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## SECTION 221123 – PUMPS FOR PLUMBING SYSTEMS

Latest Edition: 5-02-2020 See Underlined Text for Edits

(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 the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 22.

#### 1.2 SUMMARY

- A. This section Includes the requirements for plumbing system pumps as follows: <Edit list of pump types for particular project>
  - 1. Domestic water booster pumps.
  - 2. In-line centrifugal pumps.
  - 3. Sewage pumps.
  - 4. Submersible storm water sump pumps.
  - 5. Elevator sump pit – pump and oil guard system.
  - 6. Basins and basin covers.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each specified product, include manufacturers cut sheets, dimensional data, performance data, pump curves, motor data, installation instructions, wirings diagrams, power requirements, specified options, accessories, and warranty information.

#### 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.

#### 1.5 QUALITY ASSURANCE

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

## 1.6 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Specification Section "Motor Requirements for Plumbing Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Motors for submersible pumps shall be hermetically sealed.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

## 1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.9 WARRANTY/GUARENTEE

- A. See Division 22, Specification Section "Basic Mechanical Requirements – Plumbing" for warranty and guarantee requirements.

## **PART 2 - PRODUCTS**

### 2.1 GENERAL PRODUCT REQUIREMENTS

- A. Equipment Design and Selection: Pumps for plumbing systems shall be designed and selected, for the intended use, in accordance with the scheduled capacities on the drawings and the requirements of this specification.
- B. Basis of Design: The basis of design for Plumbing pumps are pumps as manufactured by the following:
  - 1. Domestic Water Booster Pumps: Hydronic Modules Company
  - 2. In Line Centrifugal Pumps: Taco Pumps
  - 3. Sewage Ejectors: Federal Pumps
  - 4. Sump Pumps: Federal Pumps
  - 5. Elevator Pit Sump Pumps: Federal Pumps

- C. Other Acceptable Manufacturers: Subject to compliance with requirements, provide Plumbing pumps by one (1) of the following:
1. Domestic Water Booster Pumps:
    - a. ITT – Bell and Gossett
    - b. Tiger Flow
  2. In Line Centrifugal Pumps:
    - a. ITT – Bell and Gossett Pumps
    - b. Armstrong Pumps
  3. Sewage Pumps:
    - a. Gorman Rupp Company
    - b. Weil Pump Company
    - c. Weinman Division; Crane Pumps and Systems
  4. Storm Water Sump Pumps:
    - a. Gorman Rupp Company
    - b. Weil Pump Company
    - c. Weinman Division; Crane Pumps and Systems
  5. Elevator Pit Sump Pumps:
    - a. Weil Pumps
    - b. Bell & Gossett Pumps
    - c. Tiger Flow
    - d. Synco Flo

2.2 DOMESTIC WATER PACKAGED BOOSTER PUMPS <Delete if not applicable to this project>

- A. General: Furnish and install a triplex variable speed, constant pressure water booster system where indicated on the drawings and as specified herein. The system shall automatically provide a constant pressure of 100 psi while supplying a flow rate of 0 gpm to 600 gpm with a minimum suction pressure of 40 psi and a maximum suction pressure of 70 psi. All components of the booster water pump package that comes on contact with the water service shall be constructed of lead free materials and comply with NSF/ANSI Standard 61. The pump impellers shall be stainless steel only, bronze or cast iron impellers will not be acceptable. The basis of design is Model HBP-300-4 PLC/VFD as manufactured by Hydronic Modules Company. <Edit psi, gpm, and model number for project requirements. Coordinate with UMB for suction pressures>
- B. Pumps: Each pump shall be variable speed close coupled end suction type pumps with mechanical seals, bronze shaft sleeve, and back pullout design with flanged suction and discharge connections, Each pump shall be rated at 33% of the system design. Provide a VFD for each pump. The lead and lag pumps shall be variable speed. System shall automatically provide complete pump shut down during low flow conditions. Variable speed pumps shall be furnished with a non-slam check valve. Check valves shall be a

Cla-valve 81-12 epoxy coated, NSF-61 certified with flanged connections, ANSI 125, maximum pressure 200 psi, and maximum temperature of 180°F. <Coordinate with UMB and edit pump rate for project requirements>

