THE ART TO CLEAR SOLUTIONS

PRODUCTS

Lenntech
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www.lenntech.com  Fax. +31-152-616-289
Membrane technology is one of the most promising and innovative technologies. It is easy to use and highly versatile and the most product friendly, environment friendly and energy efficient way to clean, concentrate or fractionate liquids.
For the plant manufacturer, it’s vitally important to choose the right product for each separation process. MICRODY-N-NADIR GmbH has the technical knowledge and experience to help you make the right choice.

For more than 45 years, we have been passionate about developing and producing membranes and modules for microfiltration, ultrafiltration and nanofiltration. Every year, we invest more than 10% of our turnover in the continuous improvement of our products. Our entire production site has recently been enlarged with several new production lines. The production processes have been optimized and redefined, resulting in increased product quality, productivity and efficiency.

Thanks to this investment program, we can now offer an even larger range of innovative membranes and modules, which open up many new application opportunities for membrane technology. In this catalogue we present our current product range and introduce the corresponding possibilities for their application.

Our mission is to support you day-in, day-out with our high-quality membrane products, delivering more efficient membrane processes and greater success for you in your markets.

MICRODY-N-NADIR GmbH is a membrane and module specialist with a global outlook. We are not satisfied until our products have been successfully integrated into your customers’ plants and processes. This is our passion.

Challenge us!

Walter Lamparter // CEO
With a product range that combines the most advanced membranes with innovative module technologies, MICRODYN-NADIR offers its customers complete solutions. Whether your application is in microfiltration, ultrafiltration or nanofiltration, we can supply hollow fiber, tubular or spiral wound modules that will deliver perfect results, even in submerged applications.
**MARKET SECTOR**

**ENVIRONMENT**
- various choices of membranes and cut-offs
- high thermal and chemical resistance
- backflushable with process fluid or chemicals
- effective retention of bacteria and solids

**WATER**
- high productivity
- compact installation
- high flow rates
- various choices of module dimensions
- effective retention of particles and bacteria

**FOOD AND BEVERAGE**
- sanitary design
- sharp cut-offs
- high thermal and chemical resistance
- FDA compliant material

**APPLICATION**
- Filtration of lipophilic substances
- Treatment of cosmetics wastewater
- Wastewater from food and beverages
- Treatment of animal feces
- Car wash water recycling
- Filtration of colloidal substances
- Oil/water separation
- Separation of emulsions and suspensions
- Removal of biomass
- Retention of cooling lubricants
- Municipal wastewater
- Treatment of river and surface water
- Process water
- Pre-treatment to ion exchange or reverse osmosis
- Tertiary treatment of biologically treated wastewater
- Potable water
- Treatment of borehole water
- Treatment of boiler feed at power stations

**SOLUTION**

**NADIR®**
- Membranes and formats

**SPIRA-CEL®**
- Spiral wound modules

**BIO-CEL®**
- Submerged modules

**SEPRODYN®**
- Modules for fine filtration

**MICRODYN**
- Tubular and capillary modules

**AQUADYN®**
- Hollow fiber modules for water filtration

**ULTRADYN**
- Hollow fiber modules for ultrafiltration

**AQUADYN®**
- Hollow fiber modules for water filtration

**FOOD AND BEVERAGE**
- standardization of milk
- Cream cheese production
- Concentration of liquid egg and gelatine
- Whey concentration
- Clarification of cheese brine
- Clarification of fish brine
- Filtration of marinades
- Vinegar filtration
- Clarification of juices
- Clarification of wine
- Defatting of whey

Note: (*) Suitability in your specific application needs to be confirmed by an official MICRODYN-NADIR representative.
MARKET SECTOR

CHEMICAL PROCESSES
- high thermal and chemical resistance
- extremely resistant to abrasion
- long lifetime
- various choices of membranes and module types

PHARMA AND BIOTECH*
- sharp cut-offs
- sanitary design
- FDA compliant material

TEXTILE
- high mechanical strength
- high flux performance
- superior separation behaviour
- high thermal and chemical resistance
- high reliability

APPLICATION
- Preparation of process water
- Catalysis separation
- Dye desalination
- Latex concentration
- Desalination of optical brighteners
- Separation of dissolved materials or compounds after catalysis
- Acid/caustic recycling
- Filtration of suspended matter from heterogeneous reactions
- Concentration after diafiltration

SOLUTION

NADIR®
- Membranes and formats
- SPIRA-CEL®
  - Spiral wound modules
- SEPRODYN®
  - Modules for fine filtration
- MICRODYN
  - Tubular and capillary modules
- ULTRADYN
  - Hollow fiber modules for ultrafiltration

MARKET SECTOR

CHEMICAL PROCESSES
- Preparation of cell culture media for fermentation
- Concentration of enzymes, animal and human vaccines, antibiotics, proteins
- Microfiltration in upstream processes before further purification
- Isolation of target products with ultra- or nanofiltration
- Diafiltration for feed or isolation processes, bioreactor techniques
- Production of ultrapure water

PHARMA AND BIOTECH*
- Preparation of process water
- Catalyst separation
- Dye desalination
- Latex concentration
- Desalination of optical brighteners
- Separation of dissolved materials or compounds after catalysis
- Acid/caustic recycling
- Filtration of suspended matter from heterogeneous reactions
- Concentration after diafiltration

TEXTILE
- Removal of dissolved dyes
- Recovery of sizing agent
- Washing solvent conditioning
- Extending the lifetime of wash solutions
- Wastewater treatment with membrane bioreactors (MBR)

CHEMICAL PROCESSES
- high thermal and chemical resistance
- extremely resistant to abrasion
- long lifetime
- various choices of membranes and module types

PHARMA AND BIOTECH*
- sharp cut-offs
- sanitary design
- FDA compliant material

TEXTILE
- high mechanical strength
- high flux performance
- superior separation behaviour
- high thermal and chemical resistance
- high reliability

Note: (*) Suitability in your specific application needs to be confirmed by an official MICRODYN-NADIR representative.
**APPLICATION**

» Process and wastewater
» Photoresists
» CMP (chemical and mechanical planarization)

**MARKET SECTOR**

**ELECTRONICS**

» high thermal and chemical resistance
» extremely resistant to abrasion
» long lifetime
» various choices of membranes and module types

**E-COAT/AUTOMOTIVE**

» high flux performance
» high packing density
» various choices of module dimensions

**METAL**

» high thermal and chemical resistance
» extremely resistant to abrasion
» long lifetime
» various choices of membranes and module types

**SOLUTION**

**SPIRA-CEL®**
Spiral wound modules

**SEPRODYN®**
Modules for fine filtration

**MICRODYN**
Tubular and capillary modules

**AQUADYN®**
Hollow fiber modules for water filtration

**ULTRADYN**
Hollow fiber modules for ultrafiltration

**MARKET SECTOR**

**ELECTRONICS**

» Filtration of cathodic electrophoretic paint (CEP)
» Filtration of anodic electrophoretic paint (AEP)
» Paint recycling
» Water based spray paint recovery
» Degreasing baths servicing and maintenance

**E-COAT/AUTOMOTIVE**

» Treatment of rinse baths
» Acid recovery
» Lifetime extension of degreasing baths
» Separation of oil/water emulsions
» Treatment of phosphating baths
» Separation of solids from process liquids
» Recycling of water used in grinding
» Heavy metal separation from wastewater

**METAL**

» Treatment of rinse baths
» Acid recovery
» Lifetime extension of degreasing baths
» Separation of oil/water emulsions
» Treatment of phosphating baths
» Separation of solids from process liquids
» Recycling of water used in grinding
» Heavy metal separation from wastewater
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For more than 45 years MICRODYN-NADIR has been manufacturing membranes in Europe’s largest membrane production facilities for industrial applications.

