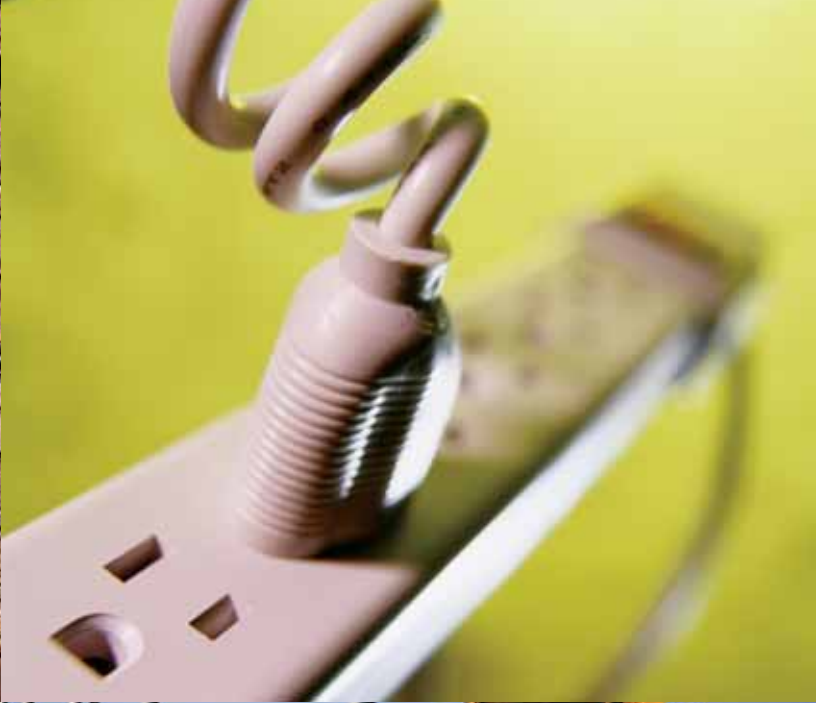




Imagine. Create. Deliver.

Technology you can build on for diesel and gas engines





Inside view

Alfa Laval is a leading supplier to the engine and engine related industries. Our systems and products can be divided into the following main categories: cleaning, oil mist cleaning, cooling, and service.

- 4 High quality
Reliable solutions
Protect the total cost of your engine

- 6 Fluid cleaning
Automatic full-flow filters
Eliminator Filter™, CCU
Hydraulic separator, HERON
Solids retaining centrifugal separator, MIB 303
Alfa Port

- 9 Oil mist cleaning
Alfdex

- 11 Cooling
Gasketed plate heat exchangers
Alfa Laval integrated cooling system, ALICS
Brazed heat exchangers

- 15 Service
Nonstop Performance

Reliable solutions

This guide gives you a simple overview of our entire range of solutions and services for the engine. Detailed technical information, dimensions and specifications are available on request.



Protect the total cost of your engine

Your partner in performance.

Alfa Laval is no stranger to the engine builder. We are a well-established original equipment supplier on diesel and gas engines. Our product development activities are focused on providing solutions for you and your customers' needs.

Alfa Laval's advanced solutions ensure that your state-of-the-art engines perform efficiently, with the lowest life-cycle costs, and minimum impact on the environment.

Advanced products

With more than 120 years of experience, Alfa Laval is a world leader in the technology of separation, heat transfer and fluid handling.

Integrated onto diesel and gas engines in the mining, railway, marine, power generation and industrial industries throughout the world, Alfa Laval integrated systems provide lifetime solutions to your challenges.

Environment

Our products increase your engine's performance and reduce the impact on the environment by:

- Extending engine lifetime
- Extending oil lifetime
- Eliminating the need for filter cartridge disposal
- Extending/eliminating service intervals
- Reducing parasitic loading
- Reducing crankcase emissions

Our engine cleaning and cooling solutions, combined with our global, around-the-clock customer service, offers you the best possible solutions to your systems challenges. We endeavor to perform all our activities as cleanly and efficiently as possible, and to take environmental aspects into consideration when developing, designing, manufacturing, servicing and marketing our products.

Global organization

All systems and products are backed up by the Alfa Laval global sales, service and spare parts network. Our worldwide presence ensures the just-in-time delivery needed to keep your production running efficiently and economically.

