

**SECTION 11205****SUBMERSIBLE (WASTEWATER) PUMPS****PART 1 GENERAL****1.01 SCOPE OF WORK**

- A. The Contractor shall furnish and install submersible non-clog wastewater pumps and appurtenances and place in satisfactory operation, in a workmanlike manner, all machinery, equipment, apparatus and accessories required for a complete installation in accordance with these specifications.
- B. It is the intent of these Specifications to obtain complete and operable equipment. All items and accessories appearing in the Drawings, in the manufacturer's literature as standard, and all items specified herein, shall be included. Items not included herein or in the Drawings or manufacturer's literature, but which can be reasonably inferred as necessary for the equipment to be properly and legally operable, shall be included.
- C. The submersible non-clog wastewater pumps shall be suitable for the environment in which it will operate. The variable in the environments are flow, clogging issues (rages and wipes), and other site conditions. The Department reserves the right to select the pump manufacturer and model for critical pump stations.

**1.02 REFERENCES**

- A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
  - 1. ABMA 9-90 Load Ratings and Fatigue Life for Ball Bearings
  - 2. ABMA 11-90 Load Ratings and Fatigue Life for Roller Bearings
  - 3. ASTM A48-00 Gray Iron Castings
  - 4. ASTM A108-99 Steel Bars, Carbon, Cold Finished, Standard Quality
  - 5. ASTM A276-00a Stainless and Heat-Resistant Steel Bars and Shapes
  - 6. ASTM A278-93 Gray Iron Castings for Pressure Containing Parts for Temperature up to 650 Degrees F
  - 7. ASTM A322-91 Steel Bars, Alloy, Standard Grades (1996)

## MDWASD

8. ASTM A576-90b Steel Bars, Carbon, Hot Wrought, Special Quality (2000)
9. ASTM A743/A743M-98a Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion-Resistances for General Application
10. Hydraulic Institute Standards of the Hydraulic Institute, (Current Edition)

### 1.03 SUBMITTALS

- A. The Contractor shall submit the following after approval of drawings, but prior to construction of pump station:
  1. Pump Drawings.
  2. Pump performance curves, including other impeller sizes.
  3. Predicted pump performance curves for each condition point specified in Part 2 showing head, power, efficiency and NPSH required on the ordinate plotted against capacity on the abscissa (x-axis).
  4. Materials of construction.
  5. Motor drawings
  6. Complete electric motor data.
- B. Submit in accordance with Section 01340, "Shop Drawings."

### 1.04 QUALITY ASSURANCE

- A. Pumping units and accessories shall be the standard product of manufacturers which have produced and sold such pumps and appurtenances for a period of at least 5 years for similar service.
- B. Spare parts shall be available from the manufacturer, not the vendor. All mounting, guides, and spare parts shall be supplied by the manufacturer.
- C. The Department has identified area with ragging and clogging problems which require the use of submersible pumps that have been field tested in the Department's system. The Department Approved Pumps in areas with rags and wipes issues shall have cutters or other features to successfully operate at the location with the severe clogging problems. Coordinate with the Department Engineer if the proposed pump is located at a severe clogging location.
- D. Pump Materials of Construction: Any pumps submitted as an alternate shall meet the design curve and material construction of the specified pump to the satisfaction of the Engineer. Any submitted alternate shall be reviewed to verify that the Department will receive the same quality of grade of steel, epoxy coating, mating to the discharge elbow and resistance to corrosion.

### 1.05 PUMP WARRANTY

## MDWASD

- A. The pump manufacturer shall warrant the units supplied to the owner against defects in workmanship and materials for a period of 5 years or 10,000 hours of operation, in normal use, operation and service. The warranty shall be in printed form and shall apply to all similar units. A copy of the warranty shall be supplied with each pump. The warranty shall consist of the following:
1. From 0 18 months or 0 - 3,000 hours, 100% warranty.
  2. From 19 39 months or 3,001 6,500 hours, 50% warranty.
  3. From 40 60 months or 6,501 10,000 hours, 25% warranty.

