



SURFONIC[®]

Performance Emulsifiers
for Metalworking Fluids

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HUNTSMAN

Enriching lives through innovation



SURFONIC®

Performance Emulsifiers for Metalworking Fluids



Metalworking Fluids

Processes such as high-speed machining create increased pressure for emulsifiers to perform under tough conditions, while continuing to maintain low foam characteristics. Stricter regulations and increased limitations on available additives have increased the need for products with cleaner labeling. Formulators are looking for safer emulsifiers with a broad range of benefits to solve their customers' needs and distinguish their product line.

High Performance Emulsification

Emulsifiers play a vital role as one of the most critical additives in water-miscible metalworking fluids. The SURFONIC® line of products encompass a range of chemistries that demonstrate high performance as emulsifiers with low foaming characteristics, as well as other benefits. They can be used as primary or secondary emulsifiers and have good environmental, health and safety profiles. SURFONIC® SM, LF, & MW series products are ideally suited to the needs of the metalworking industry.

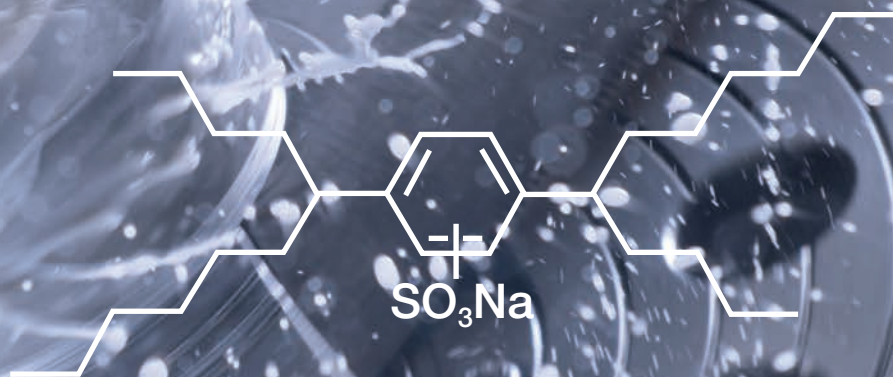
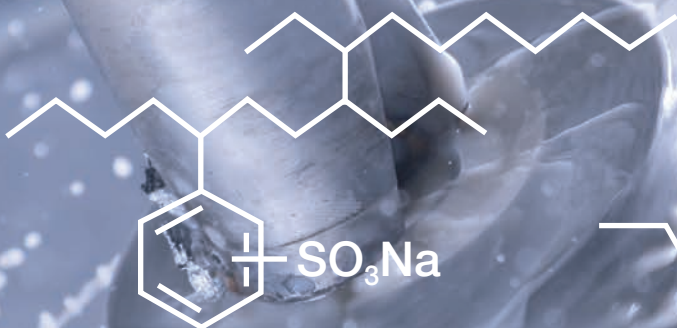
Learn more at

www.huntsman.com/metalworking



FEATURES & BENEFITS

- Multifunctional specialty emulsifiers
- Primary and secondary emulsifiers
- Broad range of alcohol ethoxylates and alkoxyates
- Mineral oil free sodium sulfonates
- Good emulsification efficiency
- Good wetting properties
- Low foaming



