

ZYRAMIC

MEMBRANE BIOREACTOR & ULTRAFILTRATION SYSTEMS

Membrane Module Warranty

Flat Sheet MBR Module — Municipal Wastewater Applications

This Warranty is issued by Zyramic, Inc. ("Zyramic") to the original purchaser ("Purchaser") of Zyramic flat sheet MBR modules and associated equipment (the "Equipment"). It is incorporated into and governed by the Zyramic Terms and Conditions of Sale. Where this Warranty and the Terms and Conditions of Sale address the same subject, this Warranty controls.

1. Coverage

- 1.1 Equipment Warranty.** Zyramic warrants that the Equipment will be free from defects in materials and workmanship for a period of two (2) years, non-prorated, commencing on the date of Final Acceptance.
- 1.2 Membrane Module Warranty.** Zyramic warrants the membrane modules against Failure, as defined in Section 4, for a period of two (2) years of operation, non-prorated, commencing on the date of Final Acceptance.
- 1.3 Final Acceptance.** "Final Acceptance" means the date on which the treatment system has completed startup and is accepted by the Owner for continuous operation. If Final Acceptance has not occurred within twelve (12) months of shipment, the warranty period shall commence on the first day of the thirteenth month following shipment, unless the delay is attributable to Zyramic.

2. Application Limitation

- 2.1 This Warranty applies only to Equipment installed in municipal wastewater treatment service. Equipment placed in industrial, commercial, landfill leachate, high-strength, high-temperature, or otherwise non-municipal service is not covered by this Warranty.**
- 2.2** Warranty coverage for non-municipal applications is available by separate written agreement, subject to Zyramic's review of the influent characterization and proposed operating regime.

3. System Design and Integration Responsibility

- 3.1** Zyramic supplies membrane modules as a component. Zyramic is not the designer of the treatment system into which the modules are installed and accepts no responsibility for the design, sizing, hydraulics, or control of that system.
- 3.2** Responsibility for the following rests with the system designer, integrator, contractor, or Owner, and defects or damage arising from any of them are not covered by this Warranty:
 - Selection, sizing, and continuous operation of influent screening and grit removal.
 - Sizing, selection, and control of scour air blowers, and the delivery of rated air flow at rated pressure to every module at all times required.
 - Sizing and control of permeate pumps, including protection against excessive vacuum.
 - Membrane tank geometry, module spacing, hydraulic distribution, level control, and provision for drainage and drying.
 - Biological process design and control, including mixed liquor concentration, sludge age, nutrient balance, foaming, and filamentous bulking.
 - Clean-in-place system design, chemical supply, dosing accuracy, and execution.
 - Permeate degassing, venting, air release, and instrumentation.

- Freeze protection, and protection of the membrane tank from stormwater and unscreened bypass flow.

3.3 Where Zyramic reviews or comments on a system design, that review is limited to the interface with the modules and does not constitute approval of the system or assumption of design responsibility.

4. Definition of Failure

4.1 For purposes of the Membrane Module Warranty, "Failure" means a loss of membrane integrity in an identified module arising from a defect in materials or workmanship, evidenced by a pinhole, tear, delamination, separation of the membrane sheet from the support plate, or breakage of the sheet.

4.2 Elevated permeate turbidity is an indicator that may prompt investigation under this Warranty, and is not by itself a Failure. Where continuous online permeate turbidity monitoring is installed, a 95th percentile above 0.2 NTU or any confirmed single reading above 0.5 NTU, measured on a rolling thirty (30) day basis while operating within the envelope of Section 5, is grounds for Purchaser to initiate the investigation described in Section 4.3.

4.3 On such an indication, Purchaser shall verify that the elevated turbidity does not originate from a source other than the membrane, including permeate tubing, barb and flange connections, gaskets, sample line contamination, entrained air, or analyzer drift or fouling. Where the elevated turbidity persists after those sources are excluded, the affected module or modules shall be identified by isolation and integrity testing in accordance with the Operation and Maintenance Manual. A Failure exists only where integrity testing confirms a breach in a specific module.

4.4 Turbidity measurement at these levels is subject to interference from air entrained on the permeate side. Any reading relied upon under this Section must be confirmed by repeat measurement on a degassed sample using a calibrated instrument.

4.5 The following are not Failures: loss of permeability recoverable by chemical cleaning in accordance with the Operation and Maintenance Manual; fouling and rising transmembrane pressure, which are normal operating phenomena; and any turbidity excursion traced to a cause outside the module.

