

OPERATION AND MAINTENANCE MANUAL

On-Board Scour Flat Sheet MBR Module

Patent-pending per-channel air scour · No bottom plenum

Municipal wastewater service · Module supplier document · Not a system design manual

Field	Entry
Document title	On-Board Scour Flat Sheet MBR Module — Operation and Maintenance Manual
Document number	ZY-OM-MBR-001
Revision	2
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Classification	Issued to the Owner and the Owner's operators
Supersedes	Revision 1 — August 2026

This manual is the Operation and Maintenance Manual for the Zyramic On-Board Scour flat sheet membrane bioreactor (MBR) module. It is written for plant operators, maintenance staff, system integrators, and the Owner's engineer.

Zyramic supplies the module as a component. Zyramic is not the designer of the treatment system. This manual does not size tanks, blowers, pumps, or screens. Those duties remain with the system designer.

NOTICE

Read Section 1 (Safety), Section 6 (Commissioning), and Section 8 (Process limits) before the first permeate is drawn. The warranty does not start until Zyramic has received the completed Commissioning Record. Do not improvise chemical cleaning. Do not apply reverse pressure to the permeate side.

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0 Document control

0.1 Identification

Item	Value
Document title	On-Board Scour Flat Sheet MBR Module — Operation and Maintenance Manual
Document number	ZY-OM-MBR-001
Revision	2
Date	August 2026
Issuer	Zyramic, Inc., Poughkeepsie, New York
Language	English (US)
Units	US customary primary for process numbers (airflow, liquid flow, line size, TMP). SI in parentheses. Plate area may be stated in m ² .

0.2 Revision history

Rev	Date	Description	Prepared	Approved
0	August 2026	Initial issue	Zyramic, Inc.	Zyramic, Inc.
1	August 2026	Corrected commercial geometry and scour: single-deck 130 plates / $\approx 136.5 \text{ m}^2$ / 48 SCFM; double-deck 260 plates / $\approx 273 \text{ m}^2$ / 96 SCFM. Scour restated as 10 L/min per m ² . CFD 20-channel / 200 L/min identified as modeled section only.	Zyramic, Inc.	Zyramic, Inc.
2	August 2026	US customary lead on airflow, permeate (liquid) flow, line size, and TMP. Permeate published as 7.5–12.6 gpm (single) and 15.0–25.2 gpm (double). Scour 48 / 96 SCFM. Envelope $\approx 7.0 \times 3.1 \times 10.0$ ft.	Zyramic, Inc.	Zyramic, Inc.

This is Revision 2. Items marked TBD are not yet published. Do not invent a value for a TBD item. Use the project submittal when it states a number. If both this manual and the project submittal are silent, stop and ask Zyramic in writing.

0.3 How to use this manual

Numbered sections are the controlling text. Tables state limits. Where a table and the surrounding text could be read two ways, the table governs.

The project submittal may tighten a limit in this manual. It may not relax one unless Zyramic has agreed in writing. Where this manual and the Zyramic Membrane Module Warranty address the same coverage question, the Warranty controls.

Figures are schematic. They are not installation drawings. Overall cassette height, dry weight, and operating weight are TBD. Use the project installation drawing and the packing list for those values.

0.4 Abbreviations

Abbr.	Meaning
BABA	Build America, Buy America
BOD5	Five-day biochemical oxygen demand
CIP	Clean-in-place (chemical cleaning of the membrane)
COD	Chemical oxygen demand
DN	Diamètre nominal (metric pipe size)
gfd	Gallons per square foot per day
gpm	Gallons per minute
gpd	Gallons per day
LMH	Liters per square meter per hour
MBR	Membrane bioreactor
MLSS	Mixed liquor suspended solids
Nm³/h	Normal cubic meters per hour
NTU	Nephelometric turbidity unit
PES	Polyethersulfone
PP	Polypropylene
SAD_m	Specific air demand, membrane-area basis
SCFM	Standard cubic feet per minute
TMP	Transmembrane pressure
TSS	Total suspended solids
UF	Ultrafiltration

0.5 Definitions

Term	Meaning in this manual
Module	One Zyramic cassette — single-deck (130 plates) or double-deck (260 plates) — with headers and the On-Board Scour manifold.
Panel / plate	One flat sheet element (both faces). Area $\approx 1.05 \text{ m}^2$.
Channel	The 6.40 mm gap between adjacent plates.
On-Board Scour	Zyramic's patent-pending per-channel air-scour arrangement. No bottom plenum. Dedicated scour valve per channel.
Scour air	Oil-free, particulate-free, condensate-free air delivered to the module air connection for channel scouring.
Relaxation	A timed stop of permeate draw while the module stays submerged and scour continues.
Failure	A confirmed integrity breach: pinhole, tear, delamination, sheet separation, or breakage. See §12 and the Warranty.

Term	Meaning in this manual
Project submittal	The Zyramic-approved submittal for the specific job, including any later written revision.
Owner	The end user of the facility.
Purchaser	The party that bought the modules from Zyramic.

0.6 Controlled copies

Confirm the revision with Zyramic before you use a printed copy. Uncontrolled copies may be outdated. CIP recipes, torque values, and weights issued after this revision will appear in a later revision or in the project submittal.

1 Safety and warnings

1.1 Signal words

This manual uses the signal words below. They follow common US process-equipment practice (ANSI Z535).

Word	Meaning
DANGER	Failure to follow will cause death or serious injury.
WARNING	Failure to follow can cause death or serious injury, or will destroy the module.
CAUTION	Failure to follow can cause injury or equipment damage.
NOTICE	An operating or warranty requirement. Not a personnel-safety hazard by itself.

1.2 Who may work on the modules

Only personnel trained on this manual and on the plant's lockout, confined-space, and lifting procedures shall install, lift, isolate, or chemically clean modules. Visitors do not enter the membrane tank.

1.3 Personal protective equipment

Wear the plant's required PPE for a municipal wastewater membrane tank. As a minimum: hard hat, safety glasses, gloves, and slip-resistant boots. Add a harness, gas monitor, and respirator when the plant's confined-space permit requires them. When approved CIP chemicals are later issued, add the PPE named on those chemical safety data sheets. Do not handle unapproved chemicals.

1.4 Membrane tank and confined space

DANGER

A membrane tank is a confined space. It can contain an oxygen-deficient or toxic atmosphere. Do not enter without a written permit, atmospheric testing, an attendant, and rescue provision. Isolate inlets, outlets, and scour air before entry. Follow the plant confined-space program.

Floors and walkways around an open tank are slippery. Keep grating in place. Do not stand on headers, plates, or guide rails.

1.5 Lifting

WARNING

Lift a module only by the designated lifting points. Use gear rated for the flooded (operating) weight stated in the project submittal. That weight is TBD in this revision. Do not guess. Do not lift by the headers, plates, guide rails, or tubing. A dropped or twisted module will destroy plates and can kill anyone under the load.

Stay clear of a suspended load. Do not pass a load over people. Use a tag line. Keep the module level so plates do not rack.

1.6 Vacuum and the permeate system

WARNING

The permeate system must have a high-vacuum cutout or equal protection. Transmembrane pressure shall not exceed 2.2 psi (15 kPa / 1.5 m H₂O) at any time. A missing cutout, or a bypassed cutout, can delaminate the sheet and is a warranty exclusion.

WARNING

Do not backflush, back-pulse, or put positive pressure on the permeate side. The flat sheet is supported on one face only. Reverse pressure risks delamination. There is no “reverse-flow clean” for this product.

1.7 Scour air

WARNING

Do not draw permeate unless scour air is reaching every module at not less than the design rate. Loss of scour while filtering will foul the membrane and can void the warranty. Interlock the permeate system so a blower trip, a closed scour valve, or a low-air alarm stops permeate.

CAUTION

Scour air must be free of oil, particulates, and condensate. Oil from a lubricated blower fouls the membrane irreversibly. Do not connect a module to air piping that has not been cleaned and flushed of construction debris.

The air connection is pressurized service. Isolate and depressurize before opening a joint. Wear eye protection.

1.8 Chemicals

WARNING

As of this revision, Zyramic has not released CIP recipes. Do not mix, store, or apply sodium hypochlorite, acid, caustic, or any other cleaning agent to these modules until Zyramic issues an approved recipe in a later revision of this manual or in the project submittal. Improvised chemistry can destroy the membrane and voids the warranty.

When recipes are issued, treat spent solution as industrial wastewater. Follow the plant discharge permit and the chemical supplier's safety data sheet.

1.9 Biological hazard

Mixed liquor is municipal wastewater. It can contain pathogens. Do not eat, drink, or smoke at the tank. Wash after contact. Cover cuts. Report exposure to the plant's safety officer.

