Specifications

Division 46
Water and Wastewater Equipment
Section 46 4321
Circular Clarifier Equipment

Part 1 - General

1.01 Summary

A. Section Includes: Labor, materials, and equipment necessary for fabrication, production, installation, and erection of the items specified in this Section as shown on Drawings or listed on Schedule.

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, including Section 01 6000, apply to the Work of this Section.

C. Products Furnished But Not Installed Under This Section: Anchor bolts shall be installed under Section 03 1500 in accordance with certified prints furnished by equipment manufacturer.

D. The equipment specified herein is intended to replace similar equipment installed during original construction.

1.02 References

A. Reference Standards:
   1. AGMA 46005: Practice for Gear Motors using Spur, Helical, Herringbone and Spiral Bevel Gears.
   5. ANSI/AGMA 6034-A87: Practice for Enclosed Cylindrical Worm Gear Speed Reducers and Gear Motors.

1.03 Definitions

A. Circular Sludge Collector Mechanism: Process flow entering the tank shall pass through the center column and influent well. Settled sludge shall be removed by scraper blades attached to a rotating arm that will plow the sludge to a well near the center of the tank.
   1. This device shall comprise the following components: Drive mechanism, motor, overload device, bridge, influent well, two sludge collecting arms, scum skimmer and scum beach with flushing mechanism, and anchor bolts.
   2. This device is intended to collect settled sludge from raw sewage, and scrape or plow the sludge to a hopper near the center of the clarifier tank.

1.04 Submittals
A. Shop Drawings: Submit in accordance with Section 01 3300, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
1. General arrangement Drawings.
2. Miscellaneous sections and details.
3. Anchor bolt layout Drawings.
4. Drive control Drawings/wiring diagram.
5. Drive arrangement Drawings including materials of construction.
7. Drive specifications with materials of construction.
8. Drive catalog cuts.
9. AGMA calculations - when requested.
10. Sludge Suction header calculations - when requested.

B. Test and Inspection Report: A written report shall be submitted to ENGINEER documenting all testing and/or inspection results. These reports shall be prepared as noted under Section 40 0500.

C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01 3300, operation and maintenance manuals for items included under this Section.

D. Warranty: Submit in accordance with requirements of Section 01 7700, warranties covering the items included under this Section.

1.05 Delivery, Storage, and Handling

A. Packing and Shipping: Structural assemblies shall be shipped in sections as large as feasible to minimize field erection.

Part 2 - Products

2.01 Manufacturers

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
1. Circular Flocculating Sludge Collector Mechanism:
   a. Ovivo-EIMCO
   b. Siemens-Envirex

2.02 Materials

A. Materials shall include:

<table>
<thead>
<tr>
<th>Component</th>
<th>Material(s) of Construction</th>
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<tbody>
<tr>
<td>Submerged steel</td>
<td>Steel 3/16-inch minimum thickness, hot dipped galvanized</td>
</tr>
<tr>
<td>Worm/worm shaft</td>
<td>Hardened steel/cast manganese bronze</td>
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<tr>
<td>Cycloidal ring</td>
<td>Hardened steel, 58 Rc minimum.</td>
</tr>
<tr>
<td>Intermediate reduction worm gear</td>
<td>Alloy bronze.</td>
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<tr>
<td>Drive chain cover</td>
<td>12-gauge galvanized steel or fiberglass.</td>
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<tr>
<td>Worm gear enclosure</td>
<td>High-grade cast iron.</td>
</tr>
<tr>
<td>Pinion and pinion shaft</td>
<td>Heat-treated steel.</td>
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<tr>
<td>Turntable</td>
<td>Cast ductile iron.</td>
</tr>
<tr>
<td>Drive mechanism base</td>
<td>Same as turntable.</td>
</tr>
<tr>
<td>Base ball bearings</td>
<td>Alloy steel hardened balls or high carbon chrome alloy steel.</td>
</tr>
<tr>
<td>Base bearing liners</td>
<td>Hardened renewable strips or forged steel raceway.</td>
</tr>
</tbody>
</table>
12. Overload device housing — High-grade cast iron or stainless steel.
14. Collector Arms — All welded steel 1/4-inch minimum thickness, galvanized
15. Blade Squeegees — Spring brass or stainless steel
16. Scum Deflector — Steel plate, 1/4-inch minimum.
18. Scum Trough — Steel, hot dipped galvanized
19. Influent Well — Steel plate, 3/16-inch minimum, galvanized

B. Each sludge collector mechanism shall comprise a complete assembly including the components and accessories described in this Section and listed on Schedule.

C. Each unit shall be of the center-column type, half bridge, with a central driving mechanism which shall support and rotate a center cage with collector arms attached thereto. The speed of the mechanism shall be approximately 4.0 revolutions per hour. The mechanism shall be so designed that there will be no chains, sprockets, bearings, or operating mechanism below the liquid surface or in contact with the liquid.

