**SECTION 11321**

**INLINE SEWAGE GRINDER**

1. **GENERAL**
   1. DESCRIPTION
      1. Work Included
         1. Furnish all labor, materials, equipment, and incidentals required for the installation of an in-line sewage grinder, as shown on the Contract Drawings and as specified herein.
         2. Included are grinder, drive unit assembly, control panel, anchorage system, and all appurtenances.
      2. Performance and design requirements:

Equipment shall be designed and selected for continuous duty grinding of concentrated solids derived from the municipal wastewater industry. Grinders shall be suitable for grinding small particles of wood, industrial solvents, greases, detergents, rags, hair, and wipes, and organic particles in concentrations as great as 7 percent. The grinder fluids are expected to range in temperatures between 60 degrees F and 140 degrees F, and the pH may vary between 6 and 9.

When mounting the Inline the grinder shall have pipe supports and not be allowed to hang on the piping.

* + 1. Equipment List

|  |  |
| --- | --- |
| Item | Equipment No. |
| Vogelsang XRP100-90Q |  |

* 1. QUALITY ASSURANCE
     1. Grinders and motor controllers shall meet the requirements of the following industry standards:
        1. ASTM A536-84 - Standard Specification for Cast Iron Castings.
        2. ASTM A36 – Standard Specification for Carbon Steel Plate.
        3. AISI 4140 - Heat Treated Round Steel.
        4. AISI 4130 - Heat Treated Alloy Steel.
        5. National Electrical Manufacturer's Association Standards (NEMA).
     2. Acceptable Manufacturers
        1. Grinders shall be supplied by one of the following manufacturers Vogelsang XRipper XRP or pre-approved equal.
        2. Manufacturer must have at least five (5) years of substantial experience in the manufacturing of two shafted grinders in the type of application specified herein.
  2. SUBMITTALS
     1. Provide full and complete shop drawings, catalog cuts, and other technical data to fully define the materials, equipment, and performance capabilities for each characteristic specified herein.
     2. Manufacturer's recommended installation instructions.
     3. Manufacturer's warranty should be a 2 year warranty, 100% parts and labor, including wear parts.
     4. Operation and Maintenance Data
        1. For all units furnished under this Section, the Contractor shall submit one (1) electronic of Operation and Maintenance Manuals to include the following:
           1. General - equipment function, description and normal and limiting operating characteristics.
           2. Installation instructions - assembly procedures and alignment and adjustment procedures.
           3. Operation instructions - startup procedures, normal operating conditions, emergency and normal shutdown procedure.
           4. Lubrication and maintenance instructions which shall list all points to be greased or oiled; shall recommend type, grade, and temperature range of lubricants; and shall recommend frequency of lubrication.
           5. Troubleshooting guide.
           6. Parts list and predicted life of parts subject to wear.
           7. Drawings - cross sectional view, assembly and wiring diagrams. Drawings shall include detailed parts lists with part numbers, instructions for ordering spare parts, and complete preventive maintenance instructions required to ensure satisfactory performance and longevity of the equipment.
           8. Performance curves.
           9. Instructions for adjustment, calibration and testing of selected electronic components or assemblies, normally considered replaceable by the manufacturer, whose performance is not ascertainable by visual inspection.
           10. Service instruction for major components not manufactured by the equipment manufacturer, but which are supplied by him in accordance with these specifications. The incorporation of literature produced by the actual component manufacturer shall be acceptable.
  3. PRODUCT DELIVERY, STORAGE, AND HANDLING
     1. Deliver, handle, and store equipment in manufacturer's original undamaged shipping containers with tags and labels intact and legible.
     2. Store all equipment up off the ground, under cover, protected from weather and construction activities or other possible damage.
  4. WARRANTY
     1. For The equipment shall be warranted to be free from defects in workmanship, design and materials for a period of two (2) years. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to the OWNER.

