**SECTION 23 21 23.13**

**HYDRONIC PUMPS for UTILTIES**

**BASED ON DFD MASTER SPECIFICATION DATED 10/18/2023**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

# P A R T 1 - G E N E R A L

### SCOPE

This section includes specifications for providing hydronic water pumps with motors and steel base plates. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Reference

Quality Assurance

Submittals

Operation and Maintenance Data

Design Criteria

Testing

Warranty

PART 2 - PRODUCTS

Base Mounted Horizontal Split Case Centrifugal Pumps

In-line Centrifugal Pumps

PART 3 - EXECUTION

Operation and Maintenance Data

Delivery

Installation Service

Startup, Functional Performance Testing, and Commissioning Services

Owner Training

**RELATED WORK**

Section 01 91 01– Commissioning Process

Section 23 05 13 – Common Work Requirements for HVAC Equipment

Section 23 05 14 – Variable Frequency Drives

**REFERENCE**

Applicable provisions of Division 1 shall govern work under this section.

**QUALITY ASSURANCE**

Refer to division 1, General Conditions, Equals and Substitutions.

**SUBMITTALS**

Refer to division 1, General Conditions, Submittals.

Provide a table of contents (TOC) as the first page of supporting information for each pump and piece of equipment. The TOC shall properly identify the section and page number of where the supporting information is located.

The first page after the TOC shall include the equipment performance and data sheet at the end of this section for each pump and piece of equipment. Pumps and equipment that are considered identical in every aspect can be included on one data sheet and their respective identification as referenced in the documents shall be included on the data sheet.

Following the data sheet, supporting information shall include, but not limited to the following as appropriate to each pump and equipment identification as referenced in the documents.

* Pump Manufacturer
* Pump Type
* Pump Model
* Pump selection and performance
* Pump curves at design operating point with net positive suction head requirements
* Pump curves for two pumps parallel operation
* Pump curves for three pumps parallel operation
* Performance data (Pump curves) at design conditions down to minimum stable operating speed for single pump operation, two pumps in parallel operation and three pumps in parallel operation.
* General arrangement drawings
* Individual component and fully assembly dimensions, flange design, materials of construction
* Individual component and fully assembly weights and rigging requirements
* Base mounted requirements and anchor patterns
* Coupling manufacturer, model number, details, materials of construction, and installation requirements
* Pump seal manufacturer, model number, details, materials of construction and installation requirements
* Rotor, bearings, oilers, design details, material of construction and installation requirements
* Provide shop fabrication details, cross sectional details showing all parts of the pump, baseplates, and 480 volt motors.
* Provide all 480 volt motor information required per section 23 05 13 – Common Work Requirements for HVAC Equipment
* Testing procedures and details of information each pump is test for
* All installation requirements and information not listed above
* Guarantee/Warranty Information

# OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

**DESIGN CRITERIA**

Pump sizes, capacities, pressures and operating characteristics shall be as indicated in schedule.

Pumps shall meet or exceed operating efficiencies scheduled.

The Pump Manufacturer, Motor Manufacturer, and VFD Manufacturer shall coordinate and provide equipment that is compatible, and performs under the best efficiency and functionality for the specified range and characteristics of pump, motor, and VFD operation.

Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard, and other accessories specified. Statically and dynamically balance all rotating parts. Provide flanged connections on all pumps unless specified otherwise. Service or repair of base mounted pumps shall not require breaking piping connections or removal of motor.

Where a pump is specified for parallel operation, the scheduled conditions are for that pump with multiple pumps operating; i.e., total system flow rate is multiplied by what is scheduled for a single pump. When only one of the parallel pumps is operating, the operating point of that pump must fall within the manufacturer's recommended operating range.

The ultimate build out (condenser water and vari-prime chilled water) includes three pumps for each system equal in capacity and head. Up to three pumps will operate in parallel. The pump manufacturer shall confirm the pumps are suitable to operate under individual and parallel arrangements and shall verify each arrangement operating range (head/flow) for the pumps provided at constant speeds.

The pump curve for the pump shall have the characteristic of continuously rising head with decreasing capacity from rated capacity to shutoff. Select motors with sufficient horsepower rating for non-overloading operation over the entire pump curve for proper system adjustment and function. Motors to be 1750 rpm unless specified otherwise.

