

Liquids to Value



Westfalia Separator®
seaprotectsolutions

Westfalia Separator® **seaprotect**solutions

Systems to protect the sensitive marine ecosystem and the value of your investment



Protection for the Maritime Environment and Your Investment

Westfalia Separator® **seaprotect**solutions

Protecting the ecosystem of the oceans and the investments of ship owners

Water is the source of all life on our planet. If the balance of the extremely sensitive ecosystem of the oceans is exposed to any danger, all other ecosystems are also in great danger. This asset, which cannot be reproduced, accordingly requires the most effective protection that modern technology can offer. For this purpose, the International Maritime Organisation (IMO) and national legislative authorities have issued strict laws and directives involving fines running into eight digits in the event of failure to comply even in minor cases.

These justified regulations mean that ship owners have to cope with considerable costs and risks that cannot be managed cost-effectively with conventional separating systems. The new Westfalia Separator® **BilgeMaster**®, **SludgeMaster**® and **CombiMaster**® systems secure the oceans' sensitive ecosystems extremely effectively and also provide protection for the value of the ship owner's investment.

The main benefits of the systems are the high separating efficiency, continuous unmanned operation combined with pronounced service friendliness and, of course, the significantly

reduced disposal costs associated with the method. The systems meet the prevailing statutory regulations of the IMO with a residual oil content of much less than 15 ppm. The systems have been awarded type approval according to the IMO Resolution MEPC 107(49). With an additional facility, the Westfalia Separator® **BilgeMaster**® can even achieve a residual oil content of less than 5 ppm.



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for your payback

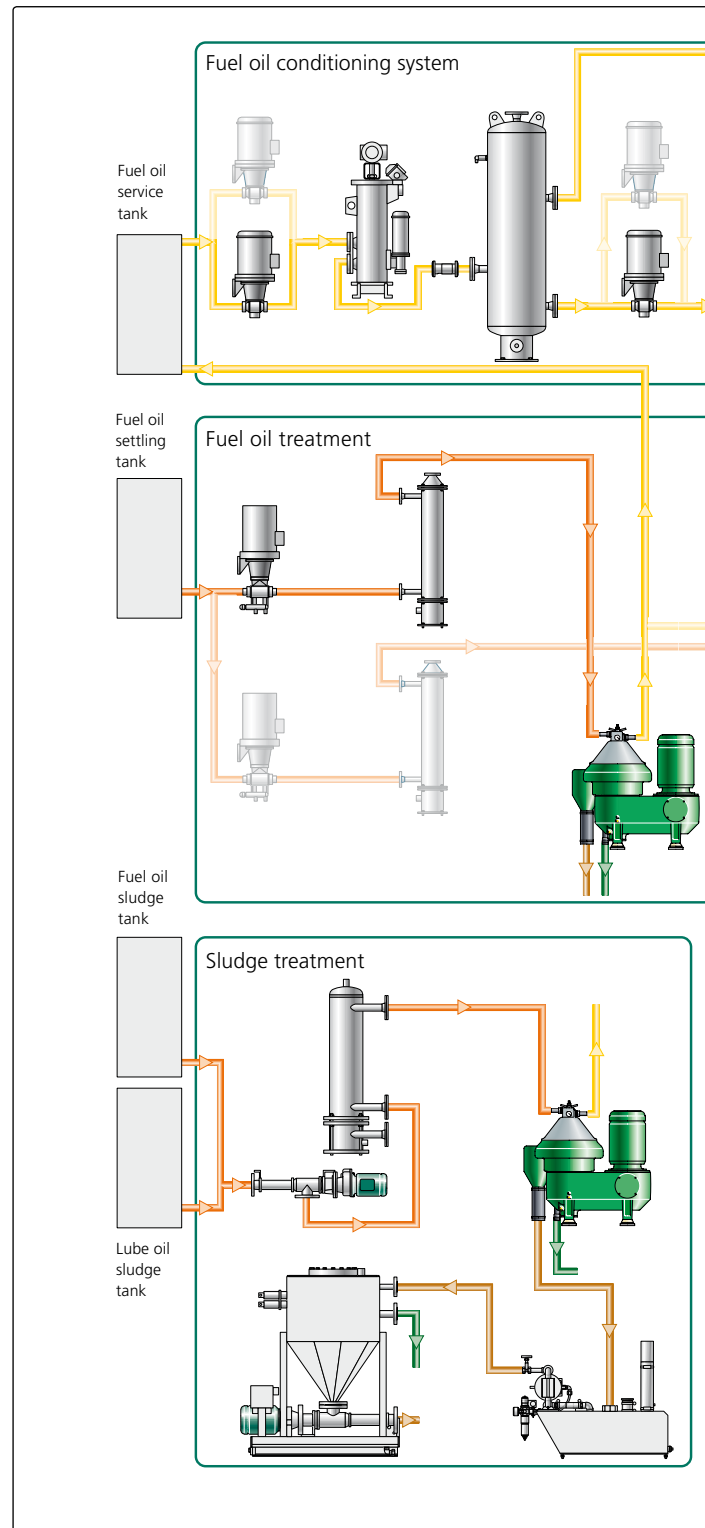
High Performance Equipment for the Engine Room

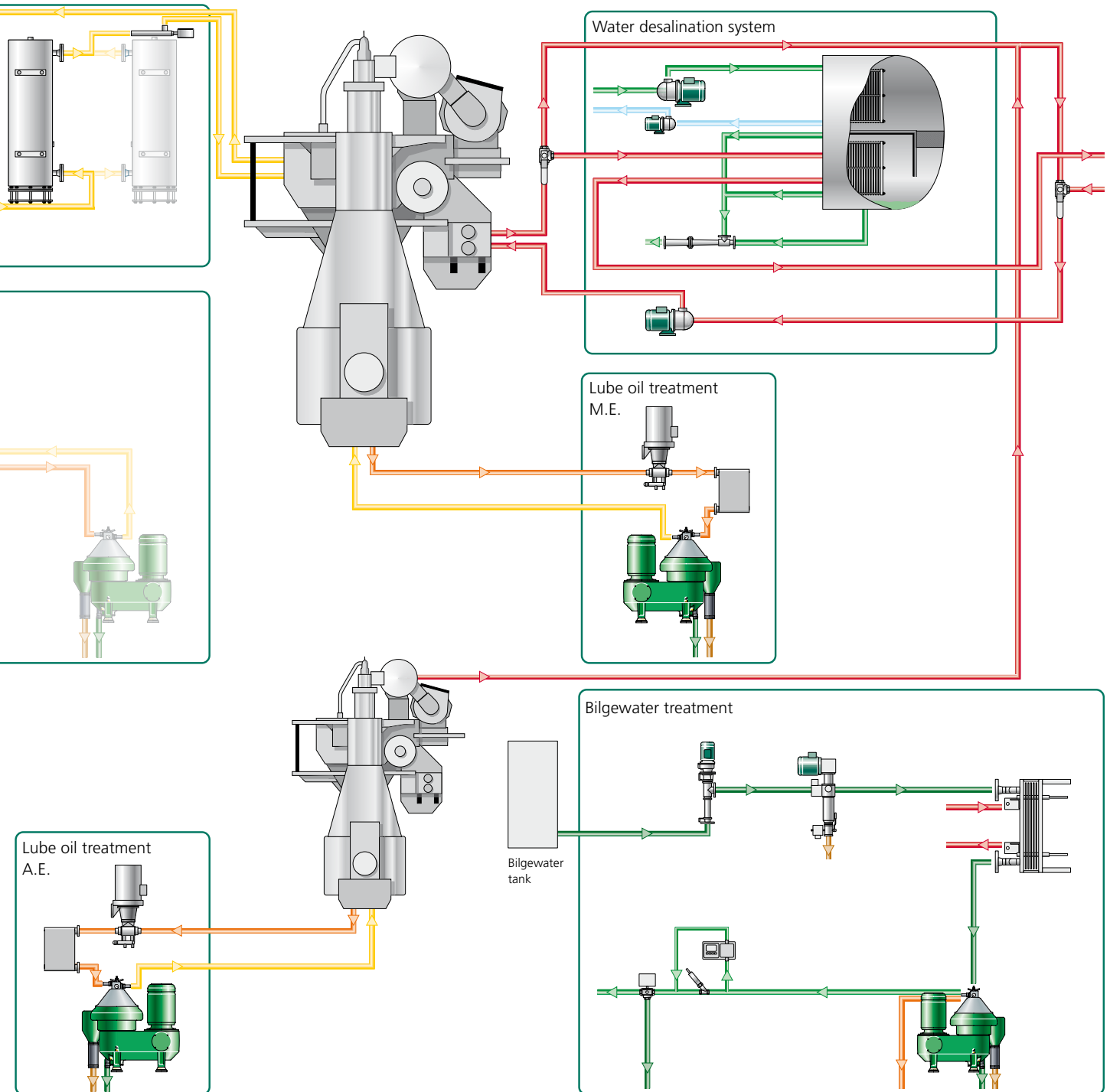
Overview Westfalia Separator® **seaprotect**solutions

GEA Westfalia Separator offers leading technologies and individual systems for marine use. Be it system engineering from one source, high quality of workmanship or the unrivalled worldwide service – GEA Westfalia Separator provides a system to rely on.

