



# Performance. Simplified.

Equipment and services for the oil and gas industry



# This is where it

In oil and gas, there's no substitute for getting it right. The work is never easy, but it becomes simpler with the right partner at your side. High-performance technology, combined with deep knowledge and broad services, can secure your results.

And that's where Alfa Laval comes in.





counts



# Performance. Simplified.

Onshore and offshore, Alfa Laval provides technology, know-how and services that drive your profitability. Drawing on decades of field experience, we bring you robust solutions that mean easy integration, trouble-free uptime and long-term efficiency. Not only do we secure the performance you count on, we save you time and resources in the process.

## From start to finish

Alfa Laval's commitment goes well beyond the equipment we supply. It often begins before a solution is on the drawing board, and it extends long past the start of operations.

We help you select the right equipment quickly, both for new solutions and for upgrades. And once selected, we get it in place through world-class delivery capabilities and expert project management. Over time we then optimize, service and support your equipment – whenever and wherever – to extend its performance.

## Concept and Design



› Page 6

## Solution and Selection



› Page 7



### Technology built for trust

We offer a comprehensive range of equipment for oil and gas, supporting not only your mission-critical processes, but also your energy efficiency and environmental goals. Ease of integration is the common denominator, along with strong performance you can count on over time.

We develop Alfa Laval technology by listening to you, and by witnessing your challenges first-hand through work in the field. By ensuring that you can depend on our equipment, we ensure that you can depend on your processes.

### Cooperation that pays off

Working with oil and gas is a long-term journey. At any step of the way, we can be a sounding board, an advisor or a close working partner, as we are to major producers in installations worldwide.

No matter how we cooperate with you, our focus is the same. Using our decades of experience and unique technical insights, we find smart ways to overcome your challenges. Simply put, working with us means much less to worry about – and everything to profit by.

## Project and Deliveries



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## Installation and Start-Up

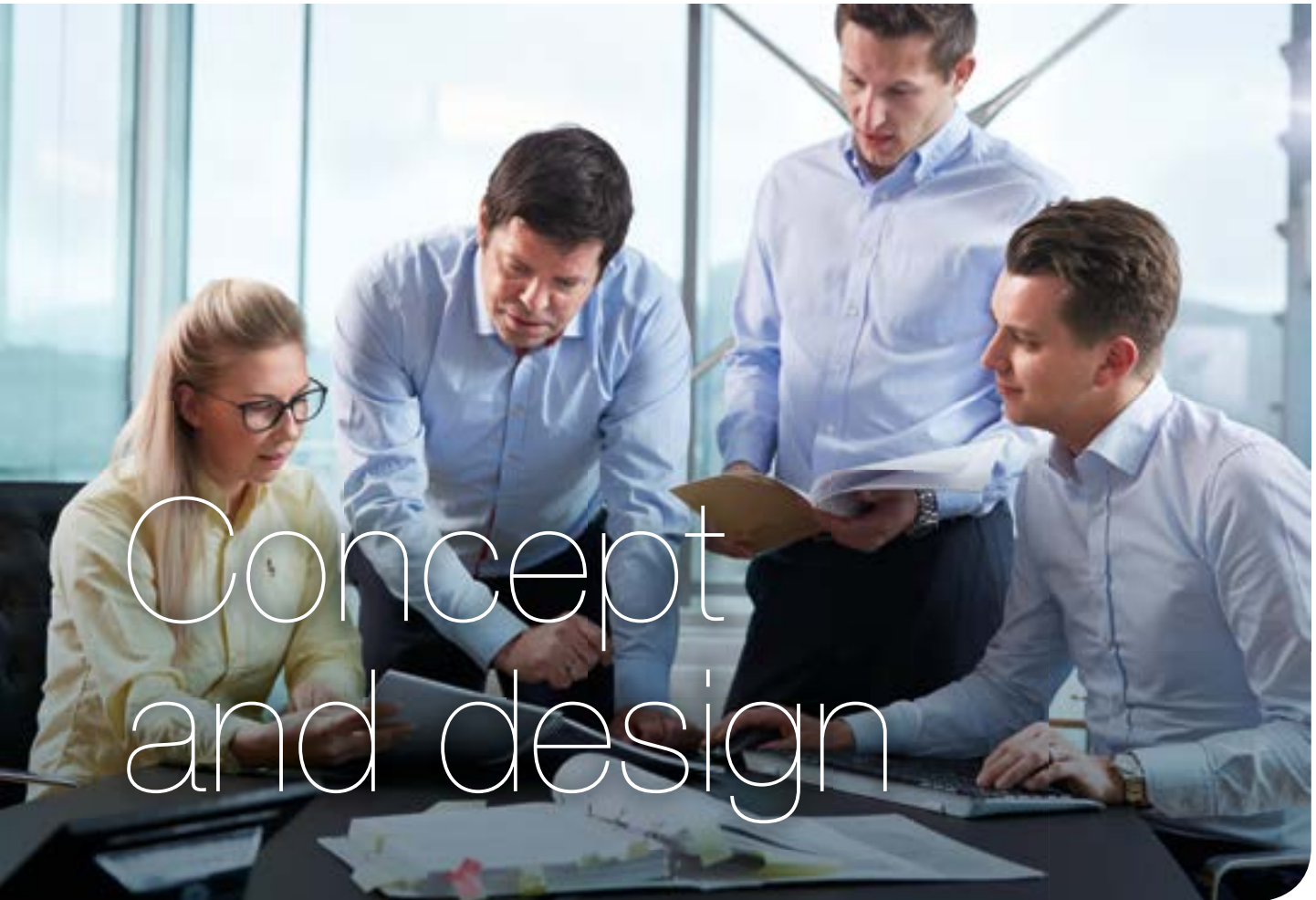


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## Operation and Maintenance



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# Concept and design

Your oil or gas solution begins already in the conceptual phase. Before any technology is chosen, you make decisions that will affect the installation and its potential in the long term. With unique technical breadth and decades of hands-on experience, Alfa Laval can help you make the right ones.

## **An open dialogue**

As you begin researching a new oil or gas installation, Alfa Laval can act as a valuable sounding board. Our experts are in easy reach, whether for a quick discussion by phone or an in-depth consultation in person.

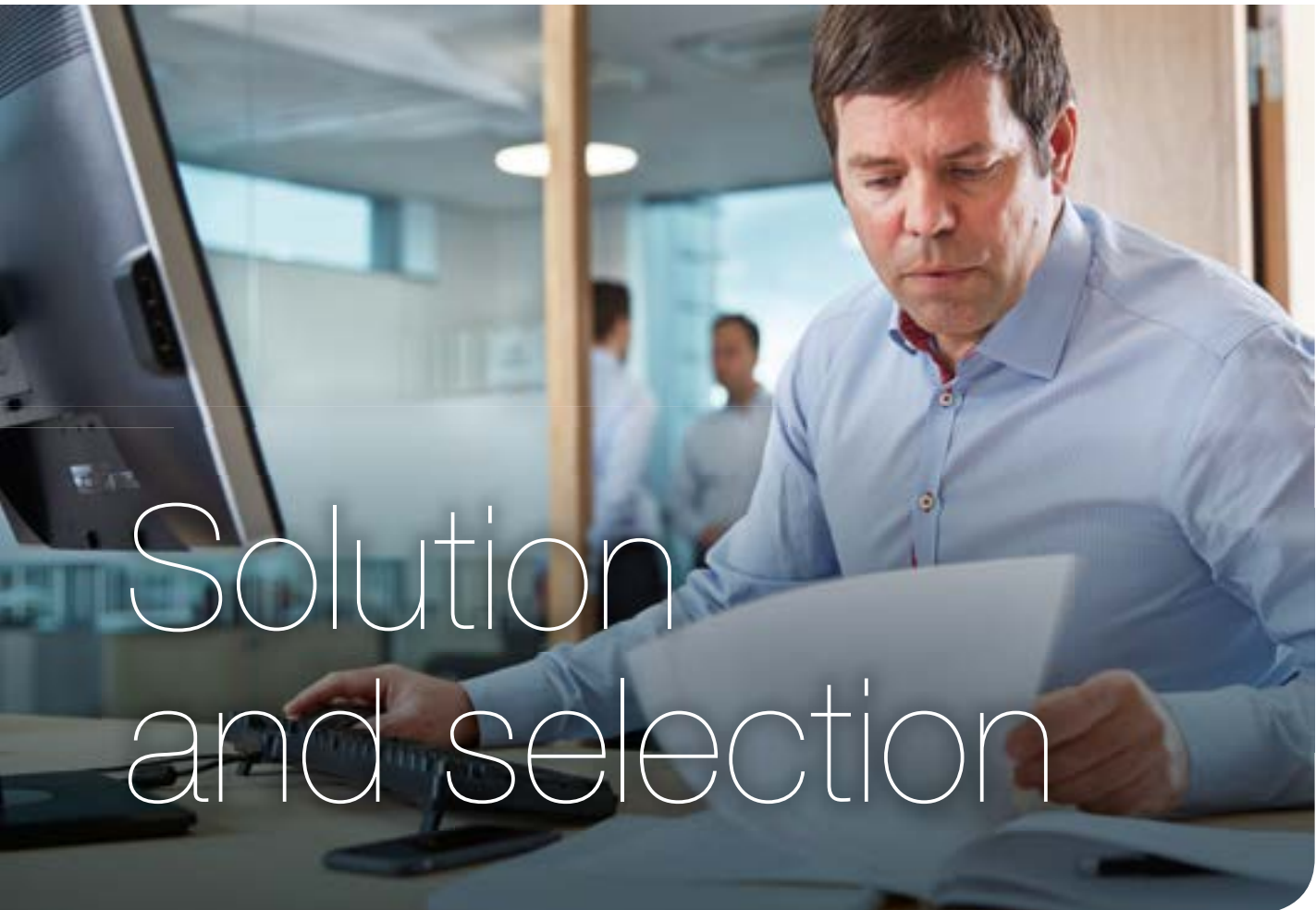
Drawing on a wide scope of offerings and technologies, we can support you from many possible angles. Our breadth of perspective, coupled with our depth of oil and gas experience, makes us a capable speaking partner in the earliest stages of your project.

