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3M™ Liqui-Cel EXF-14×28 Series Membrane Contactor with Engineered Thermoplastic End Caps

Including products used for TransMembrane ChemiSorption (TMCS) applications

Assembly and Disassembly Instructions

Contents

Safety Information

Please read and follow all safety information, warnings and instructions in this manual. Failure to follow all product warnings and instructions could cause serious injury and property damage. Retain these instructions for future reference.

Intended Use:

3M™ Liqui-Cel™ Membrane Contactor products are intended to remove dissolved gasses and bubbles from compatible liquids or to add gasses to a liquid stream. 3M Liqui-Cel Membrane Contactor products are for use in industrial separation applications of industrial fluids only, in accordance with the applicable product instructions and specifications. Certain limited 3M Liqui-Cel Membrane Contactor products are also intended for use in specific Food and Beverage (F&B) applications when used in accordance with product use requirements and instructions. Refer to the specific 3M Liqui-Cel Membrane Contactor product's performance data sheet to determine whether it includes a F&B designation and can be used for such applications.

3M Liqui-Cel Membrane Contactor products may further be used in the production of water for various pharmaceutical products upstream of the final water sterilization step.

Product Selection:

Since there are many factors that can affect a product's use, the customer and user remain responsible for determining whether the 3M product is suitable and appropriate for the user's specific application, including user conducting an appropriate risk assessment and evaluating the 3M product in user's application.

Restrictions on Use:

3M advises against the use of these 3M products in any application other than the stated intended use(s), since other applications have not been evaluated by 3M and may result in an unsafe or unintended condition. Do not use in any manner whereby the 3M product, or any extractable or leachable from the 3M product, may become part of or remains in a medical device, drug, cosmetic, supplement, infant formula; or in applications involving life-sustaining medical applications or prolonged contact with internal bodily fluids or tissues.

Explanation of Signal Word Consequences		
	**WARNING:**	Indicates a hazardous situation which, if not avoided, could result in serious injury or death.
	**CAUTION:**	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and/or property damage.
	NOTICE:	Indicates a situation, which, if not avoided, may result in property damage.

Read entire product manual. Failure to follow all product instructions and warnings could cause personal injury and/or property damage.

WARNING

To reduce the risks associated with liquid bursting or gas explosion and/or exposure to chemicals and membrane contactor damage:

- Do not introduce gas alone into the membrane contactor without liquid in the shell side except when following 3M storage guidelines.
- Do not exceed maximum operating pressure or temperature limits.
- Implement workplace safety risk controls according to local applicable laws and regulations.
- Always use appropriate personal protective equipment (PPE) when installing, servicing, operating, cleaning or disposing of the membrane contactor.
- All plumbing should be done in accordance with local regulations and code.
- To prevent buildup of pressure inside the membrane contactor, do not block or valve off all gas/vacuum ports during operation or downtime.
- Ensure chemically compatible materials of construction are used within system. - Always make sure to verify proper connections within the membrane contactor system.
- Never modify or alter the membrane contactor. Only 3M or parties authorized in writing may make changes/repairs to the equipment.
- Inspect membrane contactor prior to cleaning or installation. Only use replacement parts supplied by 3M for this product. - Inspect the membrane contactor to ensure no leaking, cracking, or other signs of damage on membrane contactor, gaskets and tubing or piping.

⚠ CAUTION

To reduce the risks associated with hot surfaces and hot exhaust gases:

- Do not touch the membrane contactor or liquid lines during operation or cleaning and drying. Surfaces may be hot.
- Avoid close proximity to blower exhaust.

To reduce the risks associated with environmental contamination:

- Exhaust gas should be vented in a safe manner and according to local regulations.

To reduce the risks associated with damaging the membrane contactor:

- Ensure membrane contactor is properly aligned with piping, and flanges are adequately tightened during use and after cleaning. Always conduct system checks in accordance with installation instructions and facility policies prior to operation.
- Ensure proper draining and flushing of membrane contactor before maintenance, service, or shipping of membrane contactors.

