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The Description of the Project
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SPECIFICATION DIVISION 23

NUMBER SECTION DESCRIPTION

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 232123 - PLUMBING AND HYDRONIC PUMPS

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DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 232123 - PLUMBING AND HYDRONIC PUMPS

THIS SECTION SPECIFIES CENTRIFUGAL PUMPS FOR HVAC SYSTEMS (CHILLED WATER, CONDENSER WATER, HEATING HOT WATER), PROCESS COOLING, AND DOMESTIC HW RETURN PUMPS. STEAM CONDENSATE PUMPS AND RECEIVERS, SMALL HVAC CONDENSATE PUMPS, CW BOOSTER PUMP PACKAGES, AND HEAT TRANSFER PACKAGES, SUMP PUMP, FIRE PUMPS ARE SPECIFIED ELSEWHERE.

7/16/12: ADDED THAT PUMP SEALS SHALL BE UNAFFECTED BY CHLORAMINES. ADDED NSF 61 REFERENCE UNDER QUALITY ASSURANCE.

2014-01-06: IMPROVED LEAD FREE REQUIRMENTS TO REFLECT U.S SAFE DRINKING WATER ACT REQUIREMENTS THAT WENT INTO EFFECT JAN. 4, 2014. D.KARLE FOR MTT.

2016-10-31: ADDED TO PART 2 - WET ROTOR, ECM VARIABLE SPEED IN-LINE CIRCULATOR PUMP FURNISHED AS AN ASSEMBLY WITH SPEED CONTROLS. WPG FOR HYDRONICS/STEAM MTT.

APRIL 2018: ELIMINATED A-C PUMPS, NOT OFFERED AS A HVAC PUMP BY B&G. D. KARLE FOR HYDRONICS MTT.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

INCLUDE PARAGRAPH 1.1.A AND B IN EVERY SPECIFICATION SECTION. EDIT RELATED SECTIONS 1.1.B TO MAKE IT PROJECT SPECIFIC.

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

B. Related Sections:

1. Section 220513: Motors.
2. Section 220548: Vibration Control
3. Division 26: Electrical.

1.2 SUMMARY

A. Includes pumps for hydronic and domestic hot water return service. Includes process pumps except those covered in other specification sections.

1. Does not include steam condensate, domestic booster package, sump, or fire pumps.

1.3 SUBMITTALS

A. Submit the following product data for approval:

1. Manufacturer information.

2. Dimensions and elevations.
3. Performance data/pump curves.
4. Materials of construction.
5. Motor data including motor manufacturer.
6. Vibration isolation and inertia bases

1.4 QUALITY ASSURANCE:

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.

1. Hydraulic Institute Compliance: Design and manufacture pumps in accordance with ANSI/ Hydraulic Institute Standards.
2. National Electrical Code Compliance: Provide components complying with NFPA 70 National Electrical Code.
3. UL Compliance: Provide HVAC pumps which are listed and labeled by UL, and comply with UL Standard 778 "Motor Operated Water Pumps."
4. Pumps used for potable water service: National Sanitation Foundation NSF/ANSI-61 (potable drinking water) and NSF-61 Annex G (listed as ≤ 0.25% weighted average lead content) (and/or NSF/ANSI-372) and Annex F.
5. Pumps used for potable water service: U.S Safe Drinking Water Act.

C. Single Source Responsibility: Obtain pumps from a single manufacturer.

SPEC EDITOR: REVISE WARRANTY PER PROJECT. LONGER WARRANTY PERIOD MAY BE APPROPRIATE FOR CERTAIN TYPES OF WORK. INCLUDE THIS ARTICLE IN EVERY SPECIFICATION SECTION.

1.5 WARRANTY

A. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL PUMP REQUIREMENTS:

A. Unless noted otherwise, provide pumps meeting these general requirements.

SPEC EDITOR: NOTE THE GENERALIZED PUMP AND SEAL T/P RATINGS AND THE NOTATION "SUITABLE FOR SERVICE," INDICATED BELOW. EDIT THE SPECIFIC PUMP SECTIONS IF YOUR PROJECT HAS SEVERE SERVICE OR MORE DEMANDING T/P REQUIREMENTS.

B. Suitable for the service, rated for the temperature and pressure indicated. When not indicated, pump and pump seals shall be rated for not less than 175 psig working pressure and 225 degrees F continuous water temperature. Provide pumps with capacities and performance as scheduled on the Drawings.