- C. Motors: Motors shall be premium efficient type, inverter ready per NEMA MG1 part 31.4.4.2, (ODP) or (TEFC). Furnish motors with AEIGIS shaft grounding ring. System Safety: System shall automatically provide complete pump shut down during low flow conditions. An aqua stat and solenoid valve shall be provided for each pump to prevent overheating of the pump casings during prolonged periods of low flow. Aqua stat shall provide a signal to the pump controller to indicate a high temperature condition.
- D. Variable Frequency Drives: The variable speed pumps shall be furnished with a Danfoss FC100 variable frequency drive. Drive shall be designed for water applications and include “Sleep Mode”, “Set Boost”, “Dry Pump Protection”, and “End –of- Curve Detection” programming. The drive shall have selectable VT or CT performance, high power factor and low harmonics via dual DC link chokes, built in line transient protection, automatic motor adaptation program. A keypad with a six line display shall be included and programmed to display system set point and performance. Unit shall have six (6) digital inputs, two (2) analog inputs, one (1) analog output, two (2) relay outputs and a RS485 port. The VFD shall also have the protective functions of: short circuit and ground fault protection, line or motor phase loss, line imbalance outside of spec, over and under voltage, over temperature, and electronic thermal motor protection. Drive shall be furnished embedded BAC Net IP protocol. Each drive shall be furnished with a fused disconnect. In addition to the requirements above comply with the following:
1. Complete drawings shall be furnished and approved before proceeding with manufacture. Drawings shall consist of a specific bill of materials, connection diagrams and suitable outline drawings showing details necessary to locate conduit stub-ups and field wiring.
  2. All VFD internal components must originate from the same VFD manufacturer.
  3. Each drive shall be mounted with it’s accessories in a single cabinet.
  4. VFDs utilizing a 3rd power section are not acceptable.
  5. Use of the following device is not permitted:
    - a. Passive filters.
  6. The VFD shall comply with the latest applicable standards of ANSI, IEEE and NEMA. The controllers shall be rated as shown in the drawings. As a minimum, the full load output current of the drive shall be equal to the equivalent motor horsepower as listed by NEC Table 430-150.
  7. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFD status, alarm and energy usage. Allows VFD to be used with an external system within a multidrop LAN configuration; settings retained within VFD's nonvolatile memory.
    - a. Embedded BAS Protocols for Network Communications: Manufacturer shall provide one (1) of the following protocols:

- b. BACNET MS/TP
- c. BACNET IP
- d. Siemens P1
- e. MODBUS TCP
- f. NOTE: MODBUS RTU is not an option

<Engineer to Coordinate with UMB and Edit for Project Requirements>

- E. Bladder Tank: System shall include a pre charged bladder type pressure tank with a replaceable bladder. The vessel shall be ASME Code and N.B. stamped for (125), (150), (200) PSIG. Tank shall be furnished with a pressure gage and relief valve. Tank shall be NSF-61 certified. Tank shall be installed (next to booster) (at top of riser). Make provisions to drain the tank without disturbing any piping or shutting down the system. <Coordinate with UMB and edit for project>
- F. Headers: For systems six (6) inches and smaller, the headers shall be constructed of type 'L' copper tube with flanged suction and discharge connections and branch connections for each pump. For systems larger than six (6) inches, the headers shall be constructed of stainless steel pipe with flanged suction and discharge connections. Each branch connection shall include either a full port lead free ball valve with stainless steel trim or a butterfly valve with stainless steel trim on the suction and discharge connections for each pump. Include a pressure gauge with a snubber and shut off valve on the suction header and the discharge header.
- G. Control Panel: Unit is to include a (NEMA 1) or (NEMA 12) control panel, UL labeled. The panel shall include: <Coordinate with UMB and edit for project>
- 1. One (1) main disconnect
  - 2. One (1) power on light
  - 3. One (1) 24VDC power supply with circuit breaker
  - 4. One (1) audible alarm
  - 5. One (1) Pressure transmitter for inlet pressure
  - 6. One (1) Pressure transmitter for outlet pressure
  - 7. One (1) flow transmitter – mounted on inlet header
- H. Control Station: NEMA 4 rated operator control station with integral microprocessor based, solid state programmable logic controller. The controller shall have off line and on line diagnostic software. The analog input and digital output modules shall be stackable. The logic controller shall power all external pressure and flow transmitters. The controller's user interface shall include a three (3) inch x five (5) inch backlit LCD display with a fourteen (14) button keypad. Display shall provide visual indication of system flow, system pressure, suction pressure, VFD Fault, low suction pressure, high suction pressure, low system pressure, high system pressure, and elapsed run times. Controller shall have an alarm log with date and time stamp. Unit shall also log the

maximum flow rate with a date and time stamp. The logic controller shall operate the pumps through a proven program. All timer, pressure and flow set points, alternation time, shall be adjustable in the field through the operator interface (password protected). Optional hardwire communication shall be provided for the energy management system. This shall include remote Start/Stop, pump status, and a single alarm output dry contact. Panel shall also include an audible alarm.

