SECTION 465349 - MEMBRANE BIOLOGICAL REACTORS

Note that this section has only been edited for NYSOGS standardization and has not been technically edited. The designer shall make all technical edits specific to the project for this section.

This Section includes membrane biological reactors (MBR or "membrane bio-reactors") and components.

An MBR is a pressurized, pre-engineered membrane system with a modular "building block" configuration of microfiltration or ultrafiltration modules intended to simplify design and operation and to reduce installation costs. The membrane unit serves as a solids separation processor.

There are two configurations available for MBR equipment: (1) internal, in which the membranes are immersed within the biological reactor; and (2) external or side stream, in which the membranes are contained within a separate unit processor (this configuration would require additional pumping). This Section specifies internal MBR equipment; if a side stream configuration is required, modify this Section accordingly.

More advanced treatment trains might include anoxic and anaerobic sections of tankage for nitrogen and phosphorus removal, as well as internal recycle streams from one section of tankage to another. In these advanced systems, solids separation would still occur in the aerated tank. This Section specifies membrane solids separation units; if aerated, anoxic, or anaerobic configurations are required, modify this Section accordingly.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes: Membrane biological reactors and appurtenances.
          2. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 262923 - Variable-Frequency Motor Controllers: Variable-speed drive for permeate pump.

Section 460548 - Vibration and Seismic Controls for Water and Wastewater Equipment: Vibration isolation and seismic control of MBR equipment and appurtenances.

Section 460553 - Identification for Water and Wastewater Equipment: Nameplates for equipment specified in this Section.

Section <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>: Permeate pump.

* + - 1. DEFINITIONS:
         1. BOD5: Five-day biochemical oxygen demand.
         2. FNU: Formazin nephelometric unit.
         3. MBR: Membrane biological reactor.
         4. NTU: Nephelometric turbidity unit.
         5. TSS: Total suspended solids.
      2. COORDINATION
         1. Coordinate Work of this Section with Work of other Sections.
      3. PREINSTALLATION MEETINGS
         1. Convene minimum [**one week**] [**<\_\_\_\_\_\_\_\_> weeks**] prior to commencing Work of this Section.
      4. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        2. Manufacturer’s installation instructions shall be provided along with product data.
        3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
        4. Product Data: Submit manufacturer product data for system materials and component equipment.
        5. Shop Drawings:

Indicate system materials and component equipment.

Submit installation and anchoring requirements, fasteners, and other details.

* + - * 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate Paragraphs for additional certifications.

* + - * 1. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
        2. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.
        3. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
        4. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.
        5. Qualifications Statements:

Coordinate following Subparagraphs with requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer and installer.

Submit manufacturer's approval of installer.

* + - 1. CLOSEOUT SUBMITTALS
         1. Project Record Documents: Record actual locations of installed MBR equipment.
      2. MAINTENANCE MATERIAL SUBMITTALS
         1. Spare Parts:

Furnish [**one set**] [**two sets**] of manufacturer's recommended spare parts.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Furnish [**two**] <**\_\_\_\_\_\_\_\_**> of <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Tools: Furnish special [**wrenches**] <**\_\_\_\_\_\_\_\_**> and other devices required for Director’s Representative to maintain and calibrate equipment.
      1. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Perform Work according to <**\_\_\_\_\_\_\_\_**> standards.
      1. QUALIFICATIONS

Coordinate following Paragraph with requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
        2. Installer: Company specializing in performing Work of this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
      1. DELIVERY, STORAGE, AND HANDLING
         1. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
         2. Store materials according to manufacturer instructions.
         3. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Provide additional protection according to manufacturer instructions.

* + - 1. EXISTING CONDITIONS
         1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

* + - 1. WARRANTY

This Article extends warranty period beyond one year. Extended warranties may increase construction costs and Owner enforcement responsibilities. Specify warranties with caution.

* + - * 1. Furnish [**five**] [**10**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for MBR equipment and accessories.

