

# CIMCOOL<sup>®</sup>

## *Technical Report*

Milacron Marketing LLC | Cimcool Fluid Technology | Cincinnati, Ohio 45209

### *HIGH-PRESSURE/ HIGH-VOLUME DELIVERY OF METALWORKING FLUIDS*

Metalworking fluids have typically been provided to the work zone at pressures below 100 psi. Conventional delivery systems use this relatively low pressure to “flood” the work area with fluid. High-pressure and high-volume metalworking fluid delivery systems provide pressures from several hundred to several thousand psi with volumes up to 50 gpm delivered to the workpiece.

#### **Benefits**

Many of the basic functions that metalworking fluids perform, such as cooling, lubricating and chip removal, can be improved with the use of high-pressure and high-volume fluid. The metalworking process can be cooled more effectively when the fluid penetrates deeper into the work zone. Lubrication is provided into areas that may otherwise be unreachable. The high kinetic energy applied to the fluid can force chips out of the cut zone and prevent chip re-cutting.

#### **Process Considerations**

Utilizing high-pressure and high-volume equipment with metalworking fluids will require certain process improvements. The machine needs to be enclosed to protect the operator and contain the fluid. Additional guarding may also be required to keep fluid away from hydraulic and electrical components. Extra precautions need to be taken to provide for operator safety, due to the high energy levels, which are applied to the fluid. Safety interlocks are necessary to automatically shut down the high-pressure pump, whenever the enclosure is opened.

#### **Metalworking Fluid Considerations**

Extra demands are placed on metalworking fluids that are used in high-pressure and high-volume applications. The fluids used for these applications must possess strong properties in the following key areas:

#### **Foam**

A high-pressure pump with rapid circulation of fluid can cause high levels of agitation. Metalworking fluids for these applications must be designed to be inherently low foaming. A sufficiently large fluid reservoir is also needed, so that pump cavitation cannot occur. A fluid retention time of 10 minutes is recommended to minimize turbulence and maximize filtration. (For example, a 50 GPM filter system would require a 500 gallon tank for a 10 minute retention time.)

Since metalworking fluids are designed to provide lubrication and good cleanliness, it is not surprising that foam can be a “side effect”. Fluids that generate large foam bubbles tend to break easily. The smaller bubbles can form stable foam, that is more of a problem. Antifoam or artificially hardening the water (with the additive Foam Depressant ) may be a temporary fix, but long term use or overuse can lead to mix instability and ultimately more foam.(see below)

Air entrainment, or the “cola” effect, is due to mechanical agitation (such as pumps, grinding wheels, and waterfalls) forcing dissolved air into the fluid. Generally it quickly dissipates, though it can cause the mix to become cloudy and/or misty.

#### **Mix Stability**

The high energy imparted to the fluid by a high-pressure pump is rapidly dissipated when the fluid strikes the tooling fixtures and workpiece.

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This type of impact requires a chemically stable fluid that can withstand this rough physical treatment. Good water quality and minimizing fluid contamination is also important to maintain mix stability.

## Thermal Resistance

During the operation of high-pressure equipment, the fluid absorbs thermal energy from the pump, in addition to the operation itself. The fluid must be resistant to reasonable levels of thermal fluctuations. Temperature variations must be minimized in order to prevent dimensional changes in the workpiece. Rapid removal of cut chips from the work zone is needed to reduce the amount of heat that the fluid will absorb. The high-pressure pump should only be run when needed, in order to minimize unnecessary thermal input into the fluid. Primary and auxiliary fluid pumps should be off, when not in use. A larger fluid reservoir can also help to dissipate the thermal energy load. A fluid chiller may be necessary, for continuous operations and high metal removal rates.

## Shear Stability

Metalworking fluids need to be tolerant to the shearing action of a high-pressure pump. Lubricants used in the fluids need to withstand the mechanical action of the pump. The high-pressure pump should also be cycled to run when needed, and should not be deadheaded, when it is not in use.

## Metalworking Fluid Recommendations

The selection of the proper metalworking fluid for any operation must be based upon a review of all aspects of the process. Operations using high-pressure and high-volume fluid are no exception. Some examples of low foaming CIMCOOL<sup>®</sup> Metalworking fluids are: CIMTECH<sup>®</sup> 310, CIMSTAR<sup>®</sup> 3800, and CIMPERIAL<sup>®</sup> 16EP. These are synthetic, semisynthetic and soluble oil fluids respectively. Consult your regional CIMCOOL<sup>®</sup> Technical Service Engineer for specific recommendations, or call Milacron CIMCOOL<sup>®</sup> Technical Service at 513-458-8199.