. Except to the extent that I do not have authority to make an assignment in materials that I have identified in (b) above, I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this assignment.

Signature (Required) _____

PLEASE USE SEPARATE FORM FOR EACH PUBLIC INPUT

To: Secretary, Standards Council National Fire Protection Association
1 Batterymarch Park · Quincy, MA 02169-7471 OR
Fax to: (617) 770-3500 OR Email to: proposals_comments@nfpa.org

**Public Input No. 60-NFPA 20-2019 [New Section after 10.4.7.2.3]****TITLE OF NEW CONTENT 10.4.7.2.3.1**

Type your content here ...

When power is supplied from multiple power sources, monitoring for phase reversal shall be permitted at any point electrically upstream of the line terminals of the contactor, provided all sources are monitored.

Statement of Problem and Substantiation for Public Input

Phase reversal is normally measured at the same point phase loss is measured. The proposed addition allows this common practice.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 09:55:33 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-95-NFPA 20-2019](#)

Statement: Modification allows for phase reversal to be measured upstream of line terminals of the contactor, same way phase loss is allowed to be measured.



Public Input No. 61-NFPA 20-2019 [Section No. 10.4.7.2.6]

10.4.7.2.6 Controller or System Trouble.

~~A- As a minimum, a controller or system trouble alarm shall actuate whenever a- any of the following alarms occur:~~

- ~~(1) ground-fault signal, when provided (see 10.4.5.9), a~~
- ~~(2) pressure-sensing device signal- signals (see 10.5.2.1.3.1 and 10.5.2.1.3.2), a variable speed trouble signal, or a~~
- ~~(3) adjustable speed trouble signals (see 10.10.8.1, 10.10.8.2 and 10.10.3)~~
- ~~(4) fail-to-start signal (see 10.5.2.7.5)- occurs.~~

Statement of Problem and Substantiation for Public Input

The proposed modification allows other trouble signals to be included in the trouble alarms. The proposal also adds the relevant references for adjustable speed trouble signals.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 10:03:48 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-27-NFPA 20-2019

Statement: Modification incorporates additional trouble signals. The relevant references for adjustable speed trouble signals are also added.

**Public Input No. 108-NFPA 20-2019 [New Section after 10.8.2.1.3]****TITLE OF NEW CONTENT**

Add new Section 10.8.2.1.3.1 For fire pump installations using one disconnecting means and associated overcurrent protection device installed in the alternate power supply to the fire pump controller as permitted in 9.3.4.1, an instantaneous trip circuit breaker shall be permitted in lieu of the overcurrent device specified in 9.2.3.4 provided it is part of an assembly listed for fire pump service and complies with 9.2.3.4.

Statement of Problem and Substantiation for Public Input

Section 10.8.2.2(3) permits the use of an instantaneous trip circuit breaker in lieu of the overcurrent devices specified in 10.8.2.2(2) provided it is part of a transfer switch assembly listed for fire pump service and complies with 9.2.3.4.1. Based on this permission for Arrangement II (Individually Listed Fire Pump Controller and Power Transfer Switch) it should also be allowed to be used for Arrangement I (Listed Combination Fire Pump Controller and Power Transfer Switch) in a similar application.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 109-NFPA 20-2019 [New Section after 9.3.4]	New Section after 10.8.2.1.3 references new Section after 9.3.4.
Public Input No. 109-NFPA 20-2019 [New Section after 9.3.4]	

Submitter Information Verification

Submitter Full Name: John Kovacic
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 26 23:08:14 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: [FR-96-NFPA 20-2019](#)

Statement: Section 10.8.2.2(3) permits the use of an instantaneous trip circuit breaker in lieu of the overcurrent devices specified in 10.8.2.2(2) provided it is part of a transfer switch assembly listed for fire pump service and complies with 9.2.3.4.1. Based on this permission for Arrangement II (Individually Listed Fire Pump Controller and Power Transfer Switch) it will also be allowed to be used for Arrangement I (Listed Combination Fire Pump Controller and Power Transfer Switch) in a similar application.



Public Input No. 106-NFPA 20-2019 [New Section after 10.8.2.1.5]

TITLE OF NEW CONTENT

Add new Section 10.8.2.1.6 For fire pump installations using one disconnecting means and associated overcurrent protection device installed in the normal power supply to the fire pump controller as permitted in 9.2.3, an instantaneous trip circuit breaker shall be permitted in lieu of the overcurrent device specified in 9.2.3.4 provided it is part of an assembly listed for fire pump service and complies with 9.2.3.4.

Statement of Problem and Substantiation for Public Input

Section 10.8.2.2(3) permits the use of an instantaneous trip circuit breaker in lieu of the overcurrent devices specified in 10.8.2.2(2) provided it is part of a transfer switch assembly listed for fire pump service and complies with 9.2.3.4.1. Based on this permission for Arrangement II (Individually Listed Fire Pump Controller and Power Transfer Switch) it should also be allowed to be used for Arrangement I (Listed Combination Fire Pump Controller and Power Transfer Switch) in a similar application.

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 26 22:30:31 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: FR-29-NFPA 20-2019

Statement: Section 10.8.2.2(3) permits the use of an instantaneous trip circuit breaker in lieu of the overcurrent devices specified in 10.8.2.2(2)

provided it is part of a transfer switch assembly listed for fire pump service and complies with 9.2.3.4.1. Based on this permission for Arrangement II (Individually Listed Fire Pump Controller and Power Transfer Switch) it should also be allowed to be used for Arrangement I (Listed Combination Fire Pump Controller and Power Transfer Switch) in a similar application.



Public Input No. 62-NFPA 20-2019 [Section No. 10.8.3.7.1]

10.8.3.7.1

Voltage- and frequency-sensing devices shall be provided to monitor ~~at least one~~ all ungrounded conductor ~~conductors~~ of the alternate power source.

Statement of Problem and Substantiation for Public Input

The proposed revision reflects the UL 1008 requirement that all transfer switches provide monitoring on all ungrounded sources.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 10:11:59 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-30-NFPA 20-2019](#)

Statement: Section is modified to cohere with the UL 1008 requirement that all transfer switches provide monitoring on all ungrounded sources.

**Public Input No. 63-NFPA 20-2019 [Section No. 10.8.3.7.3]****10.8.3.7.3**

Where the fire pump controller is marked to indicate that the alternate source is provided by a second utility power source, the requirements of 10.8.3.7.1 and 10.8.3.7.2 shall not apply ~~and undervoltage-sensing devices shall monitor all ungrounded conductors in lieu of a~~ to the frequency-sensing device.

Statement of Problem and Substantiation for Public Input

The proposed revision reflects the UL 1008 requirement that all transfer switches provide monitoring on all ungrounded sources.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 10:14:26 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-31-NFPA 20-2019

Statement: Section is modified to cohere with the UL 1008 requirement that all transfer switches provide monitoring on all ungrounded sources.

**Public Input No. 85-NFPA 20-2019 [Section No. 10.10.1.3.1]****10.10.1.3.1**

The output current rating of the variable frequency adjustable speed drive (VFD) ASD) as marked on the nameplate of the controller shall not be exceeded when operating in at the motor service factor marked on the motor nameplate .

Statement of Problem and Substantiation for Public Input

The proposed revision coordinates the adjustable speed drive with the motor service factor nameplate amps (See NEMA PI for 4.8.7)

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Tue Jun 25 09:58:19 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-32-NFPA 20-2019

Statement: This revision clarifies that the service factor amps are not always at the full 1.15 service factor.



Public Input No. 64-NFPA 20-2019 [Section No. 10.10.2]

10.10.2 Additional Marking.

In addition to the markings required in 10.1.2.5.1, the controller shall be marked with the maximum ambient temperature rating and the output current rating of the adjustable speed drive (ASD) .

Statement of Problem and Substantiation for Public Input

Since 9.5.2.2(2) now allows use of the Service Factor and 10.10.1.3.1 now requires that the current rating of the ASD not be exceeded, the current rating of the ASD needs to be on the nameplate for field verification by the AHJ.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 10:17:08 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-33-NFPA 20-2019](#)

Statement: Since 9.5.2.2(2) now allows use of the Service Factor and 10.10.1.3.1 now requires that the current rating of the ASD not be exceeded, the current rating of the ASD needs to be on the nameplate for field verification by the AHJ.

**Public Input No. 16-NFPA 20-2019 [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.

Additional Proposed Changes

File Name	Description	Approved
Issued_TIA_20-19-1_Final.pdf	NFPA 20_TIA 19-1	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 19-1 (Log 1389) issued by the Standards Council on November 6, 2018 and per the NFPA Regs., needs to be reconsidered by the Technical Committee for the next edition of the Document.

Substantiation: Due to an editorial mistake, the content of paragraph 10.10.3.4 was copied into paragraph 10.10.3.5. Paragraph 10.10.3.4 still exists as published in the 2016 edition, but the 2019 edition will show two paragraphs with the exact same contents. The absence of the 2016 edition wording in 10.10.3.5 will most likely cause the circuit breaker (disconnecting means) in the variable speed fire pump controller to trip when the controller is switched from the variable speed mode to the bypass mode while running. This is due to the motor being run at a different frequency in the variable mode than at the utility frequency in the bypass mode. The back EMF in the motor must be dissipated before it can be started at a different frequency, thus the requirement for the additional delay. This was the original reason for the addition of this paragraph.

Emergency Nature. The standard contains an error or an omission that was overlooked during the regular revision process. The proposed TIA intends to correct a circumstance in which the revised NFPA Standard has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process or was without adequate technical (safety) justification of the action Not reverting paragraph 10.10.3.5 to the existing 2016 text will leave the 2019 edition without a means for the AHJ to enforce this delay between switching. Enforcement by the AHJ, to prevent this situation from occurring in the field, is critical to keeping the fire pump running during manual operation.

Submitter Information Verification

Submitter Full Name: TC ON FIM-AAA
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 11 12:49:21 EST 2019
Committee: FIM-AAA

Committee Statement

Resolution: The committee confirms that the action taken with the TIA is appropriate and should remain in the standard.



Tentative Interim Amendment

NFPA[®] 20

Standard for the Installation of Stationary Pumps for Fire Protection

2019 Edition

Reference: 10.10.3.5

TIA 19-1

(TIA Log #1389)

Pursuant to Section 5 of the NFPA Regulations Governing the Development of NFPA Standards, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2019 edition. The TIA was processed by the Technical Committee on Fire Pumps, and was issued by the Standards Council on November 6, 2018, with an effective date of November 26, 2018.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a public input of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Revise 10.10.3.5 to read as follows:

10.10.3.5 ~~When the variable speed pressure limiting control is bypassed, automatic shutdown of the controller shall be as permitted by 10.5.4.2.~~ 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.

Issue Date: November 6, 2018

Effective Date: November 26, 2018

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo)

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NATIONAL FIRE PROTECTION ASSOCIATION



Public Input No. 65-NFPA 20-2019 [Section No. 10.10.6]

10.10.6 Power Quality.

10.10.6.1

Power quality correction equipment shall be located in the variable speed circuit.

10.10.6.1.1

As a minimum, 5 percent line reactance. A line reactor rated for continuous duty shall be provided. It shall be installed ahead of the adjustable speed drive and shall have a 5 percent impedance rating as a minimum. A reactor provided as an integral part of an adjustable speed drive may satisfy all or part of the 5 percent impedance if the reactor is connected on the line side of the converter (rectifier) section of the adjustable speed drive.

10.10.6.2*

Where higher system voltages or longer cable lengths exist, the cable length and motor requirements shall be coordinated.

10.10.6.3

Coordination shall not be required where the system voltage does not exceed 480 V and cable lengths between the motor and controller do not exceed 100 ft (30.5 m) (see 10.10.6.2).

Statement of Problem and Substantiation for Public Input

Adjustable speed drives are often provided with line reactors as part of the factory assembled product. The requirement in paragraph 14.3.4 to install a line reactor ahead of the adjustable speed drive having a 5 percent impedance rating as a minimum will result in additional impedance for an adjustable speed drive provided with a reactor as part of the factory assembled product. Most adjustable speed drives are designed to operate with a maximum line reactor impedance. Excessive line reactor impedance may cause improper operation of an adjustable speed drive such as overheating. The revised requirement will permit a reactor provided as an integral part of an adjustable speed drive to satisfy all or part of the 5 percent impedance requirement in 14.3.4 if the reactor is connected on the line side of the converter (rectifier) section of the adjustable speed drive.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 10:21:37 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-34-NFPA 20-2019

Statement: The modification permits a reactor, provided as an integral part of an adjustable speed drive, to satisfy all or part of the 5 percent impedance requirement in 14.3.4 when connected on the line side of the converter (rectifier) section of the adjustable speed drive.

**Public Input No. 111-NFPA 20-2019 [Section No. 10.10.7.2.1]****10.10.7.2.1**

~~Where redundant~~ Redundant pressure sensing elements are provided as part of a water mist positive displacement pumping unit, ~~they shall~~ elements shall be permitted for other system functions.

Statement of Problem and Substantiation for Public Input

The current wording implies redundant pressure sensing elements are optional. Section 8.4.5 requires that redundancy be built into the units such that failure of a line pressure sensor or primary control board will not prevent the system from functioning as intended. The revision eliminates the implication that redundancy is optional.

Submitter Information Verification

Submitter Full Name: John Kovacik

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Wed Jun 26 23:53:19 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-97-NFPA 20-2020

Statement: The revision eliminates the implication that redundancy is optional as section 8.4.5 requires that redundancy be built into the units such that failure of a line pressure sensor or primary control board will not prevent the system from functioning as intended.

**Public Input No. 66-NFPA 20-2019 [Section No. 10.10.9]****~~10.10.9 – Controller Contacts for Remote Indication.~~**

~~Controllers shall be equipped with contacts (open or closed) to operate circuits for the conditions in 10.10.8 .~~

Statement of Problem and Substantiation for Public Input

The proposed deletion is a companion PI to the NEMA PI to modify 10.4.7.2.6, allowing other trouble alarms to be included in the trouble alarm. Since adjustable speed alarms are included, individual contacts are not required. Contacts for remote indication for alarms in 10.4.7.2.6 are required in 10.4.8.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 10:28:13 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-36-NFPA 20-2019](#)

Statement: The proposed deletion is a companion PI to the NEMA PI to modify 10.4.7.2.6, allowing other trouble alarms to be included in the trouble alarm. Since adjustable speed alarms are included, individual contacts are not required. Contacts for remote indication for alarms in 10.4.7.2.6 are required in 10.4.8.

**Public Input No. 24-NFPA 20-2019 [New Section after 10.10.12.5]****TITLE OF NEW CONTENT**10.11 Data Storage10.11.1 Data registers shall be provided in the controller in accordance with Chapter 14.**Statement of Problem and Substantiation for Public Input**

Complementary to the proposal for a New Chapter 14 for connectivity.

Related Public Inputs for This Document

Related Input	Relationship
<u>Public Input No. 23-NFPA 20-2019 [New Section after 13.3]</u>	complementary

Submitter Information Verification

Submitter Full Name: Gayle Pennel

Organization: JENSEN HUGHES

Street Address:

City:

State:

Zip:

Submittal Date: Tue Mar 26 17:54:57 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-37-NFPA 20-2019

Statement: Section added to complement the New Chapter 14 for connectivity.

**Public Input No. 95-NFPA 20-2019 [Section No. 11.2.2.7]****11.2.2.7**

After the requirements of 11.2.2.1 through 11.2.2.6 have been complied with, engines shall have a 4-hour minimum horsepower rating equal to or greater than the brake horsepower required to drive the pump at its rated speed up to 175% of rated flow under any conditions listed for environmental conditions under pump load.

Statement of Problem and Substantiation for Public Input

This change will clarify and provide specific measurable criteria for pump testing that is reasonable. As the flow through a pump increases the boost pressure provided by that pump decreases. By the time a pump reaches 175% of its rated flow there will be much less pressure provided than is required to be useful for most fire systems. When going beyond 175% of rated flow to prevent the pump from cavitating a much higher suction pressure will be required than can be found in the vast majority of the fire pump installations around the world. By setting a specific flow rate that will be used to determine the required power rating of the pump driver all fire pump manufacturers will be on an even playing field when it comes to peak power testing. With today's requirement of testing until a peak power is achieved there is the opportunity for pump manufacturers to incorrectly test their pumps. This will most often happen if the manufacturer does not or cannot maintain a high enough suction pressure to prevent the pump from cavitating. When simply looking at the test results it can appear that a pump reached it's peak power when in fact it simply started to cavitate.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 91-NFPA 20-2019 [Section No. 3.3.38]	This change reflects the proposed change to the definition of maximum pump brake horsepower.
Public Input No. 92-NFPA 20-2019 [Section No. 4.7.6]	This change reflects the proposed change to the definition of maximum pump brake horsepower.
Public Input No. 93-NFPA 20-2019 [Section No. 4.11.3]	This change reflects the proposed change to the definition of maximum pump brake horsepower.
Public Input No. 94-NFPA 20-2019 [Section No. 9.5.2.1]	This change reflects the proposed change to the definition of maximum pump brake horsepower.

Submitter Information Verification

Submitter Full Name: Steven Baird
Organization: Armstrong Fluid Technology
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 26 15:26:57 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: The standard currently requires non-overloading over the entire pump curve. The proposed language can cause the controller and the motor to overload. Many pumps can perform past 175% rated flow.

**Public Input No. 67-NFPA 20-2019 [Section No. 11.2.4.2.6]****11.2.4.2.6 ECM Engine Supervision.**

11.2.4.2.6.1 A common supervisory signal shall be provided to the controller as a minimum for the following events:

- (1) Fuel injection trouble
- (2) Low fuel pressure
- (3) Any primary sensor failure

11.2.4.2.6.2 Means shall be provided for signaling ECM warning alarm to the pump controller. ECM warning is defined as failure of a single ECM.

11.2.4.2.6.2.1 Means shall be provided on the engine for testing the operation of the ECM warning signal to the pump controller, resulting in a visible and common audible alarm on the pump controller as required in 12.4.1.4.

11.2.4.2.6.2.2 Instructions for performing the test in 11.2.4.2.6.2 shall be included in the engine manual.

11.2.4.2.6.3 Means shall be provided for signaling ECM failure alarm to the pump controller. ECM failure is defined as failure of both ECM's.

11.2.4.2.6.3.1 Means shall be provided on the engine for testing the operation of the EMC failure signal to the pump controller, resulting in a visible and common audible alarm on the pump controller as required in 12.4.1.3.

11.2.4.2.6.3.2 Instructions for performing the test in 11.2.4.2.6.3 shall be included in the engine manual.

Statement of Problem and Substantiation for Public Input

These 2 alarms are referenced in the diesel engine fire pump driver standards (UL 1247 and FM 1333) and were implemented from 2014-2015. Adding these paragraphs harmonizes NFPA 20 with these standards.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 10:33:15 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-44-NFPA 20-2019

Statement: Section is modified to include alarms that are referenced in the UL diesel engine fire pump driver standards UL 1247 and FM 1333.



Public Input No. 68-NFPA 20-2019 [New Section after 11.2.4.4]

TITLE OF NEW CONTENT 11.2.4.4 Engine Overspeed Shutdown Control, Low Oil Pressure Signal, High and Low Coolant Temperature Signals, and High Cooling Water Temperature and Low Cooling Water Flow Signals.

Type your content here ...

11.2.4.4.9 Means shall be provided for signaling low cooling water flow alarm to the controller.

11.2.4.4.9.1 Means shall be provided on the engine for testing the operation of the low cooling water flow signal to the controller, resulting in a visible and common audible alarm on the controller as required in 12.4.1.4.

11.2.4.4.9.2 Instructions for performing the test in 11.2.4.4.11.1 shall be included in the engine manual.

Statement of Problem and Substantiation for Public Input

This alarm is referenced in the diesel engine fire pump driver standards (UL 1247 and FM 1333) and was implemented from 2014-2015. Adding these paragraphs in NFPA 20 will harmonize these standards.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 10:52:54 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-45-NFPA 20-2019

Statement: Section is modified to include alarm that is referenced in the UL diesel engine fire pump driver standards UL 1247 and FM 1333.

**Public Input No. 69-NFPA 20-2019 [Section No. 11.2.7.4.1]****11.2.7.4.1**

In addition to the requirements of Section 11.1 through 11.2.7, ~~11.2.8.1~~, 11.2.8 through 11.6.2, 11.6.4, and 11.6.6, the requirements of 11.2.7.4 shall apply.

Statement of Problem and Substantiation for Public Input

The only requirement that applies to air starting is 11.2.7.1 (reliable starting device). Section 11.2.7.2 is dedicated to electric starting method and thus does not apply to air starting. Section 11.2.7.3 is dedicated to hydraulic starting method so neither applies. While mentioning 11.2.8, the reference to 11.2.8.1 is included.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 11:02:19 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-38-NFPA 20-2019

Statement: Made appropriate corrections to align content with other portions of the standard. Changed referenced sections as only 11.2.7.1 applies to air starting. Reference to 11.2.8.1 is added.



Public Input No. 103-NFPA 20-2019 [New Section after 11.4.1.3.1]

11.4.1.3.1.1

When the fuel supply rate requirements of the engine are not known then fuel supply tank(s) shall have a capacity at least equal to 1 gal per hp (5.07L per kW), plus 5 percent volume for expansion and 5 percent volume for sump.

