

SECTION 11991

PACKAGE PRECAST CONCRETE WASTEWATER TREATMENT PLANT

1.01 WORK SPECIFIED ELSEWHERE

A. Concrete, Pre-Cast Concrete and masonry reinforcing - SECTIONS #03200 and #03310

B. Electrical - SECTION #16010

C. Earthwork - SECTION #02200

1.02 QUALITY ASSURANCE

A. System must be installed by a Contractor with a minimum of five (5) years experience in installation of sewage disposal systems.

B. Entire installation must be in strict accordance with regulations of Ten States Standards latest edition.

C. Acceptable manufacturers: wedotanks.com, LLC., 2885 Sanford SW, PO Box 18078, Grandville, MI 49418. The wedotanks.com contact numbers are 866-374-2083 (phone) and 866-681-7694 (fax) or e-mail info@wedotanks.com.

D. Provide and install equipment and processes as hereinafter specified and detailed on the project drawings.

1.03 MANUFACTURER'S SERVICES: The manufacturer shall provide the services of a qualified Representative to be on-site for a minimum of 4 man days in two (2) separate trips, if necessary. During this period the Representative shall check the equipment installation, start-up the plant, commission the process and train operators. The Contractor shall make available during this period a qualified tradesman, as required, for plant start-up activities.

2.01 GENERAL. The manufacturer will furnish one prefabricated precast concrete sewage treatment plant and related equipment in accordance with the plans and specifications stated herein. The sewage treatment plant will be of the activated sludge type, specifically known as "Extended Aeration", designed for treating 31,000 GPD of 300 PPM-BOD5 domestic sewage based on composite sewage samples of the average daily flow.

On the roof of the plant will be mounted a 8 foot high chain link fence with a 48" wide service gate. All process equipment can be reached only by standing on the roof and accessing the grating openings.

2.02 TANK CONSTRUCTION: All tank shall be constructed of pre-cast concrete panels as shown on the plans and specified in Section 11250 Precast Concrete Tank System.

2.03 PIPING AND CONNECTIONS: All internal process air piping within the plant shall be Type 304, Schedule 5, stainless steel pipe. All water piping within the plant will be Sch 80 CPVC. All exterior piping connections shall be flange connection.

2.04 INLET BOX AND SOLIDS PROCESSING:

The inlet box will be constructed of aluminum with slide gates which will allow the flow to enter a bar screen or can be diverted to a grinder so solid can be reduce to allow to be process in the wastewater treatment plant.

Grinder shall be supplied by JWC Environmental and shall be Model No. 20000 or equivalent.

The grinder shall include housings, shafts, top cover, gearmotor, cutters, spacers, bearings, and seals.

The sewage grinder 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 shall not be acceptable. Grinders designed with cutter and spacer cartridges rather than individual cutters and spacers, shall not be acceptable.

Two-shaft design shall consist of two parallel shafts alternately stacked with individual intermeshing cutters and spacers positioned on the shaft to form a helical pattern. The two shafts shall counter-rotate with the driven shaft operating at approximately two-thirds (2/3) the speed of the drive shaft.

The cutting chamber shall contain two stacks of cutters. One shaft shall have individual 5-tooth double-edged cutters

and the other stack shall have individual 11-tooth cam type cutters.

Grinder End Housings, Covers, and Shafts

1. Grinder housings shall be cast of ASTM A 536-84 ductile iron.
2. Top covers shall be ASTM A 536-84 ductile iron.
3. Grinder drive and driven shafts shall be made of Heat Treated Hexagon Steel with tensile strength rating of not less than 149,000-psi (1,027-MPa). Each shaft diameter shall be a minimum of 2-inches (51-mm).

Required Running Torque per Horsepower (kW):

1. Continuously: 1000 in-lbs. (152-Nm) minimum.
2. At Momentary Load Peaks: 3200 in-lbs. (485-Nm)
3. Individual Cutters and Spacers

The inside configuration of both the individual cutters and the individual spacers shall be hexagonal so as to fit the shafts with a total clearance not to exceed 0.015-inch (0.38-mm) across the flats to assure positive drive and increase the compressive strength of the spacers.

