

SPECIFICATION
SECTION 11XXX

RECTANGULAR CLARIFIERS

PART 1 GENERAL

1.1. SUMMARY

- A. Under this section the equipment manufacturer shall furnish and deliver ready for installation, chain and scraper type sludge collecting equipment suitable for installation in one (1) primary clarifier approximately 12 ft wide by 38 ft long and 10 ft side water depth. Dimensions are as shown on the contract drawings.
- B. Each tank shall include one longitudinal collector mechanism

1.2. QUALITY ASSURANCE

- A. The equipment covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability that is regularly engaged in the manufacture and installation of complete rectangular clarifier systems including chain and flight collector mechanisms, effluent weirs and troughs, and in-tank baffles.
- B. Component suppliers or manufacturers without minimum 15 year integrated full-system design experience will not be considered acceptable. Full-system design is defined as a system that includes, at a minimum, chain and flight collector, drive unit and deflector baffles in a complete and integrated system design.
- C. The design is based on equipment as manufactured by Guardian Environmental Products, Inc., West Chester, PA.
- D. Alternate manufacturers will only be considered if they meet a minimum 15 year experience of design of similar complete systems. Alternate suppliers will only be considered after providing written certification indicating their ability and experience to meet the specifications detailed herein without exception.

1.3. SUBMITTALS

- A. The following shall be submitted in accordance with the General and Special Provisions.
 - 1. Shop Drawings
 - a. Dimensions.
 - b. Job specific layout.
 - c. Sectional assembly.
 - d. Location and identification mark.
 - e. Equipment locations and attachment anchors
 - f. Accessories, attachments, hardware.

3. Start-Up: Complete review of installation; provide written certification that the installation is complete and operable in all respects, and that no conditions exist which may affect the warranty.
 4. Provide written report, summarizing inspection procedures, observations and any needed correction
 5. Instruction on the operation and maintenance of the equipment, addressing start-up, shut-down, troubleshooting, lubrication, maintenance and safety
- C. The Contractor shall be responsible for requesting and coordinating these services, including coordination with all affected trades.

PART 2 PRODUCTS

2.1. MANUFACTURERS

- A. The following manufacturer is named to establish a standard of quality necessary for the Project.
1. Guardian Environmental Products, Inc., West Chester, PA
 2. Alternate manufacturers will only be considered after providing written certification indicating their experience detailed in Part 1 of these specifications and their ability to meet the specifications detailed herein without exception.
 3. Contractor shall provide a written certification that the manufacture's equipment will be fully interchangeable with the existing secondary clarifier equipment including chain-to-chain interconnection, sprocket design, flight attachment, drive and drive components and accessories.

2.2 DESIGN CRITERIA

- A. The Equipment Manufacturer shall select the collector components based upon design calculations incorporating the following criteria:
1. Operation under wet tank conditions
 2. Friction factors - 0.20 to 0.30 (UHMW on UHMW)
 3. Bearing friction - 0.05 per shaft assembly
 4. Shaft deflection - not to exceed 0.033" per foot of shaft length.
 5. Average sludge loading – 3 lbs per ft of flight length for longitudinal collectors

- B. Longitudinal Collector chains shall run over four (4) sets of sprockets mounted on four (4) full width shafts. Collector mechanisms shall run at a maximum speed of approximately 2 fpm for primary collectors and 1 fpm for the secondary collectors. The flights shall convey the sludge from the tank bottom to the end of the tank and skim floated material to the scum collection pipe also provided.

2.3 EQUIPMENT

- A. The equipment to be furnished under this section shall include:

1. Longitudinal collector and drive
2. Clarifier Control Panel

2.4 COLLECTOR CHAIN

- A. Collector chain shall be NM720S non-metallic type specifically designed for the application of wastewater collector mechanisms
 1. Chain shall have 6-inch pitch links with an average weight of approximately 1.6 lbs/ft. The chain shall have a minimum published working load of 3,100 lbs and an average ultimate strength of over 6,500 lbs as demonstrated by the Ultimate Strength Testing Procedure included in this specification.
 2. The chain shall be manufactured of an acetal material meeting the minimum strength requirements and have a demonstrated performance in similar installations and of equal to or greater loadings.
 3. The chain shall be molded with the barrel and side bars as an integral assembly.
 4. The chain shall be assembled with pins that are also injection molded of glass filled nylon 6/6 material.
 5. Chain shall be capable of being assembled and disassembled in the field without the use of special tools or damage to the chain link or pin.
 6. The Authority has evaluated different chains and has demonstrated experience with collector chain meeting these specifications of design and material. Chains molded of a material other than acetal or that use clips to retain pins are not acceptable
- B. The attachment links shall be of similar construction to the plain chain links. The flight pusher plate shall extend the full height of the flight and shall accommodate four (4) 3/8" diameter Type 316 stainless steel hex head attachment bolts. Bolts shall be fastened with Type 316 stainless steel "Nylock" hex locknuts and cut washers.
- C. Collector chain shall be proof tested by the manufacturer in accordance with the following testing procedure. Only manufacturers clearly exhibiting reference installations

and history as deemed acceptable and pre-approved by the reviewing engineer will be considered.

