Storage and Handling

3M™ Liqui-Cel™ Membrane Contactors can be damaged through improper handling and storage. The guidelines below are intended to provide a framework for the proper storage and handling of these products. If you have any questions, please review the product datasheet and operating guide at 3M.com/Liqui-Cel or contact your 3M representative.

Storage: Container/packaging: 3M™ Liqui-Cel™ Membrane Contactors should be stored dry and in a sealed plastic bag or shrink wrap material to help prevent the introduction of contaminants into the contactor.

Temperature: Store 3M™ Liqui-Cel™ Membrane Contactors dry at temperatures < 49°C (120°F). Membrane contactors stored at very low temperatures < 5°C (41°F) should be allowed to equilibrate to room temperature before use.

⚠ **Exposure to Sunlight:** 3M™ Liqui-Cel™ Membrane Contactors should be stored in their original box, or other opaque box, and should not be installed where they are exposed to direct sunlight.

⚠ **Storage and Handling:** Care must be taken not to drop, hit or impact the membrane contactor. Use appropriately rated lifting equipment for lifting or moving. Review the product datasheet or operating guide for weights at 3M.com/Liqui-Cel.

Store the membrane contactors in the horizontal position. 10×28-inch membrane contactors with stainless steel housings may be packaged in cardboard boxes or wooden crates. 14×28-inch, 10×28-inch with FRP housings, 8×20-inch and 6×28-inch membrane contactors are packaged in cardboard boxes. 8×40 inch and 8×80-inch membrane contactors are individually bagged, then cradled on pallets. Membrane contactors should be stored in a safe location where they are not at risk of falling, being crushed or impacted. Always ensure the membrane contactor, and any systems using membrane contactors, are stable, level, and properly secured. Be sure the membrane contactors/system cannot tip, roll, fall, slide or make any movement that may cause injury, damage to the unit, or damage to other system components.

ISO 9001

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Liqui-Cel™ Membrane Contactors

Start-up Procedures

for 3M™ Liqui-Cel™ EXF and SP Series Membrane Contactors

- 2.5×8
- 4×13
- 4×28
- 6×28
- 8×20
- 8×40
- 8×80
- 10×28
- 14×28
- 14×40

Prior to any start-up procedure, proper installation is required.

Please read, understand, and follow all safety information contained in the Operating Guide prior to using this membrane contactor. The Operating Guide is available at 3M.com/Liqui-Cel. Download and retain the instructions for future reference.

Steps:

1. Note that for adding dissolved gases to water, the only mode of operation is sweep.
2. Mount contactor vertically or horizontally. If mounted vertically the drain port should be at the bottom end of the module. If mounted horizontally the drain port should be pointed downwards.
3. Refer to start-up procedures below for connections and mode of operation.

Notes:

- The liquid pressure should always be higher than the gas pressure inside the contactor.
- Liquids entering the membrane contactor should be prefiltered at 5 micron absolute at 99.9% removal (beta 1000).
- Gas entering the contactor should be filtered at 0.2 micron absolute at 99.9% removal (beta 1000) for high-purity applications. Filtration at 1 micron absolute at 99.9% removal (beta 1000) may be sufficient for industrial applications.
- Upon initial start-up, flush all pipes to drain prior to introducing liquid into the membrane contactors.

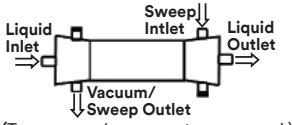
Start-up Procedures | 3M™ Liqui-Cel™ EXF and SP Series Membrane Contactors

- The vacuum pump and/or sweep gas should be on at all times unless the membrane contactors are completely drained.
- Liquid flows on the shellside in 3M™ Liqui-Cel™ EXF and SP Series Membrane Contactors.

2.5×8 with NPT, 8×20, 8×40 and 8×80-inch membrane contactors have different connections than those shown in the Mounting Position, Port Identification and Operating Mode diagrams. See below for liquid and sweep gas/vacuum port identification for these products.