NADIR® membranes are permanently hydrophilic and chemically resistant. Micro-, ultra- and nanofiltration membranes are produced with high quality and consistency in a specially developed process.

The results speak for themselves: The unequalled hydrophilic properties of NADIR® membranes increase performance, longevity and significantly reduce fouling.

NADIR® membranes are available with cut-offs covering the spectrum of micro-, ultra- and nanofiltration applications.

NADIR® membranes are available in a range of polymeric materials:

- Polyethersulfone (PES)
- Hydrophilic Polyethersulfone (PESH) and Polysulfone (PSUH)
- Regenerated Cellulose (RC)
- Polyvinylidenefluoride (PVDF)

These materials can be used in a wide range of applications.

**ADVANTAGES**

- high flux capacity
- precise cut-offs
- good fouling resistance
- high thermal and chemical resistance

Decoding of the product code: **UP150**

<table>
<thead>
<tr>
<th>Range Type</th>
<th>Cut-off</th>
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<tbody>
<tr>
<td>M Microfiltration</td>
<td>PES 4 kDa 0.05 µm</td>
</tr>
<tr>
<td>U Ultrafiltration</td>
<td>PESH 5 kDa 0.05 µm</td>
</tr>
<tr>
<td>N Nanofiltration</td>
<td>PSUH 10 kDa 0.05 µm</td>
</tr>
<tr>
<td>C RC</td>
<td>200 kDa 0.20 µm</td>
</tr>
<tr>
<td>V PVDF</td>
<td>500 kDa 0.20 µm</td>
</tr>
</tbody>
</table>

WWW.MICRODYN-NADIR.COM
## Specifications

### NADIR® Ultrafiltration Membranes

<table>
<thead>
<tr>
<th>Membrane Material</th>
<th>Nom. MWCO [kDa]</th>
<th>Permeability [ℓ/(m²hbar)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESH</td>
<td>4</td>
<td>&gt; 7</td>
</tr>
<tr>
<td>PES</td>
<td>5</td>
<td>&gt; 10</td>
</tr>
<tr>
<td>PES</td>
<td>10</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>PES</td>
<td>20</td>
<td>&gt; 70</td>
</tr>
<tr>
<td>PESH</td>
<td>30</td>
<td>&gt; 35</td>
</tr>
<tr>
<td>PESH</td>
<td>50</td>
<td>&gt; 85</td>
</tr>
<tr>
<td>PES</td>
<td>150</td>
<td>&gt; 286 (1)</td>
</tr>
<tr>
<td>PSUH</td>
<td>100</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>RC</td>
<td>500</td>
<td>&gt; 300 (1)</td>
</tr>
<tr>
<td>PVDF</td>
<td>150</td>
<td>&gt; 300 (1)</td>
</tr>
</tbody>
</table>

(1) Testing conditions: 0.7 bar, 20 °C, stirred cell 700 U/min

### NADIR® Microfiltration-Membranes

<table>
<thead>
<tr>
<th>Membrane Material</th>
<th>Nom. Pore Size [µm]</th>
<th>Permeability [ℓ/(m²hbar)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PES</td>
<td>0.05</td>
<td>&gt; 300 (1)</td>
</tr>
<tr>
<td>PVDF</td>
<td>0.20</td>
<td>&gt; 700 (1)</td>
</tr>
</tbody>
</table>

(1) Testing conditions: 0.7 bar, 20 °C, stirred cell 700 U/min

### NADIR® Nanofiltration-Membranes

<table>
<thead>
<tr>
<th>Membrane Material</th>
<th>Nom. Retention Na₂SO₄ [%]</th>
<th>Water Flux @ 40 bar [ℓ/(m²h)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PES</td>
<td>35 - 75</td>
<td>&gt; 200</td>
</tr>
<tr>
<td>PES</td>
<td>80 - 95</td>
<td>&gt; 40</td>
</tr>
</tbody>
</table>

### Properties and area of application of NADIR® membranes

<table>
<thead>
<tr>
<th>Membrane Material</th>
<th>Properties</th>
<th>pH-Range</th>
<th>Max. Temperature</th>
<th>Branch/Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PES/ PESH</td>
<td>Hydrophilic, high chemical resistance</td>
<td>0 - 14</td>
<td>95 °C</td>
<td>Environment, metal, textile, paper, food, pharma/biotech, chemical</td>
</tr>
<tr>
<td>PSUH</td>
<td></td>
<td>1 - 14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RC</td>
<td>Extremely hydrophilic</td>
<td>1 - 11</td>
<td>55 °C</td>
<td>Environment, metal, paint, paper, pharma/biotech</td>
</tr>
<tr>
<td>PVDF</td>
<td>High stability against oxidizing agents</td>
<td>2 - 11</td>
<td>95 °C</td>
<td>Environment, paint, paper, metal, chemical, pharma/biotech</td>
</tr>
</tbody>
</table>

Final sizing and selection has to be approved by an official MICRODYN-NADIR representative. Please contact phone + 49 611 962 6001 or www.microdyn-nadir.de
Tighter discharge regulations, urbanization and the increase in water recycling have made Membrane Biological Reactors (MBR) the leading innovation in wastewater treatment through conventional activated sludge. Traditionally, activated sludge treatment relies upon solids settling in a secondary clarifier to separate the biomass from the treated wastewater. This process has the disadvantages of running at a lower MLSS (Mixed Liquor Suspended Solids), thus requiring more space and producing lower and varying quality effluent. With MBR technology, the clarifier is replaced by a physical barrier – our BIO-CEL® membrane module. This physical barrier enables the MBR to operate at higher MLSS levels, thereby requiring a smaller overall footprint. The BIO-CEL® membrane separates within the ultrafiltration spectrum, producing high capacities of quality effluent at consistent flows. Efficiency, reliability and cost effectiveness, as well as long term viability, are just some of the characteristics of the BIO-CEL® module. The solids free effluent is suitable for recycling applications, such as irrigation or feeds for process water. BIO-CEL® combines the benefits of traditional hollow fiber and plate and frame configurations without any of their inherent disadvantages. The self-supporting membrane sheet is just 2 mm thick, resulting in an extremely high packing density and very low specific energy consumption.

