

Bidding Requirements, Contract Forms and Conditions of the Contract
ADDENDUM
Section 00900

ADDENDUM No. 3

Date: August 30, 2016

City of Austin

Project Name: South Austin Regional WWTP – Thickeners Improvements Project

C.I.P. No. 3333.016 IFB No.: 6100 CLMC558

This Addendum forms a part of the Contract and corrects or modifies original Bid Documents, dated **July 25, 2016**. Acknowledge receipt of this addendum in space provided on bid form. Failure to do so may subject bidder to disqualification.

A. Project Manual Revisions:

Note: Revisions per this Addendum No. 3 in the specifications have been **bolded and underlined**.

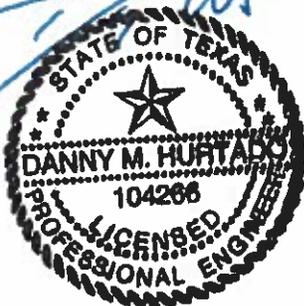
Volume 2:

Section 11258: Remove section in its entirety, and replace with the attached Section 11258.

This addendum consists of 27 pages/sheets (including this 1 page).


Approved by OWNER

8-30-16



08/30/16

Approved by ENGINEER/ARCHITECT

END

SECTION 11258
ODOR CONTROL BIOSCRUBBER SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required for the installation, start-up, warranty, and testing of two complete, bioscrubber systems as shown on the Drawings and specified herein. Each system shall include: two fiberglass reinforced plastic (FRP) bioscrubber vessels, (each equipped with vessel roof access, guardrails, ladders, and personal fall prevention system as shown on the Drawings and specified herein), exhaust stacks, media, wiring and electrical components, a local control panel, automatic irrigation systems, supplemental nutrient supply equipment, and one 55 FRP gallon nutrient tank. If the manufacturer utilizes recirculation systems, the manufacturer shall provide all components for the recirculation systems, including the recirculation pumps, as necessary for fully functional systems. Additionally, for each system, the manufacturer shall be responsible for the fan, ductwork between the fan and bioscrubber vessels (which includes isolation dampers, flexible flange connectors, and other fittings), and the pipe supports for the non-potable water/recirculation pipeline(s) and for a 3/4-inch PVC pipeline, with a minimum 1/4-in PE exhaust sample tubing line inside it, along the bioscrubber vessels. The location of the 3/4-inch PVC pipeline shall be coordinated with the Engineer. This Section gives a general description of system requirements, but does not cover all details, which will vary in accordance with the manufacturer and requirements of the application. It does, however, cover the furnishing, delivery, installation supervision, start-up, warranty, and field testing of all materials, equipment and appurtenances for the complete bioscrubber systems as specified, whether specifically mentioned in this Section or not.
- B. The bioscrubber system manufacturer shall have complete system responsibility for the bioscrubber systems. The manufacturer shall furnish and be responsible for proper functioning of all internal piping and appurtenances. The Contractor shall provide and install water, drain and interconnect piping, water and drain piping insulation, ductwork and power and control wiring to the bioscrubber system. The system manufacturer shall supply the Engineer and Contractor with all necessary wiring diagrams and shall furnish and be responsible for all integral electrical components (transformers, control panels and circuits, interlocks, instrumentation, etc.) required for proper functioning of the systems.
- C. The term "manufacturer" as used in this specification will refer to the manufacturer of the bioscrubber system or the manufacturer's authorized representative.
- D. The installation of the gravity thickeners and associated components will occur in two phases. Odor Control System No. 1 and 2 shall both be made operational during Phase 1 in conjunction with the North thickeners (2A and 2B) to provide ventilation once thickeners are in operation. Until Phase 2 is complete, each Odor Control System will ventilate one of the North thickeners. Refer to Section 01010 – Summary of Work. Contractor shall coordinate lead times and schedule with manufacturer.

1.02 RELATED WORK

- A. Section 01010 – Summary of Work

- B. Section 01170 – Special Provisions.
- C. Motors are specified in Section 01171.
- D. Section 01740 – Warranties and Bonds
- E. Metal Fabrications are specified in Section 05500.
- F. Control Panels are specified in Section 13390.
- G. Testing, Adjusting, and Balancing is specified in Section 15950.
- H. Fiberglass Ductwork and Accessories are specified in Section 15891.
- I. Instrumentation and controls are included in Division 13 and Division 17.
- J. Piping, duct valves, pipe hangers, and appurtenances are included in Division 15.
- K. Electrical is included in Division 16.

1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with this Section 01300, all materials and equipment required to establish compliance with this Section. Partial submittals will not be accepted. Submittals shall include the following at a minimum:
 - 1. Descriptive literature, bulletins, and/or catalogs of the equipment.
 - 2. Complete, detailed instructions on the installation of the bioscrubber systems.
 - 3. A statement from the manufacturer that the fabrication is in accordance with this Section.
 - 4. Design structural calculations for vessel construction of each system and for the hold down lug, stamped and sealed by a professional structural engineer registered in Texas.
 - a. Provide detailed drawing showing anchor requirements and locations where anchor bolts must be in place when the support pad is poured.
 - b. Provide signed and sealed (State of Texas PE) calculations that the bioscrubber systems, including vessels, roof access areas, ladders, and safety rails can withstand the wind load and live load design criteria specified in Paragraph 1.07, as well as meet all applicable OSHA requirements.
 - c. Current design does not include wiring restraints. If wiring restraints are required based on the calculations, modifications to the bioscrubber system design, including pad size to allow appropriate access space, shall be performed at no additional cost to the Owner.
 - 5. Certified shop and erection drawings showing all important details of construction and dimensions.
 - a. Dimensions shall include anchor bolt layout and locations, and diameters of air duct, water supply and drainage piping at the limit of work.

6. Drawings and descriptive information on the roof access areas, platforms, personal fall prevention system (including safety rails), and ladders, including the material of construction.
7. Wiring diagram and electrical requirements, including logic diagrams and wiring schematics.
8. Materials of construction, including resin and material used, as well as a statement from the manufacturer that the materials and resin used are suitable for this installation.
9. Submit fan data sheets for each system with a description of the proposed fan, fan size, type, arrangement, materials of construction, weight, motor horsepower, motor type, power supply, frame size, sheave sizes, belts size, number and length. Each submittal shall include pertinent equipment dimensional data, and a performance curve showing the fan operating point and range. Minimum curve size shall be 8-in by 6-in. Faxed copies of curves are not acceptable. A list of accessories to be furnished shall be included. Copies of operating and maintenance manuals shall be submitted. Refer to Section 01171 for motor requirements.
10. Descriptive information of media including but not limited to pressure drop through media, liquid hold-up data, and media physical characteristics.
 - a. Complete data on the head loss for the air flow through the media at design air flow rate.
 - b. Details of filter media supports.
11. Drawings and descriptive information of nozzles and liquid distribution system to include spray pattern, pressure drop, liquid flow rate, support system details and materials of construction.
12. Acclimation procedure and any required temporary piping during the acclimation period.
13. The total weight of the equipment of each system including the weight distribution at the points of supports.
14. A complete bill of materials for all equipment.
15. A list of the manufacturer's recommended spare parts.
16. A list of special tools.
17. Testing procedures and test equipment.
18. Complete description of surface preparation and shop painting of painted surfaces.
19. Complete Control Panel layout, including size, wiring, schematics internal and external equipment and device arrangement, nameplates and parts catalog cuts as specified in Section 13390.
20. If permanent recirculation systems are provided, submittals for the recirculation pumps shall include as a minimum the following:

