SECTION 11336 - SUPPLEMENTAL

CIRCULAR PRIMARY CLARIFIER MECHANISMS

PART 1-GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, appurtenances, and incidentals as shown, specified and required to furnish and install center supported circular spiral scraper type sludge removal equipment in circular center feed primary clarifiers.

2. Included, but not limited to, are the following new components for Clarifier Nos. 13, 14, 15 and 16, as indicated:

a. Center cages (Nos. 13 and 14).

b. Influent dispersion wells (Nos. 13 and 14).

c. Rotating rake arms, spiral blade sludge scrapers and sludge hopper scrapers (Nos. 13 and 14).

d. Center access platforms handrail modifications (Nos. 13 and 14).

e. Neoprene hinges and C-scrapers for skimmer arms (Nos. 13 and 14).

f. Effluent troughs (Nos. 13 - 16).

g. Effluent trough support brackets (Nos. 13 - 16).

h. Adjustable scum baffles (Nos. 13 - 16).

i. Weir plates (Nos. 13 - 16).

j. Adhesive anchors (Nos. 13 - 16).

k. Spare parts (Nos. 13 and 14).

l. Surface preparation and painting (Nos. 13 and 14).

3. Also included is the following:

a. Removal and reinstallation of existing scum deflectors and

skimmer arms (Nos. 13 and 14).

B. Related Sections:

1. Division 1, General Requirements.
2. Section 02050, Demolition.
3. Section 03300, Cast-In-Place Concrete.
4. Section 03600, Grout.
5. Section 05550, Anchor Bolts and Expansion Anchors.
6. Section 05120, Structural Steel.
7. Section 05500, Metal Fabrications.
8. Section 05520, Handrails and Railings.
9. Section 09900, Painting.
10. Section 11050, Equipment General Provisions.
11. Section 11339, Center Drive Mechanism Rehabilitation.
12. Division 15, Mechanical.
13. Division 16, Electrical.
14. Division 17, Instrumentation and Control Systems.

C. Coordination:

1. To ensure that all equipment is properly coordinated and will function in accordance with the requirements of the Contract Documents, the CONTRACTOR shall obtain all the equipment specified herein from a single manufacturer/supplier in whom shall be vested unit responsibility for the proper function of the complete system. However, the CONTRACTOR shall retain ultimate responsibility under this Contract for equipment coordination, design, fabrication, installation, operation and guarantee, and the CONTRACTOR shall furnish and install all labor, equipment, materials, appurtenances, specialty items and services not provided by the manufacturer/supplier but required for a complete and operable system. The equipment covered by this specification is intended to be standard equipment of proven ability as manufactured by reputable concerns having extensive experience in the production of such equipment. The equipment furnished shall be manufactured and installed in accordance with the best practice and methods, and shall operate

satisfactorily when installed as shown and specified in the Contract Documents.

2. Attention is directed to the fact that the Drawings and Specifications are based on the use of clarifier mechanisms manufactured by Eimco Water Technologies. If the equipment accepted requires an arrangement different from that indicated on the Drawings or specified, the Contractor shall prepare and submit for review, detailed structural, mechanical and electrical drawings and equipment lists showing all necessary changes and embodying all specified features of the equipment he proposes to furnish. Such changes, if accepted, shall be at no additional cost to the Owner.

3. The manufacturer/supplier of the equipment specified herein shall be required to review and satisfy all relevant requirements of other Sections of the Contract Documents including the requirements of the Contract Drawings. The CONTRACTOR, manufacturer, supplier, fabricator and/or subcontractors furnishing and/or installing equipment, services and specialties associated with this Section shall fully coordinate their efforts to avoid potential claims that are based on failure to review relevant Contract Documents, including the Contract Drawings."

4. CONTRACTOR shall coordinate and review installation procedures under other Sections and coordinate the installation of items that must be installed to comply with the requirements of the Work specified under this Section.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The clarifier mechanisms shall be furnished by a manufacturer that is normally engaged in the manufacturing of large diameter (150 feet or greater) sludge and scum collection equipment. The effluent trough, support brackets, scum baffles and weir plates shall be furnished by a manufacturer that specializes in the manufacturing of these stainless steel components.

B. The manufacturer of the clarifier mechanisms shall have a minimum of ten (10) years of experience in the production of substantially similar equipment, and shall show evidence of satisfactory operation in at least five (5) similar installations.

C. Structural and mechanical design/analysis of the Clarifier Nos. 13 and 14 sludge collection mechanism and scum collection components, platforms and supports, effluent troughs, effluent boxes, support brackets, scum baffles, weir plates and center drive mechanisms and the Clarifier Nos. 15 and 16 effluent troughs, effluent boxes, support brackets, scum baffles and weir plates shall be performed and certified by a Registered Professional Engineer Licensed in the State of Michigan and paid for by the Contractor.

1. The structural and mechanical analysis shall be performed on all components to demonstrate compliance with the specified objectives. The computer program shall be a nationally distributed, commercial software package accounting for simultaneous bending and axial stresses and deflection.