Once your engines are in service, we are pleased to work with you to coordinate service and parts through your service network. Alfa Laval supplies products and systems to engine builders worldwide.



Oil cleaning through separation and filtration solutions

We continuously strive to provide innovative cleaning solutions to protect your engine, significantly reduce downtime and reduce operating costs. Our goal is for you to achieve improved engine life and larger maintenance intervals.



Engine manufacturers and customers alike strive to increase maintenance intervals. The bottom line is that costs increase when an engine is not in operation.

Diesel engines often include multiple filter cartridges to clean oil. With Alfa Laval automatic backflush full-flow filter and centrifuge combination – the Eliminator Filter™ – cartridge filter disposal is eliminated.

Reduce costs:

- No need for inventory control of cartridges
- No cartridge disposal
- Eliminate the liability associated with spilled oil during cartridge change out
- Reduction of logistics management
- Free up resources with less maintenance

Our self-cleaning filters are designed to:

- Optimize cost efficiencies
- Maintenance required only at engine overhaul
- Ensure reliable, low maintenance protection with
 - a low and constant pressure drop, and
 - a continuous backflushing process

Eco-minded

Harsh environments

The fact is that engines are subjected to severe conditions. Vibration and fouling are two main concerns within the mining and locomotive industries.

Working directly with customers and OEMs, the Automatic Filter was developed to meet or exceed requirements within these industries and has been successfully proven, with continuous innovation, for over 30 years.

In addition, disposal of hazardous materials such as cartridge filters is expensive and is harmful to the environment.



The Eliminator Filter™ solves this by:

- Capturing the particles and returning excess oil to the sump
- Virtually eliminating disposal
- Promoting oil conservation
- Reducing risky oil spillage

Bolts right on existing iron

Our unique solution is designed so the engine maker improves their performance with no, or minimal modification to your engine. Our mission is to ease concerns about engineering and production costs by designing integrated systems tailored to your needs.

Our solutions are designed to help reduce inventory and costs, as they are:

- Flexible
- Modular
- Compact
- Lightweight
- Adaptable to fit your specific requirements

Power requirements

No external power supply or compressed air is required for the Alfa Laval Automatic Self Cleaning Filter. It utilizes a hydraulic motor that is driven by a small supply of the oil entering the filter.

Oil problems

Oil flow and oil change intervals are monitored due to the impact they have on the engine. The Automatic Filter was designed to have a low, constant pressure drop to reduce oil restrictions and allow more oil flow into the engine. This helps maintain oil integrity and prolongs the life of the engine, including bearings and crankshaft. Add a pressure drop indicator and you have an early warning of malfunction in the lube oil system.



Eliminator Filter™

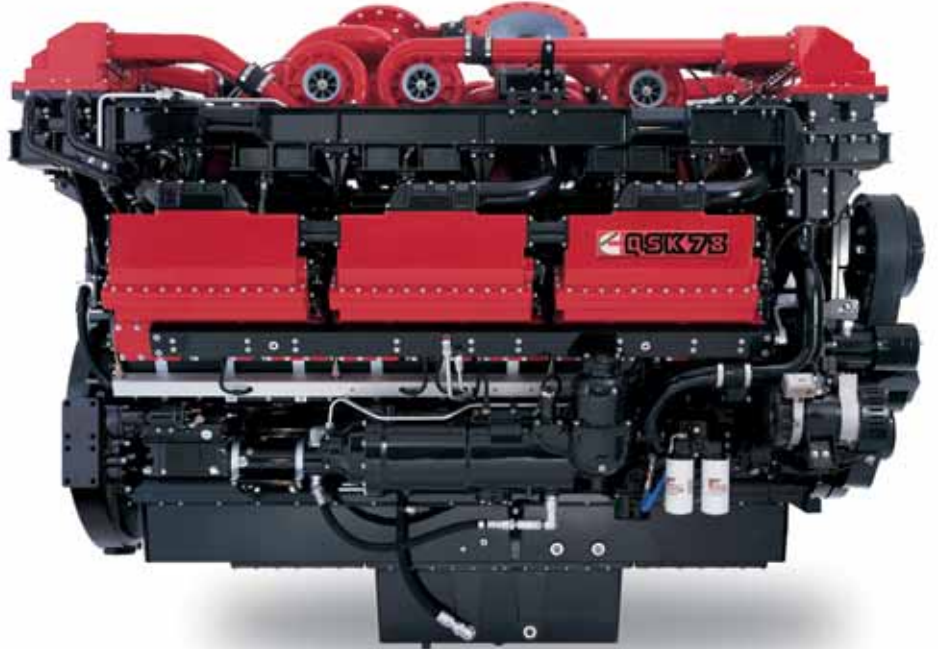
Soot

Modern engines have retarded ignition and higher operating temperatures, resulting in increased soot production and clogged lube oil filters. This can lead to a higher consumption of spare parts and costly replacement of the oil.

