ROCR Final Clarifier 5 Suction Pipe Collector Mechanisms Replacement Specification

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. There shall be provided One (1) 130' diameter circular cage drive clarifier. The equipment shall include but not be limited to a center drive unit with torque control, walkway and platform with handrail, stationary center influent column, rotating sludge collection box, center feed well, drive cage, sludge collection arms, scum skimmer, scum box, anchor bolts and all other appurtenances required or shown on the drawings.

B. Clarifier #5 was originally designed by Eimco. The design parameters per the original drawing: 23186-0l: Rev B. Rev. For APP. Nov 13, 1986.
   a. Clarifier Effluent - 12.5 MGD
   b. Mixed Liquor Flow - 18.64 MGD
   c. Return Sludge - 6.14 MGD

C. The mechanism shall be capable of removing settled sludge solids from the tank floor and delivering them to a central pocket where the sludge will be removed through the suction line to the return sludge pumps. A skimming device shall collect floating solids to the scum box to be removed through the scum pumping system. See associated drawings from Eimco.

1.2 DIMENSIONAL INFORMATION UNDERSTANDING:

A. All dimensional information shall be field verified by contractor prior to issuing prefabrication submittals and start of any manufacturing.
   a. Prefabrication site visit to see the equipment must be arranged with two weeks advanced notice.

1.3 WARRANTEE

A. The mechanism shall be warranted for two years from the time the mechanism is approved as operationally functional, after 30 day run time.

B. The drive, main bearings, shall be warranted for ten years.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Clarifier #5 shall be the center drive type supported on a stationary influent column with the flow entering the bottom of the influent column and flowing upwards to the inlet openings at the water surface. See attached drawings.

B. Major Components of the clarification equipment shall include but not be limited to:

a. Center drive mechanism, gear motor and overload alarm
b. Walkway support with handrail and grating
c. Center support/influent column
d. Center drive cage
e. Feed well and supports
f. Rotating sludge collection arms
g. Truss rake arms with suction pipes and control valves
h. Scum skimmers
i. Scum trough with flush valve
j. Fasteners and anchor bolts
k. Stainless steel baffles with stand-off bracketing
I. Stainless steel notched weir plates
m. And all other components necessary for a complete operating system.
n. Bead blast all non-submerged stainless components

C. Require that all structural sections show a comparable price for fabrication out of 304L Stainless Steel and 316L Stainless Steel

2.2 GENERAL DESIGN CRITERIA

A. Design flows (MGD) of plant, with 6 final clarifiers

a. Average Daily: 18 MGD
b. Design: 28 MGD
c. Peale 35 MGD
d. Hydraulic Design: Z+100% RAS= 4,900 GPM + 4,900 GPM= 9,800 GPM

B. Equipment Design Criteria:

See 1.1.B and 1.1.C

C. Drive Design Requirements:

a. Mechanism design shall be such that there are no chains, sprockets, or bearingsbelow or in contact with any water, including condensate.
    i. Drive shall have no lower pinion support bearing.
b. All planetary gear designs. No worm gearing.
c. Primary load carrying bearing shall be four-point loading, precision bearing.
d. Gearing shall be designed and rated per the current American Gear Manufactures Association Standards. (AGMA)
e. Drive shall have a minimum operating life of 20 years at the continuous torque and speed rating listed above.
f. All electrical and torque limiting equipment is to be enclosed in NEMA 4X SS boxes. No plastic or fiber reinforced plastics.
g. All conduits shall be 1" SS.

D. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations and properly match marked for ease of construction. Match markings shall be clearly defined on all supplied installation and fabrication drawings.

