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

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

A. AISI – American Iron and Steel Institute

B. 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

C. 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

D. ISO – International Organization for Standardization

1. ISO 9001 – 2008: Quality Management System Requirements

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

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

F. NEMA – National Electrical Manufacturers Association

G. NFPA – National Fire Protection Association

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

a. Article 90.7 – Examination of Equipment for Safety

H. 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

I. UL – Underwriters Laboratories Inc.

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

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

F. Check Valves: NIBCO, or approved equivalent.

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

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

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

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

equivalent.

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

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

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

2.02 WATER PRESSURE BOOSTER PUMP SYSTEMS

A. Constant Speed Booster Pump System – End Suction:

1. Factory-assembled components, vertical mounted, duplex constant speed, variable flow, end suction pumps, factory assembled, water booster system, with factory-supplied hydropneumatic tank for **[remote] [skid]**-mounted bladder tanks installation.

a. Pumps: Pumping system includes constant speed, single stage, end suction design with cast iron bronze fitted construction, equipped with sleeve-mounted mechanical shaft seals and close-coupled to high efficiency motor having Class “F” insulation. **[208] [480]** volt, 3 phase, 60 hertz, and **[1,750] [3,500]** rpm.

b. Motors: Totally enclosed fan cooled, high efficiency motor having Class “F” insulation and manufactured in accordance with NEMA standards.

1) Horsepower: as scheduled on the Drawings.

2) Power:

a) **[208] [480]** volt, 3 phase, 60 hertz

b) **[1,750] [3,500]** rpm

3) Pump Performance Characteristics:

c) Each pump rated for maximum demand indicated on the Drawings, at minimum boost pressure as indicated on the Drawings. Select pump system with maximum pressure or flow within 10 points of best pump efficiency.

d) Minimum suction pressure of 20 psig and maximum suction pressure of [**xx**] psig.

c. Mounting and Accessories:

4) Factory-assembled on steel skid including pumps, motors, valves, 3-inch “Type L” copper suction and discharge manifolds, and interconnecting piping, wiring and controls, hydropneumatic tank and enamel paint factory-finish on skid-mounted components and frame.

5) Factory Installed Accessories:

a) Bronze body full port 2-piece ball valves on suction and discharge of each pump.

b) 2 ea. 4½-inch, ASME B40.100, panel-mounted gauges for indicating system suction and discharge pressure.

c) Hydropneumatic tank: Pre-piped **[170]** gallon factory pre-charged hydropneumatic bladder type storage tank with 150 psi working pressure and capacity no less than 10 percent of total system demand. Include full port ball

valve type isolation valve, pressure gauge and gauge cock.

d) Pilot-operated diaphragm type combination pressure regulating and non-slam check valve. Includes cast iron main valve body with fully fused epoxy coating inside and out and stainless steel valve seat pilot regulator seat and cover. Provide one (1) pressure regulator on each pump discharge line, selected for not more than 5 psig pressure drop at full pump capacity.

6) Pump Controls: UL Listed enclosed industrial control panel in NEMA 4 enclosure factory-mounted and -wired on steel skid. Furnished with two (2) through-the-door disconnect switches with magnetic starters with 3 leg overload protection, pump run lights, H-O-A selector switches, 115 volt fused control transformer, necessary relays, timers and pump start, stop and sequence controls, and programmable controller. Panel shall have the UL Listing mark for UL 508A – Industrial Control Panels.

e) Programmable controller controls all system functions of the system and includes the following features:

(1) Non-volatile memory without battery backup preventing program loss due to power failure; program cartridge allowing program changes to be made by factory and transmitted to field for simple loading into controller by operator; input and output “on” status lights supplied for ease of monitoring; and controller designed for use in locations where electromagnetic noise, high temperature, humidity, and mechanical shock exist.

f) System program features include the following:

(1) Adjustable minimum run timer for each pump start signal
(2) Adjustable time delay on each lag pump start signal
(3) Pressure switch sequencing of lag pump(s)
(4) Automatic and manual alternation of equal capacity pumps
(5) Automatic lag pump exerciser
(6) Multiple function low system pressure alarm
(7) Single function low suction pressure alarm
(8) Status light for inputs and outputs for ease of monitoring
(9) Adjustable time delay for each alarm system
(10) Intermittent audible alarm horn with silence and reset delay
(11) Indication of first actuated alarm
(12) Indication of which alarm still exists when reset attempted
(13) Lead pump shut-down controls and energy saving mode light

g) In addition, the control panel shall be furnished with the following features:

(1) Motor O/L indicating light and auto start next pump
(2) Control power (on-off) switch and light
(3) Auxiliary relay contacts with low level alarm light to shut pumps down on signal from Liquid Level Controller within storage tank. System automatically resets when signal from liquid level controller indicates that water level has been restored to proper height.
(4) Panel-mounted pressure gauge indicating suction and system discharge pressure
(5) Pre-wired temperature probe installed in each pump and connected to common electric purge valve for over-temperature protection of pumps
(6) Elapsed time meter, one (1) per pump

h) Functions:

(1) Pump Sequence:

(a) Lead: **[0]** to **[140]** gpm
(b) Lag: **[140]** to **[280]** gpm
(c) Lead Pump: Runs only as necessary to maintain system pressure and controlled automatically by means of pressure switch and minimum run timer to prevent short cycling.
(d) Lag Pump: Sequenced on and off automatically in accordance with system demand. Includes pressure switch-operated lag sequence control with on delay and minimum run timers to prevent short cycling.
(e) Automatic alternation of lead and lag pump.

7) Field Assembly Accessories:

i) 3-inch Series 300 stainless steel braided flexible pump connectors at inlet and outlet manifold.

j) Elastomer pads for anti-vibration control at **[pump] [skid]**-mounting to housekeeping pad.

k) Hydropneumatic tanks: Bladder-type hydropneumatic tanks with carbon steel shell and replaceable FDA-approved heavy-duty bladder separating air and water, designed to prevent water from coming in contact with metal wall of tank. Features include:

(1) Air-charging fill valve.
(2) Pressure gauge connection.

(3) Bottom system suitable for 100 percent drawdown.

(4) Tank Construction: Comply with Section VII of ASME code and include National Board stamp.

(5) Provide tank volume of **[1,056]** gallons and rating of 125 psi. Dimensions of each tank limited to **[60]**-inch diameter and **[115]**-inch height.

(6) Mounting: Mounted **[remote from booster pump] [on factory-assembled skid]** as shown on the Drawings.

(7) Accessories: Provide and install air pressure gauge with gauge cock on airside of bladder tanks at 1-inch side tank connection.

l) Coordination: Provide electrical and control information to liquid level sensors and control panel manufacturer to coordinate electrical interconnections.

m) Testing: Provide factory testing and certification that booster pump system meets flow rate under design conditions. All components shall be tested for hydraulic shock, vibration or excessive noise.

8) Replace any defective parts prior to shipment.

9) Provide full documentation showing flow rates, pressures and amp draw for future service and trouble-shooting reference including X-Y plotter test data.

10) Spare Components: Provide, to the Owner, three (3) fuses (of each size), two (2) lights, one (1) can of touch-up paint, one (1) mechanical seal, one (1) shaft sleeve, and one (1) gasket for each pump.

11) Service: Make service of factory-trained representative available to check installation and start-up and instruction of Owner's operating personnel. Provide local representative to visit site after system is turned over to operating personnel to instruct them in proper system operation. Submit letter to Architect stating that system is operating satisfactory and Owner's operating personnel have been instructed.

B. Constant Speed Booster Pump System – Vertical Multi-Stage Diffuser:

1. For mid- and high-zone pumped system, provide a pre-fabricated, multi-pump water pressure booster system. System shall be capable of automatically providing constant system pressure while supplying the calculated flow rates. Refer to schedule for pump heads, capacities, and electrical characteristics. System shall automatically provide complete pump shut-down during low flow conditions while maintaining constant system pressure.

2. Pumps shall be constant speed vertical multi-stage 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 pipe connections. Each pump shall have vibration isolating mounts and Series 300 stainless steel braided flexible pump connections on each pump discharge line. Pumps shall be sized for **[20]** percent, **[40]** percent and **[40]** percent of system

design.

3. Each motor shall be **[1,750] [3,500]** rpm vertical hollow shaft drip-proof. Each pump motor shall meet NEMA standards and operate within the available service factor at any point on the pump capacity – head curve.