D. Installer Qualifications: The equipment installer shall have a minimum of five (5) years of experience in the installation of substantially similar equipment and show evidence. The welders shall be qualified within the past year in accordance with AWS.

E. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM A 36, Standard Specification for Structural Steel.

2. ASTM A 48, Standard Specification for Gray Iron Castings.

3. ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

4. AWS D1.1, Structural Welding Code.

5. AISC, Manual of Steel Construction.

6. AISC, Code of Standard Practice for Steel Bridges and Buildings.

7. AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

8. AGMA Standards.

9. AGMA 2001-C95, Fundamental Rating Factors and the Calculation Methods for Involute Spur and Helical Gear Teeth.

10. AGMA 2004, Gear Materials and Heat Treatment Manual.

11. NEC, National Electric Code.

12. AFBMA - Anti-Friction Bearing Manufacturer's Association.

13. AGMA 908-B89.

14. AGMA 6034-A87, Worm Gears.

15. OSHA, Occupational Safety and Health Administration.

16. MIOSHA, Michigan Occupational Safety and Health Administration.

17. National Fire Protection Association 79, Electrical Standard for Industrial Machinery.

18. NEMA, Standards of National Electrical Manufacturers Association.

19. IEEE, Institute of Electrical and Electronic Engineers.

20. ANSI, American National Standards Institute.

1.03 SUBMITTAL

A. Shop Drawings: Submit for approval the following:

1. Manufacturer's literature, illustrations, paint specifications and engineering data including dimensions, materials, size, and weight of all components and complete assembly.

2. Drawings showing plans and sections of the equipment to demonstrate proper coordination between components, fabrication methods, assembly, accessories, installation details, and wiring diagrams. Drawings detailing connections to the existing circular clarifier components and detailed mounting arrangements.

3. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.

4. Certified motor data sheets for the two spare drive motors to include the same information being provided for the motors included in Section 11339, Center Drive Mechanism Rehabilitation.

5. Shop test results for the two spare drive motors to include the same information being provided for the motors included in Section 11339, Center Drive Mechanism Rehabilitation. Test results shall conform to the requirements of Article 2.02.H of this section.

6. Include the following product data on Shop Drawings or on accompanying data sheets.

a. Speed of collector rotation.

b. Direction of collector rotation.

c. Loads for which center pier foundation should be designed.

d. Type of materials used to construct all components, including reference standards and Brinnel hardness where hardness is specified.

7. Structural design/analysis of the sludge and scum collection

mechanisms and supports for circular Clarifiers No. 13 and 14 and the effluent troughs, effluent boxes, scum baffles, weirs and their supports for circular Clarifiers No. 13 - 16 shall be performed and certified by a Registered Professional Engineer licensed in the State of Michigan and paid for by the Contractor. The structural design/analysis calculations shall verify that the loads resulting from transporting the primary sludge solids, as specified herein, have been considered and are reflected in the structural design. The structural analysis shall be submitted with sufficient detail to demonstrate conformance to the Contract Documents.

a. The drawings shall include a diagram showing and labeling all members and loading case diagrams showing all applied forces and torques with their direction and magnitude.

b. A detailed description of the analysis program shall be provided.

c. The input tables for the structural analysis shall correlate directly with the diagram and loading case diagrams. They shall also include the area and moment of inertia for the member section.

d. An output table for the structural analysis shall include, for each member, joint displacements, member forces, support reactions, analysis results, member section forces, member stresses, and element forces.

8. Submit additional documentation of testing and structural analysis as specified in Section 01030, Summary of Work.

9. Submit catalog bulletins or similar publications illustrating drive assembly and overload protection system and describing its features and operation. Mark out inapplicable information.

10. Description of surface preparation, shop priming and finish painting system.

11. Deviations from the Contract Documents.

B. Field Test Results:

1. Submit a written report giving the results of the field tests required.

C. Operation and Maintenance Manuals and Training Manuals:

1. Submit complete installation, operation and maintenance manuals for clarifier mechanisms, including rehabilitated center drives. Manual shall include copies of all approved Shop Drawings, test reports, maintenance data and schedules, description of operation and spare parts information.

2. Furnish operation and maintenance manuals and training manuals in conformance with the requirements of Section 01160, Training and Operation & Maintenance Manuals.

D. Lubricant Specification: Furnish a lubricant specification for the type and grade necessary to meet the requirements of the equipment. Contractor shall provide a one-year supply of lubricants that are food grade and compatible for public water supplies.

E. Manufacturer qualifications in accordance with Paragraphs 1.02.A and 1.02.B of this Section.

F. Reports in accordance with Part 3.03 of this Section.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Prior to shipping, the equipment shall be completely inspected by the manufacturer to ensure that all equipment is complete and in compliance with all requirements. It shall then be boxed or crated as required by the manufacturer to prevent damage during shipment. All machined surfaces or matching connections shall be suitably protected to prevent damage.