Pump shall have the rated capacity point between 80% and 100% the best efficiency point on the head vs. capacity curve for the impeller diameter and casing provided. The pump shall be able to operate up to 120% of the BEP without damage.

Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

All pumps to operate without excessive noise or vibration.

After completion of balancing, provide replacement of impellers, or trim impellers to provide specified flow at actual pumping head, as installed.

The pump and motor assembly shall generate less than 85dbA of noise when measured three (3) feet from the unit under normal operation conditions.

**TESTING**

FACTORY TESTING BY MANUFACTURER:

Each pump shall be factory tested.

Each pump shall be tested in accordance with the latest edition of Hydraulic Institute Standards, ANSI/HI 1.6-2000, American National Standard for Centrifugal Pump Test for Acceptance Level 1B.

All instrumentation for testing shall have been calibrated to the acceptable tolerances within the time frame as defined per ANSI.

Pump(s) shall be cleaned, painted and tested before shipment.

Manufacturer shall conduct performance test specified and provide documentation of certified testing to owner before shipment. Pump shall have half coupling installed when balanced. The pumps shall be hydrostatically tested at 1.5 times the casing working pressure. Owner’s representatives may elect to witness the tests and shall be notified of the test date three weeks prior to performing the test.

TESTING AT OWNERS SITE BY CONTRACTOR:

Contractor shall provide vibration testing of completely installed pump assembly under normal operating condition.

The pump and motor vibration shall not exceed the limits in any plane set forth by the Hydraulic Institute when measured at the bearing housings for the displacement, velocity, and acceleration at pump operating speed.

The noise level from the pump and motor combination shall be tested by the manufacturer shall be less than 85 dbA when measured 3 feet from the pump or motor under normal operating conditions.

The pumps will considered to be substantially complete after successfully passing testing at owner’s site.

# WARRANTY

All pumps and equipment specified herein shall be warranted by the manufacturer against defects in design, materials and workmanship for a period of two (2) years from date of substantial completion. Substantial completion is anticipated to be in the fourth quarter of 2019.

Warranty shall hold the Manufacturer responsible for the cost of all parts, equipment, and labor, to correct warranted defects and return the equipment to proper working order /specified performance in a timely manner. All requests for service by the Owner under the warranty provisions shall be responded to within

48 hours.

## P A R T 2 - P R O D U C T S

**BASE MOUNTED HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS**

Manufacturers:

Flowserve Model LR, Taco GT & TA, Bell & Gossett VSX-VSH or approved equal.

condenser water pump

Type:

Base mounted, horizontal shaft, single stage, double suction, double volute, and horizontal split case centrifugal pump designed for minimum 175 psig working pressure at operating temperature of 150°F continuous, 250°F intermittent.

Casing:

Casing shall be constructed with ductile iron or cast iron and be fitted with renewable 316 stainless steel wear rings designed with a positive means of preventing rotation. Shop repair of any pump casting shall not be allowed. The casing shall be provided with tapped and plugged openings for drain, vent and suction and discharge pressure gauge connections.

Pump flanges shall be suitable for connection to ANSI class 150# flat face flanges.

The pumps shall be designed so that the pumps can be serviced without disturbing the piping, motor or requiring shaft alignment. Provide pump with lifting lugs or eye bolts for removal of the top half of the casing.

Impeller:

Double suction type constructed of bronze or stainless steel, hydraulically and dynamically balanced to ISO-1940, G6.3 in order to reduce vibration and improve bearing life, Impeller shall be keyed and locked to pump shaft and secured at the hub between the shaft sleeves extending through the stuffing box with external to the stuffing box shaft nuts.

ROTATION:

Counter-Clockwise when viewed from the pump end (verify orientation).

Bearings:

Provide permanently lubricated or re-greaseable lubricated bearings.

Re-greaseable heavy duty ball bearings with a single row on the inboard side and a single row thrust bearing on the outboard end.  Mill bearing caps flat (1” diameter minimum) to accept future vibration probes in horizontal and vertical planes.

The bearing housing shall supply support for heavy-duty single row permanently lubricated ball bearings, with provision for purging or flushing if desired. Polyurea grease, capable of handling both high and low temperatures and that is resistant to washout and condensation shall be provided.