Individual cutters and spacers shall be AISI 4130 Heat Treated Alloy Steel. Cutters and spacers shall be surface ground for uniformity and through-hardened to a minimum 45-50 Rockwell C.

To maintain particle size, the height of the tooth shall not exceed 1/2-inch (13-mm) above the root diameter. Cutter to cutter root diameter overlap shall not be less than 1/16-inch (1.6-mm) or greater than 1/4-inch (6-mm) to maintain the best possible cutting efficiency while incurring the least amount of frictional losses.

The cutter shall exert a minimum force of 450-lbs./HP (2680-N/kW) continuously and 1380-lbs./HP (8230-N/kW) at momentary load peaks at the tooth tip.

4. Bearings and Seals

The radial and axial loads of each shaft shall be supported on one end using a combination of spherical and cylindrical type roller bearings.

The bearings and gear housing shall be protected by mechanical seals. Face materials shall be constructed of tungsten carbide. Seals shall not require an external flush or any type of lubrication and shall have no packing to adjust.

Products requiring continuous or occasional lubrication or flushing shall not be accepted. O-rings shall be made of Buna-N elastomers.

5. Gearmotor

The motor shall be TEFC design, 1-HP (0.75-kW), 1725-rpm, 200/208/230-volt or 400/415/460-volt, 3-phase, 50/60 Hz.

The gearmotor reducer shall be a grease filled planetary type of reducer with "Heavy Shock" load classification. The reduction ratio shall be 29:1.

Controller shall be the supplier's standard UL/cUL listed Model PC2200.

The controller shall be equipped with a HAND-OFF/RESET-AUTO three-position selector switch. In OFF/RESET the grinder shall not run. In HAND the grinder shall run. In AUTO grinder start and stop shall be controlled by a remotely located dry contact.

When a grinder jam condition occurs in either the HAND or AUTO mode the controller shall stop the grinder, then reverse its rotation to clear the obstruction. If the jam is cleared, the controller shall return the grinder to normal operation. If the jam condition still exists, the controller shall go through two additional reversing cycles within 30-seconds (3-times total) before signaling a grinder overload condition. When a grinder overload condition occurs, the controller shall shut the grinder off and activate a relay and a fail indication.

If the grinder is stopped due to a fail condition and a power failure occurs, the fail indicator shall reactivate when power is restored.

Controller reset shall be from local panel controls.

The controller shall have indicator lights for POWER ON, RUN, and FAIL conditions.

The controller shall provide overcurrent protection for the motor through an overload relay mounted directly on the starter contactor.

The controller shall be rated: 1-HP, 230/460volts, 3 phase, 60 Hz.

Short circuit protection requires that a properly sized circuit breaker or fuses be installed by others.

Supplier shall provide the following spare parts for each unit:

- Three (3) fuses
- Three (3) 6-volt, long life lamps
- One (1) complete gasket set
- Three (3) cutters
- Three (3) spacers

Controller spare parts shall be stored inside the controller.

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.

2.05 EQUALIZATION CHAMBER: The volume of this chamber will not be less than 26,300 gallons. The equalization tank will allow a constant flow to the aeration tank over each 24 hour period. A duplex set of equalization pumps will be furnished and installed within this chamber. The capacity of each pump will be 60 GPM @ 15' TDH. The pumps will be rated at 1/2 HP, 230 volt, three phase, 60 cycle and be controlled with ball floats and have an alternator. A 6" diameter emergency overflow will be provided between the equalization and aeration chambers.

2.06 FLOW CONTROL. Flow control will be accomplished by pumping plant influent to a flow control box containing an adjustable weir. The overflow broad weir will be adjustable so that a measured amount of pumped influent will discharge through the 60 degree V-notch weir to the aeration chamber, while the remaining liquid will be recycled back to the equalization chamber.

