HUBER TECHNOLOGY

HUBER MembraneClearBox® Biological Sewage Plant

H$_2$O Solutions

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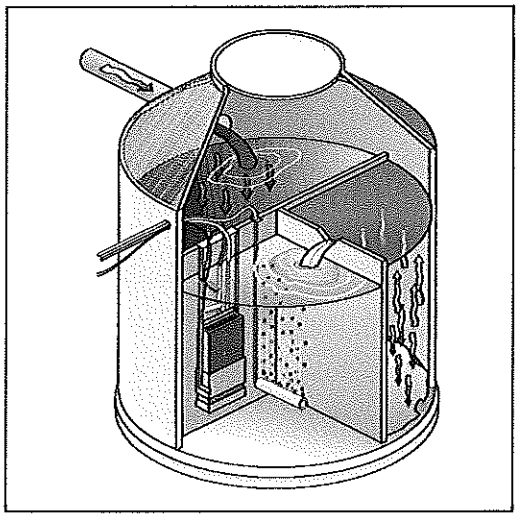
- Compliance with the latest legal EC standards for bathing waters
- Electronic plant recording
- Carefree operation with optional remote control
- Easy sampling at the control unit
- The safe solution for the operator and environment

The Quality Company – Worldwide

The situation

In view of the pollution of surface waters and seas worldwide, combined with the gradual decrease in natural drinking water resources, it has become vital to be sparing with water. Discharge of insufficiently treated wastewater seriously disturbs the natural environmental balance. More and more pollutants and new substances are a heavy burden for our environment and a health hazard for ourselves via the food chain and water cycle.

The new European standards precisely define the quality of wastewater to be infiltrated or introduced into water courses. Membrane systems, which are the most modern state-of-the-art technology presently available for biological wastewater treatment, are able to treat wastewater to such a degree that the water can even be reused as hygienic service water.



The solution: MembraneClearBox®

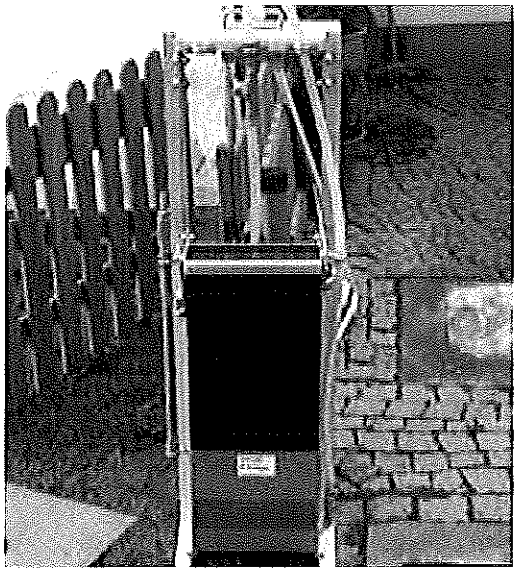
The HUBER MembraneClearBox® ultrafiltration system represents the best available clarification technique presently available for decentralised wastewater treatment.

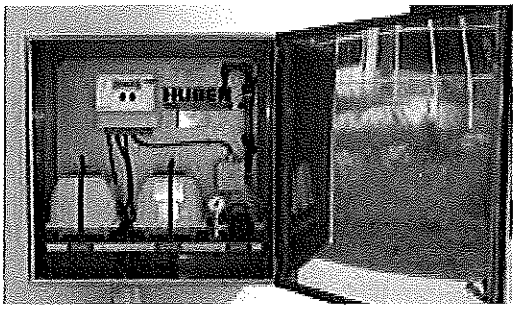
All solids, bacteria and virtually all germs are reliably retained. The treated wastewater is hygienic and can be reused as service water for irrigation of gardens for example, which can reduce the drinking water consumption of a household by up to 40%.

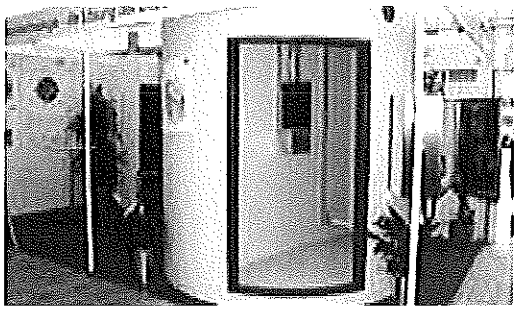
The excellent performance of the HUBER MembraneClearBox® ensures an effluent quality that even lies significantly below the EU standards for bathing waters. The MembraneClearBox® is therefore a future-proof product even if the regulations should become still tighter.

