inge watertechnologies AG

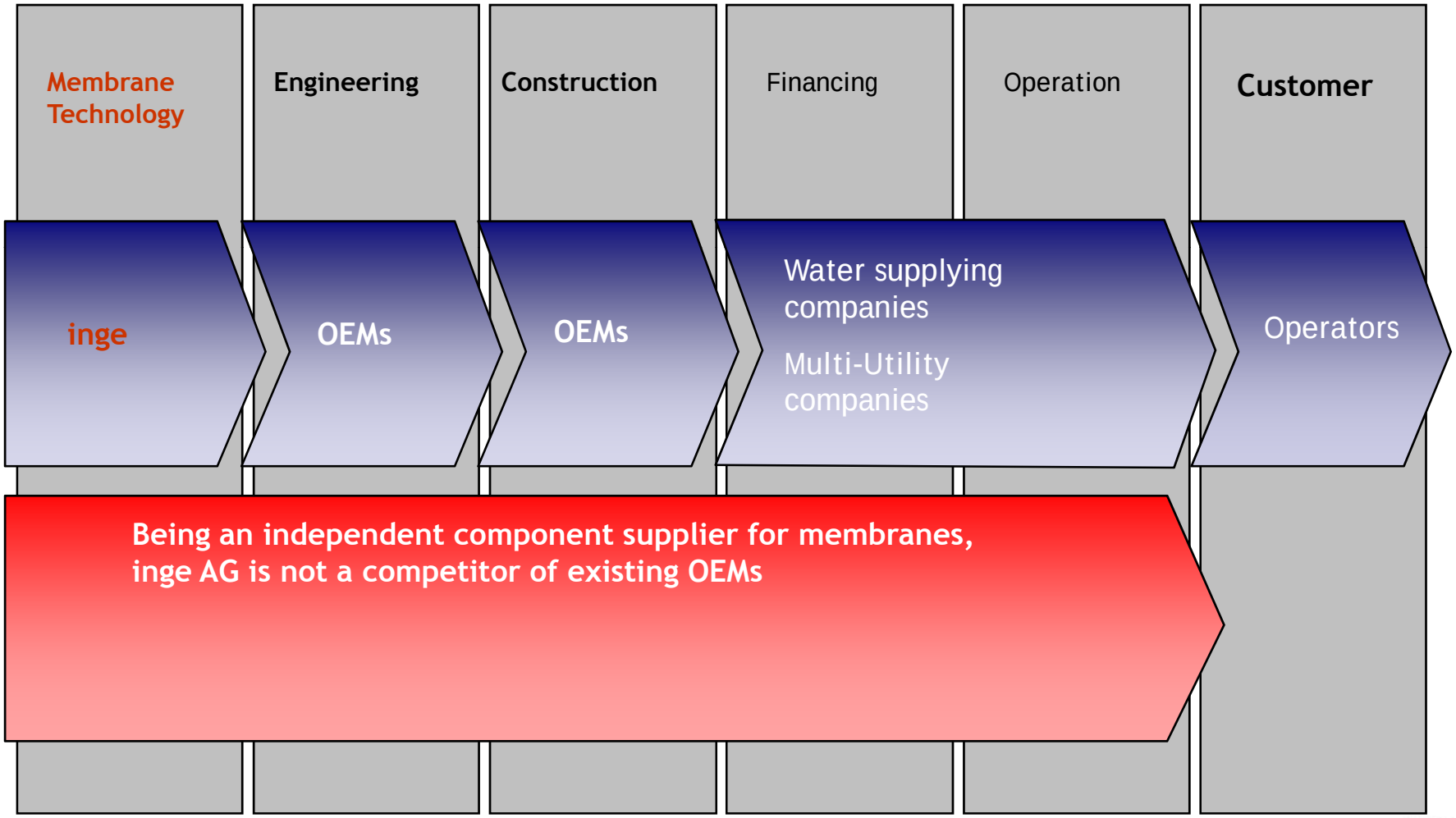
Innovative Ultrafiltration technology

inge watertechnologies AG

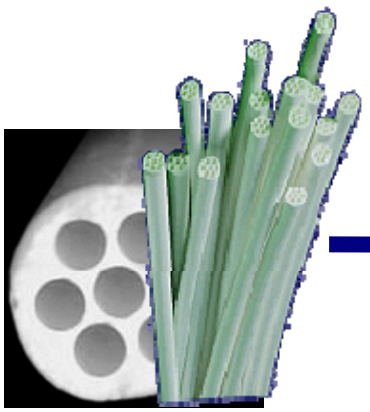
Location - headquarter and membrane production in Germany, Greifenberg near Munich

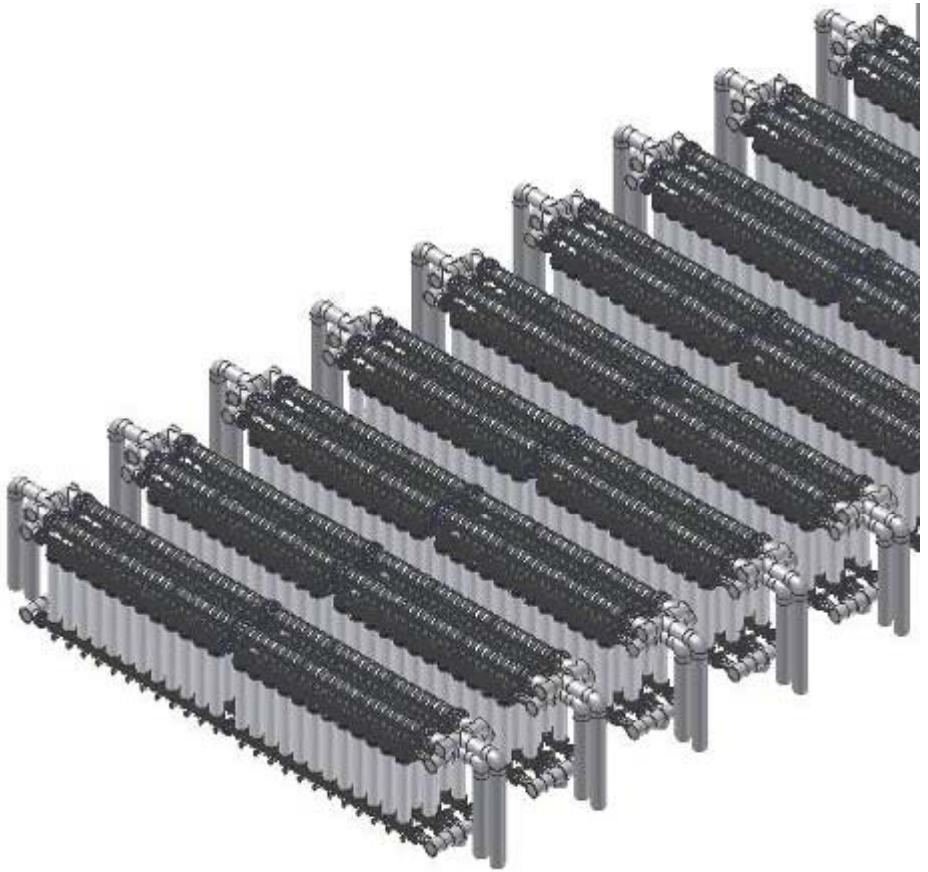
- **independent membrane manufacture**
- **approx. 80 motivated employees**
- **Highest quality standards „Made in Germany“**
- **Sales office in China (Beijing)**
- **Partners worldwide**

