

CIMCOOL[®]

Technical Report

Milacron Marketing Co. | Consumable Products Division | Cincinnati, Ohio 45209

FUNDAMENTALS OF METALWORKING FLUID RECYCLING

High quality metalworking fluids can offer significant benefits to manufacturing operations, including increased productivity and tool life and improved part quality. However when not managed properly metalworking fluid concentrate and disposal costs can add up quickly. In order to help control these costs many plants consider metalworking fluid recycling. When implemented correctly a recycling program can be an effective part of an overall fluid management system. At the same time if the program is not properly maintained recycling could potentially lead to corrosion on parts and machine tools, poor tool life, unpleasant working conditions, and ultimately increased operating costs. Therefore it is important to fully understand the process before embarking on any recycling program.

Recycling Realities & Misconceptions:

People often think of recycling as a magical fountain of youth – the used product goes in one side and comes out “brand-new” on the other. This technical report will attempt to remove some of the misconceptions associated with metalworking fluid recycling.

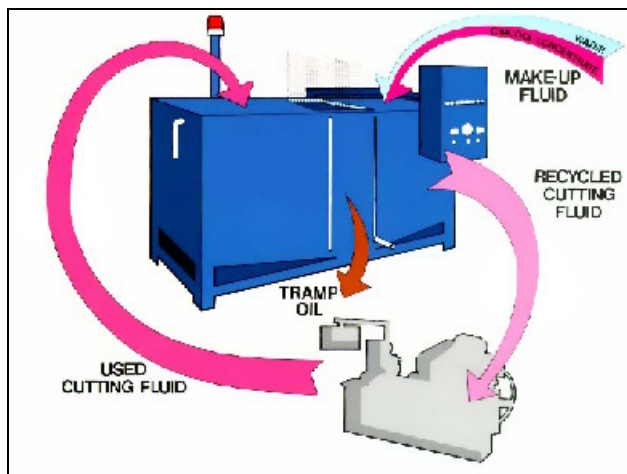


Fig. 1

Figure 1 illustrates a basic recycling system. Rather than “fluid recycling” a more appropriate term to describe the

process might be “fluid reconditioning”. In its basic form fluid recycling involves removing the fluid from the machine sump, circulating it through the recycling unit repeatedly to remove the foreign contaminants (dirt and oil), adding fresh metalworking fluid concentrate to replenish key components such as biocide, lubricants and corrosion inhibitors, and then returning the fluid to the machine tool.

Following a program such as this extends the useful life of the coolant, thereby decreasing both concentrate usage and waste fluid disposal costs.

An important point that needs to be remembered is that even with recycling all fluid will eventually require disposal, and if the condition of the fluid in the machine tool is allowed to deteriorate too much no recycling system will be able to return it to a useful form. A good bench mark of an effective recycling program is reducing concentrate usage by one-third while leaving manufacturing operations unaffected.

Requirements for an effective recycling program:

In order for this process to be effective the system must include provisions for:

- Solid particle filtration
- Tramp oil separation and removal
- Fresh concentrate replenishment
- Microbial control

The first two requirements can be accomplished through the use of filter paper or bag filters, oil skimmers, centrifuge units, or coalescers.

This equipment can be housed in a fixed recycling unit where the used fluid is transferred to the recycler, or a portable recycling unit which can be moved to each machine sump to individually process the fluid. Usually the recycling unit has separate tanks for “dirty” fluid that has been removed from the machine tools and “clean” fluid that has been processed through the recycler. The two tanks are connected together to allow the fluid to circulate between them ensuring thorough cleaning. Fresh concentrate addition is best done through the use of a fluid proportioner that can be adjusted to control the concentration of makeup fluid.

The filter paper, in bag or sheet form, is used to remove solid contaminants from the fluid. Common filter paper mesh sizes are 20-micron to 100-micron, depending on the particulate size produced during the manufacturing operations. A mesh finer than 20 microns can lead to product components being stripped from the fluid and therefore should be avoided.

