MBBR
Specifications

ADDRESS
Orenco Systems, Inc.
814 Airway Ave.
Sutherlin, OR 97479 USA

CONTACT
1-800-348-9843
+1 541-459-4449
www.orenco.com

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SECTION 00000
ORENCO MBBR SPECIFICATIONS

PART 1. GENERAL

1.01 DEFINITIONS

Wherever used in these specifications, capitalized and in bold text, the terms listed below will have the meanings indicated, which are applicable to both the singular and plural thereof.

- **Bid** – The offer or proposal of a **Bidder**, submitted on the prescribed form, setting forth the prices for the work to be performed.
- **Bidder** – An individual or entity who submits a **Bid** directly to the **Owner**.
- **Contractor** – The individual or entity with whom the **Owner** has entered into an agreement to install an Orenco Moving Bed Biofilm Reactor (**MBBR**).
- **Engineer** – The individual or entity responsible for preparation and certification of the construction plans and/or construction management.
- **Inspector** – The specific individual designated by the **Owner**, **Engineer**, **Contractor**, and **Manufacturer** to ensure quality control by inspecting and certifying that each Orenco **MBBR** complies with the **Manufacturer**'s recommendations and requirements.
- **Manufacturer** – A supplier, fabricator, distributor, or vendor having a direct or indirect contract with the **Contractor** or the **Owner** to furnish materials or equipment to be incorporated in the work by the **Contractor**.
- **Manufacturer's Representative** – A firm under contract with the **Manufacturer** to sell or solicit sales and/or represent the **Manufacturer** as a limited agent for the **Manufacturer**'s products.
- **Moving Bed Biofilm Reactor (MBBR)** – An attached-growth treatment technology using biofilm carrier submerged in liquid, in aerobic and/or anoxic conditions, designed to perform organic removal, nitrification, or denitrification of highly nitrified effluent.
- **Owner** – The individual or entity that has entered into the direct or indirect contract and for whom the work is to be performed.

1.02 GENERAL DESCRIPTION

The treatment package shall be an integrated Orenco **MBBR** treatment unit, completely assembled in an insulated fiber-reinforced polymer (FRP) composite vessel, installed in accordance with the design plans and these specifications. The **Manufacturer** or **Manufacturer's Representative** shall furnish a complete, factory-built **MBBR** unit(s), consisting of an insulated FRP composite vessel, fine-bubble air diffusers or pneumatic mixers (as applicable), air-delivery lines, and biofilm carrier. The package shall also include an air-delivery blower for organic removal and/or nitrification as well as proper mixing of the biofilm carrier in the aerobic and anoxic sections. The package shall include associated controls, either as a stand-alone control panel or as an integrated part of a larger treatment system control panel.

1.03 SUBMITTALS

The **Manufacturer** or **Manufacturer's Representative** shall submit an electronic set of shop drawings and technical data sheets. The submittals shall clearly specify the materials of construction and equipment compatibility, along with drawings for each unique package being supplied. There shall be no alternatives or substitutions considered.

1.04 OR ENGINEER-APPROVED EQUAL

For this project, "**Engineer**-approved equal" shall mean equal in the judgment of the **Engineer**, and the term "**Engineer**-approved equal" will therefore be used throughout this specification as defined in this section.

A. Should the **Bidder** seek approval of an alternative or substitute product, system, or component other than the brand or brands named in the specifications, the **Bidder** shall furnish written evidence that such substitute conforms in all respects to the specified requirements and that it has been used successfully elsewhere under similar conditions. It will not be the responsibility of the **Engineer** to research, review, or determine equality, nor the responsibility of the **Manufacturer**, specified within these specifications, to provide research, documentation, or data supporting the difference between the substitute and what is specified. This will be the sole responsibility of any **Bidder** seeking the approval.

