SECTION 11339

CENTER DRIVE MECHANISM REHABILITATION

PART 1 -GENERAL

1.01 SCOPE

A. CONTRACTOR shall provide all labor, materials, equipment, appurtenances, and incidentals as shown, specified and required in the Contract Documents to rehabilitate one existing center drive mechanism currently stored outdoors at the Detroit Wastewater Treatment Plant (DWWTP), including motors, all requisite supports and all appurtenances. All structural, mechanical, electrical, instrumentation and control work required for rehabilitating the center drive mechanism shall be done exclusively by the original equipment manufacturer, Eimco Water Technologies, in close coordination with the ENGINEER and involved subcontractors. The rehabilitated center drive mechanism is to be stored at the DWWTP as a spare unit for use on Primary Circular Clarifiers No. 13-14.

B. CONTRACTOR shall remove the center drive mechanism from the DWWTP and deliver the mechanism to Eimco Water Technologies' facility. Eimco Water Technologies shall inspect and completely disassemble the center drive mechanism and all components of the mechanism into individual parts. A complete inspection and evaluation shall be done on all components of the mechanism to determine the extent of rehabilitation or replacement required. All components shall be checked against the original manufacturing specifications to verify if component tolerances are within the original specification. Eimco shall prepare a written engineering evaluation report detailing the components that require rehabilitation and replacement and the costs associated with the rehabilitation of the center drive mechanism. The report shall be submitted to the ENGINEER for review and approval prior to proceeding with the rehabilitation work.

C. CONTRACTOR shall rehabilitate the center drive mechanism upon receipt of the ENGINEER's written authorization to proceed. It is anticipated that this authorization will be given toward the end of the construction period. Rehabilitated mechanism shall be of appropriate materials of construction and lubricants applied shall be suitable for the environment in which the mechanism will eventually be installed.

D. CONTRACTOR shall deliver to and unload, at the location directed by the ENGINEER, the rehabilitated or replacement center drive mechanism at the DWWTP.

E. All wiring, conduit, electrical equipment and appurtenances furnished shall meet the requirements of applicable Division 16 and Division 17 Specifications.

F. Related Sections:

1. Division 1, General Requirements.

2. Section 02050, Demolition.

3. Division 5, Metals.

4. Section 09900, Painting

5. Section 11050, Equipment General Provisions.

6. Section 11336, Circular Primary Clarifier Mechanisms.

7. Division 15, Mechanical.

8. Division 16, Electrical.

9. Division 17. Instrumentation and Controls.

H. Coordination:

1. To ensure that the rehabilitated center drive mechanism can function as a spare unit in Clarifiers No. 13-18, the CONTRACTOR shall obtain all the equipment specified herein from Eimco Water Technologies, in whom shall be vested unit responsibility for the interchangeability of the spare center drive mechanism with the units currently installed in Clarifiers No. 13 and 14 which were recently rehabilitated by Eimco Water Technologies. However, the CONTRACTOR shall retain ultimate responsibility under this Contract for equipment coordination, design, fabrication and guarantee.

2. 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 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.

1.02 QUALITY ASSURANCE

A. The work specified under this Section shall be furnished by Eimco Water Technologies with staff fully experienced, reputable and qualified in the dismantlement, manufacture, rehabilitation and installation of such equipment. The rehabilitated mechanisms and all related equipment, materials and appurtenances shall be designed, constructed and tested with the best practices and methods and as shown, specified and required.

B. Center drive component manufacturers shall have a minimum of ten (10) years of experience in the rehabilitation and production of substantially similar equipment, and shall show evidence of satisfactory operation in at least five (5) similar installations.

C. Shop Tests and Factory Inspections:

1. Motor Performance Shop Test:

a. Each new or rehabilitated motor shall be given a complete initial shop test at the motor manufacturer. Test reports shall provide the following minimum information:

1) Efficiency at 1/2, 3/4 and full load.

2) Power factor at 1/2, 3/4 and full load.

3) Percent slip at rated full load.

4) No load, running light, full load and locked rotor current.

5) Current balance check.

6) Test curves for current, voltage, brake horsepower and power factor.

7) Full load heat run.

8) Vibration check.

9) No load sound pressure level in dB on the A weighted scale in accordance with the procedures of IEEE Standard 85.

10) Temperature rises and results of dielectric tests.

11) Motor type and frame size.

