SECTION 22 10 00 - PLUMBING PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The Conditions of the Contract and applicable requirements of Division 1, "General Requirements", and Section 23 01 00, "Mechanical General Provisions", govern this Section.

1.2 DESCRIPTION OF WORK:

A. Work Included: Provide pumps as specified, scheduled, and indicated.

B. Types: The types of plumbing pumps required for the project include, but are not limited to, the following:

1. **[Hydropneumatic]** domestic water pumping systems.
2. Sewage ejectors.
3. Sump pumps.
4. Hot water circulating pumps.
5. Elevator sump pumps.
6. Remote plumbing pump annunciator panels.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Provide products complying with these specifications and produced by one of the following:

1. Pumps:

a. Allis-Chalmers Corporation.
b. Armstrong Pumps, Inc.
c. Aurora Pump Company.
d. Bell and Gossett, ITT Division.
e. Burks.
f. Clow.
g. Crane Company.
h. Fairbanks-Morse.
i. Grundfos.
j. ITT A-C Pump.
k. Ingersol-Rand.
l. PACO Pumps.
m. Patterson.
n. Peabody-Barnes, Inc.
o. Peerless.
p. SyncroFlo, Inc.
q. Systecon.
r. Taco, Inc.
s. Thrush.
t. Weil Pump Company.
u. Weinman.
v. Worthington Pump Division, Dresser Industries.
w. Canariis Corporation

2. Hydropneumatic Tanks:

a. Amtrol, Inc.
b. Taco.
c. Woods.

B. Electrical Standards: Provide electric motors and products which have been listed and labeled by Underwriters' Laboratories, Inc. (UL) and comply with National Electrical Manufacturers' Association (NEMA) standards.

C. Certification, Pump Performance: Provide pumps whose performance, under specified conditions, is certified by the manufacturer.

1.4 SUBMITTALS:

A. Shop drawing submittals shall include, but not be limited to, the following:

1. Pump cut sheets with all pump capacities, characteristics, features, accessories and options clearly indicated.
2. Pump curves with selection point clearly indicated.
3. Motor data as required in Section 23 04 00.
4. Control panel **[and] [,]** controller **[and remote annunciator]** information including front panel elevation, nameplate text, wiring diagram, component list and written system operational sequence.
5. Hydropneumatic tank with all ratings, capacities, features and accessories listed.
6. Sump and valve box drawings with all sizes, capacities, features and accessories listed.
7. Additional information as required in Section 23 01 00.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver pumps, controllers, and accessories in factory-fabricated water-resistant wrapping.

B. Handle pumps, controllers, and accessories carefully to avoid damage to material component, enclosure, and finish.

C. Store pumps, controllers, and accessories in a clean, dry space and protect from the weather.

PART 2 - PRODUCTS

2.1 **[HYDROPNEUMATIC]** DOMESTIC WATER PUMPING SYSTEMS:

A. General: Provide a prefabricated **[duplex,] [triplex,]** variable volume, constant speed, constant pressure domestic water pumping system consisting of a **[duplex] [triplex]** pump and motor set, **[hydropneumatic tanks]** a control panel and related piping and accessories, and capable of automatically providing system flows and pressures as scheduled and shown as on the Drawings.

[EDIT TO SUIT PROJECT]

B. Operation: [The system shall be designed for one pump to run continuously and the second [and third] pump[s] to operate only at periods of high demand. A time switch shall be provided to shutdown the lead pump during off hours.] [The system shall be designed for the pumps to cycle on to meet flow demands. At time of low and/or no flow, all pumps shall remain off and the hydropneumatic tank draw down shall satisfy the system demand.] A lead/[lag] [lag1/lag2] switch shall be provided. Automatic controls shall be provided to shutdown all pumps at low inlet pressure conditions [and upon low water level in the break tank]. A low pressure alarm bell and light shall be provided. [The lag pump[s] shall cycle "ON" and "OFF" at pressures as scheduled below, subject to the minimum run timer.] Pumps are to be selected for a minimum increase in TDH between design and zero demand.

[INCLUDE ONLY WITHOUT HYDRO TANK]

1. **[Lag [1 and Lag 2] pump ON and OFF pressures shall be field adjustable and shall be factory preset as follows:**

Pump	On Pressure	Off Pressure
Lag 1 Domestic Water Pump	**[_____] PSI**	**[_____] PSI**
[Lag 2 Domestic Water Pump	**[_____] PSI**	**[_____] PSI]** **]**

[INCLUDE ONLY WITH HYDRO TANK]

C. Hydropneumatic Tank: Provide, where shown on the Drawings, a vertical bladder type hydropneumatic tank with a minimum capacity of **[370] [__]** US gallons, and constructed for **[125] [__] psig** working pressure. Hydropneumatic tank shall be steel, designed and stamped in accordance with ASME and National Board Stamped with a replaceable heavy duty butyl diaphragm and rigid polypropylene liner, stainless steel inlet, relief, drain and charging connections, air charging valve hand hole and relief valve. Tank shall be factory precharged to provide the capacity specified.

D. Pumps:

[SELECT ONE OF THE FOLLOWING]

1. **[Provide horizontal base mounted, flexible coupled, bronze fitted, rear pullout, centrifugal type, mechanical seal pumps of the size, capacity and head scheduled on the drawings. Pump selections and submittals shall be made using pressure versus flow curves. Pump discharge velocity shall not exceed 12'per second. The total dynamic head shall be maximum at no-flow and shall decrease from no flow to design flow. Shutoff head shall be at least 110% of design head but shall not exceed 140% of design head. All pump shall have dynamically balanced impellers and the critical speed of all pumps shall be at least 115% of the design speed. Pumps shall be free from flashing and cavitation at all flow rates from 25% to 125% of design flow under the suction conditions of the pump installation.]**

[OR]

2. **[Provide constant speed, vertical multistage diffuser pumps with stainless steel shafts, water-lubricated bronze radial bearings, mixed flow balanced bronze impellers, and cast iron bowls with glass-lined diffusers. Pump barrels shall have a corrosion-inhibiting lining. Discharge head shall be fabricated steel with continuous bypass for low seal pressure. Seal shall be sleeve-mounted and replaceable without motor removal, pump disassembly, or disturbing the piping connections. Each pump shall have vibration-isolating mounts and a reinforced flexible pipe connection on each pump discharge line.]**

3. Pumps, casings, fittings, flanges and seals shall be suitable for operation at **[150]** psig minimum and shall be suitable for use within the normal temperature operating ranges of the system in which they are installed. Pump suction and discharge flanges shall be ANSI **[125#]** flanges suitable for working pressures up to **[150]** psi. Pumps shall have carbon steel shafts, stainless steel shaft sleeves, bronze impeller, bronze front and rear casing wear rings, stainless steel impeller keys and steel casing bolts.