A blower/motor unit will be supplied for the equalization chamber air requirements. The blower will be capable of delivering 37 CFM when operating at 5 PSI. The motor will be a 2 HP, submersible type for operating on 230/460 volts, three phase, 60 cycles. The blower/motor will sit on the aeration tank wall below the water level. The sound level from the blower 30 feet away will be at background level when the background level is 48 dBA. For purposes of determining the blower performance and/or diffuser condition, a pressure relief valve and pressure gauge will be mounted in the air manifold.

The Equalization pumps and blower/motor unit will be regulated by liquid level sensors. Controls will be provided in the main control panel.

2.07 AERATION CHAMBER: The aeration chamber will be of sufficient capacity to provide a minimum of 24 hours retention of the average daily flow, and/or a maximum loading of less than 20 pounds of BOD5 per 1,000 CF of aeration tank volume. The vessel will be shaped on each side to prevent scum and froth accumulation. To insure maximum retention and eliminate short circuiting of raw sewage, the aeration chamber will be constructed with air diffusers placed longitudinally to enhance the spiral rotation of the chamber contents, in conjunction with the flow control baffles. To insure adequate circulation velocity, the proportion of chamber width to depth, in the direction of rotation, will not exceed 1.33 to 1. The velocity of rotation will be sufficient to scour the chamber bottom and prevent sludge filleting as well as to prevent the escape to the surface of minuscule air diffusion bubbles and by so causing their entrapment to provide maximum oxygenation efficiency.

2.08 AIR DIFFUSION PIPING: An air distribution manifold of rectangular hollow stainless steel tubing will be installed longitudinally on one side and along the entire length of the plant with diffuser drop assemblies connected thereto.

Each diffuser drop assembly will be equipped with an air regulation and/or shut-off cock valve, a disconnecting union and a diffuser bar with air diffuser nozzles mounted thereon. The diffuser drop assemblies after the air regulation valve shall be constructed of 304 stainless steel. The diffusers shall be of the wide band, non-clog type, 24" long and also constructed of stainless steel. The diffusers will be parallel to and near the base of the vessel side wall and at an elevation that will provide the optimum diffusion and mixing of the vessel contents.

2.09 DIFFUSERS: Each non-clog, wide band, stainless steel, medium fine bubble diffuser shall consist of:

- Investment cast end cap with integral hex nut
- ¾ inch NPT Schedule 80 pipe connection
- Air distribution plenum with two levels of air exit ports
- Two high air flow release slots
- Bottom deflector and end cap
- Plastic balancing orifice

The air distribution plenum shall be formed by continuously welding the investment cast end cap to the plenum and spot welding the plenum to the end cap. The air distribution plenum shall have exit ports located on two horizontal levels to discharge air into the liquid along the perimeter for a total length of 48 inches.

The deflector shall be welded to the investment casting and spot welded to the end cap. The deflector will be shaped in a 90 degree angle and located approximately 1/2 inch below the open bottom of the air distribution plenum forming the high air flow release slots. The deflector shall direct the liquid being aerated along the perimeter of the air distribution plenum's outer walls. The air exiting from the air distribution plenum through the ports and slots shall be sheared into medium to fine bubbles and be distributed into the liquid.

The balancing orifice shall fit within a 3/4" NPT Schedule 80 male pipe connection and shall provide the proper head loss to assure uniform air distribution throughout the entire aeration system.

The investment cast stainless steel end cap shall conform to the requirements of ASTM 296, Grade CF3 stainless steel (note: this equals 304L Stainless Steel Plate) and shall have a integral hex nut and 3/4" NPT connection equivalent to Schedule 80 pipe.

The air distribution plenum, deflector and end cap of the diffuser shall be constructed of 20 gauge 304L stainless steel.

The oxygen transfer capacity of each diffuser will be such that an adequate supply of oxygen will be maintained in the aeration chamber to meet treatment requirements of the design sewage load.

2.10 CLARIFIER CHAMBER: The clarifier chamber shall have a volume of 5,550 gallons as to provide a minimum of 4 hours retention, based upon the same design flow rates governing the aeration chamber, but including adjustment of such rates to compensate for runoff period, and will have proper baffling to prevent short circuiting and to provide maximum uniform retention.

