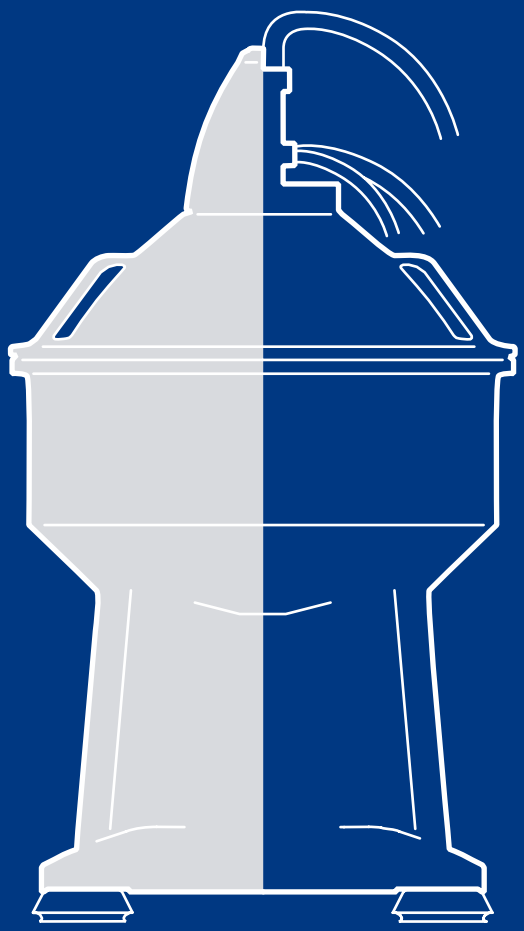
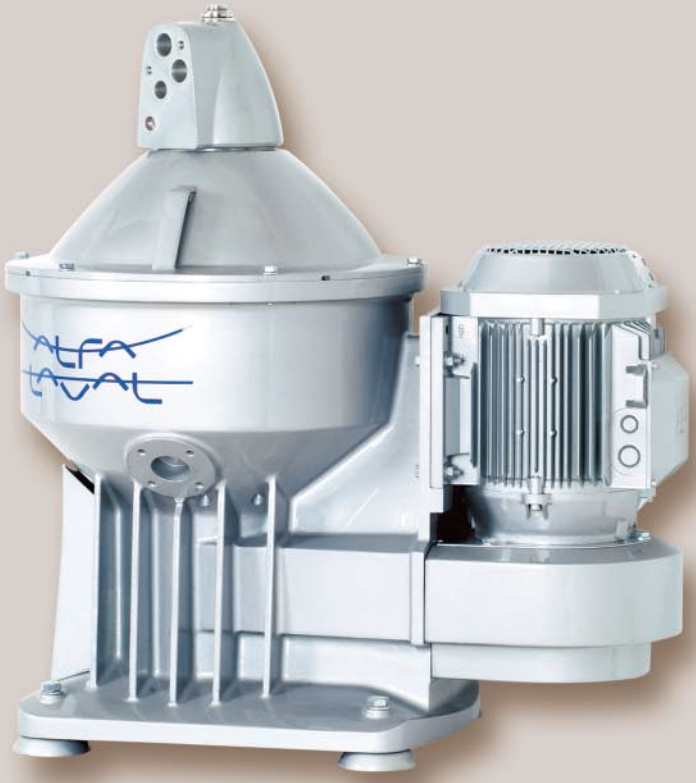
The S- and P-separators

Technical information for mineral oil treatment





S-separator.

P-separator.

Inside view

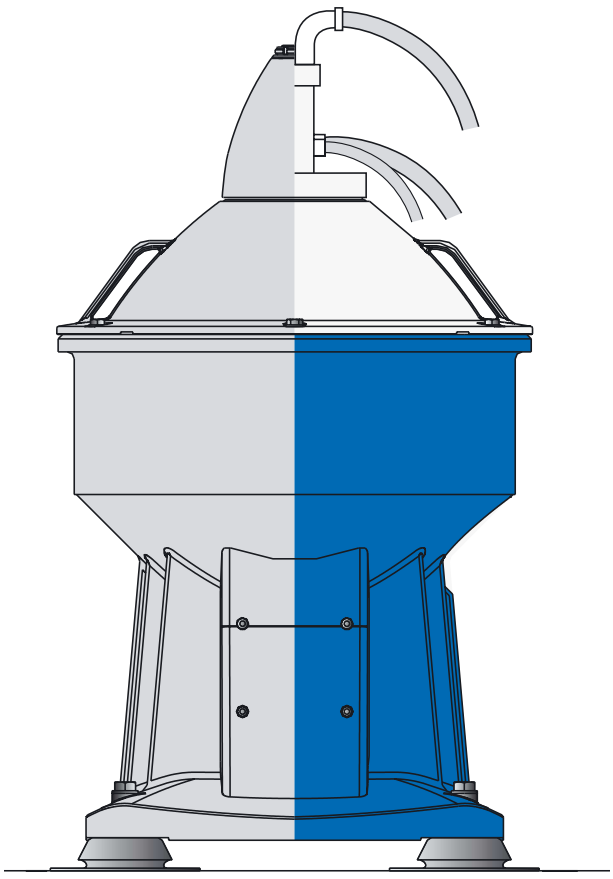
This technical information deals with the S- and P-separator systems that are designed to cover a broad range of oil treatment applications, from heavy fuel oils to lighter marine diesel oils and lubricating oils.

Summary

The purpose of this document is to provide technical information about the Alfa Laval S-separator and P-separator systems.

This includes information about marine and diesel oil characteristics, the separation process, advances in system design, system benefits and a description of equipment. It also highlights the differences and similarities between the two separator systems to facilitate the selection of system.

Not all oils are created equal. This is made apparent by the International Organization for Standardization guidelines (ISO 8217:2005) to categorize different fuel oil types.



Despite these guidelines, there are no clear-cut categories for heavy fuel oils, marine diesel oils and lubricating oils. Due to their density and other properties, they represent various process issues with regards to separation.

At one end of the scale are the residual oils or heavy fuel oils, with varying densities and which can contain harmful impurities. These fuels require the highest separation performance to ensure good separation and prevent catalytic fines from damaging the engine.

At the other end of the scale are lighter fuel oils, such as marine diesel oils and distillates. Lubricating oils are complex and also contain impurities, but their defined density makes them easier to process.

In between is a whole range of separation needs.

Two approaches to separation
Alfa Laval suggests two approaches for fuel and lubricating oil separation:

1. The S-separator for hard-to-clean heavy fuel oils that vary both in density and in the type of impurities they contain.

2. The P-separator for defined lighter fuel oils and lubricating oils with known density and fewer process issues.

Available in a wide range of sizes and in different configurations, both separator systems deliver higher cleaning efficiency than previous models and drastically reduce operation and maintenance costs not only of the separators themselves but also of the diesel engines that they serve.

S-separator

Alfa Laval's S-separator is the world's best-selling separator for marine applications. Using the latest in Alcap technology, the S-separator automatically adjusts to the nature of the fuel oil, allowing it to handle any oil on the market.

The S-separator proves its worth with complex, performance-demanding heavy fuel oils. As a sign of its high separation efficiency, it was the first separator on the market to meet the demands of the Marine Separation Performance Standard (CWA 15375).

The S-separator offers minimal oil losses. No other separator on the market today produces less sludge. Thanks to the Alcap function, it provides optimal separation – no matter what fuel or lubricating oil is used.

S-separator.

P-separator

Alfa Laval's P-separator is a new development of proven technology. While it shares the mechanical platform of the S-separator, it is specially designed for well-defined oils with fewer, but vital, process issues.

A set of gravity discs has replaced the more refined Alcap technology in the separator bowl. The result is a separator with the same high performance, but one that does not automatically compensate for density fluctuations.

If set correctly, the P-separator handles residual oils (heavy fuel oils) with good results. But more importantly, it is the perfect choice for lubricating and marine diesel oils with density that is uniform and with contamination that creates fewer performance issues.

P-separator.

Innovations in both the S- and P-separators

- The non-threaded CentriLock lock ring which makes it easy to open and close the bowl.
- The CentriShoot discharge system, which replaces the sliding bowl bottom with a patented, flexible discharge slide that is fixed within the bowl body. This eliminates metal-to-metal wear.
- A compact separator bowl which, together with CentriShoot and efficient displacement before discharge, reduces sludge production and loss of oil.
- High separation efficiency, thanks to the optimized design of the disc stack.
- Remote monitoring and control with network solutions using MODBUS or PROFIBUS and the operator's own software.
- Reduced installation and material costs. No header tank is needed to supply operating water; a separate feed pump reduces pipe work to and from the pre-heater.

Fuel and lubricating oils

To understand the challenges of cleaning fuel and lubricating oil, one must put into context the different types of oil, their characteristics and contaminants that must be separated from the oils to ensure high performance and long service intervals of marine and diesel engines.

The quality of the fuel and lubricating oils varies widely, depending on the grade and processing of fuel and lubricating oils. Some may contain higher levels of contaminants, such as water and abrasive solids, while others contain lower levels. Efficient cleaning of all fuel and lubricating oils is essential to achieve reliable and economical operation of diesel engines and other equipment.

Fuel oil

Diesel engines generally burn residual, or heavy fuel, oils. For marine installations, fuel is purchased in different locations as the ship sails from port to port. Co-mingling heavy fuels with highly diverse compositions can lead to incompatibility problems. Such stability problems are particularly severe for heavy fuel oil because of the diverse refining processes used to produce it.

Heavy fuel oil is essentially a refinery by-product. After the most valuable fractions of crude oil have been extracted, the remains are processed further to recover what is known as heavy fuel oil, a cheap source of energy – and one that is not manufactured according to specifications. The ISO 8217 Fuel Standard specifies a number of physical and chemical limitations for marine fuels, but does not define several critical characteristics that are essential for separation.

Density, or more specifically the difference in density between the water and oil to be separated, is a critical parameter for effective cleaning of fuel oil.

Because it is a residue, heavy fuel oil typically is a high-density fraction that contains the heaviest components. In the heaviest types of residual oil, the difference in density is so high that it is impossible to clean the oil using a gravity disc type purifier. This was one of the driving forces behind the development of the Alcap system.

