



ZSCHIMMER & SCHWARZ

Z&S LUBRICANT COMPONENTS

YOUR PREMIER SOURCE FOR
SYNTHETIC ESTERS &
METALWORKING ADDITIVES

EsterTec
synthetic esters

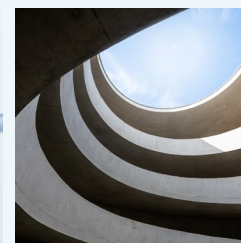
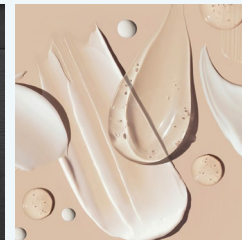
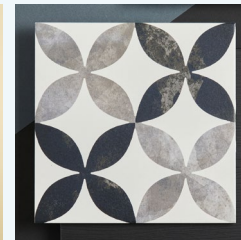
LUBRICIT
synthetic esters

lexolube
synthetic esters

2026

Z&S Business Divisions

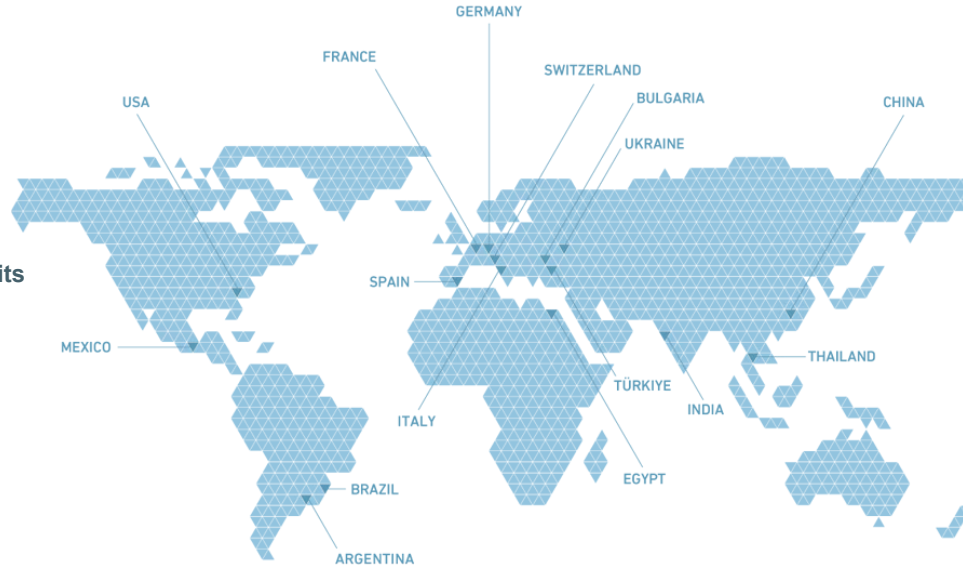
- ▶ Lubricants
- ▶ Leather Auxiliaries
- ▶ Fiber & Textile Auxiliaries
- ▶ Ceramic Auxiliaries
- ▶ Personal Care
- ▶ Cleaning Specialties
- ▶ Industrial Specialties



Zschimmer & Schwarz Group – Company Profile



28 subsidiaries
in 17 countries
on 5 continents
with 21 production units



- Lubricant Components
- Industrial Specialties
- Fibre/Textile Auxiliaries
- Personal Care
- Ceramic Auxiliaries
- Cleaning Specialties
- Leather Auxiliaries



1894

Foundation of the
company in Chemnitz,
Germany

First in-house
production

1909



1959 - 2019

Rapid globalisation.
New company
headquarters in
Oberlahnstein.



Joining the United Nations
Global Compact



2020-26

Z&S Commitment to Sustainability



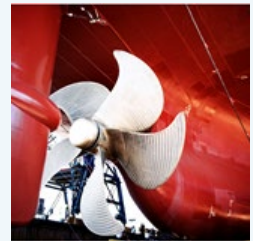
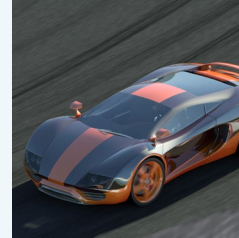
Z&S Lubricant Components

- ▶ Offering the world's most extensive line of synthetic ester base stocks for industrial, marine, transport and dielectric applications
- ▶ Explore our broad portfolio of high-performance lubricant base stocks and metalworking additives, or request a tailor-made product that meets your specific formulation needs



Applications for Z&S Synthetic Esters

- ▶ Metalworking fluids
- ▶ Hydraulic fluids
- ▶ Grease
- ▶ Compressor fluids
- ▶ Transformer oils
- ▶ Bearing lubricants
- ▶ EALs for environmentally sensitive applications
- ▶ Engine oils
- ▶ Transmission fluids
- ▶ Gear oils
- ▶ Drilling muds
- ▶ H1 lubricants for food processing
- ▶ Multifunctional dielectric/coolant/lubricants





Synthetic Esters Provide Performance Features that Petroleum Cannot Deliver

- ▶ Fire resistance – less hazardous
- ▶ Low volatility – high flash point
- ▶ Enhanced lubricity
- ▶ Minimize deposit formation
- ▶ Extreme low temperature operation
- ▶ High VI for fluid energy efficiency
- ▶ Dielectric fluids with high water tolerance

- ▶ Factory Mutual certification



- ▶ EU EcoLabel



- ▶ USDA BioPreferred



- ▶ NSF HX-1 for Incidental food contact



- ▶ IEC/UL dielectric fluid certification



- ▶ VGP/VIDA/EAL compliant



Z&S AT Lab Testing Capabilities:

Ready to Support your Formulation Development Program

- ▶ High and low temperature viscosity, pour point.
- ▶ Flash and fire point
- ▶ Foam tendency, Air release, Demulsibility
- ▶ Oxidative stability with DSC, RPVOT
- ▶ Deposit formation with Pan test and Panel Coker test
- ▶ Volatility by TGA (NOACK) and VOC methods
- ▶ Hydrolytic stability
- ▶ Copper corrosion
- ▶ Friction, Wear and Extreme Pressure measurements
- ▶ Material compatibility, seal swell testing
- ▶ Dielectric properties
- ▶ Thermal Conductivity