4. Mechanical seals shall be suitable for the working pressure and temperature of the pump application. All metal seal parts shall be 316 stainless steel. Mechanical seals shall be as manufactured by the John Crane Company and shall be suitable for the service specified. Seals for stuffing box working pressures of **[150]** psi shall be Type 1 or Type 2 **[un]**balanced seals. Seal material shall be Type BP (66) 1D1 for treated fluids up to 180°F.

5. All pumps shall have high-temperature grease-lubricated ball bearings with grease fittings and relief plugs. Bearings shall have 40,000 hours minimum life for suction pressures below 200 psi

and 20,000 hours minimum life for suction pressures 200 psi and above. Bearings shall limit impeller and mechanical seal face deflection to a maximum of 0.002".

6. Pump couplings shall be Woods Type SC Sure-flex flexible couplings. Coupling alignment shall be field calibrated to a maximum of 2 mils vibration.

7. All pumps shall have cast iron or fabricated steel drip lip bases with coupling guards, anchor bolts, provisions for grouting and shall have provisions for collection of all seal and condensation leakage. Motor and pump mounting surfaces shall be machined and the motor mounting shall include provisions for horizontal movement and alignment. A 3/4" minimum threaded outlet shall be provided in the base for drainage. All bases shall have sufficient strength to prevent vibration, warping and misalignment when installed without grouting. Bases on pumps shall be adequately stiffened to prevent flexing of panels.

8. Pump motors shall be **[energy efficient, high efficiency]** 1750 rpm open drip-proof type and shall be selected to drive the pump through its characteristic curve from zero flow to 125% of design flow without exceeding rated full load nameplate horsepower. Refer to Section 15140 for additional motor requirements.

9. Pumps with drive motors 10 hp and larger shall be individually factory capacity tested after final assembly. Provide certified copies of test results showing capacity, head, horsepower and efficiency at flow rates from shut off to 125% of design flow. The certification shall also indicate results of factory dynamic balance and pressure testing.

[INCLUDE ONLY WITHOUT HYDRO TANK]

10. **[To prevent casing overheat during periods of no flow, the contractor shall install individual bleed-off lines from the pump casings to the [surge tank] [nearest floor drain as shown on the Drawings]. Provide individual temperature control valves, solenoid valves and shutoff valves for each pump. The temperature control valve shall bleed water should pump casing water temperature exceed 90°F. The bleed-off solenoid valve (N.C.) shall be interlocked to open only when the pump is operating.]**

E. Control Panel:

1. The control panel shall be **[wall mounted] [free standing] [unit mounted]**, NEMA 1 construction, prewired for a single point electrical input with the following components:

   a. **[Two] [Three]** FVNR magnetic starters with 3-phase overload protection, phase failure relays (Refer to Section 15140), fused disconnect switches with external operators and green run indicator lights for each pump.

   b. **[Two] [Three]** H-O-A selector switches, one for each pump.

   c. One manual alternator switch to select Lead and Lag **[1 or Lead and Lag 2]** pumps.

   d. Adjustable mercoid pressure control and 0-30 minute adjustable run timer**[s]** for **[Lag Pump[s] [1 and 2]] [each pump]**.

   e. One adjustable pressure control relay, panel mounted signal light and alarm bell with silence button for low pressure**[/low water level]** shutdown and alarm.

   f. Fused Control Power Transformers.

   g. Pump controls.

[SELECT ONE OF THE FOLLOWING]

h. [One 7 day time switch programmer which, at predetermined times shall shut down the lead pump. During this interval the lag pump shall respond to demands by sensing a drop in system pressure.]

[OR]

i. [Programmable Controller shall have the following features:]

1) **[A nonvolatile memory with no battery back-up which prevents memory loss due to power failures.]**

2) **[A program cartridge which allows program changes to be made by the factory and transmitted to the field for simple loading into the controller by the operator.]**

3) **[The controller must be of modular construction so that input, output, processor, and memory sections may be replaced separately and easily.]**

4) **[Input and output "ON" status lights must be supplied for ease of monitoring.]**

5) **[The controller must be designed for use in locations where electromagnetic noise, high temperature, humidity, and mechanical shock may exist.]**

6) **[The controller must also be UL and CSA-approved.]**

7) **[Program features for [two] [three] pump systems shall include the following:]**

a) **[Adjustable time delays on all pump stop signals with automatic and manual time out.]**

b) **[Adjustable time delays on all lag pump start signals.]**

c) **[Flow switch control of lag pumps with minimum run timer.]**

d) **[Automatic and manual alternation of equal capacity pumps.]**

e) **[Automatic lag pump exerciser.]**

f) **[Multiple stage low system pressure alarm.]**

g) **Multiple stage low suction pressure alarm.]**

h) **[Multiple stage high system pressure alarm.]**

i) **[Adjustable time delays for each alarm system.]**

j) **[An intermittent audible alarm horn.]**

k) **[Indication of first actuated alarm.]**

l) **[A single dry contact which indicated normal, alarm, and power failure conditions.]**

m) **[Lead pump shutdown capability for present or future use.]**

j. One set of engraved nameplates for all control switches and indicator lights.

k. One set of auxiliary contacts (N.C.) for low-pressure and power failure alarm. Contacts shall be held open under normal conditions and shall be closed under alarm. Contacts will be monitored by **[_____]**.

l. One set of auxiliary contacts (N.O.) on starters for remote indication of pump operation. Contacts will be monitored by **[_____]**.

m. One set of auxiliary contacts (N.O.) on starters for interlocking with casing solenoid valves.

n. One remote annunciator for domestic water pumps. Annunciator shall include run-light for each pump and a low pressure/power failure alarm light and sonolert with silence switch. (This annunciator may be combined with other Plumbing System equipment annunciators).]