C. Pumps shall have steel shaft, cast iron case, and cast bronze or stainless steel impeller. Flanged pumps shall have suction and discharge taps in flanges, and drain and vent taps in the volute. Piping connections shall be flanged for connection sizes 2 1/2 inches and larger.

D. Pumps shall have statically and dynamically balanced impeller, with a constantly dropping head curve from shutoff to cutoff, and shall not overload their respective motors on any point throughout the head capacity curve. Key and lock impeller to shaft.

E. Motors shall be factory coupled to pump and comply with requirements of Related Section Motors, with rpm, voltage and HP as scheduled. Single phase motors shall have built-in overload protection.

F. Where flexible coupling is specified, coupling shall be EPDM, center dropout type, capable of absorbing torsional vibration and shaft misalignment, complete with ANSI B15.1/OSHA 1910.219 coupling guard.

G. Pumps for domestic water systems shall be lead free (less than 0.25 percent lead by weight in all wetted surfaces) all bronze or stainless steel construction.

SPEC EDITOR: FOR PUMPS USED FOR GLYCOL SERVICE, SILICON CARBIDE SEALS SHOULD BE SPECIFIED. HOWEVER, ENGINEER MUST VERIFY WHICH MFR.S CAN OFFER SILICON CARBIDE SEALS, AND THEN EDIT THE SPEC ACCORDINGLY.

H. Pump seals shall be unaffected by chloramines.

I. Pumps used for glycol shall have seals rated for glycol service.

J. Pump selection:

1. Select pumps so an impeller/volute is sized to accommodate 10 percent more head than at duty point, unless noted otherwise on pump schedule.
2. Select pump no greater than 85 percent of end of curve flow.
3. Select pump at the point of best efficiency for a given impeller-casing combination. Deviations shall be within 3 percent of maximum efficiency point on the increasing capacity side of the maximum efficiency point.
4. Maximum Pump Suction velocity:
   a. Inline: 12 fps.
   b. End Suction: 13 fps.
   c. Double Suction: 15 fps.

K. Balance pumps per ANSI / Hydraulic Institute procedures. Perform electronic vibration analysis for all pumps 1/2 hp and above. Unless noted otherwise, the maximum allowable RMS (filter in) velocity at maximum pump motor speed, measured at each pump and motor bearing, shall not exceed 0.13 inches/sec in the vertical, horizontal and axial directions. For pumps to be applied in variable speed applications, balance and test to assure this vibration limit is not exceeded at any pump speed. Pumps may be field tested after installation by an independent testing agency. Any pump found to exceed the specified vibration limits shall be corrected to perform within those limits without cost to the Owner.

2.2 IN-LINE CIRCULATORS

SPEC EDITOR: GENERALLY NOT RECOMMENDED FOR MORE THAN 1/2HP. SYSTEM LUBRICATED/NO OILING. 3-PIECE OIL LUBE MODELS TO BE PHASED OUT. TYPICAL CONSTRUCTION HAS MOTOR CARTRIDGE REPLACEABLE WITH ROTOR ATTACHED. SLEEVE TYPE BEARINGS IN LIEU OF BALL TYPE. NO MECHANICAL SEAL. AVAILABLE METALLURGY CI BODY W/ BRONZE IMPELLER; CI BODY W/ STAINLESS STEEL IMPELLER. THESE PUMPS ARE USUALLY SUPPORTED BY THE PIPE; DO NOT USE INLET/OUTLET FLEXIBLE PIPE CONNECTORS. THEY COME IN STANDARD SIZES; IMPELLER TRIMMING IS NOT DONE; SINGLE PHASE MOTORS.

A. Domestic Hot Water: Close coupled, single suction, lead free bronze or stainless steel impeller and body. System-lubricated, ceramic shaft. Permanently lubricated, bronze or carbon sleeve bearings.

B. Hydronic Systems: Close coupled; single suction bronze or stainless steel impeller. System-lubricated, alloy steel shaft, Cast iron body. Permanently lubricated sleeve bearings.

C. Rated for 150 psig working pressure, minimum.

D. Acceptable Manufacturers:

1. ITT Bell & Gossett.
2. Armstrong.
3. Grundfos.
4. Weinman.
5. Taco In-Line Circulators.
6. Patterson.

NOTE THAT FACTORY-ASSEMBLED ECM CIRCULATORS WILL NOT COMPLY WITH UM MASTER SPEC REQUIREMENTS FOR MOTORS AND VARIABLE SPEED DRIVES.

