

**SECTION 22 11 23
DOMESTIC WATER PUMPS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Hot water circulating pump, hot water recirculation pump and domestic water pressure booster system.

1.2 RELATED WORK

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- B. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
- C. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

Requirements for commissioning, systems readiness checklist, and training.
- D. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

- A. Domestic Water Pressure Booster System:
 - 1. Components shall be furnished by a single manufacturer and the system shall be the standard cataloged product of the manufacturer.
 - 2. Shop Test: Water booster unit and its component parts shall undergo a thorough electric and hydraulic operating test prior to shipment. Tests shall include a system operating flow test from zero to 100 percent of design flow rate under specified suction and system pressure conditions. Certified performance curves shall be furnished.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Pump:
 - a. Manufacturer and model.

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- b. Operating speed.
 - c. Capacity.
 - d. Characteristic performance curves.
2. Motor:
- a. Manufacturer, frame and type.
 - b. Speed.
 - c. Current Characteristics.
 - d. Efficiency.
- C. Certificate of shop test for domestic water booster system. Provide certified performance curves.
- D. Certified copies of all the factory and construction site test data sheets and reports.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
- 1. Include complete list indicating all components of the systems.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- F. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

1.5 APPLICABLE PUBLICATIONS

- 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.
- B. National Electrical Manufacturers Association (NEMA):

ICS6-93 (R2006) Industrial Control and Systems Enclosures

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250-08Enclosures for Electrical Equipment (1000 Volts Maximum)

C. American Society of Mechanical Engineers (ASME):

Boiler and Pressure Vessel Code: 2010

Section VIIIPressure Vessels, Division I and II

D. International Code Council (ICC)

ICC IPC (2012).....International Plumbing Code

E. NSF International (NSF)

NSF/ANSI 61 (2012)Drinking Water System Components – Health Effects

NSF/ANSI 372 (2011)Drinking Water System Components – Lead Content

F. Underwriters' Laboratories, Inc. (UL):

508-99 (R2008) Standards for Industrial Control Equipment

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61 or NSF 372.

2.2 CIRCULATING PUMP

- A. Centrifugal, single or multi stage, constructed to prevent contact of water with metal other than nonferrous. Driver shall be electric motor, close coupled or connected by flexible or magnetic coupling. Pump for hot water system shall be designed for 65 degrees C (150 degrees F) water service.
- B. Mounting shall be either of the following:
1. In-line mounted.
 2. Floor mounted set on common bed plate with drip lip.
- C. Casings: Epoxy coated cast iron, bronze, stainless steel, vertically or horizontally split.

- D. Impeller: High grade, cast brass or bronze, accurately machined and properly balanced.
- E. Motors: Maximum 40 degrees C (104 degrees F) ambient temperature rise, drip proof, for operation with current, voltage, phase and cycle shown in schedule on Electrical drawings, conforming to NEMA 250-Type 4. Size the motor capacity to operate the pump without overloading. In-line pump motors shall not exceed 1800 rpm and shall be provided with spring mountings or equal devices to assure quiet operation. Motors shall be equipped with thermal overload protection. When motor has cooled down it shall re-start automatically if the operating control has been left on and the system requires pump to start.
- F. Pump shall operate continuously with "on-off" switch for shut down. In the inlet and outlet piping of the pump, shutoff valves shall be installed to permit service to the pump without draining the system.
- G. A check valve shall be installed in the pump discharge piping immediately downstream of the pump

2.3 INLINE HOT WATER RECIRCULATING PUMP

- A. Centrifugal in-line horizontal oil lubricated pump designed for quiet operation and 862 kPa (125 psi).
- B. Bronze body construction capable of pumping 38 GPM @ 40 Feet of head when drive by ____ HP single phase, ____ VAC motor. Pump shall be non-overloading at any point on the pump curve.
- C. Pump controlled from on/off aquastat located at pump. In addition, the pump shall be provided with "on-off" switch for shut down. In the inlet and outlet piping of the pump shutoff valves shall be installed to permit service to the pump without draining the system. A check valve shall be installed in the pump discharge piping immediately downstream of the pump.

