



Efficiency in boilers and beyond

Steam production and waste heat recovery



A century of putting heat to work

For around 100 years, Alfa Laval's Aalborg solutions have been at the leading edge of marine thermal technology.

New times, new relevance

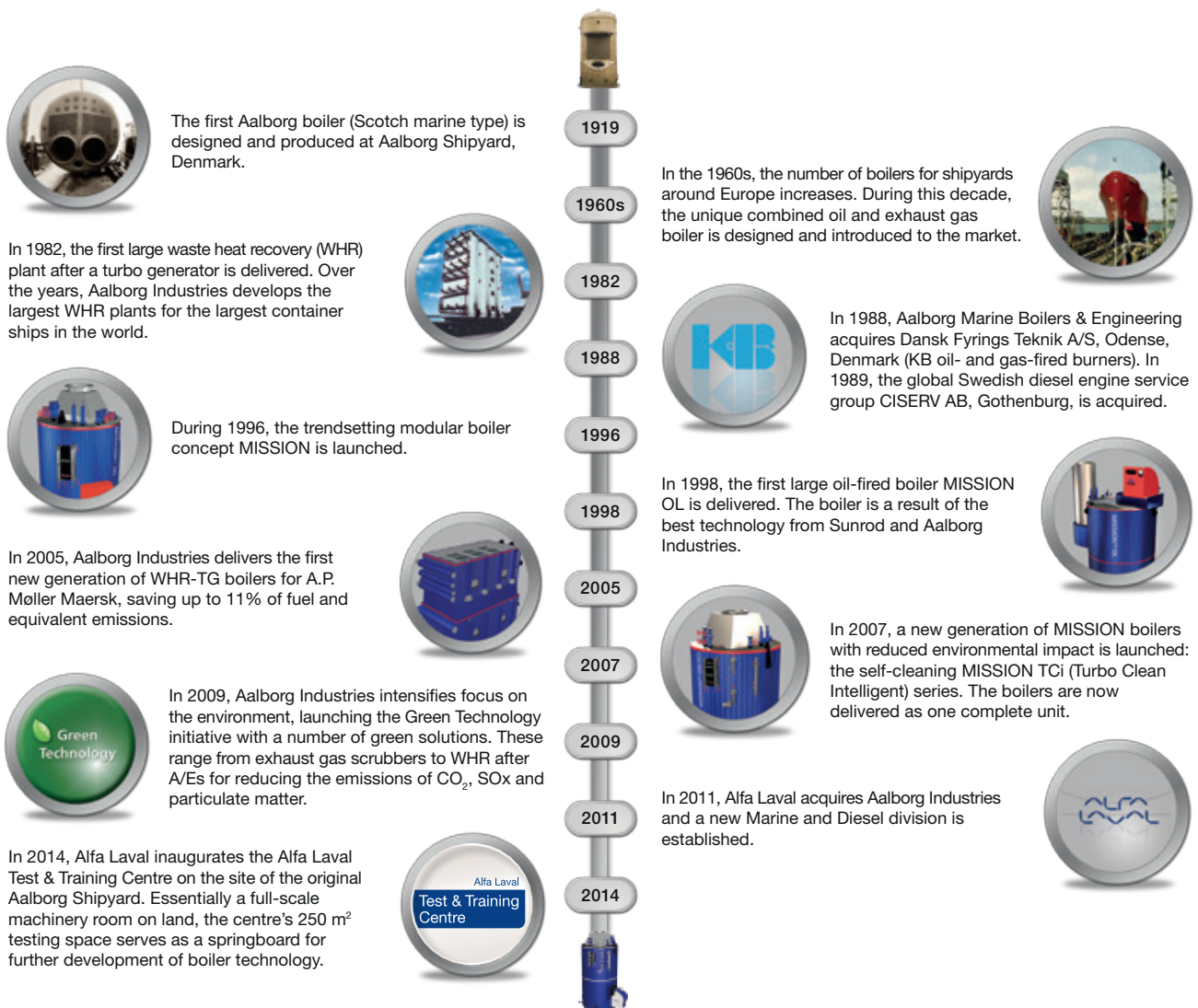
Alfa Laval has a long history of innovation in heat transfer and boiler development. Included in that history are many milestone achievements that can still be seen in our Aalborg products.

Now, however, our work with boiler technology is more important than ever. In the world of slow steaming, your vessel's economy depends on how thermal energy is produced and the efficiency with which it's handled downstream. Simply put, your choice of boiler has an impact on your profits.

Today's driving force

Energy efficiency has always been a strong driver in Alfa Laval's boiler development. This makes us a key part of the industry's push to reduce energy consumption.

