SECTION 22 11 23
PLUMBING PUMPS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Domestic water booster pump system

B. Circulating pumps

C. Submersible pump systems

D. Pump discharge valves

E. Miscellaneous components and accessories

1.02 RELATED DOCUMENTS

A. Section 22 05 01 – Plumbing General Provisions

B. Section 22 05 13 – Electric Motors for Plumbing

C. Section 22 05 14 – Variable Frequency Drives

D. Section 22 05 19 – Meters, Gauges and Thermometers for Plumbing

E. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment

F. Section 22 05 48 – Vibration Isolation and Seismic Restraints for Plumbing

G. Section 22 05 53 – Systems Identification for Plumbing

H. Section 22 11 00 – Domestic Water Systems

I. Section 22 11 10 – Plumbing Piping and Accessories

J. Section 22 13 00 – Drainage Systems

K. Division 26 – Electrical Specifications

1.03 REFERENCE STANDARDS

A. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section where cited below:

B. AISI – American Iron and Steel Institute

C. ASME – American Society of Mechanical Engineers

1. ASME Standard for Boiler and Pressure Vessel Code – 2013

a. ASME BPVC – I through XII

2. ASME B40.100 – 2013: Pressure Gauges and Gauge Attachments

D. ASTM – American Society for Testing and Materials

1. ASTM A48 / A48M – 2003 Revised 2012: Standard Specification for Gray Iron Castings
2. ASTM A108 – 2013: Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
3. ASTM A126 – 2004: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
4. ASTM A536 – 1984 Revised 2008: Standard Specification for Ductile Iron Castings
5. ASTM B36 / B36M – 2013: Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar
6. ASTM B148 – 1997 Revised 2009: Standard Specification for Aluminum-Bronze Sand Castings
7. ASTM B584 – 2013: Standard Specification for Copper Alloy Sand Castings for General Applications
8. ASTM C32 – 2013: Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)
9. ASTM C923 – 2008 Revised 2013: Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals
10. ASTM D3753 – 2012: Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells

E. AWWA – American Water Works Association

1. AWWA C652-11: Disinfection of Water Storage Facilities
2. AWWA D102-11: Coating Steel Water-Storage Tanks

F. ISO – International Organization for Standardization

1. ISO 9001 – 2008: Quality Management System Requirements

G. MSS – Manufacturers Standardization Society of the Valve and Fittings Industry

1. MSS SP-71-2011: Gray Iron Swing Check Valves, Flanged and Threaded Ends

H. NEMA – National Electrical Manufacturers Association

I. NFPA – National Fire Protection Association

1. NFPA 70, Edition 08 – NEC: National Electrical Code

a. Article 90.7 – Examination of Equipment for Safety

J. OSHA – Occupational Safety & Health Administration 29 CFR – Code of Federal Regulations, Title 29

1. Part 1910: Occupational Safety and Health Standards

a. Section 303: General requirements
b. Section 399: Definitions applicable to this subpart

K. UL – Underwriters Laboratories Inc.

1. UL Standard 508A – 2013: Industrial Control Panels

L. International Plumbing Code

1.04 QUALITY ASSURANCE

A. Comply with the applicable provisions and recommendations of the standards and codes listed in Paragraph 1.03 and the requirements of the listed related documents.

B. Alternates to scheduled pumps shall operate at or near their point of peak efficiency, allowing for operation at capacities of approximately 25 percent beyond design capacity. Maximum impeller size shall not exceed 85 percent of the difference between the maximum and minimum impeller diameter.

C. In order to insure stable operation and prevent any possibility of hunting, the pump curve shall be continuously rising from maximum capacity up to the shut-off point. Pumps shall be non-overloading over the full range of the pump curve.

D. Furnish each pump and motor with a metal engraved nameplate giving the manufacturer's name, serial number of pump, capacity in gpm and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

E. All pumps shall operate without excessive noise or vibration.

F. Furnish to Owner one spare seal and casing gasket for each pump.

G. After completion of balancing, provide replacement of impellers, or trim impellers to provide specified flow at actual pumping head, as installed.

1.05 SUBMITTALS

A. Comply with requirements of Section 01 33 00 – Submittal Procedures, and as modified below.

B. Product Data: Submit manufacturer's product literature including material specifications, pump curves and power requirements, wiring diagrams and other information required to demonstrate compliance with specified requirements for following items:

1. Water pressure booster pumps systems
2. Circulating pumps
3. Submersible pump systems
4. Pump discharge valves
5. Miscellaneous components and accessories

C. Shop drawing submittals shall include pump curves, net positive suction head requirements, and pump performance characteristics with pump and system operating points plotted.

D. Submit construction details, materials of construction, type of seals, pump base, and mounting details.

E. Submit motor construction, winding type and efficiencies as specified in Section 22 05 13 – Electric Motors for Plumbing.

F. Submit, for all equipment provided under this Section, dimensions, accessories, required clearances, electrical requirements and wiring diagrams specific to this project that clearly differentiate between manufacturer-installed and field-installed wiring and location and size

of all required field connections.

G. Submit performance test reports, where required, prior to shipping of equipment from the manufacturer's factory.

H. Submit manufacturer's installation instructions, operation data, start-up instructions, maintenance data, parts list and controls specific to this project, accessories and maintenance data.

I. Submit factory start-up report for the Water Pressure Booster Pump System.

J. Submit list of spare parts to be turned over to the Owner for the Water Pressure Booster Pump System.

1.06 PERFORMANCE REQUIREMENTS

A. Design Requirements: Provide pressure booster package systems independently third-party labeled as suitable for intended use by Nationally Recognized Testing Laboratory in accordance with OSHA Federal Regulations 29CFR1910.303 and 29CFR1910.399, NFPA 70, and National Electric Code, Article 90-7.

B. Domestic water pumps shall meet or exceed the performance requirements specified in this specification section.

C. LEED Credit EQ4.2: Low Emitting Materials, Paints and Coatings.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Domestic Water Booster Pumps: Syncroflow, PACO, Bell & Gossett, G & L Pumps, or approved equivalent.