Product range overview

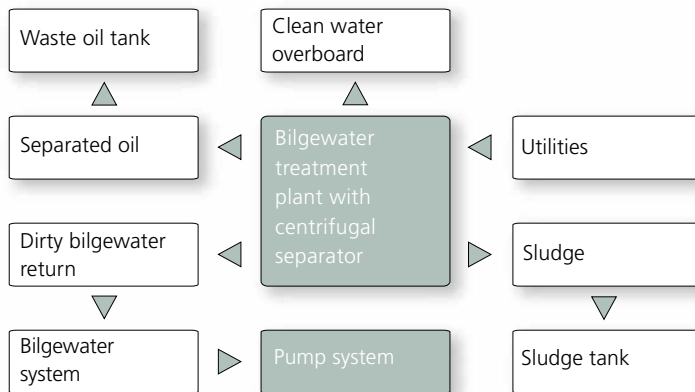
- Fuel oil treatment
- Fuel oil conditioning system
- Lube oil treatment
- Sludge treatment
- Bilgewater treatment
- Water desalination system
- Hydraulic oil treatment plants





Self-Cleaning Centrifugal System

Westfalia Separator® **BilgeMaster**® systems



The treatment of bilgewater on board ships is strictly controlled by national and international laws.

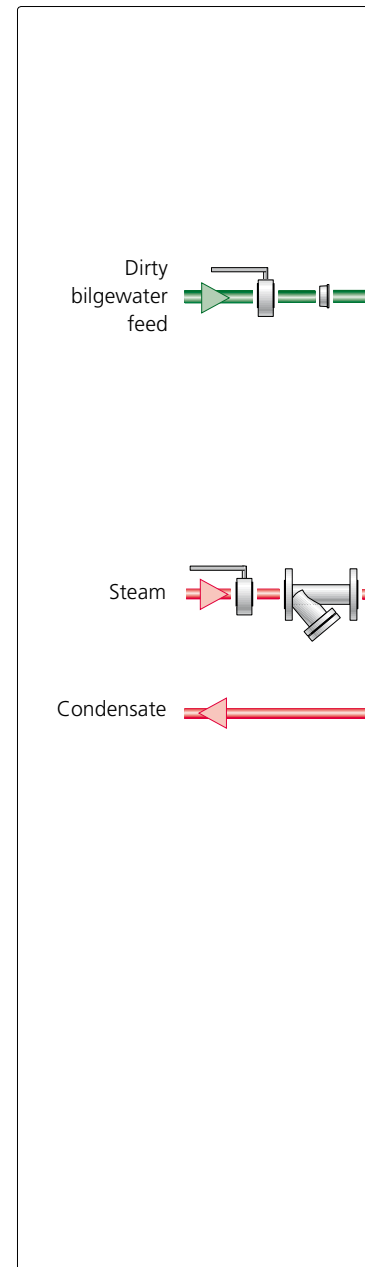
Bilgewater may only be discharged into the sea after prior de-oiling with specially approved treatment systems. The maximum oil content must not exceed 15 ppm. The limit has even been reduced to 5 ppm in special areas.

15 ppm is too much

Oily water from ship operation may only be discharged into the sea if the residual oil content in the effluent is below 15 ppm. 15 parts of oil to one million parts of water seems small but GEA Westfalia Separator believes this is still too high. Moreover, practice has shown that this value is not attained in many conventional plants under practical operation conditions anyway. The further we can reduce this value, the greater the benefit for our oceans.

Bilgewater is a mixture of the following constituents:

- Sea and cooling water leakages
- Fuel and lube oil leaks
- Drainages from settling and sludge tanks
- Effluent from various cleaning processes
- Soot and dirt particles

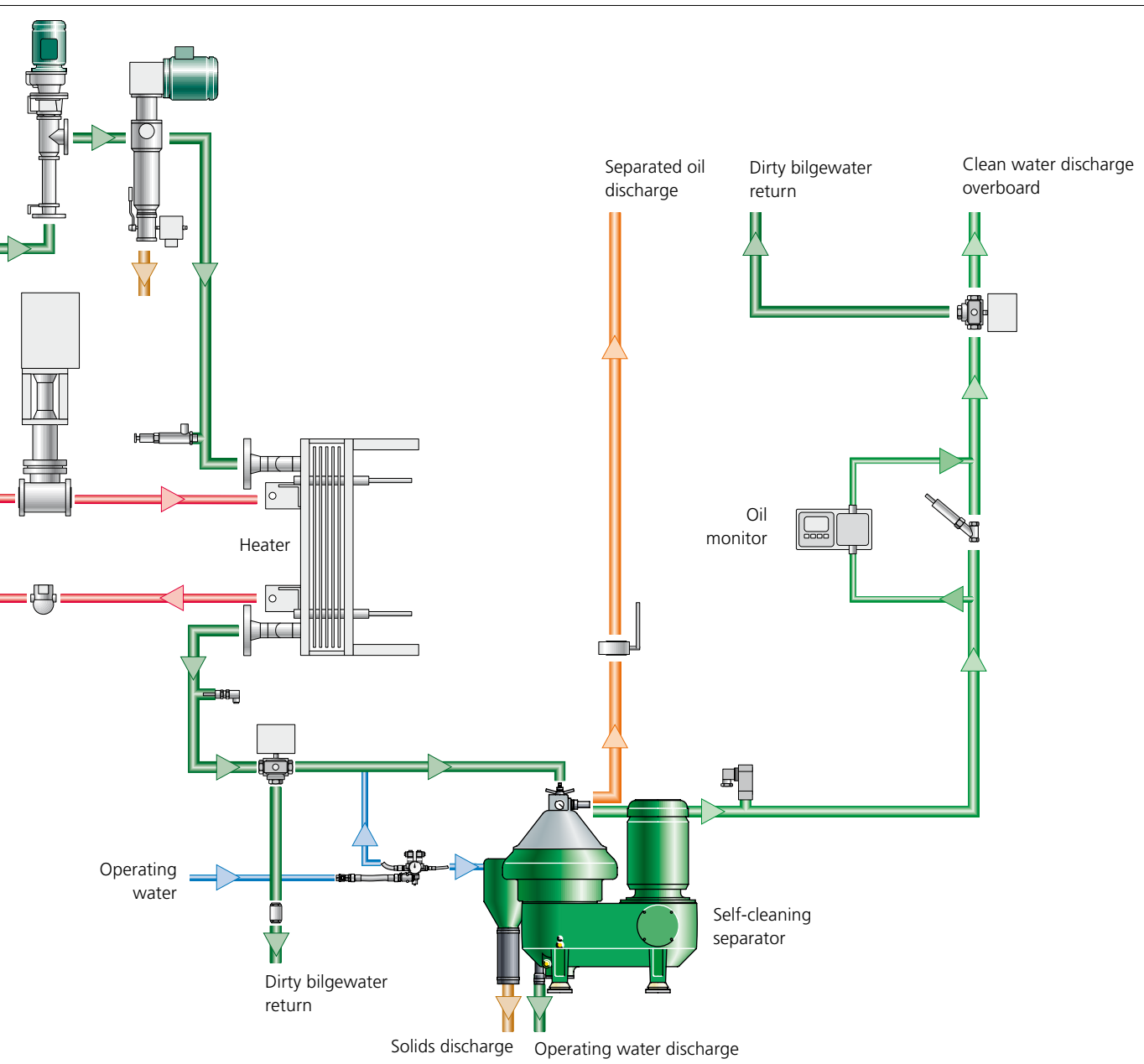


So That Our Water Stays As Nature Made It: Clean

The product (i.e. oily water) is sucked up from the oily water tank or engine room bilge and fed by the feed pump through the filter and preheater via the feed valve to the separator. During the start-up or ejection program it is led back into the oily water tank. The product flows from above into the centre of the separator bowl. The heavy water phase is separated from the finest oil particles and then conveyed under pressure by a centripetal pump to the discharge.

The separated impurities accumulated in the sludge space are discharged into the sludge tank periodically.

The clean water discharge is supervised by an oil monitor and discharged into the environment. If the oil content exceeds 15 or 5 ppm the water is recirculated into the oily water tank. An intelligent process control adapts the capacity of the system to the changes of the product.



Technologies to Protect the Sensitive Marine Ecosystem

Westfalia Separator® **BilgeMaster**® systems

The bilgewater treatment system is designed for ships which use high-density residual fuel oils.

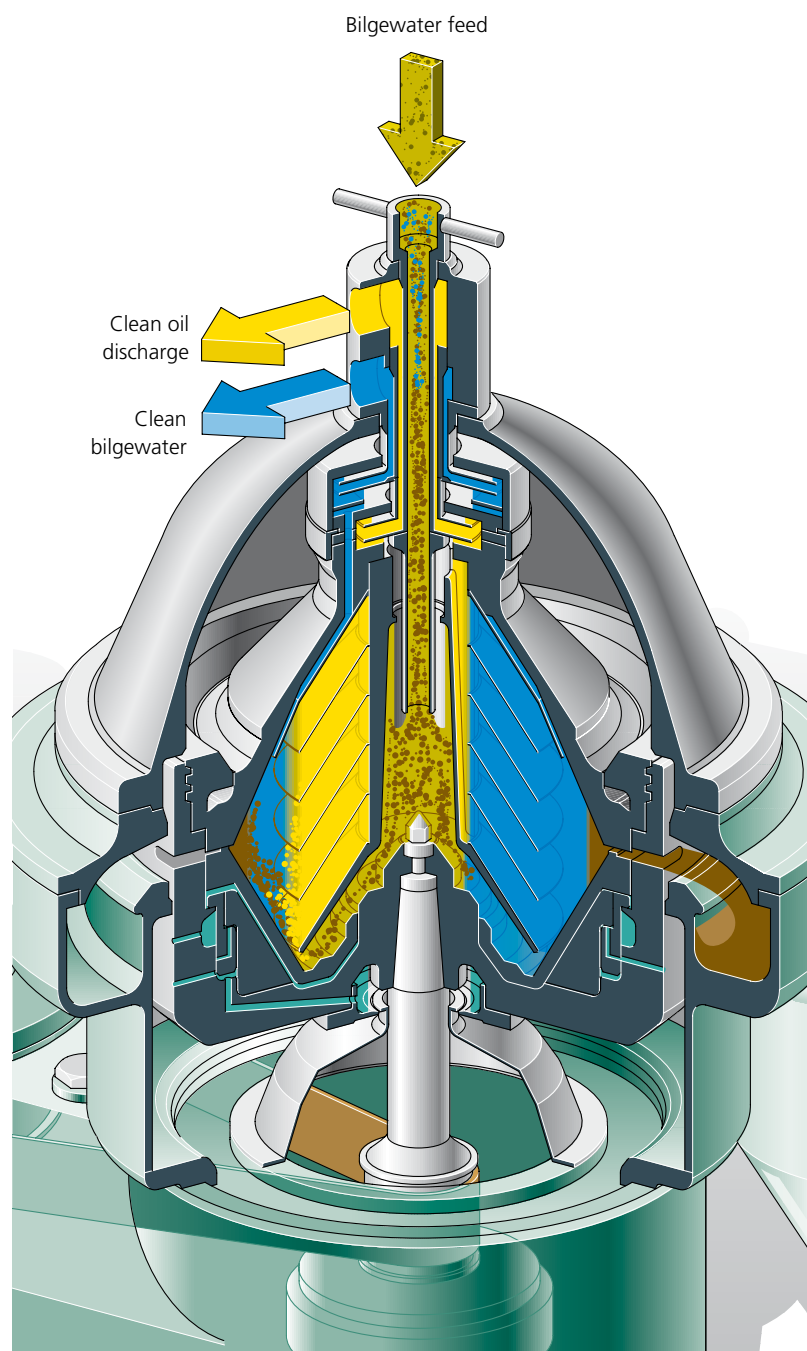
The system is supplied as a complete, self-contained Westfalia Separator® **centripack** incorporating all auxiliaries necessary for operation.

