

BENEFITS

Effective **COUPLING & WETTING**

Stable **EMULSIONS** in high electrolyte & hard water

LOW to HIGH FOAM properties

MULTIFUNCTIONALITY

Effective ANTI-WEAR & EXTREME PRESSURE additives

Excellent CORROSION INHIBITION

Low environmental impact & high **BIODEGRADABILITY**

MILD & LOW TOXICITY products

APPLICATION GUIDE FOR METALWORKING FLUIDS

Product	Chemistry	Anhydrous	Anti-wear	Extreme Pressure	Lubrication	Corrosion Inhibition	Emulsifier	Coupling	Wetting	Low Foam	Dispersion
DeCORE™ AFCI-45	Mixed Carboxylate Alkali Salt					•					
DeCORE™ IMT-100LF	Mixed Amine Carboxylate	•				•				•	
DePHOS™ 8038K						•		•	•	•	•
DePHOS™ 4AL		•	•	•	•	•	•	•	•		
DePHOS™ EP 136		•	•	•	•	•					•
DePHOS™ EP 185		•	•	•	•	•	•				
DePHOS™ EP 40LF	Alleren de tend	•	•	•				•		•	
DePHOS™ H-66	Alkoxylated Phosphate Ester							•		•	
DePHOS™ H-66-872	Thosphate Ester							•		•	
DePHOS™ P-4LF		•	•	•		•		•		•	
DePHOS™ P-4LFK								•		•	
DePHOS™ P-6LF-AS		•	•	•				•		•	
DePHOS™ P-65LF		•	•	•				•		•	
DePHOS™ RA 60		•			•		•	•	•		
MACKADET® 35K	O a diama O a da a and da ta				•						
MACKADET® 40K	Sodium Carboxylate				•						
MACKAM® 2CSF	A It					•		•	•		
MACKAM® 2CSF 40CG	Amphodipropionate					•			•		
MACKAM® 2CY 75	Amphoacetate							•	•	•	
MACKAM® 168L						•		•	•		
MACKAM® DP 122						•		•	•		
MACKAM® H2C-HA	Iminodipropionate					•		•	•		
MACKAM° OIP 40						•		•	•	•	
MACKAM° JEM	Mixed Amphoteric					•		•	•	•	
MACKAMIDE® C-5	Allicanalamaida	•			•	•	•				
MACKAMIDE® TD	Alkanolamide	•			•	•	•				
MACKAZOLINE® TD 78		•			•	•	•				
MACKAZOLINE® TD 80	Imidazoline	•			•	•	•				
MACKAZOLINE® TD 84		•			•	•	•				
MACKESTER® GDSV	Glycol Distearate	•			•		•				
MACKESTER® GSV	Glycol Stearate	•			•		•				





EMULSIFIERS

Emulsifiers are an important component when formulating cutting and forming metalworking fluids. Verdant has a range of products which can be used as emulsifiers in neat oils as well as synthetic and semi-synthetic fluids. They can produce clear formulations which give rapid emulsion formation on dilution and impart excellent emulsion stability. In addition, many of these products will provide good wetting and be stable in high electrolyte and hard water. Selected products may also give some lubrication and corrosion inhibition benefits.

Product	Chemistry	Appearance	Active, %	pH, 1% aqueous	Flash Point, °C	Suggested use level, %
DePHOS™ 4AL		Liquid	98	2.5	>150	1-6
DePHOS™ EP 185	Alkoxylated Phosphate Ester	Viscous Liquid	90	2	>150	1-6
DePHOS™ RA 60		Viscous Liquid	99	2.5	>200	1-6
MACKAMIDE® C-5	Alkanolamide	Liquid	90	10	>100	2-10
MACKAMIDE® TD	Aikanolamide	Liquid	100	10	>100	2-10
MACKESTER® GDSV	Glycol Distearate	Pastille	100	n/a	>150	2-10
MACKESTER® GSV	Glycol Stearate	Pastille	100	n/a	>150	2-10
MACKAZOLINE® TD 78		Liquid	100	11	>150	1-8
MACKAZOLINE® TD 80	Imidazoline	Liquid	100	11	>150	1-8
MACKAZOLINE® TD 84		Liquid	100	11	>150	1-8

ANTIWEAR / EXTREME PRESSURE ADDITIVES

Neat oils, soluble oils, semi-synthetic fluids and synthetics fluids all require additives to give anti-wear and extreme pressure properties to formulations at extreme friction, to prevent welding and deformation of metal surfaces and to reduce wear on machining tools by forming a protective barrier on the workpiece. The Verdant range of phosphate ester based additives are ideal for this purpose.

