	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Chapter: 01 - Yale Design Standard Division: Plumbing Standards	Section: 22 11 23 13 Domestic-Water Pressure Booster Systems
		Date: 08/05/2017
		Author: Office of Facilities
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PART 1 - INTRODUCTION


- 1.1 This equipment standard applies to Domestic-Water Pressure Booster Systems for potable water systems.

PART 2 - GENERAL DESIGN GUIDELINES

- 2.1 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.
- 2.2 The Manufactured products of this Section shall have minimum ten (10) years documented experience. The packaged system manufacturer shall have 24 hour local service available provided by a trained factory authorized representative.
- 2.3 Disconnects, transformers, and control devices shall be installed to provide minimum wire bending clearances per N.E.C. Conductors shall be numbered and identified at all termination points, and comply with Yale’s Electrical Standard. All wiring shall be installed in nylon wire ways and laced with nylon tie straps. 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.). 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 UL QCZJ.
- 2.4 The Equipment shall comply with the most current Federal and State adopted version of NSF 61 for no-lead requirements, and be potable water rated.

PART 3 - MINIMUM PRODUCT REQUIREMENTS

- 3.1 GENERAL
 - A. 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


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appurtenances shall be suitable for the anticipated system pressures in which they are installed.

- C. The booster system shall be factory assembled on a steel skid including pumps, motors, 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.
- D. Over pressurization of the system while operating across-the-line shall be prevented by a pilot operated diaphragm type combination pressure regulating and non-slam check valve on each pump. Main valve and cover shall be ductile iron with a fused epoxy coating and stainless steel stem and cover bolts. Construction shall be suitable for the maximum working pressure of the system.
- E. All pilot lights and visual indicators shall be illuminated from the rear by long life LED lamps. Neon and incandescent lamps are not acceptable.
- F. 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).
- G. Provide isolation valves at the inlet and outlet connections to allow for the removal of the booster pump package.
- H. Provide a bypass across the booster pump package such to allow for non-interruptible water service in the event of a booster pump failure, repair, and or removal.
- I. Provide two 4 1/2" ASME grade A, panel mounted gauges for indicating system suction and system discharge pressure.
- J. All skid-mounted components shall be factory finished in high quality epoxy or enamel paint. The base shall be suitable for grouting.
- K. The packaged pumping system shall include all electrical wiring between components and shall be completed and tested at the factory prior to shipment.
- L. Unions or flanges shall be provided for easy removal of pumps.
- M. Pipe headers shall be sized for a velocity not exceeding 7-1/2 FPS and shall be terminated with a suitable system and service rated flange.
- N. System shall be arranged such that single point connections are required for piping and electrical power supply.
- O. Individual pumps, motors and pressure regulating or check valves shall be serviceable with the booster system in operation.
- P. All similar components shall be of one manufacturer, (i.e., valves, gauges, etc.).

3.2 ACCEPTABLE MANUFACTURERS

- A. The following manufacturers are acceptable provided their products meet or exceed these Specifications and the Contract drawing schedules:
 1. Bell and Gossett

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2. Armstrong

3.3 PUMPS AND MOTORS

- A. System shall include a minimum of two horizontal or vertical 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. Refer to HVAC, and Electrical Standards for motor requirements.

3.4 VARIABLE FREQUENCY DRIVES

- A. See Electrical Section for Variable Frequency Drive requirements.

3.5 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.

3.6 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-pneumatic tank then shut the lead pump down and alternate, if applicable.

3.7 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 set point adjustment, timer adjustment, PID

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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. 24/7/365 electronic and programmable time clock for intermittent system operation.

PART 4 - INSTALLATION REQUIREMENTS

4.1 Quality:

- A. Assurance requirements beyond standard 1 year warranty: Provide full 2 year warranty from date of factory witnessed start-up and acceptance testing.

4.2 Commissioning:

- A. A start-up report shall be issued at turn-over to the owner. The start-up report shall include testing of all equipment, and confirmation of sequence of operation. Each item will be itemized and indicate testing was completed and passed. Additionally, all critical set-points will be logged.

END OF SECTION