inge watertechnologies AG



Scope of supply inge





Membrane Module T-Rack Treatment Plant

inge basic membrane products

Products

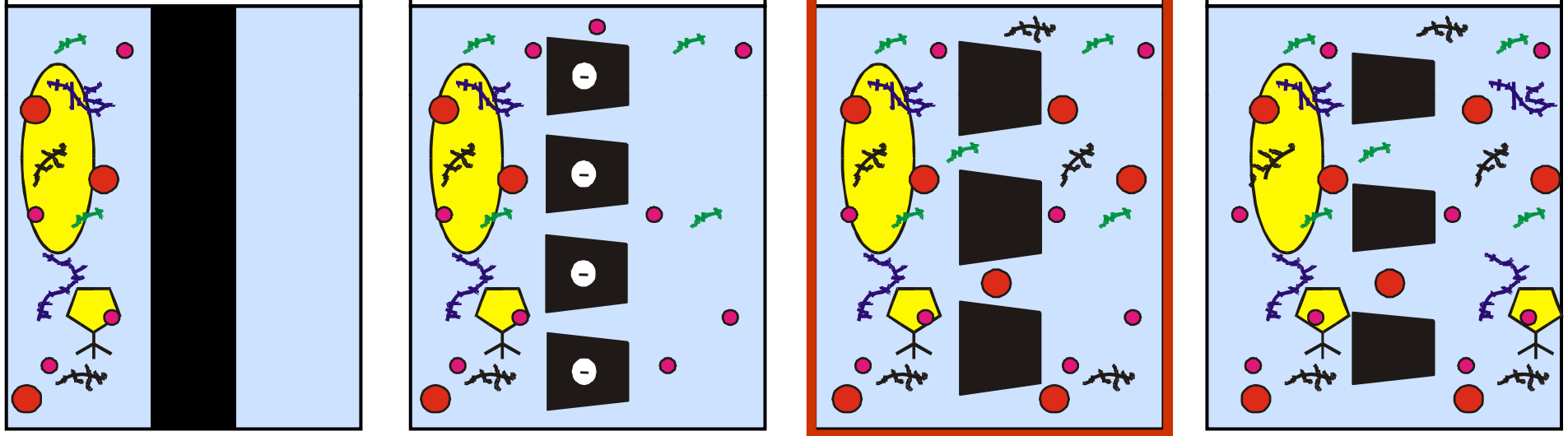
	dizzer 220 dizzer 450 2,2 / 4,5 m²	dizzer 5000 MB 50 m²	dizzer 5000 MB 1.5 38 m²
Municipal water treatment		☐	☐
Industrial water treatment	☐	☐	☐
Point of Entry	☐		
Point of Use	☐		

Custom made products possible

inge - Ultrafiltration

Only Ultrafiltration provides a safe barrier against viruses, bacteria and germs

Reverse Osmosis (RO)	Nanofiltration (NF)	inge Ultrafiltration (UF)	Mikrofiltration (MF)
no porens	d_{pore} ☐ 1 nm	d_{pore} ☐ 10-50 nm	d_{pore} ☐ 50 nm
Dp = 5 - 100 bar	Dp = 3 - 10 bar	Dp = 0.1 - 5 bar	Dp = 0.1 - 2 bar