Catalytic fines

Catalytic fines are the most harmful of all substances in heavy fuel oil. These are fragments of a catalyst added to the oil to optimize the refining process. Composed of solid particles of aluminium and silicon compounds, catalytic fines are almost as hard as diamonds and vary in size from sub-micron to approximately 50 µm. If allowed to enter the engine, catalytic fines wear down engine components – sometimes causing considerable damage within a few hours. For more information about catalytic fines and how to separate them from fuel oil, ask your Alfa Laval representative for a copy of "Marine diesel engines, catalytic fines and a new standard to ensure safe operation," (Ref. No. EMD00078EN) written by Alfa Laval, BP Marine and MAN B&W Diesel.

Low sulphur fuel

Environmental considerations have led to the increased use of fuels with low sulphur content. In certain regions known as sulphur emission control areas or SECAs the maximum allowable content of sulphur in the fuel is 1.5 percent. Few heavy fuel oils satisfy this stringent limit without further mixing or processing to remove sulphur, which causes the oil characteristics to change. This poses the risk of making the resulting heavy fuel oil incompatible with the heavy fuel oil that has not been de-sulphurized and, for economical reasons, may be burned outside SECAs. In addition, low sulphur fuel tends to contain more catalytic fines than ordinary heavy fuel oil, even though low sulphur fuel may have a lower viscosity.

Distillate and marine diesel oil

Distillate and marine diesel oils generally are more uniform in nature than heavy fuel oil. The main differences can be attributed to the origin of the oils. Refining processes have less of an impact on the characteristics of marine diesel oil and distillates than on those of heavy fuel oils. In addition, marine diesel oils and distillates typically do not contain any emulsifying compounds, which can make the separation of heavy fuel oil difficult. Thanks to lower and more consistent densities, distillate and marine diesel oils are considered to be far easier to clean using centrifugal separation than heavy fuel oils.

Lubricating oil

Lubricating oils for diesel engines in ships and power plants are essential for operation. Keeping lubricating oil clean by means of separation helps prevent the accumulation of substances that increase viscosity as well as any solid particles that can cause engine wear and pose the risk of very expensive replacement costs.

In general, there are two basic types of diesel engines that require lubricating oil: the trunk engine and the crosshead engine.

Trunk engines

There are two types of trunk engines, which are also called four-stroke engines:

1. The medium speed engine that runs at between roughly 300 and 600 rpm.

2. The high speed engine that operates at between 600 and 2000 rpm or higher.

The lubricating oil used in trunk engines is prone to contamination from blow-by, which is a leaking gas stream from the combustion chamber to the oil sump that contains remainders of burned fuel and lubricating oil.

Contaminants that result from blow-by, such as particles of soot and other partly burned hydrocarbons, must therefore be removed from lubricating oil. In addition, calcium sulphate or gypsum forms as a result of the reaction between sulphur in the fuel and the neutralizing calcium-based base number (BN) additives in the lubricating oil, and comprises a major portion of the resulting sludge. The BN additives are important for preventing the formation of sulphuric acid and thus protect against acidic, or cold, corrosion.

Crosshead engines

Called long-stroke or two-stroke engines, crosshead engines operate at lower speeds, generally between 90 and 200 rpm, than trunk engines. Larger than trunk engines, crosshead engines burn more fuel per stroke, and are capable of producing more power.

System oil in crosshead engines are, however, less susceptible to contamination than trunk engines due to the crosshead engine's stuffing box. The stuffing box is a seal that surrounds the piston rod and protects the oil sump from contamination due to leaks from the combustion chamber. Contaminants in the lubricating oil of crosshead engines therefore are less advanced in composition than those found in the lubricating oil of trunk engines.

Box oil is highly contaminated oil, which is emptied through the drain in the stuffing box. This ensures that box oil does not mix with system oil. Highly alkaline lubricants used between the cylinders and cylinder liners, called cylinder oil, are added separately. Any leaking oil together with remainders of oil burned during the combustion process is drained as box oil.

Water is another contaminant found in engine lubricants. Water may result from condensate that forms when the engine is not in operation or originate from accidental leaks. Because lubricating oil contains dispersants and detergents, it easily emulsifies water. More importantly, some BN additives may deteriorate in the presence of water. It is therefore important to keep the water content in the lubricating oil system at the lowest possible level.

An essential application

Separating lubricating oil is a relatively straightforward but essential application, thanks to defined oil density and constant system conditions. Separation is recommended during engine operation. It is also recommended for short periods while the engine is not in operation in order to prevent condensate build-up and the formation of water, which can compromise operation when the engine is put into service.

Purifier versus Alcap technology

Which technology provides the best method to separate solid particles and water from fuel and lubricating oils?

In 1983, Alfa Laval introduced the Alcap technology in response to the need for a reliable method to separate impurities from the heaviest fuel oils with densities above the maximum density limit for fuel oil handled by conventional purifiers.

Conventional purifiers handle fuel oil densities of up to 991 kg/m^3 at 15°C and require manual adjustment of the gravity disc to achieve optimum separation results. Computer-driven Alcap separators handle fuel oil densities of up to 1010 kg/m^3 at 15°C, automatically adjusting operation to the nature of the oil.

This section describes the fuel and lubricating oil cleaning process using conventional purifiers and Alcap separators.

Conventional cleaning with purifier systems

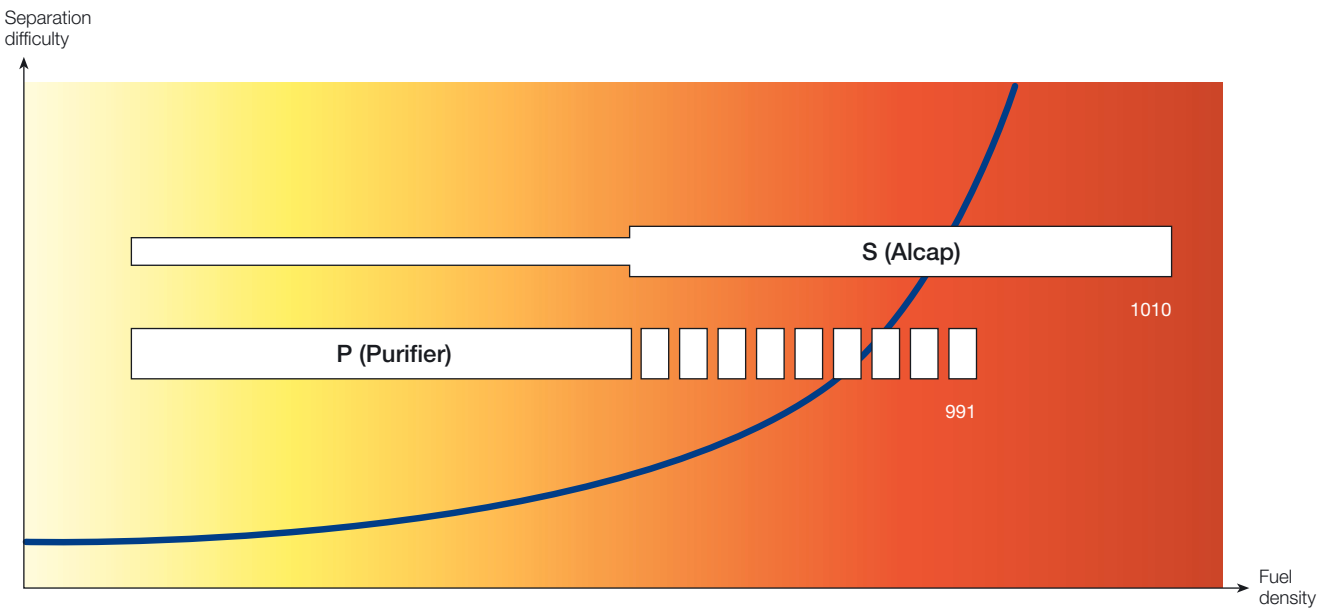
Conventional cleaning plants are based on purifier type separators. Practical operation has confirmed that the generally accepted maximum density limit for fuel oil is 991 kg/m^3 at 15°C. If this limit is exceeded at bunkering, operational difficulties with the cleaning plant can arise along with the obvious risks for unreliable engine operation or excessive engine wear.

Consequently, the density of available fuel oils can restrict the use of purifier type separators. However, for lighter marine diesel oils and lubricating oils, conventional purifiers are suitable.

Separation results with purifiers

To achieve optimum separation results using purifiers, the interface between the oil and water in the bowl must be located outside the disc stack. The position of the interface is adjusted by means of gravity disc. To get the correct interface position the purifier must be fitted with a correctly sized gravity disc.

With higher fuel densities, maintaining optimum separation results by means of gravity discs becomes increasingly difficult. Factors that affect the interface position are changes in oil density, viscosity, feed flow rate and temperature.



Separation difficulty.

With increasing fuel density, the interface position becomes progressively more sensitive to these factors. This easily leads to a situation where the interface is not in the correct position:

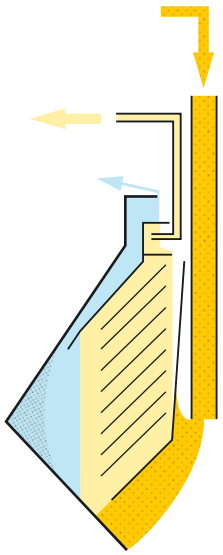
- If the interface moves too far away from the centre, the result is a broken water seal. This means that oil escapes via the water outlet and is lost.
- If the interface gets too close to the centre, water will block the upper part of the disc stack, and the lower flow channels will be overloaded. This results in poor separation efficiency.

Thus, as the interface position becomes more sensitive to disturbances, each successive gravity disc has a reduced capacity to cope with them.

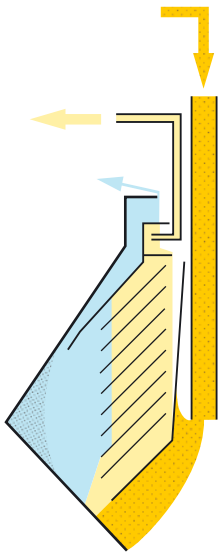
Temperature fluctuations, inherent in even the best temperature control systems, cause viscosity fluctuations. However, a proportional integral (PI) temperature controller will considerably reduce this source of disturbance and instability of interface position.

The use of conventional purifiers is limited by the use of the gravity disc:

- It restricts the use of diesel engine fuels to those with a maximum density of 991 kg/m^3 at 15°C.
- Optimum separation depends on selecting the correct gravity disc, which corresponds to the prevailing density, viscosity, feed flow rate and temperature.
- To ensure satisfactory cleaning a second separator may be required in series operation. This creates a separation system of a purifier followed by a clarifier.



Purifier principle interface in correct position.



Purifier principle interface in wrong position.