2. The panel shall be internally prewired at the factory and tested in accordance with the provisions of the National Electrical Code. Panel shall have the UL-listing mark for industrial control panels.

3. **[The domestic water pump control panel shall be interlocked with a normally closed contact in the surge tank water level alarm such that all domestic water pumps are shutdown prior to the surge tank water level dropping below the pump suction connection [and with the fire pump controller[s] such that all domestic water pumps are shutdown on fire pump operation].]**

4. **[A 120 volt alarm bell with flashing light, automatic reset silence button and engraved nameplate shall be furnished for installation and wiring by Division 16 as a low water level/ power failure alarm.]**

F. Piping and Accessories: System shall include individual 4-1/2" ASA Grade A pressure gauges for pumps, indicating system, and suction pressures, all flush-mounted in a gauge panel directly above the power and control panel.

[EDIT TO SUIT PROJECT]

G. Factory Assembly: The entire booster system shall be factory-prefabricated on a common structural steel stand with all interconnecting piping and wiring complete and operationally tested prior to shipment. Complete package shall also include isolation valves on the suction and discharge of each pump. **[Provide a pilot-operated pressure regulating valve on the inlet side of the pumping system to assure constant pressure on the suction side of pumps.]** System pressure shall be maintained by a pilot-operated diaphragm type, pressure-regulating valve on each pump discharge line. Valve body shall be cast iron with epoxy-coated cover and brass or epoxy-coated disc guide, disc retainer and diaphragm washer. In addition, separate spring loaded, nonslam type check valves shall be provided. **[Water side pipe connections to the hydropneumatic tank shall be between the discharge of the lead pump and its pressure reducing valve to assure constant pressure.]** Galvanized steel suction and discharge pipe manifolds, as well as copper tubing with shutoff cocks for gauges and pressure switches, will be furnished assembled. The only field connections required will be system suction, discharge, and power connection at the control panel.

H. Factory Testing: The factory shall certify in writing that the water pressure booster system and its component parts have undergone a complete electric and hydraulic test prior to shipment. Test shall include a "System Operating Flow Test", from zero to 100% design flow rate under specified suction and net delivery pressure conditions. Certification shall include copies of the test data as recorded by the x-y plotter. System test may be witnessed by Owner, Architect, or Consulting Engineer by reporting intent to do so to the factory.

I. Warranty: The internal multistage pumping assemblies and pressure regulating valves shall be guaranteed for 5 years from date of shipment against defective material and workmanship. Motors shall also be guaranteed for 5 years from date of shipment against burn-out from any cause when equipped with standard over temperature protection system and maintained according to factory instructions. The water pressure booster system, as a whole, shall be guaranteed in writing by the manufacturer for a period of one year from date of shipment against defects in design, materials, or construction.

J. Start-up Service: A factory-trained representative shall be made available on the job site to check installation, provide system start-up and provide 8 hours of training for operating personnel.

2.2 HYDROPNEUMATIC DOMESTIC WATER PUMPING SYSTEM:

A. General Provide a Hydropneumatic Domestic Water Pumping System consisting of a galvanized vertical bladder type hydropneumatic tank, a duplex pump and motor set, a control panel and related piping and accessories, capable of automatically providing system flows and pressures as scheduled and as shown on the Drawings.

B. Operation: One pump shall be selected as the lead pump and will start and stop in response to its pressure switch which shall be set for **[**_____**]** psi off, **[**_____**]** psi on. Should the pressure drop to **[**_____**]** psi, the second pump (designated as the lag pump) shall commence operation and shall remain in operation until system pressure reaches **[**_____**]** psi, at which time the lag pump shall

shutdown. The controls shall also incorporate a minimum run timer which shall hold the pumps in operation for a minimum of 3 minutes once they have started.

1. At time of low and/or no flow, pumps shall remain off and the hydropneumatic tank drawdown shall satisfy the system demands.

C. Hydropneumatic Tank: Provide, where shown on the Drawings, a vertical bladder type hydropneumatic tank with a minimum capacity of **[86] [_____]** US gallons, and constructed for **[125 psig] [_____ psig]** working pressure. Minimum drawdown shall be **[30.7] [_____]** US gallons. Hydropneumatic tank shall be steel, designed and stamped in accordance with ASME and National Board stamped with a replaceable heavy duty butyl diaphragm and rigid polypropylene liner, stainless steel inlet, relief, drain and charging connections, air charging valve hand hole and relief valve. Tank shall be factory pre-charged to provide the capacity specified.

D. Pumps:

[SELECT ONE OF THE FOLLOWING]

1. **[Provide horizontal base mounted, flexible coupled, bronze fitted, rear pullout, centrifugal type, mechanical seal pumps of the size, capacity and head scheduled on the drawings. Pump selections and submittals shall be made using pressure versus flow curves. Pump discharge velocity shall not exceed 12'per second. The total dynamic head shall be maximum at no-flow and shall decrease from no flow to design flow. Shutoff head shall be at least 110% of design head but shall not exceed 140% of design head. All pump shall have dynamically balanced impellers and the critical speed of all pumps shall be at least 115% of the design speed. Pumps shall be free from flashing and cavitation at all flow rates from 25% to 125% of design flow under the suction conditions of the pump installation.]**

[OR]

2. **[Pumps shall be constant speed, vertical multistage diffuser pumps with stainless steel shafts, water-lubricated bronze radial bearings, mixed flow balanced bronze impellers, and cast iron bowls with glass-lined diffusers. Pump barrels shall have a corrosion-inhibiting lining. Discharge head shall be fabricated steel with continuous bypass for low seal pressure. Seal shall be sleeve-mounted and replaceable without motor removal, pump disassembly, or disturbing the piping connections. Each pump shall have vibration-isolating mounts and a reinforced flexible pipe connection on each pump discharge line.]**

3. Pumps, casings, fittings, flanges and seals shall be suitable for operation at **[150]** psig minimum and shall be suitable for use within the normal temperature operating ranges of the system in which they are installed. Pump suction and discharge flanges shall be ANSI **[125#]** flanges suitable for working pressures up to **[150]** psi. Pumps shall have carbon steel shafts, stainless steel shaft sleeves, bronze impeller, bronze front and rear casing wear rings, stainless steel impeller keys and steel casing bolts.

