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**PART 1 GENERAL**

**1.01 SUMMARY**

- A. General Description of Equipment: The Manufacturer shall furnish complete factory-built and tested Residential Grinder Pump Sewage System(s), each consisting of a 2 HP centrifugal grinder pump suitably mounted in a collection tank constructed of rotational molded grade high-density polyethylene (HDPE), intrinsically safe water level sensor, junction box, shut off valve, pump quick disconnect sealing flange, anti-siphon valve and check valve, discharge pipe assembly and alarm panel. For ease of serviceability, all grinder pumps shall be of like type, impeller and horsepower throughout the system. To ensure single source responsibility for the equipment, the Residential Grinder Pump Sewage System(s) shall be by the same manufacturer as supplying the pump, collection tank, level control and alarm/disconnect panel.
- B. Qualifications: The Manufacturer shall demonstrate experience in the design, manufacture, and assembly of complete grinder pump systems for specific use in low-pressure sewer 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 the grinder pump system replacement parts. The manufacturer shall provide a reference list of five (5) of its grinder pump system installations.
- C. Submittals: After receipt of notice to proceed, the manufacturer shall furnish a minimum of four (4) sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. The Project Engineer and/or End User will review this data and return two (2) copies as accepted shop drawings or with requested modifications. Delivery and payment terms are to be determined upon evaluation of credit application.

**1.02 NATIONALLY RECOGNIZED TESTING LABORATORIES (NRTL) AND STANDARDS**

- A. CSA International (cCSAus) Listing on the automatic grinder pump
  - 1. CAN/CSA – c22.2 No. 108-01, Liquid Pump
- B. Underwriters Laboratories, Inc. listing on the automatic grinder pump
  - 1. UL – Pumps, Motor Operated Water
- C. Underwriters Laboratories, Inc. (UL, cUL) listing on the alarm box
  - 1. ANSI/UL – Std. No. 508, Control Panel
- D. Occupational Safety and Health Association (OSHA)
  - 1. 29 CFR 1910.146, Permit Required Confined Space Entry

**1.03 SYSTEM PERFORMANCE REQUIREMENTS**

- A. Grinder Pump: Each two horsepower pump shall be model IGP-231 as manufactured by Franklin Electric Water Transfer Systems. Pump to be rated 230 volts, single phase, 60 Hertz, and 3450 RPM. Grinder pump shall be capable of delivering 10 gallons per minute (gpm) against a total dynamic head (TDH) of 118 feet and 33 gallons per minute (gpm) against a total dynamic head (TDH) of 0 feet without overloading. Manufacturer shall provide pump characteristics diagrammed graphically on performance curve. Performance curve shall be established by measuring total dynamic head in feet of water against discharge flow in gallons per minute and shall contain at least 5 measured points. Each pump shall be expected to perform as its curve describes.
- B. Primary Level Control: Pressure Sensing
- C. High Liquid Alarm Level: Pressure Sensing

**1.04 SHOP DRAWINGS**

- A. After receipt of notice to proceed, the manufacturer shall furnish a minimum of four (4) sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. The Engineer will promptly review this data, and return two (2) copies as accepted shop drawings. The Manufacturer shall proceed immediately with the fabrication of the equipment.

**1.05 MANUFACTURER QUALITY ASSURANCE**

- A. Qualifications: Manufacturer shall demonstrate experience in the design, manufacture, and assembly of complete grinder pump systems 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 the grinder pump system replacement parts. The manufacturer shall provide a reference list of five (5) of its grinder pump system installations.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Packing, Shipping, Handling, and Unloading: Manufacturer shall provide a complete Residential Grinder Pump Sewage System(s) on skid(s) or pallet(s) ready to install. Do not drop or impact the collection tank. If collection tank must be moved, be sure that ground traversed is smooth and free of rocks, debris, etc. When lifting the collection tank, only a pliable strap or rope should contact basin. Do not use chains or steel cables.
- B. Storage and Protection: Store Residential Grinder Pump Sewage System(s) away from sun and weather exposure until installation.

