# SLOP/WASTE OIL TREATMENT INSTALLATION GF-MDL-VI

## FOR CLEANING WASTE OIL PITS , REFINERY REJECTS AND SHIPS OILY WASTES

Abstract

**G-Force Slop Oil Engineers BV supplies Port Cities and Oil Company operators slop treatment installations to treat waste oil from ships and waste oils contained in pits in oilfields and refinery rejects in order to comply with the ever more stringent environmental regulations.**

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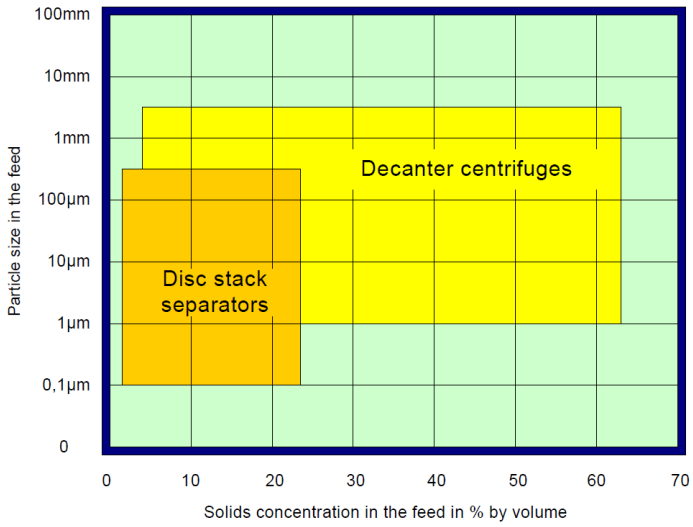
# General Introduction

Slop oil stored for years in ponds and tanks is an increasing environmental problem. Also slops discharged by vessels in ports pose increasing environmental problems When treated properly, however, this waste can be minimized and the oil recovered from such sources can be sold at a profit. G-force Slop Oil Engineers BV (GFSE) has many years of experience in successfully solving even the most complex problems related to recovering oil from slop oil, emulsions and oily waste.

Slop oil comes in many forms, which creates multiple challenges that call for efficient, specific treatment. At the core of GFSE slop oil solutions are disc stack centrifuges and decanter centrifuges that have proved to be a cost-effective way to meet these challenges, while at the same time meeting specifications for treated products. In addition, GFSE mobilization and pre-processing equipment enables us to handle the entire process in an efficient, well-integrated way.

GFSE combines extensive field experience in processing slop oil with a dynamic development program. This ensures that all our products are equipped with special features that make them stand out from the competition.

GFSE supplies a full range of solutions designed to meet almost every requirement in an efficient, profitable way.




- When compared with traditional trial-and-error test runs, GFSE proven methods for pre-installation analysis and design result in major savings in both time and money.
- Our process knowledge guarantees the correct treatment and ensures that the solution will work for your particular application.
- The high efficiency of GFSE centrifugal separation solutions significantly speeds up the payback time on your investment.
- The most versatile product range in the industry makes GFSE the right choice for all kinds of slop oil treatment assignments, from the simplest to the most complex

GFSE works closely with specialist partners throughout the world to provide process solutions for turnkey slop oil plants. We also supply a comprehensive range of systems and subsystems that include both heat exchangers and two and three-phase separation equipment. We also supply component systems directly to customers to enable them to upgrade their existing processes.

Feedstock specifications can vary considerably from one installation to another as well varying greatly over time at any particular installation. It is therefore crucial to design each treatment process to meet specific requirements. GFSE solutions can tackle virtually any combination of feedstock specifications and

requirements regarding the treated product. Our experience with numerous projects all over the world enables us to tailor process configurations to meet your specific requirements.

**The process in general**

Each particular treatment process features special requirements that need to be taken into consideration. In general, however, the feedstock normally comes from a pond, a tank or straight off a reject stream pipe. The initial transfer of the feed to the treatment equipment can involve anything from the simple installation of pumps to outright excavation. Subsequent pre-processing involves whatever action is necessary to prepare the slop oil for separation, including the sorting/screening of large solids, process heating, chemical injection and intermediate storage. Utility supply includes the generation and distribution of utilities to operate the plant, such as steam/hot water, technical water, electrical power, compressed air and chemicals. The separation stage features key GFSE components, and is where separation into the three phases – oil, water and solids – takes place. The following is a description of three typical processes using GFSE centrifugal separation technology. GFSE also provides a number of other processes that are well-suited to particular requirements associated with slop oil processing.