The BIO-CEL® configuration is based on flat sheet technology, with crossflow inhibiting clogging and reducing downtime. The module’s open top and bottom channels reliably prevent the deposition of sludge and fiber accumulation during the continuous crossflow operating process. The self-supporting structure of the membrane module enables frame-free installation, thus eliminating blockages around the external boundaries of each component. The membrane module is configured to allow for consistent permeate flow and a highly effective backflush over the entire membrane surface. In summary, the BIO-CEL® offers high packing density with optimal separation.

For large scale applications with a total inflow to the MBR plant of > 2,000 m³/d of wastewater to be treated, the BIO-CEL® XL with a total membrane area of 1,900 m² has been developed.
Design and mode of operation of the BIO-CEL® Module

1. Fine bubble crossflow aeration
2. Activated sludge
3. Filtrate flow inside laminate
4. Purified effluent
5. Filtrate drainage
   - low pressure loss
   - solid connection to membrane
6. Membrane structure
   - material: Polyethersulphone (PES)
   - permanently hydrophilic
   - ultra filtration with 150 kDa cut off
   - pore size ≈ 0.04 µm
   - pH resistant between 2 and 11
   - high mechanical stability

---

1. Crossflow aeration
2. Filtrate extraction (approx. 100 mbar)
3. Flat sheet membranes
   - no braiding
   - hydraulic conditions optimized
4. Laminated membranes
   - no gap clogging
   - no edge clogging
   - low weight
   - high packing density
5. Bottom open construction
   - no sedimentation
Separation processes which are based on membrane technology are being applied more and more frequently. As membranes do not seem to be very robust per se, the question if membranes could be a suitable solution for “rough” applications arises.

Especially when considering wastewater treatment using MBRs, the integrity of the membrane plays a significant role. The actual cleaning of the wastewater in the MBR process is being performed by the biomass in the system. The membrane used must now ensure the safe separation of the biomass from the cleaned wastewater. Superficial damages to the membrane should therefore not compromise this.

If membranes are being installed in a wastewater treatment plant for many years, minor damages to the membrane cannot be avoided – may they be caused by a screwdriver or any other debris falling into the filtration chamber. Indeed membranes are “vulnerable” but when using the appropriate module construction, superficial damages to the membrane will not result in a serious problem.

**ADVANTAGES**

» unique laminate structure with self-healing effect

» effective barrier for solids and bacteria even in case of detraction of the membrane laminate

» damages of the membrane laminate will “heal” in less than two minutes
With the membrane laminate used in the BIO-CEL® module MICRODYN-NADIR has found a way to solve this problem. Instead of fixing the membrane on a mounting plate from both sides, the membrane is being laminated from two sides onto a special spacer material.

Subsequently, “laminate sheets” are being cut out of this membrane laminate and welded on the sides. The suction of the clear filtrate is done through a permeate hole in the center of the sheet.

In case of damage caused to the membrane the spacer material allows for a sealing of the damage through the help of the biomass in the system. Even after the occurrence of a severe detraction of the membrane laminate, solids and bacteria can still be rejected by the membrane laminate.

Laboratory tests have proven that the membrane laminate “heals” itself in less than two minutes even under worst case conditions.
The MBR process is the most advanced wastewater treatment process currently available. The submerged BIO-CEL® membrane modules replace space-intensive secondary clarifiers and safely separate the purified wastewater from the biomass. MBR systems offer many advantages over conventional systems, namely the excellent effluent quality and minimal footprint.

In this MBR process, the submerged BIO-CEL® ultrafiltration membranes are protected against membrane fouling in a multi-stage process. Besides the process-integrated aeration (cross-flow along the membranes) and periodic backflushing/relaxation phases, chemical cleaning may also be used to reduce the fouling layer. The chemicals effectively clean the membrane surface, thereby restoring its original permeability and enabling stable and reliable process operation.

As a further process-integrated feature, the BIO-CEL® membrane module can also be cleaned mechanically, through the use of the patented BIO-CEL®-MCP (Mechanical Cleaning Process) which helps to reduce operating costs. Long-term experience shows, that a chemical free operation is possible. This innovative process reduces the formation of a fouling layer. The membrane cleaning process is being supported by the crossflow aeration and the use of the cleaning efficiency of inert, organic material (MCP granulate).
The MCP granulate is added directly into the activated sludge. The airflow induced by the module-integrated membrane aeration system draws the MCP granulate up between the membrane sheets. As the MCP granulate rises, the membrane area is continually cleaned through the direct contact of the granulate with the sludge on the membrane surface. The fouling layer formed during the filtration process can be removed reliably without compromising the functionality of the membrane. In the downstream area outside the membrane modules, the current draws the granulate back to the base of the module where it enters again into the upstream flow. The MCP granulate has been designed for permanent usage. It is retained in the filtration tank by suitable separation systems.

This mechanical cleaning can only be used in conjunction with BIO-CEL® modules, because other module types do not incorporate the required constructional and hydraulic characteristics to perform a mechanical cleaning.

**Note:** The Mechanical Cleaning Process (MCP) for BIO-CEL® membrane bio reactors was developed by MICRODYNA-NADIR (S. Krause), Darmstadt Technical University (Peter Cornel) and Osnabrueck University of Applied Sciences (Frank P. Helmus and Sandra Rosenberger).

### BIO-CEL®-MCP (Mechanical Cleaning Process)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cover layer</td>
</tr>
<tr>
<td>2</td>
<td>Membrane</td>
</tr>
<tr>
<td>3</td>
<td>Granulate</td>
</tr>
<tr>
<td>4</td>
<td>Drainage layer</td>
</tr>
</tbody>
</table>
One of the main advancements through the use of BIO-CEL®-MCP is the reduction of operating costs of the MBR plants.

50-70% of the whole energy demand of MBR systems is needed for the crossflow aeration, which is incurred independently of the specific flux. The BIO-CEL®-MCP system enables much higher specific flows than conventional operations, which results in a minimization of the energy demand. Moreover, investment costs are decreasing due to the reduction of the membrane area which can be achieved through the enhancement of flux. This drastically lowers investment costs (smaller membrane area needed) and reduces energy consumption (crossflow) for the entire system.

The membrane laminate’s self-supporting structure allows for chemical as well as mechanical cleaning of the membrane surface, thereby ensuring permanently high membrane system availability. Test results show that no chemical membrane cleaning has been necessary for a two year period through the application of BIO-CEL®-MCP.

The chart below outlines the advantages of the application of a BIO-CEL®-MCP, using the example of a model wastewater treatment plant designed for 10,000 PE (2,000 m³/d). The annual costs can be reduced by almost 30% through the use of MCP.