2.5×8

8×20



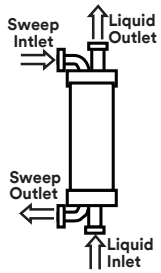
(Two vacuum/sweep ports are capped.)

8×40 and 8×80

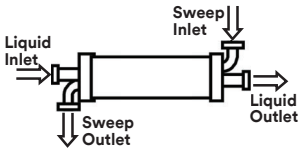
Mounting Position, Port Identification and Operating Modes

Note: See the Operating Guide in the Tech Support Section at 3M.com/Liqui-Cel if you need additional piping and instrumentation information.

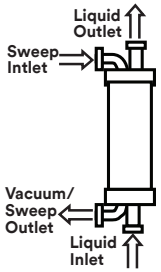
Sweep Mode, Vertical



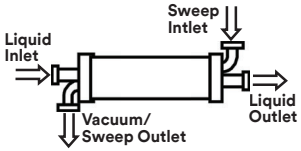
Sweep Mode, Horizontal



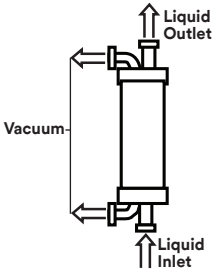
Sweep with Vacuum (Combo Mode), Vertical



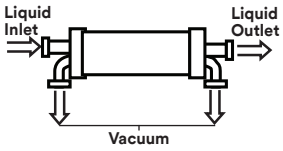
Sweep with Vacuum (Combo Mode), Horizontal



Vacuum Mode, Vertical



Vacuum Mode, Horizontal



Before you begin start-up identify the mode of operation and mount contactor in desired orientation.

A. General start-up instructions for the liquid phase

Note: Both gas/vacuum ports should not be closed during operation. These ports provide a safety vent in the contactors so that pressure does not build up.

Slowly introduce water to the system, making sure that the water inlet pressure and water flow rate through the contactor never exceed the maximum operating limits listed below. If using a SP Series Membrane Contactor device, the liquid must flow on the shellside. (Labeled as Liquid Inlet above).

Maximum flows: 2.5×8: 0.7 m³/hr (3 gpm); 4×13: 3.4 m³/hr (15 gpm); 4×28: 6.8 m³/hr (30 gpm); 6×28: 11 m³/hr (50 gpm); 8×20 PVC or SS: 11 m³/hr (50 gpm); 8×40: 28 m³/hr (125 gpm); 8×80: 28 m³/hr (125 gpm); 10×28 FRP or SS: 57 m³/hr (250 gpm); 10×28 IND: 48 m³/hr (210 gpm); 14×28: 91 m³/hr (400 gpm); 14×40: 125 m³/hr (550 gpm).

1. Adjust water flow rate and inlet pressure to desired levels by adjusting appropriate system valves.

Max. Trans-membrane pressure (TMP) differential **at 25°C** (77°F)	
X40 membrane	150 psi (10.3 bar)*
X50 membrane	120 psi (8.3 bar)
XIND membrane	75 psi (5.2 bar)
UP Membrane	75 psi (5.2 bar)

* Please note that the 8×40 and 8×80 modules can operate up to 300 psi TMP.

B. Start-Up Instructions for strip gas and vacuum phase

Note: Vacuum, when used in combo, should always be pulled from the lowest gas port to facilitate draining and ensure performance.

Sweep Gas Mode

1. Regulate gas supply pressure to membrane contactor at ≤10 psig (0.7 barg) by adjusting the appropriate system valves.
2. Set the recommended total sweep flow rate by adjusting the appropriate system valves. See the sweep guidelines for typical sweep gas flow rate ranges.
3. Introduce sweep gas into each contactor.

Note: If using compressed air, make sure it is oil free and air temp <35°C.

