

Submersible Fiberglass Grinder Lift Station

The contractor shall furnish and install one factory-built automatic underground submersible sewage pumping station with valves and all needed equipment factory installed in a fiberglass pump chamber. The principal items of equipment shall include (2) submersible sewage grinder pumps, slide away couplings with guide rail system, 2" SCH 80 piping, valves, fittings, duplex control panel, and float switches all as shown on the plans and specified herein and as supplied by Southwest Fluid Systems, LLC. (918) 398-7047.

EQUIPMENT CHAMBER SUBMERSIBLE

The submersible equipment chamber shall be a vertical cylindrical configuration with a minimum inside diameter of 60", and a minimum inside height of 150", with attached valve pit (48" dia x 48" deep) including 2" emergency pump connection and all necessary riser piping, valves, and fittings, as shown on the plans.

The resins used shall be a commercial grade polyester and shall be evaluated as a laminate by test or determined by previous service to be acceptable for the intended environment.

The reinforcing material shall be a commercial grade of glass fiber (continuous strand, chopped-strand, continuous mat and/or noncontinuous mat) having a coupling agent which will provide a suitable bond between the glass reinforcement material and resin.

The FRP laminate wall thickness shall vary with the wet well height to provide the aggregate strength necessary to meet the tensile and flexure physical properties requirements. The wet well FRP laminate must be designed to withstand wall collapse or buckling based on a hydrostatic loading of 62.4 Lbs. per cubic foot; a saturated soil weight of 120 lbs per cubic foot; a soil modulus of 700 lbs per square foot; and the pipe stiffness values in ASTM D3753, the wet well FRP laminate must be constructed to withstand or exceed two times the assuming loading on any depth of the wet well.

The finished RFP laminate will have a BARCOL hardness of at least 90% of the resin manufacturer's specified hardness for the fully cured resin. The BARCOL hardness shall be the same for both interior and exterior surfaces.

The wet well top flange shall have an outside diameter at least 4" greater than the inside diameter of the wet well. A four- or six-inch pattern shall accommodate the mounting of a cover with at least 0.25 inches in diameter 300 series stainless steel fasteners. Non corroding stainless steel threaded insert shall be fully encapsulated with non-continuous mat or chopped-strand glass fiber reinforcement. The inserts shall have an offset tab to prevent stripping or spinning out when removing and reinserting cover fasteners.

SUBMERSIBLE WET PIT SEWAGE PUMPS

SUBMERSIBLE WET PIT GRINDER SEWAGE PUMPS

PART 1 - GENERAL SYSTEM DESCRIPTION

PERFORMANCE REQUIREMENTS

Operating Conditions - Design: 45 GPM @ 17 FT TDH
Maximum Motor HP: 2 HP

Maximum Motor RPM: 3550 RPM
Voltage: 230 Volt, 1 Phase

QUALITY ASSURANCE - REFERENCED STANDARDS:

American Iron & Steel Institute (AISI)
American Society for Testing and Materials (ASTM)
Factory Mutual (FM)
Hydraulic Institute Standards for Centrifugal, Rotary, and Recip Pumps (HI)
National Fire Protection Agency (NFPA)
National Electric Code (NEC)
National Electrical Manufacturers Association (NEMA)
Anti-Friction Bearing Manufacturers Association (AFBMA)
International Standards Organization (ISO) - ISO9001

WARRANTY

The pump manufacturer shall warrant the pump and motor to the Owner against defects in workmanship and materials for a period of one (1) year under normal use and service. A copy of each warranty shall be provided to the Owner at startup.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Subject to compliance with the Contract Documents, the following are acceptable:
HOMA GRP 16/1/C or Equal as determined by the Engineer by addendum.

MATERIALS

SUBMERSIBLE SEWAGE PUMPS

Pump Case/Motor Housing: Cast Iron, ASTM A48, Class 40B
Impeller: Cast Iron, ASTM A48, Class 40B
Cutter/Grinder Ring: White Iron, AISI D3 (X210Cr12), with a minimum Brinell Hardness 600
Intermediate Casing: Cast Iron, ASTM A48, Class 40B
Discharge Base Elbow: Cast Iron, ASTM A48, Class 40B
Pump Claw: Cast Iron, ASTM A48, Class 40
Pump/Motor Shaft: Stainless Steel, ASTM A276 Type 420
O-Rings: Nitrile Rubber (NBR)
Fasteners (including impeller fastener): Stainless Steel, ASTM A276 Type 304.
Lower Seal Faces: Silicon Carbide/Silicon Carbide
Upper Seal Faces: Carbon rotating/Al₂O₃ stationary
Guide rails/cables and mounting brackets: Stainless Steel, ASTM A276 Type 316 (cables shall be nylon coated)
Lifting Chain or cable: Stainless Steel, ASTM A276 Type 316
Oil-all uses (seal lubrication, etc): Ecologically safe, paraffin or mineral base
Power/Control Cable Jacket: Waterproof synthetic rubber compound with non-wicking fillers.