B. Where the specified requirements involve conformance to recognized codes or standards, the **Bidder** shall furnish evidence of such conformance in the form of test or inspection reports, prepared by a recognized agency, and bearing an authorized signature. The **Manufacturer**'s standard data and catalog cut sheets will not be considered sufficient in themselves, and the **Engineer** will not be responsible for seeking further data from the **Manufacturer**, or for otherwise researching the alternative. Failure to provide complete data will be cause for rejection of the alternative. The submission shall include any impacts that could be expected from the substitute and shall also indicate any product that would require a license or royalty, the actual fees, and a note that these fees would be handled by the **Bidder**. The **Bidder** shall provide submissions meeting the above parameters no less than TWO WEEKS prior to **Bid** opening for review by the **Engineer**. **Bidder**(s) seeking **Engineer** approval of substitutes shall provide, at minimum, the following information:

1. Product and system submittals, including, but not limited to, the number of years the **Manufacturer** has been in the business of manufacturing relevant products/systems.
2. Company size, including:
    a. Number of employees related to relevant products/systems
    b. Number of engineers on staff related to relevant products/systems
3. Product specifications and a detailed description of how each alternative product or component is equal to the specified product, system, or component. A side-by-side comparison is required.
    a. Equipment/system warranty along with exclusions
    b. Performance claims, including, but not limited to:
        1) Treatment design
            - Surface area, including protected surface area
            - Maintenance frequency
        2) Blower description
            - **Manufacturer** and origin
            - Length of service
            - Number of units in operation
            - Life-cycle cost (repair and replacement frequency)
            - Warranty
        3) Corrosion resistance
        4) Blower power requirements
            - Acceptable cycle operating range
            - Operating costs per year
        5) Control panel components
            - **Manufacturer** and origin
            - Length of service
            - Number of units in operation
            - Warranty
            - Enclosure description
    c. Evidence of successfully obtaining approval for a system with similar permit requirements with the regulating authority
    d. Summary of product/system track record and history, including, but not limited to number of similarly sized systems

C. The **Bidder** shall specify and furnish documentation related to the **Manufacturer's** (or **Manufacturer's Representative's**) support services, including, but not limited to:

1. Installation training program and support material
2. Installation oversight program and support material
3. Operator training program and support material
4. Start-up services program and support material

D. The **Engineer** is eligible for reimbursement for the evaluation of any alternative product substitute, including, but not limited to:

1. Installation training program and support material
2. Installation oversight program and support material
3. Operator training program and support material
4. Start-up services program and support material

1.05 MANUFACTURER

The **Manufacturer** shall be Orenco Systems, Inc. The **Manufacturer** shall furnish complete, factory-built **MBBR** unit(s), consisting of an insulated FRP composite vessel, fine-bubble diffusers or pneumatic mixers (as applicable), air-delivery lines (for air feed or pneumatic mixing), and biofilm carrier. The package shall also include an air-delivery blower for organic removal and/or nitrification, as well as proper mixing of the biofilm carrier, and associated controls, either as a stand-alone control panel or as an integrated part of a larger treatment system control panel. A separate blower is required for mixing in the anoxic sections (if applicable). The **Manufacturer** or **Manufacturer's Representative** shall supply detailed installation instructions as well as operation and maintenance (O&M) instructions. The **Manufacturer** or **Manufacturer's Representative** shall also provide the following support personnel:

A. Experienced support staff dedicated to supporting the project through design, construction, and O&M

B. Asset management department dedicated to assisting operators with operational and maintenance activities

1.06 WARRANTY

The **Manufacturer** shall warrant that all component products comprising an **MBBR** shall be free from defects in materials or workmanship that cause the product to lose structural integrity, or to operate improperly electrically or mechanically for a period of three (3) years from the date of purchase. The **Manufacturer** shall submit details of all limitations and exclusions that may apply to the warranty. The warranty shall be documented in product literature. The use of any non-Orenco components during the warranty period shall render the warranty null and void.

1.07 INTEGRATED SYSTEM

The entire **MBBR** unit, consisting of an insulated fiberglass vessel, fine-bubble diffusers or pneumatic mixers, air-delivery lines, biofilm carrier, air-delivery blower, and associated controls shall be an integrated package provided by a single **Manufacturer** and designed to work together. The controls shall operate either as a stand-alone control panel or as an integrated part of a larger treatment system control panel, with the approval of the **Manufacturer** and the **Engineer**.

