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Choosing the right oil skimmer for economical fluid management

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Oil skimmers are simple, dependable and effective tools for removing oil, grease and other hydrocarbons from water. Although designs vary, all oil skimmers rely on the fluid properties of specific gravity and surface tension. Most use a moving medium to remove floating oil from the fluid's surface, as shown in Figure 1. (The exception is a floating suction skimmer.) Floating oil and grease cling to skimming media more readily than water, and water has little affinity for the media. This allows skimming media in the shape of a belt, disk, drum, etc. to pass through a fluid surface to pick up floating oil and grease with very little water. This oily material is subsequently removed from the media with wiper blades or pinch rollers.

Grease skimming involves higher viscosity hydrocarbons. These skimmers must be operated at temperatures that keep the grease fluid. For example, the patented Abanaki Grease Grabber is equipped with heating elements that keep the grease in a liquid state for easy discharge from the skimmer. However, if floating grease has formed into solid clumps or mats in the tank holding the skimmer, a spray bar, aerator or other mechanical apparatus can be used to break up grease and facilitate skimming.

Often, a skimmer by itself can achieve the desired level of water purity. In more demanding situations, skimming is a cost-effective means of removing most of the oil before using more complicated and costly treatments such as coalescers, membrane filters and chemical processes.

Typical applications for industrial oil skimmers include: wastewater sumps; coolants and cutting fluids; heat treating; parts washers; food processing facilities; parking lots, garages and service facilities; outdoor ponds, lakes, basins; and recovery/monitoring wells.

Choosing the right skimmer

There are several types of industrial oil skimmers. Choosing one best suited for your application will maximize oil removal while minimizing capital outlay and skimmer operating costs. First, define the application in terms of the following characteristics:

Figure 1. Belt skimmer removing grease from a wastewater sump.

Operating conditions: Most skimmers have a moving medium, and possibly other parts, immersed in the liquid. The performance and life of the pick-up medium, wiper blades, pulleys, etc. are affected by different conditions. These conditions include temperatures in and out of the liquid, pH of the solution, and the presence of solvents or other reactive chemicals.

Hazardous materials: Applications involving flammable materials or explosive vapours require the use of explosion proof (or air driven) motors and controls.

Temperature/Viscosity: All skimmers require floating oil to be in a liquid, free-flowing state. If the oil congeals or solidifies at ambient temperatures, the tank and/or skimmer will require heaters to maintain fluid flow. This is especially true at temperatures low enough to freeze water. A heater option is a must if a skimmer is to be used outdoors in freezing temperatures.

Removal rate: Skimmers usually have an oil removal rate expressed in gallons per hour. The rate varies with oil viscosity, so most manufacturers rate skimmers using SAE 30 weight motor oil at 65° F (18°C.) If a manufacturer doesn't specify the test oil for its rating, or your application involves a much different viscosity, it is wise to ask for additional test data. When specifying removal rate, it is better to err on the high side to allow for peaks in the oil influx.

Skimmed water content: All oil skimmers pick up some water with the oil they remove. Some designs, particularly suction skimmers, pick up more water than others. High water content increases oil recycling and disposal costs. Generally, the ratio of water-to-oil decreases with thicker films of floating oil and slower moving pick-up media. A concentrator or decanter (Figure 2) installed at the skimmer discharge port provides secondary oil/water separation that can reduce water content to nearly zero.

Residual oil: A skimmer continues to remove oils as long as they are present. Depending on oil influx rate and the skimmer's removal rate, residual oil in the water may be as low as a few parts per million. When residual oil reaches this level and further reduction is required, it may be more practical to use a secondary removal method following skimming, such as membrane filtration.

Portability: Skimmer portability is a plus in some applications. For example, in plants, mobile equipment service shops, and at remediation sites, a portable skimmer can sometimes service multiple machines, sumps, or wells.

Tank or sump characteristics: The location, shape, and capacity of a tank or water impoundment are major factors in choosing the right skimmer. Also consider fluctuations in water level, turbulence and possible emulsions. Although skimmers do not cause emulsions, they can have trouble removing certain types.

Size/Design: Oil and water can emulsify when subjected to turbulence and other mechanical agitation. Avoid this by having water return to the tank below the liquid surface at as low a velocity as practical. Make sure your tank or sump provides quiet areas, weirs, and sufficient volume to allow adequate time for oil/water separation.