## **Conceptual thinking**

Alfa Laval's support and guidance extend beyond mere technical advice. While we can provide you with detailed equipment specifications, we can also discuss complete technological concepts.

Appropriate concepts let you optimize the function, reliability and serviceability of the planned installation. Even complex targets, such as minimized environmental impact or high energy efficiency, become easier to achieve.

When it then comes to selecting the equipment, having the right concepts in place will only speed up the process.



# Solution and selection

Once your solution is determined, the right equipment has to be chosen to make it a reality. Alfa Laval has core technologies and systems to meet the full spectrum of needs and regulations. But just as importantly, we have a thorough approach that makes selecting them a fast and reliable process.

## **Quick and confident decisions**

Despite the immense breadth of Alfa Laval's portfolio, the proven technologies you need are easy to find. Knowledge support and 3D drawings are readily available, not only for individual products but also for larger solutions.

Evaluating equipment as part of well-established solutions accelerates your selection process, since you can be sure your selections will work together to achieve your goals. Because our solutions also take operation, maintenance and service into account, that certainty remains over time.

## **From decision to contract**

As selection turns to negotiation and purchasing, Alfa Laval continues to be active. We can support you not only in making your equipment choices, but also in presenting and justifying those choices to others.

Our quotations, like our technical materials, are focused on making decisions easy and execution efficient. We know that conditions and specifications change as solutions are negotiated, which is why we are flexible and quick to respond when they do.





# Project and deliveries

Alfa Laval has many decades of experience delivering to oil and gas projects, involving thousands of systems in many different types of applications. Our knowledge, capabilities and proven routines are your assurance of a smooth and successfully executed project.

## **Ready and receptive**

Even after your solution is fully planned and negotiated, getting selected equipment into place is seldom a simple path from A to B. In anything as complex as an oil or gas installation, there will continue to be specification changes throughout production and pre-delivery.

Alfa Laval has the experience and the capacity to adapt when adjustments are needed – even late in the process. By maintaining a close dialogue with you and other stakeholders in the project, we can respond quickly and effectively to the unforeseen.

## **Taking no chances**

Despite the flexibility of our project execution, our work is thorough and precise. Before delivery to you, Alfa Laval systems are evaluated and approved in full-scale testing. Tests of entire systems – beyond components and parts – ensures you can rely not only on the details, but also on the whole.

Likewise, you can rely on the capabilities of our global delivery network. World-class logistics and a dedicated team ensure our deliveries are correct, on time and ready for integration.





# Installation and start-up

In more than 100 years of supplying equipment and systems, Alfa Laval has perfected the process of bringing them into operation. From physically installing them to securing optimal performance, we create a solid foundation for successful long-term operation.

## **The right connections**

Alfa Laval oil and gas technologies pack functionality and security into the smallest possible space, but are also designed for easy installation and integration. This helps ensure that they run smoothly from day one.

Further assurance is offered by our installation specialists, who can either perform the installation or provide supervisory support. In either case, their expertise ensures that your Alfa Laval equipment is correctly set up and well integrated with peripheral equipment and systems.

## **Optimized from the start**

Another step towards peace of mind is the commissioning of your equipment and process lines. This is where we align performance fully with your expectations.

During commissioning, Alfa Laval specialists both verify and optimize the installation. This involves test runs and performance checks, but it can even extend to operator training and a maintenance dialogue.

At the end of the process is a confident handover. When operation begins, all conditions are in place for smooth operation, easy maintenance and lasting uptime.



# Operation and maintenance

Oil and gas applications are some of the most demanding on land or at sea. But no matter where they are, we're there to minimize risk and maximize uptime. From the robustness of our equipment to the strength of our global service network, you can rely on Alfa Laval.

## **Constant performance**

We believe everything should go right, which is why we cut no corners with safety, durability or ease of use. Alfa Laval equipment is as simple to operate as it is reliable, with foolproof controls and clear system overview.

Our global service network is equally easy to work with, and committed to keeping you competitive throughout your equipment's life cycle. Our experts secure your uptime, but also keep equipment optimized, energy efficient and compliant as demands and regulations change.

Within our Alfa Laval 360° Service Portfolio are all the services to ensure top performance, which can be combined in a tailor-made Performance Agreement to suit your needs.

## **Ready when it matters most**

When things do go wrong, having access to a global service network is crucial. Our committed team provides worldwide backup for all Alfa Laval equipment, including specialist troubleshooting and spare parts direct from local distribution centres.

Aware that every minute counts, our experts dedicate their skills and know-how to bringing you peace of mind. Their aim is not only to get you back in production – but also to make sure you stay there.





## **Simplifying performance – and extending it**

Service is important to consider at all stages of finding and implementing a solution. The Alfa Laval service team provides insights throughout the process, and takes an active role from installation onwards. Our experts minimize costs and maximize return on investment, ensuring constant performance even as conditions change.

Read more about how our services can extend the performance of your equipment on p 55.







# Solutions for oil and gas

The following pages explore key applications in oil and gas, highlighting Alfa Laval equipment and its role. But products alone are not solutions.

Solutions lie in the combination of equipment, insight and experience – and our ability to apply all of them in meeting the challenges at hand.



# Solutions from

In any oil or gas installation, whether offshore or on land, there are countless challenges to face. We can be involved at any stage of meeting them.

Alfa Laval is a wide-scope supplier to the oil and gas industry, with a broad spectrum of solutions that can influence the vast majority of processes. Framo is an Alfa Laval brand representing marine and offshore pumping technologies and related service.

## THE HYDROCARBON CHAIN

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Alfa Laval is present in different ways throughout the journey from hydrocarbon extraction to finished oil or gas product.

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## DRILLING

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Alfa Laval provides high-performance solutions that secure a smooth and cost-efficient drilling process, as well as a wide range of drilling utility equipment and effective means of dealing with waste.

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## OIL PRODUCTION

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Alfa Laval solutions increase productivity and profitability in oil production, no matter how difficult the conditions on site or how complex the production processes themselves.

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# start to finish

## GAS PRODUCTION

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Alfa Laval is at the forefront as the gas market develops, providing an unmatched range of solutions that mean valuable security – even in the most challenging gas undertakings.

