

METALWORKING FLUIDS FUNDAMENTALS

Water Soluble Cutting and Grinding Coolants

As the cutting edge of the tool penetrates the workpiece, temperature and pressures in the "shear zone" cause plastic deformation at the tool tip. A chip is formed which then slides up the face of the tool.

Coolants function to remove heat of internal friction from the shear zone; heat of sliding friction from chip/tool interface; and heat of sliding friction between tool/flank and the freshly cut surface.

The coolant must wet, penetrate, and dissipate heat efficiently. It must also create the chemical/lubricating films needed to reduce friction and protect against pressure welding of workpiece fragments to tool surfaces.

Cutting Oils

During the cutting operation, pressures and temperatures are high enough at the tool tip for pressure welding to take place. The welding at the tool tip is called the BUE (Built-Up Edge) and it dulls the tool. Cutting oils function to minimize or control the BUE by chemical cooling.

Additives such as chlorine, sulfur, phosphorous and fat react at certain temperatures to form and reform adsorbed films which minimize metal-to-metal contact and reduce pressure welding, thus controlling the BUE.

Poor finish is the result of BUE particles breaking off and abrading the freshly cut surface.

How well the cutting oil cools chemically is a function of the product's chemistry.

Housekeeping Tips

- Choose your coolant carefully. Investment in quality saves production dollars.
- Always pre-mix original fill and make-up solution. Don't guess! Don't just add water! Pre-mixing gives positive control of dilution and assures uniform performance. Problems of rusting, hardness build-up or bacterial attack are minimized.
- Check concentration regularly. Refractometer checks insure against coolant solutions getting out of control.
- Change and clean machines regularly.
- All coolants perform more efficiently with regular change periods.
- Put clean coolant into an antiseptically clean machine. This lengthens coolant life many times over. Use machine cleaner at every change period. It will save you money!

GENERAL TRENDS IN COOLANTS

	Heavy Duty Performance	Foam	Tank Life	Oily Residue
	Most	Most	Shortest	Most
Soluble Oil	↑	↑	↓	↑
Semi-synthetic	↑	↑	↓	↑
Synthetic	↑	↑	↓	↑
	least	least	longest	least