

SECTION 21 30 16
DIESEL-DRIVEN, FIRE PUMPS

SPEC WRITER NOTES:

1. Delete between // --- // if not applicable to the project. Also delete any other item or paragraph including NFPA references which are not applicable and renumber the paragraphs.
2. Confirm that the enclosure in which the diesel fire pump is being placed has adequate combustion air entrainment and ventilation.
3. Review designated pump room or house and its access to ensure adequate space and protection is provided in accordance with NFPA 20.
4. Ensure pump suction requirements are met to achieve 150% capacity
5. Fire pump should be designed using water supply information that is less than 12 months old.
6. Refer to the VA Fire Protection Manual for fire pump sizing.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Installation of a new fire pump system with bypass in accordance with NFPA 20, NFPA 37, and NFPA 70.

1.2 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 07 84 00, FIRESTOPPING.
- C. Section 09 90 00, PAINTING.
- D. Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 DESIGN CRITERIA

- A. The design, materials, equipment, installation, inspection, and testing of the fire pump shall be in accordance with the required provisions of NFPA 20, NFPA 37, and NFPA 70.

SPEC WRITER NOTE: The A/E's structural engineer must determine if seismic protection is required in accordance with VA Seismic Design Requirements H-18-8. The seismic calculation should be provided to the COR and the following section added when seismic protection is required.

//B. Seismic Protection: Seismically brace all fire pump piping systems in accordance with NFPA 13 and NFPA 20.//

1.4 SUBMITTALS

A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer licensed in the field of Fire Protection Engineering. As Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide an index referencing the appropriate specification section. In addition to the hard copies, provide submittal items in Paragraphs 1.4 (A) 1 through 1.4 (A) 5 electronically in pdf format on a compact disc or as directed by the Contracting Officer's Representative (COR). Submittals shall include, but not be limited to, the following:

1. Qualifications:

- a. Provide a copy of the installing contractors // fire sprinkler // and state // contractors license.
 - b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer licensed in the field of Fire Protection Engineering.
 - c. Provide documentation showing that the installer has been actively and successfully engaged in the installation of commercial automatic fire pump systems for the past 10 years.
2. Drawings: Submit detailed 1/8 inch (1:100) scale (minimum) working drawings conforming to NFPA 20. Provide drawings showing pump room configuration. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Provide wiring diagrams for connections to power, signal, and control wiring. Drawings shall include graphical scales that allow the user to determine lengths when the drawings are reduced in area.

3. Manufacturers Data Sheets: Provide for all materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheets describe items in addition to those proposed to be used for the system, clearly identify the proposed items on the sheet. Data sheets shall be provided for, but not limited to, the following:
 - a. Pipe and fittings
 - b. Valves
 - c. Pressure Gauges
 - d. Pipe Hangers and Supports
 - e. Switches
 - f. Fire Pump
 - g. Jockey Pump
 - h. Jockey Pump Controller
 - i. Test Header
 - j. Fire Pump Controller
 - k. Certified Pump Curve
 - l. Flow Meter
 - m. Fire Pump Engine
 - n. Muffler
 - o. Day Tank
 - p. Batteries
4. Calculation Sheets:
 - a. Submit fuel tank sizing calculations.
 - //b. Submit seismic load calculations for sizing of sway bracing.//.
5. Valve Charts: Provide a valve chart that identifies the location of each control valve. Coordinate nomenclature and identification of control valves with the COR. Where existing nomenclature does not exist, the chart shall include no less than the following: Tag ID No., Valve Size, Service (control valve, test header valve, etc.), and Location.
6. Factory Authorization: Two weeks prior to final inspection and testing, provide a copy of the necessary factory authorizations of the representative to be present at the acceptance testing. Authorizations shall include manufacturer's representative for the fire pump and the fire pump controller in accordance with NFPA 20 requirements.

7. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submittals shall include, but not be limited to, the following:
- a. A complete set of as-built drawings showing the installed system with the specific interconnections between the system switches and the fire alarm equipment. Provide a complete set in the formats as follows. Submit items 2 and 3 below on a compact disc or as directed by the COR.
 - 1) One full size (or size as directed by the COR printed copy).
 - 2) One complete set in electronic pdf format.
 - 3) One complete set in AutoCAD format or a format as directed by the COR.
 - b. Centrifugal Fire Pump Acceptance Test Form and Certificates: Upon completion of the fire pump system, including testing and flushing, provide a copy of a completed Centrifugal Fire Pump Acceptance Test Form and all Contractor's Material and Test Certificates as indicated in NFPA 20. The graph included on the Centrifugal Fire Pump Acceptance Test Form shall be annotated to show 1) the water supply available, 2) the manufacturer's certified pump curve, 3) the acceptance test curve, and 4) a curve showing the water supply and acceptance test curve combined.
 - c. Operating and Maintenance Manuals that include step-by-step procedures required for system startup, operation, shutdown, and routine maintenance and testing. The manuals shall include the manufacturer's name, model number, parts list, 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.
 - d. One paper copy of the Centrifugal Fire Pump Acceptance Test Form, including the graph identified in 7(b) above; the Contractor's Material and Test Certificates and the Operating and Maintenance Manuals above shall be provided in a binder. In addition, these materials shall be provided in pdf format on a compact disc or as directed by the COR.

- e. Provide one additional copy of the Operating and Maintenance Manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the fire pump controller.

1.5 QUALITY ASSURANCE

SPEC WRITER NOTE: Most states do not have or issue fire sprinkler contractor licenses, therefore as a minimum, the contractor must hold a contractors license in the state where the work is to be performed.

- A. Installer Reliability: The installer shall possess a valid State of // (insert state in which work is being performed) // fire sprinkler // contractor's license. The installer shall have been actively and successfully engaged in the installation of commercial automatic fire pumps for the past ten years.
- B. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL or approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA. All materials and equipment shall be free from defect. All materials and equipment shall be new unless specifically indicated otherwise on the contract drawings.

1.6 APPLICABLE PUIBLICATIONS

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

SPEC WRITER NOTE: Specify the latest edition of below publications at date of award of A/E contract.

- B. National Fire Protection Association (NFPA):
 - 13-2013.....Installation of Sprinkler Systems
 - 20-2013Installation of Centrifugal Fire Pumps
 - 30-2012Flammable and Combustible Liquids Code
 - 37-2010Installation of Stationary Combustion Engines
 - 70-2014.....National Electrical Code
 - 101-2012.....Life Safety Code
 - 170-2014.....Fire Safety Symbols
- C. Underwriters Laboratories, Inc. (UL):
 - 2011Fire Protection Equipment Directory

- D. Factory Mutual Engineering Corporation (FM):
2015..... Approval Guide
- E. National Electrical Manufacturers Association:
2014..... Enclosures for Electrical Equipment

PART 2 PRODUCTS

2.1 GENERAL

Fire pump systems shall be in accordance with NFPA 20.

2.2 PIPING & FITTINGS

A. General:

- 1. Piping and fittings for the fire pump systems shall be in accordance with NFPA 20.

Spec Writer Note: Coordinate underground piping details with Section 33 10 00.

B. Piping:

- 1. Piping Sizes 2 ½ inches (65 mm) through 6 inches (150 mm) shall be black steel Schedule 40 piping. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only.
- 2. Piping Sizes 8 inches (200 mm) and larger shall be black steel Schedule 30. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only.

C. Fittings:

- 1. Fittings, mechanical couplings, and rubber gaskets shall be of the same manufacturer.

2.3 VALVES

A. General:

- 1. Valves shall be in accordance with NFPA 20.

B. Control Valves:

- 1. Outside Screw & Yoke Valves (OS&Y)
 - a. The OS&Y valve shall be of cast iron construction.
- 2. Butterfly Valves
 - a. Butterfly valves shall not be installed in any location on the suction side of the fire pump.
 - b. The butterfly valve shall be of cast iron construction.
 - c. The valve tamper switch is permitted to be integral to the butterfly valve.

C. Automatic Air-Relief Valve:

- 1. The automatic air-relief valve shall be listed or approved.

D. Circulation Relief Valve:

1. The circulation relief valve shall be of brass construction and be spring loaded.
2. The circulation relief valve shall be adjustable.
3. The circulation relief valve shall discharge to the atmosphere and not be recirculated to the suction side of the fire pump.

E. Relief Valve:

1. Relief valves shall only be provided where required by NFPA 20.
2. The relief valve shall be of bronze construction and be spring loaded.
3. The relief valve shall discharge to the atmosphere and not be recirculated to the suction side of the fire pump. Provide site cone if relief valve discharge is not visible from the immediate area of the fire pump room.

