MAHLE

Industrial Filtration

BILGE WATER SEPARATION

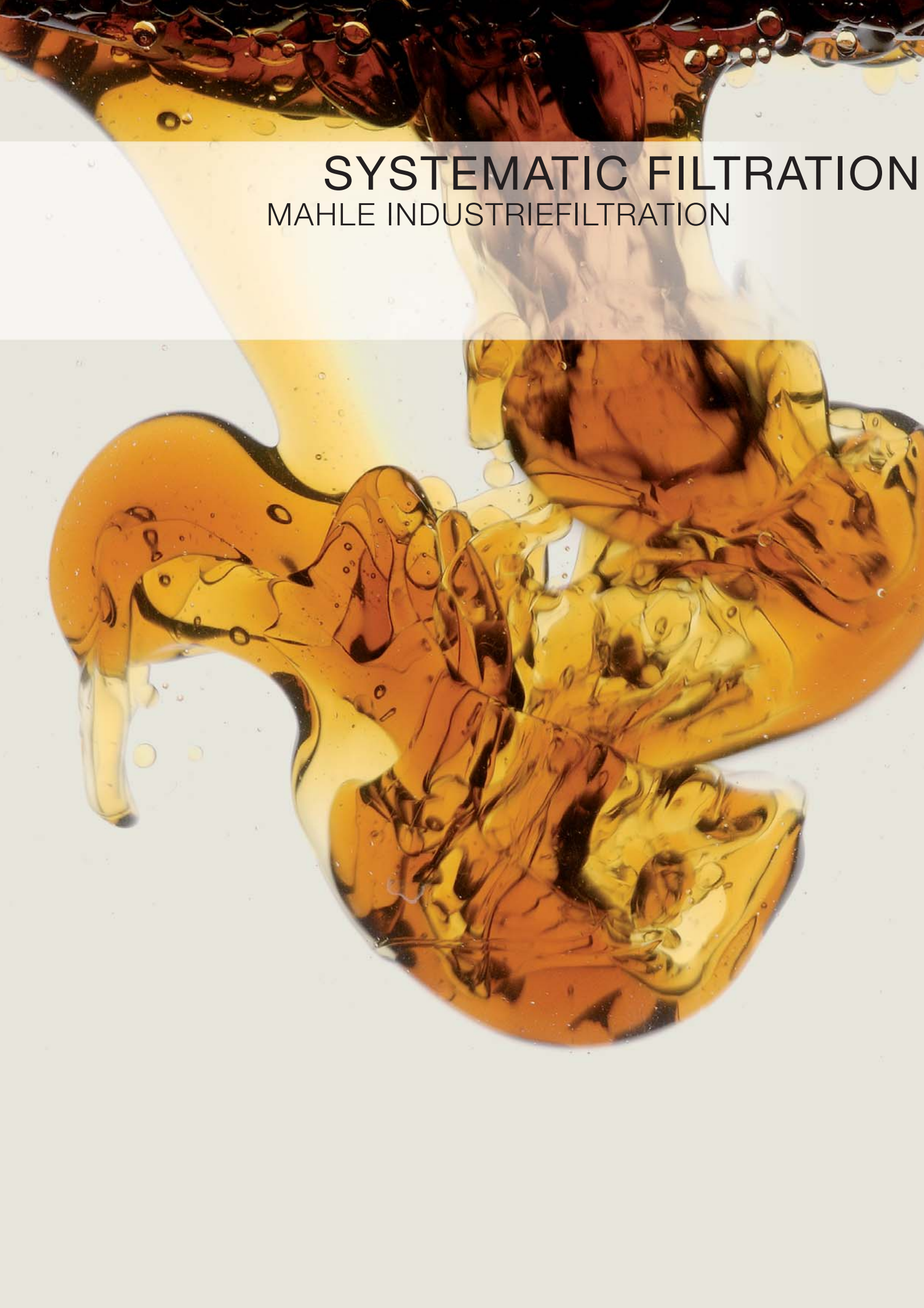
RELIABLE, POWERFUL, ECONOMICAL

MULTI-PHASE EMULSION BREAKER MPEB

NFV

SYSTEMATIC FILTRATION

MAHLE INDUSTRIEFILTRATION



AND SEPARATION

Decades of experience and innovation

MAHLE Industriefiltration has been developing and building advanced filtration and separation technology for over 50 years. Our leading systems are used in a wide range of industrial applications and in power plants, civil and military shipbuilding. Our systems are used wherever the focus is on operational safety, quality and environmental protection.

MAHLE Industriefiltration is part of the MAHLE Group, one of the 30 largest automotive suppliers in the world and the world leader in components and systems for combustion engines and peripherals.

Own developments based on efficient modular designs

Increasingly tough environmental regulations pose welcome challenges for MAHLE's highly skilled and inspired development engineers, who use their broad expertise with systematic innovation to produce results. These are evidenced by our numerous patents for core technology elements and our diverse range of products that make an important contribution to advanced process and environmental engineering.

MAHLE's global success is driven by products that are perfectly tailored to meet our customers' requirements, products which deliver unsurpassed cost-effectiveness due to their modular design. Ten of the world's top 15 shipbuilding companies and the world's three largest shipyards equip their ships with our environmentally friendly, high quality systems, placing their trust in the outstanding operating security of MAHLE Industriefiltration system.