Comparative values of BIO-CEL® vs. BIO-CEL®-MCP for a model wastewater treatment plant for 10,000 PE:

<table>
<thead>
<tr>
<th></th>
<th>BIO-CEL®</th>
<th>BIO-CEL®-MCP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average flux 1)</strong></td>
<td>13.9 l/m²h</td>
<td>16.5 l/m²h</td>
</tr>
<tr>
<td><strong>Peak Flux 1)</strong></td>
<td>27.8 l/m²h</td>
<td>33.0 l/m²h</td>
</tr>
<tr>
<td><strong>Membrane area needed</strong></td>
<td>6,000 m²</td>
<td>5,000 m²</td>
</tr>
<tr>
<td><strong>Lifetime</strong></td>
<td>8a</td>
<td>8a</td>
</tr>
<tr>
<td><strong>Annual charges “Membrane Invest”</strong></td>
<td>33,750 €/a</td>
<td>28,125 €/a</td>
</tr>
<tr>
<td><strong>Energy demand</strong></td>
<td>365,000 kWh</td>
<td>280,769 kWh</td>
</tr>
<tr>
<td><strong>Annual charges “energy” 2)</strong></td>
<td>36,500 €/a</td>
<td>28,077 €/a</td>
</tr>
<tr>
<td><strong>Annual charges “chemical cleaning” 3)</strong></td>
<td>15,075 €/a</td>
<td>0 €/a</td>
</tr>
<tr>
<td><strong>Annual charges “MCP”</strong></td>
<td>0 €/a</td>
<td>5,863 €/a</td>
</tr>
<tr>
<td><strong>Annual charges “total” (incl. invest)</strong></td>
<td>85,325 €/a</td>
<td>62,065 €/a</td>
</tr>
</tbody>
</table>

1) the assumed flux is based on the minimum achievable performance improvement through the application of MCP
2) valid for energy costs of 0.10 Euro per kWh / 3) assumption: no chemical cleaning
### BIO-CEL® Membrane Material

<table>
<thead>
<tr>
<th>Polymer</th>
<th>MWCO</th>
<th>Pore Size</th>
<th>Support Layer</th>
<th>Drainage</th>
<th>Chlorine Resistance</th>
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</thead>
<tbody>
<tr>
<td><strong>Polyethersulfone (PES)</strong></td>
<td>150 kDa</td>
<td>0.04 µm</td>
<td>Polyester</td>
<td>Polyester</td>
<td>500 000 ppmh</td>
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### BIO-CEL® Module and Operating Data

#### Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>BC10F-C10-UP150 1)</th>
<th>BC50F-C25-UP150</th>
<th>BC100F-C25-UP150</th>
<th>BC416F-C104-UP150 2)</th>
<th>BC XL-1 2)</th>
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<tbody>
<tr>
<td>Membrane surface</td>
<td>10 m²</td>
<td>50 m²</td>
<td>100 m²</td>
<td>416 m²</td>
<td>1900 m²</td>
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<tr>
<td>Frame material</td>
<td>PVC</td>
<td>PE</td>
<td>PE</td>
<td>PE</td>
<td>Stainless Steel 1.4571</td>
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<tr>
<td>Cassette material</td>
<td>-</td>
<td>PVC</td>
<td>PVC</td>
<td>PVC</td>
<td>Stainless Steel 1.4571</td>
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<td>Dimensions [mm]</td>
<td>610 x 154,5 x 1610</td>
<td>702 x 694 x 1563</td>
<td>702 x 1270 x 1563</td>
<td>1152 x 1298 x 2763</td>
<td>2100 x 2800 x 2650</td>
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<td>Operating pressure</td>
<td>-30 to -400 mbar</td>
<td>-30 to -400 mbar</td>
<td>-30 to -400 mbar</td>
<td>-30 to -400 mbar</td>
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<td>Max. Backwash pressure</td>
<td>150 mbar</td>
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<td>Max. operating temperature</td>
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<td>pH-range</td>
<td>2 – 11</td>
<td>2 – 11</td>
<td>2 – 11</td>
<td>2 – 11</td>
<td>2 – 11</td>
</tr>
<tr>
<td>Max. air flow rate (Vₙ) 3)</td>
<td>6 m³/h</td>
<td>30 m³/h</td>
<td>60 m³/h</td>
<td>140 m³/h</td>
<td>665 m³/h</td>
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<tr>
<td><strong>Recommended content</strong> suspended solids (SS) 4)</td>
<td>12 g/L</td>
<td>12 g/L</td>
<td>12 g/L</td>
<td>12 g/L</td>
<td>12 g/L</td>
</tr>
</tbody>
</table>

**Note:**
1) Only for piloting purposes // 2) Excluding extra feet // 3) Vₙ is the volume flow rate at standard conditions according to DIN ISO 2533:1979-12 // 4) Other concentrations possible. Please consult your MICRODYN-NADIR representative

### BIO-CEL® Membrane Module

Decoding of the product code: **BC50F-C25-UP150**

<table>
<thead>
<tr>
<th>Type</th>
<th>Frame Size</th>
<th>Cassette Size</th>
<th>Membrane Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIO-CEL® module</strong></td>
<td>10 m²</td>
<td>10 m²</td>
<td>Ultrafiltration 150 kDa</td>
</tr>
<tr>
<td></td>
<td>50 m²</td>
<td>25 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100 m²</td>
<td>25 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>416 m²</td>
<td>104 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1900 m²</td>
<td>475 m²</td>
<td></td>
</tr>
</tbody>
</table>

**Final sizing and selection has to be approved by an official MICRODYN-NADIR representative.**
ADVANTAGES

» hydrophilic low fouling membrane material
» effective retention of particles and bacteria
» high and stable permeate performance
» flexible flushing modes
» easy pre-treatment
» high productivity
» compact installation
» high flow rates at low pressure utilization

The conventional treatment of water is based on a multi-step process including pre-filtration, precipitation/flocculation/coagulation, sedimentation, sand filtration and finally disinfection.

Despite this complex process technology a constant effluent quality at raw water deviations is not always possible. Therefore, the dosage of additives needs to be adjusted which could result in high operating costs.

Physical separation processes, on the other hand, display another wastewater treatment option. Especially ultrafiltration is an established technology with respect to environmentally friendly and almost residue-free water treatment processes.

The AQUADYN® hollow fiber modules with their hydrophilic low fouling – high flux membranes are excellent solutions for the efficient treatment of large volumes of water.

They feature the following advantages over alternative processes:

**Plant Structure**

» compact design allows for smaller plant sizes
» high level of automation possible

**Plant Operation**

» easy pre-treatment even at high raw water turbidity
» continuously high and stable permeate performance
» modular construction provides high flexibility for fluctuations in water demand
» high recovery rates
» minimal cleaning demand resulting in:
  - less permeate consumption for cleaning
  - high operational availability
  - low operating costs

Applications

» treatment of river and surface water
» process water
» pre-treatment to ion exchange or reverse osmosis
» tertiary treatment of biologically treated wastewater
» potable water
» treatment of borehole water
» treatment of boiler feed at power stations

MANN+HUMMEL ULTRA-FLO Pte Ltd. is the manufacturer of the UE & UA Modules; the modules are marketed and distributed under the name AQUADYN® which is a registered trademark of MICRODYN-NADIR GmbH in Europe.

