Separation Technology from GEA Westfalia Separator for Oilfield Applications

Protection of the environment
Mechanical Separation Technology from GEA Westfalia Separator Enables You to Progress

Separators and decanters are centrifuges with which liquid mixtures can be separated with simultaneous removal of the solids.

Separators are vertical bowl high speed centrifuges, up to 10,000 G, which are primarily applied for the clarification and separation of liquids with and without solids content. The max. particle size that can be separated is 0.5 mm with a total solids content of 0.1-3 %. The throughput capacities of separators range from 50 to 250,000 l/h; a comfortable spectrum which accommodates the units for all process steps of separation technology.

When the solids content in the suspension to be processed is too high, up to 60 %, it’s time to call in the decanters. They are often placed upstream of a centrifuge and achieve high clarification efficiencies and maximum dewatering. They are also employed for the separation of liquids with simultaneous removal of the solids. The essential preconditions here are a high bowl speed, up to 4000 G, a powerful drive for the scroll and a scroll speed that is automatically adapted to the solids concentration in the feeds.

Available separator and decanter features
- High separation efficiency
- No impact from ship / platform movement
- Achieve down to 5 ppm oil in water
- IMO MEPC.107(49) approved
- Reduced need of chemicals
- Gastight design available
- Self-cleaning or manual centrifuges
- Nozzle centrifuges
- Ex-Zone 1 & 2
- ATEX approved
- Compact and robust design
- Plug and play system
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High-Performance Equipment for the Oilfield Industry

Overview of oilfield applications

Demand and requirements applicable for processing rigs and FPSOs for the oil industry are increasing. Operating reliability, weight and space requirements are major parameters. GEA Westfalia Separator supplies plug and play processing systems which comply with even the most stringent environmental requirements and feature the latest weight and space saving designs.

They handle continuous liquid-liquid-solids separation in a wide range of applications and a wide range of capacities. The centrifuges are specifically designed to cope with the needs and circumstances on site, with permanent reduction of costs.

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Drilling

Mud/slop/drain water treatment system

The higher demand for hydrocarbons is pushing us further into a tough environment. New high-tech rigs/FPSOs are developed to cope with these new challenges. Our contribution is to help you protect our fragile environment and to maintain the “zero-discharge” philosophy. GEA Westfalia Separator has a complete environmental system which reduces the discharge to sea to a minimum. A high efficiency slop treatment system will also have economic benefits as the costs for ship to shore and subsequent treatment are no longer required.

The treatment of slop is always a challenge as the slop tanks contain everything from drain and slop water, oil spills, brine, bentonite, barite, cement, mud etc. This results in a variable oil and solids content.

To solve this challenge GEA Westfalia Separator has developed a complete system using the full capacity of both the decanter and centrifugal technology.

Our available decanters for this application have a low bowl angle for optimal thickening and a hydraulic scroll drive for maximum power. We have also the patented bowl design for handling of brine with a specific gravity of up to 1.5 sg.
Drilling

Brine water treatment system

The first centrifugal separator has been installed on a rig to handle slop (oil containing SW, brine, soap, polymer pills etc.). No slop is now sent onshore. Only very little debris is left after the separation process. The capacity of the GEA Westfalia Separator system is 10-30 m³ per hour. Up to 1.5 specific gravity is handled.

The separator has now been used for 8 wells, with an average saving of more than 250,000 € per well. Previously a flocculation process, DE-press and cartridge filtering and more personnel were required, still resulting in larger volumes being sent onshore for expensive disposal.
Production

Crude oil dewatering and produced water de-oiling

When produced from the reservoir, crude oil contains contaminants such as water, suspended solids and water-soluble salts. These contaminants are damaging to refinery equipment, and must be removed before crude oil can be processed into fuels and other products.

Oil drilling operations can create large quantities of contaminated water known as “produced water”, or water that is produced from the well. Most underground oil reservoirs have a natural water layer called formation water, which lies underneath the hydrocarbons.

The dewatering of crude oil becomes more difficult when we talk about heavy crude oil from API 19 and higher densities. Here, the high g-forces of centrifuges help to avoid the use of chemicals and improve the separation.

As the oil/water mixture is pumped out of the well, it is separated yielding the hydrocarbon product and the produced water. As the oil level drops in the reservoir, the amount of water injected increases to fill the void.

In the United States, produced water coming from oil wells is 8 times the volume of the oil produced. These volumes represent huge amounts of contaminated water that require economical and environmentally friendly methods of treatment so it can be re-used or safely disposed of.

Produced water volumes tend to increase dramatically as older oilfields pass their peak production. GEA Westfalia Separator has solved this challenge by making it possible to convert the centrifuges from crude oil separation to produced water separation.

As a well ages and oil becomes difficult to remove, water or steam is injected into the reservoirs to help force the oil to the surface. Both formation and injected water eventually make their way to the top and are produced at the well head along with the hydrocarbons.