4.6 Nothing in this Section constitutes a guarantee of permeate quality, effluent quality, or permit compliance. The turbidity values stated are diagnostic thresholds for warranty administration only. Performance guarantees, if any, are given separately in writing and separately priced.

5. Operating Envelope

This Warranty is conditioned on continuous operation of the Equipment within the following limits. Operation outside these limits, whether or not it is shown to have caused the Failure claimed, may reduce or void this Warranty.

Pretreatment

- Influent screening: 3 mm perforated plate or mesh screening, or finer, in continuous service upstream of the membrane tank, with no bypass. Bar screens are not acceptable in place of perforated plate or mesh.
- Grit removal in continuous service upstream of the membrane tank. Settled grit at the tank floor is abrasive to the air scour orifices and to the plate root, where scour velocity is highest.
- Influent to the biological process within the following limits: COD $\leq$ 500 mg/L; BOD₅ $\leq$ 300 mg/L; TSS $\leq$ 150 mg/L; NH₄-N $\leq$ 50 mg/L; animal and vegetable oil $\leq$ 30 mg/L; mineral oil and petroleum hydrocarbons $\leq$ 3 mg/L; pH 6 to 9.
- No shock loading of oils, greases, solvents, or hydrocarbons. Mineral oil in particular forms an adherent hydrophobic layer that is not recoverable by routine chemical cleaning.

Air Scour

- Scour air supplied continuously to every module at not less than the design rate stated in the project submittal, whenever permeate is being drawn.
- Scour air free of oil, particulates, and condensate. Oil carryover from a lubricated blower will foul the membrane irreversibly.
- Scour air temperature at the module inlet not exceeding the limit stated in the Operation and Maintenance Manual.
- Air supply piping cleaned and flushed of construction debris before modules are connected.

Filtration

- Permeate flux, transmembrane pressure, temperature, and mixed liquor concentration within the ranges stated in the project submittal and the Operation and Maintenance Manual.
- Transmembrane pressure not exceeding the maximum stated in the Operation and Maintenance Manual at any time. A high-vacuum cutout or equivalent protection is required on the permeate system.
- Relaxation or intermittent permeate cycles operated as specified. Continuous permeate draw without relaxation is not permitted unless expressly agreed in writing.
- Modules kept submerged at all times when in service. Modules shall not be left exposed above the liquid surface with biological solids on the membrane.
- Membrane tank protected from freezing.

Cleaning

- Chemical cleaning performed only with the agents, concentrations, contact times, temperatures, and frequencies specified in the Operation and Maintenance Manual.
- No backflushing, back-pulsing, or application of positive pressure to the permeate side. Flat sheet membranes are supported on one face only and reverse pressure risks delamination.
- Storage prior to installation in accordance with Section 10.

6. Installation, Handling and Commissioning

- 6.1** Modules shall be installed in accordance with the Zyramic Installation and Operation and Maintenance Manual, including guide rail alignment, anti-float restraint, and torque values for all connections.
- 6.2** Modules shall be lifted only by the designated lifting points, using lifting equipment rated for the published flooded module weight. Lifting by the headers, plates, guide rails, or tubing voids this Warranty.
- 6.3 Anti-float restraint supplied with the module shall be installed and remain installed at all times. Zyramic support plates are buoyant, and operation without restraint will damage the module.**
- 6.4 Purchaser shall complete and return the Zyramic Commissioning Record before permeate is first drawn. This Warranty does not take effect until that record is received. The record documents screening in service, air flow verified at each module, restraint installed, and connections leak tested.**
- 6.5** Zyramic may, at Purchaser's cost and by prior arrangement, attend or witness commissioning. Attendance by Zyramic does not transfer installation or system design responsibility to Zyramic.

7. Required Monitoring and Records

The Owner shall monitor, log, and retain the following data for the duration of the warranty period, and shall make the records available to Zyramic on request. Failure to maintain these records may void this Warranty where, in Zyramic's reasonable determination, the operating conditions of Section 5 were exceeded.

