

CLEWER[®]

CLEAN WATER

Clewer R-4000

ROTATING BED BIOFILM REACTOR

Technical data sheet

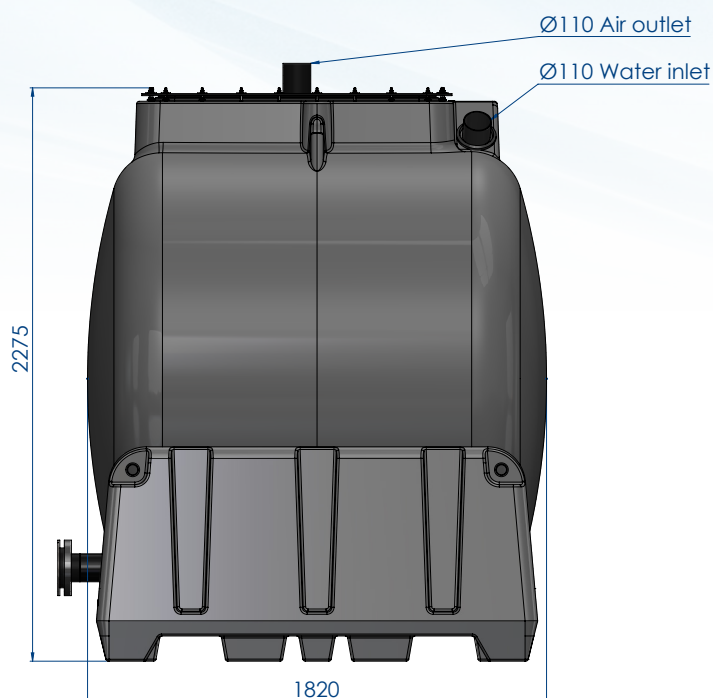
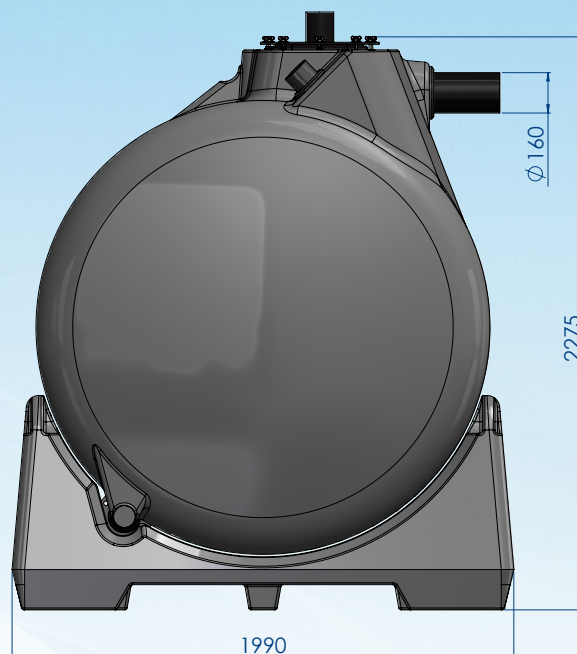


1. Rotating Bed Biofilm Reactor (RBBR)

The keystone of all Clewer applications is the patented rotating bed biofilm reactor (RBBR). Bioreactor's operating principle is utilising centrifugal forces in growing biofilm on polyethylene carrier elements. The carrier elements are slightly denser than water. The standard filling fraction of carrier elements in the RBBR is 76 %, which provides a large surface for microbial biofilm.

