



Alfa Laval PureSOx

Exhaust gas cleaning for competitive SOx compliance



Your proven route to competitive SOx compliance

SOx scrubbers are the smart choice for complying with the global sulphur cap as well as sulphur limits in Emission Control Areas (ECAs). Alfa Laval PureSOx is the smartest choice of all, because it offers a complete platform for meeting the needs of your vessel.

A route well travelled

No choice of SOx scrubber is more secure than PureSOx, a solution built with Alfa Laval core expertise and decades of marine scrubber experience. PureSOx has been at sea since 2009, reliably cleaning main and auxiliary engine exhaust gas to compliant SOx levels.

Today PureSOx has more references than any other single SOx scrubber technology. Among those references are repeat orders from major customers, as well as a wide range of vessel types and specific scrubber configurations.

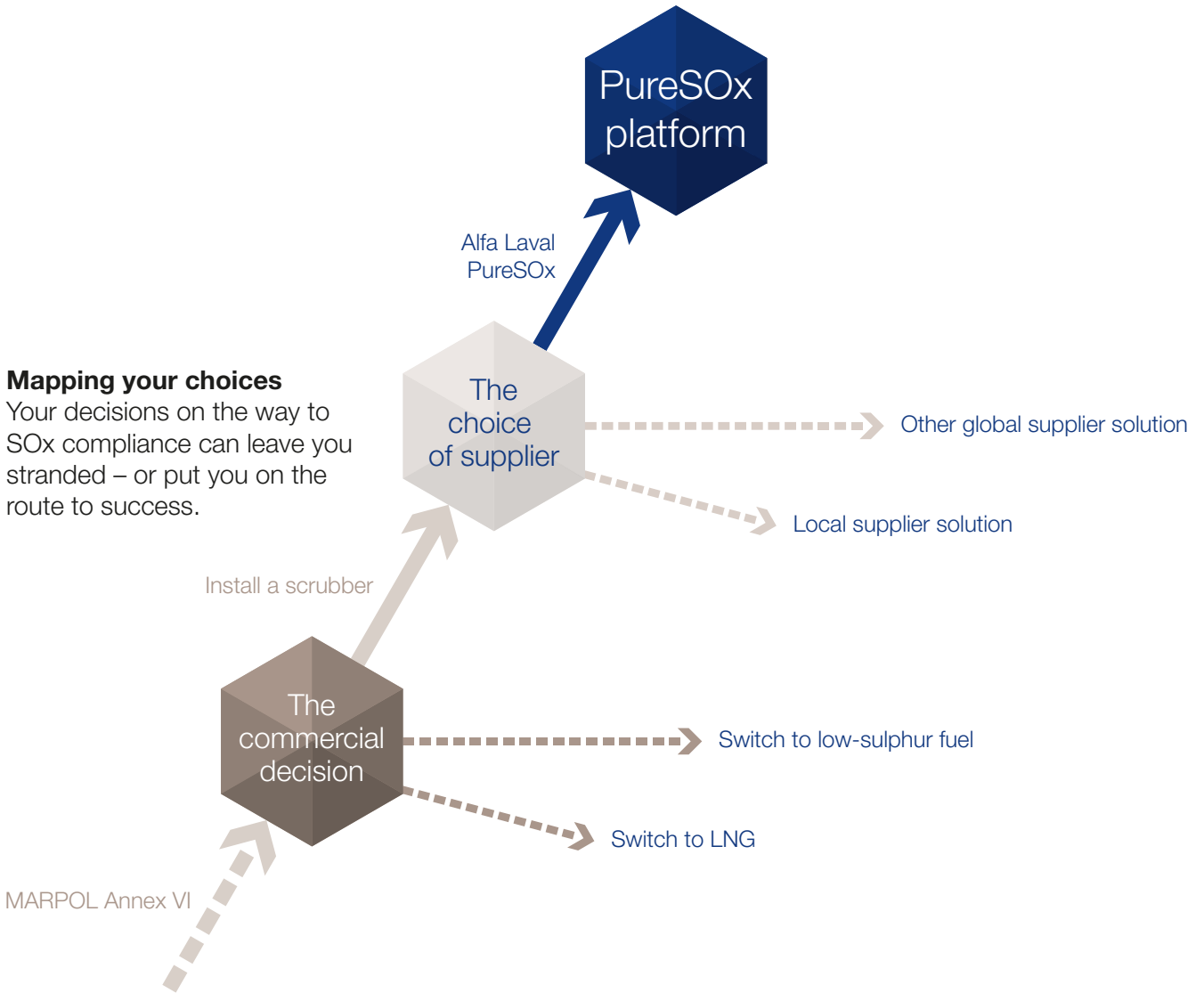
Five reasons to choose Alfa Laval PureSOx:

- Returning customers express their satisfaction
- Custom engineering matches your vessel and needs
- Core technology from Alfa Laval ensures results
- Project management means timely delivery and installation
- Global service keeps you secure wherever you sail



Mapping your choices

Your decisions on the way to SOx compliance can leave you stranded – or put you on the route to success.