- a. A certified statement from the bioscrubber manufacturer that the recirculation pump is suitable for the bioscrubber system and pumping low pH streams.
- b. Manufacturer's certified rating data.
- c. Certified shop drawings showing all important details of construction, dimensions and anchor bolt locations.
- d. Descriptive literature, bulletins and/or catalogs of the equipment.
- e. A list of the manufacturer's recommended spare parts. Include gaskets, packing, etc., on the list.
- f. Data regarding pump and motor characteristics and performance:
 - 1) Prior to fabrication and testing, provide guaranteed performance curves based on shop tests of mechanically duplicate pumping units, showing they meet specified requirements for head, capacity, horsepower and efficiency.
 - 2) For units of same size and type, provide curves for a single unit only.
 - 3) Submit curves for guaranteed performance and certified tests as specified on 8-1/2 in by 11-in sheets, one curve per sheet.
 - 4) Provide motor information as specified in Section 01171.

B. Submit shop inspection and test certificates.

1. The Engineer retains the right to have a 1-inch diameter core sample extracted from each vessel after delivery for analysis of the resin. The location of the test sample(s) shall be submitted by the manufacturer for the Engineer's review and approval. The hole(s) shall be repaired by the manufacturer, and the analysis shall be paid for by the manufacturer. The Engineer may reject any bioscrubber vessel if it does not meet the standard of the representative samples. Costs for extraction, repair and laboratory analysis shall be by the Contractor.
2. Certificates from the manufacturer shall be submitted stating that the installation of the equipment is satisfactory, the systems have been satisfactorily tested, is ready for operation and the operating personnel have been suitably instructed in the operation and care of the systems.

C. Operation and Maintenance Data.

1. Operations and maintenance instructions shall be furnished to the Engineer as specified herein and in accordance with Section 01730. These instructions shall consist of clean, legible, reproducible manufacturers' manuals prepared by the manufacturer exclusively for the equipment furnished for this installation. Operations and maintenance instructions shall be written in a clear, concise and easily understandable manner to serve in training personnel at this facility. The instruction manual shall include schematic and detailed drawings and diagrams as necessary to accompany the written instructions. A complete set of equipment shop drawings. All component parts shall be clearly identified by name and part numbers cross-referenced. A complete listing of nameplate data for each piece of equipment shall be attached to these instructions. In addition, the instructions shall include troubleshooting data and full preventive maintenance schedules.

1.04 SERVICES OF A MANUFACTURER'S REPRESENTATIVE

- A. A factory representative who has a complete knowledge of the proper operation and maintenance shall be provided as specified herein. Qualifications of the representative shall be submitted for approval. Workday requirements listed are exclusive of travel time and do not

relieve the Contractor of obligation to provide sufficient service to place equipment in satisfactory operation. The factory representative shall provide a minimum of two (2) training sessions (typically early morning and late evening) to accommodate plant staff. Owner and Engineer shall be notified in writing a minimum of fourteen (14) calendar days prior to the scheduled training.

Services Provided by Factory Representative	Minimum ^(a) No. of Trips	Minimum Time On Site Per Trip (hours)
1. Supervise installation	1	8
2. Inspect and approve installation ^(b) ^(c)	2	4
3. Supervise initial adjustment ^{(c) (d)}	2	4
4. Instruct Owner and Engineer in proper start-up and O&M ^{(d) (e) (f)}	2	4
5. Conduct acceptance testing ^(g)	1	8
<p>(a) The manufacturer's factory representative shall be present at frequent enough intervals to ensure proper installation, testing, and initial operation of the equipment.</p> <p>(b) The manufacturer's factory representative shall provide to the Engineer a written certification that the system has been installed in accordance with the manufacturer's recommendations.</p> <p>(c) These services shall be provided at two separate times; once in conjunction with the start-up of the North thickeners and once in conjunction with the start-up of the fully-installed thickener system.</p> <p>(d) May be done on the same trip upon completion of prior item if acceptable to the Engineer.</p> <p>(e) The manufacturer's factory representative shall provide start-up services and instruction to Contractor and Owner prior to start-up after Phase 1, in addition to services for Owner after thickener system is fully installed.</p> <p>(f) Instruction may be given upon completion of Item 3, provided that the O&M manuals have been submitted to and accepted by the Engineer.</p> <p>(g) Performance Testing shall occur after all four thickeners are online and operating with new mechanisms.</p>		

1.05 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM).

1. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
2. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
3. ASTM D883 - Definition of terms relating to plastics.
4. ASTM D1505 – Standard Test Method for Density of Plastics by the Density Gradient Technique.

5. ASTM D1525 - Standard Test Method for Vicat Softening Temperature of Plastics.
 6. ASTM D1693 – Standard Test Method for Environmental Stress – Cracking of Ethylene Plastics.
 7. ASTM D1998 – Standard Specification for Polyethylene Upright Storage Tanks.
 8. ASTM D2563 - Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
 9. ASTM D2583 - Test for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
 10. ASTM D3299 - “Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion Resistant Tanks.
 11. ASTM D3982 – Standard Specification for Contact Molded “Fiberglass” (Glass Fiber Reinforced Thermosetting Resin) Ducts.
 12. ASTM D4097-82 - Standard Specifications for Contact Molded Glass Fiber Reinforced Thermoset Resin Corrosion Resistant Tanks.
- B. European Standards (EN).
1. EN 13725 – Air Quality: Determination of Odour Concentration by Dynamic Olfactometry.
- C. American National Standard Institute (ANSI).
- D. Instrument Society of America (ISA).
- E. Anti-Friction Bearing Manufacturers Association (AFBMA).
- F. SPI Proposed Product Standard - Corrosion Resistant Structures - Reinforced Plastics/Composites Division Section, September 1970.
- G. National Electrical Manufacturers Association (NEMA).
- H. Underwriters Laboratories (UL).
- I. National Fire Protection Association (NFPA).
- J. National Electrical Code (NEC).
- K. International Building Code (IBC).
- L. Occupational Safety and Health Administration (OSHA).
- M. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.06 QUALITY ASSURANCE

- A. To assure compatibility of all system components and complete system responsibility, ensure that the bioscrubber systems and all accessories and controls specified herein are furnished by a single manufacturer. The manufacturer shall be fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be manufactured and installed in accordance with the best practices and methods, and shall operate satisfactorily. The bioscrubber systems shall be EcoFilter Reactor by BioAir Solutions, LLC; Biotrickling Filter by Biorem Technologies Inc.; Biotrickling Filter by ECS.
- B. The odor control systems have been designed around the EcoFilter system by BioAir. The selection of an alternate manufacturer's equipment may require additional equipment and a revised layout. The Contractor shall coordinate with potential manufacturers prior to bidding and incorporate costs into the bid price.