Statement of Problem and Substantiation for Public Input

This addition is related to the proposed change to section 11.4.1.3.1 and will provide a fallback generic sizing criteria is the engine specific fuel supply rate is not known.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 102-NFPA 20-2019 [Section No. 11.4.1.3.1]	This would be a subsection to the newly revised 11.4.1.3.1

Submitter Information Verification

Submitter Full Name: Steven Baird
Organization: Armstrong Fluid Technology
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 26 16:32:12 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: One Gallon per HP is sufficient for sizing the diesel engine fuel tank. It provides adequate reserve for proper functioning of the fire pump.



Public Input No. 102-NFPA 20-2019 [Section No. 11.4.1.3.1]

11.4.1.3.1*

Fuel supply tank(s) shall have a capacity at least equal to 1 gal per hp (5.07 L per kW) be sized for a minimum of 8 hours of engine run time based on the fuel supply rate requirements of the engine , plus 5 percent volume for expansion and 5 percent volume for sump.

Statement of Problem and Substantiation for Public Input

This change would align the fuel tank sizing requirements of NFPA 20 with the requirements of FM Global Property Loss Prevention Data Sheet 3-7 section 2.8.4.6. It will allow for fuel tanks sized more reasonably based on the improved fuel efficiency of some newer engines.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 103-NFPA 20-2019 [New Section after 11.4.1.3.1]	

Submitter Information Verification

Submitter Full Name: Steven Baird
Organization: Armstrong Fluid Technology
Street Address:
City:
State:
Zip:
Submission Date: Wed Jun 26 16:17:22 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: One Gallon per HP is sufficient for sizing the diesel engine fuel tank. It provides adequate reserve for proper functioning of the fire pump.



Public Input No. 86-NFPA 20-2019 [Section No. 11.4.4.1]

11.4.4.1

Flame-resistant reinforced flexible hose with a 30-minute fire resistance rating equal to ISO 15540, *Fire Resistance of Non-Metallic Hose Assemblies and Non-Metallic Compensators — Test Methods*, and a pressure rating no less than 2 times the fuel supply and return working pressure with threaded connections shall be provided at the engine for connection to fuel system piping.

11.4.4.2 Fuel piping supplying a fire pump from a tank located outside the room the in which the fire pump is located shall be separated from other areas of the building by a fire-resistant pipe-protection system that has been tested in accordance with UL 1489, installed in accordance with the manufacturer's installation instructions and shall have a rating of not less than 2 hours.

11.4.4.2.1 Where the building is protected throughout with an automatic sprinkler system installed in accordance with NFPA 13, the required rating shall be reduced to 1 hour.

Statement of Problem and Substantiation for Public Input

Ensure reliability of the fuel supply for the fire pump; consistent with section 4.21.2.8 (Protection of Control Wiring for Series Fire Pump Units).

Submitter Information Verification

Submitter Full Name: Kelly Nicoletto

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Wed Jun 26 13:30:11 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: The committee does not agree with the overwriting of current sections 11.4.4.2 and 11.4.4.2.1. Author addresses fire rating for fuel lines outside of the pump room but makes no mention of the fuel tank. The proposed changes are excessive.

**Public Input No. 37-NFPA 20-2019 [Section No. 11.4.5.4]****11.4.5.4**

The grade of fuel oil shall be indicated on the fuel tank by letters that are a minimum of ~~6 in~~ 2 in .
(~~152 mm~~ 50 mm) in height and in contrasting color to the tank or as acceptable to the authority having jurisdiction .

Statement of Problem and Substantiation for Public Input

6" letters are to large in real world situations. 2" letters are large enough to be ea silt seen in a typical fire pump room. Where the authority having jurisdiction wants something larger, this proposed modification will accommodate their desires.

Submitter Information Verification

Submitter Full Name: John Denhardt

Organization: Strickland Fire Protection, Incorporated

Street Address:

City:

State:

Zip:

Submittal Date: Fri May 31 16:48:59 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: There was no technical justification provided to decrease the size of the lettering on diesel fuel tank.

**Public Input No. 31-NFPA 20-2019 [Section No. 11.6.4.1]****11.6.4.1**

The fuel storage tanks shall be designed and installed so that they can be kept as full and maintained as practical at all times

but never below 66 percent
by one of the following methods:

Where the tank is sized to the minimum volume permitted by 11.4.1.3.1, the minimum tank contents shall be maintained at or above 66 percent (two-thirds) of tank capacity.

* Where the tank is sized greater than the minimum volume permitted by 11.4.1.3.1, all of the following conditions shall be met:

- (3) The minimum tank contents shall be maintained at or above 66 percent (two-thirds) of 1.1 gal per hp (5.58 L per kW).
- (4) The minimum permitted fuel level, as determined in (a) above, shall be posted on the tank or tank gauge.
- (5) An active fuel maintenance system listed for fire pump service shall be provided.

Statement of Problem and Substantiation for Public Input

In practice, many installations are managed to allow tank levels below 66 percent, in order to gain cost savings with larger volume fuel deliveries. The current language requires a minimum 66 percent of the tank volume be maintained even if the tank is oversized.

The proposed language allows this minimum volume to be less provided the tank is sized sufficiently and the minimum volume equivalent to a two-thirds of minimum sized tank is clearly marked.

It should also be noted that 1.1 gal per hp (5.58 L per kW) includes the additional 5 percent volume for expansion and 5 percent volume for sump required by 11.4.1.3.1.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 32-NFPA 20-2019 [New Section after A.11.6.4]	Annex to revised 11.6.4.1
Public Input No. 32-NFPA 20-2019 [New Section after A.11.6.4]	

Submitter Information Verification

Submitter Full Name: Thomas George
Organization: Tokio Marine America
Street Address:
City:
State:
Zip:
Submission Date: Tue Apr 09 09:56:17 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: The size of the tank is irrelevant. All tanks must be maintained at 66% or above.

**Public Input No. 70-NFPA 20-2019 [Section No. 12.4.1.3]****12.4.1.3**

Separate visible indicators and a common audible fire pump alarm capable of being heard while the engine is running and operable in all positions of the main switch except the off position shall be provided to immediately indicate the following conditions:

- (1) Critically low oil pressure in the lubrication system
- (2) High engine temperature
- (3) Failure of engine to start automatically
- (4) Shutdown from overspeed
- (5) High cooling water temperature
- (6) ECM failure

Statement of Problem and Substantiation for Public Input

The addition of alarm (6) ECM failure at the diesel fire pump controller coincides with proposed new 11.2.4.2.6.3 thru 11.2.4.2.6.3.2 at the diesel engine (see NEMA PI for 11.2.4.2.6).

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jun 24 11:07:46 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-42-NFPA 20-2019

Statement: "ECM failure" alarm added at the diesel fire pump controller to coincide with new sections 11.2.4.2.6.1 thru 11.2.4.2.6.3.

**Public Input No. 17-NFPA 20-2019 [Section No. 12.4.1.4]****12.4.1.4**

Separate visible indicators and a common audible signal capable of being heard while the engine is running and operable in all positions of the main switch except the off position shall be provided to immediately indicate the following conditions:

- (1)* Battery failure or missing battery. Each controller shall be provided with a separate visible indicator for each battery. The battery failure signal shall initiate at no lower than two-thirds of battery nominal voltage rating (8.0 V dc on a 12 V dc system). Sensing shall be delayed to prevent nuisance signals.
- (2) Battery charger failure. Each controller shall be provided with a separate visible indicator for battery charger failure and shall not require the audible signal for battery charger failure.
- (3) Low air or hydraulic pressure. Where air or hydraulic starting is provided (*see 11.2.7 and 11.2.7.4*), each pressure tank shall provide to the controller separate visible indicators to indicate low pressure.
- (4) System overpressure, for engines equipped with variable speed pressure limiting controls, to actuate at 115 percent of set pressure.
- (5) ECM selector switch in alternate ECM position (only for engines with ECM control).
- (6)* Common alarm for fuel injection malfunction (only for engines with ECM control).
- (7) Low fuel level. Signal at two-thirds tank capacity.
- (8) Low air pressure (air-starting engine controllers only). The air supply container shall be provided with a separate visible indicator to indicate low air pressure.
- (9) Low engine temperature.
- (10) Supervisory signal for interstitial space liquid intrusion.
- (11) Fuel maintenance needed if automatic fuel maintenance system is provided.

Additional Proposed Changes

File Name	Description	Approved
Issued_TIA_20-19-2_Final.pdf	NFPA 20_TIA 19-2	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 19-2 (Log 1390) issued by the Standards Council on November 6, 2018 and per the NFPA Regs., needs to be reconsidered by the Technical Committee for the next edition of the Document.

Substantiation: The alarm "high cooling water temperature" incorrectly appears in two sections, 12.4.1.3 and 12.4.1.4, and specifies two values, 4 hours (12.4.1.5.1) and 24 hours (12.4.1.5.2), creating a conflict regarding the period of time for the alarm to be silenced. This alarm is strictly a Critical alarm and should not appear in the non-critical list in 12.4.1.4.

Emergency Nature. The standard contains an error or an omission that was overlooked during the regular revision process.

Submitter Information Verification

Submitter Full Name: TC ON FIM-AAA

Organization: NFPA

Street Address:

City:

State:

Zip:

Submittal Date: Fri Jan 11 13:01:18 EST 2019
Committee: FIM-AAA

Committee Statement

Resolution: FR-43-NFPA 20-2019

Statement: Remove paragraph (8) due to redundancy.

Add "ECM Warning" alarm in line with changes in section 11.2.4.2.6.1 thru 11.2.4.2.6.3.

Add "Low cooling water flow" alarm in line with changes in section 11.2.4.4.



Tentative Interim Amendment

NFPA® 20

Standard for the Installation of Stationary Pumps for Fire Protection

2019 Edition

Reference: 12.4.1.4

TIA 19-2

(TIA Log #1390)

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2019 edition. The TIA was processed by the Technical Committee on Fire Pumps, and was issued by the Standards Council on November 6, 2018, with an effective date of November 26, 2018.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a public input of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. *Revise 12.4.1.4 to read as follows:*

12.4.1.4 Separate visible indicators and a common audible signal capable of being heard while the engine is running and operable in all positions of the main switch except the off position shall be provided to indicate the following conditions:

- (1)* Battery failure or missing battery. Each controller shall be provided with a separate visible indicator for each battery. The battery failure signal shall initiate at no lower than two-thirds of battery nominal voltage rating (8.0 V dc on a 12 V dc system). Sensing shall be delayed to prevent nuisance signals.
- (2) Battery charger failure. Each controller shall be provided with a separate visible indicator for battery charger failure and shall not require the audible signal for battery charger failure.
- (3) Low air or hydraulic pressure. Where air or hydraulic starting is provided (see 11.2.7 and 11.2.7.4), each pressure tank shall provide to the controller separate visible indicators to indicate low pressure.
- (4) System overpressure, for engines equipped with variable speed pressure limiting controls, to actuate at 115 percent of set pressure.
- (5) ECM selector switch in alternate ECM position (only for engines with ECM control).
- (6)* Common alarm for fuel injection malfunction (only for engines with ECM control).
- (7) Low fuel level. Signal at two-thirds tank capacity.
- (8) Low air pressure (air-starting engine controllers only). The air supply container shall be provided with a separate visible indicator to indicate low air pressure.
- (9) Low engine temperature.
- (10) Supervisory signal for interstitial space liquid intrusion.
- ~~(11) High cooling water temperature.~~
- (12) Fuel maintenance needed if automatic fuel maintenance system is provided.

Issue Date: November 6, 2018

Effective Date: November 26, 2018

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo)

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Public Input No. 71-NFPA 20-2019 [Section No. 12.4.1.4]

12.4.1.4

Separate visible indicators and a common audible signal capable of being heard while the engine is running and operable in all positions of the main switch except the off position shall be provided to immediately indicate the following conditions:

- (1)* Battery failure or missing battery. Each controller shall be provided with a separate visible indicator for each battery. The battery failure signal shall initiate at no lower than two-thirds of battery nominal voltage rating (8.0 V dc on a 12 V dc system). The battery failure signal shall also initiate when the battery is missing, with or without the battery charger being energized. Sensing shall be delayed to prevent nuisance signals.
- (2) Battery charger failure. Each controller shall be provided with a separate visible indicator for battery charger failure and shall not require the audible signal for battery charger failure.
- (3) Low air or hydraulic pressure. Where air or hydraulic starting is provided (*see 11.2.7 and 11.2.7.4*), each pressure tank shall provide to the controller separate visible indicators to indicate low pressure.
- (4) System overpressure, for engines equipped with variable speed pressure limiting controls, to actuate at 115 percent of set pressure.
- (5) ECM selector switch in alternate ECM position (only for engines with ECM control).
- (6)* Common alarm for fuel injection malfunction (only for engines with ECM control).
- (7) Low fuel level. Signal at two-thirds tank capacity.
- (8) Low air pressure (air-starting engine controllers only). The air supply container shall be provided with a separate visible indicator to indicate low air pressure.
- (9) Low engine temperature.
- (10) Supervisory signal for interstitial space liquid intrusion.
- (11) Fuel maintenance needed if automatic fuel maintenance system is provided.

Statement of Problem and Substantiation for Public Input

The proposed revision indicates that the failure signal is to be actuated with or without the battery charger connected. An energized battery charger can prevent a missing battery from being detected.

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Submittal Date: Mon Jun 24 11:10:33 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-43-NFPA 20-2019](#)

Statement: Remove paragraph (8) due to redundancy.

Add "ECM Warning" alarm in line with changes in section 11.2.4.2.6.1 thru 11.2.4.2.6.3.

Add "Low cooling water flow" alarm in line with changes in section 11.2.4.4.



Public Input No. 72-NFPA 20-2019 [Section No. 12.4.1.4]

12.4.1.4

Separate visible indicators and a common audible signal capable of being heard while the engine is running and operable in all positions of the main switch except the off position shall be provided to immediately indicate the following conditions:

- (1)* Battery failure or missing battery. Each controller shall be provided with a separate visible indicator for each battery. The battery failure signal shall initiate at no lower than two-thirds of battery nominal voltage rating (8.0 V dc on a 12 V dc system). Sensing shall be delayed to prevent nuisance signals.
- (2) Battery charger failure. Each controller shall be provided with a separate visible indicator for battery charger failure and shall not require the audible signal for battery charger failure.
- (3) Low air or hydraulic pressure. Where air or hydraulic starting is provided (see 11.2.7.3 and 11.2.7.4), ~~each pressure tank shall provide to the controller air supply container or hydraulic accumulator system shall be provided with~~ separate visible indicators to indicate low pressure.
- (4) System overpressure, for engines equipped with variable speed pressure limiting controls, to actuate at 115 percent of set pressure.
- (5) ECM selector switch in alternate ECM position (only for engines with ECM control).
- (6)* Common alarm for fuel injection malfunction (only for engines with ECM control).
- (7) Low fuel level. Signal at two-thirds tank capacity.
- (8) ~~Low air pressure (air starting engine controllers only). The air supply container shall be provided with a separate visible indicator to indicate low air pressure.~~
Low engine
- (9) temperature.
- (10) Supervisory signal for interstitial space liquid intrusion.
- (11) Fuel maintenance needed if automatic fuel maintenance system is provided.
- (12) ECM warning
- (13) Low cooling water flow

Statement of Problem and Substantiation for Public Input

Reference correction, 11.2.7.3 is the section dedicated to hydraulic starting. Reformulation of the sentence in paragraph (3) to include wording from sections 11.2.7.3 and 11.2.7.4. Syntax correction: Visible indicators cannot be provided to the controller as if the controller has eyes. The controller will receive either a NO or NC contact for common low-pressure signal. This contact will give a low-pressure signal regardless of the two pressure containers.

Remove paragraph (8) as it is redundant as it is already considered in paragraph (3).

The addition of alarm (12) ECM Warning at the diesel fire pump controller coincides with proposed new 11.2.4.2.6.2 thru 11.2.4.2.6.2.2 at the diesel engine (see NEMA PI for 11.2.4.2.6).

The addition of alarm (13) Low cooling water flow at the diesel fire pump controller coincides with proposed new 11.2.4.4.9 thru 11.2.4.4.9.2 at the diesel engine (see NEMA PI for 11.2.4.4).

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Zip:**Submittal Date:** Mon Jun 24 11:14:41 EDT 2019**Committee:** FIM-AAA**Committee Statement****Resolution:** [FR-43-NFPA 20-2019](#)**Statement:** Remove paragraph (8) due to redundancy.

Add "ECM Warning" alarm in line with changes in section 11.2.4.2.6.1 thru 11.2.4.2.6.3.

Add "Low cooling water flow" alarm in line with changes in section 11.2.4.4.

**Public Input No. 25-NFPA 20-2019 [New Section after 12.8.3.2]****TITLE OF NEW CONTENT**12.9 Data Storage12.9.1 Data registers shall be provided in the controller in accordance with Chapter 14.**Statement of Problem and Substantiation for Public Input**

Complementary to the proposed Chapter 14 on connectivity.

Related Public Inputs for This Document

Related Input	Relationship
<u>Public Input No. 23-NFPA 20-2019 [New Section after 13.3]</u>	

Submitter Information Verification

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Submittal Date: Tue Mar 26 17:57:52 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: The means of data collection as proposed is very limiting and does not need to be mandated by the standard. Annex C provides sufficient guidance on means of data collection regarding fire pump performance.

**Public Input No. 23-NFPA 20-2019 [New Section after 13.3]****TITLE OF NEW CONTENT**New Connectivity Chapter 14**Additional Proposed Changes**

File Name	Description	Approved
New_Chapter_14_Submitted_03262019.docx	Word version of submitted changes	

Statement of Problem and Substantiation for Public Input

Provides requirements for incorporating connectivity into controllers.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 24-NFPA 20-2019 [New Section after 10.10.12.5]	
Public Input No. 25-NFPA 20-2019 [New Section after 12.8.3.2]	

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Committee: FIM-AAA

Committee Statement

Resolution: The means of data collection as proposed is very limiting and does not need to be mandated by the standard. Annex C provides sufficient guidance on means of data collection regarding fire pump performance.

CONNECTIVITY PROPOSAL NFPA 20 2022 EDITION

PROPOSED CONNECTIVITY CHANGES

1. Add the following section to Chapter 10.

10.11 Data Storage

10.11.1 Data registers shall be provided in the controller in accordance with Chapter 14.

2. Add the following section to Chapter 12 12.9 Data Registers

12.9 Data registers shall be provided in the controller in accordance with Chapter 14.

3. Add the following new chapter 14 to NFPA 20, move current chapter 14 to chapter 15

Chapter 14 Network and Data Registers

14.1 General

14.1.1. Fire pump controllers shall be provided with standardized data registers in accordance with this chapter.

14.1.2 Non-hardwired communication between the controller and external devices shall be limited to one way (read only).

14.1.3 Non-hardwired external devices shall not be permitted to operate a fire pump or change settings within a fire pump controller.

14.2 Network Connection

14.2.1 Except as permitted in 14.1.2, the pump room shall have a wired Ethernet port providing a secure TCP/IP connection into a virtual private network or a public network for monitoring pump room data.

14.2.2 A wireless connection that meets the security and performance required by the property owners and subscribers shall be permitted in lieu of a wired Ethernet port.

14.3 Data Storage

14.3.1 Data storage registers shall be provided in the electric fire pump controllers in accordance with Table 14.3.1.

14.3.2 Data storage registers shall be provided in the diesel fire pump controllers in accordance with Table 14.3.2.

14.3.3 Data storage registers shall be provided in both electric and diesel fire pump controllers for jockey pump operation and status in accordance with Table 14.3.3.

14.2.4 Data storage registers shall be provided in both electric and diesel fire pump controllers for performance data in accordance with Table 14.3.4(a) and Table 14.3.4(b).

14.2.4.1 The controller shall be arranged to record and store the performance data for a given flow point

when so initiated by the operator either locally at the controller or remotely within the pump room.

14.3.5 Variable functions in Table 14.3.1, Table 14.3.2, and Table 14.3.3 shall be continuously monitored by the controller and time stamped and recorded in an event log in Modbus format in Table 14.3.5 1) every 24 hours 2) whenever the value changes more than 2% from the previously recorded value, and 3) whenever the pump or jockey pump starts or stops.

14.3.5.2 An Ethernet serial communications network using a standard web-based, text file format (HTML) may be used in lieu of the Modbus format in Table 14.3.5.

14.3.6 The configuration shown in figure 14.3.6 shall be a permissible connectivity arrangement for a electric fire pump installation.

14.3.7 The configuration shown in figure 14.3.7 shall be a permissible connectivity arrangement for a diesel fire pump installation.

