PureBallast 3.0

Ballast water treatment system

PureBallast 1000 system

PureBallast 3.0 effectively neutralizes organisms in ballast water.

System description

PureBallast 3.0 is a highly compact and energy-efficient ballast water treatment system. Operating without chemicals, it uses an enhanced form of UV treatment to reduce organisms in ballast water to IMO and USCG limits.

The modular system accommodates a wide range of ballast water capacities and is competitive throughout the flow range up to 6000 m^3/h. Individual PureBallast 3.0 reactors handle 300, 600 or 1000 m^3/h and are connected in parallel up to 3000 m^3/h, after which dual systems are used.

- Treatment of water with UV transmittance as low as 42%
- No salinity or temperature limitations
- Chemical-free operation
- Automatic power regulation
- Easy and flexible installation
- High-grade materials for long life
- Worldwide service backing

System features and benefits

• *No usage limitations*

PureBallast is tested and approved for use with fresh water, brackish water and seawater. The system has no salinity limitations and its performance is not affected by temperature. The system is approved for full-flow operation down to a UV transmittance as low as 42%. All this ensures that the system will perform and can be used when needed.

• *Chemical-free operation*

PureBallast 3.0 meets biological treatment requirements regardless of water salinity and without the addition or generation of chemicals. The system's operation does not pose risks to the environment or the crew, nor does it influence corrosion in the ballast water system.

Moreover, the avoidance of chemicals eliminates the expensive and time-consuming logistics of dealing with high volumes of consumables, both on board and on shore.

• *Energy efficiency*

Through extensive research and CFD (computational fluid dynamics) modelling, the components and flow of the PureBallast 3.0 reactor have been optimized for maximum biological effect. Operation at full power consumes just 100 kW per 1000 m^3/h.

Further energy is saved by an automatic "dimming" function, which lowers the power consumption to the exact level needed for type-approved treatment. Dimming of up to 50% is possible in the right conditions.

• *Easy and flexible installation*

PureBallast 3.0 is modular and designed to fit between existing pipes. Reactors are now available in 300, 600 and 1000 m^3/h capacities, and in most cases this leads to a greatly reduced number of units compared to previous versions of the system. That means a small footprint, little pipework and low complexity, which in turn means cheaper and easier installation.

The free placement of lamp drive cabinets within 150 m creates additional flexibility, especially in the design of EX systems, where they are placed safely outside the hazardous zone.

• *High-grade materials*

The AOT reactor is made of a high-alloy austenitic stainless steel that has been specially developed for seawater applications. This minimizes the risk of corrosion and ensures a long service life.

• *Worldwide support from a leading supplier*

Alfa Laval is a truly global supplier and an experienced partner in the area of ballast water treatment. Shipyards can expect clear and thorough documentation, as well as expert consultation. Ship owners and ship operators can rely on a knowledgeable organization providing support and a broad range of services that extend equipment lifetime.