## PART 2 PRODUCTS

### 2.01 PUMPS

- A. Pump shall be totally submersible, non-clogging, electrically operated, designed specifically for use in municipal wastewater applications and capable of handling raw unscreened sewage. Pumping units shall be suitable for the allotted space shown on the Drawings and shall be satisfactorily suitable for the design conditions as determined by the MD-WASD. Pump stations will be located in an area where clogging of pumps by debris in the sewer is expected. The proposed pumps shall be capable of passing debris without clogging (to the satisfaction of the Engineer).
- B. Source: Provide pumping units by one of the following submersible pumps that has completed a pilot program and are approved for use in the Water and Sewer Department system (see Pre-Approved Products List):
1. Xylem/Flygt;
  2. Grundfos;
  3. Sulzer;
  4. Shinmaywa Pumps;
  5. Vaughan;
- C. Design: The design shall be such that the pump unit shall be automatically and firmly connected to the discharge piping when lowered into place on its mating discharge connection. The pump shall be so designed that it may be lowered to or raised from its place in the wet-well by Type 316 stainless steel chain or cable and accurately guided by pipe guide bars extending from the top of the station to the discharge connection. The pump shall be guided by no less than two (2) separate Type 316 stainless steel guide rails of 2-inch minimum diameter for pumps of 29 or less horsepower; 3-inch minimum diameter for pumps between 30 and 100 horsepower and of 4-inch minimum diameter for pumps over 100 horsepower or other guide system as approved by the MD-WASD. There shall be no need for personnel to enter the wet-well.
- D. Discharge Connection: Mating discharge connection of pump unit (aka Base Elbow) shall be permanently affixed to the concrete in the wet well with Type 316 stainless steel epoxy set anchor bolts furnished by and of the size recommended by the pump manufacturer. However, anchor bolts shall be 3/4-inch stainless steel, minimum. Sealing of the pumping unit to the discharge connection shall be

## MDWASD

accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket shall not be acceptable. Provide a six-inch discharge for 20 HP and above.

- E. Each pump with its appurtenances and cable shall be capable of continuous submersion under water without loss of water-tight integrity. Major parts such as stator casing, oil casing, sliding bracket, volute and impeller shall be of cast iron ASTM A-48, Class 35B. All surfaces coming into contact with sewage other than stainless steel shall be protected by a coating resistant to sewage. All exposed bolts and nuts shall be Type 316 stainless steel.
- F. The discharge connection (aka Base Elbow) shall be design and manufactured such that it will accept a Flygt CP or NP pump model. The base elbow shall be a product of the pump manufacturer and not a third party fabricator.
- G. The pumps shall have a maximum weight of 1,500 pounds, as required to meet conditions described in these Specifications and design operating characteristics. The previously stated weight requirement supersedes any other weight listed elsewhere in these specifications. Pumps shall have a minimum efficiency of 50% at Best Efficiency Point (BEP).

## 2.02 COOLING SYSTEM

- A. Motors shall be sufficiently cooled by the surrounding environment or pumped media. Cooling system shall provide for continuous operation in ambient temperatures up to 104°F.

## 2.03 PUMP CONSTRUCTION

- A. Material and Coating: The major pump components shall be ASTM A48, "Gray Iron Castings", Class 35B cast iron, with smooth surfaces devoid of blow holes and other irregularities; of sufficient strength, weight and metal thickness to insure long life, accurate alignment and reliable operation. All exposed nuts and bolts shall be Type 316 stainless steel. All surfaces coming into contact with sewage other than stainless steel shall be protected by an approved sewage resistant coating. The pump exterior shall be sprayed first with PVC epoxy primer. All remaining surfaces where watertight seal is required shall be machined and fitted with nitrile rubber "O" rings. Fittings shall be such that the sealing is accomplished by metal-to-metal contact between the machined surfaces.
- B. Cable Entry Seal:
  - 1. The cable entry water seal shall be designed to preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall be comprised of a cylindrical elastomer grommet flanked by stainless steel washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function separate from the function of sealing the cable.

2. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top.
  3. Cable entry assemblies utilizing an epoxy for sealing may be considered, on a case-by-case basis. Epoxy shall be locally and commercially available, and shall have maximum published cure time of six (6) hours at room temperature and shall be suitable for use in a municipal sewerage environment.
- C. Impeller: The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, single or double shrouded, non-clogging design having a long throughlet without acute turns. The impellers shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in normal sewage applications. The impeller shall be of a single vane, 2 or 3 vane non-clogging design. Recessed impellers are not acceptable by the MD-WASD. Impeller(s) shall be keyed to the shaft, retained with an Allen head bolt and shall be capable of passing a minimum 3-inch diameter solid sphere. One impeller tool shall be provided with each pump.
- D. Wear Rings: A wear ring or wear plate system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet.
- E. Volute: Pump volute(s) shall be single-piece gray cast iron, Class 35B, non-concentric design with smooth fluid passages large enough at all points to pass any solids that may enter the impeller.
- F. Shaft and Mechanical Seal:
1. The pump and rotor shaft shall be the same unit. The shaft shall be ANSI Type 420 series stainless steel, or approved equal.
  2. Each pump shall be provided with a tandem mechanical rotating shaft seal system. Seals shall run in an oil reservoir. Lapped seal faces must be hydro-dynamically lubricated at a constant rate. The lower seal unit, between the pump and the oil chamber shall contain one stationary and one positively driven rotating tungsten or silicon carbide ring. The upper seal unit, between the oil sump and motor housing, shall contain one stationary tungsten carbide or ceramic ring and one positively driven rotating carbon ring. The use of a positively driven rotating tungsten or silicon carbide ring is acceptable in lieu of the positively driven rotating carbon ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall be designed to prevent over-filling and to provide oil expansion capacity. The drain and inspection plug with positive anti-leak seal shall be easily accessible from the outside. The pump

## MDWASD

shaft shall rotate on 2 permanently lubricated bearings with a minimum L10 rating of 50,000 hours.