1. Influent and effluent water quality, including oil and grease where the influent is at risk of it
2. Permeate flow rate and cumulative volume
3. Transmembrane pressure (TMP), including peak values
4. Mixed liquor temperature and suspended solids concentration
5. Scour air flow rate and pressure, and blower operating hours and any downtime
6. Filterability testing
7. Chemical cleaning method, agent, concentration, temperature, frequency, and duration
8. Record of screening and grit removal equipment operation, downtime, and maintenance
9. Record of any period during which modules were exposed above the liquid surface or the tank was drained
10. Record of periodic replacement parts and consumables

8. Exclusions

The occurrence of any of the following, as reasonably determined by Zyramic, may reduce or void this Warranty:

- Misuse, accident, fire, freezing, improper repair, tampering, or abuse of the Equipment, including damage caused by operator error in the handling, lifting, or installation of modules or cassettes.
- Failure to adhere to the preventative maintenance program set out in the Operation and Maintenance Manual.
- Failure to ensure the correct operation and functioning of the influent screening and grit removal equipment, including operation during screen bypass, overflow, or outage.
- Interruption, reduction, or loss of scour air while permeate is being drawn, whether from blower failure, control error, valve position, or fouled supply piping.
- Operation above the maximum transmembrane pressure, or absence of high-vacuum protection on the permeate system.
- Introduction of oils, greases, solvents, hydrocarbons, or other substances outside the characterized influent, whether by discharge, spill, or upstream process change.
- Chemical cleaning outside the specified agents, concentrations, temperatures, or frequencies, or any application of positive pressure to the permeate side.
- Damage arising from the design, sizing, or control of the treatment system, as described in Section 3.
- Unauthorized alteration, substitution, or repair of any component supplied by Zyramic.
- Intentional damage.

This Warranty does not cover consumable and wear items, including permeate tubing, gaskets, seals, and fasteners, which are warranted only against defects in materials and workmanship at the time of shipment.

Fouling, loss of permeability, and rising transmembrane pressure are normal operating phenomena managed by cleaning, and are not in themselves evidence of a defect.

9. Warranty Claim Procedure

- 11.1** A claim under this Warranty is triggered only upon Purchaser providing written evidence of both the Failure and Purchaser's performance of its obligations under this Warranty. Such evidence must be submitted to Zyramic within thirty (30) days of the date the Failure is identified.
- 11.2** Zyramic is entitled, at its discretion, to access the plant to inspect the Equipment and verify the cause of the Failure. Purchaser shall provide safe access and reasonable operator assistance.

- 11.3** Costs of travel, accommodation, and meals for Zyramic's inspection shall be borne by Purchaser unless the Failure is determined to be attributable to Zyramic, in which case Zyramic shall bear those costs.
- 11.4** Continued operation of Equipment known to be in a Failure condition, without notice to Zyramic, voids coverage for any consequential damage to adjacent Equipment.

10. Storage Prior to Installation

- 10.1** Zyramic membrane modules use a permanently hydrophilic PES membrane and may be stored either wet or dry. No glycerin, glycol, or other wetting agent is required, and none shall be applied.
- 10.2** Modules shall be stored in their original packaging, indoors or under cover, protected from direct sunlight, freezing, and temperatures above [X] °C, and shall not be stacked beyond the limits marked on the packaging.
- 10.3** Storage exceeding twelve (12) months from shipment requires written confirmation from Zyramic that warranty coverage is preserved.

11. Remedy and Limitation of Liability

- 11.1** Zyramic's sole obligation under this Warranty is, at its option, to repair or replace modules or components determined to have Failed. Replacement modules are supplied EX WORKS Zyramic's facility.
- 11.2** Zyramic's liability does not extend to labor associated with the removal, dismantling, reinstallation, or recommissioning of Equipment at the plant, nor to freight, duties, taxes, or brokerage on replacement Equipment.
- 11.3** The quantity of Equipment repaired or replaced under this Warranty shall not exceed the quantity originally supplied by Zyramic.
- 11.4** The warranty period of any repaired or replacement Equipment shall be the remainder of the original warranty period and shall not extend it.
- 11.5** THIS WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY GIVEN BY ZYRAMIC AND THE REMEDIES STATED HEREIN ARE PURCHASER'S SOLE AND EXCLUSIVE REMEDIES. ZYRAMIC DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. ZYRAMIC SHALL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF USE, LOST PRODUCTION, REGULATORY PENALTIES, OR COST OF SUBSTITUTE TREATMENT.

12. Extended Coverage

Extended membrane warranty terms beyond two years may be offered on qualified municipal projects, subject to Zyramic's review of the design, influent characterization, screening provisions, and operating plan, and subject to separate written agreement and pricing.

13. Transfer

This Warranty extends to the Owner of the facility in which the Equipment is originally installed. It is not otherwise transferable, and does not survive removal and reinstallation of the Equipment at a different facility without Zyramic's prior written consent.