B. Submersible Pumps: PACO, Weil, Myers, or approved equivalent.

C. Circulation Pumps: Bell & Gossett, Taco, Grundfos, or approved equivalent.

D. Hydropneumatic Tank: Armstrong, Bell & Gossett, Amtrol, Taco, Wessels, or approved equivalent.

E. Break Tank: FlowTherm, or approved equivalent.

F. Float Switches: Weil, McDonnell Miller, or approved equivalent.

G. Check Valves: NIBCO, or approved equivalent.

H. Pump Discharge Spring Check Valves: NIBCO, Victaulic, or approved equivalent.

I. Pump Discharge Gate Valves: Waterous, or approved equivalent.

J. Sump and Manhole Frames and Covers: Neenah, East Jordan, or approved equivalent.

K. Sump Access Covers and Grates: Fiberlite, BILCO, McNichols Co., or approved equivalent.

L. Asphaltic Coating (for sumps): Inertol Co., or approved equivalent.

M. Rubber Gaskets (for sumps and manholes): Dual-Seal Gaskets, or approved equivalent.

N. High Water Level Alarm and Control Panel: Weil Pump Co., or approved equivalent.

2.02 WATER PRESSURE BOOSTER PUMP SYSTEMS

A. VARIABLE SPEED PACKAGED PUMPING SYSTEM

1. Furnish and install a pre-fabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure.
2. The packaged pump system shall be a standard product of a single pump manufacturer. The entire pump system including pumps and pump logic controller, shall be designed, built, and tested by the same manufacturer.
3. The complete packaged water booster pump system shall be certified and listed by UL (Category QCZJ – Packaged Pumping Systems) for conformance to U.S. and Canadian Standards.
4. The complete packaged pumping system shall be NSF61 / NSF372 Listed for drinking water and low lead requirements.
5. The packaged pump system shall be ASHRAE 90.1 – 2010 compliant without the need of a remote mounted sensor. The control logic used to simulate a remote mounted sensor shall be proportional pressure control with squared or linear adaptation. An actual flow rate or calculated flow rate based on performance curves (5th order polynomial) loaded into the controller; shall be used to adjust setpoint pressure in proportional pressure control.

B. PUMPS

1. All pumps shall be ANSI NSF 61 / NSF372 Listed for drinking water and low lead requirements.
2. The pumps shall be of the in-line vertical multi-stage design.
3. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
4. Large In-line Vertical Multi-Stage Pumps (Nominal flows from 130 to 500 gallons per minute) shall have the following features:

   a. The pump impellers shall be secured directly to the smooth pump shaft by means of a split cone and nut design.
   b. The suction/discharge base shall have ANSI Class 125 or Class 250 flange connections in a slip ring (rotating flange) design as indicated in the drawings or pump schedule.
   c. Pump Construction.

1)	Suction/discharge base, pump head	Ductile Iron (ASTM 65-45-12)
2)	Shaft couplings, flange rings:	Ductile Iron (ASTM 65-45-12)
3)	Shaft	431 Stainless Steel
4)	Motor Stool	Cast Iron (ASTM Class 30)
5)	Impellers, diffuser chambers, outer sleeve:	304 Stainless Steel
6)	Impeller wear rings:	304 Stainless Steel
7)	Intermediate Bearing Journals:	Silicon Carbide
8)	Intermediate Chamber Bearings:	Leadless Tin Bronze

9)	Chamber Bushings:	Graphite Filled PTFE
10)	O-rings:	EPDM

d. The shaft seal shall be a balanced o-ring cartridge type with the following features:

1)	Collar, Drivers, Spring:	316 Stainless Steel
2)	Shaft Sleeve, Gland Plate:	316 Stainless Steel
3)	Stationary Ring:	Silicon Carbide
4)	Rotating Ring:	Silicon Carbide
5)	O-rings:	EPDM

e. The Silicon Carbide shall be imbedded with graphite.

f. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, motor couplings, motor and seal cover. The entire cartridge shaft seal shall be removable as a one piece component. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.

C. INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS

1. Each motor shall be of the Integrated Variable Frequency Drive design consisting of a motor and a Variable Frequency Drive (VFD) built and tested as one unit by the same manufacturer.
2. The VFD shall be of the PWM (Pulse Width Modulation) design using current IGBT (Insulated Gate Bipolar Transistor) technology.
3. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of motor. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump control and to eliminate the need for motor de-rating.
4. The VFD shall utilize an energy optimization algorithm to minimize energy consumption. The output voltage shall be adjusted in response to the load, independent of speed.
5. The VFD shall automatically reduce the switching frequency and/or the output voltage and frequency to the motor during periods of sustained ambient temperatures that are higher than the normal operating range. The switching frequency shall be reduced before motor speed is reduced.
6. An integral RFI filter shall be standard in the VFD.
7. The VFD shall have a minimum of two skip frequency bands which can be field adjustable.
8. The VFD shall have internal solid-state overload protection designed to trip within the range of 125-150% of rated current.
9. The integrated VFD motor shall include protection against input transients, phase imbalance, loss of AC line phase, over-voltage, under-voltage, VFD over-temperature, and motor over- temperature. Three-phase integrated VFD motors shall be capable of providing full output voltage and frequency with a voltage imbalance of up to 10%.
10. The integrated VFD motor shall have, as a minimum, the following input/output capabilities:

    a. Speed Reference Signal: 0-10 VDC, 4-20mA
    b. Digital remote on/off
    c. Fault Signal Relay (NC or NO)
    d. Fieldbus communication port (RS485)

11. The motor shall be Totally Enclosed Fan Cooled (TEFC) with a standard NEMA C-Face, Class F insulation with a temperature rise no higher than Class B.
12. The cooling design of the motor and VFD shall be such that a Class B motor temperature rise is not exceeded at full rated load and speed at a minimum switching frequency of 9.0 kHz.
13. Motor drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump at full rated speed.