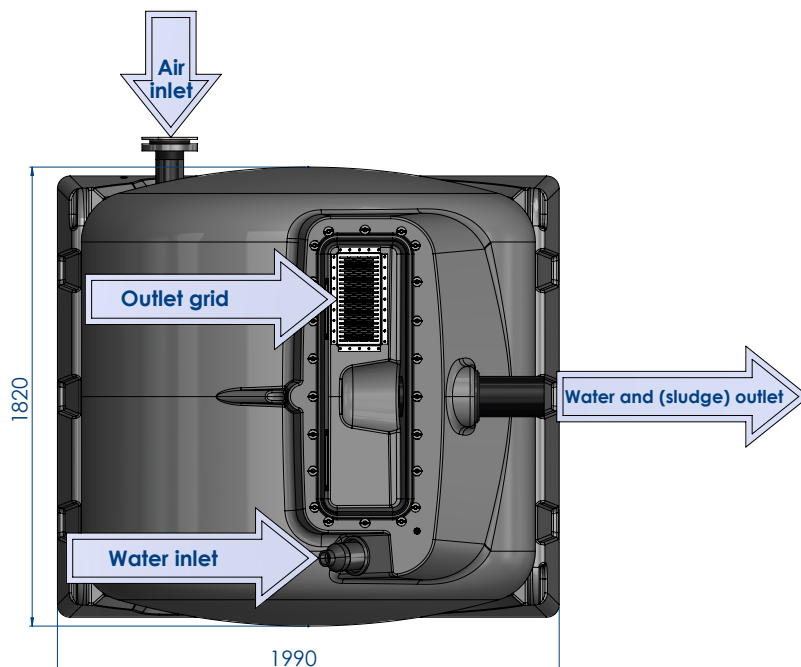


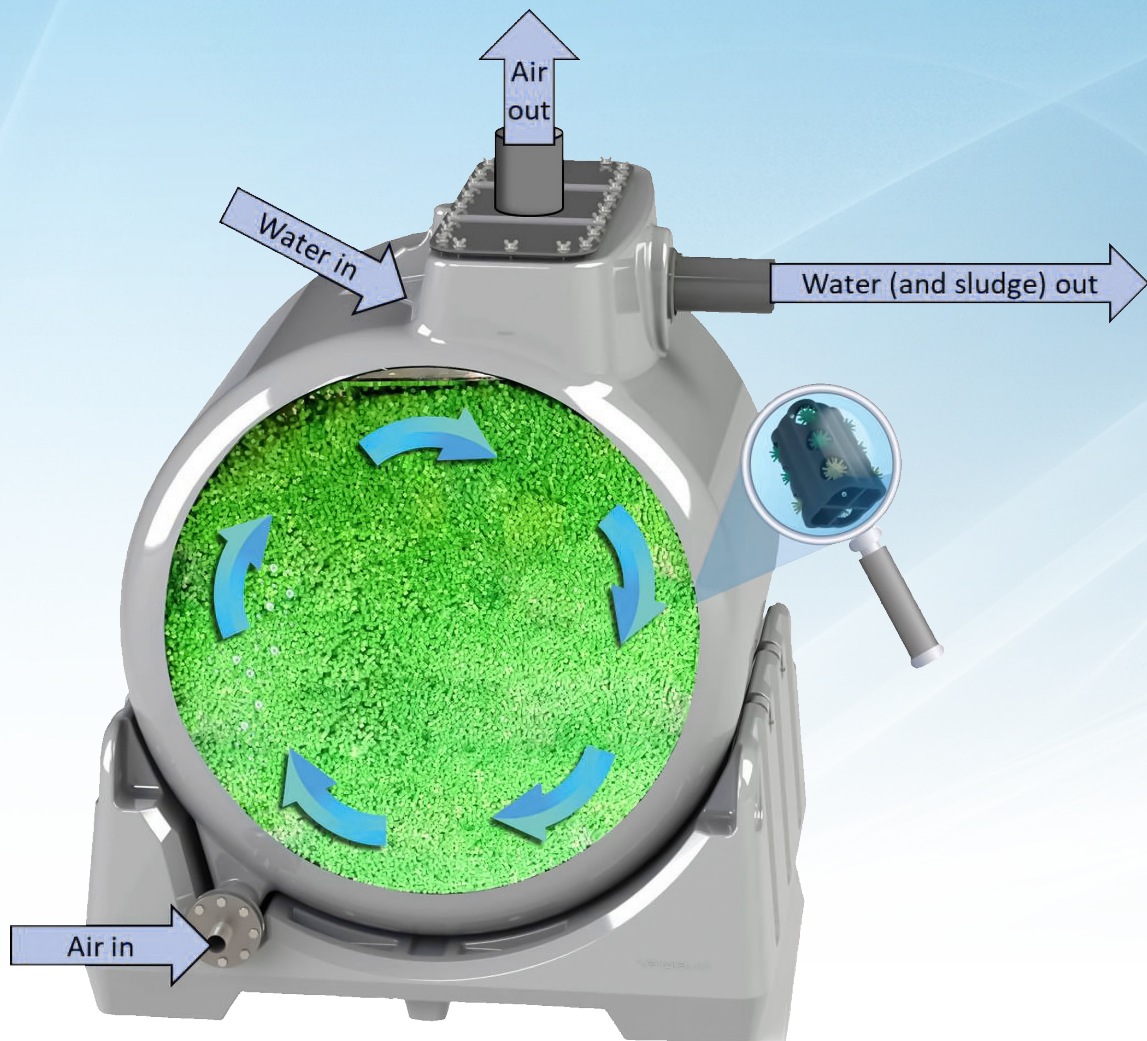
Clewer R-4000 bioreactor and carrier elements with biofilm.