SURFONIC[®] SM

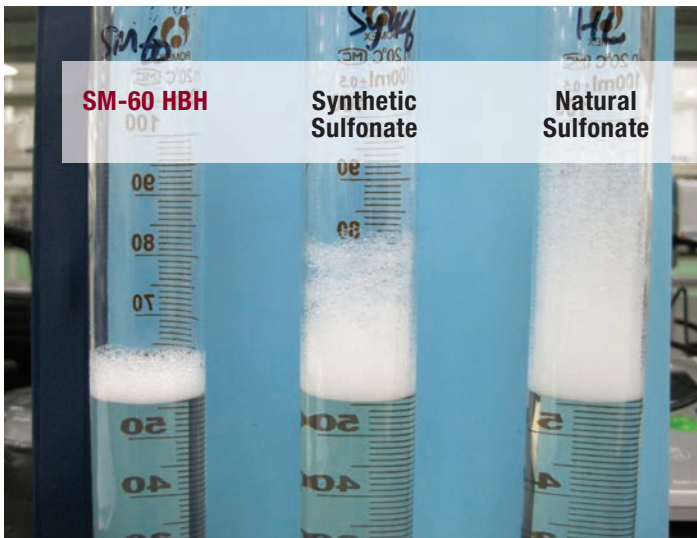
Sodium Sulfonates

SURFONIC[®] SM sodium sulfonates provide excellent emulsification and corrosion inhibition properties in industrial lubricant formulations, such as metal-working and hydraulic fluids. They are compatible with a wide range of mineral oils and synthetic base lubricants. The high molecular weight HBH sulfonates give both good emulsification and corrosion protection.

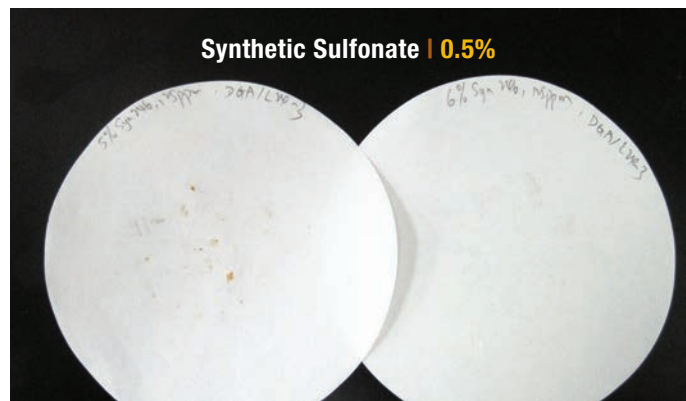
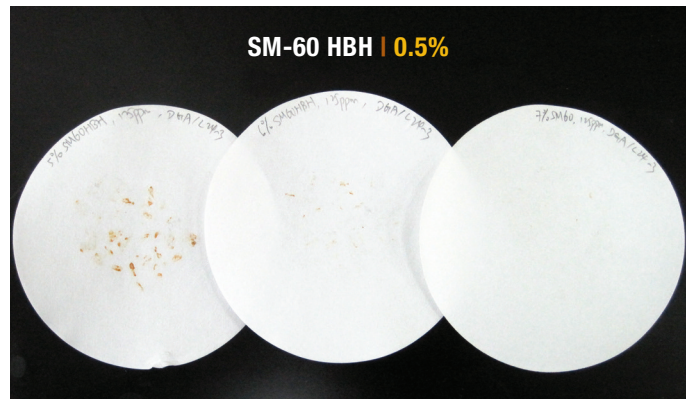
FEATURES & BENEFITS

- Corrosion inhibitor
- Excellent emulsification
- Low foaming
- Low corrosion on aluminum and copper
- High in actives content
- Mineral oil free
- Excellent hard water tolerance
- Available in high and low molecular weight

PHYSICAL PROPERTIES	SM-60 HBH	SM-100 HBH	SM-50 HBA	SM-60 MXA
Avg. molecular wt.	510	510	497	425
Active content %	60	78	50	60
Viscosity mPa.s				
25°C	2,000	12,000	—	3,000
50°C	380	2,000	3,500	900
Color	Dark brown	Dark brown	Dark brown	Dark brown
Water content %	≤ 7.5	≤ 11.0	≤ 8.5	≤ 9.5
Diluent	Naphthenic	—	Naphthenic	Naphthenic



RUST BREAK POINT



Formulated SM-60 HBH shows lower foaming compared to competition

Less SM-60 HBH needed in a semi-synthetic fluid relative to competitor synthetic and natural sodium sulfonate

No staining on aluminum and copper was observed with SM-60 HBH

SM-60 HBH has similar to better corrosion inhibition performance compared to competition

Most are diluted in naphthenic oil for easier handling

Oil free SM-60 HBH is available as SM-100 HBH



SURFONIC[®] MW-100 Emulsifier

SURFONIC[®] MW-100 emulsifier is a single-component vegetable oil emulsifier designed to enhance the properties of vegetable oil-based lubricants. While primarily designed for vegetable oils, MW-100 may also be used in mineral oil based formulations.

