

SECTION 11480

LINEAR MOTION SLUDGE MIXERS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, install, adjust, finish paint and test one (1) linear motion sludge mixer for mounting on the new 95' diameter Anaerobic Digester No. 2. The linear motion sludge mixer shall be supported from the digester cover and shall be capable of mixing sludge within the tank as shown on the Contract Drawings and specified herein.
- B. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations and properly match-marked for ease of field erection.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 - General Requirements
- B. Division 5 - Metals
- C. Section 09900 - Painting
- D. Section 11000 - Equipment General Provisions
- E. Division 16 - Electrical

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Shall be as specified in Section 01090, Reference Standards.

1.04 DESCRIPTION

- A. The anaerobic digester tanks have the following characteristics:

1. Number of Anaerobic Digesters	One (1)
2. Digester Inside Diameter	95'-0"
3. Sidewater Depth	28'-0"
4. Cone Depth	12'-6"
5. Cone Diameter	6'-0"
6. Digester Volume (each)	1.48 million gallons

B. The sludge digester mixer assemblies shall have the following characteristics:

- | | |
|-------------------------------------|-----------|
| 1. Hydro-disk diameter: | 96 inches |
| 2. Stroke length: | 20 inches |
| 3. Cycles per minute: | 30 cycles |
| 4. Maximum motor name plate rating: | 20 hp |

C. The linear motion mixer shall be suitable for mixing an anaerobically digested sludge from a municipal wastewater treatment facility comprised of primary and secondary treatment solids. The blended material in the digester shall range from 2% to 5% total solids content with typical concentrations in the 2.5% to 3.5% total solids content. The anaerobic digester are operated at typical temperatures for mesophilic anaerobic digestion (i.e. 90°F to 105°F).

1.05 SUBMITTALS

A. Two (2) sets of shop drawings, product data, and samples specific to the equipment being furnished will be provided by the Owner to the Contractor after the Notice-to-Proceed

1.06 SHOP TESTS / OPERATION AND MAINTENANCE MANUAL

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in Section 01300 - Submittals and Section 11000 – Equipment General Provisions.

B. Two copies of a preliminary O&M or reference O&M manual shall be included in the shop drawing submittal. Without inclusion of these manuals, the submittal will be considered incomplete and will be returned without review.

C. Final manuals shall include information regarding the shop testing of each mixer. The testing information shall include as a minimum the following:

1. Run the mixer drive unit with the hydro-disk in dry or wet conditions in the shop for at least 2 hours.
2. Check the shaft for straightness and plumbness.
3. Check the cam system for operation without interference and friction.
4. Complete check of the local button control station to ensure proper operation.
5. Make all final adjustments as required prior to shipment.

1.07 WARRANTY AND GUARANTEE

A. Warranty and Guarantee shall be as specified in Section 11000.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

- A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable companies. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings. The new sludge digester mixer shall be Ovivo® Type LM™ with 20 hp motor as supplied by Ovivo, Salt Lake City, UT in accordance with the United States patents covering the linear motion oscillating mixer design.
- B. The Manufacturer shall provide a history of being regularly engaged in the design, manufacture, project management, execution, shipment, field inspection and startup services of digester sludge mixers, as defined in this specification.

2.02 GENERAL

- A. The equipment to be provided with each mixer shall include the hydro-disk, lubrication systems, seal tube, mounting plate assembly, cam drive system, local bottom station, and accessories. The mixer assembly shall be removable as a unit without varying the normal sludge level or gas pressure within the digesters.

2.03 MIXER DRIVE

- A. The motor drive assembly shall consist of an explosion-proof, reversible single-speed motor, and a helical bevel gear box driving a cam-scotch-yoke mechanism that vertically moves the hydro-disk shaft.
- B. There shall be provided a minimum 96" outside diameter hydro-disk mounted at the end of the vertical drive shaft. The disk shall be a hollow circular ring (no exceptions allowed) and shall comply with the specified outer and inner diameters listed above. All other designs are not acceptable and shall be strictly enforced. The design shall create a vertical "up and down" motion of the hydro-disk producing a turbulent "liquid-core" of micro and macro eddy currents that extend through its range of motion and the tank contents. The mixing hydro-disk shall be constructed of 304 Stainless steel.
- C. The mixer drive enclosure shall include a hinged door complete with a window to allow access to the yoke mechanism.

2.04 HYDRO-DISK

- A. The hydro-disk shall be one factory assembled piece and shall be constructed of 304 stainless steel.

2.05 SEAL TUBE

- A. The seal tube shall be welded to the mixer mounting plate assembly in a gas-tight connection. The mounting plate assembly shall be designed to support the entire weight of the linear motion mixer.

2.06 SHAFT

- A. The shaft shall be 304 stainless steel.

2.07 MOUNTING PLATE ASSEMBLY

- A. The mixer manufacturer shall supply a 304 stainless steel mixer mounting plate with necessary stiffeners designed to be attached to the concrete curb. The mounting plate assembly shall be provided with the necessary bolts, anchor bolts, and gaskets. The port shall be designed to support and transfer all dynamic and dead loads imposed by the mixer to the cover.
- B. The mounting plate assembly shall be detailed to allow installation and removal of the mixer and the mounting plate assembly as one unit. The plate assembly shall include recessed lifting lugs or lug attachment points to allow the assembly to be lifted by four points.

2.08 ELECTRICAL AND CONTROL REQUIREMENTS

- A. All electrical appurtenances furnished by the equipment manufacturer for the linear motion mixer shall be rated for installation in a Class I, Division 1, Group D, hazardous location. The motors shall be as specified in Section 15170, Electric Motors.
- B. Electrical Requirements

Motor	Linear Motion Mixer
Rating	460V, 3 ph, 60 Hz
Horsepower	20
Speed, rpm	1800
Enclosure	TEXP
Insulation	Class F
Inverter Duty	No
Service Factor	1.15
Space Heater	No
Motor Winding Temperature Switches	Yes

- C. The linear motion mixer shall be provided with a NEMA 7 local control station with an on/off switch. Motor starter, disconnect, transformer, etc. shall be provided in the MCC and shall be as specified elsewhere in these specifications.