Building on our expertise with traditional boilers, we pioneered the concept of waste heat recovery. Since then, we've expanded the scope of our solutions to cover both main and auxiliary engine exhaust. Today we're expanding it further, allowing recovered energy to be used not only for electrical power, but also for propulsion.



Boilers and burners

Did you know that every second commercial ship in the world has an Aalborg boiler from Alfa Laval on board? Read more about our advanced boiler and burner systems on pages 4–7.



Waste heat recovery

Did you know that Alfa Laval's waste heat recovery solutions can provide energy savings of up to 14%? Read more about waste heat recovery on pages 8–11.



A partner to rely on

With a century of expertise to draw upon, Alfa Laval has the practical and technological depth to advise you on the most suitable boiler configuration for your vessel. In addition, we have the resources to deliver and support it.

Where competitors choose to supply equipment through joint ventures, we manufacture our solutions at our own facilities. This gives us full control over design and production, just as our broad network gives us full global coverage when it comes to service.

Boilers and burners

Aalborg boilers and burners encompass the best of the efficient features Alfa Laval has developed over the years, along with the latest advances. Yet perhaps their biggest asset is the way they operate in perfect harmony – with each other and with the steam consumers downstream.

The new generation of leadership

Meeting steam demands on board is as vital now as it always has been. But today there are new factors impacting why and how this is done. In an era of slow steaming and emission restrictions, the reduction of energy use and environmental impact can be as important as the steam volumes themselves.

Alfa Laval is at the forefront of meeting these challenges, with new boiler concepts and flexible burners that can handle multiple fuels. A perfect example is our self-cleaning TCI (Turbo Clean, intelligent) boiler design, which reduces the need for water washing and the need for effluent disposal.

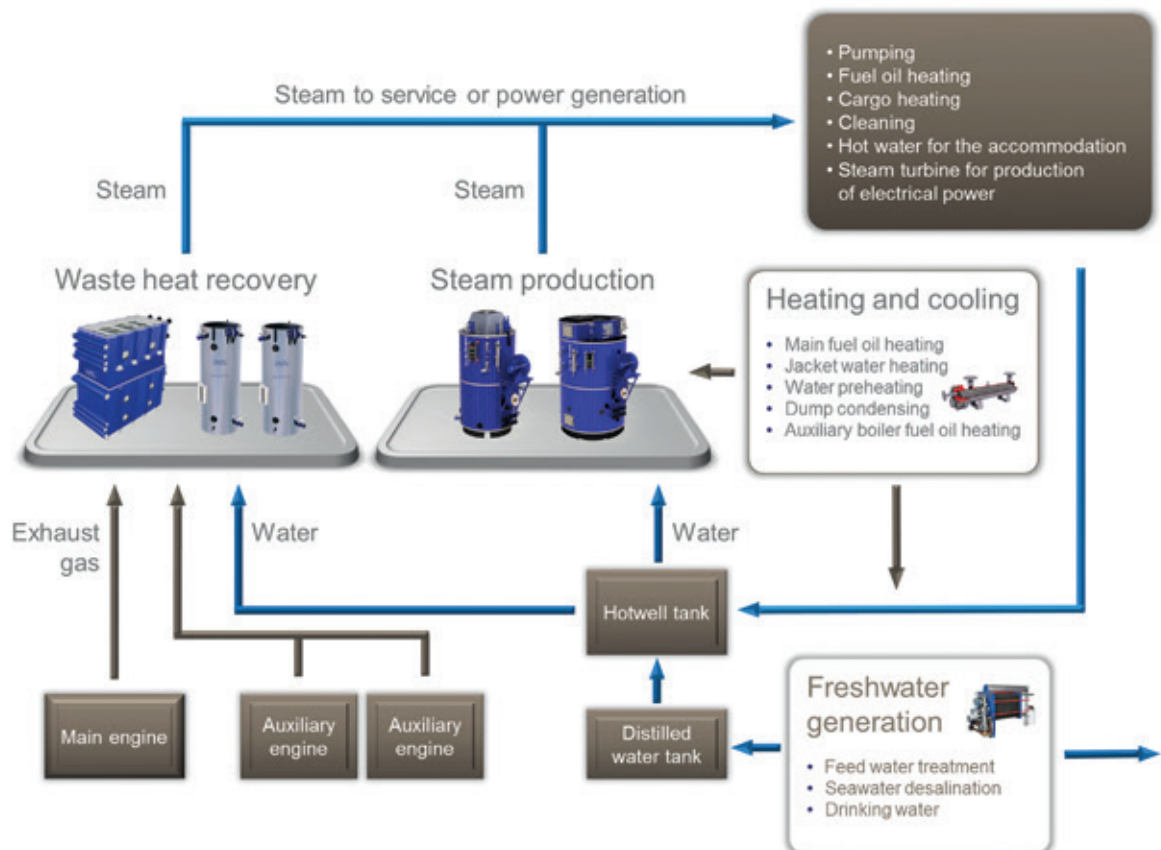
What remains unchanged is the fact that we have all the necessary components within our portfolio: boilers, burners and advanced control.