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## SERVICE

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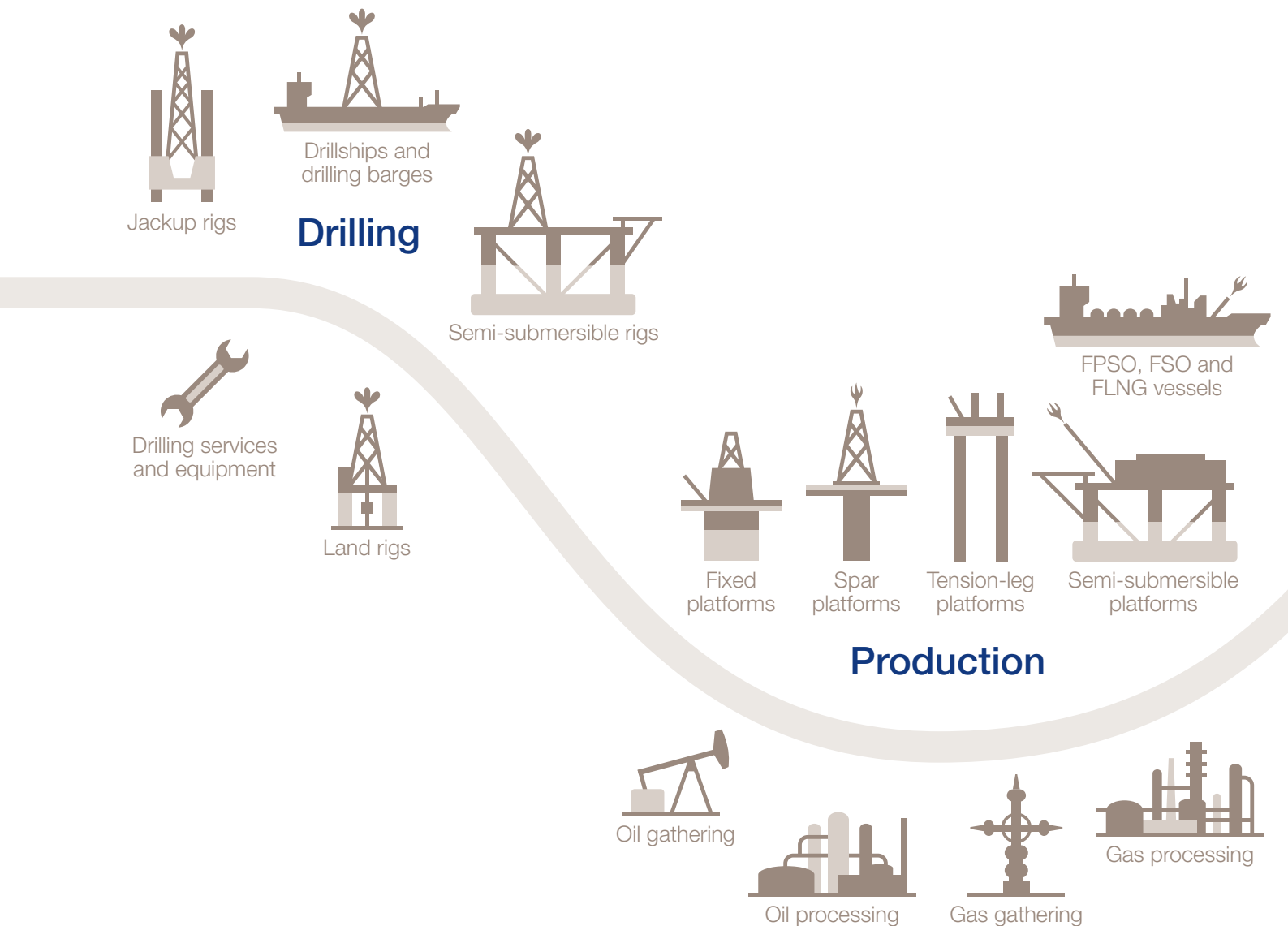
Alfa Laval's global service network provides access to parts and expertise wherever your operations are. Our experts' knowledge, skills and support can extend performance throughout the equipment life cycle.

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# The hydrocarbon

For hydrocarbons, the journey from extraction to finished product is long and complex. Drilling and production are only the first stages.

Alfa Laval is present at many points in the hydrocarbon chain, whether in the processes themselves or in the transport between them. We are also involved in many of industries connected to it, which gives us a unique breadth of experience to draw upon.





# chain

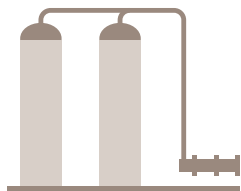


FSRU vessels



Crude oil, LPG and  
LNG carriers

## Transport & Storage



Terminals



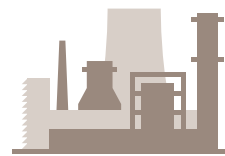
Underground  
storage



Pipelines



Storage

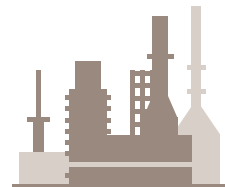


Conventional power plants

## Power



LNG processing



Refineries

## Refining & Petrochemicals





In the field, drilling is where it all begins. This is the true start of the hydrocarbon chain, and performance has to be there from the time the bit starts spinning. With comprehensive knowledge and proven technologies for the drilling process and beyond, Alfa Laval ensures it.



# Drilling

## **Knowledge that brings security**

The efficiency of drilling operations is crucial to profitability. As projects bore deeper on land and move farther out to sea, the risk of downtime increases – along with the consequences and costs. These days, there's simply no room for mistakes.

Staying ahead means looking for a performance partner instead of a supplier, especially when it comes to mixing and maintaining the all-important drilling fluids. Alfa Laval understands not only drilling equipment, but also drilling reality, and works to keep drilling operations problem-free.

## **Support both deep and wide**

Alfa Laval core technologies are perfectly suited to drilling fluids and the drilling process, but also to utilities and waste management. As environmental regulations tighten, for example, we offer the most trusted solutions for securing compliance and reducing cost in difficult offshore conditions.

Like our portfolio, our commitment is extensive. Through close cooperation, open dialogue and in-depth services like Alfa Laval Rig Surveys, we keep applications and equipment in step as needs and technologies develop.

# Offshore drilling applications

Alfa Laval can be found in nearly every aspect of drilling offshore. From creating fluids at floating mud plants to minimizing drilling waste and oily water on a drill ship or rig, our solutions ensure performance and compliance.



Utility cooling



Sea water lift



Drilling fluids management  
– waste and solids control



Drilling fluids management  
– tank cleaning and agitation



Drilling fluids management  
– mud cooling



Drilling fluids management  
– mixing and dust recovery



Sold and serviced by Framo only





Fire water pumping  




Fresh water generation



Ballast water treatment



Fuel and lube oil cleaning



Oily water treatment



Deck drain treatment



Service

# Land-based drilling applications

Alfa Laval solutions help mud plants create drilling fluids with exact properties for high performance. At the rig, our solutions maintain, recover and clean those fluids, in addition to performing a wide range of utility functions.



Drilling fluids management  
– tank cleaning and agitation



Drilling fluids management  
– waste and solids control



Drilling fluids management  
– mud cooling



Drilling fluids management  
– mixing and dust recovery





Cooling



Fuel and lube oil cleaning



Service

# Solutions for drilling

## PROCESS

### Drilling fluids management

The drilling process represents up to 80% of a well's total cost – and much of that is related to mud. Alfa Laval knowledge and solutions keep mud-related costs to a minimum, while at the same time securing the density, viscosity, chemistry and cleanliness so critical to safe and efficient drilling.

### Mixing and dust recovery

Flexibly configured to meet the needs of specific drilling applications, Alfa Laval Vortex solutions ensure fully optimized mud mixing. During the mixing process, dust can be captured and rechanneled into the mixing system, thereby ensuring a dust-free environment.



### Tank cleaning and agitation

For the mud tanks, Alfa Laval has effective Gunclean Toftejorg tank cleaning solutions that remove stubborn barite build-up. To ensure homogenous mud with uniform properties, we also have effective shearing options with side-, bottom- or top-mounted agitators.



### Mud cooling

Efficient Alfa Laval PUMA mud coolers reduce potential health, safety and environmental risk factors and complications during the drilling process. Built on decades of application experience, these dedicated modular heat exchangers reduce thermal stresses and provide better temperature control for mud processing and downhole tool accuracy, especially when drilling at high temperatures and pressures.



## PROCESS cont.

### Waste and solids control

When the mud returns from the well, our pioneering separation expertise is applied in Alfa Laval LYNX decanter centrifuges. Effectively removing cuttings and other solids, these advanced yet reliable solutions keep drilling fluids in prime condition while minimizing costly mud losses and waste.

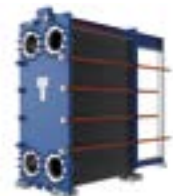


## UTILITY

### Utility cooling

Alfa Laval has a long history of mediating the exchange between heat and cold. In drilling, our experience is put to use in gasketed plate heat exchangers and air heat exchangers for a range of utility functions.

Already today, our heat transfer solutions are compact and energy efficient. Yet we continue to push limits, introducing new plate patterns and other innovations that further optimize heat transfer and minimize fouling. The resulting solutions are as easy to maintain as they are cost effective.







UTILITY cont.

### Sea water lift

Sea water lift is common in offshore applications. It may be used continuously to supply cooling water, but also intermittently, for example during ballasting. Installing caissons and using Framo pumps for the purpose eliminates flooding risk while reducing CAPEX and OPEX.

