Zschimmer & Schwarz

Innovating
Collaborating
Introducing:

EsterTec®
synthetic esters

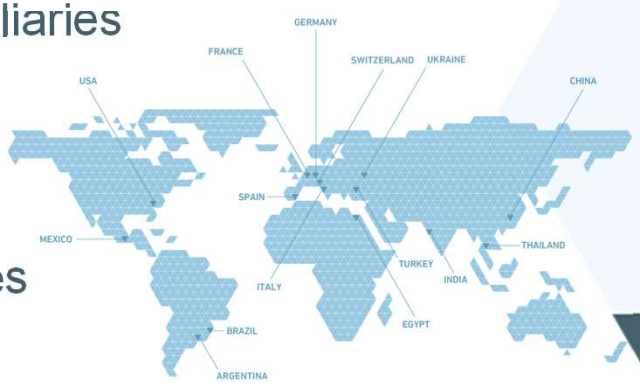
Doug Placek
Business Division Director
Lubricant Expo - September 16, 2025

ZSCHIMMER & SCHWARZ

Z&S Business Divisions

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

27 subsidiaries
in 16 countries
on 5 continents



UN GLOBAL COMPACT

RESPONSIBLE CARE
Driving Safety & Sustainability

SILVER | Top 15%
ecovadis
Sustainability Rating
AUG 2024

Market Trends Favor Synthetic Lubricant Components

Higher Performance and Longer Life for Overall Lower Cost

- Improved Performance Value
- Wider temperature range performance
- Improved control of friction and wear
- Energy efficiency advantages
- Environmentally friendly with ESG and carbon footprint advantages whenever possible

EsterTec
synthetic esters

EsterTec®
synthetic esters

A Break-through in Synthetic Ester Technology

- Superior Performance
- Cost Savings
- Sustainability

All the Performance Advantages Expected from a Polyol Ester, Plus…

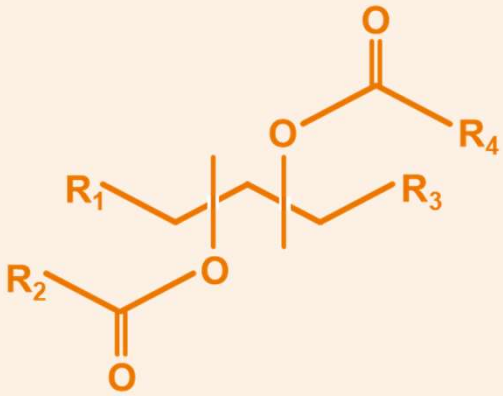
- Natural energy efficiency advantages from low density, high VI and superior lubricity
- High biogenic content compared to many synthetic polyol esters
- Excellent heat transfer and dielectric fluid properties
- Lower cost per unit volume due to lower density
- Best-in-class hydrolytic stability

EsterTec
synthetic esters

A New Ester Technology Is Now Available

EsterTec “VSP” Esters with Improved Performance

- Novel structure, unique production process
- Based on standard raw materials that are globally and readily available commodities
- High stability vicinal ester molecular positioning
- Steric hindrance that improves oxidative stability
- Secondary alcohols on adjacent carbons improve hydrolytic stability



VSP Ester Structure

Delivering:
Value - Sustainability - Performance

EsterTec
synthetic esters

EsterTec
synthetic esters

A Novel Molecular Technology Platform. Exceptional Performance in a Wide Viscosity Range

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
Biogenic Content, %	64	65	70	74	60	50	40	30
Oxidative Stability	☑	☑	☑	☑	☑	☑	☑	☑
Hydrolytic Stability	☑	☑	☑	☑	☑	☑	☑	☑
Friction/Wear Reduction	☑	☑	☑	☑	☑	☑	☑	☑
Energy Efficiency Advantage	☑	☑	☑	☑	☑	☑	☑	☑
Cost/Performance Advantage	☑	☑	☑	☑	☑	☑	☑	☑

