

PERFORMANCE PRODUCTS

**ChemGroup Delivers Huntsman Surfactants  
Advantages for Metalworking Applications**

**Greg Wehr – GM Sales and Business Development  
ChemGroup, Inc.**

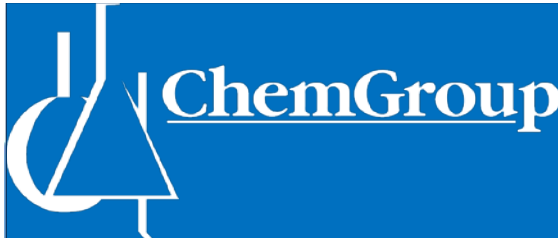






# ChemGroup and Huntsman

## Our Goal...Exceeding your Expectations



Enriching lives through innovation



-  Corporate Offices
-  Distribution Centers
-  ChemGroup Supplier Terminals
-  Supplier Managed Terminals

- **ChemGroup, Inc. is a Full Line Super Regional Distributor (Top 15 Chemical Distributor in the USA)**
  - Privately Held – with a proven track record of 39 years of industry success and service excellence servicing primarily Eastern US
  - Move ~ 800 Million Pounds of chemicals a year
- **ChemGroup is comprised of 5 Operating Companies including: Bonded Chemicals Inc., Chemical Services, Inc., Chemicals, Inc., Chemical Resources, Inc. and Specialty Chemical Co. – USA – [www.ChemGroup.com](http://www.ChemGroup.com)**
- Huntsman is a Global Technology Leader committed to leading edge innovation with over 2000 performance and specialty chemicals used widely in major industrial markets. Key product groups include: amines, carbonates, ethylene oxide, glycols, maleic anhydride and surfactants
- ChemGroup and Huntsman are working together to Advance Performance and drive commercialization of Innovative Surfactant and Amine Technology for the Metalworking Industry in the US
- ChemGroup couples Huntsman’s leading technology position with best in class customer service excellence delivered with care and knowledge of applications and local requirements

# Huntsman Performance Products

## Surfactants for Metalworking

Chemical Type	Corrosion Inhibitor	Emulsifier	Lubricity Additive	Coupling Agent	Low Foaming	*Application	Huntsman Product Line
EO:PO Block Copolymers		●			●	SS, SY	<b>SURFONIC® POA-L surfactants</b>
Reverse EO: PO Block Copolymers		●	●		●	SY	<b>SURFONIC® POA -17R2, 17R4, 25R2 surfactants</b>
Synthetic Sodium Sulfonates	●	●			●	EO, SS	<b>SURFONIC® SM-60 HBH &amp; SM-100 HBH surfactants</b>
Polyalkylene Glycols		●			●	SY	<b>JEFFOX®WL surfactants</b>
Polyethylene Glycols				●		SS, SY	<b>PEG and POGOL™ glycols</b>
Fatty Alcohol Ethoxylates		●	●			EO,SS, SY	<b>SURFONIC® L12-n, and L24-n surfactants</b>
Fatty Acid Ethoxylates		●	●			EO,SS, SY	<b>SURFONIC® CO - surfactants</b>
Amine Ethoxylates		●				EO, SS	<b>SURFONIC® T and SURFONIC® PEA-25 surfactants</b>
Fatty Alcohol Alkoxyates		●		●	●	EO, SS	<b>SURFONIC® LF, and P surfactants</b>
Nonylphenol Ethoxylates		●			●	EO, SS, SY	<b>SURFONIC® N series surfactants</b>

\* EO= Emulsified Oil      SS= Semi-synthetic fluid      SY= Synthetic fluid

PERFORMANCE PRODUCTS

**SURFONIC® MW-100**

**SURFONIC® MW-103**

**Specialty Emulsifiers**



# Huntsman Surfactants

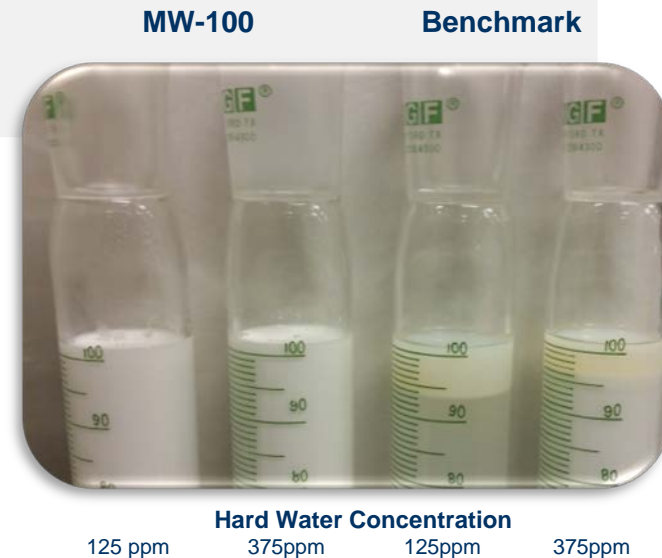
## SURFONIC® MW-100 Specialty Emulsifier

