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**SPECIFICATIONS** SP-B111B

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**Series 80 with ITSC**

**(Integrated Technologic® Sensorless Control)**

DIVISION 23 – Heating, Ventilating, and Air-Conditioning (HVAC)

23 21 00 – Hydronic Piping and Pumps

23 21 23 – Hydronic Pumps

**PART 1 – GENERAL**

**1.01 DESCRIPTION OF WORK**

A. Provide pumps and required system trim for heating, chilled water, and dual temperature water systems including all related appurtenances for a complete
and operating system.

**1.02 SECTION INCLUDES**

A. Close Coupled, Vertical Inline Pump

**1.03 RELATED SECTIONS**

A. Drawings and general provisions of the contract, including general and supplementary Conditions and Division 1 Specification Sections, apply to these Sections:

 • Section \*\*\* - Alignment of Rotating Equipment

 • Section \*\*\* - Cast-in-Place Concrete

 • Section \*\*\* - Mechanical General Requirements

 • Section \*\*\* - Supports, Anchors, and Sleeves

 • Section \*\*\* - Motors and Starters

 • Section \*\*\* - Drives

 • Section \*\*\* - Mechanical Identification

 • Section \*\*\* - Vibration Isolation

 • Section \*\*\* - Piping Insulation

 • Section \*\*\* - Equipment Installation

 • Section \*\*\* - Hydronic Piping and Specialties

 • Section \*\*\* - Testing, Adjusting, and Balancing

 • Section \*\*\* - Meters and Gauges

 • Section \*\*\* - Electrical

**1.04 REFERENCES**

A. HI - Hydraulic Institute.

B. ANSI - American National Standards Institute.

C. OSHA - Occupational Safety & Health Administration.

D. ASHRAE – American Society of Heating, Refrigeration and Air-Conditioning Engineers.

E. NEMA - National Electrical Manufacturers Association.

F. UL - Underwriters Laboratories.

G. ETL - Electrical Testing Laboratories.

H. CSA - Canadian Standards Association.

I. NEC - National Electric Codes.

J. ISO - International Standards Organization.

K. IEC - International Electrotechnical Commission.

L. ASME – American Society of Mechanical Engineers.

**1.05 SUBMITTAL**

A. Submit each item in this article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Submit manufacturer’s installation instructions under provisions of General Conditions and Division 1.

C. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts lists.

D. Under provisions of commissioning documentation, testing of pumps, as well as training of owner’s operation and maintenance personnel may be required in cooperation with the commissioning consultant.

E. Product Data including certified performance curves and rated capacities of selected model, weights (shipping, installed, and operating), furnished specialties, and accessories. Indicate pump’s operating point on curves.

F. Complete Package information Product Data including:

 • System summary sheet (where applicable)

 • Sequence of Operation

 • Shop drawing indicating dimensions, required
 clearances and location and size of each field
 connection

 • Power and control wiring diagram

 • System profile analysis including pump curves,
 system curve, and variable speed pump curves
 (where applicable)

 • Pump data sheets - Rated capacities of selected
 models and indication of pump’s operating point
 on curves.

 • Submittals on furnished specialties and accessories

 • Submittals must be specific to this project. Generic
 submittals will not be accepted.

G. Hanging and support requirements should follow the recommendations in the manufacturer’s installation instructions.

**1.06 QUALITY ASSURANCE**

A. All equipment or components of this specification section shall meet or exceed the requirements and quality of the items herein specified, or as denoted on the drawings.

B. Ensure pump operation, at specified system fluid temperatures without vapor binding and cavitation, is non-overloading in parallel or individual operation, and operates to ANSI/HI 9.6.3.1 standard for Preferred Operating Region (POR) unless otherwise approved by the engineer.

C. Ensure pump pressure ratings are at least equal to system’s maximum operating pressure at point where installed but not less than specified.

D. Equipment manufacturer shall be a company specializing in manufacture, assembly, and field performance of provided equipment with a minimum of 20 years experience.

E. Equipment provider shall be responsible for providing certified equipment start-up and, when noted, an in the field certified training session. New pump start-up shall be for the purpose of determining pump alignment, lubrication, voltage, and amperage readings. All proper electrical connections, pump’s balance, discharge and suction gauge readings, and adjustment of head, if required. A copy of the start-up report shall be made and sent to both the contractor and to the Engineer.

**1.07 DELIVERY, STORAGE, AND HANDLING**

A. Deliver materials to the site in such a matter as to protect the materials from shipping and handling damage. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Materials damaged by the elements should be packaged in such a matter that they could withstand short-term exposure to the elements during transportation.

B. Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

C. Use all means necessary to protect equipment before, during, and after installation.

D. All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect Engineer.

**1.08 WARRANTY:**

A. Provide a minimum One (1) year warranty on materials and installation under provision of Section 01 78 36

**PART 2 – PRODUCTS**

**2.01 MANUFACTURERS**

A. The specifying engineer reserves the right to specify a primary supplier / lead spec manufacturer on all supplied schedule and specification documents. These primary suppliers have led their respective industry in research and development and their products have had proven track records in the field. These primary suppliers, in the opinion of this engineering firm, produce a superior product to the alternately listed manufacturers. The contractor may choose to supply equivalent equipment as manufactured by the alternately specified manufacturer. This alternately specified equipment shall be supplied on a deduct alternate basis and based on the approval of the supplied alternate manufacturer’s submittals. The use of a primary supplier and deduct alternates protects the specifying engineer’s design concept, but allows for a check-and-balance system to protect the post-commissioning owner.

B. Contractor shall furnish and install new close-coupled vertical inline pump for chilled water and hot water heating systems as indicated on the drawings. Pumps shall be Series 80 as manufactured by Bell & Gossett under base bid. Equivalent units as manufactured by other manufacturers may be submitted as deduct alternates. Pumps shall meet types, sizes, capacities, and characteristics as scheduled on the Equipment Schedule drawings. Pump substitutions shall be provided with connection sizes equal to those scheduled. Pump connections shall not be downsized. Pump substitutions shall not be provided at efficiencies less than those scheduled.

**2.02 COMPONENTS**

A. The pumps shall be close-coupled, inline for vertical or horizontal installation, in cast iron bronze fitted (or all iron as an option) construction specifically designed for quiet operation. Suitable standard operations at 225°F and 175 PSIG working pressure (or optional operations at up to 250°F and 250 PSIG working pressures). Working pressures shall not be de-rated
at temperatures up to 250°F. The pump internals shall be capable of being serviced without disturbing piping connections.

B. As an option an EPR-Tungsten/Carbide seal (250°F maximum operating temperature), Viton seal, or EPR-Silicon Carbide/Silicon Carbide seal may be used in lieu of the standard Buna seal (225°F maximum operating temperature).

C. The pumps shall have a solid alloy steel shaft that is integral to the motor. A stainless steel shaft sleeve shall be employed to completely cover the wetted area under the seal.

D. The motor bearings shall support the shaft via heavy-duty grease lubricated ball bearings.

E. Pump shall be equipped with an internally flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Seal assembly shall have a brass housing, Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face. (As an option, a stuffing box designed may be used in lieu of the traditional internally flushed mechanical seal design. Pump shall be flushed single seal, flushed double seal, or packing gland type seal arrangements.)

F. Pump shaft shall connect to a brass or stainless steel impeller. Impeller shall be hydraulically and dynamically balanced to Hydraulic Institute Standards ANSI/HI 9.6.4.5-2000. The allowable residual imbalance conforms to ANSI grade 6.3, keyed to the shaft and secured by a stainless steel locking capscrew or nut.

G. Pump should be designed to allow for back pull-out access to the pump’s working components for ease of maintenance.

H. Pump volute shall be of a Class 30 cast iron design for heating systems rated for 175 PSIG with integral cast iron flanges drilled for 125# ANSI companion flanges (Optional 250 and 300 PSIG working pressures are available and are 250# flange drilled). Volute shall include gauge ports at nozzles, and vent and drain ports. The volute shall be designed with a base ring matching an ANSI 125# flange that can be used for pump support.

I. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Motors shall have heavy-duty grease lubricated ball bearings to offset the additional bearing loads associated with the closed-coupled pump design. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications.

J. Pumps shall conform to ANSI/HI 9.6.3.1 standard for Preferred Operating Region (POR) unless otherwise approved by the engineer.

K. Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts and not press fit components.

L. Pump manufacturer shall be ISO-9001 certified.

M. Each pump shall be factory tested and name-plated before shipment.

N. As an option, the pump may include internal casing wear rings.

O. Where noted on schedule pumping equipment may require one or all of the following optional tests: Certified Lab tests (unwitnessed), Hydraulic Institute Level B tests, or Witnessed Tests.

**2.03 ACCESSORIES**

A. Where noted on the schedule provide one mechanical seal for each model type of primary pump.

B. Where noted on schedule a Bell & Gossett Sediment Separator shall be furnished for installation on the flushing line between the pump discharge flange and the seal area. The sediment separator is installed to increase the overall life expectancy of the seal on inherently dirty systems. The separator shall remove dissolved solids from the flushing medium before the fluid enters the seal area where it can damage and shorten the life of the seal.

C. Where noted on schedule a Bell & Gossett Brazed Plate Heat Exchanger Kit shall be furnished for installation on the flushing line between the pump discharge flange and the seal area. The heat exchanger is installed to increase the overall life expectancy of the seal on high temperature systems (greater than 225°F). The kit shall decrease the temperature of the flushing water being provided to the seal area as a flushing medium to a temperature less than 225°F. Flushing temperatures higher than 225°F can damage and shorten the life of the seal.

**2.04 INTEGRATED VFD WITH SENSORLESS PUMP CONTROL**

A. The driving motor shall be of induction type incorporating an integrated pump controller, premium efficiency motor rating with controller having an UL Type 12/IP55 enclosure.
B. Integrated Pump Controller shall be factory mounted, wired, with a mains disconnect switch and menu-driven graphical interface.

