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SECTION 43 21 21 – SELF-PRIMING PUMPS

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SECTION 43 21 21
SELF PRIMING PUMPS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Division 1 specification Sections, apply to this Section.
- B. Additional requirements related to work specified in this Section include, but are not limited to, the following:

Section	Description
45 50 00	Membrane Bioreactor

1.02 SCOPE

- A. Furnish all labor, materials, tools and equipment necessary for complete installation of self priming pump(s) described in this Specification.
- B. Pump(s) shall be designed for continuous duty operation, to provide the transfer of fluid volumes as defined in the Pump Schedules in this Specification.

1.03 QUALITY ASSURANCE

- A. The manufacturer of the pump shall have a quality management system in place and shall be ISO 9001 certified.
- B. The pump and accessories specified herein shall be the design and fabrication of a single manufacturer which shall have the sole source responsibility for the pump(s) and associated accessories.
- C. The materials and equipment covered by this specification are intended to be standard materials and equipment of demonstrated successful performance and supplied by a manufacturer who has been actively engaged in the supply of similarly sized pumps for a minimum of 5 years. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's recommendations and the Contract Documents.

1.04 SUBMITTAL INFORMATION

- A. Provide a complete sets of submittal information in PDF format. All pertinent information needed to fully describe the pump(s) and accessories shall be included in the submittal. Where multiple options are included within standard literature, project specific part numbers and options shall be highlighted by

enclosing the project-specific information (circling, clouding, text boxes) and other information shall be crossed out. Any deviations to these specifications must be listed on a separate page referencing the specification section with a brief description of the deviation and why it is equal to or superior to what is specified. Submittals for each size and type shall include, but not be limited to the following:

1. Name of manufacturer
2. Type and Model
3. Rotational speed
4. Major component materials of construction
5. Pump specification describing construction details
6. Outline Dimension Drawing
7. Installation Drawing
8. Complete performance data showing capacity and power input
9. Electrical Data that includes
 - a. Motor rating, hp
 - b. Motor temperature rating
 - c. Motor full load rotational speed
 - d. Motor full load current
 - e. Motor locked rotor current
10. Motor performance curves showing speed, efficiency, current, power, etc.

1.05 OPERATION & MAINTENANCE MANUALS

- A. Furnish a complete Installation, Operation & Maintenance Manual in PDF form. Manuals shall include pump outline dimensions, motor data, nameplate data, safety instructions, transportation and storage information, general design information, mounting & installation information, electrical connection information, commissioning instructions, maintenance information and a trouble shooting guide.

1.06 SPARE PARTS

- A. Provide the following spare parts to the Owner, boxed, marked, and ready for long-term storage:
 1. One set of mechanical seal assemblies for each size pump.

2. One complete set of gaskets for each size pump.

PART 2 – PRODUCTS

2.01 PUMP DESIGN

- A. Pumps must be designed to handle raw, screened, industrial waste.
- B. Solids Handling Capability – When pumps are used for handling raw wastewater or activated sludge, all internal passages, impeller vanes, and recirculation ports shall pass a 2.5" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the engineer or owner, manufacturer's certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.
- C. Reprime Performance:
 1. During unattended operation, the pump shall retain adequate liquid in the casing to insure automatic repriming while operating at its rated speed in a completely open system. The need for a suction check valve or external priming device shall not be required.
 2. Pump must reprime the Maximum Repriming Lift shown in the Pump Schedule at the specified speed and impeller diameter while operating with only one-half of the liquid remaining in the pump casing. (Reprime lift is defined as the static height of the pump suction above the liquid.)
 3. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition.
 4. Upon request from the engineer or owner, certified reprime performance test results, prepared by the manufacturer, and certified by a registered professional engineer, shall be submitted for approval prior to shipment.
- D. Pumps shall be end suction, single stage, horizontal frame mounted, vertical V-belt type base, self-priming centrifugal type.
- E. Materials and Construction Features
 1. Pump casing: Casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:
 - a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.
 - b. Fill port cover plate, 3 1/2" diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.

