PART 1 - GENERAL REQUIREMENTS

1.01 SUMMARY

A. This Section includes the following types of plumbing pumps:

1. Inline circulator pumps
2. Inline pumps
3. Packaged domestic booster pumps

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 3 Section "Concrete Work" for specifications on concrete and reinforcing materials and concrete placing requirements for equipment pads.
2. Division 22 Section “Coordination” for basic requirements for electrical components that are an integral part of packaged system components.
3. Division 22 Section, “Basic Piping Materials and Methods” for rubber flexible connectors.
4. Division 22 Section "Vibration Isolation for Plumbing Piping and Equipment" for inertia pads, isolation pads, spring supports, and spring hangers.
5. Division 26 Section “Common Work Results for Electrical” required electrical devices.
6. Division 26 Sections "Enclosed Switches and Circuit Breakers" for field-installed disconnects.

1.02 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data including standard performance curves, weights (shipping, installed, and operating), furnished specialties, and accessories, plus installation and start-up instructions.
2. Shop drawings showing layout and connections for plumbing pumps. Include setting drawings with templates, and directions for installation of foundation bolts, anchor bolts, and other anchorages.
3. Wiring diagrams detailing wiring for power, signal, and control systems; differentiating between manufacturer-installed wiring and field-installed wiring.
4. Maintenance data for plumbing pumps, for inclusion in Operating and Maintenance Manuals specified in Division 1 and Division 22 Section "General Plumbing Requirements."

5. Submit certification that pumps, valves, fittings and specialties comply with NSF 61 Annex G.

1.03 QUALITY ASSURANCE

A. Hydraulic Institute Compliance: Design, manufacture, and install plumbing pumps in accordance with "Hydraulic Institute Standards."

B. National Electrical Code Compliance: Components shall comply with NFPA 70 "National Electrical Code."

C. UL Compliance: Plumbing pumps shall be listed and labeled by UL and comply UL Standard 778 "Motor Operated Water Pumps."

D. UL Compliance: Control panels shall be listed and labeled by UL and comply with Standard 508A “Control Panels”.

E. NEMA Compliance: Electric motors and components shall be listed and labeled NEMA.

F. Single-Source Responsibility: Obtain plumbing pumps of the same type from a single manufacturer.

G. Design Criteria: The Drawings indicate sizes, profiles, connections, and dimensional requirements of plumbing pumps and are based on the specific manufacturer types and models indicated. Pumps having equal performance characteristics by other manufacturers may be considered, provided that deviations in dimensions and profiles do not change the design concept or intended performance as judged by the Architect. The burden of proof for equality of plumbing pumps is on the proposer.

H. Comply with NSF 61 Annex G (pending) for wetted surfaces of valves, fittings and specialties containing no more than 0.25% lead by weight compliance for valves for domestic water service.

I. Valves, pumps and fittings shall be manufactured in plants located in the United States or certified that they comply with applicable ANSI, ASTM and MSS standards.

1.04 SPARE PARTS

A. Furnish spare parts described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One mechanical seal for each pump.

1.05 WARRANTY

A. Warranty on Pumps: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, pumps with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement includes both parts and labor for removal and reinstallation.

1. Warranty Period: One year from date of substantial completion.

PART 2 - PRODUCTS AND MATERIALS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Inline Circulator Pumps:

   a) Armstrong Pumps, Inc.
   b) Bell & Gossett, ITT.
   c) Grundfos Pumps, Corp.
   d) Taco, Inc.

2. Inline Pumps:

   a) Armstrong Pumps, Inc.
   b) Bell & Gossett, ITT.
   c) Grundfos Pumps, Corp.
   d) Taco, Inc.

3. Packaged Domestic Booster Pumps – Variable Speed Multistage

   a) Armstrong
   b) Bell & Gossett, ITT
   c) Canariss Corp.
   d) Delta P Carver
   e) Grundfos Pumps, Corp.
   f) QuantumFlo, Inc.

4. Simplex Packaged Domestic Booster Pumps – Variable Speed Multistage

   a) Grundfos Pumps, Corp. with no substitutions
   b) Goulds, ITT

5. Aquastats:

   a) Dayton
   b) Honeywell
   c) Penn
   d) White-Rodgers

2.02 PUMPS, GENERAL

A. Pumps and circulators: factory assembled and factory tested.

B. Preparation for shipping: After assembly and testing, clean flanges and exposed machined metal surfaces and treat with an anticorrosion compound. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

C. Motors: Conform to NEMA standards; single, multiple, or variable speed with type of enclosure and electrical characteristics as indicated; have built-in thermal-overload protection and grease-lubricated ball bearings. Select motors that are nonoverloading within the full range of the pump performance curve.

