

SECTION 23 2123 - PUMPS

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.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Close-coupled, in-line centrifugal pumps.
 - 2. Close-coupled, end-suction centrifugal pumps.
 - 3. Separately coupled, horizontal, in-line centrifugal pumps.
 - 4. Separately coupled, vertical, in-line centrifugal pumps.
 - 5. Separately coupled, base-mounted, end-suction centrifugal pumps.
 - 6. Pump specialty fittings

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.
- C. Operation and maintenance data.
- D. Grooved joint couplings and fittings specifically identified with the applicable style or series number.
- E. Northwestern University Maintenance Requirement Forms, see Division 01.

1.4 QUALITY ASSURANCE

- A. 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.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- C. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

- D. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by the same manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.
- E. All grooved couplings shall be installed strictly according to grooved manufacturer's instructions including torque verification and specific lubrication as published.

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. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 SPECIAL WARRANTY

- A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Pump motors shall be 1750 rpm maximum unless otherwise scheduled on drawings and sized for non-overloading service.
- B. Pump impeller shall be shaved to a minimum of **[110%]** **[120%]** of design flow at the required pump head after balancing.
- C. Pumps motors operated by Variable Frequency Drives shall have pump impellor balanced for variable speed operation.
- D. All pumps to be provided with permanently affixed nameplates which include impeller diameter, rated capacity in gpm, rated head in feet, rpm, and motor horsepower.
- E. Pumps to be maintenance free, or as close to maintenance free. Of course, this depends on size and performance requirements.

2.2 MANUFACTURERS FOR CHICAGO CAMPUS

- A. Pump Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
 - 1. Grundfos CR and maintenance free (Basis of Design)
 - 2. Armstrong Pumps Inc
 - 3. Bell & Gossett; Div. of ITT Industries.

2.3 MANUFACTURERS FOR EVANSTON CAMPUS

- A. Pump Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
 - 1. Bell & Gossett; Div. of ITT Industries (Preferred).
 - 2. Armstrong Pumps Inc
 - 3. Grundfos CR and maintenance free
- B. Maintenance free pumps to be used first within engineering parameters.

2.4 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. 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. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.
- B. Pump Construction:
 - 1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
 - 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 - 3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
- C. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 23 Section "Motors."

2.5 CLOSE-COUPLED, END-SUCTION CENTRIFUGAL PUMPS

- A. 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. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.
- B. Pump Construction:
 - 1. Casing: Radially split, cast iron, with drain plug at bottom and air vent at top of volute, threaded gage tappings at inlet and outlet.
 - 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 - 3. Pump Shaft: Stainless steel.

4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Equal to John Crane Type 21.
5. Pump Bearings: Permanently lubricated ball bearings through 5 hp. Over 5 hp : grease-lubricated ball bearings.
6. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; rigidly mounted to pump casing with integral pump support. Comply with requirements in Division 23 Section "Motors."

2.6 SEPARATELY COUPLED, HORIZONTAL, IN-LINE CENTRIFUGAL PUMPS

- A. 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. Rate pump for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.
- B. Pump Construction:
 1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded **[companion-flange] [union end]** connections.
 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. Trim impeller to match specified performance.
 3. Pump Shaft: **[Steel, with copper-alloy shaft sleeve] [Stainless steel]**.
 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and **[Buna-N] [EPT]** bellows and gasket. Include water slinger on shaft between motor and seal.
 5. Pump Bearings: Permanently lubricated ball bearings.
- C. Shaft Coupling: **[Molded rubber insert with interlocking spider] [Interlocking frame with interconnecting springs]** capable of absorbing vibration.
- D. Motor: Single speed, with **[permanently lubricated ball] [oil-lubricated sleeve]** bearings, unless otherwise indicated; and **[resiliently] [rigidly]** mounted to pump casing. Comply with requirements in Division 23 Section "Motors."