☑ = Equal or Better than standard synthetic esters

Fields of application for EsterTec synthetic esters

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

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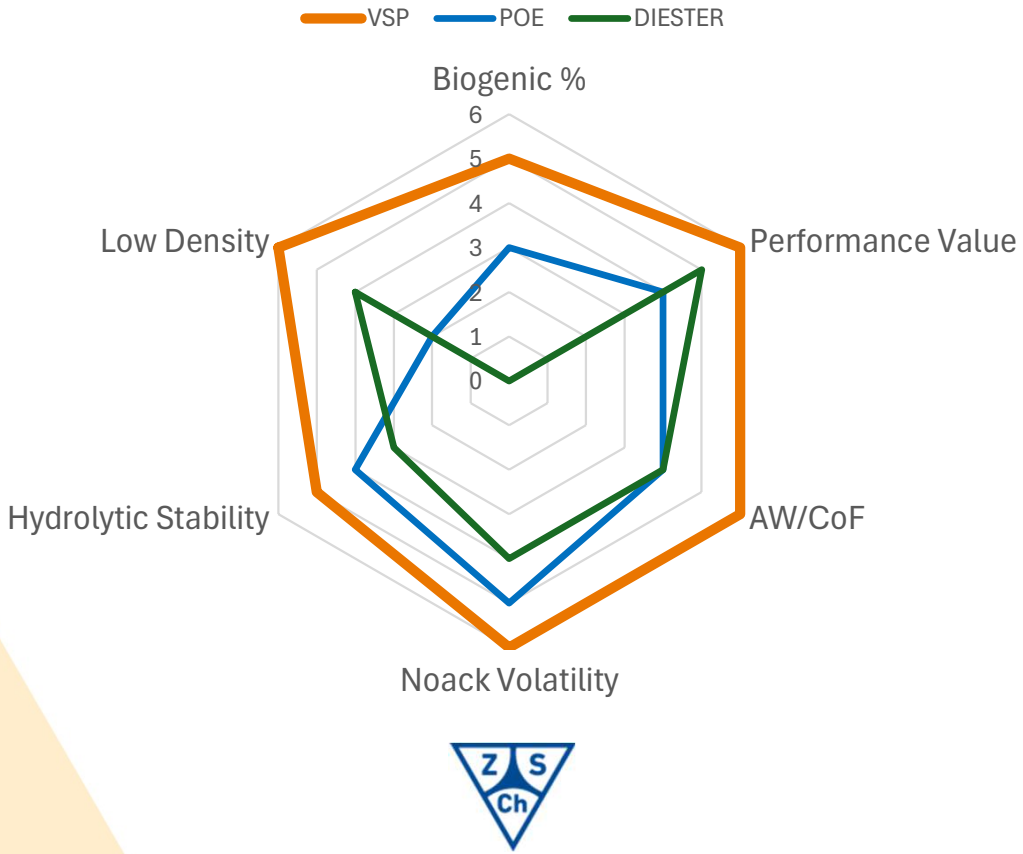
All the Performance Advantages Expected from a Standard Diester or Polyol Ester,

Plus…



EsterTec
synthetic esters

EsterTec “VSP” Esters Value Proposition

- Reduced Friction and Wear
  - Reduce formulation additive content (e.g., metalworking, automotive, industrial)
  - EV lubricant/coolants need better EP/AW (EVs are heavier, higher and lower speed torque, new bearing designs)
- Low Volatility
  - Improved low viscosity lubricant performance (0W engine oils, high speed EV motors)
  - Extended fluid life in high temperature applications (bearing grease, mist lubes, engine oils)
- Excellent Hydrolytic Stability
  - Metalworking emulsions
  - ICE engine oils, H_2ICE engine oils
  - HFO refrigeration compressor oils
  - Paper machine oils
- Low Density
  - Reduced weight in mobile systems (EV immersion coolants, UTHF, Mobile equipment HF)
  - Reduced pumping energy requirements

