

**SECTION 151640
SUBMERSIBLE GRINDER PUMPS FOR WASTEWATER
(LESS THAN 10 HORSEPOWER)**

1. DESCRIPTION

This specification shall govern all work necessary for furnishing, installing, and placing into operation, heavy duty submersible grinder pumps capable of grinding sewage into a finely ground slurry for ease in pumping.

2. GENERAL

Pumps shall be designed and constructed to grind and pump raw unscreened sanitary sewage without clogging. Design of wetwell systems shall facilitate removal and inspection of pumps. Lifting cables shall be provided and installed for each pump. Pumps shall be designed, built and installed in accordance with best available technology and practice, and shall operate satisfactorily when installed. Each pump unit, with its appurtenances, shall be capable of continuous duty underwater without loss of watertight integrity to a depth of 65 feet.

3. WARRANTY

The pump manufacturer shall furnish the City with a written guarantee to warrant pumps and components against failure due to defective materials and workmanship for a period of 5 years after full operation and acceptance by the City. The warranty shall include 100% coverage of manufacturers shop labor and parts for the first year then 50% coverage through the 5th year. Pumps repaired under warranty shall be returned to the City's Wastewater Department with freight prepaid.

4. QUALIFICATIONS OF BIDDERS

The submersible pumps and accessories, shall be furnished by a single manufacturer/supplier who is fully experienced, reputable and qualified in the manufacture of the pumps to be furnished. The manufacturer/supplier shall also maintain provisions for providing parts and/or service within 48 hours of notification by the owner.

5. MATERIALS

A. General:

Major parts including lifting cover, stator casting, volute, and impeller shall be ASTM 48, Class 30 gray cast iron. All nuts, bolts, washers, and fastenings shall be of 316 stainless steel. All metal surfaces other than stainless steel or brass coming into contact with wastewater shall be protected with a coating of rubber-asphalt paint, or other water proof coating approved by the Engineer.

B. Power Cable:

The motor power cable shall consist of well insulated cable with a double jacketed system, Hypolon outside, synthetic rubber inside, exceeding industry standards for oil, gas, and sewage resistance, and shall be permanently marked with the indicated code. Sizing shall conform to NEC and ICEA specifications for pump motors. Each pump shall be installed with a sufficiently long power cable to suit the installation as shown on the drawings without splicing.

C. Power Cable Entry:

The cable entry seal shall insure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet flanked by a stainless steel washer, all having close tolerance fit against the cable and compressed by the entire body, containing a strain relief function, separate from the function of sealing. A separate junction chamber shall provide for connection of the cable to the stator power leads. The junction chamber shall be separated from the motor stator housing by a terminal board which is bolted to a machined surface using an O-ring seal. Stator leads shall also be sealed to prevent moisture from entering the motor interior. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

- D. Impeller and Grinding System:
The grinding system shall consist of a rotating cutter of chrome alloyed cast iron and a stationary cutter of 316 "L" hardened stainless steel. Cutting systems with plastic components or coatings shall be unacceptable. The impeller shall be of the multi-vane, semi-open type of cast iron ASTM A 48-76 Class 30B, and shall be fastened to the pump-motor shaft by a tapered collet and locking screw. All mating surfaces of the pump and motor housings shall be machined and fitted with nitrile o-rings where watertight sealing is required. Machining and fitting shall be such that sealing is accomplished by controlled compression of the o-rings without the requirement of specific torque limits to achieve compression. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered adequate nor equal.
- E. Bearings:
Pumps shall be equipped with two permanently lubricated bearings, one upper and one lower. The upper shall restrain radial thrust and be of the single row ball type. The lower shall consist of a two row angular contact ball bearing. Bearings shall have a minimum design life of 40,000 hours.
- F. Shaft:
The shaft shall be of one piece design and extend through the pump and motor. The shaft shall be constructed of stainless steel.
- G. Shaft Seals:
Each pump shall be provided with a tandem mechanical shaft seal system. The upper of the tandem set of seals shall operate in an oil chamber. The upper seal shall contain one stationary carbon ring and one positively rotating ceramic ring. The lower of the tandem set of seals shall consist of a stationary ring and a positively driven rotating ring. Both rings shall be constructed of ceramic on pumps smaller than 3.0 horsepower. On pumps of 3.0 horsepower and larger, the stationary ring shall be constructed of ceramic and the rotating ring constructed of tungsten carbide.
- H. Motor:
The pump motor shall be integral to the pump for submersible or dry well operation. The motor shall be a squirrel cage induction type with class F insulation, NEMA B design, with Class H slot liners and a service factor of 1.15 or above. The stator shall be triple dipped in epoxy enamel or varnish to withstand a heat rise of 155° C as defined in NEMA standard MG-1. The NEMA starting code shall be F or less. The motor shall be statically and dynamically balanced. The motor shall be designed for continuous operation at 40° C ambient air temperature and be capable of up to 10 starts per hour. The pump motor(s) shall be furnished for operation with 230 volts, 1 phase, 60 hertz power supply.

