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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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DIVISION 21 - FIRE SUPPRESSION

SECTION 21 30 00

FIRE PUMPS

04/08, CHG 1: 08/13

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SECTION 21 30 00

FIRE PUMPS
04/08, CHG 1: 08/13

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Note: This guide specification covers the requirements for fire pumps.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

PART 1 GENERAL

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NOTE: Combustion engine drive must be provided, unless electric power is provided from two separate sources. Dual drive pumps are not permitted. The primary design references for fire pump installations are NFPA 20 Installation of Centrifugal Fire Pumps, Unified Facilities Criteria (UFC) 3-600-01 Design: Fire Protection Engineering for Facilities.

The Designer will coordinate this specification section with any applicable contract sprinkler system. The designer will provide a fully designed fire pump installation in all instances, including projects where the sprinkler system will be performance designed. The following information

will be included in the contract documents as the basis for any installation:

(1) All piping, valves, pipe hangers, and equipment including sizes will be indicated.

(2) Freeze protection and ventilation for the pump room or pump house.

(3) Where a pump has a diesel-engine-driver, the pump room or pump house will be protected by automatic sprinklers.

(4) The location of either the double-check valve or the reduced-pressure-principle backflow preventer where the potable water supply system is at risk of contamination by the fire pump(s). If required, backflow preventers will be installed on the discharge side of the pump.

(5) The sequence of operation for the pressure maintenance pump, the primary fire pump, and the secondary fire pump.

(6) An equipment schedule for the pressure maintenance pump, the primary fire pump, and the secondary fire pump that includes all pertinent information for the pumps and their respective drivers.

(7) Waterflow data including hydraulic flow graph and the location where the hydrant flow test was conducted, the location and size of existing mains and new water supply lines that will serve the fire pump(s) (including all supervisory valves), and the location and size of all risers.

(8) Other design considerations: Horizontal fire pumps will be provided only under a positive head and will not be used where a static suction or lift may be involved.

Vertical shaft pumps should take suction from a reliable source that serves a wet pit. Velocities of wet pits and approach channels serving vertical shaft turbine fire pumps will not exceed 0.3 m/s 1 ft/sec. Vertical shaft pumps mounted over and taking suction from tanks will be avoided.

Hose stream demands must be accounted for in the design so that the pump output will not be affected due to low suction pressure and deprive the sprinklers of water.

The size of the suction pipe should be such that the velocity does not exceed 4.5 m/s 15 ft/sec when pumps are operating at 150 percent capacity.

Pumps will be located at or above surrounding ground

level to avoid any possible impairment due to flooding.

Design will indicate pump units and base mounted on a raised reinforced concrete pad that is an integral part of an adequately reinforced and supported concrete floor. Vibration isolation for fire pump(s) will be in accordance with UFC 3-450-01, Noise and Vibration Control.

In most installations, fire pumps will be automatically activated by a change in water pressure in accordance with the recommended pressure settings listed in NFPA 20. Where the water supply pressure fluctuates to the extent that the pressure cannot be reliably used or where the water pressure is too low to activate the fire pumps, the pumps will be activated by waterflow in the sprinkler or fire protection system.

There may be conditions when manually stopping of the fire pump is required instead of automatic stopping. For example, NFPA 409, Standard on Aircraft Hangars, requires that fire pumps serving aircraft hangars be manually stopping only. For these special cases, Paragraph Sequence of Operation would require editing.

The following information will be shown on the project drawings:

1. Configuration, slope and sizes for each piping system;

2. Location and type of each pump, including associated equipment and appurtenances;

3. Capacity of each item of equipment, including showing the size of all floor drains and their locations. Ensure the minimum size floor drain is 150 mm 6 inches. Show the pitch of the floor also.

4. Locations and details for special supports for piping; and

5. For pipe larger than 300 mm 12 inches, details of anchoring piping including pipe clamps and tie rods.

For questions concerning system design in Navy projects, the Engineering Field Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer, should be consulted.

****

1.1 SUMMARY

Except as modified in this Section or on the drawings, install fire pumps in conformance with NFPA 20, NFPA 70, and NFPA 72. In the event of a

conflict between specific provisions of this specification and applicable NFPA standards, this specification governs. Devices and equipment for fire protection service must be UL Fire Prot Dir listed or FM APP GUIDE approved. Interpret all reference to the authority having jurisdiction to mean the Contracting Officer or the [_____] Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer for Navy projects.

1.2 SEQUENCING

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NOTE: The sequence of operation for each pump must be written in complete details to suit requirements for each project. Items that should be considered and specified as necessary in this paragraph include cut-in pressures, sequential starting arrangements, manual remote start features, AC power failure start, and provision of a pump starting circuit which is activated by deluge valve tripping.

For Navy projects use automatic shutdown of fire pump with running timer only after consultation with Engineering Field Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer.

****

1.2.1 Primary Fire Pump

Provide primary fire pump that [automatically operates when the pressure drops to [758][_____] kPa [110][_____] psi] [automatically upon tripping of the [_____] sprinkler system][, [and][or] manually when the starter is operated]. [Provide pump[s] that continue to run until shut down manually.] [Provide pump[s] that automatically shut down after a running time of [_____] minutes unless manually shutdown.] The fire pump must automatically stop operating when the system pressure reaches [862][_____] kPa [125][_____] psi and after the fire pump has operated for the minimum pump run time specified herein.

1.2.2 Secondary Fire Pump

Operate secondary fire pump at 69 kPa 10 psi increments, set below the primary fire pump starting pressure. The fire pump must automatically stop running at [862][_____] kPa [125][_____] psi and after the fire pump has operated for the minimum pump run time. Prevent fire pumps from starting simultaneously and start sequentially at intervals of 5 to 10 seconds.

1.2.3 Pressure Maintenance Pump

Operate pressure maintenance pump when the system pressure drops to [793][_____] kPa [115][_____] psi. Stop pump automatically when the system pressure reaches [862][_____] kPa [125][_____] psi and after the pump has operated for the minimum pump run time specified herein.

1.3 FIRE PUMP INSTALLATION RELATED SUBMITTALS

The Fire Protection Specialist must prepare a list of the submittals, from the Contract Submittal Register, that relate to the successful installation of the fire pump(s), no later than [7] [_____] days after the

approval of the Fire Protection Specialist and the Manufacturer's Representative. Include a letter of approval signed and dated by the Fire Protection Specialist with the submittals identified on this list when submitted to the Government.

1.4 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings
ASME B16.11	(2022) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2021) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2021) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2018) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(2020) Standard for Malleable Iron

	Threaded Pipe Unions; Classes 150, 250, and 300
ASME B31.1	(2022) Power Piping

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2017) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(2018) Hypochlorites
AWWA B301	(2018) Liquid Chlorine
AWWA C104/A21.4	(2022) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2021) Ductile-Iron and Gray-Iron Fittings
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	(2017) Ductile-Iron Pipe, Centrifugally Cast
AWWA C500	(2019) Metal-Seated Gate Valves for Water Supply Service
AWWA C606	(2022) Grooved and Shouldered Joints

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2022; E 2022) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2022) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A193/A193M	(2023) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2023) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A449	(2014; R 2020) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A536	(1984; R 2019; E 2019) Standard

	Specification for Ductile Iron Castings
ASTM A563	(2021; E 2022a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A563M	(2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A795/A795M	(2021) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B42	(2020) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B75/B75M	(2020) Standard Specification for Seamless Copper Tube
ASTM B88	(2022) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2020) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM B135/B135M	(2017) Standard Specification for Seamless Brass Tube
ASTM C533	(2017; R 2023) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM D2000	(2018) Standard Classification System for Rubber Products in Automotive Applications
ASTM D3308	(2012; R 2017) Standard Specification for PTFE Resin Skived Tape
ASTM F436	(2011) Hardened Steel Washers
ASTM F436M	(2011) Hardened Steel Washers (Metric)

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-80	(2019) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2021) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 20	(2022;TIA 21-1; TIA 21-2) Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 24	(2022) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 37	(2021) Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(2023) National Electrical Code
NFPA 72	(2022; ERTA 22-1) National Fire Alarm and Signaling Code
NFPA 1963	(2019) Standard for Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2012) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 80	(2007; Reprint Jan 2014) Standard for Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids
UL 142	(2006; Reprint Jan 2021) UL Standard for Safety Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 262	(2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service
UL 448	(2020) UL Standard for Safety Centrifugal Stationary Pumps for Fire-Protection Service
UL 1247	(2007; Reprint Jun 2020) Diesel Engines for Driving Stationary Fire Pumps
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.5 SUBMITTALS

****
NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.
****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

[The [_____] Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer, will review and approve all submittals in this section requiring Government approval.]

