

## **DIVISION 33 – UTILITIES**

### **SECTION 33 32 16 – PACKAGED SEWAGE GRINDER PUMP UNITS**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. The Authority recognizes that there are many types of grinder pumps and manufacturers of packaged grinder pump units. The Authority is also aware that operation and maintenance costs of grinder pumping stations can be substantial. Therefore, the Developer shall do or cause the following element to be done:
  - 1. Whenever possible, a pressure sewer system with grinder pumping stations shall not be used.
  - 2. Prior to the design of a pressure sewer system, the Developer shall discuss the proposed system in detail with the Authority.
  - 3. Any pressure sewer system and grinder pumping station shall be of a type satisfactory to the Authority and shall meet all applicable requirements of the Pennsylvania Department of Environmental Protection (PA DEP).
  - 4. The Authority's intent is to standardize components used in pressure sewer systems and grinder pumping station applications to facilitate inventory control, equipment familiarization, and safety.
- B. Section Includes
  - 1. Wetwell/Drywell Grinder Pump Station(s) to be owned and maintained by the Authority.
- C. Grinder Pump Stations to be owned and maintained by the private property owner are encouraged to be as specified or equal.

##### **1.02 REFERENCES**

- A. National Electric Code - N.E.C.
- B. National Electric Safety Code.

##### **1.03 SYSTEM DESCRIPTION**

- A. Operating Conditions
  - 1. The pumps shall be capable of delivering 15 GPM against a rated total dynamic head of 0 feet (0 PSIG), 11 GPM against a rated total dynamic head of 92 feet (40 PSIG), and 7.8 GPM against a rated total dynamic head of 185 feet (80 PSIG). The pump(s) must also be capable of operating at negative total dynamic

head without overloading the motor(s). Under no conditions shall in-line piping or valves be allowed to create a false apparent head.

**1.04 SUBMITTALS**

- A. Submit in accordance with Section 01 33 00.
- B. Submit shop drawings/product data and pump curves from manufacturer's descriptive literature and specifications for all materials used in this Section.
- C. Specific submittals will be included with each project as may be required for testing, warranties, project manuals, etc. Provide manufacturer's Operation and Maintenance data and manuals.

**1.05 DELIVERY, STORAGE AND HANDLING**

- A. Deliver, store, protect and handle products to site in accordance with Manufacturers recommendations.
- B. The grinder pump unit 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 unit shall be listed by Underwriters Laboratories, Inc. to be safe and appropriate for the intended use.

**1.06 QUALITY ASSURANCE AND MANUFACTURER**

- A. Grinder pump stations, complete with all appurtenances, shall form an integral system, and as such, shall be supplied by one grinder pump station manufacturer. The Contractor shall be responsible for the satisfactory operation of the entire system. 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.
- B. The equipment furnished hereunder shall be the product of a company experienced in the design and manufacture of grinder pumps specifically designed for use in low pressure systems. All manufacturers proposing equipment for this project shall have at least 10 years of experience in the design and manufacture of units of identical size(s) and performance to the specified units. All manufacturers proposing equipment for this project must also have not less than 500 successful installations of low pressure sewer systems utilizing grinder pumps of like type to the grinder pumps specified herein. An installation is defined as a minimum of 25 pumps discharging into a common force main which forms a low pressure sewer system.
- C. The Manufacturer of the grinder pump station shall be Environment One Corporation, Model DH071, or approved equal.

## 1.07 WARRANTY

- A. The grinder pump Manufacturer shall provide a warranty on the complete station and accessories including, but not limited to, control panels, valves, pump components, and wetwell, for a period of twenty-four (24) months after notice of the Authority's acceptance, but no greater than 27 months after receipt of shipment. The Authority will not accept any equipment found to be defective and Manufacturer will be required to replace any defective equipment with new material. Any manufacturing defects found during the warranty period will be reported to the Manufacturer by the Authority and will be corrected by the Manufacturer at no cost to the Authority.
- B. WARRANTY PERFORMANCE CERTIFICATION: As a bid certification requirement, each bidder shall provide with their bid schedule a Warranty Performance Certification statement executed by the most senior executive officer of the grinder pump Manufacturer, which certifies a minimum of a 24-month warranty. They must further detail any exclusions from the warranty or additional cost items required to maintain the equipment in warrantable condition, including all associated labor and shipping fees, and certify that the Manufacturer will bear all costs to correct any original equipment deficiency for the effective period of the warranty. All preventive maintenance type requirements shall be included in this form as exclusions. These requirements include, but are not limited to, unjamming of grinder mechanism, periodic motor maintenance, and periodic cleaning of liquid level controls.