1.07 SYSTEM DESCRIPTION

- A. Bioscrubber systems shall continuously and automatically treat and effectively remove hydrogen sulfide and eliminate odors from foul air exhausted from the solids thickening facilities. Exhaust rate capacities shall be 13,000 scfm for Odor Control System (OCS) No. 1 and 9,000 for OCS No. 2. Hydrogen sulfide and other odorants shall be removed by microbial action within synthetic media furnished in the bioscrubbers.
- B. For purposes of testing bioscrubber odor control system performance, inlet concentrations of odorous pollutants will be as summarized in Table 1.

Table 1
Inlet Pollutant Concentrations

Odor Control System	Pollutant	Inlet Concentration (ppmv)
1	Hydrogen sulfide - average concentration	40
	Hydrogen sulfide - peak concentration	220
2	Hydrogen sulfide - average concentration	20
	Hydrogen sulfide - peak concentration	150

- 1. The pollutant removal performance of bioscrubber systems shall be as indicated in Table 2.

Table 2
Required Odor Removal Performance

Criterion	A Required Performance After Bioscrubber
1	Average hydrogen sulfide removal efficiency shall be equal to or greater than 99.0 % under both average and peak conditions or 0.5 ppmv, whichever is less stringent.
2	Outlet odor concentration shall not exceed 1,000 dilutions-to-threshold (D/T) under both peak and average hydrogen sulfide loading conditions OR odor concentration removal shall be 90%, whichever is less stringent. Odor concentration shall be measured and analyzed in accordance with EN 13725-2003.

- C. Performance testing procedures and terms of the performance guarantee are described in Subsection 3.04 of this Specification.
- D. Each bioscrubber system will consist of two vessels with durable inorganic media, two stacks, one fan, one water distribution system, one nutrient addition system (if necessary) and controls.
- E. The bioscrubber system, including vessels, nutrient tanks, roof access areas, ladders, and fall prevention system (including safety rails) shall be able to withstand 90 mph winds and shall be in accordance with the wind loading requirements and structural design criteria requirements described in the 2012 International Building Code. The bioscrubber vessel shall be able to withstand a minimum of 300 lb. live load for roof access. The roof access area shall include a ladder, personal fall prevention system, guardrails, and either a platform or non-slip surface; all roof access components shall comply with all applicable OSHA requirements.
- F. The manufacturer shall provide two 55 gallon FRP nutrient tanks (one for each system) suitable for outdoor condition outdoor conditions and filled with nutrient.

1.08 WARRANTY

- A. The manufacturer shall warrant that bioscrubber systems be supplied in accordance with these specifications and shall perform as described herein. The manufacturer shall warrant that the systems will be free from defects in materials and workmanship for a period of one (1) year after Phase 2 startup and final acceptance of the equipment at the Owner’s facility. At the manufacturer’s discretion, the manufacturer shall repair or provide replacement for any defective components under this warranty provided that any such defect was not the result of misuse of the component by the Owner or the Owner’s Agent. Refer to Section 01740 for warranty requirements.
- B. The manufacturer shall warrant the suitability of the biological reactor media and vessel for a period of ten (10) years from the date of final start-up and final acceptance, provided that the Systems are operated in accordance with the manufacturer’s Operation and Maintenance Manual provided hereunder. In the event of a failure of the media within the ten (10) year warranty period, the manufacturer shall replace the media at no expense to the Owner or Contractor. In the event of the vessel failure the vessel shall be repaired or replaced with mutual agreement between the owner and manufacturer.

- C. Final acceptance shall occur after Performance Testing, which shall occur after all four thickeners are online and operating with new mechanisms; however, odor control systems shall begin operating in conjunction with the start-up of the North thickeners (2A and 2B). Refer to Section 01010 Summary of Work. Contractor shall coordinate Phase 1 and 2 construction schedules with bioscrubber manufacturer.

1.09 ENVIRONMENTAL CONDITIONS

- A. Ambient Environment. The ambient temperatures are expected to range between 15 degrees F and 110 degrees F with a relative humidity that will vary from 10 to 100%. The site elevation is approximately 430 feet above mean sea level.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in coordination with installation of the pads, wiring, and piping by others. If equipment is delivered before the pad is ready, the manufacturer shall be responsible for both off-loading and placement of the equipment on the pad.
- B. Exercise care during loading, transporting, unloading, and handling to prevent damage of any nature to interior and exterior surfaces of pipe and fittings.
- C. Do not drop pipe and fittings.
- D. Store materials on the project site in enclosures or under protective coverings in accordance with manufacturer's recommendations and as required by the Engineer.
- E. Assure that materials are kept clean, and all electrical components shall be stored inside.
- F. All equipment and materials shall be properly protected and maintained such that no damage will occur from the time of shipment until the completion of the installation.
- G. The Engineer and Contractor shall inspect all equipment upon delivery. Contractor shall notify manufacturer within 24 hours if damage occurred as a result of shipping.
- H. Vessels shall be shipped in either the vertical or horizontal position. Multiple shipments are acceptable. If shipped in the horizontal position, manufacturer is responsible for any damage to the shape of the units and must orient the vessels vertically upon offloading the vessels.
- I. Flange faces shall be protected from damage by covering with suitable plywood or hardboard, securely fastened.
- J. Pipe and tubing, fittings and miscellaneous small parts shall be crated or boxed.
- K. The equipment shall be inspected by contractor before unloading at the installation site.

1.11 SUBSTITUTION

- A. Any substitutions or deviations in equipment or arrangement, from that specified herein, shall be the responsibility of the Contractor. Any deviation must be accompanied by detailed structural, mechanical, and electrical drawings and additional supporting data for review by the

Owner or the Owner's Engineer, and must be stamped and certified by a registered Professional Engineer (PE) in Texas.

- B. All costs associated with the review of substitutions or deviations, and costs to the Engineer, Contractor or Owner associated with project drawing changes as a result of approval of such, shall be borne by the Contractor. There shall be no additional costs to the Owner due to substitutions or deviations.

1.12 TOOLS AND SPARE PARTS

- A. At a minimum, manufacturer shall provide an adequate supply of consumables including nutrient and calibration materials necessary to operate and maintain the equipment specified herein for one-year period after Owner's acceptance.
- B. Manufacturer shall provide the following spare parts:
 - 1. One (1) mesh strainer for water panel.
 - 2. One (1) set of fan bearings.
 - 3. One (1) set of V-belts for fans.
 - 4. If a permanent recirculation system is provided, one (1) spare recirculation pump.
 - 5. Refer to Sections 01171 and 13390 for additional requirements.
 - 6. One nutrient pump repair kit per system.