The main components of the system are:

- Self-cleaning centrifugal separator
- Feed pump
- Filter
- Preheater
- Control panel
- Oil monitor for 5/15 ppm bilge alarms
- Base frame with small sludge tank or sludge transfer unit

Benefits of the centrifuge

- High separation efficiency due to large clarification area
- Controlled de-sludging with high solid content due to the Westfalia Separator® **hydrostop** system
- Gentle product feed due to the Westfalia Separator® **softstream** system
- Continuous separation of oil and water phase
- Self-cleaning effect of disk stack due to total ejection
- No impact of the ship's movement on the separation efficiency



The Flexible Compact Unit Design is Suitable for Both Newbuildings and Retrofits



Separation results oily water treatment

With normal feed conditions, i.e.

solids content: < 0.1 %

chloride content: < 30,000 ppm

pH: 6 – 9

and no excessive oil emulsions in the water phase, the residual oil content in the clean water discharge is 10 – 12 ppm. By varying the pump output, it is possible to even further reduce the oil content. In the case of high oil and solids contents, it is prudent to separate the bilgewater in tank cleaning mode before discharging overboard.

GEA Westfalia Separator expands the Westfalia Separator® **BilgeMaster**® system from three to nine sizes. The bilgewater treatment system is hence now even more precisely tailored to actual needs.

The figure shows Westfalia Separator® **BilgeMaster**®-D 3000.

Separator	Westfalia Separator® BilgeMaster®-D	Sep. temp.	Adsorption filter	Capacity	Weight mod. compl.	Dimensions (L x W x H)
WSD 8	1000	85°C	AF 220	500 – 1000 l/h	1385 kg	2630x1100x1550 mm
	1500	85°C	AF 300	500 – 1500 l/h	1400 kg	2630x1100x1550 mm
	2000	85°C	AF 410	750 – 2000 l/h	1425 kg	2630x1100x1550 mm
WSD 18	2500	85°C	AF 300	1000 – 2500 l/h	1475 kg	2780x1100x1550 mm
	3000	85°C	AF 410	1000 – 3000 l/h	1500 kg	2780x1100x1550 mm
	4000	85°C	AF 500	1500 – 4000 l/h	1525 kg	2780x1100x1550 mm
WSD 35*	5000	85°C	AF 410	2000 – 5000 l/h	2375 kg	3380x1100x1564 mm
	6000	85°C	AF 500	2000 – 6000 l/h	2400 kg	3380x1100x1564 mm
	7000	85°C	AF 610	2500 – 7000 l/h	2500 kg	3380x1100x1564 mm

* Also available as Westfalia Separator® **CombiMaster**® with a sludge capacity of 350 – 750 l/h.



Westfalia Separator®
seaprotectsolutions
cleandesign 

Westfalia Separator® **Bilgemaster® cleandesign**

5 ppm – new standards in bilgewater processing

15 ppm without filter and chemicals

GEA Westfalia Separator has set a further milestone in the field of bilgewater processing: The new generation of separators of the Westfalia Separator® **BilgeMaster® cleandesign** system is designed for producing residual oil contents of 15 ppm in all performance classes. Right through to the Westfalia Separator® **BilgeMaster®-D 4000 cleandesign**, based on the self-cleaning separator WSD 35. Without an additional adsorption filter, without chemicals. This is achieved by means of modifications in the product feed of the bowl and the disc stack, resulting in a gentle product feed and a higher clarifying area.

5 ppm with and without filter

The requirements for the purity of bilgewater are constantly becoming more demanding – not least as a result of tighter national requirements throughout the world for sensitive areas of the ocean. In order to be in a position to meet potentially tighter requirements, many shipping companies are already demanding a guarantee of less than 5 ppm residual oil content in the processed bilgewater. GEA Westfalia Separator will also be able to meet these requirements of the market immediately with a complete system program:

- In conjunction with an optional adsorption filter, the Westfalia Separator® **BilgeMaster® cleandesign** series can offer < 5 ppm solutions for all performance ranges.
- With an adaptive flow and temperature control Westfalia Separator® **BilgeMaster® cleandesign** can offer < 5 ppm without filter for reduced capacities.





Optimized Process Safety

Westfalia Separator® **BilgeMaster® cleandesign** – safe, powerful and efficient

Benefits Westfalia Separator® **BilgeMaster®-D cleandesign**

≤ 15 ppm without chemicals & filter

- Less investment costs
- No replacement of filter cartridges
- Reduced life cycle costs
- Smaller dimensions and less weight

≤ 5 ppm without chemicals & with/without filter

- Performance beyond existing IMO standard
- Test report by GL available
- Already required standard by some customers
- In accordance with national regulations for special areas
- Retrofit of Westfalia Separator® **BilgeMaster®-D** possible

85°C separation temperature (standard)

- For steam or thermal oil heating

75°C separation temperature

- For hot water heating, if there is no steam or thermal oil available
- No expensive electrical pre-heater necessary

90°C separation temperature

- Necessary separation temperature if the Westfalia Separator® **BilgeMaster®-D cleandesign** is running without filter, and limited on 5 ppm oil-in-water content in the clean water outlet. Can be fulfilled with existing steam and thermal oil heating

Separator	Westfalia Separator® BilgeMaster®-D cleandesign	Sep. temp.	Capacity [l/h] ≤ 15 ppm without filter	Capacity ≤ 5 ppm with filter	Capacity ≤ 5 ppm without filter, 90°C sep. temp.	Weight module complete	Dimensions (LxWxH)
WSD 8	750	75 °C	350 – 750 l/h	350 – 750 l/h	–	1360 kg	2220x1300x1800 mm
	1000	85 °C	350 – 1000 l/h	350 – 1000 l/h	350 – 550 l/h	1385 kg	2220x1300x1800 mm
WSD 18	1500	75 °C	700 – 1500 l/h	700 – 1500 l/h	–	1400 kg	2370x1300x1800 mm
	2000	85 °C	700 – 2000 l/h	700 – 2000 l/h	700 – 1150 l/h	1425 kg	2370x1300x1800 mm
WSD 35	3000	75 °C	1300 – 3000 l/h	1300 – 3000 l/h	–	2200 kg	2650x1500x1800 mm
	4000	85 °C	1300 – 4000 l/h	1300 – 4000 l/h	1300 – 2300 l/h	2225 kg	2650x1500x1800 mm
Certified according to MEPC 107(49)				Special customer request			

Integrated, Retrofitted or "Stand-Alone"