Constant quality and safety

MAHLE Industriefiltration supplies highly efficient, customised solutions for a wide range of applications:

- Bilge water deoiling
- Ballast water treatment
- Cooling lubricant and detergent processing
- Industrial waste water cleaning
- Separation technology for the oil industry
- Oil and fuel treatment for engines, turbines and gears; heavy oil filtration
- Protection for hydraulic systems, pipelines, transfer and circulation systems

This comprehensive portfolio is rounded off by customer support services precisely tailored to our customers' needs, including retrofitting and the integration of new units.

CONTENT

WHAT IS BILGE WATER?

MORE THAN A COMPLICATED MIXTURE

What is bilge water?

Bilge water is the result of leakages, of dewatering processes from sedimentation and sludge tanks and of drains from different cleaning systems. Bilge water collects in a ship's bilge wells, which are located in the lowermost part of the vessel just about the hull.

The definition of bilge water is thus much wider in scope than merely the contents of a ship's bilge. In simple terms, bilge water contains two types of substreams:

- Flows that are reasonably continuous and predictable, and,
- Flows that are intermittent in nature and difficult to foresee.

The first category includes water from the separator sludge tank and water from cleaning activities in the ship's engine room. The second category may include soot water, leakage and incident spills from tanks and machinery spaces.

Bilge water is thus composed of a mixture of water, detergents and other chemicals, fuel oil, lubricating oil, hydraulic oil, catalytic fines, oil additives, soot and dirt. This mixture is collected in the bilge water holding tank, which generally is maintained at an elevated temperature. This high temperature facilitates primary separation due to the force of gravity in the bilge water tank and preferably is of the two- or three-stage type. Oil rises to the top of the tank while particles settle to the tank bottom, generally dividing the bilge water into three distinct layers in the tank:

- Top layer. This contains most of the oil and organic solvents and constitutes a small portion of the total tank volume. Skimming this top layer for separate treatment is recommended.
- Middle, or main, layer. This aqueous phase contains water polluted by oil, chemicals and particles in emulsified form. This is fed to the bilge water treatment system.
- Bottom layer. This contains solids and heavy sludge, which should also be removed for separate treatment.

Stable emulsions in bilge water

Separation of oil and particles from bilge water is becoming increasingly challenging, due to the presence of stable emulsions and suspensions. Emulsion and suspension formation and stability are of major concern in the context of bilge water treatment.

By definition, an emulsion is a mixture of two immiscible liquids. An oil-in-water emulsion consists of small oil droplets dispersed in a continuous water phase. A suspension is a mixture in which solid particles are dispersed in the continuous water phase. Emulsions, or small droplets of one liquid (the dispersed phase), can form in the other liquid (the continuous phase) under agitation, such as during pumping or throttling in valves. Droplets of oil dispersed in water generally coalesce, or combine, into larger droplets because oil is not soluble in water.

Increasing the droplet size helps facilitate separation. The presence of surfactants, such as detergents, soaps and other surface-active compounds, however, may contribute to stabilisation of small oil droplets. This makes separation very challenging.

The use of chemicals on board for cleaning and maintenance, treatment of water, fuel and lube oil conditioning contributes to the stabilisation of emulsions. Most chemical manufacturers claim that their products do not stabilise emulsions in bilge water. But the utilisation of surface-active chemicals can cause many products to contribute to the formation of stable emulsions.

Usage of chemicals always causes some type of compromise between cleaning efficiency and separation efficiency on the one hand and environmental friendliness on the other. MAHLE Industriefiltration strongly recommends the use of quick-separating, environmentally friendly and non-toxic detergents. Choosing chemicals that are compatible, non-toxic, biodegradable and non-emulsifying, helps prevent problems downstream.

TOWARDS CLEANER OCEANS
A MAJOR ENVIRONMENTAL CONCERN
FOR THE SHIPPING INDUSTRY

Current international legislation mandates that the bilge water that is discharged directly into the ocean by ships should contain no more than 15 parts per million of residual oil in water.

Regardless of its source, bilge water must be treated to reduce the oil content to levels that meet international and national regulations for release into the environment. This is critical to keeping the world's oceans and their vast marine ecosystems healthy and productive.

Efficient bilge water treatment minimises the impact of ship propulsion on the marine environment as well as the heavy fines that ship operators can face for pumping oily bilge water overboard. Efficient treatment also reduces the need for and cost of waste disposal on shore.

Over the years, waste disposal costs have continued to climb as local authorities enforce stricter laws for the land-based companies that process this waste.

Bilge water legislation

Bilge water treatment is an environmental application that must meet the stringent requirements of international legislation. Disposal of untreated bilge water into our oceans is strictly prohibited by international law and subject to heavy fines, especially in sensitive waters. Current MARPOL legislation stipulates that separated bilge water containing no more than 15 ppm oil in water can be discharged into international waters. Some national, regional and local authorities have more stringent regulations.

The International Maritime Organization (IMO) Resolution MEPC.107(49) specifies how to type approve equipment used on board ships. The NFV separators comply with the European Marine Equipment Directive, MED 2002/75/EC. Many manufacturers of bilge water separators have succeeded in meeting the specified requirements for equipment certification, but much of this equipment falls short of delivering the high separation efficiency required under real operating conditions.

Enforcement

Enforcement of bilge water regulations is now much more aggressive than before, thanks to technological developments making the detection of illegal discharges possible. Authorities around the world are pursuing the prosecution of vessel owners, operators, crewmembers, and shoreside employees who are involved in illegal discharges at sea for any criminal activity.