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- Primary emulsifier for vegetable oil based formulations
- Co-emulsifier for mineral oil based formulations
- Can be used to formulate macro/micro emulsions
- Imparts some lubricity to the formulation
- Inherently low foaming
- Compatible with phosphate esters
- Low pour point (-2°C) for easy handling

**Emulsification in  
soybean oil diluted  
by 5% in hard water  
stability after 1  
month**



**Hard Water Concentration**

125 ppm

375 ppm

125 ppm

375 ppm

PERFORMANCE PRODUCTS

# Huntsman Surfactants

## SURFONIC® MW-100 Specialty Emulsifier

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### Test Formulation with MW-100 for Falex Pin and Vee Tester

	A	B	C
MW-100,%	30	30	25
Rapeseed Oil,%	70	65	65
Aliphatic Phosphate Ester,%	-	5	10



### Test Results on FALEX Pin and Vee Tester

	A	B	C
Max load before failure, lb	4,250	4,000	4,250
Torque @ max load, lb.in	40.1	42.2	40.8
Wear (@4,500 lbs), mg	36.0	17.5	20.5

Higher failure load  
=  
better EP properties



# Huntsman Surfactants

## SURFONIC® MW-103 Specialty Emulsifier

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- Polymeric surfactant and emulsifier that is solvent free
- Able to produce both water-in-oil and oil-in water emulsions for various metalworking fluids
- Inherently low foaming

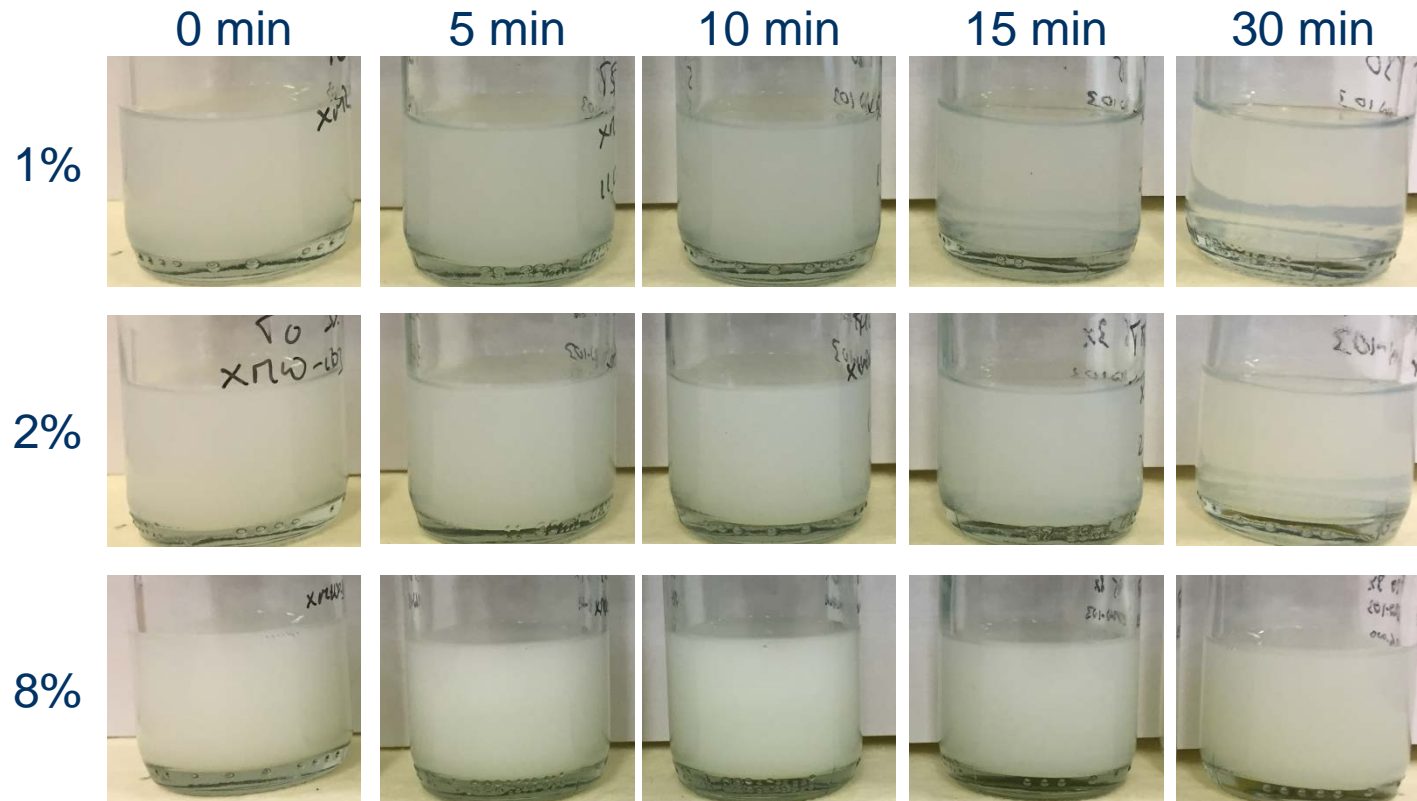


Parameter	Specification
Appearance @25° C	Viscous liquid
Color	Amber – Dark amber
Dry Residue, weight %	> 95%
Acid value (mg KOH/g)	< 16
pH (5% IPA/H2O)	4.5 – 6.5
Water content	< 0.7%
HLB	7-8