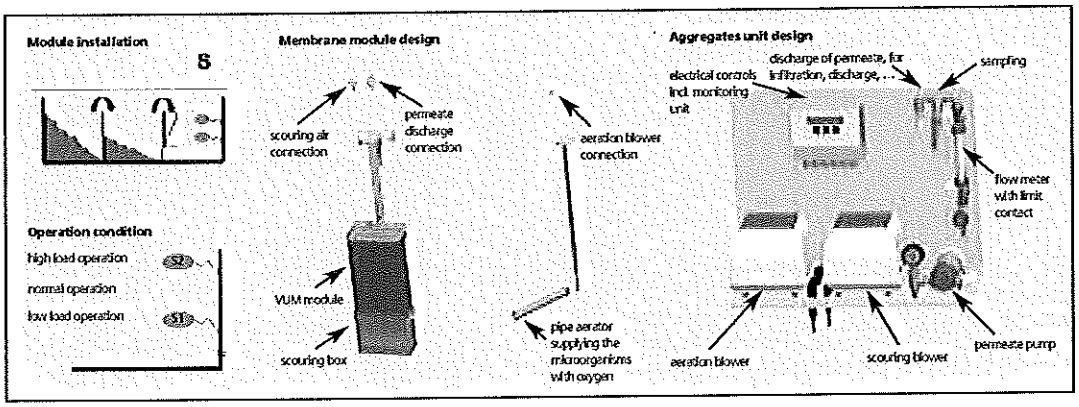
The HUBER MembraneClearBox® is suitable for any installation situation:

- **As a retrofit kit for existing tanks:** Existing tanks, whether angular or round, can easily and quickly be retrofit irrespective of the tank shape.
- **For installation into new tanks:** The equipment can also be installed into new tanks or supplied pre-assembled in a seamless concrete tank.









The plant

The MembraneClearBox® is a combination of the activated sludge process and separation of clarified water by means of submerged ultrafiltration membranes, comprising basically three process steps:

- preliminary clarification
- aeration
- membrane filtration

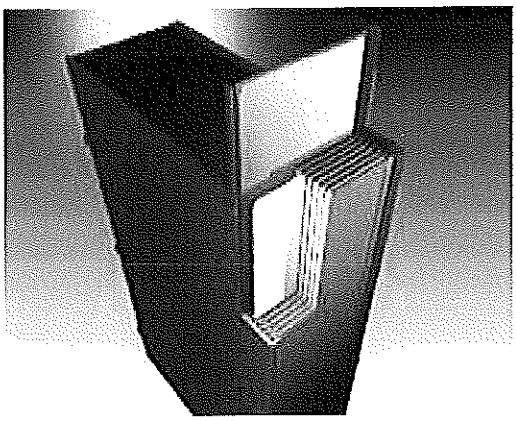
In the preliminary treatment stage most of the solids are removed from the raw wastewater by sedimentation. The first compartment of a multi-compartment septic tank, or the two first compartments, are therefore used as a pre-sedimentation chamber from which the pre-clarified wastewater flows then by gravity into the biological membrane plant.

The last compartment is operated as an aeration tank that houses the MembraneClearBox installation kit and a blower for oxygen supply. Actual clarification is accomplished by microorganisms that decompose the pollutants and nutrients contained within the wastewater and transform them into biomass.

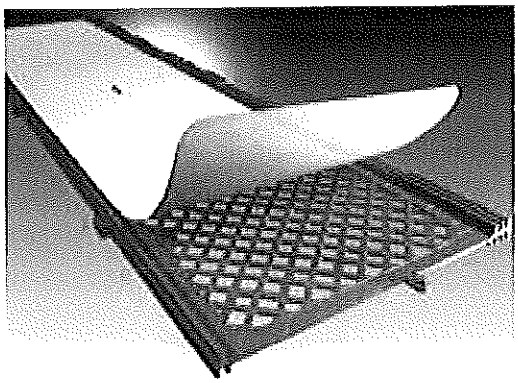
The membrane module with 38 nm separation size ensures separation of the treated wastewater from the activated sludge. The membrane reliably retains all solids and bacteria and virtually all germs as the diameter of the membrane openings is 1,500 times smaller than the diameter of a human hair. This therefore allows for the treated water to be reused.