PART 2 PRODUCTS

2.01 GENERAL

- A. General Description.
 - 1. As shown on the Drawings, each bioscrubber system shall consist of two self-contained totally enclosed vessels (four vessels total), constructed of fiberglass-reinforced resin. The vessels shall contain a durable inorganic media that serves as a support structure for a microbial population without being consumed as a source of nutrients or alkalinity. Non-potable water shall be distributed uniformly over the surface of the media to supply moisture and nutrients to the microbial population and remove process waste. The manufacturer may recirculate water and/or supply a nutrient to the irrigation water dosing system, these systems shall be completely integrated into the irrigation and electrical system. Portable totes or drums shall not be allowed.
 - 2. Each bioscrubber system shall include a fan and control panel to control flow of water and nutrients. As shown on the Drawings and as specified herein, the bioscrubber vessel unit shall include a stack, gauges to monitor pressure drop, manway, roof access area, guardrails, ladder with fall prevention system (including safety rail), manway, sampling port for drainage water, and freeze protection provisions. Freeze protection provisions shall include, yet not limited to, the installation of heater(s) and insulation for the water panels.

3. All equipment shall be new and unused and suitable for the conditions of service to which they will be subjected. Workmanship shall be of the highest quality and shall be carried out by competent and experience workmen.

2.02 DESIGN REQUIREMENTS

- A. All components of the System shall be compatible with the conditions and constituents to which they will be subjected to during normal operation. Compounds with which the materials of construction must be compatible with include, but are not limited to:
 1. Hydrogen Sulfide.
 2. Sulfuric Acid.
 3. Ammonia.
 4. Dimethyl Sulfide.
 5. Methyl Mercaptan and other Mercaptans.
 6. Other Reduced Sulfur Compounds (RSC's).

B. The Systems shall be furnished to meet the following criteria:

Parameter	OCS No. 1 Value	OCS No. 2 Value	Systems
Capacity	13,000	9,000	scfm
Number of trains	1	1	train
Capacity per train	13,000	9,000	scfm
Number of vessels in parallel per train	2	2	vessels
H2S loading (average/peak)	40/220	20/150	ppmv
Bioscrubber diameter (max)	12	12	ft.
Bioscrubber overall height, including stack (max)	30	24	ft.
Maximum allowable pressure drop for the bioscrubber system. Includes bioscrubber media, fan (suction and discharge sides), isolation damper, and associated ductwork connections. Ductwork headloss upstream of the fan inlet is not included. Refer to Paragraph 2.02 for fan sizing, which describes ductwork headloss upstream of the fan inlet.	5	5	inch water column
Pressure drop across bioscrubber media (max)	2	2	inch water column
System water flow rate (instantaneous) (max)	50	50	gallons/minute
System water pressure (max)	65	65	psi
System water consumption (approx., max)	20,000	20,000	gallons/day
System Nutrient Consumption (approx.) (average)	0*	0*	gallons/month
Empty bed residence time (EBRT) (min)	15	15	seconds

** Note: When the Total N is 3 – 20 mg/L and Total P is 1 – 5 mg/L, the system will not require any supplemental nutrients.*

C. Fiberglass Reinforced Plastic Vessel.

1. All parts of the vessels shall be proportioned to have liberal strength and stiffness and to be especially adapted for the work to be done. Ample room and facilities shall be provided for access.
2. Each bioscrubber vessel shall be a free-standing tower including media and media bed irrigation system. Each reactor vessel shall be constructed of corrosion resistant FRP. The vessel shall be designed to support the required number of media layers and treatment stages. All materials of construction shall be corrosion resistant. The interior of the vessel shall be treated with vinyl ester corrosion barrier for maximum corrosion resistance. The exterior of the vessel shall incorporate a surface veil for superior durability.

3. Equipment built to these specifications shall meet the requirements of ASTM D3299 for filament wound tanks, ASTM D4097 for contact molded tanks and ASTM 3982 for contact molded duct.
4. Vessels built to these specifications shall have the following information printed on nameplates of appropriate size for the equipment involved.
 - a. Name of Manufacturer
 - b. Capacity in Cubic Feet.
 - c. Chemical Environment.
 - d. Manufacturer Serial Number.
 - e. Year Built.
 - f. Name and Equipment Number.
 - g. Purchase Order Number.
 - h. Design Pressure and Temperature.
 - i. Resin.
5. Resins.
 - a. The resin used shall be resistant to corrosion by wet hydrogen sulfide and other corrosive gases present in wastewater treatment plants. A single, fire retardant resin shall be used throughout. Flame spread ratio shall not exceed 25 when tested in a Steiner Test Tunnel in accordance with ASTM E84.
 - b. Antimony or NYACOL additives shall not be used to achieve flame spread index.
 - c. Acceptable products:
 - 1) Derakane 510-B-400.
 - 2) Cor VE 8401.
 - 3) AOC Vipel K022.
 - 4) Reichold's Dion Impact 9303-54.
 - 5) Or Engineer approved equal.
 - d. Each bioscrubber vessel shall be constructed of factory fabricated fiberglass reinforced fire retardant vinyl ester resin as follows:
 - 1) The shell shall consist of an interior layer, a corrosion barrier, a structural layer and an exterior layer.
 - 2) No thixotropic agents may be used in the corrosion barrier.
 - 3) Reinforcing material shall be commercial grade glass fiber containing a coupling agent to produce a suitable bond with the resin used.
 - 4) Interior layer shall be a minimum of 20 mils thick single layer Nexus or C glass surface veiling in a resin rich surface. Resin content shall be approximately 90 percent.
 - 5) Corrosion barrier shall be a minimum of 100 mils thick of Type E glass strand mat, applied in two layers of equal thickeners. Resin content shall be approximately 70 percent.
 - 6) Structural layer shall be alternating layers of Type E glass, reinforced by interweaving of chopped strand mat and woven roving continuous helically filament winding glass. Resin content shall be approximately 60 percent.
 - 7) Exterior layer shall be a parafinized gel coat with UV inhibitors.
 - e. All surfaces shall be finished so as to obtain complete cure of the resin without air inhibition. The finished laminate shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, air bubbles, pinholes and pimples. Each vessel shall be post cured per the resin manufacturer's recommendations and shall conform to the resin manufacturer's minimum standard for Barcol hardness.

- f. The inner surface shall and interior layer shall meet the visual acceptance criteria in Table 5 ASTM C 582 process side. Exterior shall meet the referenced criteria for the non-process side.
- g. The structural layer or body of the laminate shall be of chemically resistant construction suitable for the service, providing the additional strength necessary to meet the tensile and flexural requirements. Where separate layers such as matt, cloth, or woven roving are used, all layers shall be lapped a minimum of 1 in. Laps shall be staggered as much as possible. If woven roving or cloth is used, the layer of chopped strand glass shall be placed as alternate layers. All filament wound structural layers shall be per ASTM D 2996. The exterior surface shall be relatively smooth with no exposed fibers or sharp projections. Handwork is acceptable, but enough resin shall be present to prevent fiber show.
- h. Any grinding, repair, or sanding of interior surfaces shall be covered with a laminate duplicating the inner corrosion liner and parafinized top coat. All exposed edges shall be sealed with the same resin as used on each vessels and shall be fully post cured.
- i. There shall be no longitudinal joints in the axial direction of the cylindrical shell. The entire shell thickness shall be built up prior to removal of the shell from the mandrel.
- j. The minimum wall thickness shall be per structural calculations but no less than 3/8 in for all vessels. Each vessel shall have external circumferential reinforcing ribs and bottom knuckle reinforcement as dictated by the design and the referenced ASTM standards. The flat bottom of both rectangular and cylindrical vessels shall be constructed integral to the straight sides off of a singular mold with no seams. Laminating flat bottom to vertical sides will not be accepted. Knuckle shall be seamless having a minimum radius of 1 1/2-inch.