The pumps employ a cable-free concept that eliminates cable handling and submerged cable penetrations. Designed with overpressure protection of the motor and all electrical and rotating parts, they provide safe and reliable operation in hazardous areas. All Framo sea water lift systems are full scale tested prior to delivery to ensure easy installation during commissioning.



### Fire water pumping

Pumped water is the first line of defence in preventing fire-related catastrophe. Framo fire water pumps have been used in offshore applications since the 1970s, becoming the firefighting system of choice for their responsiveness and reliability.

Framo fire water pumps are powered by a diesel generator and are available in hydraulic and electric versions, selected mainly on the basis of the volume of water to be discharged. All Framo fire water pumping systems are full scale tested prior to delivery to ensure easy installation during commissioning.



UTILITY cont.

### Fresh water generation

Alfa Laval fresh water generators let offshore rigs and vessels make economical use of abundant seawater. We pioneered the compact production of fresh water through vacuum distillation, doing away with bunkered water for crew and technical needs.

Introduced over 50 years ago, our thermally driven technology has since developed into a range of compact, energy-efficient systems. Based on the engine and the heat it produces, we can configure an efficient solution from our Alfa Laval ORCA, AQUA or DOLPHIN series.



### Fuel and lube oil cleaning

Alfa Laval helps get top value from all types of oils. Whether maximizing the fuel extracted from residual oils or extending the lifetime of circulated lubricants, our solutions bring long-term economy while protecting the engine or gas turbine and other sensitive equipment.

Our centrifugal separation technology has long set the standard for separation performance. No less pioneering today, our separators have become more modular and less complex, while the efficiency and protection they provide have only increased.



# Solutions for oil drilling

## ENVIRONMENTAL

### Ballast water treatment

As maritime legislation takes effect, vessels and rigs must comply with ballast water treatment regulations. Choosing the right system is key, as its limitations may also limit business – by restricting deployment and resale potential.

Only Alfa Laval PureBallast 3.1 offers all the possibilities. Energy efficient and suitable for newbuilds or retrofits, it performs in all waters: fresh, brackish and marine. It is also the ideal biological disinfection system for challenging conditions, such as frigid or low-clarity water.



### Oily water treatment

Oil-contaminated water is unavoidable on offshore rigs and vessels. Within it are hydrocarbon residues and particles from coarse to fine, but also other components, such as chemicals contributing to stable emulsions.

Alfa Laval's centrifugal separation technology removes these impurities continuously, even in the roughest of seas. Employing many times the force of gravity, it breaks emulsions and minimizes chemical dosing. Alfa Laval PureBilge secures discharge compliance with little waste for onshore disposal.



## ENVIRONMENTAL cont.

### Deck drain treatment

Deck drain water contains many different oils and a very diverse range of chemicals and solids. In particular, water from the tank wash drain and drill floor drain has a high solids concentration and very strong emulsions that complicate separation.

Here Alfa Laval's long experience with complex waste streams makes a difference. The Alfa Laval Phoenix system combines mechanical and chemical separation technologies to meet strict discharge standards while leaving as little as possible for disposal onshore.





## SERVICE

Besides simplifying performance, Alfa Laval extends it. Discover the role of service in all our solutions on p 55.









There are more pressures in oil production than those beneath the surface. Despite oil's value and importance, finding economy and reliability in processing can be more difficult than finding the crude. Alfa Laval offers expertise and capabilities that simplify the equation.



# Oil production

## **Solutions that tip the balance**

The needs of oil production plants vary as widely as the plants themselves, which can be found increasingly far afield. Today's production involves challenging conditions like those in oil sands or deep seas, plus a growing range of processes, such as advanced oil recovery techniques.

As a result, the margins of profitability are often tighter. Alfa Laval expertise and equipment can make the difference, creating viable options that stay cost-effective as conditions change. Our separation solutions, thermal solutions and other offerings enable processes and keep them problem-free.

## **Securing the perfect match**

Over years of working with oil production, we've become adept at delivering performance within footprint and integration constraints. Important at all times, these are critical in upgrade and conversion projects, for example from vessel to FPSO.

Whether our solutions are to be used offshore or on land, we tailor them fully to the process and the conditions, ensuring easy implementation and lasting availability. Our own availability – for consultation, support and service – is a constant from start to finish.

# Offshore oil production applications

Whether on platforms or FPSOs, Alfa Laval has a role in nearly every step of oil production offshore. Our solutions move, heat, cool and clean, ensuring reliable, energy-efficient processes and total compliance with regulations.



Fuel and lube oil cleaning



Fresh water generation



Waste heat recovery



Steam and heat generation



Sea water lift



Closed-loop cooling



Cargo handling



Chemicals handling



Water injection



Gas compression



Sold and serviced by Framo only





Inert gas production



Fire water pumping  




Power generation  




Ballast water pump  




Produced water treatment



Oily water treatment



Exhaust gas cleaning



Crude Oil Washing (C.O.W)



Process heating and cooling



Separation and stabilization



Service



Ballast water treatment

# Land-based oil production applications

Alfa Laval is involved in the full spectrum of oil production processes on land. From increasing process productivity to reducing environmental impact, our solutions prove their value under the toughest demands and conditions.



