

## University of Houston Master Specification

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### SECTION 23 2123 – HYDRONIC PUMPS

Maintain Section format, including the UH master spec designation and version date in bold in the center columns of the header and footer. Complete the header and footer with Project information.

Edit and finalize this Section, where prompted by Editor's notes, to suit Project specific requirements. Make selections for the Project at text identified in bold.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
  - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas, available on the web site of the Texas Facilities Commission.
  - 2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction*.

##### 1.2 DESCRIPTION OF WORK:

- A. Section Includes: Provide pumps as specified, scheduled, and indicated.
- B. Types: The types of pumps required for the project include the following:
  - 1. **Horizontal split case pumps.**
  - 2. **End-suction base-mounted pumps.**
  - 3. **In-line centrifugal pumps.**
  - 4. **Condensate return units.**

##### 1.3 QUALITY ASSURANCE:

- A. Electrical Standards: Provide electric motors and products which have been listed and labeled by Underwriters' Laboratories, Inc. (UL) and comply with National Electrical Manufacturers' Association (NEMA) standards.
- B. Certification, Pump Performance: Provide pumps whose performance, under specified conditions, is certified by the manufacturer.

##### 1.4 ACTION SUBMITTALS:

- A. Submittals shall include, but not be limited to, the following:

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1. Pump cut sheets with all pump capacities, characteristics, features, accessories and options clearly indicated.
2. Pump curves with selection point clearly indicated.
3. Motor data as required in Section 23 0400, "Motors and Controllers".
4. Additional information as required in Section 23 0100.

### 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver pumps in factory-fabricated water-resistant wrapping.
- B. Handle pumps carefully to avoid damage to material components, enclosure and finish.
- C. Store pumps in a clean, dry space and protect from the weather.

### 1.6 WARRANTY

- A. Warranty: The entire pump(s) shall have a minimum **[one]** **[Insert duration]** year warranty from date of **[Substantial Completion]** **[Insert start date]**.

## PART 2 - PRODUCTS

### 2.1 HORIZONTAL SPLIT CASE PUMPS:

- A. Manufacturers: Provide products complying with these specifications and produced by one of the following:
  1. Armstrong Pumps.
  2. Aurora Pump (Pentair).
  3. Bell and Gossett (Xylem).
  4. Goulds (Xylem).
  5. PACO Pumps (Grundfos).
  6. Patterson (Gorman Rupp).
  7. Peerless (Grundfos).
  8. Taco, Inc.
  9. Weinman (Crane).
  10. Worthington Pump (Flowserve).
- B. General: Provide double suction, split case, flexible coupled, cast iron casing, bronze fitted centrifugal type, mechanical seal pumps of the size, capacity and head scheduled on the Drawings. Pump selections and submittals shall be made using pressure versus flow curves. The selected pump operation point shall have a minimum efficiency as scheduled and impeller diameter shall not exceed **[85%]** **[the scheduled percentage]** of the cut water diameter for the selected pump casing size. Pump discharge velocity shall not exceed 12'per second. The total dynamic head shall be maximum at no-flow and shall decrease from no flow to design flow. Shutoff head shall be at least 110% of design head but shall not exceed 140% of design head, unless scheduled otherwise. All pump shall have dynamically balanced impellers and the critical speed of all pumps shall be at

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least 115% of the design speed. Pumps shall be free from flashing and cavitation at all flow rates from 25% to 125% of design flow under suction conditions of the pump installation.