# Huntsman Surfactants

## SURFONIC® MW-103 Specialty Emulsifier

### MW-103 shows stable emulsions after shear



400ml emulsion in water (100ppm Ca) , sheared using T25 ultra-turrax



# Huntsman Surfactants

## SURFONIC® MW-103 Specialty Emulsifier

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Component	Wt. % of Components
Monoethanolamine	4
Triethanolamine	8
Oleic Acid	3
Naphthenic Oil	39
Isopropyl Palmitate	5
<b>SURFONIC® MW-103 Polymeric Emulsifier</b>	<b>12</b>
SURFONIC® L12-6 Surfactant	9
Fatty Acid Amide	4
Dicarboxylic Acid	5
Diglycol Monobutyl Ether	3
Dodecanol	5
pH of 5% dilution in 125 ppm hard water	9.30



5% dilutions of emulsifiable oil formulation in different concentrations of hard water ( 400 ppm up to 3000 ppm). No separation is observed in each dilution after 24 hours.

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**SURFONIC® SM-60 HBH**

**SURFONIC® SM-100 HBH**

**Synthetic Sodium Sulfonates**



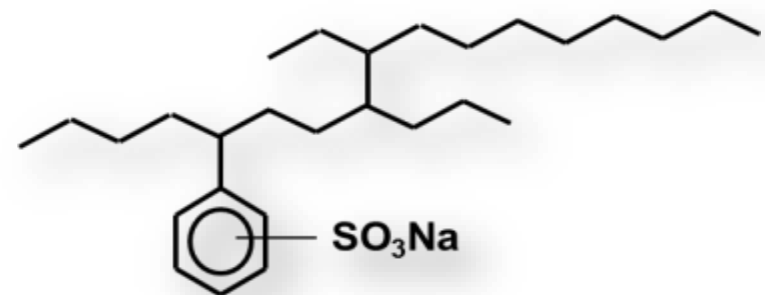
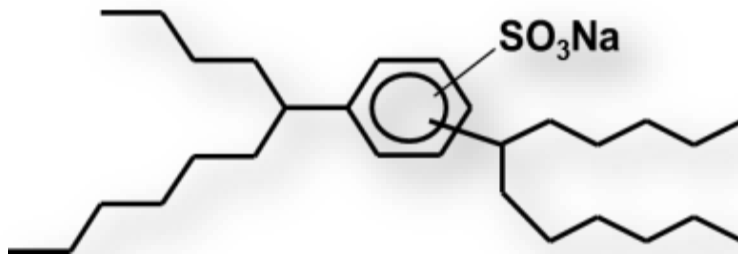
# Huntsman Surfactants

## SURFONIC® SM- HBH Synthetic Sodium Sulfonates

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- **SURFONIC® SM-60 HBH and SM-100 HBH Surfactants**
  - high molecular weight synthetic sodium sulfonate
  - excellent combination of emulsification and corrosion inhibition
- **SURFONIC® SM-60 HBH Surfactant**
  - 60% active diluted in mineral oil
  - provides low pour point in combination with low viscosity.



# Huntsman Surfactants

## SURFONIC® SM- HBH Synthetic Sodium Sulfonates

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### Emulsification in a Semi-synthetic Fluid

Component	Natural Sulfonate	Synthetic Sulfonate	SM-60 HBH
DI water	61.4	63.4	64.9
DGA™ Agent	4.0	4.0	4.0
KOH 45%	0.8	0.8	0.8
Sebacic acid	2.0	2.0	2.0
Boric acid	1.0	1.0	1.0
Benzotriazole	0.4	0.4	0.4
Mineral Oil	10.0	10.0	10.0
Biocide	2.0	2.0	2.0
Fungicide	0.9	0.9	0.9
Dicarboxylic Acid	3.0	3.0	3.5
Linear Alcohol Ethoxylate	6.0	4.5	4.5
Natural Sulfonate	8.5	-	-
Synthetic Sulfonate	-	8.0	-
SM-60 HBH	-	-	6.0
Total	100.0	100.0	100.0