- a. Factory Testing: Manufacturer will test the ultimate strength of the non-metallic chain with a rig that contains a hydraulic cylinder 6" x 12" stroke, operated by an air/hydraulic pump capable of producing up to 3000 PSI or 75,000 lbs. of linear force. There will be two digital read-outs, one that will show the elongation and breaking point of the chain within 10/1000 of an inch, and the other is the load-cell linear force that goes up to 70,000 lbs within 1/100 of an inch accuracy.
- b. Manufacturer shall furnish records of the test results as per description above. Average ultimate strength of the Non-metallic Chain shall be greater than 6,500 lbs.

2.5 FLIGHTS

- A. Flights shall be 3" x 8" nominal size fiberglass construction, essentially rectangular in cross section in a C-channel configuration. The member shall be an extruded channel section of pultruded isophthalic polyester composite construction with a minimum fiberglass content of 55% to insure member strength and total encapsulation of the glass fibers to prevent wicking. The modulus of elasticity shall be a minimum of $2.8 \times 10^{6\text{th}}$ psi in the y-axis when tested in a full section of deflection test. Tensile strength shall be a minimum of 30,000 psi longitudinal and 7,000 psi transverse. The punch shear strength shall be a minimum of 10,000 psi.
- B. The flight section shall include a scraper lip on the leading edge of the flight to optimize cleaning of the tank floor.
- C. Non-metallic filler blocks shall be furnished to allow the flight to be securely bolted to the chain attachment.
- D. Flight spacing shall be approximately 10 ft. for longitudinal collectors.
- E. Flights shall be accurately drilled and notched at the factory and banded together for shipment.

2.6 WEARING SHOES

- A. Each flight shall be provided with 1/2" thick wearing shoes to run on floor wear strips and on support tracks on the return run.
 1. The shoes shall be fully molded UHMW-polyethylene material.
 2. Wearing shoes running on the floor wear strips shall be located central to the chain attachment. The return run wearing shoes shall include a guide lug to insure proper tracking of the flight with the return track.

3. All wearing shoes shall be reversible providing two (2) usable wearing surfaces. Wear shoes shall be fully molded with a rounded leading edge to prevent potential for catching.
4. Extruded and fabricated angle, cut to length or glued wear shoes shall not be acceptable.

2.7 COLLECTOR CHAIN SPROCKETS

- A. Sprockets for the collector chains shall be molded polyurethane, hunting tooth design with integrally molded chain saver rim.
 1. Sprockets shall be of split construction and have the double life tooth profile compatible with non-metallic chain. The fully molded polyurethane design shall include and integral chain saver rim.
 2. Nylon sprockets do not meet the friction factor requirements to be considered equal and are not be acceptable.
 3. Due to the hub strength requirements fabricated or non-reinforced UHMW hubs are not acceptable.
 4. Sprocket halves shall be assembled on the shafting with 316 stainless steel bolted mounting hardware. Sprockets designs using clamping bands will not be considered as acceptable.
 5. All sprockets shall have integrally molded chain saver rims. Non-chain saver rim sprockets or sprockets using pressed or glued rims will not be accepted.
 6. The Authority has previously evaluated nylon material sprockets and has deemed fully molded or cast nylon as not acceptable
- B. Headshaft sprockets shall not be less than 22.23" pitch diameter and have 23 teeth. Driving sprockets shall be keyed and set screwed firmly to the headshaft.
- C. Cornershaft sprockets shall not be less than 16.61" pitch diameter and have 17 teeth. Cornershaft sprockets shall be set screwed firmly to the full width shafts.
- D. Free rotating or idler sprockets rotating on sleeve bearings or stub shafts do not exhibit the performance characteristics and will not be considered.

2.8 SHAFTING

- A. All shafting shall be solid, 1045 cold-finished steel, straight and true, and shall be held in position with set collars.
- B. All shafting shall extend across the full width of the tank.