POWER CABLE

Provide 30 ft of power/control cable with each pump shall be suitable for the flexible connection of the submersible pumps, sized in accordance with NEC requirements and shall be Ozone, UV, weather, oil and water resistant. The conductors shall be made of finely stranded copper. Each conductor shall be insulated by ethylene-propylene-rubber (EPR). An inner sheath of rubber shall also be utilized. The cable outer sheath shall be water and oil resistant and made of a

special rubber compound on chlorinated rubber (CM) base. Each cable shall be rated for 600/1000V, a maximum conductor temperature of 90 °C (194 °F), and a maximum medium temperature of 40 °C (104 °F). The cable entry system shall be approved by Factory Mutual and rated for a submerged depth of 100 feet. A triple sealed cable entry seal design along with strain relief and a bend protection shall be provided. First the cable entry seal shall consist of an elastomer grommet compressed by two stainless steel washers, sealing the outside of the cable against the cable entry casing. Secondly, the entire end of the cable shall be sealed inside the cable entry housing through the use of a non-shrink epoxy resin. Thirdly, a monolithic dam formed by either solder on bare stripped section or by an inserted Copper bushing shall seal each individual cable lead making sure that no entry of moisture is possible into the high-voltage motor terminal area even in the cable is damaged or severed below water level. Cable entries providing only simple rubber grommet (external cable jacket) seals will not be accepted. If a triple sealed cable entry as described is not utilized in the pump's design, then the pump shall have installed a separate moisture sensor mounted in the separated terminal area to shut the pump down should moisture approach the high voltage terminal area. A cable plug and receptacle shall be an integral design of the submersible pump allowing the mechanics to easily replace or service the pump without needing an electrician to disconnect any wires. The plug and receptacle eliminate re-wiring errors and ensures operator safety. The cable entry shall be approved by Factory Mutual.

TEMPERATURE PROTECTION

Temperature monitors shall be embedded in the motor windings for use in conjunction with and supplemental to external motor overload protection. These temperature sensitive switches shall allow for direct integration with the motor control circuit to shut down the pump if high temperatures are detected. The switches shall be normally closed rated for 250 VAC and a current of not less than 2 A. The temperature monitors shall automatically reset once motor temperature returns to normal. Set temperature monitors at levels recommended by pump manufacturer

SEAL LEAK DETECTION

Provide a detector in the motor's stator cavity which allows a control panel mounted relay to indicate leakage and de-energize the motor should leakage occur.

“GO Switch” MOTOR SENSOR MONITORING RELAY

The pump supplier shall furnish all relays required for monitoring all pump and motor sensors. The relays shall be installed by others in the motor control panel and properly wired in accordance with pump manufacturer's instructions. Relays shall mount in standard 12-pin socket bases (provided) and shall operate on available control voltage of 24-240 VAC. If relays require an input voltage that is not available in the motor control panel an adequate transformer (with fused input) shall be provided by the pump supplier. Relays shall have a power consumption of no more than 2.8 watt and shall be UL approved. Relays shall be modular in design, with each relay monitoring no more than two motor sensor functions.

Each relay module shall include a dual color (red/green or amber/green) LED to indicate the status of each monitored sensor. Green will indicate “status OK”; red or amber will indicate a high temperature failure or alarm condition. A self-corrected fault will allow the relay output contacts to reset and cause the LED to change from a steady alarm indication to a flashing signal. The LED shall continue to flash until locally cleared, providing the operator an indication of a potential intermittent fault. Each relay shall also include a power-on LED and both “test” and “reset” pushbuttons.

An independent fail-safe (switch on power loss) form-C output contact shall be included for each monitored sensor to provide a normally open / normally-closed dry contact to initiate a remote alarm device or shut down the motor. Contacts shall be rated for 3 amps at 240 VAC.

A manual/automatic selector switch shall enable the operator to provide automatic reset of temperature alarms or require a manual reset from the push button on the face of the unit or from an external controller. Seal failure alarm is always automatically reset when the fault is cleared.