high molecular org. Substances

org. substances middle sized

low molecular org. Substances

polyvalent ions

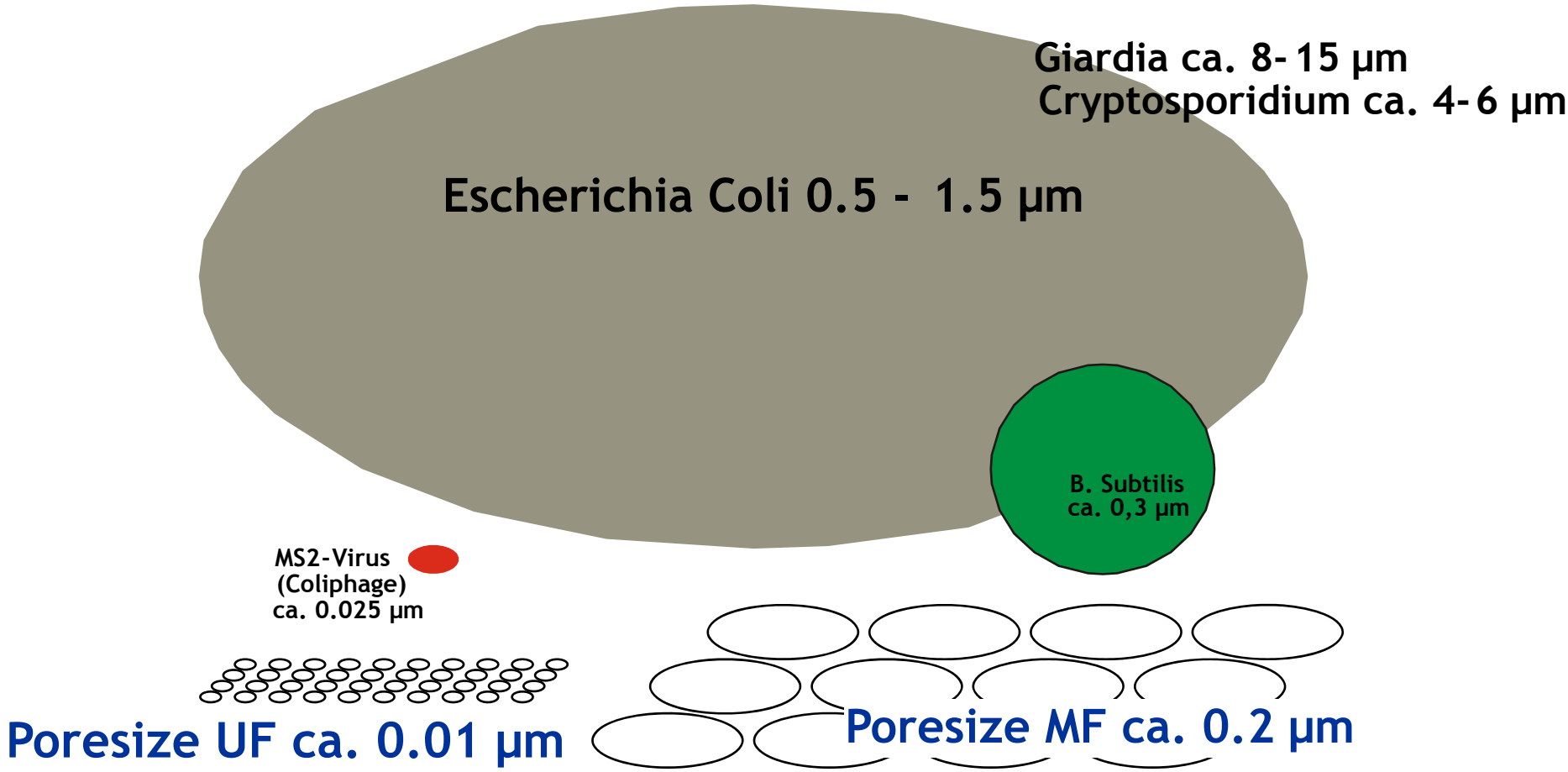
monovalent ions

germs, parasites,
particular inorganic substances

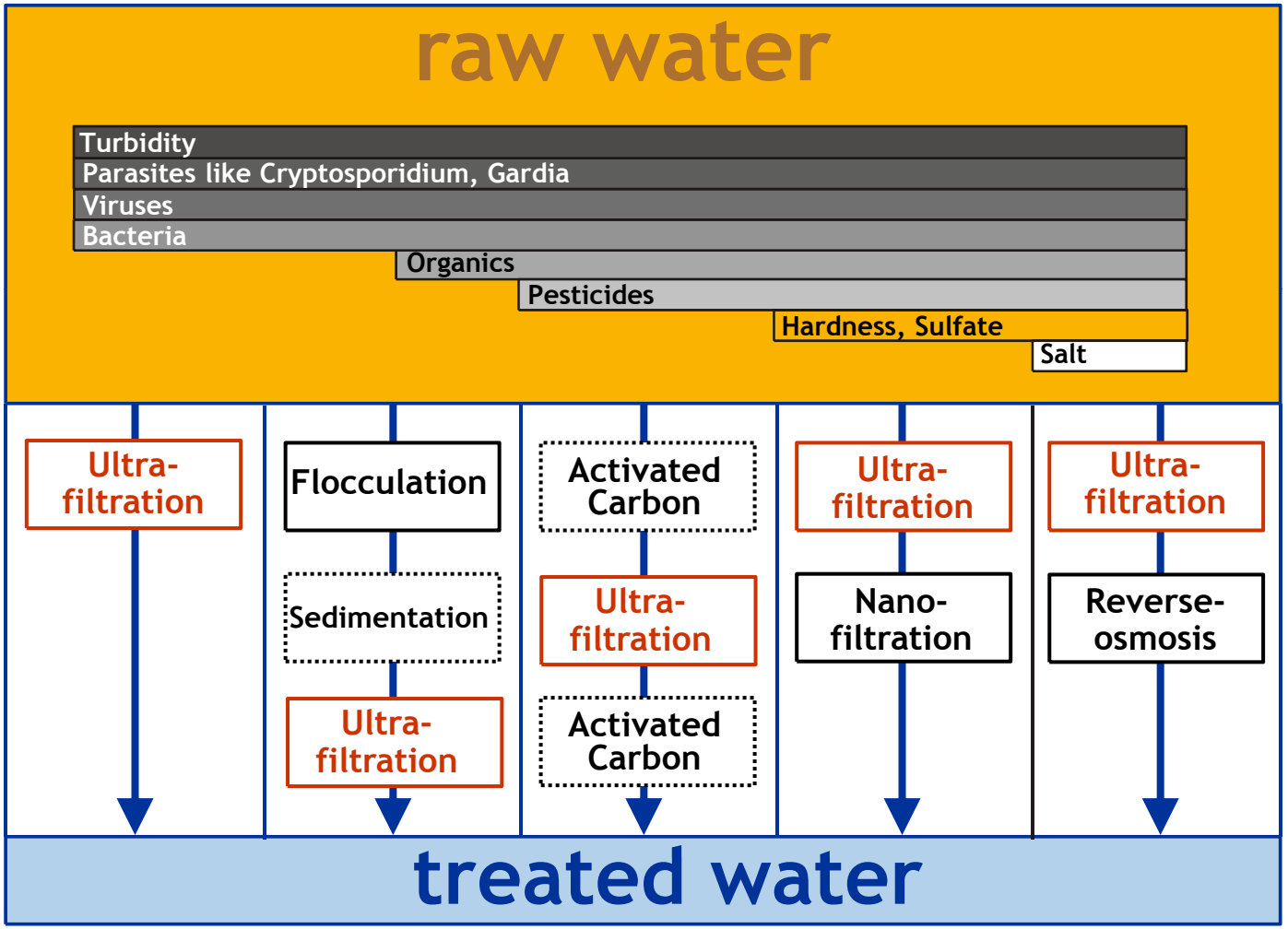
viruses

inge – Ultrafiltration

Only Ultrafiltration provides a safe barrier against viruses, bacteria and germs

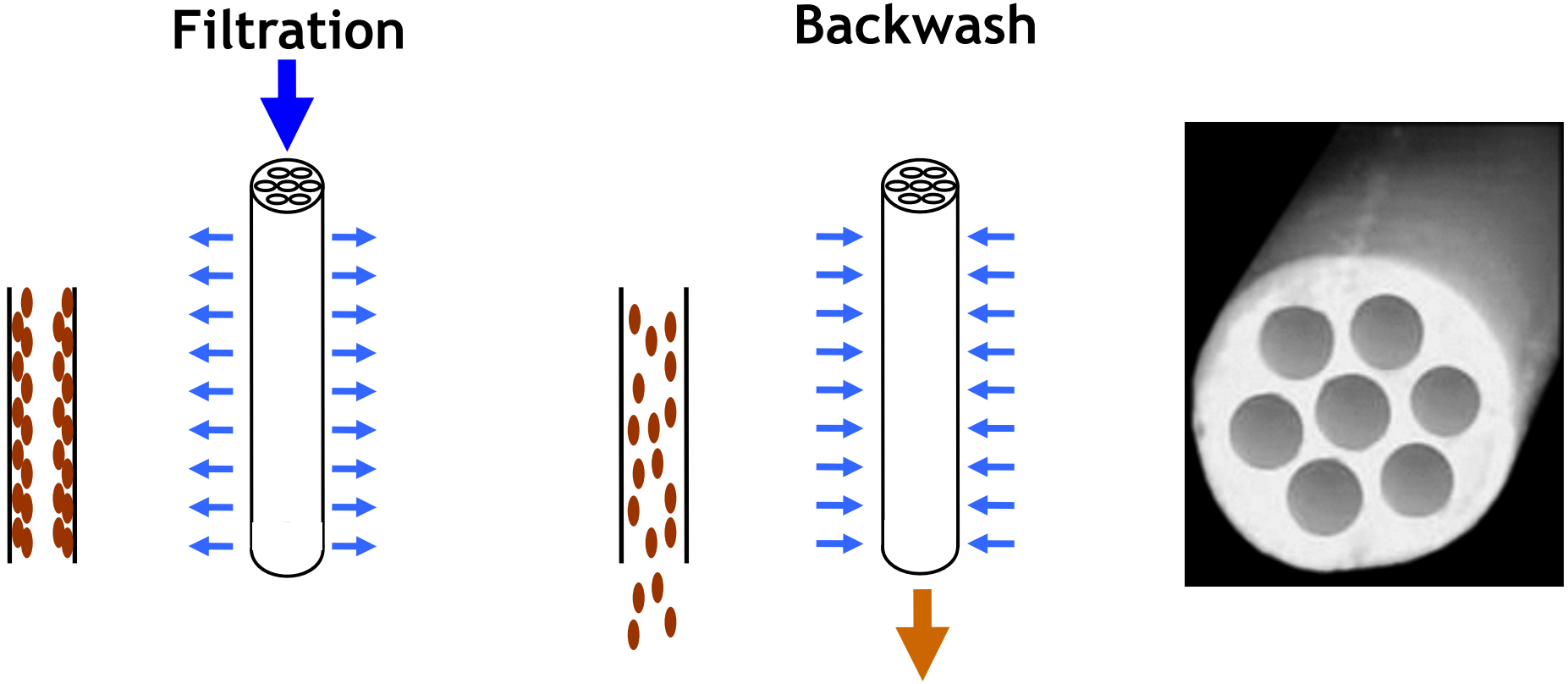


Process combinations – inge UF



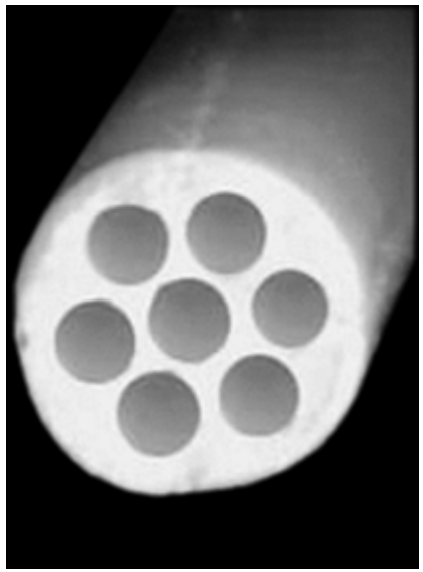
inge Multibore® Membrane

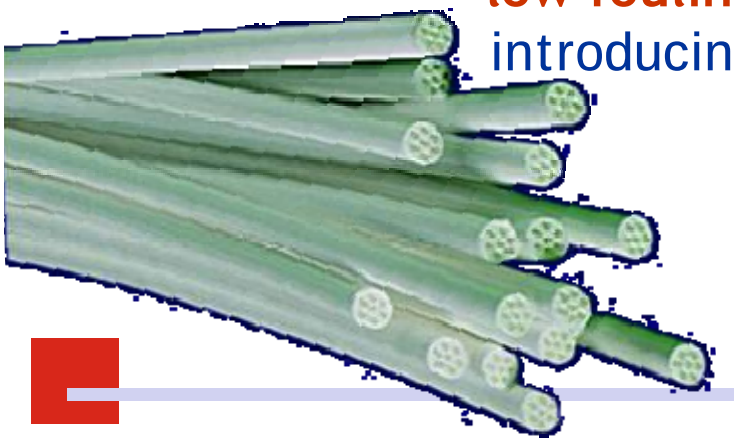
Dead End - IN to Out Filtration process



inge Multibore® Membrane

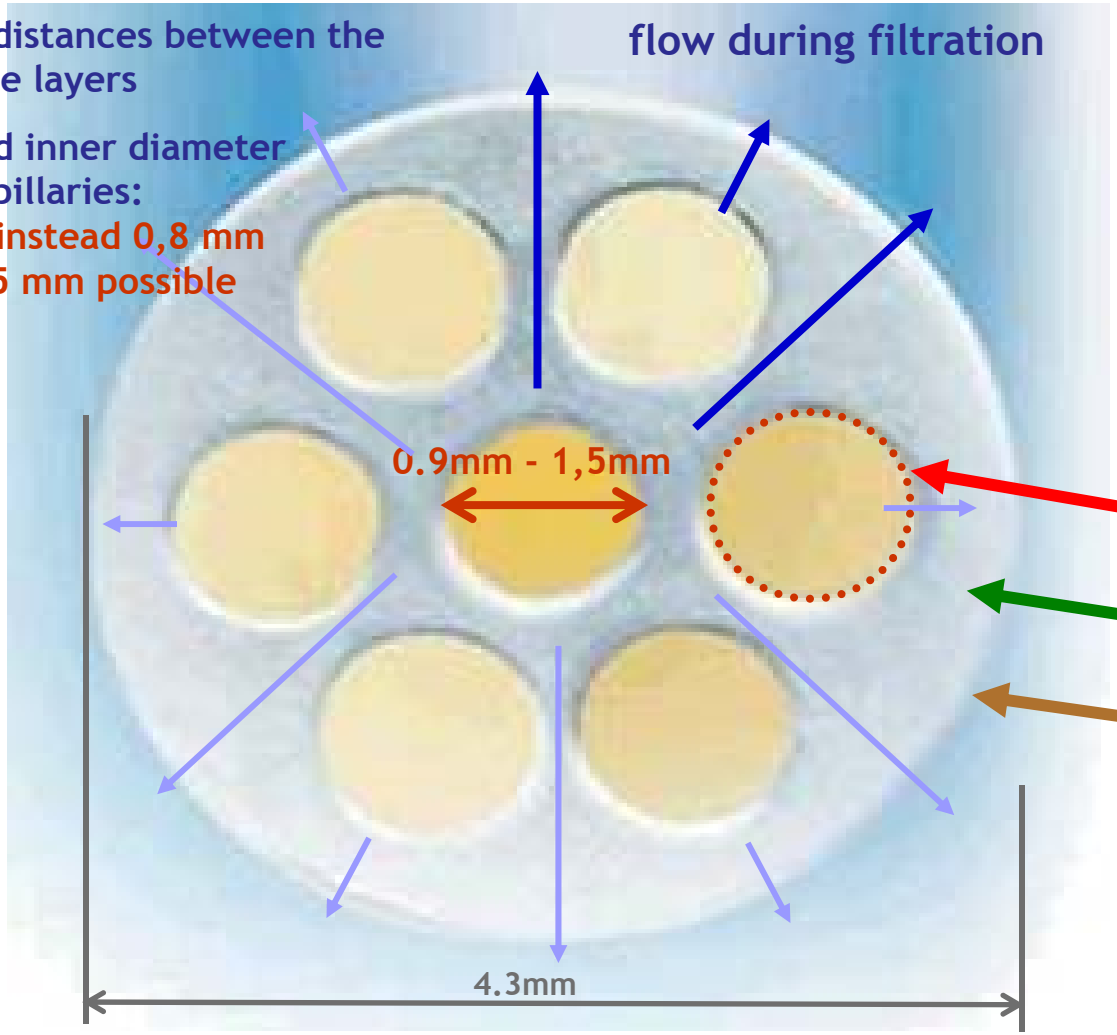
- **fiber breakage practically excluded:**
