

CO₂ Removal— Comparison of Liqui-Cel® Membrane Contactors to Forced Draft Degasifiers

Liqui-Cel Membrane Contactors have been used for over 10 years and they are clearly proven in the field. In effort to help further educate customers on the benefits of Liqui-Cel Membrane Contactors over conventional forced draft degasifiers for CO₂ removal, we have prepared the following technical comparison.

The table below lists the system design requirements that must be thought through at the beginning of the project. You will see that the Liqui-Cel System has fewer restraints.

Design Requirements

Forced Draft	Liqui-Cel® Contactors
Influent water flow rate	Influent water flow rate
Influent CO ₂	Influent CO ₂
Influent water temp.	Influent water temp.
Influent water pH	Influent water pH
CO ₂ Outlet	CO ₂ Outlet
Influent suspended solids	Not applicable
Physical site limitations	Not applicable
Seismic Zone	Not applicable
Wind Loading	Not applicable
Sump retention	Not applicable

System Size and Placement

The size of a Liqui-Cel Contactor is comparable to a reverse osmosis (RO) membrane, which makes it possible to design your RO unit and easily accommodate your degassing system in the same system skid/frame. This is impossible when using a forced draft tower. The advantages here are saving space and lowering installation costs. Additionally, no special foundation is needed for your Liqui-Cel System. These points are very important to consider when comparing a Liqui-Cel system to a forced draft tower because the foundation, support structure, and installation of a tower can be a big expense.



6 x 28 Inch Contactor

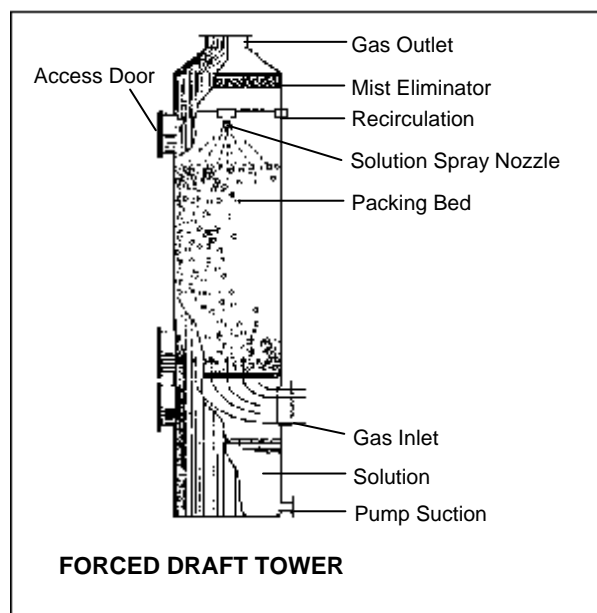
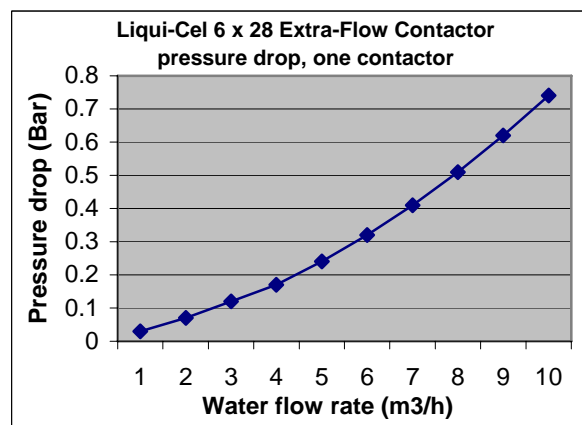
Foot print comparison

20 m³/hr (89gpm) system:
 Forced Draft: 2' ft x 20' ft high
 2 Liqui-Cel Contactors on skid with pump: 3' x 2' x 5' ft high

