****
USACE / NAVFAC / AFCESA / NASA **UFGS-21 30 00 (February 2007)**

Preparing Activity: USACE **Superseding UFGS-21 30 00 (April 2006)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2007
****

SECTION TABLE OF CONTENTS

DIVISION 21 - FIRE SUPPRESSION

SECTION 21 30 00

FIRE PUMPS

02/07

-- End of Section Table of Contents --

****
USACE / NAVFAC / AFCESA / NASA **UFGS-21 30 00 (February 2007)**

Preparing Activity: USACE **Superseding**
UFGS-21 30 00 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2007
****

SECTION 21 30 00

FIRE PUMPS
02/07

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

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

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

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents**, including their organization designation and telephone number, is on the Internet.**

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR)**.**
****

PART 1 GENERAL

****
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 and Military Handbook 1008C.

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% 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 Command, Fire Protection Engineer, should be consulted.

****

1.1 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 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.
****

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 WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2005) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(2004) Hypochlorites
AWWA B301	(2004) Liquid Chlorine
AWWA C104/A21.4	(2003) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2003) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	(2002; Errata 2002) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C500	(2002; R 2003) Metal-Seated Gate Valves for Water Supply Service
AWWA C606	(2004) Grooved and Shouldered Joints

ASME INTERNATIONAL (ASME)

ASME B16.11	(2005) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2005) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.22	(2001; R 2005) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2006) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	(1998) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.39	(1998) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.5	(2003) Standard for Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24
ASME B16.9	(2003) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.1	(2004; Addenda 2005) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A 183	(2003) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2006a) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2006a Standard Specification for) Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service or Both
ASTM A 449	(2004be1) Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A 47/A 47M	(2004) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 53/A 53M	(2006a) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 2004) Standard Specification for Ductile Iron Castings
ASTM A 563	(2004a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A 563M	(2006) Standard Specification for Carbon and Alloy Steel Nuts (Metric)

ASTM A 795/A 795M	(2004) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 135	(2002) Standard Specification for Seamless Brass Tube
ASTM B 135M	(2000e1) Standard Specification for Seamless Brass Tube (Metric)
ASTM B 42	(2002e1) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B 62	(2002) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B 75	(2002) Standard Specification for Seamless Copper Tube
ASTM B 75M	(1999; R 2005) Standard Specification for Seamless Copper Tube (Metric)
ASTM B 88	(2003) Standard Specification for Seamless Copper Water Tube
ASTM B 88M	(2005) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C 533	(2004) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM D 2000	(2006a) Standard Classification System for Rubber Products in Automotive Applications
ASTM D 3308	(2006) PTFE Resin Skived Tape
ASTM F 436	(2004) Hardened Steel Washers
ASTM F 436M	(2004) Hardened Steel Washers (Metric)

FM GLOBAL (FM)

FM P7825a	(2005) Approval Guide Fire Protection
FM P7825b	(2005) Approval Guide Electrical Equipment

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

MSS SP-58	(2002) Standard for Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(2003; R 2004) Standard for Pipe Hangers and Supports - Selection and Application
MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2006) Standard for Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1963	(2003) Standard for Fire Hose Connections
NFPA 20	(2006) Installation of Stationary Pumps for Fire Protection
NFPA 24	(2006) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 37	(2006) Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(2005; TIA 2005) National Electrical Code
NFPA 72	(2006) National Fire Alarm Code

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2003) 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 1247	(2004) Diesel Engines for Driving Centrifugal Fire Pumps
UL 142	(2006) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 262	(2004) Standard for Gate Valves for Fire-Protection Service
UL 448	(2004) Pumps for Fire-Protection Service
UL 80	(2004) Steel Tanks for Oil-Burner Fuel
UL Fire Prot Dir	(2006) Fire Protection Equipment Directory

1.2 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the

submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation 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.

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" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.]

[The [_____] Division, Naval Facilities Engineering 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 Command, use the optional approval paragraph immediately below and delete the general approval statement above for Navy projects.

****

[The [_____] Division, Naval Facilities Engineering 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 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.]

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Requirements[; G][; G, [_____]]

[Three] [_____] copies of the 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. Drawings shall indicate equipment, piping, and associated pump equipment to scale. 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 shall be indicated. Drawings shall include a legend identifying all symbols, nomenclatures, and abbreviations. Drawings shall 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.

