



Always a step ahead

Alfa Laval PureSOx and SOx emission compliance



Don't just comply – be a step ahead

You won't be alone in choosing a SOx scrubber. But you will be a step ahead, if you select the scrubber at the forefront: Alfa Laval PureSOx. At sea since 2009, PureSOx has the record others aspire to, with every system ever sold in operation and in compliance.

PureSOx leads the way

There are many good reasons for choosing a scrubber to comply with the 2020 global sulphur cap, or the even stricter SOx limits already in existence in Emission Control Areas (ECAs). Whatever your own reasons, no choice of SOx scrubber is more secure than PureSOx.

Built on 100 years of marine experience, PureSOx has been chosen for hundreds of vessels to date. What matters more are the returning customers, convinced by smooth installations, proven results and first-rate global service. They know PureSOx will keep them ahead – today, in 2020 and beyond.

Why Alfa Laval PureSOx?

- >98% SOx removal plus 80% reduction of particulate matter
- Over 100 years of marine industry experience
- Over 50 of years of marine scrubber experience
- Strong delivery logistics and project management
- A truly global network for service and support
- Proven performance and many returning customers



Built for the way you sail

PureSOx is a reliable and flexible solution that can be configured in different operating arrangements. Which one is right for you depends on where and how your vessel sails.

Open-loop arrangement

In an open-loop arrangement seawater is used to scrub the exhaust gas and remove SOx. After passing through the scrubber, the wash water is legally discharged into the sea.

An open-loop arrangement involves less capital investment and has lower operating costs, but the scrubber's use may be limited by low water alkalinity or

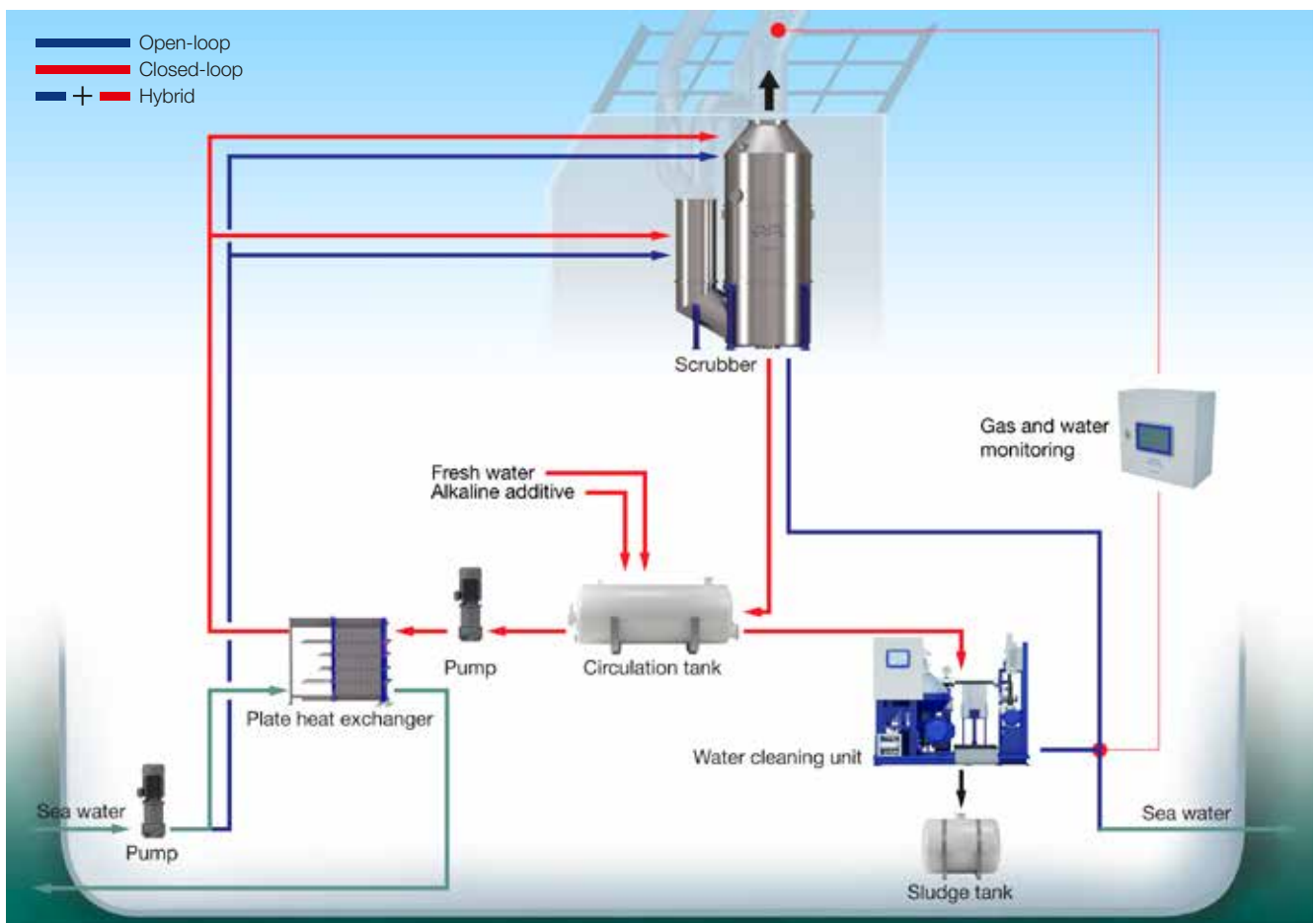
local discharge legislation. For this reason, many customers opt for a hybrid arrangement instead.

