

**SECTION 33 32 16****SMALL LIFT STATIONS****PART 1: GENERAL**

## 1.01 SCOPE

- A. This specification section contains the requirements for a fully operational submersible sewage pump station. Small lift stations are typically limited in size to duplex pumping systems with pumps sized 7.5 hp or smaller.

## 1.02 SUBMITTALS

- A. Conform to requirements of Section 01 33 00 - Submittals.
- B. Submit complete shop drawings and material certification(s) for wet well(s), pumps, motors, valves, hatches, electrical materials, concrete, pipe materials, and coatings.

## 1.03 QUALITY OF EQUIPMENT

- A. Equipment and appurtenances shall be designed for and constructed of materials for the conditions of exposure and of such strength to withstand all stresses which may occur during testing, installation, and all conditions of normal operation.
- B. Exposed surfaces shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structure shapes shall be rounded or chamfered for per personnel protection.
- C. All machinery and equipment shall comply in all respects with the provisions of the Occupational Safety and Health Act of 1970, and other applicable Federal, State and local laws & regulations.

**PART 2: PRODUCTS**

## 2.01 SEWAGE PUMPS

- A. The sewage pumps shall be vertical, recessed impeller, grinder-type submersible pumping units, complete with motor and submersible rated power and control cables. The grinder shall be capable of grinding all materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, and wooden articles into a finely ground slurry with particle dimensions no greater than 1/4 inch. For serviceability and parts availability all pumps shall be standard catalog submersible pumping products.
- B. Pump casings shall be completely open from suction to discharge with no wearing rings or impeller face plates required. All internal case clearances shall be equal to the discharge diameter so that all material which will pass through

the discharge can pass through the pump. (Maximum sphere equal to discharge diameter.)

- C. The impeller shall be keyed to the motor shaft and secured by an impeller bolt.
- D. Pump casings and impellers shall be constructed of ASTM A48, Class 25 or 30 grey cast iron material unless specifically indicated otherwise.
- E. Pumps shall be rated for operating conditions as shown on the Drawings.
- F. Energy efficient pumps that utilize premium efficiency motors shall be included within all lift stations.

## 2.02 MOTORS

- A. All motors shall be provided with thrust and radial bearings rated for L-10 life of 17,500 hours to carry the entire load which may be imposed upon it under all operating conditions. All motors shall be of nationally known American manufacture, standard frame, and shall be listed by Underwriters Laboratories for operation in a Class I, Division 1, Group D hazardous location. All motors shall be mounted using manufacturers standard bolt hole pattern. No additional holes shall be made in the motor mounting. The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation and a dielectric oil filled motor, NEMA L design.
  - 1. Motor locked rotor NEMA code shall be H or better for motors less than 15 h.p. and shall be G or better for motors 15 h.p. and above.
- B. Each motor shall have two (2) tandem mounted mechanical seals, the lower one outside the motor and protecting the upper one which shall be in an oil-filled chamber. The lower, primary seal shall consist of one stationary silicon carbide or tungsten carbide ring and one positively driven (rotating) silicon carbide or tungsten carbide ring. The upper seal between the oil and motor housing shall consist of one stationary stainless steel or tungsten carbide ring and one positively driven (rotating) carbon ring. Each interface shall be held in place by its own independent spring system.
  - 1. Moisture detector probes in the oil-filled seal chamber shall be connected to an alarm indicating the presence of moisture in the seal chamber. Thermal overload protectors shall be imbedded in the motor windings and connected to the control to disconnect the motor in the event of overheating.
- C. Each motor shall be equipped with heavily jacketed submersible cables of the length required to reach the control panel without splices or strain and allowing a minimum of 4 feet of slack. Short cables will be rejected.
- D. All motors shall be sized according to the information shown on the Drawings.

## 2.03 PIPING

- A. Piping, including fittings, shall be as shown on the Drawings and shall meet AW specifications.

- B. PVC piping, HDPE piping, and galvanized steel piping are not permitted within the wet well of the lift station or the valve vault.