Shape: Tanks without nooks and crannies for oil to accumulate in are best. If you have an irregular shape, put the skimmer where the largest amount of oil accumulates. Consider a means of directing

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oil towards the skimmer such as a floating boom or baffle plate.

Location/Installation: The physical location and characteristics of the tank and collection container are important. Does skimmed material need to be pumped from the skimmer to the container? Will skimmer access for periodic maintenance be a problem? How much mounting space is available? Are tank or container modifications required?

Types of oil skimmers

For industrial oil skimming, there are six basic designs commonly used in moving media skimmers.

Belt Skimmers: Belt-type skimmers use an endless belt of stainless steel, elastomer or polymer medium, which is lowered into the tank or vessel to be skimmed. The belt passes through resilient wiper blades where the oil is removed from both sides of the medium. Its removal rate is not affected by length. Length is chosen to assure contact with the liquid at its lowest level. The belt length should also allow easy mounting of the skimmer where oil discharge is convenient, and assure easy access for routine service. Lengths up to 100 ft. or more are possible.

Mop Skimmers: These skimmers use an endless medium shaped like a rope with mop-like tendrils that pick up the oil. As the medium leaves the liquid and enters the drive unit, it is pressed and wrung out with pinch rollers. For higher viscosity oils, the medium tends to mat down and lose effectiveness. A decant system is a must for these units, as water pickup can be very high. Also, replacement mops can be very expensive so check prices on replacements before purchasing.

Large Tube Skimmers: Tube skimmers use a floating plastic hose that snakes out over the surface of the liquid and is then drawn back through the drive unit where oil is removed. This design requires a relatively large amount of fluid surface area for proper operation. Length considerations are the same as for belt skimmers; a typical tube diameter is one inch.

Mini Tube Skimmers: These are very similar to the large tube units, but typically use either a 3/16" or a 5/16" diameter tube. The pickup rate varies from one quart/hour to 1.5 gph, depending on diameter. These units are fairly compact, and can fit in tight spots. The better units will have the motor mounted underneath, to bring room required over the lip of the tank down to near zero. The 5/16" diameter is preferable as it has enough stiffness to not drag on the housing and prematurely wipe off oil when being drawn into the unit.

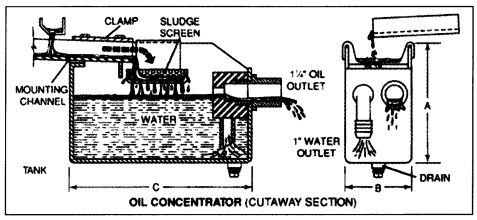

Figure 2. A concentrator or decanter can further reduce the oil content of skimmed water.

Drum/Barrel Styles: These are similar to the disk type, but use a rotating drum shaped medium. Compared to disk types, they are usually more rugged and have higher removal capacity. These units can also be rendered ineffective by fluctuating fluid levels.

Disk Skimmers: These skimmers rotate a disk shaped medium through the liquid. Oil is wiped off and discharged into a collection container in a manner similar to belt skimmers. It is important to consider reach, the portion of the disk that actually gets immersed, when looking at a disk skimmer. Less disk area in the fluid, means less oil removed. Obviously, fluctuating fluids can be a real problem for disk skimmers. Also, it is important to look at how much of the disk the wipers are actually wiping. If the wipers only wipe two inches from the edge, then any reach into the fluid beyond two inches is wasted. As a result, removal capacities for disks can be relatively low. Since the disk must always be touching the fluid, its diameter must be sized accordingly.

Besides moving media skimmers, there also are suction types. These come in several forms, but all have a floating intake. They are most suitable for relatively thick layers of oil (1/4"); otherwise they tend to ingest large amounts of water. Some equipment will actually emulsify oil due to churning as it passes through the suction pump. In most cases, a suction skimmer requires the addition of a coalescer, or a decanting unit to be effective.

Water contaminated with oils and other hydrocarbons continues to be a problem for industrial firms that need to manage their discharge. When properly selected and applied, oil skimmers are highly economical solutions for separating oil from water to allow its reuse or safe disposal.

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