The standard unit will include an RS-485 communications channel which may optionally be used to monitor status and/or fault archive information. Optional: MODBUS communications port can be added using a serial RS-485 protocol, over which a host controller may monitor pump status and / or fault archived information and remotely reset individual alarms.

FABRICATION

GENERAL

Provide pumps capable of handling raw unscreened wastewater. Design pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts or other fasteners.

Provide a pump which connects to a permanently mounted discharge connection by simple downward motion, without rotation, guided by at least two non-load-bearing guides. Pump guides (cable or pipe) shall be fastened to the discharge elbow to prevent dislodging when subjected to upward force. Final connection shall insure zero leakage between pump and discharge connection flange. Provide a discharge connection/ guide system so that no part of the pump bears directly on the floor of the wet well.

Provide Type 316 stainless steel chain of sufficient length to properly and safely lift pumps from the wet well. All exposed cast iron and ferrous surfaces shall be cleaned of dirt and grease, sandblasted to near white finish, and coated with an anti-corrosion reaction primer. The pump shall then be coated with two-component thick coat paint, with an epoxy resin base, having at minimum 82% solids by volume. This coating shall be non-toxic and approved for both wastewater and water applications. The pump shall be of submersible centrifugal, grinder, single stage, volute casing, and end suction type capable of satisfying the specified performance requirements. The pump shall be designed as "back pull-out" such that the entire rotating assembly can be removed from the casing. The pump shall be suited for continuous operation in a submerged condition driven directly by a fully submersible dry squirrel cage induction motor. The impeller shall be fitted directly to the motor shaft. The head-capacity curve shall have a single flow rate for each pumping head value and have a continuously rising head characteristic from the specified design point to shut-off so as to ensure stability and control in both individual and / or parallel operation. The operating range of the pump, as specified, is defined by the maximum and minimum operating heads against which the pump will be required to operate.

MAJOR COMPONENTS

Furnish major components (pump case, impeller, intermediate housing, and motor housing) of cast material as specified with smooth surfaces devoid of blow holes and other irregularities. Pump case design shall incorporate a centerline discharge for stability when mounted on the base elbow. Pump case and motor housing shall be cast in one only piece allowing for robust design and ease of maintenance.

IMPELLER

The impeller shall be of, free-flow, vortex action design combined with a cutter/grinder assembly capable of reducing the sewage to a fine slurry and passing a minimum 3/8 inch solid. The cutter/grinder assembly shall be a hardened white iron having a minimum Brinell Hardness (BHR) of 600 to provide sufficient wear resistance and ensure a long-life span. The free-flow vortex action impeller, having curved vanes, shall be arranged behind the cutting device and capable of handling the fine slurry produced by the cutter. The impeller shall be a one-piece casting of the material specified. It shall be smooth, will finished, free from blowholes and imperfections, and be dynamically balanced. The impeller shall be securely fitted to the pump shaft in such a manner that it does not loosen or become detached if the pump is operated in the wrong direction as may happen by reversed flow or reversed motor connections.

SHAFT

Provide common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal. The pump/motor shaft shall be of stainless steel or be completely isolated from the pumped media through the use of a stainless-steel shaft sleeve. Do not use carbon steel as a shaft material without using a stainless-steel shaft sleeve.

SHAFT SEAL

Provide two totally independent mechanical shaft seals, installed in tandem, each with its own independent single spring system acting in a common direction. The sealing shall not depend on the direction of rotation. The primary and secondary seal faces shall operate in a generously proportioned lubricant chamber that hydro-dynamically lubricates the seal faces to allow for extended periods of dry-running operation without the need for external seal lubrication or cooling systems. The lubricant chamber liquid shall be an environmentally friendly and nontoxic. The seal face material of the primary seal shall be of at minimum Silicon Carbide versus Silicon Carbide (SiC/SiC) for excellent hardness and chemical resistance across the entire "pH" range. The secondary seal shall be of Carbon versus Aluminum oxide (Carbon/Al₂O₃) for best emergency running properties. The seal faces must be of the solid material capable of being re-lapped. The seals shall require neither routine maintenance nor adjustment, but capable of being easily inspected and replaced. Mechanical seal metal parts shall be of CrNiMo-stainless steel. Seal shall be non-proprietary in design and shall be available from another vendor in addition to the pump manufacturer. Conventional double mechanical seals with a single or multiple springs acting in opposed direction, cartridge-type mechanical seals; seals with materials other than those specified; shall not be considered as adequate for this critical sealing area and will not be acceptable.