Port State Control Authorities carry out inspections, which include a visit on board a ship in order to check that the overall condition of the ship, including bilge water treatment equipment and oil record log books, meets generally accepted international rules and standards.

In the absence of valid certificates or documents or if there are clear grounds for believing that the condition of a ship or of its equipment is in violation of international regulations, further investigation is conducted. Heavy fines are levied against violators not only for crewmembers but senior shipping executives as well, and penalties are increasing in severity, often including prison.

In 2004, French authorities levied a €250,000 fine against the captain and owner of a cargo vessel that left a 6.5 km-long oil slick in its wake off the coast of Brittany due to a malfunctioning bilge separator. In another case, two chief engineers who worked for a shipping company with its headquarters in the British Virgin Islands were sentenced to two years of probation and fined for their roles in concealing the discharge of oily wastewater from their ship. Yet a third case against a U.S. shipping company that pled guilty to covering up an illegal oil discharge resulted in a $4.2 million fine.

Criminal prosections related to the illegal discharge of oily bilge water continue.

THE MULTI-PHASE EMULSION BREAKER
BILGE WATER SEPARATORS

MPEB® is a trademark owned by MAHLE Industriefiltration. The company reserves the right to make changes at any time without prior notice.

The cleaning of bilge water poses distinct challenges

Not only does the composition and flow of bilge water constantly change, making continuous and efficient treatment difficult, but treatment on board also presents another set of constraints.

Treatment methods must meet the individual requirements of shipowners for safety, reliability and automation as well as the specific design of the ships. In addition, performance of the treatment system can vary depending on the oil content and the size of the droplets and particles present in the water and on various operating conditions.

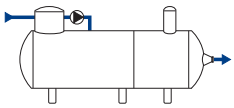
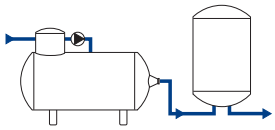
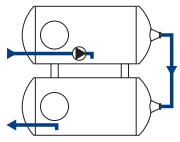
Overview

The NFV Multi-Phase Emulsion Breaker MPEB is the collective name for a series of continuous bilge water separators for the treatment of bilge water at sea.

The MPEB is easy to install for any new or existing installation. It complies with the Marine Environment Protection Committee Resolution, MEPC.107(49), of the International Maritime Organization (IMO).

The MPEB separators use patented two-stage separation technologies to remove contaminants from the bilge water. These systems do not require backflushing or the use of any chemicals, absorption processes, or absorption or membrane filters. A range of capacities between 0.25 m^3 and 10 m^3 per hour is available.

MPEB: Standard configuration, capacities and dimensions

Type	Configuration	Flow rate (m^3/h)	Size, including service space L × W × H (mm)		Weight (kg)
MPEB (Single system)		1.0	2500 × 1200 × 1400		550
		2.5	3000 × 1300 × 1800		650
		5.0	3400 × 1500 × 2000		1000
		10.0	3400 × 1500 × 2000		1050
			First stage	Second stage	
MPEB-VT (Divided system)		0.25	1600 × 1000 × 1100	700 × 500 × 1400	250
		0.5	1600 × 1100 × 1300	700 × 500 × 1400	300
		1.0	2000 × 1200 × 1400	700 × 500 × 1800	390
		2.5	2600 × 1300 × 1800	1100 × 1000 × 1800	630
		5.0	3100 × 1700 × 2000	1200 × 1100 × 2200	1030
		10.0	3100 × 1700 × 2000	1200 × 1100 × 2900	1170
MPEB Deoiler 2000 (Dual system)		0.25	1500 × 900 × 1150		400
		0.5	1600 × 1700 × 1300		520
		1.0	1600 × 2000 × 1500		600
		2.5	2700 × 2300 × 1800		900
		5.0	2800 × 2800 × 2000		1250
		10.0	2800 × 2800 × 2000		1300

References

Hundreds of MPEB units approved according to the latest IMO Resolution MEPC.107(49) are now installed on ships belonging to renowned shipowners, many of whom are returning customers who relied on previous generations of the system.

System benefits

- Compact, modular, flexible design. Three models, two pump options and several different sizes are available. Customisation is also available upon request.
- Easy to operate. Simply start the system and leave it running. By connecting the system to a level switch in the bilge water tank, the MPEB will automatically start.
- No moving parts. The MPEB does not have any moving parts and generally operates at ambient temperature.
- Lower operating costs. The MPEB reduces operating costs by eliminating the need for chemicals, absorption processes, membrane filters and backflushing.
- Technical support. All spares, service and sales engineers are available through an international service network.

Standard sizes

The MPEB from MAHLE Industriefiltration is available in three models:

- MPEB: Single system, in one pressure vessel.
- MPEB-VT: Divided system, in two individual pressure vessels. Suitable for retrofit installations.
- MPEB Deoiler 2000: High-performance dual system, in two pressure vessels built together.

Delivery options

Different delivery options are offered:

- Built-on pump to facilitate installation.
- Separate feed pump to minimise suction head where required.

What makes the MPEB a uniquely simple concept?
In addition to its simple working principle, it is
- simple to operate,
- simple to maintain,
- simple to install, and,
- simple to commission.

Working principle

The MPEB continuously separates oil, emulsions and dispersions from water without backflushing or the use of chemicals. However, because the MPEB has a self-cleaning function, it effectively overcomes the challenges of using absorption filters.