The Automatic Filter traps abrasive particles from getting into the engine and directs the particles to the centrifuge for removal. Capable of removing particles down to 2 µm, the Centrifuge cleans the lube oil more efficiently than any bypass filter on the market.

Warranty

A leading cause of warranty claims on engines is the constant exposure of the oil system to dirt and foreign particles that occurs during regular oil filter change-outs. Our automatic full flow filters are designed to last the life of your engine without the need for service. This provides a sealed oil system and eliminates concerns and reliability issues associated with engines fitted with disposal filters. These robust filters meet or exceed specifications including burst pressures that are three times those of cartridge filters. This eliminates the need for a bypass filter during cold starts – thus further protecting your engine.



Eliminator Filter™ mounted on the Cummins QSK78 engine



Hydraulic lube oil filter



Fuel/lube oil filter cutaway



Electrically driven fuel oil filter

Oil Mist Cleaning

Eliminate oil from crankcase gases

Our Alfdex maximizes turbocharger efficiency through fouling reduction and keeps intercoolers running at peak performance. Our crankcase ventilation unit allows for environmentally safe filtration, with no maintenance or service during the engine's lifetime – with Alfa Laval, you are sealed for life.



Sealed for Life: The Alfdex Oil Mist Separator maximizes turbocharger efficiency and keeps intercoolers running at peak performance.

Built with the environment in mind

The Alfdex Oil Mist Separator is a unique product, solving problems that arise with unclean ventilated exhaust gases that are returned to the inlet of the diesel engines. By connecting this unit to the crankcase breathing channel, oil droplets and soot are removed and returned to the oil sump. The Alfdex is sealed for life and requires no maintenance or service during the engine's lifetime.

New application for an old technology

The working principle of this product originates from Alfa Laval's century-old technology for industrial centrifugal separators

Higher performance Alfdex removes both oil droplets and soot from the vent gas, and these are returned to the sump via a drain pipe. The result is increased turbocharger and intercooler efficiency.

Reduce engine maintenance

The crankcase gases are cleaned so effectively that fouling of the turbochargers and intercooler is practically eliminated. The operator will see dramatically increased cleaning intervals.

Oil droplets separate out from the gas. The droplets of oil and soot are thrown onto the mounting wall where it flows down the walls to the drain outlet feeding back to the sump, eliminating the need to service the Alfdex.

Consistent engine performance

Current closed crankcase breathers typically do not have the necessary oil mist removal capabilities to keep turbo charger blades and intercoolers clean for extended periods. Over time, they become coated with oil and soot,

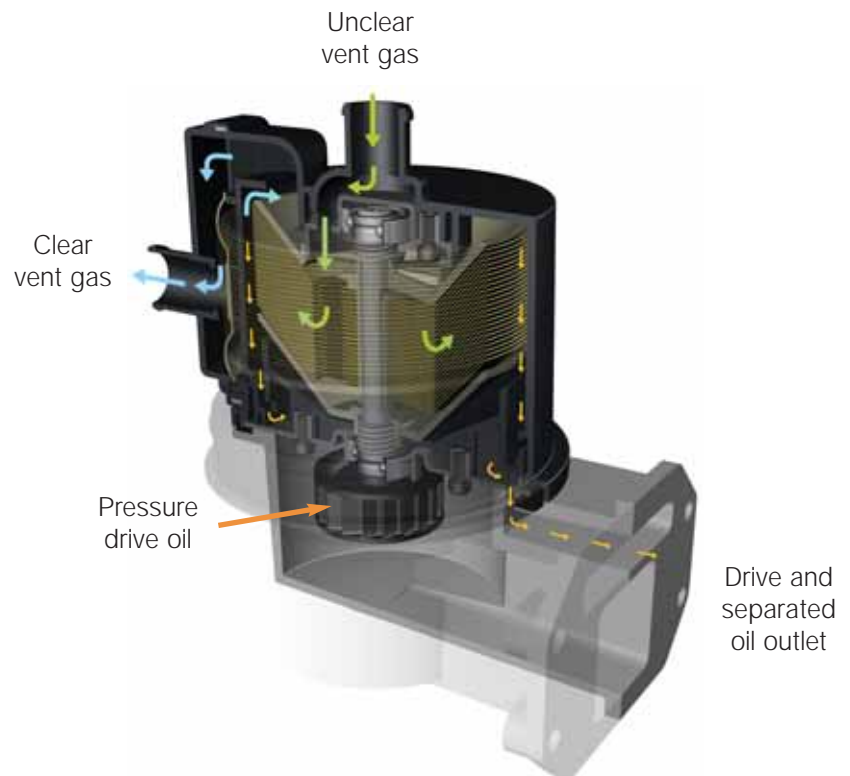
causing engine performance to degrade. With 97% - 98% oil removal efficiency, Alfdex keeps these surfaces much cleaner, allowing your engine to operate consistently at peak performance.

