

CIMCOOL[®]

Technical Report

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

PLASTIC MATERIALS for METALWORKING FLUID APPLICATIONS

Plastic materials are frequently used in the metalworking industry for their unique features. Properties such as corrosion resistance, flexibility, oil affiliation, chemical resistance, transparency and coloration, all serve functional purposes in manufacturing plants.

There are countless types of plastics available in the marketplace, just as there are a multitude of metal alloys used in industry. Plastic materials used in metalworking fluid systems need to be carefully selected for suitability and evaluated for durability. The scope of this report covers the common plastic materials that are frequently used in metalworking applications.

Common Types of Plastics Used in Metalworking Fluid Applications

The most common types of plastic materials used for metalworking fluid (MWF) applications are listed in the following table. They have proven to be compatible with a wide range of MWF formulations. Each of these plastics has an abbreviated symbol that is often used as a designation that identifies the material by family name. By itself, the family name does not specify the properties of the material.

Symbol	Plastic Family Name
HDPE	High Density Polyethylene
PVC	Polyvinyl Chloride
PP	Polypropylene
PSU	Polysulphone
PMP	Polymethylpentene

Classification of Plastic Materials

The most complete system for classifying plastic materials is ASTM D4000*, which is titled "Standard Classification System for Specifying Plastic Materials". This standard uses a line call-out system for establishing specifications. An example of a line call-out for nylon follows: PA0120G33-53380 which details the type, group, class, grade reinforcement and 5 physical properties. In order to have dependable performance of any plastic in a MWF application, the specification must be suitable and materials must be sourced from a reliable supplier.

*ASTM International – formerly the American Society for Testing and Materials.

Environmental Exposure

As a general rule, plastic materials should be selected to perform within the normal operating environment that they will experience. The most important aspects related to metalworking fluid contact are petroleum oil resistance, water resistance, and alkaline resistance. MWF concentration can vary greatly, from use dilution to neat. The most common parameters for a used MWF mix are listed in the following table:

MWF Parameters	Values
Typical Concentration	5%
Water Content	95% or greater
Typical "pH" Range	8.8 – 9.2 (see below)**
Product Oil Content	0 to < 5% (+tramp oil)
Temperature Range	60 - 90° F.

** Fluids for Aluminum may be lower, 7.6 – 8.2

Plastics can encounter a wide range of environmental exposures when used in MWF applications. Their exposure time may be from occasional, to constant contact. The degree of contact may be mist, splash or full immersion.

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The operating conditions may be at ambient or elevated temperatures and cover a wide range of operating pressures. It is necessary to consider these environmental exposure variables when selecting an appropriate plastic material.

Physical Properties of Plastics

Plastics used in metalworking fluid applications need to be selected for both their chemical compatibility and physical properties. However the functional use of the plastic determines what engineering properties are required. Each type of plastic has certain unique mechanical, thermal and electrical properties. It is necessary to understand how each property will affect the plastic's application in a MWF environment. The mechanical properties may be impacted by the fluid contact and should be qualified for use in the application with simulated-service testing.

Symbol	MWF Industry Applications
HDPE	Transportation – shipping containers
PVC	Dispensing – meters, valves, piping
PP	Fluid maintenance – oil coalescer
PSU	Fluid disposal – ultrafiltration cartridge
PMP	Laboratory – labware

Functional Properties of Plastics in the MWF Industry

Plastic materials are frequently used in the metalworking field for their specific functional properties. The following materials have all demonstrated chemical and corrosion resistance for MWF applications. The following table lists specific functional properties, such as oil affiliation, transparency and coloration ability, which increases the usefulness of these plastics in manufacturing operations.

Symbol	Functional Properties
HDPE	Color-coding ability
PVC	Structural strength, machinability
PP	Oil affiliation
PSU	Transparency, high temperature use
PMP	Glass-like clarity

Evaluation Methods for Plastics

The suitability of a plastic material can be evaluated by using a variety of standard test methods. The ASTM has over 100 testing methods developed for the evaluation of plastics. ASTM D471, Test Method for Effect of Liquids, is one of the most important methods relating to the use of plastics in MWF mixes. This method tests under static conditions. For dynamic applications of plastics, it is recommended that simulated service testing be used. It is important to evaluate plastics from typical use dilution levels up to neat product concentration in some applications.

Selection Criteria for Plastics in MWF Applications

In summary, there are many factors which can influence the ultimate performance of any plastic in a metalworking fluid application. The objective here is to reduce this complex subject into a limited number of alternatives. The process of selecting the appropriate plastic can be simplified by following these guidelines,

- Define the environmental contact
- Define the engineering requirements
- Choose a proven family of plastics
- Perform compatibility testing
- Use simulated-service testing as an evaluation tool
- Work with reliable plastic suppliers

Consult your regional CIMCOOL® Technical Service Engineer for further information or call Milacron CIMCOOL® Technical Service at 513-458-8199.