DAICEN Membrane Systems Ltd. is the manufacturer of the AQUADYN® FT 50 modules and markets and distributes them under the registered trademark MOLSEP®. AQUADYN® is a registered trademark of MICRODYN-NADIR GmbH in Europe.
Decoding of the product code: **FT50-FUC-1582**

**Module Type**

**Membrane Polymer**

**Membrane Code**

| FT50 | CTA   | (cellulose triacetate) | 1582 |

---

---

**AQUADYN® Ultrafiltration Modules**

Decoding of the product code: **UA1060**

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Membrane Polymer</th>
<th>Membrane Material</th>
<th>Ø Module [mm]</th>
<th>Module length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>UA420-BT</td>
<td>PAN</td>
<td>150</td>
<td>2.1 / 1.1</td>
<td>604</td>
</tr>
<tr>
<td>UA640</td>
<td>PAN</td>
<td>150</td>
<td>2.1 / 1.1</td>
<td>1210</td>
</tr>
<tr>
<td>UA660</td>
<td>PAN</td>
<td>150</td>
<td>2.1 / 1.1</td>
<td>1660</td>
</tr>
<tr>
<td>UA860</td>
<td>PAN</td>
<td>150</td>
<td>2.1 / 1.1</td>
<td>1642</td>
</tr>
<tr>
<td>UA1060</td>
<td>PAN</td>
<td>150</td>
<td>1.7 / 0.9</td>
<td>1737</td>
</tr>
<tr>
<td>UE1060</td>
<td>PES</td>
<td>150</td>
<td>1.7 / 0.9</td>
<td>1737</td>
</tr>
<tr>
<td>FT50-FUC-1582</td>
<td>CTA</td>
<td>150</td>
<td>1.3 / 0.8</td>
<td>1360</td>
</tr>
</tbody>
</table>

---

**Note:**

1. Only the information given in the data sheets of the single products are binding.
2. NSF Approval
Spiral wound modules have a great variety of potential combinations and consequently this module type is the most common in filtration plants.

They are used in applications ranging from the beverage, food and the pharmaceutical industry to environmental and biotechnological processes. The modules are used to separate particles like colloids, proteins and micro-organisms and to decontaminate fluids.

SPIRA-CEL® spiral wound modules are available with all types of NADIR® membranes. They have a compact design and offer an optimum surface-area-to-volume ratio. The feed channel height can be varied by the thickness of the spacer material (from 30 to 80 mil). This allows to adapt to different levels of viscosity or solids content of the liquid. This design feature leads to excellent hydrodynamics in combination with low energy demand.

SPIRA-CEL® spiral wound modules have an outstandingly high stability against temperature and pH. They can be used to clean both caustics and acids. They can also be used in biotechnological applications where extreme cleaning conditions are required.

In addition to the SPIRA-CEL®-OX type modules (pH range of 3-14, and operating temperature of 80 °C) SPIRA-CEL®-OY type modules are now available with a pH range of 0-12 and operating temperature of 80 °C. These module types are offered with polyethersulfone membranes in micro-, ultra- and nanofiltration ranges.

MICRODYN-NADIR’s SPIRA-CEL® modules are readily available in different constructions depending on the area of application: Process industry, biotechnological processes and food industry.
Possible Combinations of SPIRA-CEL® Spiral Wound Modules

Sanitary Modules* for Food, Pharma and Biotech Processes

Decoding of the product code: **D: S- U P 0 2 0 - 6 3 3 8- C 1**

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Material Group</th>
<th>NADIR® Membranes</th>
<th>Size</th>
<th>Feed-Spacer</th>
<th>(Internal) Execution Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Industry GFK shell</td>
<td>see overview on page 11, NADIR® membranes and formats</td>
<td>3638</td>
<td>B 30 mil Diamond</td>
<td>may be omitted</td>
</tr>
<tr>
<td>P</td>
<td>Industry hard shell</td>
<td>see overview on page 11, NADIR® membranes and formats</td>
<td>6338</td>
<td>C 44 mil Diamond</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8038</td>
<td>D 44 mil Parallel</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8338</td>
<td>F 80 mil Diamond</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>G 80 mil Parallel</td>
<td></td>
</tr>
</tbody>
</table>

Note: (*) Suitability in your specific application needs to be confirmed by an official MICRODYN-NADIR representative. // (1) Pharma quality is only available with the clue type S.

Non-Sanitary Modules for General Industrial Applications

Decoding of the product code: **G: Y- U P 1 5 0 - B 8 0 4 0- C 1**

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Material Group</th>
<th>NADIR® Membranes</th>
<th>Size</th>
<th>Feed-Spacer</th>
<th>(Internal) Execution Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Industry GFK shell</td>
<td>see overview on page 11, NADIR® membranes and formats</td>
<td>2440</td>
<td>B 30 mil Diamond</td>
<td>may be omitted</td>
</tr>
<tr>
<td>O</td>
<td>Industry hard shell</td>
<td>see overview on page 11, NADIR® membranes and formats</td>
<td>4040</td>
<td>C 44 mil Diamond</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8040</td>
<td>D 44 mil Parallel</td>
<td></td>
</tr>
</tbody>
</table>

Note: (1) Just available for piloting as GY-type with c-spacer // (2) no X-type available.

Non-Sanitary Modules for E-coat Filtration

Decoding of the product code: **E: Y- U V 2 0 0 - B 8 0 4 0- B 1**

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Material Group</th>
<th>NADIR® Membranes</th>
<th>Size</th>
<th>Feed-Spacer</th>
<th>(Internal) Execution Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>GFK shell</td>
<td>UV 200 (PVDF)</td>
<td>4040</td>
<td>B 30 mil Diamond</td>
<td>may be omitted</td>
</tr>
<tr>
<td>F</td>
<td>spacer wrap</td>
<td>UV 200 (PVDF)</td>
<td>7640</td>
<td>C 44 mil Diamond</td>
<td></td>
</tr>
</tbody>
</table>

Operating Conditions for SPIRA-CEL®

<table>
<thead>
<tr>
<th></th>
<th>DS- / PS-</th>
<th>EY- / FY-</th>
<th>GY-</th>
<th>OY- 1)</th>
<th>OX- 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum operating temperature/°C</td>
<td>75</td>
<td>50</td>
<td>80 1)</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Allowable ph-range in operation</td>
<td>2 – 10</td>
<td>2 – 11</td>
<td>2 – 11</td>
<td>0 – 12</td>
<td>3 – 14</td>
</tr>
</tbody>
</table>

Note: (1) With Polyether sulfone membranes // (2) We provide these configurations only with Polyether sulfone membranes. Please note: Not all combinations are available. Other module configurations and sizes can be supplied upon request.
SEPRODYN® filters are crossflow microfiltration modules used to separate suspended solids larger than 1.0 micron. The highly porous membrane contributes to a very high product flux and, with the ability to employ periodic backflush, stable and efficient processes are achievable.

SEPRODYN® tubular modules use a newly developed processing technique that allows membranes to be used in applications which require highly stable polymer materials. These membrane modules can be used across the entire pH-range from 0 to 14 and are especially recommended in applications that require a high resistance against abrasive substances.

SEPRODYN® membranes are self-supporting and extremely robust tubular membranes. Because of their large inner diameter of 5.5 mm, liquids with a high percentage of suspended solids can be filtered.