4. System shall include **[170]**-gallon factory pre-charged hydropneumatic tank with replaceable flexible membrane separating air and water. Vessel shall be ASME code and National Board stamped. 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, non-slam type check valves shall be included. Waterside pipe connections to hydropneumatic tank shall be between the discharge of the lead pump and its pressure-reducing valve to assure constant system pressure.
5. A low system pressure switch located on the discharge header shall sense a drop in system pressure and activate a visual and audible alarm and automatically start the stand-by pump.
6. Pump sequencing by a vane-, mercury- and magnetic-actuated flow switch shall respond only to flow rate changes and is insensitive to line pressure variations. Construction shall be 304 stainless steel on all parts including mounting bushings.
7. Provide a single power and control panel NEMA 4. Enclosure shall be steel, and furnished with an oven-baked enamel. The panel shall include for each pump a fused disconnect switch with external operating handle, starter with 3 leg overload protection, running light and multiple position motor control switch. The panel shall also house all control components and include 115-volt control transformer with control power switch, indicating lights, relays, visual alarm system and other necessary controls. All of the above shall be factory internally pre-wired and -tested in accordance with the provisions of the National Electrical Code. Panel shall have the UL Listing mark for UL 508A – Industrial Control Panels.
8. System operation **[shall in a high suction shut down feature with delay to]** shut off all pumps whenever suction pressure exceeds system pressure. A drop in suction will automatically restart the system.
9. Systems connected to city water mains that can experience varying inlet pressures shall have a “MaxiStore” flow switch installed in series with the adjustable pressure switch so that maximum storage can be obtained.
10. System shall include individual 4½ inch, ASME B40.100, pressure gauges for pumps, system and suction pressures panel-mounted. Controls shall shut down the pump system and activate a visual and audible alarm when incoming water pressure is lost.
11. The entire booster system shall be factory pre-fabricated on a common structural steel stand with all interconnecting piping and wiring completed and operationally tested prior to shipping. Complete packaging shall also include bronze body full port 2-piece ball valves for isolation on the suction and discharge of each pump. Galvanized steel suction and discharge pipe manifolds, as well as copper tubing with shut-off cocks for gauges and pressure switches, shall be furnished assembled. The only field connections required shall be suction and discharge and power connection at the control panel.
12. 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 system operating flow test from zero to 100 percent design flow rate under specified suction and net delivery pressure conditions. Certification shall include copies of the test data as recorded. System test may be

witnessed by Owner, Architect, or Engineer.

13. The service of a factory-trained representative shall be made available on the jobsite to check installation and start-up and instruct operating personnel.
14. Spare Components: Provide, to the Owner, three (3) fuses (of each size), two (2) lights, one (1) can of touch-up paint, one (1) mechanical seal, one (1) shaft sleeve, and one (1) gasket for each pump.

C. Variable Speed Booster Pump System – Duplex:

1. Duplex, factory assembled, skid mounted, variable speed control for constant pressure and variable flow using microprocessor controller, with factory-supplied hydropneumatic tank; “SSV Series with Aquavar Controls” by G & L Pumps, Auburn, New York.

2. Pumps: Vertically mounted, variable speed, 4 stage, AISI 316 stainless steel wetted parts construction, equipped with John Crane Type 21 Mechanical Seal for standard domestic water duty including silicon carbide rotary and stationary faces, close-coupled to motor, ANSI Class 300, **[2]**-inch flanges; “Aquavar A3SVD-316 Version” by G & L Pumps.
3. Motors: Totally enclosed fan-cooled, high efficiency motor having Class “F” insulation and manufactured in accordance with NEMA standards.

    a. Horsepower: As indicated on the Drawings.
    b. Revolutions: **[1,750] [3,500]** rpm.
    c. Power: **[208] [460]** volt, 3 phase, 60 hertz.

4. Pump Performance Characteristics: Each pump rated for maximum demand of **[60]** gpm at minimum boost pressure of **[50]** psig. Select pump system with maximum pressure or flow within 10 points of best pump efficiency. Minimum suction pressure of **[20]** psig and maximum suction pressure of **[30]** psig.
5. Mounting and Accessories:

    a. Factory-assembled on steel skid including pumps, motors, valves, stainless steel suction and discharge manifolds, interconnecting piping, wiring and controls, hydropneumatic tank and enamel paint factory-finish on skid-mounted components and frame.
    b. Bronze body full port two-piece ball valves for isolation on suction and discharge of each pump.
    c. 2 ea. 4½-inch, ASME B40.100, panel-mounted gauges for indicating system suction and discharge pressure.

    d. Hydropneumatic tank: Pre-piped **[170]** gallon factory pre-charged hydropneumatic bladder type storage tank with 150 psi working pressure and capacity no less than 10 percent of total system demand and mounted on the skid provided with the pumps. Include full port ball valve for isolation, pressure gauge and gauge cock.