- C. All shafting shall extend the full bearing depth of the wall bearings and shall rotate in the bearings mounted on the tank walls
- D. Head shafts shall have keyways with fitted keys and shall be sized to transmit the power required.
- E. Shaft diameters shall be as determined by tank width with a maximum allowable deflection of $l/360$. Calculations of deflection shall be provided as part of the submittal

2.9 WALL BEARINGS

- A. All underwater bearings shall be of cast iron "peak-cap" construction to facilitate removal of the shafting without having to remove or disassemble the bearing.
- B. Bare casting shall include a peak to ensure the self-shedding of settled solids.
- C. Bearings shall include a UHMW liner.
- D. These bearings shall be bolted directly to the concrete wall in a manner, which will permit their easy alignment.
- E. Front lower collector shaft shall have a take-up bearing assembly. The take-up bearing assembly shall mount directly to the tank wall and provide for 10" of adjustment.

2.10 RETURN TRACKS

- A. Return tracks shall be 3" x 3" x 3/8" fiberglass angles minimum with fabricated steel or fully molder glass reinforced nylon supporting brackets fastened by two (2) anchor bolts to the channel walls.
 - 1. Each bracket shall be designed to cantilever the return track approximately 9" off the channel wall.
 - 2. Support brackets shall be spaced to properly support the chain and flights without deflection.
 - 3. Track brackets will be designed to accommodate any concrete support piers or between tank openings or obstructions

2.11 WEAR STRIPS

- A. Flight wear shoes shall ride on 3/8-inch thick by 2-5/8-inch wide, minimum, wear strips. Ultra-high molecular weight (UHMW) polyethylene material shall be used.
 - 1. Wear strips shall be attached to the floor and to the return guides with all 304 or 316 stainless steel fasteners designed to prevent pinching and allow expansion and contraction.

2. Each wear strip shall include one anchoring hole and not less than three slotted holes to accommodate the fasteners.
3. Provisions shall be included to allow for anticipated thermal expansion of the wear strips and to allow unimpeded transition of the wear shoes from one strip to another.

2.12 DRIVE UNIT

- A. Collector mechanism shall operate with a dedicated drive unit. Longitudinal collectors shall have in-line gearboxes.
 1. The motor shall be rated at 0.5 hp and 1.15 Service Factor, totally enclosed, ball bearing, constant speed, of ample power for starting and continuously operating the mechanism under normal operating conditions without overloading. The motor shall conform to NEMA standards and be suitable for operation on 230/460 volts, 3 phase, 60 Hertz.
 2. The speed reducer shall be of the helical gear type, fully housed, running in oil, with anti-friction bearings throughout. The speed reducer shall be designed based on calculated average sludge load, stated under Design Criteria of this Specification, and have a 1.50 Service Factor.
 3. The drive units shall be assembled by the manufacturer and shipped as a complete assembly to ensure proper assembly of all components. The motor shall be directly connected to the speed reducer and mounted as a common unit

2.13 DRIVE CHAIN

- A. The collector drive chain shall be NH78 high strength non-metallic drive chain made of glass filled Nylon 6/6 for use in water treatment applications. Chain shall be required to meet quality control standards set by the manufacturer and shall be tested to meet these standards. Control standards shall be submitted to the engineer prior to manufacture. Test results shall be provided with delivery of the chain.
 1. The chain shall not weigh less than 1.41 lbs/ft.
 2. The chain shall have an average pitch of 2.609 inches.
 3. Links shall be assembled using stainless steel pins that have knurled ends to prevent pin rotation.
 4. Side bars shall be integrally molded to ensure squareness of the links.
 5. Pins will have a diameter of .375 inches.
 6. Working load of the chain shall be minimum 1,800 lbs.

2.14 DRIVEN SPROCKET

- A. The driven sprocket shall consist of a polymeric toothed rim bolted to a split non-metallic hub made of impact resistant glass filled polypropylene material.
 - 1. Sprocket shall have 40 teeth and a pitch diameter of 33.25-inches.
 - 2. The body shall be dished to provide an offset to provide bearing and flight clearance.
 - 3. The rim shall be molded of UHMW polyethylene.
 - 4. The body halves shall be assembled on the headshaft with two (2) bolts to exert compressive force against the hub, thereby clamping the sprocket assembly to the shaft.
 - 5. Bolts shall be located along the split line near the periphery and so designed to draw the sprocket halves together in diametrical and lateral alignment.
 - 6. The body shall have a machined keyway designed to restrict the lateral movement of the key.

