Editor Note: *Items in parenthesis and bold lettering must be edited as required for the specific project*.

**SECTION 221123 DOMESTIC-WATER PACKAGED BOOSTER PUMPS**

* 1. **SUMMARY**
1. This section covers variable speed domestic cold water and domestic hot water pressure booster systems.
	1. **QUALITY ASSURANCE**
2. Installed material not meeting specification requirements of the Contract Documents will be subject to removal and replacement.
	1. **SUBMITTALS**
3. Manufacturer’s technical data for the following:
	1. Pipe.
	2. Fittings
	3. Valves
	4. Hydro-Pneumatic Tank
	5. Pumps including materials of construction and performance curves.
	6. Controls including VFD’s, sensors, sequence of operation and enclosure type stating all door mounted items.
	7. Welding standards and procedures for piping and structural steel.
	8. Paint including primer and finish coat.
4. Three dimensional drawings showing dimensions and electrical requirements.
5. Built in Compliance with NSF/ANSI 61
6. Statement of AB1953 No Lead Compliance. **(State of California only)**
	1. **PRODUCTS**
7. Manufacturers: FlowTherm Systems or approved equal. Alternate packaged system manufacturers must be able to demonstrate a successful history of manufacturing similar systems for a minimum of 10 years.
8. Booster pump package shall be UL Listed, and have all components frame mounted, piped, painted, wired and factory tested. All wetted surfaces shall be lead free. Package shall include **(simplex) (duplex) (triplex)** pumps, manifolds, **(hydro-pneumatic bladder tank)** and control panel. Package shall have a single point **(208)** **(230) (460)** volt 3 phase power connection.
9. Pumps:
	1. Pumps shall be mounted, close coupled, end suctions, cast iron type with bronze fitted construction and mechanical seals as called out on the plans. Pumps casings shall include vent and drain ports at the top and the bottom of the casings.
	2. Pumps shall be rated with a maximum working pressure of 175psig and 225F continuous operating temperature.
	3. Pumps shall run without excessive noise or vibration.
10. Pumps motors shall be VFD-rated premium efficient motors and shall meet the requirements of NEMA MG1. Motor shall have an **(ODP)** or **(TEFC)** enclosure as called out in the equipment schedule.
11. Each pump and motor to have nameplate listing manufacturer’s name, pump serial number, capacity in GPM and feet of head at design conditions, motor horsepower, voltage frequency, speed and full load current.
12. Check valves shall be lead free, cast iron body with NSF61 approved fusion epoxy coating, center guided with stainless steel spring, and lead-free bronze discs.
13. Provide isolation valves at inlet and outlet of each pump, NSF61 approved butterfly or ball valves with union or flanged connections.
14. Pump manifold headers shall be 304 stainless steel schedule 10 welded pipe for cold water service and 316 stainless steel schedule 10 welded pipe for hot water service. Header pipe size shall be designed or a maximum of 10 fps velocity. All pipe welds shall be performed by

ASME Section IX certified welders and shall be welded to ASME/ANSI B31-9 specifications. System suction and discharge connections shall be (flanged) or (grooved).

