SECTION 232123 – HVAC SYSTEM PUMPS

First Edition 5-16-2017

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off all "Underlines".)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 23.

1.2 SUMMARY

A. This section includes the requirements for HVAC pumps using the following:

<Edit list of pumps types for particular project>

1. In line centrifugal pumps.
2. Base mounted centrifugal pumps.
3. Steam condensate pump and receiver.
4. A/C condensate pumps.
5. Base mounted pump specialties.

1.3 ACTION SUBMITTALS

A. Product Data: For each specified product, include manufacturers cut sheets, dimensional data, performance data, installation instructions, power requirements, specified options, and warranty information.

B. For each type of pump.

1. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

C. Shop Drawings: For each pump:

a. Show pump layout and connections.
b. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
c. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include a copy of each approved submittal along with any applicable maintenance data in the project operation and maintenance manual.

B. Maintenance Material Submittals:

1. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

a. Mechanical Seals: One (1) mechanical seal(s) for each pump.

1.5 WARRANTY/GUARANTEE

A. See Division 23 Specification Section "Basic Mechanical Requirements – HVAC" for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

A. Equipment Design and Selection: All HVAC pumps shall be designed and selected in accordance with the scheduled capacities on the drawings and the requirements of this specification. Where indicated in the specifications pump construction shall comply with the referenced requirements of the Hydronic Institute (HI).

B. Basis of Design: The basis of design for HVAC pumps are pumps as manufactured by the following:

1. In line pumps – Taco Inc.
2. Base mounted pumps – Taco Inc.
3. Steam condensate pumps – Federal Pacific.
4. A/C condensate pumps – Little Giant.

C. Other Acceptable Manufacturers: Subject to compliance with requirements, provide HVAC pumps by one (1) of the following:

1. In Line and base mounted pumps:
   a. Bell & Gossett Pumps, ITT Corporation.
   b. Armstrong Pumps.
   c. Weinman Pumps.
   d. Aurora Pumps.

2. Steam Condensate Pumps:
   a. Dunham Bush.
   b. Hoffman.
   c. Skidmore.

3. A/C Condensate Pumps:
   a. Hartell Pumps.
   b. Beckett Pumps.

D. HVAC Pump Products: All centrifugal pumps serving HVAC systems shall be provided by one (1) of the indicated manufacturers.

2.2 IN LINE CENTRIFUGAL PUMPS <Edit for project, delete if not required>

A. Close Coupled, In Line Centrifugal Pumps:
<Delete if not applicable to particular project>

1. Description: Factory assembled and tested, centrifugal, overhung impeller, close coupled, in line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.

2. Pump Construction:

   a. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion flange connections.
   b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant speed pumps, trim impeller to match specified performance.
   c. Pump Shaft: Steel, with copper alloy shaft sleeve.
   <Retain one of two "Seal" subparagraphs below. Retain first subparagraph for service temperatures above 200°F (93°C); retain second subparagraph for service temperatures 200°F (93°C) or lower. In first subparagraph, retain "Buna N" option for temperature rating of 225°F (107°C); retain "EPT" option for 250°F (120°C) and for glycol solutions.>
   d. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and Buna N bellows and gasket. Include water slinger on shaft between motor and seal.
   e. Seal: Packing seal consisting of stuffing box with a minimum of four (4) rings of graphite impregnated braided yarn with bronze lantern ring between center two (2) graphite rings, and bronze packing gland.
   f. Pump Bearings: Permanently lubricated ball bearings.

3. Motor: Single speed and rigidly mounted to pump casing.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.
c. Motor Bearings: Permanently lubricated ball bearings.
d. Efficiency: Premium efficient.

B. Separately Coupled, Vertically Mounted, In Line Centrifugal Pumps <Delete if not applicable to particular project>

1. Description: Factory assembled and tested, centrifugal, overhung impeller, separately coupled, in line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically.

2. Pump Construction:

a. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion flange connections.
b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps not frequency drive controlled, trim impeller to match specified performance.
c. Pump Shaft: Steel, with copper alloy shaft sleeve.

<Retain one of two "Seal" subparagraphs below. Retain first subparagraph for service temperatures above 200°F (93°C); retain second subparagraph for service temperatures 200°F (93°C) or lower. In first subparagraph, retain "Buna-N" option for temperature rating of 225°F (107°C); retain "EPT" option for 250°F (120°C) and for glycol solutions.>

d. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and Buna N bellows and gasket. Include water slinger on shaft between motor and seal.
e. Seal: Packing seal consisting of stuffing box with a minimum of four (4) rings of graphite-impregnated braided yarn with bronze lantern ring between center two (2) graphite rings, and bronze packing gland.
f. Pump Bearings: Permanently lubricated ball bearings.
g. Shaft Coupling: Axially split spacer coupling.

3. Motor: Single speed and rigidly mounted to pump casing with lifting eyebolt and supporting lugs in motor enclosure.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

a. Enclosure: Open, drip proof.

b. Enclosure Materials: Cast iron.
c. Motor Bearings: Permanently lubricated ball bearings.
d. Efficiency: Premium efficient.