1.08 SERVICEABILITY

The **MBBR** shall be serviceable, with easy access to inspect the biofilm carrier, media retention plates, and sludge removal components, if applicable. Other than pump(s) required for pre-anoxic return or sludge removal, all mechanical and electrical components shall be housed in a fiberglass shelter outside of the treatment unit.

PART 2. INFLUENT CHARACTERISTICS

MBBRs can be designed to cover a wide range of influent waste strengths and can be used for organic removal and/or nitrification with a denitrification option. Regardless of application, the influent to the **MBBR** shall be screened or filtered to a maximum particle size of 0.24in (6mm), with a particle size of 0.16in (4mm) or smaller being preferred. Prescreening or filtering may be mechanical or static, depending on influent flow volumes and characteristics, as well as space available, maintenance expectations, etc. Options for prescreening and filtering are numerous and are not covered specifically in this document.

PART 3. FRP COMPOSITE VESSEL

3.01 FRP COMPOSITE VESSEL

A. The **Manufacturer** shall be Orenco or **Engineer**-approved equal. The **Manufacturer** or **Manufacturer's Representative** shall supply detailed installation instructions, maintenance instructions, and warranty terms to the **Engineer**. The **Manufacturer** shall provide structural design and certification to the **Engineer** for review. The design shall be in accordance with accepted engineering practice. All FRP composite vessels shall be insulated, foam-core, monolithically molded structures. All vessels, when properly anchored, shall be suitable for full bury with ground water to the surface or to be free standing on the ground surface without an external support structure.

B. Loading criteria:

1. The vessel shall be rated for a minimum 500lbs/ft^2 (2441kg/m^2) loading criteria, based on a saturated backfill of 140lbs/ft^3 (2243kg/m^3) and an unsaturated backfill of 127lbs/ft^3 (2034kg/m^3).
2. Minimum lateral loading shall be 62.4lbs/ft^3 (1000kg/m^3). Lateral loading shall be determined from ground surface.

C. Two (2) typical loading conditions to be analyzed:

1. Full exterior hydrostatic load with unit buried to its top surface.
2. Interior hydrostatic load with vessel full and unsupported by soil (e.g., a mobile application sitting on a stable base). Load case 2 represents the vessel full of liquid at 62.4lbs/ft^3 (1000kg/m^3). This condition addresses seam and haunch stress-strain relationships that occur during watertightness testing, as well as poor soil bedding conditions that provide inadequate support.

D. Vessels shall be capable of successfully withstanding an above-ground static hydraulic test and shall be individually tested to **Manufacturer**'s specifications.

E. All vessels shall be manufactured and furnished with access openings allowing the system operator to inspect the treatment unit and biofilm carrier, inspect the media retention plates, and perform removal of sludge as necessary based on the configuration shown on **Manufacturer**'s drawings. Modification of completed vessels is not allowed.

F. Inlet plumbing shall either be an inlet tee protected by a media retention screen (if entering via gravity or pump from another tank or vessel) or a rectangular penetration fitted with a media retention plate (if built as part of a larger treatment system).

G. All vessels shall be installed in strict accordance with **Manufacturer**'s recommended installation instructions.

H. Vessels shall be analyzed using finite element analysis and/or structural calculations for buried or freestanding structures, and the analysis shall address the following:

1. Strength
2. Buckling
3. Deflection of 5% of the FRP vessel span, based on service load (including long-term deflection lag)
4. Buoyancy (when applicable)
5. Seismic and wind effects (when applicable)

I. The material properties and laminates considered in this analysis shall be FRP. The resin must be considered acceptable for use with tank or vessel construction. The thicknesses for different regions of the vessel shall be described and shown in shop drawings for each individual vessel. Typical ultimate yield design strength properties are as follows:

1.	Tensile yield strength, psi (kPa)	56,300 (388,175)
2.	Flexural yield strength, psi (kPa)	53,800 (370,938)
3.	Compressive yield strength, psi (kPa)	47,600 (328,190)
4.	In-plane shear yield, psi (kPa)	19,100 (131,690)
5.	Flexural modulus, psi (kPa)	2,400,000 (16,547,418)

J. Vessels shall be manufactured from FRP, using grades of resin and fiberglass considered acceptable for use in water and wastewater environments. Insulation foam is a minimum 2lbs/ft^3 (32kg/m^3) polyurethane or polyisocyanurate. All FRP laminate shall obtain a minimum glass reinforcement content of 70%. All interior surfaces shall be protected with a polyester gelcoat. Typical structural design safety factor (SF) shall range from 8 to 10. All exterior surfaces shall be

protected with an acrylic/urethane copolymer coating that is rated for continuous outdoor exposure. Any permanent metal part shall be 300-series stainless steel.

