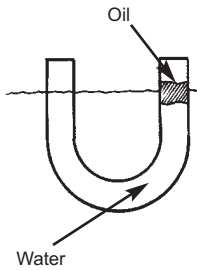
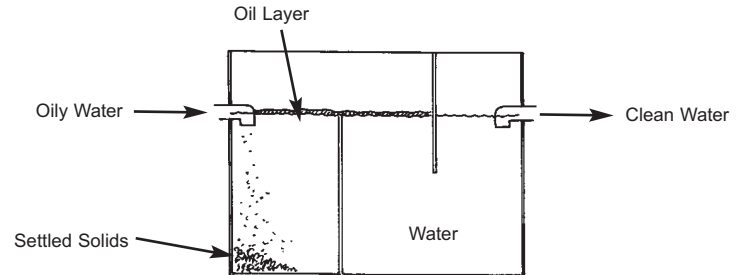


This section will cover coalescing oil/water separation. The concept of a basic gravity oil/water separator is simply a tank vessel that stalls the flow rate to permit gravity to separate oil from water. Oil, having a lower specific gravity than water, will naturally float on water if given time to separate.



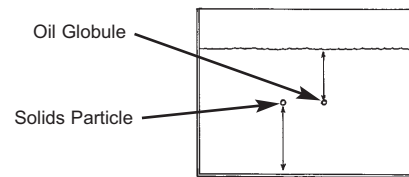
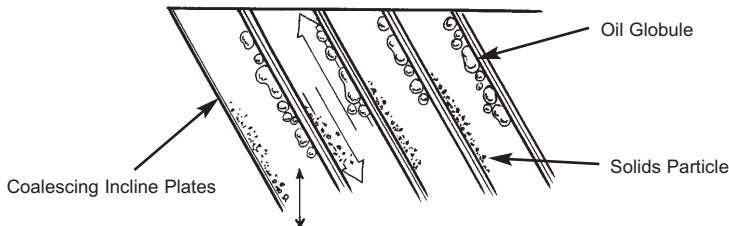
The rise rate of oil to the surface is determined by Stoke's Law. There are three main factors affecting the rise rate: oil droplet size, oil specific gravity and temperature. Other factors include oil/dirt particles and flow rate or turbulence. According to Stoke's Law, a 100 micron size oil droplet will rise three inches in five minutes. When factoring in a flow rate, you can see how a simple oil/water separator will have to be quite large to give the oil enough time to rise to the surface. A 20 micron size oil droplet will rise three inches in 60 minutes. Large oil droplets are more buoyant and, therefore, rise faster.

In order to reduce the physical size of the oil/water separator, coalescers have been used successfully for many years. The concept of a coalescer is to use oleophilic (oil loving) media such as polypropylene or teflon. As oil and water flow through the media, oil droplets impinge on the media and coalesce on the surface. Coalescing, or binding together, makes them larger and more buoyant. As you can see from the above example, a 100 micron oil particle will rise three inches twelve times faster than a 20 micron particle.



Typical Three-Part Oil/Water Separator

Now to further enhance this process, we can use these coalescing media as incline plates thereby drastically reducing the rise or fall of a particle.



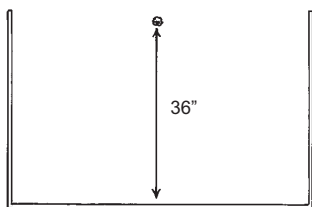
By using coalescing incline plates, the rise of an oil droplet can be reduced to 1/4" until it hits the upper surface of the plates and glides up as it coalesces with other particles. Also, solids or dirt will settle and glide downward on the plate surface. As it attaches to other dirt particles, the coalesced oil particles will gain buoyancy and rise rate, and the dirt particles will gain speed as they grow heavy and settle at a faster rate.

Example:

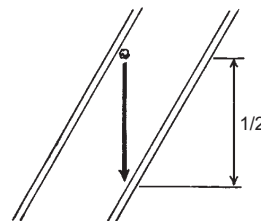
Solids Settling - Standard Separator vs. Inclined Plates

It takes fine sand 0.1 mm diameter 38 seconds to settle 12 inches in an open tank or 114 seconds in a typical 3 ft. deep separator. By adding 1/4 inch incline 60° plates, you reduce the settling time by a factor of 72. Therefore, the addition of 1/4 inch incline plates will reduce the settling time of a 0.1 mm diameter fine sand from 114 seconds in a standard separator to 1.58 seconds in a 1/4 inch incline plate separator. The same calculation can be made for oil droplet sizes and rise time utilizing incline plates.