****
NOTE: For projects administered by the Pacific Division, Naval Facilities Engineering Systems Command, use the optional approval paragraph immediately below and delete the general approval statement above for Navy projects.
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[The [_____] Division, Naval Facilities Engineering Systems Command, Fire

Protection Engineer delegates the authority to the Quality Control (QC) Representative's U.S. Registered Fire Protection Engineer for review and approval of submittals required by this section. Submit to the [_____] Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer one set of all approved submittals and drawings immediately after approval but no more later than 15 working days prior to final inspection.]

SD-01 Preconstruction Submittals

Fire Pump Installation Related Submittals

Fire Protection Specialist; G[, [_____]]

No later than [14] [_____] days after the Notice to Proceed and prior to the submittal of the fire pump installation drawings

SD-02 Shop Drawings

Installation Drawings; G[, [_____]]

[3] [_____] copies

As-Built Drawings; G[, [_____]]

Piping Layout; G[, [_____]]

Pump Room; G[, [_____]]

SD-03 Product Data

Catalog Data; G[, [_____]]

Spare Parts

Preliminary Tests

At least [14] [_____] days prior to the proposed date and time to begin Preliminary Tests

Field Tests; G[, [_____]]

At least 2 weeks before starting field tests

Manufacturer's Representative; G[, [_____]]

Field Training; G[, [_____]]

Army Final Acceptance Test

Navy Formal Inspection and Tests

SD-06 Test Reports

Preliminary Tests

[3] [_____] copies of the completed Preliminary Tests Reports, no later that [7] [_____] days after the completion of the Preliminary Tests.

Army Final Acceptance Test
Navy Formal Inspection and Tests; G[, [_____]]

SD-07 Certificates

Fire Protection Specialist

No later than [14] [_____] days after the Notice to Proceed and prior to the submittal of the fire pump installation drawings

Qualifications of Welders

Qualifications of Installer

Preliminary Test Certification

Final Test Certification

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G[, [_____]]

At least [14] [_____] days prior to conducting field training

Flow Meter

Submit Data Package 2 for flow meter and controllers in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.6 EXTRA MATERIALS

Submit Spare Parts data for each different item of equipment and material specified. Include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor.

1.7 QUALITY ASSURANCE

1.7.1 Fire Protection Specialist

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NOTE: For Navy projects administered by the Pacific Division and Engineering Field Activity Chesapeake, Naval Facilities Engineering Systems Command, include this paragraph requiring the minimum qualification of a NICET Level-III technician for preparation of all fire protection system drawings.
****

Perform work specified in this section under the supervision of and certified by the Fire Protection Specialist. Submit the name and documentation of certification of the proposed Fire Protection Specialists. The Fire Protection Specialist is an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection

Engineering Technology in accordance with NICET 1014-7. Engage the Fire Protection Specialist regularly in the design and installation of the type and complexity of system specified in the Contract documents. The specialist is an individual who has served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.7.2 Qualifications of Welders

Submit certificates of each welder's qualifications prior to site welding; certifications more than one year old are not acceptable.

1.7.3 Qualifications of Installer

Prior to installation, submit data for approval showing that the Contractor has successfully installed fire pumps and associated equipment of the same type and design as specified herein, or that he has a firm contractual agreement with a subcontractor having such required experience. Include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

1.7.4 Preliminary Test Certification

When preliminary tests have been completed and corrections made, submit a signed and dated certificate with a request for a formal inspection and tests.

1.7.5 Final Test Certification

Concurrent with the Final Acceptance Test Report, submit certification by the Fire Protection Specialist that the fire pump installation is in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.[Submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.]

1.7.6 Manufacturer's Representative

Perform work specified in this section under the supervision of and certified by a representative of the fire pump manufacturer. Submit the name and documentation of certification of the proposed Manufacturer's Representative, concurrent with submittal of the Fire Protection Specialist Qualifications. Engage the Manufacturer's Representative regularly in the installation of the type and complexity of fire pump(s) specified in the Contract documents. The representative is an individual who has served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.8 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. Additionally, either cap or plug all pipes until installed.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

a. Provide materials and equipment that are standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicates items that have been in satisfactory use for at least 2 years prior to bid opening.

b. Submit manufacturer's catalog data included with the Fire Pump Installation Drawings for each separate piece of equipment proposed for use in the system. Indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, provide a complete equipment list that includes equipment description, model number and quantity. Catalog data for material and equipment includes, but is not limited to, the following:

(1) Fire pumps, drivers and controllers including manufacturer's certified shop test characteristic curve for each pump. Shop test curve may be submitted after approval of catalog data but must be submitted prior to the final tests.

(2) Pressure maintenance pump and controller.

(3) Piping components.

(4) Valves, including gate, check, globe and relief valves.

(5) Gauges.

(6) Hose valve manifold test header and hose valves.

(7) Flow meter.

(8) Restrictive orifice union.

(9) Associated devices and equipment.

c. Provide a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, [contract number and accepted date; capacity or size; system in which installed and system which it controls] and catalog number for all equipment. Affix standard nameplates securely in a conspicuous place and easy to read to pumps and motors. Provide nameplates and markings in accordance with UL 448. Provide nameplate and markings in accordance with UL 1247 for diesel driver. Provide electric motor nameplates with the minimum information required by NFPA 70, Section 430-7.

2.2 FIRE PUMP

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NOTE: In selecting rated head pressures of fire pumps, the fact that horizontal split case fire pumps and vertical turbine fire pumps develop 140 percent of rated head pressure when operating under shutoff or "churn" conditions should be considered. Maximum desired fire pump rated head pressures are 862 kPa 125 psig for horizontal split case pumps and

690 kPa 100 psig for vertical turbine pumps.
****

Provide [electric motor driven] [diesel engine driven] fire pump. Provide pump capacity rated at [_____] L/second gpm with a rated net pressure of [_____] kPa psi. Furnish no less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Provide centrifugal [horizontal split case][water lubricated, vertical shaft turbine][end-suction][in-line] fire pump. Equip horizontal pump with automatic air release devices. Use maximum rated pump speed of 2100 rpm when driving the pump at rated capacity. Provide pump that is [automatic start and manual stop][manual pushbutton start and stop][automatic start and automatic stop]. Provide pump conforming to the requirements of UL 448. Ensure fire pump discharge and suction gauges are oil-filled type.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

2.3.1 General Requirements

Provide Materials and Equipment that have been tested by Underwriters Laboratories, Inc. and are listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, such means listed in UL Fire Prot Dir or FM APP GUIDE.

2.3.2 Alarms

****

NOTE: Power for alarms must be from a source other than the engine starting batteries and must not exceed 125 volts. Do not supply power from the same circuit supplying power to the fire pump controllers or from an emergency circuit.

The preferred arrangement for detecting an abnormal pump condition is via a remote pump trouble panel located in a constantly attended space. The preferred locations for this panel are the Fire Department or Fire Alarm Headquarters. Other locations which are acceptable, providing they are constantly attended, include Public Works Trouble Desks, Duty Water Offices, and Power Plant Control Stations.