2.4 DOMESTIC WATER PRESSURE BOOSTER SYSTEM

- A. General: Provide a factory prefabricated, prewired and pretested multi-stage pumping system including variable speed drive motors, pressure regulating valves with integral check valves, pressure transducers, vibration pads, emergency switches, duplex flow switches, power and control panels, suction and discharge manifolds, gate valves, bypass loops with appropriate valves and check valves, low pressure cut off switches, hydro pneumatic tanks and accessories. All components shall be furnished by a single manufacturer and the system shall be the standard cataloged product of the manufacturer. All components shall be factory installed on a common structural steel skid and shall be completely tested in the factory before shipment. Manufacturer

shall assume "unit responsibility" to ensure that all components effectively interface to execute the operation of the designed system. Provide auxiliary contacts for remote alarming to the Energy Control Center and BAC net compatible open-protocol type interface to DDC controls system.

B. System Operation and Controls:

1. System shall automatically maintain constant system pressure of psi at the outlet of the pressure control valve and hydropneumatic tank check valve at all times. Suction pressure varies from psi to psi. The pump station shall receive a 4-20mA signal from each pressure transducer, as provided by the pumping station manufacturer. A pressure transducer signal shall be provided for each pump controller. This will provide a complete lead/ lag system coupled with a true back-up control. The differential pressure transducers will monitor system discharge pressure versus suction line pressure and provide an analog signal (4- 20mA) to the pump control software, and allow the variable speed pump controller, to provide a variable Volts/ Hz output to the motor. Once the pressure drops below the set system pressure, the pump will start and provide system pressure (as determined by the station operator), if this pressure cannot be maintained by one pump, the next pump in sequence shall operate in a lead/lag capacity to provide the extra flow and pressure automatically without the use of additional panels or alternators. The sequence of the pumps shall be field adjustable, and completely automatic without additional panels or alternator controls. The variable speed pump controller shall be completely integrated with the VFD. Special type motors will not be allowed. Refer to Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT. Pumps shall alternate based on elapsed run time. All program settings shall be based on centrifugal pump language and centrifugal pumps. Program settings must be field adjustable to provide on site adjustments. When the system experiences low demand, the variable speed pump controllers will reduce the speed of each pump, until demand has stopped. Pump controllers will stop each pump at zero demand, without the use of external switches or controls.
2. The pump logic controller shall provide the following standard user-selectable features:
 - a. Low Suction Pressure Alarm and Cut Out
 - b. High Suction Pressure Alarm and Cut Out
 - c. Low System Pressure Alarm
 - d. High System Pressure Alarm and Cut Out

- e. High Temperature Alarm and Cut Out
 - f. Low Level Alarm and Cut Out
 - g. No-Flow Shut Down
 - h. A-V alarm with push to silence feature
 - i. Overload Failure Alarm
 - j. Pump Failure Alarm
- C. Vertical Turbine Pump: Pumps shall be vertical multistage short-coupled industrial turbine pumps with variable speed drive motor, low pressure cutoff switches and bypass loops with ball, gate, check valves as indicated on the Contract Drawings.
- 1. Impellers: SAE 40 cast bronze, mixed flow enclosed type.
 - 2. Balancing of Impellers: Each impeller shall be statically and dynamically balanced prior to assembly in pump casing.
 - 3. Pump shaft: Stainless steel type 416.
 - 4. Lubrication: Water lubricated type pump.
 - 5. Pump Bowls: Cast Iron, stainless steel or bronze flanged and bolted.
 - 6. Pump Bearings: SAE 660 bronze, radial type.
 - 7. Pump Head: Fabricated steel with continuous bypass for low seal pressure. Cast iron heads are not acceptable. Pump head shall be lined same as pump barrel.
 - 8. Seal: Mechanical general purpose type, with sleeve mounting. Seal shall be rated at 1200 kPa (175 psi) maximum.
 - 9. Adjustable Spacer Coupling: Removable type required so that pump seal can be replaced without disturbing motor.
 - 10. Motor: Solid shaft motors balanced to 0.22 mm (0.0085-inch) vibration amplitude shall be operated at any point on the pump head curve without overloading the motor. Conform to NEMA 250-Type 2.