1.10 Buoyancy

WARNING

The support plates are talc-filled polypropylene and are buoyant. The anti-float restraint must be installed before the tank is filled and must stay installed whenever the module is submerged. A free module will rise, damage plates and piping, and can strike personnel.

1.11 Freeze

WARNING

Protect the membrane tank, permeate piping, and modules from freezing. Ice will crack plates, headers, and tubing. Frozen mixed liquor on an exposed sheet is a warranty exclusion.

1.12 Mandatory prohibitions

The following are prohibited. Several of them void the warranty. See §15.

- Drawing permeate without scour air at every module.
- Continuous permeate without a relaxation cycle, unless Zyramic has agreed in writing.
- Backflushing, back-pulsing, or any positive pressure on the permeate side.
- Leaving a module exposed above the liquid with biological solids on the membrane.
- Operating with the anti-float restraint removed.
- Lifting by headers, plates, rails, or tubing.
- Connecting to dirty air piping, or supplying oily, wet, or dirty scour air.
- Applying glycol, glycerin, or any wetting agent.
- Field-welding the membrane to the plate.
- Improvising a CIP recipe.

- Bypassing the influent screen, or substituting a bar screen for 3 mm perforated plate or mesh.
- Exceeding 2.2 psi (15 kPa) TMP, or operating without a high-vacuum cutout.
- Shock loading oils, greases, solvents, or hydrocarbons.
- Stacking cartons beyond the marks on the packaging.
- Storing modules in direct sun or in freezing conditions.

2 Scope and related documents

2.1 Equipment covered

This manual covers the Zyramic On-Board Scour flat sheet MBR module as shipped: a single-deck (130-plate) or double-deck (260-plate) cassette, the polypropylene support plates, the On-Board Scour manifold, permeate tubing, permeate and air headers, the cassette frame, and the factory anti-float restraint.

It applies to municipal wastewater service. Industrial, commercial, landfill leachate, high-strength, high-temperature, or other non-municipal service is outside this manual and outside the standard warranty unless a separate written agreement exists.

2.2 Equipment not covered

Zyramic is the module supplier. The following are not Zyramic scope unless the quotation lists them, and this manual does not operate them:

- Tanks, civil works, guide rails fabricated by others, and walkways.
- Influent screening and grit removal.
- Blowers, air filters, oil knock-outs, and plant air piping upstream of the module connection.
- Permeate pumps, valves, and high-vacuum protection hardware.
- CIP skid, chemical storage, and dosing.
- Instrumentation, SCADA, and analyzers.
- Biological process design and control.
- Permits and treatment-train regulatory approval.

2.3 Related documents

Document	Use
This O&M manual (ZY-OM-MBR-001)	Install, operate, maintain, and troubleshoot the module.
Zyramic Flat Sheet MBR Module datasheet	Published geometry, materials, and design-basis figures.
Zyramic Membrane Module Warranty	Coverage, operating envelope, Failure definition, claim procedure.
Zyramic Terms and Conditions of Sale	Commercial terms. Warranty document controls on coverage.
Project submittal	Job-specific flux, scour rate, weights, drawings, and (when issued) CIP recipes.

Document	Use
Project installation drawing	Guide-rail layout, connection details, torque values, lifting points.
Commissioning Record (Appendix A)	Required before first permeate. Warranty does not start until received.

2.4 Precedence

For a numeric operating limit: (1) a written Zyramic project letter, then (2) the project submittal, then (3) this manual, then (4) the datasheet. A later document may only tighten a limit unless Zyramic relaxes it in writing.

For warranty coverage: the Zyramic Membrane Module Warranty controls. This manual tells you how to stay inside that envelope. It is not a second warranty.

2.5 Regulatory note

State reuse and discharge approval is granted at the treatment-train level (for example California Title 22). It is based on pilot and process data. The module is not separately certified as a component. Do not state that this module “is Title 22 certified.”

2.6 Design responsibility

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

3 Product description

3.1 What you have

The module is a flat sheet ultrafiltration cassette in two commercial sizes: single-deck (130 plates, $\approx 136.5 \text{ m}^2$) and double-deck (260 plates, $\approx 273 \text{ m}^2$). Mixed liquor is on the outside of the sheets. Permeate (liquid) is drawn from the inside of each plate under vacuum, or by gravity where the site hydraulics permit. At the preliminary design flux of 7.4–12.3 gfd (12.5–21 LMH), expected permeate is 7.5–12.6 gpm ($\approx 10,800$ –18,200 gpd) for a single-deck module and 15.0–25.2 gpm ($\approx 21,600$ –36,400 gpd) for a double-deck module. Scour air is 48 SCFM (single-deck) or 96 SCFM (double-deck), injected at the root of every channel.

The public product name is Zyramic On-Board Scour (patent pending).

Internal note only: the development / CFD configuration name for this arrangement was “Type B.” Do not use that name on plant documents, tags, or operator logs. Use On-Board Scour.

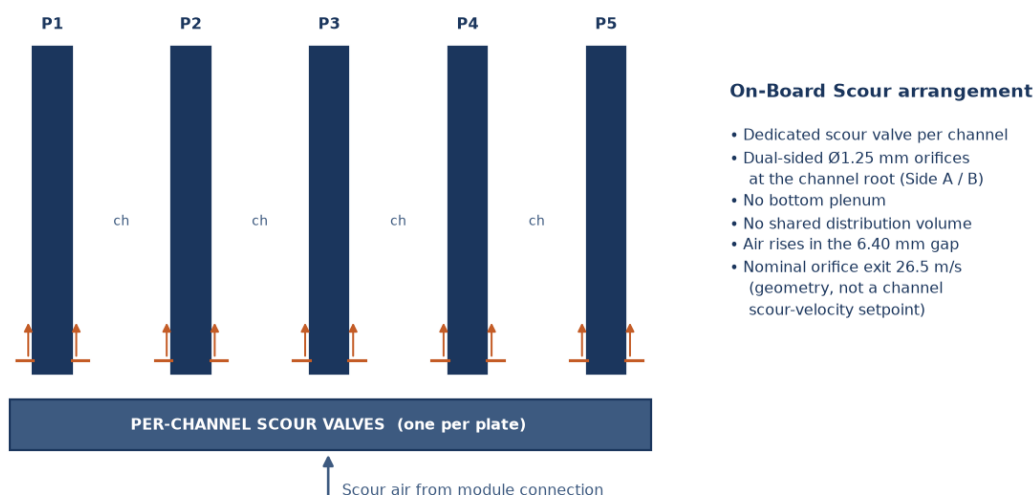
Independent CFD (Efficio Engineering SOW AEXD-145) was run on a 20-channel section ($\approx 21 \text{ m}^2$, 200 L/min). That domain is a modeled section, not the shipped product.

3.2 On-Board Scour

A conventional flat sheet cassette puts a shared plenum under the plate stack and lets air find its own way into the channels. On-Board Scour does not. There is no bottom plenum and no shared distribution volume.

Each channel has its own dedicated scour valve. Air is injected through dual-sided orifices at the plate root, Side A and Side B. Orifice diameter is 1.25 mm (0.049 in). The nominal orifice-exit velocity of 26.5 m/s (86.9 ft/s) is a factory geometry result. It is not a channel scour-velocity setpoint. Operators do not set it. Operators set module air flow.