D. PUMP SYSTEM CONTROLLER

1. The pump system controller shall be a standard product developed and supported by the pump manufacturer.
2. The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller user interface shall have a color display with a minimum screen size of 3-1/2” x 4-5/8” for easy viewing of system status parameters and for field programming. The display shall have a back light with contrast adjustment. Password protection of system settings shall be standard.
3. The controller shall provide internal galvanic isolation to all digital and analog inputs as well as all fieldbus connections.
4. The controller shall have the ability to be connected to a battery to maintain power on controller during periods of loss of supply power.
5. The controller shall have built in data logging capability. Logged vales shall be graphically displayed on the controller and able to be exported. A minimum of 3600 samples per logged value with the following parameters available for logging:

    a. Estimated flow-rate
    b. Speed of pumps
    c. Inlet pressure
    d. Process Value (usually discharge pressure of differential pressure depending on application)
    e. Power consumption
    f. Controlling parameter (process value)

6. The controller shall display the following as status readings from a single display on the controller (this display shall be the default):

    a. Current value of the control parameter, (typically discharge pressure)
    b. Most recent existing alarm (if any)
    c. System status with current operating mode
    d. Status of each pump with current operating mode and rotational speed as a percentage (%)
    e. Estimated flow-rate, (not requiring flow meter connection)

7. The controller shall have as a minimum the following hardware inputs and outputs:

    a. Three analog inputs (4-20mA or 0-10VDC)
    b. Three digital inputs
    c. Two digital outputs
    d. Ethernet connection
    e. Field Service connection to PC for advanced programming and data logging

8. Pump system programming (field adjustable) shall include as a minimum the following:

a. Water shortage protection (analog or digital)
b. Sensor Settings (Suction, Discharge, Differential Pressure analog supply/range)
c. PI Controller (Proportional gain and Integral time) settings
d. High system pressure indication and shut-down.
e. Low system pressure indication and shut-down
f. Low suction pressure/level shutdown (via digital contact)
g. Low suction pressure/level warning (via analog signal)
h. Low suction pressure/level shutdown (via analog signal)
i. Flow meter settings (if used, analog signal)

9. The system controller shall be able to accept up to seven programmable set-points via a digital input, (additional input/output module may be required).
10. The controller shall have advanced water shortage protection. When analog sensors (level or pressure) are used for water shortage protection, there shall be two indication levels. One level is for warning indication only (indication that the water level/pressure is getting lower than expected levels) and the other level is for complete system shut-down (water or level is so low that pump damage can occur). System restart after shut-down shall be manual or automatic (user selectable).
11. The system pressure set-point shall be capable of being automatically adjusted by using an external set-point influence. The set-point influence function enables the user to adjust the control parameter (typically pressure) by measuring an additional parameter. (Example: Lower the system pressure set-point based on a flow measurement to compensate for lower friction losses at lower flow rates).
12. The controller shall be capable of receiving a remote analog set-point (4-20mA or 0-10 VDC) as well as a remote system on/off (digital) signal.
13. The controller shall be able to adjust the ramp time of a change in set point on both an increase or decrease change in set point.
14. The pump system controller shall store up to 24 warning and alarms in memory. The time, date and duration of each alarm shall be recorded. A potential-free relay shall be provided for alarm notification to the building management system. The controller shall display the following alarm conditions:

a.	High System Pressure (warning and alarm)	Low system pressure Low suction pressure Individual pump failure
b.	VFD trip/failure	Loss of sensor signal (4-20 mA) Loss of remote set-point signal (4-20mA) System power loss

15. The pump system controller shall be mounted in a UL Type 3R rated enclosure. A self-certified NEMA enclosure rating shall not be considered equal. The entire control panel shall be UL 508 listed as an assembly. The control panel shall include a main disconnect, circuit breakers for each pump and the control circuit and control relays for alarm functions.
16. Control panel options shall include, but not be limited to:

a.	Pump Run Lights	System Fault Light
b.	Audible Alarm (80 db[A])	Surge Arrestor Emergency/Normal Operation Switches Service Disconnect Switches Qty (9) Configurable Digital Outputs available for monitoring

17. The controller shall be capable of receiving a redundant sensor input to function as a backup to the primary sensor (typically discharge pressure).

18. The controller shall have a pump “Test Run” feature such that pumps are switched on during periods of inactivity (system is switched to the “off” position but with electricity supply still connected). The inoperative pumps shall be switched on for a period of two to three (3-4) seconds every 24 hours, 48 hours or once per week and at specific time of day (user selectable).
19. The controller shall be capable of changing the number of pumps available to operate or have the ability limit the maximum power consumption by activation of a digital input for purposes of limited generator supplied power.
20. The controller shall be capable of displaying instantaneous power consumption (Watts or kilowatts) and cumulative energy consumption (kilowatt-hours).
21. The controller shall be capable of displaying instantaneous specific energy use (kW/gpm), (optional flow meter must be connected).
22. The actual pump performance curves (5th order polynomial) shall be loaded (software) into the pump system controller. Pump curve data shall be used for the following:

    a. Display and data logging of calculated flow rate (not requiring flow measurement)
    b. Proportional pressure control
    c. Pump outside of duty range protection
    d. Pump cascade control based on pump efficiency

23. The controller shall be capable of displaying an estimated flow-rate on the default status screen.
24. The controller shall have proportional pressure control to compensate for pipe friction loss by decreasing pressure set-point at lower flow-rates and increasing pressure set-point at higher flow- rates by using actual flow rate or calculated flow rate. Proportional pressure control that uses pump speed or power consumption only shall not be considered equal to proportional pressure control that uses actual or calculated flow rate.
25. The controller shall have the ability to communicate common field-bus protocols, (BACnet, Modbus, Profibus, and LON), via optional communication expansion card installed inside controller.
26. The controller shall have Ethernet connection with a built in server allowing for connection to a network with read/write access to controller via web browser and internet.
27. The controller shall have a programmable Service Contact Field that can be populated with service contact information including: contact name, address, phone number(s) and website.

E. SYSTEM CONSTRUCTION

1. Suction and discharge manifold construction shall be in way that ensures minimal pressure drops, minimize potential for corrosion, and prevents bacteria growth at intersection of piping into the manifold. Manifold construction that includes sharp edge transitions or interconnecting piping protruding into manifold is not acceptable. Manifold construction shall be such that water stagnation can not exist in manifold during operation to prevent bacteria growth inside manifold.
2. The suction and discharge manifolds material shall be 316 stainless steel. Manifold connection sizes shall be as follows:

    a. 3 inch and smaller: Male NPT threaded
    b. 4 inch through 8 inch: ANSI Class 150 rotating
    c. 10 inch and larger: ANSI Class 150 flanges

3. Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes 2 inch and smaller shall be nickel plated brass full port ball valves. Isolation valve sizes 3 inch and larger shall be a full lug style butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be cast iron, coated internally and externally with fusion-bonded epoxy.
4. A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the check valve shall not exceed 5 psi at the pump design capacity. Check valves 1-1/2" and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 2" and larger shall have a body material of stainless steel or epoxy coated iron (fusion bonded) with an EPDM or NBR resilient seat. Spring material shall be stainless steel. Disk shall be of stainless steel or leadless bronze.
5. For systems that require a diaphragm tank, a connection of no smaller than ¾" shall be provided on the discharge manifold.
6. A pressure transducer shall be factory installed on the discharge manifold (or field installed as specified on plans). Systems with positive inlet gauge pressure shall have a factory installed pressure transducer on the suction manifold for water shortage protection. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.
7. A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2/1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.
8. Systems with a flooded suction inlet or suction lift configuration shall have a factory installed water shortage protection device on the suction manifold.
9. The base frame shall be constructed of corrosion resistant 304 stainless steel. Rubber vibration dampers shall be fitted between each pumps and baseframe to minimize vibration.
10. Depending on the system size and configuration, the control panel shall be mounted in one of the following ways:

    a. On a 304 stainless steel fabricated control cabinet stand attached to the system skid.
    b. On a 304 stainless steel fabricated skid, separate from the main system skid
    c. On its own base (floor mounted with plinth)

2.03 CENTRIFUGAL CIRCULATING PUMPS

A. Furnish centrifugal close coupled single stage circulating pumps with capacities as scheduled in the Pump Schedule on the Drawings.

1. Centrifugal circulating pumps shall be of the in-line type suitable for vertical or horizontal installation and be serviceable without dismantling the circulator piping connections.
2. Casings shall be cast brass, ASTM B584.

3. Pump maximum working pressure shall be 175 psi.
4. Impeller shall be cast bronze, closed type, ASTM B584, 304 stainless steel impeller key, keyed to the shaft, brass impeller washer, 304 stainless steel impeller

lock washer and a 304 stainless steel impeller cap screw.

5. Pump] shall be ASTM A108 grade 1045 carbon steel. Shaft sleeve shall be copper alloy 110.

6. Shaft seal assembly shall be an internally flushed single seal of the stuffing box design with EPR “O”-rings, Carbon-Tungsten Carbide faces, all metal parts and spring shall be stainless steel. Seal shall be rated for continuous operation at 225 degrees F. The wetted area under the seal shall be completely covered by a bronze shaft sleeve.
7. Pump casing shall have gauge ports and vent and drain tapings at the suction and discharge nozzles.
8. Pump motor shall be as specified on the Drawings for horsepower, voltage and phase, and in Section 22 05 13 – Electric Motors for Plumbing. Motor shall be non-overloading throughout the entire range of the pump curve.
9. Impeller shall be hydraulically and dynamically balanced to ANSI-Hydraulic Institute Pump Standards, Grade G6.3.
10. Each pump shall be factory-tested per the ANSI-Hydraulic Institute Pump Standards.
11. Furnish strap on thermostat installed on each hot water return line for each hot water pump to cycle pump on and off.
12. Pump manufacturer shall be ISO-9001 certified.
13. Pump shall be a Bell & Gossett, all bronze pump, Series Ecocirc XL B or approved equivalent, suitable for use in a domestic water system.

B. CIRCULTING PUMP CONTROLS

1. Aquastats: Electric; adjustable for control of hot-water circulation pump.

   a. Manufacturers:

      1) Honeywell International, Inc.
      2) Square D.
      3) White-Rodgers Div.; Emerson Electric Co.

   b. Type: Water-immersion sensor, for installation in hot-water circulation piping.
   c. Range: 65 to 200 deg F.
   d. Operation of Pump: On or off.
   e. Transformer: Provide if required.
   f. Power Requirement: 120 V, ac.
   g. Settings: Start pump at 115 deg F and stop pump at 120 deg F.

2. Timers: Electric time clock for control of hot-water circulation pump.

   a. Manufacturers:

      1) Honeywell International, Inc.
      2) Intermatic, Inc.
      3) Johnson Controls, Inc.
      4) TORK.

   b. Type: Programmable, seven-day clock with manual override on-off switch.
   c. Enclosure: Suitable for wall mounting.
   d. Operation of Pump: On or off.
   e. Transformer: Provide if required.

f. Power Requirement: 120 V, ac.
g. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

3. Time Delay Relay: Control for hot-water storage tank circulation pump.

a. Manufacturers:

1) Honeywell International, Inc.
2) Intermatic, Inc.
3) Johnson Controls, Inc.
4) Square D.
5) White-Rodgers Div.; Emerson Electric Co.

b. Type: Adjustable time delay relay.
c. Range: Up to five minutes.
d. Setting: Five minutes.
e. Operation of Pump: On or off.
f. Transformer: Provide if required.
g. Power Requirement: 120 V, ac.
h. Programmable Sequence of Operation: Limit pump operation to periods of burner operation plus maximum five minutes after the burner stops.

2.04 DRAINAGE PUMP SYSTEMS

A. Elevator Sump Pump System: Includes sump pump and discharge piping and valves.

1. Sump Pump: Oil Minder SV50 by Stancor

a. Pump Rating: as indicated on drawings.
b. Pump Motor: Non-overloading over entire range of pump curve, 0.5 horsepower, 3,450 rpm, 480 volt, three phase, 60 hertz and of air-filled design:

1) Motor Housing: Water-tight cast iron shell with extended cooling fins and Class “F” insulation.
2) Motor Shaft: 300 Series stainless steel with permanently lubricated, double seal ball bearings having rated life of 17,500 hours.
3) Impeller: Bronze multi-vane semi-open closed type, statically and dynamically balanced. Inlet to pump protected by strainer assembly at suction plate.
4) On/Off Level Control: Controlled by micro-pressure switch mounted on pump.

a) Pump On Level: 12¼-inch level
b) Pump Off Level: 5¾-inch level

c. Power Cord: Sufficient length to connect to power receptacle.

B. Simplex Sump Pump System: Includes sump pump, high water alarm panel.

1. Sump Pump: LSG202A by Liberty.

a. Pump Rating: 27 gpm at 30 feet TDH with ⅝-inch solids handling capacity.

b. Pump Motor: Non-overloading over entire range of pump curve, 2 horsepower, 1,750 rpm, 208 volt, single-phase, 60 hertz and of air-filled design.