B. Deliver materials to the site to ensure uninterrupted progress of the Work.

1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to not delay that Work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

D. Store mechanical equipment in covered storage off the ground and prevent condensation.

E. All boxes, crates, and packages shall be inspected by CONTRACTOR upon delivery to the site. CONTRACTOR shall notify ENGINEER if any equipment or components are lost or damaged; CONTRACTOR shall replace such lost or repair damage to new condition, in accordance with manufacturer's instructions to ENGINEER'S satisfaction.

PART 2-PRODUCTS

2.01 SERVICE CONDITIONS

A. General:

1. The primary clarifier equipment shall be suitable for readily transporting, collecting and removing settled primary sludge and skimmings as specified herein. All components of the articles that follow shall be

provided as new, unless indicated otherwise, and installed on Clarifier Nos. 13 and 14. Of these components, only troughs, weirs, scum baffles, effluent boxes, and their supports and ancillary equipment shall be provided and installed on Clarifier Nos.15 and 16.

2. Equipment for Clarifiers Nos. 13 and 14 shall be of the center column, center feed, and peripheral overflow type. The center driving mechanisms and platforms have been previously provided and installed under a separate contract. A spare center drive shall be refurbished under PC-756, as specified in Section 11339. The equipment for each Clarifier shall contain a four arm spiral blade sludge scraper collector and a four arm surface skimmer. The surface skimmers for both clarifiers, consisting of scum deflectors, skimmer arms and their supports, shall be salvaged from the existing clarifier mechanisms and reinstalled on the new clarifier mechanisms, and new neoprene hinges and C-scrapers shall be provided on each skimmer arm. Each entire structure and mechanism, including the bridge/walkway, shall be supported by the existing center cage support column assembly. The center driving mechanism shall rotate a suspended center cage, having twelve (12) spiral scraper blades, at a speed suitable for the material to be collected, as specified and as shown on the Drawings.

B. Service Conditions:

Process:	Primary Clarification
Number of Clarifiers	2 (Nos. 13 and 14)
Material Collected and Removed	Primary Sludge
Inside Tank Diameter	250-feet
Side Water Depth	11-feet
Freeboard	As Shown on the Drawings
Bottom Slope	Dual Slope: 1-inch and 2-inch in 12-inches (refer to Drawings)
Design Flows to Each Clarifier	Average: 68.5 mgd; Minimum: 50 mgd; Peak: 180 mgd; Maximum Hydraulic Capacity: 180 mgd
Surface Overflow Rate @ Design Average	1,580 g/d/sq.ft.
Surface Overflow Rate @ Peak Diurnal	3,670 g/d/sq.ft.
Solids Removal Rate, Average	106,000 lb./day
Solids Removal Rate, Maximum	288,000 lb./day
Underfloor Solids Concentration	2.0 to 8.0 percent
Sludge Blanket Depth	14 feet at center of clarifier
Influent Dispersion Well	40-feet diameter, 12-feet 11-inch below water surface elevation of 100.5 to the bottom of the well, plus 1-foot 1-inch minimum freeboard
Peripheral Speed of Mechanism	10 to 15 fpm (0.0127 to 0.0190 rpm) (0.762 to 1.14 rpm)
Spiral Blade Depth	9 to 36 inches

2.02 DETAILS OF CONSTRUCTION

A. General:

1. Corresponding parts of multiple units shall be interchangeable.

2. No chains, sprocket gears, bearings, or similar operating components shall be below the liquid surface or in contact with the liquid.

3. The clarifier mechanisms being furnished for Clarifiers No. 13 and 14 shall operate continuously and compatibly with the existing recently-refurbished Eimco center drive mechanisms and the spare unit being refurbished under Section 11339, at the continuous torque rating without excessive wear, and shall permit development of the maximum operating torque without damage to or failure of the mechanism and drive components.

B. Materials:

1. Structural steel shall be ASTM A 36 and shall conform to requirements of AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings." Maximum allowable stresses on structural steel under continuous operating torque loading shall not exceed those permitted in the AISC specifications.

2. Welding shall conform to AWS Dl.1, Structural Welding Code.

3. Unless otherwise shown or specified, all steel and stainless steel shall have a minimum thickness of ¼ inch. All bolts shall have a minimum diameter of ¾ inch.

4. Except where otherwise shown or specified to be stainless steel, bolts and fasteners shall conform to ASTM A 307. Stainless steel shall be Type 316, or Type 316L if welded.

5. Iron castings, where used, shall conform to ASTM A 48.

6. Anti-friction bearings shall have minimum B-10 life rating of 200,000 hours.

7. Provide neoprene gasketing per ASTM C 864-90.

8. A certified welder shall do all field welding.

9. Adhesive anchors shall be Type 316 stainless steel.

C. Center Cage Support Column Assembly:

1. The existing center cage support column assembly, including pipe

columns and orifice plates, shall be retained unless testing and structural analysis specified in Section 01030 Summary of Work indicates the need for replacement or rehabilitation.