The MPEB provides continuous pressure-type separation in two stages using the principles of gravity and coalescence to separate oil and solid particles from the bilge water.

In the first stage, the NFV Multi-Phase Separator MPS uses patented profiles to separate oil and solids from the bilge water.

In the second stage, the NFV Mechanical Emulsion Breaker MESB separates fine emulsified oil droplets using patented emulsion breaker elements. Separated oil is discharged to a waste oil tank. An oil-in-water monitor measures the residual oil content before cleaned water is discharged overboard.

A UNIQUELY SIMPLE CONCEPT
TO COMPLY WITH THE MEPC.107(49) STANDARD

MPS: Patented wave-type profiles of oleophilic material are stacked one on top of the other. Ten to fifteen rows of profiles, depending on separator size, are placed in an insert.

Microfibre bed element. The second stage consists of between two and twelve elements, depending on the size of the separator.

1st stage:
NFV Multi-Phase Separator MPS

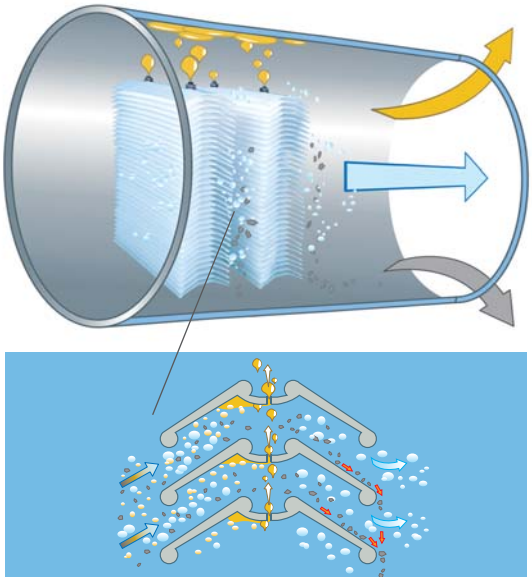
The helical rotary pump transfers the oily water mixture from the bilge water settling or collecting tank into the MPEB separator, where larger oil drops and solids are pre-separated by gravity and a good amount of oil instantly flows upward into the oil collecting dome.

After that, the oily water mixture flows through the patented Multi-Phase Separator MPS where it is led through a parallel arrangement of wave-type profiles (see figures for first stage on the lower left-hand side of page 9).
Small droplets of the lighter discontinuous phase (oil) collect at the lower edges of the profiles due to the combined effects of gravity, flow and coalescence. The small oil droplets coalesce to form larger droplets as they collect underneath the profiles, where they float to the top of the profiles, pass through the openings and flow onward to the oil dome. As the droplets rise, any solid particles that are suspended in the droplets separate from the oil due to the difference in the densities between the oil and the solids. The particles drop onto the profile below, sliding off the profile edges to the bottom of the separator, where they are drained into the sludge tank.

The oil collected in the oil dome during this first stage is automatically drained into the sludge/waste oil tank via the discharge valve, which is activated by a signal from the level electrode located in the oil dome.

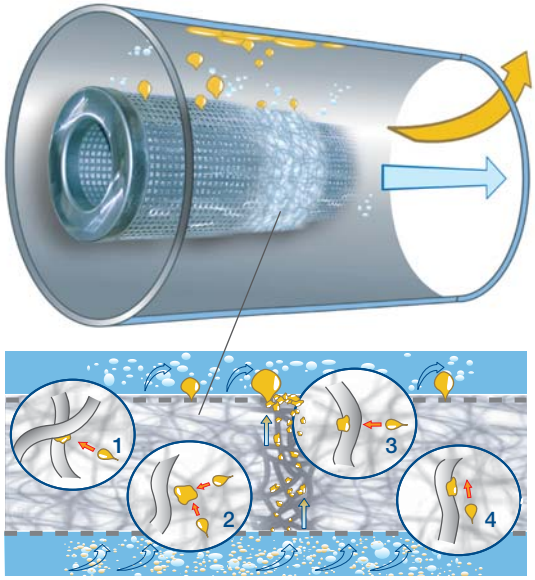
After passing through the Multi-Phase Separator, the oily water mixture is directed onward to the Mechanical Emulsion Breaker, which comprises the second stage of the system.

1st stage



Small oil droplets collect at the lower edge of the profiles and coalesce into larger droplets. These droplets flow upward into the oil dome, where it is collected and drained into the waste oil tank.

2nd stage



Coalescing effects in the microfibre bed which consists of various layers of different types of micrometre thin fibres of a special oleophilic material (a material that "loves" oil).

1. *Screen effective*
2. *Flow collision*
3. *Interception*
4. *Inertial impaction*

2nd stage:
NFV Mechanical Emulsion Breaker MESB

The MESB processes the oily water from the MPS. This stage utilises patented Emulsion Breaker elements to separate fine emulsified oil droplets which remain in the bilge water after the first stage of processing. The main principle of separation utilised in this stage is coalescence.

In the microfibre bed, the separation of oil from water is possible even when the difference in density between the two liquids is minute (see figures for the second stage above).

The oily water enters the Mechanical Emulsion Breaker through a perforated pipe and passes through a microfibre bed where the principles of filtration, collision, interception and inertial impaction contribute to the formation of larger oil droplets.

The fine droplets of oil collect between the filaments of the microfibre and form a wetting film. The oil proceeds along with the continuous phase (water) to the outer periphery of the microfibre bed where the liquids pass through a sleeve, which contributes to the formation of larger drops of oil. The drops of oil rise intermittently upward and onward into the oil dome of this second stage. The oil collected in the second oil dome is automatically drained into sludge/waste oil tank via the discharge valve.