#### 2.04 CHECK VALVES

- A. The check valves shall be ball type. The valve shall be cast iron-body and rated for 150 psi working pressure. Construction and materials shall be such that the valve shall be suitable for raw sewage service.

- 1. Check valve for valve box drain shall be as shown on the Drawings.

#### 2.05 GATE VALVES

- A. Gate valves shall be resilient seat AWWA Specification valves brass body non-rising stem "O" Ring seals and 150 PSI working pressure. The valve shall be epoxy coated inside and be equipped with a stem thrust bearing.

#### 2.06 COUPLING SYSTEM (GUIDE RAIL)

- A. A guide rail system shall be furnished and installed for each pump designed to operate under the expected head and flow conditions. The system shall be designed such that the pumps can be easily removed from the wet well without entering the well or disconnecting piping.
- B. The system shall consist of a 90° discharge elbow with support leg, stationary base support, slide rail pump assembly, dual stainless steel guide rails, upper, lower and intermediate stainless steel guide rail supports, and stainless steel lifting yoke, cable and eyes. The foot-mounted discharge elbow and adapter shall conform to ASTM A48 Class 25 or 30 grey iron. Guide rails shall be constructed using Type 326 stainless steel.
- C. The stationary base shall be constructed of ductile iron, integrally cast. The slide face shall be constructed of Class 35 cast iron. The coupling shall incorporate a self-energizing gasket to provide positive sealing under all conditions. All bolts, nuts, screws, and miscellaneous accessories not otherwise noted shall be 316 stainless steel.
- D. The guide rail system shall be a standard product of the pump manufacturer, using materials specified above.

#### 2.07 ALUMINUM ACCESS DOORS

- A. Door leaf shall be minimum ¼" aluminum pattern plate reinforced to withstand a live load of 300 pounds per square foot. Frame shall be ¼" aluminum with an anchor flange around the perimeter. Doors shall be equipped with heavy forged brass or stainless steel hinges, stainless steel pins, and an automatic hold-open arm with release handle. Provide a staple for padlock and an aluminum lifting handle. The lifting handle shall recess into the door when not in use. Hardware shall be cadmium plated and factory finish. The frame shall be mill finish with bituminous coating applied to exterior channels where they come in contact with the frame. Doors shall be hinged as shown on the Drawings. Where opposite

opening doors are indicated, safety chains shall be provided. Door assemblies shall meet OSHA requirements. On all door leafs with any dimension greater than 36 inches, supply compression springs to assist opening.

- B. Provide safety grate option and keyed locks for all access hatches. Provide master access keys in accordance with AW's requirements. Two of each key shall be provided and keys shall be tagged for lock location. Safety grating shall be manufactured with 1" square molded fiberglass or steel and be capable of supporting 300 lbs/SF.

## 2.08 FIBERGLASS WET WELL SECTIONS AND VAULT

- A. Unless otherwise indicated, the plastic terminology used in this specification shall be in accordance with the definitions given in American Society for Testing and Materials (ASTM) designations D3299. This specification is for the hand lay-up, chopped spray technique and filament wound methods for manufacturing of vertical underground fiberglass basins. Other methods of manufacturing shall not be acceptable.
- B. The resin used shall be of a commercial grade and shall be evaluated as a laminate by test or determined by previous service to be acceptable for the environment. The resins used may contain the minimum amount of fillers or additives required to improve handling properties. Up to 5% by weight of thixotropic agent which will not interfere with visual inspection may be added to the resin for viscosity control. Resins may contain pigments and dyes by agreement between fabricator and AW Project Manager, recognizing that such additions may interfere with visual inspection of laminate quality.
- C. The reinforcing material shall be a commercial grade of glass fiber having a coupling agent which will provide a suitable bond between the glass reinforcement and the resin.
- D. The laminate shall consist of an inner surface, an interior layer, and a filament-wound structural exterior layer of laminate body.
- E. The inner surface shall be free of cracks and crazing with a smooth finish and with an average of not over two pits per square foot, providing the pits are less than 1/8" in diameter with not over 1/32" deep and are covered with sufficient resin to avoid exposure of inner surface fabric. Some waviness shall be permissible as long as the surface is smooth and free of pits. Between 0.100 and 0.020 inches of resin-rich surface shall be provided.
- F. A minimum of 0.100 inch of the laminate next to the inner surface shall be reinforced with 30% by weight of chopped-strand fiber having fiber lengths from 0.5 to 2.0 inches.
- G. Subsequent reinforcement shall be continuous-strand roving fiberglass. The thickness of the filament-wound portion of the tank shell shall vary with the tank height to provide the aggregate strength necessary to meet the tensile and flexural requirements. If additional longitudinal strength is required, the use of other reinforcement, such as woven fabric, chopped-strand mat, or chopped strands shall be interspersed in the winding to provide additional strength. Glass content of this filament-wound structural layer shall be 50 to 80% by weight. The

