

SECTION 23 21 23 HYDRONIC PUMPS

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions to the Construction Contract", "Special Conditions" and "Division 01 - General Requirements" form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 ADDITIONAL RELATED DOCUMENTS

- A. Division 23 Section "Vibration Controls for HVAC" for spring supports and hangers.
- B. Division 23 Section "Hydronic Piping" including piping system component and equipment pressure ratings applies to this section, and for AC condensate pump units.
- C. Division 23 Section "Common Motor Requirements for HVAC Equipment" for pump motor requirements.

1.3 SUMMARY

- A. This Section includes the following categories of hydronic pumps:
 - 1. Close-coupled in-line circulators.

1.4 ACTION SUBMITTALS

- A. Pump Product Data: Include certified performance curves and rated capacities; shipping, installed, and operating weights; furnished specialties; final impeller dimensions; and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Shop Drawings: Show pump layout and connections.
 - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Pump start-up service reports and checklists.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For pumps to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer. All pumps shall be factory assembled and balanced. Shop or field-assembled 'pump kits' are not acceptable.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- D. Terms and Definitions: As per Hydraulic Institute Standards, HI 1.1-1.2 and HI 1.3, latest editions.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
- B. Store pumps in dry location.
- C. Retain protective covers for flanges and protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with pump manufacturer's written rigging instructions.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Mechanical Seals: One spare mechanical seal set for each pump.
 - 2. Volute Gaskets: One spare gasket set for each pump.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Close-Coupled In-Line Circulators:
 - a. Armstrong Fluid Technology. "Series 4380"
 - b. Bell & Gossett; Div. of Xylem Inc. "Series "e-90"
 - c. Taco Inc. "Series "1600 or 1900"
 - d. Grundfos Pumps Corp. Series "TP"
 - e. Or equal as approved by the Professional.

2.2 GENERAL PUMP REQUIREMENTS

- A. Pump Units: Factory assembled and tested.
- B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be nonoverloading over full range of pump performance curve.
 - 1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- C. Energy Efficiency: Minimum efficiency complying with ASHRAE 90.1-2019 requirements for pump efficiency index, PEI, to not exceed 1.0.
- D. Pump rating curves shall be the result of testing and rating in accordance with the procedures of the Hydraulic Institute.
- E. Operating Points and Pump Selections: Select and submit pumps according to the schedules on the Drawings, and the following:
 - 1. The design operating point shall be no less than 25%, and no more than 85%, of the manufacturer's maximum recommended flowrate at the selected impeller size.
 - 2. The pump shutoff head is no less than that scheduled on the Drawings (i.e. zero-flow pump head).
 - 3. The selected impeller size shall be no larger than 90% of the largest impeller size that can potentially be fitted to the selected pump volute, unless scheduled otherwise on the Drawings.
 - a. Exception: Pumps operated through a VFD, where the pump and motor have the ability to operate at 5% over the design speed using the VFD, without affecting the warranty or causing damage or accelerated wear to the pump or motor.
- F. Dynamic Balancing: All pumps shall be dynamically balanced and tested in the factory per the Hydraulic Institute Standard, ANSI/HI 9.6.4, latest edition. Residual imbalance shall conform to ANSI grade 6.3, unless otherwise specified.
- G. Pumps shall be provided with suction and discharge gauge tapings and plugs.
- H. Impellers shall be dynamically balanced, keyed to the shaft and secured with a suitable locking capscrew or locknut arrangement.
- I. Pumps shall be factory tested, cleaned and painted with one coat of machinery enamel before shipment.

2.3 CLOSE COUPLED IN-LINE CIRCULATORS

- A. Description: Horizontal, in-line, centrifugal, close-coupled, single-stage, bronze-fitted, radially split case design; rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg. F.
 - 1. Casing: Cast iron, with threaded companion flanges for piping connections, and threaded gage tapings at inlet and outlet connections.
 - 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.

3. Shaft and Sleeve: Carbon steel shaft with oil-lubricated copper sleeve.
4. Seals: Mechanical type. Include carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and Viton, EPDM, or EPR (ethylene propylene rubber) gasket.
5. Pump Bearings: Oil-lubricated, bronze journal and thrust type.
6. Motor Bearings: Oil-lubricated, sleeve type.
7. Motor: ECM type, directly mounted to pump casing.