The sampling point for the oil-in-water monitor is located in the clean water outlet of the second stage. The separation result is continuously monitored. If the separation result is less than or equal to 15 ppm, the cleaned water is directed for discharge overboard. If the result is greater than 15 ppm the bilge water is re-circulated back to the bilge water tank.

Operation and maintenance

Simply start or stop the pump to operate the unit. As an option, the unit may also be configured to operate automatically by using level switches in the bilge holding tank to start the pump.

Maintenance is easy and convenient. The NFV Multi-Phase Separator elements (first stage) must be cleaned on occasion about once a year, but no replacement is necessary.

NFV Mechanical Emulsion Breaker elements (second stage) require replacement when the differential pressure reaches the set point or about every two years.

SIGNIFICANT ADVANTAGES

MPEB VERSUS CONVENTIONAL TECHNOLOGIES

Cross section of absorption elements: New (above) and after 2.5 hour emulsion test according to IMO procedures (beyond).

Conventional gravity (static) oil separators on board most vessels sailing the oceans today are unable to meet the requirements of the IMO Resolution MEPC.107(49). These systems were designed to handle the requirements for efficient separation under the IMO Resolution MEPC.60(33) which went into effect in 1993.

For systems to be approved according to MEPC.60(33) the systems were tested with different mixtures of oil and water. These simple gravity separators have difficulties in many cases when confronted with the emulsified bilge water that is often produced on board. That's why the new MEPC.107(49) specifies that bilge water separators must also be tested with an emulsion. The test emulsion is composed of a mixture of water, heavy fuel oil, gas oil, tensides and fine iron oxide particles.

To fulfil the new rules most bilge water systems now have added a second stage downstream in order to meet the requirements of handling emulsions and dispersions according to MEPC.107(49). This second stage is of different types:

Absorption filters

Many suppliers have added absorption filters after the gravity oil separators in order to meet MEPC.107(49) requirements. These inline absorption filters are sometimes designed to last not much more than the 2.5 hour duration of the IMO MEPC.107(49) test for the handling of emulsions and dispersions. For example, for a 2.5 m^3/h system of 27 kg of oil must be absorbed during the 2.5 hours if 50 percent of the emulsified oil is to be taken up in the absorption stage.

If the absorption filters are optimised in this way for the 2.5 hour IMO test, the filters then quickly tend to reach their design capacity, become saturated and require immediate replacement. However, because the composition of bilge water varies, there isn't any scientific way to anticipate when the initial breakthrough of oil may occur. An alarm triggered by the oil-in-water monitor is the first indication to the operator that something is wrong.

This means that the service life of the filter will be short under actual operating conditions,

Comparison with conventional technologies

Principle of other make	Comment	MPEB
Suction-type system	Often requires a second pump before the system due to limited pump suction height.	Pressure-type system
	Requires the bilge separator and the bilge water holding tank to be close to or at the same level.	
Backflushing systems	Requires the interruption for cleaning with fresh water.	Continuous operation and no backflushing required
	Generates a lot of waste oil with high water content, and thus high waste disposal costs.	
	Lowers actual capacity to less than that of nominal capacity.	
Chemicals	Creates waste by contributing approximately 15 to 25 percent of the content of bilge water that requires disposal on shore.	No chemicals required
Absorption filter	Requires frequent replacement before the filter reaches its saturation point, thus increasing operating costs.	No absorption filter required
	Can cause oil to be released into the system if the filter is not replaced before reaching its saturation point.	
Active carbon bed	Does not provide an adequate filtering effect since active carbon beds are primarily used to purify drinking water systems and not to filter oil from wastewater.	No active carbon bed required
	Requires feed to contain less than 10 to 20 ppm to obtain acceptable product life cycle.	
	Is sensitive to solids.	
	Requires frequent replacement and disposal.	
	Is labour intensive, requiring more man hours for maintenance.	

even if real bilge water rarely has the amount of emulsions and dispersions as the bilge water used for the IMO test.

Whatever the interval, the filter elements may require frequent replacement, which in the case of activated carbon filters is a dirty process that requires special handling and disposal which can be expensive.

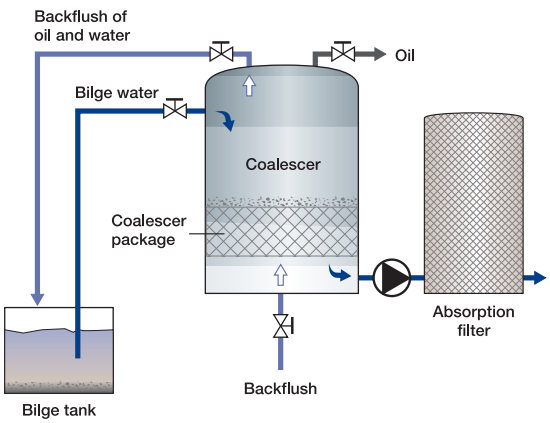
Backflushing

Most conventional gravity oil separators use intermittent backflushing sequences to clean the system. Intermittent backflushing, however, reduces the nominal capacity of the separator because it requires water for cleaning to be pumped at designated intervals into the system.

The backflushing water may contain between 70 and 80 percent waste oil. Backflushing increases the overall consumption of water on board. It also increases the volume of water that is discharged to the waste oil tank, thus generating an increased volume of sludge for onshore disposal.