1) Motor Housing: Water-tight cast iron shell with extended cooling fins and Class “F” insulation.
2) Motor Shaft: 300 Series stainless steel with permanently lubricated, double seal ball bearings having rated life of 17,500 hours.
3) Impeller: Bronze multi-vane semi-open closed type, statically and dynamically balanced. Inlet to pump protected by strainer assembly at suction plate.
4) On/Off Level Control: Controlled by micro-pressure switch mounted on pump.

a) Pump On Level: 12¼-inch level
b) Pump Off Level: 5¾-inch level

c. Power Cord: Sufficient length to connect to power receptacle.

2. Sump Pump: XLE150 by Liberty.

a. Pump Rating: 50 gpm at 40 feet TDH with ⅝-inch solids handling capacity.
b. Pump Motor: Non-overloading over entire range of pump curve, 1.5 horsepower, 1,750 rpm, 208 volt, single-phase, 60 hertz and of air-filled design.

1) Motor Housing: Water-tight cast iron shell with extended cooling fins and Class “F” insulation.
2) Motor Shaft: 300 Series stainless steel with permanently lubricated, double seal ball bearings having rated life of 17,500 hours.
3) Impeller: Bronze multi-vane semi-open closed type, statically and dynamically balanced. Inlet to pump protected by strainer assembly at suction plate.
4) On/Off Level Control: Controlled by micro-pressure switch mounted on pump.

a) Pump On Level: 12¼-inch level
b) Pump Off Level: 5¾-inch level

c. Power Cord: Sufficient length to connect to power receptacle.

3. High Water Level Alarm: NEMA 4 enclosure with alarm buzzer, alarm test switch, terminal strip, flashing red dome light, isolated alarm contact, requiring 120-volt power and including a NEMA 6 high water float switch and cable. “Panel Model 8341K1013” with “Model 8233 Alarm” by Weil Pump Co.

C. Duplex Submersible Sewage Pumps: Includes duplex submersible sewage pumps, quick disconnect and removal system, control panel, liquid level and high water alarm controls. Provides automatic control of pumps with alternating lead-lag set-up and high water level alarm and stand-by pump alarm system, pit cover and frame.

1. Sewage Pump:

a. Pump motors shall be of an air-filled design for best efficiency. Motor end bell shall be designed as a terminal box and separated from the motor shell by a combination bearing support and inspection plate. The inspection plate shall permit viewing and access to the motor from the topside of the motor. Motors shall be housed in a water-tight cast iron shell with extended cooling fans and shall have Class "F" insulation and permanently lubricated double seal ball bearings. Motors using sleeve type bearings will not be considered equal. The mating surfaces between the motor end bell, motor shell and seal housing shall be sealed by means of "X" cross section quad rings. Motor shaft shall be 300 Series stainless steel with keyway for positive positioning of impeller.

1) The impeller shall be non-clog type and shall be made of close-grained cast iron/bronze and accurately machined to the proper diameter and to be statically and dynamically balanced. It must be capable of passing a 2½-inch sphere.
2) A double mechanical seal system shall be furnished. The entire double mechanical seal assembly shall be housed in a seal chamber filled with clean dielectric oil. Seal surfaces shall be siliconized carbon variety. Systems that allow the lower seal mechanism to come in contact with the pumped media shall not be considered as equal.
3) Each pump shall be performance tested and a report of the test shall be provided to the Architect. Test data shall consist of six duty points at various heads and capacities, one of which shall be the design point. Test data shall include actual efficiencies, horsepower requirements and amp draw at each point. This test data shall be included in the O&M Manual.

2. Electrical power cord shall have an outer jacket, which is resistant to oil and other materials normally found in sewage. Power cord shall be sealed, not only by use of a cord grip, but shall have individual conductors sealed into the cord cap assembly with epoxy sealing compound. This epoxy seal shall be repeated where the conductors enter the motor from the connection box, cap and connection box to each shall be sealed with an "O"-ring. Provide a double sealed, water-tight power cord entry through which liquid cannot enter the motor by following individual conductors inside the insulation.
3. Moisture sensor shall be installed as a means of detecting a combination of mechanical seal failure and entry of moisture into the motor shell or the oil chamber. The system shall consist of a moisture-sensing electrode probe installed in the mechanical seal chamber, sensor cable and one (1) NEMA 4 test station with an electrode relay, seal failure indicating light, test button and contacts for a remote signal.
4. Temperature sensor shall be provided and installed on the stator windings to trip the motor starter out, stopping the motor when the internal motor temperature exceeds the insulation rating. Complete with automatic reset.

5. Provide an Automatic Pump Station Control in a NEMA 4 enclosure. For each pump motor, there shall be a combination circuit breaker/overload unit providing overload protection, short circuit protection, reset and disconnect for all phases; across the line magnetic contactor; hand/off/automatic selector switch, pump run lights, 120-volt control circuit transformer, 4 float ISR circuitry, alternator, high water alarm horn with silence switch and red beacon light.
6. Control panel shall be supplied by pump supplier to assure system integrity. Terminal strip shall be provided for connecting control wires. Additional terminals shall be provided to connect alarm and heat sensors. The panel shall include

transformer, where required, to reduce control voltage to 115 volts.

7. Sump level controls shall be sealed float type to control sump levels and alarm signals. The mercury tube switches shall be sealed in solid polyurethane float for corrosion- and shock-resistance. The support wire shall have heavy neoprene jacket and a weight shall be attached to cord above the float to hold switch in place in sump. Weight shall be above the float to prevent sharp bends in the cord when the float operates under water. The float switches shall hang in the sump supported only by the cord that is held to the wiring channel. Three NEMA 6 float switches shall be used to control levels: one for pump start, one for pump stop and one for both pumps stop. Provide an additional switch for high water alarm.
8. On sump level rise, lower mercury switch shall be energized first, then upper level switch shall energize and start lead pump. With lead pump operating, pump shall reduce level to low switch turn-off setting and pump shall stop. Alternating relay shall index on stopping of pump so that lag pump will start on next operation. When sump level continues to rise while lead pump is running, the override switch shall energize and start lag pump. Both pumps shall operate together until low-level switch turns off both pumps. If level continues to rise with both pumps operating, the alarm switch shall energize and signal alarm. If one pump should fail, the second pump shall operate on the override control and if level rises above override control, alarm shall signal. All level switches shall be adjustable for level setting from the surface. Alternately, the alarm float shall be located between the lead and lag floats to give an early warning of lead pump malfunction.

9. Provide gas-tight frame and covers complete with all required openings – access ways, piping and control openings. Frame shall be installed by trade constructing concrete pits. Pits shall be minimum 4 feet square/diameter with minimum depth of 36 inches below inlet inverts elevation. All sumps shall be properly vented.