K. FRP vessels shall be seamless, molded enclosures that use a vacuum-bagging process to ensure integral bonding of the foam core with the fiberglass laminates. Walls and ceiling shall range from 4in to 8in (100mm-200mm) thick with a minimum insulation value of R24 (RSI 4.23). The fiberglass laminate on either side of the foam core is a minimum 0.17in (4.3mm) thick. There shall be no mechanical fastening of walls and floor. All penetrations specified for the FRP vessel shall be provided by the Manufacturer.

L. Vessels shall be equipped with lifting brackets installed on the wall exterior or on the top to allow lifting by crane, excavator, or similar equipment.

M. To demonstrate watertightness, each vessel shall be tested at the factory prior to shipping and again during installation, to acceptance. Each vessel shall be filled with water to the level of the discharge weir. The vessel shall be inspected for leaks after a minimum two-hour wait (or as required by local rules). There shall be no drop in liquid level and no visual leakage from seams, pinholes, or other imperfections. No vessel will be accepted if there is any leakage over the two-hour period.

N. Installation shall be in accordance with the Manufacturer's recommendations, or as shown on the contract plans, whichever is more stringent, with no variations.

PART 4. VESSEL ACCESS EQUIPMENT AND PENETRATIONS

4.01 ACCESS PORTS

The Manufacturer shall be Orenco. Access ports shall be required for access to inspect the treatment process and access to the vessel for solids removal, as needed. All access ports shall be constructed of FRP and must be corrosion resistant and watertight. Standard hatches are 24in x 36in (610mm x 914mm) for tank access. Hatches for diffuser access can be either 36in x 105in (914mm x 2667mm) or 24in x 105in (610mm x 2667mm). Fasteners are stainless steel bolts.

4.02 ACCESS HATCHES AND LIDS

All access hatches and lids shall be constructed of FRP, aluminum, or stainless steel, and must be corrosion resistant and watertight. FRP hatches and lids shall be manufactured using a closed-molded RTM or vacuum-infusion process. To ensure product compatibility, Orenco shall supply all access equipment, lids, and attachment components.

4.03 MEDIA RETENTION PLATES AND WEIRS

The FRP vessel shall be constructed to ensure retention of the biofilm carrier.

A. The Manufacturer shall install an inlet tee for either a gravity inlet from another vessel or for a pumped inlet. The inlet tee nominal diameter shall be 4in (100mm) or larger Schedule 80 for gravity, or appropriately sized for a pump inlet, typically a minimum of 2in (50mm) diameter Schedule 80.

B. Two media retention plates shall be installed – one at the inlet of the vessel and one at the outlet. The media retention plates shall completely protect the penetrations to ensure that carrier shall remain in the chamber, even during a surcharge event. The media retention plates shall be removable for maintenance or replacement, if necessary.

1. The media retention plate shall be a perforated plate design with 3/8in (9.5mm) round perforations staggered by 1/2in (12.7mm), with an open area of greater than 51%.

2. The media retention plate shall be constructed of 11-gauge stainless steel; all minor parts and fasteners shall be 304 stainless steel.

PART 5. MBBR BIOFILM CARRIER

5.01 MATERIAL OF CONSTRUCTION

The biofilm carrier elements shall be constructed of durable, high-density polyethylene (HDPE) and shall be lightweight, with a specific gravity ranging between 0.93 and 1.105.

5.02 BIOFILM CARRIER ELEMENT CHARACTERISTICS

The biofilm carrier elements shall have an open internal design to resist clogging, while providing a large, protected surface area. For most MBBR treatment systems, biofilm carrier elements shall be Raschig's Kontakt® 650.

