container.blue®

The intelligent mobile wastewater treatment solution

No mechanical parts
in the wastewater

No pumps
in the wastewater

No electrical parts
in the wastewater

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GRAF - solutions for global challenges

GRAF headquarters

Pure, clean water is one of our most important resources. GRAF develops, manufactures and markets an extensive range of products for water management. GRAF provides solutions to global challenges, such as protecting watercourses or preventing flooding.

GRAF has over 50 years of experience in the development and manufacturing of high-quality plastic products. The company launched its first rainwater barrels in 1974 with the slogan „Rainwater is free“ and soon started marketing other rainwater harvesting products too. GRAF's innovative and user-friendly water management solutions have since made the company a leading system vendor in Europe.

GRAF products are exported to more than 70 countries around the world. Despite being highly active abroad, GRAF is also continually investing in its factories at Teningen (Germany) and Dachstein (France).

Just as the GRAF wastewater tank is a state-of-the-art product, for over 10 years the KLARO brand has been synonymous with reliable wastewater treatment technology. KLARO, the European market leader in SBR wastewater treatment systems with pneumatic lifting technology, has been a member of the GRAF group since 2014. Every GRAF wastewater product therefore benefits from the experience gained from over half a million satisfied wastewater customers and the quality of two established brands in decentralised wastewater treatment.

*container.*blue assembly in Bayreuth

1. General information

1.1. *container*.blue®

container.blue® is a mobile sewage plant in a standard 20 ft container. It is engineered and constructed for temporary operations and easy to set-up and take-down again. container.blue® systems are installed in many countries in a range of operating conditions in industries like mining and tourism as well as remote villages.

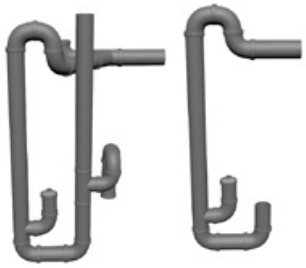
- Easy to transport (standard 20 ft container)
- Pre-engineered and modularized design
- Quick set-up and take-down (plug-and-play)
- Low power use (1.2 kWh per treated 1,000 l)
- Designed to treat to 10,000 l per day
- Parallel connection possible for bigger amounts of wastewater

1.2. Fields of Application

*container.*blue® are suitable for all temporary operations, but can be also used as a constant wastewater treatment plant.

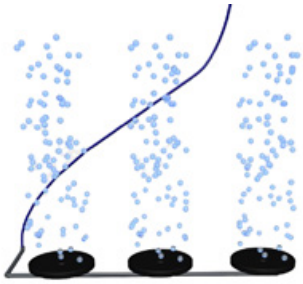
- Working camps
- Tourist camps
- Mining camps
- Military camps
- Quarries
- Logging camps
- Mobile roadworks
- Research camps
- etc.

1.3. Components



Air lifter

The clearwater lifter is used to transport the purified water along with a charging lifter used to transport wastewater and finally a sludge lifter to transport sludgy water.