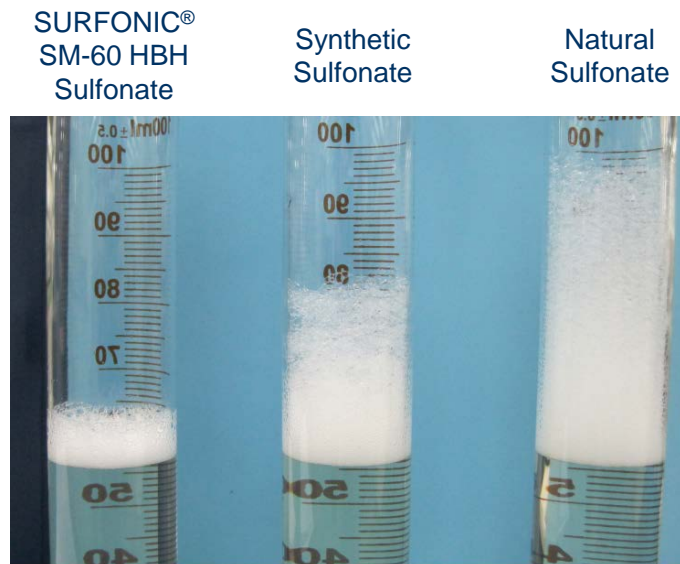
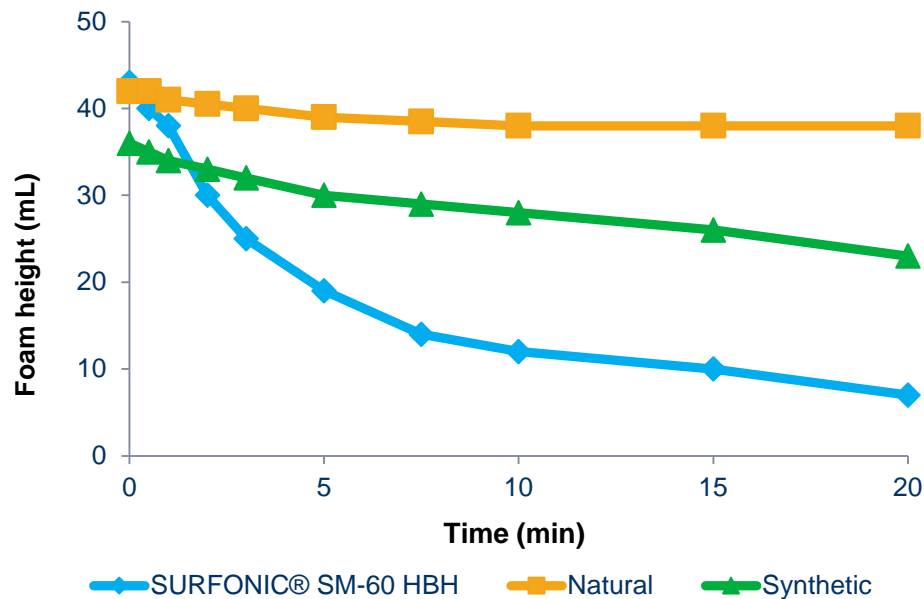
# Huntsman Surfactants

## SURFONIC® SM- HBH Synthetic Sodium Sulfonates

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### Foam breaking



**SM-60 HBH showed the lowest foaming compared to other sulfonates**

Test Conditions: 5% emulsion in 125ppm CaCO<sub>3</sub> water, shaking

# Huntsman Surfactants

## SURFONIC® SM- HBH Synthetic Sodium Sulfonates

**HUNTSMAN**

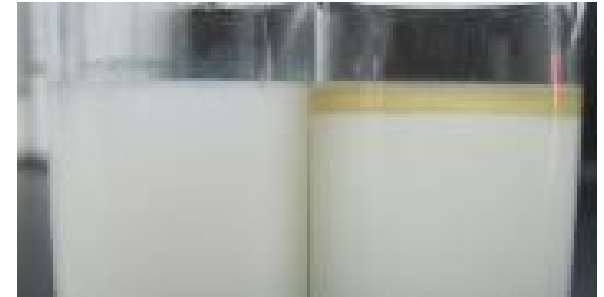
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**SM-60 HBH**



**Natural Sulfonate**



**Synthetic Sulfonate**

### Water hardness stability

- 5% dilution of semi-synthetic test formulation
- Water Hardness increased to 800 ppm
- SM-60 HBH has same tolerance at 800 ppm as competitive benchmarks



# Huntsman Surfactants

## **SURFONIC® SM- HBH Synthetic Sodium Sulfonates**

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**SM-60 HBH Rust break point at 0.50% dosage**



**Synthetic Sulfonate Rust break point at 0.50% dosage**



**Natural Sulfonate Rust break point at 0.70% dosage**





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**SURFONIC® Series Low Foaming  
Surfactants**