FEATURES & BENEFITS

- Low viscosity and easy to handle
- Low toxicity profile
- Self-emulsifying
- Inherently low foaming
- Creates both macro- and micro-emulsions
- Provides lubrication in formulations
- Good hard water tolerance
- Compatible with phosphate esters

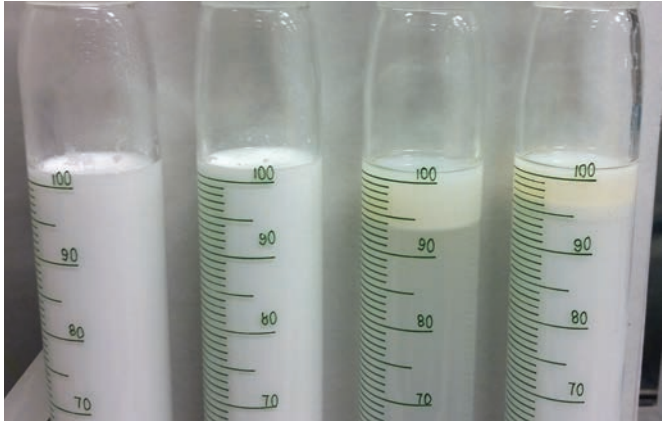
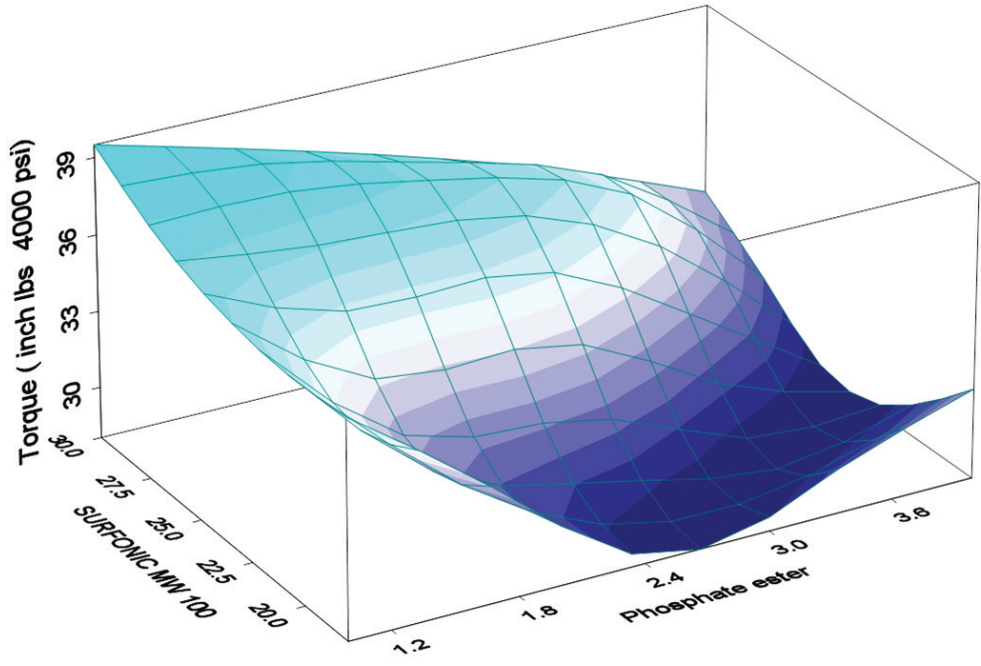
FORMULATIONS	A	B	C
MW-100, %	30	30	25
Vegetable oil, %	70	65	65
Aliphatic Phosphate Ester, %	—	5	10