Regulations

- Complies with current and future emissions regulations
- Technically developed to help you meet the global emissions regulations

Oil driven

The Alfdex is driven by an oil turbine fed by a small flow of pressurized oil. The turbine spins a centrifugal rotor which carries a number of stacked conical disks. In addition to being a separator unit, the disc stack works as a fan, extracting gas from the crankcase. Therefore, there is no pressure drop across the unit. An internal pressure control ensures the crankcase pressure is within a suitable working range.



Cooling through heat transfer solutions

We offer compact, highly efficient integrated cooling solutions for your engine, designed to meet today's and future power density and legislative demands.



Engine Cooling



Providing an edge over the competition

The engine market is filled with competitors vying to increase market share. Engine manufacturers are experiencing tighter emission requirements and limited resources. Partnering with suppliers of advanced technology allows manufacturers to provide leading-edge, cost-efficient solutions that support their market strategies. At the same time, companies are proactively reducing the number of suppliers to drive costs out of the product.

We build on this concept with ALICS, taking the integration of multiple components and functions to eliminate some of the suppliers needed for the complete scope of supply. The reduction in supplier bases allows for efficiency gains within the purchasing, quality, manufacturing, and logistics groups. Alfa Laval's long history in working with diesel engine manufacturers and end users makes us the first choice for optimal diesel engine design and operation.

Integrated solutions

The Alfa Laval Integrated Cooling System (ALICS) is a self-contained cooling system designed to bolt directly to the engine. ALICS incorporates multiple features and functions into a single, compact solution. These features include:

- Heat exchange
- Expansion tank
- De-aeration chambers
- Thermostats
- Mounting brackets
- Bypass or crossover piping into a single, compact solution

Moving more functions into the ALICS allows for a cleaner engine package and shortens the overall envelope.

Varying scope of supply

We realize that engine manufacturers have different business models. Some manufacturers keep all design and assembly in-house, while others outsource them. Alfa Laval and ALICS will work in any business model. The ALICS solution ranges from plate packs to assembled heat exchangers to more function integration. We can work together to develop a

solution and supply system that fits each company, making Alfa Laval your "easy to do business with" partner. Alfa Laval takes responsibility for the design and integration of the ALICS. The engine manufacturer saves design and engineering resources for work on core products. We will utilize cooperative engineering to create a package that meets the functional and esthetic demands, resulting in a dramatic cost reduction of new product introduction.

