Tramp Oil Removal and Control

Tramp oils, oils in a metalworking system (by other than intent) are major contributors to metalworking fluid failure. Typically these oils come from machine way, spindle, gear box, or hydraulic lubes, cutting oils, or rust preventives carried into the machine from previous operations.

The adverse effects of tramp oil are proportional to the amount of tramp oil present and are also affected by the type of the tramp oil and the fluid that they are mixed with. The problems are most pronounced on those machines which leak the most oil as a percentage of the sump size and/or have fluids that tend to emulsify the particular oil(s) in question.

As bad as these effects are on "individual sump" machines, they are even worse in central systems where reduced carryoff and continuous recirculation through powerful pumps keeps the oil emulsified. (See Master Fluid Solutions' Technical Bulletin, "Metalworking Fluid Failure Mechanisms – Tramp Oil".)

In many ways the amount of damage done to a system is directly proportional to how much tramp oil gets into the system, how long it stays in the system, and how tightly it is held in the system. The focus of this Technical Bulletin is to look at tools and techniques to remove tramp oil once it has gotten into the system. Obviously the best solution to this problem is not to put tramp oils into the system. What does get into it should be an oil that generates the least possible damage (see Master Fluid Solutions' Technical Bulletin, "Machine Tool Lubrication - Grease and Oil Compatibility").

Once you have decided that there is a tramp oil problem it will have to be addressed, at least in part, by some sort of a tramp oil removal system. The question becomes "what kind of a system?" To answer that you need to know what kind of tramp oils is in the system(s) that you want to treat.

This is not nearly as complex as it first appears. There are three different types of tramp oil. The one(s) that exists in a specific situation is a function of how hard the fluid is working in the specific system (sump size, pump flow rate and machine duty cycle, etc.), how miscible the tramp oil is, and how much surface activity (wetting or washing characteristics) the specific fluid has.



Master Fluid Solutions' XYBEX® Srounger® and Scrounger Jr.®

The types or conditions of the tramp oil are most often described as:

1. "Free" tramp oil or tramp oil that is free floating on the surface of the system as it exists at the time. Either in circulation or quiescent (shut down and quiet).
2. "Dispersed" tramp oil or tramp oil that is mechanically spread throughout the system. (Given enough time this material will separate and typically rise to the surface.)
3. "Emulsified" tramp oil is oil that has become dispersed in the fluid in such a manner that the emulsion (dispersion) is stable over an extended period of time.

Numerous techniques and devices have been developed to remove tramp oil from metalworking solution. Depending on the specifics of the situation and how the equipment is employed will determine the effectiveness of the particular plan and equipment. It is important that all these pieces of equipment only work when the tramp oil or the tramp oil and fluid mixture reach them and the fluid is in the proper condition to be treated when it reaches the equipment.

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"Vacuum skimming" is a technique where "free floating" tramp oil is removed from the surface of a tank by holding a suction device so that it just "sucks up" the "free floating" tramp oil, leaving most of the working solution in the tank.

Oil belts, oil ropes, and oil wheels are effective tools in removing "free tramp oil" – oil which is resting on top of the tank. They will not work on dispersed or emulsified tramp oils. This type of device works best when:

1. The fluid has been quiescent for a sufficient enough time for most or all of the "free floating" and mechanical dispersed tramp oil to rise to the surface.
2. The surface of the fluid is very calm, so the turbulence does not break up the oil slick.
3. The oil slick can be brought into contact with the removal surface wheel, belt, or rope.
4. The removal surface stays relatively clean.

Coalescers will remove both dispersed and free tramp oil. They are, in effect, special tanks where oleophilic (oil attracting) media or plates coalesce (merge small oil droplets into large oil droplets) the dispersed oil so that it can be skimmed off. These coalescers increase the effective size of the sump and as flow rates are low there is plenty of quiescent time for the oil to "split out" and rise to the surface. Coalescers are very effective when the tramp oils are not readily soluble in the working solution. Even a small amount of detergency in either the fluid or the oil will reduce the effectiveness of a coalescer. The classic use for coalescers is to separate "bilge and ballast" water (often salt water) from residual and spilled oil in the bilges and tanks. The efficiency of coalescers is similar to that of a settling tank with a similar retention time.



Left: High-Speed Disc-Bowl Centrifuge. Below: Master Coalescer

Master Fluid Solutions' XYBEX® High-Speed Disc Bowl centrifuge and XYBEX® Master Coalescer

High-speed disc-bowl centrifuges (liquid from liquid) are by far the most effective tramp oil removal device and are the tool of choice in managing tramp oil in central and recycling systems. These liquid from liquid centrifuges will separate two immiscible (fluids that don't mix) from each other as long as they have different specific gravities (weight per gallon). They will remove all three types of tramp oil; free, dispersed, and emulsified, if you can get the tramp oil to the centrifuge. They are, in effect, super efficient settling systems where the centrifugal force created by the turning bowl is substituted for the pull of gravity. In fact, centrifuge size is often spoken of as a unit generating X number of gravities (in excess of 4000 for those used in metalworking fluids) at a flow rate of Y gallons per minute.

Thus a centrifuge that has a bowl capacity of 1 gallon a flow rate of 60 GPH at 4000 gravities will have essentially the same affect as placing one gallon of fluid in a tank ¼ inch deep for 4000 minutes approximately 3 days.

Notes:

1. When using skimmer technology, if they are run in situations where there is not fairly high levels of tramp oil they will have a tendency to "drag out" working solution.
2. The tramp oil removed from metalworking systems often has very high levels of bacteria. Therefore, it is critical that these tramp oil removal systems be kept clean and that the oil sludge not be returned to the "working solution."

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