

SECTION 33 32 17**GRINDER LIFT STATIONS****PART 1: GENERAL****1.01 SCOPE**

- A. This Section contains the requirements for a fully operational simplex grinder pump station.

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), grinder 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 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 standards.

PART 2: PRODUCTS**2.01 GENERAL**

- 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
- B. Grinder pump stations, complete with all appurtenances, form an integral system, and as such, shall be supplied by one grinder pump station manufacturer. The equipment specified shall be a product of a company experienced in the design and manufacture of grinder pumps for specific use in low pressure sewage systems. The company shall submit detailed installation and user instructions for its product, submit evidence of an established service program including

complete parts and service manuals, and be responsible for maintaining a continuing inventory of grinder pump replacement parts. The manufacturer shall provide, upon request, a reference and contact list from ten of its largest contiguous grinder pump installations of the type of grinder pumps described within this Specification.

2.02 SEWAGE PUMPS

- A. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal.
- B. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier.
- C. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil nominal dry thickness, wet applied.
- D. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel.
- E. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2.03 GRINDER

- A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft.
- B. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable.
- C. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth.
- D. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance.
- E. The shredder ring shall be of the stationary type and the material shall be white cast iron.
- F. The teeth shall be ground into the material to achieve effective grinding.
- G. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque.
- H. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures.

- I. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:
 1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
 2. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second. This is a critical design element to minimize jamming and as such must be adhered to.
 3. The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and minimizes blinding of the pump by large objects that block the inlet shroud.
 4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.
- J. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.

2.04 MOTORS

- A. As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds.
- B. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor.
- C. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application.
- D. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability.
- E. The wet portion of the motor armature must be 300 series stainless. To reduce the potential of environmental concerns, the expense of handling and disposing

of oil, and the associated maintenance costs, oil-filled motors will not be accepted.

2.05 MECHANICAL SEAL

- A. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.06 TANK

- A. High Density Polyethylene Construction (HDPE).
 - 1. The tank shall be a wetwell design made of high density polyethylene of a grade selected for environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. Corrugations of the outside wall are to be of a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be a minimum .250 inch thick. All seams created during tank construction are to be thermally welded and factory tested for leak tightness. Tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to maximum external soil and hydrostatic pressure.
 - 2. The tank shall be furnished with a factory installed PVC inlet flange to accept a 4" inlet pipe.
 - 3. The tank shall include a lockable cover assembly providing low profile mounting and watertight capability. The cover shall be high density polyethylene, green in color, with a load rating of 150 lbs per square foot. The cover assembly shall also include an integral 2-inch vent to prevent sewage gases from accumulating in the tank. The accessway design and construction shall facilitate field adjustment of station height in increments of 3" or less without the use of any adhesives or sealants requiring cure time before installation can be completed.
 - 4. The power and control cable shall connect to the pump by means of the provided NEMA 6P electrical quick disconnect (EQD) and shall enter the tank through a factory installed watertight strain relief connector. An electrical junction box shall not be permitted in the tank.
 - 5. Tank heights shall be as shown on the contract Drawings.
 - 6. The station shall have all necessary penetrations factory sealed and tested. No field penetrations shall be acceptable.

B. Fiberglass Construction.

1. The tank shall be a wet well design consisting of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of cracks and crazing. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present.
2. The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available tank height. All lift station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The tank bottom shall be reinforced with a fiberglass plate extending beyond the tank walls to support concrete anchoring, as required, to prevent flotation.
3. The fiberglass tank shall have a stainless steel discharge bulkhead which terminates outside the tank wall with a 1-1/4" female pipe thread. The discharge bulkhead shall be factory installed and warranted by the manufacturer to be watertight. The tank shall be furnished with a field installed EPDM grommet to accept a 4" SDR 35 inlet pipe.
4. The power and control cable shall connect to the pump by means of the provided NEMA 6P EQD and shall enter the tank through a field installed watertight strain relief connector supplied by the manufacturer. An electrical junction box shall not be permitted in the tank. Installation of the inlet grommet and cable strain relief shall require field penetration of the tank wall by the installing party. The tank shall also be vented to prevent sewage gases from accumulating inside the tank by means of a factory-provided, field-installed mushroom vent. The station cover shall be factory drilled to accept the mushroom vent. The tank and stainless steel discharge bulkhead shall be factory-tested to be watertight.
5. Consult the Drawings for lift station tank sizes (diameter and height).