Limitations common to conventional clarifiers

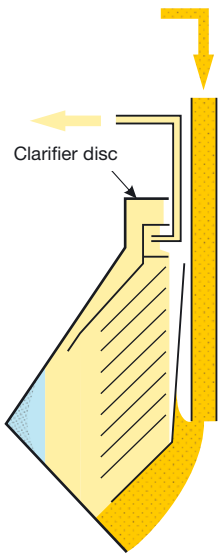
Oil losses and limited water handling capability are the basic problems encountered when treating fuel oil of any density in a clarifier. Clarifiers are not to be installed for single stage operation but should always be preceded by a purifier.

Oil losses

When operating a separator in clarifier mode, no displacement water is added prior to sludge discharge. Therefore, not only sludge and separated water are discharged, but a certain volume of oil is discharged, too.

Limited water handling capability

For optimum separation efficiency separated water must not enter the disc stack. The separated water can only be discharged with the sludge through the sludge ports at the bowl periphery since the water outlet is closed in a conventional clarifier.



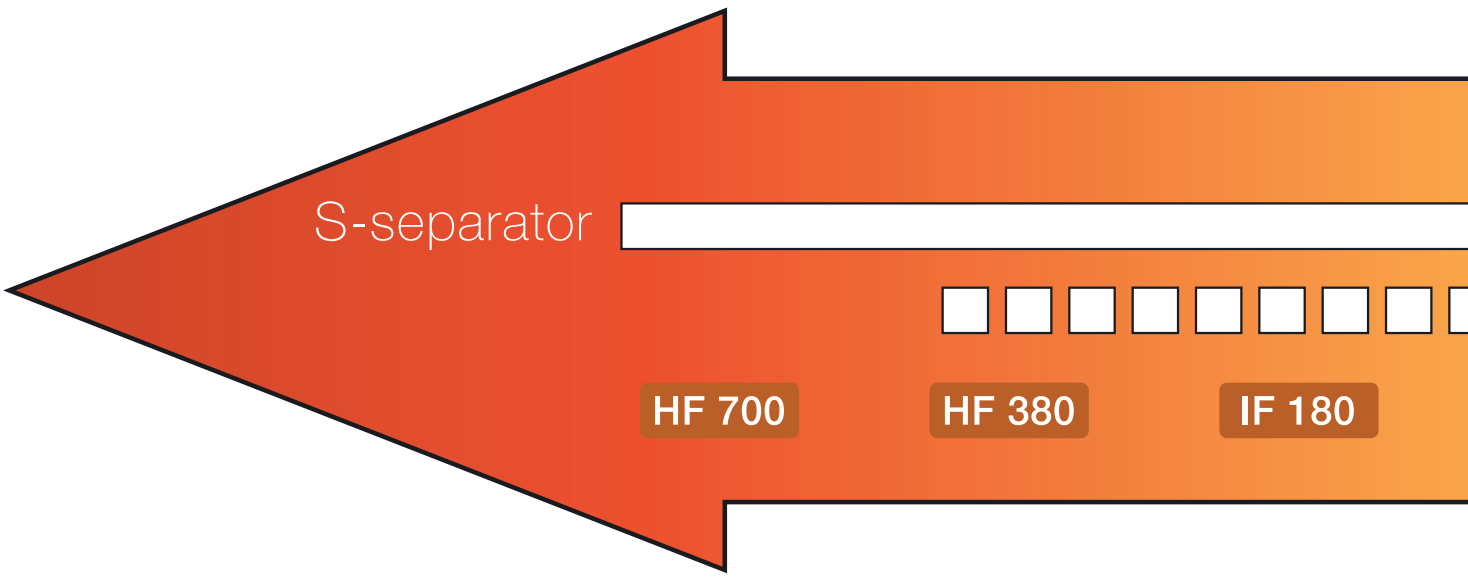
Conventional clarifier.

Purifier or Alcap?
The table below defines selection criteria to consider when deciding whether purifier or Alcap technology best suits specific requirements for fuel and lubricating separation. However, different weights may be placed on the selection criteria, making the decision process a highly subjective one.

Selecting Alcap over purifier technology is a purchasing decision that places high priority on reliable operation during demanding and fluctuating operating conditions.

In general, purifiers are recommended for use with well-defined oils of known density and fewer process issues while Alcap separators are recommended for all types of oil of variable density and critical process issues such as the removal of catalytic fines.

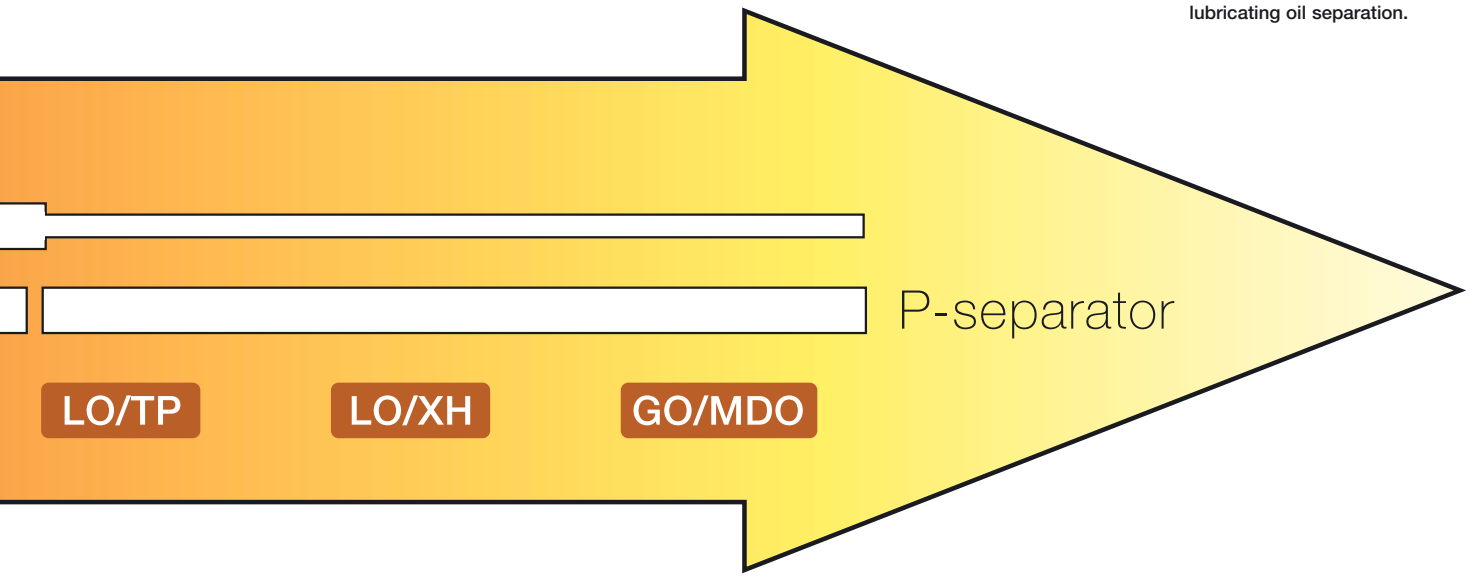
Selection criteria	Purifier	Alcap
Oil density – Variable or unknown	Not recommended	Suitable
Oil density – High	Not recommended	Suitable
Oil density – Low	Suitable	Not required
Fluctuating process conditions	Not recommended	Suitable
Water content – very high	Suitable	Not recommended
Ease of operation	Suitable	Suitable
Operation	Suitable	Excellent



The illustration below shows how Alfa Laval provides two approaches to fuel and lubricating oil separation based on the type of oil, density and process issues to be considered. The solid lines represent the type of fuel oil best handled by the respective Alfa Laval separators.

The S-separator can provide optimal performance for light fuel and lube oils and therefore has a solid white line that extends over the entire range of fuel and lube oils. The dotted line represents where the other system type may be a better choice.

Two approaches to fuel and lubricating oil separation.



Alcap technology

Operating principle
Dirty, pre-heated oil is continuously fed to the S-separator, which essentially operates as a clarifier. Clean oil is continuously discharged from the cleaned oil outlet. Separated sludge and water accumulate at the periphery of the bowl.

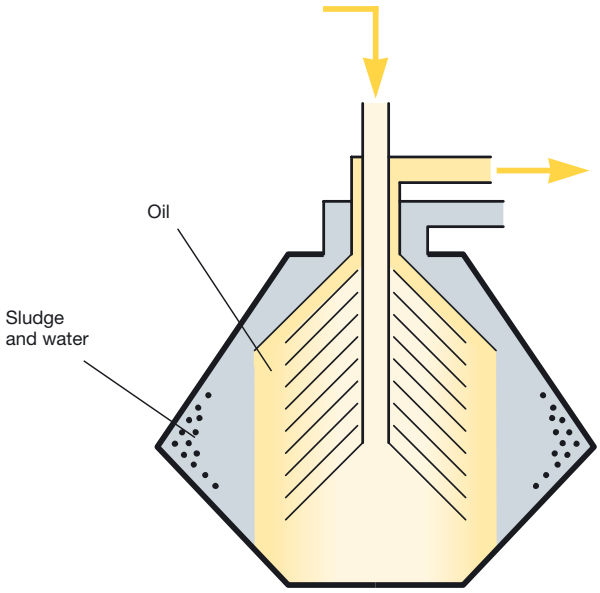
When separated water approaches the disc stack, traces of water start to escape with the cleaned oil. This minor increase in water content of the cleaned oil is detected by the transducer MT 50, which is installed in the cleaned oil outlet.

Increased water content in the cleaned oil is a sign of reduced separation efficiency not only of water, but of solid particles too.

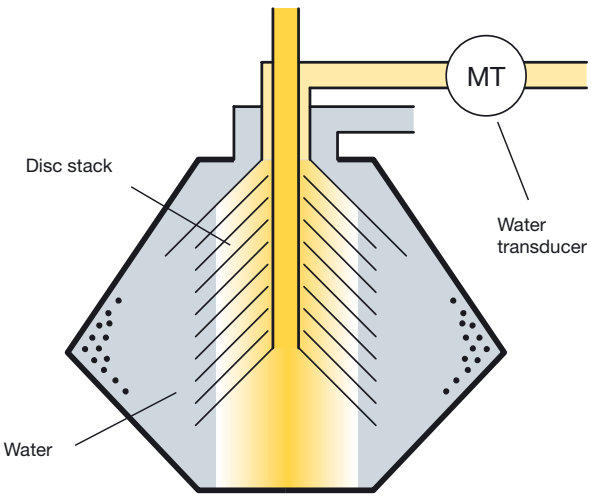
The transducer continuously measures changes in water content. No absolute values of water content or volume are involved. The transducer measures the deviation from a non-calibrated reference value and transmits a signal to the EPC 50 process controller for interpretation. Measurements that fall within the permissible deviation values are known as the trigger range.