Customized configurations for all bilgewater processing systems

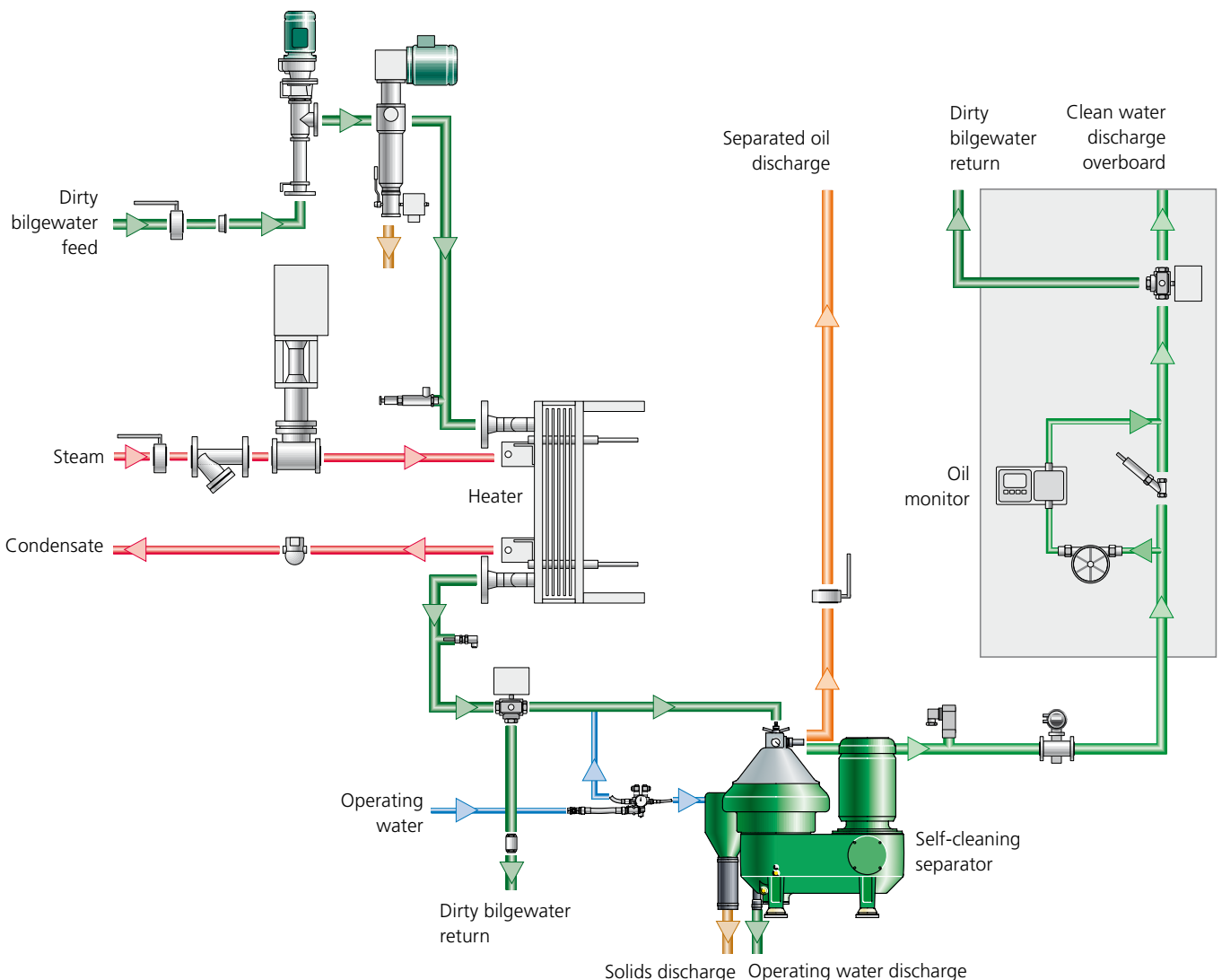
The Westfalia Separator® **BilgeMaster**® cleandesign systems feature a modular design. The main components: Feed pump, automatic filter, preheater, the self-discharging separator, oil monitor and the control unit are installed on three modules (feed pump/preheater unit, separator unit, control/monitoring unit). These modules are assembled to form a complete unit, but can also be supplied as individual modules upon request. This means that the system can be customized to meet the local circumstances in an optimum manner even in restricted spaces. An adaptive speed regulating facility of the feed pump adapts the system to the considerably fluctuating feed conditions of the product. An adsorption filter can be supplied as an option.

Westfalia Separator® **SafetyMaster** – the gain in terms of safety



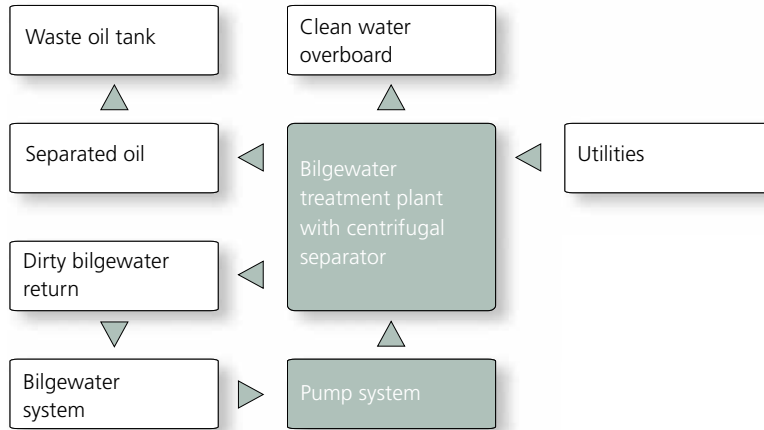
In addition to the high safety standard of the Westfalia Separator® **BilgeMaster**® series, GEA Westfalia Separator has now developed the Westfalia Separator® **SafetyMaster**. It prevents the unintentional overboard pumping of bilgewater containing excessive levels of oil by means of permanently monitoring the complete separating process including the overboard valve. An integrated data recorder saves all bilgewater processing information from the previous eighteen months. All components of the Westfalia Separator® **SafetyMaster** system are mounted in a lockable cabinet which is protected against manipulation and installed on the control and monitoring unit.

Optional in combination with Westfalia Separator® **SafetyMaster**: system-integrated or "stand-alone"



Westfalia Separator® minimaXx® – Manual Cleaning Centrifugal System

Westfalia Separator® **BilgeMaster**® systems

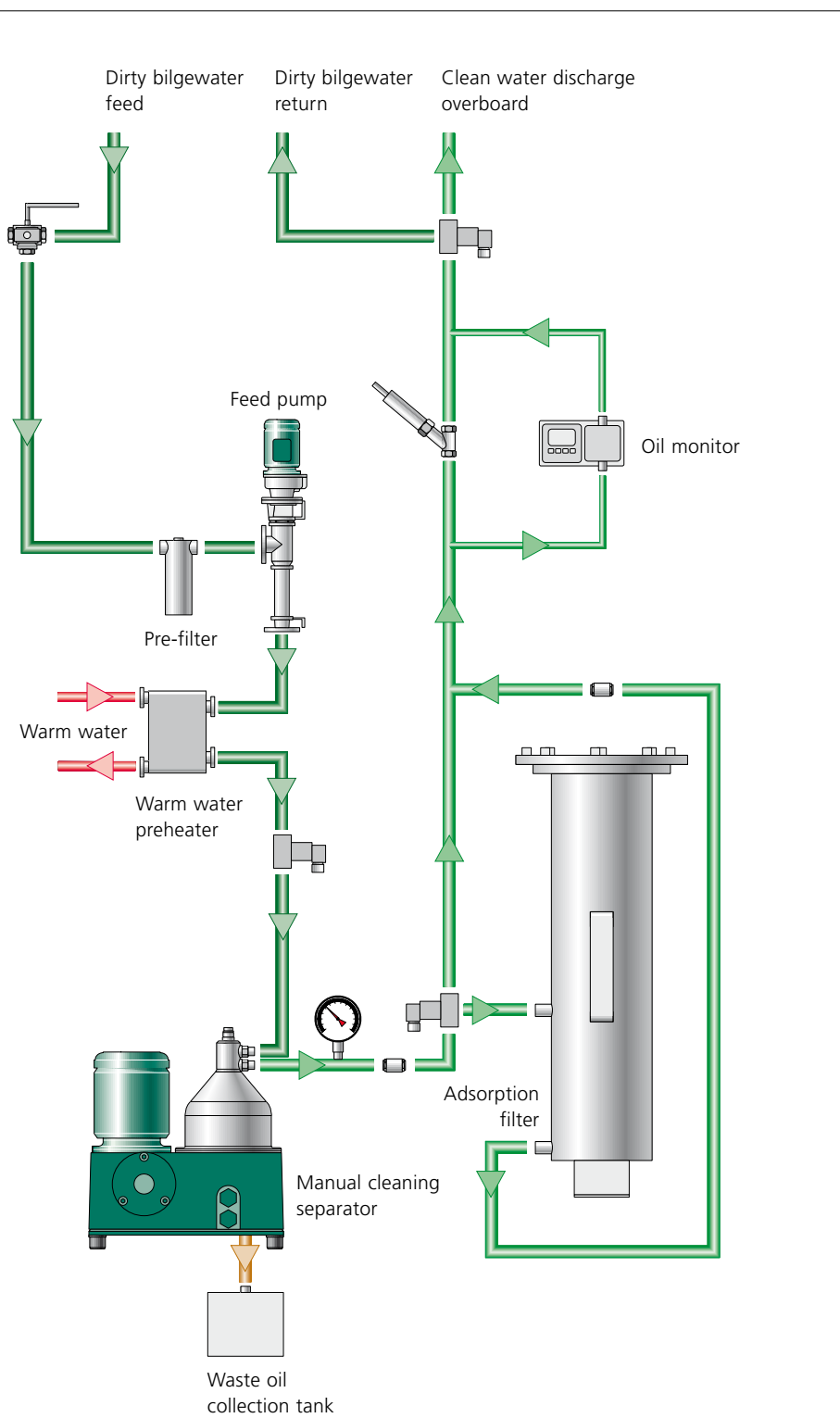


Plant concept

The bilgewater treatment system will be supplied as a 'Compact Unit' (CU). The CU consists of five main components:

- Westfalia Separator® minimaXx® separator
- Pump / pre-filter
- Preheater
- Adsorption filter
- Control unit

All the components are small and lightweight to make them easy to transport and to fit into the engine room. The components are installed on a common base frame. The modular concept can be incorporated in an existing system.



The clever solution

The new bilgewater treatment system with the Westfalia Separator® minimaXx® separator type WTC was specially designed for the rough conditions on board.

The product is fed by the feed pump via the preheater into the centre of the separator bowl. Within the rotating bowl, the product is separated into a heavy and light phase.