Oil skimmers are usually set up in a quiet part of the fluid tank where oil has time to float to the top of the fluid and

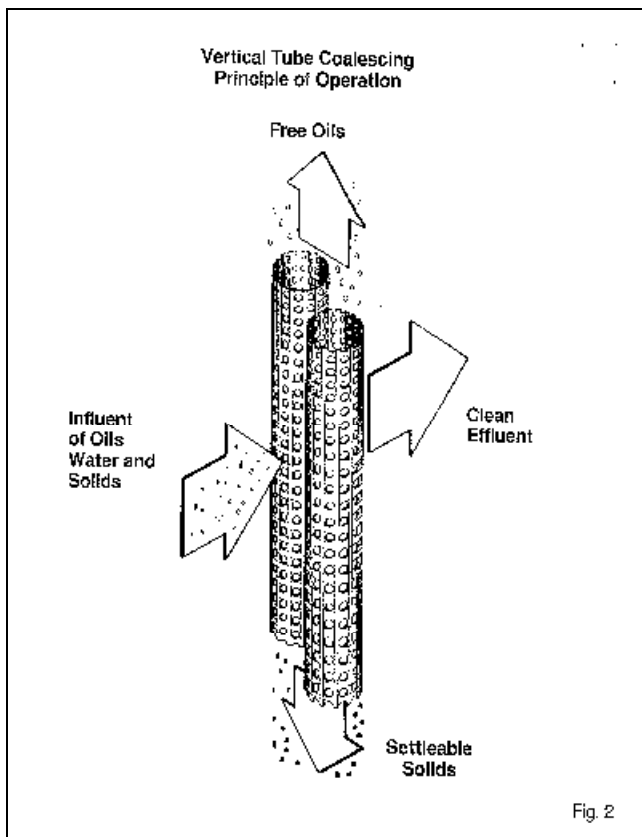
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from there can be easily removed by the skimmer. Belt skimmers and oil wheel are two types commonly used.

Coalescers come in many formats but the principles behind their operation are the same. Figure 2 shows a vertical tube type setup - the fluid in the recycling unit is made to pass through the plastic coalescing membranes where both dirt and oil can be effectively separated from the fluid.



In addition to these equipment requirements it is imperative that the condition of the fluid, before and after recycling, be determined in order to prevent large quantities of unfit fluid from entering the recycling system, or being returned to the machine tool.

Water quality:

One of the most important factors determining the success of a recycling program is the quality of the water used to mix the metalworking fluid. Naturally occurring minerals in the water will build up over time as the metalworking fluid is reused. If allowed to increase too much these minerals can promote corrosion and mix instability. Starting with water with a high mineral content greatly accelerates this process

therefore the quality of water available in the plant should be tested before recycling is implemented. In hard-water areas a water treatment system may be required. More information on this topic can be seen in the Cimcool Technical Report "The Effects of Water Impurities on Water-based Metalworking Fluids" available on www.CIMCOOL.ca

Metalworking Fluid Selection:

Another factor affecting the ability to recycle your metalworking is the type and quality of the metalworking fluid itself. A lower quality fluid will quickly degrade and will not be able to stand up to the rigors of repeated recycling. As well synthetic and semi-synthetic fluids reject tramp oil much more readily than soluble oil type products thereby allowing for much easier filtration of contaminants. Contact your fluid supplier to determine its suitability for recycling.

"Do's" and "Don'ts" of fluid recycling:

- ✓ Do – Assign responsibility for maintaining the recycling system to one person, or group of people, to ensure all required tasks are completed
- ✓ Do – monitor the concentration and pH of fluid *before* returning it to the recycler
- ✓ Do – monitor the concentration and pH of fluid *before* returning it to the machine sump
- ✓ Do – follow a set machine cleanout/recycling schedule
- ✓ Do – add a minimum of 50% fresh makeup fluid to all batches of recycled fluid
- ✓ Do – involve your metalworking fluid supplier as you begin to consider recycling
- ✗ Don't – recycle used fluid outside of supplier's recommended parameters
- ✗ Don't - recycle fluid that has been contaminated with mop water, etc - no recycling system will be able to remove contaminants such as this
- ✗ Don't - return fluid to the machine sump outside of supplier's recommended parameters

Overall Benefits:

Operating a successful recycling program requires extra discipline in fluid maintenance making it is possible to achieve improved control over your fluids. If the guidelines in the report are followed metalworking fluid recycling can help reduce overall operational costs and improve the working environment on the shop floor. ■

NOTE: For more information on metalworking fluid recycling please contact Cimcool Technical Services at 1-888-254-1919.