- I. Control Sequence: Controller shall provide the following sequence: P1; P1+P2, P1+P2+P3; with alternation between all three (3) pumps. Controller shall automatically stage around any pump that has faulted or been turned off.
- J. Building Management System (BMS) Integration: For integration with the BMS provide BAC Net IP Protocol for integration with the BMS with the following points:
  1. Total flow
  2. Suction pressure status
  3. Discharge pressure status
  4. System pressure status
  5. Booster off alarm
  6. High suction pressure alarm
  7. Low suction pressure alarm
  8. High system pressure alarm
  9. Low system pressure alarm
  10. VFD alarm for each VFV
  11. Status and alarm points from each VFD card
- K. Flow Sensor: Provide a flow sensor with a four (4) bladed impeller that measures flows from under 0.3ft/sec to over 20 ft/sec shall be installed in the suction header. Flow sensor shall provide a 4-20ma signal to the programmable controller. Flow sensor shall be rated for 600 psi at 140°F.
- L. Support Frame: All equipment shall be mounted on a structural steel frame completely piped and wired as shown on the drawings. The only field connections required shall be supply and discharge piping and the main power leads.
- M. Performance Test: The unit shall be performance tested and adjusted to job specifications at the factory. Certification of this test shall be witnessed by the engineer with written certification to be supplied with unit. After testing and adjusting, the system shall be primed and then painted with machine grade enamel paint.
- N. Start Up and Training: The services of a factory trained representative shall be made available on the jobsite to check installation, perform start up, and instruct operating personnel.

2.3 IN-LINE CENTRIFUGAL PUMPS <Delete if not applicable to this project>

A. Sealless Type Inline Pumps:

1. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
2. Pump Construction:
  - a. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
  - b. Casing: Bronze, with threaded or companion-flange connections.
  - c. Impeller: Plastic.
3. Motor: Single speed, unless otherwise indicated.

B. Horizontally Mounted, In-Line, Separately Coupled Centrifugal Pumps: <Delete if not applicable to this project>

1. Description: Factory-assembled and -tested, in-line, single-stage, separately coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shafts mounted horizontal.
2. Pump Construction:
  - a. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
  - b. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
  - c. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
  - d. Coupling: Flexible.
  - e. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
  - f. Bearings: Oil-lubricated; bronze-journal or ball type.
  - g. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
3. Motor: Single speed, with grease-lubricated ball bearings; and rigidly mounted to pump casing.

C. Horizontally Mounted, In-Line, Close-Coupled Centrifugal Pumps: <Delete if not applicable to this project>

1. Description: Factory-assembled and tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.
2. Pump Construction:

- a. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
  - b. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
  - c. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
  - d. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
  - e. Bearings: Oil-lubricated; bronze-journal or ball type.
  - f. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
3. Motor: Single speed, with grease-lubricated ball bearings; and rigidly mounted to pump casing.
- D. Vertically Mounted, In-Line, Close-Coupled Centrifugal Pumps: <Delete if not applicable to this project>
1. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.
  2. Pump Construction:
    - a. Casing: Radially split, cast iron, with wear rings and threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
    - b. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
    - c. Shaft and Shaft Sleeve: Stainless-steel shaft, with copper-alloy shaft sleeve.
    - d. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
    - e. Bearings: Oil-lubricated; bronze-journal or ball type.
    - f. Shaft Coupling: Flexible or rigid type if pump is provided with coupling.
  3. Motor: Single speed, with grease-lubricated ball bearings; and rigidly mounted to pump casing.
- 2.4 SEWAGE PUMPS <Delete if not applicable to this project>
- A. Description: Factory-assembled and -tested sewage-pump unit.
  - B. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
  - C. Pump Casing: Cast iron, with open inlet and threaded or flanged connection for discharge piping.
  - D. Pump Shaft: [Stainless-steel] [and] [steel]. <Editor to select>



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- E. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [and] [ASTM B 584, cast bronze], <Editor to select> non-clog, open, or semi-open design for solids handling, and keyed and secured to shaft.
- F. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at forty eight (48) inch maximum intervals if basin depth is more than 48 inches, and grease-lubricated, ball-type thrust bearings.
- G. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
- H. Pump Discharge Piping: Factory or field fabricated, 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.
- I. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. See "Sewage-Pump Basins and Basin Covers" Article for requirements.
- J. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.
- K. Motor: Single-speed; grease-lubricated ball bearings and mounted on vertical, cast-iron pedestal.
- L. Controls:
1. Enclosure: NEMA 250, [Type 1] [Type 4X] <Editor to select>
  2. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
  3. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
  4. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than sixty (60) inches.
  5. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- M. Control-Interface Features:
1. Remote Alarm Contacts: For remote alarm interface.
  2. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
    - a. On-off status of pump.
    - b. Alarm status.