2. Maximum exit velocity shall be 1.0 fps or less at the specified maximum flow. If needed, the existing columns shall be provided with deflector plates designed by the equipment manufacturer to evenly distribute the influent flow into the influent dispersion well.

D. Center Cages:

1. Provide center cage of steel truss construction designed to support and rotate the sludge collection rake arms. Design center cage for maximum operating torque or a minimum steel thickness of ¼ inch.

2. Design center cage for maximum specified torque developed by the center drive unit plus live loads and dead loads or a minimum steel thickness of 3/8-inch, whichever is more conservative.

3. Bolt center cage to center drive mechanism, which shall rotate the center cage, the attached skimmer arms and the influent dispersion well. Bolts and fasteners shall be Type 316 stainless steel.

E. Influent Dispersion Wells:

1. Provide welded Type 316L stainless steel influent dispersion well concentric with center column, supported by center cage, and stiffened with angles. Top edge shall be approximately 1-foot 1-inch above the water surface elevation of 100.5. Design shall be such as to diffuse feed into tank to greatest extent possible by use of energy dissipating baffles. The influent dispersion well shall have a clearance around the structural members and the center column to permit proper operation.

2. Minimum dimensions:

a. Diameter: 40-feet.

b. Depth: 12-feet, 11-inches plus 1-foot, 11-inches minimum freeboard.

c. Baffles: Seventy-two (72) symmetrical adjustable baffles sized for maximum velocity of 0.16 fps at maximum design flow.

d. Minimum Type 316L Stainless Steel Plate Thickness: 3/8-inch.

3. Each influent dispersion well shall have seventy-two (72) equally spaced baffles as shown on Drawings.

4. Support each influent dispersion well from the rotating cage with

additional support members as required. Supports shall be carbon steel.

5. All pieces shall be shop fabricated and field installed. Field welding shall be permitted as approved by the ENGINEER.

6. Each influent dispersion well shall be constructed of a welded Type 316L stainless steel frame consisting of structural stainless steel angles and channels with continuous top and bottom pieces. Structural stainless steel shall be designed by the manufacturer for the maximum operating loads.

7. Provide structural Type 316L stainless steel members at the connection of each scum deflector, 2-foot-0-inch by (depth of scum deflector) bent plate to attach the scum deflector. Provide a minimum of four 1/2-inch Type 316 stainless steel bolts for scum deflector connections.

8. The influent dispersion well shall be supported from the cage assembly, and or rake arms in a manner determined suitable by the manufacturer, and subject to submittal by the manufacturer and approval by the Engineer.

9. Field welding for structural assembly of the influent dispersion well shall be permitted as approved by the ENGINEER.

F. Rotating Rake Arms and Spiral Blade Sludge Scrapers:

1. Provide four full radius rotating rake arms conforming to dual slope of tank floor and consisting of structural steel box trusses attached rigidly to the center cage. Design trusses for minimum torque of 2,000,000 foot pounds (500,000 ft-lbs. per arm) or torque determined by the CONTRACTOR'S Registered Professional Engineer, whichever is greater for the conditions of service specified herein. Minimum truss member thickness shall be 3/8-inch.

2. Arms shall be self-supporting and without tie rods. Provide adjustable bolts at top chord and heavy pins and yoke at bottom chord for vertical adjustment or other approved means.

3. The mechanism shall include four sludge rake arms covering the full diameter of the tank. The arms shall be of steel box truss construction and shall support twelve spiral-shaped steel scraper blades and four straight scrapers at the sludge hopper with adjustable Type 316 stainless steel squeegees. Triangular truss construction is not acceptable. Each squeegee shall have 1-1/2 inch minimum projection with at least 1-inch vertical adjustment.

4. Each inner and outer blade shall have continuously varying height and arc end points as shown in the table below.

Spiral	Radius to	Radius to	Blade Height	Blade Height
Inner	11'-0"	46'-5"	36’	24’
Intermediate	42'-0"	75'-0"	24’	15’
Outer	73'-8"	123'-9"	18’	9’

5. Spiral blades shall be fabricated to attach to the bottom of the rake arms.

6. Inner spiral blades shall be attached to drive cage to stabilize mounting arrangement. Provide a minimum 2-inch by 2-inch continuous angle on each side of the truss, or other approved means, to stabilize the top blade welded to blades and truss. Provide other supporting members as required for blade stabilization.

7. For each spiral scraper blade, provide vertically adjustable full length No. 22 gage (0.036-inch thick) Type 316 stainless steel squeegees fastened with Type 316 stainless steel bolts and nuts. Squeegees shall be vertically slit at 12-inch centers and project 1-1/2-inches below scraper blades.

8. The configuration of the blades shall be a logarithmic spiral curve with a constant 30-degree angle of attack on the outer blades and 35 degree angle of attack on the intermediate and inner blades. The blades shall rake the sludge to the sludge hopper. All blades must overlap by a minimum of 3-feet. Minimum blade thickness shall be ¼ inch.