2.07 DISCHARGE HOSE AND DISCONNECT/VALVE:

- A. All discharge fittings and piping shall be constructed of polypropylene, EPDM or PVC.
- B. The discharge hose assembly shall include a shut-off valve rated for 200 psi WOG and a quick disconnect feature to simplify installation and pump removal.
- C. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

2.08 ELECTRICAL QUICK DISCONNECT:

- A. The grinder pump core shall include a factory-installed NEMA 6P EQD for all power and control functions.
- B. The EQD will be supplied with 32', 25' of useable, electrical supply cable (ESC) to connect to the alarm panel.
- C. The EQD shall require no tools for assembly, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque.
- D. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts.
- E. Junction boxes within the wet well are not acceptable due to the large number of potential leak points.
- F. The EQD shall be so designed to be conducive to field wiring as required.

2.09 CHECK VALVE:

- A. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge piping.
- B. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow.
- C. Moving parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.
- D. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of an engineered thermoplastic resin.
- E. The valve shall be rated for continuous operating pressure of 235 psi. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

2.10 ANTI-SIPHON VALVE:

- A. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge piping.
- B. Moving parts will be made of 300 series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.

- C. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure.
- D. The valve body shall be injection-molded from an engineered thermoplastic resin.
- E. Holes or ports in the discharge piping are not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped.
- F. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

2.11 CORE UNIT:

- A. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, EQD, and wiring.
- B. The watertight integrity of the core unit shall be established by a 100% factory test at a minimum of 5 PSIG.

2.12 CONTROLS:

- A. All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners.
- B. Locating motor starting controls in a plastic enclosure is not acceptable.
- C. Wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls.
- D. Level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable.
- E. Level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc.
- F. Level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermoplastic elastomer.
- G. The use of PVC for the level sensing housing is not acceptable.
- H. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch.

- I. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch.
- J. Any connections are to be radial sealed with redundant O-rings.
- K. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit.
- L. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.
- M. All fasteners throughout the assembly shall be 300 series stainless steel.
- N. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type.
- O. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit.
- P. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch.
- Q. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue.
- R. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes.
- S. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation.
- T. The grinder pump will be furnished with a 6-conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements

2.13 ALARM PANEL:

- A. Each grinder pump station shall include an alarm panel suitable for wall or pole mounting.
- B. The enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance.
- C. The enclosure shall include a hinged, lockable cover with padlock, preventing

access to electrical components, and creating a secured safety front to allow access only to authorized personnel.

- D. The alarm panel shall contain one 15-amp, double-pole circuit breaker for the pump core's power circuit and one 15-amp single-pole circuit breaker for the alarm circuit.
- E. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit.
- F. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.
- G. The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; and high level alarm capability. The alarm sequence is to be as follows when the pump and alarm breakers are on:
 - 1. When liquid level in the sewage wet-well rises above the alarm level, the contacts on the alarm pressure switch activate, and audible and visual alarms are activated.
 - 2. The audible alarm may be silenced by means of the externally mounted, push-to-silence button.
 - 3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.
- H. The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating.
- I. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).
- J. The entire alarm panel, as manufactured and including any of the following options shall be listed by Underwriters Laboratories, Inc.

2.14 SERVICEABILITY:

- A. The grinder pump core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary. The level sensor assembly must be easily removed from the pump assembly for service or replacement.
- B. All mechanical and electrical connections must provide easy disconnect

capability for core unit removal and installation.

- C. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged.
- D. A pump push-to-run feature will be provided for field trouble shooting. The push-to-run feature must operate the pump even if the level sensor assembly has been removed from the pump assembly.
- E. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.15 OSHA CONFINED SPACE:

- A. All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146 Permit-required confined spaces). *“Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant’s body breaks the plane of an opening into the space.”*

2.16 SAFETY:

- A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use. UL listing of components of the station, or third-party testing to UL standard, are not acceptable.
- B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International. Third-party testing to NSF standard is not acceptable.