D. Apply factory finish paint to assembled, tested units prior to shipping.

2.03 INLINE CIRCULATOR PUMPS

A. General Description: Circulators shall be horizontal inline, centrifugal, separately coupled, single-stage, all-bronze, radially split case design, with mechanical seals, permanently lubricated ball bearings and rated for 125 psig working pressure and 225 deg F continuous water temperature.

B. Casings: Cast lead free bronze, with threaded companion flanges for piping connections smaller than 2-1/2 inches, and threaded gauge tappings at inlet and outlet connections.

C. Impeller: Statically and dynamically balanced, closed, overhung, single suction, fabricated from cast lead free bronze conforming to ASTM B 584, and keyed to shaft.

D. Pump Shaft and Sleeve: Steel shaft with oil-lubricated copper sleeve.

E. Mechanical Seals: Carbon steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.

F. Pump Bearings: Oil-lubricated, bronze journal and thrust bearings.

G. Motor Bearings: Oil-lubricated sleeve bearings.

H. Shaft Couplings: Flexible; capable of absorbing torsional vibration and shaft misalignment.

I. Motors: Resiliently mounted to the pump casing.

2.04 INLINE PUMPS

A. General Description: Circulators shall be horizontal inline, centrifugal, separately coupled, single-stage, all-bronze, radially split case design, with mechanical seals, flexible coupling between pump and motor and rated for 125 psig working pressure and 225 deg F continuous water temperature.

B. Casings: Cast lead free bronze, with threaded companion flanges for piping connections smaller than 2-1/2 inches, and threaded gauge tappings at inlet and outlet connections.

C. Impeller: Statically and dynamically balanced, closed, overhung, single suction, fabricated from lead free bronze conforming to ASTM B 584, and keyed to shaft.

D. Pump Shaft and Sleeve: Steel shaft with oil-lubricated copper sleeve.

E. Mechanical Seals: Carbon steel rotating ring, stainless-steel spring, ceramic seat, and Buna-N bellows and gasket.

F. Pump Bearings: Oil-lubricated, bronze journal and thrust bearings.

G. Motor Bearings: Oil-lubricated sleeve bearings.

H. Shaft Couplings: Flexible; capable of absorbing torsional vibration and shaft misalignment.

I. Motors: Resiliently mounted to the pump casing.

2.05 PACKAGED DOMESTIC BOOSTER PUMPS – VARIABLE SPEED MULTISTAGE

A. Packaged, constant pressure type with duplex vertical multiple stage centrifugal pumps, control panel, motors, variable frequency drives, gauges, ball type isolation valves, dielectric isolators, remote accumulator tank, thermal bleed aquastat and solenoid valve and accessories. The packaged system, including all items listed below, shall be factory assembled on a fabricated steel base plate with structural steel framework. The completed package shall be factory tested, adjusted and certified for the specified flow conditions, and shipped as an integral unit ready for plumbing and electrical connections.

B. Pumps: Provide multiple stage vertical multiple stage centrifugal type with close-coupled motors, cast iron suction / discharge chamber, motor stool and pump shaft couplings, mechanical seals, 304 stainless steel and impellers, chambers, straps, suction interconnector and neck rings, 431 stainless steel pump shaft and 316 stainless steel bearings, neck rings retainers, split cones, split cone nuts, wear and lock rings.

C. Motors: Provide variable speed, totally enclosed fan cooled type, operate at 3500 rpm and shall not overload at any point of the pump curve.

D. Piping: Suction and discharge headers shall be 316 stainless steel with ANSI class 150 pressure rating and flanges welded to the headers. Peak velocity in headers shall not exceed 8 feet per second. Furnish with the following valves:

a) Lead Free Ball Valves, 2 Inch and Smaller: Meeting MSS SP-110, Class150, 600-psi CWP; two-piece construction; with ASTM B 584 cast lead free bronze, full port, blowout-proof stem and chrome-plated lead free brass ball with replaceable "Teflon" or "TFE" seats and seals, solder ends and vinyl-covered steel handle.

b) Lead Free Lift Check Valves, 2-Inch and Smaller: Meeting MSS SP-80; Class 125, 300-psi CWP, body, disc holder and cap of ASTM B 584 cast lead free bronze; horizontal or angle pattern, lift-type valve, with stainless steel spring, renewable "Teflon" disc and solder ends. Provide valves capable of being refitted and ground while the valve remains in the line.