FIGURE 2. On-Board Scour — per-channel injection at the plate root (schematic)

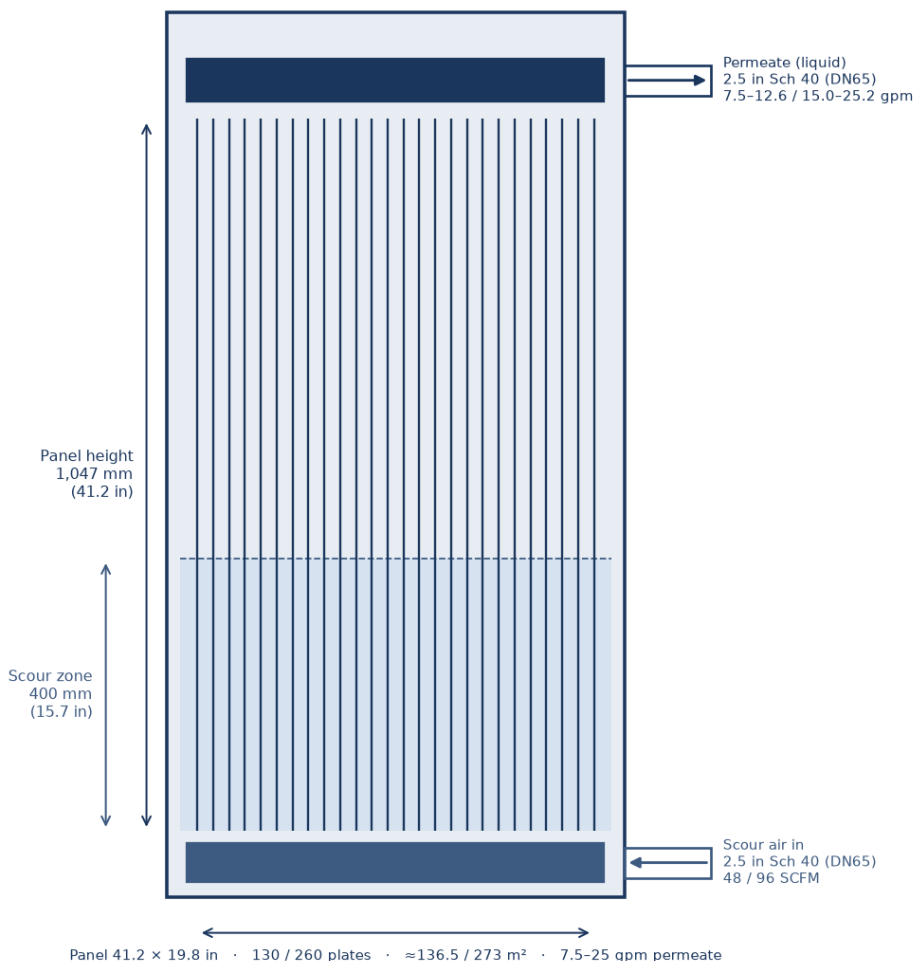


3.3 Module and panel geometry

FIGURE 1. On-Board Scour module — elevation (schematic)

Not to scale. Overall cassette height is TBD — use the project installation drawing.

Single-deck 130 plates · Double-deck 260 plates · gap 6.40 mm · no bottom plenum



Parameter	Value
Commercial sizes	Single-deck (130 plates) and double-deck (260 plates)
Panels per module	130 (single-deck) / 260 (double-deck)
Panel height	1,047 mm / 41.2 in
Panel width	502 mm / 19.8 in
Panel thickness	7.60 mm / 0.30 in
Channel gap (plate to plate)	6.40 mm / 0.25 in
Membrane area per panel (both faces)	≈1.05 m ² / 11.3 ft ²
Membrane area per module	≈136.5 m ² / 1,469 ft ² (single-deck) · ≈273 m ² / 2,939 ft ² (double-deck)

Parameter	Value
Double-deck cassette envelope	≈7.0 × 3.1 × 10.0 ft (2.12 × 0.96 × 3.05 m), two-tier assembly
Air-scour zone height	15.7 in / 400 mm
Permeate connection	2.5 in Sch 40 (DN65)
Scour-air connection	2.5 in Sch 40 (DN65)
Permeate (liquid), single-deck — preliminary	7.5–12.6 gpm (≈10,800–18,200 gpd) at 7.4–12.3 gfd
Permeate (liquid), double-deck — preliminary	15.0–25.2 gpm (≈21,600–36,400 gpd) at 7.4–12.3 gfd
Scour air, single-deck	48 SCFM (1,365 L/min / 82 Nm ³ /h)
Scour air, double-deck	96 SCFM (2,730 L/min / 164 Nm ³ /h)
Overall module height	TBD — use the project installation drawing
Module dry weight	TBD — use the project packing list / submittal
Module operating (flooded) weight	TBD — use the project submittal for lift planning

3.4 Membrane

The membrane is advanced polyethersulfone (PES) supplied by Thermo Fisher (formerly Solventum / 3M). Nominal pore size is 0.04 μm (ultrafiltration). It is laminated to an 80 μm polyolefin nonwoven with a polyolefin adhesive. Laminate thickness is 265 ± 50 μm (10.4 ± 2 mil).

The sheet is spontaneously wettable. It stays wetted through cleaning cycles. Modules may be stored wet or dry. No glycol or glycerin spray is required. None shall be applied.

Parameter	Value
Material	Advanced PES
Supplier	Thermo Fisher (formerly Solventum / 3M)
Nominal pore size	0.04 μm
Nonwoven	Polyolefin, 80 μm / 3.1 mil
Adhesive	Polyolefin
Laminate thickness	265 ± 50 μm
Wetting	Spontaneous; permanently wetted; no activating chemicals
Storage	Wet or dry; no glycol or glycerin
Clean-water permeability, 25 °C	≥ 4,200 LMH/bar minimum; > 6,000 LMH/bar typical
PFAS / fluoropolymers	None in the module
Chlorinated polymers	None in the membrane or support plate
pH, operating / cleaning	TBD — pending Thermo Fisher release
Chemical cleaning limits	TBD — pending Thermo Fisher release

3.5 Materials of construction

Item	Specification
Support plate	Talc-filled polypropylene copolymer, injection molded. Membrane removable at end of service for PP recycle (resin code 5).
Air-scour manifold	Polypropylene
Permeate tubing	Platinum-cured silicone
Permeate and air headers	PVC Sch 80 or polypropylene, as supplied on the job
Cassette frame	304 stainless steel with polymer components (standard). 316 stainless steel optional.
Wetted polymers	PES, polyolefin nonwoven, polyolefin adhesive, PP plate and manifold, platinum-cured silicone
Exclusions	No fluoropolymers (no PVDF, no PTFE). No chlorinated polymers in the membrane or plate.

Do not field-weld the membrane to the plate. Factory attachment is not an operator repair.

3.6 Country of manufacture

Modules are manufactured in the United States from US and imported parts and meet Build America, Buy America (BABA) requirements.

3.7 Identification

Identify each module by the factory marking and the project packing list. Record the module identity on the Commissioning Record and on any later isolation, inspection, or claim. If a marking is missing or unreadable, photograph the module in place and ask Zyramic before first permeate.

4 Receiving, storage, and handling

4.1 Inspection on delivery

Inspect every crate on the truck before you sign the carrier ticket. Note shortage or visible damage on the bill of lading. Photograph the crate, the labels, and any damage. Notify Zyramic in writing within ten (10) days of delivery. Transit damage is the carrier's issue, or the issue of the party that held risk of loss under the order's Incoterm.

Do not unpack a wet or crushed carton onto the tank floor and assume the module is fine. Open it under cover. Check plates for cracks, edge damage, and sheet lift. Check tubing, gaskets, and the anti-float hardware against the packing list.

4.2 Storage

The membrane is permanently hydrophilic. Store modules wet or dry. Do not apply glycerin, glycol, or any other wetting agent.

NOTICE

Store modules in the original packaging, indoors or under cover. Protect from direct sunlight and from freezing. Do not exceed the temperature marked on the packaging or stated in the project submittal. Do not invent a storage-temperature number. Do not stack beyond the limits marked on the carton.

Storage longer than twelve (12) months from shipment needs written confirmation from Zyramic that warranty coverage is preserved. Ask before the twelfth month, not after.

4.3 Handling

Keep cartons upright as marked. Do not drag a module on the plates. Do not set a module on gravel, rebar, or a grating edge. Do not use plates as a workbench. Keep oil, grease, solvent, and paint away from the sheets.

4.4 Lifting

Lift only from the designated lifting points. Rigging shall be rated for the flooded module weight in the project submittal. That weight is TBD in this revision. If the submittal does not state a flooded weight, do not lift — ask Zyramic.

Use a spreader if the installation drawing shows one. Keep slings off plates and tubing. Lift slowly. A swinging cassette will chip plates.

4.5 Unpacking at the tank

Unpack immediately before installation when you can. If you must stage unpacked modules, keep them under cover, off the ground, and restrained so they cannot blow over or float if the area floods. Leave the anti-float hardware with the module it belongs to.

5 Installation

5.1 Conditions before you install

Do not lower a module into a dirty tank. Remove construction debris, weld spatter, grout, and plastic scrap. Flush the scour-air piping until the discharge is clean. Cap the module connections until you are ready to make up the joints.

Confirm the following are in service, or will be in service before first permeate:

- Influent screening: 3 mm perforated plate or mesh, or finer, continuous, no bypass. A bar screen is not acceptable in place of perforated plate or mesh.
- Grit removal, continuous. Settled grit on the tank floor is abrasive to the scour orifices and to the plate root.
- Guide rails aligned to the project drawing, plumb, and able to take the flooded weight.
- Anti-float hardware on hand for every module.
- High-vacuum cutout installed and not bypassed on the permeate system.
- A means to measure scour-air flow at each module.