**1.07 PROJECT/SITE CONDITIONS**

- A. Environmental Requirements: per specific jobsite
- B. Existing Conditions: per specific jobsite

## **1.08 WARRANTY**

- A. The Manufacturer shall furnish a written warranty as follows for the complete package grinder pump sewage system against any and all defects in material and factory workmanship provided product is installed, serviced, and operated under normal conditions according to Manufacturer's instruction. Defects found during the warranty period will be reported to the manufacturer by the owner. Repair or parts replacement required as a result of such defect will be made free of charge during this period upon return of defective parts or equipment to manufacturer.
1. Basin shall be warranted for 30 months (2.5 years) from date of manufacture or 24 months (2 years) from date of installation, whichever comes first.
  2. Mechanical components and electrical panel shall be warranted for 30 months (2.5 years) from date of manufacture or 24 months (2 years) from date of installation, whichever comes first.
  3. Pump shall be warranted for 30 months (2.5 years) from date of manufacture or 24 months (2 years) from date of installation, whichever comes first.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURER**

- A. Equipment specified shall be produced by Franklin Electric Water Transfer Systems or approved equal, as described in Article 1.05.

### **2.02 MATERIALS**

- A. All components shall be constructed of corrosion resistant materials with proven history in residential sewage service. Painted steel or galvanized steel components exposed to effluent shall not be allowed.

### **2.03 MANUFACTURED UNIT**

- A. Manufacturer shall provide factory built and tested Residential Grinder Pump Sewage System(s) completely assembled with grinder pump suspended in a polyethylene collection tank, shut-off valve with integral extension handle, ball check and anti-siphon valve assemblies within collection tank, electrical alarm/disconnect panel, and all necessary internal wiring, piping, and controls. Collection tank shall include shallow service area well so that service to grinder pump may be performed outside wet well.

### **2.04 CORE UNIT**

- A. Residential Grinder Pump Sewage System(s) shall have easily removable pump assembly. The pump assembly shall contain pump, motor, grinder, primary motor controls, ball check/anti-siphon valve and quick disconnect sealing flange. Pump must be serviceable or repairable without special tools. Pump operating conditions shall be as described in Article 1.03.

### **2.05 COMPONENTS**

- A. Grinder Pump: Grinder pump shall be a centrifugal design with mechanical seal, vertical shaft, motor driven, solids handling pump.
1. Grinder: Grinder unit shall be on suction side of pump impeller and discharge directly into impeller inlet leaving no exposed shaft to permit packing or wrapping of ground solids. Grinder shall include a stationary hardened, stainless steel, cutter ring spaced in accurate close annular alignment with the driven cutter element. The driven cutter shall carry two (2) hardened and ground type series 440 stainless steel cutters. This assembly shall operate without objectionable noise or vibration over the entire range of operating conditions. The grinder shall be designed and constructed so as to eliminate clogging and jamming under all normal operating conditions including starting. Stationary cutter shall be reversible to provide new cutting surface without replacing with new material. Cutters shall be hardened to Rockwell 55-60C. These requirements shall be accomplished by the following, in conjunction with the pump:
    - a. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
    - b. Rotating cutters shall be precision ground to optimize grinding without excessive shaft deflection.
    - c. Annular space shall be no more than 0.006 of an inch to avoid the accumulation of ground slurry and minimize horsepower and torque requirements.
    - d. Rotating cutters shall be directly aligned with impeller vanes to immediately sweep ground material from grinding elements and out of volute into discharge piping.
    - e. The impeller and grinding mechanism must rotate at a nominal speed of at least 3400 RPM.

The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects", such as paper, plastic, diapers, and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1¼" diameter piping.