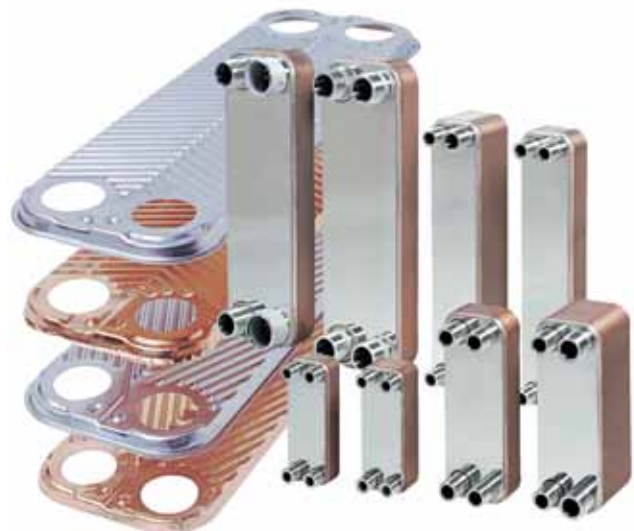
Engine platforms

Utilizing the AI-Flex concept, ALICS is a platform to use across engine families. The mounting, frame and connections can be standardized. The only feature changing is the number of plates needed to dissipate the heat per additional cylinder. When adapting products in the same engine family, the engine manufacturer can standardize on the components behind the ALICS, resulting in lower engineering costs and a shorter design and testing cycle.

ALICS integrates multi-function parts that previously were loose components – reducing assembly time. Rather than having to order, ship, manage, kit, and physically install the loose components, ALICS arrives at your facility as one complete assembly ready to bolt to the engine.

Retrofits

Older engines can benefit from new technology and gain market advantage. ALICS can be designed to fit old, as well as new, engines. The engine does not need to change; with ALICS, we adapt our product to fit your engine.





ALICS on the MTU 10V 2000 engine

Cooling with compact, efficient heat exchangers

Whether your application calls for a plate and frame or brazed heat exchanger, either may be integrated to offer the best possible ALICS solution.

Our plate heat exchangers are designed to be compact and lightweight. Compared to shell-and-tube coolers, our plate heat exchangers are typically one-quarter the size and weight.

The Alfa Laval brazed heat exchanger (BHE) is the original brazed plate heat exchanger. Consisting of channel plates, two cover plates and connections (all stainless steel), the BHE is your simple solution for heat transfer. The BHE concept is a variation of the traditional plate and frame heat exchanger, but without gaskets and frame parts. Also, in many applications the BHE is the more cost efficient, space saving solution over both the plate and frame and the shell-and-tube heat exchangers.

The thin corrugated stainless steel channel plates are vacuum brazed together using either copper or nickel as the brazing material.

- Compact size
- Low weight
- Low hold-up volume

Flexibility

For plate and frames, we call it Al-Flex. This means that without changing the frame, we can increase the capacity of the coolers simply by adding plates to the platepack.

Our BHE's offer you added space due to the smaller package compared to the shell and tubes. In the case of water vessels, this means added space to haul more product – directly affecting your bottom line.



Marine experience

The marine segment has the combined challenge of the seawater environment along with even higher horsepower ratings and severe stop and go operation. Seawater can drastically affect the operation of the engine if the cooling system is not properly designed. Although our plate heat exchangers can be made out of various metals or composites, we use titanium for seawater applications because of its high corrosion resistance. The titanium plates have a lifetime of 20 years, sometimes longer than the engine, and are lighter in weight compared to bulky copper tubes.

Depending upon the application, we can integrate either a plate and frame or BHE for the best possible solution. Alfa Laval is now more flexible than ever before with the new AlfaNova, the world's first 100% stainless steel plate heat exchanger. The secret to AlfaNova is its ability to endure the most extreme temperatures and pressures due to AlfaFusion, a unique technology patented by Alfa Laval. For your most aggressive fluids and extreme applications, we can integrate AlfaNova into your systems to further optimize your process.

Vibration resistance

On plate and frames, each plate uses a gasket to seal the plates and direct the fluids.

The gasketed plate allows for a “softer” package that is more resilient to shock and vibration loads. The plates have 5 points of alignment, preventing the plates from shifting. The gaskets will naturally provide dampening to the design in contrast to shell-and-tube coolers that tend to bend and crack at the headers.

Limiting fouling

The plate heat exchanger inherently has turbulence along the plates with shear stress values typically greater than 50 Pa. The turbulence reduces fouling resulting from poor water quality or severe operating environments. To the operator, the plate heat exchanger will have a longer maintenance interval, reducing operating costs.

Ease of service

Plate heat exchangers are easy to service.