LUBRICITY OF MW-100	A	B	C
FALEX Pin and Vee Tester (Rapeseed oil)			
Max load before failure, lbs.	4,250	4,000	4,250
Torque @ max load, lbs., in.	40.1	42.2	40.8
Wear @ 45,00 lbs., mg	36.0	17.5	20.5
Tapping Torque Tester (Soybean oil)			
Mean % Efficiency	100.0	98.4	97.9

Improved EP performance from a combination of MW-100 and a phosphate ester is observed

MW-100 imparts additional lubrication in low wear applications

EP PERFORMANCE OF MW-100 in Soybean Oil



A B
MW-100

A B
Competitor 1

Emulsification of MW-100 and competitor product in soybean oil diluted by 5% in hard water (A = 375 ppm; B = 125 ppm) after 1 week

MW-100 provides excellent emulsion stability, with lasting performance observed after three months

Enhanced emulsion stability will increase fluid life and decrease loss of additives within the formulation



SURFONIC® MW-103 Polymeric Emulsifier

SURFONIC® MW-103 specialty emulsifier is a single component polymeric surfactant, able to produce water-in-oil and oil-in-water emulsions. This single component emulsifier can be used in various metalworking applications and fluids.

FEATURES & BENEFITS

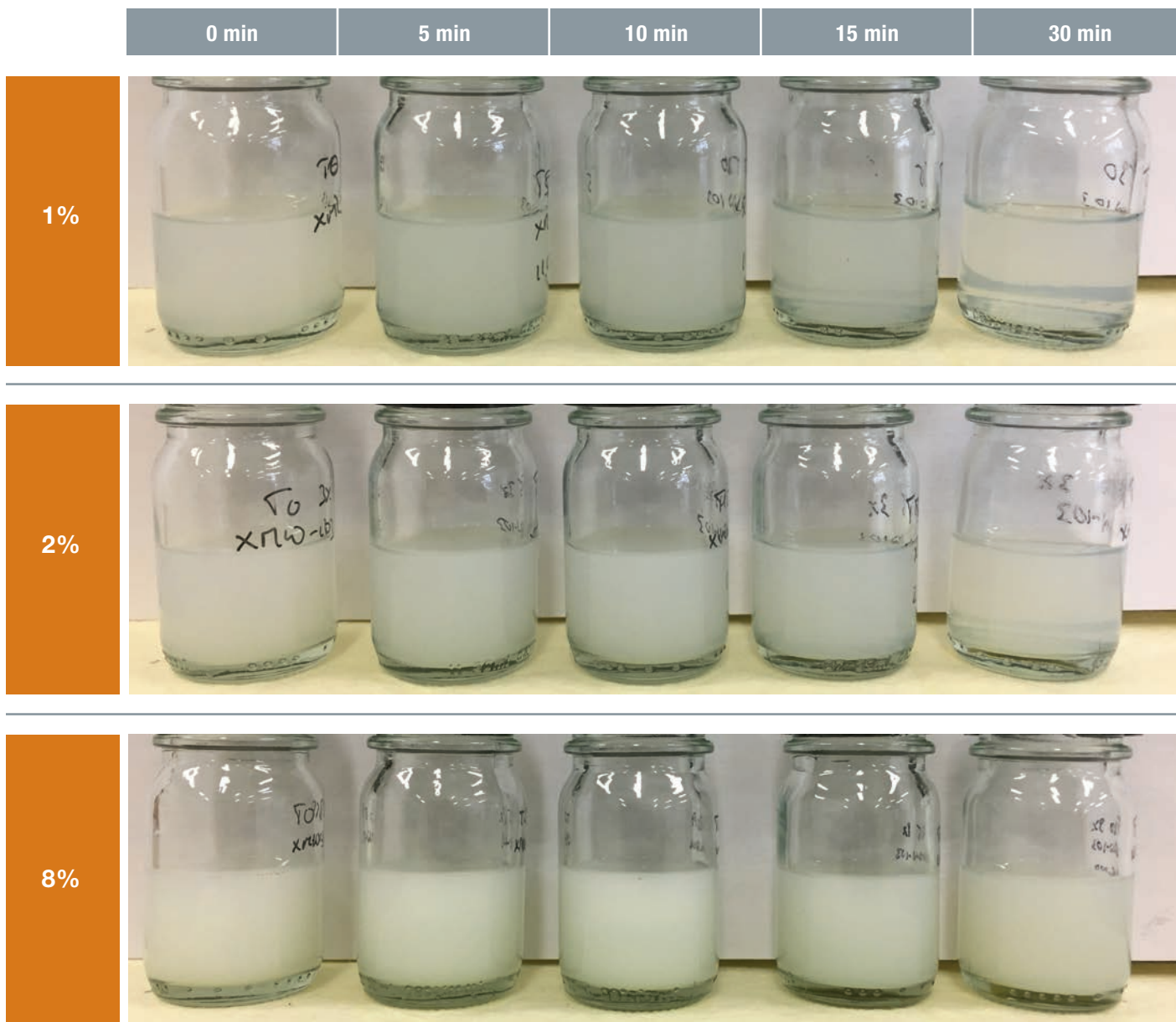
- Inherently low foaming
- Solvent free product
- Clean labeling and no VOC
- Stable emulsions after shearing