### 2.04 PUMP MOTOR

- A. The pump motor shall be squirrel cage induction, shell type design, housed in an air filled, watertight chamber, no more than 60 HP and 1,800 RPM, 240/480 volts, 3 phase, 60 Hertz, 1.15 S.F., NEMA Type B. The stator winding and stator leads shall be insulated with moisture resistant Class F insulation which will resist a temperature of 155 degree centigrade. The stator shall be dipped and baked 3 times in Class F varnish. The motor shall be designed for continuous duty capable of sustaining a minimum of 12 starts per hour. Motors shall be approved for Class 1, Division II, Group D atmospheres in accordance with NEC classification for hazardous areas. Motors shall be able to start within the 1300% factor allowed by NEC 430-52 or documentation shall be provided as to why it cannot.
- B. Each unit shall be provided with an adequately designed cooling system to permit continuous operation in totally, partially, or non-submerged condition. Cooling media channels and ports shall be sized to be non-clogging.
- C. Motor bearings shall be permanently grease lubricated. Oil filled motors are not acceptable.
- D. Thermal switches shall be embedded in the stator lead coils. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125 degrees C (260 degrees F) the thermal switches shall open, stop the motor and activate an alarm. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. Wire nuts or crimping devices are not acceptable. The motor and pump shall be designed and assembled by the same manufacturer
- E. The pump motor cable shall be suited for submersible pump applications with Underwriters Laboratory approval permanently embossed on the cable. Cable sizing shall conform to the National Electric Code Specifications for pump motors. Each pump shall be furnished with ample cable such that one continuous length of cable, supplied by pump manufacturer, will be all that is required to run from pump, when lowered in the wet-well, to the controls, without need of splices.
- F. The motor horsepower shall be adequate such that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. All equipment shall be installed as shown on the Plans and in accordance with these specifications.

## MDWASD

- B. All motors shall be factory mounted by the driven equipment manufacturer in accordance with the motor manufacturers drawings and instructions. Field installation of the unit, including final alignment shall be the responsibility of the Contractor.
- C. Installation shall include furnishing all necessary appurtenances for initial operation and making final adjustments to place the equipment in operable condition.
- D. All control and alarm wires, as required, shall be provided even if not shown on plan drawings.

### 3.02 PREPARATION FOR STORAGE

- A. All flanges shall be covered to prevent damage. Pump motors, and shafts will be stored inside warehouses. Pumps may be stored outside, on wood members away from the ground, at sufficient elevation to prevent flooding, and protected from the weather by secured canvas or plastic coverings.

### 3.03 PUMP TESTS

- A. The manufacturer shall perform the following inspections and tests on each pump before shipment from the factory:
  - 1. Impeller, motor rating and electrical connections shall be checked for compliance with customer's purchase order.
  - 2. Motor and cable insulation tests for moisture content or insulation defects shall be made.
  - 3. Prior to submergence, the pump shall be run dry, to establish correct rotation and mechanical integrity.
  - 4. Pump shall be run for 30 minutes submerged a minimum of 6 feet underwater.
  - 5. After the operation tests, the insulation test is to be performed again. A written report, signed by a professional engineer, registered in the state where the tests were performed, stating that "A" through "D" (above) were performed and that the tests were satisfactorily accomplished, shall be supplied with each pump at the time of shipment.

### 3.04 FIELD QUALITY CONTROL

- A. The supplier shall provide start-up service to place the pumps and controls in proper operation.
- B. During this service, the Manufacturer's Representative shall review the operation of the equipment and the pump and station will be inspected for proper installation and shall coordinate with Contractor and make recommendations.

MDWASD

- C. The pumps shall be tested at start-up and the voltage, current and other significant parameters recorded. The manufacturer shall provide a formal test procedure and forms for recording the data.
- D. The supplier shall submit a written report to the Contractor, stating results of the start-up inspection. A copy of the report shall be furnished to MD-WASD. The Contractor shall inform MD-WASD 24-hours prior to commencement of such start-up services and tests. These services shall be at no cost to MD-WASD.

**END OF SECTION**