

SECTION 22 11 23.13 – DOMESTIC WATER PRESSURE BOOSTING SYSTEMS (VFD)

PART 1 - GENERAL

1.1 SUMMARY

- A. Where utility water pressure cannot adequately meet the pressure requirements of the domestic water systems and where it is impractical to have a dedicated pressure booster system serving isolated equipment, furnish and install a factory packaged and tested, duplex variable-speed domestic water pressure boosting system including pumps, motors, controls, valves, interconnecting piping, bypass piping, wiring and accessories for a complete, approved system.

1.2 QUALITY ASSURANCE

- A. The manufacturer of the domestic water pressure boosting system shall be responsible for compliance with all applicable codes and regulations, and be held accountable for the complete pump package and installation.
- B. Manufacturer's Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience. The packaged system manufacturer shall have 24 hour local service available provided by a trained factory authorized representative.
- C. All disconnects, transformers, and control devices shall be installed to provide minimum wire bending clearances per N.E.C. All wiring shall be stranded copper conductors with 90° C. insulation. Conductors shall be numbered and identified at all termination points. All wiring shall be installed in nylon wire ways and laced with nylon tie straps. All disconnects, transformers, controllers, control devices, selector switches, and indicator lights shall be provided with nameplates indicating their respective function and/or identification. A factory wiring schematic shall be permanently affixed to the inside of cabinet door. The entire assembly shall be wired and tested in accordance with the National Electrical Code (N.E.C.). All components shall be built to National Electrical Manufacturers Association (NEMA) standards and be Underwriters Laboratory (U.L.) approved. The entire control panel shall bear the U.L. Label for enclosed industrial control panels. The entire package pumping system shall comply with Federal Regulations 29 CFR 1910.399 and certified through ETL under Category 225 and ULQCZJ.
- D. Installer's Qualifications: The system shall be installed by a firm having proven experience regularly engaged in the installation of variable speed domestic booster pump systems.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system with operating point indicated, NPSH curve, controls, wiring diagrams, and service connections. See *Section 01 33 23 – Shop Drawings, Product Data, and Samples*.
- B. Record Documents:
 - 1. See *Section 01 78 39 – Project Record Documents*.
 - 2. Provide full written description of manufacturer's warranty.
 - 3. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.
 - 4. Manufacturer's Installation Instruction: Indicate support details, connection requirements, and include start-up instructions for pump system.

5. Manufacturer's Certificate: Certify that pumps meet or exceed specified requirements at specified operating conditions. Submit summary and results of factory tests performed.
6. Field Reports: Submit verification statement, signed by system manufacturer representative, of start-up, adjustment service and acceptance of installation. Indicate summary of hydrostatic test and field acceptance tests performed.

C. Operation and Maintenance Data:

1. See Section 01 78 23 – Operation and Maintenance Data.
2. Operation Data: Include manufacturer's instructions, start-up data, trouble-shooting check lists, for pumps, drivers, and controllers.
3. Maintenance Data: Include manufacturer's literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers, preventive maintenance schedule, preventive maintenance recommendations and procedures. Identify place of purchase, location and contact numbers of service depot and technical support for each product installed.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Accept pumps and components on Site in factory packing. Inspect for damage. Comply with manufacturers rigging and installation instructions.
- B. Protect pumps and components from physical damage including effects of weather, water, and construction debris.
- C. Provide temporary inlet and outlet caps, and maintain in place until installation.

1.5 MAINTENANCE SERVICE

- A. Furnish service and maintenance of packaged system for one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Pressure ratings of pumps, pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the anticipated system pressures in which they are installed.
- C. The Contractor shall ascertain for himself the space and access available for the installation of a factory assembled packaged unit and as an option may assemble the various components in place at the Site in lieu of providing a factory assembled unit. However, all components of the system shall be compatible and be furnished by a single source manufacturer and all electrical services and interconnecting equipment wiring must be provided for within this Contractors bid.
- D. The booster system shall be factory assembled on a steel skid including pumps, motors, butterfly shut-off valves, wafer style silent check valves, Type "L" copper or Schedule 40 300 series stainless steel suction and discharge manifolds, all interconnecting piping, wiring, variable frequency drives with logic and power controls.
- E. Provide hydro-accumulator tank that will allow the pumps to shut down during low flow conditions.
- F. All pilot lights and visual indicators shall be illuminated from the rear by long life LED lamps. Neon and incandescent lamps are not acceptable.

- G. Provide isolation valves on the suction and discharge of each pump. The isolation valves shall be 600 WOG full-port ball valves (2" and smaller) and lug style butterfly valves (2½" and larger).
- H. Provide two 4 1/2" ASME grade A, panel mounted gauges for indicating system suction and system discharge pressure.
- I. All skid-mounted components shall be factory finished in high quality epoxy or enamel paint. The base shall be suitable for grouting.
- J. The packaged pumping system shall include all electrical wiring between components and shall be completed and tested at the factory prior to shipment.
- K. Unions or flanges shall be provided for easy removal of pumps. Pipe headers shall be sized for a velocity not exceeding 7-1/2 FPS and shall be terminated with a groove joint capable of accepting a groove coupling or groove flange furnished by Contractor.
- L. System shall be arranged such that single point connections are required for piping and electrical power supply.
- M. Individual pumps, motors and pressure regulating or check valves shall be serviceable with the booster system in operation.
- N. All similar components shall be of one manufacturer, (i.e., valves, gauges, etc.).
- O. Refer to schedules on Contract Drawings for required pump capacities and electrical characteristics.