Adapted for total efficiency

Because Alfa Laval develops and produces all necessary components in-house, we can optimize boiler and burner systems in their entirety. This involves not only the right match between boiler and burner, but also the fine-tuning of heating surfaces and other aspects for an optimal balance of cost, benefit and efficiency.

In addition, it involves matching the components to the steam consumers they serve. By adapting the plant design and performance to the specific conditions downstream, we can ensure the highest efficiency in the steam line as a whole.

Our deep experience and expert configuration tools are all a part of the package.



Always in full control

Optimized steam production depends not only on the boiler and burner, but also on the control system that steers them. Alfa Laval control ensures safety, fuel efficiency and lower emissions by securing the correct combustion conditions and constantly adjusting the boiler plant to critical parameters.



Control at your fingertips

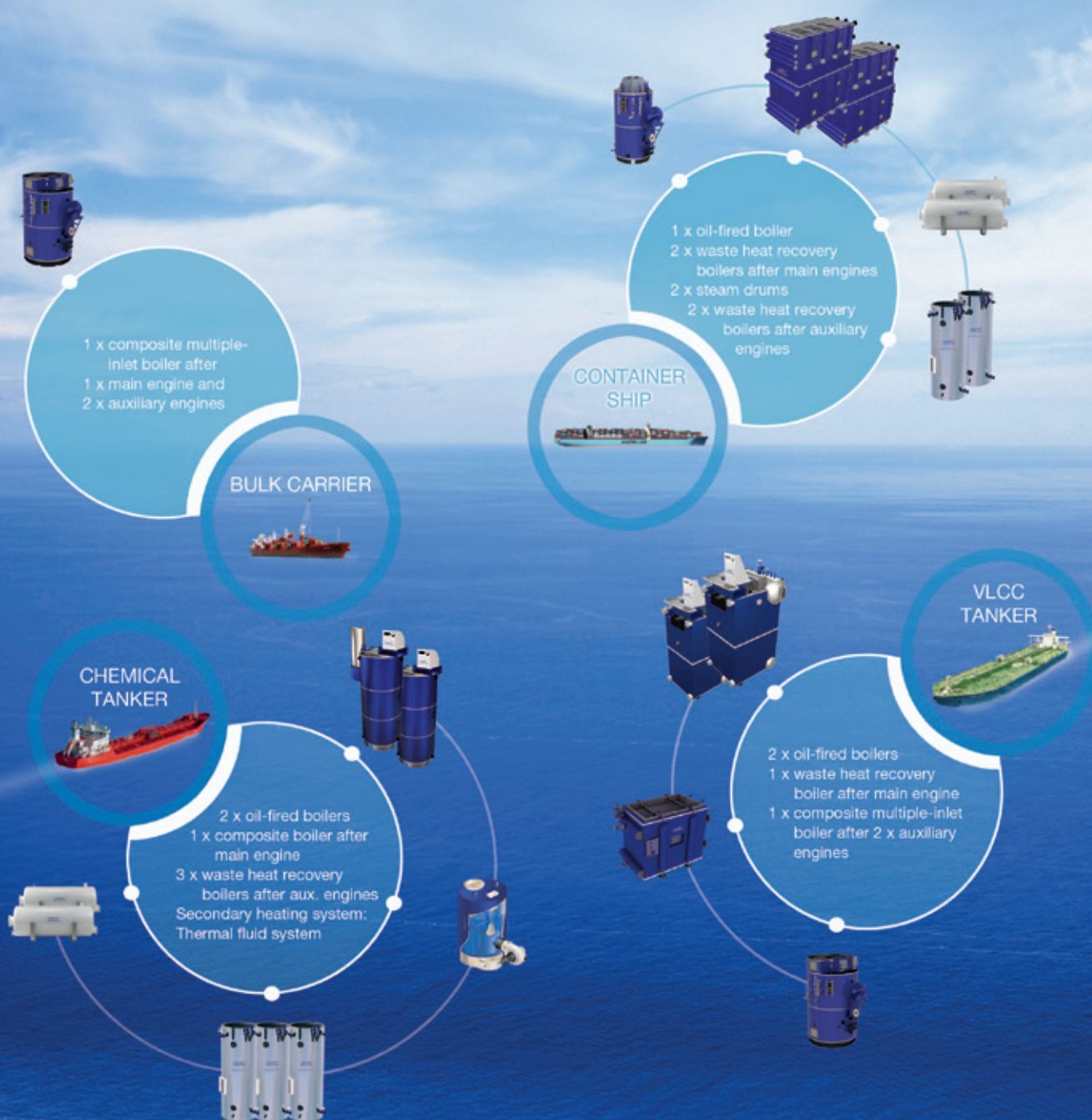
Alfa Laval has long been the leader in boiler and burner control. We were the first to introduce self-diagnostic testing for maritime boiler systems, as well as to provide a clear visualization of operating sequences.