For installations where there is a base fire alarm system which is capable of distinguishing between alarms and supervisory signals (e.g., radio systems, multiplex systems, digital alarm communication systems, or other supervised systems with similar capabilities,) the preferred method of remote pump supervision is via the supervised alarm system, not via a remote pump trouble panel. A remote pump panel should be used only as a last resort, and only if the wiring between the pump and the panel is supervised in accordance with NFPA 72.
****

Provide audible and visual alarms as required by NFPA 20 on the controller. Provide remote supervision as required by NFPA 20, in

accordance with NFPA 72 under Section [_____]. Provide remote alarm devices located [at [_____]][as indicated]. Activate alarm signal upon the following conditions: [electric motor controller has operated into a pump running condition, loss of electrical power to electric motor starter, and phase reversal on line side of motor starter] [engine drive controller has operated into an engine running condition, engine drive controller main switch has been turned to OFF or to MANUAL position, trouble on engine driven controller or engine]. Provide weatherproof exterior alarm devices. Provide alarm silencing switch and red signal lamp, with signal lamp arranged to come on when switch is placed in OFF position.

2.4 UNDERGROUND PIPING COMPONENTS

****

NOTE: The drawings must show the service connection details and the piping from the water supply. The drawings must show details of the water service point-of-entry into the pump room or pump house and through the floor slab, and underground piping restraints, including number and size of restraining rods and thrust blocks.

****

2.4.1 Pipe and Fittings

****

NOTE: In last sentence, use first phrase in brackets for connection to existing water distribution system; delete first phrase in brackets only for connection to new water distribution system. For pipe larger than 300 mm 12 inches, detail methods for anchoring piping including pipe clamps and tie rods. Consult NFPA 24 for required depth of coverage of buried fire mains.

****

Provide outside-coated, cement mortar-lined, ductile-iron pipe (with a rated working pressure of [1034][1207][_____] kPa [150][175][_____] psi) conforming to NFPA 24 for piping under the building and less than 1.50 m 5 feet outside of the building walls. Anchor the joints in accordance with NFPA 24; provide concrete thrust block at the elbow where the pipe turns up toward the floor, and restrain the pipe riser with steel rods from the elbow to the flange above the floor. Provide minimum pipe size of 150 mm 6 inches. Provide minimum cover depth as required by NFPA 24, but no less than 1 m 3 feet. Piping more than 1.50 m 5 feet outside of the building walls must be [outside coated, AWWA C104/A21.4cement mortar-lined, AWWA C151/A21.51 ductile-iron pipe, and AWWA C110/A21.10 fittings conforming to NFPA 24][provided under Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING].

2.4.2 Fittings and Gaskets

Provide ductile iron fittings conforming to AWWA C110/A21.10. Provide gaskets that are suitable in design and size for the pipe with which such gaskets are to be used. Provide gaskets for ductile iron pipe joints conforming to AWWA C111/A21.11.

2.4.3 Valves and Valve Boxes

Provide gate valves conforming to AWWA C500 or UL 262. Provide valves with cast-iron body and bronze trim and that open by counterclockwise rotation. Except for post indicator valves, provide all underground valves with an adjustable cast-iron or ductile iron valve box of a size suitable for the valve on which the box is to be used, but no less than 133 mm 5.25 inches in diameter. Coat the box with bituminous coating. Provide a cast-iron or ductile-iron cover with the word "WATER" cast on the cover for each box.

2.4.4 Gate Valve and Indicator Posts

****

NOTE: This paragraph will be deleted if underground valves are either not required or are specified elsewhere.

The Air Fore requires tamper switches on the indicator posts.

****

Provide inside screw type gate valves for underground installation with counterclockwise rotation to open. Where indicating type valves are shown or required, use indicating valves consisting of gate valves with an approved indicator post of a length to permit the top of the post to be located 900 mm 3 feet above finished grade. Provide gate valves and indicator posts with one coat of primer and two coats of red enamel paint and that are listed in UL Fire Prot Dir or FM APP GUIDE.

2.4.5 Buried Utility Warning and Identification Tape

Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping for all buried piping. Ensure tape is detectable by an electronic detection instrument. Provide tape in rolls, 80 mm 3 inches minimum width, color-coded for the utility involved and imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification must be "CAUTION BURIED WATER PIPING BELOW" or similar wording. Use permanent code and lettering that is unaffected by moisture and other substances contained in the trench backfill material. Bury tape at a depth of 300 mm 12 inches below the top surface of earth or the top surface of the subgrade under pavement.

2.5 ABOVEGROUND PIPING COMPONENTS

2.5.1 Pipe Sizes 65 mm 2.5 inches and Larger

2.5.1.1 Pipe

Provide piping consisting of [ASTM A53/A53M][ASTM A795/A795M], Weight Class STD (Standard), Schedule 40 (except for Schedule 30 for pipe sizes 200 mm 8 inchesand greater in diameter), Type E or Type S, Grade A; black steel pipe. Join steel pipe by means of flanges welded to the pipe or mechanical grooved joints only. Do not join piping by welding or weld fittings. Galvanize suction piping on the inside in accordance with NFPA 20.

2.5.1.2 Grooved Mechanical Joints and Fittings

Provide joints and fittings that are designed for no less than 1200 kPa 175 psi service and are the product of the same manufacturer. Provide malleable iron fitting and coupling houses conforming to ASTM A47/A47M, Grade 32510; ductile iron conforming to ASTM A536, Grade 65-45-12. Provide flush type gasket that fills the entire cavity between the fitting and the pipe. Provide cadmium plated or zinc electroplated, heat-treated steel nuts and bolts conforming to ASTM A183.

2.5.1.3 Flanges

Provide ASME B16.5, Class 150 flanges. Provide flanges at valves, connections to equipment, and where indicated.

2.5.1.4 Gaskets

Provide AWWA C111/A21.11, cloth inserted red rubber gaskets.

2.5.1.5 Bolts

Provide [ASTM A449, Type [1][2]][ASTM A193/A193M, Grade B7] bolts. Do not extend bolts less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.1.6 Nuts

Provide [ASTM A194/A194M, Grade 7][ASTM A193/A193M, Grade 5][ASTM A563M ASTM A563, Grade [C3][DH3]] nuts.

2.5.1.7 Washers

Provide washers meeting the requirements of ASTM F436M ASTM F436. Provide flat circular washers under all bolt heads and nuts.

2.5.2 Piping Sizes 50 mm 2 inches and Smaller

2.5.2.1 Steel Pipe

Provide [ASTM A795/A795M, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A][ASTM A53/A53M, Weight Class XS (Extra Strong)], zinc-coated steel pipe with threaded end connections. Provide [ASME B16.3][ASME B16.39], Class 150, zinc-coated threaded fittings. Provide ASME B16.39, Class 150, zinc-coated unions.

2.5.2.2 Copper Tubing

Provide copper tubing that is ASTM B88M ASTM B88, Type L or K, soft annealed. Provide ASME B16.26, flared joint fittings. Provide pipe nipples consisting of ASTM B42 copper pipe with threaded end connections.

2.5.3 Pipe Hangers and Supports

Provide adjustable hangers and supports that are [MSS SP-58][UL listed UL Fire Prot Dir or FM approved FM APP GUIDE]. Finish of rods, nuts, washers, hangers, and supports must be zinc-plated after fabrication.

2.5.4 Valves

Provide valves that are UL listed UL Fire Prot Dir or FM approved FM APP GUIDE for fire protection service and with flange or threaded end connections.

2.5.4.1 Gate Valves and Control Valves

Provide outside screw and yoke (O.S.&Y.) type gate valves and control valves which open by counterclockwise rotation. Butterfly-type control valves are not permitted.

2.5.4.2 Tamper Switch

****

NOTE: Provide tamper switches on control valves when preferred by the user or when valves are subject to tampering. An alternate allowed by NFPA is to lock OS& Y valves open with chain and padlock.

****

Equip the suction control valves, the discharge control valves, valves to test header and flow meter, and the by-pass control valves with valve tamper switches for monitoring by the fire alarm system.

2.5.4.3 Check Valve

Check valve must be clear open, swing type check valve with flange or threaded inspection plate.

2.5.4.4 Relief Valve

****

NOTE: Piping of a relief valve back to the pump suction connection should be avoided except when it is not possible to dispose of the discharge water. In such cases, the relief valve discharge piping tee connection to the suction should have its centerline plane perpendicular to the pump shaft. The tee connection should be at least 10 diameters from the pump suction flange.