The two-stage process is used when the feedstock has a high solids content or when the solids present are particularly abrasive. Once the bulk of these solids has been removed, the oil and water are then separated using the disc stack centrifuge. Any remaining solids are separated from the water in a cone tank installed downstream

- Results in treated oil of the best quality obtainable.
- Unparalleled separation performance (approx. 5000 G).
- Separates tough emulsions and coarse to very fine particles.

Handles feedstock featuring up to 50% solid

## System description

### Vibrating screen MKVS

In most cases the slops to be treated are of both high viscosity and density, it is therefor very important to heat the slop prior to separation. This heating is done using already heated/treated slops and mixing this with the incoming “cold” slop. This will increase the slop temperature so that it can be pumped across the MKVS vibrating screen. Depending on screen size installed.

Sediment removed by the vibrating screen is discharged into a screw conveyor that moves the sediment to a waste skip.

The liquid phase is collected in the small vibrating screen slop collection tank installed underneath the vibrating screen. From this tank the slops gravity flows into the vibrating screen effluent tank. The vibrating screen effluent tank has a 20m$^3$ volume and is fitted with a heating coil and two agitators so that the slop can be homogenized/further heated prior to being treated in the next separation.

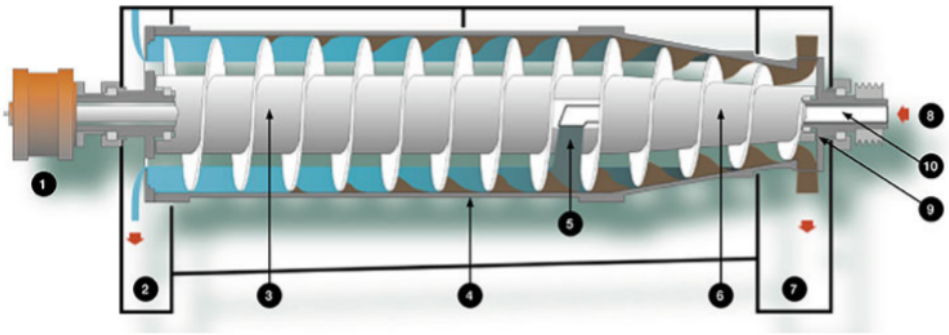
### Two phase decanter centrifuge MKDO


From the MKVS effluent tank the slop is pumped through a heat exchanger where the slop temperature is elevated to 80$^o$C.

Separation takes place in a horizontal cylindrical bowl equipped with a screw conveyor. The feed enters the bowl through a stationary inlet tube and is accelerated smoothly by. an inlet rotor. Centrifugal forces cause sedimentation of the solids on the wall of the bowl. The conveyor rotates in the same direction as the bowl, but at a different speed, thus moving the solids towards the conical end of the bowl. The MKDO design enables the decanter to scroll out high loads of solids without blockages caused by high levels of dryness. Only the very driest fraction of the sludge cake leaves the bowl through the solids discharge openings into the casing. Separation takes place along the total length of the cylindrical part of the bowl, and the clarified liquid leaves the bowl by flowing over adjustable plate dams into the casing. The MKDO decanter centrifuge

can be adjusted to suit specific requirements by varying the bowl speed, the conveying speed, the pond depth and the feed rate.

- the bowl speed to ensure the exact G force required for the most efficient separation,
- the conveying speed for the best possible balance between liquid clarity and solids dryness.
- the pond depth in the bowl for the best possible balance between liquid clarity and solids dryness.
- the feed rate – the MKDO is designed to handle a wide range of flow rates



1: Gearbox
2: Liquid outlet
3: Screw conveyor
4: Wall of the bowl
5: Inlet distributor
6: Conical end
7: Cleaned slurry/muck outlet
8: Feed inlet
9: Discharge ports
10: Feed tube

In the decanter the bulk of the solids are removed and discharged into a screw conveyor and conveyed to the waste skip. The effluent from the decanter is collected in a small decanter effluent tank from where it is possible to make the following choices.