- c. Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.
2. Cover plate: Cover plate shall be cast iron Class 30. Design must incorporate following maintenance features:
 - a. Retained by hand nuts for complete access to pump interior. Cover plate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.
 - b. A replaceable wear plate secured to the cover plate by weld studs and nuts shall be AISI 1015 HRS.
 - c. In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75-200 PSI.
 - d. Two O-rings of Buna-N material shall seal coverplate to pump casing.
 - e. Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.
 - f. Easy-grip handle shall be mounted to face of coverplate.
 3. Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, sealplate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:
 - a. Sealplate and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.
 - i. The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.
 - ii. The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.
 - iii. Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

- b. Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew and conical washer.
 - c. Shaft shall be AISI 4140 alloy steel unless otherwise specified by the engineer or owner, in which case AISI 17-4 pH stainless steel shall be supplied.
 - d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.
 - e. Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be silicon carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seat to the sealplate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be viton. Cage and spring to be AISI 316 stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings.
 - f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.
4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.
- a. Clearances shall be maintained by external shimless coverplate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings.
 - b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.
 - c. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

5. Suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the coverplate opening, without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.
6. Spool flanges shall be one-piece cast iron, class 30 fitted to suction and/or discharge ports and meeting ANSI B16.1, Class 125. Each spool shall have one 1-1/4" NPT and one 1/4" NPT tapped hole with pipe plugs for mounting gauges or other equipment.

F. Motor

1. Motors shall be squirrel cage induction type, totally enclosed, fan cooled, rated for inverter duty (unless otherwise stated).
2. Motors shall be 460 volts, 60 Hz, 3 phase.
3. Motors shall have NEMA Class F insulation.
4. Motor performance shall conform to the requirements of NEMA MG1 Part 12 and shall be expressed as indicated in NEMA MG1-12.30.
5. Motors shall have a 1.15 service factor rating. The pump brake horsepower requirements shall not exceed the motor name plate horsepower under the operating conditions listed in the Pump Schedule.
6. Motors shall be premium efficiency type.
7. Inverter Duty:
 - a. All motors indicated in the Pump Schedule to be powered from variable-frequency alternating-current drives (VFD) shall have the following features in addition to those listed above:
 - i Designed for used on pulse width modulated (PWM) VFD without external filters or cable length limitations.
 - ii Inverter grade, 1,600 volt, Class F insulation.
 - iii Service factor of 1.0 when operated from a VFD.
 - iv Meeting requirements of NEMA MG1 Part 31.

G. Hazardous Location Equipment

1. In addition to the requirements listed above, for the installations which are considered to be in hazardous locations as defined by the National Electrical Code (NEC), only motors certified by Factory Mutual for use in such locations shall be used.

2. Specifically, the pump motors used shall be certified for use in all Class I, Divisions 1 and 2, Groups C and D, Class II, Divisions 1 and 2, Groups E, and G and Class III locations as outlined in Articles 500-502 inclusive of the NEC code.

H. Manufacturer's Warranty:

1. The pump manufacturer shall warrant the pump equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.
2. All equipment, apparatus, and parts furnished shall be warranted for five (5) years, excepting only those items that are normally consumed in service, such as oils, grease, packing, gaskets, O-rings, etc. The pump manufacturer shall be solely responsible for warranty of the pump equipment and all components.
3. Components failing to perform as specified by the engineer or owner, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the owner.
4. The warranty shall become effective sixty (60) days after installation, or ninety (90) days after shipment, whichever occurs first.

I. Manufacturers

1. Gorman Rupp
2. Accepted equivalent

PART 3-EXECUTION

3.01 EXAMINATION

- A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Immediately after off-loading, contractor shall inspect complete pump and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all pump serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

3.02 INSTALLATION

- A. Contractor shall install, level, align, and lubricate pump(s) as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacture at time of delivery.

- B. Sufficient supports and thrust blocks shall be installed to prevent strain and vibration on pump piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required.
- C. After all anchor bolts, piping and control connections are installed, completely fill the grout dam in the pump station base with non-shrink grout.