F. Check Valve:

1. Shall be of the swing type with a flanged cast iron body and flanged inspection plate.

G. Automatic Ball Drips:

1. Cast brass 3/4 inch (19 mm) in-line automatic ball drip with both ends threaded with iron pipe threads.

SPEC WRITER NOTE: A vertical turbine pump can be substituted for the horizontal split case where site conditions warrant it.

2.4 FIRE PUMP

A. General

1. The fire pump shall be diesel engine driven. The pump shall have a capacity of // //gpm (// //L/Second) with a rated net pressure of // // psi (// // kPa). The fire pump shall furnish not less than 150% of the rated flow capacity at not less than 65% of rated net pressure.
2. The fire pump shall be centrifugal horizontal split case fire pump.
3. The pump must be automatic start and manual stop. The fire pump must start automatically at 10 psi (69 kPa) below jockey pump start pressure.

B. Fire Pump Engine

1. The diesel engine driver shall be of a make recommended by pump manufacturer.
2. The capacity of the engine must have adequate horsepower to drive pump at all conditions of speed and load over the full range of the

- pump performance curve. The engine horsepower must be derated for temperature and elevation in accordance with NFPA 20.
3. The engine shall be closed circuit, cooled with radiator and engine driven fan.
 - a. The fan shall be guarded for personnel protection.
 - b. The fan's exhaust shall be vented to the exterior.
 4. The engine shall be electric start type taking current from 2 battery units.
 5. The engine shall be equipped with a fuel in-line filter-water separator.
 6. The engine conditions shall be monitored with an engine instrument panel that has a tachometer, hour meter, fuel pressure gauge, lubricating oil pressure gauge, water temperature gauge, ammeter gauge.
 7. The engine shall be connected to the pump by flexible couplings. The flexible coupling shall be directly connected to the engine flywheel adaptor or stub shaft.
 8. Provide an engine block heater to maintain a temperature of 120 degrees F (49 degrees C).
- C. Exhaust System:
1. The exhaust system shall comply with the requirements of NFPA 20 and NFPA 37.
 2. An exhaust muffler shall be provided for every diesel engine driver to reduce the noise to 85 dBA.
 3. Exhaust piping including the muffler shall be insulated with fiber glass insulation. An aluminum jacket encasing the insulation shall be provided. The fiber glass insulation shall be a minimum thickness of 3/8 inches (10 mm) and the aluminum jacket shall a minimum thickness of 5/32 inches (0.4 m). The aluminum jacket shall have a polyethylene and kraft paper moisture barrier on the inside surface.
- D. Batteries:
1. Batteries must be sealed lead calcium batteries mounted on a non-corrosive non-conductive base, secured against displacement, at least 12 inches (300 mm) above the floor.
- E. Diesel Fuel System:

1. The fuel system shall be in accordance with NFPA 20 and NFPA 30. Fuel tanks greater than 1320 gallons (4996 L) shall comply with NFPA 37.
2. The fuel tank shall be sized in accordance with NFPA 20, be UL listed, and be double-walled. The fuel tank shall be located inside the building.
3. The fuel tank shall be provided with a screened weatherproof vent cap.
4. Vents shall be extended to the outside terminating at least 5 feet (1.5 m) from building openings.
5. Fuel lines shall be protected from mechanical damage.
6. Fill lines shall be extended to the exterior.
7. A gauge shall be mounted on the exterior wall of the tank near each fill line.
8. The fill cap shall be able to be locked by a padlock.

2.5 FIRE PUMP CONTROLLER

- A. The controller shall be an automatic type and shall be completely wired, ready for field connections and be mounted in a NEMA 2 enclosure.
- B. The fire pump controller shall monitor fire pump running, engine overspeed, low oil pressure, fuel tank leak, high water temperature, engine failure to start, battery, battery charger/AC failure, main switch out of position, and low fuel. Alarms shall be individually displayed on the front of the fire pump controller by lighting of visual lamps. The fire pump controller shall be equipped with terminals for remote monitoring of pump running, failure to start, controller off or in manual position, and fire pump or controller fault.
- C. Minimum run timer shall be provided to prevent short cycling.
- D. The fire pump controller shall be provided with digital readouts of the pressure and charger output voltage.
- E. The fire pump controller shall be equipped with a 7-day electric pressure recorder with 24-hour spring wound back-up. An USB port shall be provided for information download.
- F. The fire pump controller shall be equipped with two battery chargers, two ammeters, and two voltmeters, one for each set of batteries.
- G. The fire pump controller shall alternate the battery sets for starting the fire pump.