Hybrid arrangement

A hybrid arrangement is often the perfect compromise, as it provides both open-loop and closed-loop modes. In most situations the scrubber operates in open-loop mode, which provides the greatest operating economy. But the option of

closed-loop mode makes it possible to operate even in areas with low water alkalinity or zero-discharge legislation.

During closed-loop operation the scrubber uses fresh water, which is dosed with an alkaline additive and recirculated. As it becomes polluted, circulation water is cleaned, discharged and replenished to retain capacity.



Designed to meet your needs

PureSOx is engineered for reliable and efficient compliance with a minimal amount of equipment – and minimal impact on the vessel's structure.

The PureSOx scrubber

The PureSOx scrubber itself is built for robustness and reliability. The shape formed by its main absorber section and smaller jet section creates a natural water trap, which prevents water backflow to the engine without any additional equipment. Regardless of roll, pitch, temperature or alkalinity, the scrubber performs with high efficiency.

The scrubber design is flexible and can easily be adjusted or rotated to connect with vessel piping. Bracing lugs are incorporated from the start,

which makes it a plug-and-play solution. Even maintenance area is accounted for in the design, which makes the scrubber easy to inspect and care for.

Handling multiple exhaust gas sources

PureSOx can be configured for multiple inlet sources. This allows one PureSOx scrubber to clean exhaust gas from both main and auxiliary engines, as well as boiler exhaust gas.

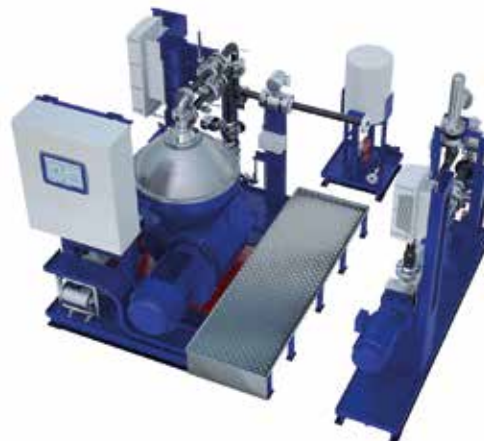
In other words, you can continue using less expensive fuel for all your needs – not just your main engine.

Reliable water cleaning

In closed-loop operation the patented PureSOx water cleaning unit ensures effective removal of particles in all conditions. Using centrifugal separation technology, it minimizes sludge and allows instant bleed-off of cleaned circulation water.



The PureSOx scrubber



The PureSOx water cleaning unit

Connectivity to take you forward

PureSOx is at the forefront of SOx scrubbing technology, but also of simplifying compliance. PureSOx Connect is a growing range of data-driven services that bring you new ways to save time and money.

Simplified reporting

PureSOx Connect services build on the Alfa Laval Remote Emission Monitor (ALREM), a data reporting and storage device. At its most basic, PureSOx Connect simplifies compliance reporting on any vessel where the ALREM is installed.

