CLARIGESTER COMPONENTS – Clarigester #2 Tafuna WWTP and Clarigester #3 Utulei WWTP

SCOPE OF WORK FOR SUPPLY AND DELIVERY

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Clarigester central driving mechanism shall support and rotate a vertical shaft with two (2) rake arms. Rake blades attached to the rake arms shall be arranged to move the settled solids to the sludge pocket at the center of the upper compartment.

B. The Clarigester mechanism shall operate at a speed of approximately 0.07 revolutions per minute. The vertical shaft shall also support and rotate the scum breaker arms and sludge raking arms for the lower digester compartment.

C. Except where specifically indicated otherwise, all plates and structural members designated for submerged service shall have a minimum thickness of 1/4 inch. All structural steel will conform to ASTM A-36 requirements and steel plate will conform to ASTM A283C requirements. All anchor bolts and assembly fasteners shall be stainless steel SS316 or better or better.

1.02 PROCESS REQUIREMENTS

C.	Drive continuous torque	12,000 ft-lb
D.	Drive 100% design torque	30,000 ft-lb
F.	Mechanism rotation	Clockwise
G.	Rake arm tip speed, constant	8 ft/min

1.03 REFERENCES

A.	ASTM A-36	American Society of Testing Materials Structural Steel Specifications
B.	ASTM A-325	American Society of Testing Materials Fastener Specifications
C.	ASTM 304	American Society of Testing Materials Bolt Specifications
D.	ASTM A-48	American Society of Testing Materials Cast Iron Specifications
E.	ASTM A-536	American Society of Testing Materials

Cast Iron Specifications

F.	AISI 4142	American Iron and Steel Institute Heat Treated Steel Specifications
G.	AGMA	American Gear Manufacturers' Association Gear Ratings
H.	AWS Standards	American Welding Society - Current
I.	AFBMA	Anti-friction Bearing Manufacturers' Association - Bearing Life Specifications
J.	ASTM A283C	American Society of Testing Materials Steel Plate Specifications
K.	NEMA	National Electrical Manufacturer's Association
		Motor Design Standards and Standards for Control Enclosures

1.04 QUALITY ASSURANCE

A. The Clarigester equipment manufacturer shall modify his standard equipment to meet the minimum values specified for dimensions, design, and the intent of this specification.

B. The Clarigester equipment shall be manufactured by EIMCO Water Technologies.

C. Manufacturers shall show evidence of quality assurance in manufacturing and supplying equipment essential in details to the equipment herein specified. This assurance will be met by certification to the quality system requirement of ISO 9001 or equivalent standard as accepted by the engineer.

1.05 Documentation

A. ASPA will document the exact materials installed.

B. The Clarigester equipment manufacturer shall furnish as a minimum the following design and description information to establish compliance with these specifications:

1. Certified general arrangement and tank dimensional drawings.

2. Certificate of design stamped by a Registered Professional Engineer stating that the equipment to be provided for this project meets or exceeds all design requirements of these specifications.

3. Drive mechanism rating calculations, stamped by a Registered Professional Engineer, verifying the compliance of the drive gears and bearings with the specified continuous torque rating and bearing life rating.

4. Motor data and catalog information. Electrical drawings as applicable to the supply of the Clarigester equipment manufacturer.

5. Catalog cut sheets for purchased sub-components.

1.06 DELIVERY

A. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations, properly match marked for ease of field erection.

B. All components shall be erected immediately upon receipt from the Clarigester manufacturer or stored in strict conformance with storage recommendations provided by the Clarigester manufacturer in the operations and maintenance manual.

C. The mechanism shall be lubricated in strict accordance with the instructions of the Clarigester manufacturer's field service representative. The required lubricants shall be provided by ASPA.

PART 2 PRODUCTS

2.01 GENERAL

A. Each Clarigester mechanism shall be of the centerdrive type, completely supported by the walkway, with the flow entering the side of the tank and flowing into the feedwell through an influent pipe. The Clarigester shall be designed to remove sludge uniformly from the bottom of the tank.

2.02 CENTER DRIVE ASSEMBLY

A. The center drive assembly shall consist of an integral motor and primary speed reducer coupled through roller chain and sprockets to a secondary final output worm gear reducer and shall have an integral overload protection system.

