PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions and the following Specification sections apply to all Work herein:
1. Section 23 00 10 - General Requirements
2. Section 23 00 20 - HVAC Scope of Work
3. Section 23 05 07 - Design Conditions
4. Section 23 05 13 - Motor Requirements for HVAC Equipment
5. Section 23 05 48 - Vibration Isolation
6. Section 23 05 93 - Testing, Balancing, and Adjusting
7. Section 23 21 13 - Pipes, Valves, Fittings, and Accessories
8. Section 23 41 00 - Tanks and Vessels

1.2 SUMMARY

A. Furnish and install all pumps herein specified and as indicated on the Drawings.

1.3 REFERENCE STANDARDS

A. All pumps shall be designed, manufactured and tested in accordance with the latest applicable industry standards including the following:
1. ANSI
2. NEMA
3. OSHA
4. Energy Policy Act of 1992 (EP Act)

B. All equipment and material to be furnished and installed on this Project shall be UL or ET listed, in accordance with the requirements of the authorities having jurisdiction, and suitable for its intended use on this Project.

1.4 SUBMITTALS

A. The following submittal data shall be furnished according to the General Conditions and Section 23 00 10 and shall include, but not be limited to:
1. Condenser, Chilled and Heating Hot Water Pumps complete with capacity curves, test data, seals, construction details, motor horsepower, coupling and guard, electrical characteristics and pump rotation. Provide certified factory test data and capacity curves for pumps with motor horsepower exceeding 20 horsepower. Provide certified pump curves indicating system operating points fully developed across the entire pump range. Selection program generated curves indicating only the one specific system curve are not acceptable.
2. In-Line Pumps complete with capacity curves, test data, seals, construction details, motor horsepower, coupling and guard, electrical characteristics, rotation for pumps with motor horsepower exceeding 10 horsepower and pump controllers.
3. Variable Speed Drives* complete with enclosure construction details, line reactor or tuned filter data, design features, accessories, disconnect, capacitor, mechanical bypass, if specified, and spare parts data.
4. Prior to execution of factory testing and lab testing, submit test procedures, recording forms, and test equipment cut sheets to Engineer for review. Refer to Section 23 00 20 titled “Scope of Work” for “Scheduling Procedures”.
5. Factory Test Schedule.
6. Factory Hydrostatic Test Report.
7. Factory Dynamic Balance Report.
8. Factory Capacity Test Report.
9. Certified Factory Performance Test Curves.*
10. Field Test Schedule.
11. Field Test Reports.

B. All items or equipment listed above with asterisks (*) shall be certified by the manufacturer using Manufacturer Certification "MCA" as set forth in Section 23 00 10. See Section 23 00 10 for certification requirements.

C. Specification compliance review required. Refer to Section 23 00 10.

1.5 WARRANTY

A. Comply with the requirements of the General Conditions and Section 23 00 10.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. If it complies with these Specifications, centrifugal condenser, chilled and heating hot water pumps manufactured by one of the following manufacturers will be acceptable:
1. Armstrong
2. Aurora
3. Bell & Gossett
4. Chicago
5. Gould
6. Grundfos
7. Ingersoll-Rand/Dresser
8. Paco
9. Peerless
10. Taco
11. Weil
12. Worthington

B. If it complies with these Specifications, in line circulating pump (150 psig and below) manufactured by one of the following manufacturers will be acceptable:
1. Armstrong
2. Bell & Gossett
3. Grundfos
4. Ingersoll-Rand
5. Paco
6. Peerless
7. Taco