  7 single capillaries combined into one fiber
  patented production technology
- **high chemical and mechanical resistance,**
  low operating pressures (burst pressure >14 bar)
  PESM – Material – pH 1-13 possible
  no risk of irreversible organic fouling
- **full protection against viruses and bacteria**
  Pore size of 10-20 nm
- **low fouling potential**
  introducing a new, extreme hydrophilic polymer

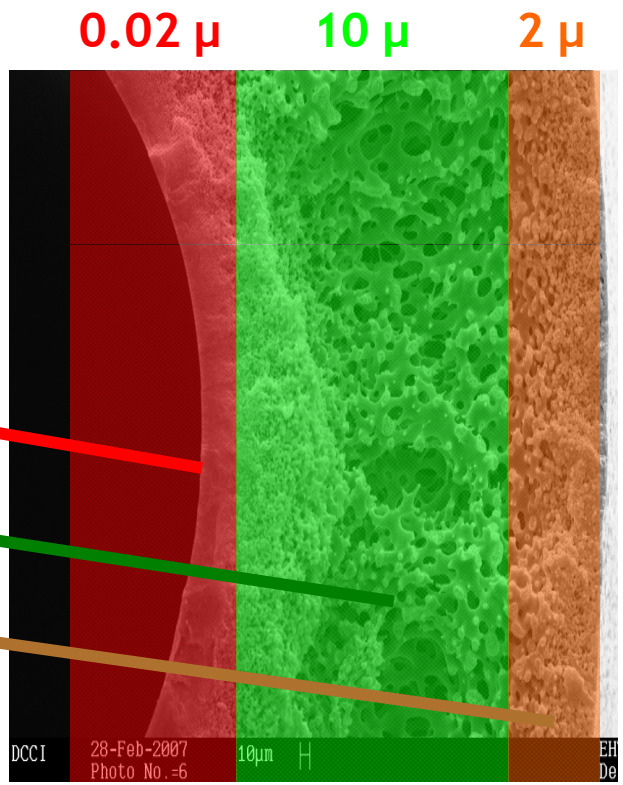




inge Multibore® Membrane

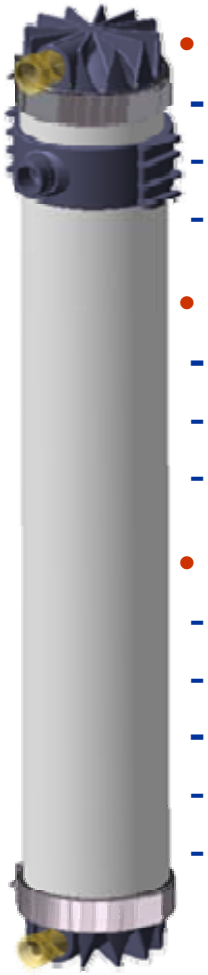
- Defined distances between the membrane layers
- increased inner diameter of the capillaries:
  - 0,9 mm instead 0,8 mm
  - up to 1.5 mm possible