E. Accumulator Tank: Provide tank size as scheduled on the drawings with a minimum pressure rating of 125psig; FDA approved elastomer bladder, tank bottom connection and air charge valve. Tank shall be complete with check valves, isolation valves and pressure reducing valve for remote installation.

F. Controls and Instruments: Control panel shall be mounted on the pump package and shall include a NEMA 1 enclosure, through door fusible disconnect, disconnect for each pump, overload relays and indicator lights, 120V control circuit transformer with primary and secondary fuse protection, low suction pressure limit switch, suction and discharge header pressure sensors, programmable logic controller and variable speed drives. Touchscreen operator interface for monitoring and adjustment of the programmable controller variables with virtual on-off-automatic selector switch for each pump, low pressure alarm, high system pressure alarm, pump running indicators and hour meter for each pump. Controls shall be arranged for termination of 1 incoming power feeder. Control panel shall have a unit short circuit current rating equal to or greater than the available short circuit current as indicated on the electrical drawings.

1. Programmable Logic Controller (PLC): Designed specifically for the control of pumps with variable speed drives capable of receiving two analog pressure inputs, analog flow input, automatic pump alternating and On-line field modified data entries for staging pumps, with software memory stored in non-volatile EPROM memory, furnish with user interface keypad with LED display.
2. Variable Frequency Drive: The variable speed drives (VFD) shall be adjustable frequency type which employs a pulse width modulated inverter. The drive shall include built in diagnostics. Diagnostics shall be annunciated through the alpha numeric keypad. The drive shall be listed

UL, ETL and/or CSA. To insure safety of the equipment, the VFD shall include these protective features and options:

a) NEMA 1 enclosure.
b) Static instantaneous over-current and over-voltage trip.
c) Static over-speed (over-frequency) protection.
d) Line or fuse loss and under-voltage protection.
e) Power unit over-temperature protection.
f) Motor inverse time overload protection.
g) Input fused disconnect or circuit breaker.
h) Total voltage harmonic distortion from the VFD shall be less than 5% to meet IEEE requirements.
i) Speed meter.
j) Automatic restart after power failure or minor drive fault. The drive shall attempt a minimum of two restarts before a complete drive shut-down.
k) Power on light.
l) Manual speed potentiometer or control capability through the keypad.
m) Hand/Off/Automatic Switch or Manual/Automatic Switch with start/stop pushbutton.
n) Test switch
o) VFD fault light and reset.
p) Output to the PLC and integral LED display
q) The VFD shall be microprocessor based and utilize digital input for all parameter adjustments. The VFD shall include a digital display for monitoring system parameters and for first fault indication, and digital input programming capability on the main logic board.
r) The VFD shall operate on a frequency range of 1 to 66 Hz with resolution of 0.1% of base speed with analog input or 0.025% with digital input and have accuracy within 0.05% of set point. VFD shall operate in environment of 0 to 40 degrees C, 3,300 feet altitude and 95% non-condensing humidity without derating.
s) All control circuit voltages shall be physically and electrically isolated from power circuit voltages.
t) All VFD's shall be tested/run in the equivalent of NEMA 1 enclosure and burned in at rated ambient (40° C) with a fully loaded motor.
u) Configured for mounting on top of motor or outside of control panel.

3. Pressure Sensors: NEMA 4 water tight enclosure with pressure rating of 2,000psi, stainless steel wetted parts, 0.25" male NPT connection, calibration from 0 to 150 psi with 4-20mA DC signal at 24 VDC. Refer to the floor plans for location of remote pressure sensor.
4. Sequence of Operation: The domestic water booster pump shall be in automatic mode per the design conditions shown on the booster pump schedule. The pump shall modulate its speed to maintain the discharge head

pressure setpoint, as determined by the internal control algorithm, simulating the performance of a system utilizing a remote differential pressure sensor. The pumps shall run in a lead/lag operation based on user defined run-time setpoint. When the flow capacity of the lead pump is exceeded, the lag pump shall start after an adjustable time delay. If the capacity of the lead pump and lag pump is exceeded, the second lag pump (and the N+1 sequencing shall continue based on the number of pumps in the system) shall start.

a) When a single pump operates at minimum flow rate, the pump speed shall be reduced to the minimum discharge header pressure as scheduled. When required flow increases, the pump speed shall increase linearly to the discharge pressure as scheduled at full flow, simulating the performance of a system utilizing a remote differential pressure sensor.

b) When the lead pump is stopped because of required zero flow, the pump speed shall increase linearly to the discharge pressure as scheduled to charge the tank, then stop.