B. All gears and bearings shall be oil bath lubricated with the rolling elements of the main bearing totally submerged in oil and the teeth of the worm gear at least partially submerged in the oil bath. The meshing action of the gears shall force the oil onto all surfaces. Oil pumps for lubrication or grease lubricated bearings are not considered appropriate for this application and will not be allowed. The oil reservoir for the main bearing and gear shall have a section of minimum depth 2” inches below the main bearing to positively prevent contamination of the main bearing and gears with condensate or other contaminants. Gear and bearing housings must also be fitted with oil level sight glasses and condensate drains. Condensate must be allowed to drain from a low point of the housing. In lieu of the oil reservoir depth requirement a continuous oil conditioner unit installed at each drive assembly and as specified herein will be considered equal. The conditioner shall consist of an electrical continuous pre-pump filter and 150 micron stainless

steel oil filter. All conditioner mounting hardware, electrical wiring/controls and necessary piping shall be provided by the thickener manufacturer.

C. Drive components will be located via a machined, registered fit to preserve the alignment of key drive components under all load conditions. Inspection of the completed drive unit shall be accomplished at the thickener manufacturer's shop, with reports of all tests and certifications of material hardness being made available for review at the Engineer's request prior to shipment to the job site.

D. Major drive components, worm gears and bearings must be designed to allow for separate and individual replacement by plant personnel to facilitate quick and economical repairs.

E. The complete center drive assembly, including the overload protection device, shall be a regularly manufactured in-house product of the Clarigester manufacturer. The center drive assembly is a key element in a successful Clarigester installation, therefore drive assemblies purchased from third party vendors will not be accepted.

F. The drive motor shall be minimum 3/4 horsepower and shall be totally enclosed, fan cooled, with a 1.15 service factor, and have bearings with a minimum B10 rating of 50,000 hours. Operating electric current will be 230/460 volt, 3 phase, and 60 hertz. Each motor will be NEMA Design B employing Class F insulation designed for an ambient temperature of 40 degree. C.

G. The gearmotor primary speed reducer shall drive the final worm gear reducer through a #60 roller chain and steel sprockets enclosed in a galvanized 22 gauge steel guard. Sprockets and chain shall be designed for the connected horsepower of the drive with a minimum service factor of 4.0. Provision shall be made for adjustment of chain tension.

H. This final output reducer shall be a worm and worm gear reducer specifically designed for this application. The worm shall be hardened alloy steel.

The worm gear rim shall be solid, one-piece centrifugal cast, manganese bronze of 65,000 PSI tensile strength and have a nominal 24 inch pitch diameter and be supported by and rotate on the main bearing. The rotating center shaft to which the rake arms are attached shall be bolted to the worm gear hub. The gear shall be removable without disturbing the walkway or platform. Gear diameter must be increased in size for cast iron gears.

I. The main bearing shall have a minimum pitch diameter of 18 inches to assure stability and shall include chrome alloy steel balls, minimum 0.75 inch diameter, which shall bear vertically and horizontally upon a four point contact precision bearing assembly fitted into the turntable base and the worm gear. The bearing assembly shall be such that the B10 life of the liner is a minimum of 50 years based on the mechanism speed and a uniformly distributed load due to the rotating mechanism.

J. The bearing life shall be based on the life to initial pitting of the bearing race.

K. Drives using integral bearing / gear assemblies will not be allowed. The gear must be replaceable independent of the bearing assembly.

L. The worm gear and bearing shall be completely enclosed in a housing provided with neoprene dust seals. In order to ensure the maximum possible base rigidity the gear housing shall be of full sidewall construction, integral with the base. Prior to assembly, the base shall be thoroughly inspected for seep holes or inclusions and given a hydrostatic test to insure no leaks are in the oil containment area. Shop inspection reports must be made available for review.

M. The drive unit shall be equipped with an electro-mechanical overload control device actuated by thrust from the worm shaft. The pointer shall provide a visual reading of the relative worm gear output torque on a 0 to 100 percent graduated scale. The 100 percent reading shall equal the 100 percent drive rating as specified in section 1.03. The control device shall also activate an alarm switch for warning of impending overload, a motor cutout switch for overload protection and a back-up safety motor cutout switch for back up overload protection. In lieu of a back-up safety motor cutout switch a slip clutch assembly will be acceptable upon review by the Engineer. The respective switches in the overload control device shall be factory calibrated and set to the following settings;

- Alarm; 40% of scale.
- Motor cutout; 85% of scale.
- Back-up motor cutout or slip clutch; 100% of scale.

All drive control components shall be mounted in a weather proof enclosure of either epoxy coated aluminum construction or stainless steel with a gasket sealed removable cover. The pointer shall be covered with a clear plastic enclosure and shall be above the walkway surface for visibility from the walkway. Amperage sensing devices are not acceptable for torque overload protection due to their inability to react quickly enough to prevent damage to the drive. Overload devices with exposed linkage connections will not be accepted due to possible corrosion problems.