The bearings shall be capable of absorbing both radial and thrust loads and maintaining the rotating element in proper axial alignment. Bearings shall be capable of being inspected and repaired by removal of only a bearing bracket.

Shaft:

Shaft shall be constructed of stainless steel with stainless steel shaft sleeve. Pump shafts shall be tapered under the keyed coupling. Shaft runout at stuffing box face shall not exceed 0.002 inches TIR (total indicator reading).

MECHANICAL Seal:

Provide cartridge type single elastomeric style bellows mechanical seals equivalent to manufactured by John Crane or Chesterton. Seals shall have carbon vs silicon carbon carbide seal faces and fluorocarbon "o" rings.

Coupling:

Flexible type coupling or coupling with extended hub keyed to the drive shafts to allow for pump and bearing service without removing the motor. Pump half couplings shall be taper bored for keyed shafts. Motor half couplings shall be bored straight for keyed shafts. Provide guard for shaft/coupling assembly. Coupling shall be equal to a Rexnord, Woods, or Thomas. Mount coupling halves to motor and pump for balancing. Provide drive coupling guard.

Baseplate:

Pump and motor shall be fabricated with a common ASTM A-36 steel base plate with integral drip rail. Base plate shall be rigid and allow for grouting. Base plate shall have a minimum 4” channel cross bracing under pump, motor and coupling. Provide screw type jacks for aligning motors and pumps.

PAINTING:

Provide prime coat of rust resistant paint and finish coat of rust resistant enamel paint to base plates, motors, coupling guards and pumps.

VARIABLE PRIME CHILLED water pump

Type:

Base mounted, horizontal shaft, single stage, double suction, double volute, and horizontal split case centrifugal pump, designed for 175 psig working pressure at operating temperature of 150°F continuous, 250°F intermittent.

Casing:

Casing shall be constructed with ductile iron or cast iron and be fitted with renewable 316 stainless steel wear rings designed with a positive means of preventing rotation. Shop repair of any pump casting shall not be allowed. The casing shall be provided with tapped and plugged openings for drain, vent and suction and discharge pressure gauge connections.

Pump flanges shall be suitable for connection to ANSI class 250# flat face flanges.

The pumps shall be designed so that the pumps can be serviced without disturbing the piping, motor or requiring shaft alignment. Provide with lifting lugs or eye bolts for removal of the top half of the casing.

Impeller:

Double suction type constructed of bronze or stainless steel, hydraulically and dynamically balanced to ISO-1940, G6.3 in order to reduce vibration and improve bearing life, Impeller shall be keyed and locked to pump shaft and secured at the hub between the shaft sleeves extending through the stuffing box with external to the stuffing box shaft nuts.

ROTATION:

Counter-Clockwise when viewed from the pump end (verify orientation).

Bearings:

Provide permanently lubricated or re-greaseable lubricated bearings.

Re-greaseable heavy duty ball bearings with a single row on the inboard side and a single row thrust bearing on the outboard end.  Mill bearing caps flat (1” diameter minimum) to accept future vibration probes in horizontal and vertical planes.

The bearing housing shall supply support for heavy-duty single row permanently lubricated ball bearings, with provision for purging or flushing if desired. Polyurea grease, capable of handling both high and low temperatures and that is resistant to washout and condensation shall be provided.

The bearings shall be capable of absorbing both radial and thrust loads and maintaining the rotating element in proper axial alignment. Bearings shall be capable of being inspected and repaired by removal of only a bearing bracket.

Shaft:

Shaft shall be constructed of stainless steel with stainless steel shaft sleeve. Pump shafts shall be tapered under the keyed coupling. Shaft runout at stuffing box face shall not exceed 0.002 inches TIR (total indicator reading).

MECHANICAL Seal:

Provide cartridge type single elastomeric style bellows mechanical seals equivalent to manufactured by John Crane or Chesterton. Seals shall have carbon vs silicon carbon carbide seal faces and fluorocarbon "o" rings.

Coupling:

Flexible type coupling or coupling with extended hub keyed to the drive shafts to allow for pump and bearing service without removing the motor. Pump half couplings shall be taper bored for keyed shafts. Motor half couplings shall be bored straight for keyed shafts. Provide guard for shaft/coupling assembly. Coupling shall be equal to a Rexnord, Woods, or Thomas. Mount coupling halves to motor and pump for balancing. Provide drive coupling guard.