Chemicals

Another solution for a second stage downstream is the addition of a chemical separation plant and additional filters filled with sand, granulate and/or activated carbon. This solution, however, is a costly, labour-intensive alternative that generates a lot of waste. Between 15 and 25 percent of the treated bilge water must be pumped ashore, which is an expensive process in many ports, and sent to a land-based plant for further processing.



Typical layout of conventional suction coalescer with absorption filter supplied by other manufacturers.

MPEB-VT 5

SIMPLE, COMPACT DESIGN
FOR THE BEST USE OF AVAILABLE SPACE

The MPEB bilge water separators are available in different designs, sizes and capacities. This enables flexibility in both design and configuration to enable shipbuilding companies to implement effective, creative solutions.

1st stage:
NFV Multi-Phase Separator MPS
The Multi-Phase Separator consists of an insert with patented wave-type profiles for the separation of oil and solid particles from the bilge water and a pump, heater and oil dome to collect separated oil.

The Multi-Phase Separator also has the following auxiliary parts:
- Automatic oil drain with level electrode and pneumatic operated oil discharge valve,
- Control cock at the oil collection dome,
- Safety valve,
- Pressure gauge, and,
- Solenoid valve for scavenger line.

2nd stage:
NFV Mechanical Emulsion Breaker MESB
The Mechanical Emulsion Breaker consists of a chamber with patented emulsion breaker elements for the separation of fine emulsified oil droplets and a pump, heater and oil dome to collect separated oil.

The Mechanical Emulsion Breaker has the following auxiliary parts:
- Automatic oil drain with level electrode and pneumatic operated oil discharge valve,
- Control cock at the oil collection dome,
- Differential pressure switch with electric contacts,
- Pressure gauge,
- Solenoid valve for scavenger line,
- Spring loaded non-return valve,
- Pneumatically operated three-way valve in the outlet to re-circulate separated bilge water if residual oil content exceeds 15 ppm, and,
- Manual three-way valve for harbour test.

Key components

Dry-run pump protection

For built-on pumps: The level electrodes in the oil domes cause both the oil discharge valve and the solenoid valve of the scavenger line that is affected to open for a pre-set interval. The scavenger line serves as the source of priming fluid. If the pre-set interval is exceeded, the pump automatically shuts off and an alarm is activated.

For pumps installed separately: An electronic Dry Running Protection Device (TSE) uses a temperature sensor installed in the pump stator to provide protection. When the pump runs dry, the valve in the suction line automatically closes and the scavenger line transfers priming fluid (in this case, bilge water) out of the MPEB and into the pump.

Patented inserts

Stacked in the Multi-Phase Separator, wave-like profiles employ the principles of gravity and coalescence to separate the oil and particles from the water.

Micro-fibre bed

A micro-fibre bed in the Mechanical Emulsion Breaker use the principles of filtration, collision, interception, inertial impaction and coalescence to remove any emulsions which remain after the first processing stage.

Oil domes

The MPEB has two oil domes, one in the Multi-Phase Separator and one in the Mechanical Emulsion Breaker. Each dome collects the oil that is separated from the bilge water during each stage of separation.

Control cocks

Control cocks are situated on the oil domes to check the function of the level electrodes.

Oil drains

Oil drains are situated in both processing stages. The level electrodes in each oil dome automatically control the drainage intervals. When the oil level reaches its maximum capacity, the level electrodes signal the control unit, which opens a valve to release the oil that has accumulated in the dome into the waste oil tank. Manual operation is also possible.

Sludge drains

Sludge drains are located at the bottom of each separation chamber to transfer sludge collected during the separation process to the sludge tank of the ship.

Differential pressure switch

A differential pressure switch monitors the pressure drop across the microfibre bed elements in the second stage. If the differential pressure exceeds the maximum allowable value, the unit automatically switches off and the control cabinet indicates that the elements must be replaced.

Control cabinet

Mounted directly on the MPEB, the control cabinet houses the main switch, pump switch, hour meter and process controller, which provides automatic operation and supervision. The process controller makes the unit easy to operate, providing fully automated monitoring and control of all system functions.

Oil-in-water monitor

This OMD 2005 type monitor continuously analyses the cleaned bilge water using samples that are extracted through the water line situated at the outlet. When the residual oil content is 15 ppm or less, the cleaned water passes through the three-way valve for immediate discharge overboard or is routed to holding tank for discharge later. When the residual oil content exceeds the 15 ppm limit, the three-way valve re-circulates the water to the bilge water tank for re-processing.

Harbour control valve

When the ship is in port, bilge water separators can undergo inspection by authorities. To facilitate inspection, a manually operated three-way valve is installed immediately after and adjacent to the three-way valve on the outlet. This enables authorities to test the bilge alarm and the automatic stopping device without discharging any bilge water overboard.

Oil-in-water monitor

Helical rotary pump
This progressive cavity pump transfers oily water from the bilge tank into the MPEB. The special design of the rotor and stator minimises agitation, thus reducing the formation of emulsions. The pump may be built on to the MPEB or delivered as a separate unit.