- exterior surface shall be relatively smooth with no exposed fibers or sharp projections. Hand work finish shall be present to prevent fiber exposure.
- H. The tank walls must be designed to withstand wall collapse based on the assumption of hydrostatic type loading by backfill with a density of 120 lb./cu.ft. The tank wall laminate must be constructed to withstand or exceed two times the assumed loading for any depth of basin.
  - I. For the tank bottoms, subsequent reinforcement shall be of 1.5 oz./sq.ft. chopped strand fiber or woven roving to a thickness to withstand applicable hydrostatic uplift pressure, with a safety factor of 2. In saturated conditions, the center deflection of any empty tank bottom shall be less than 3/8" (elastic deflection) and will not interfere with bottom pump mounting requirements nor rail system.
  - J. The width of the first layer of joint overlay shall be 3" minimum. Successive layers shall uniformly increase in width to form a smooth contour laminate that is centered on the joint  $\pm 1/2$ ". A highly filled resin paste may be placed in the crevices between joined shall be roughened to expose glass fiber. This roughened area shall extend beyond the lay-up areas so that no reinforcement is applied to an unprepared surface. Surfaces shall be clean and dry before lay-up. The entire roughened area shall be coated with resin after joint overlay is made.
  - K. The finished laminate shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, air bubbles, pinhole, pimples, and delamination.
  - L. The surfaces shall be relatively smooth, hand finish is acceptable, with no exposed fibers or sharp projections.
  - M. Tanks shall be mounted on cradles if shipping is horizontal, or on a suitable skid or pallet if shipping in the vertical position. The tank shall be secured to the cradles or skid so that there can be no movement of the tank in relation to the skid or cradle under normal handling.
  - N. The tank bottoms shall extend past the tank walls so that the O.D. is approximately 4" larger in diameter than the O.D. of the sidewalls. This larger diameter shall serve as an anti-flotation flange. Contractor shall place the tanks on concrete pads and secure with stainless steel clips catching the anti-flotation flange and anchored to the concrete pad. Anti-flotation flange shall not require bolt holes to secure the tank to the concrete pad.
  - O. Both tanks shall include NPT discharge fittings. The wet-well tank shall include a 4" caulking type bolt-on thermoplastic influent hub for mounting in the field. The hub shall be beveled approximately three degrees to accommodate gravity pipe coming in from various angles. The influent hub shall have a textured surface in order to provide better caulking adhesion. The valve vault tank shall include NPT influent fittings. Both tanks shall include appropriate NPT fitting for the valve box drain.
  - P. The top flange and cover O.D. shall assure a tight fit and afford ease of access not possible with recessed covers. Noncorroding stainless steel heli-coils shall be inserted in all bolt holes of the top flange and shall be positively locked with threads and resin to prevent stripping. A 10-hole pattern shall accommodate the mounting of the cover.

- Q. Covers shall be of fiberglass with an O.D. equal to the O.D. of the top flange on the basin. Cover shall be secured by stainless steel bolts. Covers shall be designed for live load of 350 lb./sq.ft.