D. Equipment & Tank Connections.

- 1. Lifting lugs (minimum of three) shall be provided for use in transporting and placing the vessel.
- 2. Hold downs (minimum of four) each consisting of a fiberglass reinforced polyester gusseted hold down lug laminated to the vessel sidewall and a Type 316L stainless steel anchor clip. The anchor clip shall be used for anchor bolting to the concrete foundation and clamping to the hold down lug. The hold down systems shall be of sufficient strength to hold the vessel and any exhaust duct the vessel supports against all loads.
- 3. Vessel manufacturer shall provide anchor requirements and locations to the Contractor where anchor bolts must be in place when the support pad is poured.
- 4. Anchor bolts shall be provided by the Contractor.
- 5. Vessel connection flanges shall be compatible with connecting piping and duct work and shall conform to the following:
 - a. Vessel nozzles shall be 150 psi rated flanged nozzles. Press molded or compression molded flanged nozzles will not be accepted.
 - b. All nozzles 6 in diameter and smaller shall be of the blade gusseted configuration meeting strength requirements of 1500 ft. lbs. of bending and 2000 ft. lbs. torque.
 - c. Nozzles overlays shall be as specified in ASTM D 3299 or ASTM D 4097.
 - d. The area on the back of all flanges around each bolt hole shall be the diameter of a standard washer and shall be flat and parallel to the flange face. This area shall be spot faced, if necessary, to meet this requirement. Flanges shall be manufactured by

the hand layup method and shall conform to ANSI 150 lb. standard dimensions for bolting.

- e. Blind flanges and access doors shall be the same thickness and material as the flanges to which they are attached. Tolerance as flatness shall be the same as for flanges.
 - f. Manways on bioscrubber vessel and equipment shall be a minimum of 24" I.D.
 - g. All access doors and bolted attachments shall be provided with 1/8-in thick EPDM gaskets and 316 stainless steel nuts, bolts and washers.
 - h. Access doors shall be constructed of industrial grade, clear polycarbonate that will not undergo structural deterioration or clouding and shall be of a minimum thickness of 1/2-inch.
 - i. Supports shall be suitably attached to the outer vessel walls as necessary to support vessel piping and interconnecting FRP ductwork and shall meet loading criteria specified in Paragraph 1.07.
6. Threaded couplings shall not be allowed below the liquid level.

E. Ladders and Personal Fall Prevention System.

1. Provide a ladder and personal fall prevention system for each bioscrubber tank as shown on the Drawings and specified herein. The complete system shall meet all applicable OSHA requirements. The personal fall prevention system shall be designed, engineered, and manufactured, and shall include the following:
 - a. A rigid notched carrier rail.
 - b. A means of attaching the carriers easily to ladder.
 - c. A means of dismounting at the top of ladders.
 - d. Two-locking mechanisms which travel on the carrier.
 - e. Two-full body harnesses with double (split) shock absorbing lanyards to connect the workman to locking mechanism.
2. The complete personal system shall allow the worker to operate freely in a normal climbing position. The device is to be installed in accordance with the manufacturer's instructions in such a manner to enable the worker to be attached to the device at all times during the climb without having to remove his or her hands from the ladder to operate the system effectively. This shall also enable the worker to be attached safely to the system before rotating onto the ladder.
3. The ladder and carrier rail shall be made of aluminum. All ladder and fall prevention system components shall be durable, be corrosion resistant. Unless otherwise specified in this section ladders shall meet requirements specified in Section 05500.
4. Ladder and personal fall prevention system shall adhere to structural requirements outlined in Paragraph 1.07-E.
5. The locking sleeve and safety-locking mechanism shall consist of the following:
 - a. Sleeve: Cast manganese bronze tensile strength of 110,000 P.S.I.
 - b. Locking Pawl: Tensile strength of 110,000 P.S.I.
 - c. Sleeve Springs: Dual stainless steel springs.
 - d. Roller Bearings: Six steel roller bearings.
 - e. Snaps and Links: The snap shall be drop forged steel with a proof test of 5,000 pounds.

6. The full body harness with integrated belt shall consist of the following:
 - a. Harness shall be designed to perform optimally with all other components of fall prevention system.
 - b. Harness shall meet ANSI A10.14 1991 and CSA Z259.10.
 - c. Harness shall be composed of premium 1-3/4" Nylon webbing.
 - d. Strength of webbing shall be 6,500 lbs.
 - e. All load bearing components shall be rated to 5,000 lbs. and made of drop forged plated steel.
 - f. Sliding back "D" ring on full body harness shall be used for fall arrest.
 - g. Belt shall be manufactured of two layers of one and three quarter (1-3/4) inch webbing with a two (2) inch back support pad.
 - h. Front "D" ring on belt shall be used for climbing with fall prevention system.
 - i. Harness shall have double (split) bungee cord type shock absorbing lanyard. Lanyard shall be four foot-six inches (4'-6") long un-deployed, with two and one quarter inch (2'-1/4") throat large rebar locking snap hooks on each lanyard.
7. The personal fall prevention system shall be by: Miller, North Safety Products, or approved equal.
8. The bioscrubber manufacturer shall coordinate with the fall prevention system manufacturer and the Contractor for recommended installation of the ladder and fall prevention system.
9. A lockable, mountable, weatherproof storage box shall be provided to store safety harness and accessories. A caution sign shall be provided at the lowest point of access to the ladder. The sign shall read "CAUTION – Safety Equipment Required When Climbing Ladder". The sign shall be secured to the wall.
10. Contractor shall provide fall prevention training to plant staff personnel as part of the fall prevention system and devices for this project. This training shall be provided by a firm certified in fall prevention training. Contractor shall submit information on the training firm and training agenda for approval by the Owner prior to scheduling the training. The information shall be submitted after the pre-construction conference, and before substantial completion of the project. Training shall be as scheduled by the Owner. This training shall be subsidiary to other bid items in this section.

F. Fiberglass Reinforced Plastic Fan.

1. The fans shall be sized as follows:
 - a. OCS No. 1: 13,000 scfm, adjusted to 11,000 scfm for current operation.
 - b. OCS No. 2: 9,000 scfm.
2. The fans shall be single-width single-inlet as designed and manufactured by The New York Fan Company, Hartzell Fan Co., Verantis, or approved equal.
3. The fans shall be constructed such that all surfaces in contact with the corrosive gas stream are to be made of corrosion-resistant FRP.
4. All nuts, bolts and fasteners in contact with the gas stream shall type 316 stainless steel.