## PART 2 - PRODUCTS

### 2.01 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. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. 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.

### 2.02 GRINDER

- A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. 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. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque. These materials have been chosen for their capacity to perform in the intended environment as they are materials with wear and corrosive resistant properties.

- B. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. 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.
- C. 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.

### **2.03 MOTOR**

- 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. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability.
- C. 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.

### **2.04 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.

**2.05 WET WELL AND INTEGRAL ACCESSWAY**

- A. Wet well shall be a custom molded high density polyethylene as supplied by Grinder Pump manufacturer. Along with the wet well, an integral access way shall be high density polyethylene of a grade selected for environmental stress cracking resistance.
- B. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. The corrugations of the outside wall are to be a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be 0.250" thick (minimum). All seams created during tank construction are to be thermally welded and factory tested for leak tightness. The 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 150 percent of the maximum external soil and hydrostatic pressure.
- C. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or Schedule 40 pipe. The tank capacity and dimensions shall be as follows:
  - A. Minimum Station Capacity: 70 gallons
  - B. Exterior Diameter of Wet Well: 29.5 inches
  - C. Overall Height: 91.8 inches (referenced from exterior bottom of wetwell to top of unit)
  - D. Pump Off Level: 14 inches (referenced from interior bottom of wet well)
  - E. Pump On Level: 18 inches (referenced from interior bottom of wet well)
  - F. Alarm Level: 26 inches (referenced from interior bottom of wet well)
  - G. Inlet Centerline: 36 inches (referenced from interior bottom of wet well)
  - H. Inlet Invert Depth: 55 inches (referenced from finished grade elevation)
  - I. Discharge Centerline: 42 inches (referenced from bottom of wet well)
  - J. Discharge Centerline Depth: 46 inches (referenced from finished grade elevation)
- D. The Drywell accessway shall be an integral extension of the wet well assembly and shall include a lockable cover assembly providing low profile mounting and watertight capability. The accessway design and construction shall enable field adjustment of the station height in increments of 4" or less without the use of any adhesives or sealants requiring cure time before installation can be completed.
- E. The station shall have all necessary penetrations molded in and factory sealed. To ensure a leak free installation no field penetrations will be acceptable.
- F. All discharge piping shall be constructed of 304 stainless steel. The discharge shall terminate outside the accessway bulkhead with a stainless steel, 1-1/4" Female NPT fitting. The discharge piping shall include a stainless steel ball valve rated for 235 psi WOG; PVC ball valves or brass ball/gate will not be accepted. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

- G. The accessway shall include a single NEMA 6P Electrical Quick Disconnect (EQD) for all power and control functions, factory installed with accessway penetrations warranted by the manufacturer to be watertight. The EQD will be supplied with 50 feet of useable Electrical Supply Cable (ESC) outside the station, to connect to the alarm panel. The ESC shall be installed in the basin by the manufacturer. Field assembly of the ESC into the basin is not acceptable because of potential workmanship issues. The EQD shall require no tools for connecting, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. A junction box shall not be permitted in the accessway due to the large number of potential leak points. The EQD shall be so designed to be conducive to field wiring as required.
- H. The access way on pump basins shall include a 2" PVC goose neck vent to prevent sewage gases from accumulating in the wetwell.

#### **2.06 CHECK VALVE**

- A. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the stainless steel discharge piping. 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. 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. 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. 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.

#### **2.07 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 stainless steel discharge piping. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. 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. The valve body shall be injection-molded from an engineered thermoplastic resin. 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. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

#### **2.08 CORE UNIT**

- A. The grinder pump station shall have a cartridge type, easily removable core assembly consisting of pump, motor, grinder, all motor controls, check valve, anti-siphon valve, level controls, electrical quick disconnect and wiring. The core unit shall be installed in the basin by the manufacturer. Field assembly of the pump and controls into the basin is not acceptable because of potential workmanship issues and increased installation time. In some cases, stations taller than 96" may be shipped on their side without the cores assembled in the basin for freight purposes but this is the only exception. The core unit

shall seal to the tank deck with a stainless steel latch assembly. The latch assembly must be actuated utilizing a single quick release mechanism requiring no more than a half turn of a wrench. The watertight integrity of each core unit shall be established by a 100 percent factory test at a minimum of 5 PSIG.