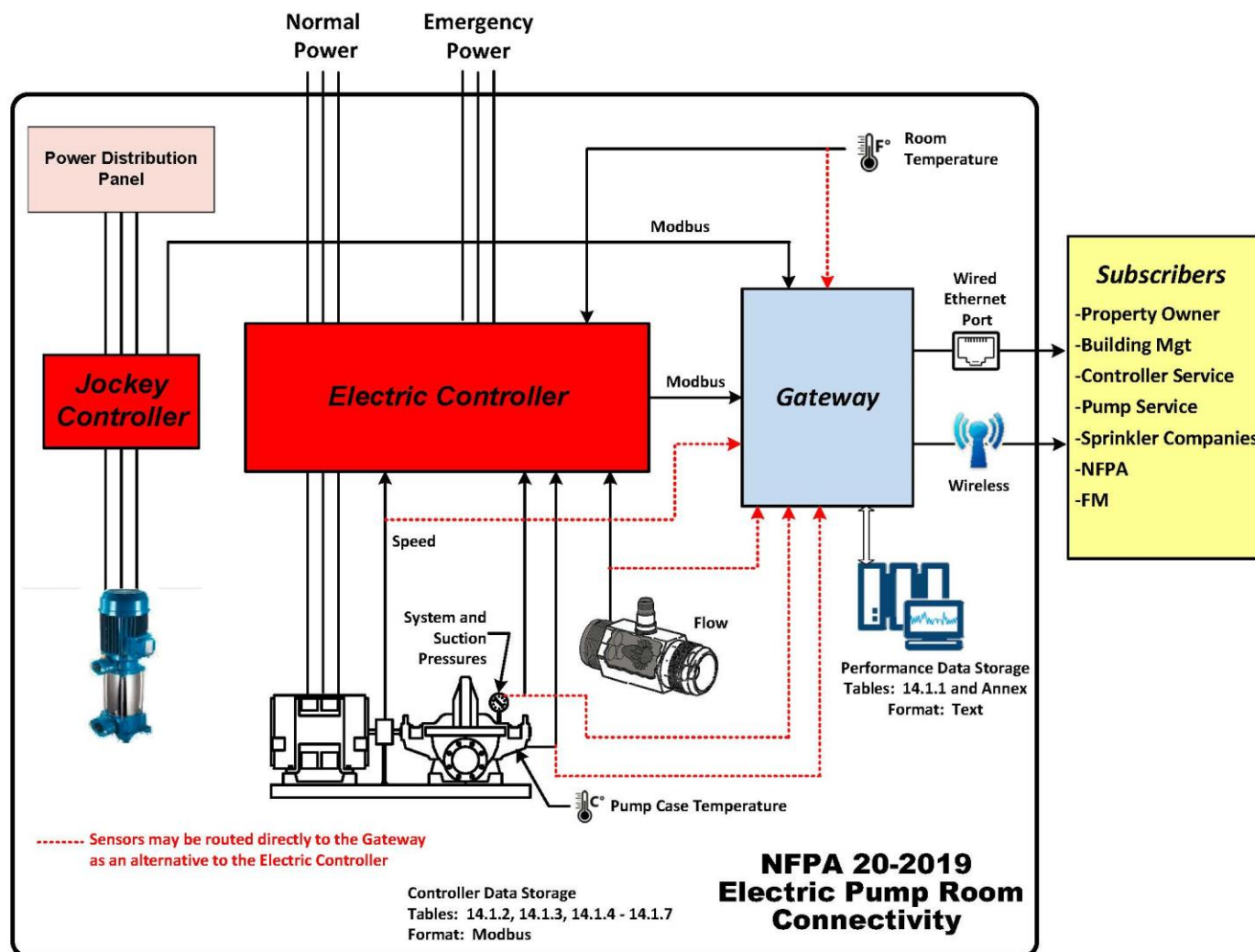


Figure 14.3.6 – Acceptable Electric Fire Pump Connectivity Arrangement

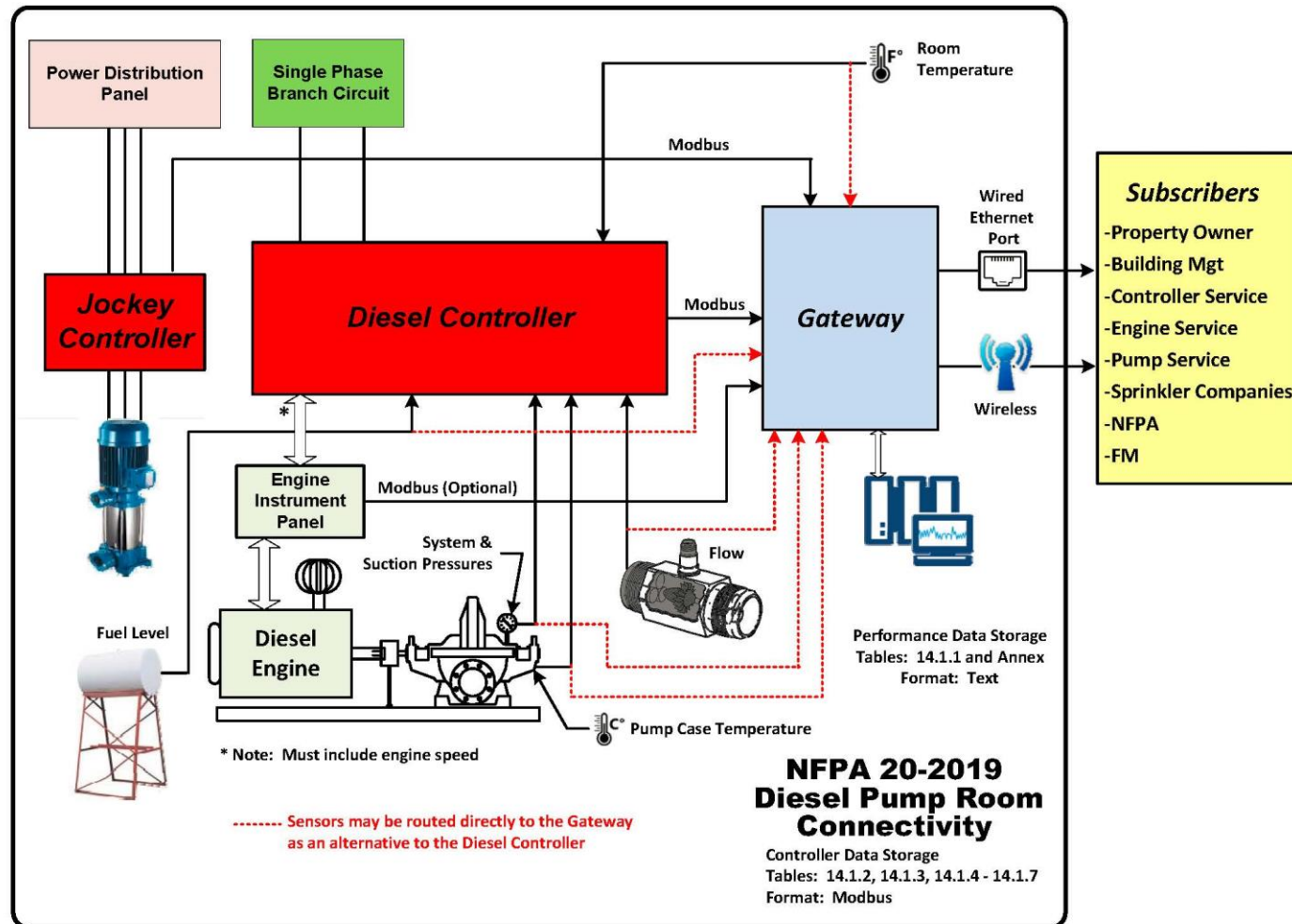


Figure 14.3.7 – Acceptable Diesel Fire Pump Connectivity Arrangement

Figure

Table 14.3.1 Standardized Electric Motor Controller Modbus Register Definitions (Modbus Registers 42000-42275) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
		Dynamic Real-time Data				
42001		AC Volts Lines 1-2	V	RO	0-60000	0.1*Raw
42002		AC Volts Lines 2-3	V	RO	0-60000	0.1*Raw
42003		AC Volts Lines 3-1	V	RO	0-60000	0.1*Raw
42004		AC Amps Line 1	A	RO	0-50000	0.1*Raw
42005		AC Amps Line 2	A	RO	0-50000	0.1*Raw
42006		AC Amps Line 3	A	RO	0-50000	0.1*Raw
42007		Line Frequency	HZ	RO	0-1000	0.1*Raw
42008		VFD Motor Speed (Hz)	Hz	RO	0-1000	0.1*Raw
42009		System Pressure (psi or bars)	PSI/Bars/kPA	RO	0-6000	0.1*Raw
42010		Suction Pressure (psi or bars)	PSI/Bars/kPA	RO	0-6000	0.1*Raw
42011		Water Temperature, Pump Casing	F°	RO	0-1000	0.1*Raw
42012		Pump Room Temperature	F°	RO	0-1000	0.1*Raw
42013		Storage Tank Level	% full	RO	0-100	
42014		System Pressure at Pump Shutdown	PSI/Bars/kPA	RO	0-1000	0.1*Raw
		Controller Settings				
42050		Pressure Start	PSI/Bars/kPA	RO	0-600	
42051		Pressure Stop	PSI/Bars/kPA	RO	0-600	

Table 14.3.1 Standardized Electric Motor Controller Modbus Register Definitions (Modbus Registers 42000-42275) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
42052		Manual Stop Only		RO	0 = Automatic, 1 = Manual Stop Only	
42053		Run Period Timer	Sec	RO	0-60000	
42054		Sequential Timer	Sec	RO	0-60000	
42055		Weekly Test Timer	Day of Week	RO	0-6 Day, Sunday = 0	
42056		Pressure Units		RO	0 = PSI, 1 = bar, 2 = kPA	
42057		Flow Units			0=gpm, 1=L/min	
42058		Temperature Units		RO	0 = F°, 1 = C°	
		Alarms				
42100	D0	Minimum Run Delay Timing		RO	Boolean	
	D1	Accelerate Delay Timing		RO	Bool	
	D2	High Zone Delay Timing		RO	Bool	
	D3	Sequence Delay Timing		RO	Bool	
	D4	Load Shed Active		RO	Bool	
	D5	Low Discharge Pressure Alarm		RO	Bool	
	D6	Low Suction Alarm		RO	Bool	
	D7	Low Suction Shutdown Active		RO	Bool	
	D8	System Over Pressure Alarm		RO	Bool	
	D9	Restart Delay Timing		RO	Bool	
	D10	Weekly Test Demand Active		RO	Bool	
	D11	Failure to Start Alarm		RO	Bool	
	D12	Lockout Active		RO	Bool	

Table 14.3.1 Standardized Electric Motor Controller Modbus Register Definitions (Modbus Registers 42000-42275) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
	D13	VFD Ready		RO	Bool	
	D14	VFD Forward Command Active		RO	Bool	
	D15	VFD Reverse Command Active		RO	Bool	
42101	D0	Pressure Start Demand		RO	Bool	
	D1	Remote Start Demand		RO	Bool	
	D2	Deluge Start Demand		RO	Bool	
	D3	Weekly Test Start Demand		RO	Bool	
	D4	Local Start PB Demand		RO	Bool	
	D5	Manual Operator Start Demand		RO	Bool	
	D6	Audible Alarm		RO	Bool	
	D	Weekly/Monthly Test Setup Error		RO	Bool	
	D8	Minimum Run Timed Out		RO	Bool	
	D9	Load Shed Delay Timing		RO	Bool	
	D10	Mod Sp 1/2 Power OK		RO	Bool	
	D11	Mod Sp 1/2 Power Loss Start		RO	Bool	
	D12	Pressure Transducer Fault		RO	Bool	
	D13	Pressure Transducer Test OK		RO	Bool	
	D14	VFD Failure		RO	Bool	
	D15	Controller in bypass, soft start/VFD only		RO	Bool	
42102	D0	Timed Trip Timing		RO	Bool	
	D1	Motor Running		RO	Bool	
	D2	Motor Overload Alarm		RO	Bool	
	D3	Motor Single Phasing Alarm		RO	Bool	
	D4	Phase Reversal Alarm		RO	Bool	

Table 14.3.1 Standardized Electric Motor Controller Modbus Register Definitions (Modbus Registers 42000-42275) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
	D5	AC Voltage Low Alarm		RO	Bool	
	D6	PhaseSmart Protection Lockout		RO	Bool	
	D7	Transfer Switch in Normal Position		RO	Bool	
	D8	Transfer Switch in Emergency Position		RO	Bool	
	D9	AC Power Available		RO	Bool	
	D10	Transfer Switch Normal Power Available		RO	Bool	
	D11	Transfer Switch Emergency Power Available		RO	Bool	
	D12	Emergency CB Open		RO	Bool	
	D13	CB Tripped		RO	Bool	
	D14	Generator Engine Start Signal		RO	Bool	
	D15	Low Pump Room Temperature		RO	Bool	
42103	D0	AC Line Under Voltage Alarm		RO	Bool	
	D1	AC Line Over Voltage Alarm		RO	Bool	
	D2	AC Line Over Frequency Alarm		RO	Bool	
	D3	AC Line Under Frequency Alarm		RO	Bool	
	D4	Unused		RO	Bool	
	D5	Unused		RO	Bool	
	D6	Unused		RO	Bool	
	D7	Unused		RO	Bool	
	D8	Unused		RO	Bool	
	D9	Unused		RO	Bool	
	D10	Unused		RO	Bool	
	D11	Unused		RO	Bool	
	D12	Unused		RO	Bool	

Table 14.3.1 Standardized Electric Motor Controller Modbus Register Definitions (Modbus Registers 42000-42275) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
	D13	Unused		RO	Bool	
	D14	Unused		RO	Bool	
	D15	Unused		RO	Bool	
		Historical Data				
42150		Maximum Starting AC Amps Line 1	A	RO	0-30000	0.1*Raw
42151		Maximum Starting AC Amps Line 2	A	RO	0-30000	0.1*Raw
42152		Maximum Starting AC Amps Line 3	A	RO	0-30000	0.1*Raw
42153		Maximum Running AC Amps Line 1	A	RO	0-50000	
42154		Maximum Running AC Amps Line 2	A	RO	0-50000	
42155		Maximum Running AC Amps Line 3	A	RO	0-50000	
42160		Minimum AC Volts Idle Lines 1-2	A	RO	0-1000	
42161		Minimum AC Volts Idle Lines 2-3	A	RO	0-1000	
42162		Minimum AC Volts Idle Lines 3-1	A	RO	0-1000	
42163		Maximum AC Volts Idle Lines 1-2	A	RO	0-1000	
42164		Maximum AC Volts Idle Lines 2-3	A	RO	0-1000	
42165		Maximum AC Volts Idle Lines 3-1	A	RO	0-1000	
42170		Minimum AC Volts Starting Lines 1-2	V	RO	0-60000	0.1*Raw
42171		Minimum AC Volts Starting Lines 2-3	V	RO	0-60000	0.1*Raw
42172		Minimum AC Volts Starting Lines 3-1	V	RO	0-60000	0.1*Raw
42180		Minimum AC Volts Running Lines 1-2	V	RO	0-60000	0.1*Raw
42181		Minimum AC Volts Running Lines 2-3	V	RO	0-60000	0.1*Raw
42182		Minimum AC Volts Running Lines 3-1	V	RO	0-60000	0.1*Raw

Table 14.3.1 Standardized Electric Motor Controller Modbus Register Definitions (Modbus Registers 42000-42275) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
42183		Maximum AC Volts Running Lines 1-2	V	RO	0-60000	0.1*Raw
42184		Maximum AC Volts Running Lines 2-3	V	RO	0-60000	0.1*Raw
42185		Maximum AC Volts Running Lines 3-1	V	RO	0-60000	0.1*Raw
42190		Minimum Frequency	HZ	RO	0-1000	0.1*Raw
42190		Maximum Frequency	HZ	RO	0-1000	0.1*Raw
42200		Last Locked Rotor AC Amps Line 1	A	RO	0-50000	
		Last Locked Rotor AC Amps Line 2	A	RO	0-50000	
		Last Locked Rotor AC Amps Line 3	A	RO	0-50000	
42210		Minimum System Discharge Pressure	PSI/Bars/kPA	RO	0-6000	0.1*Raw
		Maximum System Discharge Pressure	PSI/Bars/kPA	RO	0-6000	0.1*Raw
42220		Start Count		RO	0-10000	
42221		Calls to Start Count		RO	0-10000	
42230		Total Run Time Hours	Hr	RO	0-599999	
42231		Total Run Time Minutes	Min	RO	0-59	
42232		Total Run Time Seconds	Sec	RO	0-59	
42233		Pump Last Run Time Minutes	Min	RO	0-59	
42234		Pump Last Run Time Seconds	Sec	RO	0-59	
42235		Total Controller Power On Time Hours	Hr	RO	0-599999	
42236		Total Controller Power On Time Minutes	Min	RO	0-59	
42237		Total Controller Power On Time Seconds	Sec	RO	0-59	

Table 14.3.1 Standardized Electric Motor Controller Modbus Register Definitions (Modbus Registers 42000-42275) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
42238		Hours since last run	Hr	RO		
42239		Hours since last performance test	Hr	RO		
42240		Last Pump Start Hr	Hr	RO	0-23	
42241		Last Pump Start Minute	Min	RO	0-59	
42242		Last Pump Start Second	Sec	RO	0-59	
42243		Last Pump Start Month	Mo	RO	1-12	
42244		Last Pump Start Day	Day	RO	1-31	
42245		Last Pump Start Year	Year	RO	1700-3000	
42250		Last Phase Failure Hr	Hr	RO	0-23	
42251		Last Phase Failure Minute	Min	RO	0-59	
42252		Last Phase Failure Second	Sec	RO	0-59	
42253		Last Phase Failure Month	Mo	RO	1-12	
42254		Last Phase Failure Day	Day	RO	1-31	
42255		Last Phase Failure Year	Year	RO	1700-3000	
42260		Last Phase Reversal Hr	Hr	RO	0-23	
42261		Last Phase Reversal Minute	Min	RO	0-59	
42262		Last Phase Reversal Second	Sec	RO	0-59	
42263		Last Phase Reversal Month	Mo	RO	1-12	
42264		Last Phase Reversal Day	Day	RO	1-31	
42265		Last Phase Reversal Year	Year	RO	1700-3000	
42270		Last Locked Rotor Trip Hr	Hr	RO	0-23	
42271		Last Locked Rotor Trip Minute	Min	RO	0-59	
42272		Last Locked Rotor Trip Second	Sec	RO	0-59	

Table 14.3.1 Standardized Electric Motor Controller Modbus Register Definitions (Modbus Registers 42000-42275) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
42273		Last Locked Rotor Trip Month	Mo	RO	1-12	
42274		Last Locked Rotor Trip Day	Day	RO	1-31	
42275		Last Locked Rotor Trip Year	Year	RO	1700-3000	
		Remaining for Assignment				
		Minimum Transducer Pressure				Acceptance Test
		Pump Trouble #1 Input High				
		Pump Trouble #2 Input High				
		Pump Trouble #3 Input High				
		Pump Trouble #4 Input High				
		Pump Trouble #5 Input High				
		Pump Trouble #6 Input High				
		Pump Trouble #7 Input High				
		Pump Trouble #8 Input High				
		Pump Trouble Group Alarm High				
		Aux Input #1, 0-100%				
		Aux Input #2, 0-100%				

Table 14.3.2
Standardized Diesel Engine Controller Modbus Register Definitions (Modbus Registers 42000-42305)

Note: All Boolean values are positive true logic (logic high)

Register	Bit	Description	Units	Write	Range	Scaling and Notes
42001	---	Battery #1 Volts	V	RO	0-5000	0.01*Raw
42002	---	Battery #2 Volts	V	RO	0-5000	0.01*Raw
42003	---	Charger 1 AC Power Input	V	RO	0-3000	
42004	---	Battery #1 Amps	A	RO	0-5000	0.01*Raw
42005	---	Battery #2 Amps	A	RO	0-5000	0.01*Raw
42006	---	Charger 2 AC Power Input	A	RO	0-3000	
42009	---	System Pressure (psi or bars)	PSI/Bars/kPA	RO	0-6000	0.1*Raw
42010	---	Suction Pressure (psi or bars)	PSI/Bars/kPA	RO	0-6000	0.1*Raw
42011	---	Water Temperature, Pump Casing	F°	RO	0-1000	0.1*Raw
42012	---	Pump Room Temperature	F°	RO	0-1000	0.1*Raw
42013	---	Storage Tank Level	% Full	RO	?	
42014	---	System Pressure at Pump Shutdown	PSI/Bars/kPA	RO	0-1000	0.1*Raw
		Controller Settings				
42050	---	Pressure Start	PSI/Bars/kPA	RO	0-600	
42051	---	Pressure Stop	PSI/Bars/kPA	RO	0-600	
42052	---	Manual Stop Only		RO	0 = Automatic, 1 = Manual Stop Only	
42053	---	Run Period Timer	Sec	RO	0-60000	
42054	---	Sequential Timer	Sec	RO	0-60000	
42055	---	Weekly Test Timer	Day of Week	RO	0-6 Day, Sunday = 0	
42056	---	Pressure Units		RO	0 = PSI, 1 = bar, 2 = kPA	

Table 14.3.2
Standardized Diesel Engine Controller Modbus Register Definitions (Modbus Registers 42000-42305)

Note: All Boolean values are positive true logic (logic high)