5. Fans shall be AMCA Arrangement 1, 8, 9, 9F or 10. AMCA Arrangement 4, which places the motor shaft in the corrosive air stream is unacceptable.
6. Fan ratings shall be based on tests made in accordance with AMCA Standard 210 and licensed to bear the AMCA Certified Ratings Seal for Air Performance. Fans not licensed to bear the AMCA Seal for performance shall be tested, at contractor's expense, in an AMCA Registered Laboratory.
7. Fan brake horsepower's shall be less than or equal to 20 HP for OCS No. 1 and 20 HP for OCS No. 2, each at 10 inches static pressure. This static pressure accounts for the pressure drop in the bioscrubber system including the scrubber, media, damper, fan plus an additional 5 inches for exhaust system ductwork and for specified flow rates at site elevation of approximately 430 feet above sea level. If the manufacturer's system has less headloss through their system, they may reduce the horsepower requirements as necessary for their system.
8. Fan motors shall be selected to be non-overloading for the entire fan curve range and for the temperature and humidity range in Paragraph 1.09-A.
9. Fans shall be assembled with OSHA compliant shaft and motor guards.
10. Fan inlet and outlet connections shall be flanged type.
11. Fans shall be constructed in accordance with ASTM D-4167 standard specification for fiber-reinforced plastic fans and blowers to ensure structural integrity.
12. All parts exposed to the gas stream shall be constructed of, or encapsulated in, an FRP laminate capable of resisting continuous airstream temperatures of up to 250 degree F. All resins shall be clear to allow detection of subsurface imperfections. Use of pigments, gel coats, inhibitors and additives which may disguise flaws in the laminate are prohibited.
13. Fan housing shall be constructed of a fire-retardant polyester or vinyl ester resin with an ASTM E84 Class I rating. Housing laminate construction shall conform to ASTM Standard C-582.
14. Wheel shall be of backwardly-inclined, non-overloading design for increased efficiency. Wheel shall be fabricated of a fire-retardant vinyl ester resin with an ASTM E84 Class I Rating.
15. Wheel hub shall be permanently bonded to the shaft and completely encapsulated in FRP to ensure corrosion-resistant integrity. Steel wheels coated with FRP, or wheels with taper-lock hubs are not acceptable.
16. Shafts shall be 316 stainless steel.
17. The fan motors shall be horizontal, TEFC, severe duty, squirrel caged induction type, 460 Volt, 3 Phase, 60 Hz with Class F insulation and a minimum 1.15 service factor, suitable for full voltage starting and continuous operation at 50 degrees C ambient temperature at the specified loads. Provide motor with heater as specified in Section 01171. The fan motor shall be suitable for operation in a Class 1 Division 2 environment.

18. Bearings shall have heavy-duty grease lubricated ball or roller bearings with a minimum ABMA L-10 life of 40,000 hours minimum for both fan and motor. Bearings shall have ample thrust provision to prevent end play during the normal life of the bearing.

G. Fan Schedule.

1. 13,000 scfm for OCS No. 1 (adjusted to 11,000 scfm for current operation) and 9,000 scfm for OCS No. 2.
2. Ambient temperature range of 15 to 110 deg. F.
3. Suction pressure at connection to bioscrubber system will be minus 5.0 inches w.c.
4. Size, speed, and horsepower shall be determined by the bioscrubber system manufacturer. The horsepower shall not exceed 20 HP.
5. Sound power level shall not exceed 90 DBA at 5 feet.
6. Flanged connections, flexible connections, FRP transition pieces, and FRP dampers: Refer to Section 15891 (Fiberglass Reinforced Plastic Ductwork and Accessories).

H. Control Panels.

1. General.
 - a. Each bioscrubber system shall have the control logic circuits mounted in a single Master Control Panel (MCP) enclosure provided by the manufacturer and located outdoors near the bioscrubber fan, and specified herein. The MCP enclosures shall be NEMA 4X 316 stainless steel, constructed by a UL certified control panel build facility and supported by the appropriate UL labeling.
 - b. The bioscrubber MCPs shall contain all controls, timers, relays, PLC, main circuit breaker, and motor starters for manual and automatic starting, stopping, and sequencing of the bioscrubber systems. The MCPs shall have all controls to provide the control sequences specified herein. The bioscrubber MCPs shall include switches, pushbuttons, and indicator lamps and specified herein. The bioscrubber MCP shall be provided with a single 3-phase 480 volt source of power and shall include all power transformers, if required. Systems requiring more than one electrical connection shall not be allowed.
 - c. Controls shall be tested by the panel builder and by the bioscrubber manufacturer prior to shipment to owner.
 - d. All signal interface wiring between MCPs and the existing SCADA PLC shall be provided by the electrical contractor.
 - e. The bioscrubber control system shall be a Type A packaged control system type as specified in Section 13390.
2. Panel and Enclosure Construction.
 - a. The MCPs shall meet the requirements of Section 13390.
 - b. MCPs shall include a main circuit breaker as specified in Section 13390.
 - c. A six-digit, non-resettable elapsed run-time meter shall be installed on the front of each MCP for each fan and pump drive motor. Elapsed run-time meters shall be ENM, or equal.

- d. The MCPs shall house motor starters for drive motors. Starters shall be as specified in Section 13390.
 - e. Each MCP shall be provided with a surge protection unit on the load side of 120VAC /1Ø/60 Hz control power transformer. Control power transformer shall have both primary and secondary overcurrent protection and shall be sized by the bioscrubber supplier.
 - f. All necessary power conditioning and DC power supplies shall be furnished inside each MCP for proper operation of the equipment.
 - g. The MCPs shall include intrinsically safe barriers for termination of any signals to/from hazardous Class 1, Div. 1 and Class 1, Div. 2 areas. Provide 2-in separation or barriers between the conductors of intrinsically safe circuits and non-intrinsically safe circuits meeting the requirements of NEC 504.30.A.2.
 - h. PLC shall be required. PLC signals associated with the equipment to be controlled shall be wired directly to the PLC.
 - 1) PLC shall be a Type 2 Programmable Logic Controller as specified in 13390 and 17600.
 - 2) PLC discrete outputs shall drive a relay to provide a dry contact to interface with motor starters located in the MCP or in control panels furnished by others. Relay contacts shall be rated 10 amp at 120VAC. PLC input cards shall have optical isolation on individual channels.
 - 3) The manufacturer shall supply all necessary ventilation and cooling to accommodate a PLC in the ambient conditions.
 - i. The system supplier shall provide display and interface functionality at the LCP using knobs, buttons, switches, and indicator lamps. Digital touch screens or Operator Interface Units shall not be used as a primary form of control. Digital touch screens shall not be located on the exterior of the control panel.
 - j. Provide sun shield as specified in Section 13390.
 - k. Provide environmental controls as specified in section 13390.
 - l. Provide all other appurtenances required for a complete and fully operational control panel.
3. Each MCP shall include the following functions:
- a. Control of fan motor starter.
 - b. Control of water flow to the units with PLC and manual override, if required.
 - c. Control of nutrient flow.
 - d. If a recirculation pump is provided, control of the recirculation pump starter.
 - e. Dry contacts for plant SCADA system for common alarm, fan run status for the odor control inlet fan. If a recirculation pump is provided, also provide a dry contact for pump run status.
 - f. Provide a totalizing meter to track the consumed irrigation water on the control panel. The totalizing meter shall be a resettable meter that displays the total water consumed.
 - g. Ventilation and/or cooling as required to protect the PLC.
4. **Instrumentation Specifications, if required by the manufacturer, shall be the following:**
- a. Flow rate shall be measured by a turbine flow meter, Signet Rotor-X Paddlewheel or approved equal.
 - b. Flow Switch shall be vane or disc actuated with Form C snap action, hermetically seal switch rated for 10A, 125/250 VAC. Switches for pipe sizes 3/4 to 1-1/2 shall be provided with a flow body. Switches great than 1-1/2 shall be installed directly into field piping. Flow body and all wetted parts shall be 316 stainless steel. Switch

