Enhance the Efficiency of Oil/ Water Separators with Oil Skimmers

OILSKIMMERS, INC.®
The Oil Removal Solution Experts™

Installing an oil skimmer to remove oil following separation delivers cost savings, reduced maintenance and more.

WHITE PAPER

The American Petroleum Institute (API) oil/water separator was developed by the API and the Rex Chain Belt Company and was first installed in 1933 at the Atlantic Refining Company in Philadelphia, Pa. Simply stated, the API oil/water separator is a device designed to separate oil and suspended solids from industrial wastewater sources, such as those found in oil refineries, petroleum handling facilities, petrochemical and chemical plants, natural gas processing plants and more.[1]

Since the inception of the standard API oil/water separator, most refineries throughout the world and numerous companies in a variety of industries – from railroads to steel mills – have installed oil/water separators to aid with wastewater treatment. For industrial facilities or organizations that have a need to separate oil from wastewater, oil/water separators are a key component to operational success. However, while oil/water separators are known to successfully separate oil from water, they often do not provide an optimal solution for removing oil following separation.

This white paper discusses the benefits of adding an oil skimming solution to an oil/water separator. It showcases how oil skimmers can enhance the efficiency of oil/water separators by removing oil following separation. Highlights include: reduced equipment maintenance needs, improved operations of down-the-line filtration equipment, enhanced environmental compliance, and increased cost savings.

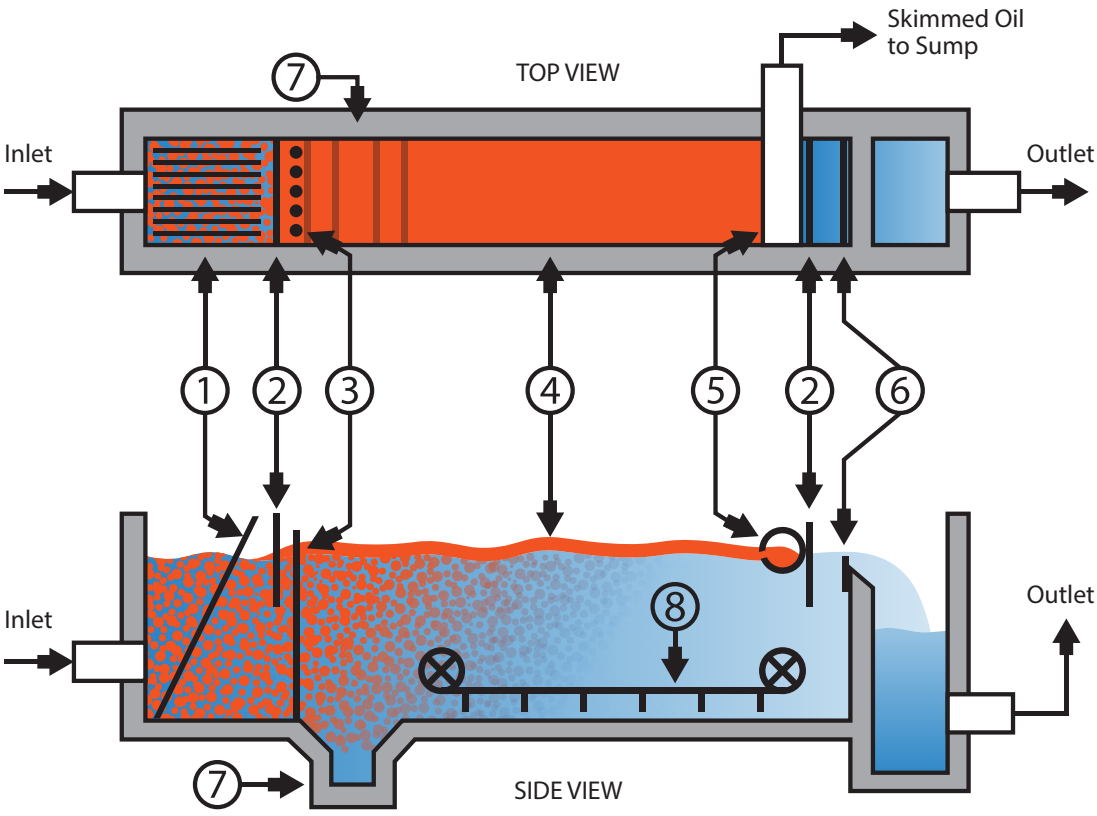
A Model 6V Brill® tube-type oil skimmer was ran for just a few hours on the right side of this API oil/water separator pit.

