TALKING ABOUT METALWORKING LUBRICANTS

Metalworking lubricants perform several functions. They protect or improve surface finish, provide corrosion protection, reduce frictional forces, cool the tooling, prevent metal pick-up on the tooling, and they flush away the chips created in a machining operation. To perform these functions they contain complex blends of a carrier, lubricity additives, corrosion inhibitors, biocides, and antifoams.

The major components of a lubricant are the carrier, lubricity additives, and in emulsions an emulsifier. Carriers are petroleum oils, water, or solvents. Their function is to provide cooling, act as a vehicle for the other additives, and flush away chips. Water based lubricants are preferred in metal machining because water removes heat caused by friction and metal removal almost twice as fast as oil. Solvents are used in vanishing lubricants that leave no or little residue.

Lubricity additives

1. Petroleum oil
2. Polar additives
3. Extreme pressure additives

Petroleum oils by themselves are not very good metalworking lubricants. Their lubricating films can take only light loading. They are use on single spindle automatics such as screw machines, lathes where free machining brass and steels are the main metals being machined. They are seldom used in stamping and drawing.

Polar additives are of two kinds: those derived from fatty oils such as lard oil and long carbon chain polymers. They have a positive charge at one end of the molecule and a negative charge at the other end. The negative end is attracted to the positive charged metal, and aligns itself at right angles to the metal surface. The positive ends of the molecules, both on the metal being worked and the tool (cutting or die) repel each other, preventing metal-to-metal contact. This is termed polar lubricity.

Extreme pressure additives are sulfurized or chlorinated fatty oils, fatty oils that have both sulfur and chlorine on the same molecule, and phosphorus compounds. They function by reacting with the metal surfaces of the cutting tool or die to form a sulfide, phosphide, or chloride compound. These compounds have plate like structure, similar to graphite, allowing the work piece and the tool to slide against each other. This reduces friction and in the case of metal cutting reduces the cutting force and in stamping and drawing lowering

friction and controlling metal flow into the die. Phosphorus compounds also provide antiwear properties.

ADDITIVE DECOMPOSITION

ADDITIVE	TEMPERATURE F (C)
PETR0LUEM OIL	150(66)
POLAR	220(103)
EXTREME PRESSURE	
CHLORINATED	550(288)
SULFUR	1100(593)
PHOPHORUS	1300(704)

Types of metalworking lubricants :

1. Emulsions
   a. Macro-emulsions(conventional emulsions)
   b. Micro-emulsions
2. Petroleum oils and solvents
   A. Uncompounded (straight)
   B. Compounded
3. Oil free
   a. Grinding fluids
   b. Synthetic fluids

Emulsions are stable dispersions of two liquids that normally do not mix; oil and water is a good example. They are composed of petroleum oil, water, and an emulsifier, usually a soap that provides stability. Emulsions are of two types: macro-emulsions or conventional which form milky white emulsions when mixed with water, micro-emulsions when mixed with water form transparent or opaque emulsions. This is due to the size of the oil droplets dispersed in the water. Macro-emulsions have large oil droplets that reflect light; micro-emulsions have very small oil droplets that do not reflect light. Micro-emulsions contain considerably much less oil than macro-emulsions, this is an important factor in waste treatment costs. The small amount of oil dispersed in micro-emulsions acts as a large amount due to the increased surface area of the oil. If we compare the surface area of a pound of ball bearing one inch in diameter with the surface area of a pound of ball bearings one-eighth of an inch; the smaller ball bearings will have a much greater surface area. It is the same when comparing macro and micro-emulsions.

GENCOOL 3920 is General Chemical's heavy duty macro-emulsion concentrate.

Uncompounded petroleum oils are poor lubricants, and are used for light duty machining and forming. Adding additives improves their performance. Compounded oils can perform all of the metalworking operations depending upon their compounding.

General Chemical's compounded oil GENCOOL 3850 used for both ferrous and nonferrous metals.

Solvents are used in forming operations where a residue free part is desired. These vanishing oils are used for light forming operations such as blanking, fin forming and, drawing light gauge metals. Additives can be added to improve their performance.

General Chemical's Vanishing oils are GENLUBE 2240 a light duty residue free lubricant and GENLUBE 3010 a light to medium duty fluid.

Oil free grinding fluids, some times called chemical solutions, are used for flat surface grinding on Blanchard and Mattison grinders and other similar machines. This type of fluid has no lubricity additives. Their function is to keep the grinding wheel clean and to prevent corrosion.

Synthetic machining and drawing fluids are totally oil free Depending on the additives used in formulating them, they can perform all the machining and forming operations from light to heavy duty. They are composed of water soluble lubricity additives, surfactants, biocides, corrosion preventives, and antifoams.

General Chemical's synthetic metalworking fluid is GENDRAW 3590 for stamping and drawing ferrous and nonferrous metals.