

## SECTION 11310 - CENTRIFUGAL SEWAGE PUMPS

### PART 1 - GENERAL

#### SUMMARY

Work Included. Furnish all labor, materials and equipment necessary for furnishing the fabrication, production, installation and erection of the items specified in this Section as shown on the Drawings or listed in the Schedule.

Related Work Specified Elsewhere.

Section 02720	Sewers
Section 02800	Restoration Work
Section 03315	Concrete Work
Section 15070	Pressure Process Piping
Section 15110	Process Valves

Products Furnished But Not Installed Under This Section. Anchor bolts shall be installed under Division 3, Concrete, in accordance with certified prints furnished by the pump manufacturer.

#### REFERENCES

ANSI	Class 125 Flanged Dimensions
ASTM A-48	Cast Iron
ANSI B.11, 1959	Bearings
AISI C1141	Steel
ASTM A532-80	Abrasion Resistant Cast Iron
SAE 1045	Steel
SAE 4140	Steel
ASTM A-532	High Chrome Iron

#### SYSTEM DESCRIPTION

Design Requirements. A minimum system head curves for each pump application are included herein. Duty points for each pump are indicated on the system curves.

Performance Requirements. Except where noted, each pump shall be designed to operate continuously at the intersection of its pump curve and the minimum system curve with available net positive suction head as shown without cavitation and without requiring throttling to prevent cavitation or overloading the motor. Multiple pumps running concurrently shall also satisfy the above condition.

Performance curves of variable speed pumps at maximum speed shall intersect the system curves, and pumps shall be designed for operation at that duty point.

Pump/Motor Coupling. Close coupled pumps with the motor fastened directly to the pump casing, without the motor adapter which allows access to the coupling, will not be acceptable.

Pumps with common motor and impeller shafts will not be acceptable.

Suction Requirements. Velocities at the pump casing inlet shall not exceed 20 feet per second at the specified duty point. The pump manufacturer shall provide suction reducing elbows if required to provide a reduction of not more than two standard pipe diameters per fitting between the suction header and the pump casing inlet.

Characteristic Curves. Constant speed pumps' characteristic curves must have a continuous test rise from duty point to shutoff head. Shutoff head must be a minimum of 10 feet above duty point.

## SUBMITTALS

Shop Drawings. Furnish Shop Drawings covering the items included under this Section of the Contract.

Test and Inspection Report. Submit a written report to ENGINEER documenting testing and/or inspection results.

Operation and Maintenance Manuals. Furnish operation and maintenance manuals for items included under this Section.

Warranty. Furnish warranties covering the items included under this Section of the Contract.

## WARRANTY

### Special Warranty

Submersible Pump Warranty. The pump manufacturer shall warrant the pumps against defects in workmanship and materials for a period of five years under normal use, operation, and service. The pump manufacturer shall also include in the warranty a progressive schedule of cost for a period of five years on certain parts that become defective through normal use and wear. These parts shall include, but not be limited to, the mechanical seal, rotor, stator, impeller, pump housing, wear ring and ball bearings. The warranty shall be in published form and submitted with each pump at the time of shipment. The warranty period shall commence at time of pump start-up.

## PART 2 - PRODUCTS

### SUGGESTED MANUFACTURERS

Submersible shall be the product of one of the following manufacturers, or equal:

Flygt Corporation  
Gorman-Rupp

ABS Pumps, Inc.

## EQUIPMENT

General. Pumps shall be vertical or horizontal in the respective capacities and duty points.

The discharge head will consist of the static lift plus the friction head in the suction and discharge piping.

The total dynamic head stated in the design calculations shall be developed by the pumping units. Any losses incurred between the suction and discharge connections furnished with the pump are not included.

Pumps shall be used to pump sewage and shall be of the nonclog type capable of passing solid spheres up to 3 inches in diameter. The diameter of the impeller furnished shall not be greater than 90 percent of the largest impeller which can be installed in the pump unless specifically approved by ENGINEER.

Pump speeds shall not exceed 1800 rpm unless authorized by the Municipality Engineer. The pumps shall be arranged as nearly as the types will permit to those indicated on the Drawings with direction of rotation as required by the installation.

Piping and bolts for connecting piping to the pumps shall be provided and installed under Division 15, Mechanical.

## COMPONENTS

Motors. Electric motors shall be of the vertical or horizontal shaft as required. Each motor shall be provided with a suitable thrust bearing which shall carry the load of the rotor together with that of such parts of the shaft as may not be carried by the pump.

Pump motor nameplate horsepower shall be sufficient for nonoverloading operation at all points on the performance curve of the impeller selected to meet the duty point including horsepower requirements of the drive. At no point shall the required brake horsepower exceed 85 percent of the motor nameplate horsepower multiplied by the motor service factor.

Anchor Bolts. All anchor bolts shall be stainless steel and furnished under this Section of the Work.

### Submersible Sewage Pumps

Submersible sewage pumps shall be constructed to be explosion-proof, Class I, Division 1, Group D, construction explosion-proof.