E. Fabricated and Structural Steel shall be per ASTM 304L SS standards and alternate of ASTM 316L SS standards.

F. Minimum metal thickness shall be ¼" for all submerged plate and membersunless otherwise specified.

G. Submittal Requirements:

a. Mechanism
   1. General arrangement drawings showing:
      1. All major tank and mechanism dimensions and elevations,
      2. Anchor bolt's locations,
      3. Mechanism loadings on the tank,
   11. Engineering calculations showing the mechanism components meet the design torque requirements listed above
   Engineering calculations showing the walkway and platform meet the design criteria listed in the Bridge Walkway section.

b. Drive
   1. Calculations shall clearly specify the values used for the following design parameters for Surface Durability and Strength rating:
      1. Number of Pinions
      2. Actual face widths
      3. Tooth geometry factor (I and J factors)
      4. Load distribution factor
      5. Allowable contact stress
      6. Allowable bending stress
      7. Pinion pitch diameter
      8. Tooth diametral pitch
      9. Hardness ratio factor
      10. Elastic coefficient
      11. Life factor

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2.3 EQUIPMENT DESCRIPTION

A. DRIVE MECHANISM

a. General: The drive mechanism shall consist of an electric motor, primary reduction unit, and an enclosed final reduction unit consisting of a pinion and an internal tooth gear with a four-point contact precision bearing. Helical and planetary gear designs preferred.

b. Primary Reduction Unit: The primary reduction unit shall be mounted on the top of the final reduction unit and properly registered to maintain accurate centers for the final reduction gearing.

1. All gears shall be planetary or helical, no worm gears or chains.

1.1. The primary reduction unit shall have sufficient bearing capacity to fully support the pinion gear without a lower support bearing.

1.1.1 The Lio life of the primary gearbox bearings shall be more than 100,000 hours at the operating torque listed in the Equipment Design Criteria section.

1.1.1.1 The primary reducer shall be AGMA rated for 10 million cycles, whendrive is operating at the continuous output torque listed in the Equipment Design Criteria section.

1.1.1.1.1 The primary reduction unit shall be coated with two-part epoxy paint for high corrosion resistance or unit shall be constructed of 304L SS.

c. Final Reduction Unit:

1. The final reduction housing shall be manufactured from stainless steel plate 304L SS, supply alternate pricing for 316L SS, all welds shall conform to applicable specifications of the American Welding Standards (AWS). After welding, all mounting, and mating surfaces shall be machined to insure proper fit and alignment of the drive pinion and mating gear. The base plate on which the gear and bearing is mounted shall be flat within 0.008". The stainless-steel plate to which the intermediate pinion drive gearbox is mounted shall be a minimum of 1" thick. Thickness is to be established by vendor engineering.

1.1. The final reduction housing shall employ a labyrinth seal between the housing and the main gear driven rotating member.

1.1.1. The final reduction unit internal tooth gear shall be machined to AGMA grade 6 or higher. Gear teeth shall have a core hardness of 250 to 300 BHN, and be induction hardened to 55 Rc. The main gear set shall be rated per AGMA Standard 2001-C95 for 20 years at a continuous torque load of at least 36,000 ft. lbs. Gear pitch diameter shall be a minimum of 40".

iv. The main gear support bearings shall be four-point contact precision bearing.
v. The final reduction unit pinion shall be made of heat-treated alloy steel and shall be mounted on the output shaft of the intermediate reduction gearbox. The gear teeth shall be induction hardened to 55 to 60 Rc.

d. Electric Motor: The drive motor shall be IP65 Wash-down Rated, 1.15 Service Factor, Class H insulation.
e. Overload Device: The overload protection device shall be housed in a stainless-steel housing and have two independent switches, which may energize an alarm circuit when the load on the mechanism approaches overload and open the motor circuit when an excessive overload occurs. The switches shall be enclosed in a NEMA 4X SS housing. Overload device shall have a 6" diameter Stainless Steel torque gauge indicating torque load on drive unit in ft-lbs. Overload alarm, and overload cut off torque settings shall be factory preset per customer specifications.
    i. Supply 4-20 mA remote torque monitoring feedback signal.
f. The entire drive unit shall be designed for a maximum overload torque listed in the Equipment Design Criteria section, and the final reduction unit main gear set shall be designed for a momentary peak torque listed in the Equipment Design Criteria section. All calculations of gear & bearing life shall be made in accordance with the latest AGMA and AFBMA standards.
g. All lubrication shall be Mobil brand.