2. Electric Motor: Motor shall be a 2 HP, 3450 RPM, 230V, 60 Hertz, single phase, capacitor start, capacitor run, ball bearing, with Class F windings. Motor shall be mounted in a sealed, dielectric oil filled, submersible housing to provide permanent lubrication and efficient cooling. Start switch shall be of solid state design. Start and run capacitors shall be mounted inside control panel for ease of replacement. Motor design shall be adequate so that the pump is non-overloading throughout the pump performance curve. Stator windings shall be insulated with moisture resistant Class F insulation rated for 311°F (155°C). The motor shall be designed for handling residential sewage of 104°F (40°C) and capable of up to thirty (30) evenly spaced starts per hour. 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 and current overload protector incorporated into the motor windings. This motor protection shall have been specifically investigated and recognized by UL and certified by CSA for the application. Because air-cooled motors do not dissipate damaging heat as efficiently as oil-cooled motors, they shall not be acceptable.
3. Pump Cable: The power cable shall be 14 AWG 4-conductor and shall be sealed at the motor end as it enters the motor casing by a two-part barrier to moisture intrusion. The barrier shall be the compression of the oil and chemical resistant grommet, which shall seal the outer jacket of the power cord. In the event that the outer jacket of the power cord should become damaged, then the second line of defense shall be the epoxy poured isolated conductors within the jacketed cable itself. The insulation shall be removed from the individual conductors and the epoxy shall be allowed to form a leak-proof seal against wicking of the power cable between the outer jacket and the insulation of the individual conductors. The outer jacket of the power cord shall be oil resistant and water-resistant. The power cable shall be rated for NEC type "SOW" or "SOOW".