N. The center drive unit shall be designed for the continuous torque rating as specified in section 1.03. The continuous torque shall be defined as the minimum torque at which the drive mechanism may operate continuously 24 hours per day, at the specified sludge collector arm speed.

Worm gearing shall be designed and rated to equal or exceed the specified continuous torque and life. The basis for rating shall be ANSI/AGMA 6034 standards for durability rating and design of worm gear reducers.

2.03 CENTER SHAFT, RAKE ARMS, SCUM BREAKER ARMS AND TRENCH SCRAPER

A. The center shaft shall be 8” Schedule 80 steel pipe. It shall be provided with connection points for the two sludge removal arms, feedwell supports, boot, scum breaker arms, digester rake arms and collection trench scraper. The shaft shall be bolted to the worm gear to rotate the attached arms, scum breaker, trench scraper and skimmer assembly.

The minimum angle size used for construction of the clarifier rake arms, digester rake arms and scum breaker arms shall be 2 inch x 2 inch x 1/4 inch members.

B. The mechanism shall include two (2) clarifier sludge removal arms and two (2) digester removal arms of steel construction with steel raking blades and adjustable 316 stainless steel squeegees. The structural steel truss arms shall conform to the slope of the tank floor shall be rigidly connected to the vertical shaft.

C. Two (2) structural steel scum breaker arms shall be rigidly connected to the vertical shaft and located below the underside of the concrete tray and be equipped with vertical steel fingers. These fingers will intermesh with stationary vertical steel fingers attached to four (4) radial steel frames anchored to the underside of the concrete tray.

D. The collection trench scraper shall be fabricated of bent steel plate and shall direct digested solids to the sludge discharge pipe.

2.08 SURFACE SCUM SKIMMING EQUIPMENT

A. Each Clarigester shall be equipped with one full radius skimmer arm assembly to collect and discharge surface scum into a full radius scum trough cantilevered from the tank wall.

B. The skimmer arm shall be a structural steel support assembly connected to the center shaft.

C. The skimmer arm shall be equipped with a hinged 1/2 inch 60 durometer neoprene wiper blade extending the full width of the arm. The neoprene blade shall be fastened to the arm with stainless steel fasteners with steel backup bars

D. The full radius scum trough shall be fabricated from 1/4 inch steel plate and shall be supported from the tank wall as shown on the drawings. The trough and support structure shall be designed for all dead loads plus a 200 hundred pound point load at the feedwell end of the trough with no more than 1/2 inch deflection. The approach ramp of the trough shall be of radial design, having a tapered width and a variable slope that will enable the full length of the skimmer wiper to make simultaneous and continuous contact with the entire ramp along a radial line, at each revolution of the skimmer arm. The trough shall be 8 inches wide with a uniformly sloped bottom to allow scum to discharge toward the tank wall. Fabrication of the trough shall be true and free of warpage. A 6 inch schedule 40 pipe connection shall be provided at for connection to the scum drain line.

E. The Clarigester equipment manufacturer shall furnish a flush valve assembly for automatic flushing of the scum trough and scum pipe. The flush valve assembly shall be adjustable to allow 0 to 4 gallons of clarified effluent to enter the scum trough as the skimmer assembly passes over the scum box. The assembly shall consist of a stainless steel lever, UHMW seal plate and neoprene diaphragm mounted to the scum trough. The diaphragm shall be opened and closed by an easily adjustable, submerged actuation arm mounted to the rotating feedwell. The flush volume adjustment mechanism shall be above the water level and shall include at least three settings.

2.11 PAINTING AND SURFACE PREPARATION

A. All nonsubmerged steel shall be sandblasted to SSPCSP6 specifications and given one coat of manufacturer's epoxy primer 2-3 MDFT. All submerged steel shall be sandblasted to SSPCSP10 specifications and given one coat of manufacturer's epoxy primer 2-3 MDFT.

B. Prior to assembly of the drive unit, the castings shall have been sandblasted and thoroughly cleaned to remove any foreign particles in the drive base. After assembly, the drive mechanism shall be solvent cleaned and power wire brushed as needed prior to application of manufacturer's standard primer.

