

**SECTION 21 10 00
FIRE PUMPING SYSTEMS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. These specifications describe a complete UL listed horizontal split case electrically driven centrifugal pump, jockey pump, controllers, alarms devices, valves, pressure regulator devices, test devices, water storage fill piping, suction piping, and associated equipment for VA Mental Health Building, Seattle, Washington. The work under this section shall start at the point of the municipal water inlet connection in the pump room and end at the discharge connection to the sprinkler and standpipe systems outside the pump room.
- B. The pumps, controllers, and associated equipment shall be located in the pump room adjacent to the water storage suction tank (by others) . The pump shall be connected to and supplied from the water storage tanks as the primary waters source. The pump and system piping shall also be connected to the municipal supply as shown on the drawings. C. Work shall include all labor, materials, tools, equipment, transportation, and temporary construction necessary to install, start-up, and test the pumps, controllers, and appurtenances in accordance with this section, the contract drawings, and the referenced codes and standards, the requirements of the VA, and the Seattle, Washington Fire and Building Code.
- C. The pumps, motors, all controls, and necessary attachments, specified herein, shall be purchased as a complete unit under a unit contract. The pump manufacturer representative shall assume unit responsibility and shall provide the services of a qualified engineer to supervise the installation of equipment check coupling alignment, operation of all equipment and enclosure related and conduct the final acceptance test. Contractor shall include these services in bid.
- D. Painting of exposed piping and supports to follow Section 09 91 00, PAINTING.
- E. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the General Contractor for clarification.

1.2 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 08 31 13, ACCESS DOORS AND FRAMES: Access panels for plaster ceilings
- C. Section 07 84 00, FIRESTOPPING Treatment of penetrations through rated enclosures
- D Section 09 91 00, PAINTING: Painting of exposed pipe
- E. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION

- F. Section 21 13 13, COMBINED WET-PIPE SPRINKLER/STANDPIPE SYSTEMS
- G. Section 28 31 00, FIRE DETECTION AND ALARM: Alarm Supervision

1.3 DESIGN CRITERIA

- A. Design automatic fire pump systems in accordance with all required and advisory provisions of NFPA 20. Each system shall include all materials, accessories, and equipment, so that the system is complete and ready for use.
- B. Friction Loss: Calculate the friction loss in piping in accordance with the Hazen-Williams formula using 'C' values found in NFPA 13.
- C. The fire pump shall be a new UL listed horizontal split case centrifugal type fire pump sized for a discharge of 3785 L/m (1000 gpm) at 1206 Kpa (175 psi). The pump and driver shall be assembled by the manufacturer and have the actual factory test performance curve for pump shipped and the pump shall have UL certification.
- D. Seismic Protection: Seismically brace all new and existing piping systems in accordance with NFPA 13 latest edition and the Seattle Building Code.

1.4 QUALIFICATIONS

- A. Designer's Qualifications: Design work and shop drawings shall be prepared by a licensed engineer practicing in the field of Fire Protection Engineering or a NICET (National Institute for Certification in Engineering Technologies) Level III sprinkler technician.
- B. Installer's Qualifications: The installer shall possess a valid State of Washington fire protection contractor's license. The installer shall provide documentation of having successfully completed three projects of similar size and scope.
- C. On-site emergency service within 4 (four) hours notification.

1.5 SUBMITTALS

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sprinkler design shall be performed by professional's Registration or Certification. All plans shall be stamped by qualified registered Professional Engineer.
- C. Emergency service point of contact name and 24 hour emergency telephone number.
- D. Manufacturer's Literature and Data:
 - 1. Fire Pump
 - 2. Jockey Pump
 - 3. Pump Test Header
 - 4. Fire Pump Controller with Electrical Transfer Switch
 - 5. Fire Pump Test Data