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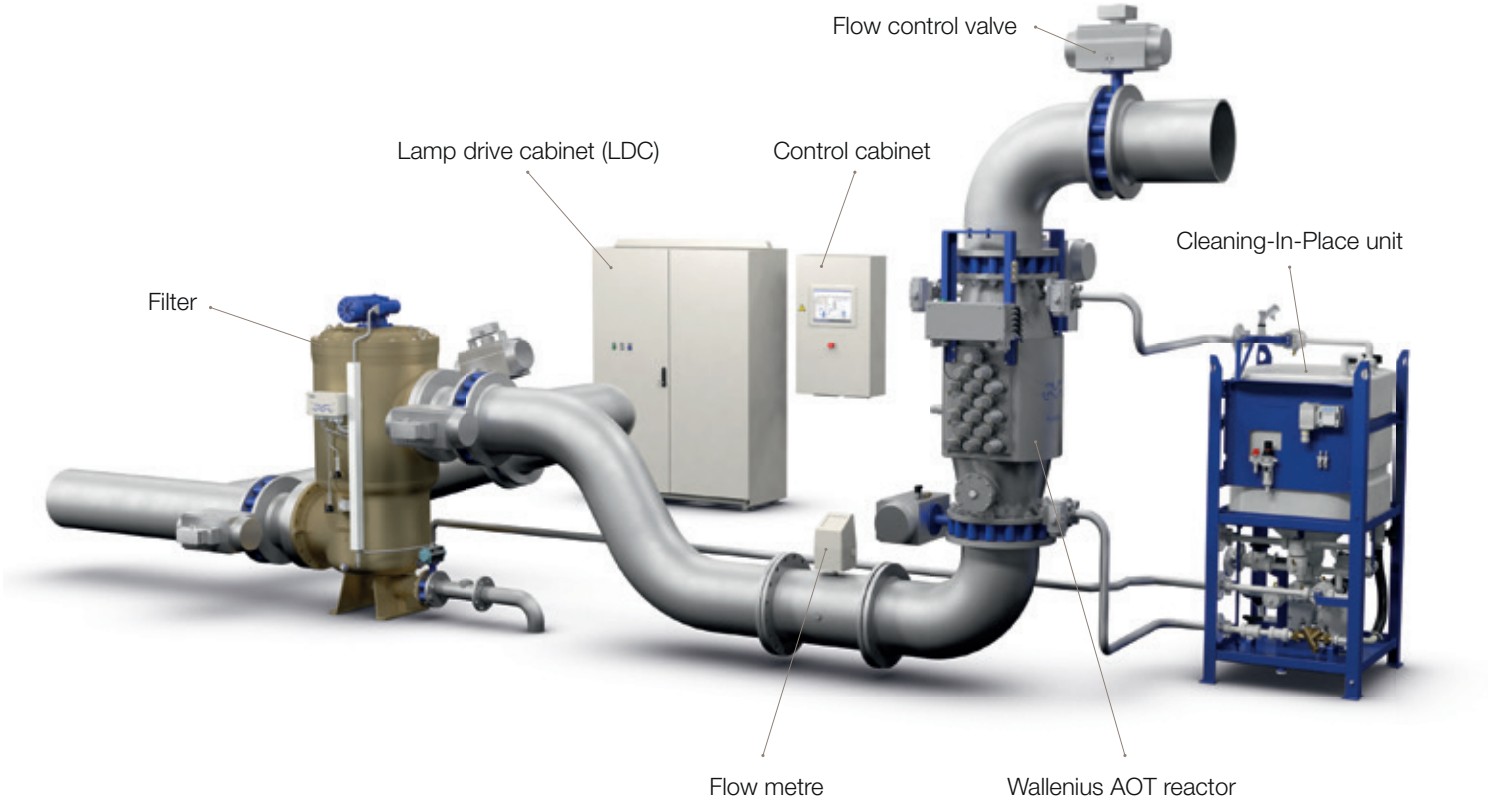

System components
The PureBallast 3.0 scope of supply includes everything needed to construct a complete ballast water treatment system with the exception of pipes and cables.

• *Wallenius AOT reactor(s)*
Depending on the system flow rate, one or more Wallenius AOT reactors comprise the enhanced UV treatment stage of PureBallast 3.0. Reactor capacities of 300, 600 and 1000 m^3/h are available. The reactors are connected in parallel up to a flow rate of 3000 m^3/h, after which dual systems are used. Reactors are constructed with SMO254, which has a significantly higher corrosion resistance than 316L.

• *Lamp drive cabinet(s)*
Each Wallenius AOT reactor is associated with a lamp drive cabinet, which supplies power to the UV lamps. In PureBallast 3.0, the lamp drive cabinet is separate from the reactor and may be placed up to 150 m away. This saves space in the engine room and simplifies the design of EX systems.

• *Hydac filter*
A 50 µm filter is used during ballasting operations to block the intake of larger organisms and reduce sediment in the ballast water tanks. (During deballasting the filter is bypassed.) The filter is cleaned via automatic backflushing using only a small part of the system flow.

• *Filtrex filter*
A compact Filtrex filter can be used as a high-performance alternative for seawater, brackish water and fresh water. The filter's fine mesh and excellent backflushing capabilities allow the system to treat water with UV transmittance as low as 42%.