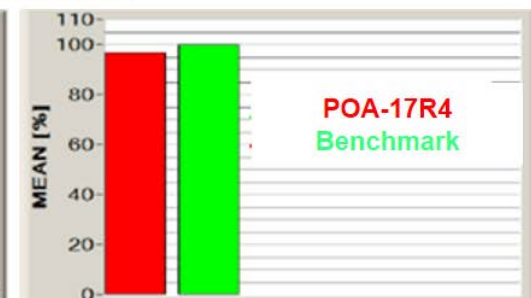
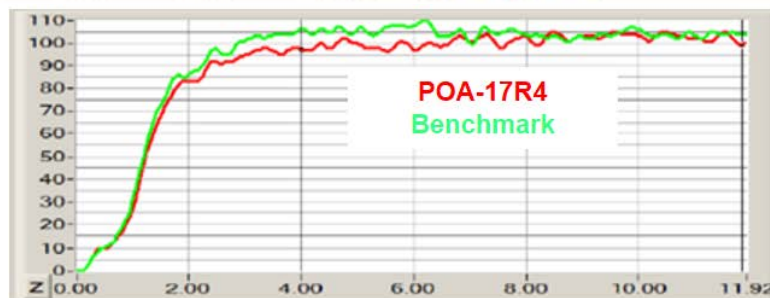
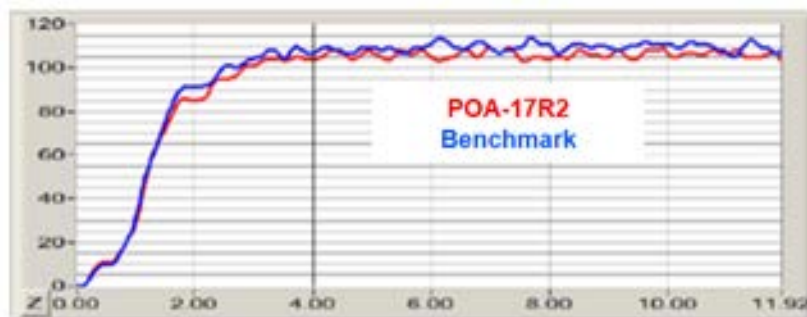


# Huntsman Surfactants

## SURFONIC® POA-17R2 and POA-17R4 Surfactants

Performance	POA-17R2	Benchmark	POA-17R4	Benchmark
Surfactant Concentration	Time to 0 mL Foam Heights	Time to 0 mL Foam Height	Time to 0 mL Foam Heights	Time to 0 mL Foam Height
1 %	52 sec.	20min ( 9 mL of Foam)	1.4min	20min ( 9 mL of Foam)
2.5 %	32 sec.	15 min	2min	4min

Foam break time in DI water. After 20minutes, foam height is measured



Tapping-torque test, 5%, DI water

# Huntsman Surfactants

## SURFONIC® POA-17R2 and POA-17R4 Surfactants

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Components	POA-17R2	Benchmark 1	POA-17R4	Benchmark 2
DI Water	60.20	60.20	60.20	60.20
Monoethanolamine	4.80	4.80	4.80	4.80
Triethanolamine	15.00	15.00	15.00	15.00
Dodecanedioic Acid	2.00	2.00	2.00	2.00
Isononanoic Acid	8.00	8.00	8.00	8.00
<b>Reverse EO/PO Block Copolymer</b>	<b>10.00</b>	<b>10.00</b>	<b>10.00</b>	<b>10.00</b>
Appearance	Clear, Colorless	Clear, Colorless	Clear, Colorless	Clear, Light Yellow
pH, 5% in 125 ppm Hard Water	9.00	9.00	9.00	9.00
Color stability of formulation after 1 month at room temperature ( Pt-Co D1209)	<b><u>75</u></b>	<b><u>94</u></b>	<b><u>101</u></b>	<b><u>310</u></b>



POA-17R2



Benchmark 1



POA-17R4

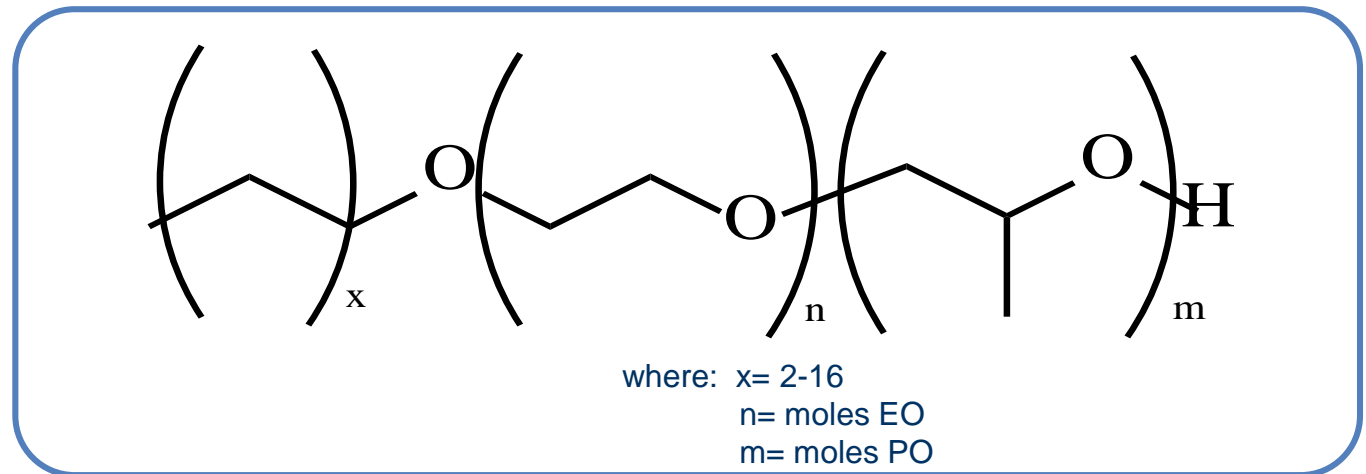


Benchmark 2

# Huntsman Surfactants

## SURFONIC<sup>®</sup> LF ,P and JL Alkoxyates

- The SURFONIC<sup>®</sup> low foaming surfactants are comprised of our SURFONIC<sup>®</sup> LF , P, and JL series
- These alcohol alkoxyates are ideally suited for metalworking operations as they tend to have low foam generation characteristics
- All of the surfactants will aid in solubilizing the components of carboxylate based corrosion inhibitors in water
- Products are suitable for use in both acid and alkaline cleaners.
- For metalworking, these products are best suited for synthetic and semi-synthetic formulations