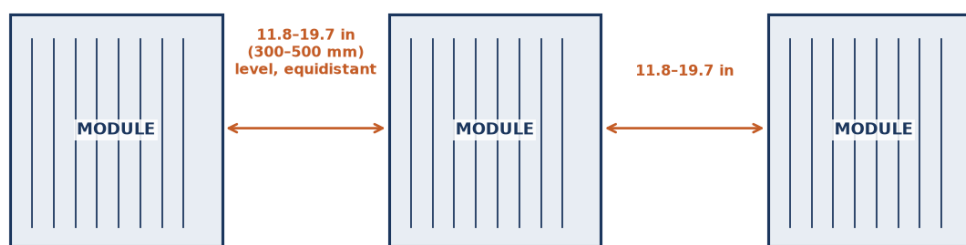
5.2 Guide rails and alignment

Install the module in the guide rails shown on the project installation drawing. Rails shall be plumb. The module shall travel freely without scraping plates. Do not force a cassette that binds. Find the obstruction.

Overall module height is TBD in this revision. Set rail height and stop elevation from the project drawing, not from this manual.

5.3 Spacing and level

FIGURE 4. Module spacing in the rack (plan, schematic)



Keep modules level with one another. Do not close the gap below 11.8 in (300 mm) unless the project drawing says so.

Space modules 11.8–19.7 in (300–500 mm) apart, level and equidistant, unless the project drawing states a tighter layout that Zyramic has accepted. Do not close the gap below 11.8 in (300 mm) on your own. A tight gap starves channels and makes isolation harder.

Modules in the same rack shall sit at the same elevation. A high module can come out of the water when the level is low. A low module can sit in grit.

5.4 Lowering the module

Use the designated lifting points. Keep the cassette square to the rails. Lower slowly. Do not drop the last few inches. Confirm the module is fully seated on the stops or floor frame shown on the drawing.

CAUTION

Do not use the permeate tubing, air hose, or header as a handle. Do not pry on a plate to “help” the cassette into the rails.

5.5 Anti-float restraint

Install the factory anti-float restraint before you fill the tank. The plates are buoyant. Operation without restraint will damage the module and voids the warranty. The restraint stays installed at all times the module is submerged, including idle and CIP soak (when a recipe is later issued).

If you must release the restraint to lift a module, isolate that module first (§12). Reinstall the restraint before the tank level comes back over the plates.

5.6 Permeate connections

The permeate connection is 2.5 in Sch 40 (DN65). Use the gasket, coupling, or flange specified on the project drawing. Support plant piping so the module header does not carry pipe weight or thermal load.

The permeate path is vacuum service in the usual arrangement. Make joints vacuum-tight. A leaking joint draws mixed liquor or air into the permeate and will look like a membrane problem. It is not.

WARNING

Do not configure the permeate piping for backflush or for any source of positive pressure on the module. Blind or remove any connection that could pressurize the permeate side.

5.7 Scour-air connections

The air connection is 2.5 in Sch 40 (DN65). Connect only after the plant air piping has been cleaned and flushed. Provide isolation and a flow measurement point for each module so you can verify the design rate at commissioning and after any outage.

Scour air shall be free of oil, particulates, and condensate. If the blower is lubricated, install filtration and an oil-knockout that the designer has sized for this duty. Oil carryover fouls the membrane irreversibly.

Scour-air temperature at the module inlet shall not exceed the limit stated in the project submittal. That limit is TBD in this revision. Do not invent a number.

5.8 Torque

NOTICE

Torque values are not published in this revision. Use the values on the project installation drawing. If the drawing is silent, ask Zyramic. Do not guess. Do not “snug it up” on a plastic flange and call it done. Over-torque cracks PVC and PP. Under-torque leaks.

5.9 Instrumentation interface

The plant shall be able to display and log the items in §9. Zyramic does not supply the instruments unless the quotation says so. Provide a permeate sample point that can deliver a degassed sample. Entrained air will fake a turbidity reading.

5.10 High-vacuum cutout

A high-vacuum cutout or equal protection is required on the permeate system. Set it so TMP cannot exceed 2.2 psi (15 kPa / 1.5 m H₂O). If the project submittal states a lower cutout, use the lower value. Test the cutout before first permeate. Do not jumper it.

5.11 Final installation check

Before you fill the tank, walk the rack and confirm:

- Every module is seated, level, and spaced as drawn.
- Every anti-float restraint is installed.
- Permeate and air joints are made up to the drawing. Caps and blinds are off the in-service connections only.
- No tool, rag, or timber is left on a header or in a channel.
- Lifting gear is clear of the tank.
- Module identities are recorded.

6 Commissioning

6.1 Purpose

Commissioning proves that the modules are installed as required and that the plant can hold the operating envelope. The Zyramic Commissioning Record (Appendix A) must be completed and returned to Zyramic before permeate is first drawn. The warranty does not take effect until that record is received.

6.2 Prerequisites

Do not start this sequence until §5 is complete and the following are true:

- Screening is in service. The bypass is closed and locked or tagged.
- Grit removal is in service.
- The tank is clean. No grit pile at the plate roots.
- Air piping has been cleaned and flushed.
- High-vacuum cutout is installed and tested.
- Relaxation is programmed (typically 8 min on / 2 min relax, unless the project submittal states another Zyramic-accepted cycle).
- A method exists to read scour-air flow at each module.
- Freeze protection is in place if weather requires it.

6.3 Sequence

Work in this order. Do not skip a step to “get water through the plant.”

1. Fill the tank with the water the designer has specified for first fill (typically screened influent after the biology is established, or clean water if the designer so states). Keep modules submerged. Do not splash dry solids onto a sheet and leave them there.
2. Confirm liquid level is above the top of every plate, with the operating freeboard shown on the drawing.
3. Confirm every anti-float restraint is still in place after fill.
4. Start scour air. Open the scour valves. Verify flow at each module. Design basis is 0.35 SCFM per m² (10 L/min per m²): 48 SCFM (1,365 L/min / 82 Nm³/h) for a single-deck module and 96 SCFM (2,730 L/min / 164 Nm³/h) for a double-deck module. If the project submittal states a site rate, use that rate. Do not run below the required minimum while you later draw permeate.

5. Walk the rack. Confirm air is leaving every channel, not a subset. A silent channel is a closed valve, a blocked orifice, or a missed connection. Fix it now.
6. Leak-test permeate and air joints under the conditions the designer specifies (vacuum on the permeate side, pressure on the air side). Repair leaks. Do not “make up” a leak by raising vacuum.
7. Prove the high-vacuum cutout. Prove that a blower trip or a low-air signal stops permeate, or that the operator cannot start permeate without air. If the plant has no interlock, write that on the Commissioning Record and do not start permeate until the designer has provided one.
8. Prove the relaxation cycle on the controller. Watch one full on/off pair.
9. Complete Appendix A. Sign it. Send it to tom@zyramic.com (or the address on the order) before first permeate.
10. Only then start permeate. Start at the low end of the design flux range. Do not step to the top of the range on day one.

6.4 First permeate

First permeate is a controlled start, not a production run. Watch TMP. Watch turbidity. Watch scour-air flow. If TMP climbs fast, stop permeate, leave scour on, and find the cause. Do not push vacuum to “get the flow.”

Prefer the lower end of the design flux. Run it low for longer. Do not exceed the design flux in the project submittal. If the submittal is silent, stay inside 7.4–12.3 gfd (12.5–21 LMH) and treat that range as preliminary (§8.3). That flux is about 7.5–12.6 gpm (single-deck) or 15.0–25.2 gpm (double-deck).

6.5 Zyramic attendance

Zyramic may attend or witness commissioning at the Purchaser’s cost and by prior arrangement. Attendance does not transfer installation or design responsibility to Zyramic. It does not replace the Commissioning Record.

7 Normal operation

7.1 Operating philosophy

Keep every plate submerged. Keep scour air on every module whenever you draw permeate. Relax the vacuum on the stated cycle. Hold flux at or below the project design. Prefer the low end of the flux range. A module run easy lasts longer than a module run at the ceiling.

Fouling and a slow rise in TMP are normal. They are managed by relaxation, scour, flux discipline, and — when Zyramic has issued a recipe — chemical cleaning. They are not by themselves a defect.

7.2 Submergence

WARNING

Modules stay submerged at all times when in service. Do not leave a module exposed above the liquid with biological solids on the membrane. If the level falls, stop permeate. Leave scour on if the orifices remain submerged. Restore level. If sheets came out of the water with solids on them, rinse the solids off before they dry. Record the event (§9).

