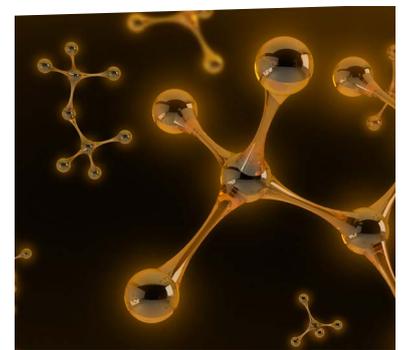


# FUNCTIONAL FLUIDS

Products.  
Services.  
Solutions.





**Your Needs.  
Our Challenge.**

**Our offer to producers of  
Industrial/Automotive Lubricants, Greases,  
Metalworking Fluids, Corrosion Protection Fluids  
and other Functional Fluids**

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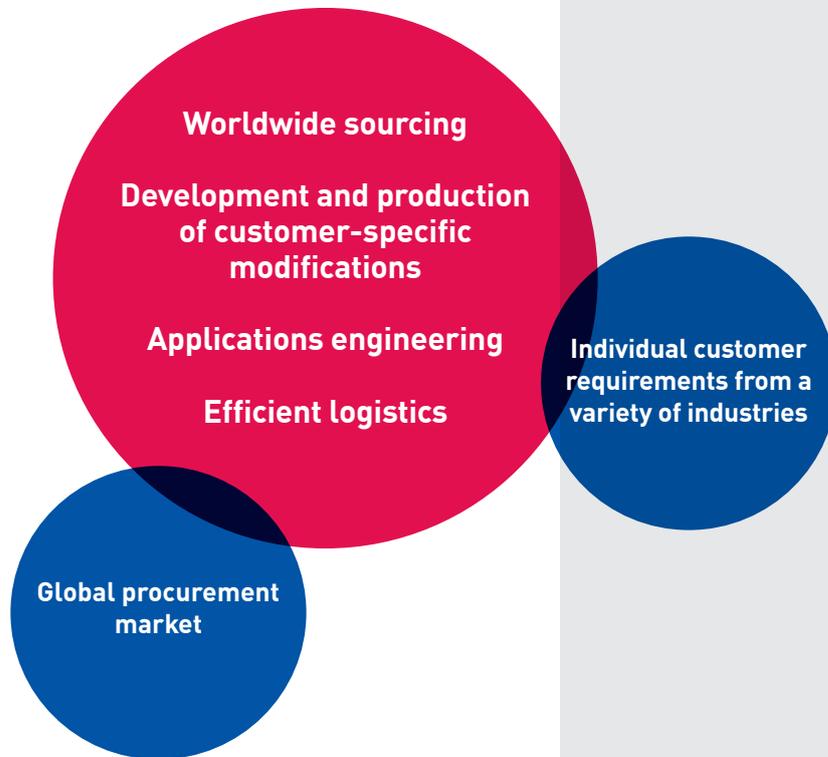
**Reliable for you.**  
For more than 120 years.



Lehmann&Voss&Co. was founded in 1894 in Hamburg, Germany. We create, produce and trade chemical and mineral specialties to numerous industries. As a fourth generation limited partnership Lehmann&Voss&Co. pursues long-term strategies and is a reliable and predictable partner for customers and suppliers.

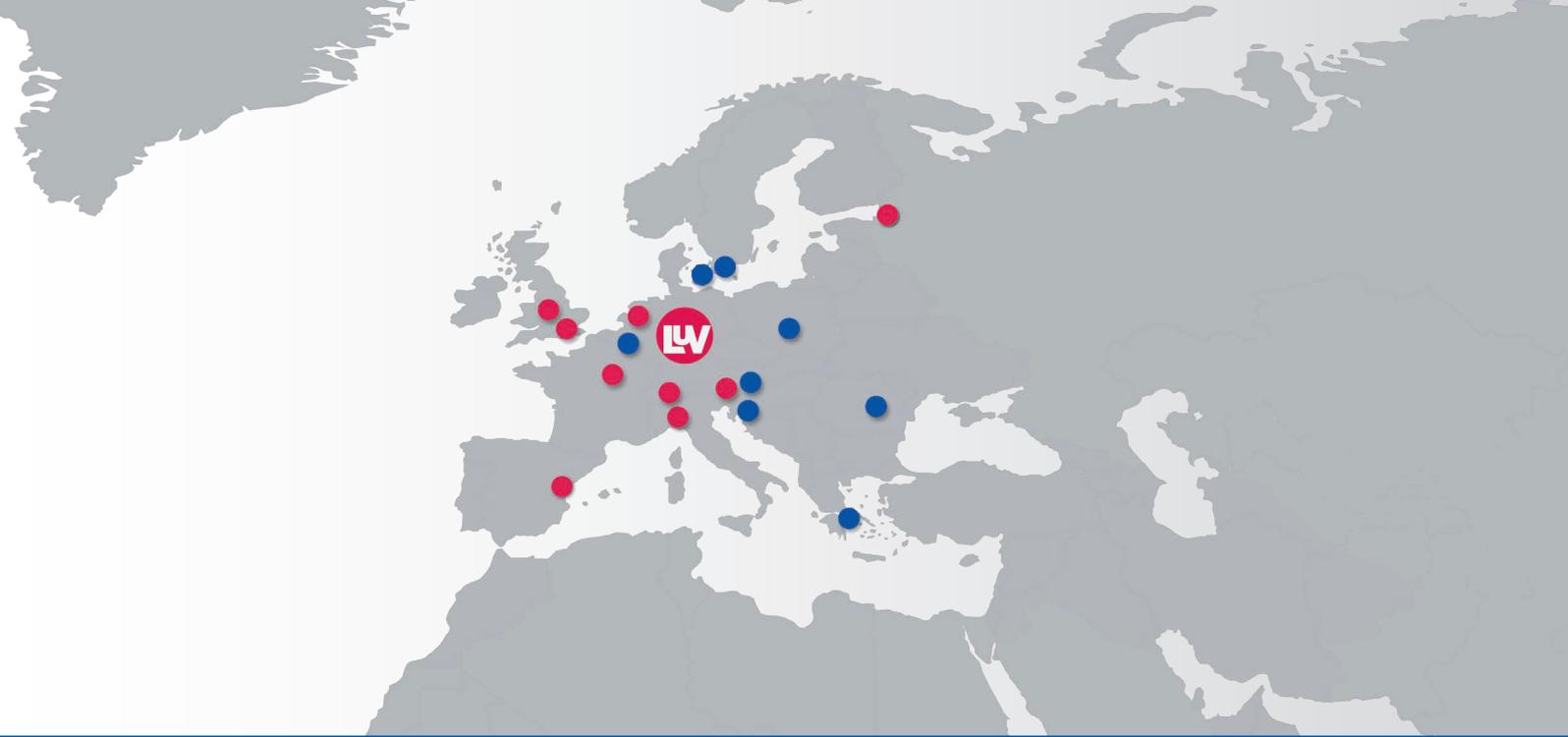
We create links in the world of chemical and mineral specialties.

# Distribution and production under one roof

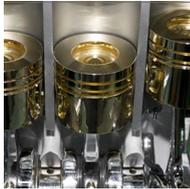


Lehmann&Voss&Co. combines the strengths of a trading and distribution business steeped in tradition with those of a flexible medium-sized problem solver and manufacturer under one roof, in keeping with the services we aspire to provide: sourcing, customizing, manufacturing.

This sets us apart from other companies in the chemicals trade and distribution.



**Industrial  
Lubricants**



**Automotive  
Lubricants**



**Rust  
Preventives**



**Metalworking  
Fluids**



**Water  
Treatment**

## Focused for you

Our Functional Fluids business team concentrates systematically on clearly defined target markets. We observe these markets very precisely and maintain a close rapport with our customers. You can therefore fully expect our advisers to be informed of current trends and developments as well as capable of providing you with a high added value of up-to-date technical and market knowledge extending beyond the details of our products.

## Experienced for you.

For more than 50 years, Lehmann&Voss&Co. surface technology has been specialized in raw materials for industrial and automotive lubricants, rust preventives and metalworking fluids. We currently have a broad range of special chemicals. However, our portfolio does not remain static. We repeatedly add to our powerful and innovative specialties to take account of future trends for customers and to meet the changing market conditions.

# We create competitive advantages through special raw materials

## Qualified for you.

Our advisers come from our customers' markets. All have a sound technical education and excellent connections within their target markets. You benefit from having a contact who speaks the same language and understands your requirements so that there is no time wasting or frictional loss due to lengthy explanations or complicated communication channels.

## Specialized for you.

We carry out applications testing in our specialized laboratories in order to analyse the product properties exactly and to check for any interactions with other constituents of the formulation. These tests also provide our technicians with support in meeting individual customer requirements.

## Flexible for you.

We offer our customers tailor-made solutions for packaging, containers and logistics beyond the usual industry standards. This allows us to develop new opportunities for optimizing production processes, warehouses and efficiency.

## Solution-oriented for you.

One particular strength of our Surface Technology/Functional Fluids business unit is to be found in the development of individual solutions. Thanks to our high level of technical qualification, our own applications technology and laboratories as well as modern plant engineering, we are able to offer our customers product modifications and configurations that are optimally suited to their special requirements

## Simply get in touch.



# KING Industries

Since the 1960s the acronym NA-SUL® has stood for premium quality rust protection. NA-SUL is a neutral corrosion inhibitor based on salts of dinonylnaphthalene sulfonic acid, which impart outstanding ferrous and non-ferrous metal protection, superior demulsibility and filterability properties as well as excellent additive compatibility and synergy with other additives. NA-SUL is designed for the industrial and automotive lubricants industry as well as metalworking fluids (both water-soluble and oil-soluble).

Rust and Corrosion Inhibitors		
KING Industries	Chem. Description	Properties
<b>Standard Products</b>		
NA-SUL® 729	Calcium Dinonylnaphthalenesulfonate (2.1%)	Outstanding demulsification properties Excellent filterability (dry and wet), thermal and hydrolytic stability Highly effective dispersant for solid additives
NA-SUL BSN	Barium Dinonylnaphthalenesulfonate (6.6%)	Non-staining rust inhibitor with outstanding demulsibility at all additive levels Excellent thermal stability and compatibility with other additives Outstanding synergy with other antirust additives
NA-SUL ZS	Zinc Dinonylnaphthalenesulfonate (2.8%)	Excellent demulsibility, thermal and hydrolytic stability Good filterability (dry and wet) Synergistic with ZnDTPs and antioxidants
NA-SUL SS	Sodium Dinonylnaphthalenesulfonate (2,4%)	Forms a highly polar, hydrophobic film which is strongly bonded to metal surfaces Solubility characteristics allow uses in oil or water systems Does not emulsify or demulsify
NA-SUL MG	Magnesium Dinonylnaphthalenesulfonate (1.3%)	Low ash rust inhibitor with excellent filterability and hydrolytic stability Synergy with other antirust additives Promotes the formation of highly water-resistant films
NA-SUL CA-50	Calcium Carbonate Dinonylnaphthalenesulfonate (3.2%)	Non-staining rust and corrosion inhibitors with excess alkalinity (TBN 50) Outstanding rust protection performance in fresh and salt water environments Reserve alkalinity for acid neutralization
NA-SUL CA-770FG	Calcium Alkyl naphthalenesulfonate (1.7%) in PAO	For H1 lubricants requiring rust protection, demulsibility, filterability (dry and wet) Water resistance at low treat levels Excellent compatibility with other additives Also fulfills Eco Label requirements (LuSC listed)
NA-SUL CA-1183	Calcium Dinonylnaphthalenesulfonate/Carboxylate (2.6%)	Excellent multi-metal corrosion inhibitor, outstanding water displacement Particularly effective on galvanized steel Resists gelling from water contact, mild odor, no oxidate wax
NA-SUL CA-1259	Calcium Dinonylnaphthalenesulfonate/Carboxylate (1.6%)	Excellent water displacement, resists gelling in the presence of bulk water Minimizes the need for heating prior to use Improved solubility enables use in a wide variety of diluents
<b>High-Temperature Products</b>		
NA-SUL CA-1089	Calcium Dinonylnaphthalenesulfonate/Carboxylate (2.2%)	Outstanding non-staining properties Excellent demulsibility, filterability (dry and wet), thermal and hydrolytic stability Resists gelling when contaminated with water
NA-SUL CA-HT3	Calcium Dinonylnaphthalenesulfonate/Carboxylate (2.5%)	Outstanding high-temperature stability and good demulsibility Low odor, no characteristic petroleum oxidate odor Easy handling, no melting required
NA-SUL MG-HT	Magnesium Dinonylnaphthalenesulfonate/Carboxylate (1.7%)	Offers exceptional rust protection with outstanding high-temperature stability Good demulsibility and low odor Excellent solubility in a wide range of base stocks
NA-SUL CA-1082	Calcium Dinonylnaphthalenesulfonate/Carboxylate (1.4%)	Good demulsibility, free flowing liquid, no melting required Resists gelling in the presence of bulk water Low odor, does not contain petroleum oxidates
NA-SUL CA-1122	Calcium Dinonylnaphthalenesulfonate/Carboxylate (2.4%)	Excellent solubility in highly paraffinic base oils and PAO Free flowing liquid, no melting required Low odor, does not contain petroleum oxidates
<b>Waxes/Oxidates</b>		
NA-SUL CA/W1177	Calcium Alkylaryl Sulfonate/Carboxylate and Oxidized Petrolatum (1.4%)	Very good water displacement Resists gelling from water contact Compatible with contamination by most alkaline cleaners and metalworking fluids
NA-SUL CA/W1213	Calcium Alkylaryl Sulfonate/Carboxylate and Oxidated Petrolatum (1.4%)	Liquid, wax-containing additive specifically designed for use in harsh environment Forms extremely hydrophobic thin films giving superior metal protection

KING Industries	Chem. Description	Properties
<b>Waterborne Products</b>		
NA-SUL 420	Sodium Dinonylnaphthalenesulfonate and Oxidates	Easily emulsifiable concentrate for the protection of metal parts during storage Effective on steel, galvanized steel and aluminum Very quick film drying, emulsions form easily even in cold water
NA-SUL 437	Dinonylnaphthalene Sulfonic acid, Organic Acid Complex and Amine	For manufacturing of water-based RP fluids Deposits extremely thin hydrophobic films Easily cut back in cold water, solutions are clear and very hard-water tolerant
NA-SUL 450	Calcium Dinonylnaphthalenesulfonate /Carboxylate (0.7%) and Alkanolamines	Emulsifiable concentrate, emulsions form easily with moderate stirring Concentrate has excellent storage stability Deposits extremely thin hydrophobic films, no mineral oil, biodegradable ester carrier
NA-SUL 1019A	Dinonylnaphthalene Sulfonic acid, Organic Acid Complex and Amine	Gives clear solutions Excellent protection for steel, galvanized steel and aluminum Excellent hard-water tolerance, ideal for coating metal parts by dipping
NA-SUL 1101	Ammonium Dinonylnaphthalenesulfonate/Carboxylate	Ashless corrosion inhibitor specifically designed for aluminum and zinc alloys Very easily emulsified, producing stable emulsions at a pH as low as 8 Low odor, free flowing liquid, no melting required

## Applications

Standard Products	Industrial Lubricants														Automotive			RP		MWF					Cl
	Circulating Oils	Compressor Oils	Eco Label	Gear Oils	Greases	Hydraulic Fluids	NSF HX-1	Paper Machine Oils	Gear Oils	Engine Oils	Greases	Rust Preventing Oils	Rust Preventing Aqueous	Dewatering Fluids	Soluble Oils	Cutting Oils	Neat Oils	Steel Rolling Oils	Aluminium Processing	Water-based Cleaners					
NA-SUL® 729	•			•	•	•		•	•	•	•	•			•	•									
NA-SUL BSN	•			•	•	•		•	•		•	•			•	•									
NA-SUL ZS	•			•	•	•		•	•		•	•			•	•									
NA-SUL SS	•			•	•	•		•		•	•	•			•	•									
NA-SUL MG	•			•	•	•		•	•		•	•			•	•									
NA-SUL CA-50				•	•	•		•		•	•														
NA-SUL CA-770FG	•	•		•	•	•	•					•													
NA-SUL CA-1183												•		•											
NA-SUL CA-1259												•		•											
<b>High Temperature Products</b>																									
NA-SUL CA-1089	•					•		•		•		•		•											
NA-SUL CA-HT3	•			•	•	•		•	•		•	•													
NA-SUL MG-HT	•			•	•	•		•		•	•														
NA-SUL CA-1082	•			•	•			•	•		•	•													
NA-SUL CA-1122	•			•	•			•		•		•													
<b>Waxes/Oxidates</b>																									
NA-SUL CA/W1177												•		•											
NA-SUL CA/W1213												•													
<b>Waterborne Products</b>																									
NA-SUL 420													•								•				
NA-SUL 437													•												
NA-SUL 450													•								•				
NA-SUL 1019A													•												
NA-SUL 1101												•	•		•	•	•	•	•						

# KING K-CORR

The K-CORR® Series is based on a unique amino acid derivative and is effective in a broad range of industrial lubricants, functional fluids and greases. One of the unique performance characteristics is the ability to improve the performance of selected anti-wear and extreme pressure agents. Antiwear and rust inhibitors compete for sites on the substrate and are typically antagonistic towards each other. K-CORR inhibitors are synergistic with a variety of antiwear/extreme pressure agents including phosphate esters, triphenylphosphorothionate (TPPT), and sulfurized olefins.

Rust and Corrosion Inhibitors		
KING Industries	Chem. Description	Properties
<b>Ashless Products</b>		
K-CORR® 100	Proprietary Ester/Amide/Carboxylate Chemicals	100% active, relatively low acid no. (<110) Good thermal and hydrolytic stability Synergistic effects in the four-ball wear test together with ashless P-containing AW or S-containing EP additives
K-CORR 100A2	Proprietary Preparation of Ester/Amide/Carboxylate and Amine	Alkanolamine neutralized version of K-CORR 100, acid no. <90 No detrimental effect on FZG performance
K-CORR 1031	Proprietary Carboxylic Acid/Amide Chemicals	Excellent solubility in low-polarity base oils Improves the performance of selected EP/AW agents No detrimental influence on the AFNOR dry and wet filtration tests
K-CORR 1227	Mixture of Organic Amino Acid and Imidazoline Derivative	Improves performance in humidity, salt fog Especially good where corrosive residues of combustion form on metal surface Boosts CI performance Effective at low treat levels
K-CORR SA-300	Proprietary Alkylated Organic Acid/Ester Chemicals in Light Mineral Oil	Highly efficient at very low treat levels with outstanding demulsification properties Good thermal and hydrolytic stability Excellent compatibility with other functional additives
K-CORR G-1086A	Proprietary Preparation of Alkylated Organic Acid/Ester and Zinc Compound in Light Mineral Oil	Excellent solubility in mineral & synthetic oils and greases Exhibits antiwear synergy with AW and EP additives, effective at very low treat levels Good thermal and hydrolytic stability
K-CORR G-1107	Proprietary Ashless Rust Inhibitor and Antiwear Additive	Metal-free rust inhibitor with excellent AW properties Fulfill severe rust requirements in greases, Emcor seawater test Good thermal and hydrolytic stability, effective at low treat levels
K-CORR G-1270	Proprietary Preparation of Zinc Phosphorus-containing Chemicals in Light Mineral Oil	Fulfill severe rust requirements in greases, Emcor 100% synthetic seawater Excellent antiwear performance, effective at low treat levels Low odor

# KING K-CORR NF

The K-CORR® NF series comprises premium ashless liquid yellow metal deactivators for industrial and automotive lubricants, greases and rust preventive fluids. They are used in all types of lubricants and greases where copper and copper-alloy machine parts need to be protected from corrosion.

Rust and Corrosion Inhibitors		
KING Industries	Chem. Description	Properties
<b>Yellow Metal Deactivator</b>		
K-CORR® NF-200	Proprietary Heterocyclic Derivative	Ashless low viscosity YMD Excellent thermal, hydrolytic stability, good demulsification properties Synergistic with primary and secondary antioxidants Compliance with FDA 21 CFR 178.3570
K-CORR NF-400	Chemicals based on Sulfur and Nitrogen	Ashless outstanding yellow metal protection Scavenging active sulfur released by sulfur carriers Good EP additive with very good thermal and hydrolytic stability Excellent solubility in different base stocks

## Applications

KING Industries	Industrial Lubricants										Automotive	RP	MWF	
	Circulating Oils	Compressor Oils	Eco Label	Gear Oils	Greases	Hydraulic Fluids	Paper Machine Oils	NSF HX-1	Engine Oils	Gear Oils	Greases	Rust Preventing Oils	Soluble Oils	Cutting Oils
<b>Ashless Products</b>														
K-CORR® 100	•		•	•	•	•	•			•	•			
K-CORR 100A2	•		•	•	•	•	•			•	•			
K-CORR 1031	•	•		•	•	•	•			•	•			
K-CORR 1227	•	•		•	•	•	•			•	•			
K-CORR SA-300	•			•	•	•	•			•	•	•		
K-CORR G-1086A					•						•			
K-CORR G-1107	•			•	•	•					•			
K-CORR G-1270					•						•			
<b>Yellow Metal Deactivators</b>														
K-CORR® NF-200	•	•		•	•	•		•		•	•	•	•	•
K-CORR NF-400	•	•	•	•	•	•				•	•		•	•

# Lehmann&Voss&Co.

**LUVODUR HVC** series of water-soluble corrosion inhibitors is based on the carboxylic acid blend which forms water soluble amine salts after neutralization with various alkonolamines. Several variations are available, which differ in either the concentration of the acid expressed as acid no. (SZ), or the chemical nature of the amine or amine blend expressed as amine no. (AZ).

**LUVODUR CI** series are dicarboxylic acids with different C-chain lengths used as corrosion inhibitors in metalworking fluids and industrial cleaners. The DSS variation is a very effective metal corrosion protection additive mainly used in bentonite-based greases. It is also water-soluble and therefore used in engine coolants.

Rust and Corrosion Inhibitors		
Lehmann&Voss&Co.	Chem. Description	Properties
<b>Salts</b>		
LUVODUR® CI DSS	Disodium Salt of Sebacic Acid	Water-miscible, can be readily added to water Highly effective metal protection in bentonite and other soap-free greases No negative impact on grease structure Provides multimetal protection in engine coolants
LUVODUR HVC 180 AMP	Amino-Methyl-Propanol neutralized Polycarboxylic Acids	Corrosion inhibitor for water-miscible cutting fluids Low cobalt-leaching tendency
LUVODUR HVC 180 MEA	Mono-Ethanol-Amine salt of a Carboxylic Acid Blend	Corrosion protection additive for water-based functional fluids Easily blended into water-based solutions by simple stirring
LUVODUR HVC 180 EXT	Octanol-Amine neutralized Polycarboxylic Acids	Supports formulators to reduce or eliminate boric acid and formaldehyde donors Corrosion inhibitor for water-miscible cutting fluids Water-based industrial cleaners Leak detection fluids
<b>Carboxylic Acids</b>		
LUVODUR CI L 190-50	2,4,6-Tri-[6-Aminocaproic Acid]-1,3,5-Triazine	Highly effective corrosion inhibitor for iron protection Low foaming tendency. Good hard-water tolerance No negative effect on EP/AW additive performance
LUVODUR HVC 411	C11-Dicarboxylic Acid	Highly effective corrosion inhibitor for water-soluble fluids
LUVODUR CI DCA 900	C9-Dicarboxylic Acid	100% water-soluble Highly effective corrosion protection for ferrous and non-ferrous metals
LUVODUR CI DCA 911	Mixture of C9 and C11 Linear Dicarboxylic Acids	Highly effective corrosion inhibitor for water-soluble fluids Extremely hard-water tolerant Low foaming character
<b>Yellow Metal Deactivator</b>		
LUVODUR® CI BTZ	Benzotriazole	Highly effective water-soluble inhibitor Excellent staining and corrosion protection of NF metals preferably copper Soluble in most base fluids of Grp I-V types
LUVODUR CI TTZ	Tolutriazole	Highly effective water-soluble inhibitor Excellent staining and corrosion protection of NF metals preferably copper Soluble in base fluids of Grp I types

## Applications

Lehmann&Voss&Co.	Aqueous Hydraulic Fluids	Greases	Release Agents	Soluble Oils	Corrosion Protection	Cutting Oils	Microbiol. Resistance with Biocides	Water miscible MWFs	High Load Carrying Capacity	Cleaning Agents	Coolants
	Lubes	RP	MWF	CI							
<b>Salts</b>											
LUVODUR® CI DSS	•	•									•
LUVODUR HVC 180 AMP					•		•	•			
LUVODUR HVC 180 MEA					•			•			
LUVODUR HVC 180 EXT					•		•	•	•		
<b>Carboxylic Acids</b>											
LUVODUR CI L 190-50			•		•			•		•	•
LUVODUR HVC 411					•			•		•	•
LUVODUR CI DCA 900			•		•			•		•	•
LUVODUR CI DCA 911			•		•			•		•	•
<b>Yellow Metal Deactivator</b>											
LUVODUR® CI BTZ	•				•		•	•			
LUVODUR CI TTZ	•				•		•	•			

# KING Industries and Lehmann&Voss&Co.

Our product line is a series of ashless, non-corrosive phenolic and aminic antioxidants that is used in a broad range of industrial lubricants, engine oils, and greases. These products retard the oxidation of lubricants thus reducing sludge formation and increasing viscosity, providing economic and ecological benefits. The antioxidants exhibit the following physical and performance properties: excellent solubility in a wide range of base fluids and enhanced thermal and oxidative stability.

Antioxidants		
KING Industries	Chem. Description	Properties
NA-LUBE® AO-130	Nonylated Diphenylamine	Excellent oxidation resistance to lubricants and greases 100% active substance Mineral-oil-free Easy to handle
NA-LUBE AO-142	Butylated, Octylated Diphenylamine	Excellent oxidation resistance and high TBN Easily blended into all types of high-performance lubricants Synergy with NA-LUBE AO-242 Compliance with FDA 21 CFR 178.3570
NA-LUBE AO-210	2,6-di-tert-Butylphenol	100% active phenolic antioxidant Less volatile than BHT Low melting point, liquefies with minimal heat Particularly effective in combination with aminic AO, YMD and K-CORR 1031
NA-LUBE AO-242	3,5-di-tert-butyl-4-hydroxyhydrocinnamic Acid Alkyl Ester	100% active highly effective phenolic antioxidant Low volatility and low viscosity Low sludge formation and light color Synergy with NA-LUBE AO-142
Lehmann&Voss&Co.		
LUVODUR® AO 101	Tetrakis[methylene-3-(3',5'-di-tert-butyl-4'-hydroxyphenyl) propionate]methane	Sterically hindered phenolic antioxidant with high molecular weight Excellent antioxidative effect High heat stability, good extraction resistance and good compatibility with resins Alkylester substituted BHP
LUVODUR AO 107	Octadecyl-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate	Highly efficient odorless phenolic antioxidant with a low volatility Low antioxidant losses at high operating temperatures Superior thermal stability in comparison to BHT In waxes it exhibits very good color retention
LUVODUR AO 115	Thiodiethylene bis [3-(3,5-di-tert-butyl-4-hydroxyphenyl) propionate]	Multifunctional primary antioxidant and peroxide decomposer Benefits synthetic fluids such as PAO, carboxylic esters and naphthenic base stocks
LUVODUR AO 135	Benzenepropanoic acid,3,5-bis(1,1-dimethylethyl)-4-hydroxy-, C7-9-branched Alkyl Esters	Solvent-free phenolic antioxidant for industrial lubricants and engine oils Very good piston cleanliness in diesel and gasoline engine oils Exhibits good oxidative stability in TOST and RPVOT Better thermal stability in comparison with BHT and other phenolic antioxidants
LUVODUR AO 150	Liquid Mixture of Amine/ Phenol-based Antioxidants	Mixture of aminic and high-molecular-weight phenolic antioxidants Good oxidation stability of industrial lubricants, especially in compressor and gas turbine oils as well as heat transfer fluids
LUVODUR AO 57	Liquid Octylated/ Butylated Diphenylamine	Oxidation protection additive for industrial lubricants, greases and engine oils Good seal compatibility, air release properties and a low volatility

Lehmann&Voss&Co.	Chem. Description	Properties
LUVOMAXX® BHT	Butyl Hydroxytoluene	Low molecular weight Non-staining hindered-phenolic antioxidant Prevents the development of rancidity and the resulting increase
LUVOMAXX CDPA	4-[1-Methyl-1-Phenylethyl]-N-[4-[1-Methyl-1-Phenylethyl]Phenyl]Aniline	High thermal stability Synergistic with sterically hindered phenolic antioxidant and imidazole derivatives
LUVOMAXX ODPA	bis[4-(1,1,3,3-Tetramethylbutyl)Phenyl]Amine	High thermal stability Acts as oxygen scavenger
LUVOMAXX SDPA	Diphenylamine Derivative	Very high molecular weight compared to similar aminic antioxidants Reduced volatility and suitability for use in high-temperature applications
LUVOMAXX TMQ	1,2-Dihydro-2,2,4-Trimethylquinoline, Oligomers	Good thermal stability Acts as oxygen scavenger

## Applications

	Circulating Oils	Compressor Oils	Eco Label	Gear Oils	Greases	Hydraulic Fluids	NSF HX-1	Paper Machine Oils	Engine Oils	Gear Oils	Greases	Temporary RP	Neat Oils	Rolling Oils
<b>KING Industries</b>	Industrial Lubricants						Automotive			RP	MWF			
NA-LUBE® AO-130	•	•		•	•	•		•	•					
NA-LUBE AO-142	•	•		•	•	•	•	•	•					
NA-LUBE AO-210	•	•		•		•		•		•				
NA-LUBE AO-242	•	•		•	•	•		•	•	•		•		
<b>Lehmann&amp;Voss&amp;Co.</b>														
LUVODUR® AO 101					•				•				•	•
LUVODUR AO 107		•			•						•			
LUVODUR AO 115				•	•					•	•			
LUVODUR AO 135	•	•		•	•	•		•	•	•	•		•	•
LUVODUR AO 150	•	•				•			•				•	•
LUVODUR AO 57	•	•		•	•	•		•	•	•	•		•	•
<b>KING Industries</b>														
LUVOMAXX® BHT		•			•						•		•	•
LUVOMAXX CDPA					•		•							
LUVOMAXX ODPA					•									
LUVOMAXX SDPA	•	•		•	•									•
LUVOMAXX TMQ					•									

# KING Industries

The NA-LUBE AW series consists of light-colored, 100% active anti-wear additives based on various phosphorus, nitrogen and sulfur chemicals. All are multifunctional in terms of providing excellent antiwear properties in combination with other properties such as corrosion protection and yellow metal deactivation as well as anti-aging preservation.

Anti-Wear/Extreme Pressure Additives		
KING Industries	Chem. Description	Properties
NA-LUBE® AW-6010	Amine Salts of Aliphatic Phosphoric Acid Esters	Metal-free anti-wear and EP additive with no detrimental FZG performance Light color Low treat levels Excellent solubility properties
NA-LUBE AW-6110	Amine Salts of Aliphatic Phosphoric Acid Esters	Multifunctional ashless additive with excellent anticorrosion Excellent solubility properties, Antiwear and EP properties Light color, low odor, easy to handle
NA-LUBE AW-6110P	Amine Salts of Aliphatic Phosphoric Acid Esters	Multifunctional ashless additive with excellent anticorrosion Excellent solubility properties, antiwear and EP properties Light color, low odor, easy to handle Lower acid no. than NA-LUBE AW-6110
NA-LUBE AW-6220	Proprietary Preparation of Amine Phosphate and Heterocyclic Derivative Chemicals	Ashless antiwear additive Excellent rust, corrosion, and yellow metal deactivation properties Low treat levels Excellent solubility properties
NA-LUBE AW-6310	Proprietary Preparation of Sulfur-Phosphorus-Nitrogen-containing Chemicals	Multifunctional ashless lubricant additive exhibiting outstanding EP/AW Rust inhibiting and demulsification properties Low treat levels Good thermal and hydrolytic stability
NA-LUBE AW-6330	Proprietary Preparation of Phosphorus-Sulfur-containing Chemicals	Multifunctional ashless lubricant additive Exhibiting excellent EP/AW and AO properties Used as a substitute for zinc dialkyldithiophosphates
NA-LUBE AW-6360	Proprietary Preparation of Sulfur-Phosphorus-Nitrogen-containing Chemicals	Exhibiting outstanding EP/AW performance Low treat levels as determined with the FZG gear test rig Excellent rust protection and demulsification properties Good thermal and hydrolytic stability
NA-LUBE AW-6400FG	Amine Salts of Aliphatic Phosphoric Acid Esters	NSF HX-1 approved multifunctional additive Excellent anticorrosion, AW/EP properties Light color, low odor Excellent solubility properties
NA-LUBE ADTC	Methylene-bis-(Dibutyldithiocarbamate)	Ashless multifunctional additive with EP/AW and AO properties Outstanding demulsibility and good thermal stability FZG booster No negative influence on AFNOR filtration

# Lehmann&Voss&Co.

LUVODUR AW/EP additives are ashless alternatives to ZnDTP. Our ATP additives are based on Dialkyl-dithiophosphoric acid (DTPA) but esterified and stabilized against hydrolysis with no ash-forming ingredients. They are used for industrial lubricants such as cutting oils, greases, hydraulic oils and similar lubes as well as for automotive crankcase lubricants.

LUVOMAXX ZDTP is our conventional zinc-containing AW/EP additive which has been used for a long time in industrial and automotive lubricants.

Lehmann&Voss&Co.	Chem. Description	Properties
LUVODUR® ATP A2	Mixture of Esters of Primary C8 - Dithiophosphoric Acid	Can replace ZnDTP Soluble in mineral oils (Grp I-III), PAO, esters and native triglyceride base oils
LUVODUR ATP G2	Mixture of Esters of Primary C8 - Dithiophosphoric Acid	Can replace ZnDTP Soluble in mineral oils of Grp I, esters and native triglyceride base oils Grp II/III and PAO are not suitable due to limited solubility
LUVODUR AW 211	Alkylated Triphenyl Phosphorothionate	Can replace phosphate esters, ZnDTP and chloroparaffins Good wear protection Excellent thermal stability and film strength at high temperatures
LUVODUR TPPT	tris-Phenyl Phosporothionate	Improves general properties of industrial lubricants with EP/AW corrosion Protect volatility of the additive by TGA and other properties
LUVOMAXX® ZDTP	Zinc-dialkyldithio-phosphate	Improves general EP/AW properties of industrial lubricants Acts additionally as anti-aging protection and corrosion protection additive

## Applications

Circulating Oils  
Compressor Oils  
Eco Label  
Gear Oils  
Greases  
Hydraulic Fluids  
NSF HK-1  
Paper Machine Oils  
Engine Oils  
Gear Oils  
Greases  
Temporary RP  
Metalworking Fluids

KING Industries	Industrial Lubricants							Automotive	RP	MWF
NA-LUBE® AW-6010				•		•		•	•	•
NA-LUBE AW-6110	•	•		•		•			•	•
NA-LUBE AW-6110P	•	•		•		•			•	•
NA-LUBE AW-6220		•		•	•	•		•	•	•
NA-LUBE AW-6310	•			•		•	•	•		•
NA-LUBE AW-6330	•			•		•	•	•		•
NA-LUBE AW-6360	•			•		•	•	•		•
NA-LUBE AW-6400FG	•	•		•		•	•		•	
NA-LUBE ADTC			•	•	•	•	•	•	•	
<b>Lehmann&amp;Voss&amp;Co.</b>										
LUVODUR® ATP A2				•	•	•		•	•	•
LUVODUR ATP G2				•	•	•		•	•	•
LUVODUR AW 211		•		•	•	•		•	•	•
LUVODUR TPPT		•		•	•	•				•
LUVOMAXX® ZDTP	•	•		•	•			•	•	•

# ANGUS Chemie

ANGUS specialty additives provide multifunctional benefits for water-miscible metalworking fluids. The CORRGUARD® portfolio includes CORRGUARD-75, 90 and 95 amino alcohols, CORRGUARD SI Corrosion Inhibitor, CORRGUARD LSA - a product containing a maximum of 0.75% secondary amines - and the most recent additions, CORRGUARD EXT and CORRGUARD FLEX amino alcohols. Additional products for metalworking fluids are ALKATERGE®, which are oxazoline-based chemicals that work as emulsion stabilizers and corrosion inhibitors, AEPD a low-VOC corrosion inhibitor and DMAMP a vapor-phase corrosion inhibitor.

pH Neutralizers		
ANGUS Chemie	Chem. Description	Properties
AEPD-85	2-Amino-1,3-ethyl-propanediol (85%)	Especially suitable for metalworking fluids for aluminium Acts as a formaldehyde and sulphur odor scavenger Reacts reversibly with formaldehyde
ALKATERGE®-E	4-Ethyl-2-(8-Heptadecenyl)-2-oxazoline-4-methanol	Good corrosion control Low foaming Mild oxidative properties Emulsion stabilizer
ALKATERGE-T	2-Heptadecenyl-2-oxazoline-4,4-dimethanol	Good corrosion control Low foaming Mildly oxidative properties Emulsion stabiliser
CORRGUARD® series	2-Amino-2-methyl-1-propanol	High-performance alkanolamine for metalworking fluids Low cobalt leaching tendency Acts as a formaldehyde scavenger
CORRGUARD LSA series	2-Amino-2-methyl-1-propanol	Stable emulsions at high pH Low ammonia release, cobalt leaching and foam generation Low secondary amine content (< 0.75%, meets TRGS 611) Improved resistance to microbial degradation
CORRGUARD FLEX	2-Amino-1-butanol, 2-amino-2-ethyl-1,3-propanediol (85%)	Primary amine suitable for low secondary amine formulations Improved corrosion control and extended fluid life Effective pH control, easy to handle and easy to formulate Compatible with a wide range of biocides
CORRGUARD EXT	3-Amino-4-octanol (85%)	Enhances the performance of many biocides Control of bacteria and fungi for lengthy periods Good corrosion control Effective pH control and longer fluid life overall is maintained
CORRGUARD SI	Proprietary anionic organic chemistry	Premier staining inhibitor for metalworking fluids Can be used for aluminum alloys and galvanized steel
DMAMP-80	2-Dimethylamino-2-methyl-1-propanol (80%)	Can be used as a vapor-phase corrosion inhibitor in water-based hydraulic fluids and various industrial and consumer aerosol formulations
HYDROGUARD® I-15	N-Isopropylhydroxylamine, Aqueous Solution	Oxygen scavenger, efficiently removes oxygen without catalysts Provides excellent passivation of steel surfaces in pre-boiler and boiler areas Safer to handle than hydrazine

## Applications

ANGUS Chemie	MWF							Water Treatment				
	Corrosion Protection	Semi-synthetic	Synthetic	pH Control	FAD scavenger	Bacteria Control	Low LSA content	Water Treatment	Hard Water Stability	Corrosion Protection	Oxygen scavenger	Vapor-Phase Corrosion Inhibition
AEPD-85	•			•	•				•			
ALKATERGE®-E				•					•	•		
ALKATERGE-T				•					•	•		
CORRGUARD® series	•			•	•			•	•	•		
CORRGUARD LSA series	•			•	•		•	•	•	•		
CORRGUARD FLEX	•	•	•	•	•	•	•		•	•		
CORRGUARD EXT	•	•	•	•	•	•	•		•	•		
CORRGUARD SI	•			•								
DMAMP-80										•		•
HYDROGUARD® I-15								•		•	•	

# Lehmann&Voss&Co.

LUVODUR HVC MWF-additives are formed from three different series of performance chemicals. These groups are formed of different chemicals such as esters to improve lubricity and wetting properties for water-miscible MWF and straight cutting oils, amide-based corrosion protection for water-based MWF and water-soluble amine soaps of carboxylic acids for water-based solutions of functional fluids.

Lubricifiers		
Lehmann&Voss&Co.	Chem. Description	Properties
LUVODUR® HVC 100	Complex Polyol Ester	Improves the efficiency of water-miscible cooling lubricants Increasing the lubricating properties Low foaming
LUVODUR HVC 144	Complex Mixture of Esters	Improved efficiency in non-water-miscible cooling lubricants Increased wetting effect Improved efficiency of water-miscible cutting fluids for AL
LUVODUR HVC 221	Mixture of Native Fatty Acid Esters	Improves the wetting effect and lubricity of neat oils Synergistic effects with EP/AW additives in the cutting oils
LUVODUR HVC 403	Carboxylic Acid Amide, based on Primary and Tertiary Amines	Corrosion protection of water miscible cutting fluids Highly active substance content Suitable for mineral-oil-containing concentrates Very effective co-emulsifier
LUVODUR HVC 887	Carboxylic Acid Amide, based on Primary Amines	Corrosion protection of water miscible cutting fluids Highly active substance content Suitable for mineral-oil-containing concentrates Very effective co-emulsifier

## Applications

Water-miscible MWF  
Oil-miscible MWF  
Coolants  
Lubricity Improvers  
Corrosion Protection  
Surface Penetration  
Low Foaming

Lehmann&Voss&Co.	Industrial Lubricants						
LUVODUR® HVC 100	•	•	•	•			•
LUVODUR HVC 144	•	•	•	•		•	•
LUVODUR HVC 221	•	•		•		•	
LUVODUR HVC 403	•				•		
LUVODUR HVC 887	•				•		

# KING Industries

In modern industrial and automotive lubricants and greases friction modifiers are used to reduce the friction coefficient and therefore to improve the lubricity and energy efficiency. Not only do high-quality engine oils contain friction modifiers to fulfill fuel economy requirements, but modern industrial lubricants also need more and more friction-reducing additives to decrease the energy consumption in gearboxes and hydraulics. All products are liquid friction modifiers which imparts antifriction and anti-wear properties.