PHYSICAL PROPERTIES	MW-103
Color	Amber – dark amber
Dry residue, weight %	> 95%
Acid value, mg KOH/g	< 16
pH, 5% IPA/H ₂ O	4.5 – 6.5
Water, weight %	< 0.7%
HLB	7.0 – 8.0

MW-103 exhibits excellent shear stability which makes this product suitable for rolling fluid applications

This emulsifier is inherently low foaming and useful in water-miscible formulations

400ml EMULSION IN WATER (100ppm Ca), sheared using ultra-turrax





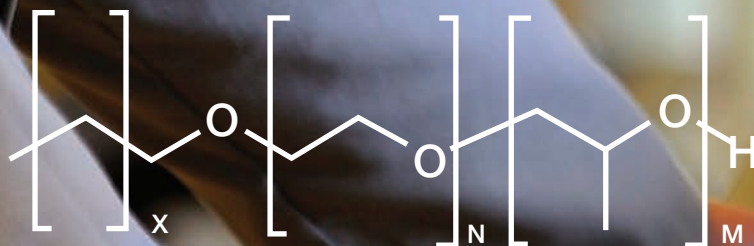
SURFONIC® LF, P, JL Series Low Foaming Surfactants

SURFONIC® LF series surfactants are ethoxylated and propoxylated linear primary alcohols. Their low foaming attribute makes them suitable in high pressure operations.

LF and P series surfactants can be used in low foam semi-synthetic cutting fluids, micro-emulsion and solution cleaners, or as a wetting agent in acid cleaners.

FEATURES & BENEFITS

- Designed to be low foaming
- Good wetting ability
- Can be used for metal cleaning
- Solubilizers/emulsifiers in emulsifiable oil and semi-synthetic fluids
- May offer a boost in lubricity in certain formulations



PHYSICAL PROPERTIES	JL-80X	LF-17	LF-18	LF-37	P1	P3	P5
HLB	13.1	—	11.9	3.0-6.0	7.0	—	—
pH, 5% Aqueous	7.0	—	5.5-7.5 ¹	5.5-7.0 ¹	6.0-7.0 ²	5.5-7.0	6.5-7.5
Viscosity, cSt, 25°C	51	96	240	96	90	56	85
Cloud Point, °C (1%)	59	34	14-20	15-19	24-26	34-36	44-46
CMC, ppm	—	6.6	—	30	4.8	4.5	6.2