1. **PRODUCTS**
   1. GENERAL
2. The grinder shall be Model XRP100-90Q manufactured by Vogelsang, or approved equal.
3. The inline grinder unit operating conditions:

|  |  |
| --- | --- |
| Primary Duty Point |  |
| Medium |  |
| Percent of Solids |  |
| Maximum HP at Duty Condition |  |
| Maximum RPM shall be |  |
| Required blade width (6mm / 10mm) |  |
| Flange connection | 4 inch |
| Number of shafts | 2 |

1. MATERIALS

| Component | Material |
| --- | --- |
| Casting | Cast iron ASTM A48 GG20, 20 – 26 Rockwell C |
| Wear Plates and Counter Blades | Hardox Carbon Steel, 43 Rockwell C |
| Cutters | High Wear Resistant Steel, nitrated, 60-65 Rockwell C |
| Shafts | Alloy steel, AISI 4140, 44 mm Diameter, tensile strength rating no less than 149,000 psi |
|  |  |

* 1. GRINDER
     1. General
        1. The sewage grinder(s) shall be two-shaft design and be capable of continuous operation, processing wet or dry. Single shaft devices utilizing a single rotating cutter bar with stationary cutters will not be acceptable.
        2. Two-shaft design shall consist of two parallel shafts equipped with monolithic cutter assemblies positioned on the shaft to form a helical pattern. If multiple cutter packages are used, O-rings shall be incorporated between each cutter package. Individual cutter and spacers will not be acceptable. The two shafts shall counter-rotate with the driven shaft operating at different speed then the speed of the drive shaft.
     2. Components
        1. Grinder gearbox housings shall be cast of ASTM A48 cast iron.
        2. The bottom end housing shall be manufactured of carbon steel and bolted together to be field changeable on demand.
        3. Grinder housing segments shall be manufactured of 1018 mild steel, bolted together.
        4. High Flow side rails shall be installed on the sides of the housing to guiding particles directly into the cutting chamber while allowing liquid to pass. The side rails shall be evenly spaced to provide maximum flow, with clearance shall not exceed .11-inches (3 mm), and have a thickness of .16-inches (5 mm).
        5. Flange connections shall be integrated as part of the one piece grinder body.
        6. The top and bottom counter blade plates shall be manufactured of Hardox, minimum hardness of 43 Rockwell C (500 Brinell), and provide counter cutting action to protect against buildup in the top and bottom of the grinder.
        7. Grinder drive and driven shafts shall be made of 4140 alloy heat-treated round steel with a tensile strength rating of not less than 149,000 psi (1027 Mpa). Each shaft diameter shall be a minimum of 1.73 inches (44 mm).
        8. Cutters & Blades
           1. Cutting stack shall be a nominal height of 3.54 inches (90mm)
           2. Cutter shall be manufactured from a monolithic assembly constructed from a solid block of alloy steel surface ground to a blade thickness of .37-inches +.000/-.001 (9.5 mm +.000/-.003).
           3. Cutters shall be heat treated to produce a hardness of 60-65 Rockwell C.
           4. Cutters shall be nitrated for high corrosion resistance.
           5. Cutters shall have 8 cam shaped teeth.
           6. Cutter tooth height shall not be greater than ½-inch (13 mm) above the root diameter of the cutter.
           7. Cutter assembly OD shall be 4.72-inches (120 mm) minimum. Spacer shall be cut into the monolithic cutter, and shall have a smooth outside diameter with no tooth profiles. Designs without a single monolithic cutter assembly shall not be acceptable.
        9. Bearings and Seals

1. The radial and axial loads of the shafts shall be borne by oversized radial spherical roller bearings on upper and deep groove ball bearings on lower end. The bearings shall be protected by a single cartridge mechanical seals. Seal face materials must be a minimum of chrome oxide vs duronit, not requiring an external flush, but in a static bath of oil. The mechanical seal shall be rated at 90 psi continuous duty by the seal manufacturer. The bearings and seals shall be housed in a replaceable cartridge that supports and aligns the bearings and seals, as well as protects the shafts and end housings. The seal elements shall be independent of the stack height. The seal shall meet required pressure rating regardless of cutter stack fit. The seal and bearing cartridge shall provide protection against axial loading on shafts and bearings during shaft detection. O-rings shall be made of Buna-N elastomers.
2. Grinders that require lower bearings shall not be acceptable.
3. Electric Motor & Reducer
   1. The grinder gearbox shall be a low speed, high-torque parallel shaft gearbox manufactured by Nord Gear. Maximum motor speed shall not exceed 1800 rpm, and should provide a minimum of 10% reserve hp as evidenced by specific requirements at maximum design.
   2. All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA standards where applicable.
   3. Motor shall be TEFC with a minimum service factor of 1.15
   4. Motors shall conform to all requirements stipulated in the motor section of this specification.
   5. The motors supplied shall be specifically designed for inverter duty to allow for the potential of future variable frequency drives. The motors shall be compatible with the grinders provided by the MANUFACTURER. The gear speed reducer shall be Nord parallel shaft geared type of reducer with "Heavy Shock" load classification. The drive shaft of the grinder shall be directly coupled with the reducer without use of a coupling.
   6. Required running torque per horsepower (kW):

At momentary load peaks: 4,756 in-lbs. (721 NM/KN).