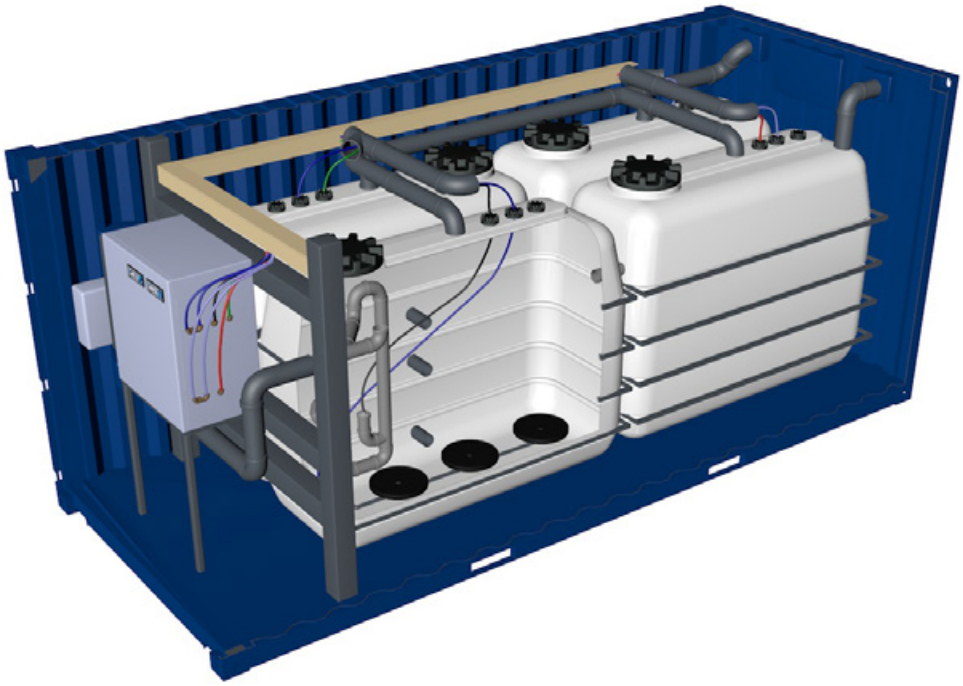


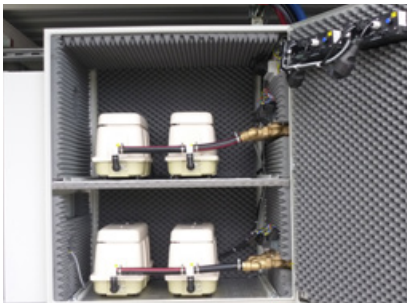
Aerator unit

Each of the four containers has an aeration unit consisting of three round membrane diffusors for fine bubble aeration.

Tanks

Four tanks of high-quality plastics (HD-PE) with a specific volume of 4,000 litres each are accommodated in the system. The material used is light, robust and resistant against all wastewater substances.





Switch cabinet

The centrepiece of the system is the metal switch cabinet in the front area of the system. It accommodates all required electromechanic components (controls, compressors and valves).

1.4. Additional components

UV disinfection

For sensitive zones with high requirements in terms of environmental protection, an additional UV module can be installed. For clear water extraction, the outflow water is intensively irradiated with UV light. This inactivates the resulting bacteria which die off within a few seconds.

WebMonitor®

Data remote surveillance enables the documentation of relevant parameters as well as the transmission of fault and status messages via SMS or e-mail. It is also possible to control the system via the surveillance portal. For the WebMonitor® an additional modem is installed in the container.blue®.

Phosphate precipitation

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Tertiary Filtration

An additional filtration unit for enhanced suspended solids removal can be integrated as tertiary treatment. The patented system is self-cleaning, fully automatic and maintenance-free. Effluent filtration is appropriate prior to any disinfection or reuse purposes.

Sludge dewatering

Excess sludge in the container.blue must be removed regularly from the system. The liquid activated sludge can be dewatered and dried onsite with the sludge dewatering unit and subsequently disposed in the dry state. The reduction in volume and mass of up to 95% saves money for disposal and enables the transport from remote sites.