B. CENTER DRIVE PLATFORM

a. The center drive platform shall provide access to the center drive assembly, lubrication fill and drainpipes, drive torque control and electric control panel.
b. The platform shall provide 36" clearance around the drive components. A removable section of the flooring shall provide access to the drive maintenance points.
c. The platform shall consist of Aluminum supported by the platform bottom members. Handrail shall be 2" Dia. aluminum.

C. BRIDGE WALKWAY

a. The walkway bridge shall be constructed of structural I-beams or two side structural trusses of welded 3041 SS, alternate pricing for 3161 SS, with a 48" wide walkway consisting of Aluminum grating supported by the walkway bottom members. Handrail shall be 2 - rail aluminum handrail. In the case of

structural truss construction, the side truss may serve as handrails for the walkway.

b. The bridge shall be supported by the center drive platform and the outer tank wall.
c. The bridge shall be designed for a total deadload plus a live load of 50 lbs. persquare foot with the deflection not to exceed 1/480 of the span.

D. STATIONARY INFLUENT COLUMN

a. The influent column shall have a minimum ¼" wall thickness with the diameter as listed in the Equipment Design Criteria. This shall conform to current engineering calculations by manufacture and not less the ¼".
b. Top mounting plate shall be drilled and tapped per the hold down bolt pattern and size determined by gear box manufacture. Mounting surface to be fabricated from 304L SS, alternate pricing for 316L SS, plate and machined true to the vertical column within acceptable OEM standards. Top plate shall have rainwater relief hole installed in the middle, no less than 1-1/2" Dia.
c. The column shall be designed to support the weight of the entire structure resting upon it and to withstand the mechanism design strength criteria.
d. Influent discharge ports shall be included at the upper end of the influent column. These ports shall diffuse the flow entering the tank and insure low velocity into the Influent Dispersion Well. Influent velocity shall not exceed 1.0 fps at the peak flow rate specified.
e. Clarifier #5 will have a rotating sludge collection box that shall be mounted around the top of the center column to house the overflow valves from the suction pipes and arranged to convey the sludge from the suction pipes to the central Return Activated Sludge (RAS) withdrawal pipe within the center column. The collection box shall be connected to and rotate with the cage truss.
f. A stainless-steel RAS withdrawal pipe shall be mounted within the center influent column, extending from a flexible connector at the base of the column to the sludge collection box. A plate mounted within the column shall be provided to convey sludge from the sludge collection box into the RAS withdrawal pipe. Minimum wall thickness of the pipe shall be ¼".

E. CENTER CAGE

a. The center cage shall be a 304L SS, alternate pricing for 316L SS, box truss construction with connections for the sludge removal arms.
b. The cage top shall bolt to the main gear.
c. The cage shall be designed to withstand the mechanism's design torque.

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A. SLUDGE COLLECTOR ARMS

a. The sludge collector arms shall be of 304L SS, alternate pricing for 316L SS, truss construction with 304L SS, alternate pricing for 316L SS, scraper blades and adjustable stainless-steel squeegees (OEM to give feedback to Macon Water Authority as per best available squeegee materials.) Squeegees shall be fastened to the rake blade with 316L bolts and 304L stainless steel nuts. The blades shall be properly sized to insure complete raking of the bottom twice per revolution. The blades shall rake heavy sludge to a center hopper while directing solids to the inlets of the individual sludge suction pipes.