NOTICE

- To reduce membrane contactor or system damage:
- Care must be taken not to drop, hit or impact the membrane contactor.
- If the membrane contactor is used with air sweep, then the temperature should not exceed 35°C (95°F). For membrane contactors used with vacuum only this statement does not apply.
- To avoid contamination of the process fluid, gloves are recommended when handling the membrane contactors.
- All plastic port extensions should be supported to prevent bending of extensions under excessive piping loads.
- 3M Liqui-Cel Membrane Contactor products should be stored dry and in a sealed plastic bag or shrink wrap material to help prevent the introduction of contaminants into the membrane contactor.
- 3M Liqui-Cel Membrane Contactor products should be stored in their original box, or other opaque box, and should not be installed where they are exposed to direct sunlight.
- Store 3M Liqui-Cel Membrane Contactor products dry at temperatures < 50 °C (122 °F), but preferably at lower temperature such as <35 °C (95 °F), to not risk reduced lifetime.
- 3M Liqui-Cel Membrane Contactor products should always be stored above freezing temperatures, and if stored at low temperature, they should be allowed to equilibrate to room temperature before use.
- Do not use thread sealant to connect fittings to membrane contactor.
- Use care if using a metal fitting to connect to a plastic connector on the membrane contactor.
- Do not allow membrane contactors containing microporous hollow fiber membranes to come into contact with surfactants, oil, or organic solvents, such as pure alcohols, glycol, acetone, etc., to reduce the risk of membrane wet out. 3M Liqui-Cel SP-Series Membrane Contactor products containing polyolefin membrane are not subject to this restriction.
- To protect the membrane contactors, prefiltration equipment should be inspected and maintained in accordance to 3M Liqui-Cel Membrane Contactors Inlet Water & Sweep Gas Operating Guidelines, in the Technical Resources section at 3M.com/Liqui-Cel.
- Suspended solids, biological contaminants, or the precipitation of soluble or insoluble salts on the membrane surface may lead to membrane plugging.
- Filtered, de-chlorinated, and deionized water is recommended for mixing cleaning solutions. If a pH shift occurs in water containing sparingly soluble compounds of Ca, Mg, Fe, Al, and silica (SiO_2) etc. precipitation from the solution could occur, blocking or damaging the membrane. Ensure that your water is free of these compounds.

- Cumulative exposure of the membrane to oxidants, such as ozone, chlorine, hydrogen peroxide, peracetic acid, etc., should be restricted to reduce the risk of membrane oxidation.
- Avoid water hammer (sudden pressure spikes) in system.

ATTENTION:

Disposal

At end of life, dispose of the membrane contactor or cartridges in accordance with all applicable local and government regulations.

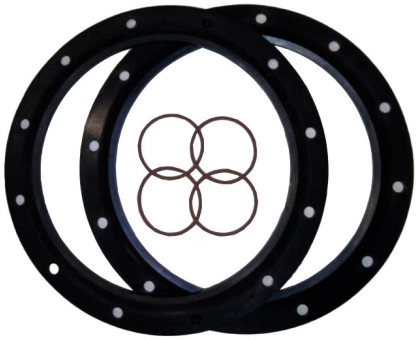
Hazards from Chemicals

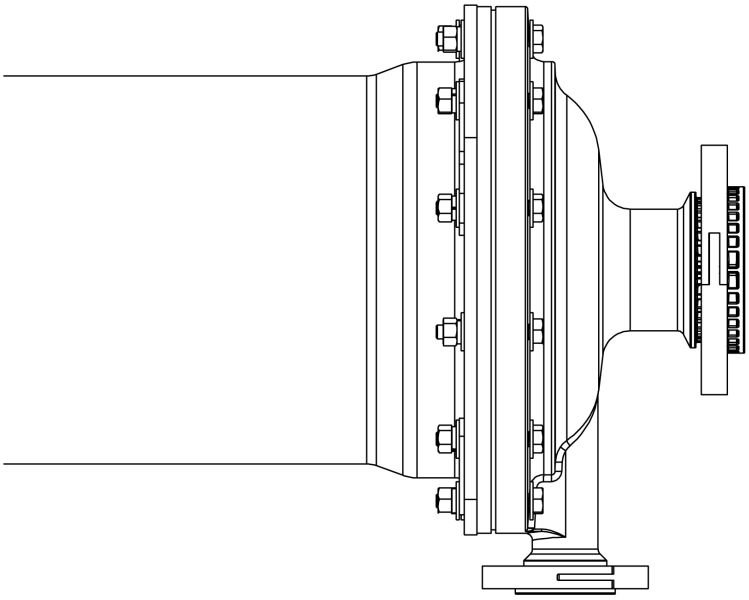
The chemicals that User selects to use in connection with the membrane can present their own hazards. User should follow all safety information and related requirements provided by the chemical supplier and applicable regulations, as well as conduct User's own workplace safety, hazard, and application assessment. This document cannot and does not address all safety and/or safe handling requirements that different chemicals could present. User is responsible for ensuring that chemicals are only used by persons familiar with their use and hazards (for example, personnel who have received hazardous material training), and who have the appropriate protective equipment as specified in their organization's safety program and the chemical's safety datasheet (SDS). User assumes all responsibility for the suitability and fitness for use as well as for the protection of the environment and for health and safety involving such chemicals.