- H. When engine emergency overspeed device operates, the fire pump controller shall cause the engine to shut down without delay and lock out until manually reset.
- I. The fire pump controller shall be located as close as practical and within site of the fire pump engine.

2.6 PRESSURE SENSING LINE

- A. The fire pump controller and jockey pump controller shall be provided with completely separate pressure sensing lines in accordance with NFPA 20.

2.7 JOCKEY PUMP

- A. The jockey pump shall be an electric motor driven //horizontal shaft// //vertical in-line// type.
- B. The jockey pump flow shall be rated a minimum of 60 gpm (3.8 L/s (60 gpm)).
- C. Pressure provided by the jockey pump must be in accordance with NFPA 20.
- D. OS&Y valves shall be provided on the supply and discharge side of the jockey pump for maintenance purposes.

2.8 JOCKEY PUMP CONTROLLER

- A. Jockey pump controller shall be arranged for automatic and manual starting and stopping. The jockey pump shall be equipped with a bourbon tube pressure switch or solid state pressure switch with independent high and low adjustments for automatic stopping and starting.
- B. The controller shall be equipped with a "manual-off-automatic" switch.
- C. The controller shall be factory assembled and pre-wired, and ready for field connections, and be mounted in a NEMA 2 enclosure.
- D. No minimum run timer allowed.

SPEC WRITER NOTE: Ensure test header is located or provided with provisions so that when tested, water discharge does not damage landscaping or other architectural features.

2.9 TEST HEADER

- A. The body of the test header shall be a //flush// //surface// type and be constructed of brass or ductile iron.
- B. The finish of the test header finish plate shall be //chrome plated// //polished brass//.
- C. The number of valves shall be in accordance with NFPA 20.

- D. Provide a cap and chain for each valve.
- E. The test header shall be piped directly to the exterior through a straight-type header.
- F. An automatic ball drip valve shall be provided at the low point of the test header between the header and check valve.

2.10 FLOW METER

- A. The flow meter shall be a venturi-type.
- B. Provide a meter throttle valve and meter control valves. The throttle valve and control valves shall be OS&Y valves.
- C. The flow meter must be suitable for flow between 50% and 175% of the rated pump capacity.
- D. Arrange piping to permit flow meter to discharge to pump suction and to discharge through test header.
- E. Provide a circulation relief valve between the flow meter and the reconnection to the suction piping.
- F. Provide calibrated gauges on the inlet and outlet of the flow meter.
- G. Provide a laminated flow chart to convert the flow meter's velocity pressure reading into gpm flow rate. The flow chart shall be affixed by metal chain to the pipe adjacent to the flow meter

2.11 IDENTIFICATION SIGNS

- A. Valves: Rigid, plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Identification signs shall be attached to the valve or piping with chain.
- B. Pipe: Pretensioned pipe labels consisting of pre-coiled, semi-rigid plastic formed to cover the full circumference of pipe and attach to pipe without fasteners or adhesive. Labels shall be red background with white letters, with the words "Fire Protection". Labels shall be provided at a maximum interval of 20 feet (6.1 m) of pipe length.

2.12 SWITCHES:

Contain in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 1/2 inch (13 mm) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.

2.13 GAUGES

- A. Provide gauges as required by NFPA 20.
- B. The gauges shall be liquid filled. Provide gauges where the normal pressure of the system is at the midrange of the gauge.

2.14 PIPE HANGERS AND SUPPORTS

Pipe hangers, supports, and restraint of system piping shall be in accordance with NFPA 13 and NFPA 20.

2.15 WALL, FLOOR AND CEILING PLATES

Provide chrome plated steel escutcheon plates.

2.16 PUMP BASE PLATE AND PAD

- A. The pump pad shall be provided with a common base plate for the pump and the engine.
- B. Construct the base plate of cast iron with a raised lip tapped for drainage or welded steel shapes with suitable drainage.
- C. Each base plate shall have a 1 inch (25 mm) steel drain line piped to the nearest floor drain.
- D. Mount pump units and bases on a raised reinforced concrete pad that is an integral part of the reinforced floor.