The total settling volume will include the volume of the upper 1/3 of the sludge hopper or hoppers. Flat bottom area of hopper will in no case be greater than one square foot. The slope of the hopper walls will not be less than 1.7 vertical to 1.0 horizontal.

Settled sludge will be returned from the clarifier sludge hopper to the aeration chamber by the positive sludge return system, consisting of one or more airlift pumps. The clarifier effluent will pass over the edge of the baffled effluent weir into the effluent trough and then out of the chamber. The effluent weir trough will be equipped with adjustment to permit precise leveling of the serrated weir after plant installation.

2.11 SLUDGE RECIRCULATION SYSTEM: There will be installed within the clarifier chamber a positive sludge recirculation system consisting of one Sch 80 CPVC, 3 inch diameter airlift sludge return assemblies per hopper meeting the following specifications: The airlift pump will have the recirculation capacity ranging from 0% to 150% of the design flow. The air line supplying air to the pump(s) will be equipped with a cock valve to vary the amount of air supplied to each pump, thus varying the capacity of the pump. The airlift pump(s) will be firmly supported and will be equipped with a clean-out plug to allow for easy cleaning and maintenance.

2.12 SCUM RECIRCULATION SYSTEM: There will be installed within the clarifier chamber a positive scum and skimming recirculation system consisting of one Sch 80 CPVC, 2" diameter airlift skimming device meeting the following specifications: The skimming device will be of the positive airlift pump type, located in a position to skim and return floating material to the aeration chamber or to the digester. The air line supplying air to the skimming device will be

equipped with a valve to regulate the rate of return. The scum intake will be equipped with an adjustment assembly that will enable exact positioning of the skimmer at water level.

2.13 SLUDGE DIGESTER: The sludge storage tank will be designed to hold a minimum of 4,723 gallons of sludge volume. The chamber will be of the aerated type. Diffused air will be supplied by the plant blower system supplying 30 CFM of air per 1000 cubic feet of volume. The diffusers will be located parallel to and near the bottom of the tank. All piping and valves within the chamber will be factory installed.

2.15 SUBMERSIBLE or ABOVE GRADE ROTARY POSITIVE BLOWERS. This work shall be subject to the conditions of the general requirements and include the furnishing of labor, materials, tools, equipment, accessories and services necessary to provide and install and as shown on the contract drawings.

The equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with detailed drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer and as approved by the engineer.

The plant supplier shall supply and install 2 submersible rotary positive displacement blowers with 7.5 Hp motors each having the capacity to deliver 155 SCFM against discharge pressure of 5 PSIG for the aeration system and one submersible rotary positive displacement blower with a 2 Hp motor having the capacity of deliver 37 SCFM against a discharge pressure of 5 PSIG for the equalization tank.

The blowers shall be rotary lobe positive displacement type, of the two lobe involute design. The impellers, impeller casings, and end plates shall be of a close-grained, high strength cast iron.

The casing and end plates shall be suitably ribbed for strength and to prevent distortion under the operating conditions.

The impellers shall be accurately, statically and dynamically balanced. The impellers shall be permanently secured by means of an adjustable timing hub, which is keyed to the shaft. The impellers shall be balanced by metal removal and not by adding counter weights. To ensure smooth operation without vibration, balancing shall be at the lobe base and not on outer profile to avoid weakening of the lobe. The shafts shall be of alloy steel and shall rotate in anti-friction bearings, having a minimum B-10 life expectancy of at least 60,000 hours. The anti-friction bearings will have bearing holders with retainers allowing positive bearing containment and with ground spacers to accurately and permanently locate rotor clearances within the blower casing.

The impellers shall operate without rubbing, or liquid seals, or lubrication, and shall be positively timed by a pair of accurately matched, hobbled, shaved, crowned hardened helical gears, keyed to the shafts.

The bottom bearings and gears shall run in a splash oil type housing.