2.3 IN-LINE WET ROTOR VARIABLE SPEED ECM CIRCULATORS

THE FOLLOWING SECTION COVERS SMALL CAPACITY AND HEAD SINGLE PHASE FRACTIONAL TO 1 HORSEPOWER, SINGLE PHASE, ELECTRONICALLY-COMMUTATED MOTOR DRIVEN SINGLE STAGE CIRCULATING PUMPS. TYPICAL CONSTRUCTION HAS BUILT-IN, FACTORY ASSEMBLED VARIABLE SPEED DRIVE AND CONTROLS FURNISHED AS AN ASSEMBLED PRODUCT. SLEEVE TYPE BEARINGS TYPICAL V. BALL TYPE. NO MECHANICAL SEAL. THESE PUMPS ARE USUALLY SUPPORTED BY THE PIPE; TYPICALLY DO NOT USE INLET/OUTLET FLEXIBLE PIPE CONNECTORS. EDIT THIS SECTION CAREFULLY FOR THE SPECIFIC APPLICATION.

A. Factory-assembled and tested, self-regulating, in line wet rotor type circulator pump, with synchronous, permanent-magnet type motor and integrated variable speed electronically commutated motor.

Construction Features:

1. Single phase, 120 VAC or 208-230 VAC as scheduled, 60 Hz.
2. Pump Shaft: Stainless steel.
3. Bearings. Metal impregnated carbon sleeve or ball bearing type.
4. Connection Style: Flanged
5. Rating: 145 psig at 230 F

B. Domestic Hot Water: Lead free bronze, glass-filled polypropylene engineered composite or stainless steel impeller; lead free bronze or stainless steel body.

C. Hydronic Systems: cast iron, glass-filled polypropylene engineered composite, or stainless steel impeller. System-lubricated, cast iron body.

D. 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. UL 778 listed for motor-operated water pumps, including protection against over/under voltage, thermal over-load (motor and electronics), over current, and protection for locked rotor and dry run/no-load condition.

E. Terminal Box to include gasketed cover, NPT power cable/conduit connection, with coded terminal strip indicating common/neutral/ground.

F. Controls: Single Phase Electronic Control Converter.

SPEC EDITOR: SELECT THE APPROPRIATE CONTROL SCHEME BELOW. EDIT FOR PROJECT-SPECIFIC PUMP CONTROL REQUIREMENTS. SOME PUMPS PROVIDE THE LISTED FUNCTIONS WITH THE ON-BOARD CONTROLLER VIA INTERNAL ALGORITHM OR SENSOR, SOME REQUIRE AN EXTERNAL SIGNAL, AND SOME CAN ACCOMMODATE EITHER. SOME LISTED FUNCTIONS ARE NOT OFFERED BY ALL THE LISTED MFRS. FURTHER, THE CHOSEN CONTROL SCHEME WILL DICTATE WHETHER THE PRODUCT REQUIRES A DIGITAL RS-485 COMMUNICATION CONNECTION (BACNET, MODBUS, OR LONWORKS), A 4-20MA EXTERNAL SIGNAL, OR CAN USE A SENSORLESS METHOD. CONTROL VIA DIGITAL COMMUNICATIONS WOULD LIKELY REQUIRE AN ADDITIONAL CONTROL MODULE.

1. Sensorless Control: Integral electronic variable speed controller shall provide the following user selectable modes of operation without the use of external(remote)sensors:
   a. Proportional Pressure/Maintain Flow Set Point.
   b. Constant Differential Pressure/Maintain Pressure Set Point.
   c. Constant Speed.
   d. Constant Temperature/Maintain Temperature Set Point
   e. Constant Temperature Rise/Differential
   f. Proportional P-T/Maintain Pressure Proportional to Varying Temperature
2. Sensor Control: The integral electronic variable speed controller shall accept an external sensor input of 4-20 mA and provide the following user selected modes of operation:

a. Proportional Pressure/Maintain Flow Set Point.
b. Constant Differential Pressure/Maintain Pressure Set Point.
c. Constant Temperature/Maintain Temperature Set Point
d. Constant Temperature Rise/Differential
e. Proportional P-T/Maintain Pressure Proportional to Varying Temperature

3. Remote Communication and Local Display: Provide single port BACnet 3-wire communication cable CAT 5/6 connection. The local display shall be field adjustable for horizontal of vertical position, allow control mode and set point changes, and display the following information:
a. Operating Status – On/Off.
b. Control Mode.
c. Current Set Point Parameter.
d. Fault and Warning Signals.

SPEC EDITOR: BASIS OF DESIGN: GRUNDFOS MAGNA 3; WILO STRATOS; B & G ECOCIRC XL.