7.3 Scour air

Continuous scour is the standard mode. It is field-adjustable to suit the site. Adjustment is not permission to go below the design rate while permeate is being drawn.

Design basis is 0.35 SCFM per m² of membrane (10 L/min per m²; not 10 L/min per plate as a total):

Parameter	Design basis
Scour intensity	0.35 SCFM per m ² (10 L/min per m ² of membrane)
Single-deck (130 plates, ≈136.5 m²)	48 SCFM / 1,365 L/min / 82 Nm ³ /h
Double-deck (260 plates, ≈273 m²)	96 SCFM / 2,730 L/min / 164 Nm ³ /h
Specific demand (SAD_m)	0.35 SCFM/m ² (10 L/m ² ·min / 0.60 Nm ³ /m ² ·h), membrane-area basis
Mode	Continuous, standard; field adjustable
Minimum while permeating	Not less than the project-submittal design rate (or the table above if the submittal is silent)

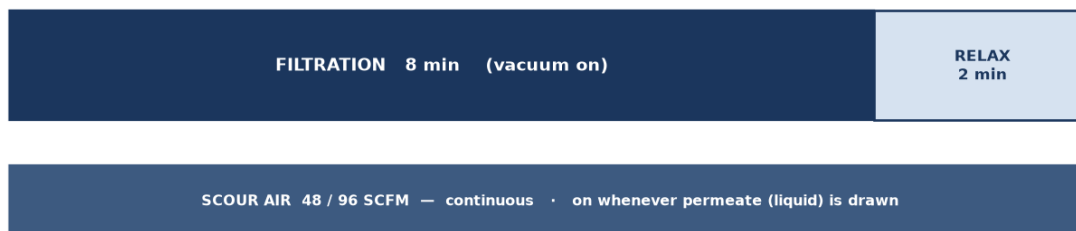
Verify flow at each module, not only at the blower discharge. A common header can starve one cassette and over-feed another.

If you must stop scour on one module (isolation, lift), stop permeate on that module first. Do not filter a silent cassette.

7.4 Permeate and relaxation

FIGURE 3. Typical vacuum permeate cycle (8 min on / 2 min relax)

Repeat. Continuous permeate without relaxation is not permitted unless Zyramic agrees in writing.



The usual mode is vacuum suction, typically 8 minutes on and 2 minutes relax. The project submittal may state another cycle. Continuous permeate draw without relaxation is not permitted unless Zyramic has agreed in writing.

During relax, the module stays submerged. Scour continues. Vacuum is released or the permeate valve closes, as the designer arranged. Do not apply positive pressure to “push the cake off.”

There is no backflush. There is no back-pulse. Operators who have run hollow-fiber plants must not import those steps.

7.5 Gravity operation

Gravity operation is supported where site hydraulics permit. The driving head shall not produce a TMP above 2.2 psi (15 kPa / 1.5 m H₂O), or any lower limit in the project submittal. Relaxation is still required: cycle the permeate valve. Scour air is still required whenever permeate is flowing. A gravity plant without a vacuum pump still needs a means to prevent excess driving head (a break, a valve, or a level interlock).

7.6 Flux

Hold permeate flux at or below the design value in the project submittal. The published design-basis range is 7.4–12.3 gfd (12.5–21 LMH). That range is preliminary. It is not yet Zyramic-validated. Pilot data will supersede it. Until then, treat 12.3 gfd (21 LMH) as a ceiling, not a target. Prefer 7.4 gfd (12.5 LMH) when the plant can meet its flow that way. At that flux the module produces about 7.5–12.6 gpm ($\approx$ 10,800–18,200 gpd) single-deck or 15.0–25.2 gpm ($\approx$ 21,600–36,400 gpd) double-deck. Log permeate (liquid) flow, not only scour air.

Do not raise flux to compensate for dirty screens, lost scour, or a tank that is too small. Fix the process.

7.7 Transmembrane pressure

Operating TMP design basis is ≤ 2.2 psi (≤ 15 kPa / ≤ 1.5 m H₂O). Do not exceed it at any time, including a transient. The high-vacuum cutout is the last line, not the operating point. If TMP is walking toward the limit, reduce flux, confirm scour and relaxation, and plan cleaning under §10. Do not wait for the cutout.

7.8 Mixed liquor

Operate MLSS between 3,000 and 12,000 mg/L unless the project submittal states a narrower band. Biology is the system designer’s responsibility. Foaming, filaments, and a dead tank will show up as filterability loss and rising TMP. That is a process problem first.

7.9 Daily operating checks

Once per shift, or on the plant’s official round, confirm:

- Tank level: every plate submerged.
- Scour-air flow and pressure: every in-service module at or above the design rate. Blower running. No oil, no water in the air filters.
- Permeate flow and TMP: instantaneous and trend. Peak TMP since last round.
- Relaxation cycle: running as programmed.
- High-vacuum cutout: not in alarm, not jumpered.

- Screening and grit: in service, no bypass, no overflow.
- Oil sheen, solvent odor, or unusual foam: report and hold permeate if you suspect a shock load.
- Leaks at headers and tubing.
- Anti-float restraints still in place (visual from the walkway).

7.10 What you do not do in operation

- Do not run permeate on a module that has no scour.
- Do not cancel relaxation to pick up more flow.
- Do not raise vacuum above the TMP limit to pick up more flow.
- Do not backflush.
- Do not hose a live rack with a pressure washer.
- Do not add defoamer, polymer, or oil-based products to the membrane tank unless the designer and Zyramic have agreed in writing.
- Do not drain the tank and walk away with solids on the sheets.

8 Process limits and operating envelope

The warranty is conditioned on continuous operation inside this envelope. Operation outside it, whether or not it is later shown to have caused a Failure, may reduce or void coverage. Where the project submittal states a tighter number, use the tighter number.

8.1 Pretreatment

Item	Requirement
Influent screening	3 mm perforated plate or mesh, or finer. Continuous. No bypass.
Bar screens	Not acceptable in place of perforated plate or mesh.
Grit removal	Continuous, upstream of the membrane tank.
Settled grit	Not permitted at the tank floor. Abrasive to orifices and the plate root.
Unscreened storm or bypass flow	Keep it out of the membrane tank.

8.2 Influent to the biological process

These limits apply to the feed to the biology, not to raw plant influent if the plant has primary treatment that brings the stream into range.

Parameter	Maximum (or range)
COD	≤ 500 mg/L
BOD5	≤ 300 mg/L
TSS	≤ 150 mg/L
NH4-N	≤ 50 mg/L

Parameter	Maximum (or range)
Animal and vegetable oil	≤ 30 mg/L
Mineral oil and petroleum hydrocarbons	≤ 3 mg/L
pH	6 to 9
Shock oils, greases, solvents, hydrocarbons	Not permitted

Mineral oil forms an adherent hydrophobic layer that routine chemical cleaning will not recover, even after recipes are issued. Keep it out.

8.3 Filtration

Parameter	Limit / basis
Design operating flux	7.4–12.3 gfd (12.5–21 LMH). PRELIMINARY. Not Zyramic-validated. Project submittal governs if stated. Prefer the low end. Do not exceed design flux.
Permeate (liquid), single-deck	7.5–12.6 gpm (≈10,800–18,200 gpd) at the design flux — preliminary
Permeate (liquid), double-deck	15.0–25.2 gpm (≈21,600–36,400 gpd) at the design flux — preliminary
Operating TMP	≤ 2.2 psi / ≤ 15 kPa / ≤ 1.5 m H ₂ O at all times
High-vacuum cutout	Required
Permeate mode	Vacuum suction, typically 8 min on / 2 min relax
Relaxation	Required unless Zyramic has agreed in writing
Continuous permeate without relax	Not permitted without written exception
Gravity operation	Allowed where hydraulics permit; TMP and relax still apply
Backflush / back-pulse / reverse pressure	Prohibited
MLSS	3,000–12,000 mg/L
Mixed-liquor temperature	Within the project submittal. No number in this revision.
Submergence	Required whenever the module is in service
Module spacing	11.8–19.7 in (300–500 mm), level and equidistant

8.4 Scour air

Parameter	Limit / basis
Delivery	Continuously to every module, at not less than the design rate, whenever permeate is drawn
Design rate	0.35 SCFM per m ² (10 L/min per m ²): 48 SCFM (1,365 L/min / 82 Nm ³ /h) single-deck; 96 SCFM (2,730 L/min / 164 Nm ³ /h) double-deck. Project submittal governs if it states a site rate
Quality	Free of oil, particulates, and condensate
Temperature at module inlet	Do not exceed the limit in the project submittal (TBD in this revision)

Parameter	Limit / basis
Piping cleanliness	Cleaned and flushed before the modules are connected
Lubricated-blower oil	Irreversible fouling. Keep it out.