2.09 SPARE PARTS

- A. Spare parts shall be provided in accordance with Section 11000, Equipment General Provisions and shall include the following:

- One (1) cam-follower assembly
- One (1) set of vertical slide rolling assembly
- One (1) shaft-to-yoke connection assembly
- Four (4) auto greasers

PART 3 -- EXECUTION

3.01 SERVICES OF MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall provide the services of a qualified manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract and instruct the Contractor's personnel and the Owner's operating personnel in its maintenance and operation as outlined in the General Conditions and Section 11000, Equipment General Provisions. The services of the manufacturer's representative shall be provided for a period of not less than two (2) days as follows:

Service	Number of Trips	Number of Days/Trip
Start-up and Operation Instruction	1	2
Services after Startup	1	1

- B. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor. The manufacturer's representative shall sign in and out at the office of the Resident representative on the day he is at the project.

3.02 FABRICATION AND WELDING

- A. All welding, both shop and field, shall be shielded arc welding and shall conform to the latest edition of the American Welding Society (AWS) D1.1 "Structural Welding Code - Steel" for gastight welding.
- B. The mixer wetted parts are either epoxy-painted mild steel or stainless steel, conforming to the requirements of "Standard Specifications for Steel for Bridges and Buildings".
- C. All bolts shall be made of 304 stainless steel with the exception of the high strength fasteners for the mixer which shall be in accordance with the manufacturer's recommendations.

3.03 FINISHES

- A. All fabricated surfaces requiring painting shall be cleaned by near white sand blast (SSPC-SP10) and shop painted with one coat Tnemec 66-1211, or equal. Any field painting and touch up of the mixer shall be as directed in Division 9 of these specifications.

3.04 FUNCTIONAL TESTING

- A. The Contractor shall inspect the mixer after installation in accordance with the manufacturer's "Field Service Check List".
- B. The Contractor, assisted by the manufacturer, shall field verify the following items as a minimum:
 - 1. Motor installed and appropriately mounted for operation.
 - 2. Mixer motion speed.
 - 3. Amperage measurements not exceeding nameplate rating.
 - 4. Assembly bolts tightened properly.

- C. The Contractor shall correct any functional deficiencies. The Contractor shall provide all labor, water and other materials necessary to complete the field testing and verification. Completed inspection reports shall be submitted to the Engineer.

3.05 PERFORMANCE TESTING

- A. Performance testing shall be conducted by the Contractor on the digester mixing system using the temperature profile test defined below.
- B. The Contractor and/or Equipment Supplier shall submit to the Engineer a Performance Testing Plan at least 30-days in advance of the scheduled performance testing date. The plan shall describe the means and methods proposed for the conduct of the performance test. Following the performance testing a report shall be submitted detailing the performance tests conducted, the data generated during the testing, interpretation of the data, and a statement of compliance with meeting, or exceeding, the performance criteria.
- C. The Engineer shall be notified at least 10 working days in advance of the actual test dates.
- D. A qualified representative of the equipment supplier shall direct the tests and certify the equipment performance during the test. The Engineer shall observe all tests. Testing shall be coordinated with the Owner to minimize the impact on plant operations. All costs for these performance testing services shall be included in the Contract Price.
- E. Performance testing shall not be started until the digester reaches a steady state operating condition with a minimum solids concentration in the tank of at least 2.0 percent total solids. Testing shall be conducted when the solids concentration in the tank is within the range of solids concentrations described in Paragraph 1.04.C of this Section.
- F. During performance testing temperature data from the digester contents shall be collected as a measurement of mixing system effectiveness. Temperature data shall be collected at each of the three (3) roof mounted sampling hatches and at a minimum of three (3) depth locations, as follows:
 - a. EL 705.50 – Approximately 25% Sidewater Depth
 - b. EL 712.50 – Approximately 50% Sidewater Depth
 - c. EL 719.50 – Approximately 75% Sidewater Depth
- G. The Contractor or equipment supplier may at their option propose additional sampling locations as part of their Performance Testing Plan, subject to approval by the Engineer.
- H. Temperature data at each sampling location shall be recorded during the performance test and the average (arithmetic mean), maximum, and minimum temperature reported.
- I. Successful demonstration of meeting the mixing system performance test shall be when the reported maximum and minimum temperatures are within $\pm 1.0^{\circ}\text{F}$ of the average temperature of all samples reported.
- J. Should the mixing system not achieve the minimum specified performance requirements, the Contractor, with the assistance of the qualified manufacturer's technical representative, shall propose improvements to the mixing characteristics of the system to achieve the

minimum specified performance requirement. The proposed measures shall be reviewed by the Owner and Engineer prior to implementation. Any costs for improvements required to achieve the minimum specified performance shall be the responsibility of the Contractor.

- K. Following implementation of any proposed improvements the Performance Test shall be repeated, at the expense of the Contractor, to demonstrate satisfactory performance has been achieved. Failure of the equipment to satisfy the performance requirements after a second performance test (after any corrective modifications and adjustments to the equipment have been completed) shall result in additional corrective modifications and/or adjustments to be made to the equipment to achieve the mixing requirements, subject to the time limitations in Paragraph 3.05.L.
- L. Failure to demonstrate satisfactory performance within 180-calendar days of the first performance trial shall result in a liquidated damage assessment of up to fifteen percent (15%) of the equipment purchase price.

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