SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Self-priming, non-clog pumps.
2. Separately coupled, base-mounted, double-suction centrifugal pumps.
3. Vertical, Cantilever Sump Pumps.
4. Separately coupled, vertically mounted, turbine centrifugal pumps.

1.2 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.3 SUBMITTALS

A. Product Data: 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.

B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of hydronic pumps and are based on the specific system indicated.

C. 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.

D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.5 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.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.7 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 set of mechanical seal(s) for each pump.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SELF PRIMING, NONCLOG PUMPS

A. Known Acceptable Source:

1. Hydromatic; Div. of Pentair, MP series

B. Description: Factory-assembled and –tested, flexible coupled driven horizontal self-priming non-clog centrifugal sewage and trash pump. Rate pump for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Casing: The pump volute case, suction elbow, priming port housing, suction and discharge connections, bearing frame assembly and priming cover shall be high quality gray cast iron, ASTM A-48, Class 30 or better. In addition the three internal wearing parts of impeller, wear plate and lip plate shall be made of high quality ductile iron. All external mating parts shall be machined and Buna-N Rubber O-ring sealed on a beveled edge. Gaskets shall not be acceptable. Casing shall have integral, internal thermostat to interlock starter to prevent pump from overheating.
2. Inlet Suction Elbow: Inlet suction elbow and wear plate shall be removable as a unit so that all parts of the pump case, including the priming port, shall be accessible for cleaning and inspection without removing the suction or discharge piping. The replaceable wear plate shall be bolted to the inlet elbow.
3. Priming Port Housing: A suction type flapper check valve shall be installed in the priming port housing. It shall consist of a flapper valve bracket, stainless steel shaft and bearings, and a Buna-N check valve gasket attached to the flapper bracket with a bolt, washer, weight and nut. The priming cover handle and priming cover arm are to be cast iron. The flapper must be accessible through the top priming port so that it can be removed or installed with the pump volute full of liquid without loss of liquid. The flap valve assembly shall be capable of being removed or replaced without draining the pump case, removing the suction elbow or disturbing the piping connections.
4. Impeller: Impeller shall be of the two-vane, semi-open, non-clog design and have pump out vanes on the backside to prevent grit and other materials from collecting in the seal area. Impeller shall be either threaded on to the shaft or pressed on to a tapered shaft and keyed. A 300 series stainless steel screw and washer shall lock impeller against reverse rotation on the shaft. Impeller clearance shall be externally adjustable without the use of shims or requiring the disassembly of the pump unit. Adjustment shall be accomplished by means of jacking or adjustment bolts located at the end of the bearing housing rotating assembly.
5. Mechanical Seals: The pump shall have two mechanical seals, mounted in tandem, with a separate oil chamber between the seals. John Crane Type 21, seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The inner seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. The inner seal shall be accessible by removing the suction inlet elbow and impeller. Pump-out vanes shall be present on the backside of the impeller to keep contaminants out of the seal area. Seals shall be locally available and a spare set provided initially with unit. There shall be an oil chamber between the outer seal and the inner seal with a drain plug opening for inspection of oil contamination or inner seal failure. The unit shall be designed so that the seal system totally separates the pumping system from the bearing system, assuring that in the event of a seal failure that contaminants will not enter into the bearing housing and damage the bearings. There shall be a space between the seal chamber and the bearing housing which is completely open, allowing visual inspection of the outer seal by maintenance personnel. The unit shall be equipped with a stainless steel shaft sleeve under the inner seal to prolong the shaft life by eliminating the possibility of scoring the shaft, should the inner seal fail. Replacement of the seals shall be accomplished without disturbing the suction or discharge piping.
6. Lip Plate: Impeller shall be used in combination with a replaceable volute lip plate. Where impeller is of full diameter, a flat back plate shall be provided. Where impeller

trim is required, a volute lip plate shall be used in combination so as not to lose priming efficiency. Pump shall be capable of operating with various matched impeller trim / lip plate combinations without disturbing the volute case. The flat back plate or volute lip plate shall be replaceable for renewed efficiency.

7. Wear Plate: The replaceable wear plate is held to the suction elbow by two Allen head screws. The clearance set between the wear plate and impeller shall be maintained at 15 thousandths (.015). Replacement of the wear plate, impeller and inner seal shall be accomplished through the removable suction elbow.
8. Pump Bearings: Permanently lubricated roller type ball bearings. Bearings shall be grease or oil lubricated, locally available, and sized for a minimum B10 life of 20,000 hours for normal operations.

D. Motor: NEMA Premium Efficiency, IEEE-841 Harsh Environment, TEFC, single speed, with permanently lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Section 23 05 13 "Common Motor requirements for HVAC Equipment." Thermostat within pump casing shall be interlocked to motor starter to prevent overheating. BMS shall monitor point.