C. Separately Coupled, Horizontally Mounted, In Line Centrifugal Pumps:
<Delete if not applicable to particular project>

1. Description: Factory assembled and tested, centrifugal, overhung impeller, separately coupled, in line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally..
2. Pump Construction:

a. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion flange connections.
b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. For pumps not frequency drive controlled, trim impeller to match specified performance.
c. Pump Shaft: Steel, with copper alloy shaft sleeve
<In "Mechanical Seal" Subparagraph below, retain "Buna-N" option for temperaturerating of 225°F (107°C); retain "EPT" option for 250°F (120°C).>
d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless steel spring, and Buna N bellows and gasket. Include water slinger on shaft between motor and seal.
e. Pump Bearings: Oil lubricated; bronze journal or thrust type.
f. Motor: Single speed and resiliently mounted to pump casing.

3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

a. Default motor characteristics are specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

4. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.
c. Motor Bearings: Permanently lubricated ball bearings.
d. Efficiency: Premium efficient.

2.3 BASE MOUNTED CENTRFUGAL PUMPS

A. Close Coupled, End Suction Centrifugal Pumps:
<Delete if not applicable to particular project>

1. Description: Factory assembled and tested, centrifugal, overhung impeller, close coupled, end suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally.

2. Pump Construction:

a. Casing: Radially split, cast iron, with replaceable bronze wear rings, drain plug at bottom and air vent at top of volute, threaded gage tappings at inlet and outlet, and flanged connections.
b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant speed pumps, trim impeller to match specified performance.
c. Pump Shaft: Steel, with bronze shaft sleeve.
<In "Mechanical Seal" Subparagraph below, retain "Buna-N" option for temperature rating of 225°F (107°C); retain "EPT" option for 250°F (120°C)>
d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless steel spring, and Buna N bellows and gasket. Include water slinger on shaft between motor and seal.
e. Pump Bearings: Permanently lubricated ball bearings.

3. Motor: Single speed and rigidly mounted to pump casing with integral pump support.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.
c. Motor Bearings: Permanently lubricated ball bearings.
d. Efficiency: Premium efficient.

B. Separately Coupled, End Suction Centrifugal Pumps:

1. Description: Factory assembled and tested, centrifugal, overhung impeller, separately coupled, end suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal.

2. Pump Construction:

   a. Not all manufacturers provide volute supports that allow removal and replacement of impeller without disconnecting piping.
   b. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and flanged connections. Provide integral mount on volute to support the casing, and provide attached piping to allow removal and replacement of impeller without disconnecting piping or requiring the realignment of pump and motor shaft.
   c. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps not frequency drive controlled, trim impeller to match specified performance.
   d. Pump Shaft: Steel, with copper alloy shaft sleeve.
      Retain one of two "Seal" subparagraphs below. Retain first subparagraph for service temperatures above 200°F (93°C); retain second subparagraph for service temperatures 200°F (93°C) or lower. In first subparagraph, retain "Buna-N" option for temperature rating of 225°F (107°C); retain "EPT" option for 250°F (120°C) and for glycol solutions.
   e. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and Buna N bellows and gasket.
   f. Seal: Packing seal consisting of stuffing box with a minimum of four (4) rings of graphite impregnated braided yarn with bronze lantern ring between center two (2) graphite rings, and bronze packing gland.
   g. Pump Bearings: Grease lubricated ball bearings in cast iron housing with grease fittings.

3. Shaft Coupling: Molded rubber insert and interlocking spider capable of absorbing vibration. <Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor. EPDM coupling sleeve for variable-speed applications.>

4. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

5. Mounting Frame: Welded steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

6. Motor: Single speed, secured to mounting frame, with adjustable alignment.

   a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   b. Default motor characteristics are specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

7. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

   a. Enclosure: Open, dripproof.
   b. Enclosure Materials: Cast iron.
   c. Motor Bearings: Permanently lubricated ball bearings.
   d. Efficiency: Premium efficient.

C. Separately Coupled, Double Suction Centrifugal Pumps:

1. Description: Factory assembled and tested centrifugal, impeller between bearings, separately coupled, double suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal.

2. Pump Construction:

   a. Casing: Horizontally split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 250 flanges. Casing supports shall allow removal and replacement of impeller without disconnecting piping.
   b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. For pumps not frequency drive controlled, trim impeller to match specified performance.
   c. Pump Shaft: Stainless steel.
      Retain one of two "Seal" subparagraphs below. Retain first subparagraph for service temperatures above 200°F (93°C); retain second subparagraph for service temperatures 200°F (93°C) or lower. In first subparagraph, retain "Buna-N" option for temperature rating of 225°F (107°C); retain "EPT" option for 250°F (120°C) and for glycol solutions.
   d. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and Buna N bellows and gasket.
   e. Seal: Packing seal consisting of stuffing box with a minimum of four (4) rings of graphite impregnated braided yarn with bronze lantern ring between center two (2) graphite rings, and bronze packing gland.
   f. Pump Bearings: Grease lubricated ball bearings in cast iron housing with grease fittings.