## 2.09 CONTROLS

- A. All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. Locating the motor starting controls in a plastic enclosure is not acceptable. The wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. The level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. The 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. The level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermo plastic elastomer. The use of PVC for the level sensing housing is not acceptable.
- B. 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. 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. Any connections are to be sealed radially with redundant O-rings. 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. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.
- C. All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. 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. 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. 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. The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY INSTALLED NEMA 6P EQD half attached to it.

## 2.10 ALARM/DISCONNECT PANEL

- A. Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. 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. The enclosure shall not exceed 12.5" W x 16" H x 7.5" D.

- B. 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. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. 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.
- C. The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; 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, audible and visual alarms are activated, and the redundant pump starting system is energized.
  - 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.
- D. 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. 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).
- E. The entire alarm panel, as manufactured and including any of the following options shall be listed by Underwriters Laboratories, Inc.

## 2.11 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. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged. 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. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

## 2.12 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.

### 2.13 SPARE PARTS

- A. Contractor shall supply the following spare parts as part of the work:
  - 1. One (1) pump core unit, complete with operational controls, level sensors, check valve, anti-siphon valve, pump/motor unit and grinder.
  - 2. One (1) complete Alarm/Disconnect Panel.

## 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. 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. Certified test results shall be available upon request showing the operation of each grinder pump at two different points on its curve. Additional validation tests include: integral level control performance, continuity to ground and acoustic tests of the rotating components.

### 3.02 INSTALLATION

- A. Each grinder pump unit shall be installed in accordance with the Manufacturer's instructions. Installation shall include all internal and external piping, concrete anchoring (as required), connection of electrical components and incidentals.

### 3.03 COMMISSIONING AND ACCEPTANCE TESTING

- A. The Manufacturer shall provide the services of qualified factory trained technician(s) who shall inspect the installation, placement and wiring of each station, perform field tests as specified herein, and instruct the Authority's personnel in the operation and maintenance of the equipment before the stations are accepted by the Authority.
- B. **Commissioning Period:** Manufacturer's technicians shall inspect the installation of each grinder pump unit to render an opinion as to if the grinder pump unit was installed in accordance with the Manufacturer's instructions. Technician shall provide written confirmation to the Authority for each grinder pump unit that states that the grinder pump unit appears to have been installed correctly and is ready for operation. If the grinder pump unit is not found by the Technician to be ready for operation, the Technician shall provide a written detailed description of issues that need to be resolved. Commissioning Period shall be considered complete after the Technician has provided their written

opinion on the acceptability of the installation of each grinder pump unit. Manufacturer's technician(s) shall provide a minimum of one (1) hour in the field per grinder pump unit in order to complete commissioning activities.

- C. **Acceptance Testing:** Manufacturer's technicians shall perform the required tests on each grinder pump station. Manufacturer's technician(s) shall provide a minimum of one (1) hour in the field per grinder pump station in order to complete acceptance testing activities. Acceptance Testing activities shall be performed on a separate site visit than the commissioning activities.
1. All equipment and materials necessary to perform testing shall be the responsibility of the INSTALLING 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.
  2. Upon completion of the installation and commissioning activities, the authorized factory technician(s) will perform the following test on each station:
    - a. Make certain the discharge shut-off valve in the station is fully open.
    - b. Turn ON the alarm power circuit and verify the alarm is functioning properly.
    - c. Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off" controls are operative. The pump should immediately turn ON.
    - d. Consult the Manufacturer's Service Manual for detailed start-up procedures.
  3. Upon successful completion of the acceptance testing, the Manufacturer shall submit to the Authority a 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.

#### 3.04 OPERATION MANUALS

- A. Manufacturer shall provide a separate Operation and Maintenance Manual to the Authority for each unit provided.

**END OF SECTION**