C. Gear motors shall be furnished with manufacturer's standard enamel.

PART 3 EXECUTION

3.01 INSTALLATION

A. The equipment shall be erected in strict accordance with the manufacturer's recommendations.

3.02 SERVICE

A. Upon request the equipment manufacturer shall provide a service representative properly trained in inspection and operation of the mechanism to approve the installation, certify that the torque settings of the drive overload protection device are correct, perform the torque test and instruct the owner's personnel on maintenance and operation. This service shall be in the form of (1) trips to the site and (3), eight (8) hour days of service. If additional service is required due to the mechanism not being fully operational, at the time of service requested by the contractor, the additional service days will be at the contractor's expense.

PART 4 – IMPLEMENTATION APPROACH

CLARIGESTER DRIVE SHAFT

A drive shaft assembly system will be installed in Clarigester #2 of the Fogagogo Wastewater Treatment plant and Clarigester #3 for the Utulei Wastewater Treatment Plant. This will replace the existing units which have been in operation for some years now. The wear and tear to these equipment have resulted in the equipment not operating as expected.. ASPA will require the drive shaft acquisition and its installation be performed according to this document, and the manufacture specifications, if any discrepancies occur, the manufacturer's specifications will take precedence.

Drive Shaft Procurement

The drive shaft assembly is a proprietary component of a Clarigester and therefore must be purchased from the manufacturer through competitive bidding (RFQ). The specification for this drive shaft can be found in Appendix C.

All supplies shall be stored and maintained by the ASPA in accordance with the manufacturer's specifications in a secured area and away from general public access. Supplies should not be subject to adverse weather conditions prior to use.

Drive Shaft Installation Preparations

ASPA will evaluate the existing drive shaft to identify and problems with its decommissioning and removal.

ASPA Wastewater will coordinate with the Electrical division to determine the best way to disconnect the power source to the drive shaft.

Concrete

A. No concrete work will be required as a result of this work.

Materials

A. All required material and, if necessary, specialized tools will be purchased through the ASPA Procurement Office in coordination with ASPA Wastewater Engineering and the US-EPA Region 9.

B. All supplies shall be stored and maintained by ASPA in accordance with the manufacturer's specifications in a secured area and away from general public access. Supplies should not be subject to adverse weather conditions prior to use.

C. All materials shall meet or exceed industry standards.

Equipment

A. ASPA will maintain any and all equipment needed for proper installation as per manufacturer's instructions.

B. ASPA shall ensure that application and installation of all materials are done in accordance with the manufacturer specifications.

C. ASPA will procure heavy equipment through an existing contract when needed. ASPA currently holds a service contract for equipment rentals which was executed via a competitive bidding process.

D. ASPA shall be responsible for supplying and storing any and all equipment needed for proper application and installation of materials as per manufacturer's instructions.

E. ASPA shall be responsible for ensuring that application and installation of materials listed above is done in accordance with the manufacturer.

Execution

A. When personnel are required to enter confined spaces, any and all applicable OSHA requirements as well as those detailed by the manufacturer's material safety sheets will be complied with fully.

B. In order to replace the drive shaft, Clarigester #2 for Fogagogo and #3 for Utulei must be taken out of service and drained and the retention time at the Fogagogo WWTP will be reduced as a result.

C. Clarigester #2 for Fogagogo and #3 for Utulei will be isolated from the treatment system and drained, sludge will be pumped from the digester tank into a nearby drying bed. The entire system will be rinsed using a high pressure hose.

D. The Clarigester unit will be thoroughly inspected, including both the structural and mechanical components. The state of each component will be assessed and documented, any equipment identified as serviceable will be salvaged and stored as spare equipment.

E. Clarigester #2 for Fogagogo and #3 for Utulei will be de-energized and the following components of the existing drive shaft system will be dismantled and removed.

a. 24A Drive Assembly b. Center drive shaft
c. Clarifier rake arms d. Digester rake arms
e. Scum box and supports
f. Center feedwell trust bearing g. Lower guide bearing
h. Anchor bolts and assembly fasteners

F. The concrete structure shall be inspected to ensure integrity and compatibility with replacement components.

G. The replacement components will be staged adjacent to the existing concrete structure and each component shall be inspected and cataloged to ensure all materials are accounted for and in working condition.

H. Installation of replacement components shall be performed according to manufacturer specifications and will require ASPA to rent a crane for placement of the shaft.

I. Once the components have been installed, Clarigester #1 will be re-energized and a dry run will be conducted to ensure the system is operating according to manufacturer specifications.

J. Once the Project Supervisor, Project Engineer and Chief Engineer have inspected the system and verified that the components have been installed according to manufacturer specifications, the system will be brought back into service.

Testing

If the use of concrete is necessary, a concrete slugs shall be cast for each different Project element and will be properly labeled and tested for the applicable standards stated in this document.

A.

END OF SECTION