Rather than analysing scrubber compliance data themselves, operators can use the Alfa Laval Touch Control system to access user-friendly, graph-based reports – which can be handed over to authorities directly.

Advanced tools and possibilities

The full possibilities of PureSOx Connect go far beyond reporting. When you connect your PureSOx system to the Internet, you can review the PureSOx data for your vessel or even your entire fleet via an online portal – from anywhere in the world. Accessible on a monthly subscription basis, the portal currently offers the following modules:

• **Compliance**

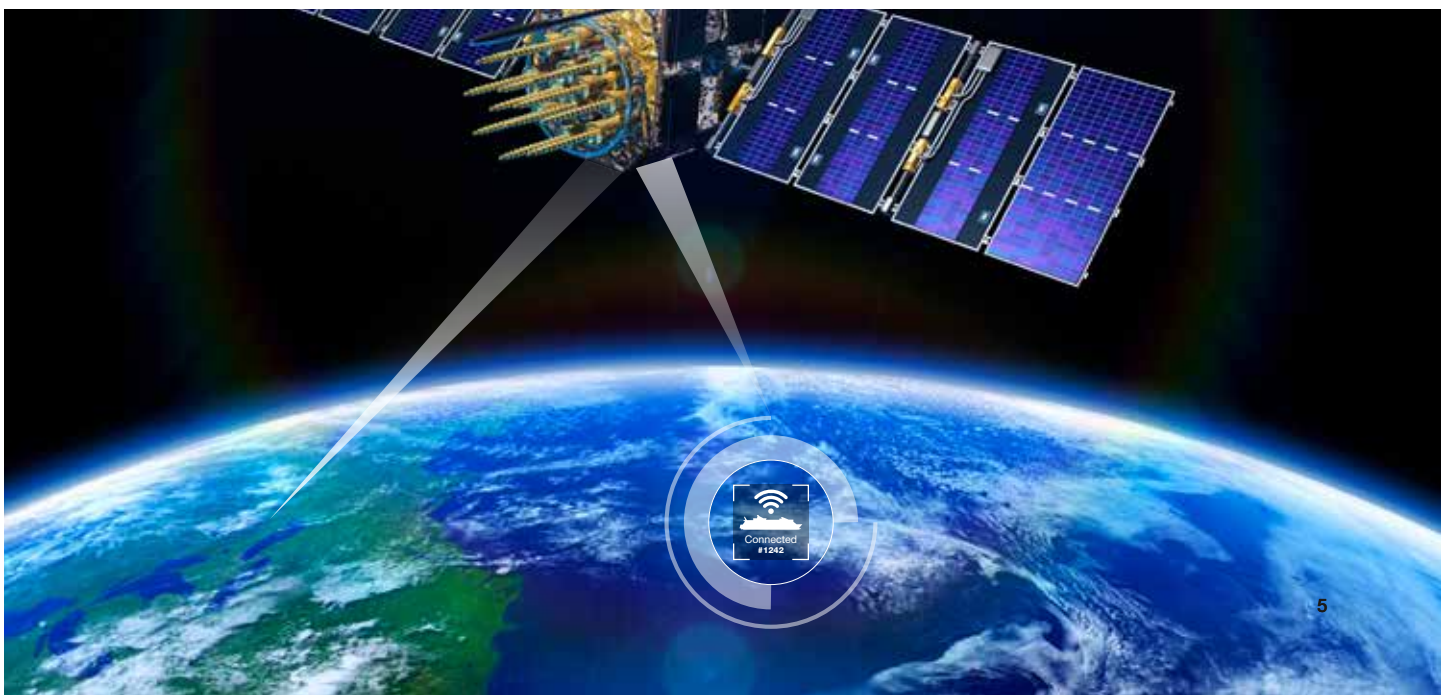
A dashboard view lets you generate different types of reports for the vessels and dates you select. The reports are automatically customized based on local legislation concerning exhaust gas emissions and discharge water.

• **Benchmarking**

PureSOx performance data can be collected and sent securely to the cloud for processing by Alfa Laval analysts. The benchmarking module assists you in optimizing PureSOx and reducing your costs over time.