6. Pressure Reducing Valves
 7. Pipe and Fittings.
 8. Valves
 9. Drips
 10. Fire Department Connection
 11. Pump Test Flow Meter
 12. Pressure Gages
 13. Pipe Hangers and Supports and Seismic Calculations
 14. Pump Running Alarm Switches
 15. Pressure Sensing Devices and Solenoid Switches
 16. Valve Tamper Switches
 17. Fire Pump Controller alarms
 18. High Level Water Storage Alarm Switch
 19. Low level water storage alarm switch
 20. Pump Suction Device
 21. Double Detector Check Valve Assembly
 22. Tank Fill device
- E. Detailed drawings in accordance with NFPA 13 and NFPA 20, the latest editions. Drawings shall utilize a minimum scale of 1/8 inch = 1 ft scale conforming to NFPA 13. Drawings shall be prepared using CADD software stamped by fire protection professional engineer and include all new and existing sprinklers and piping. Use format in use at the VA Puget Sound Health Care Ssystem. Drawings are subject to change during the bidding and construction periods. Any wall and ceiling changes occurring prior to the submittal of contractors shop drawings shall be incorporated into the contractors detailed design at no additional contract cost.
- F. Hydraulic calculations in accordance with NFPA 13 latest edition.
- G. In addition to drawings specified in this section installing contractor shall be responsible for participating in updates to the BIM Model (Revit) as required by the conditions of the contract.
- H. Operation and Maintenance Data shall be provided as follows:
1. Indicating Valves
 2. Water Flow and valve tamper switches
 3. Alarm Valves
 4. Fire Pump
 5. Excess Pressure Pump
 6. Copy of NFPA 25

- 7. Overflow alarm device
- 8. Fill control mechanism
- 9. Flow meter
- 10. Recommended preventive maintenance schedule

1.6 AS-BUILT DOCUMENTATION

- A. Full size drawing sheets shall be provided for each drawing. One copy of final CADD drawing files shall also be provided on CD diskette, for each drawing.
- B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- C. Four sets of hydraulic calculations for each sprinkler system updated to include submittal review comments and any changes to the installation which affect the calculations including one electronic set in PDF format.
- D. Four copies of the hydrostatic report and NFPA 13 material and test certificate.
- E. Four sets of operation and maintenance data updated to include submittal review comments and any equipment substitutions including one copy of NFPA 25.
- F. Manufacturers literature, hydraulic calculations, reports and operation and maintenance data shall be in a labeled 3-ring binder.
- G. Factory test discharge/pressure data for the supplied pump and driver.

1.7 WARRANTY

- A. All work performed and materials and equipment furnished under this contract shall be free from defects for a period of one year from date of acceptance by the government.
- B. All new piping and equipment incorporated into the new system shall be hydrostatically tested and warranted as new.

1.8 APPLICABLE PUBLICATIONS

- A. 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.
- B. National Fire Protection Association (NFPA)
 - 13-2010 Installation of Sprinkler Systems
 - 14-2010 Installation of Standpipe and Hose Systems
 - 20-2010 Installation of Centrifugal Fire Pump
 - 70-2008 National Electrical Code
 - 72-2010 National Fire Alarm Code
 - 170-2009 Standards for Fire Safety Symbols

- C. Underwriters Laboratories Inc. (UL)
2011 Fire Protection Equipment Directory
- D. Factory Mutual Engineering Corporation (FM)
2010 Approval Guide
- E. American Society of Sanitary Engineering (ASSE)
1015-2009 Double Check Backflow Prevention Assembly

PART 2 - PRODUCTS

2.1 GENERAL

- A. All devices and equipment shall be Underwriters Laboratories Inc. listed for their intended purpose. All sprinklers shall be Factory Mutual approved.

2.2 FIRE PUMP

- A. Provide a UL listed electric motor driven fire pump with controller. The pump shall be a 480 V, three phase, single stage, double suction, horizontal split case design, in cast iron bronze fitted construction with packing bearing directly on a bronze shaft sleeve. The casing shall be close-grained cast iron ASTM A48 Class 35A for working pressures up to 250 psig, and shall be of axially-split design with suction and discharge flanges and mounting feet cast integral with the lower half casing. Tapped and plugged holes shall be provided for priming, vent drain and gauge connections. The pump internals shall be capable of being serviced by removing the upper half casing without disturbing the piping connections or packing area. Flanges shall be 250# per ANSI B16.1 Standard. Suction and discharge shall be on a common centerline in both horizontal and vertical planes.
- B. The pump capacity at rated head shall be 3785 L/m (1000 gpm) at a discharge pressure of 1206 Kpa (175 psi). The pump shall furnish not less than 150 percent of rated capacity at not less than 65 percent of its total rated head. The pump shall not exceed 120% of its rated pressure at zero flow churn conditions. The pump shall be designed to operate at a maximum speed of 2350 rpm, faster engine speeds are not acceptable.