The tubular membranes are made of ultra-high molecular polyethylene made in a patented process by MICRODYN-NADIR. The membrane structure is symmetrical across the entire wall thickness. This ensures that the membrane separation performance is not affected when the membrane surface is damaged by abrasive material. The membranes are welded together with the housing. Since the housing and the membrane are both polyethylene a very stable bond between the membranes and the housing is achieved.

**ADVANTAGES**

» extremely resistant to chemicals and abrasion  
» high packing density per module  
» filtration can be performed in both directions  
» high solids tolerance  
» backflushing with chemical solutions  
» minimized dead zones

<table>
<thead>
<tr>
<th>Membrane Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane geometry</td>
<td>Tubular</td>
</tr>
<tr>
<td>Inner diameter</td>
<td>5.5 mm</td>
</tr>
<tr>
<td>Membrane material</td>
<td>Polyethylene</td>
</tr>
<tr>
<td>Pore size</td>
<td>1 µm</td>
</tr>
</tbody>
</table>
### SEPRODYN® Tubular Modules

Decoding of the product code: **SE-150-TP-1N/DF**

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Module Size</th>
<th>Membrane Geometry</th>
<th>Shell Material</th>
<th>Pore Size</th>
<th>Module Constr. Length</th>
<th>Module Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEPRODYN®</td>
<td>Ø diameter of shell in mm</td>
<td>T Tubular membrane</td>
<td>P Polypropylene</td>
<td>1 µm</td>
<td>M medium</td>
<td>AF: ANSI flange</td>
</tr>
<tr>
<td></td>
<td>020 module</td>
<td></td>
<td>O without shell (exchange cartridge)</td>
<td></td>
<td>N normal</td>
<td>DF: DIN flange</td>
</tr>
<tr>
<td></td>
<td>090 module</td>
<td></td>
<td></td>
<td></td>
<td>L long</td>
<td></td>
</tr>
<tr>
<td></td>
<td>150 module</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>220 module</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other module configurations and sizes can be supplied upon request. The connections are available according to DIN nomenclature, JIS and ANSI. Not all kinds of combinations are available. Further information can be found in our technical data sheet.

### SEPRODYN® Tubular Modules

<table>
<thead>
<tr>
<th>Module Type</th>
<th>SE 020 TP 1N</th>
<th>SE 090 TP 1M</th>
<th>SE 150 TP 1N</th>
<th>SE 150 TP 1L</th>
<th>SE 220 TP 1L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane surface in m²</td>
<td>0.01</td>
<td>1.0</td>
<td>4.0</td>
<td>8.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Shell material</td>
<td>Polypropylene</td>
<td>Polypropylene</td>
<td>Polypropylene</td>
<td>Polypropylene</td>
<td>Polypropylene</td>
</tr>
<tr>
<td>Module length in m</td>
<td>0.75</td>
<td>1.40</td>
<td>1.65</td>
<td>3.00</td>
<td>3.10</td>
</tr>
<tr>
<td>Number of tubes</td>
<td>1</td>
<td>46</td>
<td>174</td>
<td>174</td>
<td>336</td>
</tr>
<tr>
<td>Crossflow for 1m/sec(2)</td>
<td>71 l/h</td>
<td>3 200 l/h</td>
<td>12 300 l/h</td>
<td>12 300 l/h</td>
<td>30 000 l/h</td>
</tr>
</tbody>
</table>

**Note:** (1) Based on inner diameter (2) Recommended flow velocity: 2-3 m/sec
MICRODYN
Tubular and Capillary Modules

MICRODYN filter modules have been developed for crossflow microfiltration. This type of crossflow microfiltration represents a modern filtration method for the separation of suspended particles or emulsified liquids.

The highly porous symmetrical structure of the MICRODYN membrane leads to extremely high permeability. The pore size distribution is very narrow making sharp separations possible. The MICRODYN membrane is very resistant to abrasion and other mechanical damage due to its homogeneous construction, unlike asymmetrically structured ceramic membranes. It also has great chemical resistance because of the material properties of polypropylene.

The membranes are available as hollow fibers, capillaries and tubes. Capillary and hollow fiber membranes are potted in the module housing. The centrifugal casting of the potting material guarantees high product quality.

Tubular membranes are welded together integrally with the housing. This makes gaskets or other sealing materials unnecessary. The modules are therefore extremely chemically stable and robust (pH range 0-14).

Any surface deposits formed during filtration can be easily minimized by:

» Adjusting the velocity of the feed flow
» Periodic backwashing (PRS)
» Chemical cleaning in reverse flow to the filtration flow

These techniques result in consistently high performance levels and many years of trouble-free operation.

Polypropylene is resistant to many organic and inorganic chemicals, including most acids and caustics, with the exception of oxidants. The MICRODYN microfiltration modules can be used for the filtration of most liquids and mixtures of these chemicals.

ADVANTAGES

» well defined flow conditions
» high packing density per module
» minimized dead zones
» extremely resistant to abrasion
» backflushing with chemicals
» reduced specific energy consumption
### Overview MICRODYN Hollow Fiber Modules

<table>
<thead>
<tr>
<th>Module Type</th>
<th>MD 070 FP 1L</th>
<th>MD 070 FP 2L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane surface in m²</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>Membrane material</td>
<td>Polypropylene with 0.6 mm inner diameter</td>
<td></td>
</tr>
<tr>
<td>Pore size µm</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Shell material</td>
<td>Polypropylene cartridge</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** (1) Based on inner diameter.

### Overview MICRODYN Capillary Modules

<table>
<thead>
<tr>
<th>Module Type</th>
<th>MD 020 CP 2N</th>
<th>MD 063 CP 2N</th>
<th>MD 070 CP 2L</th>
<th>MD 150 CP 2N</th>
<th>MD 150 CS 2N</th>
<th>MD 200 CV 2N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane surface in m²</td>
<td>0.1</td>
<td>0.75</td>
<td>0.9</td>
<td>10</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Membrane material</td>
<td>Polypropylene with 1.8 mm inner diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pore size µm</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shell material</td>
<td>Polypropylene cartridge</td>
<td>Polypropylene cartridge</td>
<td>Polypropylene cartridge</td>
<td>Polypropylene</td>
<td>stainless steel shell</td>
<td>PVC shell</td>
</tr>
</tbody>
</table>

**Note:** (1) Based on inner diameter.

### Overview MICRODYN Tubular Modules

<table>
<thead>
<tr>
<th>Module Type</th>
<th>MD 020 TP 2N</th>
<th>MD 063 TP 2N</th>
<th>MD 090 TP 2N</th>
<th>MD 150 TP 2N</th>
<th>MD 150 TP 2L</th>
<th>MD 220 TP 2L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane surface in m²</td>
<td>0.036</td>
<td>0.2</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Membrane material</td>
<td>Polypropylene with 5.5 mm inner diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pore size µm</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shell material</td>
<td>Polypropylene</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** (1) Based on inner diameter.

