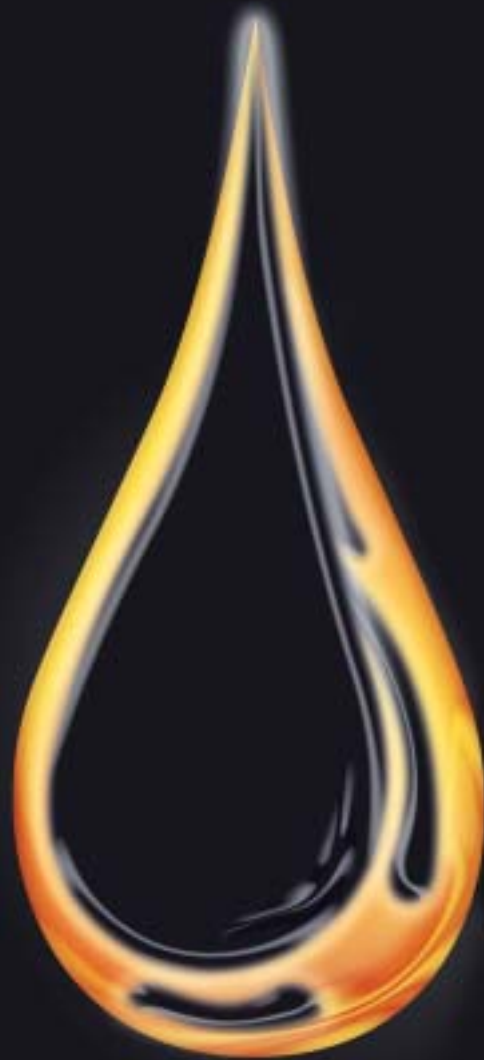




## Fuel oil treatment

Serving the power, oil and gas industries



# Boosting performance and profits

Fuel costs can be as volatile as the fuel oils themselves. A cost-effective and reliable fuel oil treatment solution that enables the use of lower-priced fuel grades is key to sustaining margins and earnings.

- Tried and tested technology incorporating the latest innovative advances

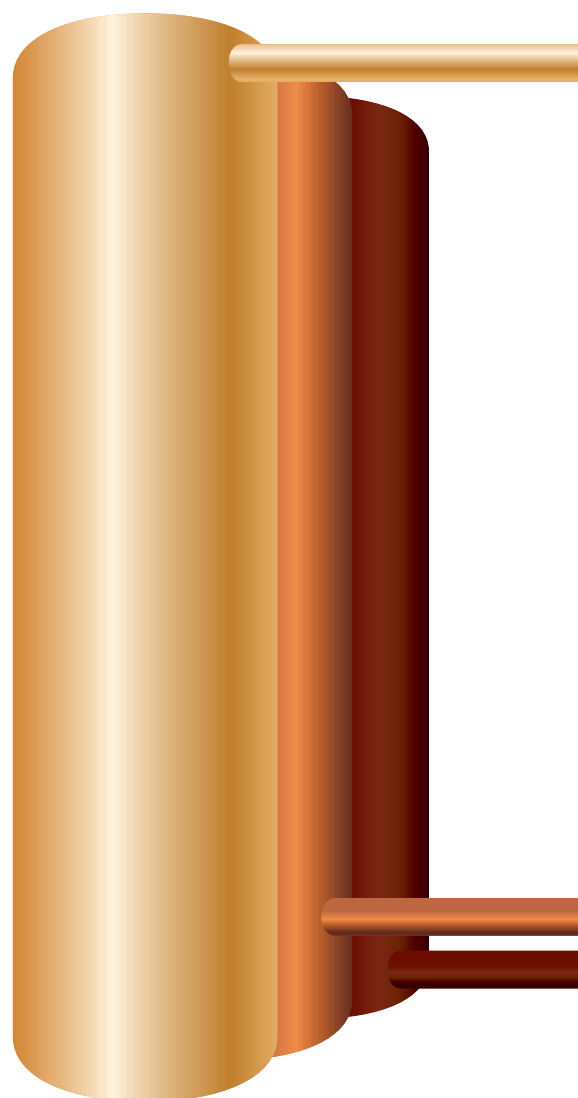
Liquid fuels vary substantially in hydrocarbon composition, physical properties and level of contaminants. Correct treatment means that a wide range of liquid fuels can be used in any modern gas turbine or diesel power plant.

