SECTION 11310

SEWAGE AND SLUDGE PUMPS

PART 1  GENERAL

1.01  DESCRIPTION

A. Work Included: Furnish all labor, materials, tools, equipment, and appurtenances as specified herein and where shown on the plans and as needed for a complete and operational wastewater pump station.

B. Related Sections: Additional Sections of the Documents which are referenced in this Section include:

1. Division 26
2. Division 27

1.02  REFERENCES

A. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.

B. American Society for Testing and Materials (ASTM):


C. American National Standards Institute (ANSI)/National Fire Protection Association (NFPA):

1. 70  National Electrical Code

1.03  GENERAL REQUIREMENTS

A. Pumps: All pumps to be installed by the CONTRACTOR shall be supplied by a single manufacturer.

1.04  SUBMITTALS

A. General: Shall be in accordance with Town of Blacksburg Submittal Procedures.

1.05  QUALITY ASSURANCE

A. Start Up Service: The CONTRACTOR shall include with this Bid the services of the equipment manufacturer's field service technician for a minimum period of 2 trips and 2 days. This service shall be for purposes of check-out, initial start-up, certification, instruction of plant personnel. A written report covering technician's findings and installation approval shall be submitted to the ENGINEER covering all inspections and outline in detail any deficiencies noted. The CONTRACTOR shall provide the OWNER within 10 days of start-up, a letter from the manufacturer of each item of equipment stating that the equipment has been properly installed and started and that nothing has been done that may violate the warranty.
B. Factory Tests: Pumps shall be tested by the manufacturer or a nationally recognized testing agency in compliance with Hydraulic Institute Standards. Where two or more identical pumps are specified, only one representative pump shall be tested. Certified test results shall be submitted to the ENGINEER.

C. Performance Test Reports: Upon completion and testing of the installed system, test reports shall be submitted in booklet form for incorporation into the O & M Manual showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria.

D. Pump Characteristics Curves: Pump characteristic curves showing capacity in gpm, head, efficiency and pumping horsepower should be submitted with the shop plans and contained in the O & M Manual.

E. Spare Parts and Lubrication: CONTRACTOR shall provide the OWNER with an adequate supply of spare parts and lubricants to last the duration of the 1 year warranty period. A complete replacement pump shaft seal assembly shall be furnished with each pump station. The spare seal shall be packed in a suitable container and shall include complete installation instructions. A spare volute gasket and seal gasket shall be provided. An adequate supply shall be defined as the quantity, type, and grade recommended by the manufacturers who will provide the equipment contained in this section. Any special lubricants that may be required during the equipment break-in period shall also be provided.

F. Name Plates: Pumps and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

G. Verification of Dimensions: The CONTRACTOR shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the ENGINEER of any discrepancy before performing the work.

H. Warranty: The Pump Manufacturer shall warrant the pumps to be supplied to the OWNER for a period of one year under normal use.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Shall be in accordance with Town of Blacksburg Delivery, Storage, and Handling.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. General: The pump station specified and shown on the plans is based on equipment and appurtenances as manufactured by Sulzer.

2.02 RAW WASTEWATER PUMPS

A. General: The CONTRACTOR shall furnish two (2) Sewage Grinder Pump(s) to deliver 41 GPM at a TDH of 159 feet. The motor shall be 10.7 HP, 3450 RPM connected for operation on a 208 volt, 60 HZ, three-phase service. The motor shall be an integral part of the pumping unit. The pump discharge shall be 2”.

The pumps shall be ABS “Piranha” Model PIR PE80/2, or pre-approved equal.
The grinder unit shall be capable of shearing and reducing to a fine slurry all material normally found in domestic and commercial sewage, such as sanitary napkins, disposable diapers, cloth diapers, wash rags, wood, plastic, etc. The slurry shall be capable of freely passing through a 1-1/4’ piping system including check and gate valves.

B. Pump Characteristics:

<table>
<thead>
<tr>
<th>Service</th>
<th>Raw Wastewater (with Grinder)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Non-Clog</td>
</tr>
<tr>
<td>Design Point</td>
<td>41 gpm @ 159 feet TDH</td>
</tr>
<tr>
<td>Discharge Diameter</td>
<td>2 inches</td>
</tr>
<tr>
<td>Operating Speed</td>
<td>3450 rpm</td>
</tr>
<tr>
<td>Minimum Motor Horsepower</td>
<td>10.7 hp</td>
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</table>

C. Pump Construction: The pump shall be of the centrifugal type with the rotating cutter mounted on the pump shaft directly against the impeller. The stationary cutter shall be mounted in an adjustable bottom plate. The stationary cutter shall have slots to facilitate better flow. The bottom plate shall be cast with grooves threading outward from the center opening of the plate to the outer diameter. The impeller shall be a multiple-vane centrifugal type. The cutter material shall be similar to an AISI 440C stainless steel with the additional of cobalt, vanadium, and molybdenum for superior abrasion resistance and a hardness of 58-62 Rockwell C.