2.3 PIPING AND FITTINGS

- A. Sprinkler piping shall **conform to ASTM A53, Type F**, schedule 40 for piping **100 mm (4-inches)** and smaller. Piping greater than **100 mm (4-inches)** shall be **conform to ASTM A53, Type F** schedule 40 or Schedule 10. The corrosion resistance ratio (CRR) of all pipes shall not be less than 1.0.
- B. Pipe shall be joined using screwed, flanged, or grooved standard or light weight, flexible or rigid type couplings installed in accordance with their individual listings. Grooves in Schedule 40 steel

pipng shall be cut grooves only. All Fittings shall have a minimum working pressure of 1724 Kpa (250 psi.) or greater.

- C. Fittings used shall meet or exceed the standards listed in NFPA 13 Table 2-4.1. Other types of fittings listed for use in sprinkler installations may also be used when installed in accordance with their listing limitations, including installation instructions.
- D. Flexible and rigid-type couplings shall be of type and manufacturer approved for use in sprinkler installations. Flexible couplings shall be installed as required by NFPA 13, minimum.
- E. Earthquake sway bracing shall be UL listed.
- F. Provide Metraflex type or equivalent type expansion joints for seismic separations.
- G. Piping Materials Standards:
 - 1. Ferrous piping – follow ASTM A 795 Standard
 - 2. Welded and seamless steel pipe – follow ANSI/ASTM A 53
 - 3. Wrought steel pipe – follow ANSI/ASME B36.10M
 - 4. Electric resistance welded steel pipe – follow ASTM A 135
- H. Fitting Materials Standards:
 - 1. Cast iron threaded fitting, Class 125 and 250 - follow ASME B16.4
 - 2. Cast iron pipe flanges and flanged fittings - follow ASME B16.1
 - 3. Malleable iron threaded fittings, Class 150 and 300 steel - follow ASME B16.3
 - 4. Factory made wrought steel butt weld fittings - follow ASME B16.9
 - 5. Buttwelding ends for pipe, valves, flanges, and fitting - follow ASME B16.25
- I. Pipe Identification – All pipe shall be marked continuously along its length by the manufacturer in such a way as to properly identify the type of pipe. Pipe identification shall include the manufacturer's name, model designation, or schedule.

2.4 VALVES

- A. Listed Indicating Valves:
 - 1. Gate: OS&Y, 1724 kPa (250 lb.) minimum WOG or equal.
 - 2. Butterfly: Gear operated, indicating type, 1724 kPa (250 lb.) WOG or equal. Butterfly valves are to be installed in a manner that does not interfere with the operation of any system component. Valve shall have an integral tamper switch. Valve position shall be clearly identifiable from a distance of 3 m (10 feet) after installation and without the need of special equipment (e.g. equipped with integral pointer).
 - 3. Ball (inspectors test and drain only): iron body, stainless steel trim, for 1724 kPa (250 lb.) service, indicating type.

4. Ball and butterfly valves shall not be used on incoming water service, and on the suction side of either the fire pump or jockey pump.
- B. Check Valves: Swing type, rubber faced or wafer type spring loaded butterfly check valve, 1724 kPa (250 lb.) WOG or equal.
- C. Drain Valves: Threaded bronze angle, globe, ball or butterfly, 1724 kPa (250 lb.) WOG or equal equipped with reducer and hose connection with cap or connected to a drain line.
- D. Double Check Backflow Prevention Assembly: Provide two independent check valves with OS&Y shut off valves, ball type test cocks. Maximum friction loss through assembly shall not exceed 35 kPa (5 psi) at design flow. Unit shall be functional in vertical or horizontal position, rated for 1200 kPa (175 psi) working pressure. Check valve assembly shall be in accordance with AWWA Class D. Double check backflow prevention assembly shall be FM approved, ASSE approved and UL listed.