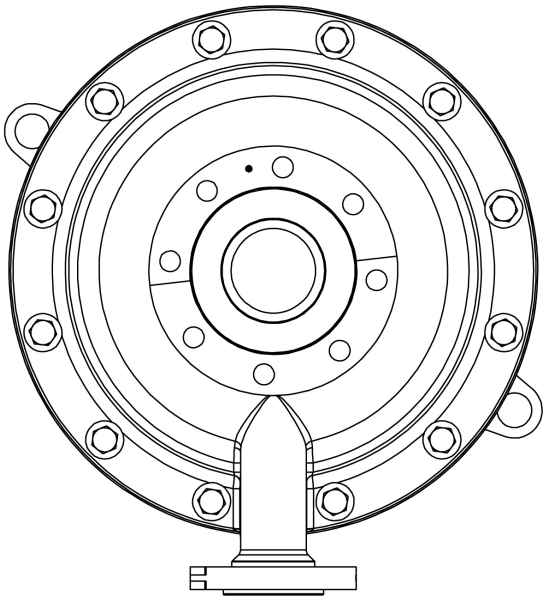
Required Materials

Tools
- 3-4 plastic wedges
- Rubber mallet
- Appropriate sockets or wrenches
- Adjustable impact or torque wrench

Parts
- End Cap
- Replacement gasket and O-rings







Disassembly: Remove the End Caps

1. To reduce the stress on the plastic parts, partially loosen the 12 bolts on the end cap in a star shaped pattern.
2. Completely loosen the bolts in the same star shaped pattern.
3. Remove all hardware from the end cap, including the nuts, bolts, backing rings,lifting rings, etc. Save these parts to use when reassembling the end caps.

Note: Even with the hardware removed, the end cap should remain in place due to the o-rings still seated on the center nozzle of the end cap.

4. Place a wedge between the gasket and the end cap. The flat side of the wedge should face toward the end cap as shown in figure 1.

NOTICE: Placing the wedge between the gasket and the vessel could lead to wedge or vessel damage when the wedge hits internal parts of the contactor. Tap gently to avoid damage.

5. Using a rubber mallet, gently tap the wedge until there is enough space between the gasket and the end cap for a second wedge as shown in figure 2.
6. Insert a second wedge between the gasket and the end cap at 90° from first one. Gently tap the second wedge until there is a large enough gap for a third wedge at 90°. See figure 2.
7. Repeat this process for a third wedge. If needed, repeat the process again for a fourth wedge.
8. After all of the wedges are in place, gently tap each wedge, one at a time to evenly move the end cap away from the contactor vessel.
9. When the wedges can go no further, the first o-ring may come free because it will no longer be seated on the center nozzle.
10. Gently and evenly pull the end cap past the second o-ring.

Note: Move slowly so that the end cap does not suddenly come loose and fall.

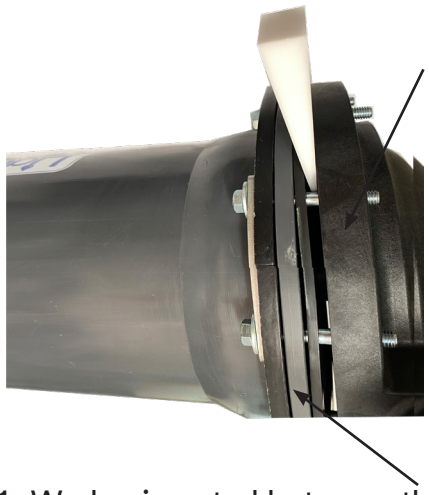


Figure 1: Wedge inserted between the gasket and end cap.

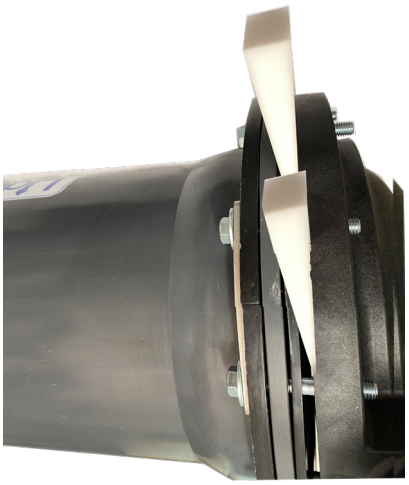


Figure 2: Two wedges inserted between the gasket and end cap.