4. Mechanical seals shall be suitable for the working pressure and temperature of the pump application. All metal seal parts shall be 316 stainless steel. Mechanical seals shall be as manufactured by the John Crane Company and shall be suitable for the service specified. Seals for stuffing box working pressures of **[150]** psi shall be Type 1 or 2 **[un]**balanced seals. Seal material shall be Type BP (66) 1D1 for treated fluids up to 180°F.

5. All pumps shall have high-temperature grease-lubricated ball bearings with grease fittings and relief plugs. Bearings shall have 40,000 hours minimum life for suction pressures below 200 psi and 20,000 hours minimum life for suction pressures 200 psi and above. Bearings shall limit impeller and mechanical seal face deflection to a maximum of 0.002".

6. Pump couplings shall be Woods Type SC Sure-flex flexible couplings. Coupling alignment shall be field-calibrated to a maximum of 2 mils vibration.

7. All pumps shall have cast iron or fabricated steel drip lip bases with coupling guards, anchor bolts, provisions for grouting and shall have provisions for collection of all seal and condensation leakage. Motor and pump mounting surfaces shall be machined and the motor mounting shall include provisions for horizontal movement and alignment. A 3/4" minimum threaded outlet shall be provided in the base for drainage. All bases shall have sufficient strength to prevent vibration, warping and misalignment when installed without grouting. Bases on pumps shall be adequately stiffened to prevent flexing of panels.

8. Pump motors shall be **[energy efficient, high efficiency]** 1750 rpm open drip-proof type and shall be selected to drive the pump through its characteristic curve from zero flow to 125% of design flow without exceeding rated full load nameplate horsepower. Refer to Section 15140 for additional motor requirements.

9. Pumps with drive motors 10 hp and larger shall be individually factory capacity tested after final assembly. Provide certified copies of test results showing capacity, head, horsepower and efficiency at flow rates from shut off to 125% of design flow. The certification shall also indicate results of factory dynamic balance and pressure testing.

E. Control Panel:

1. The control panel shall be wall mounted, NEMA 1 construction, prewired for a single point electrical connection with the following components:

   a. Two FVNR magnetic starters with 3-phase overload protection, phase failure relays (Refer to Section 15100), fused disconnect switches, and green run indicator lights for each pump.

   b. Two H-O-A selector switches, one for each pump.

   c. One manual alternator switch to select lead and lag pumps.

   d. Two adjustable mercoid pressure controls and adjustable 0 - 10 minute run timers, (one for each pump).

   e. One fused Control Power Transformer.

   f. One adjustable pressure control relay, panel mounted signal light and alarm bell with silence button for low pressure **[/low water pressure]** shutdown and alarm.

   g. One set of engraved nameplates for all control switches and indicator lights.

   h. Two pump run time meters, one for each pump.

   i. One set of auxiliary contacts (N.C.) for low-pressure and power failure alarm. Contacts shall be held open under normal conditions and shall be closed under alarm. Contacts will be monitored by **[_____]**.

   j. One set of auxiliary contacts (N.O.) on starters for remote indication of pump operation. Contacts will be monitored by **[_____]**.

   k. [One remote annunciator for domestic water pumps. Annunciator shall include run-light for each pump and a low pressure/power failure alarm light and sonolert with silence switch. (This annunciator may be combined with other plumbing system equipment annunciators). The panel shall be internally prewired at the factory and tested in accordance with the provisions of the National Electrical Code. Panel shall have the UL-listing mark for industrial control panels.]

2. The panel shall be internally prewired at the factory and tested in accordance with the provisions of the National Electrical Code. Panel shall have the UL-listing mark for industrial control panels.

3. **[The domestic water pump control panel shall be interlocked with a normally closed contact in the surge tank water level alarm such that all domestic water pumps are shutdown prior to the surge tank water level dropping below the pump suction connection and with the fire pump controller[s] such that all domestic water pumps are shutdown on fire pump operation].**

4. **[A 120 volt alarm bell with flashing light, automatic reset silence button and engraved nameplate shall be furnished for installation and wiring by Division 16 as a low water level/power failure alarm.]**

F. Piping and Accessories:

1. System pressure shall be maintained by a pilot-operated diaphragm type, pressure-regulating valve on each pump discharge line. Valve body shall be cast iron with epoxy-coated cover and brass or epoxy-coated disc guide, disc retrainer and diaphragm washer. In addition, separate spring loaded, nonslam type check valves shall be provided. Water side pipe connections to tank shall be between the discharge of the lead pump and its pressure reducing valve to assure constant pressure.

2. System shall include individual 4-1/2" ASA Grade A pressure gauges for pumps, indicating system and suction pressures, all flush-mounted in a gauge panel directly above the control panel.

3. **[Provide a pilot-operated pressure regulating valve on the inlet side of the pumping system to assure constant pressure on the suction side of the pumps.]**

G. Factory Assembly: The entire booster system shall be factory-prefabricated on a common structural steel stand with all interconnecting piping and wiring complete and operationally tested prior to shipment. Complete package shall also include isolation valves on the suction and discharge of each pump. Galvanized steel suction and discharge pipe manifolds, as well as copper tubing with shutoff cocks for gauges and pressure switches, will be furnished assembled. The only field connections required will be system suction, discharge, and power connection at the control panel.

H. Factory Testing: The factory shall certify in writing that the water pressure booster system and its component parts have undergone a complete electric and hydraulic test prior to shipment. Test shall include a "System Operating Flow Test", from zero to 100% design flow rate under specified suction and net delivery pressure conditions. Certification shall include copies of the test data as recorded by the x-y plotter. System test may be witnessed by Owner, Architect, or Consulting Engineer by reporting intent to do so to the factory.

I. Warranty: The internal multistage pumping assemblies and pressure regulating valves shall be guaranteed for 5 years from date of shipment against defective material and workmanship. Motors shall also be guaranteed for 5 years from date of shipment against burn-out from any cause when equipped with standard over temperature protection system and maintained according to factory instructions. The water pressure booster system, as a whole, shall be guaranteed in writing by the manufacturer for a period of one year from date of shipment against defects in design, materials, or construction.

J. Start-up Service: A factory-trained representative shall be made available on the job site to check installation, provide system start-up and provide 8 hours of training for operating personnel.