Pumping Unit

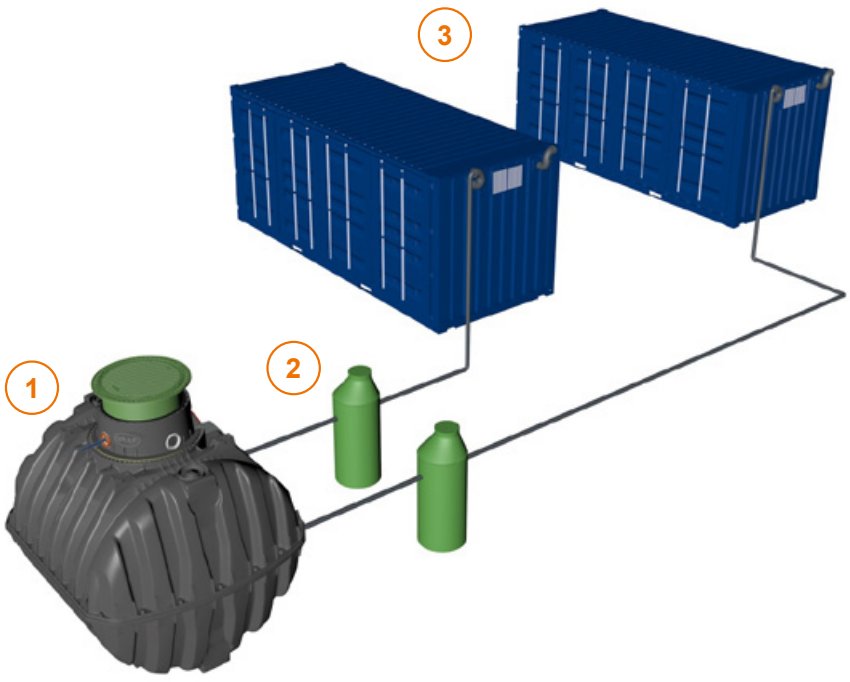
Extraction of excess sludge as well as flucculant dosing and mixing is done easily with the pumping unit within the sewage treatment plant's regular maintenance.

Filtration Unit

Dewatering and drying of the flocculated sludge finds place in the filtration unit. After filtering off the sludge it is covered and vented until the next maintenance service.

1.5. Parallel connection

For the treatment of larger wastewater volumes, two or more container.blue® systems are required. In such a case, the identically equipped systems are installed so as to operate in parallel. The systems operated in parallel are steadily fed with raw wastewater via a joint wastewater collection tank (1) and pump stations (2) (integrated in the wastewater collection tank or via external pump stations). This way, the irregular afflux may be balanced out and distributed equally to the systems. In the systems (3), the distributed wastewater is then treated via the innovative, modified SBR procedure before it is drained into receiving water (stream, river or lake).



1.6. References

Australia

Near the city Weipa in North Queensland, Australia, a container. blue® is used to purify the wastewater of a bauxite mine. It also cleans the wastewater from workers‘ accommodation.

Oman

A container wastewater treatment system is also in use in a factory in Oman. In this location, the system is exposed to high temperatures which are successfully counterbalanced by the integrated cooling system. This means that operation is not affected.

Norway

Ny-Ålesund is the northernmost settlement in the world and is located in Svalbard, Norway. Sewerage was discharged directly into an adjacent fjord up to now, which also affected the sensitive sensors of the local marine laboratory. To counteract this, a decision was made some time ago to install a container wastewater treatment plant. The plant has a capacity of 10,000 litres a day and is therefore designed for a population of up to 200 people, but there are far fewer researchers and staff in Ny-Ålesund in the winter months.

2. Technical information

The containerized aerobic wastewater treatment system (**AWTS**) is designed for the discharge of the entire domestic wastewater. The discharge of other wastewater, e.g. the wastewater from restaurants and/or industrial enterprises etc., is only permitted when this was already known and considered when designing the plant.

Biocides, toxic or biologically incompatible substances must not enter the plant; since they impede the bacteria important for the wastewater treatment and cause biological process problems (more detailed information is provided on the following pages).

The main source of effluent is wastewater resulting from

- Toilets
- Canteens
- Washrooms

The treated effluent is fit for direct irrigation.