1. Pressure transducers shall be supplied on the suction and discharge manifold headers and factory wired to the control panel. For atmospheric break tank applications, the suction pressure transducer is mounted on the break tank to indicate tank level on the touchscreen display.
2. The control system shall be configured for “pressure staging” in a lead/lag sequence. **(Flow staging is available with field-mounted flow meter)**
3. Each pump shall be fitted with a thermally activated purge valve to allow water to be purged to a remote drain in the event of a system overheating.
4. The booster pump package shall include a factory wired AqualogicTM3.0 control panel, UL 508 listed in a NEMA 1 **(NEMA 3R)** enclosure with single point power connection and all necessary components to allow for automatic operation of the variable speed pumps. The panel shall include the following components:
5. Main power disconnect, non-fused
6. Control circuit transformer with fused secondary.
7. Variable Frequency Drive for each pump
8. Through the door circuit breaker disconnect for each pump.
9. H-O-A selector switch for each pump
10. Door Mounted Pump Status Lights shall include as a minimum:
	1. Pump Run
	2. Pump Out Of Service
	3. General Alarm
11. Digital programmable logic controller
12. HMI - Door mounted 6” color graphic touch screen display.
13. Audible General Fault Alarm – includes a push to silence button and a set of dry contacts wired to a terminal strip for remote monitoring. A general fault alarm shall occur upon pump fault, VFD fault, PLC fault, transducer failure, high system pressure, low suction pressure, overload and network failure. The PLC shall maintain a data log including a date and time stamp of the past 20 system and VFD faults. These faults shall be displayed in English text on the HMI.
14. The micro-processor based supervisory controller (HMI) shall be a panel door mounted unit with color graphic touch screen display. The controller shall include PID control functions and control the VFD’s through a network interface. In addition to sending the run command and speed reference signal to the VFD’s through the network interface, the HMI shall display line voltage, output frequency, output current and fault conditions for each VFD. The HMI shall provide an easy to use operator interface to all system parameters and display those parameters in plain English and engineering unites. Monitoring functions shall be available to all users, but access to parameters shall be restricted by two levels of password protection.
15. Standard Variable Frequency Drive (VFD) features shall include over current, earth fault, electronic motor overload protection, over temperature, over voltage, under voltage, phase failure, PID close-loop controller, and automatic energy saving mode, motor synchronization, and user macro storage, auto restart after power failure, electronic motor potentiometer, 16 mixed frequencies and min/max frequency limitation.
16. Control logic shall include an energy saving proof of no demand shutdown, NDS, which tests the system demand and then shuts off the lead pump if no demand is proven. The lag pumps shall shut off when it operates at its minimum speed for an adjustable elapsed time.

The control logic shall also include the energy saving feature of dynamic set point adjustment, DSA, which automatically lowers or increases the system discharge operating pressure set point as the system demand changes. Alternative designs that do not utilize a built in software algorithm to compensate for the variable friction losses shall not be allowed to have their pressure transducer mounted on the discharge header; instead their transducer shall be provided loose and installed at the furthest remote location of the system to account for the variable friction losses within the piping system. The controls shall automatically stage the pumps and adjust the pump speed based on discharge pressure control. The lead and lag pumps shall be rotated after each system shutdown. The controls shall start a lag pump on lead pump failure. A high temperature safety shut down system shall be provided which uses a temperature sensor which measures the discharge water temperature and is directly connected to the PLC. If a high temperature occurs the system shall shut down and go into alarm. The pump water temperature monitoring must be used as a safety feature and cannot be used as an operating control. The controls shall include pump minimum run time and pump maximum run time adjustable set points.

1. The PLC shall be capable of connection to a building management system (BMS) using Modbus, BACnet or Lonworks.
2. The entire system shall be pre-assembled on a heavy structural steel frame. The frame shall be welded in accordance with AWS D1.1 specifications. The steel frame shall have a zinc oxide primer and a machine enamel finish coat.
3. Hydro-pneumatic bladder tank shall be ASME rated with a ring base and replaceable bladder. The tank shall be provided a union isolation ball valve, pressure gauge and drain valve. **(The tank shall ship loose for field installation)** *or* **(The tank shall be skid mounted and piped).**
4. **Refer to booster pump schedule on project drawings for capacity requirements.**

or

**Pump package shall be rated for XXX GPM at XX PSI at the discharge header based upon XX PSI minimum suction pressure. All pumps shall be of equal capacity unless otherwise stated in the project pump schedule.**

* 1. **EXECUTION**

A. Install pipe and fittings in accordance with reference standards, manufacturer’s recommendations and recognized industry practices.

B. Field piping includes connections to suction and discharge headers, drain piping and piping to hydro-pneumatic pressure tank, when not skid mounted, with union ball valve, pressure gauge and drain.

C. Field electrical connections include main power to the control panel and control wiring to remote pressure transducer if required.

D. Flush and clean piping prior to testing.

E. The manufacturer shall pressure test the system prior to shipment. Test piping with water to a pressure of **(125 psi)** for 1 hour. No decrease in pressure allowed. Inspect joints in system under test.

F. Defective work or material shall be replaced or repaired as necessary and inspection and test repeated. Repairs shall be made with new materials. Test reports shall be included in the owner’s manual.

G. The manufacturer shall test the control panel including operating logic, safeties and wiring prior to shipment.

H. Pressure test and control panel tests reports shall be signed by the manufacturer and included with the equipment O&M’s.

I. The manufacturer’s representative shall provide a system check and start-up service for the system. The system shall be warranted (including parts and labor) for a period of 12 months from date of start-up for 18 months after shipment, whichever comes first.

End of section