3.03 FIELD QUALITY CONTROL

- A. Contractor is to inspect the installed pump(s) for visual deficiencies
- B. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

3.04 PROTECTION

- A. The contractor shall be responsible for provisions to protect the pumps and materials after installation but prior to acceptance by the Owner. Protection of the equipment shall include provisions during installation and testing of nearby piping, valving, or other adjacent equipment. The Contractor shall remove all protective measures installed at completion and acceptance of the project.

END OF SECTION

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INDEX TO
SECTION 43 21 39
SOLIDS-HANDLING SUBMERSIBLE PUMPS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Division 1 specification Sections, apply to this Section.
- B. Additional requirements related to work specified in this Section include, but are not limited to, the following:

Section	Description
45 50 00	Membrane Bioreactor

1.02 SCOPE

- A. Furnish all labor, materials, tools and equipment necessary for complete installation of submersible pump(s) described in this Specification.
- B. Pump(s) shall be designed for continuous duty operation, to provide the transfer of fluid volumes as defined in the Pump Schedules in this Specification.

1.03 QUALITY ASSURANCE

- A. The manufacturer of the pump shall have a quality management system in place and shall be ISO 9001 certified.
- B. The pump and accessories specified herein shall be the design and fabrication of a single manufacturer which shall have the sole source responsibility for the pump(s) and associated accessories.
- C. The materials and equipment covered by this specification are intended to be standard materials and equipment of demonstrated successful performance and supplied by a manufacturer who has been actively engaged in the supply of similarly sized pumps for a minimum of 5 years. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's recommendations and the Contract Documents.

1.04 SUBMITTAL INFORMATION

- A. Provide a complete set of submittal information in PDF format. All pertinent information needed to fully describe the pump(s) and accessories shall be included in the submittal. Where multiple options are included within standard

literature, project specific part numbers and options shall be highlighted by enclosing the project-specific information (circling, clouding, text boxes) and other information shall be crossed out. Any deviations to these specifications must be listed on a separate page referencing the specification section with a brief description of the deviation and why it is equal to or superior to what is specified. Submittals for each size and type shall include, but not be limited to the following:

1. Name of manufacturer
 2. Type and Model
 3. Rotational speed
 4. Major component materials of construction
 5. Pump specification describing construction details:
 - a. Assembly drawing, nomenclature and material list
 - b. Type, manufacturer, model numbers, location and spacing of bearings.
 - c. Impeller type, diameter, through-let dimensions, sphere size, number of vanes and identification number.
 6. Setting plans shall include:
 - a. Installation Drawing
 - b. Anchor bolt layout
 - c. Anchor bolt dimensions.
 - d. Outline dimensions and weights of pumps, bases, motors, and control enclosures.
 7. Complete motor performance data including:
 - a. Rating, voltage/phase/frequency; design type; service factor; insulation class; motor pole number; actual rotation speed when combined with the specified pumps; current, power factor and active input power (KW) as a continuous function of shaft power from no load to at least 115 percent load; start (max. inrush) current; locked rotor current; NEC code letter; and motor torque as a continuous function through the motor start cycle from no rotation to full speed.
 8. Warranty for the proposed equipment.
- B. The manufacturer shall indicate, by arrows to points on the Q/H curves, limits recommended for stable operation, between which the pumps are to be operated to prevent surging, cavitation, and vibration. The stable operating range shall be as large as possible and shall be based on actual hydraulic and

mechanical characteristics of the units and shall meet the hydraulic performance requirements of the proposed system.

1.05 OPERATION & MAINTENANCE MANUALS

- A. Furnish a complete Installation, Operation & Maintenance Manual in PDF form. Manuals shall include pump outline dimensions, motor data, nameplate data, safety instructions, transportation and storage information, general design information, mounting & installation information, electrical connection information, commissioning instructions, maintenance information and a trouble shooting guide.