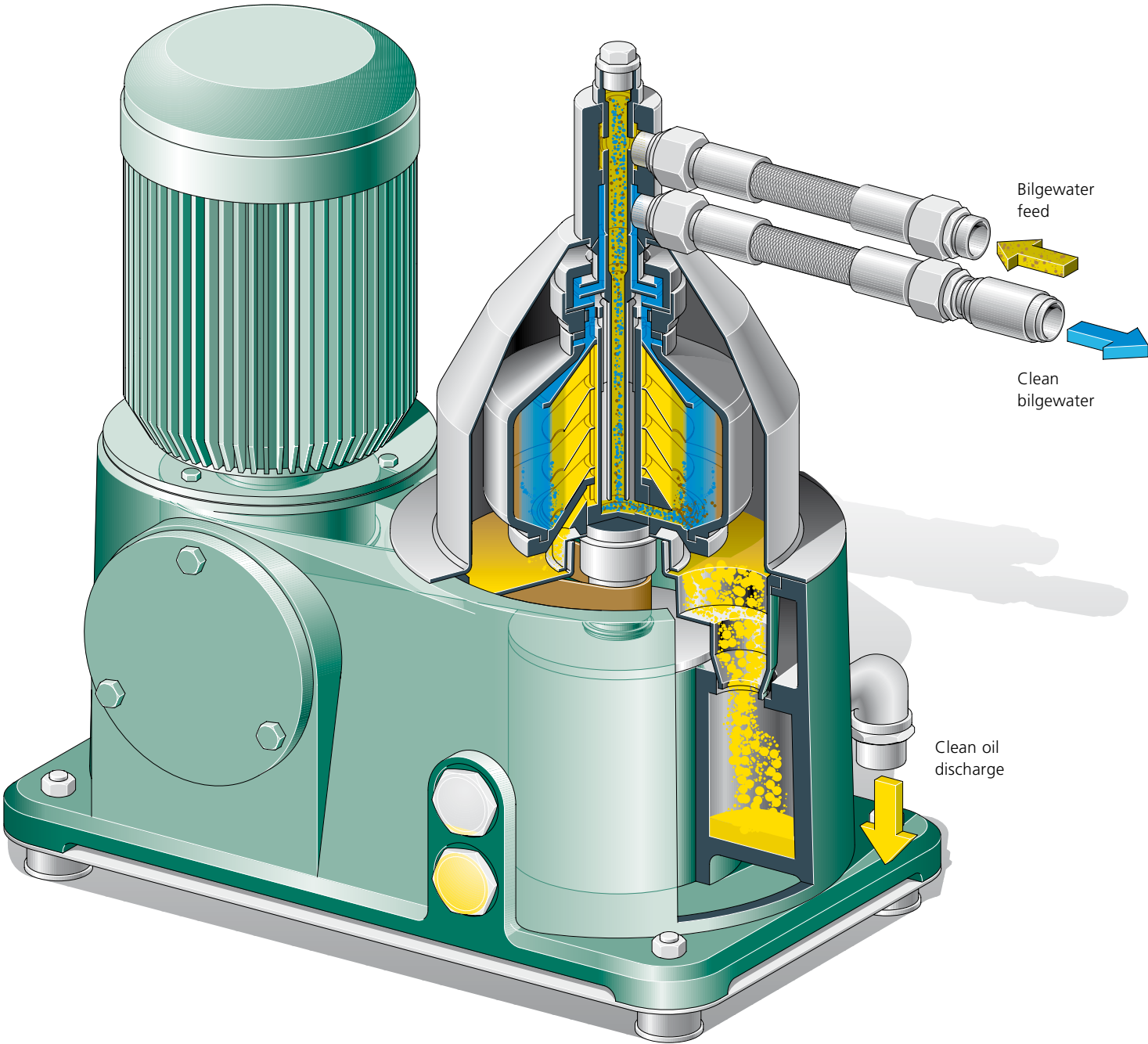
The heavy water phase is separated from the finest oil droplets and dirt particles and then conveyed under pressure by the centrifugal pump to the discharge. If the oil concentration on the clean water outlet of the centrifuge exceeds 15 ppm the water is led through an adsorption filter. The lighter oil phase flows to the centre of the bowl and is discharged by gravity.

The separated sludge is collected in the solids holding space and must be removed manually.

An intelligent control and monitoring system assures problem-free, round-the-clock unmanned operation. It also ensures that only water with an oil content lower than 15 ppm is released into the environment.

Westfalia Separator® minimaXx® – Clean and Compact

Westfalia Separator® **BilgeMaster®** systems





Separation results oily water treatment

With normal feed conditions, i.e.

solids content: < 0.1 %

chloride content: < 30,000 ppm

pH: 6 – 9

and no excessive oil emulsions in the water phase, the residual oil content in the clean water discharge is 10 – 12 ppm. By using the adsorption filter in the clean water discharge the residual oil content can be dropped down below 5 ppm.

Benefits

- Water outlet less than 5/15 ppm
- Reliable
- Easy handling
- Low maintenance cost
- Small dimensions
- Low weight
- Quick return on investment

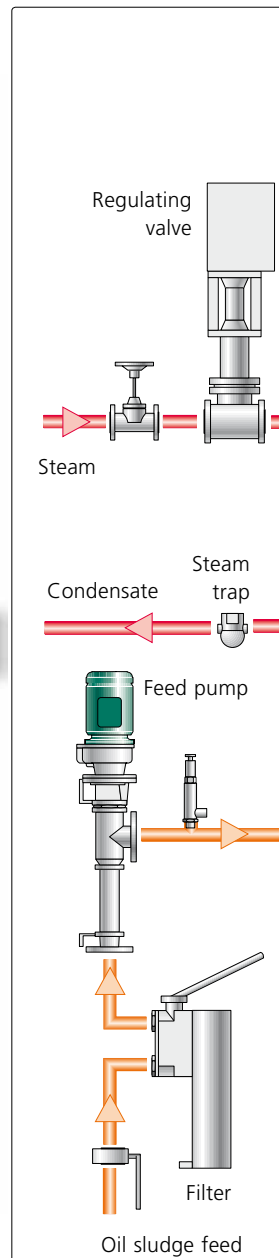
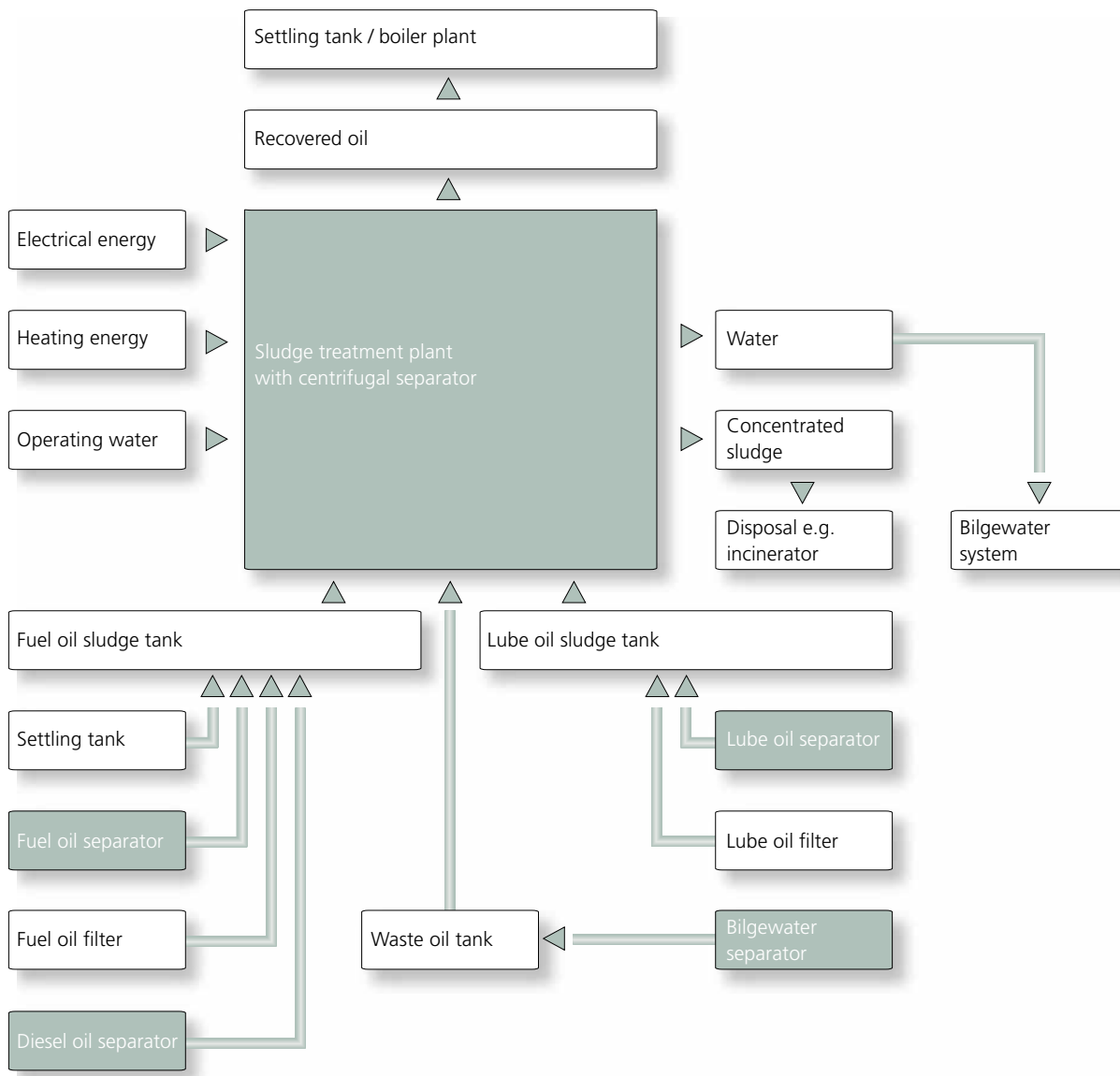


Technical data		Westfalia Separator® BilgeMaster® 200
Separator	Type	WTC 2
3-phase AC motor	Power	1.1 kW
	Speed at 50 Hz	3000 min-1
	Speed at 60 Hz	3600 min-1
Centripetal pump	Light liquid phase	–
	Heavy liquid phase	0.5 bar
Capacity	Effective throughput for oily water treatment	200 l/h
Weight	Module complete	265 kg
Dimensions	Length	900 mm
	Width	725 mm
	Height	1200 mm

Process Overview

Westfalia Separator® **SludgeMaster**® system

The trend towards burning higher viscosity and higher density fuel oils together with an increasingly common usage of residuals as the fuel for medium speed diesel engines means that the amount of sludge being created from both fuel and lube oil systems is increasing.