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

As-built drawings, as specified.

Piping Layout and Sensing piping Arrangement[; G][; G, [_____]]
Pump Room[; G][; G, [_____]]

Prepare working drawings on sheets not smaller thanA1 594 x 841 mm 24 by 36 inches; include data for the proper installation of each system.

SD-03 Product Data

Fire Pump Installation Related Submittals

A list of the Fire Pump Installation Related Submittals, no later than [7] [_____] days after the approval of the Fire Protection Specialist and the Manufacturer's Representative.

Installation Requirements[; G][; G, [_____]]

Manufacturer's catalog data included with the Fire Pump

Installation Drawings for each separate piece of equipment proposed for use in the system. Catalog data shall indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided. Catalog data for material and equipment shall include, but not be limited to, the following:

a. 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 shall be submitted prior to the final tests.

b. Pressure maintenance pump and controller.

c. Piping components.

d. Valves, including gate, check, globe and relief valves.

e. Gauges.

f. Hose valve manifold test header and hose valves.

g. Flow meter.

h. Restrictive orifice union.

i. Associated devices and equipment.

Spare Parts

Spare parts data for each different item of material and equipment specified.

Preliminary Tests

Proposed procedures for Preliminary Tests, at least [14] [_____] days prior to the proposed start of the tests. Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

Field Tests[; G][; G, [_____]]

Proposed diagrams, at least 2 weeks prior to start of related testing.

Fire Protection Specialist[; G][; G, [_____]]

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days [_____] after the Notice to Proceed and prior to the submittal of the fire pump installation drawings.

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

The name and documentation of certification of the proposed Manufacturer's Representative, concurrent with submittal of the Fire Protection Specialist Qualifications.

Field Training[; G][; G, [_____]]

Proposed schedule for field training submitted at least 14 days prior to the start of related training.

Army Final Acceptance Test
Navy Formal Inspection and Tests

Proposed date and time to begin [Army Final Acceptance Test] [Navy Formal Inspection and Tests], submitted with the Acceptance Procedures. Notification shall be provided at least [14] [_____] days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

SD-06 Test Reports

Preliminary Tests[; G][; G, [_____]]

[Three] [_____] copies of the completed Preliminary Tests Reports, no later that [7] [_____] days after the completion of the Preliminary Tests. The Preliminary Tests Report shall 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 Preliminary Tests Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative.

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

[Three] [_____] copies of the completed [Army Final Acceptance Test] [Navy Formal Inspection and Tests] Reports , no later that [7] [_____] days after the completion of the tests. All items in the reports shall 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. Each test report shall indicate the final position of the controls and pressure switches. The test reports shall include the description of the hydrostatic test conducted on the piping and flushing of the suction and discharge piping. A copy of the manufacturer's certified pump curve for each fire pump shall be included in the report.

SD-07 Certificates

Fire Protection Specialist[; G][; G, [_____]]

Concurrent with the Final Acceptance Test Report, 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.

Qualifications of Welders[; G][; G, [_____]]
Qualifications of Installer[; G][; G, [_____]]

Certificates of qualifications, as specified.

Preliminary Test Certification[; G][; G, [_____]]

Request for formal inspection and tests, as specified.

SD-10 Operation and Maintenance Data

Fire Pumps

[Six] [_____] manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days [_____] prior to field training. The manuals shall 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. Data Package 3 shall be submitted for fire pumps and drivers in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. [Each service organization submitted shall be capable of providing [4] [_____] hour onsite response to a service call on an emergency basis.]

Flow Meter

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

1.3 GENERAL REQUIREMENTS

a. Except as modified in this Section or on the drawings, fire pumps shall be installed in conformance with NFPA 20, NFPA 70, and NFPA 72, including all recommendations and advisory portions, which shall be considered mandatory; this includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Devices and equipment for fire protection service shall be UL Fire Prot Dir listed or FM P7825a approved. All reference to the authority having jurisdiction shall be interpreted to mean the Contracting Officer or the [_____] Division, Naval Facilities Engineering Command, Fire Protection Engineer for Navy projects.

b. The Contractor shall submit Spare Parts data for each different item of equipment and material specified. The data shall 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. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

c. Show detail plan view of the pump room including elevations and sections showing the fire pumps, associated equipment, and piping. 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

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

1.4 SEQUENCE OF OPERATION

****

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 Command, Fire Protection Engineer.