2.05 PUMP DISCHARGE VALVES

A. Check Valves: Swing-type with outside lever and spring manufactured in accordance with MSS-SP 71, Class 125, flanged ASTM A126 Class B cast iron body with bronze trim, non-asbestos gasket; “F918-BL&S” by NIBCO.

B. Spring Check Valves (2-inch and larger): Wafer style with stainless steel spring, bronze disc plates, Buna-N seat bonded to bronze, cast iron body ASTM A126 Class B or ASTM A48/A48M for use with Class 125/150 flanges; “W-910” by NIBCO.

C. Spring Check Valves (2½-inch and 3-inch): Spring-assisted single disc, EPDM seal on aluminum bronze disc ASTM B148, 304 stainless steel spring, 416 stainless steel shaft, ductile iron body ASTM A536 Grade 65-45-12; “Series 716” by Victaulic.

D. Gate Valves (4-inch): Open left, mechanical joint, cast iron, resilient seated, gate valve with epoxy coated inside and out non-rising stem designed for use in waste water application with valve stem extension assembly with operating nut stem guide valve stem guide and valve box and lid; “Series 500- A242” by Waterous Company, South St. Paul, MN.

2.06 SUMP ACCESS COVERS

A. General:

1. Access cover plates shall be selected to cover sump basin opening, accommodate drainage pump systems, pipe and conduit openings, support applicable surface and traffic loads, accommodate pump removal systems where applicable.
2. Gaskets and seals shall be provided for gas-tight installation of all openings

including fasteners, conduit, access covers and piping openings into the cover plate.

B. Manhole Frames and Covers:

1. Materials and Fabrication: Provide castings of uniform quality, free from blow holes, porosity, hard spots, shrinkage defects, cracks or injurious defects. Manufacture castings true to pattern with satisfactory form of component parts. Fabricate round frames and covers or grates in pavement of non-rocking design or with machined bearing surfaces.
2. Gray Iron: Conform to ASTM A48/A 48M (latest revision) Class 30 iron (supersedes Federal Specification QQ-I-652).
3. Diameter: Fit manhole, minimum weight 305 pounds; Neenah “R-1610”. Imprint covers with words utility service; e.g., “Sanitary Sewer”.

C. Access Covers:

1. 42-inch clear opening manhole cover consisting of reinforced plastic and resin-composite structure complying with AASHTO H20 rating and aluminum frame, including operating handle; “Fiberlite Model FL42” by Fiberlite Corporation, Cresskill, NJ.
2. 48-inch Square Double leaf, neoprene cushion, ¼-inch aluminum lid and frame to receive floor covering reinforced to withstand live load up to 300 psi and with removable key wrench, hinge and tubular compression spring operators; similar to BILCO Model No. TD.
3. 42-inch square single leaf, odor resistant, anodized ¼-inch aluminum lid and frame with continuous EPDM gasket affixed to frame to form odor-resistant barrier round entire perimeter of cover, 316 stainless steel hardware throughout, stainless steel submersible pump guide rail brackets, reinforced to withstand live load up to 300 psi and with recessed hasp covered by a hinged lid flush with surface to receive padlock, hinge and tubular compression spring operators; “Model No. J-5AL-R” by BILCO.
4. 24-inch square single leaf, odor resistant, anodized ¼-inch aluminum lid and frame with continuous EPDM gasket affixed to frame to form odor-resistant barrier round entire perimeter of cover, 316 stainless steel hardware throughout, stainless steel submersible pump guide rail brackets, reinforced to withstand live load up to 300 psi and with recessed hasp covered by a hinged lid flush with surface to receive padlock, hinge and tubular compression spring operators; “Model No. J-1AL-R” by BILCO.
5. Aluminum rectangular or round steel plate designed for quick removal pump systems rated for AASHTO H20 wheel loading and sized to allow removal of pumps.

2.07 SUMPS

A. General:

1. Sump basin shall be selected to meet installation dimensions required for pumps and accessories to meet or exceed manufacturer’s installation guidelines.
2. Provide stainless steel concrete anchors and fasteners within sump basin.

3. Basin shall be Fiberglass Reinforced Polyester (FRP) basin with gas-tight solid steel cover with threaded female fittings, where applicable. The size of the sump basin shall be as scheduled on the Drawings. The resins used shall be commercial grade polyester and shall be evaluated as a laminate test or determined by previous service to be acceptable for the intended environment. The reinforcing

material shall be a commercial grade of glass fiber (continuous strand, chopped-strand, continuous mat and/or non-continuous mat) having a coupling agent, which will provide a suitable bond between the glass reinforcement material and resin. The FRP laminate wall thickness shall vary with the height to provide the aggregate strength necessary to meet the tensile and flexural physical properties requirements. The FRP wall laminate must be designed to withstand wall collapse or buckling based on the following:

a. Hydrostatic pressure of 62.4 pounds per square foot
b. Saturated soil weight of 120 pounds per cubic foot
c. Soil modulus of 700 pounds per square foot
d. Pipe stiffness values as a specified in ASTM D3753

4. The FRP laminate must be constructed to withstand or exceed two times the assumed loading on any depth of the wet well. The finished FRP laminate will have a Barcol hardness of at least 90 percent of the resin manufacturer's specified hardness for the fully cured resin. The Barcol hardness shall be the same for both the interior and exterior surfaces.
5. The top flange (cover flange) shall have an outside diameter 2 inches (minimum) greater than the inside diameter of the sump. A four- or six-bolt hole pattern shall accommodate the mounting of a cover with at least ¼-inch diameter 300 series stainless steel fasteners. The inserts shall have an offset tab to prevent stripping or spinning out when removing and reinserting cover fasteners. Threaded inserts shall be 316 stainless steel; threaded inserts shall be fully encapsulated with non-continuous mat or chopped-strand glass strand reinforcement.

2.08 SUMP COMPONENTS

A. Sewer Brick: ASTM C32 Grade MA, with 1:2 Portland cement mortar, where required for final leveling to finished grade.

B. Sumps: Steel reinforced pre-cast concrete (5,000 psi at 28 days), one piece or intermediate barrel sections as required with concrete base and rubber gasket joints between sections.