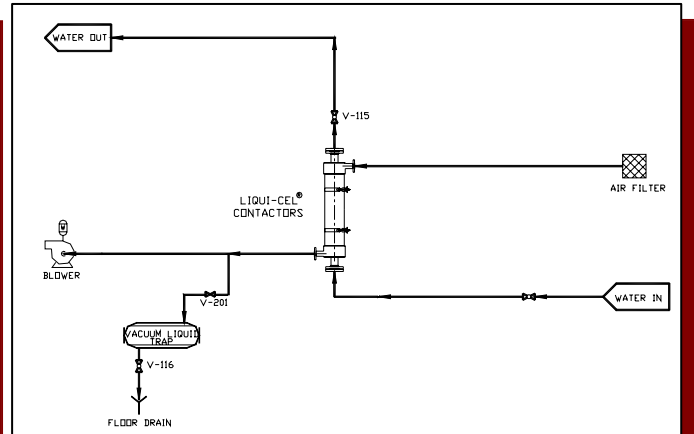
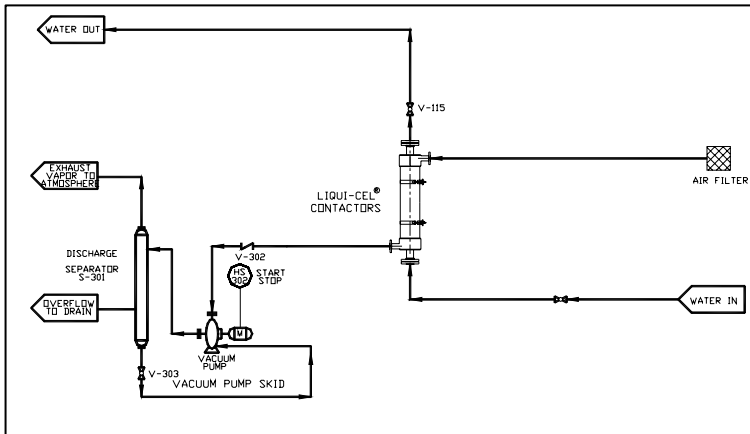
System Pressure Drop

Because the pressure drop in the Liqui-Cel Contactors is so small compared to a forced draft tower, you have a huge benefit of sending your RO permeate water through the Liqui-Cel System and then directly into the storage tank. Similarly, RO permeate can be sent directly through the Liqui-Cel System then through the ion exchange, mixed bed, or EDI and into the storage tank without the need to re-pump. This represents a big cost savings that must be taken into consideration when comparing a Liqui-Cel Contactor system to a forced draft tower.

The following graph shows the pressure drop for one 6x28 Liqui-Cel Contactor.



FORCED DRAFT TOWER



System Configuration

The Liqui-Cel system configuration is so simple that the only requirement is to connect your water line and either a liquid ring vacuum pump or a regenerative air blower. You can see the simplicity of the system by reviewing the sample P&ID's above.

Cleaner System

When using a forced draft tower, high purity RO effluent water comes in direct contact with air, which has the potential of adding particles and dissolving other substances like organic matter into your water.

Liqui-Cel Membrane Contactors, however, use Celgard[®] microporous hollow fiber membrane, which separates the gas phase from the liquid phase. Gas transfer occurs through a 0.03 micron pore making it virtually impossible to re-contaminate the high purity water. This high standard of purity has allowed Liqui-Cel Membrane Contactors to become the degas technology of choice in the pharmaceutical, power and semiconductor industries.

System Performance

The table to the right is meant to give you an understanding of system performance. You can see the CO₂ removal percentage at different water flow rates.

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These calculations are based on 20° C water temperature. For a large systems we would recommend multiple 6-inch contactors in parallel or we would suggest moving up to our 10 x 28 INDUSTRIAL Contactor.

Flow rate (m3/h)	CO ₂ removal %	6 x 28 units	Vacuum pump capacity	Vacuum level (mmHg)
2	90	1	15 m3/h	125
5	97	2	34 m3/h	250
10	94	2	65 m3/h	250

To estimate the remaining amount of CO₂ in the water, you can multiply your inlet CO₂ in ppm by (1-% removal). For example, if the CO₂ inlet is 100 ppm at a flow rate of 5 m³/h, you would have 100*(1-0.97) = 3 ppm CO₂ left in the water. As an added benefit, the contactors are non selective to gasses and they will also remove any dissolved oxygen in the water that could negatively impact your process.

In summary, Liqui-Cel Contactors are clean, small, modular, efficient, and proven in the field. We hope you agree that Liqui-Cel contactors are the best choice for your CO₂ removal application. Please call us to learn more or to let us size your specific system. You can also visit our website at www.liqui-cel.com for more information.

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