- C. Features: Pumps, casings, flanges and seals shall be suitable for operation at 175 psig or 250 psig minimum as scheduled and shall be suitable for use within the normal temperature operating ranges of the system in which they are installed. Pump suction and discharge flanges shall be minimum Class 125 or 250 ASME-rated and shall correspond to the scheduled pump casing pressure rating. Pumps shall have carbon steel shafts, stainless steel shaft sleeves, field-replaceable cast iron or bronze casing wear rings, bronze impeller with replaceable bronze wear rings, external seal water piping, cast iron deflectors, stainless steel impeller keys, coated fiber parting gaskets and steel casing studs and bolts.
- D. Pump Casing: The pump casings shall be cast iron members. They shall be split at the horizontal center line of the shaft in each case. The flanges of the upper and lower sections of the casing shall be arranged so that they may be held together rigidly with the use of appropriate bolts. The pump suction and discharge nozzles shall be located in the lower section of the casings. The design shall be such that the rotors of the pumps may be exposed for inspection or for removal by resorting to the expediency of removing the top section of the casing, but without disconnecting any part of the main interconnecting pipe systems.
- E. Seals: Seals for **[all] [chilled water] [heating hot water] [glycol] [condenser water]** pumps shall be mechanical seals suitable for the working pressure and temperature of the pump and application. All metal seal parts shall be 316 stainless steel. Mechanical seals shall be as manufactured by the John Crane Company and shall be suitable for the service specified. Seals for stuffing box working pressures as scheduled and shall be Type 1**[B]** or Type 2**[B] [unbalanced] [balanced]** seals. Seal material shall be Type BP-66-1D1 for treated fluids up to 180°F and Type XP(66)1D1 for treated fluids from 185°F to 250°F. **[Seals for [all] [chilled water] [heating hot water] [glycol] [condenser water] pumps shall be packing gland seals with five rings of graphite packing, bronze split glands, bronze lantern rings, brass gland clips and stainless steel swing bolts and nuts.]**
- F. [Seal Water Filtration]: **The mechanical seals on [the condenser water] [all] pumps shall be provided with Dorr-Oliver Type 5 "Doxie" impurity eliminators constructed throughout with 316 stainless steel. Piping shall be copper or Schedule 40 galvanized steel and shall be provided with isolation valves and valved bypass piping as shown on the Drawings.]**
- G. [Seal Water Filtration]: **The mechanical seals on [the condenser water] [all] pumps shall be provided with AMF Cuno Model 1A1 Cartridge Filter Housings with AMF Cuno Micro-Klean II (Series V30) 5 micron filter cartridges. Piping shall be copper or Schedule 40 galvanized steel and shall be provided with isolation valves and valved bypass piping as shown on the Drawings.]**
- H. Bearings: The pump rotors shall be supported in the case of each pump upon two ball type bearings. One ball bearing shall be located on each side of the pump impeller and each shall be in split bearing housings. The design of the split bearing housings shall be such as to make them dust-tight, grease-tight, water-tight with integral bearing arms cast to the main pump frame. All pumps shall have grease-lubricated ball bearings with grease fittings and relief plugs. Bearings shall have 40,000 hours minimum life for suction pressures below 200 psi and 20,000 hours minimum life for suction pressures 200 psi and above. Bearings shall limit impeller and mechanical seal face deflection to a maximum of 0.002".

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- I. Couplings: Pump couplings shall be [**Woods Type SC Sure-Flex flexible couplings**] [**Thomas metallic couplings with stainless steel flexing members**] or an approved equal. Coupling alignment shall be field calibrated to a maximum of 2 mils vibration.
- J. Pump Bases: All pumps shall have cast iron or fabricated steel drip lip bases with coupling guards, anchor bolts, provisions for grouting and shall have provisions for collection of all seal and condensation leakage. Motor and pump mounting surfaces shall be machined and the motor mounting shall include provisions for horizontal movement and alignment. Pump bases shall be provided with continuous drip canal around three sides, arranged for drainage to a 3/4" threaded drainage opening. All bases shall have sufficient strength to prevent vibration, warping and misalignment when installed without grouting. Bases on pumps of 20 hp and smaller shall be adequately stiffened to prevent flexing of panels. Bases for pumps 25 hp and larger shall be fabricated of structural steel shapes and shall have a minimum depth of 1/12th of the overall base length or 4" whichever is larger.
- K. Motors: Pump motors shall be NEMA premium efficient, maximum 1750 rpm, [**open dripproof (ODP)**] [**totally-enclosed, fan cooled (TEFC)**] type and shall be selected to drive the pump through its characteristic curve from zero flow to 125% of design flow without exceeding rated full load nameplate horsepower. Refer to Section 23 0400 for additional motor requirements.
1. Motors for variable speed pumps controlled through variable frequency controllers shall be inverter duty rated and equipped with shaft grounding rings.
- L. Testing: Pumps with drive motors [**10**] [**100**] [**Insert horsepower**] hp and larger and all pumps rated at 300 psi shall be individually factory pressure and capacity tested after final assembly using shop turbine per Hydraulic Institute Standards and a complete set of test curves shall be obtained. Provide certified copies of test results showing capacity, head, horsepower and efficiency at flow rates from shutoff to 125% of design flow. The certification shall also indicate results of factory dynamic balance and pressure testing.
- M. [**Weatherproof Pumps: The entire pump and motor assembly shall be designed for outdoor use, exposed to weather.**]