### Decoding of the product code: **MD150TP2LDF**

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Module Size</th>
<th>Membrane Geometry</th>
<th>Shell Material</th>
<th>Pore Size</th>
<th>Module Length</th>
<th>Module Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICRODYN</td>
<td>(⌀ of the shell in mm)</td>
<td></td>
<td></td>
<td></td>
<td>N normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>020</td>
<td>063</td>
<td>070</td>
<td>090</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Tubular membrane</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Capillary membrane</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Hollow fiber membrane</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P Polypropylene</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S Stainless steel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V PVC/PVC-C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U Polysulfone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>O without housing (exchangeable cartridge)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.1 µm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.2 µm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other module configurations and sizes can be supplied upon request. Not all combinations are available. The connections are available according to DIN nomenclature, JIS and ANSI. Further information can be found in our technical data sheet.**
ULTRADYN hollow fiber modules are based on double asymmetric ULTRADYN membranes.

High mechanical strength and a wide range of membrane types make ULTRADYN hollow fiber modules suitable for all applications requiring a high level of purification.

Membranes are available in polyethersulfone, polyacrylonitrile and cellulose tri-acetate.

The hollow fiber inner diameters range from 0.5 to 1.4 mm, module sizes range from 0.1 m² to 17 m².

ULTRADYN hollow fiber modules have proven particularly successful in wine filtration, pure water filtration for pharmaceuticals and electronics and surface water treatment.

Additionally, ULTRADYN hollow fiber modules can be sterilized with hot water (max. 98 °C), which is an important advantage in pure water production.

ADVANTAGES

» double asymmetric membrane

» high filtration capacity

» backwashable, hot water sterilisable at 98 °C

» high chemical resistance

» available in different types

» high packing density

<table>
<thead>
<tr>
<th>Type</th>
<th>Membrane Material</th>
<th>Properties</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUS</td>
<td>Polyethersulfone</td>
<td>high chemical resistance, double layered</td>
<td>pure water, pharmaceuticals, electronics, wine filtrations, vinegar and juice filtration</td>
</tr>
<tr>
<td>FUY</td>
<td>Modified Polyacrylonitrile</td>
<td>hydrophilic, double layered</td>
<td>juice filtration, pharmaceuticals</td>
</tr>
<tr>
<td>FUC</td>
<td>Cellulose triacetate</td>
<td>extremely hydrophilic, double layered</td>
<td>water treatment</td>
</tr>
</tbody>
</table>

DAICEN Membrane Systems Ltd. is the manufacturer of the ULTRADYN modules and markets and distributes them under the registered trademark MOLSEP®.
Product Range ULTRADYN Hollow Fiber Modules

Decoding of the product code **FS 10 - FS** FUS 0353

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td><strong>FB-02-FC</strong></td>
<td>FUS 0353</td>
<td>0.5</td>
<td>0.50</td>
<td>30</td>
<td>364</td>
<td>880</td>
<td>3</td>
<td>98</td>
<td></td>
<td>PF 1/2” Permeate clamps on the same side</td>
</tr>
<tr>
<td>Laboratory testing for all applications</td>
<td>FUS 0382, FUS 1582, FUS 5082, FUS 03A1</td>
<td>0.8</td>
<td>0.25</td>
<td>30-150</td>
<td>364-690</td>
<td>690</td>
<td>3</td>
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<tr>
<td><strong>FS 03-FC</strong></td>
<td>FUS 0353</td>
<td>0.5</td>
<td>2.2</td>
<td>30</td>
<td>406</td>
<td>3,700</td>
<td>3</td>
<td>98</td>
<td></td>
<td>Feed/ Retentate: 1” Clamp 1) Permeate: PF 1/2” Permeate clamps on the same side</td>
</tr>
<tr>
<td>Laboratory and pilot testing for all applications</td>
<td>FUS 0181, FUS 0382, FUS 1582</td>
<td>0.8</td>
<td>1.4</td>
<td>10-30</td>
<td>406-129</td>
<td>3,700-4,200</td>
<td>3</td>
<td>98</td>
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<td></td>
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<tr>
<td><strong>FS 10-FS</strong></td>
<td>FUS 1653</td>
<td>0.5</td>
<td>7.8</td>
<td>6</td>
<td>1,129</td>
<td>3,800</td>
<td>3</td>
<td>98</td>
<td></td>
<td>Feed/ Retentate: 2” Clamp 1) Permeate: 1” Clamp 1) Permeate clamps on the same side</td>
</tr>
<tr>
<td>Photo-emulsions, juice and wine filtration, pure water for pharmaceuticals, biotechnology</td>
<td>FUS 0353, FUS 0382, FUS 1582, FUS 03A1</td>
<td>0.8</td>
<td>5.0</td>
<td>10-30</td>
<td>1,129</td>
<td>3,800</td>
<td>3</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FS 10-FC</strong></td>
<td>FUC 1582</td>
<td>0.8</td>
<td>5.0</td>
<td>150</td>
<td>1,129</td>
<td>3,800</td>
<td>3</td>
<td>98</td>
<td></td>
<td>Feed/ Retentate: 2” Clamp 1) Permeate: 1” Clamp 1) Permeate clamps on the same side</td>
</tr>
<tr>
<td>Module for water filtration</td>
<td>FUS 0181, FUS 0382, FUS 1582</td>
<td>0.8</td>
<td>1.4</td>
<td>30-150</td>
<td>1,129</td>
<td>3,800</td>
<td>3</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FG 10-FC</strong></td>
<td>FUS 1071</td>
<td>0.7</td>
<td>8.6</td>
<td>100</td>
<td>1,126</td>
<td>3,500</td>
<td>3</td>
<td>98</td>
<td></td>
<td>Feed/ Permeate: V-Band coupling (116.8 mm) Retentate: Union Joint</td>
</tr>
<tr>
<td>ultra pure water for electronics, flow from shell to lumen side</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FE 10-FC</strong></td>
<td>FUS 0353</td>
<td>0.5</td>
<td>7.8</td>
<td>30</td>
<td>1,120</td>
<td>3,800</td>
<td>3</td>
<td>98</td>
<td></td>
<td>Feed/ Retentate: V-Band coupling (116.8 mm) Permeate: Union Joint (on the same side).</td>
</tr>
<tr>
<td>Prefiltration ultra pure water</td>
<td>FUS 1582</td>
<td>0.8</td>
<td>5.0</td>
<td>150</td>
<td>1,126</td>
<td>3,800</td>
<td>3</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FK 20</strong></td>
<td>FUS 0181</td>
<td>0.8</td>
<td>17</td>
<td>10</td>
<td>1,066</td>
<td>13,300</td>
<td>3</td>
<td>85</td>
<td></td>
<td>Depends on cartridge version</td>
</tr>
<tr>
<td>Cartridge-type for photo-emulsions, juice and wine filtration, biotechnology</td>
<td>FUS 0382, FUS 1582</td>
<td>0.8</td>
<td>17</td>
<td>30-150</td>
<td>1,066</td>
<td>13,300</td>
<td>3</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FN 20</strong></td>
<td>FUC 1582</td>
<td>0.8</td>
<td>16</td>
<td>150</td>
<td>1,066</td>
<td>3,500</td>
<td>2</td>
<td>40</td>
<td></td>
<td>Depends on cartridge version</td>
</tr>
<tr>
<td>Cartridge-type for water filtration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** (1) Can be connected to TRI-CLAMP® fittings. // (2) for approx. 0.2 m/s // Please note: Not all combinations are available.
The compact and light weight MAXIDYN 1" tubular modules are best suited for the filtration of solutions with high levels of suspended solids.