****

Provide [pilot operated][or][spring operated] type relief valve conforming to NFPA 20. Provide a means of detecting water motion in the relief lines where the discharge is not visible within the pump house.

2.5.4.5 Circulating Relief Valve

Provide an adjustable circulating relief valve for each fire pump in accordance with NFPA 20.

2.5.4.6 Suction Pressure Regulating Valve

****

NOTE: Delete suction pressure regulating valve unless required for the specific water supply.

When an oversized pump has been installed on a water

distribution system, the pump should satisfy the demand without drawing the residual pressure of the water system below a safe level, which is normally between 69 and 138 kPa 10 and 20 psi. A pilot-controlled, hydraulically-actuated, minimum suction pressure sustaining valve may be necessary when suction pressures can be drawn down to unsafe levels. These valves are provided on the discharge line of the fire pump. The pump suction pressure is monitored through a pressure line to the controlling mechanism of the regulating valve.

****

Provide suction pressure regulating valve that is FM approved FM APP GUIDE. Monitor suction pressure through a pressure line to the controlling mechanism of the regulating valve. Arrange valve in accordance with the manufacturer's recommendations.

2.5.5 Hose Valve Manifold Test Header

****

NOTE: Use this paragraph for Navy projects.

A detail of the hose valve manifold test header must be indicated on the contract drawings showing supply arrangement, size of header supply piping, number of hose valves, valve arrangement, and test header location. Where possible, a "straight line manifold" test header which allows the pump to be tested without the use of fire hoses should be provided in lieu of the standard "rosebud" test header. The straight line manifold test header is not a stock item and must be shop fabricated in accordance with the contract drawings. In lieu of the hose valve manifold test header, this paragraph may be changed to specify an inline water metering device in accordance with NFPA 20, subject to the approval of the Engineering Field Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer.

****

Construct header of steel pipe. Provide ASME B16.5, Class 150 flanged inlet connection to hose valve manifold assembly. Provide approved bronze hose gate valve with 65 mm 2.5 inch National Standard male hose threads with cap and chain; locate one meter 3 feet above grade in the horizontal position for each test header outlet. Ensure welding is metallic arc process in accordance with ASME B31.1.

2.5.6 Pipe Sleeves

Provide a pipe sleeve at each location where piping passes entirely through walls, ceilings, roofs, and floors, including pipe entering buildings from the exterior. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, and floors. Provide 25 mm one inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of the sleeve or core-drilled

hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, provide a fire seal between the pipe and the sleeve in accordance with Section 07 84 00 FIRESTOPPING.

a. Sleeves in Masonry and Concrete Walls, Ceilings, Roofs, and Floors: Provide hot-dip galvanized steel, ductile-iron, or cast-iron pipe sleeves. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves provided that cavities in the core-drilled hole be completely grouted smooth.

b. Sleeves in Other Than Masonry and Concrete Walls, Ceilings, Roofs, and Floors: Provide galvanized steel sheet pipe not less than 4.4 kg/square m 0.90 psf.

2.5.7 Escutcheon Plates

Provide one-piece or split-hinge metal plates for piping entering floors, walls, and ceilings in exposed areas. Provide polished stainless steel or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on plates in unfinished spaces. Secure plates in place.

2.6 DISINFECTING MATERIALS

2.6.1 Liquid Chlorine

Provide liquid chlorine conforming to AWWA B301.

2.6.2 Hypochlorites

Provide calcium hypochlorite and sodium hypochlorite conforming to AWWA B300.

2.7 ELECTRIC MOTOR DRIVER

****

NOTE: The design of the power supply to the electric drive fire pumps will comply with Chapter 6 of NFPA 20 and to NFPA 70. The fire pump power supply and fire pump power supply circuits and feeders will be indicated and detailed on the drawings.

Power supply protective devices installed in the power supply circuits and in the fire pump feeder circuits will be designed not to open at the sum of the locked rotor currents (continuous) of the fire pump motor and any other maximum loads on the circuit per NFPA 20.

Fire pump feeder circuit conductors will be physically routed outside of the building(s), excluding the electrical switchgear room and the pump room. When the fire pump feeder conductors must be routed through buildings, they will be buried or enclosed by 50 mm 2 inches of concrete or equivalent fire-rated construction.

Designer will indicate and detail the grounding of

the controller per NFPA 20.
****

Provide motors, controllers, contactors, and disconnects with their respective pieces of equipment, as specified herein and provide electrical connections under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide controllers and contactors with a maximum of 120-volt control circuits, and auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, include the cost of providing additional electrical service and related work under this section. Provide motor conforming to NEMA MG 1 Design B type. Provide premium efficiency type integral size motors in accordance with NEMA MG 1. Provide motor wattage horsepower of sufficient size so that the nameplate wattage horsepower rating will not be exceeded throughout the entire published pump characteristic curve. The motor and fire pump controller must be fully compatible.

2.8 DIESEL ENGINE DRIVER

****
NOTE: Special caution must be exercised in specifying power requirements because, once a proper pump is selected, only that diesel engine driver in the UL Fire Protection Equipment Directory corresponding to pump requirements is acceptable. Selection of a specific power may then further limit the suppliers of the equipment. Where diesel-engine-driven pumps are provided because reliable electrical power is not available to the pump, design the pump room so that electrical power is not required to supply ventilation required for engine operation or engine cooling, or provide two totally independent sources of

Ambient design temperature will be based on 6 degrees C 10 degrees F above the 2-1/2 percent summer design dry bulb temperature in UFC 3-400 02 Engineering Weather Data.
****

Provide diesel engine driver conforming to the requirements of UL 1247 which is UL listed UL Fire Prot Dir or FM approved FM APP GUIDE for fire pump service. Driver must be of the make recommended by the pump manufacturer. The engine must be closed circuit, liquid-cooled [with raw water heat exchanger][with radiator and engine-driven fan]. Diesel engine must be electric start type taking current from 2 battery units. Equip engine with a fuel in-line filter-water separator. Monitor engine conditions with engine instrumentation panel that has a tachometer, hour meter, fuel pressure gauge, lubricating oil pressure gauge, water temperature gauge, and ammeter gauge. Connect engine to horizontal-shaft pump by flexible couplings. For connections to vertical-shaft fire pumps, use right-angle gear drives and universal joints. Provide an engine jacket water heater to maintain a temperature of 49 degrees C 120 degrees F in accordance with NFPA 20.

2.8.1 Engine Capacity

Provide engine with adequate wattage horsepower to drive the pump at all conditions of speed and load over the full range of the pump performance

curve. Provide wattage horsepower rating of the engine driver as recommended by the pump manufacturer and derate for temperature and elevation in accordance with NFPA 20. Provide ambient temperature at the pump location of [_____] degrees C degrees F. Site elevation must be [_____] meters feet above mean sea level (MSL).

2.8.2 Exhaust System External to Engine

****
NOTE: Indicate and specify adequate safeguards for exhaust piping passing through walls and roof. Provide suitable thimble and clearance when pipe passes through combustible construction or roofing.
****

Provide exhaust system complying with the requirements of NFPA 20 and NFPA 37. Provide an exhaust muffler for each diesel engine driver to reduce noise levels less than [85][95] dBA. Provide a flexible connector with flange connections at the engine. Use stainless steel flexible sections suitable for diesel-engines exhaust gas at 538 degrees C 1000 degrees F.

2.8.2.1 Steel Pipe and Fittings

ASTM A53/A53M, [Schedule 40][Weight Class XS (Extra Strong], black steel, welding end connections. Provide ASME B16.9 or ASME B16.11 welding fittings of the same material and weight as the piping.

2.8.2.2 Flanges

ASME B16.5, Class [300][150]. Provide flanges at connections to diesel engines, exhaust mufflers, and flexible connections. Provide gaskets that are ASME B16.21, composition ring, 1.5875 mm 0.0625 inch. Provide ASTM A193/A193M, Grade [B8][B7] bolts and ASTM A194/A194M, Grade [8][7] nuts.