System Concepts for the Future

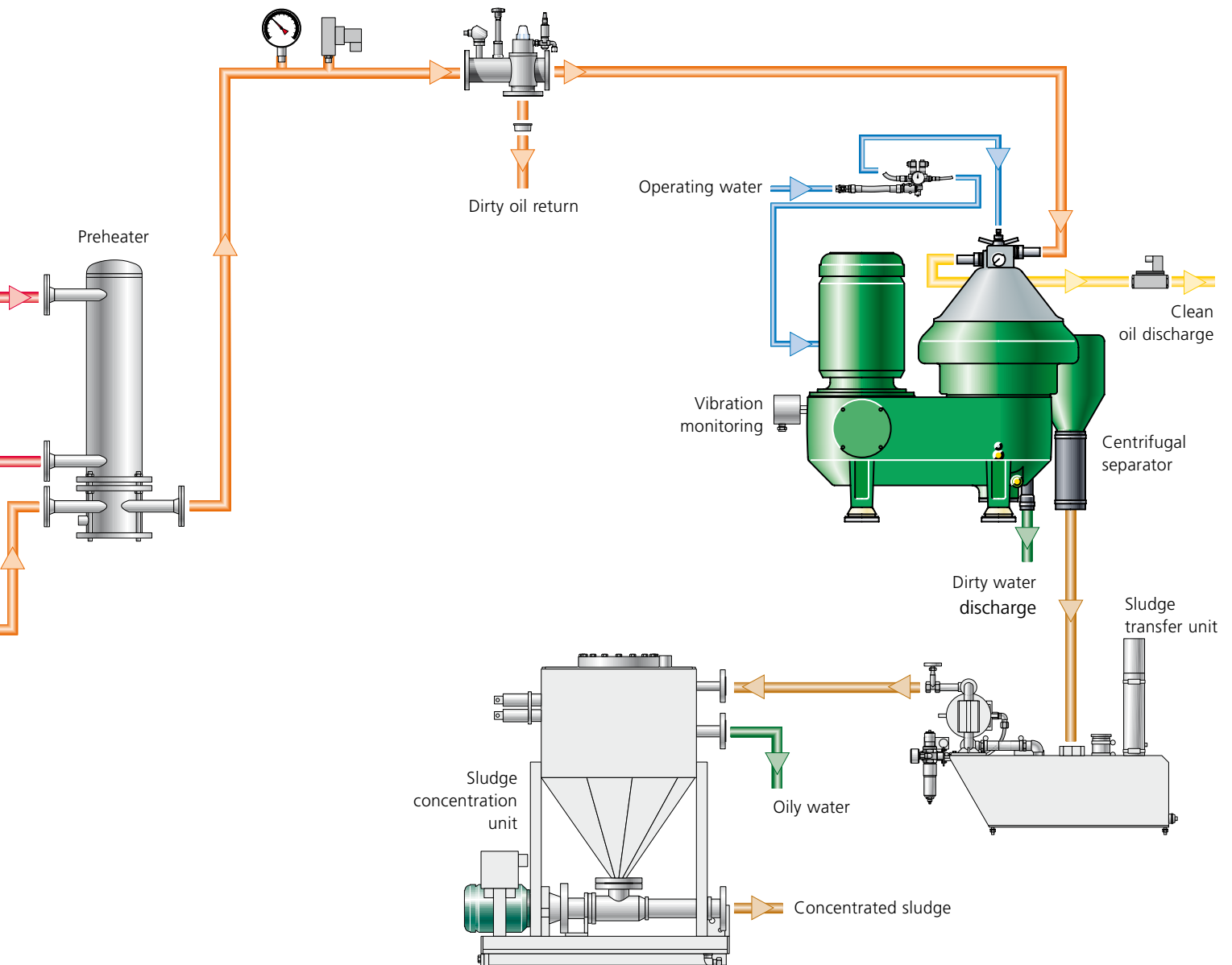
The sludge is pumped from the sludge tank by an eccentric screw pump and is fed via a heater to the centrifugal separator.

The sludge components of water, oil and solids are separated in the separator by centrifugal force. The recovered oil and water is discharged under pressure by centripetal pumps. The concentrated sludge is discharged intermittently via the sludge transfer unit into a heated sedimentation tank where final

concentration takes place. Excess water and oil is allowed to overflow back to the sludge tank.

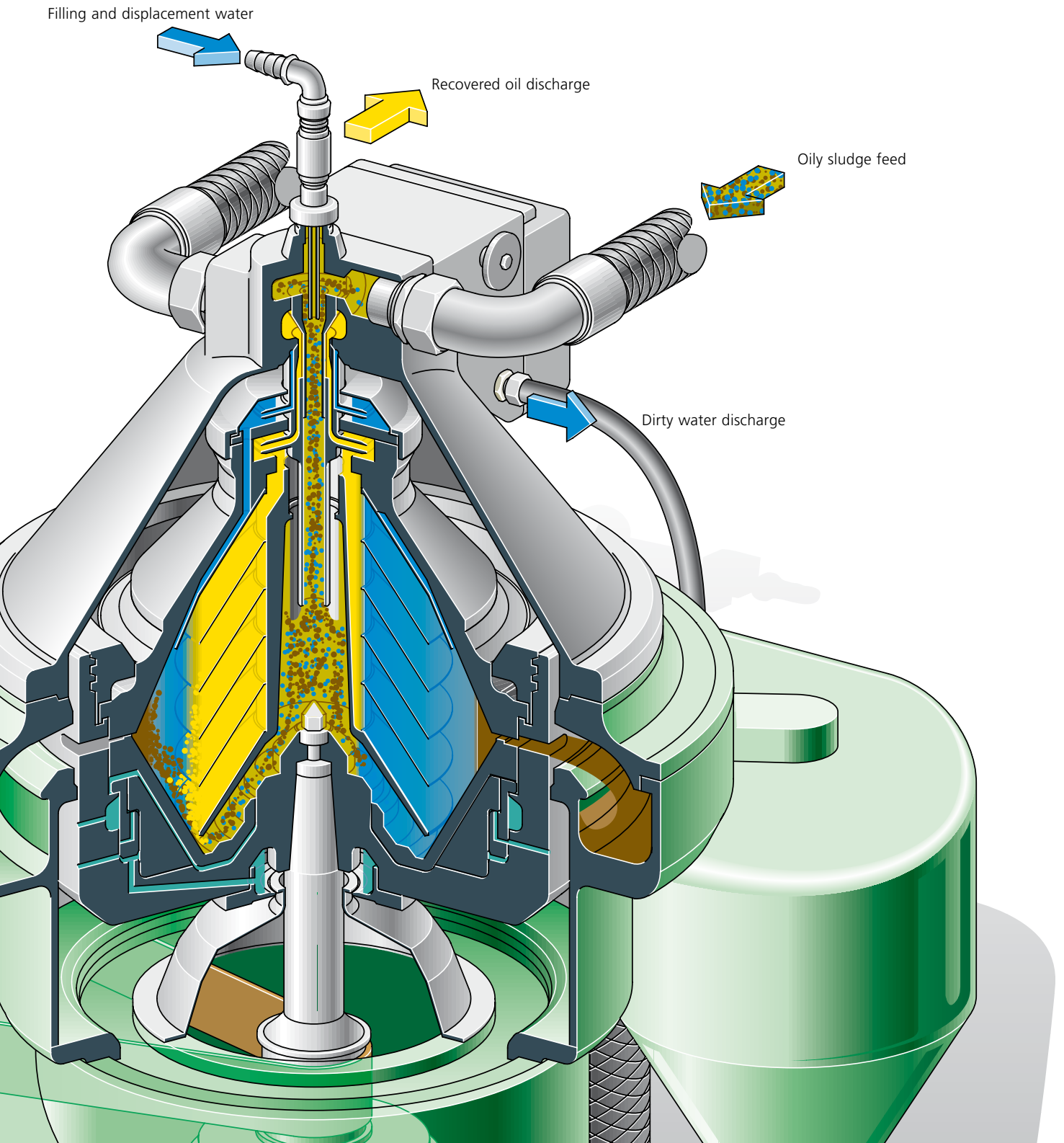
The concentrated sludge is pumped from the unit automatically by a solids discharge pump controlled by a level switch.

A microprocessor-based control cabinet supervises and controls the complete concentration process.



Economical Advantages – Ecological Merits

Westfalia Separator® **SludgeMaster**® system





Payback time of sludge treatment plant

Assumption

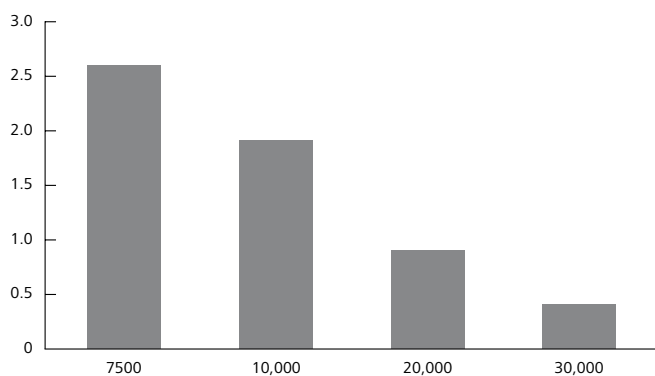
Operating time: 300 days/year

Average load: 85 %

Sludge amount: 2.5 % fuel consumption

Actual figures depending on current rates of fuel oil process and sludge disposal costs.

Payback (Years)



Diesel engine output (kW)

Oily sludge can represent 2.5 % of marine fuels. Indeed many port authorities use this figure when carrying out ship inspections.

With increasing environmental awareness as well as strict regulations and controls, most operators dispose of this sludge by incineration or by shoreside disposal using contract companies. In either case sludge disposal is becoming an expensive problem for ship owners today.