![Figure 1 – Crude oil separation](image1.png)

![Figure 2 – Produced water separation](image2.png)
Utilities
- Demulsifier
- Fresh water
- Hot process water
- Instrument air
- Nitrogen
Self-cleaning separators for MDO / LO / HFO treatment

Self-cleaning separators with disc bowl and automatic solids ejection are used where the percentage of solids in the oil is too high for manual cleaning. These are used mainly for the clarification and purification of fuel oils such as gas oil, diesel oil, heavy fuel oil and lube oil. Self-cleaning separators discharge solids automatically while the separator is running. This avoids the need to shut down the separator for frequent cleaning.

Self-cleaning separators operate continuously. Solids ejection occurs either by total or partial ejections, or a combination of both with additional self-cleaning of the disc stack. Labour intensive cleaning of the discs using CIP systems is not necessary. Optimum separation efficiency over long operating times is ensured. Maintenance work is required only after 8000 to 16,000 operating hours. The clean oil and the separated water are conveyed to the discharge under pressure by a centripetal twin pump.

Features
- Automatic operation
- Continuous operating mode
- Self-cleaning effect of the bowl without CIP systems
- Highly concentrated solids
- High separation efficiency
- Can be used as clarifier and purifier
- Discharge of light and heavy phase under pressure by a centripetal twin pump
- Low noise level
- Belt drive
- EX design available

Bowl cross-section of a self-cleaning mineral oil separator with disc bowl
Downstream Applications

MEG particle removal

Proper hydrate management is vital for all field developments. For long distance gas/condensate tiebacks continuous injection of MEG (Mono Ethylene Glycol) in a closed MEG loop is the preferred solution.

By using carbon steel production pipelines, corrosion and corrosion inhibition strategy become important issues. Although the presence of the MEG itself gives a reduction of the pipeline corrosion rate, additional means are almost always required to avoid unacceptable corrosion.

Even though alternatives for corrosion control like pH adjustment, addition of a corrosion inhibitor or a combination of the different alternatives are utilized, the pipeline will corrode and large amounts of iron ions will be formed. These iron ions, with other divalent ions like calcium stemming from the produced water, will enter the onshore plant. To prevent accumulation, and subsequently precipitation and scaling at unwanted locations, these ions must be handled with precaution at the onshore plant.

The nature of a closed loop MEG system, where water is continuously removed through conventional regeneration, requires a holistic approach to the challenge of ion and particle control and handling. Input from different disciplines like chemistry, corrosion, scaling, salt precipitation and engineering must interact in the design of the onshore plant, where the MEG is to be regenerated.

Flexibility regarding particle removal utilizing centrifuges has been built into the closed loop MEG system. The centrifuges can be run both up- and downstream of the MEG regeneration units. The reason why the base case solution is downstream the MEG regeneration units, is that the main overall concern to the project is high volumes of particles of a certain size present in the Lean MEG being injected sub sea having the ability to obstruct the injection devices. However, if problems are encountered in the MEG regeneration units that can be traced back to particles in the Rich MEG, the centrifuges can be run upstream the MEG regeneration trains.

![Diagram](image)

**MG to bind condensate and salt in sub sea natural gas pipelines**
Typical overall MEG system for gas treatment plants
Downstream Applications

Slop oil recovery – treatment solutions for refineries

In refineries all kinds of waste oils are produced, so-called slop oils. They come from drainages, residues and cleaning processes, especially cleaning oil tank bottoms. Most of these slop oils contain a high percentage of oil which can be mixed with crude oil to be processed in the refinery. If this slop oil is treated, not only disposal costs can be reduced, but profit can also be generated with the oil phase recovered from the slop.

As the oil as well as water content can vary from 10 to 90 percent and the solid content can vary from 1 to 10 percent, either disk stack centrifuges or decanters can be used for treatment of the slop oil. Decanters are normally used in feed with a solid content of more than approx. 5 percent (by vol.) A disk stack self-cleaning centrifuge can be used downstream of the decanter to polish either oil or water phase.

- 2-phase decanter to separate solids from liquid phases
- Disk stack self-cleaning separator to separate the two liquid phases
- Normally the oil phase is the one to be cleaned
- Optionally, the water phase can be treated further downstream to avoid disposal costs for oily water
- Oily water treatment systems from GEA Westfalia Separator can reduce the free oil content in water down to 5 ppm
- As an alternative, 3-phase decanters are available
Separation of solids and two liquid phases of slop oil

Reduction of disposal costs

The oil can be mixed with crude oil and processed in the refinery

Profit instead of disposal costs

Customer benefits
Downstream Applications

Systems for cat fines removal from residual oils in refineries

During modern refining processes the residual oils from vacuum distillation are sent to a cracking tower. The long hydrocarbons are cracked with the help of pulverized catalysts such as aluminum silicates which are mixed with the oil.

This cracking process takes place at a temperature of approx. 500 °C. A lot of these cat fines remain in the residues of the cracking tower and the distillates coming from the cracking process.

These cat fines can be separated from the oils to recover them and / or improve oil quality.