A. Biofilm carrier element size shall be 1in diameter by 1/4in long (25.4mm x 6.4mm).

B. The total surface area shall be at least 198ft^2/ft^3 (650m^2/m^3).

C. The protected surface area shall be at least 168ft^2/ft^3 (550m^2/m^3).

D. A minimum of two distinct colors of biofilm carrier elements shall be used to easily inspect mixing of the biofilm carrier within the vessel. The minimum quantity of elements of a second color shall be no less than 10% by volume.

5.03 SIZING CRITERIA

Only protected surface area shall be used in calculations to determine media (biofilm carrier) volume requirements.

PART 6. AERATION AND MIXING SYSTEM

The **MBBR** unit shall include an aeration system capable of meeting the organic and/or nitrogenous oxygen demands of the **MBBR** as determined by the project requirements. In addition, the aeration system shall be capable of providing complete mixing of the vessel's volume as well as helping to shear excessive growth from the biofilm carrier. The entire aeration and mixing system shall be provided as an integrated system, and all components within the vessel shall be installed at the factory by the **Manufacturer**.

6.01 FINE BUBBLE AIR DIFFUSER MANIFOLDS

A. The air diffuser system shall be mounted in the treatment vessel. Two-inch stainless steel is used above the water line; schedule 80 PVC is used below the water line. The model and quantity of diffusers are based on the air requirements necessary for proper aeration for organic removal, aeration for nitrification, and mixing as designated by the **Engineer**. Each vessel will require multiple diffuser manifold sections. Each manifold section will be comprised of one or two lines including diffusers, caps, and isolation valves. In addition, each manifold section shall be removable for inspection or repair while the system is operating. Each line of the manifold section will include a slide rail removal system.

1. For 10ft wide vessels, each line shall be capable of using up to 8 diffusers. Simplex (one-line) and duplex (two-line) assemblies shall be installed. The actual number of diffusers used per line is dependent on the oxygen delivery and mixing energy required for each process chamber.
2. For 8ft wide vessels, each line shall be capable of using up to 6 diffusers. Simplex (one-line) and duplex (two-line) assemblies shall be installed. The actual number of diffusers used per line is dependent on the oxygen delivery and mixing energy required for each process chamber.

B. Diffusers shall be coated with a polytetrafluoroethylene (PTFE) membrane barrier. The PTFE membrane reduces plasticizer extraction, shrinking, and membrane hardening, while limiting dynamic changes that can result from swell, such as creep. In addition, PTFE improves consistency of headloss over the life of the product. The model of fine-bubble diffusers used shall be SSI Aeration's Model AFD270 9in Disc Diffuser System:

1. Design flow: 1.5-3.0 standard cubic feet per minute (SCFM) (2.5-5.1sm^3/hr)
2. Flow range: 0-7SCFM (0-12sm^3/hr)
3. Active surface area: 0.41ft^2 (0.038m^2)
4. Slit quantity: 6600
5. Polypropylene body
6. 212ºF (100ºC) temperature resistance
7. Membranes with individual thermocouples in each cavity

6.02 PNEUMATIC MIXERS

A. Orenco pneumatic mixers shall be mounted in the treatment vessel. The quantity of mixers is dependent on vessel depth:

1. For a 7ft or 8ft (2.13m or 2.44m) vessel depth, there shall be one mixer per 28ft^2 (2.6m^2).
2. For a 10ft (3m) vessel depth, there shall be one mixer per 40ft^2 (3.7m^2).
3. For a 12ft (3.66m) vessel depth, there shall be one mixer per 50ft^2 (4.6m^2).

B. Pneumatic mixers shall be installed in a staggered configuration to ensure complete mixing.

C. Pneumatic mixers shall be attached to the floor of the treatment vessel.

D. Pneumatic mixers shall have no moving parts.

E. All air delivery piping within the treatment vessel shall be installed at the factory by the **Manufacturer**. Connection to the pneumatic mixers shall be via PVC manifold to flexible tubing.