2.5 SUBMERSIBLE STORM WATER SUMP PUMPS <Delete if not applicable to this project>

1. Description: Factory-assembled and -tested sump-pump unit.
2. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
3. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
4. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [and] [ASTM B 584, cast bronze], [semi-open] <Editor to select> design for clear wastewater handling, and keyed and secured to shaft.
5. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
6. Seal: Mechanical.
7. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
  - a. Motor Housing Fluid: [Air] [Oil] <Editor to select>.
8. Controls:
  - a. Enclosure: NEMA 250, [Type 1] [Type 4X] <Editor to select>
  - b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
  - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
  - d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
  - e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
9. Controls:
  - a. Enclosure: NEMA 250, [Type 1] [Type 4X] <Editor to select>; [pedestal] [wall]-mounted.
  - b. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
  - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
  - 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 alarm bell.

10. Control-Interface Features:

- a. Remote Alarm Contacts: For remote alarm interface.
- b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
  - 1) On-off status of pump.
  - 2) Alarm status.

2.6 ELEVATOR SUMP PIT – SUMP PUMP OIL GUARD SYSTEM

- A. General: Pump motor shall be hermetically sealed, submersible type operating in a high quality dielectric oil for cooling the windings and for lubrication of the motor bearings and ceramic-carbon shaft seal. Single phase motor shall have internal automatic resetting, thermal overload protection. Construction shall be of cast iron with 100% baked-on powder coated epoxy finish for corrosion resistance and longer casting durability. All fasteners and external metal parts shall be of stainless steel. Impeller shall be of vortex non-clog design.
- B. Motor: Single phase pump motor shall be as follows:
  1. 1/3 (.3) HP Motor: Cast iron series pump shall have a shaded pole motor. Guard and handle shall be stainless steel.
  2. 1/4 to 1/2 HP Motor: Cast iron series pump shall have a permanent split capacitor motor. Motor housing shall be cast iron. The impeller shall be glass reinforced thermoplastic.
- C. Oil Smart Pump Switch: The Oil Smart Pump Switch is an industrial grade switch with internal 20 amp relay and 304 SS sensor probes used to control water pumps in elevator, utility, marine and industrial sump applications. Installation will prevent oil and or hydrocarbons from being inadvertently pumped into the environment. .Options: 20 ft. cord with piggyback plug.
- D. Power Plug: Provide a 115 volt piggyback power plug.
- E. Alarm System:
  1. Oil Smart Alarm will alert residents or maintenance personnel of liquid level problems. High Oil and High Water Level Lights and standard Remote Dry Contacts (SCADA Monitoring System).
  2. Alarm System with High Liquid Audible Alarm (71db @ 2ft.), Red Beacon, Oil Present - Yellow Light and Water Present - White Light. Built with Oil Smart technology.

- F. Liquid Sensor: The liquid smart sensor incorporates both an electro-optic and Oil Smart Sensor all in one encapsulated unit. Differentiates and indicates the presence of oil and or water under high water condition.
- G. Control Panel: The control panel shall have built in with Oil Smart technology to control the pump and alert the maintenance personnel of liquid level problems through connections to the campus automation system through the buildings automation system. High Oil and High Water Level Lights and standard Remote Dry Contacts (SCADA Monitoring System). Simplex Panel 10-2149.
- 2.7 **BASINS AND COVERS FOR SEWAGE PUMPS AND SUMP PUMPS** <Delete if not applicable to the project>
- A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections. <Delete if basins are part of a poured floor system>
1. Material: Fiberglass.
  2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
  3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.
- B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.
  2. Cover Material: Cast iron or steel with bituminous coating.

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Excavation and filling are specified in Division 31 Specification Section "Earth Moving."

#### **3.2 EXAMINATION**

- A. Examine roughing-in for plumbing piping to verify actual locations of sanitary drainage and vent piping connections before sewage pump installation.

#### **3.3 CIRCULATING PUMP INSTALLATION** <Delete if not applicable to this project>

- A. Comply with HI 1.4.
- B. Install in-line, seal-less centrifugal pumps with shaft horizontal unless otherwise indicated.