b. Suction pipes and control valves: PVC suction pipes shall be provided on each rake arm. The lower end of each pipe shall be attached to the rake arm by means of a stainless-steel U-bolt clamp and the pipes shall be supported by the rake arm and cage. The pipes shall be arranged to slope upward toward the tank center, in the same horizontal plane, and shall continue to the sludge collection box so that each pipe drains freely in the event the tank is drained. Each sludge suction pipe shall terminate at the sludge collection box and shall discharge into the box by means of an adjustable overflow valve located within the box. Each valve shall be a concentric tube type, consisting of a fixed riser having a vertical slot. The sleeve shall be easily tuned to control the flow through the slot. The sleeve shall also be completely removable to allow flushing of the suction pipe. The valves shall be so arranged that they can be operated from the walkway without the use of an access platform below the elevation of the walkway and so that the flow from each can be observed, estimated, and sampled. An operating handle shall be furnished to adjust the valves.

c. The arms shall be adjustable to assure an even travel above the installed grout in the tank bottom.

B. FEED WELL

a. The feed well shall be of the size indicated in the Equipment Design Criteria. It shall be supported by stainless steel supports attached to the center cage. The well shall be fabricated of ¼" 304 SS, alternate pricing for 316L SS, plate with top and bottom reinforcing angles. Plate shall be thicker if OEM design designates yet not less than ¼".

b. The feed well shall include (4) 4" by 12" scum port openings to allow escape of surface scum inside the well. A removable scum baffle shall be provided over the ports.

C. SKIMMER

a. There shall be mounted on each sludge collector arm a skimming device arranged to sweep the surface of the of the clarification compartment once per revolution, automatically removing scum and floating material into a scum box at the tank periphery.
b. Each rotating skimmer shall consist of a stainless-steel channel supported and extended tangentially from the feed well to a recessed adjustable pivoted scum scraper at the tank periphery.
c. The scum scraper shall consist of aluminum scrapper, double acting hinged connection, support arms, neoprene wipers, outer wear strip and positive means to maintain the blade against the baffle.
d. The scum scrapers shall trap floating scum pushed outwards by the tangential stainless steel scum blade and efficiently deposit the solids into the scum trough.
e. The scum trough shall be the size indicated in the Equipment Design Criteria and constructed of minimum ¼" 304L SS, alternate pricing for 316L SS, plate with a 6" outlet. To include an automatic flush valve mechanism to assure scum is effectively flushed.

D. ANCHOR BOLTS AND FASTENERS

a. Anchor bolts shall be 304 stainless steel and be furnished by the equipment manufacture. All fasteners to be 304 stainless steel with 316 SS nuts.

E. CONCRETE REPAIR AND PROTECTIVE BIOLOGICAL INHIBITING COATING

a. The concrete effluent trough and any damaged areas of the clarifier exposing re-bar shall be blasted, cleaned, and coated in accordance with the attached specifications as issued by Sherwin Williams.

b. The effluent trough shall be coated with a protective biological inhibiting coating. This coating shall extend over the wall, under the weir plate, the entire trough and up the clarifier wall as illustrated in the attached document.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fabricator shall field verify tank dimensions prior to any material purchases and starting fabrication.

B. OEM shall supply detailed installation instructions, with sufficient details to be used to bid the installation with a local mechanical contractor.

C. OEM shall establish hold points for contractor to allow for field verification from OEM that installation is correct.

D. OEM shall supply training for plant personnel. Also, shall review with maintenance the appropriate PPMs to optimize equipment performance.

E. OEM shall specify how many trips they are proposing to verify proper installation and commissioning of said equipment.

F. Check and certify installation and instruct the plant personnel in the operation and maintenance. A minimum of 3 trips, per clarifier for 5 days total, per clarifiershall be provided.

G. Units will be taken out of service for supplier to get actual dimensions once bids have been awarded. Will coordinate this as to not disrupt operations.

H. Work is not considered complete until the following two requirements are satisfied:

a. Mechanism is successful for 30 days. Success is per operations acknowledgement of proper operation.

b. After 30 day run period OEM shall conduct training for operations and maintenance. Training can only be conducted when all "As-Built" drawings and manuals have been delivered to MWA: (2) hard copies of drawings and manuals. (1) Digital copy of all drawings and manuals.