Membrane Close Up

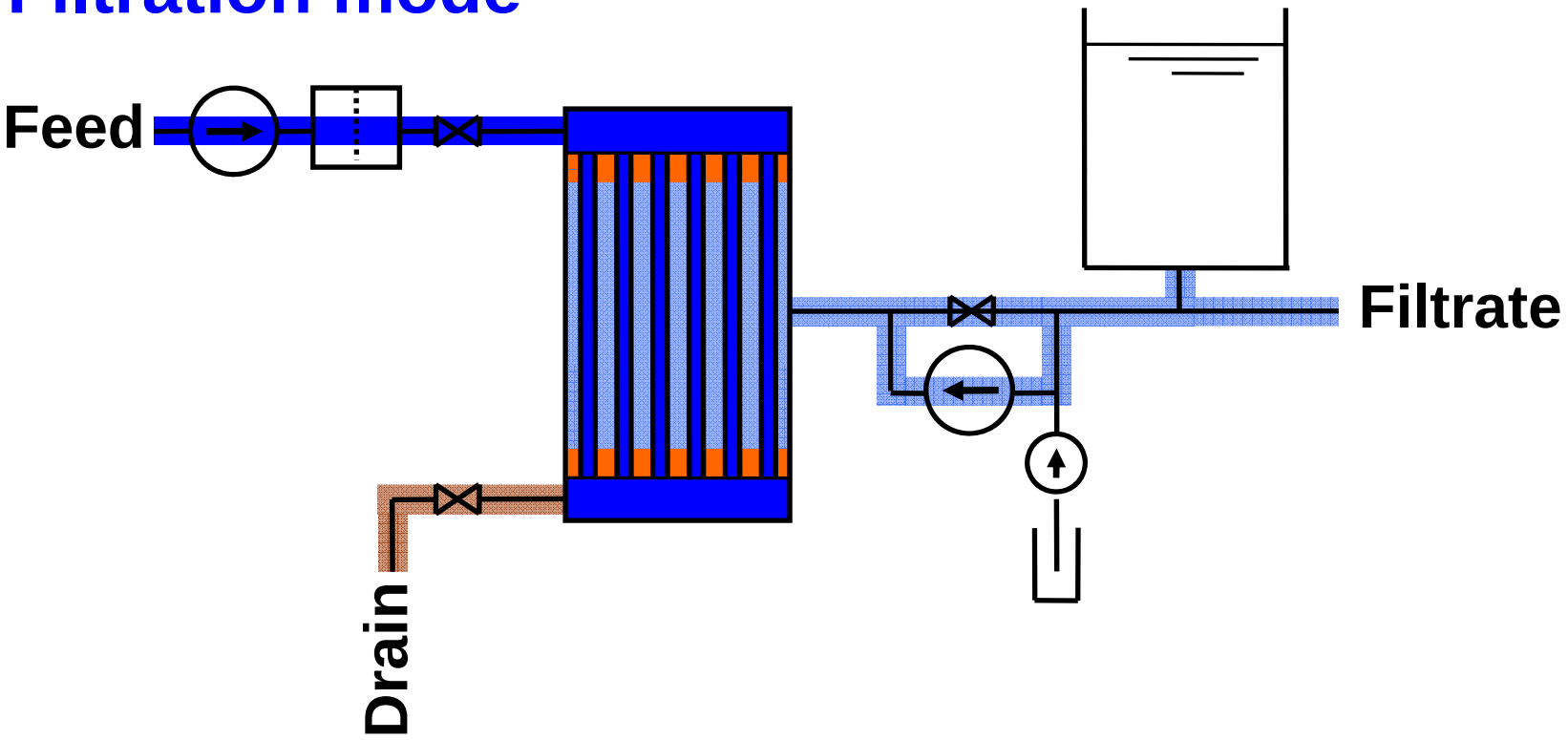
inge dizzer® – module



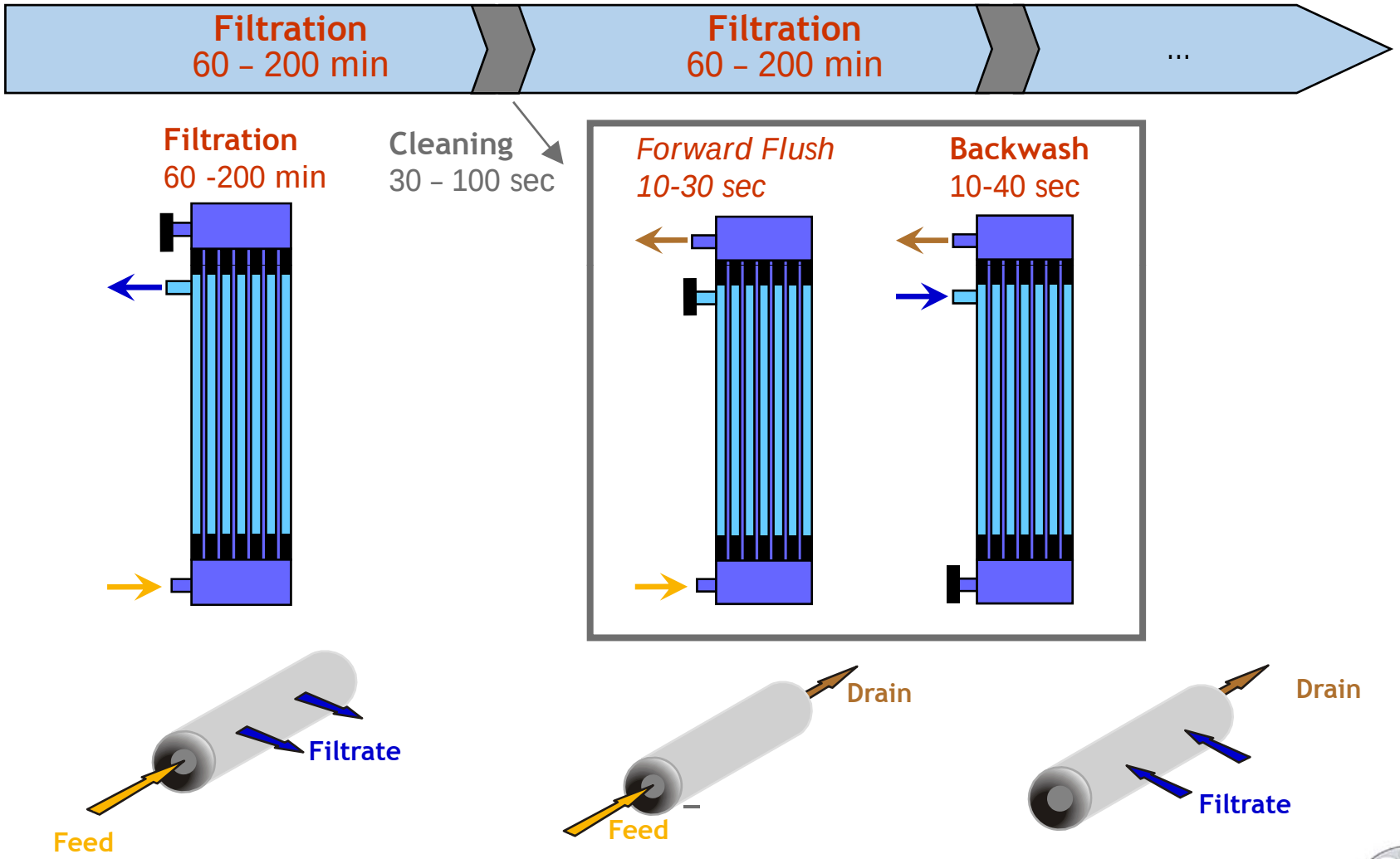
- **Hydrodynamic optimized**
  - equal backwash distribution – high efficient
  - NO AIR needed for backwashing
  - abandonment of CIP cleaning possible
- **Simple and flexible**
  - modular „Plug and Play“ System - „one man installation“
  - no crane necessary
  - no dehumidification necessary
- **Safe barrier: Feed - Filtrate**
  - no fiber breakages by process-related membrane movement
  - stable Multibore fiber potted in epoxy resin
  - no O-ring connections between feed and filtrate
  - simple integrity test
  - closed filtration process

inge dizzer® – operation - in/out

Backwash mode
Filtration mode

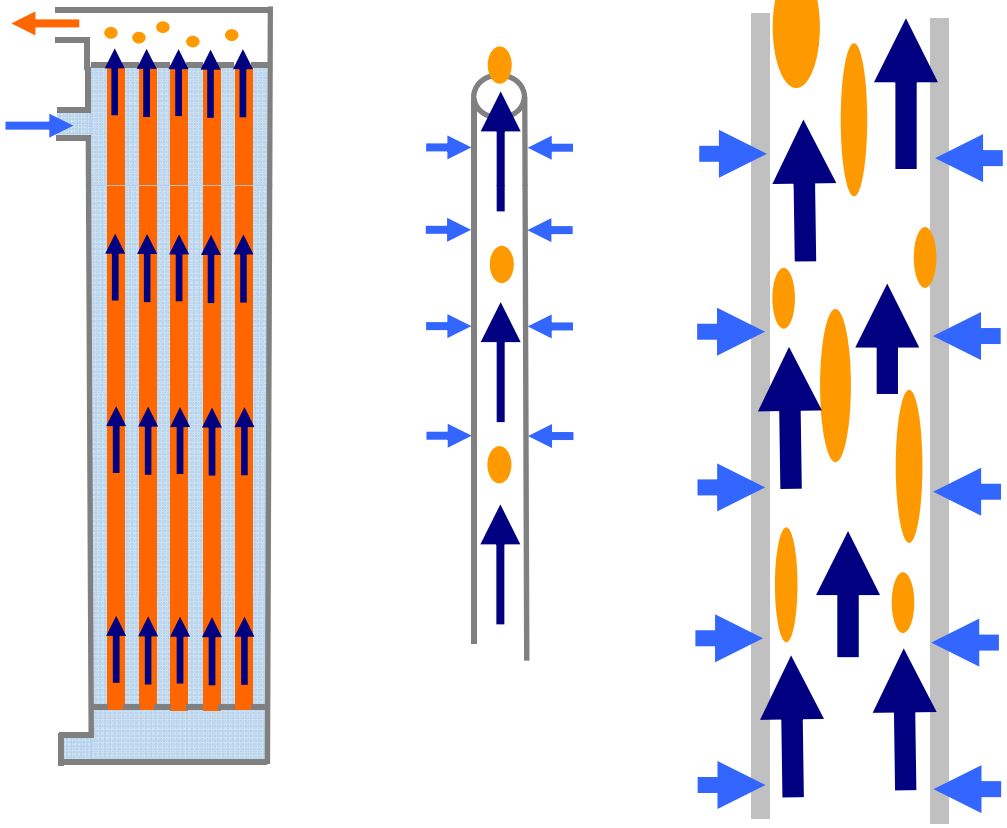


inge dizzer® – operation - in/out



inge dizzer® – operation - in/out

efficient backwash



- Due to increased inner diameter high backwash flows possible
- Defined flow inside of the capillaries
- high shear forces