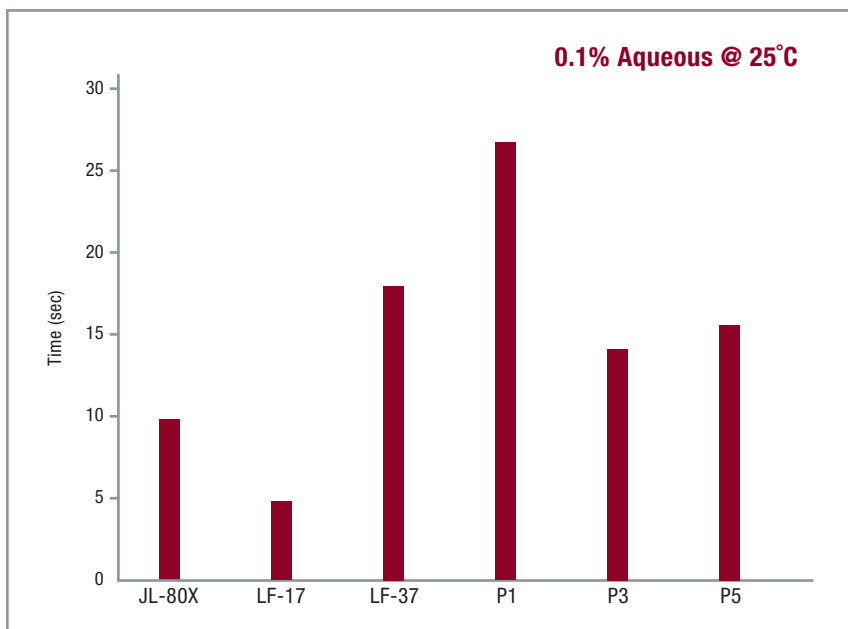
1. 1% in 10:6 IPA:H₂O

2. 1% aq.

FUNCTION

JL-80X	Used in metal cleaning operations Special structure eliminates gel phase common to alcohol ethoxylates in aqueous solutions
LF-17	Wetting agent for acid operations, low foam emulsifier/rinse aid
LF-18	LF-18 may be used as an efficient low foam emulsifier in metalworking fluids
LF-37	LF-37 has excellent wetting performance and a very low foaming tendency
P1	Emulsifier and rinse aid for metal cleaning Solubilize/emulsifier for semi-synthetic formulations
P3	Co-emulsifier for semi-synthetics Rinse aid for cleaners
P5	Emulsifier for semi-synthetics

EVALUATION OF SURFACTANTS by Draves Wetting Test



The LF series surfactants have varying solubilities in oils and aqueous solutions

These low foaming surfactants can be used for metal cleaning

Products increase the wetting ability of a formulation with no increase in foaming



About Huntsman

Huntsman Corporation is a publicly traded global manufacturer and marketer of differentiated chemicals with 2016 revenues of approximately \$10 billion. Our chemical products number in the thousands and are sold worldwide to manufacturers serving a broad and diverse range of consumer and industrial end markets. We operate more than 100 manufacturing and R&D facilities in approximately 30 countries and employ approximately 15,000 associates. For more information about Huntsman, please visit the company's website at www.huntsman.com.

Huntsman Performance Products

Performance Products brings together innovation and world-leading process technologies to produce more than 2,000 components used to formulate products that enhance people's lives:

- **Amines:** Largest global producer of specialty amines used in composites, coatings, fuel and lube additives, and gas treating
- **Maleic Anhydride:** The leading global producer and supplier into areas such as unsaturated polyester resins, food, oil additives and coatings
- **Surfactants:** Integrated producer of a wide range of products for home and personal care, oilfield, agriculture, and process industries
- **Ethylene and Derivatives:** Highly integrated manufacturer of ethylene, ethylene oxide, ethylene glycol and other derivatives

The division has 14 manufacturing plants and had 2016 revenues of USD 2.1 billion.

Contact a Huntsman sales representative for more information.

www.huntsman.com/performance_products

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