Flow diagram

1 Helical rotary pump
Transfers bilge water to the bilge separator.

2 Strainer (Not included)
Traps large particles from the bilge water before the fluid enters the bilge separator.

3 Electric heater
Heats the oil to prevent clogging by heavy fuel oil when the unit is not in operation.

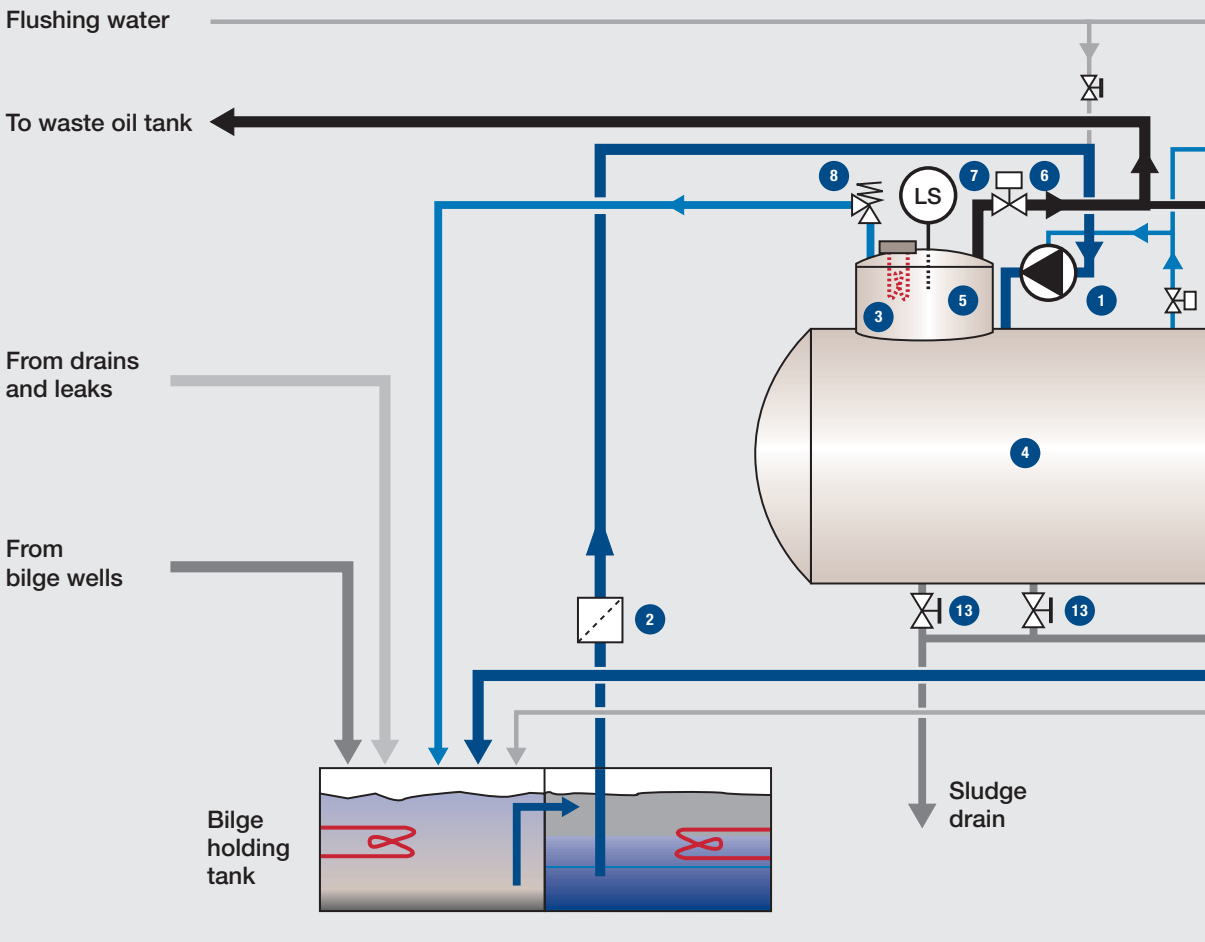
4 Multi-Phase Separator (1st stage)
Separates oil from bilge water using patented profiles and the force of gravity.

5 Oil domes
Collect oil that is separated from the bilge water.

6 Oil drains
Automatically discharge oil that collects in the dome to the waste oil tank.

7 Level electrodes
Measures the level of oil in the dome at two different levels and opens the oil drain valve for intermittent discharge of oil and air that have accumulated.

8 Safety valve
Automatically releases pressure in the unit, when pressure exceeds 3.8 bar.



9 Solenoid valve for scavenger line
Enables the passage of water into the pump in order to prevent dry-running of the pump.

10 Mechanical Emulsion Breaker (2nd stage)
Separates fine emulsions using patented microfibre bed to agglomerate fine oil droplets into a wetting film.

11 Differential pressure switch
Automatically switches the unit off if the pressure drop exceeds 1.5 bar, and indicates on the control cabinet when elements require replacement.