Steam and heat generation



Waste heat recovery



Sea water lift



Closed-loop cooling



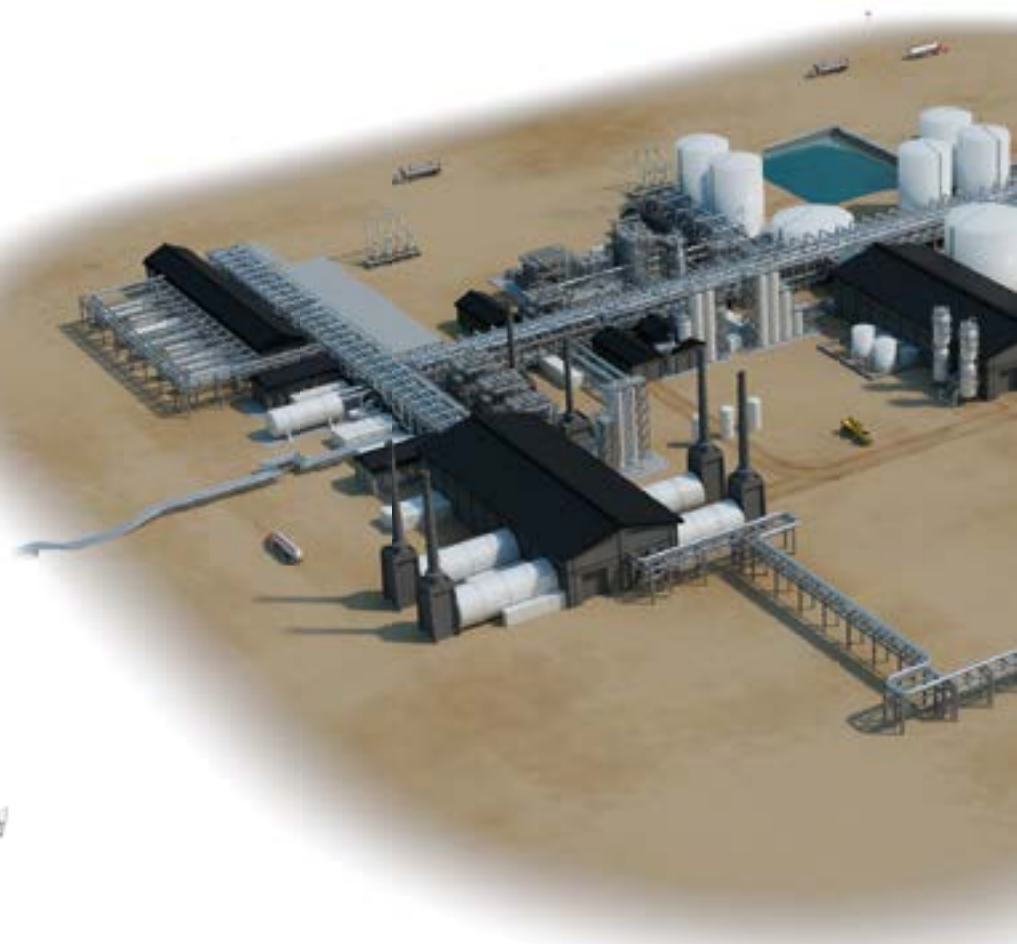
Gas compression



Process heating and cooling



Separation and stabilization



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Fuel and lube oil cleaning



Fire water pumping



Power generation



Produced water treatment



Slop oil treatment



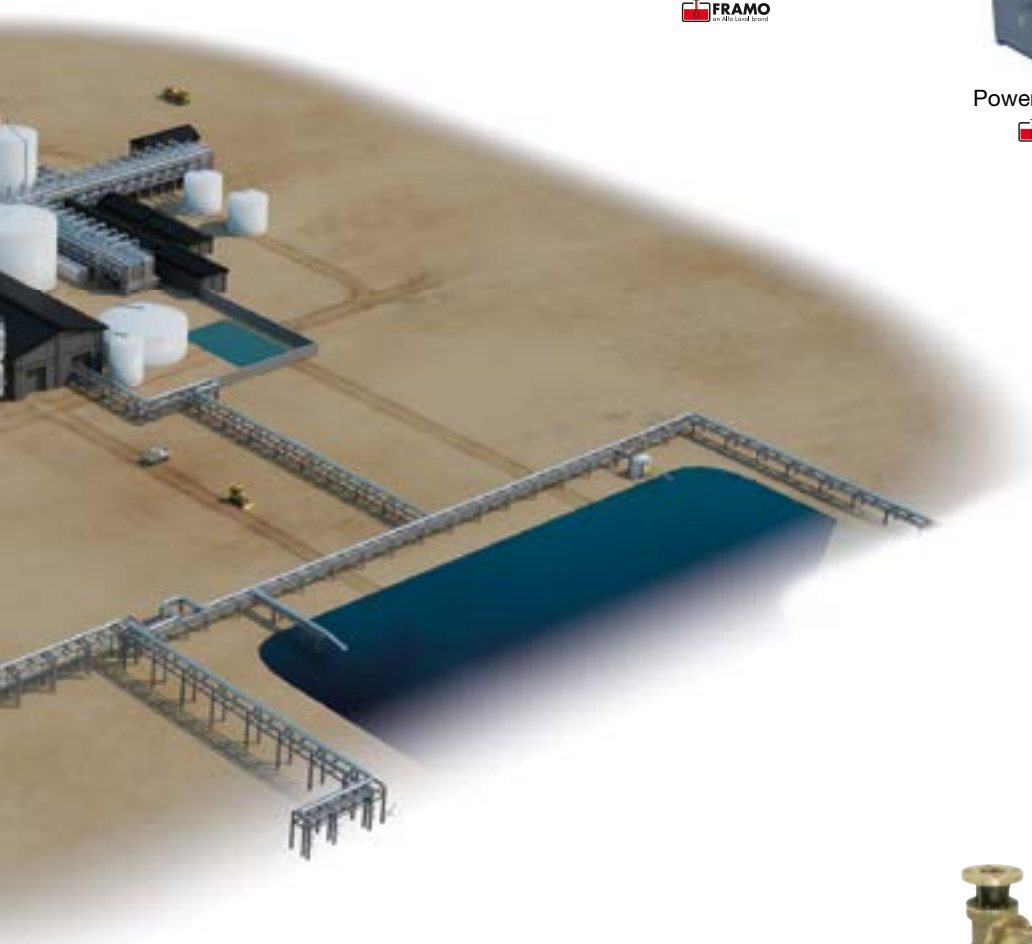
Crude Oil Washing (C.O.W)



Exhaust gas cleaning



Service





# Solutions for oil production

## PROCESS

### Separation and stabilization

At the oil production facility, solids and water must be removed from the crude oil to bring it to pipeline quality. When separation is performed with a conventional solution, Alfa Laval can use plate heat exchangers and other types of heat exchangers to optimize the use of heat and space while minimizing maintenance requirements.

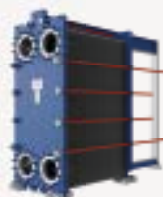
By choosing a degasser and an Alfa Laval OFX disc-stack centrifuge system instead, a simpler process can be achieved. This solution saves space and provides constant separation performance without the excessive use of heat and chemicals.



### Process heating and cooling

Optimal separation of the crude oil requires effective heating beforehand. Afterwards, the separated oil must be cooled down to prevent equipment corrosion and to minimize the production of hazardous gases.

Alfa Laval gasketed plate heat exchangers offer a compact and robust solution for both processes – resistant to gas, sand and other impurities in the crude. Drawing on many decades of application experience, we configure the heating and cooling circuits to make the most effective reuse of process heat.



## PROCESS cont.

### Gas compression

Compressing gas to the pipeline or injection pressure is a demanding process. At each step, Alfa Laval's portfolio enables robust, cost-effective solutions based on the pressures, cooling medium and maintenance needs.

On land, optimized solutions usually involve our air-cooled heat exchangers Alfa Laval ACE, Olmi and Niagara. Offshore applications may involve the Alfa Laval printed circuit heat exchanger (PCHE) or Alfa Laval Olmi shell-and-tube heat exchanger, but also our extremely robust welded plate-and-shell heat exchangers Alfa Laval DuroCore and DuroShell. Our gasketed plate heat exchangers may also be used.



### Water injection

Injecting water maintains reservoir pressure and boosts oil production – but is not without challenges. The pumping system must be flexible enough for changing reservoir conditions, plus robust enough to avoid erosion and scaling when using produced water.

Framo water injection pumps increase flexibility and serviceability through a design where individual impellers can be fitted without rebalancing the rotating assembly. Tungsten carbide wear surfaces, combined with double mechanical seals and barrier fluid, ensure reliability even when injecting produced water.



## PROCESS cont.

**Chemicals handling**

As offshore development projects move to deeper and more remote areas, the hull tanks of FPSOs are increasingly used to store chemicals for process and flow assurance. Framo submerged cargo pumps are an ideal solution for lifting these chemicals to topside process.

Besides handling any chemical, the pumps can handle any variation of specific weight or viscosity. The chemical pumping system can be combined with a Framo offloading system, or installed with its own separate hydraulic power system. All Framo cargo pumping systems are full scale tested prior to delivery to ensure easy installation during commissioning.

**Cargo handling**

Whether moving crude for separation and stabilization or pumping oil from a cavern reserve, robust and effective pumping is needed. Framo cargo pumps are the industry standard at sea, while Framo cable-free electric submersible pumps are among the few with the capacity and reliability for cavern applications. All Framo cargo pumping systems are full scale tested prior to delivery to ensure easy installation during commissioning.

**Crude Oil Washing (C.O.W)**

Regular use of Alfa Laval Gunclean Toftejorg high impact crude oil washing tank cleaning machines is strongly recommended to clean areas around the cargo pumps and to avoid corrosion caused by sediments in storage tanks. Due to a huge variety of options these machines can be customized to meet any built-in requirement for offshore installations and meet all rules and regulations for C.O.W.

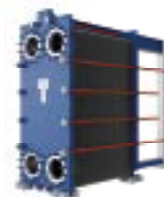


## UTILITY

**Closed-loop cooling**

Especially in an offshore process, cooling and production capacity are tightly linked. Closed-loop systems must be properly designed to maximize cooling and prevent maintenance issues.

With decades of cooling experience, Alfa Laval has the knowledge and equipment to secure effective cooling. Alfa Laval gasketed plate heat exchangers, complemented by our reliable filters, optimize heat transfer and minimize fouling. On land, our Alfa Laval Niagara wet surface air coolers are a cost-effective opportunity to reduce water and chemical footprint.

**Sea water lift**

Sea water lift is common in offshore applications. It may be used continuously to supply cooling water, but also intermittently, for example during ballasting. Installing caissons and using Framo pumps for the purpose eliminates flooding risk while reducing CAPEX and OPEX.

The pumps employ a cable-free concept that eliminates cable handling and submerged cable penetrations. Designed with overpressure protection of the motor and all electrical and rotating parts, they provide safe and reliable operation in hazardous areas. All Framo sea water lift systems are full scale tested prior to delivery to ensure easy installation during commissioning.



# Solutions for oil production

UTILITY cont.

## Steam and heat generation

Large quantities of steam, hot water or hot oil are required by many production processes. Alfa Laval has both decades of thermal expertise and a proven track record in supplying innovative boiler and combustion systems.

Our high-efficiency Alfa Laval Aalborg systems – available with multi-fuel combustion technology – can be supplied as tailored modules for any requirement. Fully integrated and ready to install, they ensure safe, trouble-free operation with low environmental impact and low cost of ownership.



## Waste heat recovery

Today's diesel engines and gas turbine engines are far more efficient than their predecessors. Yet a vast amount of fuel energy is still released as heat. By using heat energy from various sources to produce steam and hot water, Alfa Laval Aalborg waste heat recovery systems improve plant efficiency overall.

Proven effective, our waste heat recovery systems deliver documented fuel savings and reductions in CO<sub>2</sub> emissions. Compact and flexible, they can be installed and maintained easily – even within an existing plant.



UTILITY cont.