Manufacturing Sites



ZS Lubricants Division Manufacturing

- ▶ Milledgeville, GA, USA (2005)
 - Synthetic esters, Surfactants, EP/AW
- ▶ Tricerro, Italy (2016)
 - Synthetic esters
- ▶ Ivey, GA, USA (2019)
 - Synthetic esters, Surfactants
- ▶ Future production in Lahnstein, Germany



Ivey manufacturing – QEC process

- ▶ Quality, Efficiency, Consistency
- ▶ Equipment designed for challenging, lubricant grade Synthetic Esters
- ▶ Accurate charging and temperature control for fast cycles
- ▶ Reduced losses in evaporation, filtration
- ▶ Less waste to process
- ▶ Significant efficiency improvement
- ▶ Automated process control leads to lower product variability



Z&S Italiana – Tricerro Technologies

- ▶ Sulfation
- ▶ Sulfonation
- ▶ Amidation
- ▶ Quaternarization
- ▶ Compounding & Blending
- ▶ Esterification
 - New esterification line built in 2016
 - Dedicated vessels for finishing/refining
 - On-line process control testing



Manufacturing synthetic esters to optimize performance

► QUALITY RAW MATERIALS

- Food safety standards
 - Select products are also Kosher/Halal
- Color, odor, viscosity, etc.

► ACCURATE REACTOR CHARGING

- Efficient use of raw materials
- Short cycle times
- Viscosity control
- Product consistency

► ESTERIFICATION KNOW-HOW

- Low acid value
- Low water content
- Tight specifications
- Filtration

► FORMULATED FLUIDS

- Blending
- Additive treatment
- Drumming and Private labelling



PRODUCT LINE OVERVIEW

Product Name Brands

- ▶ Synthetic Esters (LEXOLUBE[®], LUBRICIT[®])
- ▶ VSP Synthetic Esters (ESTERTEC[®])
- ▶ PEG/PPG Esters (MULSIFAN[®])
- ▶ Phosphate Esters (PHOSPHETAL[™])
- ▶ Phosphonates (CUBLEN[®])
- ▶ Amides (PURTON[®])
- ▶ Emulsion Polymers for Metal forming (SYNTRAN[®])

lexolube
synthetic esters

LUBRICIT
synthetic esters

EsterTec
synthetic esters

Performance Characteristics

▶ SYNTHETIC ESTER BASE OILS

- Boundary lubrication
- Thermal and oxidative stability
- Low volatility/high flash point
- Wide temperature performance
- Low sludge or deposit formation
- Energy efficient
- Biodegradable
- Environmentally and worker friendly

▶ ALKOXYLATE ESTERS (PEG/PPG)

- Non-ionic emulsifiers
- Hard water stable
- Boundary lubrication

▶ PHOSPHATE ESTERS & AMIDES

- Emulsifier/Co-emulsifiers
- Corrosion inhibitors
- Non-staining



ESTER CHEMISTRY Design Options

”Chemistry tailor-made”

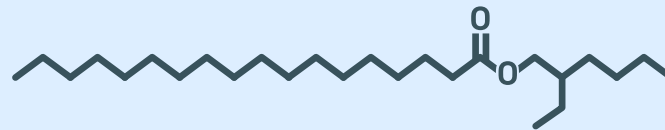
Synthetic Ester Types for Lubricant Applications

- ▶ Mono Esters
- ▶ Diesters
- ▶ Polyol Esters
- ▶ Complex Esters
- ▶ Aromatic Esters
- ▶ Glyceryl Esters
- ▶ Polymeric Esters
- ▶ Vicinal Secondary Polyol Based Esters



Monoesters

- ▶ Typically made from natural fatty acids and mono-alcohols
- ▶ 60-90% renewable
- ▶ Low viscosity
- ▶ Excellent lubricity
- ▶ Low odor and color
- ▶ Environmentally and worker friendly
- ▶ Can be designed for excellent hydrolytic stability
- ▶ Biodegradable



▶ FIELDS OF APPLICATION

- Metalworking
- Textile lubricants
- Aerosol products
- Adjuvants
- Oil field drilling mud
- Biobased lubricants
- HX-1 grades available

Monoesters



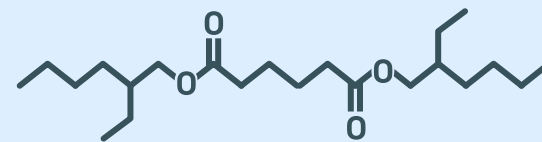
Synthetic Ester	Chemistry	Viscosity @ 40°C (cSt)	Viscosity @ 100°C (cSt)	Pour Pt. (°C)
LUBRICIT 2-EH iC9	Saturated	3.5	1.4	-75
LUBRICIT iC9-9	Saturated	4.5	1.7	-75
LUBRICIT 2-EHL	Saturated	5.0	1.8	-25
LEXOLUBE IPP	Saturated	5.0	2.0	10
LEXOLUBE IPO	Unsaturated	5.5	2.0	-25
LUBRICIT 2-EHC	Saturated	6.0	2.0	-25
LEXOLUBE NBS	Saturated	6.5	2.2	20
LUBRICIT 10L	Saturated	7.0	2.3	20
LUBRICIT 2-EHO	Unsaturated	8.0	2.7	-40
LUBRICIT 2-EHC16	Saturated	8.5	2.6	0
LUBRICIT 2-EHS	Saturated	10	2.9	5
LEXOLUBE HS-S	Saturated	11	3.0	5
LUBRICIT TDS	Saturated	16	4.2	0

► FIELDS OF APPLICATION

- Metalworking
- Textile lubricants
- Aerosol products
- Adjuvants
- Oil field drilling mud
- Biobased lubricants
- HX-1 grades available

Diesters

- ▶ Typically made from dibasic acid and mono-alcohol
- ▶ Not usually bio-based
- ▶ Low to medium viscosity
- ▶ Excellent lubricity
- ▶ Very low pour point
- ▶ Excellent oxidative stability
- ▶ Low odor and color
- ▶ Biodegradable

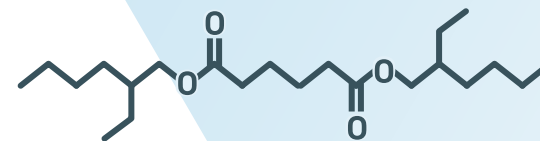


▶ FIELDS OF APPLICATION

- Engine oils
- Compressor oils
- Hydraulic fluids
- Gear oils
- Grease
- Bearings
- Seal swell additives