****

1.4.1 Primary Fire Pump

Primary fire pump shall [automatically operate when the pressure drops to [758] [_____] kPa [110] [_____] psi] [automatically upon tripping of the [_____] sprinkler system,] [and] [or] [manually when the starter is operated.] [Pump[s] shall continue to run until shut down manually.] [Pump[s] shall automatically shut down after a running time of [_____] minutes unless manually shutdown.]. The fire pump shall 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.

1.4.1.1 Secondary Fire Pump

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

1.4.1.2 Pressure Maintenance Pump

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

1.4.2 Safety Requirements

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

Coupling, rotating parts, gears, projecting equipment, etc. shall be fully enclosed or properly guarded so as to prevent possible injury to persons that come in close proximity of the equipment. The Contractor shall conduct testing of the fire pumps in a safe manner and ensure that all equipment is safely secured. Hoses and nozzles used to conduct flow tests shall be in excellent condition and shall be safely anchored and secured to prevent any misdirection of the hose streams.

1.5 COORDINATION OF TRADES

Tank supports, piping offsets, fittings, and any other accessories required shall be furnished as specified to provide a complete installation and to eliminate interference with other construction.

1.6 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed with protection from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall be either capped or plugged until installed.

1.7 FIELD MEASUREMENTS

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

1.8 QUALITY ASSURANCE

1.8.1 Fire Protection Specialist

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

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be 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. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have 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.[Contractor shall submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.]

1.8.2 Qualifications of Welders

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

1.8.3 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. The data shall 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.

1.8.4 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.

1.9 MANUFACTURER'S REPRESENTATIVE

Work specified in this section shall be performed under the supervision of and certified by a representative of the fire pump manufacturer. The Manufacturer's Representative shall be regularly engaged in the installation of the type and complexity of fire pump(s) specified in the Contract documents, and shall have 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.

1.10 NAMEPLATES

All equipment shall have 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. Pumps and motors shall have standard nameplates securely affixed in a conspicuous place and easy to read. Fire pump shall have nameplates and markings in accordance with UL 448. Diesel driver shall have nameplate and markings in accordance with UL 1247. Electric motor nameplates shall provide the minimum information required by NFPA 70, Section 430-7.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 FIRE PUMP

****
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.
****

Fire pump shall be [electric motor driven] [diesel engine driven]. Each pump capacity shall be rated at [_____] L/second gpm with a rated net pressure of [_____] kPa psi. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal [horizontal split case] [water lubricated, vertical shaft turbine] [end-suction] [in-line] fire pump. Horizontal pump shall be equipped with automatic air release devices. The maximum rated pump speed shall be 2100 rpm when driving the pump at rated capacity. Pump shall be [automatic start and manual stop] [manual pushbutton start and stop] [automatic start and automatic stop]. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

2.3.1 General Requirements

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.3.2 Alarms

****
NOTE: Power for alarms must be from a source other than the engine starting batteries and shall not exceed 125 volts. Power shall not be supplied 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 [_____] [where shown]. Alarm signal shall be activated 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]. Exterior alarm devices shall be weatherproof type. 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. Minimum pipe size shall be 150 mm 6 inches. Minimum depth of cover shall be 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 shall 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

DISTRIBUTION].

2.4.2 Fittings and Gaskets

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

2.4.3 Valves and Valve Boxes

Valves shall be gate valves conforming to AWWA C500 or UL 262. Valves shall have cast-iron body and bronze trim. Valve shall open by counterclockwise rotation. Except for post indicator valves, all underground valves shall be provided 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 not less than 133 mm 5.25 inches in diameter. The box shall be coated with bituminous coating. A cast-iron or ductile-iron cover with the word "WATER" cast on the cover shall be provided 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.

****

Gate valves for underground installation shall be of the inside screw type with counterclockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be 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. Gate valves and indicator posts shall be provided with one coat of primer and two coats of red enamel paint and shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4.5 Buried Utility Warning and Identification Tape

Detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping shall be provided for all buried piping. Tape shall be detectable by an electronic detection instrument. Tape shall be provided 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 shall be "CAUTION BURIED WATER PIPING BELOW" or similar wording. Code and lettering shall be permanent and unaffected by moisture and other substances contained in the trench backfill material. Tape shall be buried 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

Piping shall be [ASTM A 53/A 53M] [ASTM A 795/A 795M], 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. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only. Piping shall not be jointed by welding or weld fittings. Suction piping shall be galvanized on the inside per NFPA 20.