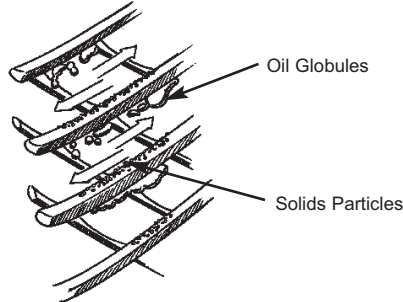
Standard Separator



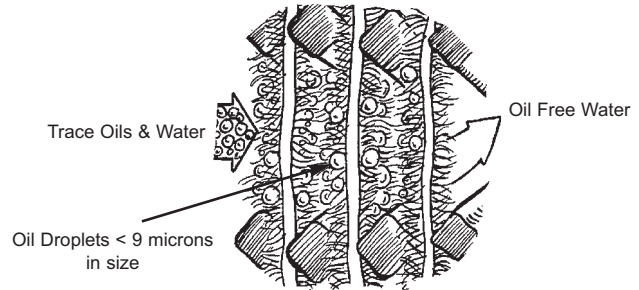
Inclined Plate



In addition to incline plate coalescing separation, RGF utilizes a Micro-Matrix Coalescor system of finely spaced poly mesh with an incline grid matrix. For final polishing, a HCA-3 absorbent filter is recommended. This filter consists of millions of very fine polypropylene hair-like fibers that crisscross into the water stream to attract and hold oil droplets less than 9 microns in size.



Magnified View of the Micro-Matrix Coalescor



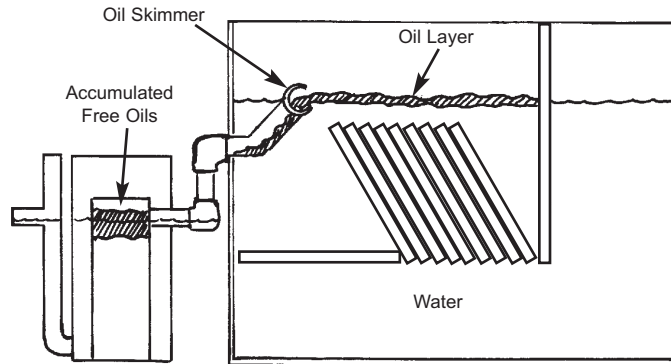
Magnified view of the HCA-3 Hydrocarbon Absorber

This RGF system of micro matrix and HCA-3 hydrocarbon absorbers are used in our Marine Bilge Filter Systems and has achieved results of 0.87 ppm during a two day UL/U.S. Coast Guard Test consisting of blended 25% to 100% diesel fuel and oil under simulated sea conditions.

The addition of auto oil skimmers and the RGF Oil Accumulator makes free oil removal easy.

Note:

The use of RGF's OWS Bio-Disks can reduce both free and emulsified oils by greater than 50% using natural bacteria



Emulsified oils, either chemically or mechanically emulsified, will not separate in a gravity separator. Emulsion splitting methods will be necessary before the emulsion reaches the separator. Alternately, quick release detergents or cleaning chemicals can be used, which will release the emulsion and permit the gravity action to occur. Alternately, a floccing or membrane system can be used for emulsified oily water problems.

NATURAL SETTLING

WATER VOLUME VS. 15 PPM OF OIL CONTAMINATION

OIL		WATER
1 Drop	in	1 Gallon
3/4 Pint	in	4,000 Gal. Tanker Truck
4 Quarts	in	50 gpm flow over 24 hrs. (72,000 Gals.)

Diameter of particles, mm	Order of Size	Time Required to Settle
10	Gravel	0.3 seconds
1	Coarse Sand	3.0 seconds
0.1	Fine Sand	38 seconds
0.01	Silt	33 minutes
0.001	Bacteria	55 hours
0.0001	Colloidal Particles	230 days
0.00001	Colloidal Particles	6.3 years

Model OWS-10 Oil Water Separator



RGF's OWS-10 System of pre-treatment technology is designed to avoid pollution problems by avoiding contaminated water discharge. It is a compact system designed to remove free oils from water prior to discharge for sanitary sewer or other treatment.