2.17 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 FACTORY TEST:

- A. Each grinder pump shall be submerged and operated for 1.5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharge assembly and each unit's dedicated level controls and motor controls.
- B. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps is not acceptable.
- C. Certified test results shall be available upon request showing the operation of each grinder pump at two different points on its curve.
- D. Additional validation tests include: integral level control performance, continuity to ground and acoustic tests of the rotating components.
- E. All HDPE basins shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets etc.).
- F. Fiberglass basins with stainless steel discharge bulkhead shall be factory tested to be watertight.

3.02 DELIVERY:

- A. All grinder pump core units, including level controls, will be delivered to the job site 100 percent completely assembled, including testing, ready for installation. Grinder pump cores will be shipped separately from the tanks. Installing the cores and discharge piping/hose into the tanks is the only assembly step required and allowed due to the workmanship issues associated with other on-site assembly. Grinder pump cores must be boxed for ease of handling.

3.03 INSTALLATION:

- A. Earth excavation and backfill are specified under Section 31 23 33.
- B. The Contractor shall be responsible for handling ground water to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding.
- C. The grinder pump station shall not be set into the excavation until the installation procedures and excavation have been approved by the AW Project Manager.

- D. Remove packing material. User instructions **MUST** be given to AW. Hardware supplied with the unit, if required, will be used at installation. The basin will be supplied with a standard 4" inlet grommet (4.50" OD) for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled or laid on its side for any reason.
- E. Installation shall be accomplished so that 1" to 4" of access way, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow for the concrete anchor.
- F. A 6" inch (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under each unit.
- G. A concrete anti-flotation collar, as detailed on the Drawings, and sized according to the manufacturer's instructions, shall be required and shall be pre-cast to the grinder pump station or poured in place. Each grinder pump station with its pre-cast anti-flotation collar shall have a minimum of three lifting eyes for loading and unloading purposes.
- H. If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8" sleeve is required over the inlet prior to the concrete being poured.
- I. The Contractor will provide and install a 4-foot piece of 4-inch SDR 35 PVC pipe with water tight cap, to stub-out the inlet, as depicted on the contract Drawings.
- J. The electrical enclosure shall be furnished, installed and wired to the grinder pump station by the Contractor. An alarm device is required on every installation, there shall be **NO EXCEPTIONS**. It will be the responsibility of the Contractor to coordinate the location for the alarm panel with the AW Project Manager.
- K. The Contractor shall mount the alarm device in a conspicuous location, as per NEC and local codes. The alarm panel will be connected to the grinder pump station by a length of 6-conductor type TC cable as shown on the contract Drawings. The power and alarm circuits must be on separate power circuits. The grinder pump stations will be provided with 32', 25' of useable, electrical supply cable to connect the station to the alarm panel. This cable shall be supplied with a **FACTORY INSTALLED EQD** half to connect to the mating EQD half on the core.

3.04 BACKFILL REQUIREMENTS:

- A. All Backfill must be in accordance with Section 31 23 23 – Utility Backfill Materials and Section 31 23 33- Excavation and Backfill for Utilities.

- B. All restoration will be the responsibility of the Contractor. The properties shall be restored to their original condition in all respects, including, but not limited to, curb and sidewalk replacement, landscaping, loaming and seeding, and restoration of the traveled ways, as directed by the AW Project Manager.

3.05 START-UP AND FIELD TESTING:

- A. The Contractor shall provide the services of qualified factory trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct AW's personnel in the operation and maintenance of the equipment before the stations are accepted by the AW Project Manager.
- B. All equipment and materials necessary to perform testing shall be the responsibility of the Contractor. This includes, as a minimum, a portable generator and power cable (if temporary power is required), water in each basin (filled to a depth sufficient to verify the high level alarm is operating), and opening of all valves in the system. These steps shall be completed prior to the qualified factory trained technician(s) arrival on site.
- C. Upon completion of the installation, the authorized factory technician(s) will perform the following test on each station:
 - 1. Make certain the discharge shut-off valve in the station is fully open.
 - 2. Turn ON the alarm power circuit and verify the alarm is functioning properly.
 - 3. Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off" controls are operative. The pump should immediately turn ON.
 - 4. Consult the Manufacturer's Service Manual for detailed start-up procedures.
- D. Upon completion of the start-up and testing, the Contractor shall submit to the AW Project Manager, the start-up authorization form describing the results of the tests performed for each grinder pump station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

END OF SECTION 33 32 17