2.3 SEWAGE EJECTORS:

[REFER TO ALTERNATE TEXT BELOW]

A. General: Provide a duplex, packaged submersible sewage ejector system designed for discharge **[through the cover] [below the cover]**. The system shall be complete with all required components including, but not limited to: **[fiberglass pump basin,] [basin cover]**, submersible pumps, pump quick removal system, waterproof junction box, float switch controls and a system control panel.

Sewage ejector capacity and electrical characteristics shall be as scheduled and as shown on the Drawings.

[SELECT ONE OF THE FOLLOWING]

[VERIFY OPERATION]

B. System Operation: Provide system operation as follows:

1. On liquid level rise in the pump basin, the lowest level (first) mercury switch shall energize, then the next level (second) switch shall energize, starting the lead pump. Lead pump shall operate until the lowest level switch is de-energized.
2. On next liquid level rise, the lag pump shall be started and again shall operate until the lowest level switch is de-energized.
3. Should liquid level continue to rise when the lead pump is operating, the lag (third) switch shall be energized, starting the idle or standby pump. Both pumps shall continue to operate until the lowest level switch is de-energized.
4. Should liquid level continue to rise after both pumps are operating, the alarm (fourth) switch shall be energized, operating the visual and audible alarms.

[SELECT BASIN TYPE]

C. Pump Basin and Valve Box: **[The pump basin and valve box shall be constructed of concrete, by the General Contractor, as detailed on the Drawings. This Division shall be responsible for coordinating basin provisions for system installation.] [The pump basin shall be constructed of fiberglass in either 60" or 72" diameter with depth as required or shown on the Drawings. The integral valve box shall also be constructed of fiberglass to the depth required or shown on the Drawings. The bottom of the basin shall be reinforced with two 3" steel H-beams, extending beyond diameter of basin for anchoring to concrete pad. Lifting lugs shall be provided on the outside of the valve box and the basin sections for ease in handling. A top flange of the valve box-pump basin segment of the unit for mounting the basin cover. Pump mounting plates shall be bolted to steel plates fastened to the bottom of the fiberglass basin.]]**

D. Basin Cover**: A hot dip galvanized, gas tight gasketed steel basin cover with gasketed access doors shall be provided. Basin cover shall be a nonslip design suitable for use in areas with pedestrian traffic. Separate access doors shall be provided for each pump [and for the valve box]. The basin cover shall be [a round style designed to fully cover the concrete basin shown on the Drawings.] [designed to cover the fiberglass basin/valve box specified.] [a rectangular style designed for installation in a case-in-place concrete basin as shown on the Drawings.] Access doors shall be equipped with [lift handles and hinges.] [a hasp, hinges, and a tension bar spring.] [Basin covers shall be suitably reinforced to withstand vehicular traffic.]**

E. Piping: **[Discharge piping from the quick removal elbow shall be field-installed.] [All piping inside the lift station shall be factory installed and tested. The discharge piping from the pumps shall be [4"] [____"], mounted in the basin and extended through the floor of the valve box and joined by flanged connections to the piping, valves and fittings contained in the integral valve box. The individual pump discharge lines shall be joined within the integral valve box to a common discharge line extending horizontally from the valve box and terminating in a 4" plain end pipe. Where the piping passes through the wall of the valve box, a flexible link-type seal within an integral sleeve shall be furnished, to provide a gas and watertight seal. A drain, with a check valve seal, to prevent water from the basin entering the valve box, shall be furnished in the valve box and piped to the basin.]**

F. Submersible Pumps:

1. A duplex set of submersible pumps shall be provided. Pumps shall be capable of handling raw, unscreened sewage, sand, silt and other soft material at temperatures up to 140°F. Each pump

shall be equipped with a hermetically sealed, Class "F" insulated motor, installed in a heavy, ribbed cast iron shell. The motor shell, pump volute and impeller shall be made of close-grained cast iron (ASTM A48-C30). Pump shaft shall be 316 stainless steel and all fastening hardware shall be stainless steel.

2. The pump impeller shall be two-vane, nonclog type, accurately machined to the proper diameter, and dynamically balanced prior to installation in pump. The pump unit shall be furnished with "Y" guides, stainless steel lifting cable, a removable discharge elbow and all necessary hardware.

3. The pump unit shall be furnished with a moisture sensing probe and relay panel with light to indicate entrance of water to the motor.

4. Pump and motor unit to receive a coat of red chromate primer and a finish coat of water resistant enamel.

G. Quick Removal System: A quick removal system shall be provided. A separate steel base plate, incorporating a stationary discharge elbow with flexible connector for pump discharge line and bottom guide rail supports for proper alignment shall be furnished. System shall include galvanized guide rails terminating into guide rail supports at the main cover. A gasket shall be furnished between the mating faces of the pump elbow and the fixed discharge elbow to facilitate removal and prevent corrosive bridging, no portion of the pump shall touch the floor of the basin.

H. Control Panel:

1. The control panel furnished shall be UL-listed NEMA 3R, dead front with blank gasketed and lockable weatherproof door and an internal dead front safety door. The control panel shall be designed for a **[single] [dual]** incoming branch circuit power feed. Panel shall contain a motor disconnect switch, a magnetic starter with 3-phase overload protection and a phase failure relay (Refer to Section 15140) for each pump. An alternating relay, to alternate lead pump, shall be provided. Panel to have a "Test-Off-Auto" selector switch and a pilot "Run" light for each pump. Control transformers for 115 control power shall be provided. **[Where a dual power feed is specified, separate control power transformers shall be provided for each feed.]**

2. Panel shall also include audible and visual alarm signals with provisions for silencing the audible alarm and dry alarm contacts for remote monitoring by **[_____]**. Signals shall be provided for "HIGH LEVEL", "PUMP 1 MOISTURE", and "PUMP 2 MOISTURE".

3. A NEMA 6 junction box shall be **[provided for field mounting] [factory-mounted]** in the **[valve box chamber] [pump basin]**. The junction box will be provided with a terminal strip to accommodate all necessary power and control wiring and have suitable watertight sealing means for all cables. Junction box and cable entrance fittings to meet NEMA 6 waterproof requirements.

I. Basin Level Controls: Provide mercury float type liquid level control for proper pump and alarm operation. Four 2-pole mercury switches, each sealed in a corrosion-resistant polypropylene float shall be provided. Each switch to have a PVC-coated, UL-listed cable and to be attached to a corrosion-resistant bracket to a galvanized suspension rod. The switch bracket to be provided with a reinforcing sleeve to prevent sharp bending and damage to cable.