• **Service**

PureSOx diagnostic data can also be collected and sent for remote use by Alfa Laval engineers, who can identify and analyse the root causes of an alarm. Ideally, the issue can be solved directly. If not, the Service Engineer will arrive fully prepared, with the right parts and information to solve the problem.



Service to keep you

The choice of PureSOx is always a secure one. Standing behind PureSOx is a global supplier with the proven skills, resources and comprehensive service offering to support your needs – today and tomorrow.

Truly global service

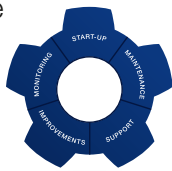
Alfa Laval has an extensive global service network, dedicated to keeping you in compliance and helping you get the most from your PureSOx scrubber system.

You can reach our Alfa Laval service experts 24/7, no matter where you sail. By taking advantage of their skills and support, you can rely on your PureSOx system for cost-effective compliance throughout your vessel's lifetime.



Alfa Laval 360° Service Portfolio

PureSOx is a smart choice, backed up by smart services. The Alfa Laval 360° Service Portfolio contains a wide range of services that secure its performance.



Performance Agreements

You get the most value by combining services from the Alfa Laval 360° Service Portfolio in a tailor-made Performance Agreement. This flexible solution gives you the ideal service for your needs at a fixed, budgeted cost.

Service examples

- **Training**
Ensure optimal scrubber performance by improving crew skills in the areas of operation, maintenance and basic troubleshooting.
- **Performance Audit**
Ensure your PureSOx scrubber system is operating according to expectations through system updates and careful evaluation of all functions.
- **Exchange Programme**
Ensure compliance at all times through the regular replacement and recalibration of crucial PureSOx system sensors.
- **Condition Audit**
Ensure uptime and reduce the risk of unscheduled repairs with expert insights into the actual condition of your PureSOx equipment.
- **Spare Parts**
Ensure peace of mind and minimize downtime with fast, easy access to high-quality, OEM spares.



ahead



● Alfa Laval field service network



PureSOx in practice

How a SOx scrubber and its supplier perform in reality is more important than any specification. Alfa Laval and PureSOx have a solid record of success, not only on board but in the whole process of getting there.

Returning customers

Nothing says more about a scrubber than its references, especially when those customers order time and time again.

Alfa Laval PureSOx has one of the largest reference lists on the market, containing many repeat orders. All PureSOx systems ever installed are still in compliant operation today.

“Hybrid scrubbers are among the most efficient alternatives to using expensive low-sulphur fuel oil. Based on our previous experience, PureSOx has proven to be a reliable and efficient retrofit solution. We have been very pleased with the cooperation with Alfa Laval.”