Diesters

Synthetic Ester	Chemistry	Viscosity @ 40°C (cSt)	Viscosity @ 100°C (cSt)	Pour Pt. (°C)
LEXOLUBE 2I-214/1	NPG	5.5	1.9	-70
LUBRICIT DOA	Diacid	8	2.3	-50
LUBRICIT NGC810	NPG	8	2.5	-30
LUBRICIT NG 710	NPG	8.5	2.5	-50
LUBRICIT NGDP/1	NPG	9	2.6	-30
LUBRICIT DIOA	Diacid	9	2.7	-60
LUBRICIT 2-EHAZ	Diacid	11	3.1	-70
LUBRICIT DINA	Diacid	11	3.1	-60
LUBRICIT DOS	Diacid	12	3.2	-60
LUBRICIT DIDA	Diacid	14	3.6	-60
LUBRICIT NGDC	NPG	18	4	0
LUBRICIT DIDS	Diacid	21	4.7	-50
LUBRICIT PGDO	PG	21	5.5	-30
LUBRICIT DTDA	Diacid	23	4.9	-55
LUBRICIT NGDO	NPG	24	5.8	-30
LUBRICIT DTDA/1	Diacid	27	5.4	-60
LUBRICIT 9515	NPG	46	8.2	-35
LUBRICIT 2-EHD	Dimer	83	13	-40
LUBRICIT 9505	Dimer	88	13	-30
LUBRICIT 2-EHD/1	Dimer	93	13	-40

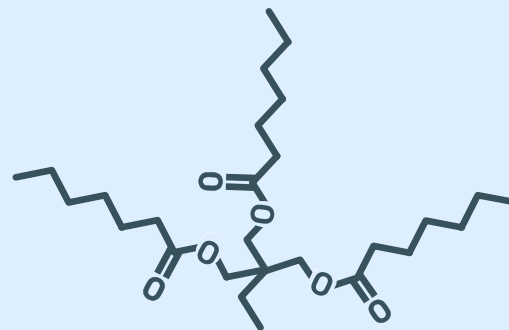


► FIELDS OF APPLICATION

- Engine oils
- Compressor oils
- Hydraulic fluids
- Gear oils
- Grease
- Bearings
- Seal swell additives

Polyol esters

- ▶ Made from neo-polyol and mono-acid
- ▶ Can be bio-based
- ▶ Low to high viscosity
- ▶ Low volatility / High flash point
- ▶ Low pour point
- ▶ Long drain intervals
- ▶ Outstanding oxidative stability
- ▶ Most are readily biodegradable

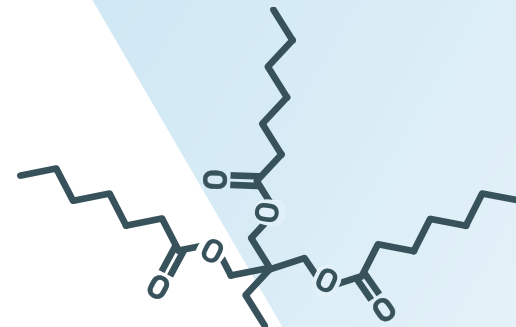


▶ FIELDS OF APPLICATION

- Compressor oils
- Fire resistant hydraulic fluids
- Oven chain oils
- Bearing lubricants
- Gear oils
- Grease
- HX-1 products available

Polyol esters

Synthetic Ester	Chemistry	Viscosity @ 40°C (cSt)	Viscosity @ 100°C (cSt)	Pour Pt. (°C)
LEXOLUBE 2I-214/1	NPG	5.5	1.9	-70
LUBRICIT NG 710	NPG	8	2.5	-50
LEXOLUBE 3I-310	TMP	14	3.4	-65
LUBRICIT TMP C810	TMP	20	4.4	-40
LUBRICIT TMP C9	TMP	21	4.6	-50
LUBRICIT PE 510/1	PE	22	4.7	-45
LUBRICIT NGDO	NPG	24	5.8	-30
LEXOLUBE PQ-25	PE	25	5.0	-55
LUBRICIT PE 4810	PE	32	6.1	-5
LUBRICIT TMP C18	TMP	46	9.4	-40
LUBRICIT TMP iC9	TMP	50	7.0	-35
LUBRICIT PE 418	PE	66	12	-20
LEXOLUBE POE-68HT	DPE	68	10	-40
LEXOLUBE PQ-68	PE	68	8.6	-30
LUBRICIT PE iC18	PE	145	18	-30
LEXOLUBE POE-220HT	DPE	220	19	-25
LUBRICIT DPE 89	DPE	305	23	-15
LEXOLUBE POE-350HT	DPE	350	25	-15

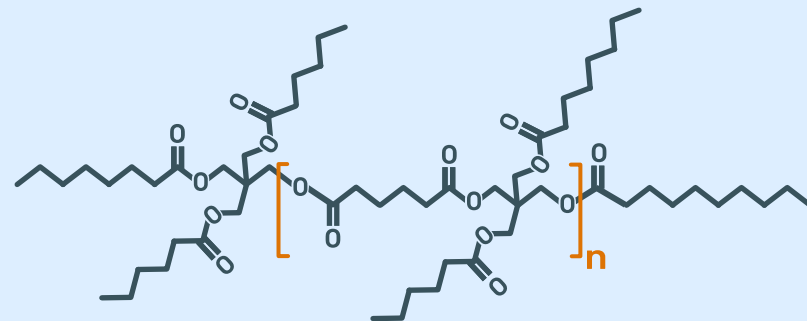


► FIELDS OF APPLICATION

- Compressor oils
- Fire resistant hydraulic fluids
- Oven chain oils
- Bearing lubricants
- Gear oils
- Grease
- HX-1 products available

Complex esters

- ▶ Capped polymeric ester based on both polyacids and polyols
- ▶ Can contain high biogenic content
- ▶ Very high viscosity possible
- ▶ Low volatility/High flash point
- ▶ High viscosity index
- ▶ Antiwear/Extreme pressure
- ▶ Can be biodegradable