6. Pump Controls:

    a. Microprocessor controller located within UL Listed enclosed industrial control panel in a NEMA 4 enclosure on pump motor with frequency inverter controlling pump based upon input from pressure transducer. Program settings for constant pressure variable volume. Panel shall have

the UL Listing mark for UL 508A – Industrial Control Panels.

b. Display: 2-line LCD display, on, run, and fault display lights.
c. Control: Modified PID with two pint control.
d. Input/output: Analog and SIO via RS-485.
e. Protection short circuit, ground fault, under voltage, overheating, overload, over voltage, motor over-temperature, low/no water with external switch, radio emission.
f. Functions:

12) Pump Sequence:

a) Lead: **[0]** to **[60]** gpm.
b) Lag: **[60]** to **[120]** gpm.
c) Lead Pump: Runs only as necessary to maintain system pressure and controlled automatically by measuring differential pressure and runs for minimum period established by pump manufacturer to prevent short cycling.
d) Lag Pump: Sequenced on and off automatically in accordance with system demand and runs for minimum period established by pump manufacturer to prevent short cycling.
e) Automatic alternation of lead and lag pump.

7. Field Assembly Accessories:

a. 2-inch Series 300 stainless steel braided flexible pump connectors at inlet and outlet manifold connections.
b. Elastomer pads for anti-vibration control at pump mounting to housekeeping pad.
c. Testing: Provide factory testing and certification that booster pump system meets flow rate under design conditions. Components tested for hydraulic shock, vibration or excessive noise.

8. Replace any defective parts prior to shipment.
9. Provide full documentation showing flow rates, pressures and amp draw for future service and trouble-shooting reference including X-Y plotter test data.
10. Spare Components: Provide, to the Owner, three (3) fuses (of each size), two (2) lights, one (1) can of touch-up paint, one (1) mechanical seal, one (1) shaft sleeve, and one (1) gasket for each pump.

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] [250]** 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 **[or aluminum bronze, ASTM B584]**.

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 **[90]** or approved equivalent, suitable for use in a domestic water system.

B. Furnish centrifugal long (flexible) 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 horizontal installation]** and be serviceable without dismantling the circulator piping connections.
2. Casings shall be cast **[bronze]**, ASTM B584.

3. Pump working pressure shall be **[175] [250]** psi.
4. Impeller shall be cast **[bronze,]** **[closed]** type, ASTM B584, **[carbon]** steel impeller key, keyed to the shaft, **[brass]** impeller washer, brass impeller lock washer and a **[brass]** impeller cap screw.
5. Pump shaft shall be steel, grade SAE 1144, and connected to the motor with a flexible type coupling. Shaft sleeve shall be copper alloy 110.

6. Shaft seal assembly shall be an internally flushed single seal of the stuffing box design, **[consisting of a housing of brass, ASTM B36/B36M; EPT bellow; carbon steel rotating ring; 304 stainless steel spring; ceramic seat and EPT seat gasket. Seal assembly]** 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 **[fitted]** pump, Series **[60]** or approved equivalent, suitable for use in a domestic water system.

C. CIRCULTING PUMP CONTROLS

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

   a. Manufacturers:
   13) Honeywell International, Inc.
   14) Square D.
   15) 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:
   16) Honeywell International, Inc.
   17) Intermatic, Inc.
   18) Johnson Controls, Inc.
   19) 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:
   20) Honeywell International, Inc.
   21) Intermatic, Inc.
   22) Johnson Controls, Inc.
   23) Square D.
   24) 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: **"[Series 1409 with Micro Switch]**" by Weil Pump Company.

a. Pump Rating: **[30]** gpm at **[18]** feet TDH
b. Pump Motor: Non-overloading over entire range of pump curve, 0.33 horsepower, 1,750 rpm, 120 volt, single phase, 60 hertz and of air-filled design:

25) Motor Housing: Water-tight cast iron shell with extended cooling fins and Class "F" insulation.
26) Motor Shaft: 300 Series stainless steel with permanently lubricated, double seal ball bearings having rated life of 17,500 hours.
27) Impeller: Bronze multi-vane semi-open closed type, statically and dynamically balanced. Inlet to pump protected by strainer assembly at suction plate.
28) 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: **["Series 1409 with Micro Switch"]** by Weil Pump Company.

a. Pump Rating: **[30]** gpm at **[18]** feet TDH with ⅝-inch solids handling capacity.
b. Pump Motor: Non-overloading over entire range of pump curve, 0.33 horsepower, 1,750 rpm, 120 volt, single-phase, 60 hertz and of air-filled design.