C. Integrated Pump Controller shall provide near unity displacement power factor (cos Ø) without need for external power factor correction capacitors at all loads and speeds using VVC-PWM type integrated controls.

D. Integrated Pump Controller shall include dual DC link reactors equivalent to 5% impedance line reactors, for reduction of mains borne harmonic currents and DC link ripple current to increase DC link capacitor lifetime.

E. System pressure to be maintained: [\_\_\_\_\_\_] feet head minimum.

F. Integrated Pump Controller orientation shall be specified as [VL1], [VL2], [VL3], [VL4]

G. Integrated Pump Controller shall support direct communication with the building management system (BMS) with built-in support for the following protocols: [Modbus RTU] [BACnet™ MS/TP] [Metasys N2]

H. Integrated Pump Controller shall support Programmable skip Frequencies and adjustable switching frequency for noise and vibration control.

I. Integrated Pump Controller shall provide a temperature controlled Fan for cooling of the heat sink in the back panel.

J. Integrated Pump Controller shall be rated to operate in ambient working conditions of [14°F to +113°F], up to [3300] feet above sea level.

K. Integrated Pump Controller shall provide 2 Analog inputs (current or voltage) and 1 current output.

L. Integrated Pump Controller shall provide 6 programmable Digital inputs with 2 configurable
as outputs.

M. Integrated Pump Controller shall support 2 programmable pulse inputs

N. Integrated Pump Controller shall provide 2 programmable relay outputs

O. Integrated Pump Controller shall provide 1 RS485 communication port

P. Sensorless control software shall be embedded in the Integrated Pump controller to provide automatic speed control in variable volume systems without the need for pump mounted (internal/external) or remote differential pressure sensor. The sensorless calibration software of complete system performance (pump, motor and controller) must be retained by manufacturing and available for warranty purposes if necessary. The software calibration to operate within sensorless mode must be derived from minimum 50 data points encompassing multiple frequency ranges from 24 Hz to 60 Hz and serialized to customer’s pump system. Calibration certification available by manufacturer
upon request.

Q. Integrated Pump Controller Sensorless control shall operate under Quadratic Pressure Control (QPC) to ensure head reduction with reducing flow conforms to quadratic control curve.

R. Integrated Pump Controller shall support a minimum head of 40% of design duty head.

S. Integrated Pump Controller shall provide user adjustable control mode settings and minimum/maximum head set points using built-in programming interface.

T. Sensorless calibration and operating mode shall allow pump performance for non-overloading power at every point of operation.

U. Integrated Pump controller with integrated control software derived from calibration performance shall be capable of maintaining flow rate data.

V. Pump, Controller and Motor protection shall include: motor phase to phase fault, motor phase to earth fault, loss of supply phase, over voltage, under voltage, motor over temperature, inverter overload, over current.

**PART 3 – EXECUTION**

**3.01 INSTALLATION**

A. Install equipment in accordance with manufacturer’s instructions.

B. Reduction from line size to pump connection size shall be made with eccentric reducers attached to the pump with tops flat to allow continuity of flow.

C. Furnish and install triple duty valves on the discharge side of all pumps and furnish and install a line size shut-off valve on the suction side of all pumps. Anywhere that 5 straight pipe diameters of pipe cannot be provided on the inlet side of a pump a suction diffuser shall be used to provide appropriate flow distribution into the eye of the pump’s impeller.

D. Provide temperature and pressure gauges where and as detailed or directed.

E. On systems where pump seals require flushing water or cooling water for a heat exchanger kit, provide cooling water supply piping and connections as well as the return piping, if required. Piping should be of adequate size to pass required flow rate.

F. Proper access space around a device should be left for servicing the component. No less than the minimum recommended by the manufacturer.

G. Provide an adequate number of isolation valves for service and maintenance of the system and its components.

H. Circulating pump shall have sufficient capacity to circulate the scheduled GPM against the scheduled external head (feet) with the horsepower and speed as scheduled and/or as denoted on the drawings. Motors shall be of electrical characteristics as scheduled, denoted and/or as indicated on the electrical plans and specifications. Pump characteristics shall be such that the head of the pump under varying conditions shall not exceed the rated horsepower of the drive motor.

I. On systems where the final balancing procedure requires the triple duty valve to be throttled more than 25% to attain design flow (on a constant speed pumping system), and no future capacity has been built into the pump, the pump impeller must be trimmed to represent actual system head resistance. The pump provider and engineer of record, based on the balancing contractor’s reports, shall determine the final impeller trim diameter.

J. All piping shall be brought to equipment and pump connections in such a manner so as to prevent the possibility of any loads or stresses being applied to the connections or piping. All piping shall be fitted to the pumps even though piping adjustments may be required after the pipe is installed.

K. On components that require draining, contractor must provide piping to and discharging into appropriate drains.

L. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer’s instruction and applicable state, federal, and local codes.

M. Control wiring for remote mounted switches and sensor / transmitters shall be the responsibility of the control’s contractor. All wiring shall be performed per manufacturer’s instructions and applicable state, federal, and local codes.

END OF SECTION



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