• *Cleaning-In-Place (CIP) unit*
UV lamp performance is safeguarded by Cleaning-In-Place (CIP), in which a fully automatic cleaning cycle is performed after each ballasting or deballasting operation. This ensures better performance over time with less manual cleaning. The CIP unit circulates a reusable, non-toxic and biodegradable cleaning solution to remove the build-up of calcium chlorides and metal ions from the UV lamp sleeves. Such build-up decreases UV transmittance and cannot fully be removed by mechanical wipers, which are ineffective against metal ions. The gentle action of the low-pH fluid is also superior to manual cleaning, as it occurs with the reactor closed and avoids scratching of the lamp sleeve surface.

• *Control cabinet and control system*
The PureBallast 3.0 control cabinet features a graphical touchscreen interface that makes things easier for international crews. Operation is started and stopped at the touch of a button. The control system, which includes comprehensive alarm and safety functions, can be integrated with onboard automation systems via Modbus. This allows access to all functions through the vessel's Integrated Ship Control System. Additional control panels can be connected for easy operation in other areas, e.g. the cargo control room or bridge.

• *Auxiliary equipment*
The auxiliary equipment provided with PureBallast 3.0 includes the following:

- A flow meter that ensures operation within the certified flow rate and measures the amount of ballast taken in or discharged.
- Sampling points that allow evaluation of water quality.
- Five valves, including bypass valves for both the filter and the entire system. One valve is a control valve that ensures the maximum rated flow is never exceeded. All valves provide feedback to the control system to indicate the correct open/closed position.

Operating sequence

• *Ballasting*

In preparation for ballasting, the lamps of the Wallenius AOT reactors undergo a brief startup sequence, during which they are cooled by a flow of seawater.

When ballasting begins, the incoming ballast water first passes through the filter, which is designed to remove most organisms and particles larger than 50 µm. The water then continues through the reactors, which treat the water to established limits before it enters the ballast water tanks. The power used in this process is minimized by an automatic dimming function.

Once ballasting is complete, the reactors are cleaned via an automated Cleaning-In-Place (CIP) cycle, which takes around 15 minutes per reactor. This cycle can be initiated directly after ballasting and should be performed within 30 hours of a ballasting or deballasting operation. The reactors are automatically rinsed with fresh water before the CIP cycle begins and filled with fresh water upon its completion.

The filter is also filled with fresh water once ballasting is completed. Flushing with fresh water increases the lifetime of components and minimizes the maintenance needed.

• *Deballasting*

The deballasting process is essentially the same as the ballasting process. However, the filter is bypassed during deballasting since the water has already been filtered.

After leaving the ballast water tanks, the outgoing ballast water passes through the Wallenius AOT reactors to eliminate any regrowth of microorganisms that may have occurred in transit. Having thus been treated to the established limits, it is then discharged into the receiving water at the deballasting site.

The same startup and shutdown sequence, including CIP, is employed during both ballasting and deballasting, as is the dimming function.

Approvals

• *IMO type approval*

Formal IMO type approval for PureBallast 3.0 was granted by Det Norske Veritas on 14 February 2014. The tests forming the basis for DNV's decision were conducted at the DHI testing institute in Denmark.

• *USCG status*

The PureBallast 3.0 approval testing has been conducted according to both IMO and EPA ETV protocols, which means it lays the groundwork for future USCG approval. AMS approval has already been granted, and the target is for PureBallast 3.0 to be among the first systems approved by the USCG.

EX systems

PureBallast 3.0 greatly simplifies the design of EX systems. Because the lamp drive cabinets can be placed up to 150 m away from the reactors they serve, the power supply can easily be located outside the hazardous zone.

Certain safety features relevant to EX systems are incorporated into the standard PureBallast 3.0 design. For example, the reactor temperature and level sensors are connected via safety relays that bypass the PLC, which prevents their signals from being missed in the unlikely event of a PLC malfunction. PureBallast components are certified according to ATEX or IEC-EX (Zone 1, IIC and T4).

Operation

- Maintenance intervals:
  - Filter inspection once per year
  - Lamp replacement recommended after 3000 hours of operation
  - CIP fluid replacement once per year or when the pH value reaches 3.0
- The System Manual provides detailed information in electronic or printed format:
  - Installation instructions
  - Operating instructions
  - Alarms and fault finding
  - Service and spare parts
- Commissioning and technical services are available from all Alfa Laval offices to start up the system and to provide advice about operation and maintenance.
- Onboard training for the crew is available upon request.