### 2.2 END SUCTION BASE-MOUNTED PUMPS:

- A. Manufacturers: Provide products complying with these specifications and produced by one of the following:
1. Armstrong Pumps.
  2. Aurora Pump (Pentair).
  3. Bell and Gossett (Xylem).
  4. PACO Pumps (Grundfos).
  5. Patterson (Gorman Rupp).
  6. Peerless (Grundfos).
  7. Taco, Inc.
  8. Weinman (Crane).

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- B. General: Provide horizontal base mounted, flexible coupled, cast iron casing, bronze fitted, true rear pullout centrifugal type, mechanical seal pumps of the size, capacity and head scheduled on the Drawings. Pumps and motors shall be individually mounted on pump base so that bearing assembly and impeller can be removed without disconnecting piping, removing pump casing, or removing motor. Pump shaft shall be supported from removable bearing assembly bolted to pump casing and shall be connected to pump motors by flexible coupling. Pump selections and submittals shall be made using pressure verses flow curves. The selected pump operation point shall have a minimum efficiency as scheduled and impeller diameter shall not exceed the scheduled percentage of the cutwater diameter for the selected pump casing size. Pump discharge velocity shall not exceed 12'per second. The total dynamic head shall be maximum at no-flow and shall decrease from no flow to design flow. Shutoff head shall be at least 110% of design head but shall not exceed 140% of design head, unless scheduled otherwise. All pump shall have dynamically balanced impellers and the critical speed of all pumps shall be at least 115% of the design speed. Pumps shall be free from flashing and cavitation at all flow rates from 25% to 125% of design flow under the suction conditions of the pump installation.
- C. Features: Pumps, casings, fittings, flanges and seals shall be suitable for operation at 175 psig or 250 psig minimum as scheduled and shall be suitable for use within the normal temperature operating ranges of the system in which they are installed. Pump suction and discharge flanges shall be minimum Class 125 or Class 250 ASME flanges and shall correspond to the scheduled pump casing pressure rating. Pumps shall have carbon steel shafts, stainless steel sleeves, field replaceable bronze front and rear casing wear rings, bronze impeller **[with replaceable bronze impeller wear rings,]** external seal water piping, stainless steel impeller keys and steel casing bolts.
- D. Seals: Mechanical seals shall be suitable for the working pressure and temperature of the pump application. All metal seal parts shall be 316 stainless steel. Mechanical seals shall be as manufactured by the John Crane Company and shall be suitable for the service specified. Seals for stuffing box working pressures scheduled and shall be Type 1**[B]** or Type 2**[B]** **[unbalanced]** **[balanced]** seals. Seal material shall be Type BP(66)1D1 for treated fluids up to 180°F and Type XP(66)1D1 for treated fluids from 181°F to 250°F.
- E. **[Seal Water Filtration: The mechanical seals [on the condenser water] [all] pumps shall be provided with a Dorr-Oliver Type 5 "Doxie" impurity eliminators constructed throughout with 316 stainless steel. Piping shall be copper or Schedule 40 galvanized steel and shall be provided with isolation valves and valved bypass piping as shown on the Drawing.]**
- F. **[Seal Water Filtration: The mechanical seals on [the condenser water] [all] pumps shall be provided with AMF Cuno Model 1A1 Cartridge Filter Housings with AMF Cuno Micro-Klean II (Series V30) 5 micron filter cartridges. Piping shall be copper or Schedule 40 galvanized steel and shall be provided with isolation valves and valved bypass piping as shown on the Drawings.]**
- G. Bearings: Pumps shall have grease-lubricated ball bearings with grease fittings and relief plugs. Bearings shall have 40,000 hours minimum life for suction pressures below 200 psi and 20,000 hours minimum life for suction pressures 200 psi and above. Bearings shall limit impeller and mechanical seal face deflection to a maximum of 0.002".