1. PRODUCTS
   * + 1. SYSTEM DESCRIPTION
          1. Components: Filtration membrane module.
       2. MBR
          1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=12290&mf=04&src=wd):

DESIGNER TO PROVIDE TWO MANUFACTURERS AND APPROVED EQUIVALENT FOR ALL LISTED PRODUCTS.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Subparagraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Performance and Design Criteria:

Flow Rate:

Maximum: <**\_\_\_\_\_\_\_\_**> gal./day

Minimum: <**\_\_\_\_\_\_\_\_**> gal./day

Average Daily: <**\_\_\_\_\_\_\_\_**> gal./day

Influent:

BOD5: [**200**] [**300**] <**\_\_\_\_\_\_\_\_**> mg/L.

TSS: [**200**] [**300**] <**\_\_\_\_\_\_\_\_**> mg/L.

Effluent:

BOD5: [**5**] [**10**] <**\_\_\_\_\_\_\_\_**> mg/L.

TSS: [**1**] [**5**] <**\_\_\_\_\_\_\_\_**> mg/L.

Turbidity: <**\_\_\_\_\_\_\_\_**> NTU

Design:

Adjustments and Routine Maintenance during Operation: Possible without interrupting process.

There are two general kinds of MBR units: (1) flat sheet, in which the membrane is held by a frame; and (2) hollow fiber, in which the membrane consists of thin, hollow tubes. In both types, permeate is drawn through the membrane by a vacuum.

* + - * 1. Flat Sheet Filtration Membrane Modules:

Description:

Flat sheets separated by pervious spacer medium.

Mounting: Held in place on either side of rectangular frame.

Multiple frames connected to permeate withdrawal manifold and assembled into module.

Liquid Flux: [**15**] <**\_\_\_\_\_\_\_\_**> gal./sf-day

Transmembrane Pressure: [**5**] <**\_\_\_\_\_\_\_\_**> psi

Cleaning Method: Automated air scour.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Hollow Fiber Filtration Membrane Modules:

Description:

Multiple hollow fibers held together by resin pots at either end to form a cassette.

Multiple cassettes connected to discharge manifold and assembled into module.

Liquid Flux: [**15**] <**\_\_\_\_\_\_\_\_**> gal./sf-day

Transmembrane Pressure: [**5**] <**\_\_\_\_\_\_\_\_**> psi

Cleaning Method: Back pulsing using clean permeate from inside outward through hollow fiber.

* + - * 1. Accessories:

Permeate Pump:

Indicate Section number and title in following Subparagraph based on type of permeate pump required for Project.

As specified in Section <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Variable speed drive, based on influent rate, as specified in Section 262923 - Variable-Frequency Motor Controllers.

Furnish automated relaxation cycle.

Aeration System:

Air piping with coarse-bubble diffusers installed beneath MBR modules.

Clean-in-Place System:

Automated.

No membrane removal required.

* + - 1. SOURCE QUALITY CONTROL
         1. Provide shop inspection and testing of ultrafiltration membrane modules.

Include one or both of following Paragraphs to require Director's inspection or witnessing of test at factory.

* + - * 1. Director’s Inspection:

Make completed MBR available for inspection at manufacturer's factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.

* + - * 1. Director’s Witnessing:

Allow witnessing of factory inspections and test at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspections and tests are scheduled.

Include following Paragraph if reliance on fabricator's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance:

If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved fabricator.

1. EXECUTION
   * + 1. EXAMINATION
          1. Verify that facility, piping, and electrical Work are ready to receive MBR.
       2. INSTALLATION
          1. According to manufacturer instructions.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Installation Standards: Install Work according to <**\_\_\_\_\_\_\_\_**> standards.
      1. FIELD QUALITY CONTROL
         1. Inspect for proper operation.
         2. Testing:

Functional Testing: Prior to system startup, inspect components for proper alignment and connection and acceptable operation.

* + - * 1. Manufacturer Services:

Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than <**\_\_\_\_\_\_\_\_**> days on Site for installation, inspection, startup, field testing, and instructing Director’s Representative's personnel in maintenance of equipment.

Performance Testing: Use plant waste activated sludge on each unit to determine actual system operating conditions and verify that units meet minimum performance requirements as specified in this Section.

* + - * 1. Equipment Acceptance:

Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

Make final adjustments to equipment under direction of manufacturer's representative.

* + - * 1. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.
      1. ADJUSTING
         1. Check control functions and adjust as required.
      2. DEMONSTRATION
         1. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Director’s Representative.

END OF SECTION 465349