D. The maximum allowable stresses on structural steel members under momentary peak loading shall not exceed those permitted by the AISC Specifications for the Design, Fabrication and Erection of Structural Steel.

E. Each unit shall be designed for a 20-year life, minimum, at 24-hour-per-day duty and sized for the continuous torque as defined in the documents and listed on Schedule. In addition, the unit shall be of sufficient strength to screed the concrete fill in the tank bottom without damage to any of its components.

2.03 Components

A. Drive Mechanism: The drive mechanism shall consist of a drive unit, containing the motor, primary reducer, and intermediate worm gear reduction unit, plus an enclosed final reduction unit consisting of a main internal gear and pinion, and a turntable base.

1. The primary gear reducer shall be a double reduction worm gear unit or other suitable AGMA-rated device, directly connected to the motor. The primary and intermediate units shall be connected through a steel roller chain and sprockets, enclosed in a chain guard.

2. The intermediate worm gear reducer shall be rated per AGMA 6034. The final reduction internal gear shall be rated per AGMA 2001. These ratings shall be used to determine the continuous torque of the drive mechanism as a unit. The continuous torque shall be defined as the drive unit's overall torque based on the rating determined from AGMA 6034 and 2001.

3. The drive mechanism's momentary peak load shall be defined as 3 times the drive mechanism's rating based on the worm rating or 2 times the main gear and pinion rating, whichever is less.

4. The drive unit shall be secured to the turntable base and shall consist of a worm gear reduction unit consisting of a worm gear driven by a worm and integral shaft supported on antifriction roller bearings and operating in an oil bath. The worm and worm shaft shall be fabricated either integral construction or with the worm keyed to worm shaft. The intermediate reduction worm gear shall be fabricated one-piece construction and shouldered, bolted, and doweled, or keyed to the pinion shaft.

5. The worm gear shall be enclosed in a high-grade cast iron housing with a cover over the worm gear and a removable cover over the worm. The worm shaft shall be driven through a roller chain drive by a horizontal or vertical motor and primary reducer. The motor and primary reducer shall be the modular type with the motor directly coupled to the primary reducer and mounted on a standard NEMA flange.

6. The pinion shaft and final reduction pinion shall be fabricated with the pinion gear either integral or keyed to the pinion shaft, and the shaft supported by an upper and lower antifriction roller bearing spaced a suitable distance apart vertically for stability.
7. The upper roller bearing outer race (stationary) shall be mounted in the worm gear housing and the inner race (rotating) shall be mounted in the worm gear hub or on the pinion shaft. The lower roller bearing inner race (rotating) shall be mounted on the lower section of the pinion shaft and the outer race (stationary) shall be mounted in the base.

8. The turntable shall be cast integrally with the final reduction spur gear (ring gear) and designed to support the rotating mechanism.

9. The base for the drive mechanism shall be designed to form a platform for mounting the drive unit and to support the walkway. The base and rotating main gear shall combine to form an annular raceway for the large-diameter main ball bearings. The raceway shall have sufficient diameter to ensure stability without the necessity of guide shoes for all the loading conditions, maintenance activities and installation procedures, and shall be equipped with four renewable liner strips upon which the balls can bear horizontally and vertically or shall be hardened and machined to match the shape of the balls. The balls shall be grease lubricated or shall run in an oil bath which shall be protected by a felt seal and a steel dust shield. An oil filling and level pipe and a drain plug with valve shall be furnished as part of this unit. The base shall be designed to provide convenient access to all components of the drive mechanism.

10. An oil sight glass shall be provided for the oil reservoirs. Readily accessible lubricant fill and drain pipe with necessary fittings shall be provided.

11. The motor shall be mounted with its base at least two feet above the liquid level and shall be of ample size to operate the clarifier as noted on Schedule.

12. All antifriction bearings shall have a B-10 life rating of not less than 150,000 hours.

13. The reducer shall be fitted with radial and thrust bearings of the proper size for all mechanism loads and grease lubricated.

14. The cycloidal reducer shall have a guaranteed shock loading of 500 percent.

B. Motors: Electric motors shall be furnished meeting the requirements of Section 26 0500.

1. Unless specified otherwise, electric motors shall be TEFC design with nonhygroscopic windings.

C. Overload Device: The overload alarm shall be mounted on the drive head at the thrust end of the worm shaft or at the cycloidal unit base

1. The alarm unit shall consist of a spring assembly, a gear rack and pinion plunger, indicator dial, two mercury or micro switches, one N.O. and one N.C., and terminal block, all enclosed in an aluminum or stainless steel, weathertight housing, gasketed and mounted to the spring housing. The end thrust of the worm shaft against the springs shall actuate the gear rack and pinion or plunger, and shall move the indicator dial, thus indicating the pressure on the spring.