The commercial decision

The ability to use economical HFO, rather than expensive low-sulphur fuel, rapidly makes a difference in operating costs. Choosing the scrubber route gives you a long-term cost advantage, without making your business dependent on an uncertain LNG infrastructure.

The choice of supplier

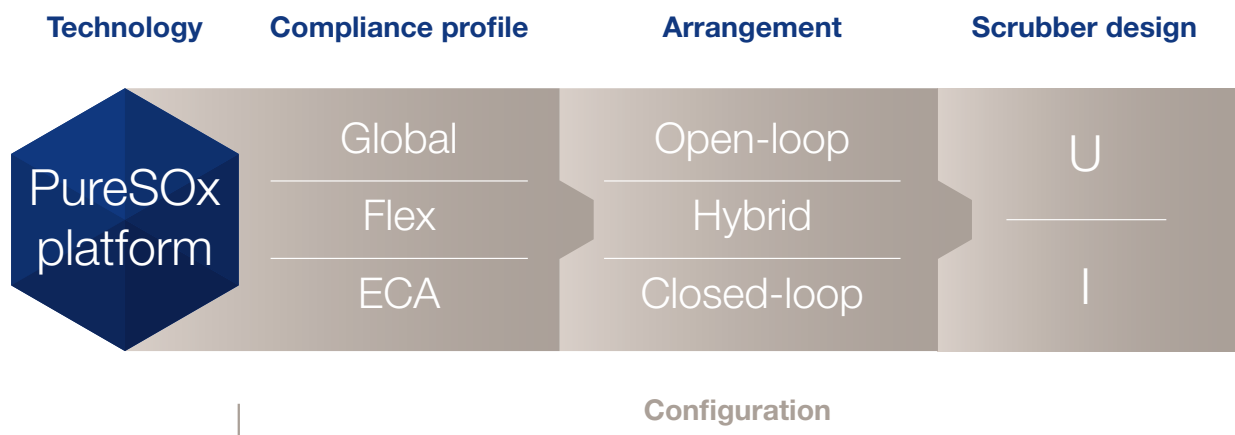
Scrubbers are simple in principle, but challenging to adapt for marine use. Although global suppliers have many resources and broader support than local suppliers, their experience should still be reviewed. A long and comprehensive reference list is the best proof that a system can operate successfully in a range of conditions.

Alfa Laval PureSOx

Not only is Alfa Laval the leading SOx scrubber supplier, the PureSOx platform is also the most complete solution on the market. Your scrubber's configuration can be perfectly adapted to the needs of your vessel, no matter where you sail.

The PureSOx platform

For all the questions about SOx compliance, there's an answer trusted by more and more ship owners. The unique flexibility of the PureSOx platform – combined with Alfa Laval's proven expertise – is your assurance of a compliant and optimized solution.



Many routes to performance

Whatever your PureSOx configuration, the results are the same:

- Sulphur removal rate >98% (exceeds IMO requirements)
- Particulate matter (PM) trapping up to 80%
- Compliance at any engine load

Compliance anywhere

As a complete scrubber platform, PureSOx offers three compliance profiles to fit your specific sailing profile. All versions can be configured as open-loop, closed-loop or hybrid arrangements, and as U-design or inline I-design scrubbers.

PureSOx Global

Optimized for use on the open seas, PureSOx Global offers an ideal solution for compliance with the 0.5%S global cap. It is the smallest version of the platform and also provides the greatest ease of installation.