6.03 BLOWER ASSEMBLIES

Air delivery to the fine-bubble diffusers shall be accomplished using a premanufactured blower assembly. The air delivery assembly shall be sized based on the required design parameters for both aeration and mixing. The blower systems shall either be based on three (3) 50% capacity blowers, running two (2) at a time and cycling daily to another set of two (2); or on two (2) 100% capacity blowers, cycling daily. Separate organic and nitrification blowers may be considered using the same concept. Air for mixing in the anoxic zone (if applicable) will be provided by a separate blower.

A. Blowers shall be the regenerative type, with the following specifications:

1. Motors shall be totally enclosed fan cooled (TEFC) with Class F insulation.
2. Motors shall be oil free.
3. Motors shall be Underwriters Laboratories (UL) Recognized and Conformité Européenne (CE) Compliant.
4. Motors shall be constructed of rugged, die-cast aluminum.
5. Blowers shall be manufactured by Airtech® or **Engineer**-approved equal.

B. Blower accessories shall be provided by the blower **Manufacturer** and shall include:

1. Isolation pads
2. Inlet filter

C. Piping and fittings:

1. All piping from the blower assembly in the building or shelter to the **MBBR**a manifold shall be stainless steel and shall connect to stainless fittings provided by the **Manufacturer**.
2. All piping from the blower assembly to the pneumatic mixer grid of an **MBBR**d shall be schedule 40 or 80 PVC and shall connect to the PVC fittings provided by the manufacturer.
3. Each blower shall be provided with an isolation valve. Valves shall be 150psi (1034kPa), stainless steel, 2-piece body design, locking handle, and full port design as manufactured by U.S. Valve or **Engineer**-approved equal.

6.04 BLOWER LOCATION

Blowers shall be located within a building or shelter where the unit is protected from exposure to the elements. The shelter shall be constructed with proper ventilation allowing for proper cooling of the blower units. For shelter specifications, see document XXX-XXX-XXX.

PART 7. ACCESSORY ITEMS

7.01 CHEMICAL FEED SYSTEM(S)

An alkalinity feed system will be required for all systems requiring nitrification. A carbon-feed system will be required for any system with a post-anoxic denitrification chamber.

A. For lower-flow applications, the liquid chemical feeder shall be an Orenco Model LCFXX36-AG for above-ground applications or Model LCFXX36-BG for below-ground applications. The feeder shall be manufactured from corrosion-resistant stainless steel and durable fiberglass parts. Feeder shall include a 1/3hp (0.25kW), 1750rpm, direct-driver mixer to keep slurries in suspension.

B. For higher-flow applications, the **Engineer** shall specify chemical feed equipment in a separate section.

C. The **Engineer** shall coordinate with the **Manufacturer** to ensure all lines to the treatment vessel are appropriately sized and installed in the vessel by the **Manufacturer** prior to shipping. No field modification shall be allowed.

7.02 AIRFLOW MONITORING

Airflow monitoring is recommended when multiple processes are used (e.g., organic removal and nitrification) and is also often preferable when multiple process stages are used. There are many options, based on the system size, complexity, and flow ranges. Airflow monitors shall be manufactured by Fox® Thermal Instruments, Inc. Airflow monitoring equipment shall be specified using the following parameters:

A. Process(es) to be monitored

B. Anticipated airflow range

C. Site indicator or signal-type output

7.03 AIR MANIFOLD THROTTLING AND ISOLATION VALVES

A. Throttling valves used for setting airflow shall be 150psi (1034kPa), 2in (50mm), stainless steel, manually adjustable gate valve.

B. Isolation valves shall be 150psi (1034kPa), stainless steel, locking handle, and full port design as manufactured by U.S. Valve or **Engineer**-approved equal.

PART 8. CONTROL SYSTEM

The control system shall be provided by the **MBBR Manufacturer**, Orenco, and shall be specifically designed to integrate with the specified **MBBR** processes.

8.01 CONTROL SPECS

All pumping system and blower components shall be installed in accordance with the **Manufacturer**'s recommendations, the **Engineer**'s plans, and all state and local regulations. Controls shall either be telemetry or PLC-controlled and manufactured by Orenco. Control panel requirements are specific to the project size, complexity, and reporting requirements, but shall be capable of the following at a minimum:

A. Reporting and communicating remotely through telemetry

B. Providing circuit breakers and an HOA (hand/off/auto) switch for each motor

C. Receiving signals from system sensors, probes, or flow monitoring devices as specified by the **Engineer**

D. Controlling chemical feed units as specified by the **Engineer**

8.02 LOCATION

The **Contractor** shall locate the control panel within the shelter unit described in Section 1.08 above.