Register	Bit	Description	Units	Write	Range	Scaling and Notes
42057	---	Flow Units		RO	0=gpm, 1=L/min	
42058	---	Temperature Units		RO	0 = F°, 1 = C°	
		Alarms				
42100	D0	Minimum Run Delay Timing		RO	Boolean	
	D1	Power Fail Start Delay Timing		RO	Bool	
	D2	High Zone Delay Timing		RO	Bool	
	D3	Sequence Delay Timing		RO	Bool	
	D4	Engine Running		RO	Bool	
	D5	High Water Temp Alarm		RO	Bool	
	D6	Low Suction Alarm		RO	Bool	
	D7	Low Suction Shutdown Active		RO	Bool	
	D8	System Over Pressure Alarm		RO	Bool	
	D9	Overspeed Alarm		RO	Bool	
	D10	Weekly Test Demand Active		RO	Bool	
	D11	Failure to Start Alarm		RO	Bool	
	D12	Lockout Active		RO	Bool	
	D13	Crank on Battery #1		RO	Bool	
	D14	Crank on Battery #2		RO	Bool	
	D15	Crank Resting		RO	Bool	
42101	D0	Pressure Start Demand		RO	Bool	
	D1	Remote Start Demand		RO	Bool	
	D2	Deluge Start Demand		RO	Bool	
	D3	Weekly Test Start Demand		RO	Bool	
	D4	Start Contactor #1 Fail		RO	Bool	

Table 14.3.2
Standardized Diesel Engine Controller Modbus Register Definitions (Modbus Registers 42000-42305)

Note: All Boolean values are positive true logic (logic high)

Register	Bit	Description	Units	Write	Range	Scaling and Notes
	D5	Start Contactor #2 Fail		RO	Bool	
	D6	Audible Alarm		RO	Bool	
	D7	Weekly/Monthly Test Setup Error		RO	Bool	
	D8	Minimum Run Timed Out		RO	Bool	
	D9	Pump Demand		RO	Bool	
	D10	Control Switch in Auto		RO	Bool	
	D11	Control Switch in Manual		RO	Bool	
	D12	Pressure Transducer Fault		RO	Bool	
	D13	Pressure Transducer Test OK		RO	Bool	
	D14	AC Power Fail Start		RO	Bool	
	D15	Low Discharge Pressure Alarm		RO	Bool	
42102	D0	Battery #1 Failure Alarm		RO	Bool	
	D1	Battery #2 Failure Alarm		RO	Bool	
	D2	Pump Trouble Group Alarm		RO	Bool	
	D3	System Trouble #1 Alarm		RO	Bool	
	D4	AC Power Fail Alarm		RO	Bool	
	D5	Battery #2 Over Voltage Alarm		RO	Bool	
	D6	Battery #1 Over Voltage Alarm		RO	Bool	
	D7	Term 301, ECMS		RO	Bool	
	D8	Term 302, FIM		RO	Bool	
	D9	Term 303, ECMW		RO	Bool	
	D10	Term 304, ECMF		RO	Bool	
	D11	Term 310, RWHIT		RO	Bool	

Table 14.3.2 Standardized Diesel Engine Controller Modbus Register Definitions (Modbus Registers 42000-42305) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
	D12	Term 311, CRWCLS		RO	Bool	
	D13	Term 312, LET		RO	Bool	
	D14	Low Oil Pressure Alarm		RO	Bool	
	D15	Low Pump Room Temperature		RO	Bool	
42103	D0	Battery #1 in Equalize		RO	Bool	
	D1	Battery #2 in Equalize		RO	Bool	
	D2	Battery #1 OK		RO	Bool	
	D3	Battery #2 OK		RO	Bool	
	D4	Charger #1 Fail Alarm		RO	Bool	
	D5	Charger #2 Fail Alarm		RO	Bool	
	D6	System Trouble #2 Alarm		RO	Bool	
	D7	Engine Coolant Temperature High		RO	Bool	
	D8	High Reservoir Level		RO	Bool	
	D9	Low Reservoir Level		RO	Bool	
	D10	Fuel Tank Level Low		RO	Bool	
	D11	Fuel Tank Spill		RO	Bool	
	D12	High Fuel Tank		RO	Bool	
	D13	Relief Valve Open		RO	Bool	
	D14	Unused		RO	Bool	
	D15	Low Pump Room Temperature		RO	Bool	
		Historical Data				
42150		Minimum Battery #1 Voltage		RO	0-5000	0.01*Raw

Table 14.3.2 Standardized Diesel Engine Controller Modbus Register Definitions (Modbus Registers 42000-42305) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
42151		Minimum Battery #2 Voltage		RO	0-5000	0.01*Raw
42152		Maximum Battery #1 Voltage		RO	0-5000	0.01*Raw
42153		Maximum Battery #2 Voltage		RO	0-5000	0.01*Raw
42160		Minimum Battery #1 Amps		RO	0-1500	0.1*Raw
42161		Minimum Battery #2 Amps		RO	0-1500	0.1*Raw
42162		Maximum Battery #1 Amps		RO	0-1500	0.1*Raw
42163		Maximum Battery #2 Amps		RO	0-1500	0.1*Raw
42210		Minimum System Discharge Pressure	PSI/Bars/kPA	RO	0-6000	0.1*Raw
		Maximum System Discharge Pressure	PSI/Bars/kPA	RO	0-6000	0.1*Raw
42220		Start Count		RO	0-10000	
42221		Calls to Start Count		RO	0-10000	
42230		Total Run Time Hours	Hr	RO	0-599999	
42231		Total Run Time Minutes	Min	RO	0-59	
42232		Total Run Time Seconds	Sec	RO	0-59	
42233		Pump Last Run Time Minutes	Min	RO	0-59	
42234		Pump Last Run Time Seconds	Sec	RO	0-59	
42235		Total Controller Power On Time Hours	Hr	RO	0-599999	
42236		Total Controller Power On Time Minutes	Min	RO	0-59	
42237		Total Controller Power On Time Seconds	Sec	RO	0-59	

Table 14.3.2 Standardized Diesel Engine Controller Modbus Register Definitions (Modbus Registers 42000-42305) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
42238		Hours since last run	Hr	RO	?	
42239		Hours since last DVS test	Hr	RO	?	
42240		Last Engine Start Hr	Hr	RO	0-23	
42241		Last Engine Start Minute	Min	RO	0-59	
42242		Last Engine Start Second	Sec	RO	0-59	
42243		Last Engine Start Month	Mo	RO	1-12	
42244		Last Engine Start Day	Day	RO	1-31	
42245		Last Engine Start Year	Year	RO	1700-3000	
42250		Last Engine Overspeed Hr	Hr	RO	0-23	
42251		Last Engine Overspeed Minute	Min	RO	0-59	
42252		Last Engine Overspeed Second	Sec	RO	0-59	
42253		Last Engine Overspeed Month	Mo	RO	1-12	
42254		Last Engine Overspeed Day	Day	RO	1-31	
42255		Last Engine Overspeed Year	Year	RO	1700-3000	
42260		Last Charger Failure Hr	Hr	RO	0-23	
42261		Last Charger Failure Minute	Min	RO	0-59	
42262		Last Charger Failure Second	Sec	RO	0-59	
42263		Last Charger Failure Month	Mo	RO	1-12	
42264		Last Charger Failure Day	Day	RO	1-31	
42265		Last Charger Failure Year	Year	RO	1700-3000	
42270		Last Battery Trouble Hr	Hr	RO	0-23	

Table 14.3.2 Standardized Diesel Engine Controller Modbus Register Definitions (Modbus Registers 42000-42305) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
42271		Last Battery Trouble Minute	Min	RO	0-59	
42272		Last Battery Trouble Second	Sec	RO	0-59	
42273		Last Battery Trouble Month	Mo	RO	1-12	
42274		Last Battery Trouble Day	Day	RO	1-31	
42275		Last Battery Trouble Year	Year	RO	1700-3000	
42280		Last Low Fuel Level Hr	Hr	RO	0-23	
42281		Last Low Fuel Level Minute	Min	RO	0-59	
42282		Last Low Fuel Level Second	Sec	RO	0-59	
42283		Last Low Fuel Level Month	Mo	RO	1-12	
42284		Last Low Fuel Level Day	Day	RO	1-31	
42285		Last Low Fuel Level Year	Year	RO	1700-3000	
42290		Last Engine High Temperature Hr	Hr	RO	0-23	
42291		Last Engine High Temperature Minute	Min	RO	0-59	
42292		Last Engine High Temperature Second	Sec	RO	0-59	
42293		Last Engine High Temperature Month	Mo	RO	1-12	
42294		Last Engine High Temperature Day	Day	RO	1-31	
42295		Last Engine High Temperature Year	Year	RO	1700-3000	
42300		Last Engine Low Pressure Hr	Hr	RO	0-23	
42301		Last Engine Low Pressure Minute	Min	RO	0-59	

Table 14.3.2 Standardized Diesel Engine Controller Modbus Register Definitions (Modbus Registers 42000-42305) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes
42302		Last Engine Low Pressure Second	Sec	RO	0-59	
42303		Last Engine Low Pressure Month	Mo	RO	1-12	
42304		Last Engine Low Pressure Day	Day	RO	1-31	
42305		Last Engine Low Pressure Year	Year	RO	1700-3000	
		Remaining for Assignment				
		Minimum Transducer Pressure				Acceptance Test
		Pump Trouble #1 Input High				
		Pump Trouble #2 Input High				
		Pump Trouble #3 Input High				
		Pump Trouble #4 Input High				
		Pump Trouble #5 Input High				
		Pump Trouble #6 Input High				
		Pump Trouble #7 Input High				
		Pump Trouble #8 Input High				
		Aux Input #1, 0-100%				
		Aux Input #2, 0-100%				

Table 14.3.2 Standardized Diesel Engine Controller Modbus Register Definitions (Modbus Registers 42000-42305) Note: All Boolean values are positive true logic (logic high)						
Register	Bit	Description	Units	Write	Range	Scaling and Notes

Table 14.3.3
Standardized Electric Motor and Diesel Engine Controller Modbus Register Definitions for Jockey Pump
Status and Operation (Modbus Registers 42400-42432)

Note: All Boolean values are positive true logic (logic high)

Register	Bit	Description	Units	Write	Range	Scaling and Notes
42400	---	Jockey Pump System Discharge Pressure	PSI/Bars/kPA	RO	0-6000	0.1*Raw
42401	---	Jockey Pump Running			1 = Pump Running	
42402	---	Jockey Power Available			1 = Power Available	
		Controller Settings				
42410	---	Jockey Stop Pressure Setting	PSI/Bars/kPA	RO	0-600	
42411	---	Jockey Start Pressure Setting	PSI/Bars/kPA	RO	0-600	
42412	---	Jockey Pump Switch is in AUTO		RO	1 = Switch in AUTO	
42413	---	Jockey Pump Switch is in MANUAL		RO	1 = Switch in MANUAL	
42414	---	Jockey Pump Switch is in OFF		RO	1 = Switch in OFF	
42415	---	Pressure Units		RO	0 = PSI, 1 = bar, 2 = kPA	
		Alarms				
42420	---	Jockey Pump Failed to Start		RO	1 = Fail to Start	
42421	---	Jockey Pump Common Trouble		RO	1 = Common Trouble	
		Historical Data				
42430	---	Start Count		RO	0-10000	
42431	---	Total Jockey Run Time - Hours	Hr	RO	0-599999	
42432	---	Total Jockey Run Time - Minutes	Min	RO	0-59	

Table 14.3.4 Standardized Electric Motor and Diesel Engine Controller Modbus Register Definitions for Performance Data (Modbus Registers 42500-42920)																				
	Address offset	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19
	Data Description	Year	Mo	Day	Hr	Min	Sec	Flow Point %	Measured Flow	Pressure			RPM	Amperage			Voltage			Units
	Starting Address									Suction	Sys-Suct	System		L1	L2	L3	L1-L2	L2-L3	L1-L3	
Present Data	42500							0												
	42520							25												
	42540							50												
	42560							75												
	42580							100												
	42600							125												
	42620							150												
Previous Data	42640							0												
	42660							25												
	42680							50												
	42700							75												
	42720							100												
	42740							125												
	42760							150												
Acceptance Data	42780							0												
	42800							25												
	42820							50												
	42840							75												
	42860							100												
	42880							125												
	42900							150												

Table 14.3.4(a) Units and Value Range for Table 14.3.4				
Data	Range	Units	Write	Scale
Year	1700-3000	YR	RO	
Mo	1-12	Mo	RO	
Day	1-31	Day	RO	
Hr	0-23	Hr	RO	
Min	0-59	Min	RO	
Sec	0-59	Sec	RO	
% Flow Point	0-150	%	RO	
Measured Flow	0 - 50,000	GPM/LPM	RO	
Suction Pressure	0-6000	PSI/bar/kPA	RO	0.1 Raw
Sys-Suc Pressure*	0-6000	PSI/bar/kPA	RO	0.1 Raw
System Pressure	0-6000	PSI/bar/kPA	RO	0.1 Raw
RPM	0-5000	RPM	RO	
Amps L1	0-60000	A	RO	0.1*Raw
Amps L2	0-60000	A	RO	0.1*Raw
Amps L3	0-60000	A	RO	0.1*Raw
Volts L1-L2	0-50000	V	RO	0.1*Raw
Volts L2-L3	0-50000	V	RO	0.1*Raw
Volts L3-L1	0-50000	V	RO	0.1*Raw
Table Units	***	***	RO	
***0 = PSI, 1 = bar, 2 = kPA, 3 = PSI/GPM, LPM, 4 = bar/LPM, 5 = kPA/LPM				

Table 14.3.5 Event Log				
Data	Range	Units	Write	Format
Year	1700-3000	YR	RW	
Mo	1-12	Mo	RW	
Day	1-31	Day	RW	

4. If this proposal passes, modify the tables in the annex accordingly



Public Input No. 73-NFPA 20-2019 [New Section after 14.2.7.3]

TITLE OF NEW CONTENT 14.2.7.3.1

Type your content here ...

A Variable Speed Pump, when operating in the variable speed mode, shall not be required to run for a specific duration during each of the operations required in 14.2.7.2.

Statement of Problem and Substantiation for Public Input

The proposed revision eliminates the 5 minute minimum run when an ASD is used. Since there is virtually no inrush with an ASD, requiring a 5-minute run for cooling the motor is not necessary.

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

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Submittal Date: Mon Jun 24 11:21:37 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: The minute run time is necessary for the motor, not for the inrush current.



Public Input No. 21-NFPA 20-2019 [Section No. A.4.22.3.4(2)]

A.4.22.3.4(2 3)

See Figure A.4.22.3.4(2 3).

Figure A.4.22.3.4(2 3) Sample Pump Test Header Calculation.

SAMPLE PUMP TEST HEADER SIZE CALCULATION					
Pump size		1500			
Number of test hose streams		6			
Size of hose		2½			
Feet of hose per test hose		50			
Nozzle size		1.75			
Nozzle coefficient		0.97			
Pump test header pipe size		8.071			
C factor		120			
Pump Test Header Pipe Fittings	Type Fitting	Number	Equiv. Length	Total Equiv. Length	
	45°	1	9	9	
	E	1	18	18	
	LRE	0	13	0	
	T	1	35	35	
	BV	0	12	0	
	GV	1	4	4	
	SW	1	45	45	
Pump test header pipe length			30		
Total equivalent length			141		
Maximum test flow			2250		
Friction loss per ft in pipe			0.0392		
Total loss in pump test header pipe				5.5	
Flow in each hose			375		
Friction loss in 100 ft of hose			28.125		
Total friction loss in hose				14.1	
Equivalent pipe length 2½ in. valve			7		
Friction loss in 2½ in. pipe			0.4561		
Friction loss through 2½ in. valve				3.2	
Required pitot pressure				18	
Elevation difference				0	
Required pump discharge				40.8	

Statement of Problem and Substantiation for Public Input

Revises existing annex material to match change made by added item in PI-20

Related Public Inputs for This Document

Related Input

Relationship

Public Input No. 20-NFPA 20-2019 [Section No. 4.22.3.4 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: MIKE MOREY

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Submission Date: Fri Feb 01 12:20:17 EST 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-11-NFPA 20-2019](#)

Statement: Bullet two added to address the friction loss created by directional fittings as it can exceed friction loss due to long pipe lengths in the test header. Corrected the referenced table number.

**Public Input No. 46-NFPA 20-2019 [Section No. A.5.6]****A.5.6**

When trying to determine the pumping capability of the fire department, the concern is for the height of the building. There are some buildings that are so tall that it is impossible for the fire department apparatus to pump into the fire department connection at the street and overcome the elevation loss and friction loss in order to achieve 100 psi at the hose outlets up in the building. In these cases, the fire protection system in the building needs to have additional protection, including sufficient water supplies within the building to fight a fire and sufficient redundancy to be safe. Since fire departments all purchase different apparatus with different pumping capabilities, this standard has chosen to address this concern with performance-based criteria rather than a specified building height. Most urban fire departments have the capability of getting sufficient water at sufficient pressure up to the top of 200 ft (61 m) tall buildings. Some have the ability to get water as high as 350 ft (107 m). The design professional will need to check with the local fire department to determine its capability. The SFPE Engineering Guide: Fire Safety for Very Tall Buildings provides additional information on the design of water supply tanks and fire pumps for very tall buildings.

Statement of Problem and Substantiation for Public Input

Designing the water supply (water supply tanks, fire pumps) for very tall buildings can be very complicated. In addition to the information provided in A.5.6, the SFPE Engineering Guide: Fire Safety for Very Tall Buildings is a resource that provides engineers with information on how to design water supply for water-based fire suppression systems that are intended to be installed in very tall buildings.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 48-NFPA 20-2019 [Section No. E.1.2]	

Submitter Information Verification

Submitter Full Name: Chris Jelenewicz
Organization: SFPE
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City:
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Submittal Date: Sun Jun 16 06:42:16 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: [FR-47-NFPA 20-2019](#)
Statement: Reference SFPE Engineering Guide: Fire Safety for Very Tall Buildings.

**Public Input No. 74-NFPA 20-2019 [Section No. A.9.5.1.5]****A.9.5.1.5**

The locked rotor currents for ~~460 V~~ 230 V motors are approximately six times the full-load current.

Statement of Problem and Substantiation for Public Input

The proposed change is a correction to match Table 9.5.1.1(a)

Submitter Information Verification

Submitter Full Name: Megan Hayes

Organization: Nema

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Submittal Date: Mon Jun 24 11:25:35 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-92-NFPA 20-2019

Statement: The modification is a correction of text to match Table 9.5.1.1(a).



Public Input No. 75-NFPA 20-2019 [Section No. A.10.1.2.2]

A.10.1.2.2

The phrase *suitable for use* means that the controller and the transfer switch have been prototype tested and have demonstrated by those tests their short-circuit withstandability and interrupting capacity at the stated magnitude of short-circuit current and voltage available at their line terminals. (See ANSI/UL 218, Standard for Fire Pump Controllers, ANSI/UL 508, Standard for Industrial Control Equipment, and ANSI/UL 1008, Standard for Transfer Switch Equipment.)

A short-circuit study should be made to establish the available short-circuit current at the controller in accordance with IEEE 141, *Electric Power Distribution for Industrial Plants*, IEEE 241, *Electric Systems for Commercial Buildings*, or other acceptable methods.

After the controller and transfer switch have been subjected to a high fault current, they might not be suitable for further use without inspection or repair.

Statement of Problem and Substantiation for Public Input

UL 218 adds additional requirements to UL 508 for fire pump controllers.

Submitter Information Verification

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Submittal Date: Mon Jun 24 11:27:44 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-49-NFPA 20-2019](#)

Statement: UL 218 added as additional requirements to UL 508 for fire pump controllers.



Public Input No. 76-NFPA 20-2019 [New Section after A.10.4.5.7]

TITLE OF NEW CONTENT A.10.3.4.5.3.

Type your content here ...

If a redundant pump not required for fire protection is installed, the following should be considered in the implementation of an interlock:

- (1) The redundant pump is locked out by the pump running signal of the required pump after a time delay.
- (2) The pump running signal is based on measured motor current.
- (3) If a failure to start or motor overload occurs on the required pump, the redundant pump starts and locks out the required pump until manual reset.
- (4) Manual operation should not be affected.

Statement of Problem and Substantiation for Public Input

The proposed addition is a companion PI to the NEMA PI for 10.3.4.5.3*. The term lockout is used in 10.9.4. The proposed addition provides guidance for the AHJ if a lockout or interlock is allowed.

Submitter Information Verification

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Submittal Date: Mon Jun 24 11:30:17 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-24-NFPA 20-2019

Statement: Added lockout to allow lockout if approved by AHJ as the term in used in 10.9.4.

New annex adds guidance for the AHJ if a lockout or interlock is allowed as per
10.3.4.5.3.

**Public Input No. 77-NFPA 20-2019 [Section No. A.10.4.7]****A.10.4.7**

~~Where unusual conditions exist whereby pump operation is not certain, a “failed-to-operate” fire pump alarm is recommended.~~ In order to supervise the power source for the fire pump alarm circuit, the controller can be arranged to start upon failure of the supervised alarm circuit power.

Statement of Problem and Substantiation for Public Input

Since failure to start is now required in 10.5.2.7.5, failure to operate is no longer needed in the annex.

Submitter Information Verification

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Submittal Date: Mon Jun 24 11:36:46 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-51-NFPA 20-2019](#)

Statement: Since failure to start is now required in 10.5.2.7.5, failure to operate is no longer needed in the annex.

**Public Input No. 78-NFPA 20-2019 [Section No. A.10.5.4.2.1(1)]****A.10.5.4.2.1(1) —**

~~Although the pump is allowed to start and stop automatically during churn testing, 4.3.1 requires qualified person(s) to be in the pump room to monitor conditions while the pump is running.~~

Statement of Problem and Substantiation for Public Input

4.3.1 no longer requires personnel in the pump room when the pump is operating.