* 1. MOTOR CONTROLLERS
     1. General
        1. Controller shall be the suppliers UL/cUL listed standard, and shall provide independent control of the grinder.
        2. The controller shall be equipped with HAND-OFF/RESET-AUTO three-position selector switch. In OFF/RESET the grinder shall not run. In HAND the grinder shall run. In AUTO the grinder start and stop shall be controlled by a remotely located dry contact.
        3. When a grinder jam condition occurs, while running in either the HAND or AUTO mode, the motor controller shall stop the grinder and reverse its rotation to clear the obstruction. If the jam condition still exists, the controller shall go through five additional reversing cycles within 45 seconds before signaling a grinder overload condition. When a grinder overload condition occurs, the controller shall shut the grinder off and activate a fail indication.
        4. If the grinder is stopped due to a fail condition and a power failure occurs, the fail indicator shall reactivate when power is restored.
        5. Controller reset shall be from local panel controls only.
        6. The controller shall have indicator lights for POWER ON, RUN and FAIL conditions.
        7. The controller shall provide overcurrent protection for the motor through an overload relay mounted directly on the contactor.
        8. The controller shall be rated 2-HP, 208/230/460/575V volts, 3 phase, 60 HZ.
        9. Short circuit protection requires that a properly sized circuit breaker or fuses be installed by others.
     2. Components
        1. Enclosure
           1. Enclosures shall be NEMA 4, fabricated of polycarbonate reinforced polyester resins for wall mounting. Doors shall have hinges and corrosion resistant latches.
           2. Enclosure shall house the control devices, relays, terminal blocks, and grinder reversing motor starter.
        2. Control Devices
           1. Pilot devices shall be mounted on the enclosure front panel.
           2. Indicators shall be LED type lights. Lamps and the selector switch shall be heavy duty NEMA 4 type.
           3. Two normally open status contacts shall be provided. One for a RUN signal and one for FAIL signal. The contacts shall be rated at 2-Amp, 240-VAC, resistive load.
           4. Control transformer shall be protected by two primary fuses and one secondary fuse. The 120 volt secondary shall have one leg grounded.
        3. Motor Starter
           1. A reversing contactor type motor starter shall be provided for the motor.
           2. Forward and reverse contactors on the starter shall have both mechanical and electrical interlocks.
           3. The overload (OL) relay shall be adjustable so that the range selected includes the FLA (full load amperes) rating and service factor.
  2. SPARE PARTS
     1. Provide the following spare parts for each unit:
        1. One (1) complete gaskets & O-ring set.
        2. One (1) set of mechanical seals.
        3. One (1) set of monolithic cutters.
     2. Grinder spare parts shall be packaged in containers suitable for long term storage and shall bear labels clearly designating the contents and the equipment for which they are intended.

1. **EXECUTION**
   1. FACTORY TEST
      1. Each grinder and motor controller shall be factory tested to ensure satisfactory operation. All in-line units shall have a hydrostatic test conducted at the factory.
   2. INSTALLATION
      1. Grinder and motor controller shall be installed in accordance with the manufacturer(s) installation instructions.
   3. FIELD QUALITY CONTROL
      1. Provide the services of a factory trained representative to check initial installation and to place each grinder in service. Factory representative shall have complete knowledge of proper installation, operation, and maintenance of equipment supplied. Representative shall inspect the final installation and supervise a start-up test of the equipment.
   4. MANUFACTURER'S SERVICES
      1. Provide manufacturer's services under provisions of Section 01731.
      2. Minimum service requirements:
         1. Installation: As required for proper installation.
         2. Start-up, field testing and operator training: 4 hours on-site.
      3. Service Scheduling: by Owner on request any time during one-year warranty period.

END OF SECTION