Today's Alfa Laval Touch Control, which features the Alfa Laval 2Touch controller, takes this expertise to a new level. As well as offering a graphical overview of the boiler plant, it provides quick access to functions and data. As the name implies, the Alfa Laval 2Touch controller makes any aspect of the plant available in just two touches of the screen.

Using the comprehensive data at its disposal, Alfa Laval Touch Control ensures thorough plant optimization. Naturally, it integrates seamlessly with other Alfa Laval automation systems and connects easily to ship control and communication.

The world's best-optimized boilers

The Aalborg boiler range from Alfa Laval combines exceptional thermal characteristics with a high degree of flexibility. Aalborg boilers are available in a full range of designs and configurations, with capacities to suit any operating profile. Pairing them with the right burner and control, we optimize their energy performance to your particular vessel.



The most efficient combustion

Optimal combustion is vital to fuel efficiency and economy on board. The right burner, in combination with the right boiler and control, can save fuel and reduce emissions. With well over a half-century of know-how going into them, the burners of our Aalborg range are perfectly matched to the boilers they serve.

Burners

Aalborg burners from Alfa Laval are designed for reliable ignition and precise combustion. Able to effectively atomize liquid fuels, they maintain a uniform and accurate air-fuel ratio. This ensures ideal heat transfer efficiency and reduces the fouling of convection surfaces in the boilers they support.

Over the years, our burners have become steadily lighter and more versatile. As a result, they possess all the flexibility needed for today's high demands. Easier to install and maintain as well, they feature smart modular constructions that simplify assembly and access.



Aalborg KBSD

Multi-fuel solutions

Today's vessels run on a range of fuels, often having multiple fuels on board. Multi-fuel burners and boilers have long been a part of Alfa Laval's offering, including options for use with LNG in addition to residuals and distillates.

Producing steam with LNG is no simple task. A separate gas valve unit for the burner is necessary, as are further safety precautions and additional monitoring. Even the boiler must be differently configured and sized, owing to the differing flame characteristics.

Given Alfa Laval's unmatched application knowledge and fuel experience, we are the ideal partner to help you meet these challenges.



Alfa Laval has provided Aalborg boilers and burners for the LNG ship VELIKIY NOVGOROD. The ship is equipped with two large oil-fired Aalborg OL boilers with Aalborg dual fuel burners and four Aalborg XW-TG waste heat recovery boilers after MAN dual fuel engines.

Waste heat recovery

As energy efficiency grows even more important, the focus is widening from the production of thermal energy to the reuse of what already exists on board. Already the leader in waste heat recovery, Alfa Laval is expanding both the application and its potential for every vessel.

Why let fuel go up in smoke?

Only 50% of the fuel energy released by your vessel's main engine actually goes to propulsion. The rest of it escapes as heat, and it makes sense to reclaim as much of this energy as possible. Alfa Laval boiler technology can recover a substantial amount of it from the exhaust gas – not only from the main engine, but from auxiliary engines as well.

Energy to push forward

Waste heat recovery today is a broader application than ever before, with a significant potential for all vessels. And in a time of slow steaming, it pays to think more broadly.

Recovering heat energy from auxiliary engine exhaust, for example, can do more than meet steam needs in port. For vessels whose long-stroke main engines produce cooler exhaust, it can also provide a needed boost in steam production en route.

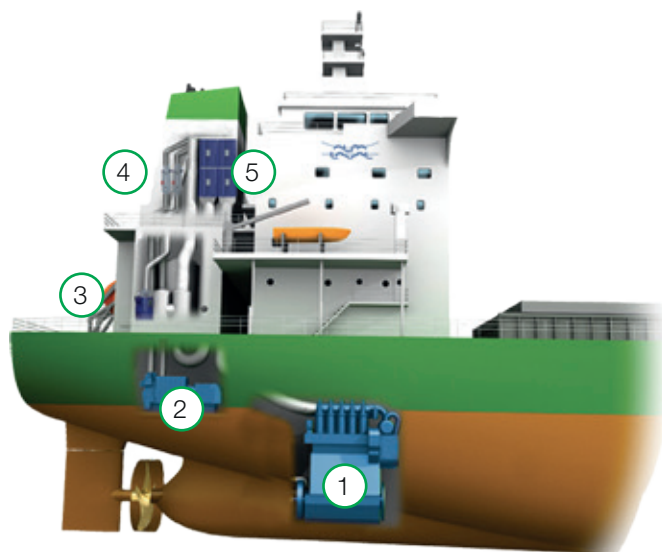
Not limited to serving onboard equipment, today's waste heat recovery systems can even be constructed to provide a boost in propulsion.