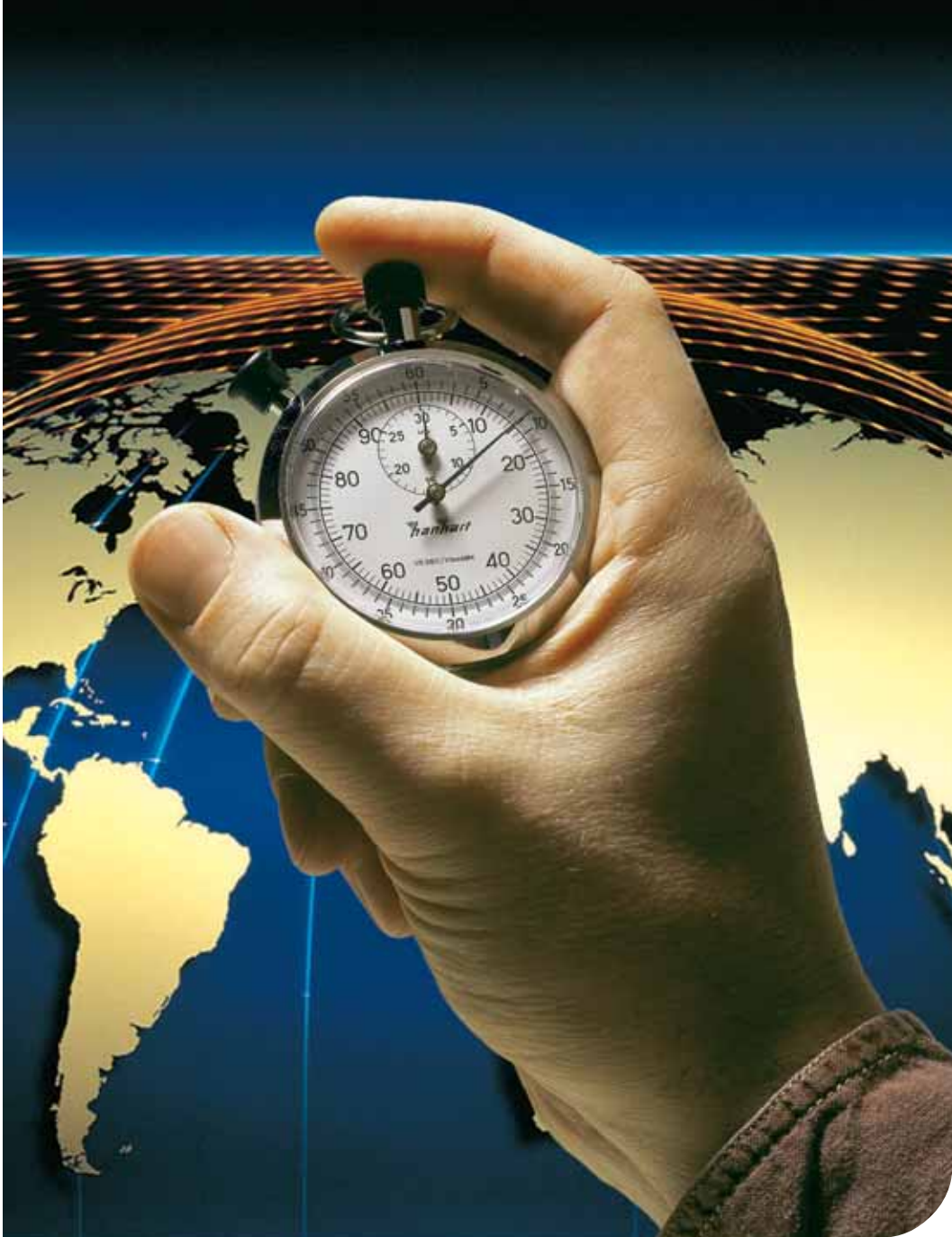
- Flat plates are much easier to clean than small tubes
- Contrary to the expensive inspection necessary with shell-and-tubes, the entire surface is visible and can be readily inspected to verify cleanliness
- Easy to service gaskets – our patented clip-on gasket is designed to fit without any additional glue or fastening device
- The special sealing function is not compromised by the fastening method
- The heat exchanger returns to 100% operational level following cleaning

A typical shell-and-tube cooler requires enough room to remove the entire tube bundle from the shell. This makes for an overall larger installation envelope and a bigger engine room. Our plate heat exchangers can be serviced by allowing 1.4 times the heat exchanger size – a far smaller amount than the 2 times needed for a much larger shell-and-tube. To the owner, this means a smaller engine room with smaller, lighter engines allowing more product and faster speeds.