The aggregates and electrical controls required can be installed either into the cellar of the house or into a heated adjacent control cabinet arranged next to the septic tank.

The HUBER MembraneClearBox® can as an option be equipped with a patented remote control that reports any fault immediately by SMS, email or fax. Due to the combination of on-site and remote control the plant can be operated with minimum operator attendance and the operating reliability optimised to the maximum.



The inside of a membrane module



Membrane carrier plate with membrane foil

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Effluent quality and plant efficiency

The HUBER MembraneClearBox® is certified according to the new DIN EN 12566-3 and is the first ultrafiltration plant that was granted the design approval.

Parameter	Unit	Limit	Average with MCB
BOD_5	mg/l	< 15	2.0
COD	mg/l	< 75	23.7
NH_4-N	mg/l	< 10	5.4
N_{anorg}	mg/l	< 25	24.2
AFS	mg/l	< 50	2.3
Coliform bacteria	1/100ml	< 100	45.8

Average plant efficiency.:

- BOD_5: 99.1 %
- COD: 95.5 %
- NH_4-N: 81.9 %
- AFS: 99.3 %
- Coliform bacteria: 99.9 %

The certification was granted for the new classes C, N, D and +H.

Benefits and unique features

- Excellent effluent quality (bacteria-free and virtually germfree) meeting EU standards for bathing water quality
- Future-proof solution due to the excellent effluent quality that gives scope for anticipated tighter legislation
- Utilisation of intact existing septic tanks is possible
- Electronic plant recording minimises the required operator invention.
- Carefree operation due to the optional remote control with automatic fault indication (by SMS, email, fax)
- Due to external installation of all aggregates there are no electrical or moving components installed in the tank itself.
- Insensitive to overload and underload
  - due to level control and intelligent electrical plant control
  - pollution loads due to increased biomass concentration
- Easy representative sampling directly at the control unit
- Compact, space-saving, sturdy stainless steel design
- Ready to plug in unit for quick and easy installation and start-up

Fields of application

- The optimal solution for sensitive discharge areas
  - Carst areas
  - Water catchment areas
  - Water protection areas
  - Sensitive receiving water bodies
  - Areas without receiving water bodies or soil without infiltration capacity
- Irrigation or toilet flushing
- Reuse of clarified wastewater saves potable water.

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HUBER MembraneClearBox®

What is the German Design Certificate?

- Minimum product and performance standards
- Similar to the NSF Standard 40 in the US
- European Norm EN 12566 Part 3
- 38 weeks of standardized performance testing
- Individual treatment plants up to 50 persons

German Design Certificate

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German Performance Classification Classes

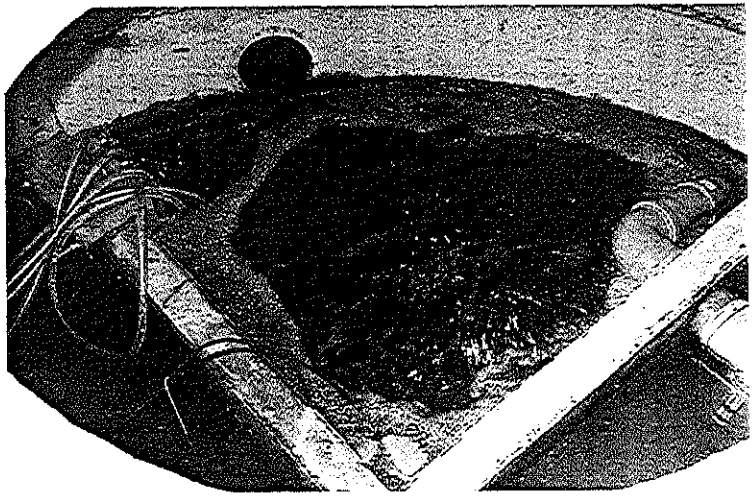
Class	COD [mg/L]	BOD_5 [mg/L]	NH_4-N [mg/L]	TIN [mg/L]	Fecal Coliform [CFU/100mL]	TP [mg/L]	TSS [mg/L]
C	150*/100**	40*/25**					75*
N	90*/75**	20*/15**	10**				50*
D	90*/75**	20*/15**	10**	25**			50*
+H					100*		
+P						2**	

