

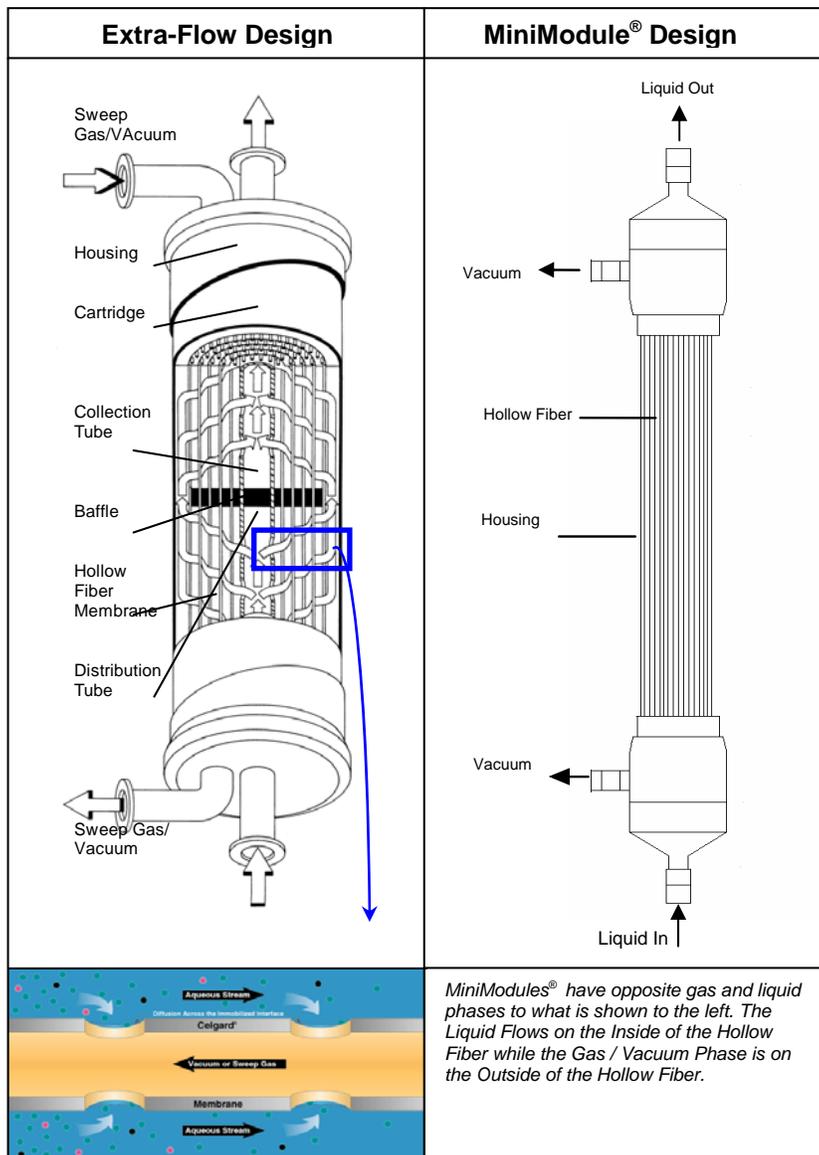
## The differences between Liqui-Cel® Extra-Flow and MiniModule® Product Designs

Membrana offers two product designs for gas transfer. We have Liqui-Cel® Extra-Flow, or radial flow, products and MiniModule® parallel flow products. Both designs utilize our Celgard® microporous polypropylene hollow fiber. These hollow fibers are hydrophobic and provide a surface area for a liquid and a gas phase to come into direct contact with each other without the liquid penetrating the pores. This TechBrief was prepared to illustrate the differences of the Extra-Flow and MiniModule® designs.

Our Extra-Flow products maximize surface area for larger flow rates by flowing the liquid stream on the outside of the fiber. Celgard Hollow fiber is knit into a fabric which is wound around a distribution tube. Liquid is forced radially across the fibers by using a central baffle within the contactor. Extra-Flow devices include our 2.5, 4 and 10-inch contactors and are used for flow rates > 0.5 gpm.

Our MiniModule®, or parallel flow devices, do not utilize fabric or a central baffle. The hollow fibers are potted on each end of the device and the fluid is sent through the inside of the Hollow fibers. Our MiniModule® contactors are used for flow rates < 2500 ml/min.

A vacuum source or strip gas is used in both contactor designs. The gas or vacuum phase is always located on the opposite side of the fiber wall as the liquid stream.



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