8.5 Environment and mechanical

Parameter	Limit / basis
Freeze	Tank, piping, and modules protected
Anti-float restraint	Installed at all times the module is submerged
Lifting	Designated points only; gear rated for flooded weight in the project submittal
Membrane pH, operating / cleaning	TBD — pending Thermo Fisher
CIP chemistry	Zyramic-approved agents only. Recipes TBD. Do not improvise.

8.6 What this section is not

This section is not a process guarantee. Zyramic does not guarantee effluent quality, permit compliance, or membrane life except where a written performance guarantee is issued and separately priced. Flux figures in §8.3 are design-basis guidance. They are not validated plant results.

Do not take velocities from any computational study and enter them as operator setpoints. The operator setpoints are the flows, pressures, times, and concentrations in this section and in the project submittal.

9 Monitoring and records

9.1 Required records

The Owner shall monitor, log, and retain the following for the full warranty period, and shall make the records available to Zyramic on request. Failure to keep them may void the warranty where Zyramic reasonably determines that the §8 envelope was exceeded. This list is the Warranty §7 list.

#	Record
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 (once a recipe is issued and used)

#	Record
8	Screening and grit-removal operation, downtime, and maintenance
9	Any period during which modules were exposed above the liquid surface or the tank was drained
10	Periodic replacement parts and consumables

9.2 Filterability

Test mixed-liquor filterability on the schedule in the project submittal. If the submittal does not name a method, use the plant's established method and keep that method constant so the trend means something. A sudden loss of filterability is a process signal. Do not answer it by raising vacuum.

9.3 Turbidity is diagnostic

Elevated permeate turbidity is a reason to investigate. It is not, by itself, a Failure. Where continuous online turbidity is installed, a 95th percentile above 0.2 NTU, or any confirmed single reading above 0.5 NTU, on a rolling thirty-day basis while operating inside §8, is grounds to start the investigation in §12.

Confirm the reading on a degassed sample with a calibrated instrument. Entrained air on the permeate side will read as turbidity. Exclude tubing, barb and flange joints, gaskets, a dirty sample line, and analyzer drift before you call the membrane.

These NTU values are warranty-administration thresholds. They are not a permeate-quality guarantee and not a permit limit.

9.4 Retention

Keep the §9.1 records for the warranty period at a minimum. Keep them longer if the plant's permit or the Owner's policy requires it. Electronic logs are acceptable if they cannot be quietly edited and if Zyramic can read them on request.

9.5 When to call Zyramic

Call or write when any of the following is true:

- You cannot complete the Commissioning Record.
- You need a CIP recipe and one has not been issued for the job.
- A TBD value is blocking a lift, a torque, or a storage decision.
- Turbidity investigation under §12 has isolated a module and integrity testing shows a breach.
- Oil, grease, solvent, or hydrocarbon has entered the tank.
- Modules were exposed with solids on the sheets, or the tank froze.
- You want to run without relaxation, above the flux range, or in non-municipal service.

10 Cleaning

10.1 Purpose

Cleaning restores permeability that relaxation, scour, and flux discipline have not held. Physical measures come first. Chemical cleaning comes second, and only with a Zyramic-approved recipe.

10.2 Physical measures (always available)

Before anyone reaches for a chemical, do the following:

1. Confirm scour air at every module. Restore any shortfall.
2. Confirm the relaxation cycle is actually running.
3. Drop flux toward the low end of the design range.
4. Confirm screening and grit are in service. A week of bypass will look like a dirty membrane.
5. Check MLSS and filterability. A process upset is not a CIP problem.
6. Inspect for oil sheen or solvent odor. If you find it, stop permeate and call Zyramic. Do not wash oil in with a homemade solution.

These steps are not a substitute for chemistry when chemistry is later authorized. They are the first response, and they are the only response until a recipe exists.

10.3 Chemical cleaning policy

WARNING

Chemical cleaning shall be performed only with the agents, concentrations, contact times, temperatures, and frequencies approved in writing by Zyramic. As of this revision, those details have not been released. They are pending confirmation of compatibility with the Thermo Fisher PES membrane. Until Zyramic issues the recipes in a later revision of this manual or in the project submittal, do not perform chemical cleaning. Do not improvise. Do not apply a recipe copied from another plant or another product.

TBD

CIP recipes — agent, concentration, contact time, temperature, frequency, and any pH window — will be issued in the project submittal or in a later revision of this manual. Membrane operating and cleaning pH limits are likewise TBD pending Thermo Fisher. This revision on purpose does not state a hypochlorite strength, an acid strength, or a soak time.

10.4 Framework for when a recipe is issued

The following will apply once a written recipe exists. It is not permission to clean now.

- Use only the named agent at the named concentration. Dilute as the recipe states. Measure. Do not “pour until it looks right.”

- Hold the named contact time and the named temperature. Do not extend a soak to “make sure.”
- Keep modules submerged. Keep the anti-float restraint on. Follow the recipe on whether scour runs during the soak.
- Do not backflush the chemical. Do not pressurize the permeate side to push solution through the sheet.
- Record agent, concentration, temperature, duration, TMP before and after, and the volume of spent solution. That record is a warranty record (§9.1 item 7).
- Dispose of spent solution under the plant permit. Neutralize only as the later recipe and the plant permit allow.
- Rinse as the recipe states before you return the module to permeate.

10.5 Prohibited cleaning methods

- Backflushing, back-pulsing, or reverse pressure.
- High-pressure water on the sheet.
- Steam, solvents, hydrocarbons, or glycol.
- Abrasive pads, scrapers, or wire brushes on the membrane.
- Any chemical not named in a Zyramic-approved recipe.
- Field-welding, glue, or tape on a damaged sheet as a “repair.” Isolate and call Zyramic.

10.6 After a clean

When a recipe has been used, restart under §11.5. Confirm scour and relaxation before permeate. Log the event. If TMP does not respond to an approved clean, stop and call Zyramic. Repeating an unauthorized stronger dose is not the next step.

11 Shutdown, idle, restart, and freeze protection

11.1 Short idle (hours to a few days)

Stop permeate. Leave the modules submerged. Leave scour air on if the plant can supply it; it keeps channels moving. Leave the anti-float restraint on. Leave screening in service if influent is still entering the tank. Do not drain “to look at the plates” unless you are prepared to rinse solids off immediately.

11.2 Extended idle

For an idle longer than a few days, keep modules submerged in mixed liquor or in clean water as the designer specifies. Maintain freeze protection. Run scour periodically if the designer so states; this manual does not invent a periodic-scour interval. Keep the restraint on.

If the tank must be emptied, see §11.3. Unused spare modules go back to the storage rules in §4.2. Wet or dry is acceptable. No glycol. No sun. No freeze. No stacking past the carton marks.

11.3 Drain and exposure

WARNING

Do not leave a module exposed above the liquid with biological solids on the membrane. If you must drain, stop permeate first. Rinse solids off the sheets as the level falls, or immediately after the plates come free of the liquid. Dried mixed liquor on a sheet is a fouling event and a warranty record. Photograph and log the exposure (§9.1 item 9).

Support the cassette so plates do not take the weight of the module on their edges. Do not lean a drained cassette on a wall.

11.4 Freeze protection

The membrane tank, the permeate piping, and the modules shall be protected from freezing whenever they contain water. Heat, cover, drain, or circulate as the designer specified. This manual does not publish a minimum mixed-liquor temperature. If the project submittal is silent, do not assume a number — keep the tank from freezing and ask Zyramic if you are in a climate where that is a seasonal project.

A frozen module is a failed module. Do not thaw it with a torch, steam, or a pressure washer.

11.5 Restart

Restart is a short commissioning, not a switch-flip.

1. Confirm screening and grit are in service. Bypass still closed.
2. Confirm modules are submerged and restraints are on.
3. Confirm air piping is still clean. Drain condensate. Check oil filters on a lubricated blower.
4. Start scour. Verify flow at each module before any permeate.
5. Confirm relaxation is still programmed. Confirm the high-vacuum cutout is live.
6. Start permeate at the low end of the flux range. Watch TMP.
7. If the idle included a drain or an exposure, inspect before you start (§12). Log the restart.

11.6 Seasonal shutdown

A seasonal plant follows §11.2 and §11.4. If modules will sit more than twelve months from shipment — including warehouse time plus idle — obtain Zyramic's written confirmation that warranty coverage is preserved.

12 Inspection, integrity testing, and module isolation

12.1 In-service visual

From the walkway, look for a module that is riding up (restraint), a dry top (low level), a silent channel (lost scour), a leak at a joint, oil sheen, and ice. You cannot see a pinhole from the walkway. You can see a process problem.

