



UCON Fluids & Lubricants

UCON Metalworking Lubricant EMPL-X

Product Description

UCON™ Metalworking Lubricant EPML-X is a mixture of an alkanolamine and an anionic polymer, modified to provide extreme pressure lubrication for heavy-duty machining. EPML-X was developed to be used as a lubricant base in synthetic metalworking fluid formulations. By varying the concentration of EPML-X, synthetic fluids can be developed which provide the machinability of heavy-duty soluble oils, synthetic, and semi-synthetic metalworking fluids. EPML-X does not require combination with lubricity modifiers such as fatty acids, phosphate acid esters, or other extreme pressure agents to be an effective lubricant.

EPML-X is completely soluble in water at ambient temperatures. It exhibits inverse solubility and thus is able to provide both hydrodynamic and extreme pressure lubrication at low concentrations in water. EPML-X is both stable and usable in hard water, resists foaming and bacterial attack, and remains fluid to prevent tacky or gummy residue formation. Unlike many other extreme pressure agents, EPML-X is not selectively depleted from coolant systems, and thus when used in a fully formulated product is capable of providing long-term, trouble-free service in recirculating central coolant systems.

Features

- Ease in Formulation
 - Forms homogeneous mixtures with ethanolamines and most amine based additives
 - Eliminates need for lubricant modifiers such as phosphate esters or fatty acids
- Superior Machinability
 - Increases tool life—use results in lower cutting forces and tool tip temperatures
 - Provides heavy-duty machining without the use of chlorine, sulfur, or phosphorous extreme pressure agents
 - Use concentration can be varied to accommodate various machinability levels
- Completely Water Soluble at Ambient Temperatures
- Low Foam Tendency, Rapid Foam Collapse
- Unaffected by Hard Water
- Hydrolytic, Oxidative, and Biologically Stable
- Remains Liquid, Leaves no Gummy or Tacky Residues

Typical Physical Properties⁽¹⁾

Form	Liquid
Appearance	Amber Red
Viscosity, 25°C	4000-5600 cst
Alkalinity, MEQ/g	3.76-4.07
Closed Cup (ASTM D 93)	149°C, 300°F
Flash Point Open Cup (ASTM D 92)	182°C, 360°F
Specific Gravity, 20/20°C	1.116
Weight per Gallon, 20°C	9.299 lbs/gal

1. The physical property data listed are considered to be typical properties, not specifications

Table 1 • Concentration Range of UCON Metalworking Lubricant EMPL-X

Commercial Fluid at 30:1 Dilution	Final Use Concentration of EPML-X Needed for Equal Machinability
Heavy-Duty Sulfonated, Chlorinated Soluble Oil	1.5%–2.2%
General Purpose Soluble Oil	0.5–1.0%
Semi-Synthetic Coolant	0.5–1.0%
Heavy-Duty Synthetic Coolant	0.7–1.2%

Machinability

Machinability characterizes the lubricating and cooling abilities of metalworking fluids under dynamic cutting conditions. A lathe test was developed to evaluate the machinability of cutting fluids under actual metal removal conditions. In this respect it differs from the more traditional tests such as the Falex or Fourball tests which have shown a limited correlation to metalworking applications.

Machinability ratings are determined by continuously monitoring the tangential cutting force and tool tip temperature during a single point turning operation on an instrumented lathe. Since both of these parameters are related to tool life and surface finish, it is possible to determine the relative machinability of cutting and grinding fluids. From this data it is possible to determine the concentrations of various cutting fluids, which give equal machining performance. Table 1 summarizes the concentration range of EPML-X necessary to achieve equal machinability with some different types of commercially available commercial cutting fluids.

The performance of EPML-X versus a chlorine and sulfur containing heavy-duty soluble oil is presented in Figures 1 and 2. The conditions used for this test are very severe and approach that of a broaching operation. Most synthetic and semisynthetic coolants based on conventional lubricants cannot machine under these conditions.

Applications

EPML-X has proved to be an excellent metalworking fluid base for both light and heavy-duty machining applications. EPML-X has performed well in cutting and grinding operations as well as in tapping, gun-drilling, drawing, and forging. An EPML-X based formulation can machine as effectively as a heavy-duty soluble oil while providing additional benefits such as low toxicity and longer coolant life. EPML-X may be used at reduced concentrations to provide good machinability in less severe metalworking operations.

Corrosion Protection

EMPL-X contains an amine functionality that contributes to the rust protection of cast iron and steel. However, we recommend that EPML-X be combined with a nonnitrite corrosion inhibitor to develop maximum protection.