PureSOx ECA

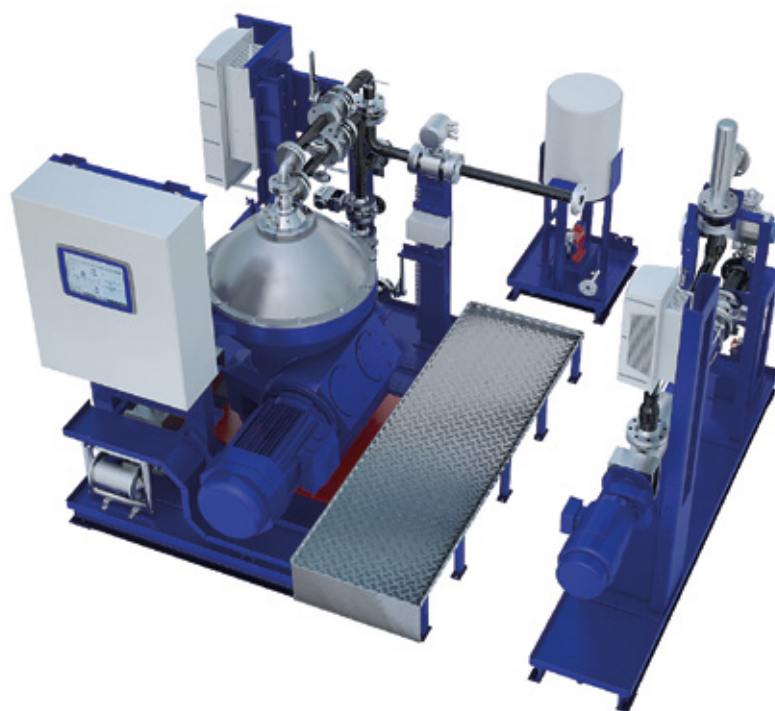
Vessels that spend most or all of their time in Emission Control Areas (ECAs) can meet the more stringent 0.1%S emission limits with PureSOx ECA. This option is also designed to handle the technical restrictions these vessels face, such as low-alkalinity water.

PureSOx Flex

PureSOx Flex provides an easy switch between 0.5%S and 0.1%S compliance modes. For vessels with more varied operating profiles, this option ensures maximum savings and the lowest possible OPEX.

Built on core expertise

The PureSOx platform is successful because it builds on Alfa Laval core expertise. For over 40 years, Alfa Laval has delivered marine scrubbers as a part of inert gas systems for oil, chemical and LNG carriers. Still more of our expertise is used in closed-loop and hybrid configurations. We pioneered centrifugal separation, which is the only reliable means of cleaning circulation water at sea. The PureSOx water cleaning unit removes particles effectively in all conditions, which minimizes sludge and allows instant bleed-off of cleaned circulation water.



Built for the way you sail

PureSOx can be configured in three different operating arrangements. Which one is right for you depends on where and how your vessel sails.