2.5.1.2 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.3 Flanges

Flanges shall be ASME B16.5, Class 150 flanges. Flanges shall be provided at valves, connections to equipment, and where indicated.

2.5.1.4 Gaskets

Gaskets shall be AWWA C111/A21.11, cloth inserted red rubber gaskets.

2.5.1.5 Bolts

Bolts shall be [ASTM A 449, Type [1] [2]] [ASTM A 193/A 193M, Grade B7]. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.1.6 Nuts

Nuts shall be [ASTM A 194/A 194M, Grade 7] [ASTM A 193/A 193M, Grade 5] [ASTM A 563M ASTM A 563, Grade [C3] [DH3]].

2.5.1.7 Washers

Washers shall meet the requirements of ASTM F 436M ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Piping Sizes 50 mm 2 inches and Smaller

2.5.2.1 Steel Pipe

Steel piping shall be [ASTM A 795/A 795M, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A] [ASTM A 53/A 53M, Weight Class XS (Extra Strong)], zinc-coated steel pipe with threaded end connections. Fittings shall be [ASME B16.3] [ASME B16.39], Class 150, zinc-coated threaded fittings. Unions shall be ASME B16.39, Class 150, zinc-coated unions.

2.5.2.2 Copper Tubing

Copper tubing shall be ASTM B 88M ASTM B 88, Type L or K, soft annealed. Fittings shall be ASME B16.26, flared joint fittings. Pipe nipples shall be ASTM B 42 copper pipe with threaded end connections.

2.5.3 Pipe Hangers and Supports

Pipe hangers and support shall be [MSS SP-58 and MSS SP-69] [UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b] and shall be the adjustable type. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.5.4 Valves

Valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire protection service. Valves shall have flange or threaded end connections.

2.5.4.1 Gate Valves and Control Valves

Gate valves and control valves shall be outside screw and yoke (O.S.&Y.) type 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.

****

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

2.5.4.3 Check Valve

Check valve shall 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.

****

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

2.5.4.5 Circulating Relief Valve

An adjustable circulating relief valve shall be provided for each fire pump in accordance with NFPA 20.

2.5.4.6 Suspension 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.
****

Suction pressure regulating valve shall be FM approved FM P7825a and FM P7825b. Suction pressure shall be monitored through a pressure line to the controlling mechanism of the regulating valve. Valve shall be arranged 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 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. Welding shall be metallic arc process in accordance with ASME B31.1.

2.5.6 Pipe Sleeves

A pipe sleeve shall be provided 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, a fire seal shall be provided 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. Plates shall be secured in place.

2.6 DISINFECTING MATERIALS

2.6.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.6.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform 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.
****

Motors, controllers, contactors, and disconnects shall be provided with their respective pieces of equipment, as specified herein and shall have electrical connections provided under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Controllers and contactors shall have 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, the cost of providing additional electrical service and related work shall be included under this section. Motor shall conform to NEMA MG 1 and be marked as complying with NEMA Design B standards. Motor wattage horsepower shall be 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 shall 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.
****

Diesel engine driver shall conform to the requirements of UL 1247 and shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire pump service. Driver shall be of the make recommended by the pump manufacturer. The engine shall be closed circuit, liquid-cooled [with raw water heat exchanger] [with radiator and engine-driven fan]. Diesel engine shall be electric start type taking current from 2 battery units. Engine shall be equipped with a fuel in-line filter-water separator. Engine conditions shall be monitored with engine instrumentation panel that has a tachometer, hour meter, fuel pressure gauge, lubricating oil pressure gauge, water temperature gauge, and ammeter gauge. Engine shall be connected to horizontal-shaft pump by flexible couplings. For connections to vertical-shaft fire pumps, right-angle gear drives and universal joints shall be used. An engine jacket water heater shall be provided to maintain a temperature of 49 degrees C 120 degrees F in accordance with NFPA 20.

2.8.1 Engine Capacity

Engine shall have adequate wattage horsepower to drive the pump at all conditions of speed and load over the full range of the pump performance curve. The wattage horsepower rating of the engine driver shall be as recommended by the pump manufacturer and shall be derated for temperature and elevation in accordance with NFPA 20. Ambient temperature at the pump location shall be [_____] degrees C degrees F. Site elevation shall 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.