The scope of work includes:

- Detail design and drawings
- Coordination during installation and commissioning

2.1. Plant specifications

Plant		20 ft side door container Containerized AWTS configuration
Material		Steel
Weight (tare)		3,180 kg
Dimensions (external)	Length	6,058 mm
	Width	2,438 mm
	Height	2,591 mm
Rear door opening	Width	2,144 mm
	Height	2,169 mm
Side door opening	Width	5,702 mm
	Height	2,154 mm
Capacity		31 cu.m
Inlet		Sewer pipe connection Ø 110 mm, Back side of rear door, External level: 2,310 mm
Outlet		Sewer pipe connection Ø 110 mm, Back side of side door, External level: 1,074 mm
Ventilation tanks		Sewer pipe connection Ø 110 mm, Back side of rear door, External level: 2,310 mm
Rated operational voltage		400 V, 50 Hz (60 Hz)
Rated connector current		32 A
Operating temperature range		-10°C … +35°C
Residual current Device RCD		25 / 0.03 A
Power consumption		12 kWh/d

2.2. Design criteria

The containerized AWTS is designed on the basis of local wastewater treatment guidelines. When designing the containerized AWTS, hydraulic as well as organic loadings have to be fixed as raw data for design. The components/assemblies of the AWTS are then sized in accordance to these demands.

Basic data on raw wastewater

The plant is designed for the following raw wastewater characteristics:

Total Suspended Solids TSS	150 – 400 mg/l
BOD_5	150 – 500 mg/l
COD	300 – 1,000 mg/l
pH	7.5 – 8.5
TN	20 – 80 mg/l
TP	6 – 25 mg/l

Flow rate pattern

The plant is designed for maximum wastewater flow of 10 m³/d (KLD):

Total flow (maximum)	10 m³ per day (for approx. 55 persons)
Operating hours	24 h
Flow rate	0.42 m³ per hour
Mode	Automatic

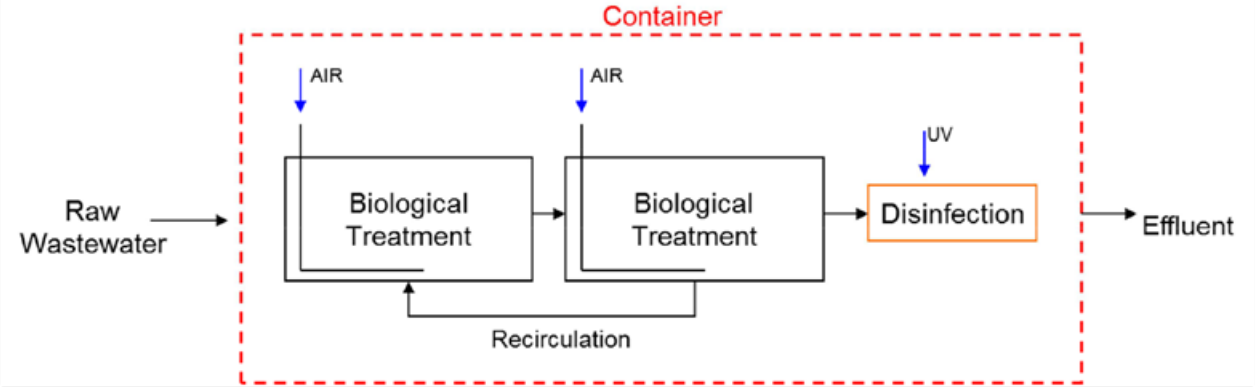
Treated wastewater quality

The treated effluent quality shall be within the following values for various parameters:

pH	7.0 – 8.0
TSS	< 30 mg/l
BOD_5	< 10 mg/l
COD	< 120 mg/l
NH_4-N	< 10 mg/l
TP	< 20 mg/l
E. coli	< 100 cfu
Enterococci	< 100 cfu

2.3. Function of the containerized wastewater treatment system

The containerized AWTS is a fully biological wastewater treatment plant that works according to the principle of the two-stage SBR process (activated sludge plant in the impoundment method).
Based on the raw wastewater characteristic following wastewater treatment steps within one cycle are carried out:



① The raw wastewater enters the container by passing through a distributor and optionally a screening unit for gross solids removal.

② In the container the wastewater is treated biological by a SBR (Sequencing Batch Reactor) procedure, which is elaborated as a two-stage aerobic wastewater treatment system AWTS.