The electric motor shall be of the squirrel-cage induction type design. The motor housing shall be gray cast iron equal to ASTM A48 Class 40. The motor shall be designed for continuous duty, completely submerged operation and be suitable for 460/230 volts, 60 cycle, three phase power. The motors shall be 1750 RPM and have sufficient power to drive the blowers at their maximum required capacity and operating pressure. The motors shall have sufficient horsepower to discharge full blower capacity through the relief valve.

The motors shall be capable of delivering full rated horsepower continuously throughout the blower range and the motors shall not operate within the service factor.

Each phase of the motor shall contain a bi-metallic temperature monitor in the upper portion of the stator windings. The monitors shall be connected in series and shall be coupled to the motor contact coil such that any one switch opening will shut down the motor. The temperature setting shall be 140 degree C \pm 5 degree C and shall automatically reset once the stator temperature returns to normal.

The pump motor cable shall be of type SOW-A, SOW, or MCA as required. The cable sizing shall conform to NEC, ICE and SA specifications. Standard cable length shall be 30 feet.

The cable entry design shall not require specific torque requirements to insure a watertight seal. The cable entry shall consist of a cylindrical elastomer grommet, flanked by stainless steel washers. A cable cap incorporating a strain relief shall mount to the cable entry boss compressing the grommet ID to the cable while the grommet OD seals against the bore of the cable entry. The entry as part of the motor shall be rate as explosion proof for Class I, Division I, Group C & D locations.

The manufacturer shall provide inlet filters as required, suitable for mounting outdoors, with a weatherhood. The filters shall be arranged for bottom connection to a 125 lb. ASA pipe flange. The filter elements shall be of the dry, washable, synthetic media type, selected to filter 99% of 10 micron and above particles. The filter shall be complete with a filter restriction indicator.

The manufacturer shall provide an inlet silencer for each blower, designed for maximum silencing and submerged application. The submerged silencers to be of the chamber absorption type and shall be complete with matching 125 lb. drilled flanges and shall be of an all welded steel construction, with connections sized and located as shown on contract drawings.

The manufacturer shall provide a discharge silencer for each blower, designed for maximum silencing and submerged application. The submerged silencers shall be of the chamber absorption type and shall be complete with 125 LB. drilled flanges and shall be of an all-welded steel construction, with connections sized and located as shown on contract drawings.

Each blower shall be provided with a spring loaded, or weighted type, pressure relief valve, set at 1/2 PSIG above the maximum working pressure and capable of discharging total blower output with 10% pressure accumulation.

Each blower discharge line shall be furnished with a wafer split disc-type, check valve, designed for heavy duty type shut-off service.

Each blower discharge shall be provided with a lever operated butterfly valve, flanged or wafer, per blower manufacturer's recommendations.

Each blower suction and discharge line shall be provided with a 125 LB. ASA flange single arch type, multiple-ply, rubber or synthetic elastomer, reinforced flexible connection, and shall be complete with steel backing rings.

Each submerged blower shall be equipped with a high temperature safety switch to stop motor power in the event an unsafe blower temperature is reached. The switch shall be of the vapor pressure actuated type, and shall utilize a sealed, tilting type mercury switch to interrupt power.

Each submerged blower shall be furnished with one discharge temperature gauge and one discharge pressure gauge. Gauges shall be 4-1/2 inch dial face type with MPT fittings for pipe insertion.

The submerged blower manufacturer shall furnish the services of a factory based mechanic to check the installation of the blowers and make any field adjustments necessary to ensure proper mechanical operation. The blower manufacturer shall submit to the engineer, a written report certifying that the equipment has been satisfactorily installed and lubricated.

2.16 UV DISINFECTION SYSTEM The UV disinfection system will be a "U" shaped system on constructed on stainless steel. The unit will be located in the aeration tank and will be so constructed that the disinfection tubes will be in a vertical position and can be removed from the roof of the plant when the grating over this area is removed. The flow from the clarifier effluent trough will flow by gravity to the bottom of the UV disinfection system and flow up through the disinfection zone which will have 4 bulbs and over a 60 degree V notch weir and out.