5. Safeties:

a) Low Suction Pressure

1) When the suction pressure drops below the low suction pressure alarm point as determined by the integral suction pressure sensor, the pumps shall be disabled and an audible alarm shall be sent to the BMS or local building alarm system.

b) High Discharge Pressure

1) When the discharge pressure rises above the high discharge pressure alarm point as determined by the integral discharge pressure sensor, the pumps shall be disabled and an audible alarm shall be sent to the BMS or local building alarm system

c) High Flow Shutdown

1) When the discharge flow, as calculated by the control system, rises above the high flow alarm point, the pumps shall be disable and an audible alarm shall be sent to the BMS or local building alarm system.

6. Control Wire: Domestic booster pump manufacturer shall furnish the appropriate type and amount of wire for interlock of the remote sensors with the domestic booster pump control panel.

G. Startup Services: Domestic booster pump manufacturer shall provide factory start-up and check out of the booster pump. The Contractor shall provide the Owner's Representative with certification of proper installation and system operation.

2.06 SIMPLEX PACKAGED DOMESTIC BOOSTER PUMPS – VARIABLE SPEED MULTISTAGE

A. Packaged, constant pressure type with simplex vertical multiple stage centrifugal pump, motor, variable frequency drive, gauges, ball type isolation valves, dielectric isolators, accumulator tank, thermal bleed aquastat and solenoid valve and accessories. The packaged system, including all items listed below, shall be factory assembled on a fabricated steel base plate with structural steel framework. The completed package shall be factory tested, adjusted and certified for the specified flow conditions, and shipped as an integral unit ready for plumbing and electrical connections.

B. Pump: Provide multiple stage vertical multiple stage centrifugal type with close-coupled motors, cast iron suction / discharge chamber, motor stool and pump shaft couplings, mechanical seals, 304 stainless steel and impellers, chambers, straps, suction interconnector and neck rings, 431 stainless steel pump shaft and 316 stainless steel bearings, neck rings retainers, split cones, split cone nuts, wear and lock rings.

C. Motor: Provide variable speed, totally enclosed fan cooled type, operate at 3500 rpm and shall not overload at any point of the pump curve.

D. Piping: Suction and discharge headers shall be 304 stainless steel with ANSI class 150 pressure rating and flanges welded to the headers. Peak velocity in headers shall not exceed 8 feet per second. Furnish with the following valves:

   a) Ball Valves, 2 Inch and Smaller: MSS SP-110, Class 150 saturated steam pressure, 600-psi CWP; two-piece construction; with bronze body conforming to ASTM B 584, conventional port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, solder ends and vinyl-covered steel handle.
   b) Lift Check Valves, 2-Inch and Smaller: Class 125; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends.

E. Accumulator Tank: Provide tank size as scheduled on the drawings with a minimum pressure rating of 125psig; FDA approved elastomer bladder, tank bottom connection and air charge valve. Tank shall be complete with check valves, isolation valves and pressure reducing valve for remote installation.

F. Controls and Instruments: Pump package shall include a disconnect with NEMA 1 enclosure, suction and discharge pressure switches and variable speed drive. Controls shall be arranged for termination of 1 incoming power feeder. Disconnect and VFD shall have a unit short circuit current rating equal to or greater than the available short circuit current as indicated on the electrical drawings.