2.5 PRESSURE REGULATING DEVICE

- A. A UL listed pressure reducing valve shall be provided in the municipal water supply pump suction supply. The valve shall have a pilot operated regulator capable of holding down stream pressure to a predetermined pressure. Valve shall be adjustable and have an iron body with flanged fittings.

2.6 AUTOMATIC BALL DRIPS

- A. Cast brass 20 mm (3/4 in.) in line automatic ball drip with both ends threaded with iron pipe threads.

2.7 TEST HEADER

- A. Flush, ductile iron body with end inlet, 150 mm (6-inch), 4 outlet, brass plate lettered "Pump Test Connection", brass NRS hose gate valve with loose bonnets, three in. female NPT inlet by 65 mm (2 1/2 in.) male hose thread outlet with caps and chains.

2.8 FIRE PUMP FLOW METER

- A. Test flow meter shall be UL or FM approved, venture type, sized for the pump discharge volume, complete with all gauges and connections. The unit shall be an assembly, and factory calibrated. The meter shall include a direct gpm readout gage with a dial featuring a 270 degree arc for accurate reading.

2.9 PRESSURE MAINTENANCE (JOCKEY) PUMPS

- A. Provide a 208VAC, 3 phase jockey pump and controller to maintain supervisory pressure on the system. Provide electrically driven jockey pump. The jockey pump shall be rated at approximately 38 L/m (5 gpm) at 1310 Kpa (190 psi) and be complete with its own dedicated pump controller. Pump shutoff pressure shall not exceed 1379 Kpa (200 psi). The controller

shall be UL listed with magnetic starter, fusible disconnect switch, control circuit transformer, run timer, and adjustable pressure start switch. Enclosure shall be NEMA 2, drip tight. Provide approved indicating gate valves of the outside screw and yoke type in the maintenance discharge piping. The controller shall be complete with pressure sensing lines, and adjustable start and stop pressures.

2.10 FIRE PUMP CONTROLLER

- A. Fire Pump Controller: Controller shall be factory assembled, wired and tested, and conform to the latest edition of NFPA 20. **One of the following fire pump controller types shall be utilized – across the line type, or Wye-Delta starting (open circuit transition), or Wye-Delta (closed circuit transition), or primary resistance reduced voltage starting.** The controller shall include a built-in automatic emergency power transfer switch. The controller enclosure shall be a NEMA Type 3R, weather proof metal, wall mounted or standing a minimum of 300 mm (12-inches) above the floor, approved for fire pump service and arranged for automatic and manual push-button pump starting and automatic and manual push-button pump shutdown. Controller shall be completely terminally wired, ready for field connections, and mounted in a moisture resistant enclosure arranged so that controller current carrying parts will not be less than 12 inches above the floor. The controller shall include an alpha numeric LED display for all settings and status readings. Controller shall be 480VAC input power. Controller shall include an a run timer and data recorder with tape printout record of pressure log, set points, and system data along with a minimum 7-day pump running record log. The controller shall include a run period timer set to keep motor in operation, when started automatically, for a period not to exceed ten minutes.

2.11 REMOTE FIRE PUMP STATUS PANEL

- A. Provide remote fire pump alarm panel and mount at location of constant attendance. Alarm panel shall operate on 115 volt, 60 Hertz power for supervisory voltage. Furnish panel with visible/audible pump power failure, pump running supervisory power failure alarm signals and phase reversal on line side of motor starter. Provide auxiliary contacts for connection to Engineering Control Center.

2.12 SPRINKLERS

- A. Quick response sprinklers shall be provided in the pump room.

2.13 IDENTIFICATION SIGNS

- A. Provide for all new sectional valves, riser control valves, system control valves, drain valves, test and drain connections and alarm devices with securely attached identification signs (enamel on metal) in accordance with NFPA 13.

2.14 HANGERS AND EARTHQUAKE BRACING

- A. Provide hangers and supports in accordance with NFPA 13 and 14. Provide earthquake sway bracing as required by NFPA 13.