1.06 SPARE PARTS AND TOOLS

- A. Provide the following spare parts to the Owner, boxed, marked, and ready for long-term storage:
1. One set of mechanical seal assemblies for each size pump.
 2. One complete set of gaskets for each size pump.
 3. One complete set of bearings for each size pump.

1.07 PUMP DESIGN (WET WELL MOUNTED)

- A. The pump shall be capable of handling raw, unscreened sewage. The discharge elbow shall be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbow when lowered into place. Pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for the purpose and no need for personnel to enter the pump well. Sealing of the pumping unit to the discharge elbow shall be accomplished by a simple linear downward motion of the pumps with the entire weight of the pumping units guided to and pressed tightly against the discharge elbow with a metal to metal watertight contact. No portion of the pump shall bear directly on the floor of the sump, and there shall be no more than one 90-degree bend allowed between the volute discharge flange and sump piping. Guide bars, which shall steer the pump into proper contact with the discharge elbow shall be non-adjustable and shall not bear the weight of the pump.
- B. Pumps shall be submersible, single stage, centrifugal type, supplied with integral electric motor, discharge elbow, guide bar brackets and installation accessories. The pumps shall be suitable for pumping raw sewage and shall be designed and fully guaranteed for this use. The fluid temperature range shall be from 35 degrees to 104 degrees F.
- C. Materials and Construction Features
1. Pump casing and construction shall incorporate following features:
 - a. Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel. All metal surfaces coming into contact with the

pumped media, other than stainless steel and/or brass, shall be protected by a factory-applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish or two-part epoxy on the exterior of the pump.

- b. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Pump/Motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton Rubber O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific bolt torque limit.
- c. Rectangular cross sectioned gaskets that require specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

D. Cable entry

1. The cable entry seal design shall provide strain relief and preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of at least one elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. For units greater than 100 HP, cable entry shall incorporate dual grommets which shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.
2. The cable junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression-type terminals. The use of wire nuts or crimp-type connectors is not acceptable.

E. Bearings

1. The integrated pump/motor shaft shall rotate on two (2) sealed and permanently lubricated bearings. External bearing lubrication ports, which allow bearing contamination and over-packing, will not be allowed. The upper bearing, providing for radial thrust, shall be a single row, roller or ball bearing. The lower bearing shall consist of one double row angular contact bearing for combined axial and radial loads. Minimum L_{10} bearing life shall be 50,000 hours at any usable portion of the pump curve.

F. Motor

1. Each pump shall be driven by a vertical, submersible squirrel cage induction motor, shell type NEMA B design, housed in a dry watertight chamber. The motor and the pump shall be produced by the same manufacturer.
2. The stator winding shall be insulated with moisture resistant Class H insulation, rated for a temperature of 180OC. The stator shall be insulated using Class H monomer-free polyester resin, resulting in a winding fill factor of at least 95%. The stator shall be heat shrink fitted into the cast iron stator housing. The use of multiple step dip and bake type stator insulation process is not acceptable. The use of bolts, pins, screws, or other fastening devices used to locate or hold the stator and that penetrate the stator housing shall be rejected. The motor shall be designed for continuous duty, while handling pumped media of up to 104 degrees F. The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum.
3. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with, and supplemental to, external motor overload protection, and shall be connected to the motor control panel.
4. The motor service factor (combined effect of voltage, frequency, viscosity, and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for continuous operation in a 40OC. ambient environment and shall have a NEMA Class B maximum operating temperature rise of 80OC. A motor performance curve shall be provided upon request, showing torque as a function of speed, and current, power factor, speed, input power in KW, and efficiency as a function of shaft power.
5. The motor shall be sized to be non-overloading when the pump is operated at any point on the pump performance characteristic curve. See Section 4.0 for application-specific motor performance requirements.
6. Motors shall be 460 volts, 60 Hz, 3 phase.
7. Motor performance shall conform to the requirements of NEMA MG1 Part 12 and shall be expressed as indicated in NEMA MG1-12.30.
8. Motors shall be premium efficiency type.
9. Inverter Duty:
 - a. All motors indicated in the Pump Schedule to be powered from variable-frequency alternating-current drives (VFD) shall have the following features in addition to those listed above:
 - i. Designed for used on pulse width modulated (PWM) VFD without external filters or cable length limitations.
 - ii. Inverter grade, 1,600 volt, Class F insulation.