Product	Chemistry	Appearance	Active, %	рН	P content in product, %	Flash Point, °C
DePHOS™ 4AL		Liquid	98	2.5	6.0	>150
DePHOS™ EP 136		Liquid	98	2.5	4.6	>150
DePHOS™ EP 185	Alkoxylated Phosphate Ester	Viscous Liquid	90	2	4.8	>150
DePHOS™ EP 40LF		Viscous Liquid	98	2	5.6	>150
DePHOS™ P-4LF		Viscous Liquid	70	2	8.6	>100
DePHOS™ P-6LF-AS		Viscous Liquid	99	2.5	6.8	>150
DePHOS™ P-65LF		Viscous Liquid	95	2	5.7	>150

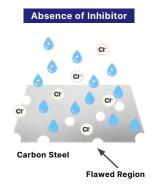


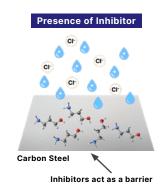
CORROSION INHIBITION

Corrosion is a natural, electrochemical process that converts refined metals into more chemically stable metal oxides. This is observed as pitting, cracking and staining on metal surfaces.

Corrosion inhibitors can slow or prevent oxidative processes by being adsorbed onto metal surfaces, forming a hydrophobic layer which acts as barrier to oxidants. Verdant has a diverse range of products for use in corrosion inhibitor formulations to protect a range of different metals and alloys.

Corrosion Inhibitor Mechanism





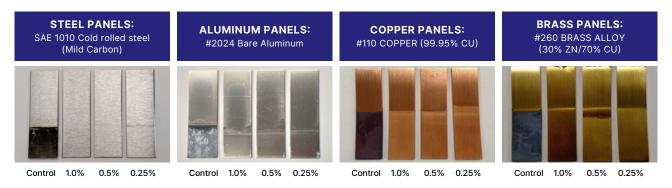
		Range	of Me	tal Prot	ection	Te	Technical Information			
Product	Chemistry	Mild Steel	Aluminum	Brass	Copper	Activity, %	Effective pH Range	Foam Profile		
DeCORE™ AFC1-45	Mixed Carboxylate Alkali Salt	**	***	***	***	45	5.5-10	Low / Moderate		
DeCORE™ IMT-100LF	Mixed Amine Carboxylate	***	**	***	***	100	7-10	Low		
DePHOS™ 4AL		**	***			98	2-10	Low / Moderate		
DePHOS™ 8038K		**	**			80	2-10	Low		
DePHOS™ EP 136	Alkoxylated Phosphate Ester	***	**			99	2-10	Low / Moderate		
DePHOS™ EP 185		***	***			90	2-10	Low / Moderate		
DePHOS™ P-4LF		***	**			80	2-10	Low		
MACKAM® 2CSF		***	***			39	2-10	Moderate / High		
MACKAM® 2CSF 40CG	Amphodipropionate	***	**			39	2-10	High		
MACKAM® 168L		***	**			30	2-10	High		
MACKAM® DP 122	Iminodipropionate	***	***			30	2-10	High		
MACKAM® H2C-HA	iminodipropionate	***	***			30	2-10	High		
MACKAM° OIP 40		**	*			40	2-10	High		
MACKAM [®] JEM	Mixed Amphoteric	**	***		***	34	2-10	Low		
MACKAMIDE® C5	Alkanolomida	**	**			90	7-10	Moderate / High		
MACKAMIDE® TD	Alkanolamide	**	**			100	7-10	Moderate / High		
MACKAZOLINE® TD 78		**	**			100	2-10	Low		
MACKAZOLINE® TD 80	Imidazoline	**	**			100	2-10	Low		
MACKAZOLINE® TD 84		**	**			100	2-10	Low		



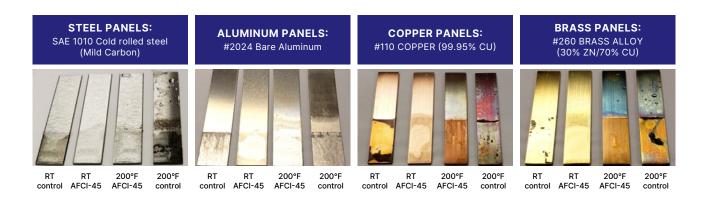
CORROSION INHIBITION

METAL PANEL SUBMERSION TEST: The bottom half of various metal coupons are submerged in hard water solutions containing a Verdant product vs a control. The top half are exposed to the vapor phase in closed glass containers. Corrosion is subjectively evaluated compared to control solutions that do not contain a corrosion inhibitor.

DeCORE™ AFCI-45



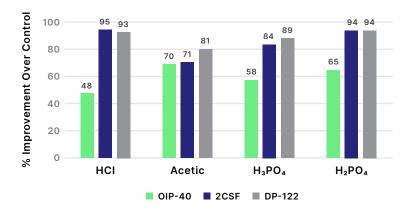
<u>Test conditions:</u> Varying solutions of **DeCORE AFCI-45** from 0.25% to 1.0% as is by weight, water hardness 100 ppm as CaCO3 and 71 ppm as chloride), room temperature, 12 weeks.