2.8.2.3 Piping Insulation

Comply with EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. Products containing asbestos will not be permitted. Insulate exhaust piping system including the muffler with ASTM C533 calcium silicate insulation, minimum of 75 mm 3 inches. Secure insulation with no less than 9.525 mm 0.375 inch width fibrous glass reinforced waterproof tape or Type 304 stainless steel bands spaced no more than 200 mm 8 inches on center. Provide an aluminum jacket encasing the insulation. Provide aluminum jacket with a minimum thickness of 0.406 mm 0.016 inches, a factory-applied polyethylene and kraft paper moisture barrier on the inside surface. Secure the jacket with no less than 13 mm 0.5 inch wide stainless steel bands, spaced no less than 200 mm 8 inches on centers. Lap longitudinal and circumferential seams of the jacket no less than 75 mm 3 inches. Install jackets on horizontal line so that the longitudinal seams are on the bottom side of the pipe. Place the seams of the jacket for the vertical lines on the off-weather side of the pipe. On vertical lines, overlap the circumferential seams of the jacket so the lower edge of each jacket overlaps the upper edge of the jacket below.

2.9 FIRE PUMP CONTROLLER

****

NOTE: The designer will coordinate with the base fire department any connections required from the fire pump controller and alarms to a central alarm panel (usually located in the fire department that services the area where the pump is installed). Details regarding this connection will be shown on the drawings.

****

Provide automatic type controller which is UL listed UL Fire Prot Dir or FM approved FM APP GUIDE for fire pump service. Arrange pump for automatic start and stop, and manual push-button stop. Accomplish automatic stopping only after all starting causes have returned to normal and after a minimum pump run time has elapsed. Provide controllers that are completely terminally wired, ready for field connections, and mounted in a [NEMA Type 2 drip-proof][NEMA Type 4 watertight and dust tight] enclosure arranged so that controller current carrying parts will not be less than 300 mm 12 inches above the floor. Provide controller with voltage surge arresters installed in accordance with NFPA 20. Equip controller with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments, automatic starting relay actuated from normally closed contacts, visual alarm lamps and supervisory power light. Equip controller with a thermostat switch with adjustable setting to monitor the pump room temperature and to provide an alarm when temperatures falls below 5 degrees C 40 degrees F [Equip controller with a sequential start timer/relay feature to start multiple fire pumps in sequence.][Provide controller which is factory-equipped with a heater operated by thermostat to prevent moisture in the cabinet.]

2.9.1 Controller for Electric Motor Driven Fire Pump

****

NOTE: Designer will determine requirement for across-the-line or reduced voltage starting. If reduced voltage starting is needed, designer must determine most suitable type or types. Selections should be based on the motor size, electrical system capacity and characteristics, etc. Fire pumps that are served by back-up generators should be equipped with electronic soft start or auto-transformer reduced voltage type controller.

****

Controller must be [electronic soft start][across the line][auto-transformer][wye-delta, open circuit transition][wye-delta, closed circuit transition] starting type. Design controller [for [_____] kW HP at [_____] volts][as indicated]. Provide controller[and transfer switch] with a short circuit rating [of [_____] amps r.m.s. symmetrical at [_____] volts a.c.][as indicated].[Provide an automatic transfer switch (ATS) for each fire pump in compliance with NFPA 20 and specifically listed for fire pump service. The ATS must transfer source of power to the alternate source upon loss of normal power.] Controller must monitor pump running, loss of a phase or line power, phase reversal[, low reservoir] and pump room temperature. Display alarms individually in front of panel by lighting of visual lamps. Label each lamp with rigid etched plastic labels. Equip controller with terminals for remote

monitoring of pump running, pump power supply trouble (loss of power or phase and phase reversal), and pump room trouble (pump room temperature [and low reservoir level]), and for remote start. Limited service fire pump controllers are not permitted, except for fire pumps driven by electric motors rated less than 11 kW 15 hp. Equip controller with a 7-day electric pressure recorder with 24-hour spring wound back-up. Provide a readout of the system pressure from 0 to 207 Pa 0 to 15 hp, time, and date. Controller must require the pumps to run for ten minutes for pumps with driver motors under 149 kW 200 horsepower and for 15 minutes for pumps with motors 149 kW 200 horsepower and greater, prior to automatic shutdown. Equip the controller with an externally operable isolating switch which manually operates the motor circuit. Provide means in the controller for measuring current for all motor circuit conductors.

2.9.2 Controller for Diesel Engine Driven Fire Pump

****

NOTE: Pump alarms will be constantly monitored and will usually require transmission to a constantly attended location. Pump alarms may be monitored by the building alarm system or base fire reporting system. Designer will indicate and specify remote alarm transmission devices, controls, conductors, conduit, connections, etc. Pump running, loss of pump power, and pump room trouble alarms must be remotely transmitted for electric fire pumps. Pump running, main switch mis-set, engine trouble, pump room trouble will be remotely transmitted for diesel fire pumps. Designer should coordinate transmission of alarms with the base fire department.

****

Controller must require the pump to run for 30 minutes prior to automatic shutdown. Equip controller with two battery chargers; two ammeters; two voltmeters, one for each set of batteries. Automatically alternate the battery sets for starting the pumps. Equip the controller with the following supervisory alarm functions:

a. Engine Trouble (individually monitored)

(1) Engine overspeed

(2) Low Oil Pressure

(3) High Water Temperature

(4) Engine Failure to Start

(5) Battery

(6) Battery Charger/AC Power Failure

b. Main Switch Mis-set

c. Pump Running

d. Pump Room Trouble (individually monitored)

(1) Low Fuel

(2) Low Pump Room Temperature

(3) Low Reservoir Level

Display alarms individually in front of panel by lighting of visual lamps, except that individual lamps are not required for pump running and main switch mis-set. Equip controller with a 7-day electric pressure recorder with 24-hour back-up mounted inside the controller. Provide a readout of the system pressure from 0 to 207 Pa 0 to 300 psi, time, and date. Equip the controller with an audible alarm which will activate upon any engine trouble or pump room trouble alarm condition and alarm silence switch. Equip the controller with terminals for field connection of a remote alarm for main switch mis-set, pump running, engine trouble and pump room trouble; and terminals for remote start. When engine emergency overspeed device operates, the controller must cause the engine to shut down without time delay and lock out until manually reset.

2.10 BATTERIES

Provide sealed lead calcium batteries for diesel engine driver. Mount batteries in a steel rack with non-corrosive, non-conductive base, no less than 300 mm 12 inches above the floor.

2.11 PRESSURE SENSING LINE

Provide a completely separate pressure sensing line for each fire pump and for the jockey pump. Arrange the sensing line in accordance with Figure A-7-5.2.1. of NFPA 20. Provide sensing line of 13 mm 1/2 inchH58 brass tubing complying with ASTM B135/B135M. Equip the sensing line with two restrictive orifice unions each. Provide restricted orifice unions consisting of ground-face unions with brass restricted diaphragms drilled for a 2.4 mm 3/32 inch. Mount restricted orifice unions in the horizontal position, no less than 1.5 m 5 feet apart on the sensing line. Provide two test connections for each sensing line. Test connections consist of two brass 13 mm 1/2 inch globe valves and 8 mm 1/4 inch gauge connection tee arranged in accordance with NFPA 20. Equip one of the test connections with a 0 to 2100 kPa 0 to 300 psi water oil-filled gauge. Connect sensing line to the pump discharge piping between the discharge piping control valve and the check valve.

2.12 PRESSURE MAINTENANCE PUMP

****

NOTE: Include this item when it is required that a higher pressure be provided in the water system than that available from primary protection supplies such as elevated storage tanks, standpipes, and city water mains.

****

2.12.1 General

Provide pressure maintenance pump that is electric motor driven,[horizontal shaft][or][in-line vertical shaft,] centrifugal type with a rated discharge of [0.63][_____] L/second [10][_____] gpm at [862][_____] kPa [125][_____] psig. Pump must draft [from the suction supply side of the suction pipe gate valve of the fire pump][as indicated] and discharge into the system at the downstream side of the pump discharge gate valve. Provide an approved indicating gate valve of the outside screw and yoke

(O.S.&Y.) type in the maintenance pump discharge and suction piping. Provide oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping. Provide swing type check valve with removable inspection plate.