Submitter Information Verification

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Submittal Date: Mon Jun 24 11:38:48 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-52-NFPA 20-2019](#)

Statement: 4.3.1 no longer requires personnel in the pump room when the pump is operating.

**Public Input No. 81-NFPA 20-2019 [Section No. A.11.2.6.2]****A.11.2.6.2**

Terminations should be made using insulated ring-type compression connectors for post-type terminal blocks. Saddle-type terminal blocks should have the wire stripped with about 1/8 in. (1.6 mm) of bare wire showing after insertion in the saddle, to ensure that no insulation is below the saddle. Wires should be tugged to ensure adequate tightness of the termination. See Figure A11.2.6.2.1 and Table A11.2.6.2.2.

Additional Proposed Changes

File Name	Description	Approved
NEMA_Public_Input_2022_A11.2.6.2.docx	Diagram for New Tables A11.2.6.2.1 and Table A11.2.6.2.2	

Statement of Problem and Substantiation for Public Input

While diesel engine alarms are explained in general within Chapters 11 and 12, there is no reference to a wiring diagram or definition of standardized terminal numbering between the diesel engine and fire pump controller. Similar tables already exist in the diesel engine and fire pump controller standards however a field electrician or AHJ would not necessarily have reason to have those standards to reference. Adding this reference within the Annex of NFPA 20 should help clarify the purpose of each diesel engine terminal number, in order to avoid mis-wiring between the two pieces of equipment. It is important for this interconnect wiring to be installed correctly as it is the sole link for automatic starting of the diesel fire pump driver and alarming at the controller if any fault conditions arise.

Submitter Information Verification

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Submittal Date: Mon Jun 24 14:06:14 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: [FR-53-NFPA 20-2019](#)
Statement: References added to section for the wiring diagram of diesel engine and fire pump controller.

NFPA Public Input Form

NOTE: All Public Input must be received by 5:00 pm EST/EDST on the published Public Input Closing Date.

For further information on the standards-making process, please contact the Codes and Standards Administration at 617-984-7249 or visit www.nfpa.org/codes.

For technical assistance, please call NFPA at 1-800-344-3555

FOR OFFICE USE ONLY

Log #: _____

Date Rec'd: _____

Date _____ Name Megan Hayes Tel. No. _____

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Please indicate organization represented (if any) NEMA

1. (a) Title of NFPA Standard Standard for the Installation of Stationary Pumps for Fire Protection NFPA No. & Year 20-2019

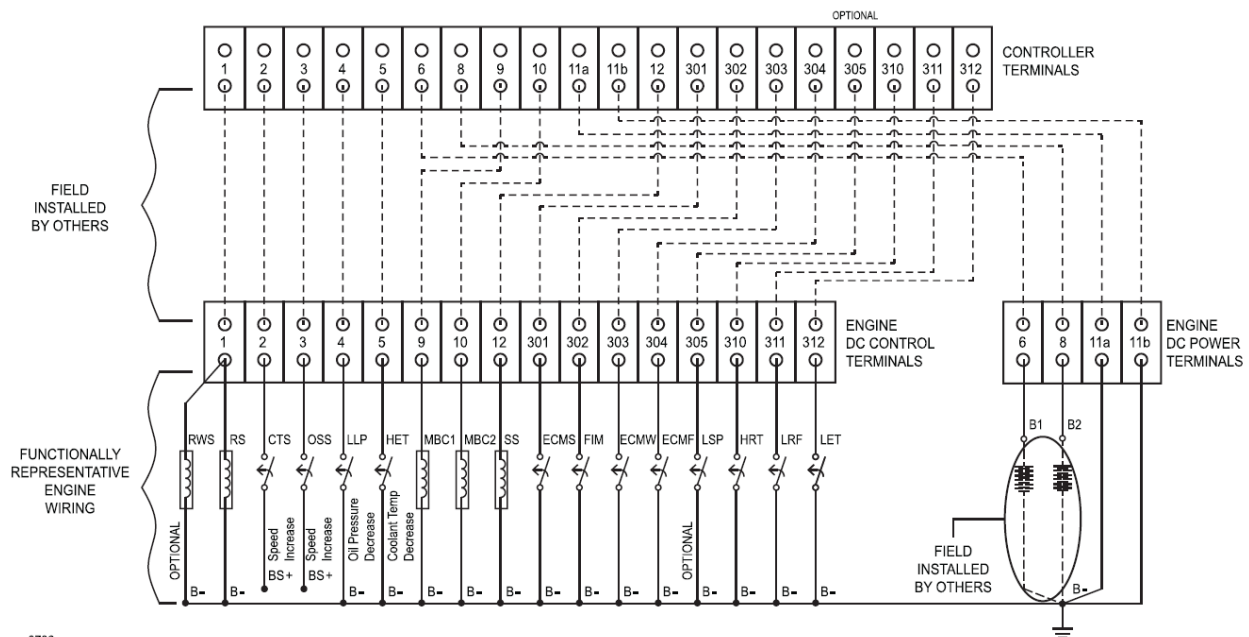
(b) Section/Paragraph A11.2.6.2

2. Public Input Recommends (check one): ☐ new text ☒ revised text ☐ deleted text

3. Proposed Text of Public Input (include proposed new or revised wording, or identification of wording to be deleted):

[Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~.)]

A11.2.6.2 Terminations should be made using insulated ring-type compression connectors for post-type terminal blocks. Saddle-type terminal blocks should have the wire stripped with about 1/16 in. (1.6 mm) of bare wire showing after insertion in the saddle, to ensure that no insulation is below the saddle. Wires should be tugged to ensure adequate tightness of the termination. See Figure A11.2.6.2.1 and Table A11.2.6.2.2



Legend	Description
B-	Common Battery 1 and 2 Negative
B1	Battery 1 Positive
B2	Battery 2 Positive
BS+	Battery System Positive
CTS	Crank Termination Switch
ECM	Electronic Control Module
ECMF	Electronic Control Module Failure
ECMS	Electronic Control Module Switch
ECMW	Electronic Control Module Warning
ETR	Energized To Run
ETS	Energized To Stop
FIM	Fuel Injection Malfunction
HET	High Engine Temperature
HRT	High Raw Water Temperature
LET	Low Engine Temperature
LLP	Low Lubricant Pressure
LRF	Low Raw Water Flow (Required by others)
LSP	Low Suction Pressure (Optional - required for variable speed suction limiting control engines)
MBC1	Main Battery Contactor 1 coil or Battery Relay 1 coil
MBC2	Main Battery Contactor 2 coil or Battery Relay 2 coil
OSS	Overspeed Switch
RS	Run Solenoid/Circuit
RWS	Raw Water Solenoid Valve (when used)
SS	Shutdown Solenoid/circuit

Figure A11.2.6.2.1 – Diesel Engine to Fire Pump Controller Terminal Wiring Diagram

Terminal	Diagram Circuit Function (as seen by terminal strip)
1	Receives battery positive from the fire pump controller (FPC) when the FPC acts to cause the engine to run. The FPC shall remove this battery positive upon receiving an overspeed signal on terminal #3. Optional RWS shall also be permitted to be connected to this terminal. (This circuit functions as a run circuit.) Note: ETR engines cannot run (except Manual Operation at engine) without this battery positive and will stop running when this battery positive from the FPC is removed.
2	Receives battery positive from the engine when engine speed reaches crank terminate speed. (Accomplished on increasing speed).
3	Receives battery positive from the engine when engine speed reaches an overspeed condition. This battery positive shall be maintained until a manual reset has been performed at the engine. (Accomplished on increasing speed).
4	Receives battery negative from the engine when engine lubricating pressure falls below a minimum pressure. (Accomplished on decreasing lubricating pressure while engine is running).
5	Receives battery negative from the engine when engine reaches excessively high coolant temperature. The engine shall open this circuit when the engine is not running. (Accomplished on increasing coolant temperature).
6	Receives B1 battery positive from the engine. The size of the wire shall be selected for both ampacity and resistance.
7	Reserved for future use. (not shown in figure)
8	Receives B2 battery positive from the engine. The size of the wire shall be selected for both ampacity and resistance.
9	Receives battery positive from the FPC when the FPC acts to cause the engine to crank utilizing B1. Connected to and provides battery positive to Battery Relay #1 which is used in the description for MBC1.
10	Receives battery positive from the FPC when the FPC acts to cause the engine to crank utilizing B2. Connected to and provides battery positive to Battery Relay #2 which is used in the description for MBC2.
11a	Receives common ground and common battery negative for both B1 and B2 from the engine.
11b	
12	Receives battery positive from the FPC when the FPC acts to cause the engine to stop running. This shall be connected to the SS on engines designed for ETS.
301	Receives battery negative from the engine when the ECM selector switch is in the alternate ECM position. Accomplished when the ECM's is transferred to the alternate ECM position for engines with ECM.
302	Receives battery negative from the engine when a FIM is identified by either ECM for engines fitted with ECM. (Accomplished on fuel injection malfunction).
303	Receives battery negative from engine when a single ECM fails for engines fitted with ECM.
304	Receives battery negative from the engine when both ECM's have failed for engines fitted with ECM.
305	Receives battery negative from engine when a low suction pressure is identified. (Accomplished on decreasing suction pressure). Note: Required for optional variable speed suction limiting control on engine.
306-309	Reserved for future use. (not shown in figure)
310	Receives battery negative from engine when the cooling -raw water temperature is too high. (Accomplished on increasing cooling -raw water temperature while engine is running).

311	Receives battery negative from engine when the cooling ^{raw} water strainer in the cooling loop becomes clogged or low flow is detected. Note: This feature is provided for some installations.
312	Receives battery negative from the engine when engine minimum temperature is not maintained. (Accomplished on decreasing engine temperature when the engine is not running).

Table A11.2.6.2.2 – Additional notes for Figure A11.2.6.2.1

4. Statement of Problem and Substantiation for Public Input: (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Public Input, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

While diesel engine alarms are explained in general within Chapters 11 and 12, there is no reference to a wiring diagram or definition of standardized terminal numbering between the diesel engine and fire pump controller. Similar tables already exist in the diesel engine and fire pump controller standards however a field electrician or AHJ would not necessarily have reason to have those standards to reference. Adding this reference within the Annex of NFPA 20 should help clarify the purpose of each diesel engine terminal number, in order to avoid mis-wiring between the two pieces of equipment. It is important for this interconnect wiring to be installed correctly as it is the sole link for automatic starting of the diesel fire pump driver and alarming at the controller if any fault conditions arise.

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To: Secretary, Standards Council National Fire Protection Association
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**Public Input No. 32-NFPA 20-2019 [New Section after A.11.6.4]****A.11.6.4.1**

In practice, many installations are managed to allow tank levels below 66 percent, in order to gain cost savings with larger volume fuel deliveries. By installing a larger tank than required, it is permissible to allow the tank to be drawn down to a level below 66 percent of total capacity, provided the remaining fuel volume meets the minimum requirement of 11.4.1.3.1.

It should also be noted that 1.1 gal per hp (5.58 L per kW) includes the additional 5 percent volume for expansion and 5 percent volume for sump required by 11.4.1.3.1.

Consideration should be given to limiting the tanks size to the minimum permitted where tanks are located outside or subject to extreme environmental conditions that could adversely impact the fuel quality if stored for extended periods. However the additional requirement of an active fuel maintenance system is intended to address the concerns with long term oil storage associated with oversized fuel tanks.

Statement of Problem and Substantiation for Public Input

Explanatory material to support proposed change to 11.6.4.1. The goal is to provide a compliant means to install oversized tanks for users to meet the intent of the standard and accept larger volume fuel deliveries.

Fuel stabilizers and location of tanks inside the pump room have alleviated concerns with fuel aging, which can result from the extended storage duration associated with larger fuel tanks. However, the proposed language incorporates a requirement for an active fuel maintenance system to address fuel oil aging associated with the slow contents turnover in an over-sized tank.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 31-NFPA 20-2019 [Section No. 11.6.4.1]	Supporting Annex Material
Public Input No. 31-NFPA 20-2019 [Section No. 11.6.4.1]	

Submitter Information Verification

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Submission Date: Tue Apr 09 10:00:58 EDT 2019
Committee: FIM-AAA

Committee Statement

Resolution: The size of the tank is irrelevant. All tanks must be maintained at 66% or above.

**Public Input No. 80-NFPA 20-2019 [New Section after A.12.3.3.1]****TITLE OF NEW CONTENT A 12.3.6.2**

Type your content here ...

See Figure A.11.2.6.2.1 for Diesel Engine-to-Fire Pump Controller Terminal Wiring Diagram and Table A.11.2.6.2.2 for Additional Notes for Figure A.11.2.6.2.1.

Statement of Problem and Substantiation for Public Input

While diesel engine alarms are explained in general within Chapters 11 and 12, there is no reference to a wiring diagram or definition of standardized terminal numbering between the diesel engine and fire pump controller. Similar tables already exist in the diesel engine and fire pump controller standards however a field electrician or AHJ would not necessarily have reason to have those standards to reference. Adding this reference within the Annex of NFPA 20 should help clarify the purpose of each diesel engine terminal number, in order to avoid mis-wiring between the two pieces of equipment. It is important for this interconnect wiring to be installed correctly as it is the sole link for automatic starting of the diesel fire pump driver and alarming at the controller if any fault conditions arise

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Committee: FIM-AAA

Committee Statement

Resolution: FR-91-NFPA 20-2019

Statement: References added to section for the wiring diagram of diesel engine and fire pump controller.



Public Input No. 104-NFPA 20-2019 [Chapter C]

Annex C Fire Pump 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 related to data storage and data access of information related to fire pump 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 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 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, 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.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 that includes microcontrollers and associated firmware.

C.2.3 Cloud.

The system of 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 4-8 bit (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 version. Most of the current 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) 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 that is more advanced than RS-232 It allows connection to multiple pieces of equipment. Many serial protocols, such as 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, LonWorks, BacNet, and CAN bus.

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

The protocol used for most of the Internet including 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 the USB connection on personal devices (computers and so forth).

C.2.26 User.

The person or entity who accesses or desires to access a fire pump controller(s) [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 Stand-alone 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

Modern fire pump controllers are almost all universally stand-alone 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 or a USB 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 modem, serial port or USB 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 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 (USB or other) via a computer (laptop, tablet, and so forth), smartphone, or 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) 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. 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 horses, and so forth, despite installed antivirus 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 page ("spoofing"), or used to gather data.

C.4.4.3

Web servers can also become infected and be forced to use hosted 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 C.4.5.1 and 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.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 Δ percent change during pump run with Δ adjustable up to 5 percent
- (3) Pressure every hour
- (4) Pressure value exceeding Δ percent change with Δ 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

Data	Information Source	Data Accessible to						Independent Third-Party Analysis
		Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer	Diesel Engine Manufacturer		
Fire pump manufacturer	M		X	X	X	X		X
Fire pump type	M		X	X	X	X		X
Rated flow	M		X	X	X	X		X
Rated pressure	M		X	X	X	X		X
Rated speed	M		X	X	X	X		X
Horsepower	M		X	X	X	X		X
Factory test pressure	M		X	X	X	X		X
Net churn pressure	M		X	X	X	X		X
Net 150 percent pressure	M		X	X	X	X		X
Pump start pressure	M		X	X	X	X		X
Pump shutoff pressure	M		X	X	X	X		X
Design suction pressure	M	X	X	X	X	X		X
Design discharge pressure	M	X	X	X	X	X		X
Electric motor manufacturer	M		X	X	X	X		X
Electric motor type	M		X	X	X	X		X
Electric motor serial number	M		X	X	X	X		X
Electric motor model number	M		X	X	X	X		X
Electric motor date in service	M		X	X	X	X		X
Nominal system voltage	M		X	X	X	X		X
Electric motor horsepower	M		X	X	X	X		X
Electric motor rated speed	M		X	X	X	X		X

Data	Information Source	Data Accessible to					Independent Third-Party Analyst
		Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer	Diesel Engine Manufacturer	
Motor rated FLA at the system nominal voltage	M		X	X	X	X	X
Motor service factor	M		X	X	X	X	X
Motor starting code	M		X	X	X	X	X
Diesel engine manufacturer	M		X	X	X	X	X
Diesel engine serial number	M		X	X	X	X	X
Diesel engine model number	M		X	X	X	X	X
Diesel engine date in service	M		X	X	X	X	X
Diesel engine horsepower	M		X	X	X	X	X
Diesel engine rated speed	M		X	X	X	X	X
Controller manufacturer	M		X	X	X	X	X
Controller type	M		X	X	X	X	X
Controller serial number	M		X	X	X	X	X
Controller model number	M		X	X	X	X	X
Controller date in service	M		X	X	X	X	X
Jockey pump manufacturer	M		X	X	X	X	X
Jockey pump type	M		X	X	X	X	X
Jockey pump serial number	M		X	X	X	X	X
Jockey pump model number	M		X	X	X	X	X

Data	Information Source	Data Accessible to					Independent Third-Party Analysis
		Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer	Diesel Engine Manufacturer	
Jockey pump date in service	M		X	X	X	X	X
Jockey pump horsepower	M		X	X	X	X	X
Jockey pump start pressure	M		X	X	X	X	X
Jockey pump shutoff pressure	M		X	X	X	X	X
Jockey pump controller manufacturer	M		X	X	X	X	X
Jockey pump controller manufacturer	M		X	X	X	X	X
Jockey pump controller type	M		X	X	X	X	X
Jockey pump controller serial number	M		X	X	X	X	X
Jockey pump controller model number	M		X	X	X	X	X
Jockey pump controller date in service	M		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

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-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

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

Data Accessible to							
Data	Information Source	Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Diesel Engine Manufacturer	Controller Manufacturer	Independent Third-Party Status Analysis
Fuel maintenance system status	A	X	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

Time-Stamped Data Multiple Data Sets ¹	Data Accessible to						Independent Third-Party Analyst
	Information Source	Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer	Diesel Engine Manufacturer	
Test Data							
Test date	A		X	X	X	X	2
Test reference identifier	A		X	X	X	X	2
Data set reference identifier	A		X	X	X	X	2
Suction pressure	A		X	X	X	X	2
System pressure	A		X	X	X	X	2
Water temperature in pump casing	A		X	X	X	X	2
Room temperature	A		X	X	X	X	2
Pump started	A		X	X	X	X	2
Pressure at pump start	A		X	X	X	X	2
Type of start (automatic demand, automatic test, manual)	A		X	X	X	X	2
Pump shutdown	A		X	X	X	X	2
System pressure at pump shutdown	A		X	X	X	X	2
Type of shutdown (automatic demand, automatic test, manual)	A		X	X	X	X	2
Loss of power	A		X	X	X	X	2
Transfer of power	A		X	X	X	X	2
Test date	A		X	X	X	X	2
RPM	A		X	X	X	X	2
Voltage phase A – B	A		X	X	X	X	2
Voltage phase B – C	A		X	X	X	X	2

Time-Stamped Data Multiple Data Sets ¹	Information Source	Data Accessible to					Diesel Engine Manufacturer	Independent Third-Party Analysis
		Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer			
Voltage phase C – C	A		X	X	X		X	2
Amperage phase 1	A		X	X	X		X	2
Amperage phase 2	A		X	X	X		X	2
Amperage phase 3	A		X	X	X		X	2
Suction pressure	A		X	X	X		X	2
Discharge pressure	A		X	X	X		X	2
Net pressure	A		X	X	X		X	2
Minimum transducer pressure	A		X	X	X		X	2
Nozzle 1 coefficient	M		X	X	X		X	2
Nozzle 1 size	M		X	X	X		X	2
Nozzle 1 pitot	M/A		X	X	X		X	2
Nozzle 2 coefficient	M		X	X	X		X	2
Nozzle 2 size	M		X	X	X		X	2
Nozzle 2 pitot	M/A		X	X	X		X	2
Nozzle 3 coefficient	M		X	X	X		X	2
Nozzle 3 size	M		X	X	X		X	2
Nozzle 3 pitot	M/A		X	X	X		X	2
Nozzle 4 coefficient	M		X	X	X		X	2
Nozzle 4 size	M		X	X	X		X	2
Nozzle 4 pitot	M/A		X	X	X		X	2
Nozzle 5 coefficient	M		X	X	X		X	2
Nozzle 5 size	M		X	X	X		X	2
Nozzle 5 pitot	M/A		X	X	X		X	2
Nozzle 6 coefficient	M		X	X	X		X	2
Nozzle 6 size	M		X	X	X		X	2
Nozzle 6 pitot	M/A		X	X	X		X	2
Fuel tank level	A		X				X	2
RPM	A		X	X	X		X	2

Time-Stamped Data Multiple Data Sets ¹	Information Source	Data Accessible to					Diesel Engine Manufacturer	Independent Third-Party Analysis
		Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer			
Analysis Data								
Flow through pump	C		X	X	X		X	2
RPM								
adjusted net pressure	C		X	X	X		X	2
RPM								
adjusted flow	C		X	X	X		X	2
Percentage of factory certified curve	C		X	X	X		X	2
Hours on diesel engine or electric motor	A		X	X	X		X	2
Maximum system flow demand (at pump discharge flange)	M		X	X	X		X	2
Maximum system pressure demand (at pump discharge flange)	M		X	X	X		X	2
Pump passed initial test	M		X	X	X		X	2
Pump could supply maximum system demand	M		X	X	X		X	2
Pump was significantly impaired	M		X	X	X		X	2
Pump was partially impaired	M		X	X	X		X	2
Pump passed after adjustments	M		X	X	X		X	2
Failure mode	M		X	X ²	X ³		X ⁴	2
Explanation of failure	M		X	X ²	X ³		X ⁴	2
Part replaced (1)	M		X	X ²	X ³		X ⁴	2
Part replaced (2)	M		X	X ²	X ³		X ⁴	2

Time-Stamped Data Multiple Data Sets ¹	Information Source	Data Accessible to					Diesel Engine Manufacturer	Independent Third-Party Analysis
		Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer			
Part replaced (3)	M		X	X ²	X ³		X ⁴	C
Part replaced (4)	M		X	X ²	X ³		X ⁴	C
Description of maintenance, repair, and/or part replacement	M		X	X ²	X ³		X ⁴	C
Routine maintenance or repair	M		X	X ²	X ³		X ⁴	C
Date and time repair completed	M		X	X ²	X ³		X ⁴	C

A: 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 can be able to record automatically.