Pumps shall be capable of handling raw, unscreened sewage. The design shall be such that pumping units shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pump shall be of a close fit to have minimum leakage at the discharge flange. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose, and no need for personnel to enter pump well. Each pump shall be fitted with a stainless steel chain of adequate strength and length to permit raising the pump for inspection and removal.

Casings. The stator casing, oil casing and impeller shall be of gray iron construction, with all external parts coming into contact with sewage protected by a coat of corrosion-resistant paint. All external bolts and nuts shall be of stainless steel. A wear ring designed for abrasion resistance shall be installed at the inlet of the pump to provide protection against wear to the impeller. The corrosion-resistant impeller shall be of an enclosed or semi-enclosed, nonclog design, capable of passing 3-inch solids, fibrous material, heavy sludge, and constructed with long throughway with no acute turns. Pump motor shaft shall be of 300 series stainless steel.

Mechanical Seal. Each pump shall be provided with a tandem double mechanical seal. The upper running in an oil reservoir consisting of one stationary ceramic or tungsten-carbide ring and one rotating carbon or tool steel ring, and the other consisting of one stationary and one rotating tungsten-carbide ring, with each pair held in contact by a separate spring so that the outside pressure assists spring compression in preventing

the seal faces from opening. The seals shall require neither maintenance nor adjustment, and shall be easily replaceable. Conventional double mechanical seals with a single or double spring between the rotating faces, that require constant differential pressure to effect sealing, and which are subject to opening and penetration by pumping forces, shall not be considered equal to the tandem seal specified. Seal oil chamber shall be fitted with an electrode probe and signal box shall be supplied to indicate contamination in the chamber.

Motor. Pump motor shall be housed in an air or oil filled, watertight casing and shall have resin encapsulated Class F insulated windings. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally unsubmerged condition. Motor thermal switch and leak detectors shall be provided. Indicators shall be provided on the control panel with operation interlocks for each condition. Cable junction box and motor shall be separated by a stator-lead sealing gland or terminal board which shall isolate motor from any water or solids gaining access through pump top.

Pump motor cable shall be suitable for submersible pump application, and this shall be permanently embossed on the cable. The cable shall be continuous with no splices from the junction box to the pump or from the control box to the pump.

## ACCESSORIES

Submersible Sewage Pumps. Submersible sewage pumps shall include discharge base elbow with hydraulically sealed discharge flange, pump mounting stand with bottom rail supports, upper and intermediate rail supports, lifting chain with chain hook and holder, corrosion-resistant nameplate and watertight cable long enough to reach the control panel.

Hatches. Provide standard duty aluminum watertight access hatch, complete with stainless steel hinged and hasp-equipped cover, upper guide holder and level sensor and float support bracket as indicated in the Schedule. Frame shall be securely anchored in the top slab concrete above the pumps as per the manufacturer's specifications. Each access hatch assembly shall be provided with a positive latch open device and a dependable lock with an inside keyless release.

Lifting System. Each pump shall be fitted with a Type 316 stainless steel forged link chain sling of adequate strength and length to permit a chain "gripping eye" to be positioned on it to grip the chain and allow the pump to be removed from and installed into the wet well. The "gripping eye" shall be suitable for attachment to an Owner furnished hoist. Two "gripping eyes" shall be furnished. A Type 316 stainless steel guide cable of sufficient length to span from the lifting chain on the pump to 5 ft. above the grade floor shall be provided for each pump and shall be securely attached to the lifting chain and a stainless steel eye bolt located within or adjacent to the wet well access hatch. The "gripping eye", pump chain, guide cable and all appurtenances required to provide a complete pump removal system shall be supplied shall be supplied by the pump manufacturer.

Guide System. A sliding guide bracket shall be an integral part of the pumping unit and the pump casing shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the sump and designed as to receive the pump connecting flange without the need of any bolts or nuts.

Guide rail system shall be stainless steel and designed to be nonsparking through the use of removable bronze or nonmetallic inserts at points of contact.

Sealing of the pumping unit to the discharge connection shall be accomplished by a single linear downward motion of the pump guided to and pressing tightly against the discharge connection. Sealing

at the discharge connection by a means to insure a tight connection. Necessary guide bars shall be furnished. Guide bars shall be of stainless steel pipe or an approved stainless steel cable or "T" or "U" bar guide rail system.

Grinder Pump Cutters. The grinder stationary and rotating cutters shall be of 60 Rockwell, hardened and ground stainless steel or alloy tool steel molybdenum, chromium and cobalt hardened to Rockwell 68. Complete grinder assembly shall be removable without disturbing the pump.

#### SOURCE QUALITY CONTROL

Shop Tests. Prior to shipment, each pump shall be fully tested on water at the manufacturer's plant. The purpose of the shop tests shall be to demonstrate that the pumps to be furnished will meet the requirements of the Specifications and, if applicable, the Special Warranties included in the Agreement.

