



Alfa Laval PureBallast 3.1 (IMO)

Ballast water treatment system



600 m³/h system

Alfa Laval PureBallast 3.1 is an automated inline treatment system for the biological disinfection of ballast water. Operating without chemicals, it combines initial filtration with an enhanced form of UV treatment to remove organisms in accordance with stipulated limits.

The main component of the modular system is an enhanced UV reactor in which disinfection treatment occurs. The special design of the reactor's synthetic quartz lamp sleeves supports transmission of a broader wavelength spectrum, providing more UV light during disinfection. Combined with the reactor's internal design, this ensures optimal UV dosage and low energy consumption.

Application

PureBallast 3.1 is certified for ballast water treatment in all types of water: fresh, brackish and marine. Flows of 32–3000 m³/h can be accommodated by a standard system.

Due to its enhanced UV technology and power ramp-up capabilities, PureBallast 3.1 provides unmatched biological disinfection performance in low-clarity waters. Full-flow treatment is possible in waters where the UV transmittance is as low as 42 %.

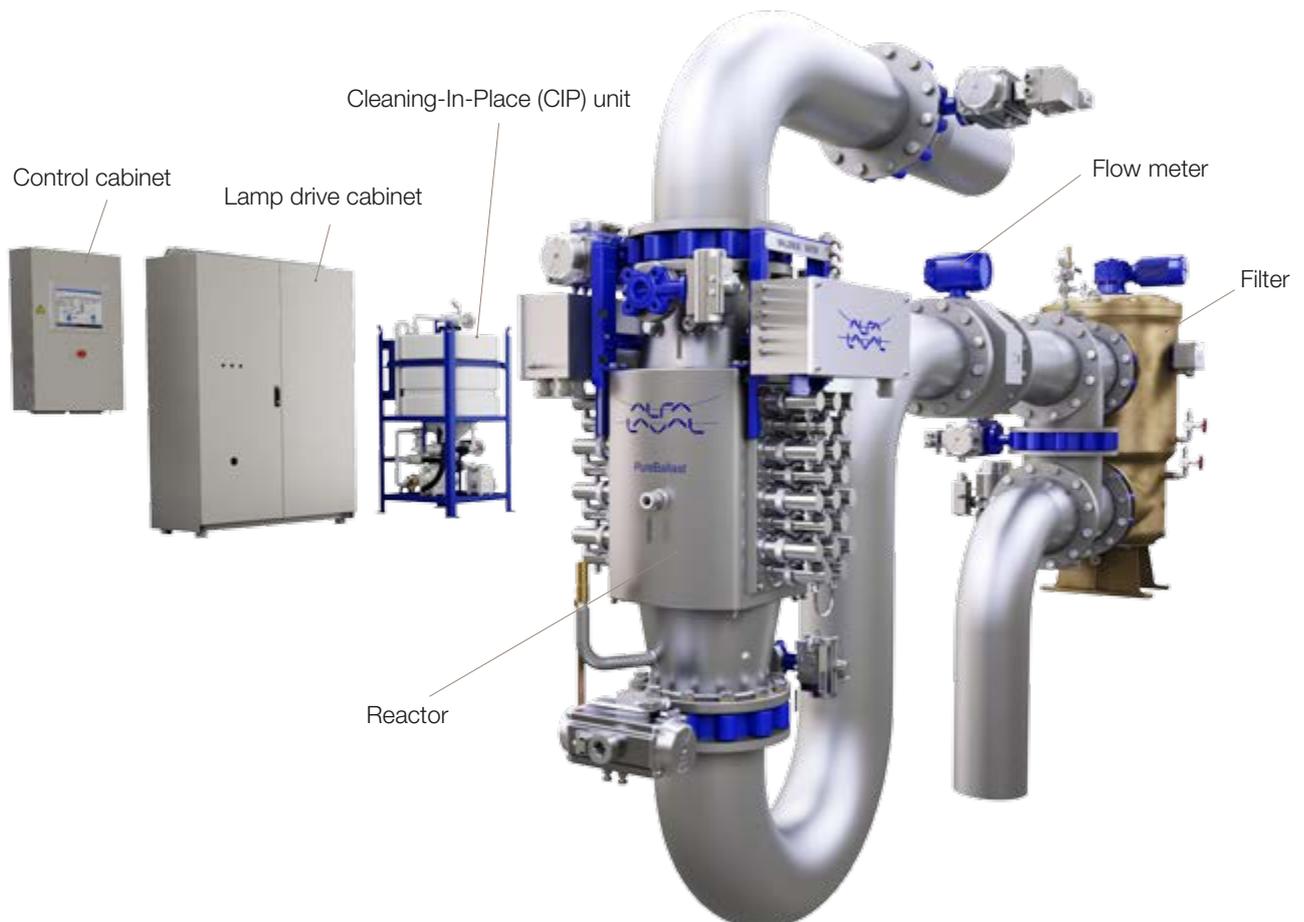
U.S. Coast Guard
UPGRADEABLE

Benefits

- *Superior performance in any waters*
PureBallast 3.1 offers unmatched biological disinfection performance in any type of water: fresh, brackish or marine. This includes water in liquid form at frigid temperatures. Even in low-clarity waters with UV transmittance as low as 42 %, the system can perform at full flow. This gives vessels full freedom of movement without operating constraints.
- *Ease of use*
PureBallast 3.1 is fully enclosed, fully automated and thoroughly integrated with the ballast water system. The system requires no manual intervention.
- *Effective power management*
Because of its high biological disinfection performance, PureBallast 3.1 runs at just 50 % of its potential operating power in most situations. It can be ramped up to full power when needed, for example to handle low-clarity waters where the UV transmittance is extremely low.
- *Space-saving inline construction*
PureBallast 3.1 is an inline system in which the major components (filter and reactor) are incorporated into the ballast water piping. The reactor diameter, in particular, is only marginally larger than that of the piping itself.

This creates a highly flexible system with a small footprint. System design is further simplified by the free placement of the lamp drive cabinet up to 150 m away. This allows additional space to be saved in the engine room, and it enables placement outside the hazardous zone for Ex systems.

- *Chemical-free operation*
PureBallast 3.1 meets biological disinfection requirements without the addition of salt or chemicals, even when operating in fresh water. No dosing is required, and there are no tanks or ventilation systems needed to manage consumables and residuals.
- *Complete worldwide support*
Alfa Laval is a global supplier and an experienced partner in ballast water treatment, with a complete range of solutions for both newbuild and retrofit needs. Shipyards and engineering companies can expect clear and thorough documentation, as well as expert consultation. Ship owners have access to far-reaching ownership support, including Performance Agreements and other services for cost-efficient peace of mind.



