



Fixed bed biological reactor (FBBR)

A plug and play, modular, expandable, cascaded FBBR module that can be used for municipal and industrial wastewater treatment

The ClearFox® fixed-bed bio modules are fully equipped bioreactors in a high-quality PE tank. All equipment, such as aeration system, distribution systems as well as the fixed bed material in a cubic tank are part of the pre-installed standard equipment of the high-performance bioreactors. The typical application is the reduction of carbon and/or nitrogen concentrations from any type of pre-treated (solids removed) wastewater of industrial or municipal source.

The tank is manufactured from one piece of highly resistant polyethylene by the seamless rotational moulding process. The modules are designed for installation in the customer's tank (concrete chambers, steel frame systems) or HC sea containers (i.e. ClearFox® container modules). The interfaces to the customer are designed for quick and easy installation on site.

Multiple modules can be connected in series; for parallel installation. The scope of delivery includes a blower and an air distributor, which is matched to the number of units and the type of connection.

Screened wastewater ($\leq 3\text{mm}$) must be provided by the customer. A lamella clarifier is recommended after the modules to reduce TSS. Depending on the customer's requirements (influent concentration, wastewater demand, carbon and/or nitrogen removal), different biocarriers are used in the modules.

The design is carried out according to the DWA guidelines, the cleaning performance is confirmed in field tests by external wastewater institutes. **Test reports and certificates on statics, performance, origin, DWA guidelines are available on request.**





Prüfinstitut für Abwassertechnik GmbH

Prüfeinrichtung des Prüf- und Entwicklungsinstituts
für Abwassertechnik an der RWTH Aachen



Prüfinstitut für
Abwassertechnik
GmbH

**Prüfbericht über die
Reinigungsleistung der modularen
Container-Kläranlage**

Clearfox-Festbett-Container

PPU Umwelttechnik GmbH

Prüfbericht-Nr. PIA2017-1510-1056

Aachen, im Juni 2017

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Advantages of the ClearFox[®] FBBR modules:

- Quick commissioning, cost savings during installation, low space requirement
- Flexible with underload and overload
- Modular system, adaptable to any application
- Both industrial and municipal wastewater
- High performance with high quality, Made in Germany
- Stable and very robust process technology
- Low OPEX and simple, automatic operation

Technical Data:

| | ½ – FBBR-Module: | 1 – FBBR-Module: |
|------------------------------------|------------------------------|------------------------------|
| Dimensions: (l, w, h) / module [m] | 1,35 x 2,10 x 2,57 | 2,74 x 2,10 x 2,57 |
| Space requirement: | 33% of a 20 ft. HC Container | 50% of a 20 ft. HC Container |
| max. transport weight: | 350 kg | 650 kg |
| max. operating weight: | 7.800 kg (water-filled) | 15.000 kg (water-filled) |
| Area: [m ²] | 2,80 | 5,75 |
| Manhole opening: | 60 cm x 60 cm | 60 cm x 60 cm |
| Connected load Fan (outlet C) | 1.000 Watt | 1.350 Watt |
| Connected load Fan (drain N) | 1.200 Watt | 1.500 Watt |
| Inlet: DN / height: | DN 100 / 2,45 m | |
| Drain: DN / Height: | DN 100 / 2,40m | |
| Ventilation system: | DN 75 (Connection DN 50) | |

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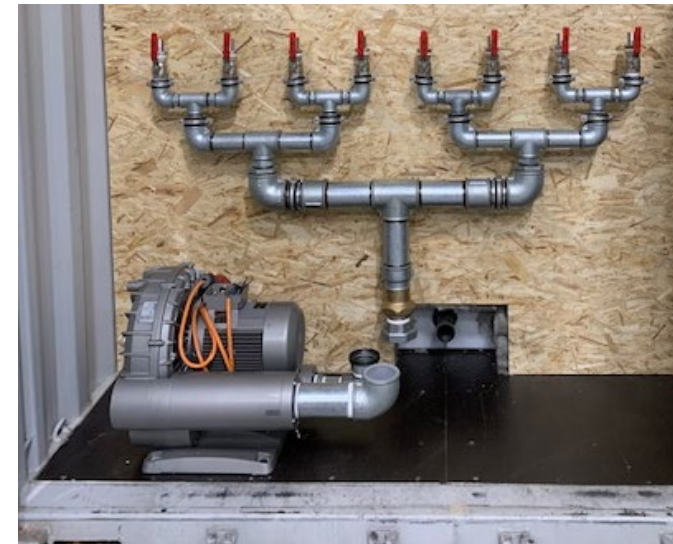
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Technical dismantling capacity per module at 20 hours:

| | Max. flow rate [m ³ /hr] | | | | Removal rate per day [kg] | | | | Biologically usable surface area [m ² /m ³]. Cascaded: |
|------------------------------------|--|----------------------|----------------------|----------------------|---------------------------|----------------------|---------------------|----------|---|
| | Single | Stakes (Parallel) | Inserts (Series) | | Single | Stakes (Parallel) | Inserts (Series) | | |
| Number of modules | ½ | 1 | 1 | 2 | 1 | 2 | 1 | 2 | |
| Carbon reduction (COD) | 1 m ³ /hr | 2 m ³ /hr | 2 m ³ /hr | 5 m ³ /hr | 40 kg/d | 80 kg/d | 40 kg/d | 100 kg/d | 100-150-200 |
| Nitrification (NH ₄ -N) | 1 m ³ /hr | 2 m ³ /hr | 2 m ³ /hr | 5 m ³ /hr | 8 kg/d | 16 kg/d | 8 kg/d | 20 kg/d | 150-300 |

The specific surface area of the fixed bed material depends on the concentration of the influent. Degradation is calculated for municipal/domestic concentrations; higher concentrations, as in industrial applications, result in higher performance rates. Plants in series operate at a higher treatment efficiency, resulting in a higher degradation rate per day.

Nitrification requires COD reduction in advance. It must be ensured that after each reactor the TSS is reduced by a secondary treatment unit.



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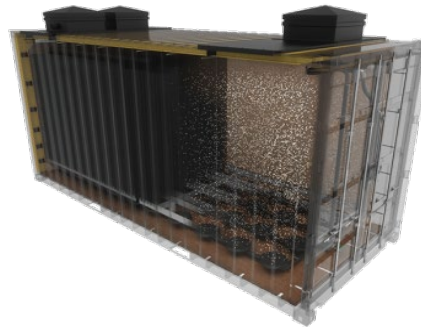
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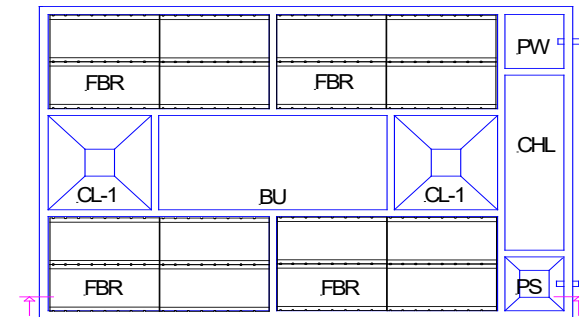
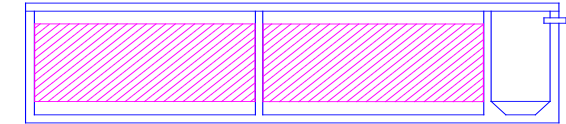
Application:



Installation of the bio module in a sea container



3D model of a sea container equipped with two FBBR modules



Treatment plant 8,000 p.e. in concrete with FBBR modules

PPU version: 20 feet or 40 feet HighCube sea container

PPU Umwelttechnik GmbH installs 2 or 4 FBBR modules in a reinforced ISO container. The bio-modules are connected in series or parallel. The container has ready-mounted flanges In/Out DNI100, height = 2.45 m/2.40m. With CSC approvals they can be exported by sea anywhere in the world.

When connected in series, first bio-module corresponds to cascade no. 1. The second bio-module includes cascades 2 and 3. The sea container is equipped with an air distributor for all 3 cascades, both for individual aeration and backwash. One container is equipped with 3 access openings 600x600 mm with extensions, lids and a foam outlet pipe. Optionally, an automatic backwash can also be realised.

This design makes the container a plug & play system.