2.4 PUMP SPECIALTY FITTINGS

- A. Silent Check Valves: Refer to Division 23 Section "Hydronic Piping".
- B. Flexible Pump Connectors: Refer to Division 23 Section "Common Work Results for HVAC".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation.
 1. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
 2. Examine foundations and bases for suitable conditions where pumps are to be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

- A. Install pumps according to manufacturer's written instructions.
 1. Install pumps according to HI 1.4, latest edition.
- B. Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping separately so piping is not supported by pumps or flexible pump connectors.
- D. Independently support pumps and piping separately so pumps are not supported by piping.
- E. Suspend in-line centrifugal pumps independent of piping using channel supports. Install pumps with motor and pump shafts oriented as recommended by the manufacturer. Hang pumps from the building structural system using continuous-thread hanger rods and spring vibration hangers of sufficient size to support pump weight.
 1. Provide vibration isolation hangers as specified in Division 23 Section "Vibration Controls for HVAC."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Install suction and discharge pipe sizes equal to those shown on the drawings. Valves and appurtenances at the pumps shall be the same size as system piping. If transitions are required, provide transitions at the pump flanges or suction diffuser inlet flange.
- D. Pipe connections to pumps shall be made in such a manner so as not to exert any stress on pump housings.
- E. Install valves as detailed on the Drawings on the discharge side of pumps.
- F. Install pressure gages on pump suction and discharge. Install at integral pressure-gage tapings where provided. Install compound type gauge on suction side.
- G. Install electrical connections for power, controls, and devices.
- H. Electrical power wiring and connections are specified in Division 26 Sections.
- I. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 USE OF PERMANENTLY INSTALLED PUMPS DURING INITIAL FLUSHING OF THE HYDRONIC SYSTEM

- A. The Contractor is prohibited to use the permanently installed hydronic pumps to perform the initial flushing the hydronic system. The Contractor shall furnish and install a temporary pump for this purpose, or shall utilize a clean water source in a once-through manner. After flushing operations are complete, the Contractor shall remove the temporary pump and/or fresh water connections and install and operate the permanent pump. The permanent pump may be used for cleaning, passivation, and chemical treatment process. All temporary electrical and piping connections to perform the required system flushing without the use of the permanent pump are the responsibility of the Division 23 Contractor.
 - 1. Refer to Division 23 Sections "Hydronic Piping", and "Water Treatment for Closed-Loop Hydronic Systems" for additional requirements.
- B. If the Contractor does not comply with the above, the Contractor shall replace the seals and volute gaskets in all pumps exposed to the flush water 11 months after system start-up at no additional cost to the Client Agency. Extra seals and volute gaskets shall be furnished by the Contractor for this purpose (i.e. do not use the spare materials required by the Article "Extra Materials" elsewhere in this Section).

3.5 FIELD QUALITY CONTROL AND STARTUP SERVICE

- A. Verify that pumps are installed and connected according to the Contract Documents.

- B. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.
- C. Perform the following preventive maintenance operations and checks before starting:
 - 1. Lubricate bearings.
 - 2. Remove grease-lubricated bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
 - 3. Disconnect coupling and check motor for proper rotation that matches direction marked on pump casing.
 - 4. Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag, until cause of trouble is determined and corrected.
 - 5. Check suction piping connections for tightness to avoid drawing air into pumps.
 - 6. Clean strainers. Use startup strainer for initial startup.
 - 7. Verify that pump controls are correct for required application.
- D. Pumps shall NOT be run dry to check rotation. Only start up pumps on a system filled with clean water.
- E. Starting procedure for pumps with shutoff power not exceeding safe motor power is as follows:
 - 1. Prime pumps by opening suction valves and closing drains, and prepare pumps for operation. Verify that pumps are vented and completely full of water.
 - 2. Open warm-up valves of pumps handling hot liquids if pumps are not normally kept at operating temperature.
 - 3. Open circulating line valves if pumps should not be operated against dead shutoff.
 - 4. Start motors.
 - 5. Open discharge valves slowly.
 - 6. Check general mechanical operation of pumps and motors.
 - 7. Close circulating line valves once there is sufficient flow through pumps to prevent overheating.
- F. When pumps are to be started against closed check valves with discharge shutoff valves open, steps are the same, except open discharge valves before starting motors.
- G. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for detailed requirements for testing, adjusting, and balancing hydronic systems.

3.6 DEMONSTRATION

- A. Train Client Agency's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:
 - 1. Train Client Agency's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
 - 2. Review data in maintenance manuals.
 - 3. Schedule training with Client Agency, through Architect, with at least seven days' advance notice.

END OF SECTION