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 5 data sets for constant speed pumps and 7 data sets for variable speed pumps.

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

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

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

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 maintenance.

Table C.9.2.5 Recommended Maintenance Data

Data	Information Source	Data Accessible to				
		Supervision Monitoring	Performance Monitoring	Fire Pump Manufacturer	Controller Manufacturer	Diesel Engine Manufacturer
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 ¹	X ²	X ³
Explanation of failure	M		X	X ¹	X ²	X ³
Part replaced (1)	M		X	X ¹	X ²	X ³
Part replaced (2)	M		X	X ¹	X ²	X ³
Part replaced (3)	M		X	X ¹	X ²	X ³
Part replaced (4)	M		X	X ¹	X ²	X ³
Description of maintenance/repair	M		X	X ¹	X ²	X ³
Routine maintenance or repair	M		X	X ¹	X ²	X 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: 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.

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

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

³For 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(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.

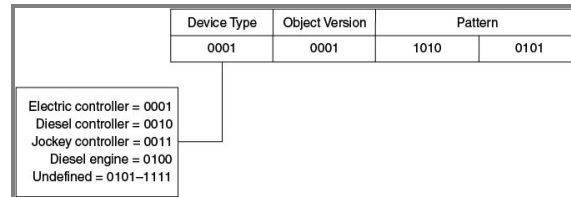


Table C.9.2.10.1(a) Pump Room Data Storage Structure

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
42051–42060		Software version			RO	ASCII Text	20 characters

Modbus Register (42001–42290)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
		Time and Date Stamp					
42061–42064		Date and time	milliseconds		RO	64-bit binary number	See Note 3
42065–42070		Undefined			RO		
		Alarms					
42071	D0	AC power available			RO	Boolean	See Note 4
	D1	Audible alarm (common alarm)			RO	Bool	
	D2	Phase failure alarm			RO	Bool	
	D3	Phase reversal alarm			RO	Bool	
	D4	Motor running alarm			RO	Bool	
	D5	Motor single phasing alarm			RO	Bool	
	D6	Motor overload alarm			RO	Bool	
	D7	Failure to start alarm			RO	Bool	
	D8	Circuit breaker tripped alarm			RO	Bool	
	D9	AC line under voltage alarm			RO	Bool	
	D10	AC line over voltage alarm			RO	Bool	
	D11	AC line under frequency alarm			RO	Bool	
	D12	AC line over frequency alarm			RO	Bool	
	D13	Low pump room temperature alarm		X	RO	Bool	
	D14	Undefined			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	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	

Modbus Register (42001–42290)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
	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	
	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	

Modbus Register (42001–42290)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
	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					
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	0–10000	0.1·Raw
42105		Flow	gpm/L/ min	X	RO	0–50000	
42106		Motor speed	rpm	X	RO	0–4000	
42107		VFD motor speed	Hz	X	RO	0–1000	0.1·Raw
42108–42110		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	0–10,000,0000	
42115–42130		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	

Modbus Register (42001–42290)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
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		Maximum starting current line A	A	X	RO	0–30000	0.1·Raw
42152		Maximum starting current line B	A	X	RO	0–30000	0.1·Raw
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

Modbus Register (42001–42290)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
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					
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					

Modbus Register (42001–42290)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
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

Modbus Register (42001–42280)	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
42051–42060		Software version			RO	ASCII Text	20 characters
		Time and Date Stamp					
42061–42064		Date and time	milliseconds		RO	64-bit binary number	See Note 3
42065–42070		Undefined			RO		
		Alarms					
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	

Modbus Register (42001–42280)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
	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	
	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	

Modbus Register (42001–42280)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
	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	
	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	

Modbus Register (42001–42280)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
	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	
	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

Modbus Register (42001–42280)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
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	
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					

Modbus Register (42001–42280)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
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	
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

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

Modbus Register (42291–42430)	Bit	Description	Units	Optional (X)	Write	Range (See Note 1)	Scaling and Notes
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
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

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
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

Modbus Register (42461–42490)	Description	Units	Write	Range	Scaling and Notes
42461	Rewind event log oldest		RO		Read register to rewind
42462	Rewind event log 1 day ago		RO		Read register to rewind
42463	Rewind event log 7 days ago		RO		Read register to rewind
42464	Rewind event log 30 days ago		RO		Read register to rewind
42465	Rewind event log 60 days ago		RO		Read register to rewind
42466	Rewind event log 90 days ago		RO		Read register to rewind
42467–42470	Undefined				
42471–42473	Date and time stamp	milliseconds	RO	64-bit binary number	See Note 2
42474	Event ID		RO	1–250	See ID Table C.9.2.10.1(j) Event ID = 0 is EOF

Modbus Register (42461–42490)	Description	Units	Write	Range	Scaling and Notes
42475	Event value1	psi/bar/kPa	RO	0–6000	0.1·Raw
42476	Flags, event value1				
42477–42480	Undefined				
42481–42490	Manufacturer configurable			10 registers	
42491–42500	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(h) Electric Event Messages

ID	Event Message
1	Pump Running
2	Pump Stopped
3	Fail to Start
4	Fail to Start Noted
5	Call to Start
6	Locked Rotor Trip
7	Rotor Trip Clear
8	Over Voltage
9	Over Frequency
10	Under Voltage
11	Under Frequency
12	Voltage Imbalance
13	Phase Failure
14	Phase Reversal
15	Current >320% FLA
16	Motor Overload
17	Nominal Voltage
18	Voltage Balanced
19	Nominal Frequency
20	Phase Nominal
21	Phase Sequence
22	Nominal Current
23	Motor Normal
24	Interlock On
25	Interlock Off
26	Deluge Open
27	Deluge Closed
28	Low Pressure
29	Normal Pressure
30	Manual Stop Button
31	Manual Stop Released
32	Power Transferred

ID	Event Message
33	Power Re-Transferred
34	Control Voltage OK
35	No Control Voltage
36	Load Disconnect
37	Load Reconnect
38	Local Start Input
39	Local Start Clear
40	Remote Start Input
41	Remote Start Clear
42	Emergency Run On
43	Emergency Run Off
44	Emergency Isolation Switch On
45	Emergency Isolation Switch Off
46	Soft Start Over Temp Bypass
47	Soft Start Over Temp Normal
48	Motor Start Checked
49	Pressure Fail
50	Pressure in Range
51	Pressure Log
52	Pressure Log Run
53	Database Clear
54	System Reset
55	Data Log Cleared
56	Low Suction Pressure
57	Suction Pressure OK
58	Reservoir Low
59	Reservoir OK
60	Low Pump Room Temp
61	Pump Room Temp OK
62	Pump Room Trouble
63	Pump Room Normal
64	Min Start Volts
65	Max Start Current
66	Load Shed
67	Load Restored
68	Weekly Test Running
69	Weekly Test Done
70	Parameters Reset
71	Passwords Reset
72	Low Suction Level
73	Suction Level OK
74	Automatic Start
75	Automatic Start Clear
76	Calibration Error
77	Calibration Error Cleared
78	Test In Progress
79	Test Completed

ID	Event Message
80	Jockey Pump Running
81	Jockey Pump Off
82	Jockey Pump Trouble
83	Jockey Pump OK
84	Emergency Stop
85	Emergency Stop Released
86	VFD Bypass
87	VFD Active
88	VFD Failure
89	VFD Failure Clear
90	System Overpressure
91	System Pressure OK
92	Weekly Test Due
93	Weekly Test Due Clear
94	Softstarter Fault
95	Softstarter Ok
96	VFD Ready
97	VFD Not Ready
98	Shunt Trip Normal
99	Shunt Trip Emergency
100	Flow Meter On
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

ID	Event Message
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ID	Event Message
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
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

ID	Event Message
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
63	Calibration Error
64	Calibration Error Cleared
65	No Control Voltage
66	Control Voltage OK
67	Missing Battery
68	Missing Battery OK
69	AC Power Lost
70	AC Power Restored
71	Test In Progress
72	Test Completed
73	Automatic Start
74	Automatic Start Clear
75	Low Suction Level
76	Suction Level OK
77	Main Switch Off
78	Main Switch Auto
79	Main Switch Manual
80	Jockey Pump Running
81	Jockey Pump Off
82	Jockey Pump Trouble
83	Jockey Pump OK
84	Battery 1 Out
85	Battery 1 Out Off
86	Battery 2 Out
87	Battery 2 Out Off
88	Charger 1 Out
89	Charger 1 Out Off
90	Charger 2 Out
91	Charger 2 Out Off
92	Weekly Test Due
93	Weekly Test Due Clear
94	System Overpressure

ID	Event Message
95	System Pressure OK
96	Fuel Injector Fail
97	Fuel Injector OK
98	Coil Continuity 1 Fail
99	Coil Continuity 2 Fail
100	AC Power Loss Start
101	AC Voltage High
102	AC Voltage Normal
103	AC Voltage Low
104	AC Power Loss Delay
105	Fuel Valve Relay Status
106	Low Pressure Sensor
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

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

Table C.9.2.10.1(j) Jockey Event Messages

ID	Event Message
1	Pump Running

ID	Event Message
2	Pump Stopped
3	Fail to Start
4	Fail to Start Noted
5	Call to Start
6	Phase Failure
7	Phase Reversal
8	Motor Overload
9	Motor Normal
10	Low Pressure
11	Normal Pressure
12	Pressure Fail
13	Pressure in Range
14	Pressure Log
15	Pressure Log Run
16	System Reset
17	Parameters Reset
18	Passwords Reset
19	Automatic Start
20	Automatic Start Clear
21	Main Switch Off
22	Main Switch Auto
23	Main Switch Manual
24	System Overpressure
25	System Pressure OK
26	Auto Start Input Off
27	Pressure Delta
28	Mode Off Off
29	Mode Auto Off
30	Mode Manual Off
31–250	Undefined

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

	Address Offset	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
	Data Description	Year	Mo	Day	Hr	Min	Sec	Flow Point	Measured Flow	System Pressure	Suction Pressure	Sys–Suc Pressure
	Starting Address											
Present Data Table	42501	42501						0				
	42521	42521						25				
	42541	42541						50				
	42561	42561						75				
	42581	42581						100				
	42601	42601						125				
	42621	42621						150				

	Address Offset	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
	Data Description	Year	Mo	Day	Hr	Min	Sec	Flow Point	Measured Flow	System Pressure	Suction Pressure	Sys–Suc Pressure
	Starting Address											
Previous Data Table	42641	42641						0				
	42661	42661						25				
	42681	42681						50				
	42701	42701						75				
	42721	42721						100				
	42741	42741						125				
	42761	42761						150				
Acceptance Data Table	42781	42781						0				
	42801	42801						25				
	42821	42821						50				
	42841	42841						75				
	42861	42861						100				
	42881	42881						125				
	42901	42901						150				

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(l) Pump Curve Parameters

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

Offset	Data Description	Range	Units	Write	Scale
+18	Table units		0 = psi, 1 = bar, 2 = kPa	RO	
+19	Table units		0 = gpm, 1 = L/min	RO	

*Net pressure calculation.

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

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

C.9.2.10.2

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(c) is beyond what should be included in a fire pump controller, a stand-alone device could be developed to handle the information in this table. The data in 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

Reference Name	Format	Possible Values			
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

Category	Item	Format	Possible Values
	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

Data	Format	Possible Values	Permanent, Static, Dynamic
Type of record	String(48)	FIRE PUMP (FP) RECORD	—
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	–900° 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	
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, or passed but needs attention	Character	(P) Passed	—
		(F) Failed	
		(A) Passed but needs attention	
Passed visual inspection	Character	(Y) Yes	—
		(N) No	
		(A) Not applicable	
Maintenance required	Number	Number ≥ 0	—
Maintenance done	Character	(1) Not applicable	—
		(2) Completed	
		(3) Ordered but not completed	
		(4) Not ordered	
End of item record marker	String(16)	RECORD END	—
End of ITM (all components reported)	String(48)	END OF INSPECTION, TEST, AND MAINTENANCE REPORT	—

Data	Format	Possible Values	Permanent, Static, Dynamic
Basic information (should be supplied by the fire pump package integrator)	—	—	—
Start fire pump info	String(16)	START BASIC FP	—
Fire pump type	String(40)	—	P
Rated flow	Number	≥0	P
Rated pressure	Number	≥0	P
Rated speed	Number	≥0	P
Rated horsepower	Number	≥0	P
Factory test pressure	Number	≥0	P
Design net churn pressure	Number	≥0	P
Design net 150% pressure	Number	≥0	P
Pump start pressure	Number	≥0	S
Pump reset pressure	Number	≥0	S
Design suction pressure	Number	≥0	S
Design discharge pressure	Number	≥0	S
Maximum system flow demand (at pump discharge flange)	Number	≥0	P
Maximum system pressure demand (at pump discharge flange)	Number	≥0	P
End fire pump info	—	END BASIC FP	—
Start fire pump motor	—	START FP MOTOR	—
Electric motor manufacturer	String(40)	Alphanumeric	P
Electric motor type	String(40)	Alphanumeric	P
Electric motor serial number	String(40)	Alphanumeric	P
Electric motor model number	String(40)	Alphanumeric	P
Electric motor date in service	Date	Date	P
Nominal system voltage	Number	≥0	P
Electric motor rated horsepower	Number	≥0	P
Electric motor rated speed	Number	≥0	P
Motor rated FLA at the system nominal voltage	Number	≥0	P
Motor service factor	Number	≥0	P
Motor starting code	Character	—	P
Nameplate full load amps	Number	≥0	P
End fire pump motor	—	END FP MOTOR	—
Start diesel engine	—	START DIESEL ENG	—
Diesel engine manufacturer	String(40)	Alphanumeric	P
Diesel engine serial number	String(40)	Alphanumeric	P
Diesel engine model number	String(40)	Alphanumeric	P
Diesel engine date in service	Date	Date	P
Diesel engine rated horsepower	Number	≥0	P
Diesel engine rated speed	Number	≥0	P
End diesel engine	—	END DIESEL ENG	—
Start FP controller	—	START FP CONTROL	—
Controller manufacturer	String(40)	Alphanumeric	P
Controller type	String(40)	Alphanumeric	P
Controller serial number	String(40)	Alphanumeric	P

Data	Format	Possible Values	Permanent, Static, Dynamic
Controller model number	String(40)	Alphanumeric	P
Controller date in service	Date	Date	P
End FP controller	—	END FP CONTROL	—
Start jockey pump	—	START JOCKEY	—
Jockey pump manufacturer	String(40)	Alphanumeric	P
Jockey pump type	String(40)	Alphanumeric	P
Jockey pump serial number	String(40)	Alphanumeric	P
Jockey pump model number	String(40)	Alphanumeric	P
Jockey pump date in service	Date	Date	S
Jockey pump horsepower	Number	≥0	P
Jockey pump start pressure	Number	≥0	S
Jockey pump reset pressure	Number	≥0	S
Jockey pump controller manufacturer	String(40)	Alphanumeric	P
Start jockey pump	—	END JOCKEY	—
Start jockey pump controller	—	START JP CONTROL	—
Jockey pump controller type	String(40)	Alphanumeric	P
Jockey pump controller serial number	String(40)	Alphanumeric	P
Jockey pump controller model number	String(40)	Alphanumeric	P
Jockey pump controller date in service	Date	Date	P
End jockey pump	—	END JP CONTROL	—
Start fire pump status	—	START FP STATUS	—
From controller	—	—	—
AC volts lines 1–2	Number	Number ≥0	D
AC volts lines 2–3	Number	Number ≥0	D
AC volts lines 3–1	Number	Number ≥0	D
AC amps line 1	Number	Number ≥0	D
AC amps line 2	Number	Number ≥0	D
AC amps line 3	Number	Number ≥0	D
Battery #1 volts	Number	≥0	D
Battery #2 volts	Number	≥0	D
UNUSED	Number	≥0	D
Battery #1 amps	Number	≥0	D
Battery #2 amps	Number	≥0	D
UNUSED	Number	≥0	D
System pressure (psi or bar)	Number	Number ≥0	D
Suction pressure (psi or bar)	Number	Number ≥0	D
VFD speed (Hz)	Number	Number ≥0	D
Aux input #1, 0–100%	Number	Number ≥0	D
Aux input #2, 0–100%	Number	Number ≥0	D
DESCRIPTION ALARM ON STATE	—	—	—
From controller alarm register #1	—	—	—
Minimum run delay timing high	Character	Y or N	D
Accelerate delay timing high	Character	Y or N	D
High zone delay timing high	Character	Y or N	D
Sequence delay timing high	Character	Y or N	D
Load shed active high	Character	Y or N	D

Data	Format	Possible Values	Permanent, Static, Dynamic
Power fail start delay timing high	Character	Y or N	P
High zone delay timing high	Character	Y or N	P
Sequence delay timing high	Character	Y or N	P
Engine running high	Character	Y or N	P
High water temp alarm high	Character	Y or N	P
Low discharge pressure alarm high	Character	Y or N	D
Low suction alarm high	Character	Y or N	D
Low suction shutdown active high	Character	Y or N	D
System overpressure alarm high	Character	Y or N	D
Restart delay timing high	Character	Y or N	D
Weekly test demand active high	Character	Y or N	D
Failure-to-start alarm high	Character	Y or N	D
Lockout active high	Character	Y or N	D
Crank on battery #1 high	Character	Y or N	P
Crank on battery #2 high	Character	Y or N	P
Resting high	Character	Y or N	P
Alarm register #2	Character	Y or N	—
VFD ready high	Character	Y or N	D
VFD forward command active high	Character	Y or N	D
VFD reverse command active high	Character	Y or N	D
Alarm register #2	Character	Y or N	D
Pressure start demand high	Character	Y or N	D
Remote start demand high	Character	Y or N	D
Deluge start demand high	Character	Y or N	D
Weekly test start demand high	Character	Y or N	D
Local start PB demand high	Character	Y or N	D
Manual operator start demand high	Character	Y or N	D
Audible alarm high	Character	Y or N	D
Weekly/monthly test setup error high	Character	Y or N	D
Minimum run timed out high	Character	Y or N	D
Load shed delay timing high	Character	Y or N	D
Mod SP½ power OK high	Character	Y or N	D
Mod SP½ power loss start high	Character	Y or N	D
Start contactor #1 fail high	Character	Y or N	P
Start contactor #2 fail high	Character	Y or N	P
Audible alarm high	Character	Y or N	P
Weekly/monthly test setup error high	Character	Y or N	P
Minimum run timed out high	Character	Y or N	P
Pump demand high	Character	Y or N	P
Control switch in auto high	Character	Y or N	P
Control switch in manual high	Character	Y or N	P
Pressure transducer fault high	Character	Y or N	D
Pressure transducer test OK high	Character	Y or N	D
VFD failure high	Character	Y or N	D
Controller in bypass mode, soft start/VFD only high	Character	Y or N	D

Data	Format	Possible Values	Permanent, Static, Dynamic
Alarm register #3	Character	Y or N	D
Timed trip timing high	Character	Y or N	D
Motor running high	Character	Y or N	D
Motor overload alarm high	Character	Y or N	D
Motor single phasing alarm high	Character	Y or N	D
Phase reversal alarm high	Character	Y or N	D
AC voltage low alarm high	Character	Y or N	D
Phase smart protection lockout high	Character	Y or N	D
Transfer switch in normal position high	Character	Y or N	D
Transfer switch in emergency position high	Character	Y or N	D
AC power available high	Character	Y or N	D
AC power fail start high	Character	Y or N	D
Low discharge pressure alarm high	Character	Y or N	D
Alarm register #3	Character	Y or N	D
Battery #1 failure alarm high	Character	Y or N	D
Battery #2 failure alarm high	Character	Y or N	D
Pump trouble group alarm high	Character	Y or N	D
System trouble #1 alarm high	Character	Y or N	D
AC power fail alarm high	Character	Y or N	D
Battery #1 overvoltage alarm high	Character	Y or N	D
Battery #2 overvoltage alarm high	Character	Y or N	D
Term 301, ECMS high	Character	Y or N	D
Term 302, FIM high	Character	Y or N	D
Term 303, ECMW high	Character	Y or N	D
Term 304, ECMF high	Character	Y or N	D
Term 310, RWHIT high	Character	Y or N	D
Term 311, CRWCLS high	Character	Y or N	D
Term 312, LET high	Character	Y or N	D
Low oil pressure alarm high	Character	Y or N	D
Transfer switch normal power available high	Character	Y or N	D
Transfer switch emergency power available high	Character	Y or N	D
Emergency CB open high	Character	Y or N	D
CB tripped high	Character	Y or N	D
Engine start signal low	Character	Y or N	D
UNUSED	Character	Y or N	D
Alarm register #4	Character	Y or N	D
Pump trouble #1 input high	Character	Y or N	D
Pump trouble #2 input high	Character	Y or N	D
Pump trouble #3 input high	Character	Y or N	D
Pump trouble #4 input high	Character	Y or N	D
Pump trouble #5 input high	Character	Y or N	D
Pump trouble #6 input high	Character	Y or N	D
Pump trouble #7 input high	Character	Y or N	D
Pump trouble #8 input high	Character	Y or N	D