9. Provide all additional bracing for the center cage and truss arms as required to maintain the unit integrity.

10. The rotating rake arms on Clarifier No. 13 shall be interchangeable with the rotating rake arms on Clarifier No. 14.

11. All hardware shall be Type 316 stainless steel.

G. Bridge and Walkways and Center Drive Platforms:

1. The existing upper center drive platforms and bridge and walkway assemblies of Clarifiers No. 13 and 14 shall not be demolished. The existing lower center drive platform and the existing ladder between the two platforms shall be demolished. Bridge and walkway assembly shall be supported from the tank wall and the upper drive platform. Bridge/walkway and walkway railings shall be painted in accordance with Section 09900, Painting, after fabrication. Bolted connections shall use Type 316 stainless steel bolts. Field welded connections and other touch

up shall be cleaned and coated in accordance with Section 09900, Painting. The camber shall be a minimum of 3-inches.

2. Railings around upper center drive platforms shall be extended to fill the gaps caused by the demolition of the ladders to the lower platforms. Conform to applicable requirements of Section 05520, Handrails and Railings.

3. If the existing bridges are temporarily removed to facilitate removal of lead paint, they shall be reinstalled after the completion of the paint removal in accordance with the manufacturer's recommendations. During bridge removal, Contractor shall also conform to applicable requirements in Division 16 and Division 17. Existing bridges and their railings shall be sandblasted and painted in accordance with Section 09900, Painting, Section 02075, Hazardous and Toxic Materials, and Section 02085, Lead Based Paint Removal.

4. If bridge is removed during construction, provide Teflon or high density polyethylene bearing for the bridge at the tank wall.

H. Center Drive Mechanisms: <u>No new center drive mechanisms are being provided or installed as part of this contract.</u> One existing drive unit is being refurbished under Specification Section 11339 for use as a spare drive. This unit was originally manufactured to the following specifications (excerpted from specification Section11336 of PC-740):

1. Provide center drive mechanism mounted on center column with Type 316 stainless steel leveling bolts. The drive mechanisms shall be designed for continuous and peak operating torques specified in accordance with AGMA standards. The mechanism shall be designed to resist overturning moments resulting from unbalanced loads and to maintain stability of the mechanism. The center drive mechanism shall consist of turntable base with ball race, spur gear with pinion gear; dual gear motor, and drive units.

2. Each drive assembly shall consist of dual gear motor drives, worm gear units, turntable type main spur gear with pinion gears, shear pin couplings, low level oil alarm, oil heater and thermostat, zero speed indicating device, overload alarm system, drive and driven sprockets, drive chain housings and supporting structure.

3. Drives shall have a minimum design life of 20-years based on 365 day, 24-hour, continuous operation at the rated maximum speed and continuous operating torque rating with moderate shock loading of 1.5 times the continuous operating torque

4. Drive Units:

   a. Motors shall be high efficiency totally enclosed, fan cooled,

severe duty, chemical service type, suitable for outdoor operation.

b. Motors shall be suitable for operation on 480 volt, 3 phase, 60 Hz power.

c. Motor shall be of adequate size so that there is no overload on the motor above rated nameplate horsepower under all conditions of service. Motors shall not be rated less than 5 hp and a speed of 1750 rpm.

d. Furnish and install space heaters, 120V, single phase

e. Motor shall have a 1.15 service factor, be NEMA designed for electrical load sharing and shall comply with the latest ANSI, NEMA, and IEEE Standards as a minimum.

f. Locked rotor current shall be as specified in NEMA standards.

g. Motor thrust bearings shall be adequate to carry continuous thrust loads under all conditions of service and shall have a minimum B-10 Life of 30,000 hours.

h. Motor shall have a stainless steel nameplate which shall provide the following: type, frame, insulation, class, Hp, full load current, RPM, centigrade degree rise, manufacturer's name and serial number, model, voltage, locked rotor KVA code, bearing number and a connection diagram.

i. Motor terminal box shall be oversized to provide adequate space for connections and shall be constructed of cast iron neoprene gasketed and bolted. The motor leads shall be permanently marked in agreement with the connection diagrams.

5. Center drive mechanism shall be designed:

a. Continuous operating torque: 1,000,000 ft.-lbs. @ 0.0127 rmp.

b. Alarm torque: 1,100,000 ft.-lbs.

c. Shutdown torque: 1,600,000 ft.-lbs.

d. Release clutch/shear pin setting: 1,800,000 ft.-lbs.

e. Maximum operating torque: 2,000,000 ft.-lbs. (500,000 ft-lbs per arm) or torque determined by the CONTRACTOR's Registered Professional Engineer, whichever is greater for the conditions of service specified herein.

f. Field test torque: (at alarm and shutdown torques).

6. The gear train including the gear motors, worms, dual pinion gears and spur gear shall be designed to develop to the continuous torque specified above at a design stress not exceeding 40% of the yield strength of the parent material used for the manufacture of the gears. The entire drive system shall safely withstand a shutdown torque specified above.