The ultraviolet equipment described shall be supplied by a manufacturer capable of meeting the following requirements:

1. Have a minimum of 5 years experience in the design and manufacture of ultraviolet disinfection equipment.
2. Have one or more successful installations in operation for more than one year disinfecting a wastewater effluent.

There shall be ultraviolet disinfection unit(s) supplied, each capable of disinfecting 35 gpm of wastewater having the characteristics described in Section 2.02 below. The fecal coliform count in the effluent shall be reduced to less than 200 MPN/100 ml at the final discharge.

Prior to disinfection, the wastewater shall have the following characteristics:

Maximum fecal coliform count	5000 MPN/ 100 ml
Maximum suspended solids:	50 mg/L
Maximum BOD5:	50 MG/mg/L

Description of the UV System:

1. UV MODULE

All wetted metal parts shall be constructed of type 304 stainless steel. All materials and wire exposed to UV light shall be unaffected by prolonged exposure to 2537 A. The UV lamps are to be protected from contact with the effluent by a quartz sleeves which provide a UV transmission of 90%. The UV channel shall provide a minimum contact time of 7 seconds.

2. Quartz lamp jackets shall be fitted to the vertical channel using compression fittings and neoprene gaskets. Wiring in the enclosure shall be numbered terminal strips which shall correspond to the numbering in the main panel.
 - a. Each lamp module shall be self supporting in the vertical channel.
 - b. The lamp module enclosure shall be fitted with a waterproof wiring connector. The connector shall allow the enclosure to be disconnected and removed from the vertical channel.
 - c. All lamp connections shall be above the water line to protect against electrical hazard.
 - d. Safety interlock switches shall turn off all power to the UV lamps when lamp module enclosure covers are opened.
 - e. A float switch shall be provided in each enclosure to turn off all electricity in the event that water enters the enclosure.
 - f. Ultraviolet lamps shall be so arranged that they may be replaced without any need for disassembly or removal of the disinfecting module.

ULTRAVIOLET LAMPS

The UV unit shall utilize low pressure mercury vapor lamps. Each lamp shall produce UV light with at least 90% of the UV emission at 2537 A.

After 7500 hours of operation the lamps output shall be no less than 70% of a new lamp (after a 100 hour burn in)

All electrical components are to be housed in a NEMA 4X enclosures.

Power supply shall be 230/460V 60 Hz.

Fans shall be provided to prevent overheating of the ballasts.

ULTRAVIOLET INTENSITY AND MONITORING

Each ultraviolet channel' shall have a minimum of one (1) ultraviolet intensity sensor which responds only to germicidal portions of light generated.

1. The sensor shall not utilize a filter.
2. The sensor shall not be degrade after prolonged exposure to UV light.

The intensity measured by the UV sensor shall be displayed on a visual indicating meter.

1. The meter shall not depend upon amplifier voltage gain greater than 1:1 or current gain greater than 3:1 of the sensor's output to provide an indication.
2. The UV intensity meter shall be clearly labeled and located on the remote control panel.

UV INTENSITY ALARM CIRCUIT

1. A set of dry contacts must be provided for remote indication of a "safe" intensity

condition.

- a. A green indicator light located on the UV monitor shall signal a "safe" intensity.
 - b. A push-to-test button shall be provided to check circuit integrity.
2. A set of dry contacts shall be provided for remote indication of a "low safe" intensity.
 - a. An amber warning light located on the UV monitor shall signal a "low safe" intensity.
 - b. A push-to-test button shall be provided to check circuit integrity.
 3. A set of dry contacts shall be provided for remote indication of an "unsafe" intensity condition.
 - a. A red warning light located on the remote control panel must signal an "unsafe" condition.
 - b. A push-to-test button shall be provided to check circuit integrity.

ULTRAVIOLET LAMP MONITORING

A logic circuit shall be provided which monitors the operating condition of each individual lamp and provides a dry contact for remote notification in the event of a lamp failure.

1. A red warning light labeled LOW (Lamp Out Warning), located on the remote control panel shall become illuminated in the event of a lamp failure.
2. The means to determine proper circuit function shall be by disconnecting a lamp.

A lamp indicating display utilizing 40,000 hour rated illuminated indicators shall be provided.