Optimization of capital investment and operating costs depends on matching the sophistication of the fuel oil cleaning equipment with the properties of the fuel oil and the application for which it is to be used.

## Complete supplier

The key to finding the best solution is to find a supplier with the knowledge and experience to help you define your specific needs, the flexibility to provide a customized solution, and the global resources to provide lifelong service.

Alfa Laval is a complete supplier of fuel oil treatment systems, including a range of modular separator options for distillates and diesel, crude oil, and heavy fuels. Our solutions and expertise are based on decades of experience gained by working together with world-leading gas turbine and diesel engine manufacturers. By using Alfa Laval as your complete solution supplier, you gain the extra assurance of total process reliability and performance.



### Compact solutions for mobile production systems

The Norwegian contractor, Bergesen, uses virtually the entire Alfa Laval product range, including plate heat exchangers, separators and fresh water generators. According to Bergesen, Alfa Laval compact solutions, including separation equipment for fuel oil cleaning, have proven their reliability on offshore platforms for decades, and make up an important foundation for their continued dedication to the FPSO business.



- Complete solutions customized to your individual needs

### The need for cleaning

Three basic types of fuel oil are used in the power, oil and gas industries – diesel, light crude and heavy fuel oil. Regardless of the fuel employed, it must be supplied within a certain specification of cleanliness in order to prevent high temperature corrosion, ash deposition and fuel system problems.

High temperature corrosion can result from the presence of trace metals in the fuel, notably sodium, potassium and vanadium.

Ash forming impurities may be present in the fuel as oil soluble metallic compounds, water-soluble salts and solids, which may be deposited on hot-gas path components during combustion, resulting in a loss of efficiency.

Fuel system problems such as clogging of filters and fuel distributors and ero-

sion of fuel pumps can result from the presence of water and solids such as sand, rust, scale and dirt as well as microorganisms.

The Alfa Laval fuel treatment process is designed to overcome these harmful effects. By ensuring consistent compliance with specific fuel oil purification requirements, your treatment plant will contribute to longer service life of your machinery, and to a reduction in operating costs through less maintenance and downtime.

### Centrifuge performance data

Element	Reduction
Sodium + Potassium	80–99%
Calcium	20–80%
Magnesium	40–60%
Water	80–90%
Ash	10–50%
Particles	70–99%

### Tried and tested to your specifications

Alfa Laval combines field experience in fuel oil treatment with a dynamic development programme adapted to the specific industry requirements. Innovative design and precision engineering combine to provide compact and robust solutions that are built for consistent performance and easy maintenance.

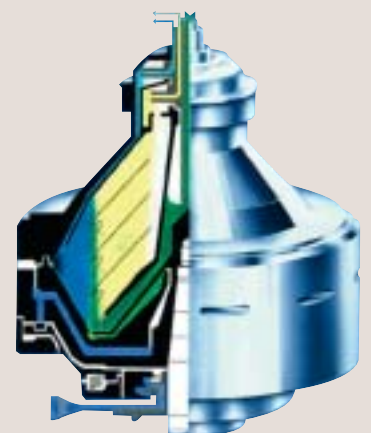
### Rapid delivery, rapid pay-back

Alfa Laval's new modular design standards mean that even the most complex fuel oil treatment solutions can be quickly configured, delivered and commissioned anywhere in the world. Competitive capital investment combined with significant operational savings mean rapid return on investment.