- housing shall be NEMA 4X and manufactured by Magnetrol F50 and F10 or approved equal.
- c. Differential Pressure Transmitters shall provide accuracy of 0.075% of span or better, NEMA 4X (IP66), and shall be Rosemount 3051CD or approved equal.
 - d. Pressure Switches shall be diaphragm actuated and provide repeatability or better than 1% of full scale. Set point shall be field adjustable with fixed dead band and automatic reset. Housing shall be NEMA 4X (IP65) with hermetically sealed switches, single pole double throw (SPDT) and rated for 10A at 230VAC. Switches shall be manufactured by Ashcroft or approved equal.
 - e. Pressure Gauges shall be bourdon tube actuated dial face and provide accuracy of 1% of span or better, Case shall be phenolic shock resistant or type 316 stainless steel. Gauge shall be manufactured by Ashcroft or approved equal.
 - f. Temperature Transmitters shall be three wire platinum RTD and provide accuracy of plus or minus 0.2 deg. C, NEMA 4X (IP66) and shall be Rosemount 3144P or approved equal.
 - g. High Level Float Switch shall be a hermetically seal reed switch rated for 120/240 VAC. Level Switch shall be Series F6 & F7 Horizontal Level Switch or approved equal.
 - h. All instruments shall be listed for use in Class I Division II environments.
5. The display on the control panel shall include the following items, at a minimum:
- a. Odor Control Fan failure
 - b. Odor Control Fan run status
 - c. High water level.
 - d. Irrigation water flow
 - e. Irrigation water and nutrient water totalization
 - f. If a recirculation pump is provided, pump run status and pump failure
 - g. Irrigation water
 - h. Alarms as shown on the Drawings
- I. Synthetic Media.
1. The media shall be either structured media as supplied by BioAir or random media as supplied by Biorem, or ECS. Regardless of whether the media is structured or random, the material shall be synthetic, chemically resistant polyurethane, polyethylene, or polyvinyl chloride.
 2. The media shall resist shrinking or swelling with varying moisture content.
 3. Media layers shall be removable single media blocks or randomly dumped.
 4. The treatment layers shall be designed not to short circuit or be subject to channeling under operating conditions.
 5. The manufacturer is responsible for providing the proper media content to ensure system meets specified performance.
 6. Organic media shall not be allowed.
 7. Non-synthetic inorganic media shall not be allowed.

8. Manufacturer shall warranty the media for a minimum of 10 years. Warranty shall be a full replacement warranty and non-pro-rated.

J. Irrigation System.

1. Each reactor shall be configured with sufficient fluid spray nozzles to provide sufficient irrigation.
2. Each spray nozzle shall be inspected and tested by the manufacturer to ensure even dispersion of irrigation water, and certified to be operating properly prior to shipment.
3. When required, a nutrient addition system shall be provided to allow the Owner to supplement the nutrients in the non-potable irrigation water supply, or to use potable water for irrigation.

K. Water Panel.

1. The water panels shall be constructed of 316 stainless steel and shall be of a modified NEMA 4X design. NEMA 4, 12, and 3R ratings shall not be allowed. Materials of construction other than 316 stainless steel shall not be allowed.
2. The water panels shall contain all necessary piping, valves and instruments for proper operation of the system. Provide and install a schedule 80 inline, wye strainer for the non-potable water line. A single water panel shall be provided for **each bioscrubber system**.
3. Provide panel heater as specified in section 13390.

L. Nutrient Tank.

1. The nutrient tank shall be constructed of the same material as the vessel.
2. The tank shall have a low level switch.
3. The tank shall have a water connection with ball valve.
4. A 12" diameter flanged opening shall be provided on the top of the tank with 316 SS quick-connections, bolts are not allowed.
5. The tank shall have a 2" flanged drain fitting.
6. The tank shall be fastened to the concrete sufficient to withstand the specified wind loads.
7. The tank shall have a means to release vacuum while the tank is draining during operation.

M. Recirculation System.

1. Temporary: If a temporary recirculation system is necessary for start-up, the manufacturer shall provide a fully functional temporary recirculation system.
 - a. The temporary recirculation system shall be utilized as required for the full acclimation and start-up of the bioscrubber and shall remain in the property of the manufacturer at all times.

- b. Contractor shall disconnect the temporary recirculation system once start up is complete and connect the system for normal operating mode per manufacturer's instruction.
 2. Permanent: If a permanent recirculation system is required for the bioscrubber operation, the manufacturer shall provide a fully function permanent system, including a recirculation pump as specified herein.
- N. Recirculation Pump (if necessary based on the manufacturer's recommendation and proposed system).
 1. Each recirculation pump shall pump the low pH liquid from the vessel's sump to the spray headers.
 2. Each pump shall have a capacity adequate to meet necessary irrigation pressure and flow requirements for a fully functioning recirculation system. The pump capacity and head shall be based on the selected manufacturer's system and may be revised as necessary in order to provide a functional system. All deviations shall be submitted to the Engineer for review and approval.
 3. Pump motor horsepower shall be a 7.5 HP (maximum).
 4. The number of recirculation pumps is one (1) per bioscrubber system. One (1) shelf spare pump shall be provided for use at both systems.
 5. Pump shall be seal less, magnetically driven, horizontal, single stage, base mounted, end suction centrifugal configuration manufactured in accordance with ANSI Horizontal End Suction Pumps for Chemical Process.
 6. The pump casings have a top discharge. Suction and discharge connections shall be 150 lb. standard ANSI flanges.
 7. The pump casings shall be constructed of polypropylene and shall be designed to be suitable for pressures of at least 1.5 times the shut off head of the pump.
 8. Magnets shall be rare earth, high performance.
 9. The impellers shall be constructed of the same material as the casing and shall be fully open with contoured passages. The impellers shall be balanced for high efficiency.
 10. The pump shafts shall be of Type 316 stainless steel and shall be manufactured such that deflection is minimal. Where the shaft is directly exposed to the liquid being pumped, the shaft shall be protected by polypropylene shaft sleeves.
 11. The shaft shall be guided by low PV stationary bearings and rotary sleeve/thrust bearings that are resistant to corrosion from the process fluid.
 12. Each pump shall have an electrically non-conductive containment shell that is resistant to corrosion from the low pH process liquid.