no air necessary

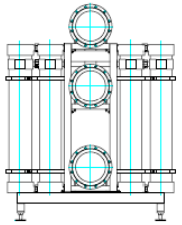
- Fast and direct soil discharge

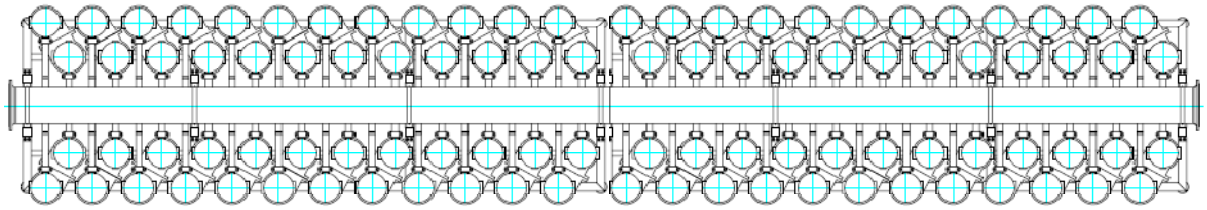
no dead zones

inge innovation T-Rack

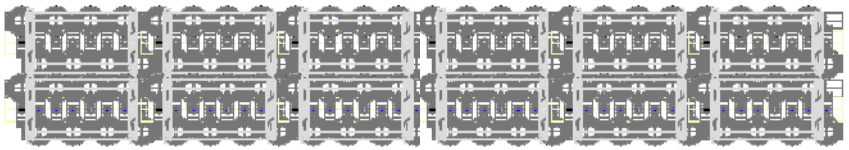
- Standardized rack construction
- 4-96 modules per rack
- optimized rack-hydraulic
- Up to 50% less space requirement
- Flexible backwash operation