### The disc-stack centrifuge

The rotation of the disc-stack centrifuge bowl generates forces in excess of 5,000 G which greatly enhance separation velocity. Carefully designed internals provide extremely short settling paths for the water droplets, thus further increasing efficiency. Fitted inside the separation bowl there is a stack of up to 200 truncated cones - the disc-

stack. Between these discs annular channels about 0,5 mm high are formed. Separation takes place within these channels which may be considered as a large number of settling vessels all connected in parallel. This explains why disc-stack centrifuges are so efficient when it comes to separation of the smallest of droplets and particles.



# Efficient and reliable solutions

Modular separation systems from Alfa Laval can be customized for all grades of fuel oil and purity specifications, and are designed for straightforward installation in any fuel oil treatment process.

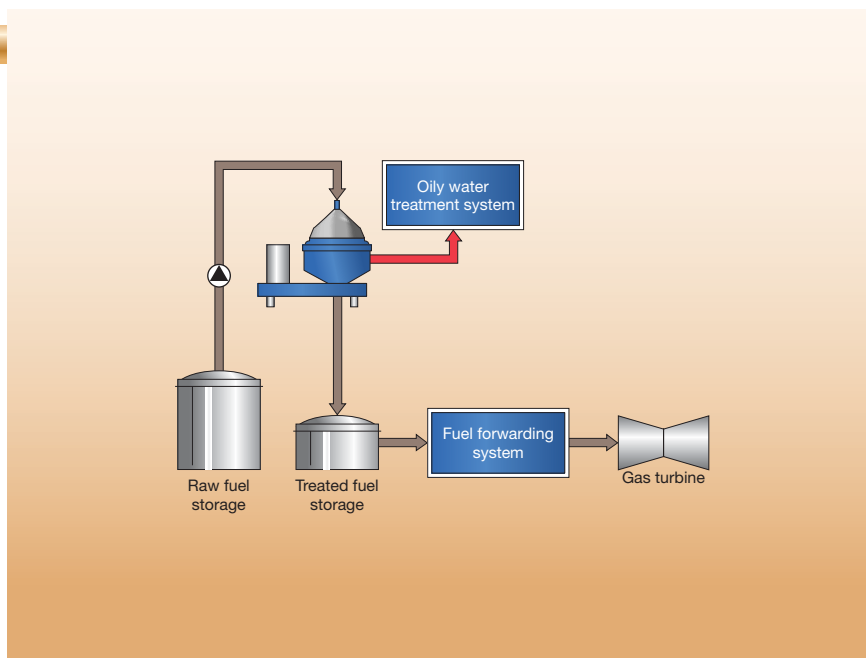
- Cost-effective solutions that prolong service life, cut maintenance costs, and minimize downtime

## Distillate fuel cleaning

Light fuel oils such as distillates and diesel oil are the most common form of liquid fuel burnt in gas turbines and diesel engines. True distillate fuels have low water, solids and trace metal contaminant levels. However, experience has shown that most problems are caused by salt water and solids contamination. Remarkably small amounts of salt water are enough to raise sodium content to unacceptable levels. This contamination is normally introduced in the delivery chain between the refinery and the plant.

## Continuous cleaning process

In a basic fuel treatment system, untreated fuel is pumped continuously via suction strainers to the separator where water and particles are removed from the diesel/distillate oil by centrifuging.



The purified oil is pumped to a treated fuel storage tank prior to being forwarded to the gas turbine or diesel engine.

Sludge and effluent water removed by the centrifuge process are pumped to a waste treatment system.



## Performance at sea

The SBM Group specializes in tanker-based floating production and storage systems (FPSOs/FSOs) as well as mooring terminals for the loading and unloading of tankers, for the offshore oil and gas industry. Alfa Laval has been one of their selected suppliers for many years. SBM has made use of Alfa Laval centrifuge-based solutions for fuel oil treatment, describing them as a quick, convenient method for reducing contaminants to an acceptable level.



### Reliable performance and support

The Rabigh Power Plant in Saudi Arabia uses one of many crude oil treatment installations supplied by Alfa Laval to sites throughout the country. The plant director at the Rabigh Power Plant, Mr.