The EPC 50 process controller stores a new reference value after the transducer stabilization time that follows every sludge discharge sequence has elapsed. During the reference time the best possible separation result is obtained.

At the trigger point, which is when the water content in cleaned oil reaches its maximum allowable deviation of approximately 0.2 percent in water content, the EPC 50 process controller initiates an automatic discharge of the water that has accumulated in the separator bowl.



Low free water content in feed.



Medium free water content in feed.

Depending on the amount of water in the oil, water is discharged either through the water drain valve, or with the sludge through the sludge ports at the periphery of the bowl.

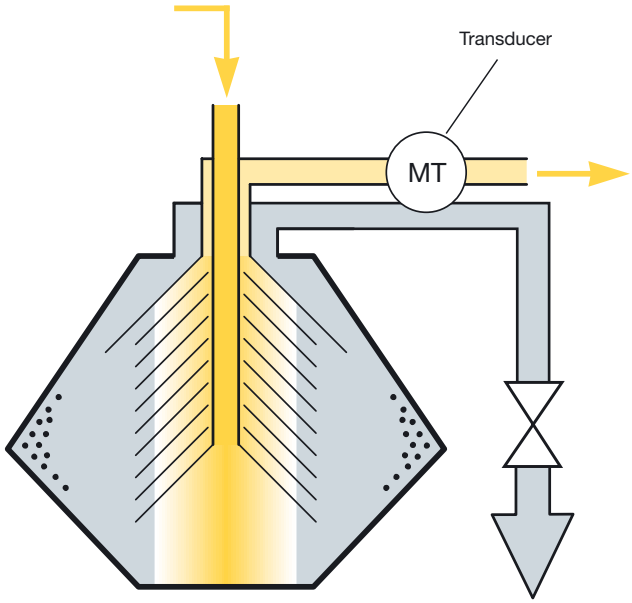
Medium free water content in feed
When separated water approaches the disc stack the transducer signal triggers the EPC 50 process controller to open the water drain valve.

High free water content in feed
When excessive amounts of water are present in the feed and if the water drain valve activation does not provide sufficient drainage, the EPC 50 process controller automatically initiates a sludge discharge.

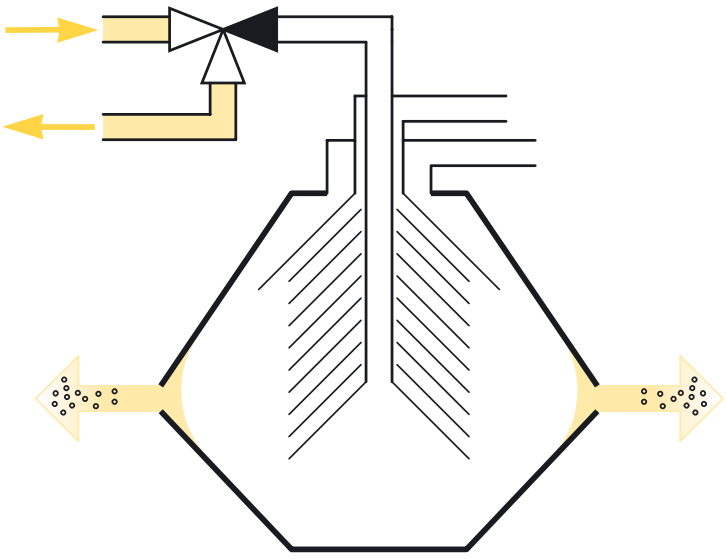
Transducer MT 50 operating principle
The transducer includes a cylindrical capacitor through which the full flow of cleaned oil passes, forming a dielectric medium. The working principle of the transducer exploits the large difference between the dielectric constants of mineral oil and water.

Dielectric constant (Approximate values)
Mineral oil: 2–4
Water: 80

The dielectric constant of oil contaminated with water increases when the water content of the oil increases, and vice versa. Changes in the dielectric constant of the cleaned oil are very sensitive, convenient measures of changes in its water content.



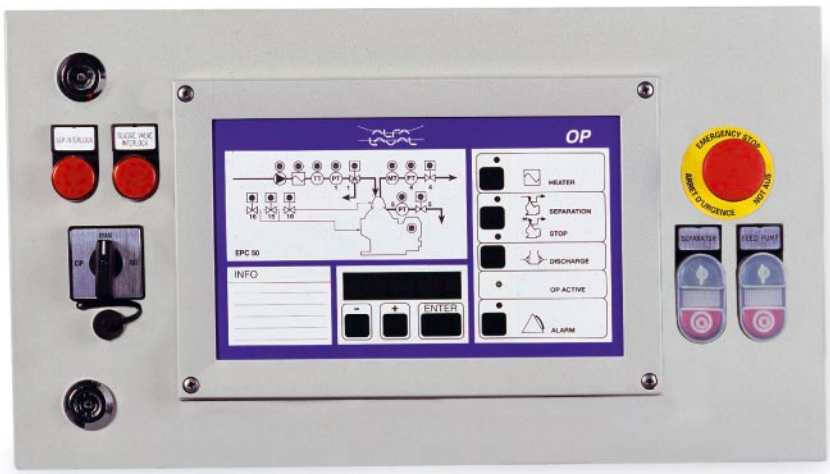
High free water content in feed – water drain valve activated.



High free water content in feed – sludge discharge.

Purifier and Alcap systems

An EPC 50 process controller regulates the operation of the separators. The separator bowl can be arranged as a purifier, a clarifier or an Alcap system. All these separators separate sludge and water from the oil. The sludge that accumulates at the bowl periphery is intermittently discharged.



In a purifier, water is continuously discharged from the bowl. Here the EPC 50 unit automatically controls the water admitted to the separator for the water seal and displacement of oil prior to sludge discharge.

When operating in the purifier mode, a gravity disc must be fitted to obtain the correct interface position in the separator bowl, setting the boundary between the oil and the water seal.

The size of the gravity disc must match the oil density, viscosity, temperature and oil feed rate to the separator. In the clarifier mode, a clarifier disc is fitted instead of a gravity disc.

In a clarifier, the water outlet is blocked, thus limiting the clarifier's capability to handle water. Water is accumulated and discharged like sludge.

Alcap is an intermediate between a purifier and a clarifier. Depending on the actual process conditions, the EPC 50 process controller selects the operating mode. The water transducer supplies information about process conditions in the cleaned oil outlet to the EPC 50 unit. This makes it possible to operate under optimal conditions with regard to discharge, oil displacement and other cleaning operations.

During normal operation vital process parameters are monitored. The EPC 50 unit provides alarm functions for low oil pressure and power failure. Alarm functions are also provided for errors involving the EPC 50 process controller. Special text messages indicate process parameters and alarms on the LED display.

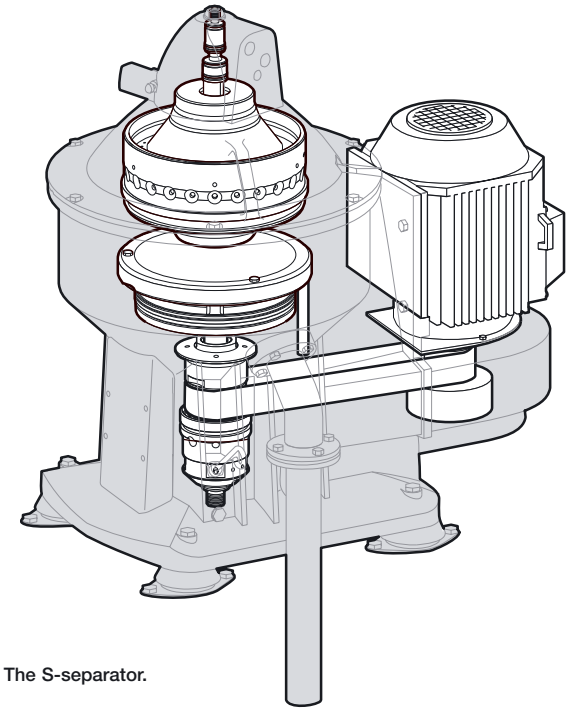
In addition, functions are available for vibration and low speed alarm when the optional vibration and speed sensors are fitted.

The S- and P-separators

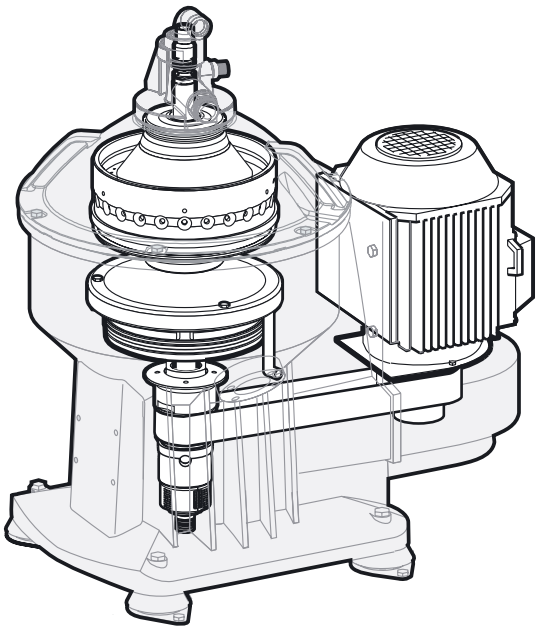
With its unique design features, the centrifugal separator incorporated in the S-separator and P-separator is the most advanced separator ever produced for the marine and power industries.

The descriptions here apply to the larger S- and P-separators. The smaller separators, P 605 and 615, are based on a more conventional design and originate from the well-known MMPX series.

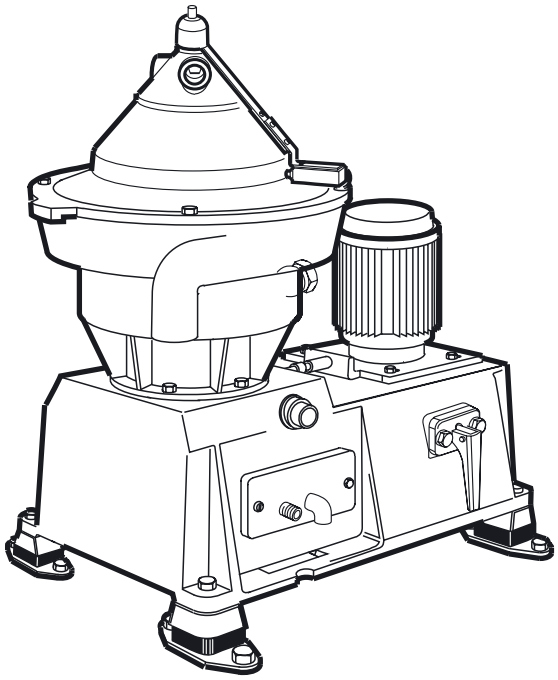
Drive
The separator is driven by an electric motor via a flat belt to the spindle that is supported in the frame by bearings and special composite springs. No tensioning of the drive belt is required.