## Fresh water generation

Alfa Laval fresh water generators let offshore facilities make economical use of abundant seawater. We pioneered the compact production of fresh water through vacuum distillation, doing away with bunkered water for crew and technical needs.

Introduced over 50 years ago, our thermally driven technology has since developed into a range of compact, energy-efficient systems. Using waste heat or electricity, we can configure an efficient solution from our Alfa Laval ORCA, AQUA or DOLPHIN series.



## Fuel and lube oil cleaning

Alfa Laval helps get top value from all types of oils. Whether maximizing the fuel extracted from residual oils or extending the lifetime of circulated lubricants, our solutions bring long-term economy while protecting the engine or gas turbine and other sensitive equipment.

Our centrifugal separation technology has long set the standard for separation performance. No less pioneering today, our separators have become more modular and less complex, while the efficiency and protection they provide have only increased.







UTILITY cont.

### Inert gas production

Combustible gas mixtures are a primary concern, especially during offloading. Alfa Laval has the knowledge and tools to ensure a stable tank environment, both in safe and in hazardous areas.

Modular Alfa Laval Smit systems, which produce inert gas through a number of methods, are the leading solutions for degrading tank oxygen levels. Most are based on the unique Ultramizing® principle, which atomizes the fuel oil for soot-free gas, even at partial loads.



### Fire water pumping

Pumped water is the first line of defence in preventing fire-related catastrophe. Framo fire water pumps have been used in offshore applications since the 1970s, becoming the firefighting system of choice for their responsiveness and reliability.

Framo fire water pumps are powered by a diesel generator and are available in hydraulic and electric versions, selected mainly on the basis of the volume of water to be discharged. All Framo fire water pumping systems are full scale tested prior to delivery to ensure easy installation during commissioning.



UTILITY cont.

### Power generation

Whether offshore or on land, the loss of power to production processes means loss of income. Framo containerized or skid-mounted diesel generator systems provide valuable security, ensuring that essential or emergency electrical power is available at all times.

Framo generator systems are designed for fail-safe start up, even during a cold-start sequence. Arranged as self-contained units that include all necessary auxiliary systems, they allow continuous operation for a specified time at rated power. All Framo power generator systems are full scale tested prior to delivery to ensure easy installation during commissioning.



### Ballast water pumping

A smartly designed ballast system provides greater safety while freeing up more space for cargo. This is why Framo submerged ballast pumps are the standard solution on modern tankers.

The pumps are installed inside the ballast tanks. In combination with a submerged Framo cargo pump in each cargo tank, this arrangement makes the pump room superfluous and installation easy. The air ejector connected to the pumps' suction side starts and stops automatically, which makes the ballast pumps self-priming.



# Solutions for oil production

## ENVIRONMENTAL

### Produced water treatment

Before produced water can be injected back into a reservoir, reused in production or discharged into the environment, it must be cleaned to strict oil ppm levels. Alfa Laval designs effective solutions to manage this process under specific operating conditions.

Comprising both heat exchangers and separation systems, our solutions ensure results while minimizing process maintenance. At their heart are Alfa Laval OF and OFX disc-stack separators employing centrifugal separation, the most reliable means of overcoming difficult separation challenges.



### Oily water treatment

Oil-contaminated slop and bilge water is unavoidable on offshore rigs and vessels. Within it are hydrocarbon residues and particles from coarse to fine, but also other components, such as chemicals contributing to stable emulsions.

Alfa Laval's centrifugal separation technology removes these impurities continuously, even in the most demanding situations. Employing many times the force of gravity, it breaks emulsions and minimizes chemical dosing. As a result, Alfa Laval OF and PureBilge separators secure discharge compliance with little waste for onshore disposal.



## ENVIRONMENTAL cont.

### Exhaust gas cleaning

Sulphur limits now apply for units operating in Emission Control Areas (ECAs). By installing a scrubber to meet them, operation on HFO or crude oil can be maintained.

Alfa Laval PureSOx is the only complete SOx scrubber platform, offering scrubbers with a U- or an I-design, in open-loop, closed-loop or hybrid arrangements. Built with Alfa Laval core technology and over 40 years of scrubber experience, it ensures reliable environmental compliance.



### Ballast water treatment

As maritime legislation takes effect, vessels and rigs must comply with ballast water treatment regulations. Choosing the right system is key, as its limitations may also limit business – by restricting deployment and resale potential.

Only Alfa Laval PureBallast 3.1 offers all the possibilities. Energy efficient and suitable for newbuilds or retrofits, it performs in all waters: fresh, brackish and marine. It is also the ideal biological disinfection system for challenging conditions, such as frigid or low-clarity water.







## ENVIRONMENTAL cont.

### Slop oil treatment

Slop oil varies greatly in composition, which makes it complicated to split into clean oil and water. Alfa Laval can provide a well-designed process that reaches ppm targets for both streams – without accumulating unnecessary waste.

Three-phase Alfa Laval LYNX decanter centrifuges have a central role, with their effective solids removal and ability to deliver exceptionally clear liquids. Supporting them are our welded spiral heat exchangers and Alfa Laval OF disc-stack centrifuges, as well as Framo slop pumps to move slop oil from the tank.



### SERVICE

Besides simplifying performance, Alfa Laval extends it. Discover the role of service in all our solutions on p 55.









Clean-burning gas is proving its worth as a fuel of the future. That puts gas production in focus today, as capacity and technologies are geared towards tomorrow's supply. Alfa Laval is at the forefront, providing solutions that make even the boldest developments secure.



# Gas production

## Answers in the widest scope

Each gas production plant has unique challenges, deriving from its location and from the properties of the gas to be processed. Alfa Laval is uniquely prepared to help meet them, with decades of global experience and an often game-changing breadth of solutions.

In applications such as gas compression, fractionation and treatment, it's the mix that determines our strength. With many strong technologies to draw from, we can develop the solution most effective for the process – and the one most cost effective as well.

## The experience to go further

Our abilities and flexibility become even more relevant as gas projects grow more ambitious. FLNG plants, for example, will take the full brunt of deep-sea conditions while handling the entire processing scope in a fraction of the traditional space.

Alfa Laval's dependable systems, deep experience and demonstrated engineering know-how are instrumental in this context. In a setting where so much is at stake, it becomes all the more important to have a partner who is proven.

# Offshore gas production

Gas has a growing presence offshore, and Alfa Laval is present throughout the production process. Involved in nearly every process step, our compact and reliable solutions are enabling advances like those being made in FLNG.



Condensate handling



Steam and heat generation



Waste heat recovery



Sea water lift



Closed-loop cooling system (integrated)



Closed-loop cooling



Chemicals handling



Regasification



MEG regeneration



NGL fractionation



Gas treatment



Sold and serviced by Framo only

# applications



Fresh water generation



Fuel and lube oil cleaning



Inert gas production



Fire water pumping



Power generation



Ballast water pump



Produced water treatment



Oily water treatment



Separation and stabilization



Gas compression



Service



Ballast water treatment



Tank cleaning



# Land-based gas production applications

From compressing gas to isolating its valuable components, Alfa Laval solutions allow smarter gas production. Our solutions can be found in nearly all production stages, offering ways to increase safety, reliability and profitability.