The common pump and motor shaft shall be 420 stainless steel supported by a heavy duty lower double row ball bearing and an upper single row ball bearing. The cutting elements and impeller shall be designed to keep the overhung load distance to a minimum. All fasteners shall be T304 stainless steel.

D. Non-Clog Impeller: Non-clog impeller shall be of cast iron and shall be of a double shrouded non-clogging design to minimize clogging of solids and fibrous materials. Impellers shall contain pressure vanes on the back shroud to prevent accumulation of debris around seals. The impeller shall be statically, dynamically, and hydraulically balanced. The pump impeller shall be of the enclosed two-port type made of close-grained cast iron and shall be balanced. The eye of the impeller as well as the ports shall be large enough to permit the passage of a three (3) inch sphere and any trash and stringy material which can pass through a four (4) inch house lateral. The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device. The impeller shall be readily removable without the use of special tools.

To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than the full diameter shall be trimmed inside the impeller shrouds. The shrouds shall remain full diameter so that close minimum clearances from shrouds to volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.

E. Grinder Impeller: Grinder impeller assembly shall be two stage with a primary radial cutter followed by a secondary axial cutter which cuts perpendicular to the first stage. Cutters and cutter ring shall be hardened stainless steel.
F. **Pump Shaft:** The pump shaft shall be of 303 or 304 stainless steel and shall be of adequate size and strength to transmit the full horsepower with a liberal safety factor. The pump shaft shall be sealed against leakage by a single mechanical seal constructed so as to be automatically drained and primed each time the pump is drained and primed. Water which lubricates the mechanical seal shall be automatically drained from around the seal if the pump loses prime, in order to allow both the pump and the seal to be drained. This prevents freezing and breakage of the seal during power outages in sub-freezing temperatures.

G. **Wear Rings:** Renewable wearing rings shall be provided on the impeller and casing and shall have wearing surfaces normal to the axis of rotation. Wear rings shall be constructed of brass. Wear rings shall be designed for ease of maintenance and shall be adequately secured to prevent rotation.

H. **Shaft Seals:** Each pump shall be equipped with two (2) seals. The lower seal (pump side) shall be of the mechanical type with silicon carbide faces. The upper seal shall be a lip-type seal. An upper mechanical seal with silicon carbide faces shall be available as an option.

I. **Bearings:** Pump bearings shall be ball and roller type designed to handle all thrust loads in either direction. Bearing shall have a B-10 life of 50,000 hours minimum at any point on the pump curve.

J. **Motor:** The Premium Efficiency motor shall meet efficiency standards in accordance with IEC 60034-30, level IE3 and NEMA Premium. Motor rating tests shall be conducted in accordance with IEC 60034-2-1 requirements and shall be certified accurate and correct by a third party certifying agency. A certificate shall be available upon request. Pumps whose motors do not comply with the above-listed standards will NOT be acceptable.

The Premium Efficiency motor shall be housed in a water tight gray cast iron, EN-GJL-250 (ASTM A-48, Class 358) enclosure capable of continuous submerged operation underwater to a depth of 20 meters (65 feet), and shall have an IP68 protection rating. The motor shall be of the squirrel-cage induction design, NEMA type B, Premium Efficiency. The copper stator windings shall be insulated with moisture resistant Class H Insulation material, rated or 180 degrees centigrade (356 degrees F). The stator shall be press fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is unacceptable. The rotor bars and short circuit rings shall be made of cast aluminum.

The motor shall be designed for continuous duty. The maximum continuous temperature of the pumped liquid shall be 40 degrees C (104 degrees F), and intermittently up to 50 degrees C (122 degrees F). The motor shall be capable of handling up to 15 evenly spaced starts per hour without overheating. The service factor (as designed by the NEMA MG1 standard) shall be 1.3. The motor shall have a voltage tolerance of +/-10% from nominal, and a phase to phase voltage imbalance tolerance of 1%. The motor shall have a NEMA Class A temperature rise, providing cool operation under all operating conditions. The Premium Efficiency Motor shall be FM and CSA approved for use in NEC Class I, Division I, and Groups C & D Hazardous locations. The surface temperature rating shall be T3C. The motor shall meet the requirements of NEMA MG1 Part 30 and 31 for operation on PWM type Variable Frequency Drives.
K. Motor Seal Leak Detection and Over-Temperature Sensing:
   1. Heat Sensor: Bi-metallic heat sensors shall be embedded in the end turns of each phase group. Sensors shall be normally closed contacts that should be wired into the control circuit for each pump to alarm on high temperature in the stator. Sensor shall be wired into the pump starter to shut the pump down on high temperature. The contacts shall close back to normal once the stator cools.
   2. Moisture Sensor: Moisture sensor shall be a stainless steel probe located in the seal oil chamber. The probe shall sense the presence of water intrusion into the seal oil chamber and indicate water leakage past the lower mechanical seal. The probe shall be energized through a relay located in the control panel. The relay shall be powered by 120V AC line.
   3. Seal leak detection and over-temperature sensing relay shall be Sulzer Model CA462, or equal.