2.2 ACCEPTABLE MANUFACTURERS

- A. The following manufacturers are acceptable provided their products meet or exceed these Specifications and the Contract drawing schedules:
 1. Patterson Pump, Aqua FloPak
 2. Bell and Gossett
 3. Armstrong
 4. Metropolitan
 5. Aurora

2.3 PUMPS AND MOTORS

- A. System shall include two horizontal mounted close-coupled end suction centrifugal pumps with ANSI flanged connections. Pump features to include foot supported casing, back pull out design, top centerline discharge and hydraulically balanced impeller. Pump shall be cast iron bronze fitted or stainless steel construction with a replaceable shaft sleeve and mechanical seal with carbon-ceramic seal faces.
- B. Each pump shall be provided with an individual temperature probe and purge valve having adjustable high temperature set point and differential to sense heat buildup in the pump casing. On sensing high temperature the probe circuit shall open a solenoid valve that allows the heated water to flow out.
- C. See Section 26 60 00 – Common Motor Requirements for motor information.

2.4 VARIABLE FREQUENCY DRIVES

- A. See Section 26 29 23 – Variable Frequency Drive Controllers for VFD requirements.

2.5 PRESSURE SENSOR/TRANSMITTER

- A. Provide one pressure sensor/transmitter that provides a 4 to 20 mA DC output, compatible with the system controls, temperature and pressure requirements. Pressure sensor/transmitter shall have zero, span and damping devices. The transmitter shall be installed on the system discharge header and factory wired to the control panel.

2.6 SEQUENCE OF OPERATION

- A. The lead pump shall run only as necessary to maintain system pressure and will be controlled automatically by means of a pressure sensor/transmitter and programmable logic controller (PLC) programmed to prevent short cycling. If the lead pump is unable to maintain system pressure the lag pump(s) will be called on after a time delay and will operate in parallel with the lead pump in accordance with the PLC program. When one pump can handle the system demand the controls will shut down the lag pump. When a low or no flow condition is reached, the controls will accelerate the lead pump to charge the system and hydro-accumulator tank then shut the lead pump down and alternate.

2.7 CONTROL PANEL

- A. Logic Section - Provide, mount and wire on the skid a programmable logic controller in a NEMA 1 enclosure to interface the signal from the pressure sensor to the VFD's and provide a stabilized response to speed up or slow down or add pumps to meet system requirements. The controller shall provide setpoint adjustment, timer adjustment, PID functions and both system and controller self-diagnostics via touch screen display. The touch screen display / human machine interface shall include a 5.7" (minimum) STN display, resistive analog touch, numerical system keyboard. All user interface set points shall be easily accessible via a password protected display screen. Normal system operation shall be tuned to eliminate hunting. Controller shall have one RS 485 Communication port, real time calendar/clock and EEPROM memory transfer cartridge.
- B. Power Section - Each system shall include a UL listed enclosed industrial control panel in a NEMA 1 enclosure, factory wired and mounted on the steel skid. The panel shall be furnished with individual pump disconnects with through the door handles, pump run lights, H-O-A selector switches and 115 volt fused control transformer and include the following features:
 1. Control power (on-off) switch and light.
 2. Low suction pressure shutdown circuit with auto reset, delay timer and light.
 3. High system pressure shutdown circuit with auto reset and light.
 4. Power failure monitoring.
 5. Audible alarm with silence push button.
 6. Auto alternate three equal pumps.
 7. Auxiliary relay contacts for all alarm conditions.
 8. PLC enable switch.
 9. Individual pump temperature probe and purge valves.
 10. Main Disconnect.
 11. Audible and visual indication of low storage tank level (signal by others), with silence push button.
 12. Elapsed time meters.
 13. Flow sensor with digital display in GPM.
 14. Seven day time clock for intermittent system operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances.
- B. Install the system level and in accordance with manufacturer's published recommendations.
- C. Locate equipment with allowance for manufacturer's recommended clearances around unit.
- D. Set entire unit on 4" high reinforced concrete equipment pad. Provide vibration isolators and bolt skid to pad. Structurally connect equipment pad to building slab to prevent movement.
- E. Pipe discharge from all relief valves, drains and individual pump thermal purge protection solenoid valves, indirectly to floor drain having adequate capacity to accept discharge.
- F. Provide valved Type "L" copper branch feed to the bladder tank from system distribution main as shown on the Contract Drawings.

3.2 FACTORY TESTING

- A. The booster system shall be hydrostatically tested and shall undergo a complete electric and hydraulic test from 0 to 100% design flow at the factory. All control devices including transmitters and all safety features shall be factory calibrated and tested.

3.3 VERIFICATION AND TESTING

- A. Verify that the pumps and prime movers have been aligned according to manufacturers' recommendations. Test the system performance by verifying the operation of the pumps and system vs. the pump curves, alarms, controls, etc. Contractor shall inform Owner 48 hours in advance of verification and testing so that Owner's Commissioning Authority (CxA) may observe pump alignment, performance verifications, and testing of system performance, alarms and controls.

3.4 INSTRUCTIONS AND START-UP

- A. Provide for the service of a competent factory-trained supervising agent from the pump package manufacturer to inspect the completed installation, start the system and acquaint the operators with the proper operation and maintenance of the equipment.

END OF SECTION 2 11 23.13

This section of the *U of I Facilities Standards* establishes minimum requirements only.
It should not be used as a complete specification.