7. The secondary gear assemblies and worm gear assemblies shall be enclosed in cast iron, dust tight housings and provided with neoprene seals. The main gear shall run in an oil bath. The housing shall be provided with oil level sight gauges. Low level oil sensing and warning system, oil fill and drain connections and condensate drain connections from the low points of the oil reservoir. An oil heater with thermostat shall also be provided. The main gear housing shall be bolted to the top of the stationary influent column with Type 316 stainless steel bolts and shall be capable of transmitting the Mechanisms Design Strength.

8. The main gear shall be constructed of Alloy Steel AISI 4140 heat treated to 29-32 Rc, supported and rotated on the main bearing. The main gear shall have a minimum pitch diameter of 120 inches and minimum tooth face depth of 15 inches.

9. The main bearing and the main gear shall be two separate and separable entities, such that the replacement of the other.

10. The two (2) main pinions shall be constructed of heat treated Alloy Steel, AISI 4142H heat treated 43-46 Rc, and machined after heat treatment to ensure alignment of gear teeth for proper tooth contact.

11. Each pinion must rotate in a lower taper roller bearing assembly and similar upper bearing encasement machined into the worm gear housing. The lower bearing pocket shall not be the collection point for the condensation. Pinion shafts shall be one piece extending through the worm gear without intermediate couplings.

12. The two (2) secondary gears shall be constructed of heat treated Alloy Steel, AISI 4135, heat treated to 29-32 Rc. The secondary pinions shall be constructed of AISI 4142H Alloy Steel, heat treated to 43-46 Rc.

13. The two (2) worm gear assemblies shall consist of a heat treated Alloy Steel worm (AISI 4142H) heat treated to 43-46 Rc, and worm gear with manganese bronze gear rim. Manganese bronze worm gear minimum pitch diameter shall be 21.49 inches and a minimum face depth of 2.75 inches.

14. The worm gear shall be designed per AGMA 440 standards for the torque specified. Planetary gear units are not considered equal in design.

15. The main bearing shall be a 4-point contact, precision type bearing with

fully contoured raceways. The bearing race diameter shall be aluminum of 123 inches. Bearing ball diameter shall be a minimum 1 ¼". Bearing balls shall be chrome steel AFBMA GR.500 minimum.

16. The bearing life shall be based on the life to initial pitting of the linear element. The drive unit shall be designed for reverse capabilities.

17. Gearing shall be designed and rated using the criteria established by the following A.G.M.A. Standards. Surface durability (Pitting) and Strength rating of spur gear teeth shall conform to AGMA 218.01. The output torque rating of the drive shall be based on the smaller of the two valves determined from the above AGAM Standards.

18. Manufacturers of this equipment shall submit calculations to the ENGINEER for approval substantiating the output torque rating of the drive selected. Calculations shall include all gears and pinions and other components of the drive train. Calculations shall be submitted per the requirements of Paragraph 1.03 of this Section.

19. The calculations shall clearly specify the values used for the following design parameters for Surface Durability and Strength ratings:

    a. Number of Pinions

    b. Actual Fact Width

    c. Tooth Geometry Factors (I and J factors)

    d. Load Distribution Factor

    e. Allowable Contact Stress

    f. Allowable Bending Stress

    g. Pinion Pitch Diameter

    h. Tooth Diametrical Pitch Hardness Ration Factor

    j. Elastic Coefficient

    k. Life Factor

20. A load distribution factor shall be determined using the empirical method outlined in AGMA 218.01. Mesh alignment factor shall be based on AGMA values shown for Commercial Enclosed Gear Units (the minimum value allowed for load distribution factor shall be 1.3). The net face width for surface durability calculations shall not exceed the actual face width of the narrower of the two mating gears. For parameters, which are material dependent, such as allowable contact stress, the calculations

shall include a full description of the materials and heat treatment used.

I. Surface Skimmers (scum deflectors and skimmer arms):

1. For Clarifiers No. 13 and 14, remove the four existing rotating PVC scum deflectors per clarifier and their supports and reinstall them on the new clarifier mechanisms to collect and move skimmings outward from the influent dispersion wells toward the scum baffles. The existing skimmer arms and their supports shall be reinstalled on the ends of the scum deflectors to sweep the skimmings collected by the scum deflectors to the scum troughs. The skimmer arms shall be configured as shown on the Drawings. The surface skimmers shall be supported from the four sludge collector rake arms. Do not support skimmer from scum baffle.

2. Install each skimmer arm so that it is carried across the opening of the scum trough without resting on the bottom neoprene strip. The skimmer arm shall be adjustable to vary the quantity of liquid discharged with the scum. Also, movement in vertical plane shall be feasible so that the bottom edge of the blade is always in contact with the scum trough, even if the arm is not horizontal.

3. The skimmer arms shall trail the scum deflectors and shall be designed to sweep the scum up the scum trough ramp and into the scum trough.

   The skimmer arms shall be fitted with new replaceable neoprene wipers to maintain contact with the perimeter scum baffle. Fasteners for the wipers shall be Type 316 stainless steel. The skimmer arm shall be adjustable to correct for irregular alignment.