C. Coating: Asphaltic Coating "Inertol Standard" as manufactured by Inertol Co.

D. Pipe Openings: Molded rubber gasket conforming to ASTM C923, integrally cast into manhole, consisting of funnel-shaped boot which is combined with hook-shaped pressure ring and hollow "O"-ring on exterior face of boot; Dual-Seal II manufactured by Dual-Seal Gaskets in Navron, PA.

E. Manhole Frames and Covers: Cast iron construction, solid lid, gas-tight bolted design and dimensions meeting the clear dimensions indicated on the Drawings; by Neenah, East Jordan, or approved equivalent.

2.09 BREAK TANK

A. BREAK TANK CONSTRUCTION

1. The Break Tank shall be of the size and configuration as shown on the plans as manufactured by FlowTherm Systems or equal. Tank shall be constructed in accordance with American Welding Society Specifications, NSF-61, California AB1953 low lead regulation, San Jose Water Company, and Uniform Plumbing Code for both potable and reclaimed water.
2. The Break Tank shall be constructed of either 10-gauge carbon steel with and

NSF-61 certified interior epoxy coating, epoxy coated exterior with UV protective modified polycarbamide top coat or 10 gauge 304 stainless steel (unpainted).

3. The Break Tank shall be equipped with a 16” hinged and gasketed inspection opening (12” opening on 120-gallon nominal capacity or less). The Tank shall be provided with an overflow connection of the size indicated on equipment schedule and/or plans to be field piped to an appropriate drain location by the installing contractor. A stainless steel screened, code-compliant vent opening/air gap shall be provided on the side of the tank located above the overflow connection.
4. The Break Tank shall include the following and such other items detailed on the plans.

    a. Top, bottom, and sides are 10-gauge minimum plate thickness.
    b. Grooved outlet and overflow connections. Sized according to the equipment schedule and/or plans
    c. Stainless steel screened, code-compliant vent opening/air gap
    d. Inlet piping connection without funnel. Size per equipment schedule and/or plans
    e. Water-level sight glasses including angle valves with ball checks, drain valve, and 5/8” clear sight glass with brass protection rods.
    f. Water level transmitter with service isolation valve. Transmitter connected to the tank exterior with protective cover to prevent damage, 4-20mA analog output.
    g. Float switch type High Water Alarm/Fill Valve Shut-off mounted to tank side wall.
    h. Drain valve, gate type.
    i. Anchor clips, quantity four ¼” angle with 5/8” hole for ½” anchor.
    j. Lifting lugs, quantity two.

B. TANK PROTECTIVE COATING

1. Application procedure shall conform to the standards of Craftsmanship in the Steel Structures Painting Manual, Volume 1, Good Painting Practice.
2. Materials shall be thinned only the amount required to adjust the viscosity for temperature variations, proper atomization, and flow.
3. All coats for paint on the interior surfaces shall be from the same manufacturers and shall be listed under ANSI/NSF Standard 61 Listing for Drinking Water Systems. Coatings shall be applied per manufacturer’s recommendations.

C. PROTECTIVE COATING SYSTEMS

1. INTERIOR SURFACES

    a. Surface preparation – per SSPC-SP10NACE 2 Near-White Blast Cleaning with a minimum angular profile of 1.5 mils.
    b. Thick-Film Coating – 3M Scotchkote #134 Fusion-Bonded Epoxy Coating with 15 mils dry film thickness.

2. EXTERIOR SURFACES

    a. Surface preparation – per SSPC-SP10NACE 2 Near-White Blast Cleaning with a minimum angular profile of 1.5 mils.
    b. Prime Coat – Tnemec 664HS Hi-Build Epoxy 3-5 mils thickness.
    c. Finish Coat - Tnemec UVX Series 750 2-4 mills thickness.

3. COATING INSPECTION

a. Coating thickness is verified using a Defelsko PosiTector 6000 electronic coating thickness gauge with Certificate of Calibration showing traceability to NIST or PTB. Conforms to national and international standards including ISO and ASTM.

D. WATER SUPPLY FILL VALVE(S)

1. Fill valve, sized on plans, shall be Cla-Val model 136-01 solenoid pilot-operated diaphragm valve with closing speed control and 24VAC solenoid.
2. Fill valve is shipped loose for field installation by contractor.

E. BREAK TANK LEVEL MANAGEMENT SYSTEM

1. Break Tank shall be provided with a level sensing pressure transducer with a 4-20mA output signal, 14-30 VDC power requirement. The transducer is field-wired to a FlowTherm Aqualogic booster pump controller or equivalent to monitor tank level and provide a “low level shut down” of the booster pump system. Once the tank level is restored, the booster pump will automatically resume normal operation.
2. A mechanical float switch type High Water Alarm/Fill Valve Shut-Off shall be provided and mounted to a coupling on the side of the tank. The float switch is field wired to the FlowTherm Aqualogic booster pump controller or equal by the installing contractor. Cable-type float switches are not acceptable. If a high water condition is detected, the fill valve is signaled to close by the controller. The booster pump will continue to operate normally.
3. grooved overflow connection, as sized on plans, is provided for piping to a drain location appropriately sized for the application.

2.10 MISCELLANEOUS COMPONENTS AND ACCESSORIES

A. High Water Level Alarm: NEMA 4 enclosure with alarm buzzer, alarm test switch, terminal strip, flashing red dome light, isolated alarm contact, requiring 120-volt power and including a NEMA 6 high water float switch and cable; “Panel Model 8341K1013” with “Model 8233 Alarm” by Weil Pump Co.

B. Grate Cover: Aluminum grating, 2-foot square, swage locked 1-inch by ⅛-inch bar size with 2-inch by $1^{3}/_{16}$-inch rectangular spacing; “Model GAL-100A-2” by McNichols Co.

C. Elevator Sump Pump Flow Switch: 1 inch NPT, Paddle type flow detectors, low flow activation, 120-volt, 7.7 amp rated, two SPDT switches, reinforced paddle; “FS4-3T2-RP” by McDonnell Miller.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General

1. The Contractor shall be responsible for aligning in the field prior to start-up of all flexibly coupled pumps. Alignment accuracy of plus or minus 0.002 inch shall be verified with a dial indicator. Prior to start-up, the manufacturer shall submit a written report certifying that the alignment work has been performed and that the pumps are ready for operation.
2. Pump motor, suction and discharge openings shall be covered during construction period. If the motor is started, the Contractor shall be responsible to ensure that

the environment in which the motor is running is clean.