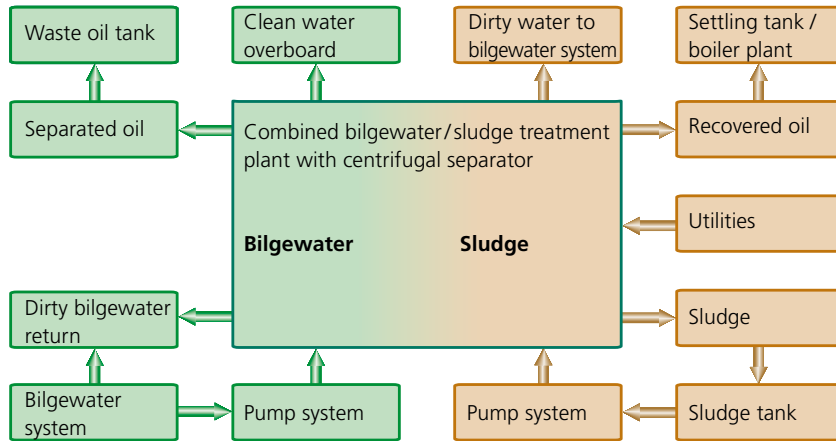
The GEA Westfalia Separator sludge treatment system incorporating a specially designed centrifugal separator is capable of reducing the volume of sludge for disposal by up to 90 %. In addition, fuel oil is recovered for re-use and recovered lubricating oil can be used as boiler fuel.

Technical data		Westfalia Separator® SludgeMaster® 300
Separator	Type	ESD 18
3-phase	Power	5.5 kW
AC motor	Speed at 50 Hz	3000 min-1
	Speed at 60 Hz	3600 min-1
Centripetal pump	Light liquid phase	2.0 bar
	Heavy liquid phase	2.5 bar
Capacity	Effective throughput for oily water treatment	300 l/h
Weight	Module complete	900 kg
	Bowl	72 kg
Dimensions	Length	2450 mm
	Width	1000 mm
	Height	1950 mm

Benefits
■ Saves up to 90 % disposal costs
■ Recovers valuable fuel oil
■ Unburdens the bilgewater system from oil residues
■ Protects our sensitive marine ecosystem

Process Overview

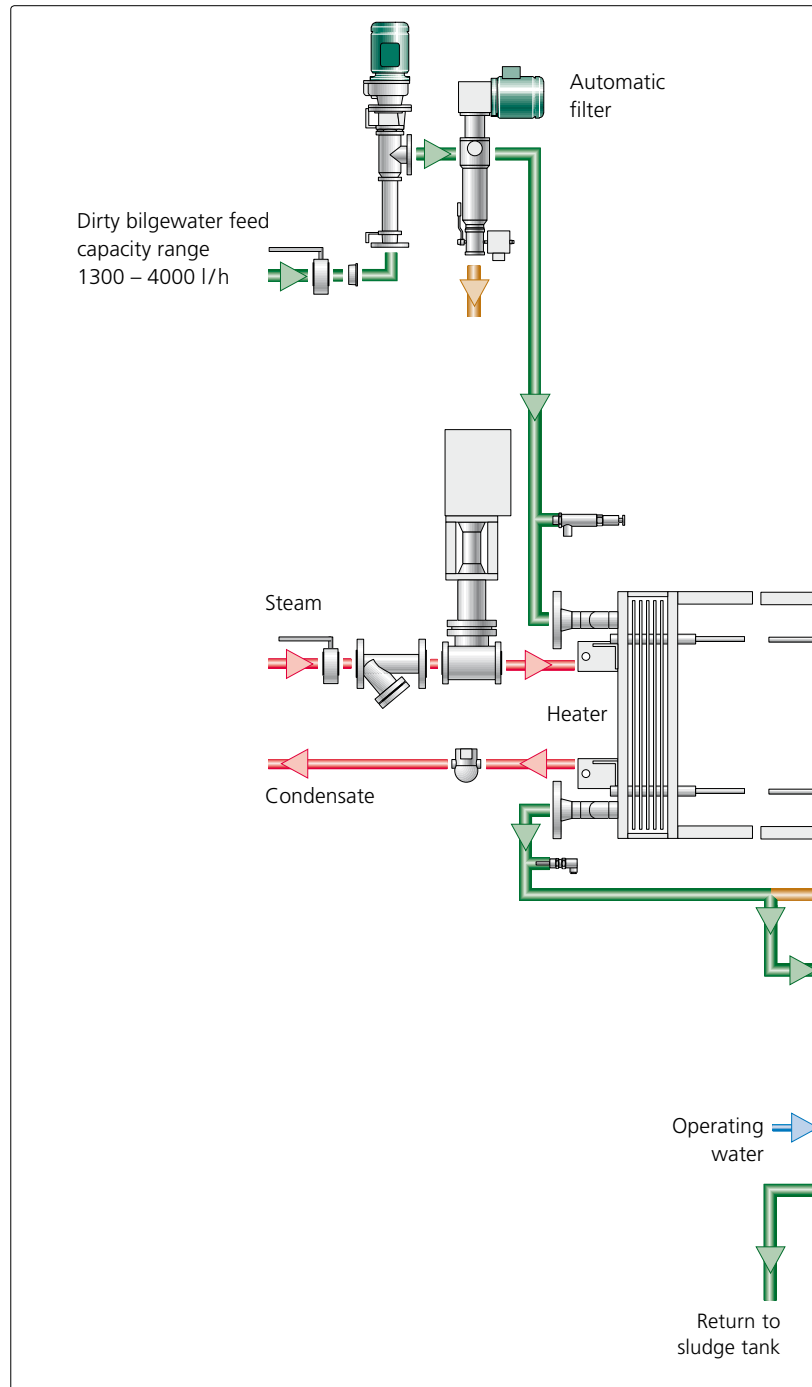
Westfalia Separator® **CombiMaster**® system



Bilgewater is a mixture of fuel, lube oil, cooling water and seawater leakage that collects in the engine room of a ship as well as the effluent that is produced during cleaning processes. Water with a considerable seawater content accounts for the most part. Bilgewater is heavily contaminated with partially emulsified oil. Impurities are largely bonded in the oil phase.

Sludge is produced particularly in fuel, lube oil and bilgewater treatment. There are wide fluctuations in the product composition due to the sedimentation processes in the storage tanks. Water and oil make up the biggest proportion. Solids are mainly concentrated on the tank bottom or bonded in the oil phase.

Centrifugal technology efficiently separates these products into their main constituents water, oil and solids. GEA Westfalia Separator has developed a centrifuge capable of treating both products.



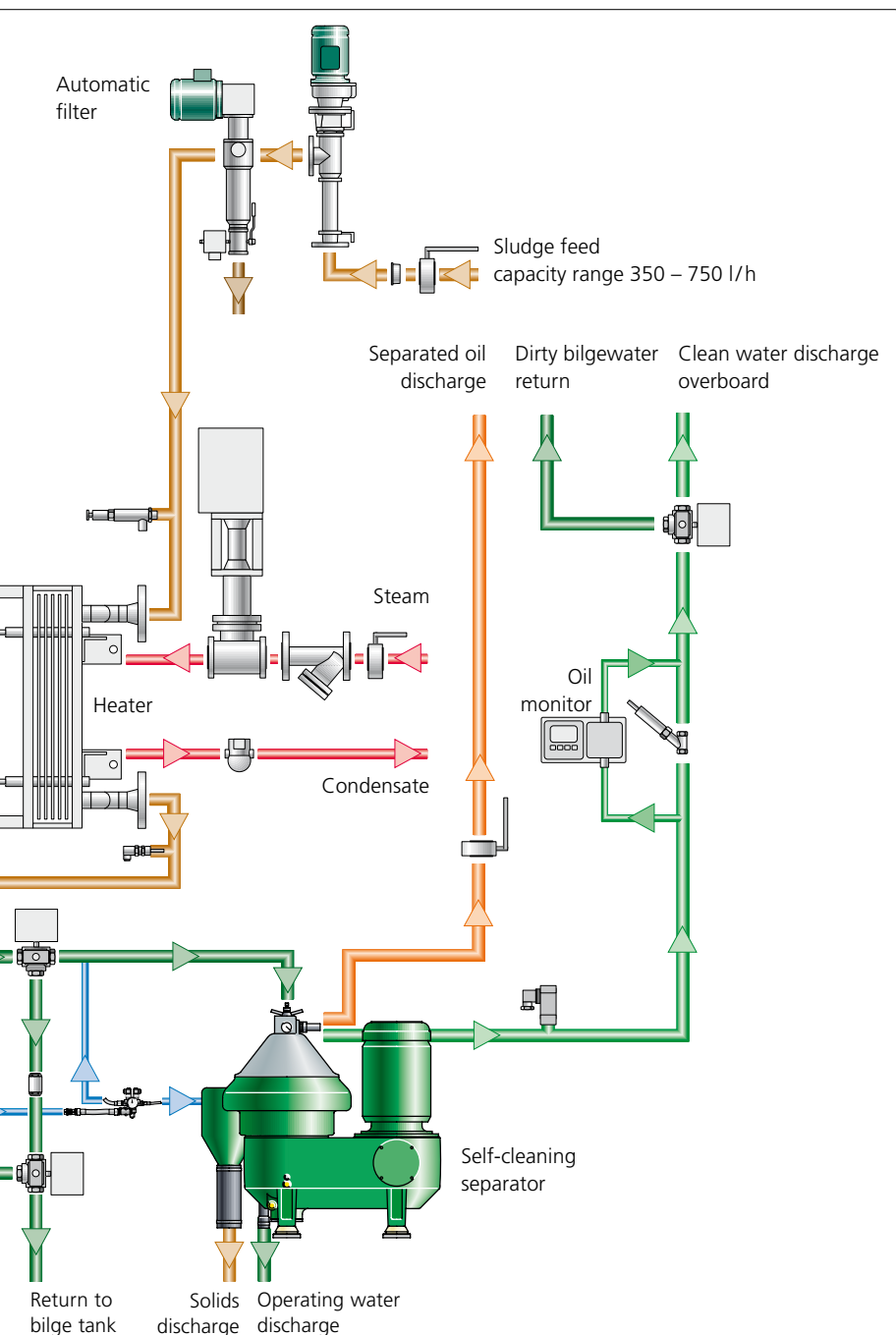
Westfalia Separator® **CombiMaster**® – Combined Bilgewater/Sludge Treatment

The new Westfalia Separator® **CombiMaster**® was specially designed for the rough conditions in shipping and the offshore industry. The capacity range is 1300 up to 4000 l/h. The product flows from above into the centre of the separator bowl. It is gently accelerated to the operating speed by the

optimised distributor. The heavy water phase is separated from the finest oil droplets and dirt particles and then conveyed under pressure by a centripetal pump to the discharge. The lighter oil phase flows to the centre of the bowl and is discharged by the second centripetal pump.

