PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 230500 - Basic HVAC Materials and Methods, and other Sections in Division 23 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:
1. Flexible coupled end suction pumps.
2. In-line flexible coupled pumps.
3. In-line circulators
4. Expansion tanks - diaphragm type pre-pressurized.
5. Air separators.
6. Air elimination valve.
7. Suction diffusers.
8. Chemical pot feeders.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230500: Basic HVAC Materials and Methods

B. Section 230593: Testing, Adjusting and Balancing

C. Section 230900: Building Automation System (BAS) Controls

D. Section 230902: Variable Frequency Drives (VFD)

E. Section 233113: Air Distribution

F. Section 233412: Air Handling Equipment

G. Section 238239: Heat Transfer

H. Division 26: Electrical

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide systems that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products.

B. Codes and Standards: Provide pumps which conform to the requirements of:
1. Hydraulic Institute (HI): Manufacturer pumps in accordance with "Standards for Centrifugal Rotary and Reciprocating Pumps."
2. National Electrical Manufacturers Association (NEMA): Provide electrical components which comply with NEMA Standards.

3. National Fire Protection Association CEC: California electrical Code
4. Underwriters Laboratories (UL) UL-778: Motor Operated Water Pumps

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for units showing dimensions, weights (shipping, installed, and operating), capacities, ratings, performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, and installation instructions.
   1. Parallel pump plots: For all parallel and series pump applications submit a combined pump curve showing parallel pump operation and single pump non-overloaded operation verifying that the pump selections operate non-overloading on curve in a single pump operation.
   2. Submittal information to verify all scheduled characteristics are met including efficiency.

B. Shop Drawings: Submit manufacturer's shop drawings indicating dimensions, weight (shipping, operating), required clearances, methods of assembly of components, and location and size of each field connection.

C. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, tube replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in operating and maintenance manuals.

D. Wiring Diagrams: Submit manufacturer's ladder-type wiring diagrams for power and control wiring required. Differentiate between factory-installed and field-installed wiring.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver units to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products and units against dirt, water, chemical, and mechanical damage. Do not install damaged units - remove from project site.

C. Rigging: Comply with the manufacturer's rigging and installation instructions.

1.7 WARRANTY

A. Provide general one year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.1 FLEXIBLE COUPLED END SUCTION PUMPS

A. Furnish and install pumps with capacities as shown on plans. Pumps shall be base mounted, single stage, end suction design with true back pull-out, capable of being serviced without disturbing piping connections.

B. Pump volute shall be Class 30 cast iron with integrally cast pedestal support. The

impeller shall be cast bronze, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew. Impeller trim shall be no greater than 85% of the maximum impeller size for the pump.

C. The liquid cavity shall be sealed off at the pump shaft by an internally flushed mechanical seal with ceramic seal seat of at least 98% alumina oxide content, and carbon seal ring, suitable for continuous operation at 225° F. A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.

D. Pumps shall be rated for minimum of 175 psi working pressure. Casings shall have gauge ports at nozzles and vent and drain ports at top and bottom of casing.

E. Pump bearing housing assembly shall have heavy duty regreaseable ball bearings, replaceable without disturbing piping connections and have foot support at coupling end.

F. Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area. A flexible type coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor, and shall be equipped with an OSHA approved coupling guard. Contractor to level and grout each unit according to manufacturer's instructions.

G. The motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans. Pump and motor shall be factory aligned, and shall be realigned by contractor after installation. Provide premium efficiency motors in accordance with Section 230500.

H. Each pump shall be factory tested, it shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

I. Each unit shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for owner's reference.

J. Manufacturer: Bell & Gossett series "1510" or approved equal by TACO, PACO, Patterson, Peerless or Armstrong.

2.2 CLOSED COUPLED END SUCTION PUMPS

A. Furnish and install pumps with capacities as shown on plans. Pumps shall be close coupled, single stage, vertically split case design, capable of being serviced without disturbing piping connections.

B. Pump volute shall be Class 30 cast iron, and impeller shall be cast bronze enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew. Impeller trim shall be no greater than 85% of the maximum impeller size for the pump.

C. The liquid cavity shall be sealed off at the motor shaft by an internally flushed mechanical seal with ceramic seal seat of at least 98% alumina oxide content, and carbon seal ring, suitable for continuous operation at 225° F. A replaceable shaft sleeve of bronze alloy shall completely cover the wetted area under the seal.

D. Pumps shall be rated for minimum of 175 psi working pressure. Casings shall have gauge ports, and vent and drain ports at top and bottom of casing.

E. Motor shall meet NEMA specifications and shall be of the size, voltage and enclosure called for on the plans. It shall have heavy duty grease lubricated ball bearings, completely adequate for the maximum load for which the motor is designed. Provide premiumefficiency motors in accordance with Section 230500.

F. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

G. Each pump shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to pump for owner's reference.

H. Manufacturer: Bell & Gossett series "1531" or approved equal by TACO, PACO, Patterson, Peerless or Armstrong.

2.3 IN-LINE FLEXIBLE COUPLED PUMPS

A. Furnish and install pumps with capacities as shown on plans. Pumps shall be in-line type for installation in vertical or horizontal piping. Pump must be capable of being serviced without disturbing piping connections.

B. Pump body shall be of Class 30 cast iron, rated 175 psi working pressure, with gauge ports at nozzles, and with vent and drain ports.

C. Impeller shall be non-ferrous material, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew or nut. Impeller trim shall be no greater than 85% of the maximum impeller size for the pump.

D. The liquid cavity shall be sealed off at the motor shaft by an internally flushed mechanical seal with ceramic seal seat, and carbon seal ring, suitable for continuous operation at 225° F. A non-ferrous shaft sleeve shall completely cover the wetted area under the seal.

E. Pump bearing bracket shall have oil lubricated bronze journal and thrust bearings. Bracket shaft shall be alloy steel having ground and hardened thrust bearing faces. A flexible coupling to dampen starting torque and torsional vibrations shall be employed. Flexible coupling shall be equipped with an OSHA approved coupling guard.

F. Motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans. Provide premiumefficiency motors in accordance with Section 230500.

G. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

H. Manufacturer: Bell & Gossett series "60" or approved equal by TACO, PACO, Patterson, Peerless or Armstrong.

2.4 IN-LINE CLOSE COUPLED PUMPS

A. Furnish and install pumps with capacities as shown on plans. Pumps shall be in-line type, close coupled, single stage design, for installation in vertical or horizontal position, and capable of being serviced without disturbing piping connections.

B. Pump casing shall be Class 30 cast iron, and impeller shall be of cast bronze enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew. Impeller trim shall be no greater than 85% of the maximum impeller size for the pump.

C. The liquid cavity shall be sealed off at the motor shaft by an internally flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225° F. A bronze shaft sleeve shall completely cover the wetted area under the seal.

D. Pumps shall be rated for minimum of 175 psi working pressure. The pump case shall have gauge tappings at the suction and discharge nozzles and will include vent and drain ports.

E. Motor shall meet NEMA specifications and shall be of the size, voltage and enclosure called for on the plans. It shall have heavy duty grease lubricated ball bearings, completely adequate for the maximum load for which the motor is designed. Provide premiumefficiency motor in accordance with Section 230500.

F. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

G. Manufacturer: Bell & Gossett series "80" or approved equal by TACO, PACO, Patterson, Peerless or Armstrong.

2.5 IN LINE WATER LUBRICATED CIRCULATING PUMPS (SECONDARY PUMPING AND BOOSTER APPLICATIONS)

A. Furnish and install pumps with capacities as shown on plans. Pumps shall be in-line type for installation in vertical or horizontal piping. Pump must be capable of being serviced without disturbing piping connections.

B. Pump body shall be of all bronze construction, rated 175 psi working pressure, with gauge ports at nozzles, and with vent and drain ports.

C. Impeller shall be non-ferrous material, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew or nut.

D. The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat, and carbon seal ring, suitable for continuous operation at 225°F. A non-ferrous shaft sleeve shall completely cover the wetted area under the seal.

E. Motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans.

F. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

G. Provide H-O-A switch with overload protection. Pump shall run continuously. Wiring between switch and pump provided under Division 23, as stated in Section 230500.

H. Manufacturer: ITT Bell and Gossett Series SLC-25, TACO, Armstrong SS-30 through 100, Grundfos UP-15 & 26.

2.6 CONDENSATE RETURN PUMP AND RECEIVER SETS

A. General: Provide as indicated, packaged duplex condensate pump and receiver sets, of capacity as scheduled, consisting of cast-iron receiver, inlet strainer, duplex water pumps, float switches, electrical controls, and accessories.

B. Receiver: Construct of close-grained case iron. Equip with externally adjustable 2 pole float switches, water level gage, condensate thermometer, pump discharge pressure gages, bronze isolation valves between receiver and pump, and 2 lifting eye bolts. Provide isolation valve on inlet of each pump.

C. Strainer: Equip receiver inlet with cast-iron inlet strainer with self-cleaning bronze screen, dirt pocket, and clean-out plug.

D. Pump: Flange mount centrifugal water pump on receiver. Provide close-coupled pump, vertical design, permanently aligned, bronze fitted, equipped with stainless steel shaft, enclosed bronze impeller, renewable bronze case ring, and mechanical shaft seal. Provide drip-proof motor close-coupled to pump.

E. Control Panel: Provide wall mounted NEMA II control cabinet factory-wired for external electrical connection only, with hinged door and grounding lug. Provide the following within cabinet:
1. Combination magnetic starter for each pump.
2. Electrical alternator.
3. Momentary contact "Test" push buttons for each pump.
4. Numbered terminal strip.
5. Fusible control circuit transformer for each circuit.

F. Control Circuits: Provide completely independent pump control circuit for each pump. Provide electrical alternator to:
1. Change operating sequence automatically after each cycle.
2. Provide simultaneous operation under peak load conditions.
3. Operate idle pump automatically, should active pump or its controls fail.