Open-loop arrangement

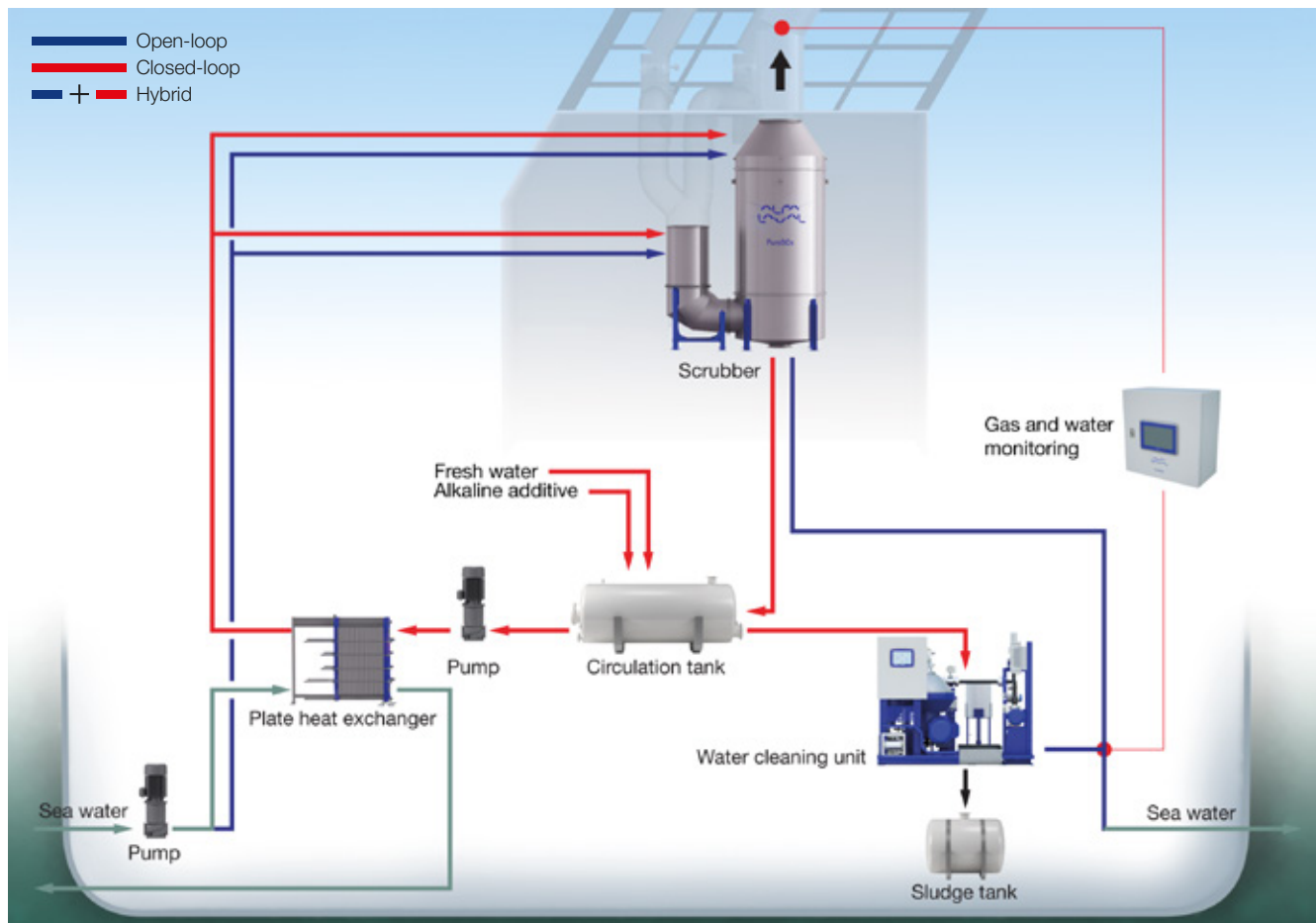
In an open-loop arrangement seawater is used to scrub the exhaust gas, after which it is legally discharged back into the sea. Though the investment and operating costs are lower, the scrubber's use may be limited by low water alkalinity or local legislation.

Closed-loop arrangement

In a closed-loop arrangement the scrubber water is dosed with an alkaline additive and recirculated. As it becomes dirty, the circulation water is cleaned, discharged and replenished to retain capacity. The scrubber can be used anywhere and at any time, but has higher operating costs.

Hybrid arrangement

A hybrid arrangement is often the perfect compromise, as it provides both open-loop and closed-loop modes. Open-loop operation reduces costs whenever possible, but a switch to closed-loop operation can be made whenever demanded.



Designed for your vessel

U-design

In most cases the PureSOx scrubber is configured with a U-design. Suitable for the majority of vessels, this configuration offers a number of advantages. For example, the shape of the scrubber itself forms a natural water trap, preventing water backflow to the engine without any additional equipment.

I-design

On vessels with more complex structural needs, such as certain cruise ships and RoPax vessels, PureSOx can be configured with an inline I-design. In this configuration, water backflow is prevented by an internal water trap combined with overboard arrangements.

Choosing an I-design can overcome more difficult space and stability issues.

Inlets for multiple exhaust gas sources

Both U-design and I-design scrubbers can be configured with multiple inlets. This allows one PureSOx scrubber to clean exhaust gas from both main and auxiliary engines, as well as boiler exhaust gas.

Multiple inlets greatly reduce the footprint and weight of the scrubber system overall, along with the cost of the equipment and installation.



U-design



I-design



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, and repeat orders are the best seal of approval available.

Alfa Laval PureSOx has more references than any other single SOx scrubber technology, many of which are repeat orders. All PureSOx systems ever installed are still in compliant operation today.

"We are very satisfied in our dealings with Alfa Laval, in terms of both project execution and the technical performance of the PureSOx scrubber. The systems already delivered have all received class approval, and we expect equivalent results from the deliveries in progress."