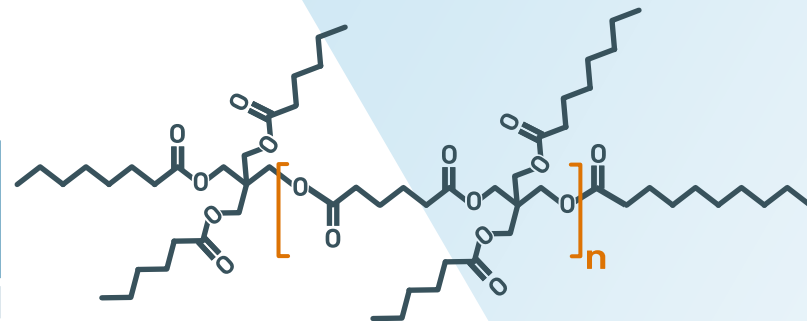


▶ FIELDS OF APPLICATION

- Compressor oils
- Gear oils
- Grease
- Thickening
- Metal protection
- HX-1 products available

Complex esters

Synthetic Ester	Chemistry	Viscosity @ 40°C (cSt)	Viscosity @ 100°C (cSt)	Pour Pt. (°C)
LEXOLUBE CPE-70	Polyol	68	11	-15
LUBRICIT 9522	Dimer	140	19	-50
LUBRICIT 9538	Dimer	140	22	-20
LEXOLUBE CPE-220	Polyol	220	30	-15
LUBRICIT 9526	Polyol	330	45	-40
LUBRICIT 9538/1	Dimer	330	45	-40
LUBRICIT 9552	Trimer	350	35	-40
LEXOLUBE KL-435	Dimer	435	38	-30
LEXOLUBE CLG-460	Polyol	460	40	-20
LEXOLUBE CP-460LC	Polyol	460	46	-25
LUBRICIT 9468/1	Dimer	475	55	-35
LEXOLUBE CPE-1000	Polyol	1000	96	-20
LEXOLUBE CQ-3000	Polyol	3000	205	-15
LEXOLUBE CG-3000	Polyol	3000	290	-20

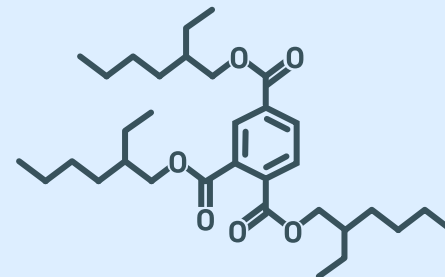


► FIELDS OF APPLICATION

- Compressor oils
- Gear oils
- Grease
- Thickening
- Metal protection
- HX-1 products available

Aromatic esters

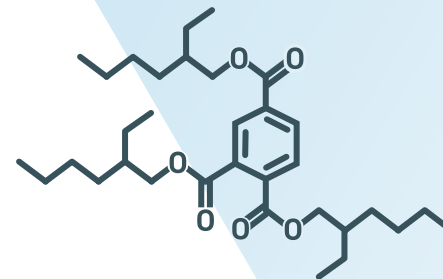
- ▶ Made from aromatic anhydrides and mono-alcohols
- ▶ Not bio-based
- ▶ High viscosity
- ▶ Low viscosity index
- ▶ Low volatility / High flash point
- ▶ Reduced varnish
- ▶ Stable against oxidation & hydrolysis
- ▶ Long fluid life



- ▶ FIELDS OF APPLICATION
 - Compressor oils
 - Gear oils
 - Grease
 - Oven chain lubricants
 - Plasticizers

Aromatic esters

Synthetic Ester	Chemistry	Viscosity @ 40°C (cSt)	Viscosity @ 100°C (cSt)	Pour Pt. (°C)
LUBRICIT 3810	TM	52	8.1	-50
LUBRICIT 3090/1	TM	115	12	-15
LUBRICIT 3010	TM	135	13	-40
LEXOLUBE 4PM-114	PM	170	16	-30
LUBRICIT 3013	TM	185	17	-30
LUBRICIT 2026	TM	195	17	-35
LUBRICIT 3023/1	TM	220	16	-25
LUBRICIT 3013/1	TM	320	20	-30

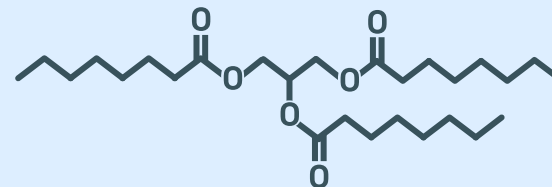


► FIELDS OF APPLICATION

- Compressor oils
- Gear oils
- Grease
- Oven chain lubricants
- Plasticizers

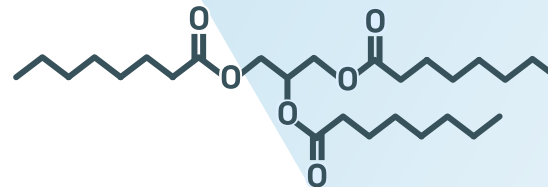
Glyceryl esters

- ▶ Made from glycerol reacted with mono-acids
- ▶ High biogenic content
- ▶ Fast biodegradability
- ▶ Low aquatic toxicity
- ▶ Available as mono-, di-, or triesters
- ▶ Can be HX-1 food grade
- ▶ Excellent as friction modifier additives



- ▶ FIELDS OF APPLICATION
 - Friction modifier additives
 - EAL/EcoLabel lubricants
 - Biobased fluids

Glyceryl esters



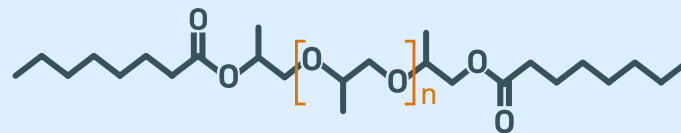
Synthetic Ester	Chemistry	Viscosity @ 40°C (cSt)	Viscosity @ 100°C (cSt)	Pour Pt. (°C)
LEXOLUBE GT-855 IG	Saturated	15	4	-15
LUBRICIT GTO	Unsaturated	40	8.5	-25
LUBRICIT 9504	Unsaturated	42	6.1	5
LUBRICIT GMO	Unsaturated	50	9	0
LUBRICIT GMO-VEG	Unsaturated	50	9	0
LUBRICIT GMT	Unsaturated	75	10	-20
LUBRICIT GMIS	Saturated	129	13	0
LUBRICIT GTL	Saturated	Solid	4.6	45