### General Structure of LF Series Surfactants

# Huntsman Surfactants

## SURFONIC® LF ,P and JL Alkoxylates

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	Appearance	HLB*	Pour Point °C	Cloud Point °C	Solubility in Mineral Oil	
					Paraffinic	Naphthenic
<b>SURFONIC® N-95 Surfactant</b>	Clear Liquid	13.1	4	54	-	-
<b>SURFONIC® L24-7 Surfactant</b>	Clear to Hazy Liquid	11.9	16	53	-	-
<b>SURFONIC® LF-17 Surfactant</b>	Clear Liquid	6.5 – 7.5	-12	34	-	-
<b>SURFONIC® LF-18 Surfactant</b>	Clear to Hazy Liquid	11.9	-6	20	-	-
<b>SURFONIC® JL-80X Surfactant</b>	Clear Liquid	13.1	-5	59	-	-
<b>SURFONIC® P1 Surfactant</b>	Clear to Hazy Liquid	7.0	-30	25	S	S
<b>SURFONIC® P3 Surfactant</b>	Clear to Hazy Liquid	6.0 - 7.0	-30	35	-	S
+ = Soluble      - = Insoluble						

\* Calculated



# Huntsman Surfactants

## SURFONIC® LF ,P and JL Alkoxylates

### Solubility of SURFONIC® Low Foaming Surfactants in Different Solvents ( at Room Temperature)

	Water	5% Sodium Hydroxide	15% Potassium Hydroxide	5% Sodium Phosphate	5% Sodium Chloride	5% Hydrochloric Acid	42.5% Phosphoric Acid	Aromatic Hydrocarbon
SURFONIC® N-95 Surfactant	+	-	-	-	-	-	-	+
SURFONIC® L24-7 Surfactant	+	+/-	-	-	-	-	-	+
SURFONIC® LF-17 Surfactant	+	-	-	-	+	+	+	+
SURFONIC® LF-18 Surfactant	+/-	-	-	-	○	+	+	+
SURFONIC® JL-80X Surfactant	+	+	+/-	+	+	-	+	+
SURFONIC® P1 Surfactant	+	-	-	-	-	+	+	+
SURFONIC® P3 Surfactant	+	-	-	-	○	-	+	+

+ = Soluble      +/- = Dispersible; No Droplets      - = Insoluble      ○ = Slightly Soluble

# Huntsman Surfactants

## SURFONIC® LF ,P and JL Alkoxylates

Simple Alkaline Formulation	
Component	Wt.% of Component
Water	75
50% Sodium Hydroxide	10
Surfactant	2
40% Sodium Xylene Sulfonate	13

Simple Acid Formulation	
Component	Wt.% of Component
Water	65
85% Phosphoric Acid	30
Surfactant	5

# Huntsman Surfactants

## SURFONIC® LF ,P and JL Alkoxylates

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Surface Tension (Lower = Better Wetting)				
Chemical Family	Surfactant	1% Aqueous	1% Alkaline	1% Acid
Nonylphenol Ethoxylate	N-95	32.00 mN/m	32.00 mN/m	-
Linear Alcohol ethoxylate	L 24-7	29.00 mN/m	29.00 mN/m	-
Linear Alcohol Alkoxylate	LF-17	33.00 mN/m	35.00 mN/m	34.00 mN/m
Linear Alcohol Alkoxylate	JL-80X	31.00 mN/m	30.00 mN/m	30.00 mN/m

Draves-Wetting Times in Seconds		
Surfactant	3% Simple Alkaline Formulation	3% Simple Acid Formulation
N-95	26.00	-
L24-7	36.00	-
LF-17	39.00	19.00
JL-80X	31.00	14.00