- iii Service factor of 1.0 when operated from a VFD.
- iv Meeting requirements of NEMA MG1 Part 31.

10. Shaft

- a. Pump and motor shaft shall be a solid continuous unit. The pump shaft is an extension of the motor shaft. Couplings and shafts incorporating sleeves shall not be acceptable. The pump shaft shall be completely isolated from the pumped liquid.

11. Motor Cables

- a. Pump motor power cables installed shall be oil resistant chloroprene rubber jacketed, type SPC multi-conductor cable, suitable for submersible pump applications and heavy mechanical stresses. The power cable shall also be sized according to NEC and ICEA standards. The total length of each cable shall be a minimum of 40 feet long. Power cables shall each include a ground check conductor (see Sec. 5.14).

G. Guide bars and brackets (wet well mounted)

- 1. Guide bar(s) shall be provided for guiding the pump unit in raising and lowering. The guide bars shall not support any portion of the weight of the pump. The lower guide bar holders shall be integral with the discharge elbow. Guide cables shall not be considered equal to guide bars and will not be accepted. The pump unit shall be guided on the bars by a guide bracket which shall be an integral part of the pump.
- 2. The anchor bolts, upper guide bar brackets and cable holder shall be fabricated from 300 series stainless steel.

H. Lifting cable and fittings (wet well mounted)

- 1. Each pump shall be fitted with 20 feet of AISI 304 stainless steel lifting chain, (or stainless steel wire rope), with necessary fittings, capable of lifting the pump and motor.

I. Manufacturer's Warranty

- 1. The pump manufacturer shall warrant the pump equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.
- 2. All equipment, apparatus, and parts furnished shall be warranted for one (1) years, excepting only those items that are normally consumed in service, such as oils, grease, packing, gaskets, O-rings, etc. The pump manufacturer shall be solely responsible for warranty of the pump equipment and all components.
- 3. Components failing to perform as specified by the engineer or owner, or as represented by the manufacturer, or as proven defective in service during

the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the owner.

4. The warranty shall become effective sixty (60) days after installation, or ninety (90) days after shipment, whichever occurs first.

J. Manufacturers

1. Flygt (No other pump will be acceptable)

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Immediately after off-loading, contractor shall inspect complete pump and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all pump serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

3.02 INSTALLATION

- A. Contractor shall install, level, align, and lubricate pump(s) as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacture at time of delivery.
- B. Sufficient supports and thrust blocks shall be installed to prevent strain and vibration on pump piping. Install and secure all service lines as required.

3.03 FIELD QUALITY CONTROL

- A. Contractor is to inspect the installed pump(s) for visual deficiencies
- B. Equipment shall be field tested as specified hereinafter. Field testing shall be composed of preliminary tests and acceptance tests. The Contractor shall provide the services of authorized equipment supplier's representatives to conduct all field tests.
- C. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it

is safe and in optimum working condition; and conforms to the specified operating characteristics.

- D. Preliminary tests shall be run on all pumps, motors, and control systems to demonstrate that they are in proper working order.

3.04 ACCEPTANCE TESTS

- A. Acceptance tests shall be run to demonstrate that the pumping units, motors and control system meet the following requirements:
 - 1. The pumping units operate as specified without excessive noise, cavitation, vibration, and without overheating of the bearings.
 - 2. All automatic and manual controls function in accordance with the specified requirements.
 - 3. All drive equipment operates without being overloaded.

3.05 PROTECTION

- A. The contractor shall be responsible for provisions to protect the pumps and materials after installation but prior to acceptance by the Owner. Protection of the equipment shall include provisions during installation and testing of nearby piping, valving, or other adjacent equipment. The Contractor shall remove all protective measures installed at completion and acceptance of the project.