****

Exhaust system shall comply with the requirements of NFPA 20 and NFPA 37. An exhaust muffler shall be provided for each diesel engine driver to reduce noise levels less than [85] [95] dBA. A flexible connector with flange connections shall be provided at the engine. Flexible sections shall be stainless steel suitable for diesel-engines exhaust gas at 538 degrees C 1000 degrees F.

2.8.2.1 Steel Pipe and Fittings

ASTM A 53/A 53M, [Schedule 40] [Weight Class XS (Extra Strong], black steel, welding end connections. ASME B16.9 or ASME B16.11 welding fittings shall be of the same material and weight as the piping.

2.8.2.2 Flanges

ASME B16.5, Class [300] [150]. Flanges shall be provided at connections to diesel engines, exhaust mufflers, and flexible connections. Gaskets shall be ASME B16.21, composition ring, 1.5875 mm 0.0625 inch. ASTM A 193/A 193M, Grade [B8] [B7] bolts and ASTM A 194/A 194M, Grade [8] [7] nuts shall be provided.

2.8.2.3 Piping Insulation

The Contractor shall comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. Products containing asbestos will not be permitted. Exhaust piping system including the muffler shall be insulated with ASTM C 533 calcium silicate insulation, minimum of 75 mm 3 inches. Insulation shall be secured with not less than 9.525 mm 0.375 inch width fibrous glass reinforced waterproof tape or Type 304 stainless steel bands spaced not more than 200 mm 8 inches on center.

An aluminum jacket encasing the insulation shall be provided. The aluminum jacket shall have a minimum thickness of 0.406 mm 0.016 inches, a factory-applied polyethylene and kraft paper moisture barrier on the inside surface. The jacket shall be secured with not less than 13 mm 0.5 inch wide stainless steel bands, spaced not less than 200 mm 8 inches on centers. Longitudinal and circumferential seams of the jacket shall be lapped not less than 75 mm 3 inches. Jackets on horizontal line shall be installed so that the longitudinal seams are on the bottom side of the pipe. The seams of the jacket for the vertical lines shall be placed on the off-weather side of the pipe. On vertical lines, the circumferential seams of the jacket shall overlap 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.

****

Controller shall be the automatic type and UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire pump service. Pump shall be arranged for automatic start and stop, and manual push-button stop. Automatic stopping shall be accomplished only after all starting causes have returned to normal and after a minimum pump run time has elapsed. Controllers shall be 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. Controller shall be provided with voltage surge arresters installed per NFPA 20. Controller shall be equipped 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. Controller shall be equipped 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 [Controller shall be equipped with a sequential start timer/relay feature to start multiple fire pumps in sequence.] [The controller shall be 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 shall be [electronic soft start] [across the line] [auto-transformer] [wye-delta, open circuit transition] [wye-delta, closed circuit transition] starting type. Controller shall be designed [for [_____] kW HP at [_____] volts] [as indicated]. Controller [and transfer switch] shall have a short circuit rating [of [_____] amps r.m.s. symmetrical at [_____] volts a.c.] [as indicated]. [An automatic transfer switch (ATS) shall be provided for each fire pump. The ATS shall comply with NFPA 20 and shall be specifically listed for fire pump service. The ATS shall transfer source of power to the alternate source upon loss of normal power.] Controller shall monitor pump running, loss of a phase or line power, phase reversal, [low reservoir] and pump room temperature. Alarms shall be individually displayed in front of panel by lighting of visual lamps. Each lamp shall be labeled with rigid etched plastic labels. Controller shall be equipped 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. Controller shall be equipped with a 7-day electric pressure recorder with 24-hour spring wound back-up. The pressure recorder shall provide a readout of the system pressure from 0 to 207 Pa 0 to 15 hp, time, and date. Controller shall 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. The controller shall be equipped with an externally operable isolating switch which manually operates the motor circuit. Means shall be provided 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 shall require the pump to run for 30 minutes prior to automatic shutdown. Controller shall be equipped with two battery chargers; two ammeters; two voltmeters, one for each set of batteries. Controller shall automatically alternate the battery sets for starting the pumps. Controller shall be equipped 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

Alarms shall be individually displayed in front of panel by lighting of visual lamps, except that individual lamps are not required for pump running and main switch mis-set. Controller shall be equipped with a 7-day electric pressure recorder with 24-hour back-up mounted inside the controller. The pressure recorder shall provide a readout of the system pressure from 0 to 207 Pa 0 to 300 psi, time, and date. The controller shall be equipped with an audible alarm which will activate upon any engine trouble or pump room trouble alarm condition and alarm silence switch. Controller shall be equipped 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 shall cause the engine to shut down without time delay and lock out until manually reset.