► FIELDS OF APPLICATION

- Friction modifier additives
- EAL/EcoLabel lubricants
- Biobased fluids

Polymeric esters

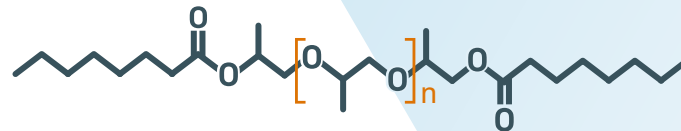
- ▶ Made from polyglycol capped with mono-acids
- ▶ Very high viscosity
- ▶ High viscosity index
- ▶ Low volatility / High flash point
- ▶ Stable against oxidation & hydrolysis
- ▶ Not miscible with polyol esters



▶ FIELDS OF APPLICATION

- Grease
- Thickeners
- Tackifiers

Polymeric esters



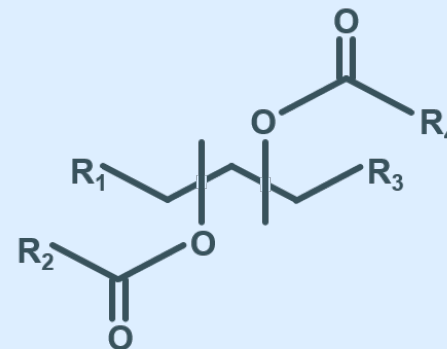
Synthetic Ester	Chemistry	Viscosity @ 40°C (cSt)	Viscosity @ 100°C (cSt)	Flash Pt. (°C)	Pour Pt. (°C)
LEXOLUBE Z-100	PGA	960	80	285	5
LEXOLUBE Z-6000	PGA	1600	120	285	0

► FIELDS OF APPLICATION

- Grease
- Thickeners
- Tackifiers

Vicinal Secondary Polyol based esters - VSP

- ▶ Made from vicinal secondary polyols and biogenic fatty acids
- ▶ Exceptional hydrolytic stability
- ▶ Energy efficient based on high viscosity index, excellent lubricity and low density
- ▶ Low volatility / High flash point
- ▶ Low deposit forming tendency
- ▶ Steric hindrance improves oxidative stability
- ▶ Long fluid life

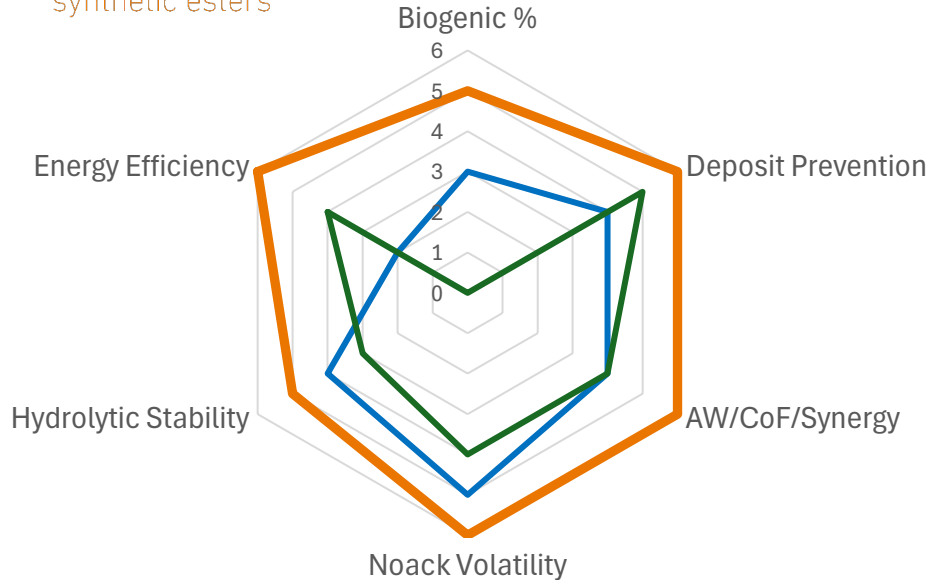


▶ FIELDS OF APPLICATION

- Industrial lubricants
- Engine/Driveline oils
- Metalworking fluids
- Grease
- Marine oils
- Dielectric fluids

All the Performance Advantages Expected from a Standard Diester or Polyol Ester, **Plus...**

EsterTec — VSP — POE — DIESTER
synthetic esters



Standard POE Features

- ▶ Low Pour Point
- ▶ High Flash Point
- ▶ Low Foam Tendency
- ▶ Good Demulsibility
- ▶ Not Corrosive to Copper
- ▶ Good Oxidative Stability
- ▶ Strong Dielectric Properties
- ▶ Good Thermal Conductivity
- ▶ Clear with Low Odor & Color

Product Name	ESTERTEC 2N-1416	ESTERTEC 2LN-1418	ESTERTEC 2L-1425	ESTERTEC 2G-1432	ESTERTEC 7GX-1446	ESTERTEC 7GX-1468	ESTERTEC 8LX-14100	ESTERTEC 8LX-14150
KV100, cSt	3.6	4.1	5	7	9	11	14	18
KV40, cSt	16	18	25	32	46	68	100	150
Viscosity Index	115	125	140	180	165	155	140	130
Pour Point, °C	-60	-40	-25	-42	-40	-40	-35	-30
Density	0.895	0.893	0.890	0.890	0.900	0.915	0.925	0.935
NOACK volatility, %	9	7	3	1	1	1	1	1
Biodegradability	Readily	Readily	Readily	Readily	Readily	Readily	Inherently	Inherently
Biogenic Content, %	64	65	70	74	60	50	40	30
Oxidative Stability	☑	☑	☑	☑	☑	☑	☑	☑
Hydrolytic Stability	☑	☑	☑	☑	☑	☑	☑	☑
Friction/Wear Reduction	☑	☑	☑	☑	☑	☑	☑	☑
Energy Efficiency Advantage	☑	☑	☑	☑	☑	☑	☑	☑
Cost/Performance Advantage	☑	☑	☑	☑	☑	☑	☑	☑

BENEFITS OF SYNTHETIC ESTERS



Synthetic Ester Design Considerations

► DETERMINE CRITICAL APPLICATION PERFORMANCE REQUIREMENTS

- Low cost – Oleates, natural fatty acids, commodity raw materials
- High viscosity – Dipentaerythritol, complex esters or polymeric
- High viscosity index – Linear structures, long chain fatty acids
- Thermal stability – Polyols, branched acids, fully saturated components
- Biodegradability – Natural fatty acids, less branching
- Food contact – Ingredients with detailed information on toxicity, NSF listed
- Dielectric strength – High purity, low water and acidity