12 Spring-loaded non-return valve
Directs the cleaned water overboard. Spring loaded at 0.7 bar in the outlet.

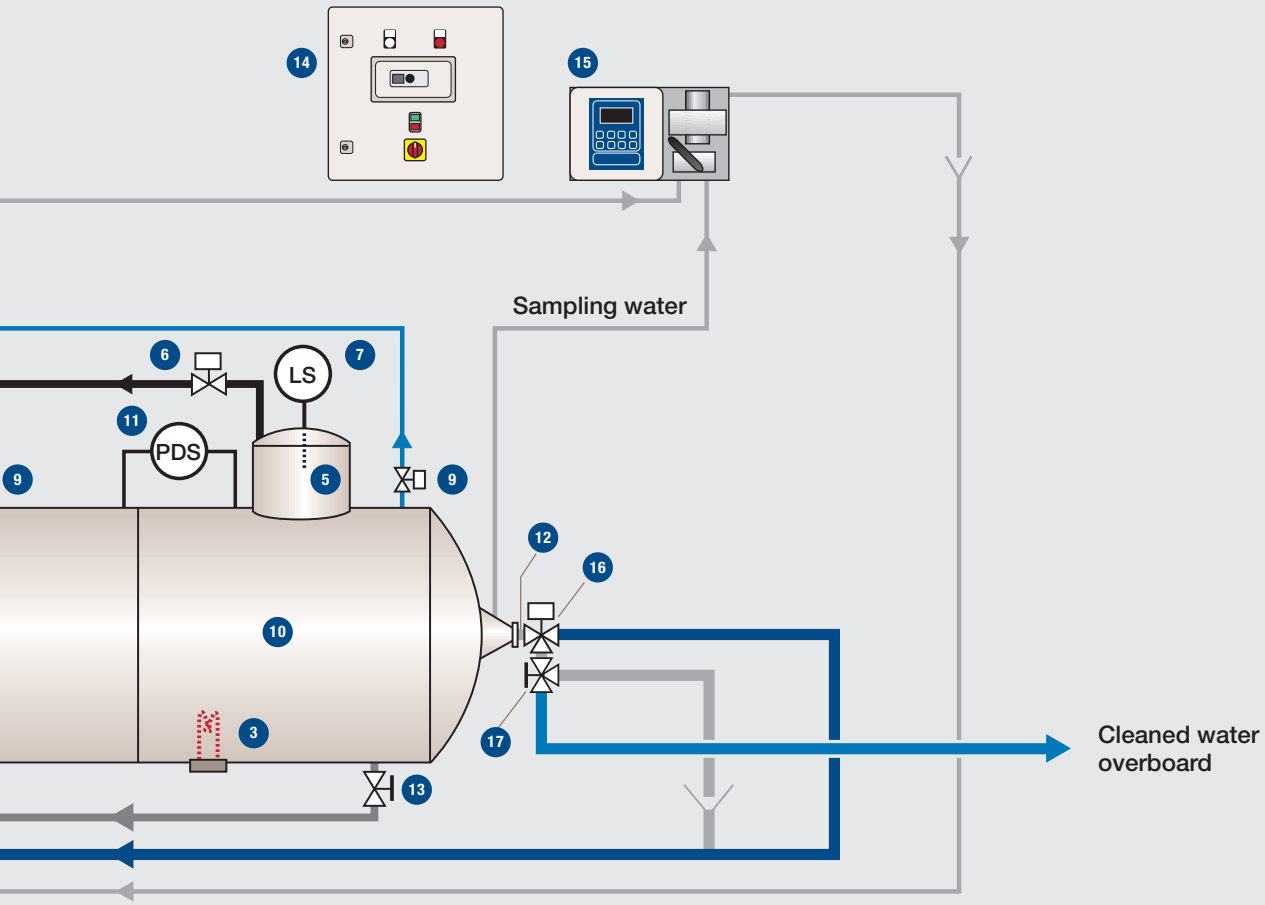
13 Sludge drains
Discharge collected sludge and particles to sludge tank.

14 Control cabinet
Automatically controls bilge water separator functions and starts the pumps.

15 Oil-in-water monitor
Continuously measures oil content of cleaned bilge water.

16 Three-way valve
Discharges clean water overboard and re-circulates oily water that exceeds the 15 ppm limit to the bilge water tank.

17 Harbour control valve
Enables manual testing of the bilge water separator while the ship is in port.



Benefits for shipyards

- Pre-mounted system for easy installation.
- Complete delivery, including harbour control valve, dry-run protection and overboard non-return valve.
- Easy commissioning and initial start-up.
- Flexible configuration for different engine room designs.

Benefits for shipowners

- Reliable, easy-to-operate system provides continuous operation with automated control and monitoring system.
- High separation efficiency, thanks to the patented profiles and emulsion breaker elements.
- Reduced operating costs, thanks to automated control, low maintenance and minimal fresh water consumption.

TREATMENT OF OILY

MPEB 5

MPEB-VT 5

Retrofitting

MPEB is ideal for replacing older bilge water separator systems. It is available as the MPEB-VT, which is a separator unit that consists of two vessels. The first vessel is placed in the same location as the old bilge water separator; the second vessel may be placed anywhere in the engine room where there is any available space.

Approval

The MPEB and the oil-in-water monitor are approved according to the IMO Resolution MEPC.107(49) as well as the European Marine Equipment Directive, MED 2002/75/EC.

The MPEB also fulfils the requirements of all major classification societies. Upon request, the MPEB can be delivered with individual test certificates (USCG-certificate No.162.050/9041/0 or RMRS-certificate No. 06.001.08.272).

Documentation

MAHLE Industriefiltration supplies each MPEB bilge water separator with full documentation either as paper copies or as PDF (Portable Document Format) files on a CD-ROM. The instruction manual, which can also be made available in most major languages, covers:

- Safety
- System description
- Operating instruction
- Alarms and fault finding
- Installation instructions
- Spare parts
- Component descriptions

Spare parts, service and support

MAHLE Industriefiltation provides spare parts kits for all service and maintenance needs. Global technical service, training and support are available throughout the lifetime of the MPEB.

WASTE WATER
ON BOARD SHIPS

MAHLE

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