System components – biological disinfection

Biological disinfection with PureBallast 3.1 comprises an initial filtration stage followed by enhanced UV treatment in a specially designed reactor. Both stages are integrated into the ballast water piping as inline components.



- *Filter*
A filter is used during ballasting operations to block the intake of larger organisms and reduce sediment in the ballast water tanks. Bypassed during deballasting, the filter is cleaned via automatic backflushing using a small portion of the system flow.

In combination with the reactor, the effective basket filter design enables full-flow treatment of fresh, brackish and marine water with UV transmittance as low as 42%.

- *Reactor*
The enhanced UV treatment stage of PureBallast 3.1 occurs within a reactor. Four reactor sizes are available, each with a flow-optimized interior that ensures high turbulence and the concentration of the UV dose.

The reactor lamps employ specially designed lamp sleeves of synthetic quartz. These support transmission of a broader wavelength spectrum, thus providing more UV light during disinfection. Temperature and level sensors within the reactor ensure its safety.



The reactor design, which draws on treatment technology from Wallenius Water, is specially developed for marine applications. The reactor construction is of 254 SMO steel, which ensures a long lifetime without corrosion.

System components – support

The additional components of PureBallast 3.1 are support systems that can be flexibly placed for an optimal design.



- *Lamp drive cabinet*
The UV lamps are supplied with power by a lamp drive cabinet associated with the reactor. The cabinet is physically separated 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.

- *Control cabinet*
The PureBallast 3.1 control cabinet features a graphical touchscreen interface that is easy and intuitive to use. Operation can be started or stopped with a single touch. The control system can also be integrated with onboard automation systems via Modbus, allowing access to all functions through the vessel's Integrated Ship Control System.



- *Cleaning-In-Place (CIP) unit*
UV lamp performance is safeguarded by an automatic CIP cycle. The CIP unit circulates a reusable, non-toxic and biodegradable cleaning solution that prevents any UV-impairing build-up. Such build-up cannot be removed by wiping, which would also risk scratching the sleeve surface.



- *Auxiliary equipment*
A broad range of auxiliary equipment is available to support integration into any vessel, including backflush pumps, sampling points, valve packages and remote control panels.

Operating sequence

- *Ballasting*

PureBallast 3.1 is a fully automated system. When initiated, it undergoes a brief startup sequence.

When ballasting begins, the incoming ballast water first passes through the filter stage. This removes any larger organisms and particles, which improves the quality of the water for treatment. The filter stage is of benefit for operation in cloudy coastal waters and fresh water.

After filtration the water continues through the reactor stage, where it is disinfected by means of enhanced UV before entering the ballast water tanks.