Kasper Moos, Vice President Technical Org., DFDS Seaways

DFDS RoRo and RoPax vessels

- Seventeen hybrid PureSOx systems, including the very first



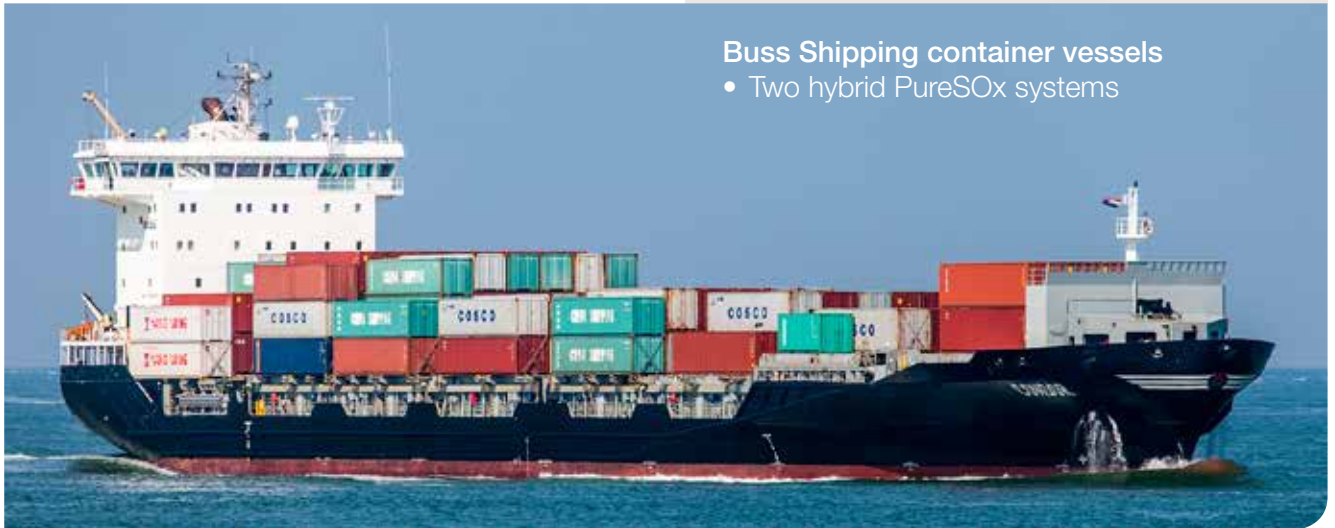
Smart engineering

To be a lasting solution, your scrubber must be engineered to suit your vessel and sailing profile. PureSOx provides a high degree of system flexibility, with different operating arrangements, support for multiple inlet sources and many other options.

The design possibilities allow almost any challenge to be overcome, even on vessels with space and stability issues.

"The PureSOx solution was well engineered and allowed a sophisticated integration of the scrubber system into our container feeder ships. The custom construction let us avoid major modifications inside the vessel, which together with the pre-outfitting gave us a short installation time. All those factors contributed to a competitive price."

Christoph Meier, Project Manager, Buss Shipping



Buss Shipping container vessels

- Two hybrid PureSOx systems

Core technology

It takes considerable knowledge to optimize a scrubber, especially in a closed-loop or hybrid system where compliant cleaning of the circulation water is needed.

Alfa Laval has over 50 years of experience with marine scrubbers specifically, as well as over a century of experience with centrifugal separation – the most reliable method of water cleaning.

"The PureSOx scrubber commissioning and operation during sea trials was exceptional. It was amongst the equipment on board without alarms during the endurance and UMS tests in the sea trials."

Miltos Synefias

Technical Director, Pleiades Shipping Agents S.A.

Pleiades Shipping tankers

- Two open-loop PureSOx systems



Pictured vessel is an example.

Project management

A solid delivery track record, combined with structured preparation for scrubber installation and integration, offers insurance against expensive delays and difficulties in gaining class approval.

Alfa Laval has not only many years of experience and a strong delivery infrastructure, but also well-documented procedures and clear project management that facilitate class approvals. Your project's skilled engineering team is led by a dedicated Project Manager, who acts as a single point of contact throughout the process.

EXMAR LPG carriers built by Hanjin Heavy Industries & Construction (HHIC-PHIL INC.)

- Two hybrid PureSOx systems

“Alfa Laval has made things easier in our work with EXMAR so far, and we anticipate that will continue as the EXMAR projects progress. We expect a lot from Alfa Laval as an experienced marine supplier, and when it comes to the professional level of support regarding PureSOx and exhaust gas cleaning, the company delivers.”

Lee Dong-hoon, Senior Manager, Hanjin Heavy Industries & Construction (HHIC-TMS)



See multimedia content and additional references at www.alfalaval.com/puresox

Finnlines and ACL RoRo and ConRo vessels for Grimaldi Group

- Seventeen open-loop PureSOx systems
- Twelve PureSOx systems



Global service

Your scrubber will be with your vessel for many years and will also affect its resale value. This makes it important to choose a stable supplier with a strong global network, who can offer assistance wherever your vessel sails.

Alfa Laval has served the marine industry for a century, providing service and support both worldwide and 24/7. The Alfa Laval 360° Service Portfolio offers all the services you need to ensure top performance, uptime and operating efficiency from your PureSOx system throughout its life cycle.

“PureSOx was an obvious choice for us. But Alfa Laval is more than an equipment supplier. In Alfa Laval, we have a reliable partner who can make sure our vessels are always in compliance and that we get the most out of our investment.”

Juha Ahia, Manager for Newbuildings & Projects, Finnlines

Alfa Laval in brief

Alfa Laval is a leading global provider of specialized products and engineered 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

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