

**SECTION 23 21 23
HYDRONIC PUMPS**

 SPEC WRITER NOTES:

1. Delete between // ---- // if not applicable to project. Also delete any other item or paragraph not applicable in the Section and renumber the paragraphs.
2. Provide the year of latest edition to each publication given in paragraph APPLICABLE PUBLICATIONS.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Hydronic pumps for heating, ventilating and air conditioning.
- B. Definitions:
 1. Capacity: Liters per second (L/s) (Gallons per minute (gpm)) of the fluid pumped.
 2. Head: Total dynamic head in kPa (feet) of the fluid pumped.
 3. Flat head-capacity curve: Where the shutoff head is less than 1.16 times the head at the best efficiency point.
- C. A complete listing of common acronyms and abbreviations are included in //Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT AND STEAM GENERATION// //Section 23 05 11, COMMON WORK RESULTS FOR HVAC//.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- D. //Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- E. //Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//
- F. //Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT AND STEAM GENERATION.//
- G. //Section 23 05 11, COMMON WORK RESULTS FOR HVAC.//
- H. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
- I. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- J. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- K. //Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//
- L. Section 23 21 13, HYDRONIC PIPING.

M. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

SPEC WRITER NOTES:

1. Make material requirements agree with requirements specified in the referenced Applicable Publications. Verify and update the publication list to that which applies to the project, unless the reference applies to all mechanical systems. Publications that apply to all mechanical systems may not be specifically referenced in the body of the specification, but shall form a part of this specification.
2. Insert the year of approved latest edition of the publications between the brackets // // and delete the brackets if applicable to this project.

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur, these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

B16.1-//2020//.....Gray Iron Pipe Flanges and Flanged Fittings:
Classes 25, 125, and 250

C. American Society for Testing and Materials (ASTM):

A48/48M-//2003(R2021)//.Standard Specification for Gray Iron Castings
B62-//2017//.....Standard Specification for Composition Bronze
or Ounce Metal Castings

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION XX XX XX, SECTION TITLE", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Pumps and accessories.
2. Motors and drives.

3. Variable speed motor controllers.
- D. Characteristic Curves: Head-capacity, efficiency-capacity, brake horsepower-capacity, and NPSHR-capacity for each pump and for combined pumps in parallel or series service. Identify pump and show fluid pumped, specific gravity, pump speed and curves plotted from zero flow to maximum for the impeller being furnished and at least the maximum diameter impeller that can be used with the casing.
- SPEC WRITER NOTE: Coordinate O&M Manual and commissioning requirements with Section 01 00 00, GENERAL REQUIREMENTS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS. O&M Manuals shall be submitted for content review as part of closeout documents.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
 2. Include complete diagrams of the internal wiring for each item of equipment.
 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- F. //Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//
- G. //Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//

1.5 QUALITY ASSURANCE

- A. Design Criteria:
1. Pumps design and manufacturer shall conform to Hydraulic Institute Standards.
 2. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.
 3. Head-capacity curves shall slope up to maximum head at shut-off.. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable

- operation. Select pumps for open systems so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA). Provide pumps with non-overloading motors.
4. Pump Driver: Furnish with pump. Size shall be non-overloading at any point on the head-capacity curve, including in a parallel or series pumping installation with one pump in operation.
 5. Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.
 6. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in gpm and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency. Name plates shall be visible when pumps are insulated.
 7. Test all pumps before shipment. The manufacturer shall certify all pump ratings.
 8. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.
- B. Allowable Vibration Tolerance for Pump Units: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- C. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.
- D. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

- A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.7 SPARE MATERIALS

- A. Furnish one spare seal and casing gasket for each pump to the //COR// //Project Manager//.