13. The bearing frames and bearing housing adapters shall be of cast iron construction with chemically resistant two-part epoxy resin coating and shall have a registered fit with the pump casings.
 14. The recirculation pump shall be able to operate outdoors and be exposed to sunlight and hot temperatures, specified in Paragraph 1.09-A, without pump material degradation.
 15. The recirculation pump motors shall be horizontal, TEFC, severe duty, squirrel caged induction type, 460 Volt, 3 Phase, 60 Hz with Class F insulation and a minimum 1.15 service factor, suitable for full voltage starting and continuous operation at 50 degrees C ambient temperature at the specified loads. The pump motors shall be suitable for operation in a Class 1 Division 2 environment. Provide motor with thermal protection and heater as specified in Section 01171.
 16. If required, fiberglass base plates shall support the pumps and motors. The base plates shall have holes mounting to a concrete equipment pad. The pumps and motors shall be assembled on the base plates in the manufacturer's shop.
 17. Brass or stainless steel nameplates giving the name of the manufacturer, model number, the rated capacity, head, speed and any other pertinent data shall be permanently attached to each pump.
 18. Brass or stainless steel nameplates giving the name of the manufacturer, serial number, model number, horsepower, speed, voltage, amperes and other pertinent data shall be attached permanently to each motor.
 19. The pump manufacturer shall supply all drive units and factory mount them on a common baseplate with the pumps. Acceptable vendors:
 - a. Vanton Pump and Equipment Corp
 - b. ANSI Mag
 - c. Goulds Pumps
 - d. Or Engineer approved equal
- O. Exhaust Stack.
1. Provide a connection location (flange outlet or NPT) and necessary fitting(s) such that the 1/4-in exhaust sample PE tubing inside the 3/4-inch PVC pipeline can be connected to each exhaust stack. The location of the 3/4-inch NTP shall be coordinated with the location of the 3-inch pipe supports along the vessel. The sample connection and piping described above shall also be provided for the inlet side of the system. The manufacturer shall coordinate the inlet sample location with the Engineer.
- P. Test ports
1. Provide test ports as shown on the Drawings, at minimum. Additional test ports shall be provided per the manufacturer's recommendation at no additional cost to the Owner

PART 3 EXECUTION

3.01 INSTALLATION OF BIOSCRUBBER SYSTEM

- A. The manufacturer/supplier shall be responsible for shipping the equipment and shall coordinate with the Contractor for proper off loading at the job site. The Contractor shall provide rigging services to place the equipment on the concrete pad. Anchor bolt holes shall be provided in accordance with the manufacturers shop drawing submittal. Any changes in bolt placement due to errors in the shop drawing shall be the responsibility of the manufacturer. The manufacturer or authorized representative shall have a technical representative, who is experienced in installing the equipment, on-site at the time of installation.
- B. The exhaust duct, power and control wiring, water supply, and drain line will be brought to the concrete pad by others. The Contractor will be responsible for connecting the exhaust duct, power and control wiring.
- C. Installation of the systems shall be completed by Contractor in accordance with the manufacturer's written instructions. At the discretion of the manufacturer, a manufacturer's technical representative may be present during the installation.

3.02 UTILITIES

- A. Electrical:
 - 1. A single 480V / 3-phase / 60 Hz electrical connection shall be made by the Contractor to the control panel. Systems requiring separate 110V and 480V power supplies shall not be allowed.
- B. Water:
 - 1. Water supply lines shall be provided by the Contractor as shown on the Drawings. The water supply shall be provided at a sufficient pressure and flow as required for system irrigation.
- C. Connection of the water supply to the water panel shall be completed by the installing Contractor.
- D. Heat tracing and aluminum jacketed insulation, in accordance with Section 15250, shall be provided by the Contractor.

3.03 START-UP

- A. Start-up shall occur in conjunction with start-up of the North two thickeners (2A and 2B, Phase 1 construction) to provide ventilation during thickener operation. Bioscrubbers shall be utilized to treat odors from the North thickeners while Phase 2 construction is completed, however the specified performance is not required until the complete thickener system is substantially complete. Phase 1 start-up shall follow manufacturer recommended procedures.
- B. The Contractor shall coordinate testing, adjusting and balancing per Section 15950. Testing, adjusting and balancing shall be provided at two separate times; once in conjunction with the

start-up of the North thickeners and once in conjunction with the start-up of the fully-installed thickener system.

- C. A representative of the manufacturer who is experienced in the start-up of bioscrubber systems shall provide the services during start-up.
 - 1. Check all fan and water flow functions.
 - 2. Measure air flows after the odorous air collection system is adjusted to the specified flow rates.
 - 3. Make all provisions required to minimize acclimation time of the bioscrubber systems.
 - 4. Install all sampling taps in the bioscrubber required for acceptance testing.
- D. Once all thickeners are online, operating, and connected to the odor control systems, an acclimation period of up to 28 days after initial startup shall be allowed. Once the acclimation period is completed, the manufacturer shall commence Performance Testing as outlined in the following section.
- E. Start-up of the systems shall be the responsibility of the manufacturer, who shall furnish factory-trained personnel to complete this activity. Start-up will commence following a visual inspection and check out of the systems by the manufacturer's technical representative.

3.04 ACCEPTANCE TESTING

- A. Performance Testing shall not commence until the Testing and Balancing Report for the entire ductwork system is submitted and approved by the Engineer.
- B. The Owner shall schedule acceptance testing within 90 days of connecting Thickeners No. 1A and 1B to OCS No. 1 and 2. The total acclimation period shall not exceed 28 days.
- C. The fan speeds or inlet dampers shall be adjusted so that 5,500 scfm (current **operation**) goes to each vessel of OCS No. 1 and 4,500 scfm goes to each vessel of OCS No. 2, with the media microbial population fully developed.
- D. Sample collection equipment and hydrogen sulfide monitoring instruments will be provided by the manufacturer but must be approved by the Engineer.
- E. Inlet and outlet hydrogen sulfide concentrations will be monitored and logged continuously over a period of 24 hours. Inlet measurements shall be collected from the main duct upstream of the bioscrubber system inlet. Outlet conditions will be monitored at the discharge stack for each bioscrubber vessel.
- F. For each bioscrubber system, two inlet odor sample and four outlet odor samples (two per vessel) will be taken concurrently under average conditions, as shown on hydrogen sulfide monitors.
- G. Thus, there will be a total of twelve (12) odor samples. The samples shall be sent to St. Croix Sensory, Inc. of Stillwater, MN by overnight delivery for odor analyses. Odor concentrations will be measured and analyzed in accordance with EN 13725.

- H. To pass the acceptance test, the bioscrubber systems shall meet both hydrogen sulfide and odor reduction criteria set forth in Table 2, shown in Paragraph 1.07.
- I. If either system fails the acceptance test, the manufacturer shall conduct up two additional rounds of testing at no expense to the Owner. If the system does not pass after the additional testing, the manufacturer shall make whatever provisions are required to meet the criteria as defined in Paragraph 1.07 at no expense to the Owner. Failure to pass the acceptance test within 3 months of the initial acceptance test may result in forfeiture of the final payment, at the sole discretion of the Owner.

END OF SECTION