1. Variable Frequency Drive: Designed specifically for the control of pump with variable speed drive capable of receiving two analog pressure inputs, with software memory stored in non-volatile EPROM memory and with LED display and user remote interface keypad. The variable speed drives (VFD) shall be adjustable frequency type which employs a pulse width modulated inverter. The drive shall include built in diagnostics. Diagnostics shall be annunciated through the LED display and user remote interface keypad. The drive shall be listed UL, ETL and/or CSA. To insure safety of the equipment, the VFD shall include these protective features and options:

   a) NEMA 1 enclosure.
   b) Static instantaneous over-current and over-voltage trip.
   c) Static over-speed (over-frequency) protection.
   d) Line or fuse loss and under-voltage protection.
   e) Power unit over-temperature protection.
   f) Motor inverse time overload protection.
   g) Input fused disconnect or circuit breaker.
   h) Total voltage harmonic distortion from the VFD shall be less than 5% to meet IEEE requirements.
   i) Speed meter.
   j) Automatic restart after power failure or minor drive fault. The drive shall attempt a minimum of two restarts before a complete drive shut-down.
   k) Power on light.
   l) Manual speed potentiometer or control capability through the keypad.
   m) Hand/Off/Automatic Switch or Manual/Automatic Switch with start/stop pushbutton.
   n) Test switch
   o) VFD fault light and reset.
   p) Output to the PLC and integral LED display
   q) The VFD shall be microprocessor based and utilize digital input for all parameter adjustments. The VFD shall include a digital display for monitoring system parameters and for first fault indication, and digital input programming capability on the main logic board.
   r) The VFD shall operate on a frequency range of 1 to 66 Hz with resolution of 0.1% of base speed with analog input or 0.025% with digital input and have accuracy within 0.05% of set point. VFD shall operate in environment of 0 to 40 degrees C, 3,300 feet altitude and 95% non-condensing humidity without derating.
   s) All control circuit voltages shall be physically and electrically isolated from power circuit voltages.
   t) All VFD's shall be tested/run in the equivalent of NEMA 1 enclosure and burned in at rated ambient (40° C) with a fully loaded motor.
   u) Configured for mounting on top of motor or outside of control panel.
   v) Low pressure limit automatic shutdown and alarm.

w) High pressure automatic shutdown and alarm.

2. Pressure Sensors: NEMA 4 water tight enclosure with pressure rating of 2,000psi, stainless steel wetted parts, 0.25" male NPT connection, calibration from 0 to 150 psi with 4-20mA DC signal at 24 VDC. Refer to the floor plans for location of remote pressure sensor.
3. Sequence of Operation: Each sensor/transmitter shall send a 4-20mA signal to the VFD, indicative of process variable condition. The VFD shall compare each signal to the independent, user determined set points. Single pump speed shall remain constant at optimum energy consumption level when all set points are satisfied. The VFD shall continuously scan and process variable to its individual set point. The VFD shall speed up or slow down the pump/motor as the worst case zone deviates from set point.
4. Control Wire: Domestic booster pump manufacturer shall furnish the appropriate type and amount of wire for interlock of the remote sensors with the domestic booster pump control panel.

G. Startup Services: Domestic booster pump manufacturer shall provide factory start-up and check out of the booster pump. The Contractor shall provide the Owner's Representative with certification of proper installation and system operation.

2.07 AQUASTATS:

A. Remote sensing bulb type, non-modulating, single pole double pole throw with surface mount sensing bulb and mounting bracket, adjustable direct reading scale for set point with adjustable differential.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install pumps in accordance with manufacturer's installation instructions.

B. General: Comply with the manufacturer's written installation and alignment instructions.

C. Install pumps in locations and arrange to provide access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.

D. Support pumps and piping separately so that the weight of the piping system does not rest on the pump.

E. Suspend inline pumps with althread hanger rod and vibration isolation hangers of sufficient size to support the weight of the pump independent from the piping system.

3.02 EXAMINATION

A. Examine areas, equipment foundations, and conditions with Installer present, for compliance with requirements for installation and other conditions affecting performance of plumbing pumps. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine rough-in for plumbing piping systems to verify actual locations of piping connections prior to installation.

3.03 CONCRETE EQUIPMENT BASES

A. Refer to Division 22 Section “Basic Mechanical Materials and Methods” for concrete equipment bases.

1. Form concrete equipment bases by using framing lumber with form release compounds. Chamfer top edge and corners of pad.
2. Install reinforcing bars, tied to frame, and place anchor bolts and sleeves using manufacturer's installation template.
3. Place concrete and allow to cure before installation of pumps.

3.04 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundations, after grout has been set and foundations bolts have been tightened, and after piping connections have been made.