Abdul Ghoni Najoom says, "Our Alfa Laval fuel treatment plant was installed in 1990, and we have benefited both from its reliable performance and local operational support."

- Robust heat exchangers, separators and pumps for reliable and consistent treatment

### Distillates fuel forwarding

The cleaned fuel oil is delivered under controlled conditions of flow and pressure from the day tanks to the gas turbine or diesel engine. The demand for heating depends to a large extent on the climate in the area of operation. In the same way as the cleaning unit, all Alfa Laval fuel forwarding systems are delivered as factory tested units, designed and manufactured in accordance with relevant international standards and specifications.

### Crude oil treatment

There are many different types of crude oil from free-flowing to viscous, and with widely varying types and degrees of contamination. Lighter crude oil is used typically in the power industry, and in the offshore oil and gas industry in locations where it is readily available.

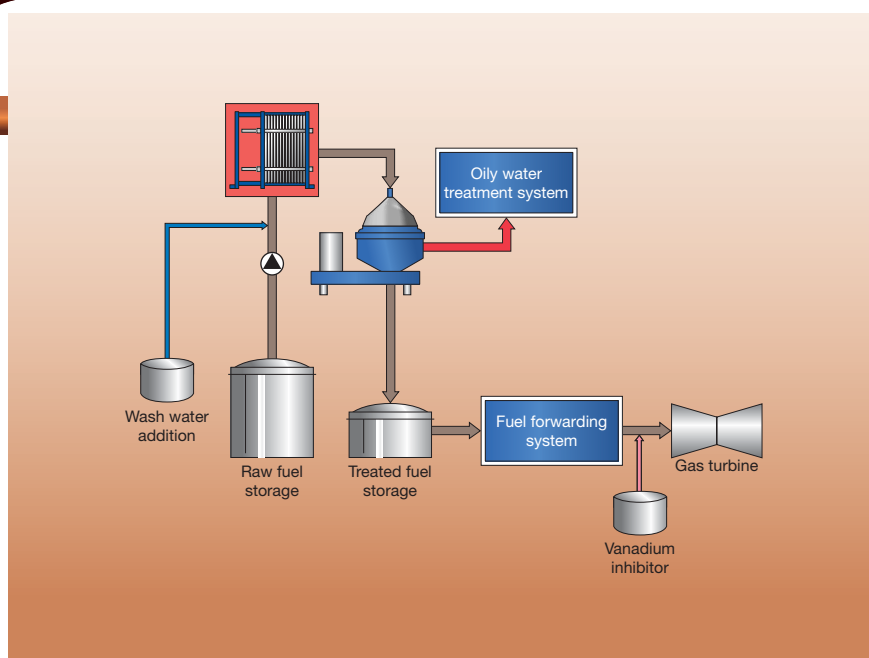
### Additional requirements

Lighter grades of crude oil can be treated in a similar manner as diesel and distillates, but additional equipment may be needed in the following cases:

- Oils with low flash points require explosion-proof equipment.
- High viscosity oils require preheating for handling and separation.

- Higher sodium and potassium content, typically above 15 ppm, must be controlled by a simple "static" water wash system followed by centrifuging.

Some crude oils also have a significant content of vanadium, an oil-soluble contaminant, which cannot be removed by washing or centrifuging. The addition of a vanadium inhibitor dosing system after the fuel forwarding system may be necessary.



# Making light of heavyweight tasks

Heavy fuel oil requires more complex treatment before it can be used in a turbine. This places heavyweight demands on fuel oil treatment processes, in particular on pumping, heating and centrifugal separation.

- Efficient removal of sodium and potassium

- Worldwide service network and hotline support

## Heavy fuel oil cleaning

Although distillates are the most popular choice of liquid fuel for gas turbines, heavy fuel oils and crudes are still an interesting option, usually for reasons of economics and availability. Heavy fuel oils are residual oils. As such, they contain nearly all contaminants found in the original crude oil and others, which may be introduced in the processing and delivery chains

## Dual process

Due to the less favourable physical properties and higher contamination levels of heavy fuel oils and some heavy crude oils, it is impossible to consistently reduce contaminants to the low levels obtainable in distillates and light

crudes by simple cleaning in a centrifuge.