No oil skimmer on this side of the separator

Oil skimmer added to this side of the separator

Overview of common oil/water separators

Used in some of the toughest applications worldwide, oil/water separators are flow-through devices designed to separate oils from industrial wastewater and/or storm runoff systems.



The top and side views of a typical API oil/water separator.

1. Trash trap (inclined rods)
2. Oil retention baffles
3. Flow distributors (vertical rods)
4. Oil layer
5. Slotted pipe skimmer
6. Adjustable overflow weir
7. Sludge sump
8. Chain and flight scraper

Under certain conditions, oil will separate from water because of the difference in specific gravity between oil and water. Oil, which is lighter than water, separates from a fluid at a rate explained by Stoke's Law. The formula predicts how fast an oil droplet will rise or settle through water. This is based on factors such as the density and size of the oil droplet, the distance the object must travel, the size of the collection tank, the flow rate, and more.[2]

An oil/water separator is designed to consider these factors and subsequently, helps to create the ideal conditions needed for oil to separate from water. There are two primary types of oil/water separators: gravity separators, like API oil/water separators, and coalescing separators.

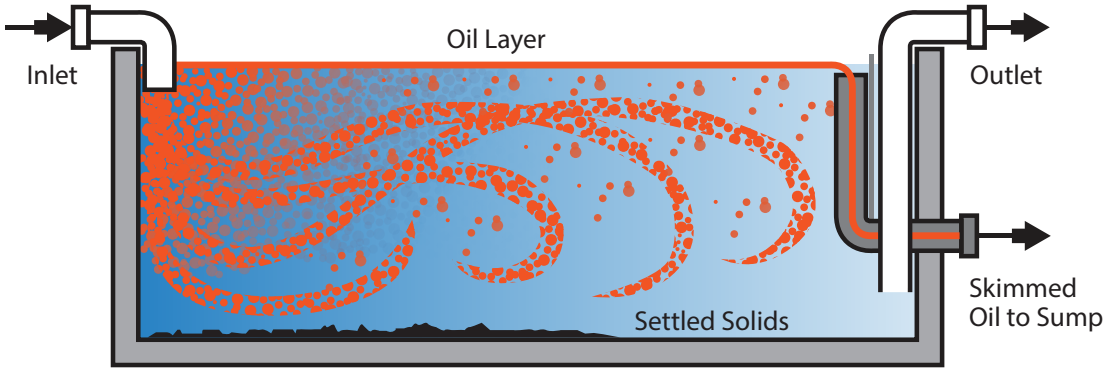
Overview of common oil/water separators - Continued

1 Gravity oil/water separators

This type of separator relies on the difference between the specific gravity of water and the specific gravities of oils, operating as follows:

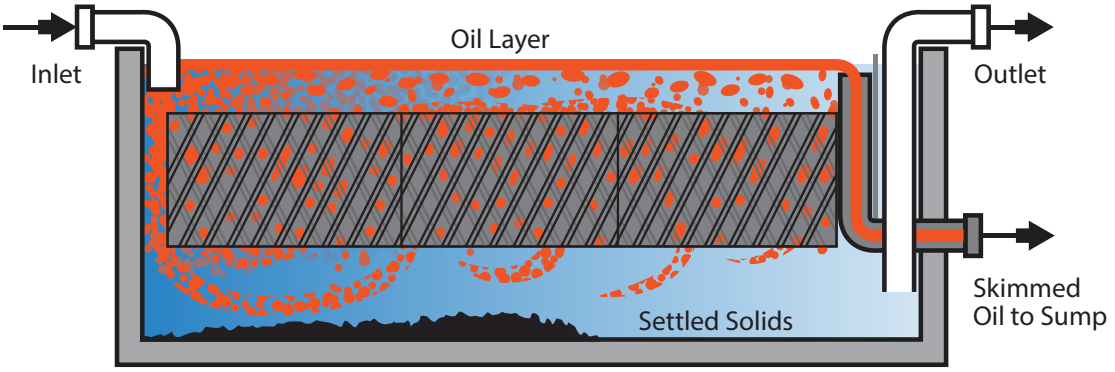
- Oily water enters the inlet of the separator
- Water turbulence is reduced when it meets the first baffle as most solids settle to the bottom of the separator.
- As wastewater flows to the second chamber near the middle of the separator, the oil droplets float to the top of the water but are prevented from exiting the separator by a second baffle; any remaining solids settle

1 Gravity oil/water separator



Gravity, or conventional separation, is the first and oldest type of separation. Coalescing, or parallel plate, incorporates coalescing plates for separation.

2 Coalescing oil/water separator



2 Coalescing oil/water separators

With coalescing separators, also known as parallel plate separators, the general flow of oil and water through the separator is similar to a gravity separator. However, in a coalescing separator, oil and water also flows through oleophillic media like polypropylene or Teflon®. This media is intended to slow the flow of the oil and water to allow oil droplets to bind together on the surface of the media. By coalescing, or binding together, the oil droplets become larger and more buoyant, further enhancing separation.[3]

Variables affecting oil/water separator performance

For many organizations faced with wastewater oil/water separation needs, traditional oil/water separators are often capable of initial separation. However, there are a number of variables that impact how well the separator functions:

Proper design

Oil/water separators must be designed to accommodate established maximum flow rates as well as variables such as storm water runoff so flow doesn't exceed design capacity. Excessive drainage of storm water to an oil/water separator could significantly impair its operation and efficiency.[4]

Maintenance

To function properly, oil/water separators require ongoing service and maintenance by trained personnel. Frequent system inspections are necessary to prevent operational and mechanical failures that may cause leaks or accidental discharge of oil into water.[5]

Emulsifying agents

In many industries, detergents and soaps are used to remove oily grime from equipment or vehicles. However, when these soapy wastewaters enter an oil/water separator, it takes significantly longer for oil to separate from water. And, excessive use of detergents can render a separator ineffective by completely emulsifying oils into the wastewater stream, allowing them to pass through the separator.

Sludge build-up

Sludge forms when particles and/or debris in the wastewater combine with oil droplets and settle to the bottom of the oil/water separator. This sludge often requires close monitoring. For example, under the Resource Conservation and Recovery Act (RCRA) sludge is deemed a hazardous waste if it exhibits certain toxicity characteristics. Oil/water separator users often need to take extra measures to maintain environmental compliance, such as reducing the accumulation of sludge by dry-sweeping floors before washing.[6]

Importance of oil removal from oil/water separators

When oil is not continuously removed from the surface of the wastewater in an oil/water separator, a number of issues can arise:

- Visual inspection of the separator and its components can be very difficult to conduct
- Heavy rain or water flow can exceed the design of the separator and wash out the oil build-up, causing spills and increased risk of groundwater pollution
- Oxygen is prevented from reaching the wastewater, allowing anaerobic bacteria to grow, thus plugging the separator plates and/or emitting foul odors
- As the water level is lowered for certain maintenance procedures, or as components are lifted out, the tank walls and interior components can become heavily oil-coated. And, if the unit is drained, residual oil can escape into the outlet piping and may unintentionally be released downstream upon refilling the separator

Faced with challenges like these, organizations often struggle with determining how best to optimize the performance of oil/water separators to also adequately remove oil.