Data	Format	Possible Values	Permanent, Static, Dynamic
Pump trouble group alarm high	Character	Y or N	D
Thru bit-15 UNUSED	Character	Y or N	D
Battery #1 in equalize high	Character	Y or N	D
Battery #2 in equalize high	Character	Y or N	D
Battery #1 OK high	Character	Y or N	D
Battery #2 OK high	Character	Y or N	D
Charger #1 fail alarm high	Character	Y or N	D
Charger #2 fail alarm high	Character	Y or N	D
System trouble #2 alarm high	Character	Y or N	D
UNUSED	Character	Y or N	D
OTHER INFO	—	—	—
Start count	Number	≥0	D
Run time hours	Number	≥0	D
Hours since last run	Number	≥0	D
Hours since last DVS test	Number	≥0	D
Fire pump power status	Number	≥0	D
Fire pump running status	Number	≥0	D
Fire pump test running	Number	≥0	D
Suction pressure (psi or bar)	Number	≥0	D
System pressure (psi or bar)	Number	≥0	D
Pump discharge pressure (psi or bar)	Number	≥0	D
Water temperature in pump casing	Number	≥0	D
Room temperature	Number	≥0	D
Last pump start date	Date	Date	S
Last pump start time	Time	Time	S
Pressure at pump start	Number	≥0	S
Type of start (1-automatic demand, 2-automatic test, 3-manual)	Integer	(1) Automatic demand	S
		(2) Automatic test	
		(3) Manual	
Last pump shutdown date	Date	Date	S
Last pump shutdown time	Time	Time	
System pressure at pump shutdown	Number	≥0	S
Type of shutdown (1-automatic demand, 2-automatic test, 3-manual, 4-overspeed, 5-other trouble)	Integer	(1) Automatic demand	S
		(2) Automatic test	
		(3) Manual	
		(4) Overspeed	
		(5) Other	
Loss of power	—	—	S
Transfer of power	—	—	S
Fuel tank level	Integer	(0) Above $\frac{2}{3}$	S
		(1) Below $\frac{2}{3}$	
Fuel tank level (% full)	Number	≥0	—
Fuel maintenance system status	Character	(A) Active	S
		(O) Turned off	
		(N) Not functioning properly	
End pump status	—	END PUMP STATUS	S

Data	Format	Possible Values	Permanent, Static, Dynamic
Start non-flow (NF) test	—	START NF TEST	S
Non-Flow Test Data Sets – 10 sets	—	—	—
Last non-flow monitoring reset date	Date	Date	S
Last non-flow monitoring reset time	Time	Time	—
Total number of non-flow test during monitored period	Number	≥0	S
Total pump test run time during monitored period (minutes)	Number	≥0	S
Non-flow test start date	Date	Date	S
Non-flow test start time	Time	Time	S
Non-flow test end date	Date	Date	S
Non-flow test end time	Time	Time	S
Non-flow test reference identifier	Number	≥0	S
Non-flow test data set reference identifier	Number	≥0	S
Non-flow test suction pressure (psi or bar)	Number	≥0	S
Non-flow test system pressure (psi or bar)	Number	≥0	S
Non-flow test pump discharge pressure (psi or bar)	Number	≥0	S
Non-flow test net pressure (psi or bar)	Number	≥0	S
Non-flow test water temperature in pump casing	Number	≥0	S
Non-flow test room temperature	Number	≥0	S
Non-flow test pump start date	Date	Date	S
Non-flow test pump start time	Time	Time	—
Non-flow test pressure at pump start	Number	≥0	S
Non-flow test minimum transducer pressure	Number	≥0	S
Non-flow test type of start	Integer	(1) Automatic demand	S
		(2) Automatic test	
		(3) Manual	
Non-flow test pump shutdown	Date	Date	—
Non-flow test pump shutdown time	Time	Time	S
Non-flow test system pressure at pump shutdown	Number	≥0	S
Non-flow test type of shutdown	Integer	(1) Automatic demand	S
		(2) Automatic test	
		(3) Manual	
		(4) Overspeed	
		(5) Other trouble	
Non-flow test rpm	Number	≥0	S
Non-flow test voltage phase A–B	Number	≥0	S
Non-flow test voltage phase B–C	Number	≥0	S
Non-flow test voltage phase C–A	Number	≥0	S
Non-flow test amperage phase 1	Number	≥0	S
Non-flow test amperage phase 2	Number	≥0	S
Non-flow test amperage phase 3	Number	≥0	S
End non-flow test	—	END NF TEST	—
Start acceptance test	>—	START ACCPT TEST	—

Data	Format	Possible Values	Permanent, Static, Dynamic
Acceptance Test Data Set – Permanent – 0%, 25%, 50%, 75%, 100%, 125%, and 150%	—	—	—
Test date acceptance test (day month year)	Date	Date	P
Test reference identifier acceptance test	Number	≥0	P
Data set reference identifier acceptance test	Number	≥0	P
Suction pressure acceptance test	Number	≥0	P
System pressure acceptance test	Number	≥0	P
Discharge pressure acceptance test	Number	≥0	P
Net pressure	Number	≥0	P
Water temperature in pump casing acceptance test	Number	≥0	P
Room temperature acceptance test	Number	≥0	P
Initial pump start date acceptance test	Date	Date	P
Initial pump start time acceptance test	Time	Time	P
Final pump stop date acceptance test	Date	Date	P
Final pump stop time acceptance test	Time	Time	P
Pump start dates acceptance test (record up to 10)	Date	Date	P
Pump start times acceptance test (record up to 10)	Time	Time	P
Pump stop dates acceptance test (record up to 10)	Date	Date	P
Pump stop times acceptance test (record up to 10)	Time	Time	P
Pressure at pump start acceptance test	Number	≥0	P
Type of start acceptance test	Integer	(1) Automatic demand (2) Automatic test (3) Manual	P
Minimum transducer pressure at startup acceptance test	Number	≥0	P
Number of start and stops during acceptance test	Number	≥0	P
Final pump shutdown time acceptance test	Time	Time	P
System pressure at final pump shutdown	Number	≥0	P
Type of shutdown	Integer	(1) Automatic demand (2) Automatic test (3) Manual (4) Overspeed (5) Other trouble	P
Loss of power (for transfer) date	Date	Date	P
Loss of power (for transfer) time	Time	Time	P
Transfer of power date	Date	Date	P
Transfer of power time	Time	Time	P
Date power restored to normal	Date	Date	P
Time power restored to normal (hr min sec)	Time	Time	P
Date readings recorded	Date	Date	P
Time readings recorded	Time	Time	P

Data	Format	Possible Values	Permanent, Static, Dynamic
RPM	Number	≥0	P
Voltage phase A–B acceptance test	Number	≥0	P
Voltage phase B–C acceptance test	Number	≥0	P
Voltage phase C–A acceptance test	Number	≥0	P
Amperage phase 1 acceptance test	Number	≥0	P
Amperage phase 2 acceptance test	Number	≥0	P
Amperage phase 3 acceptance test	Number	≥0	P
Battery 1 amperage	—	—	—
Battery 2 amperage	—	—	—
Nozzle coefficient acceptance test, up to 20 per test	Number	≥0	P
Nozzle size acceptance test, up to 20 per test (in. or cm)	Number	≥0	P
Nozzle pitot pressure acceptance test, up to 20 per test	Number	≥0	P
Fuel tank level acceptance test (0-above ¾, 1-below ¾)	Number	≥0	P
Fuel tank level acceptance test (% full)	Number	≥0	P
Flow through pump acceptance test	Number	≥0	P
RPM adjusted net pressure acceptance test	Number	≥0	P
RPM adjusted flow acceptance test (gpm or L/min)	Number	≥0	P
% of factory certified curve acceptance test	Number	≥0	P
Hours on diesel engine or electric motor at start of acceptance test	Number	≥0	P
Hours on diesel engine or electric motor at conclusion of acceptance test	Number	≥0	P
Pump passed initial acceptance test	Character	Y or N	P
Pump could supply maximum system demand acceptance test	Integer	(1) Yes	P
		(2) No	
		(3) Demand not known	
Pump was significantly impaired acceptance test	Character	Y or N	P
Pump was partially impaired acceptance test	Character	Y or N	P
Pump passed after adjustments acceptance test	Character	Y or N	P
Failure mode acceptance test (see standardized list)	Number	Integer ≥0	P
Explanation of failure acceptance test	String(80)	Alphanumeric	P
End acceptance test	—	END ACCPT TEST	—
Start performance test	—	START PERF TEST	—
Current Performance Test Data Set – Permanent – 0%, 25%, 50%, 75%, 100%, 125%, and 150%	—	—	—
Start data set	—	START TEST DS	—
Test subset number	—	—	—
Test date current performance test	Date	Date	S

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

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

Data	Format	Possible Values	Permanent, Static, Dynamic
Failure mode current performance test (see standardize list)	Number	Integer ≥ 0	S
Explanation of failure current performance test	String(80)	Alphanumeric	S
End performance test data set	—	END TEST DS	—
End performance test	—	END FP PERF	—
Start previous performance	—	START PREV PERF	—
Start previous performance data set	—	Start PP DS	—
Previous Performance Test Data Set – Static – 0%, 25%, 50%, 75%, 100%, 125%, and 150%	—	—	—
Test date previous performance test	Date	Time	S
Test reference identifier previous performance test	Number	≥ 0	S
Data set reference identifier previous performance test	Number	≥ 0	S
Suction pressure previous performance test	Number	≥ 0	S
System pressure previous performance test	Number	≥ 0	S
Discharge pressure previous performance test	Number	≥ 0	S
Net pressure	Number	≥ 0	S
Water temperature in pump casing previous performance test	Number	≥ 0	S
Room temperature previous performance test	Number	≥ 0	S
Initial pump start date previous performance test	Date	Date	S
Initial pump start time previous performance test	Time	Time	S
Final pump stop date previous performance test	Date	Date	S
Final pump stop time previous performance test	Time	Time	S
Pump start dates previous performance test (record up to 10)	Date	Date	S
Pump start times previous performance test (record up to 10)	Time	Time	S
Pump stop dates previous performance test (record up to 10)	Date	Date	S
Pump stop times previous performance test (record up to 10)	Time	Time	S
Pressure at pump start previous performance test	Number	≥ 0	S
Type of start previous performance test	Integer	(1) Automatic demand	S
		(2) Automatic test	
		(3) Manual	
Minimum transducer pressure at startup previous performance test	Number	≥ 0	S
Number of start and stops during previous performance test	Number	Integer ≥ 0	S

Data	Format	Possible Values	Permanent, Static, Dynamic
Final pump shutdown time previous performance test	Time	Time	S
System pressure at final pump shutdown	Number	≥0	S
Type of shutdown	Integer	(1) Automatic demand	S
		(2) Automatic test	
		(3) Manual	
		(4) Overspeed	
		(5) Other trouble	
Loss of power (for transfer) date	Date	Date	—
Loss of power (for transfer) time	Time	Time	S
Transfer of power date	Date	Date	—
Transfer of power time	Time	Time	S
Day power restored to normal	Date	Date	—
Time power restored to normal	Time	Time	—
Date readings recorded	Date	Date	S
Time readings recorded	Time	Time	S
RPM	Number	≥0	S
Voltage phase A–B previous performance test	Number	≥0	S
Voltage phase B–C previous performance test	Number	≥0	S
Voltage phase C–A previous performance test	Number	≥0	S
Amperage phase 1 previous performance test	Number	≥0	S
Amperage phase 2 previous performance test	Number	≥0	S
Amperage phase 3 previous performance test	Number	≥0	S
Battery 1 amperage	—	—	—
Battery 2 amperage	—	—	—
Nozzle coefficient previous performance test, up to 20 per test	Number	≥0	S
Nozzle size previous performance test, up to 20 per test (in. or cm)	Number	≥0	S
Nozzle pitot pressure previous performance test, up to 20 per test	Number	≥0	S
Fuel tank level previous performance test	Integer	(0) Above $\frac{2}{3}$	S
		(1) Below $\frac{2}{3}$	
Fuel tank level previous performance test (% full)	Number	≥0	S
Flow through pump previous performance test	Number	≥0	S
Rpm adjusted net pressure previous performance test	Number	≥0	S
Rpm adjusted flow previous performance test (gpm or L/min)	Number	≥0	S
% of factory certified curve previous performance test	Number	≥0	S

Data	Format	Possible Values	Permanent, Static, Dynamic
Hours on diesel engine or electric motor at start of previous performance test	Number	≥0	S
Hours on diesel engine or electric motor at conclusion of previous performance test	Number	≥0	S
Pump passed initial previous performance test	Character	Y or N	S
Pump could supply maximum system demand previous performance test	xxxxx	(1) Yes	S
		(2) No	
		(3) Demand not known	
Pump was significantly impaired previous performance test	Character	Y or N	S
Pump was partially impaired previous performance test	Character	Y or N	S
Pump passed after adjustments previous performance test	Character	Y or N	S
Failure mode previous performance test (see standardized list)	Number	Integer ≥0	S
Explanation of failure previous performance test	String(80)	Alphanumeric	S
End test data subset	—	END PP DS	—
End performance test	—	END PREV TEST	—
Start repair record	—	START REPAIR	—
Repair Maintenance Data (20 sets)	—	—	S
Start repair data subset	—	START REPAIR DS	—
Date of maintenance/repair	Date	Date	S
Maintenance/repair identifier	Number	≥0	S
Repair preventative or result of failure	Character	(P) Preventative	S
		(F) Failure	
Failure mode	Integer	Develop List	—
Pump out of service during maintenance/repair	Character	Y or N	S
Date pump out of service (day month year)	Date	Date	S
Time pump out of service (hour min sec)	Time	Time	S
Date pump restored to service (day month year)	Date	Date	S
Time pump restored to service (hour min sec)	Time	Time	S
Date pump maintenance/repair completed	Date	Date	S
Part replaced (1)	String(40)	Alphanumeric	S
Description of maintenance, repair, and/or part 1 replacement	String(80)	Alphanumeric	S
Part replaced (2)	String(40)	Alphanumeric	S
Description of maintenance, repair, and/or part 2 replacement	String(80)	Alphanumeric	S
Part replaced (3)	String(40)	Alphanumeric	S
Description of maintenance, repair, and/or part 3 replacement	String(80)	Alphanumeric	S
Part replaced (4)	String(40)	Alphanumeric	S
Description of maintenance, repair, and/or part 4 replacement	String(80)	Alphanumeric	S

Data	Format	Possible Values	Permanent, Static, Dynamic
Routine maintenance or repair	String(40)	Alphanumeric	S
Date repair completed	Date	Date	S
Fuel tank level current performance test	Integer	(0) Above $\frac{2}{3}$ (1) Below $\frac{2}{3}$	S
Fuel tank level current performance test (% full)	Number	>0	S
Fuel maintenance system status	String(3)	ON, OFF, IMP (impaired)	S
Unused	—	—	S
19 additional repair maintenance data sets	—	—	S
End repair data subset	—	END REPAIR DS	—
End repair record	—	END REPAIR	—
Start jockey operation	—	START JP OPER	—
Jockey Pump Operation	—	—	S
Last jockey pump monitoring reset date	Date	Date	S
Last jockey pump monitoring reset time	Time	Time	—
Total number of starts (since reset)	Number	≥ 0	S
Total jockey pump run time (minutes since last reset)	Number	≥ 0	S
Jockey pump start pressure (most recent)	Number	≥ 0	S
Jockey pump stop pressure	Number	≥ 0	S
Most recent run time (seconds)	Number	≥ 0	S
End jockey operation	—	END JP OPER	—
Start FP operation	—	START FP OPER	—
Fire Pump Operation	xxxxx	—	S
Last fire pump monitoring reset date	Date	Date	S
Last fire pump monitoring reset time	Time	Time	—
Fire pump start date and time (last 10 times)	Date	Date	S
Fire pump stop date and time (last 10 times)	Time	Time	S
Fire pump start pressure (most recent)	Number	≥ 0	S
Fire pump stop pressure (most recent)	Number	≥ 0	S
Stop automatic or manual (most recent)	Character	(A) Automatic (M) Manual	S
Total number of starts since reset	Number	Integer ≥ 0	S
Total run time since reset (minutes)	Number	≥ 0	S
Date loss of electrical power with switch in on position since last reset (50 sets)	Date	Date	S
Time loss of electrical power with switch in on position since last reset (50 sets)	Time	Time	S
Date power restored after loss of power with switch in on position since last reset (50 sets)	Date	Date	S
Time power restored after loss of power with switch in on position since last reset (50 sets)	Time	Time	S
Date power switch turned off (50 sets)	Date	Date	S
Time power switch turned off (50 sets)	Time	Time	S
Date power switch turned back on (50 sets)	Date	Date	S

Data	Format	Possible Values	Permanent, Static, Dynamic
Time power switch turned back on (50 sets)	Time	Time	S
End Fire Pump Operation		END FP OPER	—

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

Category	Item	Format	Possible Values
Equipment repair data	Type of record	String(48)	REPAIR
	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
	Repair date	Date	Year/month/date
	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Repair preventative or result of failure	Character	(P) Preventative (F) Failure
	Failure mode (develop list)	5 character	Correspond to list
	Failure impaired fire protection system	Character	(I) Impaired (P) Partially functional (N) Not impaired
	Repair code (develop list)	5 character	Correspond to list
	Component replaced (develop list)	5 character	Correspond to list
	Repair description	String(96)	Alphanumeric
	Component replacement date	Date	Year/month/date
	End of repair record	String(48)	END OF REPAIR

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
	Type of inspection or test	Character	(I) Inspection
			(T) Test
			(M) Maintenance
			(R) Repair
Item inspected, tested, maintained or repaired — repeat for each item inspected, tested, maintained, or repaired	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	
	Passed visual inspection	Character	(Y) Yes
			(N) No
			(A) Not applicable
	Maintenance required	Number	Number ≥ 0

Category	Item Format	Format	Possible Values
	Maintenance done	Character	(1) Not applicable
			(2) Completed
			(3) Ordered but not completed
			(4) Not ordered
End of ITM record	End of item record marker	String(16)	RECORD END
	End of ITM (all components reported)	String(48)	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.
Ball drip (automatic-type) drain valves	Common data	See Table C.9.2.10.2 Common Equipment Data	
	Operated satisfactorily	Character	(Y) Yes
			(N) No
			(3) N.A.
Bladder tank	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Fill level OK	Character	(Y) Yes
			(N) No
			(3) N.A.

