

## Technology Backgrounder

Versatic Acids and Derivatives

# Corrosion Protection in Metalworking Fluids

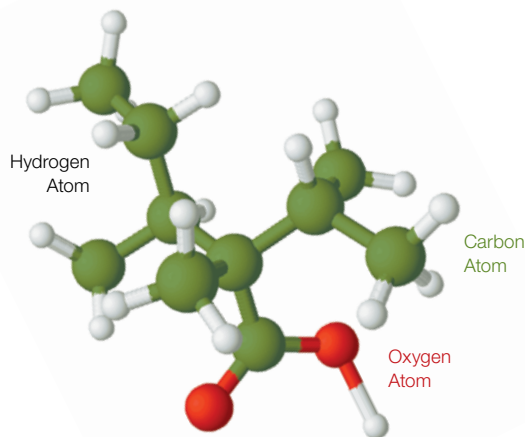


### Versatic™ Acid 10 for Corrosion Protection in Metalworking Fluids

Versatic Acid 10 is a synthetic, highly branched tertiary carboxylic acid. Versatic Acid 10 exhibits excellent ferrous corrosion inhibition properties when formulated as an amino alcohol salt in semi-synthetic and synthetic metalworking fluids (MWF). Versatic Acid 10 offers superior corrosion protection compared to alternative long-chain dicarboxylic acids. Additionally,

because Versatic Acid 10 has a low level of biodegradability, it is expected that lower levels of biocides would be required in the formulated MWF and then it will guarantee long cycle times. Other substantial benefits of Versatic Acid 10 are the facts that it is an easy to handle and non-toxic liquid (not classified in the Annex I of Directive 67/548/EEC).

### Characteristics and Structure



Acid value	318 - 330 mg KOH/g
Appearance	Clear liquid
Melting point	< -30 °C

### Ferrous Corrosion Protection

The ferrous corrosion protection effectiveness of Versatic Acid 10 for a (semi-) synthetic MWF was evaluated against two dicarboxylic acids, according to the ASTM D4627 cast iron chip test.

### Corrosion inhibitor concentrate based on Versatic Acid 10

Soft water	30.0 wt%
Amino alcohol	34.1 wt%
Tolutriazole	0.25 wt%
Versatic Acid 10	35.6 wt%

This concentrate based on Versatic Acid 10 is a clear liquid with pH around 9.3.

Two amino alcohol alternatives have been tested: Monoethanolamine/Triethanolamine (MEA/TEA) 50/50 wt.% and Diglycolamine® 100% (DGA®).

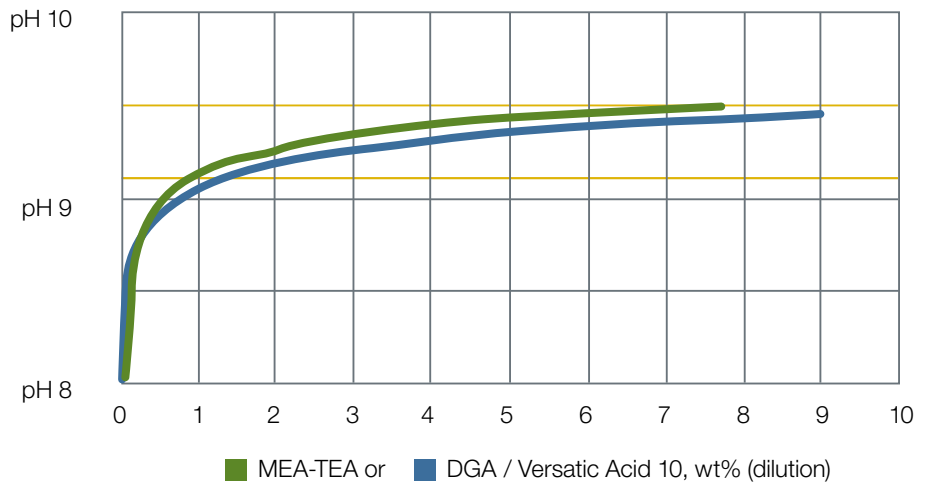
The diacids tested for comparison were azelaic and sebacic.