③ The first biological treatment stage (tank 1 + 2) serves as an equalisation and buffer unit. Here the untreated flow is collected, aerated and mixed with the activated biomass. The aeration and mixing is provided with fine pore disc diffusers.

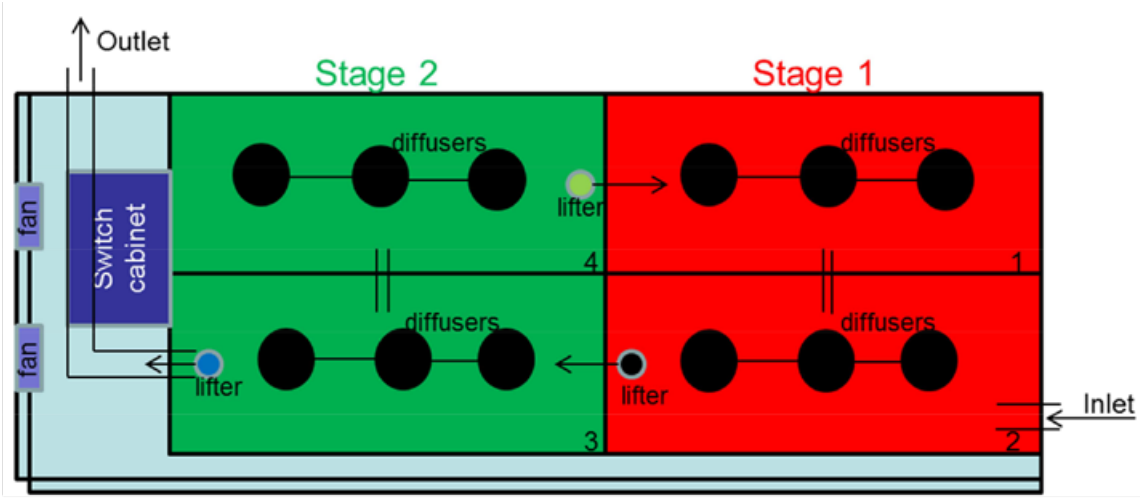
④ After the separation of the activated biomass and pre-clarified wastewater the temporally buffered flow is discharged into the second biological treatment stage using an air-lifting unit.

⑤ The second stage (tank 3 + 4) is the final aerobic wastewater treatment unit, which comprises fine disc diffusers as well.

⑥ From the second stage the excess biomass is recirculated back to the first stage. The necessary biomass retained in the stage for the next treatment cycles.

⑦ Finally the clarified water is discharged out of the second stage after a final separation step passing through a disinfection unit.

⑧ The disinfection unit is an UV-reactor, which comprises 3 UV-lights for proper radiation of the effluent.



Plan view of containerized AWTS

After these work steps has been completed, the treatment procedure can start again with work step 1.
The frequency range is normally between three and four cycles per day. An individual adjustment of the switching times and the cycle number is possible after consultation with manufacturer. This adjustment may only be carried out by an authorised specialised maintenance company. In addition to this, it is possible to manually switch the plant into the vacation mode. The vacation mode is a significantly reduced operation of the plant during longer periods of time without inflowing wastewater.

Important: All tanks have to be vented. This is normally performed by the wastewater line vented via the exhaust opening on back of the container. If required, additional ventilation lines or ventilation openings must be installed. In doing so, the ventilation lines must be positioned in such a manner that natural ventilation is possible (chimney effect).

Flow rate pattern

The containerized AWTS overall operation consists of the following devices:

- Collection tank for inflow equalisation (optionally).
- Pumping station(s) for feeding the containerized AWTS (must be provided by the customer).
- Containerized AWTS(s) for wastewater treatment system.
- Effluent tank(s) for storage of treated water (optionally).

The entire sewage treatment unit is carried out in a parallel connection mode. In each containerized AWTS wastewater is treated in the same way. The number of parallel connected containerized AWT systems is variable.

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