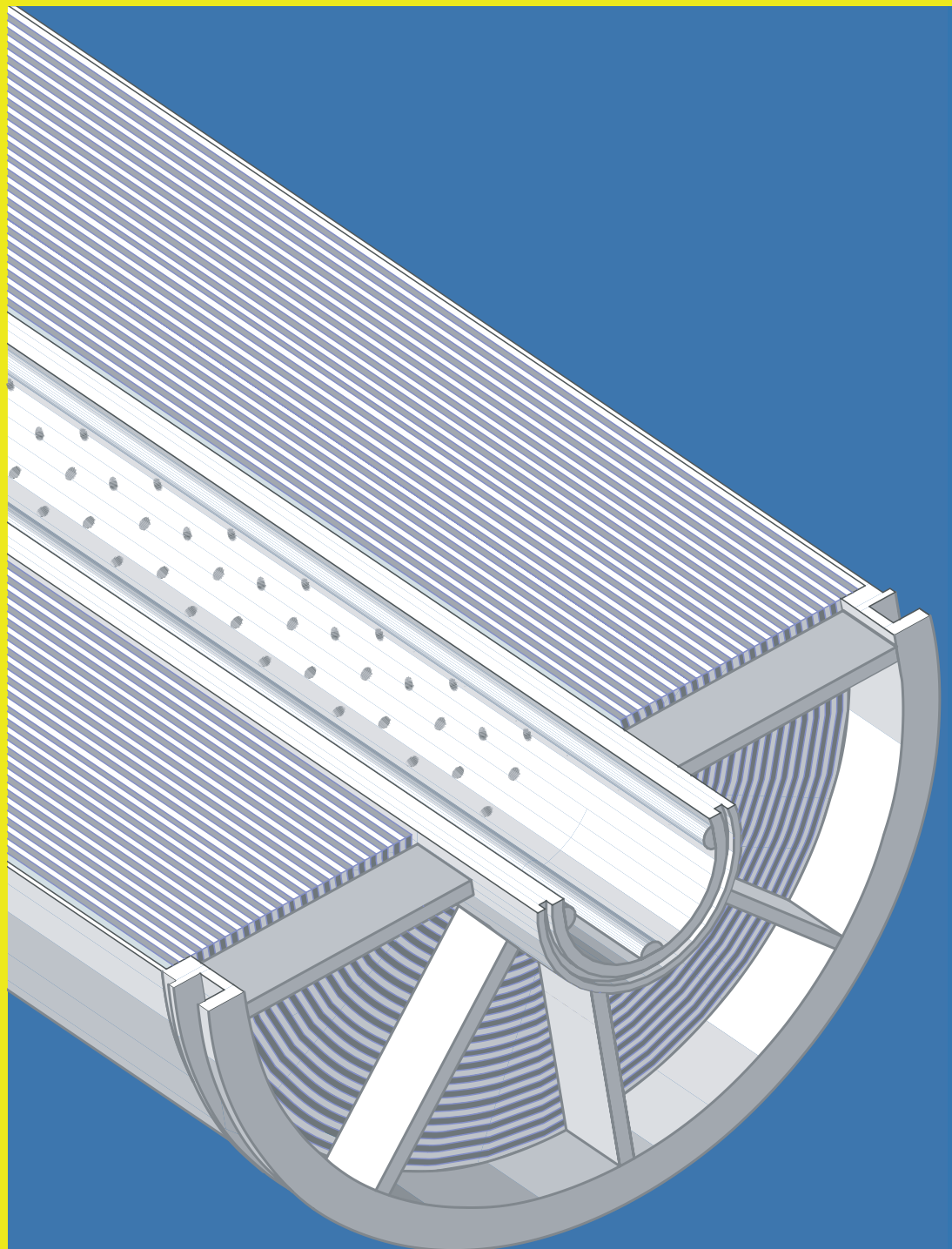




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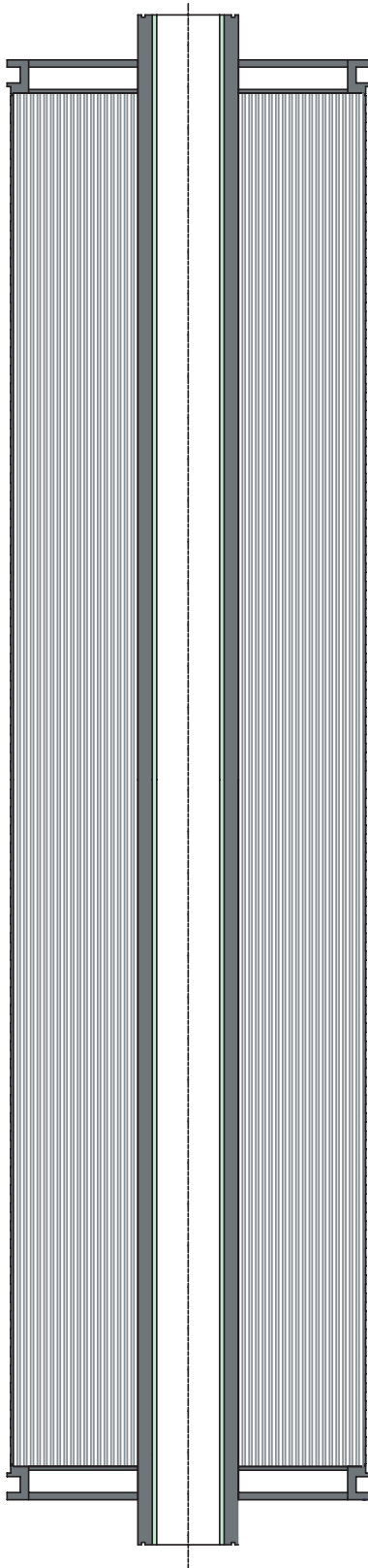
SPACER-TUBE[®] MODULE



Unit of Three Spacer Tube® Modules



THE SPACER TUBE[®] MODULE



The ROCHEM Spacer Tube[®] element

The Spacer Tube[®] module has been developed to gain hybrid advantages from an open channel and spiral module design. The result is a membrane element with a channel design that is narrow and open.

In order to optimize the feed water channel extensive research has been carried out in the United States several years ago. On the basis of that research the Spacer Tube[®] module has been developed.

A spiral module is equipped with a spacer which is easily fouled and scaled. Consequently, the raw water channel becomes restricted thus increasing the differential pressure. The Rochem Spacer Tube[®] element largely eliminates the disadvantages of the spiral module spacers through the formation of an open channel.

Advantages of the Spacer Tube[®] module:

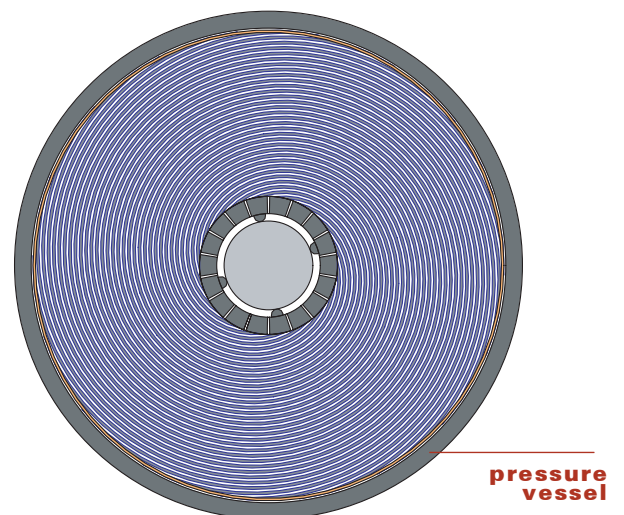
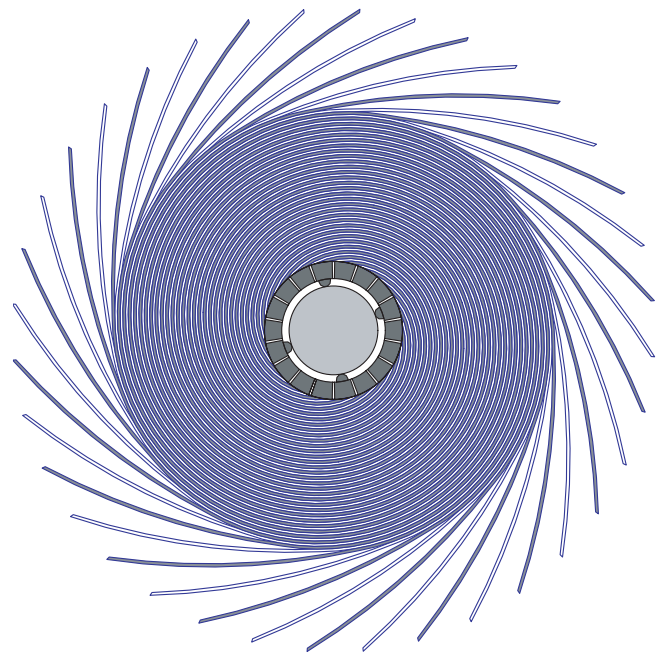
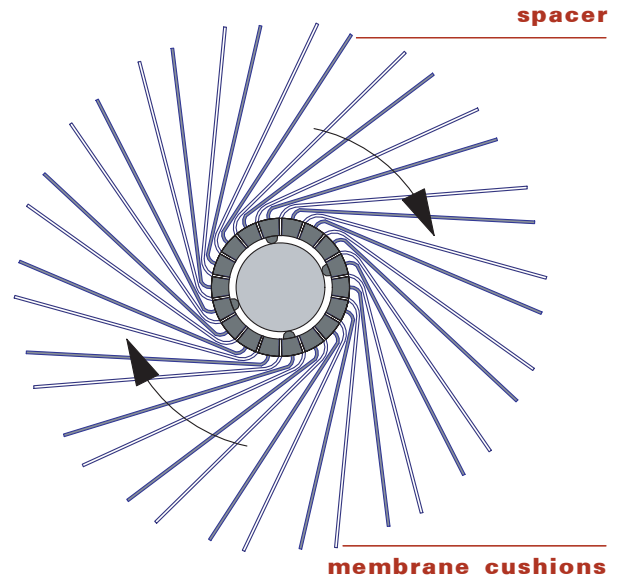
- high packing density
- reduced fouling
- easy cleaning
- directed flow
- extensive reduction of seals
- no membrane substrate discs
- reduced differential pressure

MEMBRANE ELEMENT

The essential part of the Spacer Tube® membrane is the membrane element. This consists of membrane cushions and spacer wrapped on a tube element.

The completed membrane element is then pushed on the rod-shaped permeate outlet and collecting device. The membrane element, which is composed of the multi-element spirals and the tube element is provided with end flanges on both sides.

The end flanges consist of at least one input for the feed medium to be separated and one output for the retentate. The border elements are kept sealed to the tube element through sealing compounds and wrapping capsules.



SPACER:

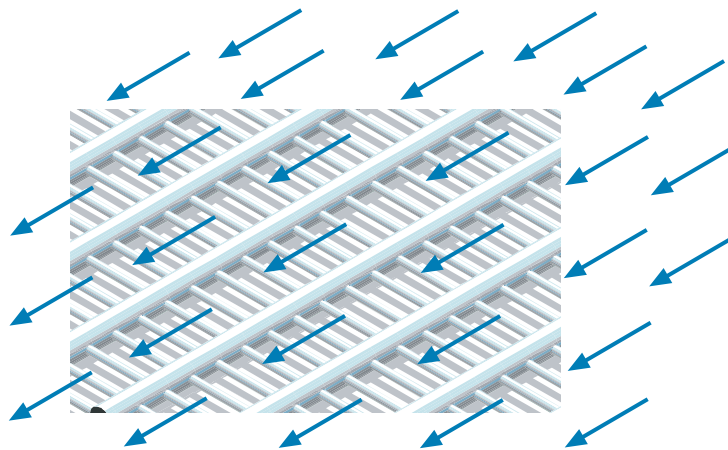


In order to achieve an undisturbed linear flow channel through the Spacer Tube® module, it is necessary to guarantee an equidistant space between the single membrane cushions which form the multi-element spiral.

A second spiral with spacers arranged between the membrane cushions always guarantees the unrestricted feed flow channel for the medium that has to be separated.