Due to the module construction and the materials used, high process stability can be achieved.

MAXIDYN FS 1" tubular modules are available in PES or a PVDF high performance membrane with different molecular weight cut-offs (MWCO).

The tubes can be arranged in parallel or series depending on process or system requirements.

Series designs are best suited for low feed volumes and parallel designs are recommended for solutions with a high fouling potential.

The dimensions and connections of the ready-to-mount modules have been chosen for quick and easy installation.

**ADVANTAGES**

» filtration with very high solids

» virtually no clogging

» compact module construction

» high chemical resistance

» simple installation and maintenance

» chemical and mechanical cleaning is possible
### MAXIDYN 1” Tubular Modules

#### Decoding of the product code: FS 1 TM - 251 - FNO

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Module Length</th>
<th>Membrane Characteristics</th>
<th>Shell Material</th>
<th>Sealing Material</th>
<th>(Internal) Execution Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAXIDYN 1” Tubular module</td>
<td></td>
<td>251</td>
<td>150 kDa</td>
<td>PVDF</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>887</td>
<td>70 kDa</td>
<td>PVDF</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td></td>
<td>522</td>
<td>20 kDa</td>
<td>PES</td>
<td>C-PVC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>587</td>
<td>100 kDa</td>
<td>PES</td>
<td>without shell</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V Viton (FPM) may be omitted</td>
</tr>
</tbody>
</table>

#### Short module

<table>
<thead>
<tr>
<th>Module Type</th>
<th>FS 1 TM-251</th>
<th>FS 1 TM-587</th>
<th>FS 1 TM-887</th>
<th>FS 1 TM-522</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane surface in m²</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Membrane material</td>
<td>PVDF</td>
<td>PES</td>
<td>PVDF</td>
<td>PES</td>
</tr>
<tr>
<td>MWCO in kDa</td>
<td>150</td>
<td>100</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>Max. temperature in °C</td>
<td>FVO 45 °C // PVO 60 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Long module

<table>
<thead>
<tr>
<th>Module Type</th>
<th>FS 3 TM-251</th>
<th>FS 3 TM-587</th>
<th>FS 3 TM-887</th>
<th>FS 3 TM-522</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane surface in m²</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Membrane material</td>
<td>PVDF</td>
<td>PES</td>
<td>PVDF</td>
<td>PES</td>
</tr>
<tr>
<td>MWCO in kDa</td>
<td>150</td>
<td>100</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>Max. temperature in °C</td>
<td>FVO 45 °C // PVO 60 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WE SUPPORT YOU WORLDWIDE!

- Global availability
- Intensive technical advice
- Ideal choice/selection of membranes and modules
- Support at construction and design phases
- Laboratory and pilot scale assistance
- After Sales Service
Global availability
Intensive technical advice
Ideal choice/selection of membranes and modules
Support at construction and design phases
Laboratory and pilot scale assistance
After Sales Service
MICRODYN-NADIR has a worldwide reputation for its innovative membrane products for micro, ultra and nanofiltration. A global player today, the company maintains strong links with its origins. Its headquarters are located at the Kalle Albert Industrial Park in Wiesbaden, Germany, where the MICRODYN-NADIR story began more than 45 years ago.

Our high-quality flat sheet membranes are based on designs which were originally developed at the former Hoechst AG. They are produced in one of the world’s largest membrane casting machine.

These flat sheet membranes as well as our tubular membranes and various capillary membranes are processed into a variety of membrane module types.

Our membrane and module production are maintained at a constantly high technical level. Almost all stages of the manufacturing process are automated to guarantee consistent quality which we can pass on to our customers. Our highly qualified and experienced production team places quality and quality assurance at the foundation of all our processes. Besides, the DIN EN ISO 9001:2008 certified quality control management system, clients approve our quality standards in regular company audits.

Our demands on quality and consistency equally apply to our spiral wound module production unit in China, which was successfully established in 2006. Our highly proficient R&D team is continuously developing innovative products and is always looking for new opportunities in order to assure sustainable improvement in products and processes.

This commitment to innovation is essential to open up new applications for membrane technology.

**ADVANTAGES**

» more than 45 years of experience
» our own membrane production facility
» global player and manufacturer
» quality control management system (DIN EN ISO 9001:2008 certified)
» competent research and development
» experienced and involved staff
<table>
<thead>
<tr>
<th>Micrometers (Log Scale)</th>
<th>ST Microscope</th>
<th>Scanning Electron Microscope</th>
<th>Optical Microscope</th>
<th>Visible without magnification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ionic Range</td>
<td>Molecular Range</td>
<td>Macro Molecular Range</td>
<td>Micro Particle Range</td>
<td>Macro Particle Range</td>
</tr>
<tr>
<td>0.001</td>
<td>0.01</td>
<td>0.1</td>
<td>1.0</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
<td>1000</td>
<td>10^4</td>
<td>10^4</td>
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<td>10^4</td>
<td>10^5</td>
<td>10^6</td>
<td>10^7</td>
<td>10^8</td>
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<tr>
<td>10^8</td>
<td>10^9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ångström Units (Log Scale)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approx. Molecular Wt. (in Dalton)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>200</td>
<td>1 000</td>
<td>10 000</td>
<td>500 000</td>
</tr>
</tbody>
</table>

### Relative Size of Common Materials

- **Aqueous Salt**
- **Carbon Black**
- **Endotoxin/Pyrogen**
- **Paint Pigment**
- **Giardia Cyst**
- **Human Hair**
- **Yeast Cell**
- **Sand**
- **Metal Ion**
- **Synth. Dye**
- **Virus**
- **Bacteria**
- **Mist**
- **Sugar**
- **Gelatin**
- **Colloidal Silica**
- **Blue Indigo Dye**
- **Pollen**
- **Granular Activated Carbon**
- **Albumin Protein**
- **A.C. Fine Test Dust**
- **Lactic Emulsion**

### Process for separation

- **Reverse Osmosis**
  - Ultrafiltration
  - Nanofiltration
  - Microfiltration
- **Particle Filtration**
SEPARATION – OUR PASSION

For more than 45 years, MICRODYN-NADIR has developed innovative membranes and membrane modules for micro-, ultra- and nano-filtration as well as solutions to support our customers’ needs in operation, performance, efficient membrane processes and regulatory compliance.

We will deliver products, information and services, which fully meet or exceed customer expectations. Our team focuses on continual improvement to achieve the highest possible level of customer satisfaction and to be recognized by our customers as the technology and quality leader.

We are not satisfied until our products have been successfully integrated into your customers’ plants and processes. That is our passion.

Our quality system is designed to support these goals.

WE SUPPORT YOU – WORLDWIDE!

» Global availability
» Intensive technical consulting
» Ideal choice of membranes and modules
» Support with engineering and plant design
» Laboratory and pilot tests
» After Sales Service