Maximize effectiveness of oil/water separators with oil skimmers

When oil/water separators are paired with oil skimmers to remove the separated oil, facilities can realize several benefits, including:

- Cost savings, new potential revenue: Most oil skimmers require little to no manpower or supervision, so labor hours that may have previously been used to maintain equipment resulting from oil build-up, for example, are saved. And, plant personnel can focus on other, more profitable tasks and responsibilities. Also, depending on the application and type of waste oil, facilities can sell the skimmed oil for a profit. Often, oil recovered by skimming holds significant dollar value.

- Reduced maintenance needs, minimized operational downtime: Every time a facility pumps, plunges or moves oil within an oil/water separator, that action causes large oil droplets to become smaller (mechanical emulsion), increasing separation difficulty. By adding an oil skimmer to the separator to continuously remove oil at the time of initial separation, separator performance is optimized. Additionally, wear on separator filtration equipment is reduced, presenting minimal operational downtime and less need for maintenance.

- Improved operations down-the-line: As an added benefit, using a skimmer to remove oil on an ongoing basis also helps reduce wear on down-the-line equipment, improving the overall efficiency of the entire wastewater filtration system.

One of the biggest variables that can impact oil/water separator performance is neglecting to continuously and effectively remove the separated oil from the separator.

- Aid with environmental compliance: Removing oil 24/7 with an oil skimmer allows for an improved wastewater treatment process. Facilities that add an oil skimmer to an oil/water separator are often able to eliminate or reduce the need for chemicals in wastewater treatment. Additionally, wastewater that passes through a separator and a skimmer puts less pressure on the municipality or wastewater treatment plant processing the water—all of which must comply with the Clean Water Act that seeks to maintain water quality by controlling pollutant discharges.[7] When successfully skimmed, oil can also either be sold to be processed and recycled—or, in some cases, even reused to manufacture biodiesel—a fuel made from virgin or recycled vegetable oil, animal fats or fish oil.[8]

Tube-type oil skimmers deliver higher ROI, greater operational efficiency

For best results, those wanting to optimize their oil/water separation efforts should select a floating tube-type oil skimmer to recover oil from wastewater. Tube-type skimmers are designed to attract floating oil to the outside of a floating tube. As the tube is drawn across the surface of the fluid and through a set of scrapers, oil is removed and gravity-drained into a collection tank.

With a floating tube-type skimmer, there is no fixed path as there are with other types of skimmers, and all working parts are out of the water for safe, easy access and minimal maintenance. The tube floats freely around debris and continues to skim oil effectively even when water levels fluctuate. Tube-type skimmers also cover more surface area than any other skimming technology because the tube is on the surface collecting oil at all times. And, with the continuous movement of the floating tube, more oil is attracted to the tube for faster, more complete oil removal.

Numerous organizations in various industries have realized the added cost savings and efficiencies tube-type oil skimmers bring to oil/water separators. The two examples that follow highlight companies in the utility and transportation services industries that use customized tube-type oil skimmers to enhance the efficiency and operation of oil/water separators.

Power Plant Success Story: Brooklyn Navy Yard Cogeneration Partners

Brooklyn Navy Yard Cogeneration Partners is a 286-megawatt plant that produces 220 megawatts of electricity and up to 1,000,000 pounds of steam per hour. The facility's power plant has a waste stream, that includes oily water waste that travels to a sump and is then processed via an oil/water separator.

Oil entering the sump separates and rises to the liquid's surface. This oil remains on the surface and is not pumped to the oil/water separators as a series of floats that turn the pumps on and off maintain a low sump level. Over time, dirt and particles combine with the oil creating a sediment/sludge that is heavier than water so the oily sludge falls to the bottom of the sump where it is then pumped through the oil/water separators. The oil/water separators are designed to remove clean-floating hydrocarbons. However, since the sludge-laden hydrocarbons are heavier than water, they can get trapped inside the piping, oil/water separator and auxiliary controls; interrupting the facility's monitoring equipment and causing increased operating and maintenance costs.