G. Manufacturer: Alyn, Weil or approved equal.

2.7 EXPANSION TANKS

A. Diaphragm Type Pre-pressurized:
1. The pressurization system shall include a diaphragm-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. It shall maintain minimum operating pressure necessary to eliminate all air. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank.
2. The expansion tank shall be welded steel, constructed, tested and stamped

in accordance with Section VIII of the ASME Code for a working pressure of 125 psi and precharged to the minimum operating pressure.

3. The manufacturer shall be Wessels, ELBI, Amtrol or approved equal with at least five years experience in the fabrication of diaphragm-type ASME expansion tanks.

2.8 AIR SEPARATORS

A. Tangential and coalescing media type:
   1. All free air originally contained in the system, and all entrained air bubbles carried by system water shall be eliminated at all system points as indicated on the drawings.
   2. The air separator shall be welded steel, constructed, tested and stamped in accordance with Section VIII of the ASME Code for a working pressure of 125 psi.
   3. Air separators shall be sized as indicated on plans.
   4. Provide with strainer unless otherwise noted.
   5. Manufacturer: Bell & Gossett, TACO, Patterson, Wheatley, Armstrong, Spirovent or approved equal.

2.9 AIR ELIMINATION VALVE (AUTOMATIC)

A. Air shall be eliminated to the atmosphere as fast as it is separated from system water, through a float activated remote pressure operated, air elimination valve installed at the top of the air separator.

B. The air elimination valve shall have a high removal rate at low pressure differentials and shall be fully open for the removal of air at all pressures in the operating range from 2 to 150 psig. It shall be tightly sealed against loss of system water and prevent entrance of air in negative pressure situations.

C. The air elimination valve shall be constructed of metal and all working parts shall be non-corrosive. Working pressure shall be 125 psi.

D. Provide minimum 3/8” drain line from vent and route to nearest floor drain or floor sink or other approved drainage location.

E. Manufacturer: Amtrol, Hoffman or approved equal.

2.10 SUCTION DIFFUSERS

A. Furnish and install as shown on plans, an angle pattern flow straightening fitting equipped with a combination diffuser-strainer-orifice cylinder, flow straightening vanes, start-up strainer, permanent magnet and adjustable support foot. The combination diffuser-strainer-orifice cylinder shall be designed to withstand pressure differential equal to the system pump shutoff head and shall have a free area equal to five times the cross section area of the pump suction opening. The length of the flow straightening vanes shall be no less than 2-1/2 times the diameter of the system suction connection.

B. Fitting to be of cast iron construction with flanged connections unless otherwise noted. See plan for sizes.

C. The fitting shall have a stainless steel combination diffuser-strainer-orifice cylinder with 3/16 inch diameter perforation to protect system pump. Provide with stainless steel straightening vanes. Start-up strainer to be 16 mesh bronze. All internal components to be replaceable.

D. Manufacturer: Bell & Gossett, TACO, Patterson, Wheatley, Victaulic or approved equal.

2.11 CHEMICAL POT FEEDER

A. Provide five gallon pot feeder with removable cover, bottom drain valve, and shut-off valves. Provide balancing valve and check valves as shown on Drawings.

B. Mount on support stand or to the wall and pipe between the supply and return piping as shown on Drawings. Provide clearance under the pot feeder for draining.

C. Manufacturer: Dearborn, Garrett-Callahan, J.L Wingert or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment, unless otherwise shown or noted on the Drawings, is to be installed in accordance with industry standards and manufacturer's recommended installation instructions.

B. Grouting Pump Base: For all base mounted flexibly coupled pumps fill the pump base frame with grout after completing pump/motor alignment.

C. Provide vibration isolation, inertia bases, seismic snubber, flexible pipe connections, etc, as specified in related specification sections.

D. For variable flow pumping applications, see Section 230902 for additional requirements.

E. Mechanical contractor to assist testing and balancing contractor in verifying correct pump rotation and system operation.

F. Flush and clean equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls.

G. Isolation for Service: Provide pump installations with a discrete isolation valve on both the supply and intake side of the pump to permit service of the pump and any related strainer, check or balancing valves. Triple duty valves are not equivalent for this shut-off service.

H. Balancing Coordination and Impeller Trimming: Coordinate final pump flow with test and balance contractor. For pumps larger than 5 horsepower, if the system tests and balance indicate that flow exceeds the specified flow by greater than 20%, it is not acceptable to reduce flow merely by adjusting balance valves to create additional head or reducing VFD peak flows. Excess system flow must be reduced by trimming the impeller to match the load.

3.2 MANUFACTURER'S START-UP SERVICES

A. The manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, verify pump systems mounting, verify piping installation, verify control wiring, verify power wiring, and check for proper operation. The service technician shall provide final adjustments to meet the specified performance requirements. Fully staffed parts and service personnel shall be within four hours travel from the jobsite.

END OF SECTION