3. Shaft Coupling: Molded rubber insert and interlocking spider capable of absorbing vibration. <Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor. EPDM coupling sleeve for variable-speed applications.>

4. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

5. Mounting Frame: Welded steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

6. Motor: Single speed, secured to mounting frame, with adjustable alignment.

   a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

   b. Default motor characteristics are specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

7. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

   a. Enclosure: Open, dripproof.
   b. Enclosure Materials: Cast iron.
   c. Motor Bearings: Grease lubricated.
   d. Efficiency: Premium efficient.

2.4 STEAM CONDENSATE PUMP AND RECEIVER <Delete if not applicable to particular project>

A. Description: Factory fabricated, packaged, electric driven pumps; with receiver, pumps, controls, and accessories suitable for operation with steam condensate.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. ASME Compliance: Fabricate and label steam condensate receivers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

B. Configuration: Duplex floor mounted pump with receiver and float switches; rated to pump 200°F steam condensate.

C. Receiver:

1. Floor mounted.
2. Close grained cast iron.
3. Externally adjustable float switches.
4. Flanges for pump mounting.
5. Water level gage and dial thermometer.
6. Pressure gage at pump discharge.
7. Bronze fitting isolation valve between pump and receiver.
8. Lifting eyebolts.
9. Inlet vent and an overflow.

10. Cast iron inlet strainer with vertical self cleaning bronze screen and large dirt pocket.

D. Pumps:

1. Centrifugal, close coupled, vertical design.
2. Permanently aligned.
3. Bronze fitted.
4. Replaceable bronze case ring.
5. Mechanical seals rated at 250°F.
6. Mounted on receiver flange.

E. Motor:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Specification Section "Motor Requirements for HVAC Equipment."
2. Enclosure: Open, dripproof.
3. Enclosure Materials: Cast iron.
4. Efficiency: Premium efficient.

F. Control Panel:

1. Factory wired between pumps and float switches, for single external electrical connection.
2. Provide fused, control power transformer if voltage exceeds 230 V ac.
3. NEMA 250, Type 1 enclosure with hinged door and grounding lug, mounted on pump.
4. Motor controller for each pump.
5. Electrical pump alternator to operate pumps in a lead/lag sequence and allow both pumps to operate on receiver high level.
6. Manual lead/lag control to override electrical pump alternator and manually select the lead pump.
7. Momentary contact "TEST" push button on cover for each pump.
8. Numbered terminal strip.
9. Disconnect switch for each pump.

2.5 AIR CONDITIONING CONDENSATE PUMP UNITS

A. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory or field installed check valve and a seventy two (72) inch minimum, electrical power cord with plug.

2.6 BASE MOUNTED PUMP SPECIALITIES

A. Suction Diffuser: Suction diffusers shall be by the pump manufacturer and complying with the following:

1. Angle pattern.
2. 175 psig pressure rating, cast iron body and end cap, pump inlet fitting.
3. Bronze startup and bronze or stainless steel permanent strainers.
4. Bronze or stainless steel straightening vanes.
5. Drain plug.
6. Factory fabricated support.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4 and HI 2.4.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Steam Condensate Pump Units: Install units for collecting condensate and extend to open drain.

E. Equipment Mounting:

1. Install base mounted pumps on cast in place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Architectural Specification Section "Miscellaneous Cast in Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Division 23 Specification Section "Vibration and Seismic Controls for HVAC Systems."

3. Comply with requirements for vibration isolation devices specified in Division 23 Specification Section "Vibration Controls for HVAC Systems."

F. Equipment Mounting: Install in line pumps with continuous thread hanger rods and elastomeric hangers of size required to support weight of in line pumps.

1. Comply with requirements for seismic-restraint devices specified in Division 23 Specification Section "Vibration and Seismic Controls for HVAC Systems."
2. Comply with requirements for hangers and supports specified in Division 23 Specification Section "Hangers and Supports for HVAC Piping Systems."

3.3 ALIGNMENT

A. Engage a factory authorized service representative to perform alignment service.

B. Retain this article only for separately coupled, end and double suction centrifugal pumps.

C. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

D. Comply with pump and coupling manufacturers' written instructions.

E. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Division 23 Specification Section “HVAC Piping Systems and Specialties”. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to pump, allow space for service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install isolation valves on the suction and discharge side of pumps.

F. Install Y type strainer on the suction side of pumps.

G. Install flexible connectors on suction and discharge sides of pumps between pump casing and valves.

H. Install pressure gages on pump suction and discharge or at integral pressure gage tapping, or install single gage with multiple input selector valve.

I. Install check valve and ball valve on each condensate pump unit discharge.

J. Ground equipment according to Division 26 Specification Section "Grounding and Bonding for Electrical Systems."

K. Connect wiring according to Division 26 Specification Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 STARTUP SERVICE

A. Engage a factory authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.6 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 232123