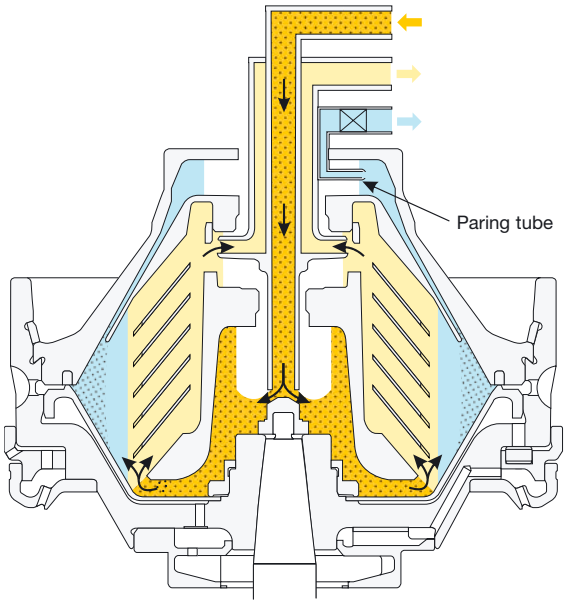
The S-separator.



PA 625/635 separator.



PA 605/615 separator.



S-separator bowl.

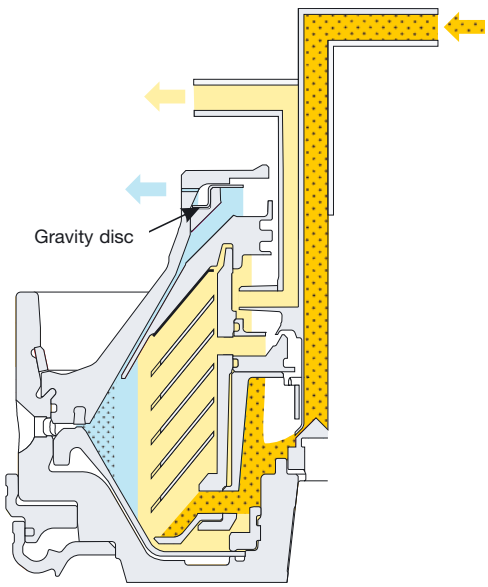
Bowl

While the bowls of S- and P-separators differ slightly, they share advantages over those of other separators.

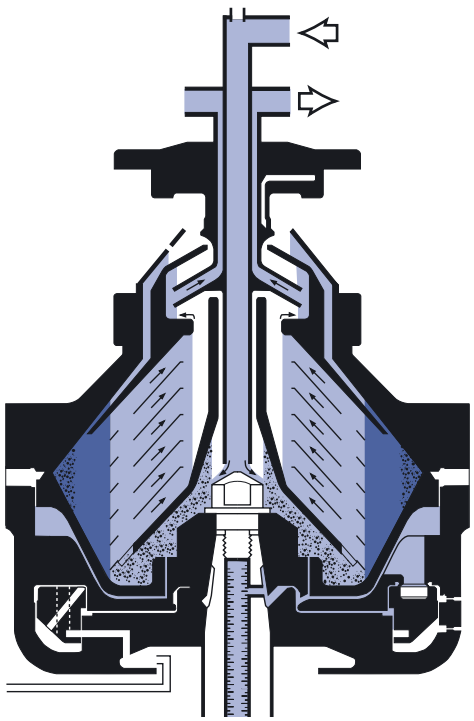
The bowl is appreciably smaller than those of previous separator models for a given capacity requirement. Both separators have smaller optimized volumes, which combined with the CentriShoot discharge system, reduce sludge output.

For the S-separator, the bowl has a simple paring tube that “floats” on the surface of the heavy water phase instead of a conventional heavy phase paring disc.

For the P-separator, the bowl must be fitted with a gravity disc to obtain the correct interface position. The size of the gravity disc must match the oil density, viscosity, temperature and oil feed rate to the separator.

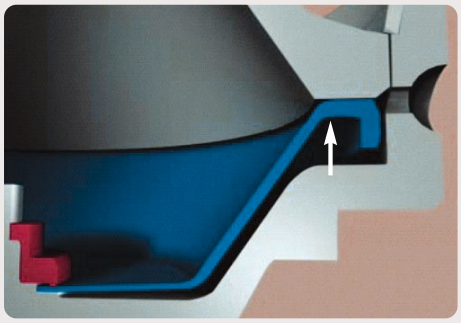


P 625/635 separator bowl.

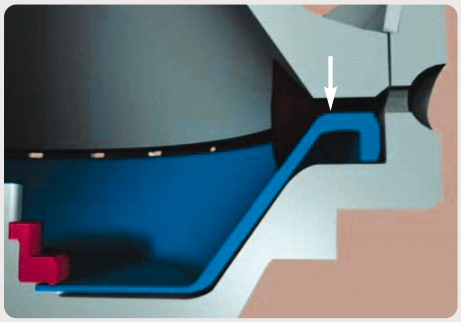


P 605/615 separator bowl.

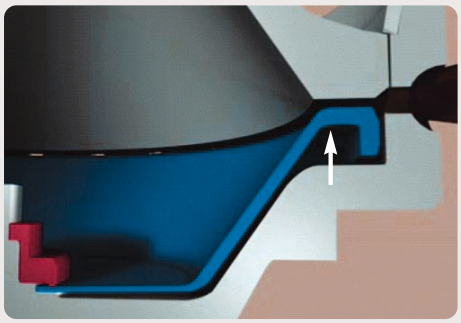
CentriShoot discharge system



STEP ONE: CentriShoot's discharge slide is fixed at the centre. During separation it covers the discharge ports.



STEP TWO: During sludge discharge, the edge of the slide flexes downward, exposing the ports.

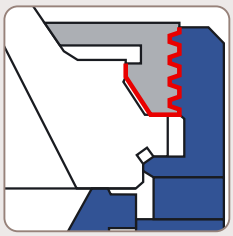


STEP THREE: After discharge, the slide moves gently back into position, closing the ports. Closing is done hydraulically, without any springs.

CentriLock lock ring

CentriLock can be removed with only an Allen key.

CentriLock lifts out and snaps in easily – without any threads to wear.



CentriLock eliminates the need to handle threaded lock rings that cause metal-to-metal wear between bowl and lock ring. Metal-to-metal wear leads to expensive bowl repair or replacement.

Discharge system

The separator operates with the new CentriShoot discharge system. The sliding bowl bottom of previous models has been replaced by a discharge system that uses a patented, flexible discharge slide that is fixed in the bowl body.

During discharge, only the outer periphery of the disc flexes downward exposing the discharge ports. The frame of the separator easily absorbs the impact energy of the sludge.

Because of the smaller bowl volume, longer intervals between sludge discharges and more accurate controls, the new system provides efficient sludge removal but with less oil loss, lower water consumption and reduced total waste production than previous models.

Lock ring

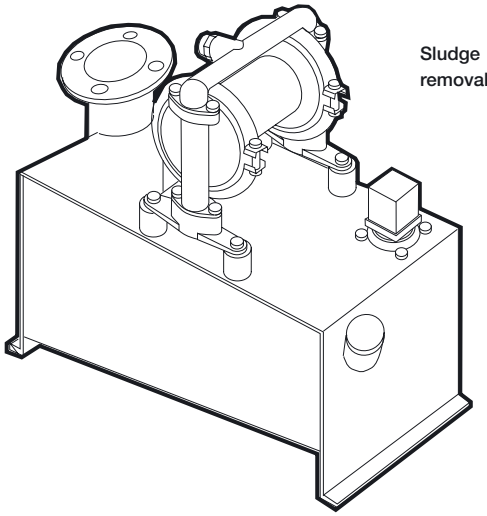
In the new separators CentriLock, a simple patented snap-in spring lock ring, has replaced the traditional threaded lock ring, the lock ring spanner and hammer.

The bowl is assembled and then compressed, using the mechanical disc stack compression tool that comes with the separator. This enables the spring lock ring to snap easily into place.

Removal is equally simple. With the help of an Allen key and a screw, the lock ring is easily pushed out of its groove.

Ancillaries for S- and P-separators

Most ancillaries are the same for the two systems. The delivery comprises block-mounted components with the separator and ancillaries as individual units. The main block consists of the inlet and outlet connections, control and regulating valves, temperature and pressure transmitters. There is a control unit, an optional starter and also a smaller block for operating water. The blocks are connected as the system is built together.



Sludge removal kit.

Sludge outlet butterfly valve kit

When several separators serve the same sludge tank, there may be a flow of gases into the covers of separators, especially if they are not in operation. To prevent the condensation of corrosive gases in the separator, a butterfly valve can be installed in the sludge outlet duct.

Sludge removal kit

Thanks to the new discharge system it is no longer necessary to have a large sludge tank under the separator. Instead, a very small optional intermediate sludge tank can be mounted beside the separator.

EPC 50 process controller

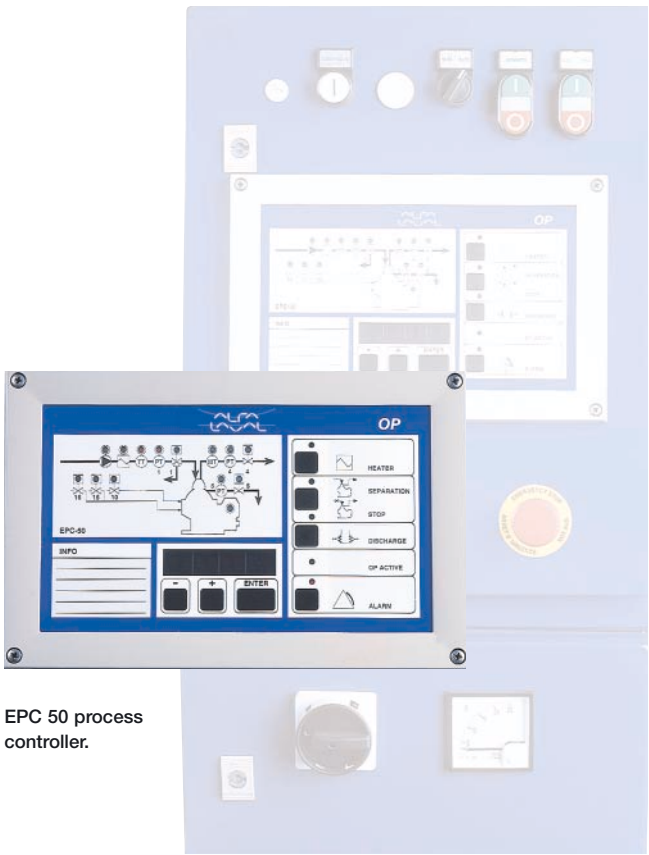
The control cabinet for the separator unit combines the motor starters and the process controller into a single unit. However, the separator ancillary system requires the process controller to be installed in a separate cabinet.