Closed-loop cooling



Sea water lift



Steam and heat generation



NGL fractionation



Gas treatment



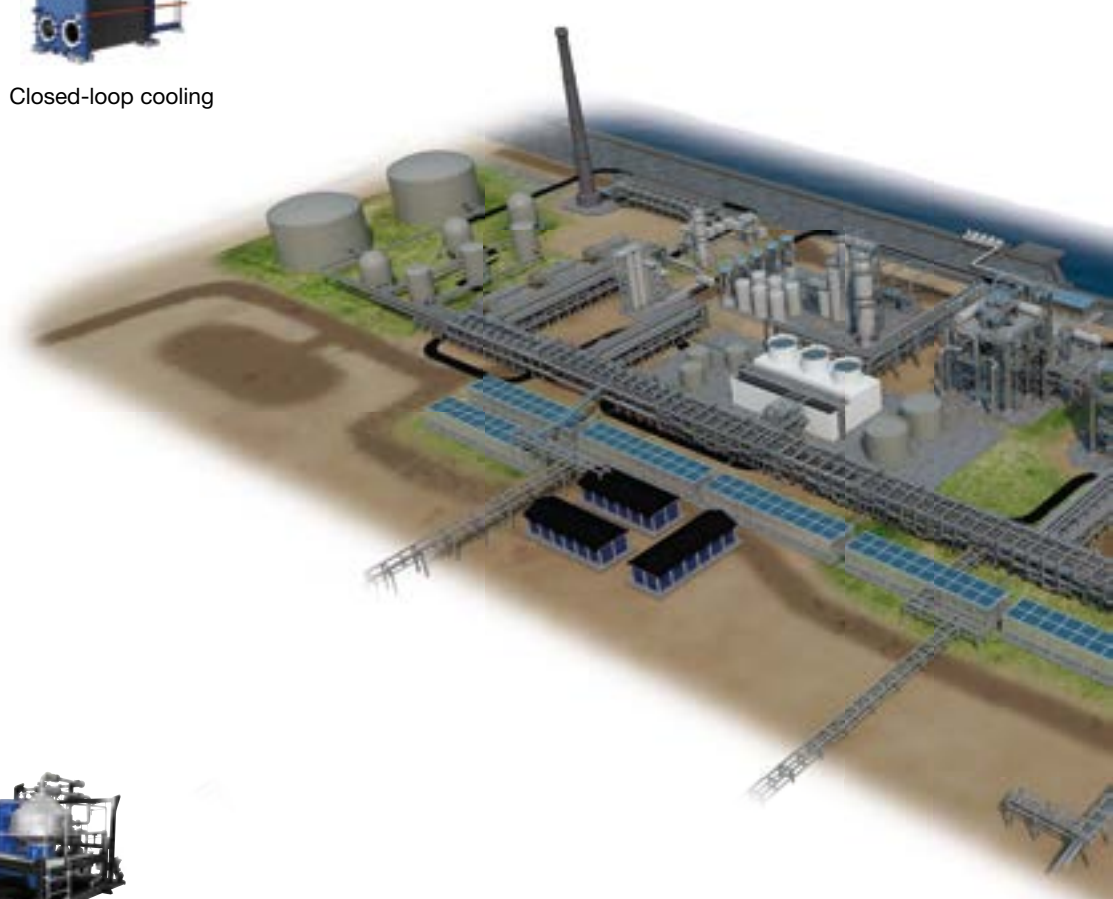
Separation and stabilization



Gas pipeline compression



Gas compression



Sold and serviced by Framo only



Waste heat recovery



Fuel and lube oil cleaning



Fire water pumping



Power generation



Oily waste treatment



Service



Gas wellhead compression



# Solutions for gas production

## PROCESS

### Gas wellhead compression

At the wellhead, compression skids are often used to bring natural gas to the required pipeline pressure. Portable and unmanned, the skids call for robust, purpose-built equipment that secures high performance within a small footprint.

Alfa Laval ACE air-cooled heat exchangers are versatile and compact cooling solutions, developed with harsh applications like wellhead compression in mind. With a finned-tube technology that withstands high temperatures and pressures, they can be flexibly configured and engineered for a truly customized approach.



### Gas compression

Compressing gas is demanding, and Alfa Laval is the only vendor with a full portfolio of compression technologies. These allow robust, cost-effective solutions adapted to the pressures, cooling medium and maintenance needs.

On land, optimized solutions usually involve our air-cooled heat exchangers Alfa Laval ACE, Olmi and Niagara. Offshore applications may involve the Alfa Laval printed circuit heat exchanger (PCHE) or Alfa Laval Olmi shell-and-tube heat exchanger, but also our extremely robust welded plate-and-shell heat exchangers Alfa Laval DuroCore and DuroShell. For the first step in the compression train, many customers use our semi-welded plate heat exchangers.



## PROCESS cont.

### Gas pipeline compression

Located at regular distances, the unmanned compression stations that secure pressure in a gas pipeline must operate reliably with minimal maintenance. Alfa Laval provides durable solutions that ensure this lasting performance.

Dependable cooling is provided by our Alfa Laval ACE, Niagara and Olmi air-cooled heat exchangers, as well as by our extremely robust welded plate-and-shell heat exchanger Alfa Laval DuroShell. With our maintenance-free filter, we can remove free liquids or particles before the gas enters the compressors.



### Separation and stabilization

As well stream components are isolated, detrimental contaminants must be removed from the condensate before reaching downstream equipment. Along the way are opportunities to recover energy and to design an overall process with minimal footprint and fouling.

Alfa Laval offers a range of high-efficiency gasketed plate heat exchangers for this process, and more as well. Alfa Laval OF disc-stack separators can be used to separate by means of centrifugal force, ensuring the removal of water and all contaminants.





PROCESS cont.

## Gas treatment

Gas sweetening is often a challenge, especially under sour and lethal service conditions. Alfa Laval contributes to the engineering of robust, maintainable AGRUs and SRUs with an optimal cost of ownership.

Our thermal solutions for gas treatment duties range from air-cooled heat exchangers and wet surface air coolers to plate-based heat exchangers in gasketed, semi-welded, welded and fusion-bonded designs. Chief among them is Alfa Laval Compabloc, which has become the industry standard for gas sweetening duties.



## NGL fractionation

Distilling NGL into pure components with high value greatly increases potential revenues. The fractionation process itself, however, can be difficult to build and operate in an economical manner.

Alfa Laval provides a comprehensive range of thermal solutions for cost-effective fractionation, including gasketed plate heat exchangers and welded heat exchangers in both openable and non-openable configurations. For fractionation on land, air-cooled solutions like our Alfa Laval Niagara wet surface air coolers offer exceptional efficiency and operating flexibility.



PROCESS cont.

## MEG regeneration

Removing the water and contaminants absorbed by MEG in subsea pipes can be difficult to do in a compact manner, especially when uptime is in focus. Alfa Laval provides space-saving vaporization and separation capabilities that ensure reliability under varied conditions.

Relevant thermal solutions include Alfa Laval Compabloc, but especially our welded spiral heat exchangers, whose inherent self-cleaning properties secure uptime in fouling liquid duties. Alfa Laval OF centrifugal separators complete the chain, ensuring thorough solids removal for high-purity MEG.



## Regasification

After dramatic cooling for sea transport, LNG requires controlled heating at the receiving end to vaporize it for pipeline distribution. Alfa Laval provides a wide range of gasketed plate heat exchangers to support this process, but more advanced technology as well.

Regasification often occurs offshore, creating extreme demands for compactness and durability. In these cases the Alfa Laval printed circuit heat exchanger (PCHE) is superior, offering a footprint far smaller than that of shell-and-tube constructions.



# Solutions for gas production

## PROCESS cont.

### Chemicals handling

As offshore development projects move to deeper and more remote areas, hull tanks are increasingly used to store chemicals for process and flow assurance. Framo submerged cargo pumps are an ideal solution for lifting these chemicals to topside process.

Besides handling any chemical, the pumps can handle any variation of specific weight or viscosity. The chemical pumping system can be combined with a Framo offloading system, or installed with its own separate hydraulic power system. All Framo cargo pumping systems are full scale tested prior to delivery to ensure easy installation during commissioning.



### Tank cleaning

Regular use of Alfa Laval Gunclean Toftejorg high impact tank cleaning machines are recommended to clean areas around the pumps and to avoid corrosion caused by sediments in storage tanks for slop and condensate. Alfa Laval Gunclean Toftejorg tank cleaning machines are developed to meet the toughest tank cleaning requirements with a minimum consumption of cleaning media.



## UTILITY

### Closed-loop cooling

Cooling and production capacity are tightly linked. Closed-loop systems must be properly designed to maximize cooling and prevent maintenance issues, which is why Alfa Laval's decades of cooling experience make a difference.

Alfa Laval gasketed plate heat exchangers, complemented by our reliable filters, optimize heat transfer and minimize fouling. On land, Alfa Laval Niagara wet surface air coolers are a cost-effective alternative to cooling towers that can provide an opportunity to boost plant cooling capacity.



### Closed-loop cooling system (integrated)

In FLNG applications, where cooling is especially critical, an integrated closed cooling water system is ideal. It combines closed-loop cooling with an open cooling loop, allowing both parts to be optimized and streamlined.

The system replaces traditional topside pump modules with compact Framo sea water lift pumps, which reduces both footprint and weight. In the open seawater loop, the cooling performance is fully optimized to minimize the equipment required. The total result is lower CAPEX, along with reduced space needs and power consumption.



### Sea water lift

Sea water lift is common in offshore applications. It may be used continuously to supply cooling water, but also intermittently, for example during ballasting. Installing caissons and using Framo pumps for the purpose eliminates flooding risk while reducing CAPEX and OPEX.





## UTILITY cont.

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**Condensate handling**

After treatment, the heavy hydrocarbons condensed from the gas are a valuable commodity for trade. Framo cargo pumps, with their ability to handle even the most viscous materials, are an excellent solution for managing condensate storage and offloading condensates for onward sale.

The submerged cargo pumps, which are hydraulically driven, save topside space and weight. The offloading system can be combined with a Framo chemical pumping system, or installed with its own separate hydraulic power system. All Framo cargo pumping systems are full scale tested prior to delivery to ensure easy installation during commissioning.