Biological Resistance

EMPL-X has a high degree of resistance to bacterial attack and has not shown any unusual problems when used in large recirculating systems. With a bactericide added, fluids containing EPML-X have remained usable and trouble-free for long periods of time. The bactericide protects against spoilage from contaminants picked up during use.

Environmental Acceptability

EPML-X is not expected to contain added oils, nitrites, phosphates, phenolic compounds, borates, or other materials considered unacceptable to the environment. However, since EPML-X contains amine functionalities, nitrites should not be used.

Suggested Starting Formulations

Cutting Fluid

UCON Metalworking Lubricant EPML-X	20–30%
Nonnitrite Corrosion Inhibitor	15–20%
Triethanolamine	5–10%
Biocide	as recommended by manufacturer
Water	balance

Dilute 10:1 – 50:1 depending on the severity of the operation

Grinding Fluid

UCON Metalworking Lubricant EPML-X	10–15%
Nonnitrite Corrosion Inhibitor	10–15%
Triethanolamine	5–10%
Biocide	as recommended by manufacturer
Water	balance

Dilute 10:1 – 50:1 depending on the severity of the operation

Figure 1 • Cutting Force vs. Concentration

Synthetics, Semisynthetics, and general purpose soluble oils cannot machine under these conditions.

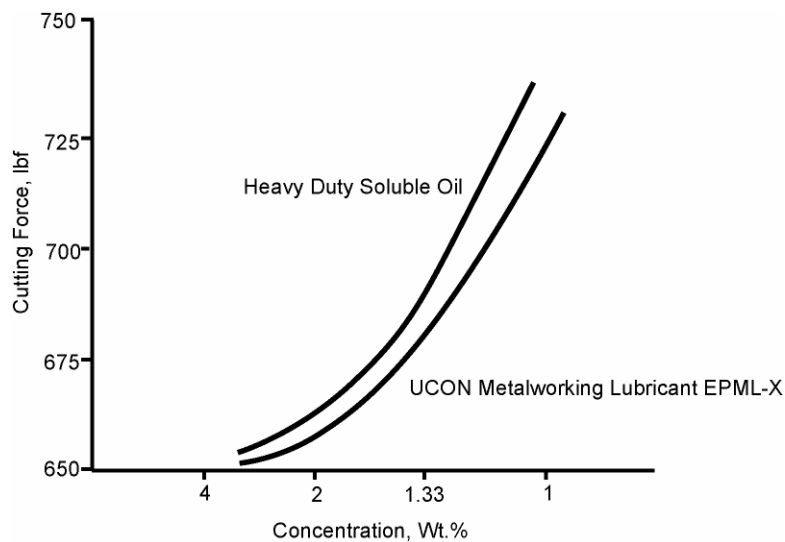
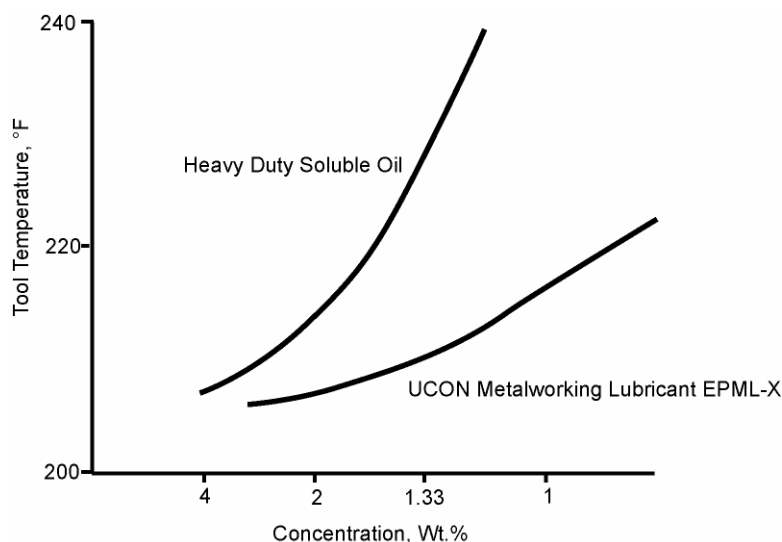


Figure 2 • Tool Temperature vs. Concentration

Synthetics, Semisynthetics, and general purpose soluble oils cannot machine under these conditions.



Product Stewardship

Dow encourages its customers and potential users to review their applications from the standpoint of human health and environmental aspects. To help ensure that Dow products are not used in ways for which they are not intended or tested, Dow personnel will assist customers in dealing with environmental and product safety considerations. Dow literature, including Material Safety Data Sheets, should be consulted prior to use.

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