Emanuele Grimaldi, Managing Director, Grimaldi Group



Finnlines and ACL RoRo's and ConRo's for Grimaldi Group

- Five open-loop PureSOx systems with U-design and multiple inlets
- Five hybrid PureSOx systems with U-design and single inlets

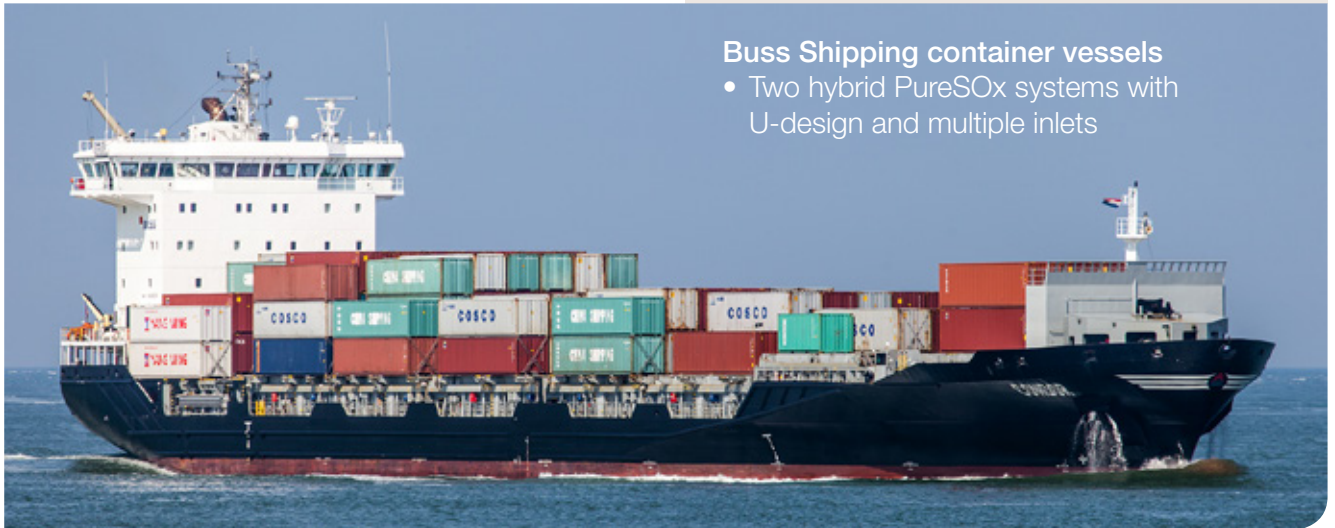
Custom engineering

To be a lasting solution, your scrubber must be engineered to suit your vessel and sailing profile. The PureSOx platform provides a high degree of system flexibility, with multiple operating arrangements, a choice of scrubber designs and many other options.

These 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 with U-design and multiple inlets

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 40 years of experience with scrubbers specifically, as well as over a century of experience with centrifugal separation – the most reliable method of water cleaning.

"[Our vessels'] area of operations will require a closed-loop mode with reliable water cleaning. This is where Alfa Laval's separation expertise comes into play."

Kevin Douglas, Vice President, Technical Projects and Newbuild, RCL

RCL cruise ships

- Three hybrid PureSOx systems with U-design and multiple inlets
- One hybrid PureSOx system with inline I-design



Project management

A solid delivery track record and a structured method of preparing scrubber installations offer insurance against expensive delays and difficulties in 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.

“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)

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

- Two hybrid PureSOx systems with U-design and multiple inlets



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

DFDS RoRo and RoPax vessels

- Four hybrid PureSOx systems with U-design and multiple inlets
- Nine hybrid PureSOx systems with U-design and single inlets



"We've been extremely pleased with the cooperation with Alfa Laval. DFDS's policy is that we will never ever bring us in a situation where we can't comply with the legislation."

Kasper Moos, Vice President Technical Org., DFDS Seaways

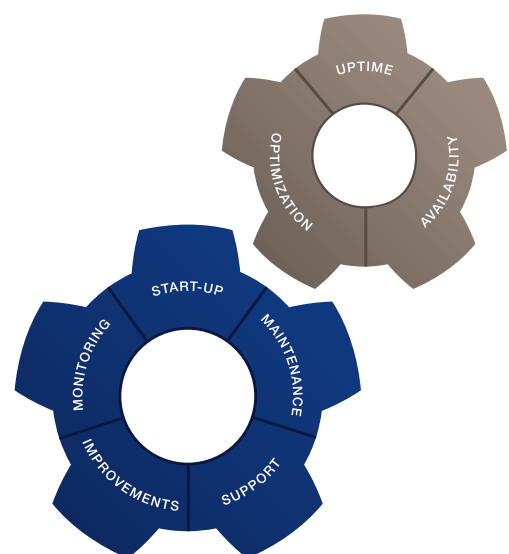
Global service

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. You gain easy access to cost-saving insights, high-quality spares and much more.

An Alfa Laval Performance Agreement lets you tailor a service plan to your needs. It ensures optimized performance and operating costs for total peace of mind.



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