1. Main engine(s)
2. Auxiliary engine(s)
3. Oil-fired boiler
4. Auxiliary engine waste heat recovery
5. Main engine waste heat recovery

Partnered for guaranteed savings

The effectiveness of Alfa Laval waste heat recovery systems derives not only from our own boiler technologies, but also from our ability to work with others. Our systems are developed in deep cooperation with other suppliers, from the engine maker to the turbine manufacturer.

Each part of a waste heat recovery system is optimized in relation to others. By partnering with the suppliers of related equipment, we can provide an absolute guarantee of your energy savings – which can be as high as 14%.



EEC module to increase steam production

A growing number of vessels have a bypass valve in their engine system. This lets them bypass the main engine turbocharger, making more energy available for waste heat recovery. In this way, they can compensate for low exhaust gas temperature and increase their steam production at sea.

With Alfa Laval's EEC module, the function is fully optimized. A pressure transmitter on the boiler communicates with the turbocharger bypass, keeping it open just enough to support waste heat recovery. This secures the needed steam, but without diverting more from the turbocharger than necessary.

Utilizing all energy sources

At today's fuel prices, it makes sense to recover heat energy wherever possible – not only from the main engine exhaust. In light of modern engine constructions and slow steaming practices, looking at all exhaust gas sources can actually be a necessity.

Auxiliary engine solutions

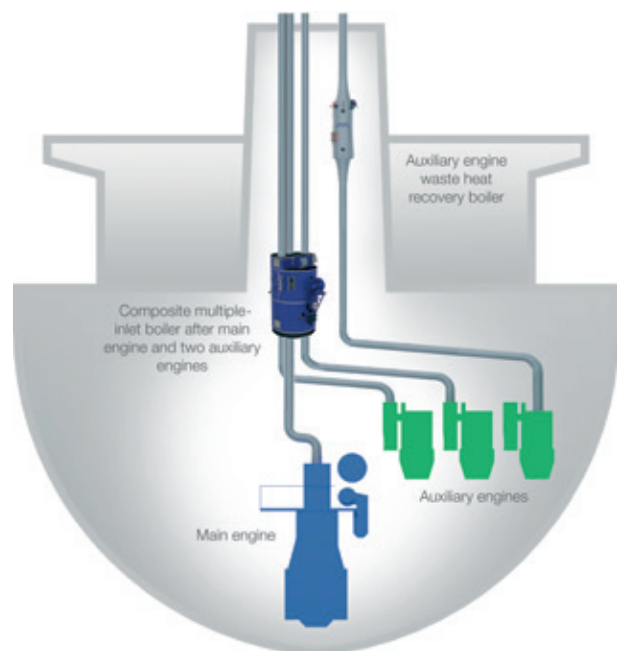
When fuel prices were lower, the waste heat from auxiliary engines seemed less important. But low fuel prices are a thing of the past, and the payback time for auxiliary engine solutions is now less than two years.

In some cases today, auxiliary engine waste heat makes a critical difference – and not only for meeting steam needs in port. Increasingly often, the cooler exhaust of long-stroke main engines is not enough to meet steam needs en route. By integrating auxiliary engines into the steam line, use of the oil-fired boiler can still be prevented at most engine loads.

Solution 1

Direct utilization of steam

In its most basic configuration, a waste heat recovery system provides steam for direct utilization by vessel steam consumers. This is especially common on cruise ships, for example, where a wide range of steam-driven processes can be found on board.



The chemical tanker STOLT SNELAND is equipped with two medium-size oil-fired Aalborg OM boilers with Aalborg burners and an Aalborg XW waste heat recovery boiler system.



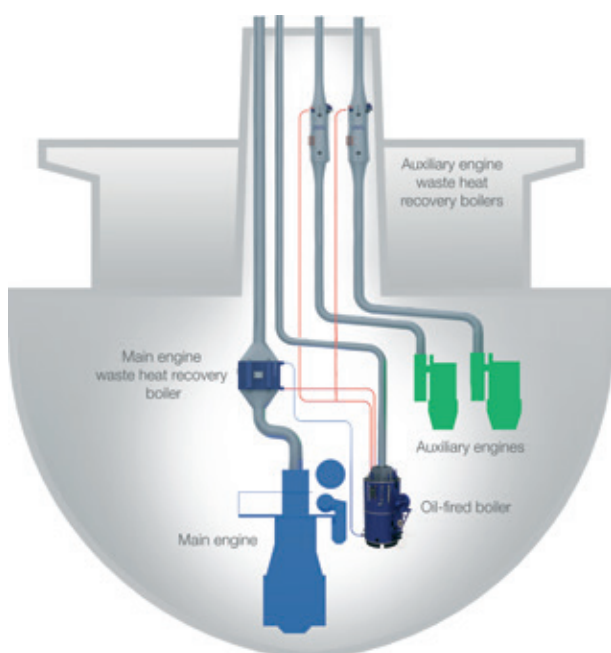
A systematic approach to energy efficiency