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# Solutions for gas production

UTILITY cont.

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UTILITY cont.

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## UTILITY cont.

**Ballast water pumping**

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## ENVIRONMENTAL

**Produced water treatment**

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**Oily water treatment**

Oil-contaminated slop and bilge water is unavoidable on offshore facilities. Within it are hydrocarbon residues and particles from coarse to fine, but also other components, such as chemicals contributing to stable emulsions.

Alfa Laval's centrifugal separation technology removes these impurities continuously, even in the roughest of seas. Employing many times the force of gravity, it breaks emulsions and minimizes chemical dosing. As a result, Alfa Laval OF and PureBilge separators secure discharge compliance with little waste for onshore disposal.



## ENVIRONMENTAL cont.

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Oily waste varies greatly in composition, which makes it complicated to split into clean oil and water. Alfa Laval can provide a well-designed process that reaches ppm targets for both streams – without accumulating unnecessary waste.

Three-phase Alfa Laval LYNX decanter centrifuges have a central role, with their effective solids removal and ability to deliver exceptionally clear liquids. Supporting them are our welded spiral heat exchangers and Alfa Laval OF disc-stack centrifuges, as well as Framo slop pumps to move oily waste from the tank.

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## SERVICE

Besides simplifying performance, Alfa Laval extends it. Discover the role of service in all our solutions on p 55.





Service for  
oil and gas



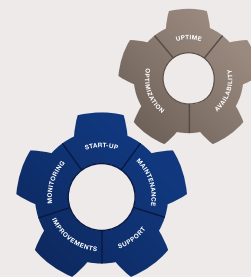








Alfa Laval's global service network keeps you competitive by minimizing costs and maximizing the return on your equipment investment. With the knowledge, skills and support of our service experts, you can rely on your oil and gas equipment for as long as you own it.



# Extending performance

## Expertise in easy reach

Alfa Laval's committed service team secures performance that keeps you competitive throughout your equipment's life cycle. Our service experts possess deep process and application knowledge, drawn from Alfa Laval's vast installed base and over 130 years of experience.

You'll find our network wherever your operations are, supplying the services and solutions to adapt your equipment to new challenges. Local professionals with thorough expertise and relevant certification help you benefit from a long tradition of finding solutions in oil and gas applications worldwide.

## Driven by your needs

Our team's sole focus is bringing you peace of mind. You experience it in the form of reliable uptime, equipment and process optimization, and the availability of parts and expertise worldwide.

Our experts save you time and money by preventing unplanned interruptions, helping you stop problems before they occur. They care about your equipment and process performance, and they know that every minute counts. By listening closely to your needs, they provide the right solutions for you – even as the challenges you face change over time.

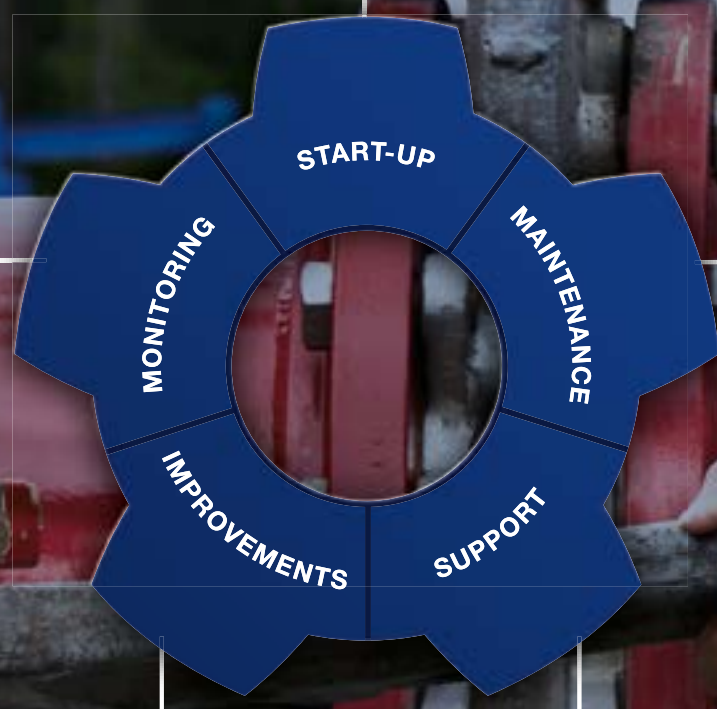
# Extending performance with the Alfa Laval 360° Service Portfolio

Whatever your equipment's type or age, there are options to safeguard or enhance its operation. The Alfa Laval 360° Service Portfolio offers full support – from planning, installation and commissioning to advice on the best replacement if the time comes.

**START-UP**  
Installation  
Installation Supervision  
Commissioning  
Commissioning Supervision

**MONITORING**  
Condition Monitoring  
Condition Audit  
Performance Audit

**IMPROVEMENTS**  
Equipment Upgrades  
Redesign  
Replacement & Retrofit



**MAINTENANCE**  
Calibration  
Cleaning Services  
Exchange  
Preventive Maintenance  
Reconditioning  
Repair  
Service Kits  
Service Tools  
Spare Parts

**SUPPORT**  
Exclusive Stock  
Technical Documentation  
Telephone Support  
Training  
Troubleshooting

## Start-up services

### The beginning of a healthy life cycle

Avoiding errors at the outset saves headaches and money over time. We help you get every detail of your start-up right with a full range of services – from strategic consultation to hands-on installation.

Our skilled engineers use their knowledge to ensure your equipment is ready for coming challenges, and to put it into operation as smoothly and safely as possible. With Alfa Laval on your side during start-up, you can be sure every piece of equipment will live up to expectations and perform like it should over the long term.

## Maintenance services

### Letting you count on performance

A strong maintenance strategy keeps operating costs down by keeping your equipment's performance level up. It increases uptime, lengthens equipment lifespan and gives you transparent cost control.

Our expert maintenance both secures the function of your Alfa Laval equipment and helps you get more out of peripheral equipment. Our offering includes cleaning services that save time and optimize performance, as well as reconditioning that leaves equipment good as new.

Meticulously designed Alfa Laval spare parts, which ensure lasting reliability, are readily delivered from stocks worldwide.

## Support services

### Expert assistance anytime, anywhere

Every minute is costly when a problem slows you down. But with Alfa Laval, you're never alone. In person, by phone and even online, our committed service experts help you troubleshoot and solve issues effectively.

Our service specialists, who can be found in every part of the world, have in-depth knowledge that can protect your equipment and improve the way you use it. Similar insights are provided through our in-depth trainings, which take place both at our own sites and in other locations around the globe.

## Improvement services

### Optimizing for an even stronger future

The better your equipment performs, the more you benefit from it. Our improvement services help you optimize performance, or even take it to the next level.

As business drivers and regulations change over time, we can help you adapt your existing equipment, or provide upgrades and retrofits to let you take advantage of the latest technical developments. Best of all, there are opportunities to optimize that don't require a large investment. Many smart, cost-effective ways are available to improve operations and your bottom line.

## Monitoring services

### Solving problems before they start

Avoiding the unexpected is among the best ways to save time and money. Our monitoring solutions let you wlower cost of ownership while experiencing even greater peace of mind.

Inspections or audits of your equipment are one approach to monitoring – and a good way to identify opportunities. Another is condition monitoring, in which operating data is reviewed in order to optimize service intervals and prevent unplanned downtime. The earlier you identify an issue, the smaller and more cost-effective the solution to correct it.

## Performance Agreements

### Top performance at a predictable cost

Performance Agreements are tailor-made service solutions, combining your choice of services from the Alfa Laval 360° Service Portfolio. You can choose different services for different pieces of equipment, and review or change your agreement as needed.

### More than the sum of the parts

Combining services achieves a greater total result. You enjoy top performance and maximum uptime, while knowing your service costs in advance. That brings you true security, as well as a short payback time.



# Extending performance through



Alfa Laval's global service network is dedicated to helping you get the most from your equipment and processes. With service centres and partners in nearly 100 countries and in key marine harbours, our experts are always nearby – ready to see that you experience maximum uptime and the highest degree of optimization.

- Alfa Laval service centres
- Framo service centres

**FRAMO** Framo products are sold and serviced by Framo only

# a global service network



*Alfa Laval service centres reflect the breadth of our product portfolio.  
Some services, e.g. boiler and inert gas generator repair, are only available at selected service centres.*

### **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.

### **How to contact Alfa Laval**

Contact details for all countries are continually updated on our web site. Please visit [www.alfalaval.com](http://www.alfalaval.com) to access the information.