Optional equipment

• *Remote control panels*

The main PureBallast control panel can be complemented with up to two remote control panels per system. This allows PureBallast to be started, stopped and monitored from any location on board.

• *Remote interface*

Modbus communication is possible between the main PureBallast control panel and the vessel's general control system. If connected in this way, PureBallast is run via a graphical user interface as part of the vessel's Integrated Ship Control System.

• *High-pressure system (10 bar)*

PureBallast 3.0 can be delivered for use with high-pressure ballast water pumps operating at 10 bar rather than 6 bar.

Capacity range
The system size of a PureBallast 3.0 system is determined by the capacity of the ballast water pumps it is used with.
An optimized configuration is achieved by matching a reactor setup and filter capacity to the desired ballast water flow.

Flow in m³/h	250	300	500	600	750	1000	1200	1500	2000	3000
Number of 300 m³/h reactors	1	1								
Number of 600 m³/h reactors			1	1			2			
Number of 1000 m³/h reactors					1	1		2	2	3

For flows in excess of 3000 m³/h, dual systems are installed. With this configuration strategy, PureBallast 3.0 is competitive over the entire flow range up to 6000 m³/h.

Technical data for main components
The system size of a PureBallast 3.0 system is determined by the capacity of the ballast water pumps it is used with.

Component	*Size (H×W×D) in mm incl. access area*	*Net/Dry weight*	*Volume*
Wallenius AOT reactor 300 m³/h	1300 × 700 × 2000	230 kg	80 L
Wallenius AOT reactor 600 m³/h	1400 × 900 × 2000	320 kg	100 L
Wallenius AOT reactor 1000 m³/h	1500 × 1000 × 2000	330 kg	190 L
Lamp drive cabinet 300 m³/h	2000 × 900 × 900	250 kg	
Lamp drive cabinet 600 m³/h	2000 × 1350 × 600	370 kg	
Lamp drive cabinet 1000 m³/h	2000 × 1350 × 600	400 kg	
CIP module	1800 × 1800 × 1800	155 kg	Max 250 L
Control cabinet	1100 × 650 × 900	50 kg	
Hydac filter 250 m³/h	1800 × 1020 × 1250	445 kg	95 L
Hydac filter 500 m³/h	2100 × 1270 × 1270	550 kg	160 L
Hydac filter 750 m³/h	2200 × 1380 × 1430	725 kg	304 L
Hydac filter 1000 m³/h	2200 × 1450 × 1580	880 kg	452 L
Hydac filter 1500 m³/h	2200 × 1610 × 1730	1190 kg	616 L
Hydac filter 2000 m³/h	2600 × 1710 × 2000	1355 kg	891 L
Hydac filter 3000 m³/h	2650 × 2520 × 1970	2560 kg	1489 L
Filtrex filter 250 m³/h	1500 × 850 × 1000	360 kg	61 L
Filtrex filter 300 m³/h	1700 × 900 × 1000	400 kg	82 L
Filtrex filter 500 m³/h	1800 × 1100 × 1100	620 kg	146 L
Filtrex filter 750 m³/h	2000 × 1400 × 1200	860 kg	241 L
Filtrex filter 1000 m³/h	2500 × 1500 × 1300	1020 kg	370 L

Power consumption 300 m³/h	17-33 kW
Power consumption 600 m³/h	32-63 kW
Power consumption 1000 m³/h	51-101 kW
Power	400 – 440 VAC, 50/60 Hz
System pressure drop	Max 0.8 bar
Working pressure	Max 6.0 bar (10.0 bar optional)

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Alfa Laval in brief

Alfa Laval is a leading global provider of specialized products and engineering solutions.

Our equipment, systems and services are dedicated to helping customers to optimize the performance of their processes. Time and time again.

We help our customers to heat, cool, separate and transport products such as oil, water, chemicals, beverages, foodstuffs, starch and pharmaceuticals.

Our worldwide organization works closely with customers in almost 100 countries to help them stay ahead.

How to contact Alfa Laval
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