Zschimmer & Schwarz

PERFORMANCE DATA DETAILS

EsterTec 2N-1416 Performance Data

Ester Class	VSP	Diester
	EsterTec 2N-1416	DIDA
KV100, cSt	3.6	3.6
KV40, cSt	16	14
Pour Point, °C	-60	-60
Density	0.896	0.92
EsterTec Density Advantage	**2.6%**	---
4-Ball Wear, mm*	0.52	0.84
Wear Protection Improvement**	**78%**	---
Coefficient of Friction*	0.167	0.208
CoF Increase, %	**25%**	---
Noack Volatility, %	**9%**	15%

*40kg load, 1200 rpm, 75C, 52100 steel, 1 hour

**Considering the Hertzian contact diameter of 0.43mm

EsterTec synthetic esters

EsterTec Performance Data

Ester Class		VSP	Diester		Polyol	Glyceryl Ester
	Test Method	EsterTec 2N-1416	DIDA	DINA	TMP-C7	C8/10
KV100, cSt	ASTM D7042	3.6	3.6	3.1	3.4	4.0
KV40, cSt	ASTM D7042	16	14	11	14	15
Pour Point, °C	ASTM D5950	-60	-60	-60	-65	-15
Density	ASTM D4052	0.896	0.920	0.923	0.963	0.950
EsterTec Density Advantage	Δ	---	2.6%	2.9%	7.0%	5.7%
4-Ball Wear, mm*	ASTM D4172	0.52	0.84	0.79	0.65	0.69
Wear Protection Improvement**	Δ	---	78%	75%	59%	65%
Coefficient of Friction*	ASTM D4172	0.167	0.208	0.221	0.217	0.196
CoF Decrease, %	Δ	---	25%	32%	30%	17%
Noack Volatility, %	ASTM D6375	9%	15%	19%	10%	8%

Visit www.EsterTec.com for additional technical data

EsterTec 2G-1432 Performance Data

Ester Class	VSP	POE
	EsterTec 2G-1432	PE C5/10
KV100, cSt	7.0	7.0
KV40, cSt	33	46
Pour Point, °C	-42	-40
Density	0.890	0.965
EsterTec Density Advantage	**8.4%**	---
4-Ball Wear, mm*	0.63	0.77
Wear Protection Improvement**	**41%**	---
Coefficient of Friction*	0.182	0.246
CoF Increase, %	**35%**	---
Noack Volatility, %	**<1%**	3%

*40kg load, 1200 rpm, 75C, 52100 steel, 1 hour

**Considering the Hertzian contact diameter of 0.43mm

EsterTec synthetic esters

EsterTec 7GX-1446 Performance Data

Ester Class	VSP	Polyol Ester	
	EsterTec 7GX-1446	TMP+C18	PE + C5/9
KV100, cSt	9	9	7
KV40, cSt	46	46	46
Pour Point, °C	-40	-40	-40
Density	0.900	0.915	0.970
EsterTec Density Advantage	---	1.6%	7.2%
4-Ball Wear, mm*	0.61	0.77	0.89
Wear Protection Improvement**	---	47%	61%
Coefficient of Friction*	0.178	0.218	0.227
CoF Decrease, %	---	22%	28%
Noack Volatility, %	1.5%	3%	3%

*40kg load, 1200 rpm, 75C, 52100 steel, 1 hour

**Considering the Hertzian contact diameter of 0.43mm

EsterTec synthetic esters

EsterTec 7GX-1468 Performance Data

Ester Class	VSP	POE
	EsterTec 7GX-1468	DPE + C5/10
KV100, cSt	11	10
KV40, cSt	68	68
Pour Point, °C	-40	-40
Density	0.915	0.990
EsterTec Density Advantage	---	8.2%
4-Ball Wear, mm*	0.73	0.82
Wear Protection Improvement**	---	38%
Coefficient of Friction*	0.178	0.212
CoF Decrease, %	---	42%
Noack Volatility, %	<1%	2%

*40kg load, 1200 rpm, 75C, 52100 steel, 1 hour

**Considering the Hertzian contact diameter of 0.43mm

EsterTec synthetic esters

EsterTec 8LX-14150 Performance Data

Ester Class	VSP	POE
	EsterTec 8LX-14150	DPE+C5/9
KV100, cSt	18	18
KV40, cSt	150	160
Pour Point, °C	-30	-30
Density	0.935	0.980
EsterTec Density Advantage	**4.8%**	---
4-Ball Wear, mm*	0.78	0.90
Wear Protection Improvement**	**27%**	---
Coefficient of Friction*	0.180	0.246
CoF Increase, %	**37%**	---
Noack Volatility, %	**<1%**	<1%

*40kg load, 1200 rpm, 75C, 52100 steel, 1 hour

**Considering the Hertzian contact diameter of 0.43mm

EsterTec synthetic esters

How does density impact product cost?