2.17 VALVE TAGS

Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 1/4 inch (8 mm) for service designation on 19 gage, 1-1/2 inches (40 mm) round brass disc, attached with brass "S" hook, brass chain, or nylon twist tie.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. Piping shall not obstruct the minimum means of egress clearances required by NFPA 101. Pipe hangers, supports, and restraint of system piping, //and seismic bracing// shall be installed in accordance with NFPA 13 and NFPA 20.
- C. Welding: Conform to the requirements and recommendations of NFPA 13.
- D. Drains: Install drains where necessary and required by NFPA 20. Drain piping shall be routed to properly discharge over floor drains or to site cones attached to floor drains. Such floor drains shall be of adequate size to readily accept the discharge from each drain under full flow and maximum pressure conditions. Drain piping shall also be

- allowed to be routed to the outside of the building, provided its discharge will not negatively impact the exterior conditions.
- E. Supervisory Switches: Provide supervisory switches for control valves, including the test header control valve.
 - F. Provide escutcheon plates for exposed piping passing through walls, floors, or ceilings.
 - G. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material in accordance with Section 07 84 00, FIRESTOPPING. Where core drilling is used in lieu of sleeves, also seal space around penetrations. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.
 - H. For the fire pump test header, provide the symbolic sign given in NFPA 170 and locate 8 to 10 feet (2400 to 3000 mm) above the header location. Size the sign to 18 by 18 inches (450 by 450 mm) with the symbol being at least 14 by 14 inches (350 by 350 mm).
 - I. Firestopping shall be provided for all penetrations of fire resistance rated construction. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.
 - J. Securely attach identification signs to control valves, test header, pump suction, pump discharge, and bypass valves.
 - K. Securely attach valve tags to each control valve.
 - L. Repairs: Repair damage to the building or equipment resulting from the installation of the fire pump system by the installer at no additional expense to the Government.
 - M. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the COR. Contractor shall develop an interim fire protection program where interruptions involve occupied spaces. Request in writing at least one week prior to the planned interruption.
 - N. The fire pump controller shall be located as close as practical and within site of the fire pump motor.
 - O. Painting of Pipe: Pipe shall be painted only where located in areas with corrosive conditions or in finished areas where walls and ceilings have been painted. Paint primed surfaces with two coats of gloss red enamel. Paint valves and operating accessories with two coats of gloss red enamel. Exercise care to avoid painting sprinklers. Painting of

sprinkler systems above suspended ceilings and in crawl spaces is not required. Painting shall comply with Section 09 90 00, PAINTING. Any painted sprinkler shall be replaced with a new sprinkler.

- P. All fire pump alarm and signals required by NFPA 20 for remote monitoring shall be supervised by the fire alarm system, including fire pump running, failure to start, controller off or in manual position, and fire pump or controller fault in accordance with Section 28 31 00, FIRE DETECTION AND ALARM. Fire pump running, failure to start, controller off or in manual position, and fire pump or controller fault shall be supervisory fire alarm signals.
- Q. Initial filling and refill of the diesel fuel after inspection and testing shall be performed by the Contractor at no expense to the Owner.
- R. 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.

SPEC WRITER NOTE: For projects where a Commissioning Agent is being contracted in accordance with Section 01 09 00, coordinate commissioning with Section 21 08 00.

3.2 INSPECTION AND TEST

- A. Preliminary Inspection and Testing: Subject system to all inspections and tests in accordance with NFPA 20. When all necessary corrections have been accomplished, advise COR to schedule a final acceptance inspection and test. Flushing and hydrostatic testing and fire alarm monitoring of fire pump controller alarms and signals shall be witnessed by the COR or his designated representative.
- B. Final Acceptance Inspection and Testing: Perform in accordance with NFPA 20 in the presence of the COR or his designated representative. Furnish all labor and materials as required by NFPA 20 for the final acceptance test, including verification of fire alarm system monitoring of fire pump controller alarm and signals. The final acceptance test will not be conducted unless the required test equipment and equipment manufacturers or the equipment authorized representatives are present.
- C. Gauges used for preliminary testing and final inspection and testing shall have been calibrated by an accredited laboratory within one year of the testing. Date of latest calibration shall be listed on the pressure gauge.

3.3 INSTRUCTIONS

Furnish the services of a factory trained instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COR.

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