An intelligent control and monitoring system assures problem-free, round-the-clock unmanned operation. And it also ensures that only water with an oil content lower than 15 ppm is released into the environment.

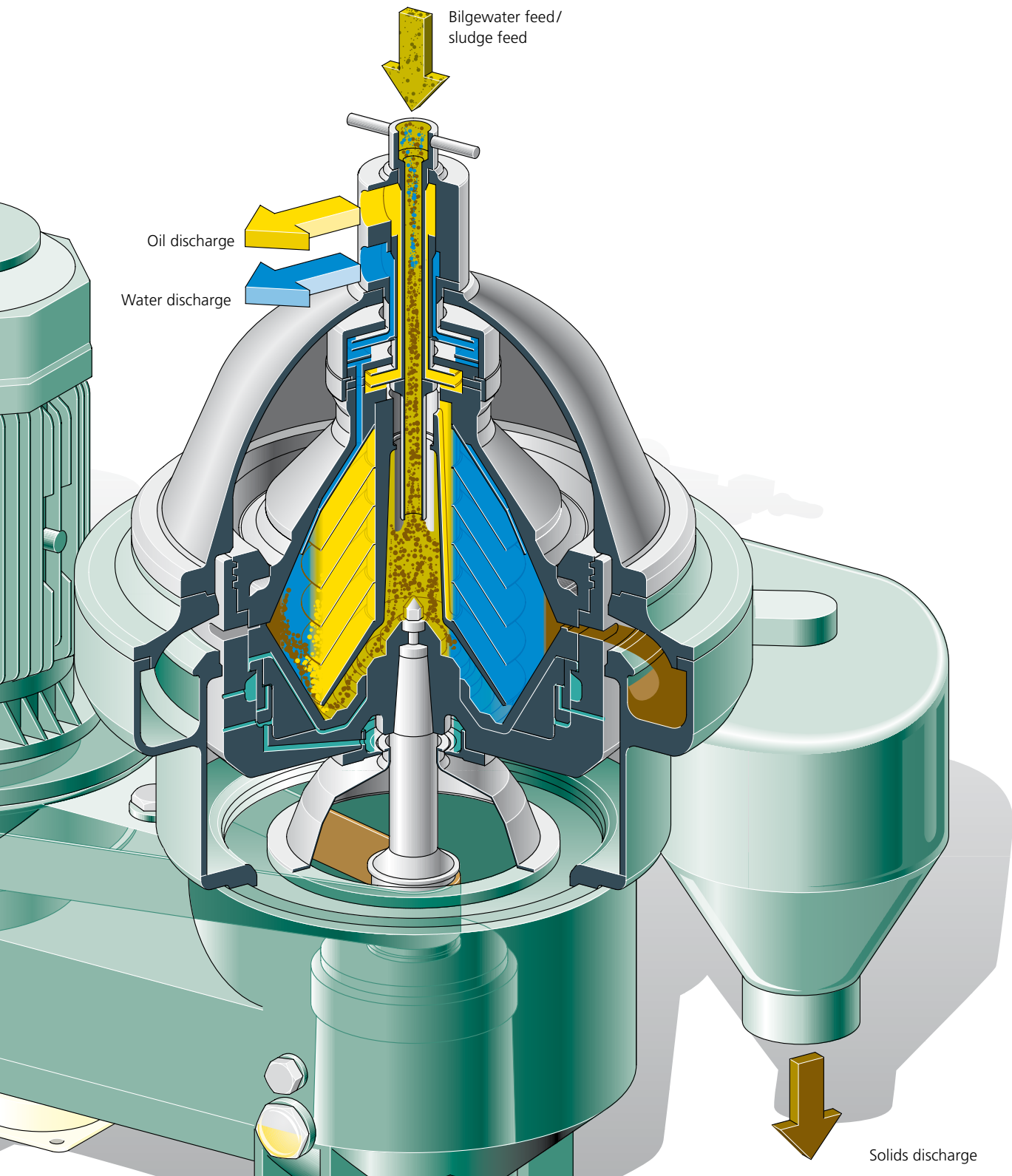
When processing sludge, only the regulating ring has to be exchanged. The effect is to displace the separating zone outside the disk stack so that the entire clarification surface can be utilised for purifying the oil phase. The throughput capacity is adjusted to 350 to 750 l/h by means of a separate feed pump/preheater unit. During the bilgewater separation process impurities accumulate in the sludge space. They are discharged into the sludge tank at periodic intervals by means of total bowl ejections. The self-cleaning bowl is equipped with the modern Westfalia Separator® **hydrostop** system. The result is highly compacted solids. The separated water is discharged to the bilgewater system. In this operation mode water may not be discharged overboard.



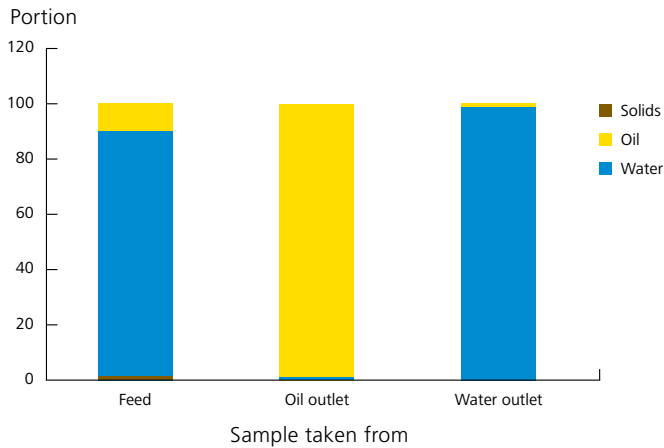
Westfalia Separator® **CombiMaster**®
for bilgewater and sludge treatment

One System – Double Performance

Westfalia Separator® **CombiMaster**® system



Separation results sludge treatment



	% (by vol.)	% (by vol.)	% (by vol.)
Oil	10.0	99.6	0.5
Water	89.6	0.4	99.5
Solids	0.4	0.0	0.01

Separation results bilgewater treatment

With normal feed conditions, i.e.

solids content: < 0.1 %

chloride content: < 30,000 ppm

pH: 6 – 9

and no excessive oil emulsions in the water phase, the residual oil content in the clean water discharge is 10 – 12 ppm.

Benefits

- Saves up to 90 % disposal costs
- Water outlet less than 15 ppm
- Reliable
- Easy handling
- Low maintenance cost
- Small dimensions
- Low weight
- Quick return on investment

Technical data		Westfalia Separator® CombiMaster
Separator	Type	WSD 35
3-phase AC motor	Power	11.0 kW
	Speed at 50 Hz	1500 min-1
	Speed at 60 Hz	1800 min-1
Centripetal pump	Light liquid phase	3.0 bar
	Heavy liquid phase	3.0 bar
Capacity	Sludge	350 – 750 l/h
	Oily water treatment	1300 – 4000 l/h
Weight	Module complete	2500 kg
	Bowl	163 kg
Dimensions	Length	3400 mm
	Width	1100 mm
	Height	1600 mm



Westfalia Separator® **seaprotectsolutions**

Systems to Protect the Sensitive Marine Ecosystem and the Value of Your Investment

Westfalia Separator® **seaprotectsolutions** for your payback

GEA Westfalia Separator provides reliable and future-proofed separating technology with the Westfalia Separator® **BilgeMaster®**, **SludgeMaster®**, **CombiMaster®** and **SafetyMaster** systems.

The powerful processing systems protect not only endangered ecosystems in the oceans, they also assure the sustainability of your investments

The benefits are as follows:

Reduced operating costs

- Oil recycled from the separating process can be used as fuel oil. Recovered lubricating oil can be recycled as fuel for generating heat

- Reduced quantity of sludge means lower disposal costs thanks to separating technology
- The sludge processing system quickly pays for itself
- Legal certainty as the machines operate with values lower than defined limits.
- Space-saving design

High separating efficiency

- Large equivalent clarification area due to centrifugal forces.
- Compared with static separating systems, separators in bilgewater systems have a theoretical separating limit for oil droplets that has been reduced by a factor of 10 (1 – 2 µm)





- Continuous separation of oil and water phase
- Self-cleaning effect of disk stack due to total ejection
- Adaptation of the flow rate and temperature to the changing product conditions.
- Reduction of oil residues in the bilgewater system

High operating reliability

- High operating reliability owing to the use of quality-tested systems and a worldwide service network
- No impact of the ship's movement on the separation efficiency
- Simple process control and monitoring

- Beverage Technology
- Dairy Technology
- Renewable Resources
- Chemical / Pharmaceutical Technology
- Marine
- Energy
- Oil, Gas & Industrial Fluids
- Fluids & Water
- Engineering
- Second Hand Machinery
- Original Manufacturer Service

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Binding information, in particular relating to capacity data and suitability for specific applications, can only be provided within the framework of concrete inquiries.

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