A waste heat recovery system is much more than just an exhaust gas boiler. The complete system incorporates the engine, steam turbine and steam consumers – and increasingly a shaft generator. Alfa Laval works closely with all suppliers involved, which is the only way to achieve maximum energy savings.

Main engine solutions

When we first began adapting our Aalborg boiler technology to waste heat recovery, the main engine was in full focus. This was the natural place to start, given that 50% of the fuel energy released by the engine is turned into heat rather than propulsion.

Today we can recover up to 14% of that energy, which means both substantial cost savings and lower emissions through reduced fuel consumption. Over the years we've refined our main engine solutions, creating high-efficiency boilers that remain problem-free in challenging, sooty exhaust conditions.



Solution 2

Conversion of steam to electricity

Most often, the waste heat recovery system extends to the steam turbine as well. Part or all of the steam produced from the waste heat is thus used to generate electricity. On container vessels, for example, such a system frequently provides electrical power for container refrigeration.

Solution 3

Power for propulsion

Today, waste heat recovery can even support vehicle propulsion. In this case there is an electric motor integrated into the shaft line, to which the electrical power from the steam turbine can be diverted.

Operating in a standalone mode, the electric motor can serve as a shaft generator. In addition to preventing the auxiliary engines from running, this increases the reliability of the onboard power supply and reduces wear and tear on the auxiliary engines.

Recovery solutions for all needs

Alfa Laval's waste heat recovery solutions can improve the energy efficiency of virtually any vessel. Our portfolio stretches from advanced tailor-made systems to simpler plug-and-play solutions, including composite boilers fired with either fuel or exhaust gas.

Aalborg OC-TCi



Aalborg XS-TC7A



Tailored systems

Like our traditional boilers, our exhaust gas boilers are generally adapted to the vessel they serve, especially when it comes to main engine waste heat recovery. The more complex the system, the more attention must be paid to sizing, spacing and the configuration of heating surfaces – not only for reasons of energy efficiency, but also to prevent soot build-up and ensure high operating reliability.

Standardized systems

Some applications can be handled with less complexity, such as waste heat recovery from auxiliary engine exhaust. Compact solutions like the Aalborg XS-TC7A are designed to be more or less plug-and-play, combining a high degree of energy efficiency with easy configuration and implementation.

Aalborg XW-TG



Composite boilers

Especially on smaller vessels, a composite boiler can be an economical solution that saves space and reduces pumping needs. Available in single-inlet or multiple-inlet configurations, the Aalborg OC-TCi is a plug-and-play solution that can be fired with either fuel or exhaust gas.

Developing the future

Our work with steam production has its roots in Aalborg, Denmark, where our first marine boilers were produced. Today Aalborg is still on the cutting edge of development.