2.2 CENTRIFUGAL CONDENSER, CHILLED AND HEATING HOT WATER PUMPS

A. Centrifugal pumps shall be located where shown by the Drawings and shall have the capacities and service as listed in the schedules on the Contract Documents. Pumps shall be of the following types:
1. Double suction, split case, flexible coupled, bronze fitted with case wearing rings and shaft sleeves, single stage or two (2) stage centrifugal type with mechanical seal. Bearing housings shall be of the split type for ease of maintenance and shall be bolted and doweled to casing. In the schedules on the Contract Documents, this type of pump is marked ("DSSS") for "Double Suction Single Stage".
2. Double suction, split case, similar to single stage above, but two (2) stage centrifugal type. In the schedules on the Contract Documents, this type of pump is marked ("DSTS") for "Double Suction Two Stage".
3. Single suction, flexible coupled, bronze fitted, front and back wearing rings, of the single stage centrifugal type with mechanical seal. In the schedules on the Contract Documents, this type of pump is marked ("SSSS") for "Single Suction Single Stage".
4. Single or double suction, split coupled, vertical in line centrifugal pump similar to Armstrong Series 4300 with mechanical seal. In the schedules on the Contract Documents, this type of pump is marked ("SSV") for Single Suction Vertical.

B. The entire pump assembly including, but not limited to, the casing or enclosure, suction and discharge flanges and seals shall be suitable for operation with the "Pump Working Pressure" and temperatures indicated in the schedules on the Contract Documents. For the purpose of this Specification, the "Pump

Working Pressure" shall be defined as the sum of the scheduled maximum suction pressure and the maximum dynamic head at shutoff developed by the pump required for pumping duty specified. Each entire pump assembly shall be hydrostatically tested at the factory at least 50 psig pressure above the "Pump Working Pressure".

C. Pumps shall have dynamically balanced impellers and shall be capacity tested for design flow after final assembly. For each pump with a motor horsepower of 20 and larger, furnish a certified shop performance test curve indicating capacity, head, horsepower and efficiency at flow rates from shutoff to one hundred and twenty-five (125%) percent of design flow or for flow rates over the full range of the entire pump curve if the pump is non-overloading as indicated in the pump schedule. No pump shall be installed before its performance test data has been reviewed by the Engineer. Where the water balance determines the water flow exceeds one hundred and ten (110%) percent of the design flow with all valves wide open, the HVAC Subcontractor shall trim the pump impellers to provide flow within one hundred and ten (110%) percent of design flow. The pump manufacturer shall calculate the amount of trim required and provide this information to the Contractor in writing. Pumps shall be returned to the dynamically balanced condition and this shall be verified as specified in Section 23 05 93 titled "Testing, Balancing and Adjusting".

D. Pumps shall have Omega "E" Series, Woods Type "S", or Falk Steel Flex T10 or T20 couplings. Pumps controlled with variable speed drives shall have couplings, which are rated for variable speed duty, similar to Falk Steel Flex couplings. Face and radial coupling alignment and pump vibration shall be field checked on pumps driven by a motor over 50 H.P. See Section 23 05 93 titled "Testing, Balancing and Adjusting" for alignment and vibration tests. Provide factory manufactured coupling guards, which comply with OSHA requirements.

E. Horizontal base mounted type pump and motor assemblies shall be mounted on a common fabricated structural steel base with integral drip lip furnished by the pump manufacturer. The base shall have provisions for grouting and anchor bolts. The base shall have machined surfaces for the motor and pump mounting surfaces. Motor mounting shall permit horizontal adjustment. The base shall be of sufficient strength to prevent vibration, warping or misalignment of the pump and motor when installed without grouting. The base shall be rigidly bolted to the vibration isolation base and be filled with concrete or grout after installation on the isolation base. After final alignment, all pumps driven by a motor over 30 H.P. shall have the pump and motor doweled to the base with tapered pins.

F. End suction pumps and vertical in-line pumps may be mounted on a common fabricated structural steel base with a stainless steel drain pan factory installed under the pump, in lieu of an integral drip lip base, furnished by the pump manufacturer. Stainless steel drain pan shall be sized to catch all seal leakage or casing condensation from the pump.