2. A visual torque dial indication will be provided and oriented so that it may be read from the walkway.

3. The switches are adjusted to 1) sound an alarm when the load on the mechanism reaches continuous torque capacity of the drive, and 2) to stop the motor when the load reaches 100 percent of the continuous torque capacity. Switches shall be factory adjusted to accurately calibrate the alarm torque valve and the overload position. The overload system shall be capable of field adjustment.

4. Additional protection above the shutoff point shall be provided by shear pins actuated by lugs on the shear coupling.

D. Bridge: The bridge shall be approximately 3 feet wide, braced for rigidity, and shall extend across approximately one-half the tank diameter. The maximum allowable vertical deflection shall be 1/360th of the bridge length under a design load of 50 pounds per square foot imposed in addition to the calculated dead loading. The access bridge shall be supported on the drive mechanism base which, in turn, shall be supported by center pier support structure. Bridge shall include painted steel guardrail with kickplates.

E. Skimmer: A rotating scum deflector blade supported from two rake arms shall be furnished to move the floating scum outward from the well and extending to the skimming blade. The blade shall be the width of the scum trough and have a wearing plate on its outer edge and strips on the bottom and inner edges to properly seal the entrapped scum and water when discharging into the trough. The blade shall be
constantly forced against the scum baffle on the tank by a torsion bar or a spring-loaded arrangement to
effectively keep the scum baffle clean. The blade shall be adjustable so that the quantity of liquid
discharged with the scum can be varied and shall be so designed that the blade can move in a vertical
plane so that the bottom edge of the blade is always in contact with the scum trough even if the trough
is not horizontal.

F. Influent Well: The influent well shall receive the influent flow and shall diffuse the liquid into the tank
without disturbance. The well shall have a diameter and depth as noted in the Schedule, and shall be
fabricated with the necessary stiffening members. Vertical baffles shall be located within the well to
minimize mass water rotation. The influent well shall be provided with two slots at water level to
permit escape of floating material. The slots shall be provided with baffles to prevent any short
circuiting.

G. Collector Arms: The four sludge collecting arms, equipped with scraper blades set and spaced to scrape
settled sludge along the tank bottom to a sludge pocket located near the center of the tank, shall be
rigidly connected to the center cage. The arms shall be truss construction, requiring no tie-rods for
support, and shall be an all-welded construction, galvanized after welding.
1. The blade setting is to be identical for each arm with the blades so spaced that the entire circular
portion of the tank bottom is scraped by each arm for each revolution of the mechanism. The main
rake blades shall have a minimum depth of 7-1/2 inches. Radial blades shall be furnished at the
center. Adjustable spring squeegees shall be furnished for all blades, and they shall project 1-1/2
inches below the bottom of the blades and shall be adjustably secured by stainless steel bolts and
nuts.
2. Arms shall conform to tank bottom elevation and slope as shown on the drawings.

H. Anchors: All anchors shall be stainless steel, the chemical epoxy type, and furnished under this Section.
The anchors shall be installed in accordance with certified prints furnished by equipment manufacturer.

I. Finishes: All steel, cast steel or cast iron parts shall be cleaned to SSPC-SP-6 specifications and
finished in manufacturers standard epoxy primer and paint. All submerged steel shall be galvanized.

Part 3 - Execution

3.01 Erection

A. Equipment furnished and installed under this Section shall be fabricated, assembled, erected, and placed
in proper operating condition in full conformity with detail drawings, specifications, engineering data,
instructions, and recommendations of equipment manufacturer as approved by ENGINEER.

3.02 Field Quality Control

A. Installation Check: In addition to the requirements of installation check as described in Section 01 6000,
manufacturer shall furnish a qualified representative, for a period of not less than 2 man-days, to
instruct OWNER’s operator in the maintenance and operation of the equipment.

End of Section
CIRCULAR CLARIFIER EQUIPMENT
Equipment Schedule

Number of Units: 1
Type: Circular Sludge Collector
Location: Primary Clarifier 14
Center Column Diameter: 30 inches, min
Influent Well Diameter: 12’-0”
    SWD: 5’- 0”

Tank Dimensions
    Diameter (feet): 80’-0”
    SWD (feet): 12’-0”

Design Flow Rates
    Average Clarifier Flow, mgd 5.4
    Peak Clarifier Flow, mgd 9.4

Overflow Rate, gpd/sq. ft./Tank
    Ave Design Flow: 1075 gpd/sf
    Peak Design Flow: 1871 gpd/sf

Influent Pipe Diameter (inches): 30 inches

Minimum Continuous Torque, (ft.-lbs): 20,000

Remarks: Drive motor shall be 3/4 Hp, 460/3/60.