J. Factory Testing: Before shipping all component parts shall be tested for compliance with the hydraulic, mechanical and electrical requirements of the specifications. After assembly and testing, units exceeding 7'-6" overall height shall be broken down into sub-assemblies for ease of handling and shipment. Subassemblies shall be match marked. Complete installation, operating and maintenance instructions shall be provided by the pump manufacturer.

K. Start-up Service: System checkout, start-up, and adjustment shall be provided by a representative of the system manufacturer.

2.4 SEWAGE EJECTORS AND SUMP PUMPS:

A. General: Provide sewage ejectors of the type, capacity, duty, motor horsepower, and speed as scheduled on the Drawings. Furnish grease-lubricated intermediate guide bearings for every 6'length of pump shaft.

B. Sumps and Covers: Sump pits shall be constructed under Division 3, "Concrete". This Contractor shall furnish and install a steel cover plate and ring for each sump pit. Cover plate shall have 1-1/2" x 1-1/2" x 1/4" structural steel angle reinforcement on the underside, gasketed gastight bolted manhole, and threaded or flanged vent connection. Furnish and install a gastight steel base plate equipped with a lantern ring shaft stuffing box and means for removing each of the pumps separately without removing the large gastight cover.

C. Impellers: Sewage ejector impellers shall be nonclog-type capable of pumping a 2-1/2" sphere. The pump casing and suction cover shall be of cast iron. The casing shall be provided with a cast integral discharge elbow. The shaft shall be stainless steel. The pump shall be suitable for handling drainage containing sand and a water temperature of 140°F.

[VERIFY REMOTE ALARM REQUIREMENT]

D. Controls: Provide a nonfloat type control with high water alarm contacts for each pump, with provisions for actuating a local **[and remote]** alarm **[in the Building Control and Automation Systems' office (refer to Paragraph 2.08)]**. Alternator shall be as manufactured by Allen-Bradley or approved equal. Control panel shall be a factory-wired NEMA Type 1 enclosure and shall include a disconnect switch, alternator, FVNR starter with circuit breaker for each motor, control panel-mounted high level alarm bell, control power transformer with fused disconnect switch tapped from the line side of the pump disconnect switch and pump running lights. Alarm switch and all controls shall **[be rated for] [operate on]** 120 volt, 60 Hz, alternating current. Pump motor and electrical controls, including switch and motor controller, shall be mounted on an integral steel frame 2'above the level of the floor on which pump is located. This will allow the pumps to operate during any emergency flooding. Upper shaft bearing shall be at least 6" above pit cover plate. The Contractor shall provide the necessary steel framework and supports for elevating the electrical equipment by means acceptable to the Architect and Engineer.

2.5 SUMP PUMPS (SUBMERGED-TYPE):

A. General: Provide sump pumps of the type, capacity, and duty shown on the Drawings. The pumps shall have a cast iron casing and shall be equipped with bronze enclosed impellers dynamically balanced for all hydraulic loads within the operating range of the pump. Tripod support shall be integrally cast with pump casing. The design of the pump shall permit removal of motor shaft/impeller assembly without the need to disconnect the discharge piping or remove the pump casing from the basin. Pumps shall be capable of handling drainage containing sand and a water temperature of 105°F.

B. Sumps and Covers: Sump pits shall be constructed under Division 3, "Concrete". This Contractor shall furnish and install a steel cover plate and ring for each sump pit. Cover plate shall have 1-1/2" x 1-1/2" x 1/4" structural steel angle reinforcement on the underside gasketed gastight, bolted manhole, and threaded or flanged vent connection.

[VERIFY REMOTE ALARM REQUIREMENT]

C. Controls: Provide a float switch with gastight rubber bellows, bronze float and rods, alternator, high level automatic alarm switch with gastight rubber bellows, and provisions for activation of a local **[and remote]** alarm **[in the Building Control and Automation Systems' (refer to Paragraph 2.08)]**. Control panel shall be a factory-wired NEMA Type 1 enclosure and shall include a disconnect switch, alternator, FVNR motor starter with circuit breaker, control panel-mounted high level alarm bell, control power transformer with fused disconnect switch tapped from the line side of the pump disconnect switch, and pump running lights. Alarm switch and all controls shall **[be rated for] [operate on]** 120 volt, 60 Hz alternating current.

D. Motors: Motors shall be of the oil-filled, totally-enclosed, immersible design. Each motor shall be of the ball-bearing type, equipped with a stainless steel shaft, expansion diaphragm, and a face-type seal on output shaft to seal motor from the liquid being pumped. Each motor shall be supplied with not less than 10'of immersible unitized cable.

2.6 SUBMERSIBLE SUMP PUMPS:

[REFER TO ALTERNATE TEXT ABOVE]

A. General: Provide a duplex, packaged submersible sump pump system designed for discharge **[through the cover] [below the cover]**. The system shall be complete with all required components including, but not limited to: **[fiberglass pump basin,] [basin cover]**, submersible pumps, pump quick removal system, waterproof junction box, float switch controls and a system control panel. Sump pump capacity and electrical characteristics shall be as scheduled and as shown on the Drawings.

[SELECT ONE OF THE FOLLOWING]

[VERIFY OPERATION]

B. System Operation: Provide system operation as follows:

1. On liquid level rise in the pump basin, the lowest level (first) mercury switch shall energize, then the next level (second) switch shall energize, starting the lead pump. Lead pump shall operate until the lowest level switch is de-energized.
2. On next liquid level rise, the lag pump shall be started and again shall operate until the lowest level switch is de-energized.
3. Should liquid level continue to rise when the lead pump is operating, the lag (third) switch shall be energized, starting the idle or standby pump. Both pumps shall continue to operate until the lowest level switch is de-energized.
4. Should liquid level continue to rise after both pumps are operating, the alarm (fourth) switch shall be energized, operating the visual and audible alarms.