4. Provide Type 316 stainless steel anchor bolts in accordance with the manufacturer's recommendations.

J. Effluent Troughs:

1. Provide Type 316L stainless steel effluent trough, sized as shown, of welded or bent-plate construction, angles, bolts and nuts and all required anchors and fasteners.

2. Fabricate trough of 5/16-inch minimum Type 316L stainless steel plate in chord sections suitable for field assembly.

3. All welds shall be continuous and watertight. Troughs shall be shop fabricated in sections complete with attaching angles, splice plate holes designed for convenient assembly to adjoining sections in the field. All angles, miter, bolt holes, and joints shall be made to produce accurate fitting.

4. All connections between adjoining sections and at concrete walls shall be made watertight by means of approved gasketing.

5. The stainless steel trough shall be fastened to Type 316L stainless steel trough support brackets, which shall be so spaced to adequately support the effluent troughs, scum baffles and weirs. Approved shims shall be installed as required to bring the effluent trough supports to proper elevation. Shim stock less than 1/8 inch thick shall be Type 316 stainless steel.

6. Provide Type 316L stainless steel effluent boxes from the effluent trough to the concrete wall as shown.

K. Scum Baffles:

1. Provide scum baffles of 5/16-inch thick Type 316 stainless steel plate supported from effluent trough brackets.

2. The clarifier mechanism manufacturer shall design the scum baffles to have adjustable heights, as indicated on the drawings.

3. Adjust baffle to form a true circle conforming to radius of the skimmer. Top of baffle shall be adjusted to the height requested by the Owner,

4. All bolts and nuts shall be of Type 316 stainless steel.

L. Weir Plates:

1. Provide effluent weir plates of 5/16-inch thick Type 316 stainless steel, secured to the effluent trough and adjustable. The weir plate shall have "V" notches and shall use butt plates at the joints. Rubber gaskets shall be provided where shown or required for watertight seals.

2. All bolts and nuts shall be of Type 316 stainless steel.

M. Manufacturer: Provide Circular Primary Clarifier Mechanisms of one of the following:

1. EIMCO Water Technologies.

2. Or ENGINEER approved equal.

2.03 FABRICATION AND MANUFACTURE

A. Fabricate in sections as large as truck or rail shipment permit.

B. Assemble equipment for each tank in the shop. Manufacturer shall contact the OWNER for inspection at the OWNER'S option. Match mark equipment with erection marks before dismantling for shipment.

2.04 SPARE PARTS

A. Furnish and deliver the following spare parts carefully boxed or packaged and plainly marked for reordering:

1. Two (2) sets of Type 316 stainless steel squeegees.

2. Two (2) sets of neoprene gaskets for skimmers.

3. Two (2) sets of oil seals.

4. Two (2) sets each of oil seals for the worm shaft and pinion shaft of the existing drives.

5. Two (2) scum deflector wipers including necessary bolts, nuts and washers.

6. Four (4) skimmer wiper clamps including bolts and nuts.

7. Four (4) skimmer bottom wiper blades and two (2) slide wiper blades.

8. One (1) zero speed sensor.

9. One (1) worm gear for the existing drives.

10. One (1) spur and pinion gear for the existing drives.

11. Six (6) shear pin couplings and 50 shear pins for the existing drive mechanism.

12. Two (2) 5-HP drive motors meeting the requirements of Article 2.02.H of this section.

13. One (1) low level oil sensor.

14. One (1) spare sight glass.

15. One (1) spare immersion heater.

B. CONTRACTOR shall store and safeguard spare parts until completion of the Work, at which time they shall be inventoried, delivered and placed in an area designated by OWNER for stocking and tagging.

C. Manufacturer shall furnish a list of additional recommended spare parts for an operating period of one (1) year. The list shall describe each part, the quantity recommended, and the unit price of the part. OWNER will purchase all, some, or none of the recommended parts at his option.

2.05 SURFACE PREPARATION AND PAINTING

A. Motors, drives, frames, baseplates, and appurtenances shall receive shop primer and shop coating in accordance with Section 09900, Painting.

B. Machined, polished, and non-ferrous surfaces shall be coated with corrosion prevention compound.

C. Surface prepa`ration and painting shall conform to Section 09900, Painting.

D. CONTRACTOR shall certify, in writing that the shop primer and coating system is compatible with the finish coating system in accordance with Section 09900, Painting.

E. Surface preparation and field painting of structural steel, scrapers, and other ferrous metals shall conform to Section 09900, Painting.

PART 3 -EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with the Drawings, approved Shop Drawings, the manufacturer's instructions, and the supplemental requirements below.

B. Place concrete overlay over top of the structural slab as shown on Drawings, after equipment has been installed. Minimum acceptable concrete overlay thickness is 2-inches. Concrete overlay shall be applied in accordance with Section 03300, Cast in Place Concrete, and as follows:

1. Install screed along collector arm, in place of scraper blades, in accordance with manufacturer's recommendations. Ensure that equipment has been checked for accurate adjustment before starting the placement of concrete overlay. Place sand piles around bottom of tank. Rotate mechanism with screed attached and check level of sand piles to ensure proper clearance of screed over bottom of tank. If there is insufficient room for placing the concrete overlay, remove the high spots in the concrete or adjust the mechanism, or both, to provide proper clearance.