2.10 BATTERIES

Batteries for diesel engine driver shall be sealed lead calcium batteries. Batteries shall be mounted in a steel rack with non-corrosive, non-conductive base, not less than 300 mm 12 inches above the floor.

2.11 PRESSURE SENSING LINE

A completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with Figure A-7-5.2.1. of NFPA 20. The sensing line shall be 13 mm 1/2 inchH58 brass tubing complying with ASTM B 135M ASTM B 135. The sensing line shall be equipped with two restrictive orifice unions each. Restricted orifice unions shall be ground-face unions with brass restricted diaphragms drilled for a 2.4 mm 3/32 inch. Restricted orifice unions shall be mounted in the horizontal position, not less than 1.5 m 5 feet apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass 13 mm 1/2 inch globe valves and 8 mm 1/4 inch gauge connection tee arranged per NFPA 20. One of the test connections shall be equipped with a 0 to 2100 kPa 0 to 300 psi water oil-filled gauge. Sensing line shall be connected 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

Pressure maintenance pump shall be 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 shall draft [from the suction supply side of the suction pipe gate valve of the fire pump] [as indicated] and shall discharge into the system at the downstream side of the pump discharge gate valve. An approved indicating gate valve of the outside screw and yoke (O.S.&Y.) type shall be provided in the maintenance pump discharge and suction piping. Oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.12.2 Pressure Maintenance Pump Controller

Pressure maintenance pump controller shall be arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely prewired, ready for field connections, and wall-mounted in a NEMA Type 2 drip-proof enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, PRESSURE SENSING LINE. The sensing line shall be completely separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be set 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 liters per kilowatt (1 gallon per horsepower) plus 10%. 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.
****

Fuel system shall be provided that meets all requirements and advisory provisions of NFPA 20 and NFPA 37. The fuel tank vent piping shall be equipped with screened weatherproof vent cap. Vents shall be extended to the outside. Each tank shall be equipped with a fuel level gauge. Flexible bronze or stainless steel piping connectors with single braid shall be provided at each piping connection to the diesel engine. Supply, return, and fill piping shall be steel piping, except supply and return piping may be copper tubing. Fuel lines shall be protected against mechanical damage. Fill line shall be equipped with 16 mesh removable wire screen. Fill lines shall be extended to the exterior. A weatherproof tank gauge shall be mounted on the exterior wall near each fill line for each tank. The fill cap shall be able to be locked by padlock. The engine supply (suction) connection shall be located 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 shall 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. The bottom of the tank shall be pitched 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 Steel pipe

ASTM A 53/A 53M, hot-dipped zinc-coated, Schedule 40, threaded connections. Fittings shall be ASME B16.3, zinc-coated, threaded malleable iron fittings. Unions shall be ASME B16.39 zinc-coated, threaded unions.

2.13.2 Copper Tubing

ASTM B 88M ASTM B 88, Type K, soft annealed, with ASME B16.26 flared fittings.

2.13.3 Diesel Fuel Tanks

UL 80 or UL 142 for aboveground tanks.

2.13.4 Valves

An indicating and lockable ball valve shall be provided in the supply line adjacent to the tank suction inlet connection. A check valve shall be provided in fuel return line. Valves shall be suitable for oil service. Valves shall have union end connections or threaded end connections.

a. Globe valve: MSS SP-80 Class 125

b. Check valve: MSS SP-80, Class 125, swing check

c. Ball valve: Full port design, copper alloy body, 2-position lever handle.