► ZS BUILDS THE ESTER FROM COMPONENTS THAT WILL DELIVER THE CUSTOMERS DESIRED PROPERTIES

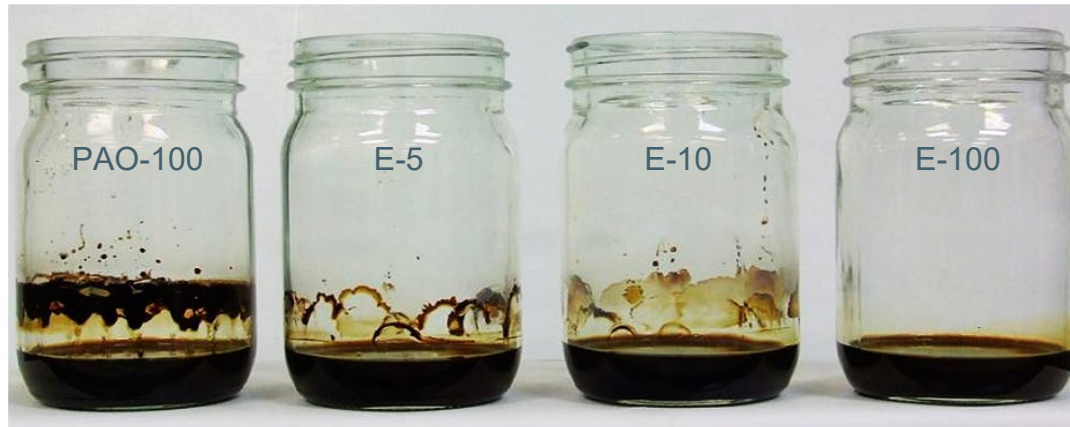
Esters as base oil blend components reduce deposits and sludge

► BLENDS OF PAO AND POE

- All fluids were ISO 68
- Tested 20 hours at 260°C

► RESULTS

- 6-7% evaporation for all samples
- 5% POE significantly reduces deposits



Hydraulic fluids

- ▶ Synthetic Esters provide excellent thermal and oxidative stability
- ▶ Low sludge formation
- ▶ Fire resistance (“Less Hazardous” HFDU fluids)
- ▶ Low volatility
- ▶ Very low compressibility
- ▶ High VI provides improved energy efficiency
- ▶ Typical viscosity grades – ISO 32, 46, 68
- ▶ Good lubricity



Oven chain oils

- ▶ Synthetic Esters provide excellent thermal and oxidative stability
- ▶ Typical viscosity grades (ISO 68-460)
- ▶ 97% synthetic ester, 3% additives
- ▶ Polyol esters – up to 275°C
 - Best oxidative stability, very clean, low varnish
- ▶ Aromatic esters – up to 250°C
 - Higher evaporation, softer deposits
- ▶ Complex esters – up to 225°C
 - Better lubricity and antiwear, low evaporation



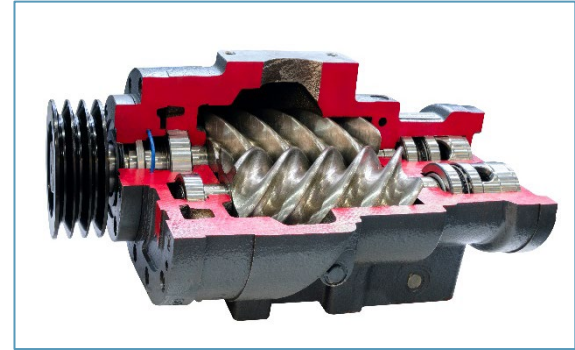
Grease

- ▶ Synthetic Esters allow wide temperature range performance
- ▶ Typically formulated with non-soap thickener (urea, silica, etc.)
- ▶ Polyol esters: up to 240°C
 - Best oxidative stability, very clean, low varnish
- ▶ Arctic grease: down to -60°C
 - Low viscosity diester or polyol ester
- ▶ Bio-based esters: -20 to +175°C
 - Excellent lubricity
 - Recommended for environmentally sensitive areas



Air Compressor Oils

- ▶ Synthetic Esters offer deposit control and long life
- ▶ Excellent thermal/oxidative stability
- ▶ POE used in combination with PAO or Group III MO
- ▶ Reciprocating and rotary vane compressors
 - Diesters and Aromatic esters for lubricity and solvency
- ▶ Rotary screw and centrifugal compressors
 - Polyol esters for oxidation stability
- ▶ NSF HX-1 Polyol esters
 - For compressors in food processing plants



Refrigeration Compressor Oils

- ▶ Optimal solubility/compatibility with HFC, HFO and HC refrigerant gases
- ▶ Reciprocating, rotary vane and centrifugal compressors
 - High purity polyol esters for long life
- ▶ Excellent thermal and hydrolytic stability
- ▶ High thermal conductivity
- ▶ Excellent electrical resistivity
- ▶ Provides wear protection and noise reduction
- ▶ Long life



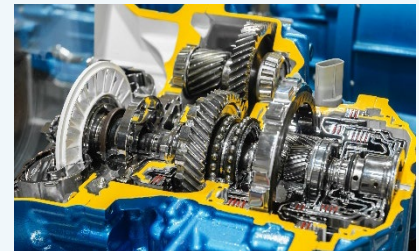
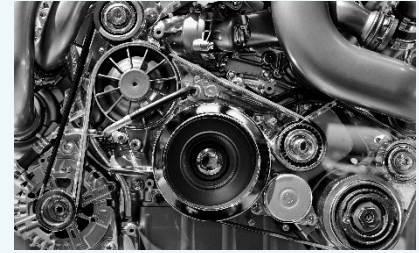
Synthetic Transformer Oils and Dielectric Fluids

- ▶ High flash and fire point
- ▶ Good thermal stability for long life
- ▶ Low viscosity with low volatility
- ▶ Excellent dielectric properties
- ▶ Compliant with IEC 61099, FM 6933, UL EOUV
- ▶ Environmentally friendly
- ▶ Bio-based esters offer improvement over vegetable oils and mineral oils



Automotive Applications

- ▶ Synthetic Esters have a long history of high performance in racing oils and premium synthetics
- ▶ Full synthetic oils typically utilize a combination of PAO and synthetic ester. Low viscosity trend (0W-20 and lower)
- ▶ Diesters improve additive solubility and provide seal conditioning
- ▶ Low NOACK volatility
- ▶ Clean, reduces sludge formation
- ▶ Long drain intervals



Environmentally Acceptable Lubricants (EAL)

- ▶ Synthetic Esters are optimum for environmentally sensitive applications:
 - Marine
 - Mining
 - Forestry
 - Agriculture
 - Railroad
 - Wind turbines
- ▶ Performance is equal or better than petroleum oils

- ▶ Most esters meet USA EPA Marine (VGP) Vessel General Permit standards



- ▶ Many esters are renewable, sustainable, and have USDA BioPreferred status



- ▶ Wide variety of synthetic esters on LuSC list achieve EU Ecolabel status





PRODUCTS FOR METALWORKING FLUIDS

Esters in metalworking fluids

▶ MONO and POLYOL ESTERS

- Excellent lubricity
- Non-toxic, Non-hazardous handling
- Low color and odor
- Biodegradable

▶ COMPLEX ESTERS

- Boundary lubrication
- Improves AW/EP

▶ ALKOXYLATE ESTERS (PEG/PPG)

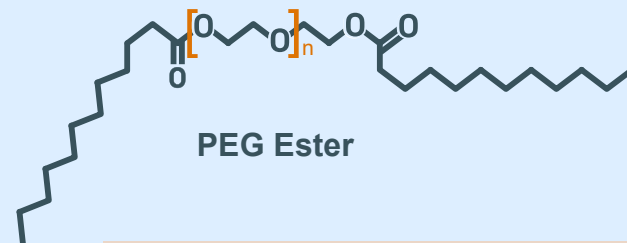
- Non-ionic emulsifiers
- Hard water stable
- Boundary lubrication

▶ PHOSPHATE ESTERS

- Emulsifier/Co-emulsifier
- Corrosion inhibitor
- Non-staining

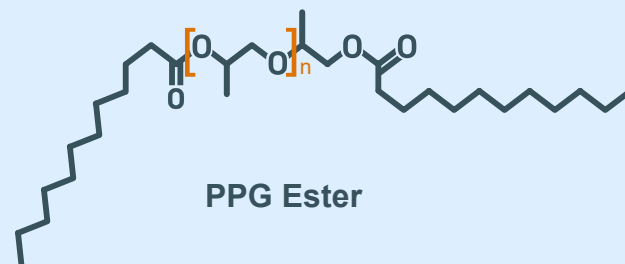
MULSIFAN® Series

- ▶ Esters of natural fatty acids and polyglycols
- ▶ Emulsifiers with HLB 6 to 14
 - Higher PEG increases HLB
 - Longer fatty acid decreases HLB
 - Diesters have lower HLB
- ▶ Couplers, dispersants, defoamers
- ▶ Good lubricity
- ▶ Non-toxic, Non-hazardous handling
- ▶ Low foam, hard water stable



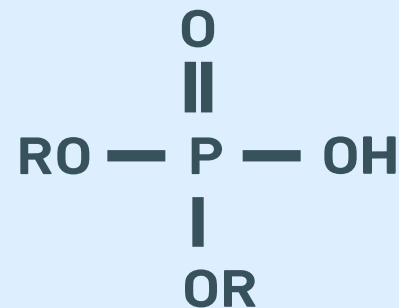
▶ FIELDS OF APPLICATION

- Metalworking
- Textile lubricants
- Cosmetics
- Oil field
- Agricultural products



PHOSPHE[®]TAL Series

- ▶ Monophosphoric acid esters of linear alcohols and alcohol ethoxylates
- ▶ Available as acid form or neutralized
- ▶ Corrosion inhibitors
- ▶ EP Enhancement
- ▶ Co-Emulsifiers
- ▶ Dispersing agents

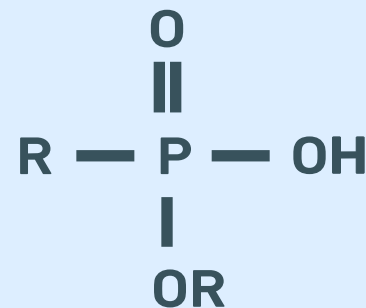


▶ FIELDS OF APPLICATION

- Metalworking
- Lubricants
- Textile finishing
- Oil field
- Water treatment
- Cleaning products

CUBLEN® Series

- ▶ Phosphonates
- ▶ Organic carbon directly bonded to phosphorus
- ▶ Wide range of phosphonates available
- ▶ High stability in aqueous systems
- ▶ Outstanding metal chelation
- ▶ Effective at low concentrations
- ▶ Dispersion stabilizers
- ▶ Scale and soap deposit inhibitor

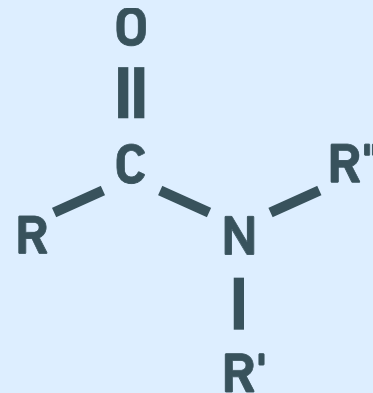


▶ FIELDS OF APPLICATION

- Metalworking
- Lubricants
- Textile finishing
- Oil field
- Water treatment
- Cleaning products

PURTON® Series

- ▶ Amides made from fatty acid + secondary amine
- ▶ Non-ionic emulsifier
- ▶ Corrosion inhibitor
- ▶ Antistatic additive
- ▶ High stability in aqueous systems
- ▶ Effective at low concentrations
- ▶ Dispersion stabilizers



▶ FIELDS OF APPLICATION

- Metalworking
- Oil field
- Lubricants
- Personal Care
- Cleaning and Degreasing
- Metal treatment
- Paints and Coatings

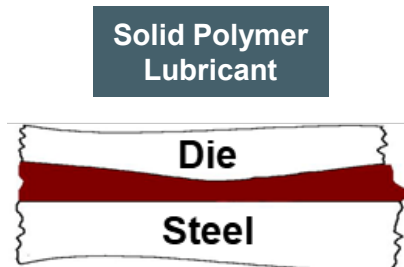
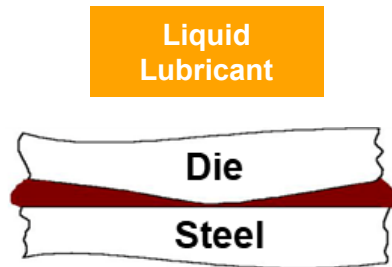
SYNTRAN® Metal forming Lubricants

A water-based emulsion polymer coating is applied over sheet metal, forming a solid film on the surface.

The polymer coating provides controlled and consistent lubrication when forming or stamping.

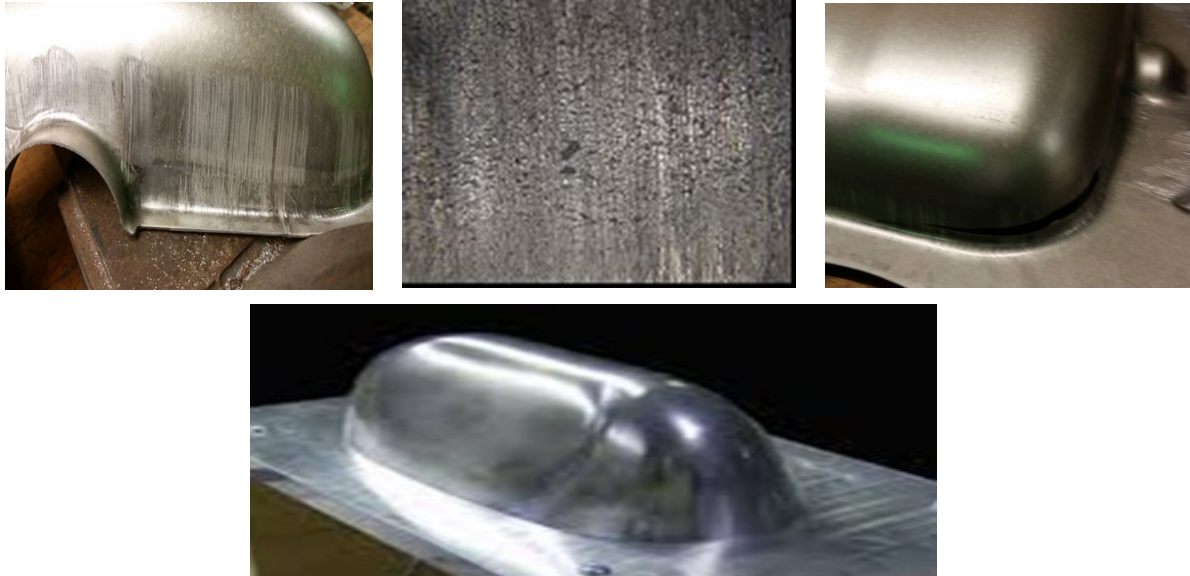
Product benefits include:

- Part Surface Finish Quality
- Production Cost Savings
- Improved Manufacturing Environment
- Worker Safety



SYNTRAN[®] Metal forming Lubricants

- ▶ Improved wear protection from polymer film technology will reduce costs by:



- Reducing defects due to galling, flaking, and forming failures.
- Extend the life of the molds and dies used for forming or stamping.

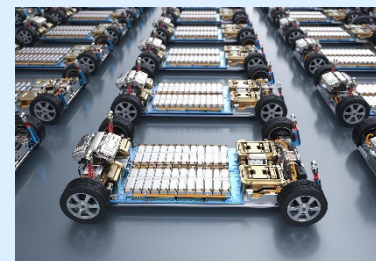
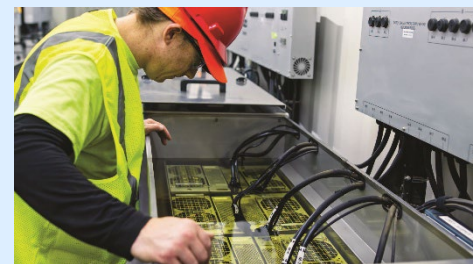
DIELECTRIC INSULATING FLUIDS



Synthetic Esters for Multipurpose EV Lubricant/Coolants/Dielectric Fluids

Ref #	Product Name	KV, cSt @20°C	KV, cSt @40°C	KV, cSt @100°C	Pour Point, °C	Flash Point, °C	DBV, kV IEC 60156 2.5mm
ULV-1	LUBRICIT EXP 23016A	2.6	1.8	0.8	<-80	115	>75
ULV-2	LUBRICIT EXP 23016B	3.8	2.6	1.1	<-80	140	>75
ULV-3	LUBRICIT EXP 23016D	4.0	2.7	1.0	-77	135	>75
ULV-4	LUBRICIT EXP 23016C	4.5	2.9	1.2	-80	150	>75
ULV-5	LUBRICIT 2-EH iC9	5.8	3.6	1.4	-75	150	>75
LV-8	LUBRICIT iC9-9	7.7	4.7	1.7	-75	145	>75
LV-11	LUBRICIT EXP 23018B	8.7	5.2	1.8	-20	190	>75
LV-12	LUBRICIT 2-EHL	8.7	5.2	1.8	-25	185	>75
LV-15	LEXOLUBE 2I-214	10.0	5.7	1.9	-70	190	>75
LV-17	LUBRICIT DOA	14.6	7.6	2.3	-50	215	>75
LV-18	LUBRICIT EXP 23018E	15	7.7	2.1	-50	195	>75
LV-19	LUBRICIT EXP 23018F	15	7.8	2.3	-80	200	>75
LV-22	LUBRICIT NG 710	15	8.3	2.5	-50	210	>75

Please inquire about tailor-made products that can be made to fit your exact performance requirements!



Product Property	ESTERTEC 2N-1416	ESTERTEC 2LN-1418	ESTERTEC 2L-1425	ESTERTEC 2G-1432	Standard PE Ester
KV100, cSt	3.6	4.1	5	7	5
KV40, cSt	16	18	25	32	30
Viscosity Index	115	125	140	180	120
Pour Point, °C	-60	-40	-25	-42	-50
Density	0.895	0.893	0.890	0.890	0.970
Flash/Fire Point, °C	230 / 255	240 / 265	250 / 275	295 / 315	270 / 310
Biogenic Content, %	64	65	70	74	0
Specific Heat Capacity, J/g·°K	2.17	2.11	2.16	2.19	1.928
Thermal Conductivity, W/m·K	0.135	0.137	0.142	0.145	0.142
Dielectric Breakdown Voltage, 2mm, kV	> 50	> 50	> 50	> 50	> 50
Hydrolytic Stability	☑	☑	☑	☑	☑
Oxidative Stability	☑	☑	☑	☑	☑
Cost/Performance Advantage	☑	☑	☑	☑	



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THANK YOU

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