ACID CORROSION TEST:

Mild steel washers are submerged in 10% acid solutions and 0.1% active of a MACKAM® amphoteric in sealed jars and held at room temperature. Weight loss of the washers is measured after 48 hrs, compared to a control that does not contain a corrosion inhibitor. Results are reported as a percent improvement over control.

Mild Steel, 48 hrs, RT, 10% acid, 0.1% Corrosion inhibitor





LUBRICANTS

Lubricants are a fundamental aspect of a metalworking fluid formulation because they help reduce the friction between the metal surfaces during cutting and rolling operations. Verdant offers a range of lubricant additives applicable for cutting fluids and rolling oils.

Product	Chemistry	Appearance	Active, %	рН	Flash Point, °C
DePHOS™ 4AL		Liquid	98	2.5	>150
DePHOS™ EP 136	Alkoxylated	Liquid	98	2	>150
DePHOS™ EP 185	Phosphate Ester	Viscous Liquid	90	2	>150
DePHOS™ RA 60		Viscous Liquid	99	2.5	>200
MACKADET® 35K	On diverse On the second state	Liquid	35	10	>100
MACKADET® 40K	Sodium Carboxylate	Liquid	40	10	>100
MACKAMIDE® C-5		Liquid	90	10	>100
MACKAMIDE® TD	Alkanolamide	Liquid	100	10	>100
MACKESTER® GDSV	Glycol Distearate	Pastille	100	-	>150
MACKESTER® GSV	Glycol Stearate	Pastille	100	-	>150
MACKAZOLINE® TD 78		Liquid	100	11	>150
MACKAZOLINE® TD 80	Imidazoline	Liquid	100	11	>150
MACKAZOLINE® TD 84		Liquid	100	11	>150

LOW FOAMING ADDITIVES

Modern metalworking processes often employ high pressures and pumping rates with high-speed machinery which means that foam control is an important issue when formulating products for these applications. The products below from Verdant are low foaming or even virtually non-foaming which make them ideal for these applications.

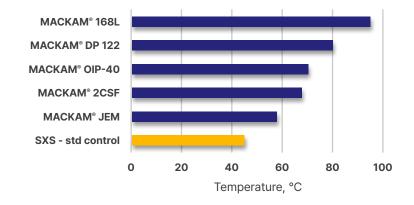
Product	Chemistry	Appearance	Active, %	рН	Flash Point, °C
DePHOS™ 8038K		Liquid	80	7	>100
DePHOS™ EP 40LF	Alkoxylated Phosphate Ester	Viscous Liquid	98	2	>150
DePHOS™ H66-872		Liquid	50	9	>100
DePHOS™ P-4LF		Viscous Liquid	70	2	>100
DePHOS™ P-6LF-AS		Viscous Liquid	99	2.5	>150
MACKAM® 2CY 75	Amphoacetate	Liquid	38	10	>100
MACKAM® JEM	Mixed Amphoteric	Liquid	29	9.5	>100
MACKAM® OIP 40	Iminodipropionate	Liquid	39	9	>100



COUPLING AGENTS/METAL CLEANING

Verdant has an extensive range of coupling agents which help to create stable, clear formulations especially in high electrolyte conditions and in hard water. Many are also excellent wetting agents & degreasing detergents and so can be used in metal cleaning formulations.

Product	Chemistry	Appearance	Active, %	рН	Flash Point, °C
DePHOS™ 4AL		Liquid	98	2.5	>150
DePHOS™ 8038K		Liquid	80	7	>100
DePHOS™ EP 40LF		Viscous Liquid	98	2	>150
DePHOS™ H66		Liquid	50	9	>100
DePHOS™ H66-872	Alkoxylated	Liquid	55	9	>100
DePHOS™ P-4LF	Phosphate Ester	Viscous Liquid	70	2	>100
DePHOS™ P-4LFK		Liquid	65	7	>100
DePHOS™ P-6LF-AS		Viscous Liquid	99	2.5	>150
DePHOS™ P-65LF		Viscous Liquid	99	2.5	>150
DePHOS™ RA 60		Viscous Liquid	95	2	>150
MACKAM® 2CSF	Amphodipropionate	Liquid	39	9.5	59
MACKAM° 2CY 75	Amphoacetate	Liquid	38	10	>100
MACKAM [®] JEM	Mixed Amphoteric	Liquid	29	9.5	>100
MACKAM° OIP 40		Liquid	39	9	>100
MACKAM® 168L	lminodinyonionat -	Liquid	30	7	>100
MACKAM ^o DP 122	Iminodipropionate	Liquid	30	10	>100
MACKAM® H2C-HA		Liquid	30	6.5	>100



Hydrotrope/Coupling Test:

3 component system of a nonionic surfactant, a source of electrolyte and a test hydrotrope. At 25° the solutions are clear. As the temperature is raised, the nonionic will eventually cloud out. The higher the temperature before clouding, the more effective the hydrotrope is.

Test Solutions:

2% **DeTHOX™ 91-6** in 5% NaOH plus 2% active test hydrotrope.





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