1. Adjust alignment of pump and motor shafts for angular and parallel alignment by one of the two methods specified in the Hydraulic Institute "Centrifugal Pumps - Instructions for Installation, Operation and Maintenance."

B. After alignment is correct, tighten the foundation bolts evenly but not too firmly. Fill the base plate completely with nonshrink, nonmetallic grout, with metal blocks and shims or wedges in place. After grout has cured, fully tighten foundation bolts.

1. Alignment tolerances shall meet manufacturers recommendations.

3.05 CONNECTIONS

A. General: Install valves that are same size as the piping connecting the pump.

B. Install suction and discharge pipe sizes equal to or greater than the diameter of the pump nozzles.

C. Install a nonslam check valve and shutoff valve on the discharge side of pumps.

D. Install a gate valve and strainer on the suction side of inline pumps.

E. Install pressure gauges on the suction and discharge of each pump at the integral pressure gauge tappings provided.

F. Install pressure gauge connector plugs in suction and discharge piping around pump. Pressure gauge connector plugs are specified in Division 22 Section "Meters and Gauges for Plumbing Piping."

G. Install surface mounted aquastat on bare metal pipe, fastened securely to pipe upstream of circulator pump when indicated on the drawings.

H. Interlock aquastat and or timer with hot water recirculation pump motor. Electrical wiring and connections are specified in Division 26 section “Common Work Results for Electrical”.

I. Electrical wiring and connections are specified in Division 26 section “Common Work Results for Electrical”.

J. Install domestic booster pump remote sensors as recommended by the manufacturer. Coordinate interlock of the sensors and domestic booster pump. Install control wire furnished with the domestic booster pump for interlock with the sensors. Electrical wiring and connections are specified in Division 26 section “Common Work Results for Electrical”.

K. Install flexible connectors at the header inlet and outlet of domestic booster pump, refer to Division 22 Section “Basic piping Materials and Methods”.

L. Provide concrete inertia base and vibration isolators, refer to Division 22 Section “Vibration Isolation for Plumbing Piping and Equipment”.

1. Provide an equipment pad, separate from the inertia pad, to 2” beyond elbows, shutoff valves and flexible connectors. Anchor base elbows and shutoff valves to equipment pad.

M. Coordinate interlock of high flow rate, low suction pressure and high discharge pressure level alarms with the building automation system. Alarm wiring and alarm interlock with the building automation system are specified in Division 23 Section “Direct-Digital Control for HVAC”.

3.06 FIELD QUALITY CONTROL

A. Check suction lines connections for tightness to avoid drawing air into the pump.

3.07 STARTUP

A. Final Checks Before Start-Up: Perform the following preventative maintenance operations and checks before start-up:

1. Lubricate oil-lubricated bearings.

2. Remove grease-lubricated bearing covers and flush the bearings with kerosene and thoroughly clean. Fill with new lubricant in accordance with the manufacturer's recommendations.
3. Disconnect coupling and check motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.
4. Check that pump is free to rotate by hand. For pumps handling hot liquids, pump shall be free to rotate with the pump hot and cold. If the pump is bound or even drags slightly, do not operate the pump until the cause of the trouble is determined and corrected.

B. Starting procedure for pumps with shutoff power not exceeding the safe motor power:

1. Prime the pump, opening the suction valve, closing the drains, and prepare the pump for operation.
2. Open the valve in the cooling water supply to the bearings where applicable.
3. Open the sealing liquid supply valve if the pump is so fitted.
4. Open the warm-up valve of a pump handling hot liquids if the pump is not normally kept at operating temperature.
5. Open the recirculating line valve if the pump should not be operated against dead shutoff.
6. Start motor.
7. Open the discharge valve slowly.
8. Observe the leakage from the stuffing boxes and adjust the sealing liquid valve for proper flow to ensure the lubrication of the packing. Do not tighten the gland immediately, but let the packing run in before reducing the leakage through the stuffing boxes.
9. Check the general mechanical operation of the pump and motor.
10. Close the recirculating line valve once there is sufficient flow through the pump to prevent overheating.

C. If the pump is to be started against a closed check valve with the discharge gate valve open, the steps are the same except that the discharge gate valve is opened some time before the motor is started.

D. Start Up Services for Booster Pump:

1. Certification: Prepare certificates for factory compliance of the installation and completion of factory training signed by the factory-authorized service representative and turn over to the Architect upon completion of the project.

END OF SECTION