L. Cable: A single multi-conductor cable shall enclose the 208 volt power conductors, the seal leak detection conductors, and the over-temperature sensing conductors. The cable shall be sized according to NEC and CSA standards and shall be of sufficient length to reach the pump control panel without requiring splices. The outer jacks of the cable shall be oil, water, and UV resistant, and shall be capable of continuous submerged operation underwater to a depth of 65 feet.

M. Cable Entry/Junction Chamber: The cable entry design shall not require a specific torque to insure a watertight seal. The cable entry shall consist of cylindrical elastomer grommets, flanked by stainless steel washers. A cable cap incorporating a strain relief and bend radius limiter shall mount to the cable entry boss, compressing grommet ID to the cable while the grommet OD seals against the bore of the cable entry. The junction chamber shall be isolated and sealed from the motor by means of sealing glands. Electrical connections between the power cables and motor leads shall be made via a compression or post type terminal board, allowing for easy disconnection and maintenance.

N. Trolley Beam: To allow on-site maintenance of the pumps, a beam and trolley system shall be provided to lift each pump. The beam and trolley assembly shall be installed over the motor. The trolley assembly shall include a hook designed to support a hoist (provided by others). The hoist shall be used to remove the motors, impellers and pumps from the station.

O. Rail Mounted Systems: Rail mounted systems shall consist of guide rails, a sliding bracket, and a discharge connection elbow. Guide rails shall be of the size standard with the pump manufacturer and shall not support any portion of the weight of the pump. Guide rails shall be constructed of stainless steel. The sliding guide bracket shall be an integral part of the pump unit. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection and service without entering the wet well.

P. Lifting Chain: A lifting chain to raise and lower the pump shall be provided for each pump. The chain shall be galvanized and shall be capable of supporting the weight of the pump.

2.03 STATION PIPING

A. Check Valves: The check valves shall be of the spring loaded type with external lever arm and an easily replaced resilient seat for added assurance against vacuum leaks. Check valves shall have stainless steel shaft with replaceable bronze shaft bushings and shall be scaled with
a-rings or an adjustable Teflon seal. Ball type check valves without an external lever arm are not acceptable.

B. Plug Valves: Valves shall be cast iron provided with flange ends as shown on the plans and shall be ANSI rated at 150 psi. Valves shall be capable of bubble tight closure, allow full port passage, and equipped with a handwheel or a standard 2 inch operating nut (operating wrench to be provided). Valve liners and seats shall be of a material suitable for use with an abrasive sanitary sludge.

C. Pressure Gauge: Liquid filled pressure gauge shall be installed on each pump discharge and shall consist of an Ashcroft 4” glycerin filled gauge with Red Valve Series 42/742 diaphragm protecting it. Gauge assembly shall have a ball valve to isolate the pressure line.

D. Wet-well vent: Vent shall be Orenco CF-4 carbon filter.

E. Piping Connection: Protrusions through the station floor shall be sealed where necessary to effect sealing between the equipment chamber and the wetwell. The suction and discharge connections, where they pass through the floor, shall be sealed by gaskets in order to prevent corrosive, noxious fumes from entering the station. The pump station manufacturer shall extend the suction and discharge connections below the floor at the factory so that field connections can be made without disturbing the gas-tight seals. Once the station is installed, however, it shall be possible to remove the entire 4" or 6" suction pipes through the station floor without having to enter the wetwell to unbolt them.

The manufacturer of the pump station shall provide a compression-type sleeve coupling for installation on the common discharge pipe. A minimum of two anchoring points shall be provided on the bottom of the station baseplate for attachment of coupling joint restraints.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: The CONTRACTOR shall install all equipment in strict accordance with the manufacturer's recommendations. The CONTRACTOR shall supply all equipment and accessories not specifically provided by the manufacturer but required for satisfactory installation and operation. All anchor bolts shall be plated steel while all other miscellaneous fasteners shall be stainless steel. All bolts shall be of ample size for the purpose intended.

B. Deliver the seal leak detection and over-temperature sensing relay to the Division 27 System Integrated for installation in the pump control panel.

C. Startup: The CONTRACTOR shall coordinate startup services of the equipment manufacturer's field service technician with the ENGINEER and OWNER.

END OF SECTION 11310