2.14 JOINTS AND FITTINGS FOR COPPER TUBE

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75M ASTM B 75. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62. 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. Grooved mechanical joints and fittings shall be designed for not less than 862 kPa 125 psig service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 110 degrees C 239 degrees F. Grooved joints shall conform to AWWA C606 Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

2.15 PUMP BASE PLATE AND PAD

A common base plate shall be provided for each horizontal-shaft fire pump for mounting pump and driver unit. The base plate shall be constructed of cast iron with raised lip tapped for drainage or welded steel shapes with suitable drainage. Each base plate for the horizontal fire pumps shall be provided with a 25 mm 1 inchgalvanized steel drain line piped to the nearest floor drain. For vertical shaft pumps, pump head shall be provided with a cast-iron base plate and shall serve as the sole plate for mounting the discharge head assembly. Pump units and bases shall be mounted on a raised [100][150] mm [4] [6] inchesreinforced 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.

****

Hose valve test header shall be connected by ASME B16.5, Class 150 flange inlet connection. Hose valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b bronze hose gate valves with 65 mm 2.5 inches American National Fire Hose Connection Screw Standard Threads (NH) per NFPA 1963. The number of valves shall be per NFPA 20. Each hose valve shall be equipped with a cap and chain, and located no more than 900 mm 3 feet and no less than 600 mm 2 feet above grade.

2.17 FLOW METER

****

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.

****

Meter shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and

FM P7825b as flow meters for fire pump installation with direct flow readout device. Flow meter shall be capable of metering any waterflow quantities between 50 percent and 150 percent of the rated flow of the pumps. The flow meter shall be arranged in accordance with Figure A-2-14.2.1 of NFPA 20. The meter throttle valve and the meter control valves shall be O.S.&Y. valves. Automatic air release shall be provided if flow meter test discharge is piped to the pump suction and forms a closed-loop meter arrangement as defined in Figure A-2-14.2.1 of NFPA 20. Meter shall be of the [venturi] [annular probe] [orifice plate] [_____] type.

PART 3 EXECUTION

3.1 FIRE PUMP INSTALLATION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the fire pump(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall 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. There shall be no excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems. Inspection shall include piping and equipment clearance, access, supports, and guards. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered. The Fire Protection Specialist shall witness the preliminary and final acceptance tests and, after completion of the inspections and a successful final acceptance test, shall sign test results and certify in writing that the installation the fire pump installation is in accordance with the contract requirements.

3.3 INSTALLATION REQUIREMENTS

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

3.4 PIPE AND FITTINGS

Piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used. [Photograph all piping prior to burying, covering, or concealing.]

3.4.1 Cleaning of Piping

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

3.4.2 Threaded Connections

Jointing compound for pipe threads shall be [polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D 3308] [Teflon pipe thread paste] and shall be applied to male threads only. Exposed ferrous pipe threads shall be provided 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

Additional hangers and supports shall be provided for concentrated loads in aboveground piping, such as for valves and risers.

3.4.3.1 Vertical Piping

Piping shall be supported at each floor, at not more than 3 meters 10 foot intervals.

3.4.3.2 Horizontal Piping

Horizontal piping supports shall be spaced as follows:

MAXIMUM SPACING (METERS)

Nominal Pipe Size (mm)	25 and Under	32	40	50	65	80	90	100	125	150+
Copper Tube	1.8	2	2.4							
Steel Pipe	2	2.4	2.7	3	3.3	3.6	3.9	4.2	4.8	5.0

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	1 and Under	1.25	1.5	2	2.5	3	3.5	4	5	6+
Copper Tube	6	7	8							
Steel Pipe	7	8	9	10	11	12	13	14	16	17

3.4.4 Underground Piping

Installation of underground piping and fittings shall conform to NFPA 24. Joints shall be anchored in accordance with NFPA 24. Concrete thrust block shall be provided at elbow where pipe turns up towards floor, and the pipe riser shall be restrained with steel rods from the elbow to the flange above the floor. After installation per NFPA 24, rods and nuts shall be thoroughly cleaned and coated with asphalt or other corrosion-retard material approved by the Contracting Officer. Minimum depth of cover shall be 900 mm 3 feet.

3.4.5 Grooved Mechanical Joint

Grooves shall be prepared according to the couping manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured 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. Groove width and dimension of groove from end of pipe shall be measured for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used 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

****

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

Include Section 28 31 74.00 20 INTERIOR FIRE DETECTION AND ALARM SYSTEM and Section 29 31 33.10 20 EXTERIOR FIRE REPORTING SYSTEM, RADIO TYPE or Section 28 31 33.00 10 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 33.00 10 or Section 29 31 33.10 20 whenever included in the contract.