12) Bearing type and lubrication medium.

13) Insulation and enclosure type.

b. If the shop tests results indicate that a motor does not conform to specified or guaranteed performance as specified herein and in Section 11336, the motor shall be modified and retested, at no additional cost to the OWNER, until full compliance with specified and guaranteed performance can be demonstrated.

c. Ten copies of certified test data covering each shop test shall be submitted to the ENGINEER for approval.

2. Drive Performance Shop Test:

a. Each drive shall be given a complete initial shop test at the drive manufacturer. Each drive shall be tested under load over its full operating range for a minimum of 2 consecutive hours.

b. If the shop tests results indicate that a drive does not conform to specified or guaranteed performance as specified herein and in Section 11336, the drive shall be modified and retested, at no additional cost to the OWNER, until full compliance with specified and guaranteed performance can be demonstrated.

c. Ten copies of certified test data covering each shop test shall be submitted to the ENGINEER for approval.

3. Performance Shop Tests:

a. Each test shall be witnessed by a Registered Professional Engineer, who may be an employee of the manufacturer. He shall sign and seal all reports and shall certify all tests were performed. Tests shall be conducted in conformance with applicable methods described in Section A6 of AWWA E101.

b. All testing apparatus and measuring devices shall be properly calibrated and proof of calibration shall be furnished to the Engineer for approval.

c. Shop tests shall be witnessed as specified in Section 01180, Equipment, Materials, Parts and Tools.

d. If the shop tests results indicate that a system does not conform to specified or guaranteed performance as specified herein and in Section 11336, the system shall be modified and retested, at no additional cost to the OWNER, until full compliance with specified and guaranteed performance can be demonstrated.

e. New and rehabilitated center drive mechanisms shall not be shipped until the ENGINEER has approved the test reports.

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

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

2. AGMA Standards.

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

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

5. AGMA 908-B89.

6. AGMA 6034-A87, Worm Gears.

7. AISC, Manual of Steel Construction.

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

9. ANSI, American National Standard Institute.

10. ASTM A 36, Standard Specifications for Structural Steel.

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

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

13. AWS D1.1, Structural Welding Code.

14. IEEE, Institute of Electrical and Electronic Engineers.

15. MIOSHA, Michigan Occupational Safety and Health Administration.

16. National Fire Protection Association (NFPA) 79, Electrical Standard for Industrial Machinery.

17. NEC, National Electrical Code.

18. NEMA, Standards of National Electrical Manufacturers Association.

19. OSHA, Occupational Safety and Health Administration

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following;

1. Complete shop drawings, plans, sections and schematics which shall show details of installations and connections to work to demonstrate proper coordination between components, fabrication methods, assembly, accessories, installation details and wiring diagrams. Drawings shall detail connections to the existing circular clarifier components and detailed mounting arrangements. Also, furnish catalog data and parts schedule in sufficient detail to serve as a guide in assembly and

disassembly of the drive units and in ordering repair and replacement parts.

2. Setting drawings, templates and directions for the installation of all appurtenances. Three (3) certified motor data sheets for each type and size of motor. The data sheet shall show winding resistances; torques; guaranteed minimum efficiencies at full, 3/4 and 1/2 load; power factors; slip; full load, locked rotor, and running light amperes; and temperature rise and results of dielectric tests. All values shall be from tests of previously manufactured electrically duplicate motors. Data sheets shall be marked to indicate motor application, manufacturer, type, frame size, bearing type, lubrication medium, insulation type, and enclosure type.

3. Calculations based on AGMA standards for spur and pinion gear durability and strength, to verify compliance with the specified continuous twenty (20) year torque rating. The entire clarifier mechanism shall be sized and the torque calculations shall verify that the loads resulting from transporting the primary sludge solids and scum, as specified herein, have been considered and are reflected in the sizing and design.

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

    a. Torque at which collector will stall.

    b. Torque at which collector high torque warning and shutdown alarm is set.

    c. Torque at which collector is designed to operate continuously.

    d. Speed of collector rotation.

    e. Direction of collector rotation.

    f. Service factor rating of primary gear reducer.

5. Type of materials used to construct all components, including reference standards and Brinnel hardness where hardness is specified. Submit catalog bulletins or similar publications illustrating drive assembly and overload protection system and describing its features and operation. Mark out inapplicable information.