2. Start two rings of concrete overlay which can be worked by a crew, 2’ wide, one for each arm, at the outer edge of the clarifier. These rings can be gradually widened as they approach the center of the clarifier. The concrete overlay material should not be allowed to build up in front of the screed. Continue the outer ring in a spiraling pattern, working towards the center of the basin. Concrete finishers should work just ahead of the screed arm(s) to be certain the concrete overlay is proper thickness to cover the area and to prevent excessive loads accumulating

in front of the screed board. Also wet down the concrete floor ahead of the concrete overlay to ensure a good bond. When a load of concrete overlay material is placed in front of a moving arm, it should be wide enough for the cement finishers to work it at the rate of arm travel. Never stand or put weight on an arm during placement of the concrete overlay material. Do not stop the mechanism once placement has started. Restarting will result in screed jerking and digging in the concrete overlay material.

3. When placement is complete, rotate the mechanism 2 to 3 times to pick up any concrete overlay material that may have sloughed toward the center. If sloughing occurs, it will be necessary to remove the excess and fill in the low areas with fresh concrete overlay material. Careful placement should produce a fished bottom that is uniform within +/- ¼" of the specified elevation.

4. Remove any concrete overlay that may have fallen into the sludge hopper before it sets up.

5. Remove the screeds after the concrete overlay has dried.

6. Install scraper blades and squeegees after curing operation. Set squeegees on basin bottom. Rotate collectors and adjust squeegees to touch basin bottom in high areas. Check clearance in lower areas.

C. Install weir plates and scum baffles so that tops of same are within 1/16inch, plus or minus, of elevations shown on the Drawings.

D. Align, adjust, and lubricate equipment in accordance with the manufacturer's instructions, and leave in proper working condition.

E. Touch up minor scratches and scrapes in painted finishes as specified in Section 09900, Painting.

3.02 FIELD TESTS

A. After CONTRACTOR and ENGINEER have mutually agreed that the equipment installation is complete and ready for continuous operation, CONTRACTOR and a qualified field service representative of the manufacturer shall conduct a running test and a torque test in the presence of ENGINEER to demonstrate that the mechanism and its controls will function correctly and that it is structurally sound.

B. All sludge collector units with their controls shall be field tested. Tests shall demonstrate to ENGINEER that each part and all parts together function in the manner intended. The CONTRACTOR at his expense shall provide all necessary testing equipment and manpower. CONTRACTOR will furnish all power and incidental material and labor required for the tests.

C. In the event that the manufacturer is unable to demonstrate to ENGINEER that his equipment meets the requirements of the above described test, the deficient equipment will be rejected and CONTRACTOR shall adjust and/or modify and retest the equipment as often as necessary to meet the specified requirements. No separate payments will be made for adjustments and/or modifications.

D. Field Testing:

1. Field test and calibrate equipment to demonstrate to the OWNER'S representative that all equipment will satisfactorily perform the functions and criteria specified in Part 2.

2. Demonstrate to the OWNER'S representative that each sludge collector shall do the following:

a. Activate high torque alarm at specified alarm torque in accordance with the Drawings.

b. Activate high-high torque alarm and shutdown automatically when it reaches the specified shutdown torque condition.

3. The foregoing requirements shall be accomplished strictly in accordance with procedures designed and recommended by the manufacturer and shall involve the use of hydraulic cylinders anchored to clarifier floors to apply loads to collector arms.

4. Provide all test apparatus required at no additional cost to OWNER.

5. Follow testing procedures recommended by the manufacturer and approved by the ENGINEER.

3.03 MANUFACTURER'S SERVICES

A. A factory-trained representative shall be provided for installation supervision, start-up and test services, and operation and maintenance personnel training services. The representative shall make three (3) visits to the site. The first visit shall be for assistance in the installation of equipment. The second visit shall be for checking the completed installation and startup of the system. The third visit shall be as described under Section 01160, Training and Operations & Maintenance Manuals.

B. All costs, including travel, lodging, meals, and incidentals shall be considered as included in CONTRACTOR'S lump sum bid price.

C. Reports: Submit to OWNER a report by manufacturer of each visit to the site that provides complete information on time, schedule, tasks performed, persons contacted, problems, corrections, test results, training, instruction, and all other pertinent information.

D. After field testing services by the manufacturer, the CONTRACTOR shall submit to the ENGINEER, per the requirements of Section 01180, Equipment, Materials, Parts, and Tools, a certification letter on the manufacturer's letterhead and signed by the manufacturer certifying that the equipment was installed per the manufacturer's recommendations and requirements and shall furnish all field test data per Section 01180, Equipment, Materials, Parts, and Tools.

End of Section