Product	Specific Gravity	Density Difference	Price, €/kg*	Price, €/liter*	€/liter % Difference
EsterTec VSP	0.890		4.80	4.27	
Standard Ester Example A	0.941	5.7%	4.80	4.52	+6%
Standard Ester Example B	0.941	5.7%	5.75	5.41	+27%
Standard Ester Example C	0.960	7.9%	7.50	7.20	+69%

Z&S sells VSP Esters to Formulators by weight. (kg/pounds)
Formulators sell lubricants to Users by volume. (liters/gallons)
Equipment operators fill machines by volume.

*General indication of relative selling prices based on contracted volumes greater than 250MT/year. This is not a price quote.

Visit www.ESTERTEC.com - Use the Cost Savings Calculator

ZSCHIMMER & SCHWARZ

BENEFITS APPLICATION AREAS PERFORMANCE TESTING LAB DOWNLOAD

ESTERTEC SAVING CALCULATOR

SELECT INPUT

Select Unit System:

EUR

Select your current type of standard ester:

Complex ester (ISO 100 ~3

- **Density:** 0.980 g/cc, 8.17 lb/gal

Select your EsterTec Type:

Series 8X (ISO 100 – 350)

- **Density:** 0.935 g/cc, 7.80 lb/gal

Cost of your Current ester (€/kg):

1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0

€5.50/kg

OUTPUT SAVINGS

Product Cost Savings

Cost savings for a 1250 liter IBC tote

€611.94

Cost Savings in %

4.81%

Cost of one liter EsterTec

€10.29

Cost of one liter Standard Ester

€10.78

Cost savings for one liter

€0.49

Weight Savings

Difference in IBC container weight

55 kg

Weight of EsterTec in a 1250 liter IBC tote

1168 kg

Weight of Standard ester in a 1250 liter IBC tote

1223 kg

Weight of Standard ester in a 22712 liter tanker

22235 kg

Weight of EsterTec in a 22712 liter tanker

21228 kg

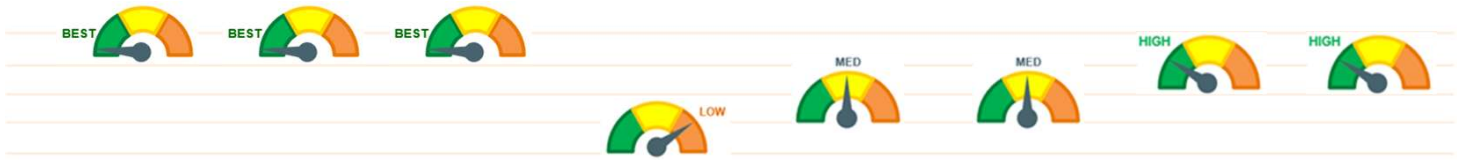
Hydrolytic Stability, ISO 15 – 150 Viscosity Grades

EsterTec demonstrates excellent hydrolytic stability.

– All esters compared with no inhibitor or passivation additives

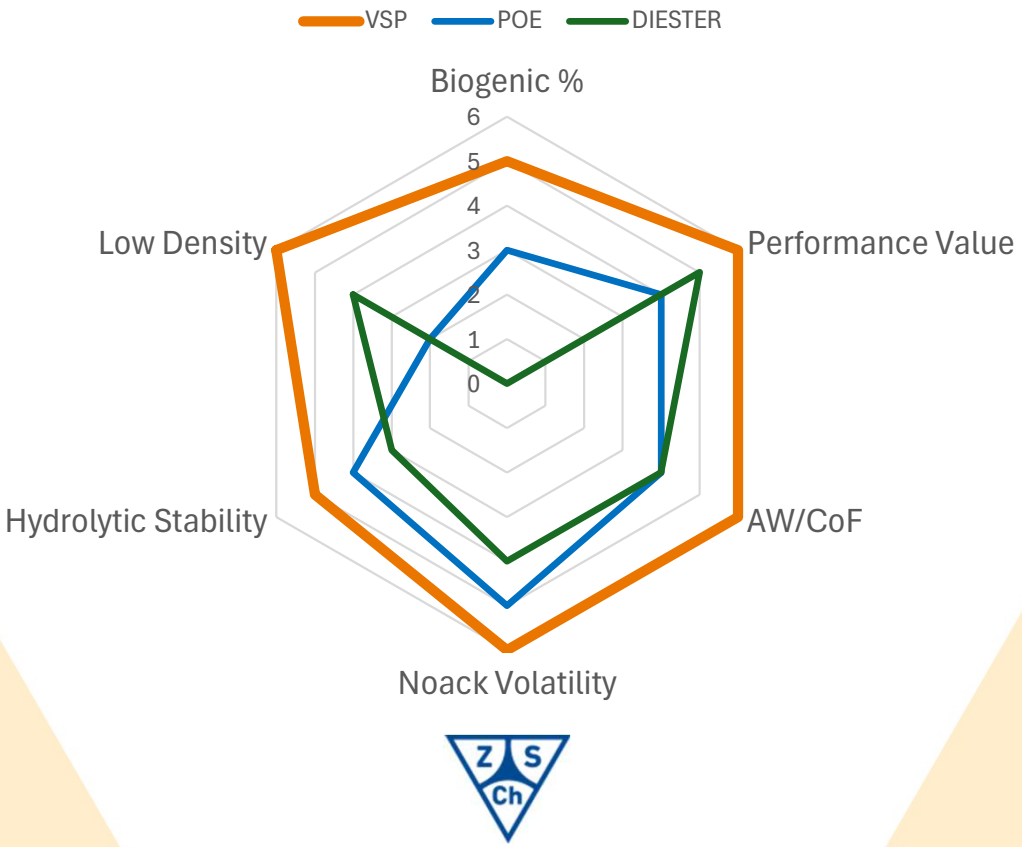
ASTM D2619	EsterTec 2N-1416	EsterTec 2G-1432	EsterTec 8LX-14150	NGDO	DIOA	DTDA/1	PE C7/9	TMP C8/10	Pass/ Fail*
Oil Tan Δ, mg KOH/g	0.03	0.01	0.12	2.90	0.16	0.05	0.10	0.05	<0.2
Water Layer Acidity, mg KOH	1.00	0.80	0.30	18.0	3.47	3.75	1.65	1.26	<5.0
Copper Corrosion Rating, ASTM D130	1b	1b	1b	2	1b	1b	1b	1b	<2

Rating Scale:
0-2 = HIGH
2-5 = MED
>5 = LOW



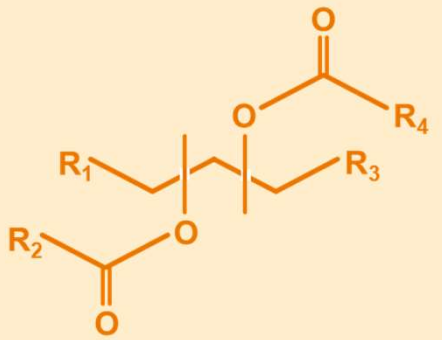
*Typical limits for a formulated lubricant

Once Again, Esters are “State-of-the-Art” Technology for Industrial Lubrication



LUBRICANT EXPO EUROPE

EsterTec®
synthetic esters



Thank You

Visit Z&S at Booth 351

VSP Esters Deliver:
Value - Sustainability - Performance

Doug Placek
Global Business Division Director
September 16, 2025

www.estertec.com

ZSCHIMMER & SCHWARZ