Leading-edge technology, manufacturing facilities throughout the world, more than a million units delivered each year – Alfa Laval understands volume production. With numerous points of distribution, all linked together in a global network, we deliver wherever and whenever you need it. Our timing is perfect.

Service



Around the world, around the clock...

Today's globalization requires suppliers who can meet customers' needs: around the world, around the clock. This means being large enough internationally to be strong locally. We stock your parts for easy, immediate delivery and offer regional service centers and field service for your convenience. Alfa Laval is there for you – wherever and whenever you need us.

- Total concept service
- Worldwide presence
- Around the clock, Just-In-Time delivery
- Experienced service teams

A lifetime commitment

We call it Nonstop Performance.

At Alfa Laval, we are committed to a relationship that extends throughout the lifetime of the product or system. Our mission is to raise your productivity, reduce your downtime and ensure Nonstop Performance for your systems.

Our contact center, field service representatives and service centers are dedicated to this commitment we make – to every customer – from the moment they choose Alfa Laval. This dedication is to optimize the performance of your processes. Time and time again.

Tailored to your requirements

Alfa Laval service is based on knowledge and expertise obtained from years of experience in a multitude of industries. We see every product as a key part of your process and understand the role it plays within your business.



Whether it is on an "as-needed" basis, through a Performance Agreement alone, or an agreement with Alfa Laval's TurnKey option, the choice is yours. We will work in close collaboration with you to tailor an individual service package that matches your requirements for optimizing performance, streamlining costs and reducing downtime.

Service Centers

With seven Service Centers to serve you in the USA, we minimize your turnaround time to keep you running smoothly. Our TurnKey service reduces unplanned downtime, extends machine life, allows for quick turnaround and takes the overall maintenance burden away from you so that you may focus on your business. Our service experts are there to work with you throughout the process.

Delivery

Our global distribution network ensures continuous, just-in-time delivery for your operation. Alfa Laval's leading-edge production resources are at your service, with just-in-time delivery to meet your needs.

Customer service

Alfa Laval has the resources to offer full commitment throughout the lifetime of your project. We have been here for you since 1885, and we are here for you today. Call our customer service consultants, on call twenty-four hours a day, seven days a week. We are here to serve you – whether you are in need of technical expertise, Alfa Laval genuine spare parts and service quoting, training, field service scheduling, or just general information.

Training

On-site or at one of our Alfa Laval facilities – Alfa Laval will provide you with the training you need to maintain optimal performance for your systems.

Streamlined order processing: E-business, EDI

When you become an Alfa Laval partner, our order handling systems can be electronically interfaced with yours. This ensures greatest cost efficiencies and highest order accuracy.



Alfa Laval's leading-edge production resources are at your service, with just-in-time delivery to meet your needs.

Solid foundations

The foundation of our Nonstop Performance concept is our worldwide network of service and distribution centers in more than 50 countries. Located close to the customer, these centers stock a complete range of Alfa Laval genuine spare parts. Our well-trained specialist teams can provide on-site service when needed, usually within 24 hours. And they are backed by the entire Alfa Laval organization.

Global or local, we're there to serve you

Alfa Laval is as vital to customers with limited geographic operation as to those serving worldwide markets. Our operations include everything from volume production to customized solutions, combining our core competencies in several processes with an extensive guarantee and service commitment.

Alfa Laval offers:

- Global competence
- Systems solutions
- Training
- Modular units
- R&D
- Operations support
- Applications know-how

Worldwide presence to serve you best



Imagine, create, deliver...

Alfa Laval's core competencies are separation, heat transfer, and fluid handling. We continuously develop products and processes that help protect the environment, save natural resources, and make industry more efficient. This strong focus on research and development, and the concentration of our activities, makes us market leaders in the industries in which we operate.



Our mission is to optimize the performance of our customers' processes, time and time again.

- Solutions based on industry needs
- Integrated systems
- Measurable benefits

Creative solutions with measurable benefits

Product development is conducted in close cooperation with the customer in order to achieve results that are commercially viable for the customer and for us.

One of our strengths is the capability to combine our knowledge of the customer's needs with integrated technical solutions, providing measurable benefits in terms of efficiency and utilization of resources.

Our know-how adds value to your engines.

Don Matthey and Lori Mallison from the OEM team review drawings for a new system

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, foodstuff, 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.us

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