Once ballasting is complete, reactor cleaning is performed via an automatic Cleaning-In-Place (CIP) cycle. This cycle is prompted immediately after ballasting and should be performed within 30 hours. The reactor stage is rinsed with fresh water when the CIP cycle begins and filled with fresh water upon its completion.

The filter stage is also filled with fresh water once ballasting is completed.

- *Deballasting*

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

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

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

Type approvals

- *IMO*

All generations of PureBallast, current and previous, have IMO type approval. PureBallast 3.1 is explicitly certified for use in all water types: fresh, brackish and marine.

When comparing IMO type approval certificates for different ballast water treatment systems, it is important to note the certification date. Certificates issued before 2014 do not state the system limitations.

- *USCG*

PureBallast 3.1 systems with USCG type approval are available for vessels that need to discharge ballast in United States waters. However, these vessels can also benefit from choosing the IMO version of the system.

PureBallast 3.1 systems with IMO type approval are approved for use in the United States as Alternate Management Systems (AMS) during a five-year acceptance period from the vessel's compliance date. If needed, they can then easily be upgraded to a USCG version.

Ex systems

PureBallast 3.1 is available in a range of Ex configurations, for example for Zone 1, IIC and T4 compatibility. Ex designs are simplified by the flexible placement of the lamp drive cabinets, which can be located outside the hazardous zone and up to 150 m away from the reactors they serve.

To increase safety in operation, PureBallast 3.1 safety features have been designed with redundancy. 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.

Operation

- Maintenance intervals:

- Filter inspection once per year
- Lamp replacement after 3000 hours of operation (a safe and easy procedure performed in minutes)
- CIP fluid replacement once per year or when the pH value reaches 3
- 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 control panel can be complemented with a maximum of four remote control panels per system. This allows ballast water treatment to be started, stopped and monitored from any location on board.

- *High-pressure system (up to 10 bar)*

PureBallast 3.1 can be delivered for use with high-pressure ballast water pumps operating at 9 or 10 bar rather than 6 bar.

Technical data

Power consumption, 300 m ³ /h reactor	Optimal 17 kW (32 kW at full ramp-up*)
Power consumption, 600 m ³ /h reactor	Optimal 32 kW (63 kW at full ramp-up*)
Power consumption, 1000 m ³ /h reactor	Optimal 52 kW (100 kW at full ramp-up*)
Power supply	400-440 VAC, 50/60 Hz
Working pressure	Max 6.0 bar (up to 10.0 bar optional)

* Power consumption can be increased to handle low-clarity water with low UV transmittance.

Capacity range

The size of a PureBallast 3.1 system is determined by the capacity of the ballast water pumps it is used with. An optimal configuration is achieved by matching a reactor setup and filter capacity to the required ballast water flow.

Flow in m ³ /h	(32)*	85	135	170	250	300	500	600	750	1000	1500	2000	3000
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* PB3.1/85 system at reduced flow rate.

For flows in excess of 3000 m³/h, multiple systems are installed. With this configuration strategy, PureBallast 3.1 is competitive over the entire flow range up to 6000 m³/h.

Component dimensions

	Size (mm) Footprint (W × D × H)	Net/Dry weight (kg)	Volume (L)
Reactor, 300 m ³ /h	700 × 650 × 1310	250	80
Reactor, 600 m ³ /h	855 × 765 × 1400	320	100
Reactor, 1000 m ³ /h	1030 × 950 × 1500	400	190
Lamp drive cabinet, 300 m ³ /h reactor	900 × 480 × 2000	250	
Lamp drive cabinet, 600 m ³ /h reactor	1350 × 610 × 2000	370	
Lamp drive cabinet, 1000 m ³ /h reactor	1350 × 610 × 2000	400	
CIP unit	740 × 870 × 1800	155	Max 250
Control cabinet	650 × 310 × 1100	50	

Filters

	Size (mm) Footprint (W × D × H)	Net/Dry weight (kg)	Volume (L)
Basket filter, 250 m ³ /h	460 × 498 × 1146	360	61
Basket filter, 300 m ³ /h	490 × 503 × 1201	400	82
Basket filter, 500 m ³ /h	610 × 637 × 1296	620	146
Basket filter, 700 m ³ /h	730 × 715 × 1579	860	241
Basket filter, 1000 m ³ /h	765 × 786 × 1753	1020	370
Basket filter, 1500 m ³ /h	775 × 794 × 2248	1150	480
Basket filter, 2000 m ³ /h	1000 × 1008 × 2367	1780	890
Basket filter, 3000 m ³ /h	1300 × 1288 × 2476	2595	1700

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.

Alfa Laval reserves the right to change specifications without prior notification.

How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com