PART 2 - PRODUCTS**2.1 CENTRIFUGAL PUMPS, BRONZE FITTED**

A. General:

1. Provide pumps that will operate continuously without overheating bearings or motors at every condition of operation on the pump curve, or produce noise audible outside the room or space in which installed.
2. Provide pumps of size, type and capacity as indicated, complete with electric motor and drive assembly, unless otherwise indicated. Design pump casings for the indicated working pressure and factory test at 1-1/2 times the designed pressure.
3. Provide pumps of the same type, the product of a single manufacturer, with pump parts of the same size and type interchangeable.
4. General Construction Requirements:
 - a. Balance: Rotating parts, statically and dynamically.
 - b. Construction: To permit servicing without breaking piping or motor connections.
 - c. Pump Motors: Provide high efficiency motors, inverter duty for variable speed service. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT. Motors shall be //open drip-proof// //TEFC// and operate at 1750 RPM unless noted otherwise.
 - d. Heating pumps shall be suitable for handling water to 107 degrees C (225 degrees F).
 - e. Provide coupling guards that meet OSHA requirements.
 - f. Pump Connections: Flanged.
 - g. Pump shall be factory tested.
 - h. Performance: As scheduled in the contract documents.
5. Variable Speed Pumps:
 - a. The pumps shall be the type shown in the contract documents and specified herein flex coupled to //an open drip proof// //a TEFC// motor.
 - b. Variable Speed Motor Controllers: Refer to Section 26 29 11, MOTOR CONTROLLERS and to //Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT AND STEAM GENERATION// //Section 23 05 11, COMMON WORK RESULTS FOR HVAC// paragraph, VARIABLE SPEED MOTOR CONTROLLERS. Furnish controllers with pumps and motors.

- c. Pump operation and speed control shall be as shown in the contract documents.

SPEC WRITER NOTE: For simple systems, integrated VFD pumps may be specified. Coordinate the integrated VFD specifications with electrical Section 26 29 11, MOTOR CONTROLLERS.

- d. //Direct drive pumps with integrated variable frequency drive (VFD) utilizing the design pump curve programmed on board the built-in controller (also known as sensor-less, or self-sensing). Pump to comply with paragraphs in this section. VFD and motor to comply with Section 26 29 11, MOTOR CONTROLLERS and Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.//

B. Inline Type, Base Mounted End Suction or Double Suction Type:

1. Casing and Bearing Housing: Close-grained cast-iron, ASTM A48/A48M.
2. Casing Wear Rings: Bronze.
3. Suction and Discharge: //Plain face flange, 861 kPa (125 psig), ASME B16.1 //Union End//.
4. Casing Vent: Manual brass cock at high point.
5. Casing Drain and Gauge Taps: 13 mm (1/2 inch) plugged connections minimum size.
6. Impeller: Bronze, ASTM B62, enclosed type, keyed to shaft.
7. Shaft: Steel, Type 1045 or stainless-steel.
8. Shaft Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and //NBR// //EPDM// //FKM// // // bellows and gasket.
9. Shaft Sleeve: Bronze or stainless-steel.
10. Motor: Furnish with pump. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
11. Base Mounted Pumps:
 - a. Designed for disassembling for service or repair without disturbing the piping or removing the motor.
 - b. Impeller Wear Rings: Bronze.
 - c. Shaft Coupling: Non-lubricated steel flexible type or spacer type with coupling guard, bolted to the baseplate.
 - d. Bearings (Double-Suction pumps): Regreaseable ball or roller type.
 - e. Provide lip seal and slinger outboard of each bearing.

- f. Base: Cast-iron or fabricated steel for common mounting to a concrete base.
- 12. Provide line sized shut-off valve and suction strainer, maintain manufacturer recommended straight pipe length on pump suction (with blowdown valve). Contractor option: Provide suction diffuser as follows:
 - a. Body: Cast-iron with steel inlet vanes and combination diffuser-strainer-orifice cylinder with 5 mm (3/16 inch) diameter openings for pump protection. Provide taps for strainer blowdown and gauge connections.
 - b. Provide adjustable foot support for suction piping.

SPEC WRITER NOTE: Coordinate with the air separator. A strainer is only needed in 1 location and recommended in the suction diffuser.
 - c. Strainer free area: Not less than 5 times the suction piping.
 - d. Provide disposable startup strainer.