Item	Item Component	Format	Possible Values
	Operated satisfactorily (Y-Yes, N-No, 3-N.A.)	Character	(Y) Yes
			(N) No
			(3) N.A.
	Comment if needed	String(80)	Alphanumeric
Check valve(s)	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Type	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
	Prevents backflow	Character	(Y) Yes
			(N) No
			(3) Not verified
	Non-flow upstream pressure	Number	Number ≥ 0
	Non-flow downstream pressure	Number	Number ≥ 0
	Demand test flow rate	Number	Number ≥ 0
	Demand flow upstream pressure	Number	Number ≥ 0
	Demand flow downstream pressure	Number	Number ≥ 0
	Unit type identifier	String(48)	Alphanumeric
	Where installed	Character	(1) On fire pump discharge
			(2) Loop piped back to suction
	Operated satisfactorily	Character	(Y) Yes
			(N) No
			(3) N.A.
Control valve(s)	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Type of valve	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
	Nominal valve size (in. or cm)	Number	Number ≥ 0

Item	Item Component	Format	Possible Values
	Original position of valve	Character	(1) Normally open valve open
			(2) Normally open closed
			(3) Normally closed valve closed
			(4) Normally closed valve open
			(5) Valve partially closed
	Stops flow of water when closed	Character	(1) Yes
			(2) Minor leakage
			(3) No
	Obstructs flow of water when open	Character	(4) Not tested for flow
			(Y) Yes
			(N) No
	Operated satisfactorily	Character	(3) Not tested for flow
			(Y) Yes
			(N) No
			(3) N.A.
Detector check valve	See backflow prevention devices	—	—
Enclosure (during cold weather)	Adequate heat	Character	(Y) Yes (N) No
Fire department connection	Connection supplies	Character	(1) Sprinkler
			(2) Standpipe
			(3) Standpipe and sprinkler
			(4) Other
	Connection flushed	Character	(Y) Yes
			(N) No
	Connection tested	Character	(Y) Yes
			(N) No
	System passed	Character	(Y) Yes
			(N) No
Fire pumps	Common data	—	See Table C.9.2.11.2 Common Equipment Data
Fittings — except rubber gasketed	Indication of leakage present	Character	(1) No
			(2) Minor
			(3) Significant
Fittings (rubber-gasketed)	Indication of leakage present	Character	(1) No
			(2) Minor
			(3) Significant
Foam concentrate	Manufacturer	String(48)	Alphanumeric
	Type	String(48)	Alphanumeric
	Adequate quantity	Character	(Y) Yes (N) No
	Samples submitted for testing	Character	(Y) Yes (N) No
	Samples tested satisfactory	Character	(Y) Yes

Item	Item Component	Format	Possible Values
			(N) No
Foam concentrate strainer(s)	Strainer clear initial	Character	(Y) Yes
			(N) No
	Tank full	Character	(Y) Yes
			(N) No
Foam concentrate tank	Protective coating (mineral oil) on top of foam concentrate OK	Character	Y-Yes
			N-No
	Foam percentage	Number	Number ≥0
Foam-water solution	Solution passed	Character	(Y) Yes
			(N) No
			(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
Gauges	Gauge on	Character	(Y) Yes
			(N) No
	Gauges reading correctly	Character	(Y) Yes
			(N) No
General information sign	Required signs provided	Character	(Y) Yes
			(N) No
	Signs readable & correct	Character	(Y) Yes
			(N) No
	Water level OK	Character	(Y) Yes
			(N) No
Gravity tanks	Adequate heat provided	Character	(Y) Yes
			(N) No
Hangers/pipe supports	Passed visual inspection	Character	(Y) Yes
			(N) No
	Required signs/placards provided	Character	(Y) Yes
			(N) No
Hydraulic design information sign/hydraulic placards	Signs readable & correct	Character	(Y) Yes
			(N) No
	Required signs/placards provided	Character	(Y) Yes
			(N) No
Identification signs	Signs readable & correct	Character	(Y) Yes
			(N) No

Item	Item Component	Format	Possible Values
Information sign	Required signs/placards provided	Character	(Y) Yes (N) No
	Signs readable & correct	Character	(Y) Yes (N) No
Inspector's test connection	Flowed without obstruction	Character	(Y) Yes (N) No
	Activated alarm	Character	(Y) Yes (N) No
Mainline strainers	Strainer without excessive debris and damage	Character	(Y) Yes (N) No
Manual actuation device(s)	Passed test	Character	(Y) Yes (N) No
Mist system compressed gas cylinder	Cylinders full	Character	(Y) Yes (N) No
Mist system control equipment	Passed test	Character	(Y) Yes (N) No
Mist system plant air, compressors, and receivers	Operated satisfactorily	Character	(Y) Yes (N) No
Mist system pneumatic valves, cylinder valves, and master release valves	Passed test	Character	(Y) Yes (N) No
Mist system standby pump	Passed test	Character	(Y) Yes (N) No
Mist system water storage cylinder (additive storage cylinder)	Passed test	Character	(Y) Yes (N) No
Mist system water storage cylinder (high pressure)	Passed test	Character	(Y) Yes (N) No
Mist system water storage cylinder (high pressure) filters on refill connection	Passed test	Character	(Y) Yes (N) No
Mist system water storage cylinder (high pressure) support frame/restraints	Passed visual inspection	Character	(Y) Yes (N) No
Mist system water storage cylinder (high pressure) vent plugs at refilling	Operated satisfactorily	Character	(Y) Yes (N) No
Mist system water storage cylinder (high pressure) water level (load cells)	Passed test	Character	(Y) Yes (N) No
Mist system water storage tank	Tank full without leaks	Character	(Y) Yes (N) No
Mist system water storage tank all valves, appurtenances	Passed test	Character	(Y) Yes (N) No
Mist system water storage tank sight glass valves (confirm open)	Operated satisfactorily	Character	(Y) Yes (N) No
Mist system water storage tank water level (supervised)	Passed test	Character	(Y) Yes (N) No
Pipe (above ground)	Type of system	Character	(1) Wet pipe sprinkler (2) Dry pipe sprinkler

Item	Item Component	Format	Possible Values
			(3) Preaction
			(4) Deluge
			(5) Water mist
			(6) Other
	Environment	Character	(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
	Free of leads and excessive corrosion	Character	(Y) Yes
			(N) No
Fittings (above ground)	Type of system	Character	(1) Wet pipe sprinkler
			(2) Dry pipe sprinkler
			(3) Preaction
			(4) Deluge
			(5) Water mist
			(6) Other
	Environment	Character	(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
	Free of leaks and excessive corrosion	Character	(Y) Yes
			(N) No
Pipe and fittings (underground)	Environment	Character	(1) Sandy soil
			(2) Clay soil
			(3) Corrosive soil
			(4) Other
	Unit type identifier	String(48)	Alphanumeric
	Type of pipe	Character	(1) Ductile iron
			(2) Steel
			(3) CPVC
			(4) Polyethylene
			(5) Other
	Pipe encasement	Character	(1) Polyethylene wrap
			(2) Culvert

Item	Item Component	Format	Possible Values
			(3) None
	Water supply source	Character	(1) From municipal system
			(2) From water storage tank
			(3) From pond, lake, river, etc.
			(4) Other
	Free of excessive leakage	Character	(Y) Yes (N) No
Pipe stands	Passed visual inspection	Character	(Y) Yes (N) No
			(Y) Yes (N) No
Post indicator and wall indicator valves	Opened and closed	Character	(Y) Yes (N) No
			(Y) Yes (N) No
	Stopped flow of water when closed	Character	(Y) Yes (N) No
			(3) Not verified
High flow pressure relief valve (fire pump, etc)	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Type	Character	(1) Pilot operated
			(2) Spring loaded
			(3) Other
	Discharge to	Character	(1) Atmosphere
			(2) Tank
			(3) Fire pump suction
			(4) Other
	Relief pressure	Number	Number ≥ 0
	Shut off pressure	Number	Number ≥ 0
	Functioning properly	Character	(Y) Yes
			(N) No
Pressure-reducing valve	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Type	Character	(1) Pilot operated
			(2) Spring loaded
			(3) Other
	Installation with other pressure-reducing valves	Character	(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
	Static inlet pressure	Number	Number ≥ 0
	Static outlet pressure	Number	Number ≥ 0

Item	Item Component	Format	Possible Values
	Residual low flow inlet pressure	Number	Number ≥ 0
	Residual low flow outlet pressure	Number	Number ≥ 0
	Residual low flow inlet pressure	Number	Number ≥ 0
	Residual low flow outlet pressure	Number	Number ≥ 0
	Functioning properly	Character	(Y) Yes (N) No
Pump suction control valve	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Type	Character	(1) Pilot operated (2) Spring loaded (3) Other
	Set suction pressure	Number	Number ≥ 0
	Static inlet pressure	Number	Number ≥ 0
	Static outlet pressure	Number	Number ≥ 0
	Inlet pressure @ 100% rated pump capacity	Number	Number ≥ 0
	Outlet pressure @ 100% rated pump capacity	Number	Number ≥ 0
	Inlet pressure @ 150% rated pump capacity	Number	Number ≥ 0
	Outlet pressure @ 150% rated pump capacity	Number	Number ≥ 0
	Functioning properly	Character	(Y) Yes (N) No
Reduced-pressure detectors	Common data	See Table C.9.2.11.2 Common Equipment Data	
	Functioning properly	Character	(Y) Yes (N) No
Retainer glands	No visible leakage or damage	Character	(Y) Yes (N) No
Sight glass	No visible leakage or damage	Character	(Y) Yes (N) No
Suction tanks	Tank full	Character	(Y) Yes (N) No
Supervisory device	Functioned correctly	Character	(Y) Yes (N) No
Supports	Correctly installed	Character	(Y) Yes (N) No
System pressure-regulating devices	Functioned correctly	Character	(Y) Yes (N) No
Tank alarm and supervisory component, enclosure temperature	Connected to constantly monitored location	Character	(Y) Yes (N) No
	Functioned correctly	Character	(Y) Yes (N) No
Tank alarm and supervisory	Connected to constantly	Character	(Y) Yes

Item	Item Component	Format	Possible Values
component, high and low water level	monitored location		(N) No
	Functioned correctly	Character	(Y) Yes
			(N) No
Tank alarm and supervisory component, low water temperature alarms	Connected to constantly monitored location	Character	(Y) Yes
			(N) No
	Functioned correctly	Character	(Y) Yes
			(N) No
	Connected to constantly monitored location	Character	(Y) Yes
			(N) No
Tank alarm and supervisory component, temperature alarms	Functioned correctly	Character	(Y) Yes
			(N) No
			(Y) Yes
Tank alarm and supervisory component, valve supervision	Connected to constantly monitored location	Character	(Y) Yes
			(N) No
	Functioned correctly	Character	(Y) Yes
			(N) No
	Connected to constantly monitored location	Character	(Y) Yes
			(N) No
Tank alarm and supervisory component, water level alarms	Functioned correctly	Character	(Y) Yes
			(N) No
			(Y) Yes
Tank alarm and supervisory component, water temperature	Connected to constantly monitored location	Character	(Y) Yes
			(N) No
	Functioned correctly	Character	(Y) Yes
			(N) No
	Passed visual inspection	Character	(Y) Yes
			(N) No
Tank check valves	Functioned correctly	Character	(Y) Yes
			(N) No
			(3) Not verified

C.9.2.11.7

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

Statement of Problem and Substantiation for Public Input

Annex C needs to be removed for NFPA 20 and set to it own technical committee

Submitter Information Verification

Submitter Full Name: Corey Miller

Organization: Sierra Monitor Corp

Street Address:

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Submission Date: Wed Jun 26 18:13:11 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: The committees intent is to maintain Annex C in NFPA 20.



Public Input No. 26-NFPA 20-2019 [New Section after C.8.2.3]

TITLE OF NEW CONTENT

C.9 Modify tables and requirements as needed to mesh with the proposed new Chapter 14 on connectivity.

Statement of Problem and Substantiation for Public Input

Complementary to the proposed new Chapter 14 on connectivity.

Submitter Information Verification

Submitter Full Name: Gayle Pennel

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Submittal Date: Tue Mar 26 18:03:27 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: The means of data collection as proposed is very limiting and does not need to be mandated by the standard. Annex C provides sufficient guidance on means of data collection regarding fire pump performance.



Public Input No. 3-NFPA 20-2018 [Chapter E]

Annex E Informational References

E.1 Referenced Publications.

The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

E.1.1 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2016 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2017 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2015 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2019 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 edition.

NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 2016 edition.

NFPA 70[®], *National Electrical Code*[®], 2017 edition.

NFPA 77, *Recommended Practice on Static Electricity*, 2019 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2019 edition.

E.1.2 Other Publications.

E.1.2.1 ASCE Publications.

American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400.

ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*, 2010 201 6.

E.1.2.2 AWWA Publications.

American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235.

AWWA C104/A21.4, *Cement-Mortar Lining for Ductile-Iron Pipe and Fittings*, 2013 201 6.

E.1.2.3 HI Publications.

Hydraulic Institute, 6 Campus Drive, First Floor North, Parsippany, NJ 07054-4406.

ANSI/HI 1.4, *Rotodynamic Centrifugal Pumps for Manuals Describing Installation, Operation and Maintenance*, 2014.

ANSI/HI 3.6, *Rotary Pump Tests*, 2016.

ANSI/HI 9.6.4, *Rotodynamic (Centrifugal and Vertical) Pumps for Vibration Measurement and Allowable Values*, 2009.

ANSI/HI 9.6.6, *Rotodynamic Pumps for Pump Piping*, 2016.

ANSI/HI 9.8, *Rotodynamic Pumps for Pump Intake Design*, 2012.

E.1.2.4 IEEE Publications.

IEEE, Three Park Avenue, 17th Floor, New York, NY 10016-5997.

ANSI/IEEE C62.11, *IEEE Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1 kV)*, 2012.

IEEE 141, *Electric Power Distribution for Industrial Plants*, 1986 - **1993, reaffirmed 1999** .

IEEE 241, *Electric Systems for Commercial Buildings*, 1990.

IEEE 493, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems*, 2007.

IEEE 802.3, *Standard for Ethernet*, 2012 **2018** .

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*, 2012 **2016, amendment 5, 2018** .

Anthony, M., et al, "Reliability Analysis for Power to Fire Pump Using Fault Tree and RBD," *IEEE Transactions on Industry Applications*, Vol. 49, No. 2, March-April 2013, pp. 997–1003.

Anthony, M., et al, "Reliability engineering applied to Critical Operations Power Systems (COPS)," *Proc. 2011 Industrial and Commercial Power Systems Technical Conference (I&CPS)*, 1-5 May 2011, pp. 1–8.

Arno, R.G., E. Stoyas, and R. Schuerger, "NEC Article 708," *Industry Application Magazine*, IEEE, Vol. 17, No. 1, Jan.-Feb. 2011, pp. 20–25.

Arno, R.G., E. Stoyas, and R. Schuerger, "Risk Analysis for NEC Article 708 Critical Operations Power Systems," *Industry Applications Society Annual Meeting*, IEEE, 4-8 Oct. 2009, pp. 1–7.

E.1.2.5 NEMA Publications.

National Electrical Manufacturers Association, 1300 North 17th Street, Suite 900, Arlington, VA 22209.

NEMA ICS 14, *Application Guide for Electric Fire Pump Controllers*, 2015.

NEMA 250, *Enclosures for Electrical Equipment (1000 V Maximum)* , 2014.

E.1.2.6 SAE Publications.

Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE J-1349, *Engine Power Test Code — Spark Ignition and Compression Engine*, 2011.

E.1.2.7 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 508, *Standard for Industrial Control Equipment*, 2013 **2018** .

ANSI/UL 1008, *Standard for Transfer Switch Equipment*, 2011 **2014** , revised 2015 **2018** .

E.2 Informational References.

The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

E.2.1 HI Publications.

Hydraulic Institute, 6 Campus Drive, First Floor North, Parsippany, NJ 07054-4406.

ANSI/HI 1.1–1.2, *Rotodynamic Centrifugal Pumps for Nomenclature and Definitions*, 2014.

ANSI/HI 1.3, *Rotodynamic Centrifugal Pumps for Design and Application*, 2013.

ANSI/HI 2.1–2.2, *Rotodynamic Vertical Pumps for Radial, Mixed, and Axial Flow Types for Nomenclature and Definitions*, 2014.

ANSI/HI 2.3, *Rotodynamic Vertical Pumps for Radial, Mixed, and Axial Flow Types for Design and Application*, 2013.

ANSI/HI 3.1–3.5, *Rotary Pumps for Nomenclature, Definitions, Application, and Operation*, 2015.

ANSI/HI 14.6, *Rotodynamic Pumps for Hydraulic Performance Acceptance Tests*, 2011.

E.2.2 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 80, *Standard for Steel Tanks for Oil Burner Fuels and Other Combustible Liquids*, 2007, revised 2014.

UL 2080, *Standard for Fire Resistant Tanks for Flammable and Combustible Liquids*, 2000.

ANSI/UL 2085, *Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids*, 1997, revised 2010.

E.3 References for Extracts in Informational Sections. (Reserved)**Statement of Problem and Substantiation for Public Input**

Referenced current national consensus standard editions.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2-NFPA 20-2018 [Section No. 2.3]	Referenced current national consensus standard editions.

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk

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Submittal Date: Mon Oct 29 23:59:30 EDT 2018

Committee: FIM-AAA

Committee Statement

Resolution: [FR-86-NFPA 20-2019](#)

Statement: References updated to latest published editions.



Public Input No. 48-NFPA 20-2019 [Section No. E.1.2]

E.1.2 Other Publications.

E.1.2.1 ASCE Publications.

American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400.

ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*, 2010.

E.1.2.2 AWWA Publications.

American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235.

AWWA C104, *Cement-Mortar Lining for Ductile-Iron Pipe and Fittings*, 2013.

E.1.2.3 HI Publications.

Hydraulic Institute, 6 Campus Drive, First Floor North, Parsippany, NJ 07054-4406.

ANSI/HI 1.4, *Rotodynamic Centrifugal Pumps for Manuals Describing Installation, Operation and Maintenance*, 2014.

ANSI/HI 3.6, *Rotary Pump Tests*, 2016.

ANSI/HI 9.6.4, *Rotodynamic (Centrifugal and Vertical) Pumps for Vibration Measurement and Allowable Values*, 2009.

ANSI/HI 9.6.6, *Rotodynamic Pumps for Pump Piping*, 2016.

ANSI/HI 9.8, *Rotodynamic Pumps for Pump Intake Design*, 2012.

E.1.2.4 IEEE Publications.

IEEE, Three Park Avenue, 17th Floor, New York, NY 10016-5997.

ANSI/IEEE C62.11, *IEEE Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1 kV)*, 2012.

IEEE 141, *Electric Power Distribution for Industrial Plants*, 1986.

IEEE 241, *Electric Systems for Commercial Buildings*, 1990.

IEEE 493, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems*, 2007.

IEEE 802.3, *Standard for Ethernet*, 2012.

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*, 2012.

Anthony, M., et al, "Reliability Analysis for Power to Fire Pump Using Fault Tree and RBD," *IEEE Transactions on Industry Applications*, Vol. 49, No. 2, March-April 2013, pp. 997–1003.

Anthony, M., et al, "Reliability engineering applied to Critical Operations Power Systems (COPS)," *Proc. 2011 Industrial and Commercial Power Systems Technical Conference (I&CPS)*, 1-5 May 2011, pp. 1–8.

Arno, R.G., E. Stoyas, and R. Schuerger, "NEC Article 708," *Industry Application Magazine*, IEEE, Vol. 17, No. 1, Jan.-Feb. 2011, pp. 20–25.

Arno, R.G., E. Stoyas, and R. Schuerger, "Risk Analysis for NEC Article 708 Critical Operations Power Systems," *Industry Applications Society Annual Meeting, IEEE*, 4-8 Oct. 2009, pp. 1–7.

E.1.2.5 NEMA Publications.

National Electrical Manufacturers Association, 1300 North 17th Street, Suite 900, Arlington, VA 22209.

NEMA ICS 14, *Application Guide for Electric Fire Pump Controllers*, 2015.

NEMA 250, *Enclosures for Electrical Equipment*, 2014.

E.1.2.6 SAE Publications.

Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE J-1349, *Engine Power Test Code — Spark Ignition and Compression Engine*, 2011.

E.1.2.7 SFPE Publications

Society of Fire Protection Engineers, 9711 Washingtonian Blvd. Suite 380, Gaithersburg, MD 20878.

SFPE Engineering Guide: Fire Safety for Very Tall Buildings, 2013.

E.1.2.7 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 508, *Standard for Industrial Control Equipment*, 2013.

ANSI/UL 1008, *Standard for Transfer Switch Equipment*, 2011, revised 2015.

Statement of Problem and Substantiation for Public Input

PI is related to PI-46 that References the SFPE Engineering Guide: Fire Safety for Very Tall Buildings.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 46-NFPA 20-2019 [Section No. A.5.6]	

Submitter Information Verification

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Submittal Date: Sun Jun 16 06:52:37 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-86-NFPA 20-2019](#)

Statement: References updated to latest published editions.

**Public Input No. 45-NFPA 20-2019 [Section No. E.1.2.7]****E.1.2.7** UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 508, *Standard for Industrial Control Equipment*, 2013 2018 .

ANSI/UL 1008, *Standard for Transfer Switch Equipment*, 2011 2014 , revised 2015 2018 .

Statement of Problem and Substantiation for Public Input

Update the publishing dates for each of the UL standards listed to reflect the most up to date edition.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 43-NFPA 20-2019 [Section No. 2.3.10]	
Public Input No. 44-NFPA 20-2019 [Section No. E.2.2]	

Submitter Information Verification

Submitter Full Name: Kelly Nicoello

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Submittal Date: Wed Jun 12 16:58:31 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-86-NFPA 20-2019](#)

Statement: References updated to latest published editions.



Public Input No. 82-NFPA 20-2019 [Section No. E.1.2.7]

E.1.2.7 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*, 2013

ANSI/UL 218, *Standard for Fire Pump Controllers*, 2018

ANSI/UL 508, *Standard for Industrial Control Equipment*, 2013.

ANSI/UL 1004-5, *Standard for Fire Pump Motors*, 2014

ANSI/UL 1008, *Standard for Transfer Switch Equipment*, 2011, revised 2015.

ANSI/UL 1247, *Standard for Diesel Engines for Driving Stationary Fire Pumps*, 2014

ANSI/UL 1449, *Standard for Surge Protective Devices*, 2016

Statement of Problem and Substantiation for Public Input

The proposed additions reference the diesel engine and fire pump controller standards since these, in addition to UL 508 and UL 1008, contain many relevant construction and test requirements.

Submitter Information Verification

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Submittal Date: Mon Jun 24 14:12:04 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: FR-86-NFPA 20-2019

Statement: References updated to latest published editions.

**Public Input No. 44-NFPA 20-2019 [Section No. E.2.2]****E.2.2** UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 80, *Standard for Steel Tanks for Oil Burner Fuels and Other Combustible Liquids*, 2007, revised 2014 2019 .

UL 280, *Standard for Fire Resistant Tanks for Flammable and Combustible Liquids*, 2000.

ANSI/UL 285, *Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids*, 1997, revised 2010.

Statement of Problem and Substantiation for Public Input

Update the publishing dates for each of the UL standards listed to reflect the most up to date edition.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 43-NFPA 20-2019 [Section No. 2.3.10]	

Submitter Information Verification

Submitter Full Name: Kelly Nicoletto

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Submission Date: Wed Jun 12 16:56:00 EDT 2019

Committee: FIM-AAA

Committee Statement

Resolution: [FR-86-NFPA 20-2019](#)

Statement: References updated to latest published editions.