Effective refining principle

Combining disk stack centrifuges and decanters

- Disk stack centrifuges for cat fines removal (operated as clarifier)
- Due to high product temperature oil is recommended as operating liquid
- Downstream cat fines concentration with decanters possible

![Typical refinery process diagram](image)
Catalyst fine removal from residual oils

Optimum oil quality as refinery product

Higher sales prices for refinery product obtainable

These cat fines can be reinjected into catalyst tower
Liquids to Value

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GEA Westfalia Separator

Liquids to Value

Westfalia Separator® mini maXx® – Sophisticated Technology in Confined Spaces

Hydraulic oil treatment plant

The part played by separators in the shipping industry has changed drastically in recent years. Not just stand-alone machines, but complete systems, even for small product streams, are required to face the increasing demands for high performance and low costs. The compact units with Westfalia Separator® minimaXx® separators were developed to fulfill these requirements and features.

The compact units of the minimaXx® class are made in a space-saving design. Each one is based on a separator of the Westfalia Separator® minimaXx® family. This is mounted together with all necessary monitoring equipment in a mobile system.

VBU – Westfalia Separator® ViscoBooster® Unit

Fuel oil conditioning system

Efficient operation of diesel engines operated with crude oil and heavy fuel oil requires optimum fuel supply. This key condition is accomplished by the Westfalia Separator® ViscoBooster® Units for fuel conditioning.

This unit consists of a treatment system that meets the fuel requirements between the clean oil tank and injection system for the main and auxiliary engines in terms of the required injection viscosity and temperature. Supply and booster pumps are provided for a stable system pressure. The modules are designed for the different engines as well as to the required injection viscosity (approx. 10 – 24 cSt) and corresponding temperature (approx. 135 – 150 °C).

With the ViscoBooster® Units, GEA Westfalia Separator offers a complete, compatible system from the service tank to the engine for safe and economic fuel oil treatment.

Westfalia Separator® ViscoBooster® Units are supplied as package systems. They can be delivered as separate systems or as a complete module for the main engine and auxiliary engines for heavy fuel oil and diesel oil. They are designed for 24-hour unattended operation and meet the requirements of the classification societies.

(Please see left figure on page 17.)
Sea water is fed through the condenser of the Westfalia Separator® SeaWaterDistiller, where it absorbs the latent heat of the condensing vapour. Some sea water is used as feed water for the evaporator whilst the remaining brine and non condensable gases are discharged using a combined ejector.

In the evaporator the sea water is heated up to the saturation temperature corresponding to the vacuum maintained by the ejector and a proportion is evaporated. The evaporator generally utilizes the waste heat from the main diesel engine jacket water, however, other heating media may also be used (e.g. steam, thermal oil).

The vapour produced passes through the demister located in the upper casing to remove entrained droplets of water and is led to the condenser. The distillate is drawn from the condenser by the distillate pump and discharged through the salinity measuring unit. Depending on the residual salt content of the distillate, it is either led to the distillate tank or, if the maximum allowable residual salt content is exceeded, back to the evaporator. All parts of the Westfalia Separator® SeaWaterDistiller in contact with sea water are constructed of corrosion-resistant materials (CuNi, stainless steel). The plates are made of titanium.

Features

- Compact
- Easy to operate, fully automatically controlled
- Reliable
- Low weight
- Low maintenance costs
- Integrated anti-scaling system
- Corrosion resistant materials
- High performance

Fuel oil conditioning system with VBU (above) and single stage evaporating system (right)
Package Design
Complete system solutions for your benefits

Portable container solution with centrifuge WSC 50, control panel in ex design. Scope of delivery includes all necessary valves, instrumentation, pump and duplex filter for plug & play operation. The container is equipped with manual traverse carriage, mechanical ventilation, illumination, storage cases for centrifuge bowl and special tools.

Open skid with 3 x WSC 50 centrifuges; complete installation with nitrogen blanketing system, material handling equipment and separate sludge and water system. Typical application MEG.

Skid with noise enclosure incl. mechanical ventilation. 3 x WSD 200 centrifuges with direct drive motors; complete installation with nitrogen blanketing system, material handling equipment and separate sludge and water system. Typical application MEG and produced water/crude oil.
Portable container solution with decanter CA 458 with hydraulic scroll drive. Local operator panel in ex design. Scope of delivery also includes feed pumps. The container has mechanical ventilation and detachable skylight for maintenance. Typical application is slop and mud treatment.

Open skid with 2 x WSC 50 centrifuges; complete installation with junction boxes and sludge transfer system. Typical application drain/slop water treatment.

Open skid with 1 x OSC 30 centrifuge; complete installation with junction boxes and sludge transfer system and feed pumps. Scope of delivery also includes inlet strainer & filter skids. Typical application diesel oil treatment.

Open skid with 1 x OSD 18 centrifuge; complete installation with junction boxes and sludge transfer system and feed pumps. Scope of delivery also includes inlet strainer & filter skids. Typical application diesel oil treatment.
The information contained in this brochure merely serves as a non-binding description of our products and is without guarantee.

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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