The Alfa Laval Test & Training Centre

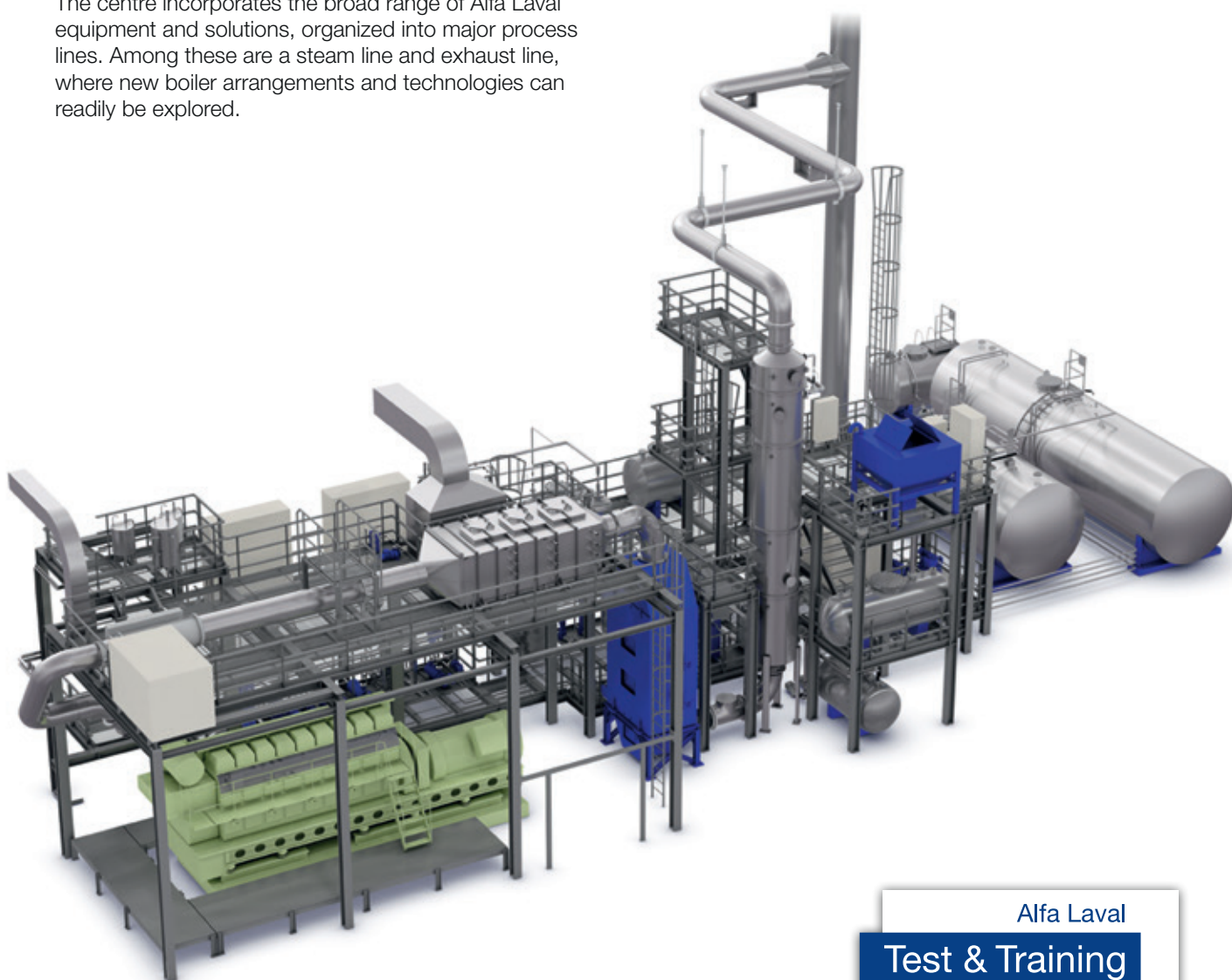
Boiler technology continues to evolve in Aalborg at the Alfa Laval Test & Training Centre. Here equipment and applications can be tested on the scale of an oceangoing ship – but with the control and convenience that cannot exist at sea.

The centre is the closest thing on land to the machinery room of a full-sized commercial vessel, which makes it a springboard for accelerated development. Tests are conducted under operating conditions in a space of 250 m², using a large 2 MW marine diesel engine and a flow of natural seawater.

The centre incorporates the broad range of Alfa Laval equipment and solutions, organized into major process lines. Among these are a steam line and exhaust line, where new boiler arrangements and technologies can readily be explored.

Valuable partnerships

To supplement our own capabilities, Alfa Laval maintains close working relationships with universities, maritime organizations and classification societies. In addition, we cooperate effectively with other leading suppliers of marine equipment, which enables the development of complete and optimized vessel solutions.



Alfa Laval

Test & Training
Centre

Service around the world

Alfa Laval has everything you need in support of your boilers, burners and waste heat recovery solutions. Our assistance begins at the design stage and follows with you wherever you sail.

From drawing board to on board

Alfa Laval is at your service from day one. With our deep knowledge and advanced configuration software, we can respond quickly to inquiries, no matter how complex. Our solutions are presented as accurate designs and backed up with comprehensive, high-quality documentation.

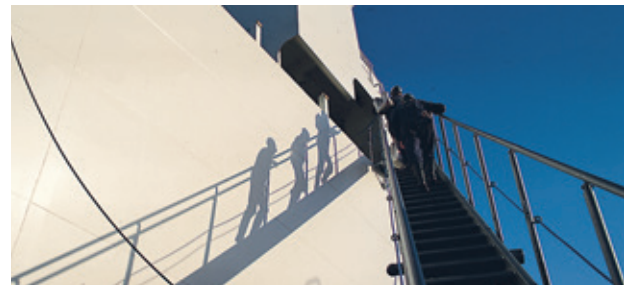
Your chosen solution is delivered to your shipyard on time, where we support its installation and provide expert commissioning services. If you wish, we can also provide training for its future operators concerning daily maintenance, safety precautions and optimized use.

Extending performance

Alfa Laval's commitment doesn't end at equipment delivery. We continue delivering 24/7 to ensure that you receive the benefits of uptime, availability and optimization.