1. The indicators shall be arranged in the same geometric pattern as the UV lamps in the contact chamber.
2. Each indicator shall be identified numerically with the corresponding UV lamp.
3. The indicator light shall be turned off the instant its corresponding UV lamp goes out.

A non-resettable (to 99,999 hours) elapsed time indicator shall be provided for each module of lamps to record hours of operation.

2.17 FLOW METER SYSTEM The flow from the UV system will pass over a 60 degree V notch and fall into the discharge box and out. The flow will be measured by a ultrasonic probe and will measure and record the flow on a strip chart. The flow meter will be mounted on a support above the roof of the plant inside the fenced area on the roof.

2.17 CENTRAL CONTROL PANEL: A central control panel within a NEMA 12 enclosure will be provided. The electrical controls will consist of magnetic starters, program timers and switches necessary to automatically control all electrical devices and/or motors on the sewage treatment system. The blower motor will be controlled by H-O-A selector switches and magnetic starters in conjunction with the program timer(s). The program timers will have the capability to operate the treatment system when required as determined by the variation in the daily flow rate. All electrical equipment and circuitry will be protected by properly sized circuit breakers and fuses. All duplex or standby equipment will be designed so that it may be operated by devices within the control system.

The enclosure will be wired for 230/460 volt, three phase, 60 Hz, incoming power.

2.18 WARRANTY: The manufacturer of the prefabricated sewage treatment plant will guarantee for one (1) year from the date of plant start-up, not to exceed eighteen months from date of shipment, that the equipment he provides will be free from defects in design, material and workmanship. Warranties and guarantees of the suppliers of various components in lieu of a single source responsibility by the manufacturer will not be accepted. The manufacturer will furnish replacement parts for any component considered in the opinion of the manufacturer to be defective, whether of his or other manufacturer during the guarantee period. The repair or replacement of those items normally consumed in service, such as seals, grease, etc., shall be considered as part of routine maintenance and upkeep.

3.01 GENERAL: The Contractor shall inspect all material or equipment as it is received to determine damage and/or missing parts. It shall be his responsibility to repair or replace damaged items in accordance with the manufacturer's instructions. Installation by the contractor shall include but not be limited to the following:

- A. Each item shall be furnished complete and installed as shown on the drawings and in accordance with the manufacturer's recommendations, instructions and directions. All installed equipment shall be properly protected during subsequent construction operation.
- B. All excavation, backfilling and grading.
- C. Equipment Installation. Equipment shall be installed in accordance with the manufacturer's instructions. Installation of the equipment shall be the responsibility of the installing contractor and will be in accordance with the contract documents.
- D. Adjusting. Field adjustment shall be made as required for proper operation of the equipment.
- E. Testing: This shall be in accordance with the equipment manufacturers recommendations. (Oil and grease necessary for initial operation shall be provided by the Contractor in quantities and grades recommended by the manufacturer.)
- F. Supply and installation of electrical conduits, supply and installation of conductors and the related numeric marking or conductors
- G. Termination of motor conductors or grounding

The manufacturer shall be responsible for the following tasks:

- A. Submit to the Engineer (3) complete sets of point to point diagrams. The point to point diagrams shall illustrate the quantity of conductors, size, type and numbering methods required for each field device.
- B. Cooperate with other trades to avoid interference in the installation of this work. Install all equipment and systems so as not to delay progress of construction and correlated with other trades to avoid delay. Should differences of opinion develop, the Engineer's decision shall be final.

3.02 START-UP, TRAINING AND PERFORMANCE TESTING: Upon written or verbal confirmation from the engineer certifying that the package plant installation is ready for startup, the manufacturer shall provide the services of a qualified service technician field person as required in Section 1.03, Manufacturers Services. The field person shall do a functional check of each item furnished by the manufacturer, and startup the process. When notified by the engineer that the plant is complete, the field representative shall return to the site to provide operation training which shall include familiarization with the prefabricated plant, its requirements, and review of the Operation and Maintenance Manuals.

END OF SECTION 11991