Maximum reliability and user-friendliness were among the major design considerations for the new EPC 50 process controller.

Pressure transmitters have replaced pressure switches in the ancillaries unit, providing a higher degree of accuracy and reliability. They also supply the process controller with a continuous stream of information.

Instead of the message codes used in previous systems, the new unit provides information in clear language in a rolling text window. Eight different languages are provided as standard, enabling the operator to select the language of choice at the initial start-up.

In rigorous tests over many years, the process controller has proven to be stable and the light-emitting diode (LED) display legible under conditions of high humidity and temperatures of +55°C and above. The EPC 50 has been granted approval from the leading classification societies.



EPC 50 process controller.

The S-separator

The Alfa Laval S-separator is the principle component of a range of high-efficiency heavy fuel oil separation systems. Based on proven Alcap oil treatment technology, the Alfa Laval S-separator combines heavy fuel oil and lubricating oil treatment into a single separator, thanks to software that makes it possible to set the relevant parameters in the process controller.

The Alfa Laval S-separator.

The Alfa Laval S-separator system can handle:

- Heavy fuel oils with high densities up to 1010 kg/m^3 at 15°C and viscosity up to 700 cSt at 50°C. Handling of higher viscosity is available upon request.
- Distillates and marine diesel oils (MDO).
- Lubricating oils for all diesel engine types.

The Alfa Laval S-separator system consists of a separator and its ancillary components, together with control system and starter box. It can be delivered in two ways:

1. As the Alfa Laval Separator Ancillary (SA) system, which consists of six individual components that can be assembled on site to facilitate delivery, or,
2. As the Alfa Laval Separator Unit (SU), which is a fully integrated modular system on its own base plate.

Both systems include:

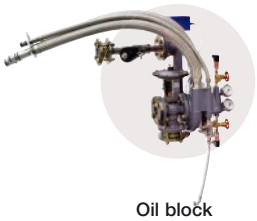
- a high-speed S centrifuge,
- an EPC 50 process controller,
- an MT 50 transducer (capacitive transmitter), and,
- other ancillary equipment.

SU – Separation Unit

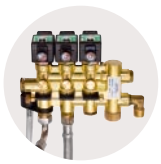
Easy to work with but occupying only a minimum volume, the plug-and-play Separation Unit integrates a separator and ancillaries with a control cabinet and starter box. All components pre-installed on a single base plate, saving installation time, material and space.

SU Module

The plug-and-play SU Module combines a Separation Unit with a heater and feed pump. This makes it a complete oil cleaning system and an optimum solution for engine protection. Double and triple configurations are also available, each mounted on a single base plate with all of the interconnecting piping.



Oil block



Water block

Sludge outlet kit

SA – Separation Ancillaries

A non-integrated solution, the SA separation system minimizes initial investment by assembling it on site. Specialized block components allow flexible installation of the system.

Air block

Optional starter

EPC 50 control unit

To further simplify the design process, 3-D AutoCAD drawings for all separator configurations are available in electronic format.

Flow chart

The Alfa Laval S-separator

1. **Feed pump**
   Feeds unprocessed oil to the separator.

2. **Heater**
   Heats unprocessed oil to the separation temperature.

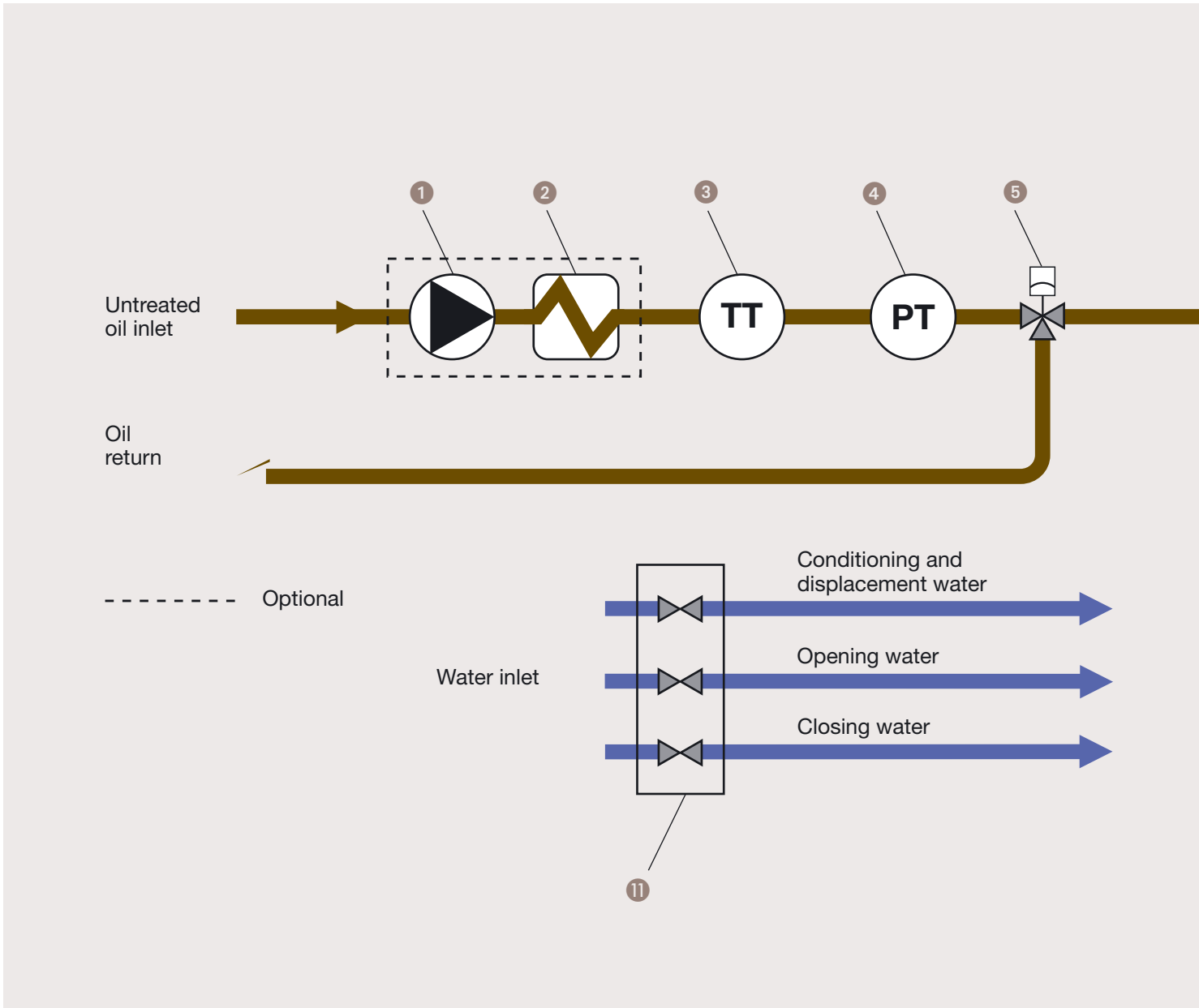
3. **Temperature transmitter**
   Measures the oil temperature and signals the process controller.

4. **Pressure transmitter, oil**
   Measures the pressure in the oil inlet and signals the process controller.

5. **Pneumatically controlled changeover valve**
   Leads the untreated oil to the separator, or back for recirculation.

6. **Control unit**
   Supervises the S-separator.

7. **Pressure transmitter, oil**
   Measures the pressure in the oil outlet and signals the process controller.



8 Transducer
Continuously monitors changes in water content in the oil outlet and signals the process controller. Provides a "separation efficiency check".

9 Regulating valve
Regulates the back-pressure in the cleaned oil outlet.

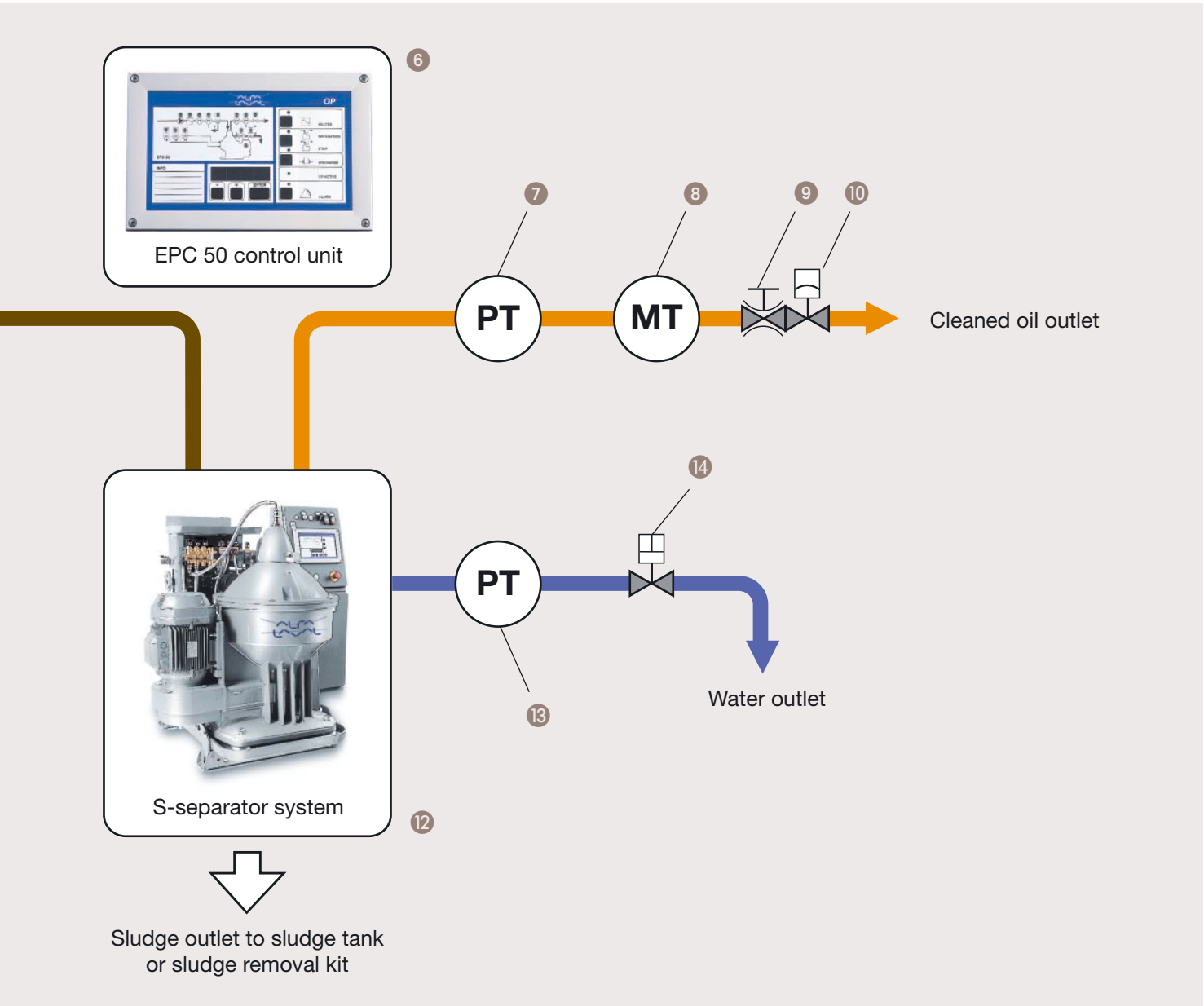
10 Pneumatically controlled shut-off valve
Closes the cleaned oil outlet.