2. Connections

Top view of RBBR bioreactor inlet and outlet pipes and outlet grid





Operating principle
of RBBR bioreactor

3. Principle of Aeration in RBBR

Air is blown in the RBBR through an aeration pipe located at approx. 5 o'clock at the bottom of the reactor. Aeration drives the carrier and water mass into a rotation movement. The carrier, rotating inside a reactor, passes through the air bubbles and captures them. As a result, part of the air bubbles remains to rotate together with the carrier. This creates the conditions for better oxygenation.

4. Technical Data

Weight without water 900 kg
Weight with water 4550 kg
Acceptable amount of air 500 l/min - 2000 l/min
R4000 volume 4,1 m³

Carrier filling rate 77 %
Carrier material recycled HDPE
Carrier total surface area 900 m² / m³
Carrier effective surface area 650 m² / m³
Amount of carrier 3160 l

Clewer R-4000 Rotating Bed Biofilm Reactor

- Treatment efficiency examples

1 pc Clewer R-4000 Rotating Bed Biofilm Reactor (RBBR) can biologically treat a domestic sewage load and meet the effluent requirements presented in the following tables.

NOTE: R-4000 RBBR is only a biological treatment unit. Meeting the effluent requirements requires also applicable physical-chemical operations such as coagulant/flocculant addition followed by dissolved air flotation (DAF), lamella clarifier, or other applicable technology.

PERFORMANCE OF R-4000 RBBR

Water flow $\leq 20 \text{ m}^3/\text{h}$ (HRT $\geq 12 \text{ min}$)

Water influent temperature 6 - 45°C

Parameters	Removal		Effluent concentration
	kg/d	%	mg/L
BIOLOGICAL OXYGEN DEMAND(BOD ₅)	7 - 32	90 - 97	4 - 15
AMMONIUM NITROGEN (NH ₄ -N)	0,7 – 2,1	90 - 99	0,1 - 6

MUNICIPAL WASTEWATER

BOD removal example

WASTEWATER TYPE	MUNICIPAL SEWAGE			
WASTEWATER FLOW	25 m ³ /d			
PEOPLE EQUIVALENT ⁽¹⁾	110			
INFLUENT TEMPERATURE	14°C			
WASTEWATER PARAMETERS	Influent load	Influent concentration	Effluent concentration	Removal
	(kg/d)	(mg/L)	(mg/L)	(%)
BIOLOGICAL OXYGEN DEMAND (BOD ₅)	5,5	220	7	97

BOD removal & nitrification example

WASTEWATER TYPE	MUNICIPAL SEWAGE			
WASTEWATER FLOW	17,5 m ³ /d			
PEOPLE EQUIVALENT ⁽¹⁾	70			
INFLUENT TEMPERATURE	15-20°C			
WASTEWATER PARAMETERS	Influent load	Influent concentration	Effluent concentration	Removal
	(kg/d)	(mg/L)	(mg/L)	(%)
BIOLOGICAL OXYGEN DEMAND (BOD ₅)	3,5	200	6	97
AMMONIUM NITROGEN (NH ₄ -N)	0,98	56	3	95

1) People equivalent calculated according to Finnish Government Decree 157/2017 (BOD7-50 g/p/d, Ntot-14 g/p/d, water consumption 120 l/p/d)