To reduce contamination, a dynamic water washing extraction process must be used in combination with a demulsifying agent to improve the separation of water emulsions.

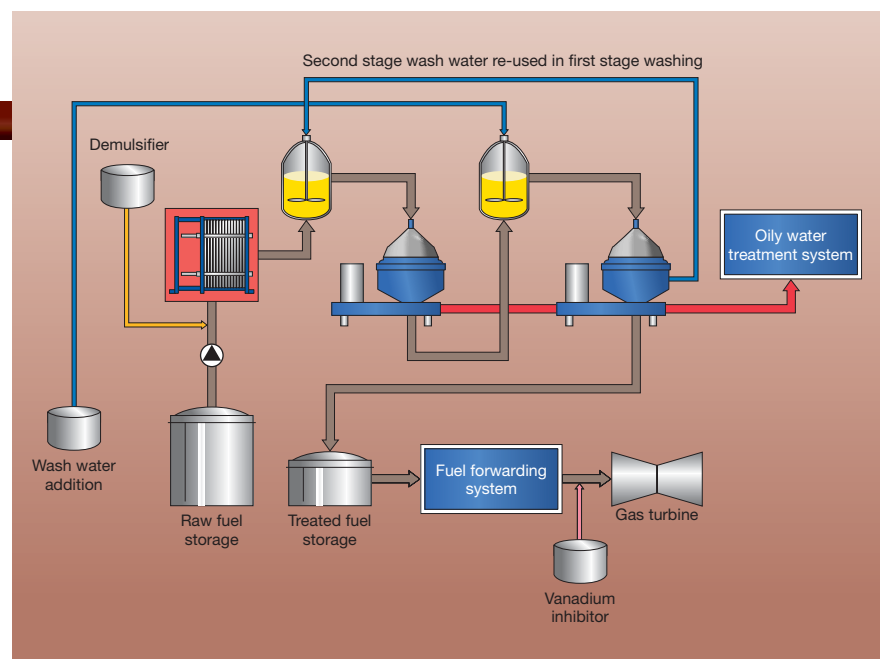
High-viscosity fuel oils require heating before water washing and, critically, before centrifugal separation.

Two stages of washing and separation are often necessary.

## Heavy fuel oil forwarding

The major functions of a heavy fuel forwarding system are: pumping, heating, fuel selection, filtration, and metering. Heating requirements will vary depending on the viscosity of the fuel. However, heavy fuel oils may require heating to 135-160°C to reduce viscosity to an acceptable level.

A high content of filterable dirt in these oils usually means that self-cleaning filters must be employed in the fuel train to prevent frequent filter changes. Vanadium inhibitor dosing will be necessary prior to the gas turbine





### Trouble-free operation

For the electrical needs of a city the size of Shanghai you cannot afford to make mistakes with contaminated fuel. When the Zhadian Gas Turbine plant in Shanghai opted for Alfa Laval's centrifugal separators to ensure trouble free turbine operation, it was a decade of experience in China as well as the

quality of service from Alfa Laval that tipped the balance. "We are very happy with the oil treatment system from Alfa Laval; the system is very reliable and well designed with attention to detail," says Cao Sonogran, Maintenance Engineer, Zhadian Power plant, China.

- Environmentally sound disposal of sludge and oily water



### Partner with innovation and experience

Alfa Laval has decades of development and field experience in fuel oil treatment for the power, oil and gas industries. Our research and development laboratories work continuously with customers and equipment manufacturers to enhance existing solutions and develop new groundbreaking technologies. Our mission is to provide true non-stop performance at the highest possible

level and at the lowest possible cost. By partnering with Alfa Laval from the start you can be assured of complete solutions with documented reliability and performance. Our global network of experts is on constant standby to provide you with genuine spare parts on site, in more than 50 countries, 365 days a year.

## **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 more than 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) for more information.