****

Electric motor and controls shall be in accordance with NFPA 20, NFPA 72 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Electrical wiring and associated equipment shall be provided 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

****

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 shall be as specified in Section 09 90 00

PAINTS AND COATINGS.

3.7 FLUSHING

The fire pump suction and discharge piping shall be flushed at [120] [150] percent of rated capacity of each pump. Where the pump installation consists of more than one pump, the flushing shall be 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. No underground piping shall be flushed by using the fire pumps. Flushing operations shall continue until water is clear, but not less than 10 minutes. The Contractor shall submit a signed and dated flushing certificate before requesting field testing.

3.8 FIELD TESTS

The Contractor shall submit, atleast 2 weeks before starting field tests, 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 shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

3.8.1 Hydrostatic Test

Piping shall be hydrostatically tested 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

The Fire Protection Specialist shall 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) shall 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 shall 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. Fire pumps, drivers and equipment shall be thoroughly inspected and tested to insure that the system is correct, complete, and ready for operation. Tests shall ensure that pumps are operating at rated capacity, pressure and speed. Tests shall 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 shall 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, the corrections shall be made and the entire preliminary test shall be repeated.

3.8.3 Navy Formal Inspection and Tests

The [_____] Division, Naval Facilities Engineering 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 shall 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 shall be present.

3.8.3.1 Full Water Flow Test

Acceptance test shall include a full water flow test. The securing of all hoses and nozzles during the tests is the responsibility of the Contractor. Water flow testing shall be conducted in a safe manner with no destruction to the existing facility or new construction. Tests shall 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 provided by the Contractor, 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 shall 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) shall also witness for the final tests. The Contractor shall be responsible for repairing any damage caused by hose streams or other aspects of the test. The final acceptance test shall include the following:

3.8.4.1 Flow Tests

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

3.8.4.2 Starting Tests

Pumps shall be tested for automatic starting and sequential starting. Setting of the pressure switches shall be tested when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, each pump shall be started automatically 10 times and manually 10 times, in accordance with NFPA 20. Tests of engine-driven pumps shall be divided equally between both set of batteries. The fire pumps shall be operated for a period of a least 10 minutes for each of the starts; except that electric motors over 149 kW 200 horsepowershall be operated for at least 15 minutes and shall not be started more than 2 times in 10 hours. Pressure settings that include automatic starting and stopping of the fire pump(s) shall be indicated on an etched plastic placard, attached to the corresponding pump controller.

3.8.4.3 Battery Changeover

Diesel driven fire pumps shall be tested for automatic battery changeover in event of failure of initial battery units.

3.8.4.4 Alarms

All pump alarms, both local and remote, shall be tested. Supervisory alarms for diesel drivers shall be electrically tested for low oil pressure, high engine jacket coolant temperature, shutdown from overspeed, battery failure and battery charger failure.

3.8.4.5 Miscellaneous

Valve tamper switches shall be tested. Pressure recorder operation relief valve settings, valve operations, operation and accuracy of meters and gauges, and other accessory devices shall be verified.

3.8.4.6 Alternate Power Source

On installations with an alternate source of power and an automatic transfer switch, loss of primary power shall be simulated and transfer shall occur while the pump is operating at peak load. Transfer from normal to emergency source and retransfer from emergency to normal source shall not cause opening of overcurrent devices in either line. At least half of the manual and automatic starting operations listed shall be performed 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, the Contractor shall performed corrective actions and repeat the tests. Tests shall be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.8.4.8 Test Documentation

The Manufacturer's Representative shall supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Fire Protection Specialist shall record all test results and plot curve of each pump performance during the test. Complete pump acceptance test data of each fire pump shall be recorded. The pump acceptance test data shall 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. All test data records shall be submitted in a three ring binder.

3.8.5 Test Equipment

The Contractor shall 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. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. The [Government will] [Contractor shall] furnish water for the tests.

3.8.6 As-Built Drawings

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

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, each portion of the piping specified in this Section system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material.

3.9.1 Chlorination

The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). 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 shall be used. Chlorination application shall continue until the entire system if filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system.

3.9.2 Flushing

The system shall then be flushed 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

Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated 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 FIELD TRAINING

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

The Fire Protection Specialist and the Manufacturer's Representative shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of [2] [8] hours of normal working time and shall start after the fire pump installation is functionally complete and after the Final Acceptance Test. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --