

QUALITY BOOSTS.



Lubricant Additives

Synthetic base fluids & lubricant additives

QUALITY WORKS.

LANXESS
Energizing Chemistry

LUBRICATION COMPONENTS AND SOLUTIONS: NEW FORMULATING POSSIBILITIES FROM ONE OF THE INDUSTRY'S BROADEST PORTFOLIOS

LANXESS is a leading global supplier of components to the lubricants industry. These components are essential to automotive, aviation, marine, mining, refrigeration, power generation, gas pumping and other industries.

Our products help our customers to comply with increasingly demanding government-mandated emissions and fuel-economy standards, protect braking systems from wear and tear, and extend the life of machinery operating at high temperatures or operating continuously.

With manufacturing sites in North and South America, Europe and Asia-Pacific, we are positioned to deliver lubricant components that significantly improve the performance of motor oils, transmission fluids, industrial and hydraulic oils, metal-working fluids and fuels, with exceptional customer care.

We bring you resources on a whole new scale. Our extensive product line enhances lubricant formulations and brings solutions to meet complex technical challenges. Our research capabilities, practical experience, global delivery, dedicated laboratory and on-site support staff make LANXESS the supplier of choice.

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SYNTHETIC BASE FLUIDS

Synthetic Base fluids can significantly enhance the performance of lubricant formulations by providing unique properties and characteristics that cannot be obtained from conventional mineral-based fluids.

They are engineered to support improved performance in lubricant applications where extremes in low and high temperature and heavy loads may be experienced.

Synton® polyalphaolefin

Synton® PAO products are high viscosity, highly saturated, linear/branched polymers that are designed to be used as the high viscosity synthetic oil or viscosity modifier component of a high performance lubricant or synthetic lubricant formulation. The highly saturated chemistry provides excellent response to anti-oxidants and can be an asset in a lubricant formulation for use under high temperature conditions. Blends made with Synton® PAO products can have a high Viscosity Index, with good low and high temperature performance, providing

a lubricant that is usable under widely varying temperature conditions. The relatively low molecular weight of the Synton® PAO products, compared to the classic viscosity modifiers, makes these products stable to the significant shear stresses seen in many applications – especially gear oils. This shear stability behavior, both temporary and permanent, means a more consistent oil film thickness is provided to the working parts and can potentially help with wear protection.



Synton® high viscosity PAO

Synton® PAO 40 Synton® PAO 100

Attributes

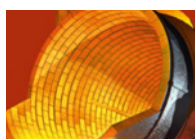
- Excellent shear stability
- High VI providing improved wear protection and better fuel efficiency
- Good low temperature properties for improved flow
- Outstanding oxidation and thermal stability to support extended drain intervals
- Low volatility for lower oil consumption
- FDA 21 CFR 178.3570 / 178.3620 Compliant
- Kosher and Halal approved
- Proven industry standard with extensive formulary application experience
- Manufactured at two regional sites which provides high level of supply security

Property	Synton® PAO 40	Synton® PAO 100
Kinematic viscosity, cSt @ 100 °C	40	100
Kinematic viscosity, cSt @ 40 °C	399	1250
Viscosity index	152	168
Pour point, °C	-36	-24
Flash point, COC, °C	288	301
Fire point, COC, °C	325	327
Specific gravity (20/20 °C)	0.847	0.847

Reolube® phosphate ester base stocks

For general industrial application, **Reolube® 225**, a fully synthetic phosphate ester, is an excellent base stock for formulating ISO VG 46 HFDR fire resistant hydraulic fluids. **Reolube® 225** provides excellent solubility and responds well to a range of additive packages. Where ISO VG 32 is required, **Reolube® 140** synthetic phosphate ester is recommended.

LANXESS also supplies trixylenyl phosphate and low toxicity tert-butylphenyl phosphate ester basestocks that are designed to be blended into fire-resistant hydraulic fluids for use in high risk applications such as nuclear power stations and steel mills.



Reolube®
Isopropylphenyl phosphate ester

Reolube® 140
Reolube® 225

Hatcol® synthetic esters

Hatcol® synthetic ester base stocks are used extensively in synthetic lubricant formulations to enhance high and low temperature performance, improve additive solubility and increase lubricity. They can be used alone for maximum high tempera-

ture performance or in combination with PAOs and Group III oils to improve additive solubility, stability, elastomer compatibility and cleanliness. Our broad synthetic ester line and expert technical support can fulfill virtually any need in lubrication.



Hatcol® monoesters
Hatcol® diesters
Hatcol® triesters
Hatcol® polyol esters

Central ester linkages
Adipates, sebacates, phthalates & dimerates
Trimellitates
NPGs, TMPs, PEs, DiPEs, complexes & specialties

Market	Application	Attributes	Product	Viscosity at 40°C cSt	Benefits (vs. MO, VO & other synthetics)*
Refrigeration	HFC compatible refrigeration compressor oils	Miscibility with HFC refrigerants, materials compatibility, load carrying ability, elastomeric seal compatibility, lower energy consumption.	Hatcol® 3337	15	Reduced energy consumption, polarity to provide miscibility with HFC refrigerant gases, extended life in hermetically sealed applications.
			Hatcol® 3505	22	
			Hatcol® 3506	32	
			Hatcol® 3501	46	
			Hatcol® 3504	68	
			Hatcol® 3503	100	
			Hatcol® 3507	220	

* MO = Mineral Oil, VO = Vegetable Oil

SYNTHETIC ESTERS APPLICATIONS

Market	Application	Attributes	Product	Viscosity – cSt at 40 °C	Benefits (vs. MO, VO & other synthetics)*
Automotive	Crank case oils	High stability in highly oxidative environment, high load bearing at friction points, lower deposits, elastomeric seal compatibility, lower energy consumption	Hatcol® 2938	19	Improved additive solubility and elastomeric compatibility through the modification of polarity of the base oil, improved lubricity and interaction of the base oil with metal surfaces
			Hatcol® 2330	22	
			Hatcol® 2990	31	
			Hatcol® 3169	32	
			Hatcol® 2907	40	
			Hatcol® 2362	72	
			Hatcol® 3391	80	
Automotive	2- stroke engine oils	High temperature stability, lower valve deposits, lower smoking, lower oil and energy consumption	Hatcol® 2999	80	Dramatic reduction in deposits and smoking, cut oil consumption (100:1 gas: oil ratio possible) lower cost of ownership (maintenance and downtime)
			Hatcol® 2949	83	
Industrial	Air compressor oils	High stability in highly oxidative environment, longer drain intervals, lower deposits, lower maintenance and downtime, lower energy consumption	Hatcol® 2938	19	Longer drain intervals, reduced deposits on recip valves, lower maintenance and downtime, reduced energy consumption
			Hatcol® 2901	28	
			Hatcol® 5068	68	
			Hatcol® 2922	85	
Industrial	Oven chain oils	Performance in extreme environments (up to 300 °C), low deposits on chain drives, minimal fumes and odor, lower energy and maintenance costs	Hatcol® 2372	125	Dramatic reduction in deposits, reduction in fumes and odors, cut oil consumption by up to 80%, reduce energy consumption by up to 50%, lower maintenance and downtime
			Hatcol® 5150	178	
			Hatcol® 2941	213	
			Hatcol® 3165	390	
Industrial	Gas turbines	Performance in extreme environments (up to 300 °C), no hot spots which cause hard deposits to form, lower energy and maintenance costs	Hatcol® 2954	24	Dramatic reduction in deposits, reduced energy and oil consumption, reduced maintenance and downtime
			Hatcol® 2960	24	
Biorenewable / biodegradable	Esters having specific natural acid content	Use of green raw materials and green end products	Hatcol® 2938	19	75 % Biorenewable / > 60 % biodegradable
Biorenewable / biodegradable	Esters having specific natural acid content	Use of green raw materials and green end products	Hatcol® 5068	68	10 % Biorenewable / < 60 % biodegradable
Biorenewable / biodegradable	Esters having specific natural acid content	Use of green raw materials and green end products	Hatcol® 2377	20	0 % Biorenewable / > 60 % biodegradable

* MO = Mineral Oil, VO = Vegetable Oil

NAUGALUBE®

AMINIC AND PHENOLIC ANTIOXIDANTS

Antioxidants

Antioxidants are vital components in the prevention of lubricant oxidative degradation due to exposure to oxygen, heat, light and metals during storage and service. Our Naugalube® antioxidant family is suitable for various types of lubricants, including mineral oil based products, synthetic base fluids and greases.

Naugalube® antioxidants meet the challenging requirements of today's industrial standards for stabilization of lubricants and fuels. Synergistic blends can be formulated to optimize cost/performance benefits. Depending on the specific products, antioxidants are available in liquid, powder or flake form. Naugalube® 438L with its extensive application experience serves as a proven industry standard.



Alkylated diphenylamine antioxidants

- Naugalube® 438L
- Naugalube® 438
- Naugalube® 750
- Naugalube® AMS



Phenyl-alpha-naphthylamine based antioxidants

- Naugalube® PANA
- Naugalube® APAN

Hindered Phenolic Antioxidant

- Naugalube® 531

Naugalube® antioxidants application table

Product	Applications	Attributes
Naugalube® 438L	Automotive engine oils, Industrial lubricants and grease	<ul style="list-style-type: none"> ■ Efficient: high performance AO for mineral & synthetic base oils ■ Non-sludging and non-corrosive ■ Effective for deposit control ■ Liquid for easy blending and handling ■ LuSC listed (Ecolabel)
Naugalube® 438	Aviation turbine oils, gear oils, hydraulic fluids, compressor oils, and grease	<ul style="list-style-type: none"> ■ Efficient: high performance AO for mineral & synthetic base oils ■ Non-dusting solid AO ■ NSF HX1 approved
Naugalube® 531	Turbine oil, hydraulic oil, gear oil, gasoline engine oil, metalworking oils, industrial grease, natural and synthetic esters, polyglycols	<ul style="list-style-type: none"> ■ Liquid antioxidant for easy blending and handling ■ High molecular weight providing lower volatility at elevated temperatures ■ LuSC listed (Ecolabel) ■ Polar molecule with a unique branched alkyl ester structure offering excellent solubility in mineral oil and non-conventional base stocks ■ Effective at lower temperatures, allows for broader oxidation control over a wider temperature range when used in conjunction with other antioxidant chemistries such as ADPA ■ Synergistic with aminic antioxidants providing improved deposit control and piston cleanliness
Naugalube® 750	Automotive engine oils, food grade lubricants, and industrial lubricants	<ul style="list-style-type: none"> ■ Efficient: high performance AO for mineral & synthetic base oils ■ NSF HX1 approved ■ Kosher and Halal Certified ■ Non-sludging and non-corrosive ■ Effective for deposit control ■ Liquid for easy blending and handling ■ LuSC listed (Ecolabel)
Naugalube® AMS	Marine diesel engine oils, ATF and industrial oils and grease	<ul style="list-style-type: none"> ■ Excellent high temperature performance ■ Low volatility and high purity ■ Efficient: high performance AO for mineral & synthetic base oils ■ Solid AO
Naugalube® PANA	Aviation turbine oils, industrial lubricants and grease	<ul style="list-style-type: none"> ■ NSF HX1 approved ■ Excellent high temperature performance ■ Solid AO
Naugalube® APAN	Turbine oils and industrial lubricants	<ul style="list-style-type: none"> ■ Efficiency and cleanliness (non-sludging) ■ Excellent high temperature performance ■ Liquid for easy blending and handling

DETERGENTS

Detergents

Additives designed to clean the metal surfaces within a fired engine and prevent the build-up of deposits. The insoluble by-products of the combustion process are removed by the detergents in the lubricants.

Lobase® and Hybase® detergents for transport applications

LANXESS offers a wide range of products from neutral to 500 TBN overbased detergents. These find extensive use in marine, passenger car motor oil and heavy duty diesel applications. In addition to cleaning the metal surfaces within a fired engine, overbased detergents also help neutralize acidic combustion by-products to prevent corrosion within the engine.

Calcium sulfonate and magnesium sulfonate detergents

Property	Lobase®				Hybase®								
	C-45 02	C-4503	C-4506	C-4509	C-231	C-311	C-313	C-320	C-401	C-402	C-400 HS	C-500	M-401
Carbonate form	–	–	–	–	Crys- talline	Amor- phous	Amor- phous	Amor- phous	Amor- phous	Amor- phous	Amor- phous	Amor- phous	Amor- phous
Calcium, wt%	2.35	2.79	2.00	2.95	10.5	12.0	12.0	12.70	15.7	15.2	15.0	18.5	–
Ca Sulfonate, wt%	42.0	44.5	44.0	45	18.5	28.0	28.0	25	19.3	18.5	25.0	20.0	–
Magnesium, wt%	–	–	–	–	–	–	–	–	–	–	–	–	9.3
Mg Sulfonate, wt%	–	–	–	–	–	–	–	–	–	–	–	–	28.0
TBN, mgKOH/g	20	30	8	31	285	305	305	320	418	405	395	495	395
Viscosity @ 100 °C, cSt	45	55	70	60	100	75	75	100	70	75	90	200	150

CORROSION AND RUST INHIBITORS

Corrosion inhibitors

Additives that prevent chemical attack on a metal surface. This group of additives repels water and helps neutralize the acidic reaction by-products of corrosion formed at the lubricant surface. These products are typically used on a variety of metals.

Rust inhibitors

Calcium sulfonate and oxidized petrolatum additives specifically designed to prevent chemical attack on iron and steel surfaces. They displace water from the metal surface by depositing a water-resistant film and neutralize the acidic reaction by-products of corrosion formed at the metal surface. These products are typically used on rolled steel products.



**Calcinate corrosion /
rust inhibitors**

**Calcinate NC
Calcinate C-300CS
Calcinate C-300R**

**Calcinate OTS
Calcinate OR
Calcinate C-400CLR**



**Barium sulfonate
corrosion inhibitors**

**Barinate B-70
Surchem 404
Surchem 404D**



**Hybase® fire-side
corrosion inhibitors**

**Hybase® M-11D
Hybase® M-12D
Hybase® M-13D
Hybase® M-14D**

CALCINATE OVERBASED CALCIUM SULFONATE CORROSION INHIBITORS, ANTI-WEAR AND EXTREME PRESSURE ADDITIVES

Corrosion and rust inhibitors

Our complete line of **Calcinate** overbased calcium sulfonates are used for both corrosion inhibition and EP/AW performance in industrial and metalworking lubricant applications. These products can be used on a variety of metals. They may find use in metal working fluids, industrial oils and grease. Enhanced corrosion inhibition can be found by using LANXESS' barium sulfonates. Overbased detergents can also be effectively used to prevent wear and provide EP performance to lubricants. Typically products containing amorphous calcium carbonate are used for applications where oil clarity is critical, while products containing the crystalline form of calcium carbonate are used when additional EP/AW performance is required.



Property	Method	Calcinate						
		NC	C300CS	C300R	OTS	OR	C-400CLR	C-400W
Carbonate form			Crystalline	Amorphous	Amorphous	Amorphous	Amorphous	Crystalline
Average micelle size, nm		0.5–10	40–80	10–30	10–30	10–30	10–30	100–200
Calcium, wt%	ASTM D4951	2.7	10.5	12.0	12.0	15.2	15.2	14.5
Ca sulfonate, wt%	ASTM D3712	44.5	18.5	28	28.3	18.5	18.5	17.6
TBN, mgKOH/g	ASTM D2896	30	285	305	305	405	405	385
Viscosity @ 100°C, cSt	ASTM D445	55	100	75	75	75	75	–
Viscosity @ 25°C, cPs	–	–	–	–	–	–	–	40,000
Sp. gravity @ 15°C	ASTM D4052	0.96	1.10	1.13	1.13	1.20	1.20	1.15
Color (dilute)	ASTM D1500	5	5	5	5	5	5	5
Free alkalinity, mgKOH/g		–	20	21	30	10	1	–
Copper strip corrosion	ASTM D130	1b	1b	1b	1b	1b	1b	1b
Rust	ASTM D665A	Pass	Pass	Pass	Pass	Pass	Pass	Pass
4-Ball Wear*	ASTM D4172	0.63	0.35	0.33	0.31	0.31	0.32	0.36
4-Ball EP*, weld	ASTM D2783	160	200	200	200	200	250	250
Pin and Vee- Block*, lb.	ASTM D3233A	977	2353	1315	1963	1618	1686	4500

* 10% in 100 SUS naphthenic oil

Magnesium sulfonates – heavy fuel additives: fire-side corrosion inhibitors

Fire-side corrosion inhibitors are additives that are designed to prevent corrosion from combustion products resulting from the burning of fuels containing sulfur, vanadium and other heavy

metals. These products are primarily used in heavy fuel-fired turbines for electrical power generation.

Property	Method	Hybase®			
		M-11D	M-12D	M-13D	M-14D
Magnesium, wt%	ASTM D4951	11.2	12.2	13.2	14.2
Mg Sulfonate, wt%	ASTM D3712	10.0	11.0	12.0	13.0
TBN, mgKOH/g	ASTM D2896	505	550	595	640
Viscosity @100°C, cSt	ASTM D445	15	25	50	60
Sp. gravity @15°C	ASTM D4052	1.150	1.190	1.230	1.250
Flash point, COC, °C	ASTM D92	100	100	100	100
Color (dilute)	ASTM D1500	3.0	3.5	3.5	4.0

Barium sulfonate – enhanced corrosion inhibitors (industrial specialty corrosion applications)

Property	Surchem 404	Surchem 404D	Barinate B-70
Barium, wt%	6.6	6.6	14.0
TBN, mgKOH/g	4.0	4.0	68
Viscosity @100°C, cSt	110	110	40
Sp. gravity @15°C	1.000	1.000	1.160
Color (dilute)	6.0	6.0	5.0
Water demulsibility	---	Pass	Pass
Copper strip corrosion	1b	1b	1b
Rust	Pass	Pass	Pass

ANTI-WEAR & EXTREME PRESSURE ADDITIVES

Anti-wear additives

Commonly used in more severe boundary lubricant applications to reduce wear in areas of high load. Typically, high quality engine oils contain anti-wear additives to protect the engine components in the valve train and gear box.

Extreme pressure additives

Used to prevent sliding surfaces from welding together at high local temperatures and pressures under the most severe conditions. Typically, metalworking fluids require extreme pressure additives to prevent excessive tool wear from scoring or galling.

Calcinate overbased calcium sulfonates corrosion inhibitors, anti-wear and extreme pressure additives

Our complete line of **Calcinate** overbased calcium sulfonates are used for both corrosion inhibition and EP/AW performance in industrial metalworking lubricant applications. These products can be used on a variety of metals. They may find use in metalworking fluids, industrial oils and grease. Overbased detergents can also be effectively used to prevent wear and provide EP performance to lubricants. Typically products containing amorphous calcium carbonate are used for applications where oil clarity is critical while crystalline calcium carbonate products are used when additional EP/AW performance is required. For more information please view the **Calcinate** table on the Corrosion and Rust Inhibitors section, page 10.

Key attributes

- Low sediment/excellent clarity crystalline sulfonates
- Compatible with most mineral base oils, white oils and synthetic base stocks
- Globally registered
- Synergistic EP/AW performance with other additives
- Corrosion inhibition and acid scavenging properties
- Contains no chlorine, phosphorus or active sulfur



**Calcinate anti-wear /
Extreme pressure additives**

**Calcinate C-300CS
Calcinate C-300R
Calcinate OTS**

**Calcinate OR
Calcinate C-400CLR
Calcinate C-400W**

Naugalube® alkyl citrate esters for automotive applications

Naugalube® 810 and **Naugalube® 812** are organic anti-wear additives specially developed for use in automotive engine oils to prolong engine life. Free from metals, sulfur and phosphorus, these additives assist in sustaining the integrity of an engine's catalytic converter. **Naugalube® 812**'s molecular structure gives it an advantage for applications where operating temperatures may exceed 120°C.

Key Benefits

- Metal, phosphorus and sulfur free
- Synergistic with ZDDP
- No friction increase
- Anti-wear retention
- Liquid additive

Attributes

- Oil soluble
- Non-corrosive
- Seal compatible
- Biodegradable








**Naugalube®
Alkyl citrate esters**

**Naugalube® 810
Naugalube® 812**

Durad® phosphate ester based anti-wear/extreme pressure additives

Phosphate Esters are widely known as effective, ashless, anti-wear and mild extreme pressure additives for lubricants and functional fluids. The primary function of phosphate esters is to reduce friction and wear in applications where high loads cause boundary lubrication conditions. They also enhance

solubility and stability in a wide range of lubricant base stocks. The Durad® product line offers a broad range of physical and performance properties tailored for specific applications.

		Phosphorous content wt%	Viscosity @40°C cSt
	Durad® Trialkyl phosphates	Durad® 40	12.0
		Durad® 48	7.8
	Durad® Tricresyl phosphates	Durad® 125 Aviation	8.4
	Durad® Isopropylphenyl phosphates	Durad® 110	8.3
		Durad® 150	8.0
		Durad® 220	7.6
		Durad® 300	7.1
	Durad® t-Butylphenyl phosphates	Durad® 110B	8.5
		Durad® 150B	8.1
		Durad® 220B	7.9
	Durad® EP/AW and Copper corrosion inhibitors	Durad® 220B-EP	8.85
		Durad® 310M	7.3

Durad® 220B-EP

displays excellent anti-wear and extreme pressure performance in laboratory tests. It also shows high resistance to micropitting wear in the FZG test. As a multifunctional additive, Durad® 220B-EP has shown the additional benefits of excellent rust and corrosion protection. It also possesses good solubility and stability in a wide range of lubricant base stocks.

Benefits

- Excellent extreme pressure/anti-wear performance
- Excellent rust/corrosion protection
- Good oxidation stability
- Excellent FZG performance
- High resistance to micro-pitting wear
- Ash free



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Unless specified to the contrary, the values given have been established on standardized test specimens. The figures should be regarded as guide values only and not as binding minimum values. Kindly note that the results refer exclusively to the specimens tested. Under certain conditions, the test results established can be affected to a considerable extent by the processing conditions and manufacturing process.

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