- C. Install horizontally mounted, in-line, separately coupled and close-coupled centrifugal pumps with shaft(s) horizontal.
- D. Install vertically mounted, in-line, close-coupled centrifugal pumps with shaft vertical.
- E. Pump Mounting: Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base using [elastomeric pads] [elastomeric mounts] [restrained spring isolators] <Editor to select>. Comply with requirements for concrete base specified in Architectural Specification Section "Miscellaneous Cast-in-Place Concrete."
  - 1. Comply with requirements for vibration isolation devices specified in Division 22 Specification Section "Vibration and Seismic Controls for Plumbing Systems." Fabricate brackets or supports as required.
  - 2. Comply with requirements for hangers and supports specified in Division 22 Specification Section "Hangers and Supports for Plumbing Systems."
  - 3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on eighteen (18) inch centers around the full perimeter of concrete base.
  - 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
- F. Install in-line pumps using continuous-thread hanger rods and spring hangers of size required to support pump weight.
  - 1. Comply with requirements for vibration isolation devices specified in Division 22 Specification Section "Vibration and Seismic Controls for Plumbing Piping Systems." Fabricate brackets or supports as required.
  - 2. Comply with requirements for hangers and supports specified in Division 22 Specification Section "Hangers and Supports for Plumbing Systems."
- G. Install pressure switches in water supply piping.

### 3.4 BOOSTER PUMP INSTALLATION

- A. The Contractor shall properly protect all equipment to prevent damage from water, dirt, etc. Protection shall include, but not be limited to, temporary plastic wrap to maintain equipment in original factory condition.
- B. Wiring installation and handling shall be in accordance with manufacturer's recommendations.

C. Startup and Testing:

1. Make 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.
2. System Test: After installation is completed provide an operational test of the completed system including flow rates, pressure compliance, alarms and all control functions.
3. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
4. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Contractor shall provide a minimum of 10 working days prior to startup and testing.

D. Commissioning:

1. Provide commissioning documentation in accordance with the requirements of Division 22 Specification Section "Commissioning Plumbing Systems".
2. Components provided under this section of the specification will be tested as part of a larger system.

E. Demonstration and Training:

1. Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.
2. Submit training plans and instructor qualifications in accordance with the requirements of Division 22 Specification Section "Commissioning Plumbing Systems".

3.5 SEWAGE PUMP INSTALLATION <Delete if not applicable to particular project>

A. Pump Installation Standards:

1. Comply with HI 1.4 for installation of centrifugal pumps.
2. Comply with HI 3.1-3.5 for installation of progressing-cavity sewage pumps.

B. Equipment Mounting:

1. Install progressing-cavity sewage pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Architectural Specification Sections "Cast-in-Place Concrete." and/or "Miscellaneous Cast-in-Place Concrete."

2. Comply with requirements for vibration isolation devices specified in Division 22 Specification Section "Vibration and Seismic Controls for Plumbing Piping Systems."
  - C. Wiring Method: Comply with requirements in Division 26 Specification Section "Low-Voltage Electrical Power Conductors and Cables."
  - D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- 3.6 SUMP PUMP INSTALLATION <Delete if not applicable to this project>
- A. Comply with HI 1.4 for installation of sump pumps.
- 3.7 CONNECTIONS
- A. Install piping adjacent to equipment to allow service and maintenance.
  - B. Comply with requirements for piping specified in Division 22 Specification Section "Sanitary, Chemical and Vent Piping Systems." Drawings indicate general arrangement of piping, fittings, and specialties.
  - C. Comply with requirements for piping specified in Division 22 Specification Section "Domestic and Laboratory Water Piping Systems and Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
  - D. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
    1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
      - a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
      - b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
      - c. Vertically mounted, in-line, close-coupled centrifugal pumps.
      - d. Comply with requirements for flexible connectors specified in Division 22 Specification Section "Domestic and Laboratory Water Piping Systems and Specialties."
    2. For skid mounted pumps such as booster pumps, install flexible connections and isolation valves where the water piping connects to the skid.
    3. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Division 22

Specification Section "Valves for Plumbing Piping Systems" and comply with requirements for strainers specified in Division 22 Specification Section "Domestic and Laboratory Water Piping Systems and Specialties."

4. Install pressure gauge and snubber at suction of each pump and pressure gauge and snubber at discharge of each pump. Install at integral pressure-gauge tapings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Division 22 Specification Section "Thermometers and Gauges for Plumbing Piping."
- E. Connect pressure switches, thermostats, time-delay relays, and timers to pumps that they control. <Edit for particular project>
- F. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.
- G. Comply with requirements for piping specified in Division 22 Specification Section "Facility Storm Water Piping System and Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

### 3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  1. Perform each visual and mechanical inspection.
  2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Pumps and controls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.9 STARTUP SERVICE

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



- B. Complete installation and startup checks according to manufacturer's written instructions.

### 3.10 ADJUSTING

- A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust control set points.

### 3.11 DEMONSTRATION

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

END OF SECTION 221123