2.2 VERTICAL TURBINE PUMP

SPEC WRITER NOTE: Vertical turbine pumps shall be used for condenser water systems where the centrifugal pumps or the piping layouts are such that the required net positive suction head is in excess of what the conventional centrifugal pump can produce. Indicate on pump schedule the number of stages. Provide scaled drawing detail showing the following distances from the sump/basin bottom: to underside of suction strainer, to minimum water surface level, to the underside of baseplate.

- A. Pump Bowls: Close-grained cast-iron, flanged and bolted type, reinforced with 4 ribs (minimum), which are at least 1/2 the flange metal thickness. Number of stages as indicated in the contract documents.
- B. Impellers: Bronze, enclosed type, secured to the shaft with steel tempered keys.
- C. Replaceable Wear Rings: Bronze.
- D. Pump Shaft: Type 416, stainless-steel.
- E. Suction Bell: Cast-iron, belled to reduce entrance losses.
- F. Suction Strainer: Bronze, basket type, with net open area at least twice the calculated area at the suction bell lip.

- G. Sleeve Bearings: Bronze provided in each bowl and in the suction bell, to be lubricated by the pumped fluid. Suction bell bearing shall be packed permanently with non-soluble grease and fitted with a bronze sand collar.
- H. Discharge Column Pipe: Steel with threaded or flanged connections.
- I. Line-shaft: Type 1045, steel connected through steel threaded couplings. Shaft (and column) sections shall not exceed 3 m (10 feet) in length. Provide the necessary length of column and shaft as required to mount pump with the distances shown.
- J. Replaceable Shaft Sleeves: Stainless-steel "shrunkfit" on the line-shaft at each bearing location.
- K. Column Connection Bearings: Fluted rubber supported by non-threaded "spider" type retainers butted between the machined faces of the discharge column. "Spider" shall be made of nickel-iron with a minimum Brinell hardness number of 170.
- L. Surface Discharge Head Assembly: Close-grained cast-iron with integral 861 kPa (125 psig) flat face flange, ASME B16.1. Provide 2 lifting lugs with capacity to support the weight of the entire pump. Provide steel base plate and hardware for securing the discharge head to the base plate.
- M. Stuffing Box: Manufacturer's standard, 2 Teflon seal cages, and split type packing gland.
- N. Stuffing Box Bearing Housing: Cast-iron, 1-piece, with bronze sleeve bearings.
- O. Motor: Vertical, hollow shaft type, direct connected. //WPI (Weather Protected Type I)// //WPII (Weather Protected Type II)//.

2.3 //AUTOMATIC CONDENSATE PUMP UNITS

SPEC WRITER NOTE: The use of automatic condensate pumps shall be coordinated with the facility and only used when there are no other options for condensate removal.

- A. Packaged units with corrosion-resistant pump, //aluminum// //plastic// tank with cover, and automatic controls. Collects and removes condensate from fan coil units, air handling units, condensing boilers, and similar components. Include factory- or field-installed check valve and 1829 mm (72 inch) minimum, electrical power cord with plug.//

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.
- B. Follow manufacturer's written instructions for pump mounting and startup. Access/Service space around pumps shall not be less than minimum space recommended by pumps manufacturer.
- C. Provide drains for bases and seals for base mounted pumps, piped to and discharging into floor drains.
- D. Coordinate location of thermometer and pressure gauges as per Section 23 21 13, HYDRONIC PIPING.

3.2 STARTUP AND TESTING

- A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- C. //The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.//
- D. Verify that the piping system has been flushed, cleaned and filled.
- E. Lubricate pumps before startup.
- F. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.
- G. Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.
- H. Field modifications to the bearings and or impeller (including trimming) are prohibited. If the pump does not meet the specified vibration tolerance, send the pump back to the manufacturer for a replacement pump. All modifications to the pump shall be performed at the factory.
- I. Ensure the disposable strainer is free of debris prior to testing and balancing of the hydronic system.

- J. After several days of operation, replace the disposable startup strainer with a regular strainer in the suction diffuser.

3.3 //COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.//

3.4 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for //4//
// // hour//s// to instruct each VA personnel responsible in operation and maintenance of the system.
- B. //Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//

- - - E N D - - -