# The Use of SURFONIC® Low Foaming Surfactants in Metal Cleaning

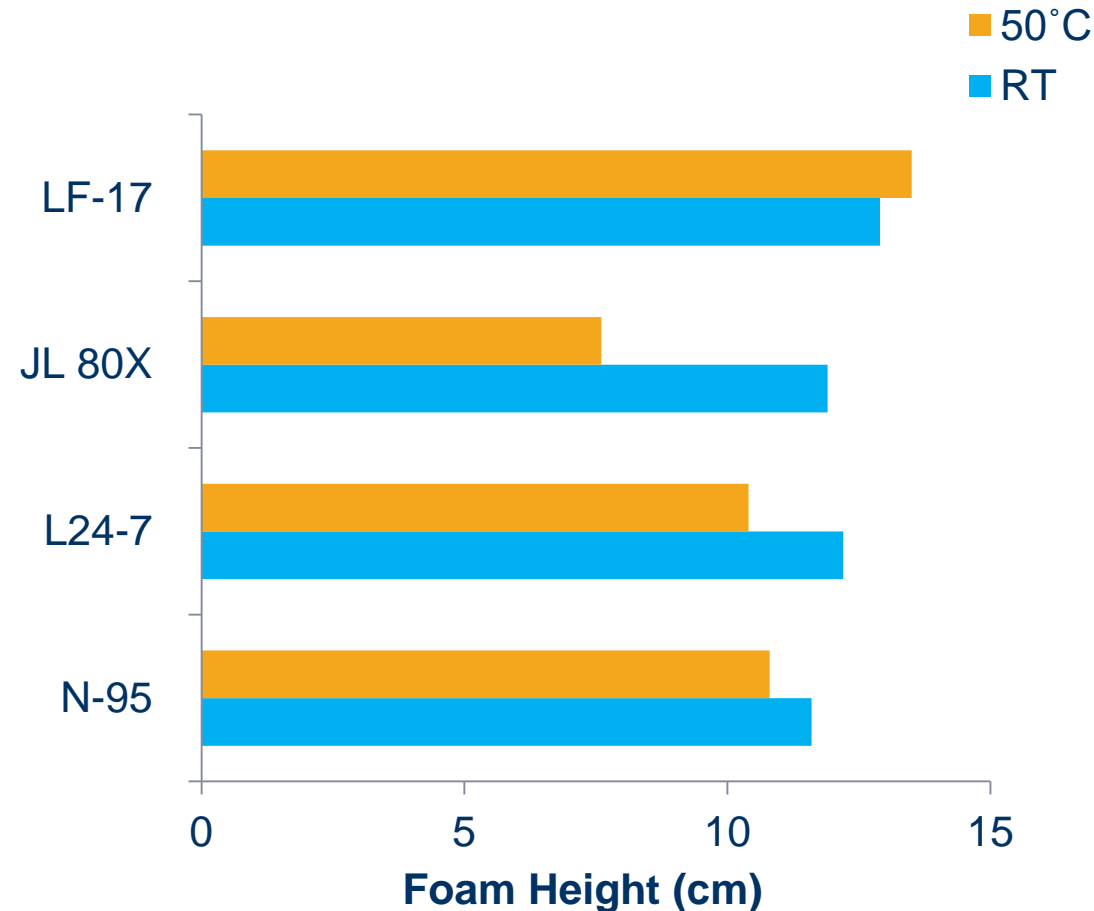
## Ross-Miles Foam Test

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### Initial Foaming by Ross-Miles Foam Test

- Concentrate formulations were diluted by 5% using DI water and evaluated by the Ross- Miles foam test
  - Samples are introduced in a tall, cylindrical vessel of standard dimensions. A second amount of solution is then introduced from above which in turn causes agitation of the fluid below. Final foam height taken after 5 minutes
- By evaluating the products by this method, we were able to look at the foaming ability of the formulations at a higher temperature.



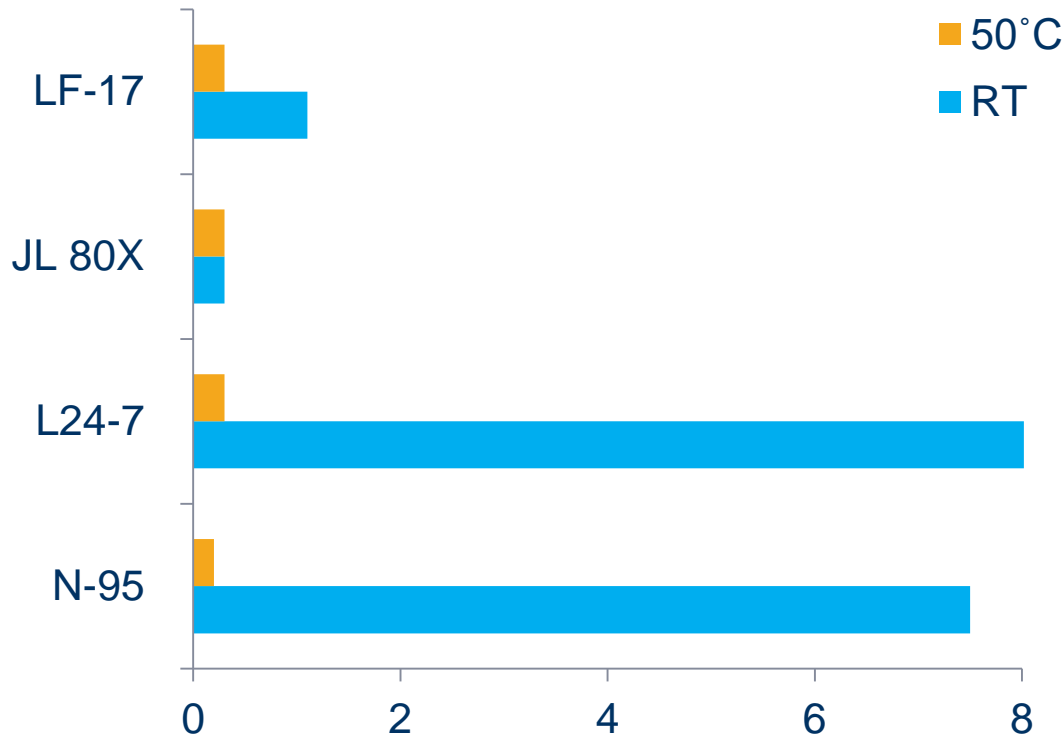
# The Use of SURFONIC® Low Foaming Surfactants in Metal Cleaning