4. Mechanical Seal: Grinder pump shall be provided with a mechanical shaft seal to prevent leakage between the pump and motor. Seal shall have a stationary ceramic seat and a carbon rotating surface with faces precision lapped. Seal interface shall be held in contact by stainless steel spring and hardware. Seal system shall be cooled and lubricated with dielectric oil from the motor housing. Seal system shall not rely upon the pumped media for lubrication. Seal system shall be protected from solids in pumped media by pump-out vanes on pump impeller back shroud.
  5. Pump Construction: Motor housing, bearing housing and volute shall be of ASTM A-48 gray cast iron, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be Type 304 stainless steel or brass construction. All metal surfaces coming into contact with the residential sewage other than stainless steel or brass, shall be protected by an electrocoat paint finish on the interior and exterior of the pump. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with BUNA-N O-rings. Fittings will be the result of controlled compression of O-rings in two planes without the requirement of a specific torque limit. Rectangular cross-sectioned gaskets shall not be considered adequate or equal. No secondary sealing compounds, grease or other devices shall be used.
  6. Pump/Motor Shaft: Shaft shall be constructed of solid 300 series stainless steel. Shaft length measured from lower ball bearing to end of shaft shall not exceed 2-3/4 inches to minimize deflection and prolong bearing and mechanical seal life.
  7. Bearings: Pump/motor shaft shall rotate on two single row ball bearings. Motor bearings shall be permanently lubricated by complete submergence in dielectric oil. Bearings shall be designed to compensate for axial thrust and radial forces developed by pump operation at all points on the pump performance curve and a twenty (20) percent grinder duty cycle. Calculations shall be provided by the pump manufacturer upon request. Sleeve or grease packed bearings shall not be acceptable. Bearings which require lubrication according to a prescribed schedule shall not be acceptable.
  8. Impeller: Impeller shall be of cast silicon bronze, ASTM C87500, seven vane design. Impeller shall be aligned with rotating cutter to ensure fine slurry from the cutters is swept from the volute into the discharge piping. Back shroud of impeller shall have pump out vanes to protect mechanical seal from grit and other solids in ground residential sewage. Cast iron or plastic impellers shall not be considered acceptable because of inferior abrasion, corrosion and heat dissipation characteristics.
- B. Collection Tank and Integral Shallow Service Area Well (54", 72", 84", 96" models): The collection tank shall be made of rotational molded grade high-density polyethylene (HDPE) for tank applications, with corrosion resistance to domestic sewage and environmental stress. HDPE shall be stabilized against UV degradation to UV-8 protection level (ASTM D-2565). The collection tank wall shall be a minimum of 0.375 inches thick. Tank shall be monolithic in design; no seams shall be allowed in collection tank. Collection tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth and not allow a center deflection of more than 3/8 of an inch. All grinder pump station(s) components must function normally when exposed to maximum external soil and hydrostatic pressure.
- Under no conditions shall mechanical joints or fasteners penetrating tank exterior be allowed. The grinder pump station(s) shall have all necessary penetrations molded-in and factory sealed; field penetrations shall not be acceptable. All tank connections shall be made by use of solvent weld sockets.
- Collection Tank and Integral Shallow Service Area Well (108", 120" models): The collection tank shall be made of rotational molded grade high-density polyethylene (HDPE) for tank applications, with corrosion resistance to domestic sewage and environmental stress cracking. HDPE shall be stabilized against UV degradation to UV-8 protection level (ASTM D-2565). The collection tank wall shall be a minimum of 0.375 inches thick. Only one (1) seam shall be allowed in collection tank. Seam shall be thermally welded for leak tightness. Collection tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth and not allow a center deflection of more than 3/8 of an inch. All grinder pump station(s) components must function normally when exposed to maximum external soil and hydrostatic pressure.
- Under no conditions shall mechanical joints or fasteners penetrating tank exterior be allowed. The grinder pump station(s) shall have all necessary penetrations molded-in and factory sealed; field penetrations shall not be acceptable. All tank connections shall be made by use of solvent weld sockets.
1. Comprehensive Design Basis: Structural calculations using short term physical properties shall be de-rated with 20 year design coefficient. Lateral backfill and hydrostatic pressure shall be calculated as 120 pounds per cubic foot and 62.4 pounds per cubic foot, respectively.
  2. Anti-Flotation Flange: Collection tank shall incorporate integral anti-flotation flange. Flanges attached with glue or welding shall not be acceptable.
  3. Cover Attachment: Six (6) 3/8 inch 300 series stainless steel cover fasteners shall be molded in work basin.
  4. Integral Shallow Service Area Well: To meet safety provisions in Article 1.02 C, collection tanks shall incorporate a shallow dry well for access to service a system. It shall be built no more than 7 inches deep, contain the pump junction box and isolation valve handle. It shall not be considered a confined space by OSHA 1910.146 definition.
  5. Anti-Shear Discharge: Discharge connection shall be protected by an integrally molded reverse boss to prevent line breakage from backfill and tank settlement. Solvent weld and threaded connections directly exposed to backfill shall not be acceptable.
  6. Working Volume: Volume calculated from the collection tank bottom to the inlet invert, shall be a minimum of 90 gallons.
- C. Piping and Valves:
1. Internal Discharge Piping: Collection tank shall be equipped with series 300 stainless steel and/or engineered thermoplastic discharge piping joined by tapered pipe threads or solvent cement.
  2. External Discharge Piping: 48 inches of high density polyethylene (HDPE) piping or engineered thermoplastic flexible piping shall be installed to discharge connection to reduce the possibility of shearing from downward backfill settlement.
  3. Integral Ball Check/Anti-Siphon Valve: Pump discharge shall be equipped with a factory installed, gravity operated, self-cleaning, integral cast iron ball check/anti-siphon valve to prevent drainage back into the collection tank. Check valve shall provide a full-port passageway and an access port for visual and physical inspection without disassembling the discharge piping. All working parts shall be non-metallic to ensure corrosion resistance.

4. Isolation Valve with Integral Extension Handle: Discharge piping shall be equipped with a PVC single union ¼ turn ball valve rated at 235 PSI at 73°F (23°C). Ball valve shall be equipped with an integral handle extending into the shallow drywell.
5. Compression Piping Seals: All pipe penetrations shall be sealed with compression pipe grommets injection molded from DuPont Alcryn® thermoplastic. The use of mechanical fasteners or other thermoplastic materials shall not be acceptable.