PART 9. SPARE PARTS

Applicable spare parts shall be included with the system and shall include, but not be limited to, the following:

A. Blower components
   1. One (1) spare blower of each model specified
   2. One (1) full set of blower silencer gaskets
   3. One (1) inlet air filter cartridge for each blower inlet size specified
   4. One (1) blower check valve of each size specified

B. Valves
   1. One (1) blower isolation valve of each size specified
   2. One (1) airflow control valve, if used

C. Sensor components (if used)
   1. One (1) probe guard
   2. One (1) sensor cable

D. Aeration components
   1. One (1) fine-bubble diffuser for every ten (10) specified

E. Control panel components
   1. Two (2) motor contactors
   2. Two (2) circuit breakers
   3. One (1) CR relay

PART 10. SUPPORT, TRAINING, TESTING, AND OVERSIGHT

10.01 PRECONSTRUCTION CONFERENCE

Before any work at the site is started, and when specified by the **Engineer**, a conference attended by the **Owner**, **Contractor**, **Engineer**, and **Manufacturer** (or **Manufacturer's Representative**) and others, as appropriate, will be held to establish a working understanding among the parties as to the work involved for installing the **MBBR** treatment unit(s). At this conference, the **Owner**, **Contractor**, **Engineer**, and **Manufacturer** shall designate, in writing, a specific individual to act as the **Inspector** for the installation of the **MBBR**. Any cost or fees associated with the services of the **Inspector** or the **Engineer** during construction will be the responsibility of the **Owner**.

10.02 INSTALLATION AND FIELD-TESTING TRAINING

Upon request, the **Manufacturer** or **Manufacturer's Representative** shall provide the services of a trained representative to instruct the installing **Contractor**'s crew and the **Inspector** regarding the proper installation and field-testing of each **MBBR** unit per the **Manufacturer**'s recommendations and requirements. The **Manufacturer** or **Manufacturer's Representative** shall have a trained representative provide installation and training services for a minimum of one (1) four-hour day at the beginning of construction.

10.03 QUALITY CONTROL

A. To ensure quality control, the **Inspector** shall inspect and certify that the installation of the **MBBR** unit(s) is in compliance with the **Manufacturer**'s recommendations and requirements.

B. Upon completion of the inspection, the **Inspector**, in coordination with the **Engineer**, shall perform or direct the **Contractor** to perform any required adjustments to the equipment and place it into operation under the supervision of the **Engineer**. All equipment and materials required to perform the testing shall be the responsibility of the **Contractor**. The completed inspection checklist shall be signed by the **Inspector** and copies faxed, emailed, or mailed to the **Engineer** and **Manufacturer**(s) within one (1) week of installation and prior to system commissioning.

10.04 SYSTEM COMMISSIONING

The **Manufacturer** or **Manufacturer's Representative** shall provide the services of a trained representative for training the **Owner**'s service provider.

For systems requiring nitrification, a second visit shall be provided after the nitrifiers are established. The second visit will ensure proper air and mixing is occurring within all stages in the treatment system. A short report will be provided to the **Engineer** confirming the system is operating as designed.

10.05 OPERATION AND MAINTENANCE

A. The **Manufacturer** shall provide three (3) operation and maintenance manuals: two (2) to be sent to the **Owner**, and one (1) to be sent to the **Engineer**.

B. During the first full year of operation, the **Owner** shall provide all testing results and a list of maintenance activities monthly to the **Manufacturer**. The **Manufacturer** shall review results and provide feedback on operating parameters, equipment performance, and maintenance activities.

C. At the end of the first year of operation, if requested by the **Owner**, the **Manufacturer** or **Manufacturer's Representative** shall commit to a site visit to assess equipment integrity and operational and maintenance processes, and to address issues raised by the **Owner** specific to the **MBBR** treatment equipment or control parameters. [A service package may be offered. Details TBD.]