2.12.2 Pressure Maintenance Pump Controller

Arrange pressure maintenance pump controller for automatic and manual starting and stopping and equip with a "manual-off-automatic" switch. Provide controller which is completely prewired, ready for field connections, and wall-mounted in a NEMA Type 2 drip-proof enclosure. Equip the controller with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. Provide a sensing line connected to the pressure maintenance pump discharge piping between the control valve and the check valve. Provide sensing line conforming to paragraph, PRESSURE SENSING LINE. The sensing line must be completely separate from the fire pump sensing lines. Provide an adjustable run timer to prevent frequent starting and stopping of the pump motor. Set the run timer for [2][_____] minutes.

2.13 DIESEL FUEL SYSTEM EXTERNAL TO ENGINE

****

NOTE: Fuel supply system for the diesel engine must be shown and detailed on the drawings. Design will follow the recommended design listed in the appendix of NFPA 20. Fuel tanks will be sized to have a capacity at least 5.1 L/kw 1 gallon per horsepower plus 10 percent. Larger tanks or a reserve supply with transfer facilities may be needed where prompt refilling is unlikely. Provide a separate fuel tank for each pump. Tanks will be located in the pump room. For tanks located above the lowest story, cellar or basement, the designer will provide proper fuel containment such as a sealed containment curbs or walls that will contain the entire volume of each tank. Delete low reservoir level alarm where it is not needed.

****

Provide fuel system that meets all requirements of NFPA 20 and NFPA 37. Equip fuel tank vent piping with screened weatherproof vent cap. Extend vents to the outside. Equip each tank with a fuel level gauge. Provide flexible bronze or stainless steel piping connectors with single braid at each piping connection to the diesel engine. Use steel piping for supply, return, and fill piping, except supply and return piping may be copper tubing. Protect fuel lines against mechanical damage. Equip fill line with 16 mesh removable wire screen. Extend fill lines to the exterior. Mount a weatherproof tank gauge on the exterior wall near each fill line for each tank. The fill cap must be able to be locked by padlock. Locate the engine supply (suction) connection on the side of the fuel tank so that 5 percent of the tank volume provides a sump volume not useable by the engine. The elevation of the fuel tank must be such that the inlet of the fuel supply line is located so that its opening is no lower than the level of the engine fuel transfer pump. Pitch the bottom of the tank 21 mm/m 1/4 inch/foot to the side opposite the suction inlet connection, and to an accessible 25 mm 1 inchplugged globe drain valve.

2.13.1 Fuel Piping

As specified in NFPA 20.

2.13.2 Diesel Fuel Tanks

UL 80 or UL 142 for aboveground tanks.

2.13.3 Valves

Provide an indicating and lockable ball valve in the supply line adjacent to the tank suction inlet connection. Provide a check valve in fuel return line. Valves mustl be suitable for oil service. Valves must have union end connections or threaded end connections.

2.13.3.1 Globe Valve

MSS SP-80 Class 125

2.13.3.2 Check Valve

MSS SP-80, Class 125, swing check

2.13.3.3 Ball Valve

Full port design, copper alloy body, 2-position lever handle

2.14 JOINTS AND FITTINGS FOR COPPER TUBE

Provide wrought copper and bronze solder-joint pressure fittings conforming to ASME B16.22 and ASTM B75/B75M. Provide cast copper alloy solder-joint pressure conforming conform to ASME B16.18. Provide cast copper alloy fittings for flared copper tube conforming to ASME B16.26 and ASTM B62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Provide grooved mechanical joints and fittings that are designed for no less than 862 kPa 125 psig service and are the product of the same manufacturer. Provide ductile iron grooved fitting and mechanical coupling housing conforming to ASTM A536. Use gaskets in grooved joints consisting of molded synthetic polymer of pressure responsive design and conforming to ASTM D2000 for circulating medium up to 110 degrees C 239 degrees F. Provide grooved joints conforming to AWWA C606 Use steel coupling nuts and bolts in grooved joints conforming to ASTM A183.

2.15 PUMP BASE PLATE AND PAD

Provide a common base plate for each horizontal-shaft fire pump for mounting pump and driver unit. Construct the base plate of cast iron with raised lip tapped for drainage or welded steel shapes with suitable drainage. Provide each base plate for the horizontal fire pumps with a 25 mm 1 inchgalvanized steel drain line piped to the nearest floor drain. For vertical shaft pumps, provide pump head with a cast-iron base plate which serves as the sole plate for mounting the discharge head assembly. Mount pump units and bases on a raised [100][150] mm [4] [6] inches reinforced concrete pad that is an integral part of the reinforced concrete floor.

2.16 HOSE VALVE MANIFOLD TEST HEADER

****

NOTE: The design will include method of flow testing the fire pump and the suction supply piping. This should be accomplished by providing an exterior hose test header and a flow meter. The exterior test header is necessary for testing the condition of suction supply, valves and piping. Hydrants will not be used for this purpose. The design will clearly indicate the test arrangement. See NFPA 20, Figure A-2-14.2.1.

****

Connect hose valve test header by ASME B16.5, Class 150 flange inlet connection. Provide UL listed UL Fire Prot Dir or FM approved FM APP GUIDE bronze hose gate valves with 65 mm 2.5 inches American National Fire Hose Connection Screw Standard Threads (NH) in accordance with NFPA 1963. Provide number of valves in accordance with NFPA 20. Equip each hose valve with a cap and chain, and locate no more than 900 mm 3 feet and no less than 600 mm 2 feet above grade.

2.17 FLOW METER

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NOTE: On the drawings, show a straight line run of pipe without valves or fittings equal to at least 10 times the pipe diameter on the intake side and at least 5 times the pipe diameter on the discharge side of the flow meter. Where possible, arrange the piping so that the metered flow can be discharged through the pump test header and/or back into the pump suction supply by the proper configuration of valves.

****

Provide meter that is UL listed UL Fire Prot Dir or FM approved FM APP GUIDE as flow meters for fire pump installation with direct flow readout device. Provide flow meter that is capable of metering any waterflow quantities between 50 percent and 150 percent of the rated flow of the pumps. Arrange piping to permit flow meter to discharge to pump suction and to discharge through test header. The meter throttle valve and the meter control valves must be O.S.&Y. valves. Provide automatic air release if flow meter piping between pump discharge and pump suction forms an inverted "U". Provide [venturi][annular probe][orifice plate][_____] type meter.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSPECTION BY FIRE PROTECTION SPECIALIST

Periodically perform a thorough inspection of the fire pump installation, including visual observation of the pump while running, to assure that the

installation conforms to the contract requirements. Excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems are not acceptable. Inspection includes piping and equipment clearance, access, supports, and guards. Bring any discrepancy to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered. The Fire Protection Specialist must witness the preliminary and final acceptance tests and, after completion of the inspections and a successful final acceptance test, sign test results and certify in writing that the installation the fire pump installation is in accordance with the contract requirements.

3.3 INSTALLATION

Provide equipment, materials, workmanship, fabrication, assembly, erection, installation, examination, inspection and testing in accordance NFPA 20, except as modified herein. In addition, install the fire pump and engine in accordance with the written instructions of the manufacturer.

3.3.1 Installation Drawings

Submit Fire Pump Installation Drawings consisting of a detailed plan view, detailed elevations and sections of the pump room, equipment and piping, drawn to a scale of not less than 1:20 1/2 inch = 1 foot. Indicate equipment, piping, and associated pump equipment to scale. Indicate all clearance, such as those between piping and equipment; between equipment and walls, ceiling and floors; and for electrical working distance clearance around all electrical equipment. Include a legend identifying all symbols, nomenclatures, and abbreviations. Indicate a complete piping and equipment layout including elevations and/or section views of the following:

a. Fire pumps, controllers, piping, valves, and associated equipment.

b. Sensing line for each pump including the pressure maintenance pump.

c. Engine fuel system for diesel driven pumps.

d. Engine cooling system for diesel driven pumps.

e. Pipe hangers and sway bracing including support for diesel muffler and exhaust piping.

f. Restraint of underground water main at [entry-point][entry-and exit-points] to the building including details of pipe clamps, tie rods, mechanical retainer glands, and thrust blocks.

g. A one-line schematic diagram indicating layout and sizes of all piping, devices, valves and fittings.

h. A complete point-to-point connection drawing of the pump power, control and alarm systems, as well as interior wiring schematics of each controller.