- I. Motor Overload Protection:
Motors shall have a forced convection type of cooling system. In addition, thermal radiators (cooling fins), integral to the stator housing, shall be adequate to provide the cooling required by the motor at the maximum rated power of this unit. A minimum of two thermal sensors shall be imbedded in the stator winding and coils. The thermal sensors shall be wired to the control panel and wired in series so that the opening of either sensor will cause the motor to shut down. Thermal sensors and controls which average the temperature across the phases of the winding and coils will not be acceptable. Stator temperature sensor switches shall stop the motor when the stator temperature exceeds 155° C. The motor shall resume operation when the stator cools down to 150° C.
- J. General Accessories:
Pump accessories, controls, hardware, etc. shall be furnished by the pump manufacturer. The pump manufacturer shall be responsible for the coordination and compatibility of all accessories. The accessories shall be warranted against defects and corrosion by the manufacturer for five years after final acceptance of the project.
- K. Lifting Cable:
A lifting cable assembly shall be provided and installed for each pump. The cable and shackle shall be of 304 stainless steel and have a minimum working load of twice the pump weight. The cable shall be secured to the pump with the shackle and to the access cover with a hook. A four foot length of excess cable shall be suspended at the hook to facilitate the lifting of the pump.
- L. Access Covers:
Access covers and frames shall be of aluminum. The door panels shall be diamond plate finish and designed to withstand a live load of 300 lbs per square foot. The door shall be provided with stainless steel hinges with tamperproof fasteners. All hardware shall be stainless steel. The door shall close flush with the top of the frame and shall have lockable hardware installed.
- M. Float Cable Rack:
A cable rack fabricated of type 304 stainless steel shall be provided and attached to the access cover frame. The rack shall have provisions for holding in place and supporting the level control float cables.
- N. Power Cable Supports:
Stainless steel power cable supports (Kellums Grip) shall be used for all power cables. The supports shall be attached to eye bolts bolted into the side of the access opening, or other support approved by the Engineer. Supporting the power cables on the cable rack will not be acceptable.
- O. Hardware:
All nuts, bolts, anchor bolts, wedge anchors, and other hardware (including nuts and bolts for pipe fittings) shall be minimum grade type 304 stainless steel.
- P. Electrical Pump Controls:
The electrical control panels for the pump(s) shall be supplied to the Contractor by the pump supplier to assure component compatibility. The pump supplier and Contractor shall provide for proper control operation and protection. The control panel shall be factory wired and tested prior to shipment. The control panel shall include but is not limited to the following:

1. Incoming power, neutral, and ground lug connections
2. Thermal magnetic circuit breakers for motor and control circuits
3. Magnetic starters with overload protection for each motor phase with manual reset
4. Magnetic starter shall meet NEMA requirements and shall be sized as required for the motor horsepower
5. 115 volt control power
6. Hand-off-automatic (HOA) selector switches with red running lights
7. High level alarm light, weatherproof, vaportight, with red globe, 100 watt
8. Run time meter for each pump
9. Space heater with thermostat and on/off switch
10. Terminal blocks as required for connection of pump and level sensor cables

Q. Enclosure:

All components shall be housed in a NEMA 3R fiberglass enclosure. The enclosure shall have a minimum of two stainless steel latches. A stainless steel piano hinge shall extend the full length of one side of the enclosure door. The enclosure shall be provided with pad-locking capability. Enclosures shall be mounted as shown in the plans or as called for elsewhere in the specifications.