[SELECT BASIN TYPE]

C. Pump Basin and Valve Box: [The pump basin and valve box shall be constructed of concrete, by the General Contractor, as detailed on the Drawings. This Division shall be responsible for coordinating basin provisions for system installation.] [The pump basin shall be constructed of fiberglass in either 60" or 72" diameter with depth as required or shown on the Drawings. The integral valve box shall also be constructed of fiberglass to the depth required or shown on the Drawings. The bottom of the basin shall be reinforced with two 3" steel H-beams, extending beyond diameter of basin for anchoring to concrete pad. Lifting lugs shall be provided on the outside of the valve box and the basin sections for ease in handling. A top flange of the valve box-pump basin segment of the unit for mounting the basin cover. Pump mounting plates shall be bolted to steel plates fastened to the bottom of the fiberglass basin.]

D. Basin Cover: A hot dip galvanized, gas tight gasketed steel basin cover with gasketed access doors shall be provided. Basin cover shall be a nonslip design suitable for use in areas with pedestrian traffic. Separate access doors shall be provided for each pump **[and for the valve box]**. The basin cover shall be **[a round style designed to fully cover the concrete basin shown on the Drawings.] [designed to cover the fiberglass basin/valve box specified.] [a rectangular style designed for installation in a case-in-place concrete basin as shown on the Drawings.] Access doors shall be equipped with [lift handles and hinges.] [a hasp, hinges, and a tension bar spring.] [Basin covers shall be suitably reinforced to withstand vehicular traffic.]**

E. Piping: **[Discharge piping from the quick removal elbow shall be field-installed.]** All piping inside the lift station shall be factory installed and tested. The discharge piping from the pumps shall be **[4"] [_____"]**, mounted in the basin and extended through the floor of the valve box and joined by flanged connections to the piping, valves and fittings contained in the integral valve box. The individual pump discharge lines shall be joined within the integral valve box to a common discharge line extending horizontally from the valve box and terminating in a 4" plain end pipe. Where the piping passes through the wall of the valve box, a flexible link-type seal within an integral sleeve shall be furnished, to provide a gas and watertight seal. A drain, with a check valve seal, to prevent water from the basin entering the valve box, shall be furnished in the valve box and piped to the basin.

F. Submersible Pumps:

1. A duplex set of submersible pumps shall be provided. Pumps shall be capable of handling raw, unscreened sand, silt and other soft material at temperatures up to 140°F. Each pump shall be equipped with a hermetically sealed, Class "F" insulated motor, installed in a heavy, ribbed cast iron shell. The motor shell, pump volute and impeller shall be made of close-grained cast iron (ASTM A48-C30). Pump shaft shall be 316 stainless steel and all fastening hardware shall be stainless steel.

2. The pump impeller shall be two-vane, nonclog type, accurately machined to the proper diameter, and dynamically balanced prior to installation in pump. The pump unit shall be furnished with "Y" guides, stainless steel lifting cable, a removable discharge elbow and all necessary hardware.

3. The pump unit shall be furnished with a moisture sensing probe and relay panel with light to indicate entrance of water to the motor.

4. Pump and motor unit to receive a coat of red chromate primer and a finish coat of water resistant enamel.

G. Quick Removal System: A quick removal system shall be provided. A separate steel base plate, incorporating a stationary discharge elbow with flexible connector for pump discharge line and bottom guide rail supports for proper alignment shall be furnished. System shall include galvanized guide rails terminating into guide rail supports at the main cover. A gasket shall be furnished between the mating faces of the pump elbow and the fixed discharge elbow to facilitate removal and prevent corrosive bridging, no portion of the pump shall touch the floor of the basin.

H. Control Panel:

1. The control panel furnished shall be UL-listed NEMA 3R, dead front with blank gasketed and lockable weatherproof door and an internal dead front safety door. The control panel shall be designed for a **[single] [dual]** incoming branch circuit power feed. Panel shall contain a motor disconnect switch, a magnetic starter with 3-phase overload protection and a phase failure relay (Refer to Section 15140) for each pump. An alternating relay, to alternate lead pump, shall be provided. Panel to have a "Test-Off-Auto" selector switch and a pilot "Run" light for each pump. Control transformers for 115 control power shall be provided. **[Where a dual power feed is specified, separate control power transformers shall be provided for each feed.]**

2. Panel shall also include audible and visual alarm signals with provisions for silencing the audible alarm and dry alarm contacts for remote monitoring by **[_____]**. Signals shall be provided for "HIGH LEVEL", "PUMP 1 MOISTURE", and "PUMP 2 MOISTURE".

3. A NEMA 6 junction box shall be **[provided for field mounting] [factory-mounted]** in the **[valve box chamber] [pump basin]**. The junction box will be provided with a terminal strip to accommodate all necessary power and control wiring and have suitable watertight sealing means for all cables. Junction box and cable entrance fittings to meet NEMA 6 waterproof requirements.

I. Basin Level Controls: Provide mercury float type liquid level control for proper pump and alarm operation. Four 2-pole mercury switches, each sealed in a corrosion-resistant polypropylene float shall be provided. Each switch to have a PVC-coated, UL-listed cable and to be attached to a

corrosion-resistant bracket to a galvanized suspension rod. The switch bracket to be provided with a reinforcing sleeve to prevent sharp bending and damage to cable.

J. Factory Testing: Before shipping all component parts shall be tested for compliance with the hydraulic, mechanical and electrical requirements of the specifications. After assembly and testing, units exceeding 7'-6" overall height shall be broken down into sub-assemblies for ease of handling and shipment. Subassemblies shall be match marked. Complete Installation, Operating and Maintenance instructions shall be provided by the pump manufacturer.

K. Start-up Service: System checkout, start-up, and adjustment shall be provided by a representative of the system manufacturer.

2.7 HOT WATER CIRCULATING PUMPS:

A. General: Provide all bronze, in line hot water circulating pumps with capacities and electrical characteristics as scheduled and as shown on the Drawings. Pumps shall be suitable for working pressures **[up to [125] [175] psi] [as scheduled on the Drawings]** and water temperatures up to 300°F per ASA B16.1. Pumps shall be fitted with a dynamically balanced brass enclosed type impeller with mechanical seal. Mechanical seal shall be Type 1 or Type 2 material, Code BP-1D1 as manufactured by John Crane Company or an approved equal, suitable for service specified. Pumps, casings, flanges, and seals shall be suitable for operation with the working pressures and temperatures scheduled and indicated. The scheduled working pressure applies to the entire pump assembly.