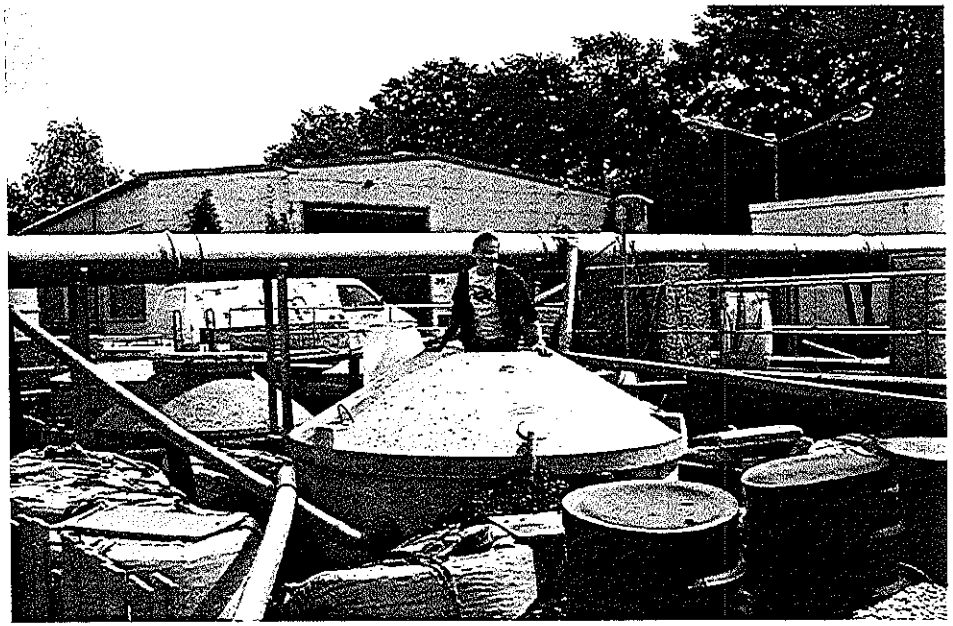
*Grab sample; **24-hr composite sample

German Design Certificate

PIA Test Field in Aachen, Germany

- 1,690 gallon (6.4 m^3) concrete tank
- 3 compartments
- MCB unit installed in last compartment





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Testing Schedule According to EN 12566 Part 3

Load Type	Period
Nominal load (100%)	5 weeks
Low load (50%)	2 weeks
Nominal load (100%) with power failure (24-hr)	6 weeks
High load (150%)	2 weeks
Vacation condition	2 weeks
Nominal load (100%)	5 weeks
Low load (50%)	2 weeks
Nominal load (100%) with power failure (24-hr)	6 weeks
Nominal load (100%)	8 weeks
	38 weeks

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System Performance and Limit for Class D+H

Parameter	Units	Limit	Average	
BOD_5	mg/L	< 15	2	(a)
COD	mg/L	< 75	24	(a)
NH_4-N	mg/L	< 10	5	(a)
TIN	mg/L	< 25	24*	(a)
TSS	mg/L	50	2	(b)
Fecal Coliform	CFU/100mL	<100	46**	(b)

** values with wastewater temperature in bioreactor > 12°C; ** geometric mean*
(a) 24-hr composite samples, (b) grab sample)

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Average Treatment Efficiencies

Parameter	Efficiency
COD	95.9 %
BOD_5	99.1 %
NH_4-N	81.9 %
TP	46.1 %
TSS	99.3 %
Fecal Coliform	99.9 %

European Norm vs. NSF Standard 40

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Parameter	EN 12566	NSF
Flow capacity	4-50 PE - 600-7,500 L/d	1,514 - 5,678 L/d (400-1,500 gpd)
Test duration	38 weeks	26 weeks
Classes	C, N, **D, +H**,+P 15/50/25/100 (BOD/TSS/TIN/Fecal)	Class 1: 25/30 (BOD/TSS) Class 2: <60/100 for 90% of samples
Influent loading	BOD 109-390, avg. 218 (PIA) TSS 210-738, avg. 286 (PIA)	BOD 100-300 TSS 100-350
Test protocol- Stress tests	5 wk design 2 wk low load 6 wk design with power failure 2 wk high load 2 wk vacation 5 wk design 2 wk low 14 wk design with power failure	16 wk of design loading 7.5 wk of stress loading 2.5 wk of design loading Stress tests include: 3 wash days within 5 day period Working parent, 5 days Power failure, 48h Vacation, 10 days
Parameters sampled	BOD, COD, TSS, Ammonia, TIN, TP, Turbidity, Fecal Coliform, pH	BOD, CBOD, TSS, pH