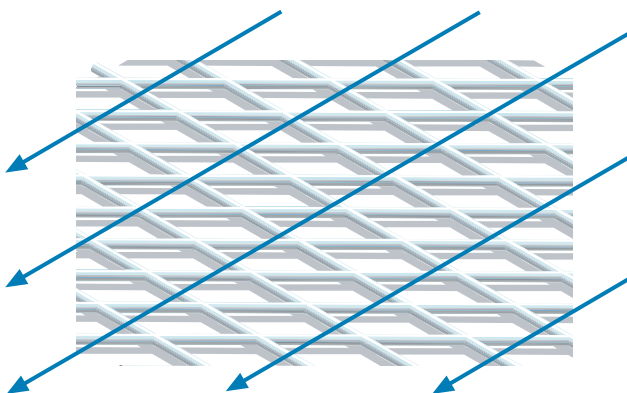
The spacers have been developed in such a manner that they only come into marginal contact with their neighbouring membrane cushions. In this way the spacers are able to minimize the resistance that is exerted on the feed flow.

The Rochem Spacer Tube® membrane module has decisive advantages compared to all of the traditional spiral and disc modules.

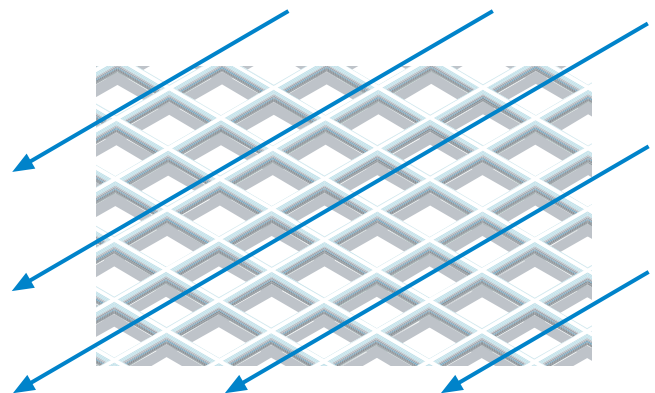


Spacer Tube® module

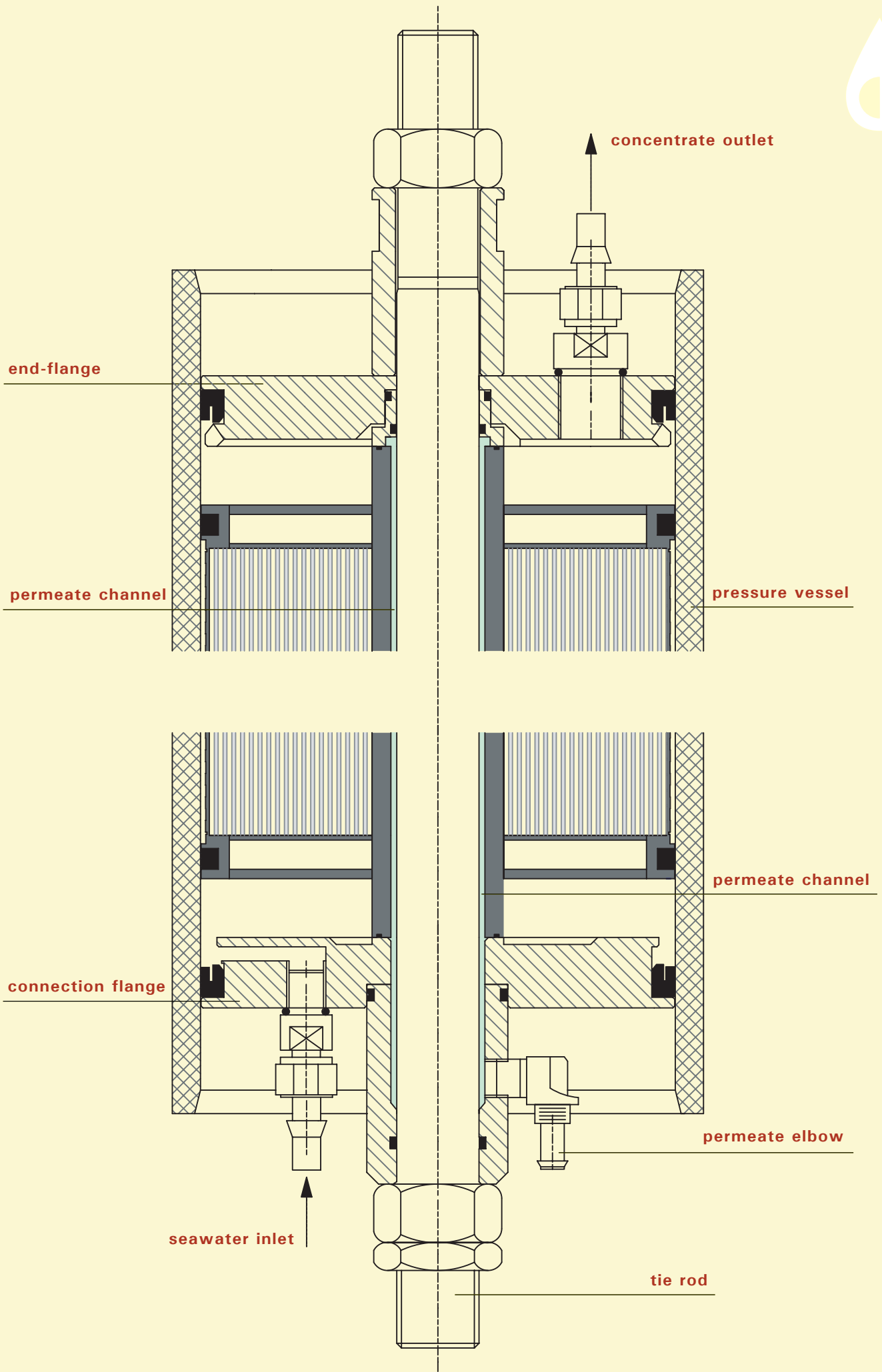
RAW WATER



spiral module type A



spiral module type B





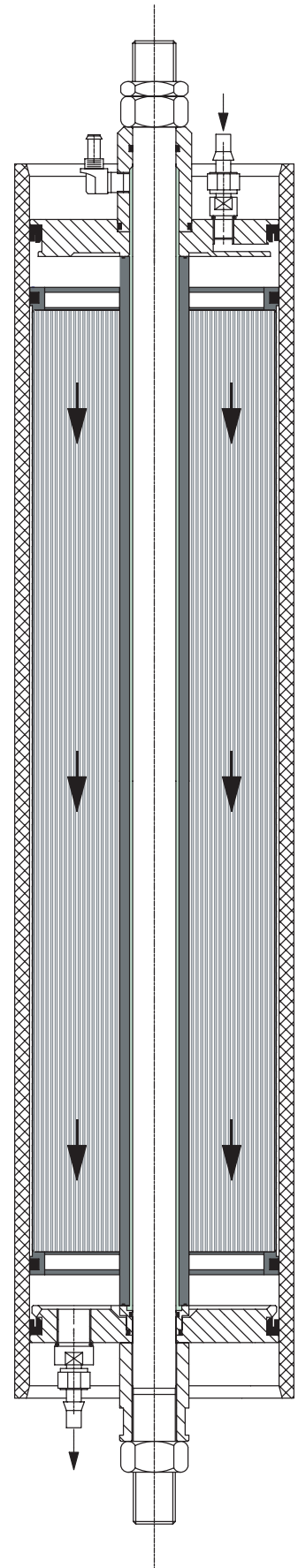
Landfill leachate treatment

The disc and tubular module type has been successfully employed in the treatment of landfill leachate. In a disc and tubular system, blocks of ten modules receive controlled feed flow from a circulation pump. The comparison of our developed „spacer tube[®] module“ with the traditional disc and tubular module follows:

| | Spacer Tube [®] module | disc module |
|----------------------------|---------------------------------|-----------------------------|
| Membrane surface | 25,6 m ² | 7,6 m ² |
| Permeate flow design | 13,16 ltr/m ³ /h | 13,16 ltr/m ³ /h |
| Permeate flow per module | 336,80 ltr/h | 100,02 ltr/h |
| Module per block | 3 | 10 |
| Membrane surface per block | 76,8 | 76,0 |
| Differential pressure | 0,1 - 0,3 bar | 3 - 4 bar |
| Seals | 2 | 340 |

This comparison proves the great advantage of the Spacer Tube[®] module. The installation of the Rochem Spacer Tube[®] module allows for a reduction of modules and, consequently, less space is required. Furthermore, there is a conservation of energy.

The use of Spacer Tube[®] module requires only a few modifications to existing disc and tubular systems.





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