3.3.2 Pump Room Configuration

Provide detail plan view of the pump room including elevations and sections showing the fire pumps, associated equipment, and piping. Submit working drawings on sheets not smaller than A1 594 by 841 mm 24 by 36 inches; include data for the proper installation of each system. Show

piping schematic of pumps, devices, valves, pipe, and fittings. [Provide an isometric drawing of the fire pump and all associated piping]. Show point to point electrical wiring diagrams. Show piping layout and sensing piping arrangement. Show engine fuel and cooling system. Include:

a. Pumps, drivers, and controllers

b. Hose valve manifold test header

c. Circuit diagrams for pumps

d. Wiring diagrams of each controller

3.3.3 Accessories

Furnish tank supports, piping offsets, fittings, and required accessories as specified to provide a complete installation and to eliminate interference with other construction.

3.4 PIPE AND FITTINGS

Piping must be inspected, tested and approved before burying, covering, or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes using tapered reducing pipe fittings. Do not use bushings.[Photograph all piping prior to burying, covering, or concealing.]

3.4.1 Cleaning of Piping

Interior and ends of piping must be clean and free of any water or foreign material. Keep piping clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of the piping so that no water or foreign matter will enter the pipes or fittings. Inspect piping before placing in position.

3.4.2 Threaded Connections

Provide jointing compound for pipe threads consisting of [polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D3308][Teflon pipe thread paste] and apply to male threads only. Provide exposed ferrous pipe threads with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 0.025 mm 1 mil.

3.4.3 Pipe Hangers and Supports

Provide additional hangers and supports for concentrated loads in aboveground piping, such as for valves and risers.

3.4.3.1 Vertical Piping

Support piping at each floor, at no more than 3 meters 10 foot intervals.

3.4.3.2 Horizontal Piping

Space horizontal piping supports as follows:

MAXIMUM SPACING (METERS) (FEET)										
Nominal Pipe Size (mm) (inches)	25 1 and Under	321.25	401.5	502	652.5	803	903.5	1004	1255	150+6+
Copper Tube	1.86	27	2.48							
Steel Pipe	27	2.48	2.79	310	3.311	3.612	3.913	4.214	4.816	5.017

3.4.4 Underground Piping

Install underground piping and fittings in conformance to NFPA 24. Anchor joints in accordance with NFPA 24. Provide concrete thrust block at elbow where pipe turns up towards floor, and restrain the pipe riser with steel rods from the elbow to the flange above the floor. After installation in accordance with NFPA 24, clean rods and nuts thoroughly and coat with asphalt or other corrosion-retard material approved by the Contracting Officer. Provide minimum cover depth of 900 mm 3 feet.

3.4.5 Grooved Mechanical Joint

Prepare grooves according to the coupling manufacturer's instructions. Use grooved fittings, couplings, and grooving tools which are products of the same manufacturer. Ensure pipe and groove dimensions comply with the tolerances specified by the coupling manufacturer. Measure the diameter of grooves made in the field using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Measure groove width and dimension of groove from end of pipe for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Do not use grooved joints in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.5 ELECTRICAL WORK

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NOTE: Coordinate wiring with the contract drawings and other specification sections.

Include Section 28 31 60 INTERIOR FIRE ALARM SYSTEM, NON-ADDRESSABLE; Section 28 31 66 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, NON-ADDRESSABLE; Section 28 31 70 INTERIOR FIRE ALARM SYSTEM, ADDRESSABLE; or Section 28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE or Section 28 31 33 FIRE ALARM REPORTING SYSTEM, RADIO TYPE when a fire alarm panel or transmitter is required to transmit pump supervisory signals to a constantly attended location as required by NFPA 20 and to reference Section 28 31 33 whenever included in the

contract.
****

Provide electric motor and controls in accordance with NFPA 20, NFPA 72 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Provide electrical wiring and associated equipment in accordance with NFPA 20 and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide wiring in rigid metal conduit or intermediate metal conduit, except electrical metallic tubing conduit may be provided in dry locations not enclosed in concrete or where not subject to mechanical damage.

3.6 PIPE COLOR CODE MARKING

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NOTE: Designer will coordinate color code marking with Section 09 90 00 PAINTS AND COATINGS. Color code marking for piping which are not listed in Table I of UFGS Section 09 90 00 will be added to the table.
****

Color code marking of piping as specified in Section 09 90 00 PAINTS AND COATINGS.

3.7 FLUSHING

Flush the fire pump suction and discharge piping at [120][150] percent of rated capacity of each pump. Where the pump installation consists of more than one pump, the flushing is the total quantity of water flowing when all pumps are discharging at [120][150] percent of their rated capacities. The new pumps may be used to attain the required flushing volume. Do not flush underground piping using the fire pumps. Continue flushing operations until water is clear, but no less than 10 minutes. Submit a signed and dated flushing certificate before requesting field testing.

3.8 FIELD TESTS

Submit system diagrams that show the layout of equipment, piping, and storage units, and typed condensed sequence of operation, wiring and control diagrams, and operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system must be framed under glass or laminated plastic. After approval, post these items where directed.

3.8.1 Hydrostatic Test

Hydrostatically test piping at 1551 kPa 225 psigfor a period of 2-hours, or at least 345 kPa 50 psiin excess of the maximum pressure, when the maximum pressure in the system is in excess of [1207][1379] kPa [175][200] psi in accordance with NFPA 20.

3.8.2 Preliminary Tests

Submit proposed procedures for Preliminary Tests prior to the proposed date and time to begin Preliminary Tests. The Fire Protection Specialist must take all readings and measurements. The Manufacturer's

Representative, a representative of the fire pump controller manufacturer, and a representative of the diesel engine manufacturer (when supplied) must witness the complete operational testing of the fire pump and drivers. The fire pump controller manufacturer's representative and the diesel engine manufacturer's representative must each be an experienced technician employed by the respective manufacturers and capable of demonstrating operation of all features of respective components including trouble alarms and operating features. Thoroughly inspect and test fire pumps, drivers and equipment to insure that the system is correct, complete, and ready for operation. Ensure that pumps are operating at rated capacity, pressure and speed. Include manual starting and running to ensure proper operation and to detect leakage or other abnormal conditions, flow testing, automatic start testing, testing of automatic settings, sequence of operation check, test of required accessories; test of pump alarms devices and supervisory signals, test of pump cooling, operational test of relief valves, and test of automatic power transfer, if provided. Pumps must run without abnormal noise, vibration or heating. If any component or system was found to be defective, inoperative, or not in compliance with the contract requirements during the tests and inspection, make corrections and repeat the entire preliminary. Submit Preliminary Tests Reports, to include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Report must be signed by the Fire Protection Specialist and the Manufacturer's Representative.

3.8.3 Navy Formal Inspection and Tests

The [_____] Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer will witness formal tests and approve all systems before they are accepted. Submit the request for formal inspection at least [15] [_____] days prior to the date the inspection is to take place. An experienced technician regularly employed by the pump installer must be present during the inspection. Where pumps are engine driven, an experienced technician regularly employed by the engine manufacturer capable of demonstrating that all engine trouble alarms and operating features perform as required must be present. Submit proposed date and time to begin Navy Formal Inspection and Tests, with the Acceptance Procedures. Provide notification at least [14] [_____] days prior to the proposed start of the test. Include a copy of the Contractor's Material & Test Certificates. Submit [3] [_____] copies of the completed Navy Formal Inspection and Tests Reports, no later that [7] [_____] days after the completion of the tests. All items in the reports must be signed by the Fire Protection Specialist and the Manufacturer's Representative. Test reports in booklet form (each copy furnished in a properly labeled three ring binder) showing all field tests and measurements taken during the preliminary and final testing, and documentation that proves compliance with the specified performance criteria, upon completion of the installation and final testing of the installed system. Indicate the final position of the controls and pressure switches in each test report. Include the description of the hydrostatic test conducted on the piping and flushing of the suction and discharge piping. Include a copy of the manufacturer's certified pump curve for each fire pump in the report.