conventional rack





inge T-Rack

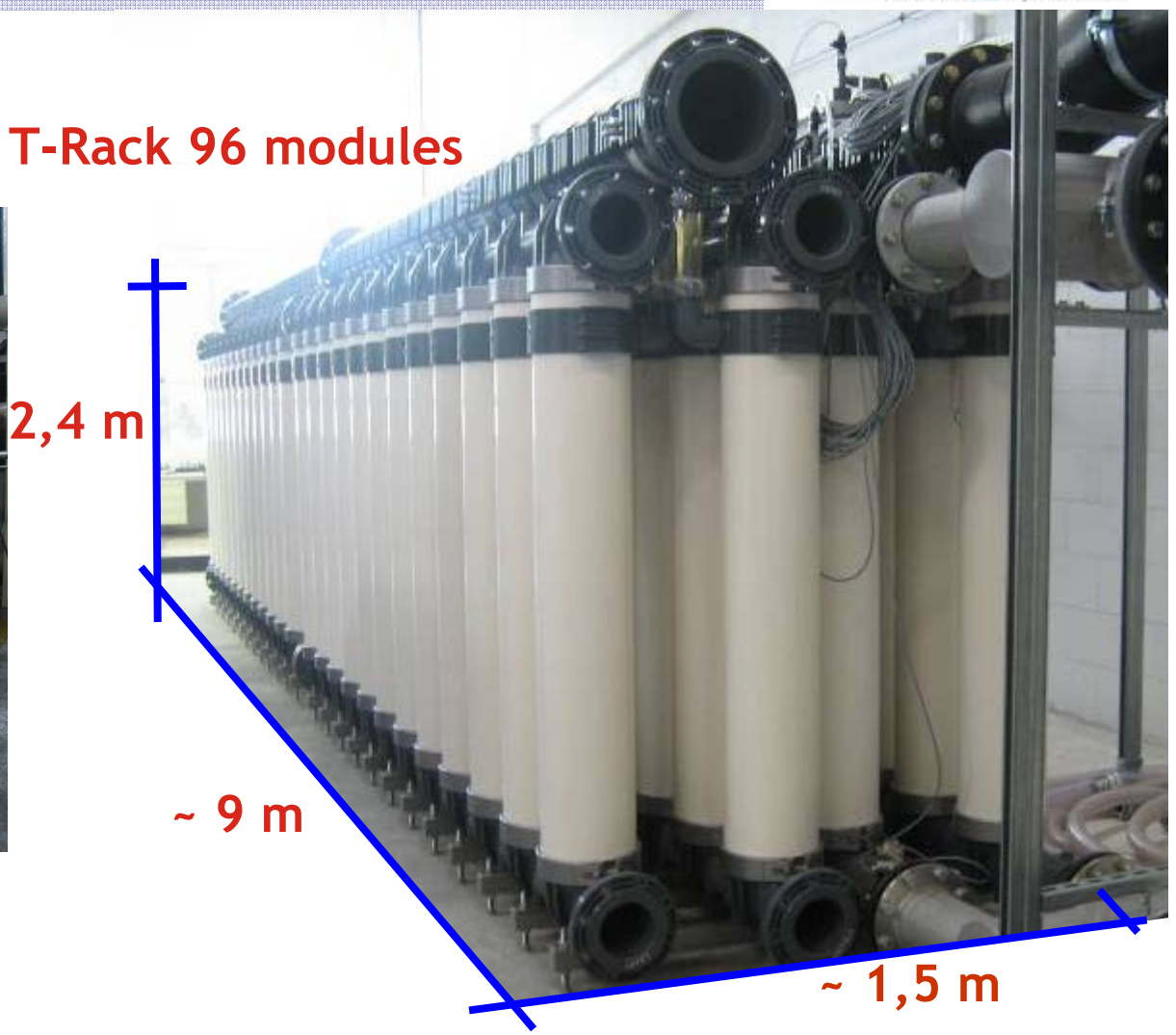


inge innovation T-Rack

inge innovation T-Rack

Standardized flexible rack construction 4-96 modules per rack

T-Rack 96 modules



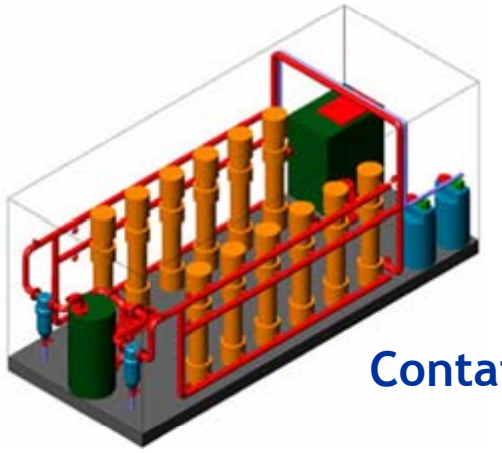
T-Rack

Selected references > 250 m³/h

Type of water	Country	Location	Capacity [m³/h]	Type of module	Commissioned
Sea Water	Turkmenistan		2430	T-Rack	2009
Surface-/ waste water	Ukraine		2000	dizzer 5000	2005
Sea Water	China Nuclear Plant	Dalian	1440	dizzer 5000plus	2008
Sea Water	UAE	Abu Dhabi	1200	dizzer 5000plus	2008
Municipal Waste Water	China CNPC Phase 2	Dalian	1212	dizzer 5000plus	2008
Sea Water	Italy	Torrevaldaliga	980	dizzer 5000	2008
River water	China Power Plant	Guangdong	900	dizzer 5000	2006
Surface water	Switzerland	Männedorf	800	dizzer 5000	2005
Sea Water	Oman		730	dizzer 5000plus	2008
Municipal Waste Water	China WWTP	Shanxi	660	dizzer 5000	2007
Sea Water	Middle East		630	dizzer 5000plus	2008
Backwash water	Germany	Roetgen	600	dizzer 5000 SB	2005
Municipal Waste Water	China Capital Airport	Beijing	600	dizzer 5000plus	2007
Surface water	Egypt	Damietta	570	dizzer 5000plusMB/SB	2009*
Well water	China Steel Plant	Shandong	460	dizzer 5000plus	2007
Yellow River Water	China Petrochemical Plant	Hebei	400	dizzer 5000plus	2007
Surface water	Germany	Neckartailfingen	400	dizzer 5000	2007
Surface water	Russia	Shatura	360	dizzer 5000plus	2008
Surface water	Korea		350	dizzer 5000	2006
Recycling Mix	China Power Plant	Shanxi	330	dizzer 5000	2006
Industry Waste water	China Chemical Plant	Xinjiang	320	dizzer 5000	2005
Well Water	China Chemical Plant	Shandong	320	dizzer 5000plus	2007
Well water	Germany	Bad Hersfeld	300	dizzer 5000	2005
Well water	Germany	Marktschorgast	300	dizzer 5000	2008
Municipal Waste Water	China CNPC Phase1	Dalian	300	dizzer 5000	2006
Surface Water	Russia	Stavropol	270	dizzer 5000plus	2008
River Water	China Power Plant	Anhui	270	dizzer 5000	2008
Surface Water	Russia	Acinsk	250	dizzer 5000plus	2008
Surface Water	Russia	Novocherkassk	250	dizzer 5000	2007
Cooling Water	South Africa	Grootvlei	250	dizzer 5000	2008

Selected references - small units

More than 5000 small units 0 - 6 m³/h world wide



Container

Overall more than 3000 m³/h circulating capacity

in pool applications

(circulation water and backwash water)

inge AG

drinking water

Until now over 80
drinking water UF systems dizzer5000 in Germany

inge UF references

Sandberg ca. 17 m³/h

Bad Hersfeld ca. 300 m³/h

Pfronten ca. 110 m³/h

inge UF - estimated costs

- **Investment costs:**
  pumps, valves, PLC, piping, pre-filter, cleaning equipment, tanks, racks, UF membranes (all EU Standard)
  - small systems (20-200 m³/h): 2.500- 4.000 Euro/m³
  - medium sized systems (200 - 800 m³/h): 1.500 - 3.000 Euro/m³
  - big systems (> 800 m³/h): 1.000 - 2.000 Euro/m³

- **Operation costs**
  - Energy: 0,03 - 0,05 kWh/m³ (0,3 - 0,7 cent/m³)
  - Chemicals: 0,05 - 0,3 cent/m³

Advantages of inge UF technology

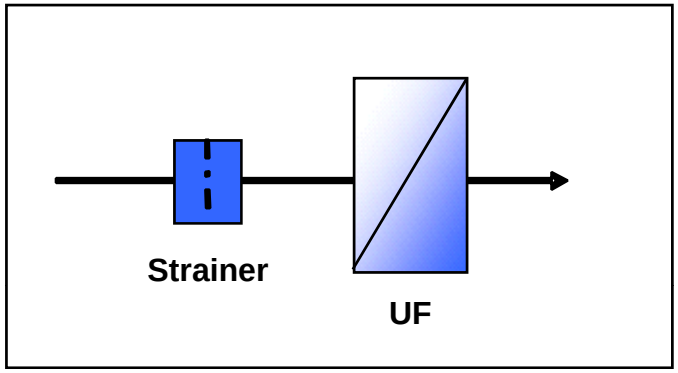
over conventional sand filtration

- Highest filtrate quality - safe barrier against turbidity, viruses (4 log) and bacteria (> 6 log)
- Long membrane lifetime (over 10-15 years)
- Automated operation – low maintenance needed
- Reliable operation on fluctuation water qualities
- Low space requirement - easy to integrate even on existing plants
- Decreasing investment costs

special inge features

- Inge Multibore most stable polymeric membrane ensures longest membrane lifetime (over 10-15 years)
- Abandonment of chlorine cleaning possible (AOX!) due to high caustic resistance
- Only low pressure needed

Seeburg – carstic water



Capacity: 180 m³/h

Application: drinking water

Contractor: Gesellschaft für Wassertechnik, Nellingen

Technical Data: 48 dizzer 5000 MB

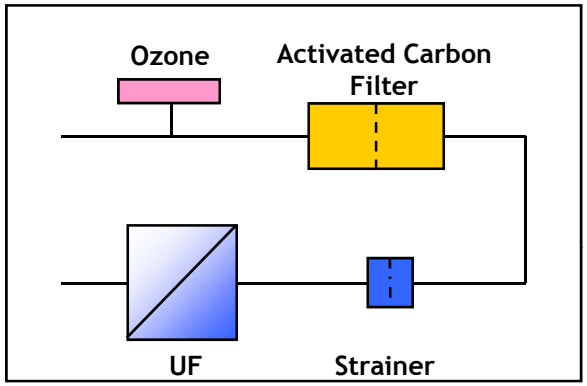
2 trains, each equipped with 24 elements

Remarks: flux rate 83 lmh; recovery > 98%

disinfection 1/days

no chemical cleaning

Männedorf - Surface Water



Capacity: 800 m³/h

Application: drinking water

Contractor: WABAG Switzerland

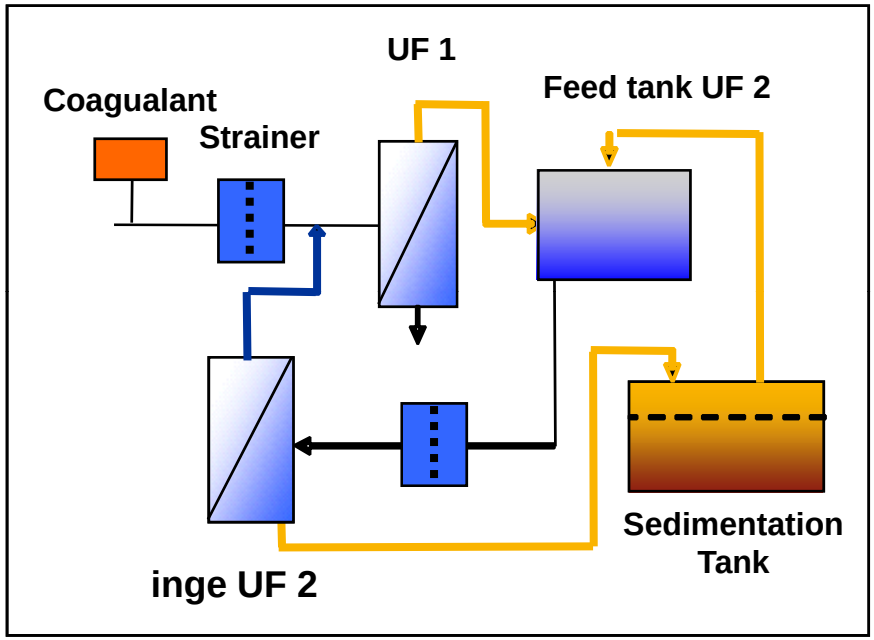
Technical Data: 164 dizzer 5000

4 trains, each equipped with 41 elements

Remarks: max. flux rate 110 lmh. No chemical cleaning apart from a daily chlorine CEB

Männedorf - Surface Water

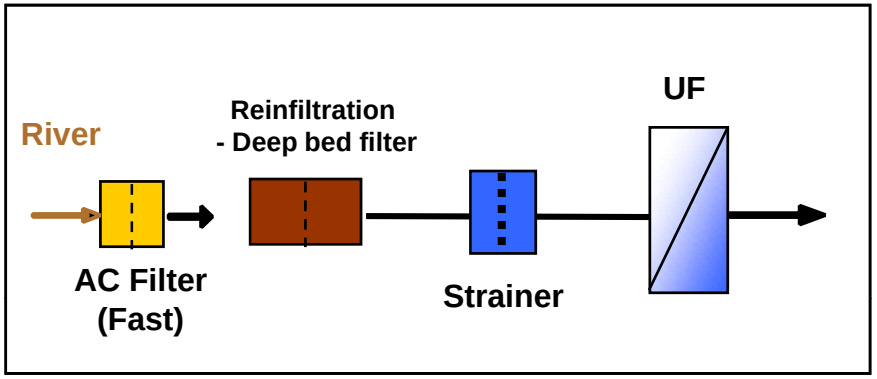
Roetgen – Backwash Water Treatment



Capacity:	600 m³/h
Application:	backwash water
Contractor:	Krüger WABAG Germany
Technical Data:	234 dizzer 5000 SB
	3 trains, each equipped with 78 elements
Remarks:	flux rate 90 lmh; recovery > 98%
	CEB every 3-14 days (caustic pH 12 / acid pH 2)
	no chlorine necessary