G. Acceptable Manufacturers:

1. ITT Bell & Gossett.
2. Wilo.
3. Grundfos.

2.4 IN-LINE HORIZONTAL CLOSE COUPLED PUMPS - HANGER SUPPORTED

SPEC EDITOR: SIZE GENERALLY 1/4 TO 3HP. KEEP MOTOR IN HORIZONTAL POSITION WHERE POSSIBLE, BUT UNIVERSAL MOUNT MOTOR ALLOWS FOR ANY PIPE ORIENTATION. SUPPORT PUMP VIA PIPES, NOT MOTOR. TYPICALLY DO NOT USE FLEXIBLE COUPLINGS. CONSIDER ADDING CAST IMPELLER (VS STAMPED) AS REQUIRED.

A. Close/rigid coupled, single suction impeller. Ceramic mechanical seal. Permanently sealed, permanently lubricated.

B. Domestic Hot Water: Lead free.

C. Pump shall be equipped with an internally flushed seal assembly.

D. Provide universal mount motors that meet NEMA specifications and of size, voltage and enclosure indicated on Drawings. Motor shall be provided with heavy-duty, permanently lubricated ball bearings rated for the maximum load for which the pump is designed.

E. Acceptable Manufacturers:

1. ITT Bell & Gossett Series 60.
2. Armstrong.
3. Grundfos.
4. Weinman.
5. Taco Series 1600.
6. Patterson.

2.5 FLOOR-MOUNTED, VERTICAL IN-LINE SPLIT COUPLED PUMPS

SPEC EDITOR: GENERALLY, FOR SIZES MORE THAN 3HP; TO 1000 HP. TYPICAL SPLIT-COUPLED PUMPS CAN BE DIRECT-COUPLED OR FLEXIBLE-

COUPLED. CONSTRUCTION HAS BALL BEARINGS, MECHANICAL SEAL; THESE PUMPS ARE SUPPORTED/ANCHORED TO CONCRETE PAD, WITH INLET/OUTLET FLEXIBLE PIPE CONNECTORS. CONSIDER ADDING REQUIREMENT FOR FLEXIBLE COUPLING (DODGE, OMEGA, DURA - FLEX) FOR SEPARATE REMOVAL/REPLACEMENT OF LARGER (+15 HP) MOTORS. USE SLOWER SPEEDS 1800/1200 RPM FOR HIGH FLOW, LOW HEAD APPLICATIONS. VERTICAL MOTOR ORIENTATION OFFERS LOWER VIBRATION/NOISE, LOWER IMPELLER/SHAFT LOADING (LESS PRESSURE IMBALANCE), LOWER CAVITATION POTENTIAL. NO SUCTION DIFFUSER REQUIRED.

A. Split-coupled, single suction enclosed impeller. Mechanical seals. Carbon graphite throttle bushing.

B. Pump shall be equipped with an externally flushed seal assembly with manual air vent valve.

C. Provide universal mount motors that meet NEMA specifications and of size, voltage and enclosure indicated on Drawings. Motor shall be provided with heavy-duty, greaseable or permanently lubricated ball bearings rated for the maximum load for which the pump is designed.

D. Acceptable Manufacturers:

1. ITT Bell & Gossett Series 80-SC.
2. Armstrong.
3. Grundfos.
4. Weinman.
5. Taco KS Vertical Split coupled.

2.6 FLOOR MOUNTED, DOUBLE SUCTION PUMPS

SPEC EDITOR: THIS SECTION CAN BE USED FOR VERTICAL OR HORIZONTAL SPLIT CASE. EDIT TO SUIT PROJECT REQUIREMENTS. VERTICAL SPLIT CASE PUMPS SAVE SPACE BUT ARE SINGLE SOURCE AND SHALL ONLY BE SPECIFIED WITH THE PERMISSION OF THE U-M DESIGN MANAGER.

A. Single stage, double suction centrifugal, bronze fitted, base mounted, flexibly coupled pump.

B. Vertical or horizontal split case as indicated, cast iron volute with integrally cast feet, gauge ports at nozzles, vent, and drain ports. Horizontal shaft unless specifically indicated otherwise.

C. Stainless steel shaft designed for less than 0.002 inch deflection, with mechanical seals suitable for temperature and service scheduled, with re-greaseable bearings. Bearing life shall be L10 50,000 hr. life minimum. Bearing grease shall be rated to 700 Deg F and resist water/condensation washout.