Brooklyn Navy Yard was investing in in-plant personnel time and outside contractors to clean the separator and sump to keep them performing under the New York Department of Environmental Protection's required hydrocarbon level of 50 parts per million.[9] These protocols were not only costly but also time consuming. In an effort to reduce the operation and maintenance costs, the company began researching alternative maintenance solutions.

Within one month of installation of a tube-type oil skimmer, plant personnel saw an immediate reduction in hydrocarbon concentration in the wastewater stream leaving the plant. It went from a continuous 15 to 25 parts per million to zero. The company took samples of the wastewater stream and sent them to a lab, which confirmed a very low level of hydrocarbon presence. Findings from the facility's online continuous hydrocarbon analyzer and the lab results confirmed that the oil skimmer is the reason for the wastewater's improvement. After being in place for 20 months, Brooklyn Navy Yard saw a substantial decrease in maintenance costs. The plant has saved approximately $30,000 to $40,000 annually between in-house and contractor labor, and replacement parts for monitoring equipment.

Model 6V Brill® Frame Mount Oil Removal System with free-floating collector tube
(skimmer safety cover removed for photograph)

Transportation Services Success Story: Food Express, Inc.

As a transporter of food-grade products with several locations and equipment stationed throughout the Northwest U.S., Food Express, Inc. meets the needs of bulk-product shippers throughout the U.S. In addition to their transportation services, Food Express also operates a food-grade tank-washing facility in Vancouver, Washington. As a result of the facilities truck tank washing process, the facility's wastewater was becoming contaminated with oil. The city of Vancouver required Food Express to treat their wastewater to meet municipal regulations or risk being shut down.

The company designed its own 2,500-gallon aluminum oil/water separation and holding tank and attached a tube-type oil skimmer using a pre-fabricated mounting system. The skimmer removes, on average, 2,000 gallons of oil each week. After installation of the oil skimmer, analysis of the wastewater indicated there were no detectable levels of oil in the water. Additionally, Food Express sells the recovered oil to a farmer who works in the biodiesel industry.

Regardless of the industry, oil skimmers have proven their worth when it comes to maximizing the efficiencies of oil/water separators. Designed to improve wastewater treatment by effectively removing oil following separation, oil skimmers can increase cost savings, lower maintenance needs, aid with environmental compliance, and reduce wear on down-the-line filtration equipment.

For optimal results, a quality tube-type oil skimmer, such as those offered by Oil Skimmers, Inc., will remain in operation for decades. Tube-type oil skimmers from Oil Skimmers, Inc. feature a unique design and an extremely rugged construction that encompasses a cast aluminum housing, wear-resistant ceramics, internal gearing and high-strength steel and bronze for a dependable skimming solution, 24/7.

For nearly 50 years, Oil Skimmers, Inc., has designed and installed oil skimming solutions for more than 30,000 applications. This breadth of experience has made us the leader in designing and delivering oil removal solutions for even the most diverse and demanding applications. Our oil skimming solutions can be custom engineered to meet your facility's needs. From the basic to the complex, we have developed complete waste oil recovery solutions for facilities both large and small that are easy, efficient, maintenance-free and effective.

With Oil Skimmers, Inc., you are not only guaranteed the very best in oil removal technology, you are also provided superior customer service. We meet with our customers, visit their facilities, and we make it our mission to help solve their issues, address their challenges and devise solutions that will meet their individual needs.

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[4] US Army Corps of Engineers (January, 2010). AED Design Requirements: Oil/Water Separators (http://www.aed.usace.army.mil/EngineeringDocuments/AED%20Design%20Requirements%20-%20Oil-Water%20Separator%20-%20Jan10.pdf)

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