Figure 3: End cap moved away from the vessel

Assembly: Installing the End Caps

1. Hold the inner diameter corner radius side of the backing ring towards you and link two backing ring sections together at the puzzle joint as shown in figure 4.
2. On the contactor vessel side of the flange with the gas port pointing up, assemble the linked sections of backing ring.
3. Add the remaining two backing ring sections to complete the full backing ring assembly.
4. As shown in figure 5, install two metallic tie bars and two lifting rings over the indicated puzzle joints.

NOTICE: The position of the lifting rings, tie bars, and puzzle joints are critical to product strength. Do not deviate from the positions shown in figure 5.

Notes:

- Orient the lifting ring of the second end cap 180˚ from the first lifting ring.
- When adding the tie bar, make sure it curves the same way as the backing ring and contactor vessel flange.
- Nozzle orientation should be the same as the original.

5. Insert bolts with large flat washers completely through the bolt holes to hold the backing rings in place.
6. Place the gasket over the bolts with the contoured side of the gasket facing the contactor vessel.

Figure 4: Backing Ring

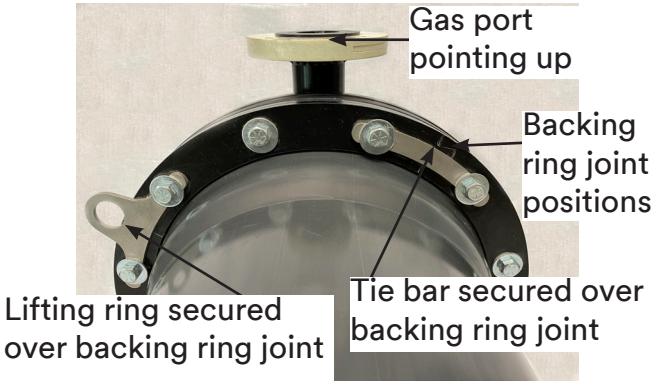


Figure 5: Flange

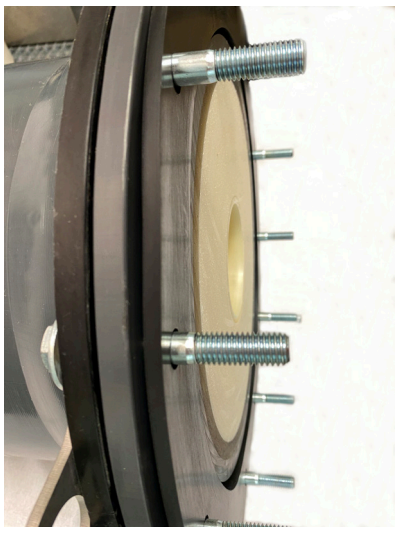


Figure 6: Gasket and bolts on the contactor vessel

7. Place two o-rings into the grooves on the center nozzle on both end caps as shown in figure 7.
    - If the first o-ring will not go into the groove by hand:
        1. Put a nut on every fourth bolt.
        2. Use an impact wrench set to 30 ft-lbs and slowly tighten each bolt in a star pattern. Be sure that the o-ring does not get pinched.
        3. When the second o-ring gets to the groove, remove the four nuts.
8. Lubricate the o-rings with deionized (DI) water.

Figure 7: O-rings on the center nozzle grooves of the end cap

Attach the End Cap to the Contactor Vessel

1. Make sure that the bolts on the contactor vessel flange are sticking out so that they will hold the end cap.
2. Line up the holes in the end cap with the bolts on the contactor vessel flange and press the end cap nozzle into the contactor vessel center tube as far as it will go.
3. Add a large flat washer, a lock washer, and a nut to each bolt, and tighten by hand.
4. Use an impact or torque wrench, set to 30 ft-lbs, in a star pattern to tighten the nuts. This will evenly pull the end cap into the center tube.

Note: Use a wrench on the bolt head to prevent the bolt from rotating during tightening.

5. Set calibrated torque wrench to 40 ft-lbs. With the wrench on the bolt and the torque wrench on the nut, turn until the torque wrench starts clicking.
6. Repeat this action for each bolt in a star pattern to equalize the flange stresses.
7. Verify the torque on all bolts.
8. Repeat the end cap disassembly and assembly process for the other end of the contactor.

Figure 8: Attach the end cap to the contactor vessel.

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