Primary Level Control: Pump level shall be controlled by sensing the water pressure in the tank and providing this feedback to the control panel. The control panel will compare the water level against user preset levels to turn on and off the pump. The water pressure will be measured from a pressure bell housing made of durable ABS plastic. This bell will have a nitrile diaphragm that contacts the water and is pushed inward by the water pressure. This pressure is then transmitted back to the control panel through a ¼" flexible tubing where an integrated silicon pressure sensor converts the pressure into a voltage output. The user will be able to change the Pump On and Pump Off levels simply by turning separate dials inside the control panel.

High Level Alarm: Each system must incorporate a high level alarm. The pressure bell will provide feedback to the control panel of the water level through the water pressure it senses. The control panel will compare the water level against a user predefined level to activate the alarm. The user will be able to change the High Water Alert level simply by turning a dial inside the control panel.

- D. Alarm/Disconnect Panel: Each grinder pump sewage system shall include a NEMA 4X, UL listed, Alarm/Disconnect Panel suitable for wall (indoor or outdoor) or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, lockable cover. The enclosure shall not exceed 12" W x 15" H x 7 ½" D. The enclosure will act as the junction box for the main wiring coming in from the house and the wiring going to the junction box in the collection tank service area well.

Electrical specifications for each alarm/disconnect panel are as follows:

Input voltage

- 230 VAC 60 Hz Single Phase (Pump)

Current

- Pump – 20 Amp Max
- Alarm - < 1 Amp

Circuit Breakers

- Pump – 20 Amp, 2 Pole
- Alarm – 10 Amp, 1 Pole
- Main feed to Alarm/Disconnect Panel – 30 Amp, 2 Pole

The Alarm/Disconnect Panel shall contain separate breakers for the pump and alarm electronics to allow the alarm to still function if the pump breaker has tripped. Power to the unit should be provided via a 30 Amp, 2 pole breaker to allow the provided 20 Amp pump breaker (located inside alarm box enclosure) to trip prior to the breaker in the house.

The Alarm/Disconnect Panel shall include the following features: HOA switch with light, HWA light and buzzer with silence switch, motor contactor with overload, pump circuit breaker. In the event the high water alarm float is triggered, a horn and light will activate. The Alarm/Disconnect Panel shall include a momentary push button linked to a relay silence circuit that will allow the user to deactivate the horn while keeping the light ON. The visual alarm remains illuminated until the water level in the wet well drops below the OFF setting of the alarm float. HOA switch allows for either "Hand" (manual), "Off" or Automatic pump operation. The entire Alarm/Disconnect Panel as manufactured shall be listed by Underwriters Laboratories, Inc.

## 2.06 SAFETY

- A. Confined Space: All preventive maintenance tasks for Residential Grinder Pump Sewage System(s) shall be accomplished outside wet well, eliminating confined space entry as described in 29 CFR 1910.146. The Occupational Safety and Health Administration defines in 1910.146 confined space to be one large enough and shaped in a way that allows workers to enter and perform assigned work. Confined space has limited or restricted means for egress, has poor natural ventilation, and is not designed for continuous occupancy. Permits are required to enter confined spaces if they contain chemical or mechanical hazards.
- B. Biological Hazards: All preventive maintenance tasks shall be performable with minimum contact with residential sewage.
- C. Electrical Equipment: Grinder pump, level sensor and controls shall meet accepted standards for equipment for use in or near residences, and shall have been tested by a nationally recognized testing laboratory (NRTL) to certify their capability to perform in the system as specified. Reference Article 1.02.
- D. NEC requires that the power disconnect switch be within line of sight of PowerSewer.

## 2.07 GROUNDING THE SYSTEM

Grounding the system will help protect against lightning damage. Each PowerSewer system must be grounded to the building's electrical system ground. It is recommended that an additional grounding point be added as close to the PowerSewer control panel as possible. Grounding methods must comply with any local codes and the National Electrical Code (NEC). If you are not familiar with these codes then you should contact a qualified electrician.