The formulations using these alternative acids were adjusted so that their respective 3% emulsions exhibited a pH around 9.3.

**Dilution Curves**

The 3% aqueous solution of the concentrate shows a pH of 9.3. Versatic Acid 10 provides dilution curves with stable pH over a broad dilution range.

**Corrosion inhibitor concentrate dilution curve for metalworking fluid applications**



The relative corrosion inhibition performance of Versatic Acid 10 and

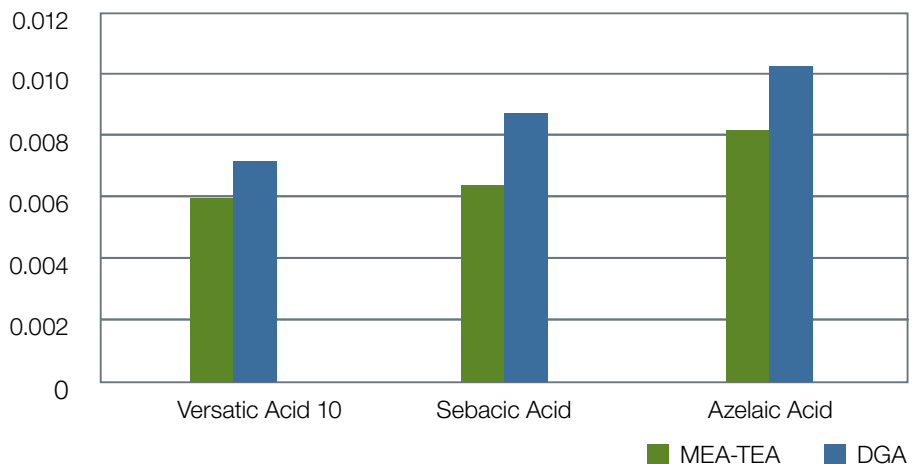
dicarboxylic acids was tested using the ASTM D4627 cast iron chip test.

**Procedure**

Each corrosion inhibitor package was diluted in several levels in hard water (100 ppm CaCO<sub>3</sub>, 71 mg/l as chloride) and the exact concentration of (di) carboxylic acid was calculated. Filter papers, diluted corrosion inhibitor concentrate and sieved cast iron chips were placed in Petri dishes.

The filter papers were examined visually after 24h and the breakpoint determined. The breakpoint is defined as the weakest concentration leaving no rust stain on the filter paper.

**Breakpoint effective (di)carboxylic acid amount (grams)**



## Excellent Corrosion Inhibition

Versatic Acid 10 offers superior corrosion protection compared to sebacic and azelaic dicarboxylic acid when formulated as a MEA/TEA and DGA®\* salt.

### Corrosion inhibition tests (ASTM D4627)

MWF Dilution	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%	4.0%
<b>Versatic Acid 10</b>							
Sebacic							
Azelaic							

Breakpoint



## High Resistance to Bacterial Growth

Due to its unique branched structure, Versatic Acid 10 has a low level of biodegradability compared to other dicarboxylic acid mixtures. Therefore, it

is expected that lower levels of biocides would be needed in the corresponding metalworking fluid formulation and it will guarantee long cycle times.

## Easy Handling

Versatic Acid 10 is an easy to handle clear liquid. The product is readily soluble when added to the liquid amino alcohol. In contrast with some solid acids or mixtures of acids, there is no need for heating to achieve good dissolution.

## Health, Safety & Environmental

Versatic Acid 10 is not classified as a hazardous product (not classified in the Annex I of Directive 67/548/EEC).

## Key Points

- The unique highly branched structure provides **excellent corrosion inhibition** by forming a layer, which protects against attack of metallic surfaces by oxygen and moisture. This technology principle can be applied to other applications such as engine coolants.
- The branched aliphatic structure offers **low biodegradability** (not readily biodegradable according to OECD 301 B), **guaranteeing long cycle times**.
- **Easy to handle product** in liquid form.
- Following GHS, no need for specific risk phrases on labels for Versatic acid 10.

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Please refer to the literature code HXN-614 when contacting us.



## World Headquarters

180 East Broad Street  
Columbus, OH 43215-3799

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