11. Pump Barrel: Schedule 40 steel pipe with two-coat "baked" internal lining to meet the potable water requirements of U.S. Food and Drug Administration. Unlined pump barrels are not acceptable. Provide drain tapping.
- D. Pressure Regulating Valves: System pressure shall be maintained by pilot-operated, diaphragm type pressure regulating valves, rated at 2050 kPa (300 psi) minimum, one for each pump. Valves shall be piloted to control system pressure and to cause the valve to act as a non-slam check valve. Pilot shall be rated at 1200 kPa (175 psi) minimum.
- E. Hydropneumatic Tank: Bladder type, hydropneumatic, designed and constructed in accordance with requirements of the ASME Pressure Vessel Code and stamped with appropriate symbol. Tank shall include pre-pressurized, sealed-in air cushion which shall accommodate pressure increases and expanded water volumes in the tank. Tank shall include butyl rubber or polypropylene liner in lower, or water side of chamber. Minimum working pressure of tank shall be 1200 kPa (175 psi). Unit shall be designed and manufactured for domestic water applications. Insulate tank as specified. Check valve at hydropneumatic tank shall include small orifice for undue loading.
- F. Power and Control Panel: Class "A" shadow box double NEMA 1 enclosure, UL labeled, bonderized double prime coated with baked enamel finish:
1. Fused disconnect switches with external operating handles.
 2. Magnetic contactor for each motor with H.O.A. switch.
 3. Door interlock.
 4. Thermal overload protection relay for each motor, three leg type.
 5. Running light for each motor.
 6. Power light for each motor.
 7. Minimum run timers to prevent short cycle operation.
 8. Control transformer, switch, circuit breaker, light.
 9. Lead pump failure protection.
 10. Provide auxiliary contacts for remote alarm monitoring to Energy Control Center II for a connection to a DDC type open protocol system control system capable of backnet interface.

- G. Motor and Starter: Maximum 40 degrees C (104 degrees F) ambient temperature rise, drip proof type motor, ball bearings, voltage and phase as shown in schedule on Electrical drawings, conforming to NEMA 250-Type 4. Motor shall be of such capacity that brake horsepower required by driven equipment at normal rated capacity will not exceed nameplate rating of the motor. Refer to Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT. Provide each motor with automatic, fully enclosed, magnetic starter of type specified in Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.
- H. Instrumentation: All instrumentation shall be factory installed and shall include the following 115 mm (4-1/2 inch) dial gages with shut-off cock.
1. Pump pressure gage for each pump.
 2. System pressure gage.
 3. Suction pressure gage.
- I. Operating and Emergency Controls:
1. The pump station shall receive a 4-20mA signal from each pressure transducer, as provided by the pumping station manufacturer. A pressure transducer signal shall be provided for each pump controller. This will provide a complete lead/ lag system coupled with a true back-up control. The differential pressure transducers will monitor system discharge pressure versus suction line pressure and provide an analog signal (4- 20mA) to the pump control software, and allow the variable speed pump controller, to provide a variable Volts/ Hz output to the motor. Once the pressure drops below the set system pressure, the pump will start and provide system pressure (as determined by the station operator), if this pressure cannot be maintained by one pump, the next pump in sequence shall operate in a lead/lag capacity to provide the extra flow and pressure automatically without the use of additional panels or alternators. The sequence of the pumps shall be field adjustable, and completely automatic without additional panels or alternator controls. The variable speed pump controller shall be completely integrated with the VFD. Special type motors will not be allowed refer to Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT. Pumps shall alternate based on elapsed run time. All program settings shall be based on centrifugal pump language and centrifugal pumps. Program settings must be field adjustable to provide on site adjustments. When the system experiences low demand, the variable speed pump controllers will reduce the speed of each pump, until demand has stopped. Pump controllers will stop each pump at zero demand, without the use of external switches or controls.

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 - f. Low Level Alarm and Cut Out
 - g. No-Flow Shut Down
 - h. A-V alarm with push to silence feature
 - i. Overload Failure Alarm
 - j. Pump Failure Alarm
- J. Factory Test: The booster system and its component parts shall undergo a complete operation flow test from zero to 100 % design flow rate under the specified suction and net system pressure conditions. The system certification shall include copies of the test and test data as performed in the factory prior to shipment. Performance test certifications should be placed inside the system control panel and two extra copies shall be provided with the installation manual.

PART 3 - EXECUTION

3.1 STARTUP AND TESTING

- A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. System Test: After installation is completed provide an operational test of the completed system including flow rates, pressure compliance, alarms and all control functions.
- C. When any defects are detected, correct defects and repeat test.

- D. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior to notice.

3.2 COMMISSIONING

- A. Provide Commissioning Documentation accordance with the requirements of Section 22 08 00 – COMMISSIONING OF PLUMBING SYSTEMS for all inspection, startup, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this Section of the specification will be tested as part of a larger system. Refer to Section 22 08 00 – COMMISSIONING OF PLUMBING SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.3 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

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