## Ross-Miles Foam Test

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### Final Foam Height by Ross Miles Foam Test



- Initial foam height of LF-17 is maintained at both temperatures
- Initial foam height of JL-80X is improved at a higher temperature
- Final foam heights of LF-17 and JL-80X at room temperature are better compared to other surfactants
- At 50°C, all surfactants had similar final foam height
- Even with higher amount of hydrotrope in alkaline formulation, LF-17 shows better final foam height performance than LAE and NPE at room temperature

# SURFONIC® LF ,P, and JL Series Surfactants

## Alkaline Cleaner Formulation for Cleaning of Synthetic Grease

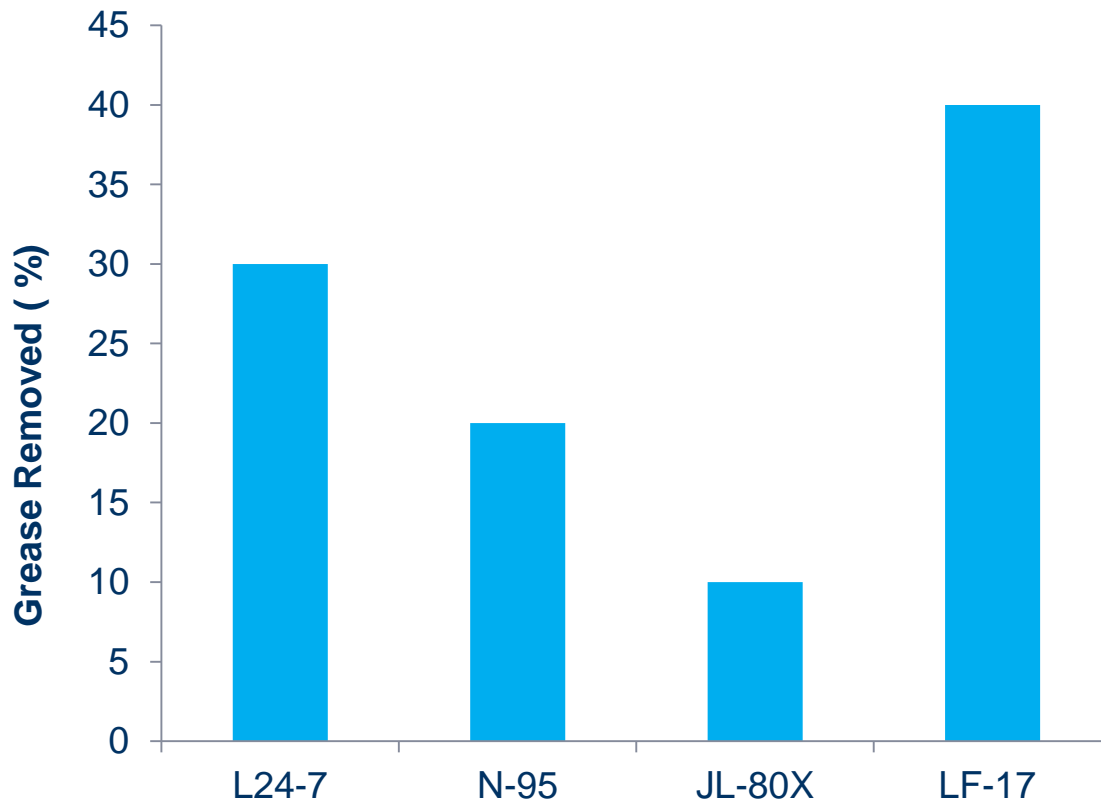
Component	Wt. % of Component			
	L24-7	N-95	JL-80X	LF-17
Sodium Phosphate	2	2	2	2
DGA™ Agent	3	3	3	3
<b>Surfactant</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>
40% Sodium Xylene Sulfonate	6	6	6	7
Deionized Water	83	83	83	82
Appearance	Clear	Clear	Clear	Clear
pH Concentrate	12.15	12.14	12.17	12.15
pH 5% Dilution in DI Water	11.72	11.70	11.73	11.72



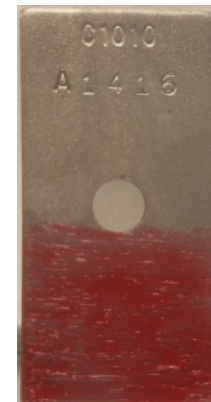
# SURFONIC® LF ,P, and JL Series Surfactants

## Cleaning Evaluation

### Grease Removal by Immersion Method



- Compared to other surfactants, LF-17 removed more grease from metal surface



Before



After



# Huntsman Surfactants



THANK YOU and QUESTIONS

## ChemGroup Delivers Huntsman Surfactants Advantages for Metalworking Applications

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