The Alfa Laval Service team is available worldwide, with a 360° Service Portfolio containing everything you need to maximize your equipment's lifetime value. Our offering includes not only spare parts, but also inspections, service, upgrades and refurbishment – of our own equipment, as well as boilers and burners from other manufacturers.

In any port and even en route, Alfa Laval is there to extend your performance.



Alfa Laval service centres can be found all over the world and reflect the breadth of our portfolio.



Product range

Oil- and gas-fired boilers



Aalborg OS



Aalborg OS-TCi



Aalborg OM/OM-TCi



Aalborg OL



Aalborg D

CAPACITY	0.75-6.5 t/h	1.2-8.0 t/h	8.0-45.0 t/h 8.0-20.0 t/h	12.5-55.0 t/h	25.0-120.0 t/h
DESIGN	Cylindrical Vertical Water tubes - pin tube elements in convection part	Cylindrical Vertical Smoke tubes - helix tubes in convection part	Cylindrical Vertical Water tubes - pin tube elements in convection part OR Smoke tubes - helix tubes in convection part (OM-TCi)	Cylindrical Vertical Pin tubes in convection part with integrated soot blowers	Two-drum D-type design Pin tubes or bare tubes in convection part
PRESSURE (working/ design)	7/9 bar(g)	8/10 bar(g)	8/10 bar(g) (OM-TCi) 9/11 bar(g) 16/18 bar(g)	7/9 bar(g) ≤ 20 t/h 18-22 bar(g) ≥ 20 t/h	18-24 bar(g) 40 bar(g)
MEDIUM	Saturated steam	Saturated steam	Saturated steam Hot water	Saturated steam	Saturated or superheated steam Hot water
BURNER	Pressure jet KBOG-E Rotary cup KBE	Pressure jet KBM Rotary cup KBE	Steam-atomizing KBSA Rotary cup KBE Steam-atomizing MPF	Steam-atomizing KBSD Steam-atomizing MPF	Steam-atomizing KBSD Steam-atomizing MPF

Burners



Aalborg KBE



Aalborg KBM



Aalborg KBOG-E



Aalborg KBSA



Aalborg KBSD

CAPACITY (kg oil/hour)	150-1300 kg/h	100-620 kg/h	150-600 kg/h 75-500 kg/h (OC)	600-4150 kg/h	950-4150 kg/h
DESIGN	Rotary cup burner Electronic air/fuel ratio control Compact and low weight Low power consumption The new generation	Pressure-atomizing burner Highly reliably and robust construction Straightforward, modular, user- and service-friendly design	Pressure-atomizing burner Gas-fired dual-fuel burner Safety, simplicity and reliability	Steam-atomizing burner Minimal installation and operating costs	Steam-atomizing burner Minimal installation and operating costs

Waste heat recovery



Aalborg OC/OC-TCi



Aalborg XS-2V/
Aalborg XS-7V



Aalborg XW



Aalborg XW-TG



Aalborg XS-TC7A

0.75-6.5 t/h (oil-fired)
1.2-6.5 t/h (oil-f. OC-TCi)
Up to 5 t/h (exhaust)

0.5-5.0 t/h depending on
diesel engine

0.2-17.0 t/h depending on
diesel engine

15.0-34.0 t/h depending
on diesel engine or
turbo-generator

0,5-5,0 t/h depending on
auxiliary engine

Cylindrical
Vertical
Smoke and pin tubes
Helix and smoke
tubes (OC-TCi)
Bare tubes (OC)

Cylindrical
Vertical (XS-2V & -7V)
Horizontal (XS-4H)
Smoke tubes
Bare tubes with (2V)/
without steam space

Water tubes
Double-gilled tubes
Forced circulation

Water tubes
Double-gilled tubes
Forced circulation
Dual pressure
Superheater

9 bar(g)

10 bar(g)

12-22 bar(g)

18-24 bar(g)

10 bar(g)

Steam

Steam

Steam

Steam

Steam
Hot water

Pressure-atomizing
KBM (OC-TCi)
Rotary cup KBE
Pressure jet KBO-E

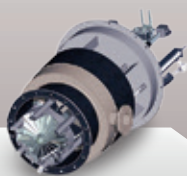
Unfired

Unfired

Unfired

Unfired

Control systems



Aalborg MPF



Aalborg control touch



Aalborg touch control



Aalborg WHR control

640-7500 kg/h

Computerized burner/boiler
control system with panel
and local memory

Multi-functional 15-inch
touchscreen and PLC-
controlled system
Fast access to control
functionality

PLC based control system

Steam-atomizing
dual-fuel burner

Connection to PC with
SCADA software

Reduced installation,
operating and main-
tenance costs

Extensive interfaces with
engine and T/G control
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, 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

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