3. Install all pumps in strict accordance with manufacturer's instructions. Access/service space around pumps shall not be less than minimum space recommended by pump manufacturer.
4. Support piping adjacent to pump such that weight is not carried on pump casings.
5. Decrease from line size at pump connections with long radius reducing elbows or concentric reducers/increasers in the vertical piping, or eccentric reducers/increasers for horizontal piping. Install eccentric reducers/increasers with the top of the pipe level.

B. Water Booster Pump System: Install in accordance with manufacturer's instructions.

1. Pumps:

a. Remove air from system prior to running pump.
b. Install pumps and piping system properly for quiet and vibration free operation.
c. Install booster pump on 4-inch high concrete housekeeping pad.
d. Provide copper tubing from the over-temperature protection purge valve on the pressure booster pump system to discharge into a floor drain with air gap. Provide corrosion-proof supports on floor to support tubing and route in a neat and uniform manner.

2. Hydropneumatic Tank:

a. Anchor tanks rigid to housekeeping pads using corrosion-resistant fasteners.
b. Flush and sterilize tanks prior to start-up of booster pump system.
c. Check air pressure in tank, and adjust pressure to meet system requirements.
d. Pressurize tank with oil-free compressed air or nitrogen gas only.
e. Check air charging fill valve for leakage or damage. Replace with new valve if there are any signs of damage.

3. Circulating Pumps:

a. Install in accordance with manufacturer's instructions.
b. Remove air from system prior to running pump.
c. Install pumps and piping system properly for quiet and vibration-free operation.
d. Do not support pump at motor.
e. Do not mount motor shaft in vertical position.
f. Brace vertical piping to wall or floor.

4. Pumps Control and Alarm Panels:

a. Locate control and alarm panels with bottom of panels at no less than 4 feet-6 inches above finished floor.
b. Provide identification system identifying function of switches, control devices, panel lights, and buttons; and securely fasten to panels.
c. Provide power and control wiring for submersible type pumps.
d. Provide conduit and junction boxes for power and control wiring outside of sump to control and alarm panels.
e. Provide sufficient length of control and power wiring to connect to pumps, pump controls, and alarm controls to reach pump control panel and alarm

panel locations.

f. Provide wiring from panels to pumps and controls for complete and operating system.

C. High Water Level Alarm:

1. Provide control wiring to alarm float switch, and alarm wiring control panel.
2. Install control wiring inside conduit. Refer to Division 26 for materials.
3. Test and adjust controls for complete alarm functions.

D. Pre-cast Concrete Sumps:

1. Provide extension to grade where indicated.
2. Provide hand-trolled surface in base of sump at ¼-inch per foot slope (minimum) using Portland cement grout mix, sloping perimeter of sump to suction opening at submersible pump installations.
3. Provide asphaltic coating on all surfaces of interiors of sump basin.
4. Provide asphaltic coating on all surfaces of interiors and exteriors of pre-cast concrete sump basins.

E. Provide electrical wiring in accordance with Division 26 and Section 23 09 230 Building Management System (BMS).

F. Break Tank

1. Pipe and install the break tank as shown on the plans and per manufacturers recommendations. The break tank shall be installed on a level equipment housekeeping pad.
2. Thoroughly clean the inside and outside of the tank and verify that all required trims are installed prior to filling the tank. Verify level sensor calibration and signal span settings to properly indicate tank level on the Aqualogic booster pump controller. Verify fill valve is operating properly. Secure inspection opening prior to operating tank.
3. Break tank shall be disinfected before they are placed in service. Break tank facilities taken out of service for inspection, repair, painting, cleaning, or other activity that might lead to water contamination shall be disinfected before it is returned to service.

3.02 FIELD QUALITY CONTROL

A. Water Booster Pumps:

1. Pump Start-up:

a. Water Booster Pump Systems:

1) Do not operate pumps until piping tightness tests, flushing and disinfection has been completed on water piping systems.
2) Verify power source and wiring is adequate and connected to specified power source which meets the operating conditions of the pump motor.
3) Confirm pump rotation matches pump manufacturer’s specifications.
4) Document suction pressure and boosted pressure conditions at all operating mode.

5) Confirm relief valves and discharge lines are installed and operable.

b. Circulator Circulating Pumps:

1) Adjust balancing valves so that amount of water circulated by circulating pump under actual normal operating conditions is not less than 90 percent, nor more than 120 percent of required amount, unless otherwise noted or approved.
2) Do not operate pumps until piping tightness tests, flushing and disinfection has been completed.
3) Delete the following if circulating pumps are to run continuously.
4) Control installation:

a) Install immersion-type aquastats in hot-water return piping.
b) Install timers.

2. Pump Testing and Adjustment:

a. Compute pump capacities from pump curves supplied by pump manufacturer and from actual pressure readings taken from pressure gauges located at proper points in the pump inlet and outlet. Apply all necessary corrections due to static head differences, etc.
b. Adjust impeller size by trimming or factory replacement, if necessary to reduce pump capacity beyond that which can be accomplished by reasonable adjustment of balancing cocks or valves or to obtain necessary quiet and vibrationless operation within specified operating conditions. Trim impeller in accordance with recommendations of pump manufacturer using factory or competent machine shop approved by pump manufacturer.

B. Drainage Pump Systems:

1. Trim or replace impeller in accordance with recommendations of pump manufacturer using factory or competent machine shop approved by pump manufacturer to obtain optimum pump and motor operating conditions required for each installation.
2. Confirm motor rotation matches manufacturer’s specifications.
3. Remove all debris from sump basin and pump prior to turning over to Owner the drainage pump system.
4. Adjust pump and alarm levels to comply with field conditions.
5. Make all openings into basins with cover plate gas-tight and seal annular space of all pipe penetrations.

C. Manufacturer’s Field Service:

1. Provide manufacturer’s field service for the following systems:

a. Water booster pump systems
b. Drainage pumps systems

2. Manufacturer’s field service to include two site visits, unless otherwise directed.

a. Start-up visit: Service of factory-trained representative available to check

installation and start-up and instruction of Owner's operating personnel for following systems.

b. Contract close-out visit: Instruct Owner's operating personnel in proper system operation and maintenance of systems after systems are turned over by Contractor to Owner's operating personnel. Submit letter to Architect stating that system is operating satisfactory and Owner's operating personnel have been instructed.

END OF SECTION 22 11 23