Tests shall consist of running the pumps with furnished impeller at their rated capacity, head and speed, or range of speeds if furnished with variable speed drives, and at such other conditions of head and capacity to properly establish a performance curve or family of curves in the case of variable speed units. Performance data including efficiency and horsepower shall be collected and noted as part of the performance curve.

All pumps shall be tested in accordance with the standards of the Hydraulic Institute. Certified copies of the test results and the performance curves, for each of the pumps to be furnished, shall be submitted to ENGINEER and approved prior to shipment of the pumps to the Project.

Generally, pumps shall be tested as a complete assembly including drive and motor. If the pumps are tested separately from the motors, or variable speed drives and motors, CONTRACTOR shall submit to ENGINEER, certified performance curves of the equipment to be furnished as guaranteed by the manufacturer. These certified curves shall be obtained either from actual tests of the equipment to be furnished or from tests of equipment of the same size and construction. The motor manufacturer's curves shall supply all the necessary information concerning the equipment as indicated for the complete shop tests.

When pumps are tested separately from the variable speed drives, CONTRACTOR shall test one of each size drive complete with the actual motor to be furnished. Each drive and motor shall be tested at the specific speeds, torques, and power requirements for the duty point conditions required for any performance guarantee provisions of the Contract.

#### Submersible Pumps.

Test. The pump manufacturer shall perform the following tests on each pump before shipment from the factory:

1. Execute a standard commercial motor test.
2. Prior to submergence, the pump shall be dry and be checked for correct rotation.
3. Pump shall be run for 30 minutes in a submerged condition. The pump shall be tested as a complete assembly including variable frequency drive.
4. Pump shall be removed from test tank, meggered immediately for moisture, oil plugs removed for checking lower seal; inspection plug removed for checking of upper seal and possible water intrusion of stator housing. If plugs are not provided, check for intrusion of water using a moisture probe.

5. A written certified test report giving the above information shall be supplied with each pump at the time of shipment.
6. All ends of pump cables will be fitted with a rubber shrink fit boot to protect cable prior to electrical installation.

Concrete Wet Well. The base slab shall be installed as detailed on the Drawings. Concrete for the base slab shall be Class A as specified under Section 03315, Concrete Work. Any excavation below the required elevation shall be filled with Class C concrete. Edges of the base slab shall be formed.

CONTRACTOR shall construct the wet well and valve vault using reinforced concrete culvert pipe or box meeting ASTM Specifications C76, Class and size shall be as shown on the Drawings.

Joints in reinforced concrete pipe shall be equal to ASTM C443, with compression-type rubber gasket. Rubber gaskets shall meet the physical requirements of ASTM C361. Lubricant shall be supplied by the manufacturer to be used on the groove and on the tongue in making up joints, and the joints shall be coupled in accordance with the pipe manufacturer's recommendations. The complete wet well shall be watertight.

The roof slab shall be constructed as detailed on the Drawings, using Class A concrete. This Work shall include necessary wet well grouting with Class C concrete.

The precast sections shall be provided with all necessary openings for the installation of incoming piping, and pump discharge piping. Suitable wall sleeves shall be furnished and installed, and the space between the pipe and the sleeve shall be sealed.

Backfill around the submersible pump well shall be sand-gravel MDOT Class II, compacted to 95 percent of maximum density. Soil Density by ASTM D1557.

### PART 3 - EXECUTION

#### ERECTION

Equipment furnished and installed under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer as approved by ENGINEER.

#### FIELD QUALITY CONTROL

Performance Tests. After the pumping units have been erected, performance tests shall be conducted. The purpose of these performance tests shall be to demonstrate that the units have been properly erected, and that they and their appurtenant equipment will operate satisfactorily and meet the specified conditions and the guarantees of CONTRACTOR. For the purpose of these tests, OWNER will furnish the electricity, lubricating oil, and the water for a test load when these items are available. The measurement of the quantity of water pumped may or may not be included in the performance test. The performance tests shall be conducted under the supervision of ENGINEER with the cooperation of the manufacturer's factory representative. It is intended that these tests shall be carried out by operating each pumping unit through the range specified for a continuous period of at least 2 hours, or until it is shown to the satisfaction of ENGINEER that all of the equipment is in perfect condition and will meet the requirements specified. Throughout these tests of the pumping equipment,

the motors and pumps must run smoothly without vibration or heating, otherwise the test shall be stopped and not again undertaken until the unit shall have been put into condition to comply with the requirements for smoothness of operation.

Installation Check. The manufacturer shall provide the services of a factory-trained representative to check the installation of all equipment installed in this Section.

#### TESTING AND TRAINING

Operator Training. The station manufacturer shall furnish, in addition to the performance tests, operator training for two of Municipality's personnel. The training programs shall be conducted at the Project and shall be for a period of approximately one day. Training shall include, but not be limited to, operation safety, emergency, maintenance of equipment and testing procedures.

END OF SECTION 11310