2.7 SEPARATELY COUPLED, VERTICAL, IN-LINE CENTRIFUGAL PUMPS

- A. 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. Rate pump for **[125-psig] [175-psig] [250-psig]** minimum working pressure and a continuous water temperature of **[200 deg F] [225 deg F] [250 deg F]**.
- B. Pump Construction:
 1. Casing: Radially split, cast iron, with **[replaceable bronze wear rings,]** threaded gage tappings at inlet and outlet, and threaded **[companion-flange] [union end]** connections.
 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 3. Pump Shaft: **[Steel, with copper-alloy shaft sleeve] [Stainless steel]**.
 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and **[Buna-N] [EPT]** bellows and gasket. Include water slinger on shaft between motor and seal.

5. Packing Seal: 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.
6. Pump Bearings: [**Permanently lubricated ball bearings**] [**Oil lubricated; bronze-journal or thrust type**].

C. Shaft Coupling: Axially split spacer coupling.

D. Motor: Single speed, with [**permanently lubricated**] [**grease-lubricated**] ball bearings, unless otherwise indicated; rigidly mounted to pump casing with lifting eye and supporting lugs in motor enclosure. Comply with requirements in Division 23 Section "Motors."

2.8 SEPARATELY COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

A. 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. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

B. Pump Construction:

1. Casing: Radially split, cast iron, with drain plug at bottom and air vent at top of volute, threaded gage tapings at inlet and outlet.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw.
3. Pump Shaft: Stainless steel.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Equal to John Crane Type 21.
5. Pump Bearings: Permanently lubricated ball bearings through 5 hp. Over 5 hp : grease-lubricated ball bearings.

C. 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**].

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

E. 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.

F. Motor: [**Open Drip Proof**] [**TEFC**] Single speed, with permanently lubricated ball bearings, unless otherwise indicated; secured to mounting frame, with adjustable alignment. Comply with requirements in Division 23 Section "Motors."

2.9 PUMP SPECIALTY FITTINGS

A. Suction Diffusers:

1. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:

- a. Same manufacturer as associated pump.
 - b. Victaulic.
2. Angle pattern, 175-psig pressure rating at 250 degree F, cast ductile-iron body and end cap, pump-inlet fitting; with removable strainer (bronze for startup and stainless-steel for permanent); bronze or stainless-steel full length straightening vanes; drain plug; and factory-fabricated support. Provide optional magnetic insert.
 3. Angle pattern, grooved pump inlet with flanged outlet system connections, 300-psig pressure rating at 250 degree F, ductile-iron body, coupling and cap, 304 stainless steel frame and perforated sheet diffuser with 3/16" diameter holes. Integral flow straightening device. Removable 16 mesh bronze start-up pre-filter, pressure port with drain plug. Provide optional magnetic insert.
- B. Triple-Duty Valve or Tri-Service Assembly:
1. Not allowed.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install all pumps in strict accordance with manufacturer's instructions. Provide service space around pumps as recommended by the pump manufacturer.
- 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. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Vibration Isolation." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 23 Section "Mechanical Supporting Devices."
- E. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and spring hangers of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Vibration Isolation." Hanger and support materials are specified in Division 23 Section "Mechanical Supporting Devices."
- F. 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.
- G. Do not mount pumps on walls that are common to critical areas such as offices, conference rooms, classrooms, etc. In-line pumps shall be installed directly in the piping system, and supported independently from the piping.

- H. Install grooved piping products in accordance with the manufacturer's guidelines and recommendations. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove.
- I. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. A field representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

3.2 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 non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.
- E. Grout pump mounting base full after piping is connected but before pump drive is aligned. After grouting, align pump drive shaft to 5 mils, even if pump is factory aligned, and conduct vibration test.

3.3 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 throttling valve on discharge side of pumps.
- F. Install Y-type strainer and shutoff valve on suction side of pumps. Suction diffusers can be used in lieu of in-line strainers, long radius elbow and spool piece.
- G. Install flexible connectors or Victaulic flexible couplings on suction and discharge sides of base-mounted pumps between pump casing and valves.
- H. Install pressure gages on pump suction and discharge, 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. Install electrical connections for power, controls, and devices.

3.4 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 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.
 - b. Verify that pump is rotating in the correct direction.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Division 01 Section covering demonstration and training.

END OF SECTION 23 2123