2.15 VALVE SUPERVISORY SWITCHES

- A. Provide each indicating sprinkler, standpipe and fire pump control valve with adequate means for mounting a valve supervisory switch.
- B. Mount switch so as not to interfere with normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem is moved no more than one fifth of the distance from its normal position.
- C. The mechanism shall be contained in a weatherproof die cast aluminum housing, which shall provide a 20 mm (3/4 in.) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
- D. Switch housing to be finished in red baked enamel.
- E. Supervisory switches for ball and butterfly valves may be integral with the valve.
- F. All conduit and wiring connected thereto shall be provided in Section 28 31 00, FIRE DETECTION AND ALARM.

2.16 PRESSURE SWITCHES

- A. Provide with 15 mm (1/2 in.) NPT male pressure connection.
- B. Alarm switch shall be activated by any flow of water equal to or in excess of the discharge from one sprinkler.
- C. Supervisory switch shall be activated by either high or low air pressure condition.
- D. Furnish switch in a red baked enamel, weatherproof, oil resistant housing with tamper resistant screws.

2.17 WALL, FLOOR AND CEILING PLATES

- A. Exposed piping passing through walls, floors or ceilings shall be provided with chrome colored escutcheon plates.
- B. Comply with NFPA 101 Fire Barrier Penetration codes.

2.18 PRESSURE GAUGE

- A. Provide a 1280 kPa (200 psi) pressure gauge at on the suction and discharge of the fire pump, and pump controllers.

2.19 HANGERS

- A. Hangers shall be designed to support five times the weight of the water filled pipe plus 250 Lb (114Kg) at each point of piping support.
- B. These points of support shall be adequate to support the system.

- C. The spacing between hangers shall not exceed the value given for the type of pipe as indicated in NFPA 13 tables.
- D. Hanger components shall be ferrous.
- E. Detailed calculations shall be submitted, when required by the reviewing Authority, showing stress developed in hangers, piping, fittings and safety factors allowed.

2.20 TOOLS AND REPLACEMENT PARTS

- A. Include the following accessories with the fire pump unit:
 - 1. Pressure gages.
 - 2. Circulation relief valve.
 - 3. Automatic air release valve.
 - 4. Ball drip valve.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hydrostatically test the pump at 150 percent of the working pressure but in no case to less than 1700 kPa (250 psi). Provide a complete factory performance test and furnish characteristic curves prepared from the test results.
- B. Piping arrangement shall avoid contact with other piping and equipment and allow clear access to other equipment or devices requiring access or maintenance.
- C. Cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections, shall be affixed near to the pipe where the originated. They shall be displayed until final inspection and then removed.
- D. Firestopping shall comply with Section 07 84 00, FIRESTOPPING. All holes through stairways, smoke barrier walls, and fire barrier walls shall be sealed on a daily basis.
- E. Install electric motor-driven fire pump, jockey pump, electric driver, controllers, piping, relief valves, control valves, check valves, test loop, hose valves, and all appurtenances, as required, in compliance with the referenced codes and standards. Provide the services of a factory-trained representative to align coupling and be available to assist in final acceptance test.
- F. Mount jockey and fire pump controllers on the wall at such height as to allow visibility and ready access to all controls and lights. Approximate mounting location is shown on the drawings.
- G. Prepare pipe, valve, and fitting surfaces, and paint fire engine red color.
- H. Wire all equipment to complete a fully operational fire pump installation. Coordinate with relevant Division 16 specification sections.

- I. Install all approved and/or listed equipment in accordance with the limitations of the approval and/or listing.
- J. Install all equipment plumb, level and true.

3.2 TEST

- A. Coordinate and conduct field acceptance test with the General Contractor, the Owner, and the Seattle Fire Department. Provide 48 hours minimum advance notice to all parties prior to testing. Test procedures shall be as submitted and approved by the contracting Officer.
- B. An authorized representative of the fire pump and controller manufacturer(s) shall be present during the fire pump test.
- C. Ensure that no damage to property will occur during the fire pump test.
- D. Contractor shall repair and retest any items found to be defective in any way, to the satisfaction of the Contracting Officer and Fire Department.

3.3 INSTRUCTIONS

- A. Furnish the services of a competent instructor for not less than two four-hour periods for instructing personnel in the operation and maintenance of the fire pump and sprinkler system, on the dates requested by the Contracting Officer.

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