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- H. Couplings: Pump couplings shall be **[Woods Type SC Sure-Flex flexible couplings] [Thomas metallic couplings with stainless steel flexing members]** or an approved equal. Coupling alignment shall be field calibrated to a maximum of 2 mils vibration.
- I. Pump Bases: Pumps shall have cast iron or fabricated steel drip lip bases with coupling guards, anchor bolts, provisions for grouting and shall have provisions for collection of all seal and condensation leakage. Motor and pump mounting surfaces shall be machined and the motor mounting shall include provisions for horizontal movement and alignment. Pump bases shall be provided with continuous drip canal around three sides, arranged for drainage to a 3/4" threaded drainage opening. All bases shall have sufficient strength to prevent vibration, warping and misalignment when installed without grouting. Bases on pumps shall be adequately stiffened to prevent flexing of panels.
- J. Motors: Pump motors shall be NEMA premium efficient, maximum 1750 rpm, **[open dripproof (ODP)] [totally-enclosed, fan cooled (TEFC)]** type and shall be selected to drive the pump through its characteristic curve from zero flow to 125% of design flow without exceeding rated full load nameplate horsepower. Refer to Section 23 0400 for additional motor requirements.
1. Motors for variable speed pumps controlled through variable frequency controllers shall be inverter duty rated and equipped with shaft grounding rings.
- K. Testing: Pumps with drive motors **[10] [100] [Insert horsepower]** hp and larger and all pumps rated at 300 psi shall be individually factory pressure capacity tested after final assembly using shop turbine per Hydraulic Institute Standards and a complete set of test curves shall be obtained. Provide certified copies of test results showing capacity, head, horsepower and efficiency at flow rates from shut off to 125% of design flow. The certification shall also indicate results of factory dynamic balance and pressure testing.
- L. **[Weatherproof Pumps: The entire pump and motor assembly shall be designed for outdoor use, exposed to weather.]**

### 2.3 IN-LINE CENTRIFUGAL PUMPS:

- A. Manufacturers: Provide products complying with these specifications and produced by one of the following:
1. Armstrong Pumps.
  2. Aurora Pump (Pentair).
  3. Bell and Gossett (Xylem).
  4. PACO Pumps (Grundfos).
  5. Patterson (Gorman Rupp).
  6. Peerless (Grundfos).
  7. Taco, Inc.
  8. Weinman (Crane).
- B. General: Provide circulating pumps with all-bronze construction of the size, type, and capacity scheduled or shown on the Drawings. Pumps shall be fitted with a dynamically balanced brass

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enclosed type impeller with mechanical seal. Mechanical seal shall be Type 1 or Type 2 material, Code BP-1D1 as manufactured by John Crane Company or an approved equal, suitable for service specified. Motor shall have a maximum speed of 1750 rpm. Pumps, casings, flanges, and seals shall be suitable for operation with the working pressures and temperatures indicated. The scheduled working pressure applies to the entire pump assembly.