Friction Modifiers		
KING Industries	Chem. Description	Properties
NA-LUBE® FM-1187	Molybdenum Chemicals based on Organic-Type Raw Materials	Liquid molybdenum-based Non-phosphorus, non-sulfur friction modifier Good friction-reducing and anti-wear properties
NA-LUBE FM-1191	Tungsten Chemicals based on Organic-Type Raw Materials	Liquid tungsten-based Non-phosphorus, non-sulfur friction modifier Excellent solubility and good friction-reducing properties Synergistic with Mo-based FM and alkylated diphenylaminic antioxidants
NA-LUBE FM-12137M	Organomolybdate	Liquid molybdenum-based Non-phosphorus, non-sulfur friction modifier Good friction-reducing properties Good solubility in low polarity base oils such as Grp. III and PAO
Lehmann&Voss&Co.		
LUVODUR® FMX	2-Ethylhexyl-Molybdenum Dithiophosphate	Improves anti-wear properties Reduces friction in straight oils and greases Good solubility in standard solvents and mineral oils
LUVODUR MBO	Molybdenum Compounds, Modified Amine, Mineral Oil	Used for various lubricants to reduce friction coefficient Intended for use in neutral or acidic environments only

## Applications

KING Industries	Circulating Oils Compressor Oils Gear Oils Greases Hydraulic Fluids Engine Oils Gear Oils Greases Neat Oils							
	Industrial Lubricants				Automotive			MWF
NA-LUBE® FM-1187	●	●	●	●	●	●	●	●
NA-LUBE FM-1191	●	●	●	●	●	●	●	●
NA-LUBE FM-12137M	●	●	●	●	●	●	●	●
Lehmann&Voss&Co.								
LUVODUR® FMX			●	●	●	●	●	
LUVODUR MBO			●	●				●

## Lehmann&Voss&Co.

Viscosity modifiers are primarily used in multigrade engine oils, gear oils, automatic transmission fluids, power steering fluids, greases and various hydraulic fluids.

Viscosity Modifiers		
Lehmann&Voss&Co.	Chem. Description	Properties
LUVODUR® PAO 400	Poly-alpha-olefin	Conventional High viscose PAO (40 mm <sup>2</sup> /s at 100°C) Good VI Good Low temperature properties
LUVODUR PAO 1000	Poly-alpha-olefin	Conventional High viscose PAO (100 mm <sup>2</sup> /s at 100°C) Good VI Good Low temperature properties
Synfluid® mPAO 65	Isoparaffinic Poly-alpha-olefin	High VI offers to use it in a wide temperature range Excellent low temperature properties compared to conventional PAO's
Synfluid mPAO 100	Isoparaffinic Poly-alpha-olefin	High VI offers to use it in a wide temperature range Excellent low temperature properties compared to conventional PAO's
Synfluid mPAO 150	Isoparaffinic Poly-alpha-olefin	High VI offers to use it in a wide temperature range Excellent low temperature properties compared to conventional PAO's

## Applications

Lehmann&Voss&Co.	Industrial Lubricants					
	Compressor Oils	Gear Oils	Greases	NSF HX-1	Turbine Oils	VI Improvers
LUVODUR® PAO 400	•	•	•	•	•	•
LUVODUR PAO 1000	•	•	•	•	•	•
Synfluid® mPAO 65	•	•	•	•	•	•
Synfluid mPAO 100	•	•	•	•	•	•
Synfluid mPAO 150	•	•	•	•	•	•



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# KING Industries

Many of the NA-SUL<sup>®</sup>, NA-LUBE<sup>®</sup> and K-CORR<sup>®</sup> additives are multifunctional. Ongoing additive technical service and the continued study of interactions, both positive and negative, lead to the development of packages that incorporates the desirable features into one blend for formulating industrial lubricants and greases. These ashless packages are the results of projects targeted at specialty requirements and are generally available in lieu of additive component formulating.

Blends and Packages		
KING Industries	Chem. Description	Properties
KX1200	Combination of Anti-Wear and Corrosion Protection Additives and Antioxidants	Ashless, for synthetic oils Excellent antioxidation properties Good anti-wear and anti-corrosion performance Excellent solubility in mineral and synthetic base stocks
NA-LUBE <sup>®</sup> BL-1208	Combination of Antioxidants and Corrosion Inhibitors	Ashless, good AW and anti-corrosion performance RPVOT 1500 minutes at 0.7% Excellent solubility in mineral and synthetic base stocks Boost with AW additive -> compressor oil Boost with EP/AW-Booster -> industrial gear oil
NA-LUBE BL-1232EL	Combination of Anti-Wear and Corrosion Protection Additives and Antioxidants	Ashless, multifunctional Readily biodegradable (EEL) Good AW, AO (RPVOT & dry TOST) properties Good SRE-NBR seal compatibility
NA-LUBE BL-1300FG	Combination of Anti-Wear and Corrosion Protection Additives and Antioxidants	Food grade approved Very good oxidation thermal and hydrolytic stability Good anti-wear and anti-corrosion performance Passes the Vickers Vane Pump test (V 104-C)
KX1301	Combination of Anti-Wear and Corrosion Protection Additives and Antioxidants	Ashless, multifunctional Excellent AO and anti-corrosion performance in Group III Excellent AO properties (>1000 minutes RPVOT at 0.7%) >10,000h TOST, low sludge
KX1323	Combination of Anti-Wear and Corrosion Protection Additives and Antioxidants	Biodegradable (EEL) gear oil package Excellent AW and anti-corrosion performance Good antioxidant properties Excellent solubility in synthetic base stocks
NA-LUBE BL-1400	Combination of Anti-Wear and Corrosion Protection Additives and Antioxidants	Ashless hydraulic fluid package, low treat rate Very high oxidation stability, high load carrying capacity Good demulsification, excellent thermal/hydrolytic stability Meets Parker Hannifin Denison, SEB, U.S. Steel, AFNOR, VDMA, also VDL
NA-LUBE BL-1792	Combination of Anti-Wear and Corrosion Protection Additives and Antioxidants	Ashless pack for slideway applications Excellent friction control at a low treat level Good compatibility (demulsification) Fully tested in collaboration with SKC

Applications

KING Industries	Industrial Lubricants										
	Circulating Oils	Compressor Oils	Eco Label	Greases	Hydraulic Fluids	Industrial Gear Oils	NSF HX-1	R&O Oils	Slideway Oils	Turbine Oils	Wire Rope
KX1200	•	•			•	•				•	
NA-LUBE® BL-1208	•	•				•		•		•	
NA-LUBE BL-1232EL			•		•						
NA-LUBE BL-1300FG		•			•	•	•	•		•	
KX1301	•							•		•	
KX1323			•	•	•	•					•
NA-LUBE BL-1400	•	•			•					•	
NA-LUBE BL-1792								•			



# Lehmann&Voss&Co.

PAOs are used in many synthetic products such as lubricants, greases and fluids, and have emerged as essential components in many industries and applications. They have numerous advantages in industrial applications. Poly-alpha-olefins offer low coefficients of friction, high thermal stability, superior heat-transfer capabilities and low temperature properties. They are available in a wide viscosity range from 2 to 100 mm<sup>2</sup>/s @ 100°C.