R. Float Switches:

Float switches installed for the grinder pump systems shall consist of epoxy encapsulated, single pole, heavy duty, mercury tilt switches housed in a non-corrosive PVC float body. The float switches shall be internally weighted and wired directly into the pump control panel. They shall also be UL listed and CSA certified.

6. PRECONSTRUCTION SUBMITTALS

A. Pump Data:

The Contractor shall furnish certified pump curves showing the results of test pumping units of identical design, size, and horsepower as those to be furnished. Catalog curves are not acceptable. Graphs shall include:

1. Pump Curve with Q in GPM and H in feet
2. Power input curve in kilowatts
3. Efficiency curve (including motor), wire to water
4. N.P.S.H. curve
5. Pump model, impeller/grinder model, serial numbers
6. Motor rated horsepower and voltage

7. Date and location of test
 8. Customer for whom test was performed
 9. Data in English units
 10. NEC Code letter
- B. Parts List and Specifications:
A comprehensive list of all station accessories and pump components, listing material type shall be submitted for the Engineer's review and approval.
- C. Shop Drawings:
Shop drawings of station accessories and pump components and connections shall be submitted for the Engineer's review and approval.
- D. Supplemental Construction Details:
The construction drawings depict the approximate locations of pumps and access covers. Supplemental drawings depicting the precise locations of anchor bolts, pump mounting systems, access covers, etc. will be required for the type of pump to be used. These supplemental drawings shall be prepared by the pump supplier and submitted by the Contractor to the Engineer for documentation of the project. The supplier shall be responsible for completeness and accuracy of shop drawings and any applicable revisions, as required to successfully complete the construction.
- E. Wiring Diagrams:
Wiring diagrams shall also be prepared and submitted by the Contractor/Supplier to the Engineer for review and project documentation.

7. PUMP OPERATING CONDITIONS

The proposed pump installation shall be designed to operate at approximately 40 GPM and 73 feet of head, and approximate the characteristics of the Flygt model M-3085 pump with 23 horsepower motor in 1 phase, 230 volt operation, and No. 257 (high head) impeller.

8. CONSTRUCTION METHODS

- A. Delivery and Storage of Materials:
Parts and equipment shall be properly protected so that no damage or deterioration will occur during transport or storage. Factory assembled components shall not be dismantled, unless done so under the supervision of an authorized pump manufacturer representative.
- B. Installation:
Installation of the pumps shall be in strict accordance with the manufacturer's instructions and recommendations. The location of the discharge piping is shown on the construction drawings. The location of the pumps, access covers, and discharge connection are approximate. The precise placement and alignment of anchor bolts, discharge assemblies, access covers, etc., shall be in accordance with supplemental construction details provided by the pump manufacturer.
- C. Installation Inspection:
Prior to completing installation (but after wiring of the pump(s)), the Contractor shall:
1. Megger pump motor stator and power cables

2. Check seal lubrication
 3. Verify proper pump rotation
 4. Check power supply voltage
 5. Measure pump motor no load current
- D. Operating Check:
After initial inspection the Contractor shall lower the pump(s) into pumping position and confirm proper alignment and connection. The Contractor shall then perform an initial operation check of each pump including:
1. Motor current with discharge valve closed
 2. Motor current with discharge valve open
 3. Power supply voltage with pump(s) running
 4. Vibration
 5. Check level control and sequence

9. FINAL SUBMITTALS

- A. Inspection Report:
The results of the Installation Inspection and Operating Check shall be submitted as a written report of findings and data determined with regard to the pumps, motors, level controls, sequences, accessories, electrical, etc. The report shall be prepared by the Contractor/Supplier and three copies submitted to the Engineer for review and approval.
- B. Operation and Maintenance Manual:
The Operation and Maintenance Manual shall be included with the Inspection Report with one manual for each of the three copies of the report. The O & M manual shall include a minimum of the following:
1. Service location & phone number
 2. Fact sheet with pump data such as serial number and pump curves
 3. Maintenance instructions and schedule
 4. Shop service manual
 5. Assembly manual showing all parts by catalog number

10. MEASUREMENT AND PAYMENT

Submersible Grinder Pumps and accessories shall not be measured and paid for directly, but shall be considered subsidiary to the various other bid items unless indicated otherwise in the Contract Documents or Plan Details.