### 2.4 CONDENSATE RETURN UNITS:

- A. Manufacturers: Provide products complying with these specifications and produced by one of the following:
1. Aurora Pump (Pentair).
  2. Bell and Gossett (Xylem).
  3. Roth Pump.
  4. Skidmore.
  5. Spirax Sarco.
  6. Sterling.
  7. Weinman.
- B. General: Provide a condensate pump/receiver unit with capacities and electrical characteristics as scheduled or shown on the Drawings.
- C. Receiver: Receiver shall be of the vented cast iron design with capacity as scheduled on the Drawings. Connections to the receiver shall include inlet, vent, drain and gauge glass. The condensate receiver shall be furnished with a back angle thermometer and a brass water level gauge assembly complete with shut-off valve and protector rods. A full size vent from the receiver shall be routed **[through the building roof] [as shown on the Drawings]**.
- D. Pumps: Pumps shall be vertical flange mounted, bronze fitted duplex pumps with a bronze case wearing ring and a mechanical seal with 316 stainless steel metal parts, Buna-N bellows, Ni-resist seat and carbon washer. The pumps shall be close coupled to ODP motors with characteristics as scheduled. Motor shafts shall be stainless steel. The pumps shall be flange mounted to the receiver.
- E. 3-Way Valve: The receiver inlet connection shall consist of a 3-way strainer valve. The valve shall allow condensate flow to be channeled through the strainer, bypassed around the strainer or completely shutoff.
- F. Control Panel: The control panel shall be wall mounted, NEMA 1 construction, prewired for a single point electrical input with the following components:
1. Two FVNR magnetic starters with three phase overload protection, fused disconnect switches and green run indicator lights for each pump.
  2. Two HOA selector switches, one for each pump.
  3. One mechanical alternator to switch lead and lag pump at each pump start.
  4. Adjustable float switch to start and stop lead pump and for high level alarm.

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5. One fused Control Power Transformer.
6. One set of engraved nameplates for all control switches and indicator lights.
7. One set of N.C. auxiliary contacts for high condensate alarm. Contacts shall be held open under normal conditions and shall be closed under alarm. **[Contacts will be monitored [Insert Requirement]].**

### PART 3 - EXECUTION

#### 3.1 INSPECTION:

- A. General: Installer shall examine conditions under which pumps are to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

#### 3.2 INSTALLATION OF PUMPS:

- A. General: Install pumps where shown, in accordance with manufacturer's written instructions and recognized industry practices to ensure that pumps comply with requirements and serve intended purposes. Comply with NEMA standards and requirements of NFPA 70.
- B. Base-Mounted Pumps: Pumps shall be leveled, bolted, and grouted to pump bases. Piping shall be arranged so pump cases are not subjected to any piping forces. Contractor shall check for proper angular and concentric alignment of pumps and motors and shall get Engineer's approval of this alignment before pumps are operated. Pump bases shall be grouted in place after pump alignment.
- C. Alignment: Check alignment and, where necessary, realign shafts of motors and pumps within tolerances recommended by manufacturer.
  1. Align pumps according to Hydraulic Institute standards.
  2. Follow a reserve alignment procedure utilizing laser instruments.
  3. Submit copies of align report to Owner before startup.
- D. Housekeeping Pads/Vibration Isolation: Refer to Section 23 0300 and Section 23 0548 for applicable requirements.
- E. Drain Lines: Provide a drain line (3/4" minimum) from each pump drip base to the nearest floor drain.
- F. Casing Relief Valves: Provide individual casing relief drain lines from each pump casing relief valve for the nearest floor drain.

#### 3.3 ELECTRICAL CONNECTIONS:

- A. Power: Coordinate pump power connections according to Division 26 requirements.
- B. Grounding: Provide positive electrical pump and motor grounding in accordance with applicable requirements of the NEC.

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### 3.4 FIELD QUALITY CONTROL AND STARTUP:

- A. Start-up: Pump supplier shall provide pump checkout, start-up, testing and adjusting of system components.
- B. Field Test: Upon completion of pump installation and after motor has been energized from normal power source, bleed air from pump casing and test pump to demonstrate compliance with requirements. When possible, field-correct malfunctioning units then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.
- C. Condensate Return Unit: Unit installation checkout, start-up, and adjustment shall be performed by the installing Contractor.
- D. Seals: After pumps have been in operation for 90 days, check all seals and replace any which are defective.

### 3.5 TESTING:

- A. General: Test and adjust all installed pumps and controllers to verify proper operation as specified herein and as recommended by the manufacturers. Where specified hereinabove, start-up, testing, and adjustment shall be provided by a representative of the equipment supplier.
- B. Functional Tests: Test controllers and annunciators to verify that all control, alarm, and indicator functions operate properly and to verify that pump discharge pressures and flows are as specified.
- C. Refer to Section 23 0593 "Testing, Adjusting and Balancing" for additional start-up, testing, and adjustment requirements.

### 3.6 IDENTIFICATION:

- A. Refer to Section 23 0300 "Basic Materials and Methods" for applicable painting, nameplates, and labeling requirements.

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