D. Mechanical carbon face seal rotating against a stationary silicon carbide face.

E. Pump shall be equipped with an internally flushed seal assembly.

F. Impeller shall be of the enclosed double suction type made of low zinc silicon brass or bronze, hydraulically and dynamically balanced and keyed to shaft.

G. The pump bearings and mechanical seals shall be serviceable without disturbing the upper casing half, piping connections or electrical motor connections.

H. Base: Pump and motor shall be mounted on a single, rigid, groutable, welded, structural steel frame.

I. Acceptable Manufacturers Vertical Split Case Pumps:

1. ITT Bell & Gossett VSX.

J. Acceptable Manufacturers Horizontal Split Case Pumps.

1. ITT Bell & Gossett.
2. Armstrong.
3. Weinman.
4. Paco.
5. Patterson.

2.7 END-SUCTION, CLOSE-COUPLED PUMPS

SPEC EDITOR: BASIS OF DESIGN: SERIES 1531 BELL & GOSSETT. OCCASIONALLY USED FOR HYDRONIC SERVICE, OFTEN USED FOR DOMESTIC BOOSTERS.

A. Single stage, end suction centrifugal, bronze fitted, close-coupled with base plate.

B. Provide lead free when used for domestic water service.

C. Mechanical seals with ceramic seal seat and carbon seal ring. Oil or grease lubricated, bronze sleeve bearings. Provide slinger on motor shaft between motor and seals to prevent liquid that leaks past pump seals from entering the motor bearings.

D. Back pull-out design to allow pump bearings and seals to be serviced without disturbing piping.

E. Provide universal mount motors that meet NEMA specifications and of size, voltage and enclosure indicated on Drawings.

F. Acceptable Manufacturers:

1. ITT Bell & Gossett.
2. Armstrong.
3. Weinman.
4. Taco.
5. Patterson.

2.8 FLOOR-MOUNTED, END-SUCTION, FLEXIBLY-COUPLED PUMPS

SPEC EDITOR: BASIS OF DESIGN: SERIES BELL & GOSSETT 1510

A. Single stage, end suction centrifugal, bronze fitted, base mounted pump, flexibly-coupled.

B. Vertical split case back pull-out design to allow pump bearings and seals to be serviced without disturbing piping connections or electric motor connections.

C. Wear Rings (if provided as standard): Replaceable, bronze.

D. Mechanical seals with ceramic seat and carbon seal ring. Oil or grease lubricated, bronze sleeve bearings.

E. Base: Pump and motor shall be mounted on a single, rigid, groutable, welded, structural steel frame.

F. Acceptable Manufacturers:

1. ITT Bell & Gossett.
2. Armstrong.
3. Weinman.
4. Taco.
5. Patterson.

PART 3 - EXECUTION

3.1 GENERAL PUMP INSTALLATION

A. Install the pump as recommended by the manufacturer and as shown on the Drawings. Provide adequate clearance for service access.

B. Independently support piping from the pump casing, regardless of what is recommended by the manufacturer. Demonstrate to the Commissioner that the piping is independently supported.

C. Fill and vent the system of all air. Purge the pump of air as recommended by manufacturer; check for proper rotation.

D. Place the pump in service and check for proper operation. When required by the Commissioner, record voltage and amperage draw (separate from the T&B contractors work) and provide report to Commissioner.

3.2 IN-LINE PUMP INSTALLATION

A. Install suction and discharge flexible connectors as recommended by the manufacturer and as shown on the drawings.

B. Verify pump is designed for the intended orientation; horizontal versus vertical motor/shaft orientation.

C. Support the pump as recommended by manufacturer. Do not attach supports to motor.

3.3 FLOOR-MOUNTED PUMP INSTALLATION

A. Set pump base level, using stainless steel shims and metal blocks designed for leveling machinery bases. Anchor/attach to base as recommended by the manufacturer. Pre-align, connect piping, re-check alignment, and then grout with non-shrink grout.

B. Provide final alignment in field via laser alignment device, by the manufacturer's representative. Submit alignment test data for approval. If report indicates pump cannot be aligned properly, correct conditions and re-laser-align.

3.4 COMMISSIONING

A. Perform the commissioning activities as outlined in the Division 01 Section Commissioning and other requirements of the Contract Documents.

3.5 MANUFACTURER INSPECTION AND START-UP

A. For all floor mounted pumps and for all inline pumps greater than 3 HP, after installation and prior to operation, pump manufacturer's factory trained field representative shall inspect the pumps for proper installation and lubrication, final align pump/motor/coupling using laser alignment, conduct start-up, and submit written report.

END OF SECTION 232123