11 Solenoid valve block, water
Distributes separator opening/ closing water, conditioning and displacement water.

12 Separator
Cleans the oil by removing water and solid particles.

13 Pressure transmitter, water
Measures the pressure in the water drain outlet and signals the control unit.

14 Drain valve
Opens to drain water from the separator.



The P-separator

The Alfa Laval P-separator is a new development of proven technology. It is specially designed for well-defined oils with fewer but vital process issues. Manually set gravity discs have replaced the more refined Alcap technology in the separator bowl. The result is a separator with the same high performance, but one that does not automatically compensate for process fluctuations.

The descriptions here apply to the larger P-separators and in part to the smaller separators, P 605 and 615. P 605 and 615, however, are based on a more conventional design and originate from the well-known MMPX series.

The Alfa Laval PA 625/635 separator.

The Alfa Laval PA 605/615 separator.

The Alfa Laval P-separator system can handle:

- Heavy fuel oils with densities up to 991 kg/m³ at 15°C and viscosities up to 600 cSt at 50°C.
- Lubricating oils for all diesel engine types.
- Distillates and light diesel oils (MDO).

The Alfa Laval P-separator system consists of a separator and its ancillary components, including control system and starter box.

Differentiation of P-separators from conventional systems

Alfa Laval continually develops new separation products, solutions and applications. As the latest addition to the company's broad range of purifiers, the P-separator is designed to replace the proven MMPX and the MOPX.

Conventional purifier systems are often considered as systems that cause oil losses in great quantities during discharge. This interpretation lead to the perception that all purifiers cause high oil losses, which is not correct.

With its innovative bowl design, the P-separator is more compact, produces less sludge, consumes less water and loses less oil than conventional purifiers.

In addition, the P-separator has a modern EPC 50 process controller that has replaced the EPC 41 found on the MMPX and MOPX separators. Fewer ancillary components is yet another advantage that the P-separator has over its predecessors.

An installation with S-separators for fuel oil and P-separators for lubricating oil will have the same system build-up, the same separator configuration and the same parameters of the process controller.

PA – Purifier Ancillaries

A non-integrated solution, the P-separator minimizes initial investment by assembling it on site. Specialized block components support simple installation.

Water block

Changeover valve

Optional starter

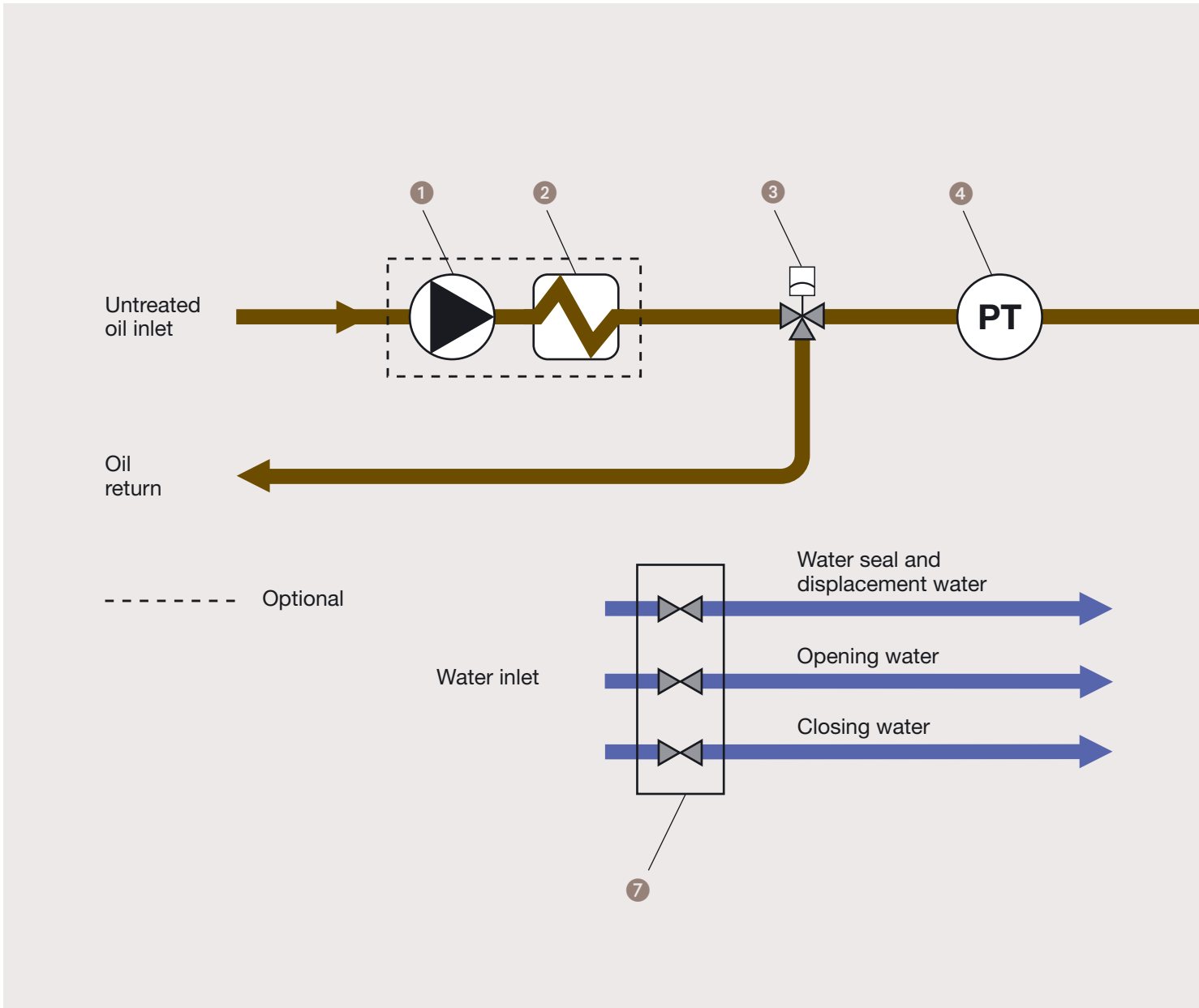
EPC 50 control unit

To further simplify the design process, 3-D AutoCAD drawings for all separator configurations are available in electronic format.