BEARINGS

Furnish upper and lower antifriction bearings. The bearing system shall be adequately designed so as to be capable of handling all axial thrust loads plus any and all radial loads. The bearings shall be sealed/shielded (permanently lubricated for life).

BOLTS AND NUTS

All nuts or bolts exposed to the pumped media shall be of stainless steel as specified.

NAMEPLATE

Each pump shall be provided with a stainless-steel nameplate firmly attached to the pumping unit. It shall be clearly and durable inscribed with the manufacturer's name, year of manufacture, pump-type, serial number, and principal rating data. For easy identification of the

submerged pumping unit, a second equal nameplate shall be supplied along with documentation for attachment outside the wet well.

MOTOR

Provide a motor which is squirrel cage, induction in design, housed in a completely watertight and air-filled chamber, with a min 1.15 service factor. The motor shall be adequately sized and rated for continuous operation at a maximum fluid temperature of 104° F (40° C) Allowable maximum submergence shall not be less than 100ft (30 m). The motor stator shall be wound using Class H monomer-free polyester resin insulation resulting in an overall motor rating of 311 Degrees F (155 degrees C), Class F insulation. The stator windings shall be trickle impregnated resulting in a winding fill factor of at least 95%. The use of a multiple step “dip and bake” type stator insulation method shall not be acceptable. The rotor bars and short circuit rings shall be made of aluminum. The motor and pump set complete shall be designed and manufactured by the same company. Provide temperature protection and seal leak detection as described in section above. Provide adequately rated motor with sufficient surface area for ambient only cooling suited for the intermittent mode of operation in wet well wastewater applications, submerged or partially submerged, without damage. Motors containing di-electric oils used for motor cooling and/or bearing lubrication or motors where the pumped media or externally provided fresh water is directed through the motor shell for cooling are not acceptable.

Provide motors which are FM listed for use in Class I Division 1 Groups C&D hazardous locations as defined by the National Electric Code.

CONTROL PANEL

The electrical control equipment shall be mounted and wired in a NEMA type 3R painted steel enclosure. The enclosure should be equipped with drip shield and door gasket to prevent liquid or moisture from entering the panel. The hinged outer door shall be securely held closed with provisions for padlocking. All operating controls and indicators shall be mounted through a hinged inner swinging dead front door equipped with screw fittings to hold it securely closed It shall not be necessary to expose any internal components to perform normal operating procedures.

The Control panel shall include the following standard features:

- overload relays
- circuit breakers
- running lights
- H-O-A switches
- Alternator
- terminal strip
- time delay relay (For lag pump following power failure.)

The sewage pumps shall alternate automatically on the completion of each pumping cycle. One pump shall start as the lead pump and the other pump shall be started if the wet well level continues to rise to the start level of the lag pump. After each operating cycle the lead and lag positions shall alternate. A manual selector switch shall be provided so that the operator can designate either pump to stay continuously in the lead position. Adjustable time relays shall be provided to prevent simultaneous starting of pumps after power failure.

A heavy-duty, three-position, hand-off-automatic selector switch shall be flush-mounted on the inner door of the control center for the operation of each motor magnetic starter. This selector

switch shall operate the starter when it is in either the "hand" position or the "automatic" position and the automatic control system is calling for the operation of the equipment in the manner as herein described.

All control wiring within the control panel shall conform to the National Electrical Code. All wiring shall be neatly installed and run-in plastic raceways to prevent interference with any operating devices. All door mounted devices shall be labeled to functions with permanently attached nameplates and all internal wiring, terminal strips, etc. shall be properly identified for field connections and trouble shooting.

The following options shall also be included:

- running time meters
- motor heat sensor with light
- moisture sensor with light
- alarm light and horn
- Four alarm dry contacts
- lightning arrestor
- UL 508 listing

Heavy-duty oil tight red "High Level" indicating light shall operate from the pump controller.

A door mounted heavy-duty oil tight type pilot light operated from a respective starter auxiliary contact shall be provided to indicate a "pump running" condition. The pilot light shall have a replaceable screw-base bulb.

Over temperature protection shall be provided in the control panels to operate in conjunction with the over temperature switch in each pump motor. The control shall provide pump lockout of operation upon occurrence of high temperature. The circuitry shall also include a red failure indicating light and reset push button on the inner panel for each pump for alarm indication and manual reset capability.