12.2 Lifted-module inspection

When a module is lifted, rinse solids off as it leaves the water. Inspect every plate for pinhole, tear, delamination, sheet separation from the plate, and breakage. Inspect the plate root and the orifices for grit wear. Inspect tubing, gaskets, and the restraint. Photograph anything you will report.

Do not probe a sheet with a knife, a wire, or a pressure-washer tip. Do not field-weld a lift.

12.3 What is a Failure

For warranty purposes, Failure means a loss of membrane integrity in an identified module arising from a defect in materials or workmanship, shown by one or more of the following:

- Pinhole.
- Tear.
- Delamination.
- Separation of the membrane sheet from the support plate.
- Breakage of the sheet.

The following are not Failures: loss of permeability that an approved chemical clean would recover; fouling and rising TMP; and any turbidity excursion traced to a cause outside the module (tubing, joints, gaskets, sample line, entrained air, analyzer).

A Failure exists only where integrity testing confirms a breach in a specific module. Turbidity of 0.2 NTU or 0.5 NTU is a diagnostic trigger, not a Failure.

12.4 Isolation

Isolate one module at a time so you can tell which cassette is contributing permeate solids.

1. Stop permeate to the candidate module. Leave scour on until the permeate valve is closed.
2. Close the permeate isolation valve. Cap or bag the open sample point if you will take a sample from the header.
3. If you will lift the module, stop its scour, disconnect, release the restraint, and lift from the designated points.
4. If you will test in place, collect permeate from that module only, or confirm that its isolation drops the train turbidity.
5. Do not pressurize the isolated permeate side.
6. Tag the valve. Log the module identity, time, TMP, and turbidity.

12.5 Integrity testing

WARNING

Do not perform a positive-pressure hold, a reverse-flow test, or any test that puts pressure on the permeate side. Those tests are used on some other membrane formats. They will delaminate this sheet.

Use only methods that keep the permeate side at or below atmospheric pressure:

- Visual inspection of the lifted module (§12.2).
- Isolation and observation of that module's permeate (clarity, degassed turbidity).
- A vacuum hold on the isolated permeate connection, if the project submittal states a procedure and an acceptance number. This revision does not publish a leak-rate number. Do not invent one. If the submittal is silent, use visual inspection and isolation. Ask Zyramic before you add a vacuum-decay test of your own.

A dye test, if later authorized in writing, shall be run only to the written method. Do not pick a dye and a concentration from another product's manual.

12.6 After a confirmed breach

Leave the module isolated. Notify Zyramic under §15.4. Do not keep a known failed module in permeate service. Continued operation of Equipment known to be in a Failure condition, without notice to Zyramic, voids coverage for consequential damage to adjacent Equipment.

Do not patch a sheet in the field. Do not swap plates between cassettes unless Zyramic has written a procedure for that job.

12.7 Return to service

A module that passed inspection returns under §11.5. Reinstall the restraint. Leak-test the remade joints. Verify scour flow before permeate.

13 Troubleshooting

Start with the process, the air, and the joints. The membrane is the last thing you blame, not the first.

Symptom	Likely cause	What you do
TMP rising toward 2.2 psi	Fouling; low scour; flux too high; poor filterability; screen bypass; grit at the roots	Confirm scour at each module. Confirm relax. Drop flux. Restore screening. Do not raise vacuum. Plan CIP only after a recipe is issued.
High permeate turbidity	Joint leak; entrained air; dirty sample line; analyzer; or a real breach	Degassed sample. Check tubing and flanges. Isolate modules (§12). Do not call it a Failure until a specific module shows a breach.

Symptom	Likely cause	What you do
One module “silent” (no scour)	Closed valve; blocked orifice; missed connection; header imbalance	Stop permeate on that module. Restore air. Inspect orifices for grit if you lift. Do not filter a silent cassette.
Low air on the whole rack	Blower down; dirty filter; condensate; closed plant valve	Stop permeate. Fix air. Log blower downtime. Oil in the air is an emergency — see below.
Oil sheen, oily air, or sudden hydrophobic fouling	Lubricated-blower carryover or influent mineral oil / hydrocarbon	Stop permeate. Leave modules submerged. Call Zyramic. Do not improvise a solvent wash. Oil fouling may be irreversible.
Module riding up or listing	Missing or loose anti-float restraint; buoyancy	Stop permeate. Secure the restraint. Inspect plates and piping for damage. Log it.
Tops of plates in air	Low tank level; unequal module elevation	Stop permeate. Restore level. Rinse any exposed solids. Log the exposure.
No permeate flow	Closed valve; pump down; frozen line; cutout tripped; clogged tubing	Check the plant system first. Confirm the cutout has not tripped on high TMP. Do not bypass the cutout.
Gravity plant over-flushing	Driving head above 2.2 psi (1.5 m H ₂ O)	Throttle or break the head. TMP still applies. Relax still applies.
Fast TMP rise after a weekend idle	Solids dried on sheets; lost scour; screen outage	Rinse if exposed. Restore scour. Check the screen log. Restart at low flux.
Permeate looks milky, then clears on standing	Entrained air, not solids	Degassed sample. Fix vacuum leaks. Do not start a Failure claim on a milky sample that clears.
Broken plate or pulled sheet	Impact, ice, lift on the header, reverse pressure, missing restraint	Isolate. Photograph. Call Zyramic. Do not run that module.

13.1 Oil and hydrocarbons

Mineral oil and petroleum at or above the §8.2 limit, or any shock load, is a warranty event in the making. Stop permeate. Keep scour on if the air is still clean. Sample the tank. Notify Zyramic. Do not add detergent and hope.

13.2 Lost scour while permeating

This is an exclusion. Stop permeate at once. Restore air. Log the downtime. If the outage was more than a momentary blip, inspect filterability and TMP before you return to the previous flux.

14 Spare parts and consumables

14.1 Consumables

The following are consumable and wear items. They are warranted only against defects in materials and workmanship at the time of shipment. They are not covered for wear in service.

Item	Notes
Permeate tubing	Platinum-cured silicone. Replace when cracked, flattened, or leaking. Same compound; do not substitute an oil-leaching tube.
Gaskets	Replace on any joint that is broken and remade if the gasket is damaged or has taken a set.
Seals	As supplied with the header connections.
Fasteners	Replace in kind. Do not mix uncoated carbon steel into a wetted joint.

14.2 Recommended holdings

Hold the quantities stated in the project spare-parts list. This revision does not invent a site stock. As a minimum, the plant should be able to remake every permeate and air joint on one module without waiting for a shipment, and to replace tubing that fails on a weekend.

14.3 What you do not substitute

- Do not replace platinum-cured silicone with a tube that sheds oil or plasticizer onto the permeate side.
- Do not replace a PP or PVC header with a random shop fitting of another resin without Zyramic's written agreement.
- Do not replace the anti-float restraint with rope, wire, or a timber wedge.
- Do not install a "cleaning connection" that can pressurize the permeate side.

14.4 End of service

At end of life the membrane and nonwoven can be removed from the support plate. The plate is talc-filled polypropylene and can enter a conventional PP recycle stream (resin code 5). Follow the plant's residual-solids and industrial-waste rules for the used membrane. Do not landfill a plate that can be cleaned and recycled if a recycle path is available.

Do not field-weld a new sheet onto a used plate. Plate refurbishment, if offered, is a factory or Zyramic-authorized operation.

15 Warranty interface

This section tells the operator how the warranty touches daily work. It does not replace the Zyramic Membrane Module Warranty. If this section and that document conflict on coverage, that document controls.

15.1 What is covered

For municipal wastewater service, Zyramic warrants the Equipment free from defects in materials and workmanship for two (2) years, non-prorated, from Final Acceptance, and warrants the membrane modules against Failure as defined in §12.3 for two (2) years of operation, non-prorated, from Final Acceptance.

Final Acceptance is the date the treatment system has completed startup and the Owner accepts it for continuous operation. If Final Acceptance has not occurred within twelve months of shipment, the warranty period starts on the first day of the thirteenth month after shipment, unless the delay is Zyramic's.

Industrial, commercial, landfill leachate, high-strength, high-temperature, and other non-municipal service is excluded unless a separate written agreement exists.

15.2 Conditions you must keep

Coverage is conditioned on the envelope in §8, the installation and lifting rules in §4 and §5, the Commissioning Record in §6, the records in §9, and the cleaning rules in §10. The Commissioning Record must be in Zyramic's hands before first permeate. The warranty does not start until it is received.