G. The mechanical seals for chilled, condenser and heating hot water pumps shall be as manufactured by John Crane Company or approved equal and shall be suitable for the service specified herein and listed in the schedules on the Contract Documents.
   1. Seals for stuffing box working pressures 150 psig and below shall be John Crane Company Type 1 or 2. Seals for stuffing box working pressures greater than 150 psig shall be John Crane Company Type JC8B1 or JC8B2 pressure balanced shaft seals.
   2. For pumps handling treated fluids at temperatures up to 160ºF at the face of the seal, seal materials shall be John Crane Company Material Code BF501D1 for chilled water pumps and Material Code BF501D1 for condenser water pumps. For temperatures from 165ºF to 240ºF, seal materials shall be John Crane Company Type XP- 66-1D1.

H. Critical speed of each pump shall be at least one hundred and fifteen (115%) percent of the running speed listed in the schedules on the Contract Documents.

I. Pumps shall be free of flashing and cavitation at all flow rates from twenty-five to one hundred and twenty-five (25 - 125%) percent of design flow under the suction conditions of the pump installation. The Contractor shall provide pumps suitable for satisfactory operation with the available Net Positive Suction Head (NPSH).

J. The impeller selected for compliance with design requirements shall not exceed eighty-five (85%) percent of cut water diameter for the selected pump casing size. This shall be clearly indicated on the Shop Drawing submittal.

K. Each motor shall have a maximum speed of 1750 rpm and shall be selected to drive the pump through its characteristic curve, from zero flow to twenty-five (0 - 25%) percent above the design flow, without exceeding rated full load nameplate horsepower. Pump shall be non-overloading and the motor nameplate rating shall not be exceeded in pump operation anywhere on the pump curve for specific non-overloading pumps as listed in the schedules on the Contract Documents. See Section 23 05 13 titled "Motor Requirements for HVAC Equipment" for additional motor specification requirements.

L. Constant speed chilled water pumps serving variable flow systems, i.e., (pumps serving central chiller plant systems with pressure bypass valves, etc.) shall be selected by the pump manufacturer to provide 20 to 30 feet of W.C. differential between shutoff and the scheduled design operating condition.

M. Under Division 26 motor controllers for constant speed pumps will be furnished as indicated on the Drawings. The Division 23 Subcontractor shall transmit written certification that the size and type of the controller and the size of the overload heaters are acceptable.

2.3 IN-LINE CIRCULATING PUMP (150 PSIG AND BELOW)

A. In-line circulating pumps shall be direct coupled bronze or stainless steel fitted with a dynamically balanced brass or stainless steel enclosed type impeller and with mechanical seal. Mechanical seal shall be Type 1 or 2 material code BP-1D1 as manufactured by John Crane Company or an approved equal, suitable for service specified and listed in the schedules on the Contract Documents. Motor shall have a maximum speed of 1750 rpm. Pump capacities shall be as listed in the schedules on the Contract Documents.

B. Pumps, casings, flanges and seals shall be suitable for operation with the working pressures and temperatures indicated in the schedules on the Contract Documents. The scheduled working pressure applies to the entire pump assembly.

2.4 AIR HANDLING UNIT CONDENSATE PUMP

A. Provide and install condensate return systems as indicated on the Drawings with the capacity indicated in the schedules on the Contract Documents.

B. System shall be a simplex pumping system with a cast iron sump having an inlet center line no higher than 7". Pumps shall be all bronze construction with stainless steel shafts and built in brass strainer.

C. Control shall be a float switch in a NEMA 1 enclosure.

D. Condensate systems shall be similar and approved equal to Weil Series 4100.

PART 3 EXECUTION

3.1 INSTALLATION

A. All pumps shall be installed in accordance with the latest industry standards, per the manufacturer's recommendations, and as indicated on the Drawings.

3.2 FACTORY TESTING

A. All pumps shall be tested in accordance with the latest applicable industry standards and as specified herein.

3.3 FIELD TESTING

A. Prior to execution of field testing, submit test procedures, recording forms, and test equipment cut sheets to Engineer for review. Refer to Section 23 00 20 titled "Scope of Work" for "Scheduling Procedures".

B. The Subcontractor shall notify the Engineer and Owner in writing at least two (2) weeks prior to the day of the field test. The Engineer and Owner may witness the field test if they so desire.

C. Refer to Section 23 05 93 for additional testing requirements for pumps.

END OF SECTION