6. Control system data including, but not limited to, the following:

    a. Detailed product information on the control system instruments, components and control devices.

    b. Control system panel construction and layout drawings including locations of external wiring and piping connections and mounting

and installation details.

c. Panel wiring and piping diagrams including identification of external wiring connections.

d. Electrical control schematics in accordance with NFPA 79, Annex AD@ standards.

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

8. Manufacturer and installer qualifications..

9. Deviations from the Contract Documents.

B. Shop Test Results:

1. Submit results of drive performance tests.

2. Submit results of motor performance tests.

C. Operation and Maintenance Manuals:

1. Submit complete installation, operation and maintenance manuals including 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 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.

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

F. Reports in accordance with Part 3.05 of this Section.

G. Certificates:

1. The manufacturer shall provide an affidavit of compliance with all applicable provisions of this Section.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The center drive mechanism shall be complete when shipped and the manufacturer shall use all due and customary care in preparing them for shipment to avoid damage in handling or in transit. Particular care shall be

taken to see that the parts are completely secured in position before shipment. Parts that are to be anchored to existing or modified structures may be shipped separately if requested by the CONTRACTOR. The transported rehabilitated center drive mechanism shall be securely bolted or otherwise fastened to skids in such a manner that they may be safely handled. 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 properly wrapped and packed by the test facility for long term storage and 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. Store materials as directed by the Owner 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.

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

D. 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.

1.05 WARRANTY

A. Rehabilitated and new center drive mechanisms warranty shall be a two year warranty, including parts and labor, against defects in material, construction, workmanship and performance from the OWNER'S date of acceptance and placement into full, continuous operation.

B. Warranty shall be in accordance with the General Conditions and Section 01170, Warranties and Bonds.

PART 2-PRODUCTS

2.01 CENTER DRIVE MECHANISM

A. The center drive mechanism to be rehabilitated is an Eimco model C120B2P drive with two 5 hp motors.

B. The manner of rehabilitation for the rehabilitated center drive mechanisms shall depend upon an inspection(s) and an engineering evaluation(s) performed by Eimco Water Technologies and, in turn, concurred with, in advance, in writing, by the ENGINEER.

2.02 OVERLOAD PROTECTION SYSTEMS

A. Each drive unit shall be equipped with an electrical-mechanical overload control device. The device shall be activated by thrust from the worm shaft. A calibrated spring will react to the worm thrust and allow axial movement of the worm shaft to activate a pointer. The pointer shall provide a visual reading of the relative main gear output torque on a 1 to 100 percent graduated scale. (100% equals 2,000,000-ft. lbs. or torque determined by the CONTRACTOR's Registered Professional Engineer, whichever is greater for the conditions of service specified herein). The device shall also activate an alarm switch and a motor cutout switch. Amperage sensing devices are not considered equal to the overload device specified.

B. The alarm and motor cutout switches in the control device shall be factory calibrated and set to the required torque. The settings shall be as follows:

1. Alarm torque set at 55% of Rated Torque (1,200,000 ft.lbs.)

2. Motor cutout set at 80% of Rated Torque (1,600,000 ft.lbs.)

C. The entire control device shall be mounted in a weatherproof NEMA 4X Type 316 stainless steel rated enclosure with an integral conduit box and terminal strips.

2.03 SHEAR PIN SPROCKET / ZERO SPEED SENSOR

A. On the input shaft of each worm gear assembly shall be mounted a shear pin sprocket and zero speed indicator. Each shear pin sprocket shall be designed to fail at a torque of 1,000,000 ft.lbs. The zero speed indicator shall be provided as an emergency last step protection for the drive mechanism. Should the drive shear pin break, the machine will stop and the zero speed indicator shall operate on the motor generator principle and shall consist of a magnet collar and induction sensing head. All components shall be suitable for outdoor and corrosive atmosphere application. The control shall be enclosed in a stainless steel NEMA 4X enclosure.

2.04 LOW OIL LEVEL ALARM

A. Each rehabilitated center drive mechanism shall be equipped with a new low oil level sensor/alarm for the main gear housing. The Type 316 stainless steel sensor shall have a watertight cast aluminum enclosure. The sensor unit shall be designed such that calibration and field adjustment of the sensor unit and system is possible. DPDT relay contacts shall be furnished for the output. Power input shall be 105-125 V.