3.8.3.1 Full Water Flow Test

Include a full water flow test in the acceptance test. The securing of all hoses and nozzles during the tests is the responsibility of the Contractor. Conduct water flow testing in a safe manner with no

destruction to the existing facility or new construction. Tests include 100 and 150 percent capacity flows and pressures, and no-flow pressures for compliance with manufacturer's characteristic curves. At this inspection repeat the required tests as directed.

3.8.3.2 Correcting Defects

Correct defects in the work, and make additional tests until the Contractor has demonstrated that the system complies with the contract requirements.

3.8.3.3 Documentation of Test

Manufacturer's certified shop test characteristic curves for each pump being tested must be furnished by the Contractor at the time of the pump acceptance test.

3.8.4 Army Final Acceptance Test

The Fire Protection Specialist must take all readings and measurements. The Manufacturer's Representative, the fire pump controller manufacturer's representative, and the diesel engine manufacturer's representative (when supplied) must also witness for the final tests. Repair any damage caused by hose streams or other aspects of the test. Submit proposed date and time to begin Army Final Acceptance Test, with the Acceptance Procedures. Provide notification at least [14] [_____] days prior to the proposed start of the test. Submit [3] [_____] copies of the completed Army Final Acceptance Test Reports, no later that [7] [_____] days after the completion of the tests. All items in the reports must be signed by the Fire Protection Specialist and the Manufacturer's Representative. Test reports in booklet form (each copy furnished in a properly labeled three ring binder) showing all field tests and measurements taken during the preliminary and final testing, and documentation that proves compliance with the specified performance criteria, upon completion of the installation and final testing of the installed system. Indicate the final position of the controls and pressure switches in each test report. Include the description of the hydrostatic test conducted on the piping and flushing of the suction and discharge piping. Include a copy of the manufacturer's certified pump curve for each fire pump in the report. Include a copy of the Contractor's Material & Test Certificates. Include the following in the final acceptance test:

3.8.4.1 Flow Tests

Conduct flow tests using the test header, hoses and playpipe nozzles. Perform flow tests at churn (no flow), 75, 100, 125 and 150 percent capacity for each pump and at full capacity of the pump installation. Take flow readings from each nozzle by means of a calibrated pitot tube with gauge or other approved measuring equipment. Take rpm, suction pressure and discharge pressure reading as part of each flow test. Take voltage and ampere readings on each phase as part of each flow test for electric-motor driven pumps.

3.8.4.2 Starting Tests

Test pumps for automatic starting and sequential starting. Test setting of the pressure switches when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, start each pump automatically 10 times and manually

10 times, in accordance with NFPA 20. Divide tests of engine-driven pumps equally between both set of batteries. Operate fire pumps for a period of a least 10 minutes for each of the starts; except operate electric motors over 149 kW 200 horsepower for at least 15 minutes and do not start more than 2 times in 10 hours. Indicate pressure settings that include automatic starting and stopping of the fire pump(s) on an etched plastic placard, attached to the corresponding pump controller.

3.8.4.3 Battery Changeover

Test diesel driven fire pumps for automatic battery changeover in event of failure of initial battery units.

3.8.4.4 Alarms

Test all pump alarms, both local and remote. Electrically test supervisory alarms for diesel drivers for low oil pressure, high engine jacket coolant temperature, shutdown from overspeed, battery failure and battery charger failure.

3.8.4.5 Miscellaneous

Test valve tamper switches. Verify pressure recorder operation relief valve settings, valve operations, operation and accuracy of meters and gauges, and other accessory devices.

3.8.4.6 Alternate Power Source

On installations with an alternate source of power and an automatic transfer switch, simulate and transfer loss of primary power while the pump is operating at peak load. Do not cause opening of overcurrent devices in either line when transferring from normal to emergency source and retransferring from emergency to normal source. Perform at least half of the manual and automatic starting operations listed with the fire pump connected to the alternate source.

3.8.4.7 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, perform corrective actions and repeat the tests. Conduct tests and repeat if necessary until the system has been demonstrated to comply with all contract requirements.

3.8.4.8 Test Documentation

The Manufacturer's Representative must supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Fire Protection Specialist must record all test results and plot curve of each pump performance during the test. Record complete pump acceptance test data of each fire pump. The pump acceptance test data must be on forms that give the detail pump information such as that which is indicated in Figure A-11-2.6.3(f) of NFPA 20. Submit all test data records in a three ring binder.

3.8.5 Test Equipment

Provide all equipment and instruments necessary to conduct a complete final test, including 65 mm 2.5 inch diameter hoses, playpipe nozzles, pitot tube gauges, portable digital tachometer, voltage and ampere meters,

and calibrated oil-filled water pressure gauges. Provide all necessary supports to safely secure hoses and nozzles during the test. The [Government will][Contractor must] furnish water for the tests.

3.9 DISINFECTION

****

NOTE: For modification of existing systems, provide specific procedures for disinfection of new equipment. If piping specified in this Section is isolated from the domestic water piping systems by means of a reduced pressure backflow prevention assembly or if sprinkler piping in not connected to the domestic water piping, this paragraph should be deleted.

****

After all system components are installed including pumps, piping, and other associated work, and all hydrostatic tests are successfully completed, thoroughly flush the pumps and all piping to be disinfected with potable water until there is no visible sign of dirt or other residue, and hydrostatic test are successfully completed, flush each portion of the piping specified in this Section system to be disinfected thoroughly with potable water until all entrained dirt and other foreign materials are removed before introducing chlorinating material.

3.9.1 Chlorination

Provide chlorinating material consisting of hypochlorites or liquid chlorine. Feed the chlorinating material into the sprinkler piping at a constant rate of 50 parts per million (ppm). Use a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump. Continue chlorination application until the entire system is filled. Keep the water in the system for a minimum of 24 hours. Open and close each valve in the system several times to ensure its proper disinfection. Following the 24-hour period, allow no less than 25 ppm chlorine residual to remain in the system.

3.9.2 Flushing

Flush the system with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer.

3.9.3 Sample Testing

Test samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. Use either the multiple-tube fermentation technique or the membrane-filter technique testing method. Repeat disinfection until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 SYSTEM STARTUP

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NOTE: Provide adequate clearance and access space to safely install, test and maintain the fire pump system.

****

Fully enclose or properly guard coupling, rotating parts, gears, projecting equipment, etc. so as to prevent possible injury to persons that come in close proximity of the equipment. Conduct testing of the fire pumps in a safe manner and ensure that all equipment is safely secured. Use hoses and nozzles to conduct flow tests that are in excellent condition and safely anchor and secure to prevent any misdirection of the hose streams.

Post operating instructions for pumps, drivers, controllers, and flow meters.

3.11 CLOSEOUT ACTIVITIES

3.11.1 Field Training

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NOTE: The number of hours of instruction should be determined based of the number and complexity of the systems specified.

****

Conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Submit the proposed schedule for field training at least 14 days prior to the start of related training. Provide training for a period of [2] [8] hours of normal working time and start after the fire pump installation is functionally complete and after the Final Acceptance Test. Cover all of the items contained in the approved Operating and Maintenance Instructions. Submit manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance. Include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Submit Data Package 3 for fire pumps and drivers in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. [Submit service organization that is capable of providing [4] [_____] hour onsite response to a service call on an emergency basis.]

3.11.2 As-Built Drawings

Submit As-Built Drawings, no later than [14][_____] days after completion of the Final Tests. Update the Fire Pump Installation Drawings to reflect as-built conditions after all related work is completed and prepare drawings on reproducible full-size mylar film.

3.12 PROTECTION

Carefully remove materials so as not to damage material which is to remain. Replace existing work damaged by the Contractor's operations with new work of the same construction.

-- End of Section --