Baseplate:

Each pump and motor shall be fabricated with a common ASTM A-36 steel base plate with integral drip rail. Base plate shall be rigid and allow grouting. Base plate shall have a minimum 4” channel cross bracing under pump, motor and coupling. Provide screw type jacks for aligning motors and pumps.

PAINTING:

Provide prime coat of rust resistant paint and finish coat of rust resistant enamel paint to base plates, motors, coupling guards and pumps.

**IN-LINE CENTRIFUGAL PUMPS**

Manufacturers:

Bell and Gossett, Armstrong, Thrush, Taco, Grundfos, Aurora, or approved equal.

Type:

Single stage, direct connected, resiliently mounted motor for in-line mounting, oil lubricated, 175 psig maximum working pressure at operating temperature of 225 ° F. continuous, 250 ° F. intermittent.

Casing:

Cast iron or stainless steel; flanged suction and discharge connection; with plugged taps for vent, drain, suction and discharge gauges.

Impeller:

Brass or bronze, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

Bearings:

Two, oil lubricated bronze sleeves or ball bearings capable of being greased.

Shaft:

Stainless steel or carbon steel with stainless steel or bronze sleeve, integral thrust collar.

Seal:

Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

Drive:

close coupled.

**P A R T 3 - E X E C U T I O N**

# INSTALLATION SERVICE

The Pump Manufacturer shall provide an onsite technical service representative to supervise general installation and perform pre-alignment of the pumps and component assemblies. The manufacturer shall be responsible for travel, lodging and expenses in addition to the durations and services noted above.

Final pump alignment readings shall be verified by owner (Plant Superintendant).

Contractor shall provide the services of an onsite technical service representative to perform final alignment and verify all manufacturers’ installation requirements are met prior to startup and functional performance testing.

**STARTUP, FUNCTIONAL PERFORMANCE TESTING, AND COMMISSIONING SERVICES**

Contractor shall utilize the construction verification checklist and functional performance test procedures supplied under specification section 01 91 01 in accordance with the procedures of this section.

Contractor shall provide services of an onsite technical service representative to observe startup, and assist the installing contractor with any issues identified for each pump.

Contractor shall provide services of an onsite technical service representative to observe functional performance testing, commissioning, and verification providing assistance to the contractor with any issues identified for each pump. At the time of the functional performance testing the pump manufacturer shall coordinate with the contractor and provide vibration testing and sound measurements for each pump. Measurements for any pump that exceeds specified requirements shall be corrected by the Manufacturer or Technical Services Representative at no cost to the owner.

Manufacturer to provide trimming of standard impellers to meet capacity requirements specified at no additional cost to the Owner. If the measured pump flow and head doesn’t meet the specifications, the pump manufacturer shall provide additional trimming or replacement of the impeller and reinstallation and alignment at no additional cost to the Owner. Rotor float shall be limited to a maximum of 0.005 inches.

Upon completion of the startup and testing but before acceptance of the pumps and motors the manufacturer shall submit a written report signed by the startup service person supervising the startup of the pumps.

The report shall indicate that the pump and motor are installed properly and indicate final alignment measurements, measured sound power level in dB, measured at 3ft and 20ft, motor horsepower, normal operating amps, vibration at the pump bearing housings (inboard and outboard), motor bearing (inboard and outboard), inlet and outlet pressures, rpm, and flow.

Pumps shall meet ANSI/HI14.6 (current edition) testing requirements.

**OWNER TRAINING**

Training shall occur within 15 days after completion of functional performance testing. The pump manufacturer shall coordinate the time and the duration of each session with the owner and or owner’s operator, A/E and Commissioning Agent.

Contractor shall provide services of a qualified technical representative for a minimum of one training session with the owner and or owner’s operator(s) at the installation site.

Contractor shall coordinate the time and the duration of each session with the owner and or owner’s operator. Duration of each session shall be that which is necessary to instruct a minimum of (4) personnel about equipment operation and maintenance procedures necessary for proper equipment operation. Pump manufacturer shall be responsible for travel, lodging, and expenses in addition to the duration determined.

One training session shall be videotaped. Provide owner with (3) copies of training video on USB drive.

END OF SECTION