## Poly Alpha Olefins (PAO)

Lehmann&Voss&Co.	Chem. Description	Properties
LUVODUR PAO (low visc.)	Poly-alpha-olefin	Good thermal stability High VI Very good low-temperatur properties Low volatility
LUVODUR PAO (high visc.)	Poly-alpha-olefin	High VI Good low-temperatur properties Low volatility

Fatty esters meet the most stringent requirements of the lubricants industry. They are used as lubricity improvers in applications such as steel, copper and aluminum rolling. Furthermore, they are used in neat oils and emulsions for cutting, grinding and drilling operations. Ester base stocks for industrial gear oils meet the technical requirements of many standards and specifications. In the case of greases ester base stocks contribute to improved cold flow properties, lower volatility, good thermal stability, low noise level, good air release and water separation. Esters are used in a wide range of environmental lubricants. If the chemicals in esters are taken into account as well as the raw materials used, many esters are eligible for Eco Label registration.

## Esters

Lehmann&Voss&Co.	Chem. Description	Properties
<b>Mono Esters</b>		
LUVODUR® ES 4801	2-Ethylhexyl Tallowate	Very good hydrolytic stability Low odor Excellent thermal stability Exhibits synergistic effects with EP/AW additives
LUVODUR ES 4802	2-Ethylhexyl Laurate	Very good hydrolytic stability Good low-temperature properties Good thermal stability
LUVODUR ES 4804	Isotridecyl Stearate	Hydrolytically stable Readily emulsifiable
LUVODUR ES 4805	2-Ethylhexyl Oleate	Hydrolytically stable Low odor High thermal stability
LUVODUR ES 4807	2-Ethylhexyl Palmitate	Hydrolytically stable Readily emulsifiable Very good lubricity properties
<b>Di-Esters</b>		
LUVODUR ES 4820	Di-isotridecyl Adipate	Excellent low-temperatur properties Excellent thermal and oxidative stability
LUVODUR ES 4821	2-Ethylhexyl Sebacate	Outstanding low-temperature properties Excellent thermal and oxidative stability

# Lehmann&Voss&Co.

Polyol-Esters		
LUVODUR ES 4841	Neopentyl Glycol Dioleate	Base fluid for environmental hydraulic fluids Diluent for rapeseed oils Low volatility and good thermal stability Synergistic effects with EP/AW additives
LUVODUR ES 4842	Trimethylolpropane Fatty Acid Ester	Excellent oxidative and hydrolytic stability Good low-temperature properties
LUVODUR ES 4843	Pentaerythritol Fatty Acid Ester	Excellent thermal and oxidative stability Hydrolytically stable
LUVODUR ES 4844	Glycerol Trioleate	Good thermal stability Low volatility Carrier fluid for anti-wear additives
LUVODUR ES 4845	Trimethylolpropane Trioleate	Good hydrolytic stability Good low-temperature properties Excellent lubricity Can be used for biodegradable lubricants
LUVODUR ES 4849	Trimethylolpropane Trioleate	High viscosity Good hydrolytic stability and low temperature properties Excellent lubricity Can be used for biodegradable lubricants
Complex-Ester		
LUVODUR ES 4860	Trimethylolpropane Complex Ester	Good thermal and oxidative stability Improves rheological properties
LUVODUR ES 4862	Complex Ester	Good thermal and oxidative stability Improves rheological properties Soluble in mineral oils Good lubricifier
LUVODUR ES 4863	Complex Ester	Good thermal, oxidative and hydrolytic stability Rheology modifier in MWF concentrates and neat oils Soluble in mineral oils Good lubricifier

Applications

Chain Oils  
Compressor Oils  
Eco Label  
Gear Oils  
Greases  
Heat Transfer Oils  
Hydraulic Fluids  
Low Temp. Application  
NSF HX-1  
Paper Machine Oils  
Turbine Oils  
Vacuum Oils  
Engine Oils  
Gear Oils  
Transmission Fluids  
Greases  
Cutting Oils  
Rolling Oils  
Neat Oils  
Quenching  
Dielectric Fluids  
Friction Modifiers  
Lubricifiers  
VI Improvers

Poly Alpha Olefins (PAO)																				
Lehmann&Voss&Co.	Industrial Lubricants										Automotive				MWF				Add	
LUVODUR PAO (low)		•		•	•					•				•	•			•		•
LUVODUR PAO (high)	•	•		•	•	•	•	•	•					•						•
Esters																				
Lehmann&Voss&Co.	Industrial Lubricants										Automotive				MWF				Add	
Mono Ester																				
LUVODUR® ES 4801																	•		•	•
LUVODUR ES 4802																		•	•	•
LUVODUR ES 4804																	•		•	•
LUVODUR ES 4805				•		•	•										•		•	•
LUVODUR ES 4807																	•		•	•
Di-Esters																				
LUVODUR ES 4820		•		•		•	•							•	•		•			
LUVODUR ES 4821				•		•								•		•				
Polyol-Esters																				
LUVODUR ES 4841						•												•		
LUVODUR ES 4842	•			•			•							•	•	•	•		•	
LUVODUR ES 4843	•			•														•		
LUVODUR ES 4844				•													•		•	•
LUVODUR ES 4845			•			•	•										•	•	•	
LUVODUR ES 4849			•	•		•	•											•		•
Complex-Esters																				
LUVODUR ES 4860	•			•	•		•	•									•			
LUVODUR ES 4862	•			•				•							•	•		•		•
LUVODUR ES 4863	•			•	•										•	•				•



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The product range introduces you to our comprehensive supply of efficient speciality products. It includes professional quality assurance and logistics services that are naturally both smooth and efficient. Yet we are able to deliver more because Lehmann&Voss&Co. also offers an unusual variety of options, experiences and solutions expertise. We apply all of this in a flexible manner so that we are able to offer targeted services.

- **Selectively optimize product properties?**

Regardless of which properties you are striving to achieve for your product, you can expect expert solutions from us with regard to the choice of suitable raw materials.

- **Alter the dosing characteristics?**

Dust-free processing of powders or solutions using special packaging and containers – even seemingly small changes may save time and money in your production process.

- **Test new components and processes?**

Thanks to our outstandingly equipped applications technology and development laboratory together with our decades of experience, we are able to investigate many issues in detail under realistic conditions.

- **Modify physical properties?**

Converting liquids into solids or vice versa – if you wish to have certain product properties changed for your processes, we may have the solution ready and waiting.

- **Simplify production steps?**

Through the premixing of components or the use of raw material packages, for example. Contact us to enable targeted individualization.

- **Individual configurations?**

Whether you are integrating specific additives into a tried and tested matrix or wish to test entirely new combinations – we will support you with our experience and expertise.

- **Develop unconventional solutions?**

Why not try thinking outside of the box? We are particularly keen to discuss unconventional ideas with you. Regardless of whether it is a question of tailor-made container and packaging options, individually adapted material properties or optimization potential in your production process, the expert team from Lehmann&Voss&Co. will support you with extremely efficient and individual solutions to reach your goals.

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