#### 2.09 PRESSURE TEST VALVE AND GAUGE

- A. Pressure test valve shall be a brass curb stop of the oroseal or Teflon coated ball-type with a brass saddle and fitting for pressure gauge connection. Pressure gauge shall be 0-40 psi range, 4½" liquid-filled gauge with stainless steel dial and bourdon tube and ½" ANPT stainless steel connection stem.

#### 2.10 ELECTRICAL SPLICE JUNCTION BOX

- A. The electrical splice j-box shall be located in an easily accessible location adjacent to the wet well, shall provide easy access for inspection and servicing, and be of corrosion resistant materials. Junction boxes are not permitted to be located on top of the wet well. The electrical splice box shall be UL approved for wet locations.

### **PART 3: EXECUTION**

#### 3.01 PUMP STATION (GENERAL)

- A. Construct wet well and valve pit as shown on the Drawings and specified herein. Compact clean subgrade under wet well to 100% of maximum density at optimum moisture content as determined by AASHTO T-99, Method A. Place 6" minimum of #57 crushed stone properly compacted under wet well anti-buoyancy slab. Compact clean backfill around the station in 8-inch lifts to not less than 95% of the maximum density at optimum water content as determined by AASHTO T-99, Method A. Access door units shall be flush with concrete surface and in alignment to permit unobstructed removal of pumps and valves. Complete the pump station piping and fittings in accordance with the Drawings and Specifications relating thereto. Remove all lifting eyes etc. from precast units, rub all joints, coat interior of pump station wet wells, clean hatches to bare metal, touch up paint on electric panels, clean wet well, valve pit and drains and grade site.

#### 3.02 INSTALLATION OF EQUIPMENT

- A. The Contractor shall install equipment as required by the manufacturer's written installation instructions and approved shop drawings unless otherwise directed by the AW Project Manager.
- B. The floor of the pump station shall be constructed level to a point 6 inches outside of all pump supports before installing pumps. Pump piping shall be completely made up and secured to prevent any excess movement. Provide permanent supports, and wedges as indicated to restrain movement.

- C. Excess motor and control wire shall be carefully coiled and hung inside the wet well. These wires shall not be cut and all identification tags shall be in place. Cables shall be supported with S.S. basket weave type strain reliefs hung in the wet well and be routed in a manner that will not interfere with access to any equipment or terminals in the control panels

### 3.03 CONTROLS INSTALLATION

- A. Field Calibration: All instrumentation shall be calibrated in the presence of the AW Project Manager in accordance with the range and accuracy specified herein.
  - 1. All equipment shall be calibrated using a standard calibration sheet which has been approved by the AW Project Manager. This calibration sheet shall be filled out identifying the instrument or item to be calibrated and signed with date and initials of the person calibrating the device.

### 3.04 START-UP, TESTING, AND TRAINING

- A. The Contractor shall provide a factory certified technician that is fully familiar with the equipment installed to startup and completely check out the pump station. The technician shall first perform a pre-start check to include, at a minimum, proper impeller rotation, proper service voltage, and proper operation of the phase monitor. Then the technician shall perform start-up checking for, at a minimum, proper operation, including all control functions, motor operation, and measurements of vibration, current, pressures and flows to verify compliance with the Drawings and Specifications. Amp readings on each motor lead shall be recorded on the start-up report. Final technical checkout (with technician(s) present) will be made in the presence of the AW Project Manager. The Contractor shall furnish all materials, equipment, including test gauges calibrated in feet, and incidentals to conduct the tests.
- B. Before the main circuit breaker is energized to allow power to the control panel, verify incoming service voltage is within normal range on all phases.
- C. The factory certified technician shall also instruct the Owner and Engineer in the operation of the controls, including changing all settings, and shall set all settings for proper operation of the pump station and record these initial settings on the start-up report form.
- D. A written report by the factory certified technician shall be given to the Engineer and this report shall include, at a minimum, the results of all tests and instructions indicated above.

**END OF SECTION 33 32 16**