- If the bulk of the effluent is water the decanter effluent can be directed to the API separator. Where the oil will be skimmed off and gravity flows into the oil collection tank. The water phase equalizes into the water collection tank
- if however the bulk of effluent is oil the slop can be directed to the oil collection tank. From where it can be pumped to the high-speed separator for purification

**API Separator**

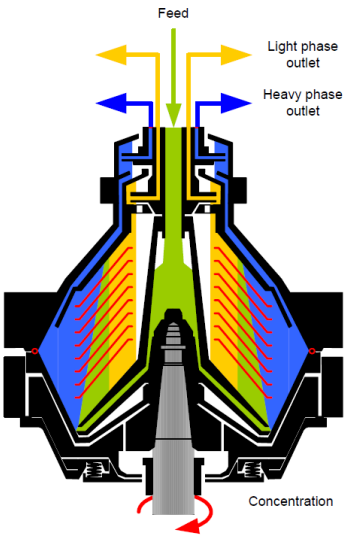
The API separator is a gravity separation device designed using “Stokes law” principles that define the rise velocity of oil droplets based on their density, size and water properties. The design of the separator is based on the specific gravity difference between the oil and the wastewater,

The oil will rise to top of the separator, and the wastewater will be the lower layer between the oil on top and the water on the bottom

Typically in operation of API separators the oil layer, which may contain entrained solids, is continually skimmed off. This removed oily layer is separated and processed in the oil purification high speed separator to recover valuable oil. The heavier water layer equalizes into the water collection tank from where it is further processed in the water clarification high speed separator

**Water clarification high speed separator MKWC**

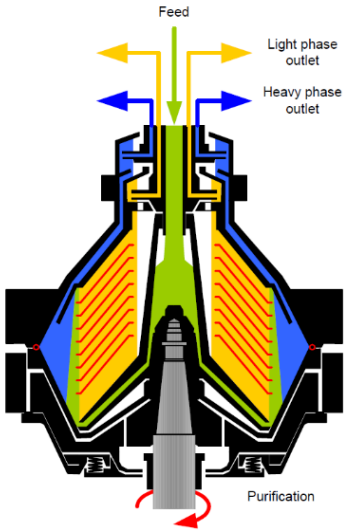
Unlike static systems, high-speed or dynamic centrifugal separators operate with a gravitational force of 5000 G, enabling them to cope with the complexities of modern oily water mixtures. With a long track record of effective performance, this type of oily waste water treatment system is not sensitive to solids or oil loads. No additional chemicals are required, and maintenance is minimal, centrifugal separation succeeds where static technologies fail. Whereas static systems operate in batches and require frequent filter changes and/or chemical dosing to do the job, a high-speed centrifugal oily water separator can operate continuously without requiring much attention. Varying oily water feed, oil shocks and even the toughest emulsions pose no difficulty when using centrifugal separation. The oily water treatment system comprises four main functions: forwarding/pumping; oily water pre-treatment; centrifugal separation; and, process control and monitoring on the central HMI in the control room. A positive displacement pump with a variable frequency drive transfers oily water from the water phase buffer tank, the fluid then passes through a heat exchanger, which raises the fluid temperature to between 85ºC and 95ºC. When all process conditions (feed temperature, pressure and separator speed) are met, the oily water enters the separation stage. If conditions are not met, fluid is re-circulated to the oily water tank. During the separation stage, the fluid enters a highspeed centrifugal separator. Oil and emulsions separated from the oily water are continuously discharged and directed to the oil collection tank. Solids are discharged intermittently through the self- cleaning mechanism of the centrifuge. Treated water is also continuously discharged. An oil-in water monitor (optional) measures the oil content in the treated oily water to comply with local regulations