2.05 OIL HEATER / THERMOSTAT

A. A new immersion element type heater shall be provided to heat the main gear compartment of the rehabilitated center drive mechanisms.

2.06 POTENTIOMETER TRANSMITTER

A. Each rehabilitated center drive mechanism shall be equipped with a new potentiometer transmitter. The device shall provide accurate conversion of potentiometer signals to a standard process signal such as a 4-20mA DC, 1-5 V DC or zero based output.

B. The device shall provide constant current excitation to the potentiometer such that calibration will not be affected by lead length or lead temperature changes.

C. The device shall have the ability to provide elevated ranges such as for 0 - 1000 ohm potentiometer.

D. The device shall have the ability to be ordered for a 400 to 800 ohm input range and still provide a full-scale output such as 4-20mA DC.

E. The device shall provide a standard output current or voltage signal on the output with a maximum of 10 mV P/P outside ripple, therefore allowing any computer or computer type system to have improved measurement resolution.

F. The device shall have a standard input span of 10 to 10,000 ohms.

G. The device shall have an accuracy of +0.1% of span, and a typical repeatability of +0.02% of span.

H. The device shall be an Adtech PTT73 Non-Isolated Potentiometer Transmitter or the most recent model with the latest technology as approved equal by the ENGINEER.

2.07 FABRICATION AND MANUFACTURE

A. All parts in the center drive mechanism and accessories shall be accurately machined on mating and bearing surfaces. All like parts, except the bronze seating surfaces shall be interchangeable so that replacement parts can be furnished at any time and attached in the field with a minimum of fitting, chipping or re-machining. All parts shall conform to the original design dimensions and tolerances and shall be free of defects of material and workmanship. All attaching bolt holes shall be drilled accurately to match the existing layout. All gears, shafts and pinions shall be heat treated as specified in Section 11336, Circular Primary Clarifier Mechanisms, Article 2.02.H.

B. Before final assembly all seating surfaces shall be thoroughly cleaned of all foreign materials and final adjustments made.

2.08 SURFACE PREPARATION AND PAINTING

A. The center drive mechanism shall be prepared and painted as specified in Section 11336, Circular Primary Clarifier Mechanisms.

B. The ENGINEER shall inspect and approve center drive mechanism prior to shop priming.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Before fabrication and/or installation verify all in-place dimensions. Check anchors and/or other components for adequacy. Correct all defects and deficiencies before proceeding with the work

3.02 PREPARATION

A. Surfaces shall be clean of all dust, dirt or other debris, which would impair proper installation.

B. Surface preparation and painting shall conform to Section 09900, Painting.

3.03 REHABILITATION

A. As a minimum, once the existing center drive mechanisms are dismantled and shipped to the original equipment manufacture's facility, the manufacturer shall perform the following:

1. Completely disassemble all components of the drive into individual parts. All parts shall be cleaned. A complete engineering evaluation shall be done on all components of the drive to determine what needs to be replaced or repaired. All gears and pinions shall be checked against original manufacturing drawings to ensure that they are still within the tolerances set by the original equipment manufacturer.

2. Original Equipment manufacturer's written engineering evaluation report shall include the rehabilitation tolerances of all existing components. These tolerances shall be compared to the manufacturer's original specification tolerances.

B. The rehabilitation process shall include the following minimum items:

1. Blast and clean all bases, housings, covers and end caps.

2. Hand dress the teeth and threads on all gears, worm gear and shaft along with the pinions. If any gears are worn beyond the allowable tolerances, original equipment manufacturer shall replace these items. All gears, shafts and pinions shall be heat treated as specified in Section 11336, Circular Primary Clarifier Mechanisms, Article 2.02.H.

3. Inspect all bearings and seal surfaces and restore to like new, condition.

4. Replace the drive control with the latest state of the art control assembly. This new drive control unit would also include the 4-20 mA DC output signal proportional to the torque output of the drive.

5. Provide new motors with reducer drive packages. Two (2) drive packages are required for the center drive mechanism.

6. Replace all wear items such as bearings, bearing strips, bearing balls, retaining rings, seals, gaskets, keys, gauging, piping and fasteners.

7. Install a new reverse thrust bearing, spring adjustment screw and stop screw.

8. Assemble and rehabilitate the complete drive.

9. Test the drive in accordance with Paragraph 1.02 of this Section and calibrate the torque settings.

10. Polish all shafts.

End of Section