1. Pumps shall be non-overloading and shall have easily replaceable mechanical seals. Impeller shall be cast bronze, dynamically balanced. All wetted parts shall be bronze or cupro-nickel. Bearings shall be sleeve or ball type.

B. Motors: Pump motors shall be resiliently mounted, flexible or magnetically coupled and shall not require external overload protection on single phase motors. Motor shall have a maximum speed of 1750 rpm. Refer to Section 15140 for additional requirements.

C. Controls: Pumps shall be provided with a Johnson Controls Series A19DAC-1 hot water circulator control **[and an automatic alternator]**. Controller shall be set to start the **[lead]** pump when the loop temperature drops below **[10°F (adjustable) below design temperature] [_____°F]** and stop the pump when loop temperature reaches **[design temperature] [_____°F]**. **[The alternator shall be wired to change the lead pump at each start.]**

D. Time Switch: Pumps shall be provided with a Tork W100 or equal 7 day dial electro mechanical time switch in a NEMA 1 enclosure.

2.8 ELEVATOR SUMP PUMPS:

A. General: Provide complete and operational elevator sump pumps as specified herein, as scheduled and as shown on the Drawings.

B. Pumps: The elevator sump pump shall be cast iron shell with bronze impeller, 303 stainless steel shaft and housing, motor shall be hermetically sealed with built-in overload protection, bearings shall be factory sealed grease lubricated ball type. Pump capacities shall be as scheduled on the Drawings.

C. Controls: Pump shall include factory installed integral low level micro switch to turn pump on at 5" water depth and shut off at 3-3/4" water depth.

[VERIFY REMOTE ANNUNCIATOR REQUIREMENTS]

2.9 REMOTE PLUMBING PUMP ANNUNCIATOR PANELS:

A. General: Provide a flush-mounted alarm annunciator **[at the Control and Automation Systems' office]**. The annunciator shall include an indicator light for each alarm to be annunciated and a common audible alarm with silence switch. The silence switch shall not prevent the audible alarm

from resounding for subsequent alarms. If the alarm contact is reset and the silence switch is not reset, then the audible alarm shall sound until the switch is reset. Alarms to be annunciated shall include:

1. Domestic water **[cooling tower]** pump shutdown for each individual pumping system.
2. Sump pump high level alarms for each sump pump.
3. Sewage ejector high level alarms for each sewage ejector.
4. **[Position for each fire pump.]**
5. **[Jockey pump input power failure for each jockey pump.]**
6. Break tank high and low level alarms for each break tank.
7. Boiler low water level alarm for each boiler.
8. **[Four]** spare lamps for future alarms.

B. Labeling: Label each alarm lamp with an engraved nameplate identifying the alarm indicated.

C. Power Source: The remote annunciator shall be served by a dedicated 120 volt emergency power branch circuit.

PART 3 - EXECUTION

3.1 INSPECTION:

A. General: Installer shall examine conditions under which pumps are to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 TYPICAL INSTALLATION OF PUMPS:

A. General: Install pumps where shown, in accordance with manufacturer's written instructions and recognized industry practices to ensure that pumps comply with requirements and serve intended purposes. Comply with NEMA standards and requirements of NEC.

B. Base-mounted Pumps: Pumps shall be leveled, bolted, and grouted to pump bases. Piping shall be arranged so pump cases are not subjected to any piping forces. Contractor shall check for proper angular and concentric alignment of pumps and motors and shall get Engineer's approval of this alignment before pumps are operated.

C. Alignment: Check alignment and, where necessary, realign shafts of motors and pumps within tolerances recommended by manufacturer.

D. Housekeeping Pads/Vibration Isolation: Refer to Section 15100 and Section 15250 for applicable requirements.

E. Drain Lines: Provide a drain line (3/4" minimum) for each pump drip base to the nearest floor drain.

F. Casing Relief Valves: Provide individual casing relief drain lines from each **[domestic water] [and] [fire]** pump casing relief valve **[to the] [nearest floor drain] [house/break tank]**.

G. [Hydropneumatic Tanks: Pipe and install hydropneumatic tank as shown on the drawings and per manufacturers recommendations. Adjust tank air charge to provide specified drawdown capacity.]

3.3 ELECTRICAL CONNECTIONS:

A. Controllers and Annunciators: Set pump controllers and annunciators in place for wiring by Division 16.

B. Grounding: Provide positive electrical pump and motor grounding in accordance with applicable requirements of the NEC.

3.4 COORDINATION:

A. General: This Contractor shall be responsible for coordinating installation requirements and provisions with the work of other Divisions and the General Contractor.

B. [Sumps: This Contractor shall be responsible for coordinating the [construction] [installation] of [field-constructed] [factory-fabricated] sumps with the work of the General Contractor. This coordination shall include, but not be limited to, [location, sump size and shape, sump depth, pipe and conduit entries and exits, and cover/access door installation.]

C. [Construction Pumping: All construction sewage and storm drainage pumping shall be done with temporary equipment. After building is completely closed in and lower floors are broom clean and dry, the sumps shall be emptied and cleaned to the surface of the bottom of the pit. At that time, permanent sump and sewage pumps shall be installed, lubricated, adjusted, checked and placed in service.]

3.5 START-UP SERVICES:

A. General: The pump supplier shall provide pump checkout, start-up, testing and adjusting of system components for the **[domestic water,] [sewage ejector,] [sump,] [and] [hot water circulating]** pumps. The pump supplier shall also train the Owner's Engineer in the proper operation and maintenance of **[these] [this]** pump system**[s]**.

B. Checkout: After pumps have been in operation for 90 days, the contractor shall check all seals and replace any which are defective.

3.6 TESTING:

A. General: Test and adjust all installed plumbing pumps**[,] [and]** controllers**[, and annunciators]** to verify proper operation as specified herein and as recommended by the manufacturers. Where specified hereinabove, start-up, testing, and adjustment shall be provided by a representative of the equipment supplier.

B. Functional Tests: Test pumps**[,] [and]** controllers, **[and annunciators]** to verify that all control, alarm and indicator functions operate properly and to verify that pump discharge pressures and flows are as specified.

C. Refer to Section 23 05 93 for additional start-up, testing, and adjustment requirements.

3.7 IDENTIFICATION:

A. Refer to Section 23 03 00 "Basic Materials and Methods", for applicable painting, nameplates, and labeling requirements.

END OF SECTION 22 10 00