15.3 What reduces or voids coverage

Any of the following, as reasonably determined by Zyramic, may reduce or void the warranty:

- Misuse, accident, fire, freezing, improper repair, tampering, or abuse, including handling, lifting, or installation errors.
- Failure to follow the preventative maintenance in this manual.
- Screen or grit outage, bypass, or overflow.
- Interruption, reduction, or loss of scour air while permeate is being drawn.
- Operation above the maximum TMP, or no high-vacuum protection.
- Oils, greases, solvents, hydrocarbons, or other substances outside the characterized influent.
- Chemical cleaning outside approved agents, concentrations, temperatures, or frequencies — including any improvised CIP — or any positive pressure on the permeate side.
- Damage from system design, sizing, or control (see Warranty §3).
- Unauthorized alteration, substitution, or repair.
- Intentional damage.
- Storage outside §4.2, including glycol or glycerin, sun, freeze, over-stacking, or storage beyond twelve months without Zyramic's written confirmation.
- Lifting on headers, plates, rails, or tubing.
- Operation without the anti-float restraint.
- Missing operating records where those records would have shown an envelope breach.

15.4 Claim procedure

A claim starts only when the Purchaser gives Zyramic written evidence of the Failure and of the Purchaser's performance of its obligations. Send that evidence within thirty (30) days of the date the Failure is identified.

Zyramic may inspect the plant. The Purchaser provides safe access and reasonable operator help. Travel, lodging, and meals for that inspection are the Purchaser's cost unless the Failure is determined to be Zyramic's, in which case Zyramic bears those costs.

Zyramic's sole obligation is to repair or replace modules or components determined to have Failed. Replacements ship EX WORKS Zyramic's facility. Plant labor, freight, duties, and taxes are not included. The quantity repaired or replaced will not exceed the quantity originally supplied. A replacement carries the remainder of the original period only.

15.5 What Zyramic does not guarantee here

Nothing in this manual is a guarantee of permeate quality, effluent quality, or permit compliance. Performance guarantees, if any, are separate, written, and separately priced.

15.6 Transfer

The warranty extends to the Owner of the facility in which the Equipment is first installed. It does not otherwise transfer. It does not survive removal and reinstallation at a different facility without Zyramic's prior written consent.

16 Contacts

Use this address for commissioning records, TBD questions, CIP-recipe status, and warranty claims. Do not use any other street or telephone number that may appear on an older draft.

Item	Detail
Company	Zyramic, Inc.
Address	10 Tucker Dr
City	Poughkeepsie, NY 12603 USA
Telephone	+1 845 402 6318
Email	tom@zyramic.com
Document	ZY-OM-MBR-001, Revision 2, August 2026

For after-hours plant emergencies (injury, spill, tank overflow), follow the plant emergency plan first. Call Zyramic when the people and the permit are stable and you need module-specific direction.

Appendix A Commissioning Record

Complete this record before first permeate. Send a signed copy to tom@zyramic.com. The warranty does not take effect until Zyramic receives it. Use one form per train, or one form per job if all modules are commissioned together. Attach extra sheets for additional module identities.

Project data	Entry
Project / plant name	
Owner	
Purchaser / integrator	
Site address	
Zyramic order / serial range	
Number of modules on this record	
Date of this record	

A.1 Prerequisites (initial each line)

#	Item	Initial / date
1	Influent screening in service: 3 mm perforated plate or mesh (or finer). Bypass closed. Bar screen not used as the membrane screen.	
2	Grit removal in service. Tank floor free of settled grit at the plate roots.	
3	Scour-air piping cleaned and flushed before modules were connected.	
4	Scour air oil-free, particulate-free, and condensate-free at the module inlet.	
5	Every module seated, spaced 11.8–19.7 in / 300–500 mm (or as the accepted drawing), level and equidistant.	
6	Anti-float restraint installed on every module and still installed after fill.	
7	Permeate and air connections leak-tested. No reverse-pressure path on the permeate side.	
8	High-vacuum cutout installed, tested, and not jumpered. Set so TMP cannot exceed 2.2 psi / 15 kPa (or the lower project value).	
9	Relaxation programmed (typically 8 min on / 2 min relax, or the accepted project cycle).	
10	Permeate interlocked so it cannot run without scour air, or an equivalent administrative control is written and posted.	
11	Freeze protection in place if required by weather.	
12	Module identities recorded (attach list).	

A.2 Scour-air verification

Record measured flow at each module. Design basis is 48 SCFM (1,365 L/min) single-deck or 96 SCFM (2,730 L/min) double-deck unless the project submittal states a site rate. Note the module size. Attach a sheet if more than eight modules.

Module ID	Measured flow	Unit (SCFM or L/min)	At or above design? (Y/N)	Initial

A.3 Sign-off

Role	Name	Signature	Date
Installer / integrator			
Owner / operator			
System designer (if present)			
Zyramic witness (if present)			

Zyramic attendance, if any, does not transfer design or installation responsibility and does not replace this record. First permeate shall not be drawn until this record has been sent to Zyramic.

Appendix B Operating log — required fields

Use the plant historian where it already captures a field. Fill the rest by hand or by a daily sheet. Keep the warranty-period archive.

Field	Typical interval	Notes
Influent COD, BOD5, TSS, NH4-N, pH	As the permit / process lab already runs	Hold against §8.2
Oil and grease (when at risk)	As the risk requires	Mineral oil ≤ 3 mg/L
Effluent / permeate quality	As the permit requires	Not a Zyramic guarantee
Permeate (liquid) flow and totalizer, gpm / gpd	Continuous or daily	Warranty §7 — liquid, not air
TMP instantaneous and peak	Continuous or each shift	Ceiling 2.2 psi (15 kPa)

Field	Typical interval	Notes
MLSS and mixed-liquor temperature	Daily or as designed	MLSS 3,000-12,000 mg/L
Scour-air flow and pressure (each module or each header, as installed), SCFM	Each shift	≥ 48 SCFM single / 96 SCFM double whenever permeating
Blower hours and downtime	Daily	Log every outage
Filterability	Per project submittal	Keep the method constant
Screen and grit status / downtime	Each shift	Bypass is a recordable event
Exposure or drain events	When they occur	Photograph if sheets came out
Consumable replacements	When they occur	Tubing, gaskets, seals, fasteners
CIP (only after a recipe is issued)	Each clean	Agent, concentration, temperature, time

Appendix C Isolation and integrity checklist

#	Step	Done
1	Record train turbidity on a degassed sample. Calibrate or check the instrument.	
2	Exclude tubing, joints, gaskets, sample line, and analyzer before you isolate modules.	
3	Stop permeate on the candidate module. Then stop or isolate its scour if you will disconnect.	
4	Close and tag the permeate isolation valve. Record module ID and time.	
5	If testing in place: collect that module's permeate only, or confirm the train turbidity response.	
6	If lifting: disconnect, release restraint, lift on designated points, rinse solids off at the waterline.	
7	Inspect every plate for pinhole, tear, delamination, sheet separation, breakage. Photograph.	
8	Do not apply positive pressure to the permeate side. Do not backflush. Do not field-weld.	
9	If a breach is confirmed: keep the module isolated, notify Zyramic within 30 days with evidence.	
10	If no breach: remake joints, reinstall restraint, verify scour, restart under \$11.5. Log the result.	

Appendix D TBD and open items

This revision leaves the following unpublished on purpose. Do not invent a value. Use the project submittal when it states one. Otherwise ask Zyramic in writing.

#	Item	Where it will appear
1	Overall module / cassette height	Project installation drawing
2	Module dry weight	Packing list / project submittal
3	Module operating (flooded) weight — required for lift planning	Project submittal
4	Membrane pH range, operating	Later O&M revision, after Thermo Fisher release
5	Membrane pH range, cleaning	Later O&M revision / project submittal
6	CIP agent, concentration, contact time, temperature, frequency	Project submittal or a later O&M revision. Do not improvise.
7	Scour-air temperature limit at the module inlet	Project submittal
8	Storage temperature upper limit	Packaging mark / project submittal
9	Connection torque values	Project installation drawing
10	Design flux 7.4–12.3 gfd (12.5–21 LMH) is preliminary, not Zyramic-validated. Permeate 7.5–12.6 gpm single / 15.0–25.2 gpm double at that flux.	Pilot data will supersede; project submittal may tighten
11	Integrity-test numeric acceptance (vacuum-decay, if used)	Project submittal, if Zyramic authorizes the test
12	Filterability test method	Project submittal, or the plant's established method
13	TMP value at which to initiate CIP	Not published. Do not exceed 2.2 psi (15 kPa). Recipe still required.

End of ZY-OM-MBR-001, Revision 2.

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