Flow chart

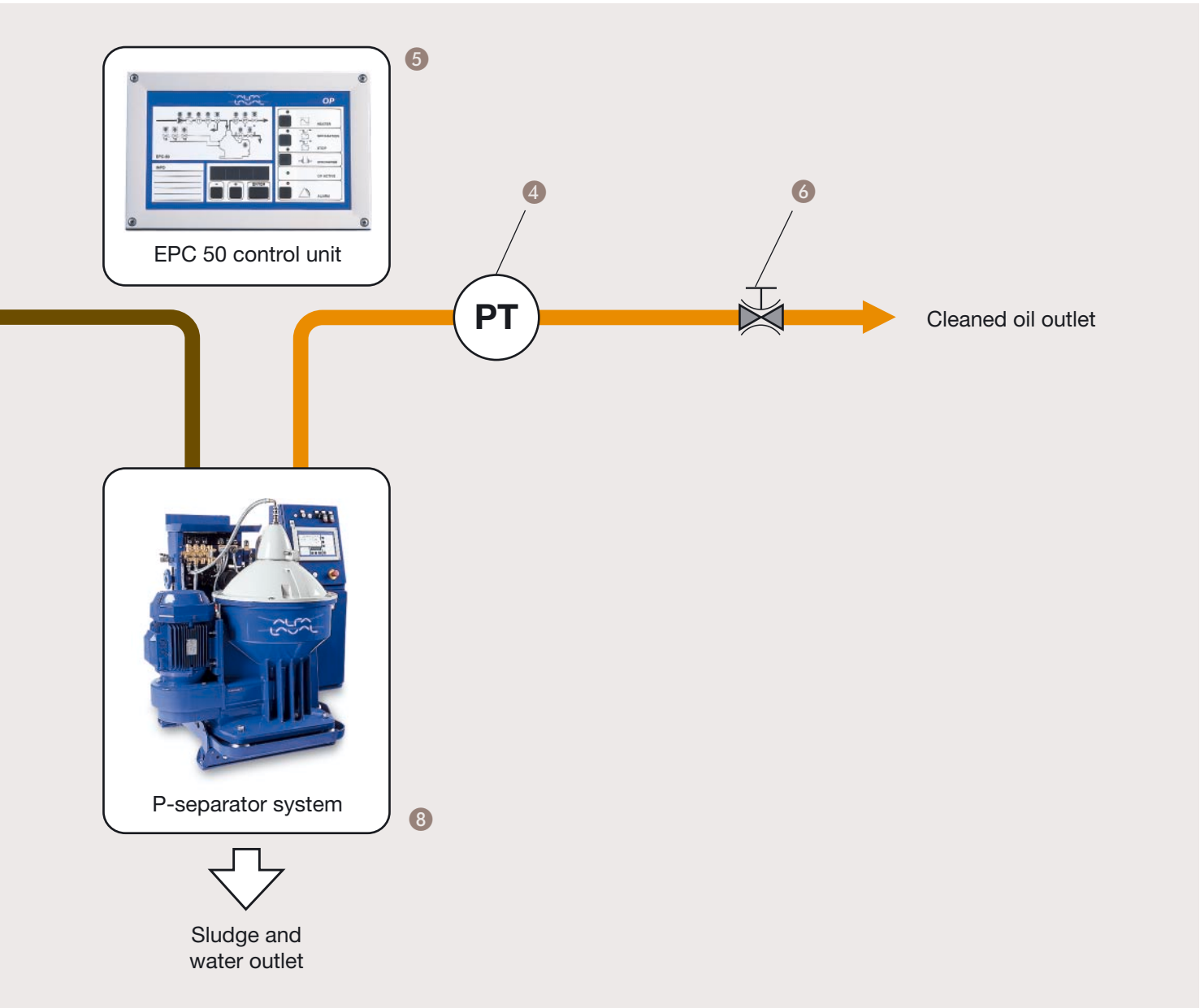
The Alfa Laval P-separator

1. **Feed Pump**
   Feeds unprocessed oil to the separator.
2. **Heater**
   Heats unprocessed oil to the separation temperature.
3. **Pneumatically controlled changeover valve**
   Leads the untreated oil to the separator, or back for recirculation.
4. **Pressure transmitter, oil**
   Measures the pressure in the oil inlet and signals the process controller.
5. **Process controller**
   Supervises the P-separator.
6. **Regulating valve**
   Regulates the back pressure in the cleaned oil outlet.



7 Solenoid valve block, water
Distributes separator opening/ closing water, water seal and displacement water.

8 Separator
Cleans the oil by removing water and solid particles.



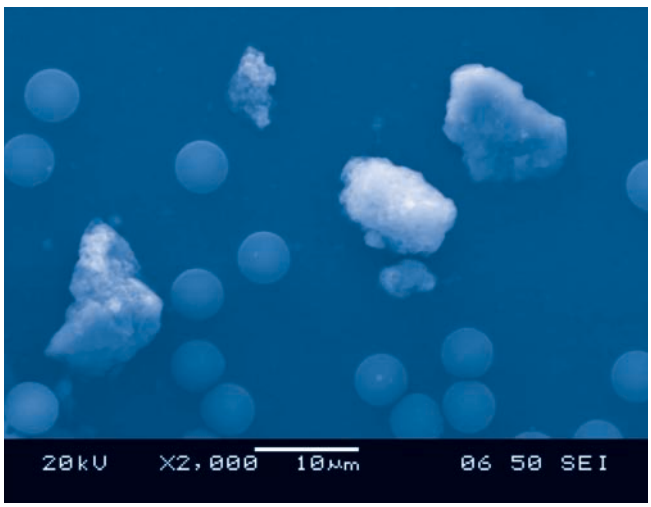
Separation Performance Standard

In general, marine diesel engines burn residual fuel oils. The quality of the fuel oils varies widely, depending on the grade and processing of the fuels. Some may contain higher levels of contaminants, such as water and abrasive solids, than others. To achieve reliable and cost-effective operation of the marine diesel engines it is necessary to clean all residual fuel oils before injection into the engines.

The leading cleaning method used on board ships today is centrifugal separation. For years engine builders, ship owners and classification societies have been demanding reliable performance criteria to be able to compare how one manufacturer's centrifuge performs against that of another manufacturer with regard to the removal of hard abrasive particles such as catalytic fines from marine residual fuels. If unchecked, these catalytic fines can endanger ship safety by causing engine wear and damage.

According to the ISO 8217 Fuel Standard for Specifications of Marine Fuels, the maximum allowable content of catalytic fines in bunkered fuel, expressed as the total content of aluminium and silicon, is 80 mg/kg (ppm). However, engine builders generally anticipate that this amount will be reduced by the fuel cleaning system onboard to a maximum of 15 ppm before the fuel oil is injected into the engine.

Manufacturers of centrifuges now supply buyers with their own maximum recommended capacity (MRC) tables as guidelines to select a fuel cleaning system. However, buyers cannot be sure that the centrifuges that are specified and installed using these tables actually ensure the safe removal of harmful solids from bunker fuels.



Catalytic fines in relation to controlled artificial particles called dynospheres.

In June 2004 the European Committee for Standardization (CEN) began to establish an operational specification of a method to measure separation performance of centrifuges with regard to the presence of solid particles in residual fuel oils.

The CEN Workshop finalized an agreement, called CWA 15375, in August 2005 that effectively established a new standard that defines the performance of centrifuges installed on board ships. This standard is based on tests using controlled artificial particles, which are considered as reliable performance criteria and establish a fuel oil centrifuge's ability to remove solid, abrasive particles from marine residual fuels to safe operational levels.

This makes it possible to make objective comparisons between centrifuges from different suppliers.

With the workshop agreement secured, the participants intend to advance the agreement into a full international standard recognized by the International Organization for Standardization.

The Separation Performance Standard is primarily aimed at providing a marine standard for centrifuges that clean heavy fuel oil, not lubricating oil. Therefore Alfa Laval S-separators, not purifiers, conform to the standard and were in fact the first to receive type approval for the SPS standard from leading classification societies.

For more information about CWA 15375, request a copy of the handbook "Marine diesel engines, catalytic fines and a new standard to ensure safe operation" (Reference No. EMD00078EN) from Alfa Laval by sending e-mail to separation.info@alfalaval.com or fax to +46 8 530 345 55.

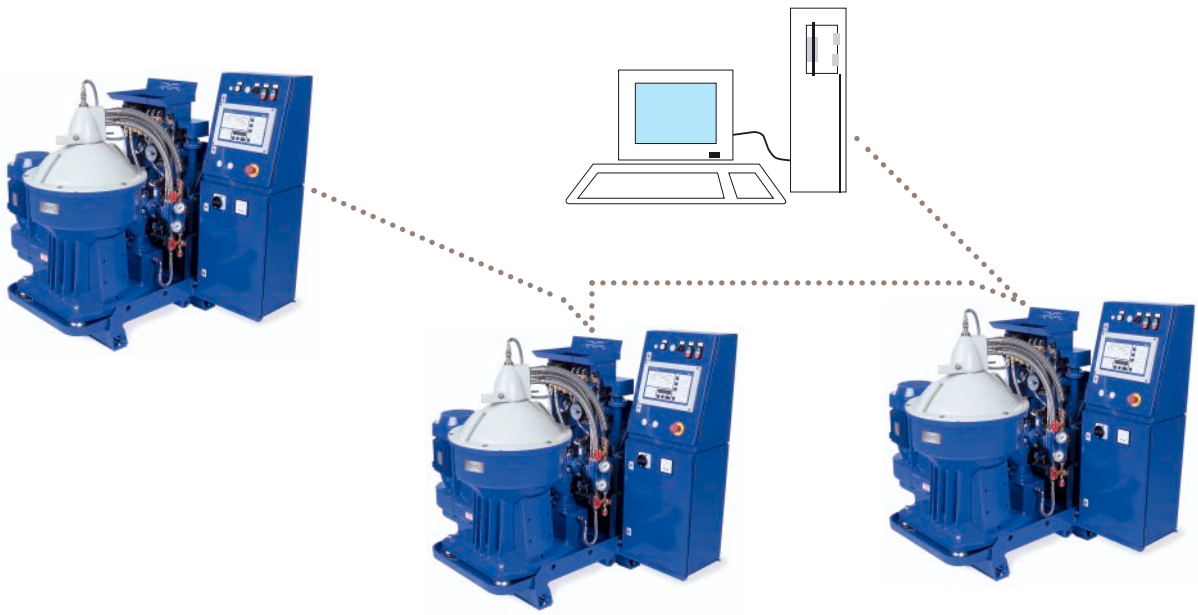
Remote operation

Unlike previous systems, the S-separator and P-separator have several options for remote operation. This has been made possible due to built-in safety features, such as a speed sensor and a vibration sensor.

Depending on the installation, the alternatives for remote control include:

- Bus communication that enables up to nine systems to be connected as a network. Installation of the customer's own software package enables remote operation. A MODBUS or PROFIBUS board must be installed in each EPC 50 process controller.
- An additional EPC 50 control panel (remote operator panel) that can be installed for local operation or for operation from an alternative location.
- A simple remote operation version that uses two switches connected to an I/O expansion board.

Each alternative provides safety interlocks to prevent accidental operation during unsafe conditions.



Remote control network version.

Retrofitting

The Alfa Laval S-separator and P-separator are ideal for newbuildings, for replacing older separator units on existing ships, or for supplementing existing cleaning systems.

Compact size enables the separators to fit into available space in an existing engine room. The S-separators can also be divided into smaller separate modules in order to facilitate transport through narrow passage-ways.

In addition, the pipe connections for the separator units enable greater flexibility for the placement of the unit; the units no longer need to be situated over the sludge tank or in the same location as the unit it is replacing.

Documentation

Alfa Laval supplies each S-separator and P-separator with full documentation either as paper copies or as PDF (Portable Document Format) files on a CD-ROM. Documentation is clearer and easier to understand, thanks to improved graphics. The instruction manual, which is available in most major languages, covers:

- Safety
- System description
- Operating instruction
- Parameter list
- Alarms and fault finding
- System reference/installation instructions
- Service manual
- Spare parts catalogue

Classification society approval

Alfa Laval ensures that the S-separator and P-separator fulfil the requirements of all major classification societies. Upon request, Alfa Laval delivers S-separators and P-separators with individual test certificates. This includes approval by the respective societies of the main components as well as workshop testing of the separator. Most key components are also type approved by the leading classification societies. Alfa Laval has type approval for certified flow rate capacities of the S-separators from six classifications societies.

Spare parts, service and support

Alfa Laval provides spare parts kits for all service and maintenance needs. Global technical service, training and support are available throughout the lifetime of the separators.

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Alfa Laval in brief

Alfa Laval is a leading global provider of specialized products and engineered solutions.

Our equipment, systems and services are dedicated to helping customers to optimize the performance of their processes. Time and time again.

We help our customers to heat, cool, separate and transport products such as oil, water, chemicals, beverages, foodstuff, starch and pharmaceuticals.

Our worldwide organization works closely with customers in almost 100 countries to help them stay ahead.

How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com

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