Roetgen – Backwash Water Treatment

River Water Treatment



Capacity: 400 m³/h

Application: drinking water

Contractor: BHU

Technical Data: 88 dizzer 5000 MB

2 trains each equipped with 44 elements

Remarks: flux rate 95 - 110 lmh;

recovery >98%

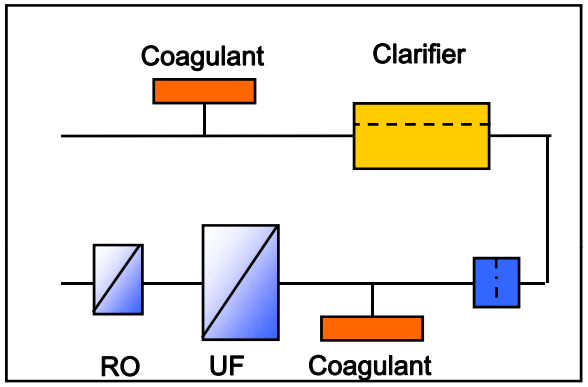
CEB 1/day (chlorine)

River Water Treatment

inge AG

pretreatment RO

Surface-/Waste Water Treatment in Ukraine



Capacity: 2000 m³/h of surface-/waste water (2005)

Application: pretreatment to RO for a chemical plant

Contractor: GE Water

Technical Data: 9x72 dizzer 5000 (648 total)

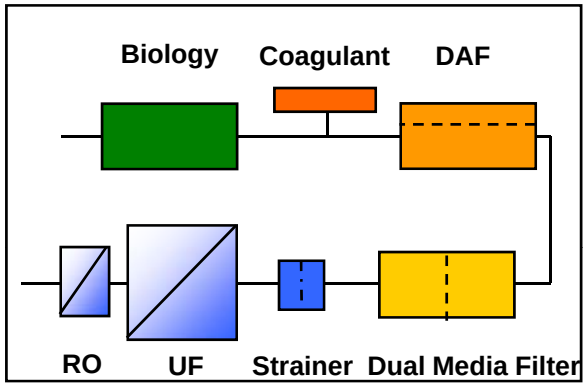
Remarks: flux approx. 80 l/m²h, inge UF modules were selected after successful pilots supervised by inge technicians at site

Surface-/Waste Water Treatment in Ukraine

Feed water to the UF system

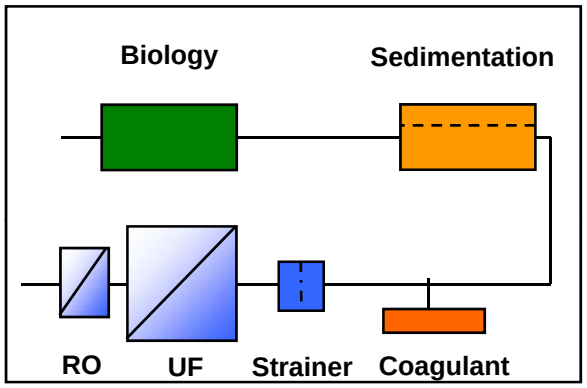
-	suspended matter	≤	50 mg/l
-	iron content	≥	2.0 mg/l
-	manganese content	≤	1.0 mg/l
-	permanganate oxidation	≤	30 mg/l O2
-	pH value		7.5-8.5
-	total salt content	≤	3500 mg/l
-	total alkalinity	≤	7.0 mg-eq/l
-	sulfate content	≤	1100 mg/l
-	chloride content	≤	400 mg/l
-	total microbial value	≤	10000 unit/ml

Reclamation of Municipal Wastewater for a Petrochemical Complex, China



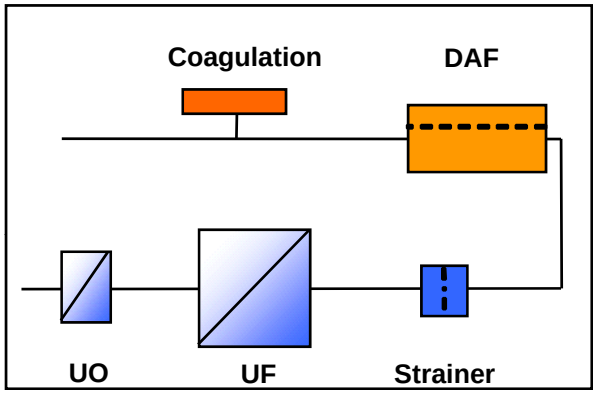
Capacity:	Phase 1: 270 m³/h (2005) Phase 2: 1212 m³/h (2009)
Application:	RO Pre-treatment
Contractor:	Georgi Water Treatment, Dasmart
Enduser:	China National Petrochemical Group
Technical Data:	Phase 1: 82 dizzer5000, 2 trains, each equipped with 41 elements Phase 2: 416 dizzer5000plus, 8 T-Racks, each equippet with 52 elemnts
Remarks:	flux at approx. 72 l/m²h, daily chlorine CEB, CIPs expected 1-2 per year after first 6 months in operation

Tertiary waste water - Capital Beijing Airport - China



Capacity:	**600 m³/h (2008)**
Application:	**RO Pretreatment**
Contractor:	**Beijing E&E Technologies Co.,Ltd**
Technical Data:	**192 dizzer5000plus,**
	3 trains, each equipped with 64 elements
Remarks:	**flux approx. 70 l/m²h,**
	recovery > 90%
UF feed water:	**COD ≤ 60 ppm**
	BOD ≤ 20 ppm
	TSS ≤ 20 ppm
	Fe ≤ 0,4 ppm

Seawater - Torrevaldaliga - Italy



Capacity: 980 m³/h (2008)

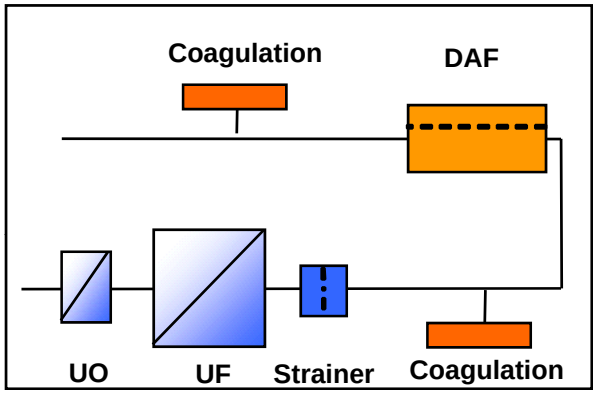
Application: RO Pretreatment

Contractor: Termomeccanica

Technical Data: 372 dizzer5000plus,
6 trains,
each equipped with 62 elements

Remarks: flux approx. 78 l/m²h,
recovery > 90%
2/day Chemical Enhanced Backwash (CEB) 5ppm

Seawater - Abu Dhabi



Capacity: 1200 m³/h (2009)

Application: RO Pretreatment

Contractor: Bernadinello

Technical Data: 410 dizzer5000plus,
5 trains, each equipped with 82 elements

Remarks: flux at approx. 72 l/m²h,

Pool application

Ruhstorf (pool) – circulation water approx. 240 m³/h

Bad Aibling – 90 modules

Conclusions

- **Pressurized inge UF is a technically proven and economical viable solution to treat**
  - **effluent water for re-use**
  - **sea water**
  - **drinking water**

- **inge UF technology is chosen for**
  - **robustness**
  - **highest filtrate quality**
  - **innovative features to reduce invest and operational costs**

inge Watertechnologies AG

your partner for clean water

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