2.3 SEPARATELY COUPLED, BASE-MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS

A. Known Acceptable Source:

1. American-Marsh Pumps.
2. Armstrong Pumps Inc.
3. Aurora Pump; Division of Pentair Pump Group.
4. Buffalo Pumps, Inc.
5. Crane Pumps & Systems.
6. Flowserve Corporation.
7. ITT Corporation; Bell & Gossett.
8. Mepco, LLC.
9. PACO Pumps.
10. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
11. Peerless Pump Company.
12. TACO Incorporated.

B. 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.

C. Pump Construction:

1. 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 125 flanges. Casing supports shall allow removal and replacement of impeller without disconnecting piping.
2. 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.
3. Pump Shaft: Stainless steel.

4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket.
5. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings.

D. 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.

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

F. 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.

G. Motor: Secured to mounting frame, with adjustable alignment.

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

    a. Enclosure: NEMA MG-1 Inverter Duty, TEFC with Ingress Protection rating greater or equal to IP-54.

    b. Motors shall be sized for non-overloading over entire pump curve.

    c. Special condition: Altitude at 4226 feet.

3. Motors on variable speed pumps shall be compatible with variable frequency drives provided in Division 26 29 23, “Variable-Frequency Motor Controllers.”
4. Motors shall have shaft mounted static grounding ring: Aegis SGR or approved equal.

2.4 VERTICAL, CANTILEVER SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps:
1. Know Acceptable Source:

    a. Basis of Design: Carver GVC Series
    b. Alyan Pump Company.
    c. Armstrong Pumps, Inc.
    d. Chicago Pump Company; Grundfos Pumps Corporation.
    e. Federal Pump Corp.
    f. Flo Fab inc.
    g. PACO Pumps; Grundfos Pumps Corporation, USA.
    h. Peerless Pump Company.
    i. Pentair Pump Group.
    j. Swaby Manufacturing Company.

k. Tramco Pump Company.
l. Vertiflo Pump Company.
m. Weil Pump Company, Inc.
n. Weinman; a Crane Pumps & Systems brand.
o. Yeomans Chicago Corporation.

B. Description: Factory-assembled and -tested sump-pump unit.

C. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.

D. Pump Casing: Cast iron, with strainer inlet and flanged connection discharge piping.

E. Impeller: Statically and dynamically balanced, ASTM A 532/A 532M, abrasion-resistant cast iron, ASTM B 584, cast bronze, or 316 Stainless Steel, designed for clear wastewater handling, and keyed and secured to shaft.

F. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

G. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings.

H. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 2 "Sump-Pump Basins and Basin Covers" Article for requirements.

I. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.

J. Motor: Single-speed; grease-lubricated ball bearings and mounting on vertical, cast-iron pedestal.

1. Oil Monitoring and Controls:

a. Enclosure: NEMA 250, Type 4X, wall-mounted.
b. Special condition: Altitude at 5300 feet.
c. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float switch matching control and electric bell; 120-V ac, with transformer and contacts for remote audible alarm.
e. Oil Detection: Visual and audible alarms and override of pump start upon detection of oil on surface of water.

2.5 SEPARATELY COUPLED, VERTICALLY MOUNTED, TURBINE CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, multistage, centrifugal, impeller-between-bearings, end-suction pump as defined in HI 2.1-2.2 and HI 2.3; designed for installation with pump and motor shafts mounted vertically and projecting into a sump.

B. Pump Construction:
1. Pump Bowl: Cast iron, with basket strainer and suction bell. Water passages of intermediate bowls shall be coated with porcelain enamel.
2. Impeller: ASTM B584, cast bronze; statically and dynamically balanced and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance.
3. Pump Shaft: Carbon steel sized according to manufacturer's requirements.
4. Pump Bearings: Water-lubricated bronze and rubber sleeve bearings in cast-iron housing.
5. Pump Column: ASTM A53/A53M, Grade B steel pipe.
6. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.
7. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.

C. Shaft Coupling: Keyed with locking collets.

D. Discharge Head: ASME B16.1, Class 125 discharge flange with threaded gage tapping. Top of discharge head shall have a registered fit to accurately locate the driver.

E. Drive Ratchet: Nonreversing ratchet.

F. Hollow Shaft Motor: Single speed and secured to discharge head.
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. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

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 work.

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

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

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

3.2 CONCRETE BASES

A. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Section 23 05 00, "Common Work Results for HVAC."

3.3 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories. Set sump pump(s) at proper elevation off bottom of sump floor. Make direct connections to sanitary drainage piping. Install sump pump and connect to drainage piping. Install cover so top surface is flush with finished slab.

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. Vibration isolation devices are specified in Section 23 05 48 "Vibration controls for HVAC Piping and Equipment." Fabricate brackets or supports as required. Hanger and support materials are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

E. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

3.4 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.

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

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

D. 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.

3.5 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 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 check valve and isolation valve on discharge side of pumps.

F. Install electrical connections for power, controls, and devices.

G. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.6 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.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train FAA's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION 23 21 23