Sweep Gas with Vacuum (Combo) Mode

1. Regulate gas supply pressure to membrane contactor at ≤1 psig (0.07 barg) by adjusting the appropriate system valves.
2. Set the recommended total sweep flow rate by adjusting the appropriate system valves. See sweep guidelines for typical sweep gas flow rate ranges in the table below.
3. Introduce sweep gas into each contactor.
4. Apply vacuum as described in the vacuum section below.

Note: If using compressed air, make sure it is oil free and air temp <35°C.

Note: If the lumens are filled with condensed water vapor, contactor performance can be restored by flowing pressurized sweep gas at ≤30 psig for 5 minutes. Gas pressure in the membrane contactor should always be lower than liquid pressure.

Blower in suction mode with atmospheric air as sweep gas for CO_2 removal (for 4×13, 4×28, 6×28, 8×20 PVC, 10×28 and 14×28 products).

Refer to Air Sweep Guidelines for Sweep-Only Mode in table below for typical air flow rates.

1. Start blower using suction mode operation.
2. Open isolation valve (if applicable).
3. Close relief valve.

Vacuum Only Mode

1. Start vacuum pump following vacuum pump manufacturer's instructions.
2. Apply vacuum to the contactor by opening appropriate valve.
3. Adjust absolute gas pressure on the vacuum side to the desired level at the vacuum port on the contactor.

	Air Sweep Guidelines for Sweep-Only Mode	Air Sweep Guidelines for Combo Mode	N_2 Sweep Guidelines for Combo Mode
2.5×8	0.25 – 1.25 scfm (0.4 – 2.0 Nm³/hr)	0.05 – 0.25 scfm (0.1 – 0.4 Nm³/hr)	0.02 – 0.1 scfm (0.03 – 0.16 Nm³/hr)
4×13	1.0 – 5.0 scfm (1.6 – 7.9 Nm³/hr)	0.2 – 1.0 scfm (0.3 – 1.6 Nm³/hr)	0.1 – 0.5 scfm (0.2 – 0.8 Nm³/hr)
4×28	1.0 – 10.0 scfm (1.6 – 15.8 Nm³/hr)	0.2 – 2.0 scfm (0.3 – 3.2 Nm³/hr)	0.1 – 1.0 scfm (0.2 – 1.6 Nm³/hr)
6×28	2.0 – 10.0 scfm (3.2 – 15.8 Nm³/hr)	0.4 – 2.0 scfm (0.6 – 3.2 Nm³/hr)	0.1 – 1.0 scfm (0.2 – 1.6 Nm³/hr)
8×20 PVC	3.0 – 15.0 scfm (4.7 – 23.7 Nm³/hr)	0.5 – 5.0 scfm (0.8 – 7.9 Nm³/hr)	0.2 – 1.0 scfm (0.3 – 1.6 Nm³/hr)
8×20 SS	Not Recommended		0.2 – 1.0 scfm (0.3 – 1.6 Nm³/hr)
8×40	5.0 – 20.0 scfm (7.9 – 31.7 Nm³/hr)	1.0 – 4.0 scfm (1.6 – 6.3 Nm³/hr)	0.4 – 0.8 scfm (0.6 – 1.3 Nm³/hr)
8×80	Not Recommended		0.5 – 1.0 scfm (0.8 – 1.6 Nm³/hr)
10×28	5.0 – 30.0 scfm (7.9 – 47.5 Nm³/hr)	2.0 – 10.0 scfm (3.2 – 15.8 Nm³/hr)	0.4 – 1.0 scfm (0.6 – 1.6 Nm³/hr)
14×28	10.0 – 50.0 scfm (15.8 – 79.1 Nm³/hr)	3.0 – 15.0 scfm (4.7 – 23.7 Nm³/hr)	0.5 – 1.0 scfm (0.8 – 1.6 Nm³/hr)
14×40	Not Recommended		0.5 – 1.0 scfm (0.8 – 1.6 Nm³/hr)

* Note that the gas side/vacuum pressure limits may be less than this. See Operating Guide for other pressure restrictions in the European Communities (EU).