2.15 SHEAR PIN HUB AND DRIVE SPROCKET

- A. The drive sprocket shall consist of a polymeric plate sprocket bolted to a 316 stainless steel driving hub.
 - 1. The sprocket plate shall be molded of nylon.
 - 2. The sprocket shall be not less than 9.26" pitch diameter and have 11 teeth.
- B. The drive sprocket shall be provided with a shear pin device to provide for protection of the drive equipment in the event of excessive loading.
 - 1. Shear pins shall be provided to transmit torque from the driving hub to the sprocket shear plate with a polymeric gasket located between the shear faces to prevent seizing.
 - 2. Shear pins shall have a reduced diameter neck sized to protect the drive gearbox from overload damage
 - 3. A shear pin indicator trip shall be included in the driving hum to actual a limit switch for remote indication of an overtorque condition.

2.16 DRIVE CHAIN TIGHTENER

- A. The drive chain arrangement shall include a chain tightener to take up excessive slack in the drive chain.

1. The tightener assembly shall include a stainless steel mounting bracket
2. Sliding tensioning arm shall be stainless steel or glass reinforced non-metallic and include stainless steel spindle for mounting of tensioner sprocket
3. Tensioning sprocket shall be a minimum of 7 tooth and be a self-centering and self-lubricated molded UHMW polyethylene.

2.17 CHAIN GUARD

- A. The drive chain and sprockets located above the operating platform shall be covered with a removable metal guard of No.14 gauge Type 304 stainless steel.

2.18 ANCHOR BOLTS

- A. All anchor bolts shall be Type 316 stainless steel furnished by the Equipment Manufacturer, of ample size and strength for the purpose intended.
 1. All anchor bolts shall be set by the General Contractor in accordance with the manufacturer's instructions.

2.19 CONTROLS

- A. A local control panel shall be provided for control each settling basin collector.
 1. Control Panel will include a lock-out panel power disconnect
 2. Control Panels shall be designed and rated for 230VAC supply voltage.
 3. Control panel will be NEMA 4X 304 stainless steel
 4. Panel shall include the following front mounted controls at a minimum
 - a. Local/Remote selector for drive motor
 - b. Start/Stop push button for drive motor
 - c. Run indicator light for each drive

2.20 ROTARY SCUM SKIMMER

- A. Scum Pipes shall be 8-inch diameter constructed of 304 stainless steel
 1. Removal of floating materials conveyed to the effluent end of the tanks.
 2. Scum pipe shall be handwheel actuated to rotate in either direction.
 3. Scum pipe shall accommodate minor vertical and horizontal misalignment without binding.

- B. The scum pipe system shall have the following design features.
 - 1. Nominal 12 ft 0 in wide. Contractor shall field verify concrete wall dimensions before fabrication
 - 2. 8-inch diameter.
 - 3. Minimum wall thickness: 0.250 inch for stainless steel
 - 4. Tipping angle: Approximately 21.12 degrees from vertical.
 - 5. Provide longitudinal slots spaced no longer than 30 inches, with two-inch uncut bands between the slots to act as stiffeners to the scum pipe.
 - 6. Furnish scum pipe with one open end and one blank end or open both ends as location requires
- C. The design shall allow each of the scum pipes in each tank to be operated independently.
- D. The scum troughs shall revolve in fabricated 304 stainless steel flange wall support bearing housings for stainless steel design.
 - 1. These housings shall allow both vertical and horizontal misalignment without interfering with smooth operation of the scum pipes.
 - 2. Each scum pipe bearing shall be manufactured of UHMW polyethylene. The UHMW bearing is to be of such design as to not require lubrication.
 - 3. Each end of the scum pipe shall incorporate an adjustable seal to prevent water leakage.
 - 4. The seal shall have adjustment bolts to tighten the retainer and maintain an effective seal.
- E. Scum pipes shall have a manual lever actuator fabricated 304 stainless steel pipe no less than 1-1/2" diameter
- F. Ensure that troughs and supports are installed plumb and true, free of warp or twist, within the tolerances specified by the manufacturer and as shown on the drawings.
- G. After the manufacturer has approved the installation, and prior to startup, the Contractor shall clean all surfaces in accordance with the manufacturer's instructions.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install the Clarifier internal components complete and operational in every respect as shown on the plans and specified herewith.
1. Verify correct alignment of all components and operate the unit dry to observe for alignment and smooth operation.
 2. Provide the services of a factory representative for a total of two, eight hour days travel time excluded, to inspect the equipment, perform start-up, and instruct Owner's staff in operation and maintenance issues.
 - a. Start-Up: Complete review of installation; provide written certification that the installation is complete and operable in all respects, and that no conditions exist which may affect the warranty.
 - b. Provide written report, summarizing inspection procedures, observations and any needed correction
 - c. Instruction on the operation and maintenance of the equipment, addressing start-up, shut-down, troubleshooting, lubrication, maintenance and safety
 3. Operate the equipment after introduction of wastewater and check again for improper alignment and make necessary corrections.