

# CIMCOOL<sup>®</sup>

## Technical Report

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

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

Metalworking fluids have typically been provided to the work zone at pressures below 100 psi (7 bar). Conventional delivery systems use this relatively low pressure to “flood” the work area with fluid. High-pressure metalworking fluid delivery systems provide pressures that range in the hundreds to thousands (psi), with higher volumes of coolant 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 fluids. The metalworking process can be cooled more effectively when the fluid penetrates deeper into the work zone. The fluid is delivered 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**

Using high-pressure delivery systems with metalworking fluids will require certain process changes. 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. You should always consult with the manufacturer for safe operation of the equipment.

#### **Metalworking Fluid Considerations**

Extra demands are placed on metalworking fluids that are used in high-pressure 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 extreme levels of agitation. Metalworking fluids designed for these applications must be inherently low foaming. A sufficiently large fluid reservoir is needed to prevent pump cavitation and supply enough fluid based on machine horsepower. An “ideal” 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.) It is recommended to put an automatic shutoff on the system to prevent foam caused by pump cavitation.

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 more easily. Smaller bubbles can form stable foam that is more of a problem. Antifoam or artificially hardening the water (with an additive like CIMCOOL<sup>®</sup> Foam Depressant ) may be a temporary fix, but long term use or overuse can lead to mix instability and ultimately more foam.

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

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fluid strikes the tooling fixtures and workpiece. 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 must withstand the mechanical action of the pump. The high-pressure pump should be cycled to run only when needed, and should not be deadheaded, when it is not in use.

## Equipment Considerations

The installation of high-pressure fluid delivery equipment introduces a tremendous amount of thermal energy into the metalworking operation. The performance of the application begins with the selection of the equipment which establishes the key operating parameters of pressure and flow rate. Supporting equipment is also required for the continuous removal of chips from the operation. Next, it is necessary to operate the system in a way that minimizes thermal buildup. Run the high-pressure coolant pump only as needed. A chiller may be required to control

metalworking fluid temperature for continuous operation. Since fluid make-up rates could be higher in a high-pressure application, it is important to control the water quality to avoid excessive mineral buildup. Also, monitor the metalworking fluid for proper mix concentration in order to maintain optimum performance.

## 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 fluids are no exception.

Milacron recommends the use of one of the CIMCOOL<sup>®</sup> HFP with FACT fluids designed specifically for high-pressure applications. These are:

CIMTECH<sup>®</sup> 320 HFP with FACT<sup>™</sup>  
CIMTECH<sup>®</sup> 510Z HFP with FACT<sup>™</sup>  
CIMSTAR<sup>®</sup> 70 HFP with FACT<sup>™</sup>  
CIMSTAR<sup>®</sup> 60C HFP with FACT<sup>™</sup>  
CIMPERIAL<sup>®</sup> 16EP HFP with FACT<sup>™</sup>  
CIMPERIAL<sup>®</sup> 1060CF HFP with FACT<sup>™</sup>  
CIMPERIAL<sup>®</sup> 1070CF HFP with FACT<sup>™</sup>

In addition, many CIMCOOL<sup>®</sup> synthetic products (CIMTECH<sup>®</sup>) are very low foaming.

Consult your regional CIMCOOL<sup>®</sup> Technical Service Engineer for specific recommendations, or call Milacron CIMCOOL<sup>®</sup> Technical Service at 513-458-8199.