Pump seal failure alarm lights shall be provided to indicate pump seal failure alarm condition of each sewage pump. These lights shall be operated by a contact closure from each pump.

A weatherproof, high water alarm light assembly including a high impact resistant lexan red lens shall be included. The alarm light bulb shall be replaceable from inside the control panel without having to remove the weatherproof red lens from the panel. A solid-state flasher shall be included to strobe the alarm light for any of the specified alarm conditions.

A thermal magnetic circuit breaker shall be supplied as branch circuit protection for each pump motor. The circuit breaker must have a minimum ampere interrupting capacity of (10,000-240 volt - 14,000-480 volt) symmetrical RMS amps. The circuit breakers shall be operable through the operator's door of the enclosure.

The circuit breaker shall be properly sized to protect the control circuit conductors, motor starter and the motor against overcurrent due to short circuit or grounds.

A full voltage non-reversing motor starter with manual reset, ambient compensated, 1 phase thermal overload relay shall be provided for each of the pumps listed below.

A wetwell level-responsive automatic pump controller/alternator and abnormal level alarm module shall be furnished to control two pumps in response to direct-acting liquid level sensors in the wetwell. The controller/alternator shall have float operation LED indicators and terminals for connection of a three-position alternator override switch (1-2, auto, 2-1). The controller shall provide independent on, common off operation of 2 pumps with high-level alarm. An internal solid-state alternator shall change the pump sequence after each cycle of operation. Each pump control circuit shall have field adjustable time delay relay to provide staggered start and prevent simultaneous starting of the pump motors after a power failure condition. The controller/alternator/alarm module shall be a standard stocked unit and be UL 913 listed intrinsically safe.

WET WELL LEVEL SENSING FLOAT SWITCHES

Four floats will be provided to control the operation of the duplex pumps. As the liquid level rises in the wetwell the pumps stop float energizes first. As the level increases the lead start float energizes and starts the lead pump. With the lead pump running, the level decreases to the pumps stop float, and turns the pump off. When the pump stops, the alternator shall index so that the other pump starts on the next rise in level. If the level continues to rise with the lead pump running, the lag start float will energize and start the lag pump. Both lead and lag pumps shall operate together until the stop float is deenergized. A fourth float shall be provided to signal the High-Level alarm if the level continues to rise with both pumps running

The contractor shall furnish, install and wire the float switches as shown on the drawings. The float switches shall be individually suspended in the wetwell with weight kits. The float switch cables shall be suspended from a cable rack mounted to the top of the wetwell.

The pump level controller shall connect to the float switch level sensors through an intrinsically safe module. The module shall provide an intrinsically safe interface for the sensors located in a hazardous area rated Class 1 Group A, B, C and D and Class 2 Group E, F and G. The module shall contain an LED indicator providing visible indication of sensor actuation. The intrinsic safety barrier shall be UL listed.

GATE VALVES

All gate valves shall be resilient seat complying with the requirements of AWWA C 504 and AWWA C 500 and as manufactured by Mueller co., or equal.

CHECK VALVES

Check valves shall be swing-type, operated with heavy cast iron body fully bronze mounted, with rubber-faced bronze clapper disc secured to large diameter stainless steel shaft with bronze bushings. Working pressure shall be 175 psi. Check valves shall be Mueller, or equal.

INSPECTION AND TEST

Prior to assembly, all station components shall be inspected for quality and tested for proper function and freedom from defects. Upon completion, the station shall be connected to a test tank and an operational test performed under simulated field conditions while a final inspection is conducted. Any deficiencies or irregularities shall be corrected at the factory. Automatic controls shall be adjusted to approximate job requirements.

INITIAL OPERATION

After the installation is complete, the manufacturer shall provide the services of a factory trained representative for a maximum period of one day to perform initial start-up of the pump station and to instruct the owner's operating personnel in the operation and maintenance of the equipment. Two (2) copies of O and M manuals will be supplied to the owner prior to initial operation.

GUARANTEE

The manufacturer of the pump station shall guarantee for a period of (1) one year from the date station is placed into operation or eighteen months from date of shipment, whichever occurs first, that the entire station and all equipment therein shall be free from defects in design, materials, and workmanship. In the event a component fails or is proven defective during the guarantee period, the manufacturer will provide a replacement part without cost, upon return of the defective part. Normal use items, such as grease, light bulbs, mechanical seals, packing, and belts are excluded.