- *Flow Rate*: 10 gpm
- *Dimensions*: 35"W x 35"L x 36"H
- *System Capacity*: 120 gallons
- *Free Oil Capacity*: 10 gallons
- *Separation Type*: 1/4" Vertical Tube Coalescor, Gravity Separation, Micro-Matrix Coalescor
- *Materials*: Polyethylene / Polypropylene / PVC
- *Options*: RGF OWS Bio-Disks for oil reduction

<i>Item #</i>	<i>Description</i>	<i>Ship Weight</i>
OWS-10-Q	Model OWS-10	268 Lbs.
FI-093	Small Permanent Coalescing Filter	

Models OWS-20 & OWS-50 Oil Water Separators



Shown - OWS-50

RGF's Oil Water Separators are designed to process wastewater containing free oils. The patented systems utilize over five technologies to remove and store the free oils before discharge for reclaim or sanitary sewer.

- *Flow Rate*: OWS-20: 20 gpm
OWS-50: 50 gpm
- *Dimensions*: OWS-20: 26"W x 50"L x 46"H
OWS-50: 76"W x 56"L x 54"H
- *System Capacity*: OWS-20: 180 gallons
OWS-50: 550 gallons
- *Free Oil Capacity*: OWS-20: 7 gallons
OWS-50: 7 gallons
- *Separation Type*: 1/4" Inclined Tube Coalescor, Gravity Separation, Micro-Matrix Coalescors
- *Materials*: Polyethylene / Polypropylene / PVC
- *Options*: RGF OWS Bio-Disks for oil reduction

<i>Item #</i>	<i>Description</i>	<i>Ship Weight</i>
OWS-20A-Q	Model OWS-20	312 Lbs.
OWS-50A-Q	Model OWS-50	1067 Lbs.
FL-093	Small Permanent Coalescing Filter	
SA-IP-SM-02	Small Incline Plate Pack	
SA-IP-LG-02	Large Incline Plate Pack	

Model SD I Sewer Discharge Oil Water Separators

RGF's Sewer Discharge Systems are designed to collect contaminated source water, which typically contains petroleum hydrocarbons, heavy metals solid and cleaning fluids. The collected water is processed through the system and contaminants are removed utilizing over 12 technologies prior to discharge to sewer.



- Flow Rate: 30 gpm
- Dimensions: 76"W x 56"L x 84"H
- System Capacity: 850 gallons
- Free Oil Capacity: 7 gallons
- Separation Type: 1/4" Inclined Tube Coalescor, Gravity Separation, Micro-Matrix Coalescors, Multi-Media Absorption
- Final Filtration Media: 638 lbs. Multi-Media
Multi-Media consists of Activated Alumina, Carbon, Activated Carbon, Volcansorb Rock
- Oxidation System: TurboHydrozone® (XL only)
- Materials: Polyethylene / Polypropylene / PVC
- Options: RGF OWS Bio-Disks for oil reduction
Coalescing Centrifugal Separator (XL only)

Item #	Description	Ship Weight
SD-I-Q	Model SD-I	726 Lbs.
SD-I-XL-Q	Model SD-I w/ TurboHydrozone® & H.E.C.S.	756 Lbs.
OI-002	Coalescing Separator for Model SD-II	
OI-004	TurboHydrozone® for Model SD-II	
FI-096X	HCA-2 Filter - SD-I & SD-I-XL	
FI-101	Filter Media - SD-I & SD-I-XL	

Model SD II Sewer Discharge Oil Water Separators



- Flow Rate: 15 gpm
- Dimensions: 56"W x 32"L x 54"H
- System Capacity: 250 gallons
- Free Oil Capacity: 7 gallons
- Separation Type: 1/4" Inclined Tube Coalescor, Gravity Separation, Micro-Matrix Coalescors, Multi-Media Absorption
- Final Filtration Media: 161 lbs. Multi-Media
Multi-Media consists of Activated Alumina, Carbon, Activated Carbon, Volcansorb Rock
- Materials: Polyethylene / Polypropylene / PVC
- Options: RGF OWS Bio-Disks for oil reduction

Item #	Description	Ship Weight
SD-II	Model SD-II	310 Lbs.
OI-002	Coalescing Separator for Model SD-II	
OI-004	TurboHydrozone® for Model SD-II	
FL-012	Filter Media - SD-II	
FL-001-X	HCA-2 Filter - SD-II	