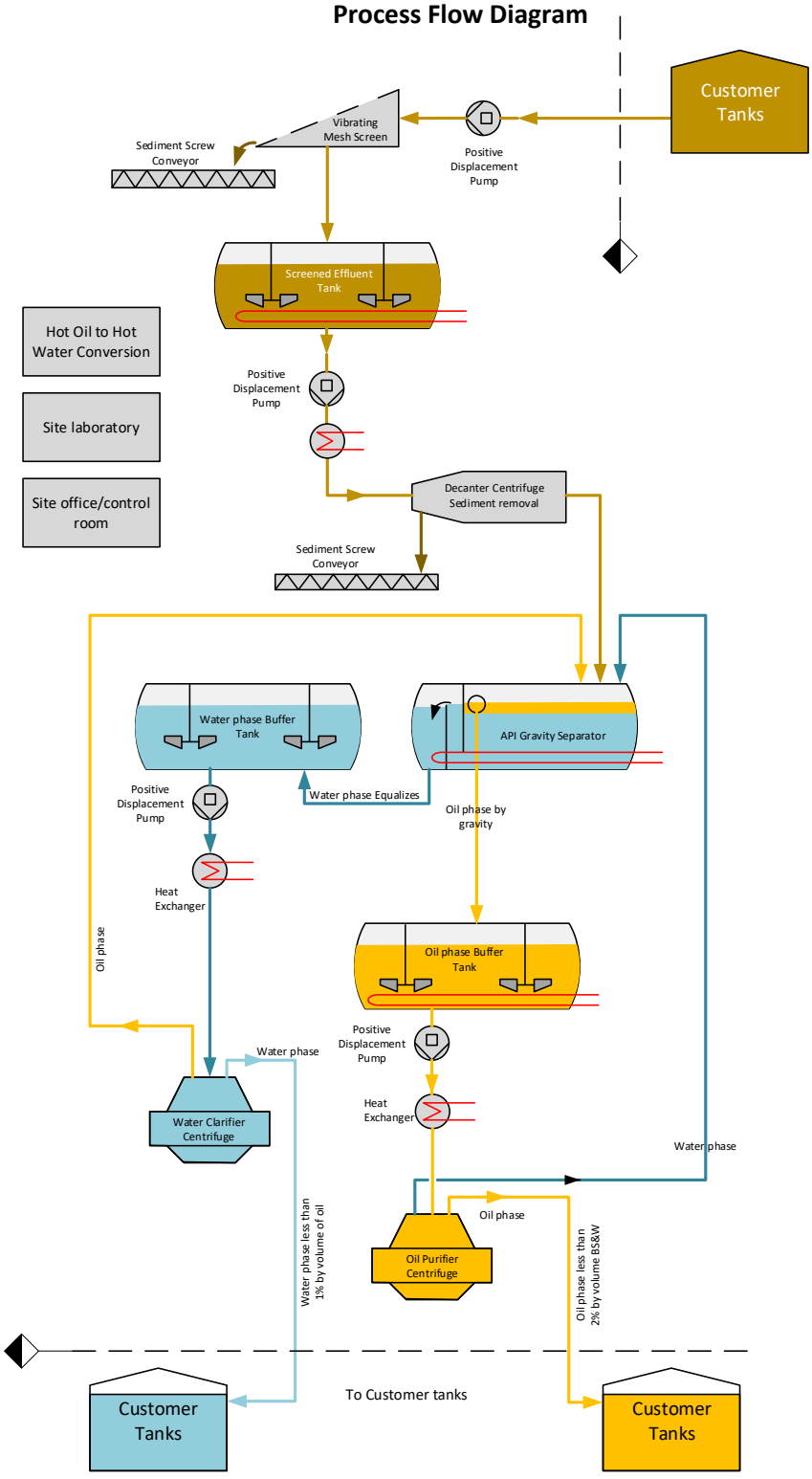

The disc-stack and bowl arrangement provide the maximum surface area and features distribution holes and an optimized caulk configuration to enhance separation efficiency further. The design provides stable, continuous operation to ensure proper handling of oil shocks that generally bring static cleaning systems to a standstill. The high centrifugal force of 5000 G within the oily water separator bowl induces coalescence and flocculation, which contribute to the breakdown of emulsions.

**Oil purification high speed separator MKOP**

The MKOP module will pump untreated waste oil with a variable speed positive displacement pump through a heat exchanger where the temperature is increased to 95°C and then enters the separator. The centrifugal separator is the heart of the oil purification unit and provides a reliable and consistent method for the removal of solids and water simultaneously from waste oils. Untreated waste oil is fed continuously through the separator, where any water and solids are separated from the waste oil by the action of centrifugal force. Separation takes place in a rotating bowl. When the water seal has been established, the feed is introduced to the bowl inlet. The oil is forced towards the center of the bowl through the disc stack. A built-in paring disc pump discharges cleaned oil continuously. Separated water rises along the outside of the disc stack and is continuously discharged by a paring disc in the water outlet. Separated sludge and solid particles accumulate at the periphery of the bowl and are discharged periodically before they build-up to a point where they would interfere with the separation process. The discharge cycle is initiated at the HMI control panel by either pushbutton or automatically by the electronic program control system on completion of a set time cycle. Water is discharged into the water phase buffer tank and sludge removed by the centrifugal separator collect in the centrifuge sludge tank and are pumped to the sludge thickener During process alarm conditions, the divert valve switches the flow of the purified oil away from the customer clean oil tank to the oil phase buffer tank. The waste oil cleaning unit is controlled, monitored, and supervised from a centralized HMI. A state-of-the-art PLC-based control system provides monitoring and control functions necessary for operation of the system.



## Process Flow Diagram



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