29) Motor Housing: Water-tight cast iron shell with extended cooling fins and Class "F" insulation.
30) Motor Shaft: 300 Series stainless steel with permanently lubricated, double seal ball bearings having rated life of 17,500 hours.
31) Impeller: Bronze multi-vane semi-open closed type, statically and dynamically balanced. Inlet to pump protected by strainer assembly at suction plate.
32) 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. 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 Sump Pump System: Includes duplex submersible sump pumps, quick disconnect and removal system, control panel, liquid level and high water alarm controls. Provides automatic control of pumps with alternating lead-lag setup and high water level alarm and standby pump alarm system.

1. Pumps: Weil Pump **["No. 1607" with Weil "No. 2613 Quick Disconnect and Removal Elbow Assemblies"]**:

a. Pump Rating: **[115]** gpm at **[29]** feet TDH with ⅝-inch solids handling capacity.

b. Pump Motors: Non-overloading over entire range of pump curve, 1½ horsepower, 1,750 rpm, **[208] [480]** volt, 3-phase, 60 hertz.

33) Motor Housing: Water-tight cast iron, air-filled shell with extended cooling fins with Class "F" insulation.

34) Motor Shaft: 300 Series stainless steel with permanently lubricated, double seal ball bearings having rated life of 17,500 hours.

35) Impeller: Cast iron closed type, machined to proper diameter and statically and dynamically balanced.

c. Float Switches: UL Listed, NEMA 6 construction, hermetically sealed and made of non-corrosive materials; Weil "No. 8230".

36) Provide heavy neoprene jacket on support wire.

37) Set float switches at heights indicated on the Drawings.

38) Provide four float switches to perform the following functions:

a) Both pumps off
b) Lead pump on
c) Lag pump on
d) High water alarm

d. Control Panel(s): Control components housed in NEMA 4 enclosure panel. Includes the following features:

39) 2 motor circuit breakers

40) 2 contactors

41) 1 electric alternator

42) 2 test-off-automatic selector switches

43) 2 red running pilot lights

44) 1 numbered and wired terminal strip

45) 1 set of auxiliary contacts and non-cancelable alarm light and alarm buzzer with silencer for stand-by pump alarm system

e. Provide stand-by pump alarm to activate alarm if lead pump fails to operate. If lead pump fails to operate lag, pump automatically activates.

2. High Water Alarm System: NEMA 4 enclosure wall-mounting with dedicated 110-volt power source external to pump power panel; "No. 8301" by Weil Pump with option listed below. High water alarm panel may be combined with pump control cabinet with a dedicated 110-volt power source to power high water alarm circuits.

a. 4-inch Alarm Bell mounted on top of panel with silencing switch with automatic reset; "No. K7051" by Weil.

b. Alarm Dome Light remotely mounted with no manual reset; "No. K7053"

by Weil.

c. Dim Glow Alarm Lights; “No. K7092” by Weil.
d. Alarm Test Pushbutton energizing all lights and audible alarms; “No. K7094” by Weil.
e. Lamps glow dim at all times except under alarm conditions, when lamps glow bright and flash.

3. System Operation:

a. When sump level rises, lower mercury float switch energizes first, then upper level switch energizes and starts lead pump.
b. With lead pump operating, sump level lowers to pump off mercury switch setting and pump stops.
c. Alternating relay indexes on stopping of pump and lag pump starts on next operation.
d. If sump level continues to rise when lead pump operates, both pumps on mercury float switch energize, lag pump starts, and high water alarm activates.
e. Both lead and lag pumps operate together until water level reaches mercury float switch “Both Pumps Off” setting.
f. If one pump fails for any reason, second pump operates override control and alarm bell and light signals.

4. Provide 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.
5. Accessories

a. Control and Power Cords: Sufficient length to connect to control panel on wall. Route wiring in conduit to control panel.

D. 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.

46) 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.

47) 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.

48) 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 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).

3.02 FIELD QUALITY CONTROL

A. Water Booster Pumps:

1. Pump Start-up:

a. Water Booster Pump Systems:
49) Do not operate pumps until piping tightness tests, flushing and disinfection has been completed on water piping systems.
50) Verify power source and wiring is adequate and connected to specified power source which meets the operating conditions of the pump motor.
51) Confirm pump rotation matches pump manufacturer’s specifications.
52) Document suction pressure and boosted pressure conditions at all operating mode.
53) Confirm relief valves and discharge lines are installed and operable.

b. Circulator Circulating Pumps:

54) 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.

55) Do not operate pumps until piping tightness tests, flushing and disinfection has been completed.

56) 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