

Zschimmer & Schwarz

**Innovating  
Collaborating  
Introducing:**

**EsterTec**  
synthetic esters



ZSCHIMMER & SCHWARZ



## Business divisions

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

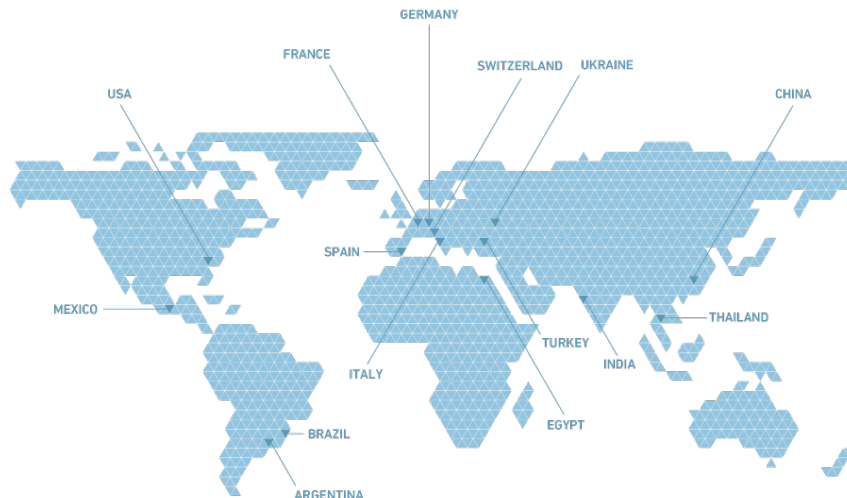


# Zschimmer & Schwarz – Company Profile

## Key figures 2023

Turnover €M ~700

Number of employees 1,558



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

27 subsidiaries  
in 16 countries  
on 5 continents



1894

Foundation of the  
company in Chemnitz,  
Germany

First in-house  
production

1909



1959 - 2019

New company headquarters in Oberlahnstein,  
Rapid growth and globalisation



Construction of new company  
headquarters

2019



2024

130th anniversary



# 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



Zschimmer & Schwarz

# VALUE PROPOSITION

# 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



# Market Trends Favor Synthetic Lubricant Components

## Higher Performance and Longer Life for Overall Lower Cost

- ▶ Group III- Hydrocracked Petroleum
- ▶ GTL- Gas-to-Liquid Hydrocarbons
- ▶ PAO- Polyalphaolefins
- ▶ PAG- Polyalkylglycols
- ▶ POE- Polyol Esters
- ▶ AN- Alkylated Naphthalenes



Z&S introduces a new and improved POE for your formulation toolbox



# 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 5% lower density
- ▶ Best in class hydrolytic stability

**EsterTec**  
synthetic esters

[zslubes.com/estertec](http://zslubes.com/estertec)





| Product Name                | ESTERTEC<br>2N-1416 | ESTERTEC<br>2LN-1418 | ESTERTEC<br>2G-1432 | ESTERTEC<br>7GX-1446 | ESTERTEC<br>7GX-1468 | ESTERTEC<br>8LX-14100 | ESTERTEC<br>8LX-14150 |
|-----------------------------|---------------------|----------------------|---------------------|----------------------|----------------------|-----------------------|-----------------------|
| KV100, cSt                  | 3.6                 | 4.1                  | 6.8                 | 9                    | 11                   | 14                    | 18                    |
| KV40, cSt                   | 16                  | 18                   | 32                  | 46                   | 68                   | 100                   | 150                   |
| Viscosity Index             | 115                 | 125                  | 180                 | 165                  | 155                  | 140                   | 130                   |
| Pour Point, °C              | -60                 | -40                  | -42                 | -40                  | -40                  | -35                   | -30                   |
| Density                     | 0.895               | 0.893                | 0.890               | 0.900                | 0.915                | 0.925                 | 0.935                 |
| NOACK volatility, %         | 9                   | 7                    | 1                   | 1                    | 1                    | 1                     | 1                     |
| Biogenic Content, %         | 64                  | 65                   | 74                  | 60                   | 50                   | 40                    | 30                    |
| Oxidative Stability         | ☑                   | ☑                    | ☑                   | ☑                    | ☑                    | ☑                     | ☑                     |
| Hydrolytic Stability        | ☑                   | ☑                    | ☑                   | ☑                    | ☑                    | ☑                     | ☑                     |
| Friction/Wear Reduction     | ☑                   | ☑                    | ☑                   | ☑                    | ☑                    | ☑                     | ☑                     |
| Energy Efficiency Advantage | ☑                   | ☑                    | ☑                   | ☑                    | ☑                    | ☑                     | ☑                     |
| Cost/Performance Advantage  | ☑                   | ☑                    | ☑                   | ☑                    | ☑                    | ☑                     | ☑                     |



# 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
- ▶ Food processing H1 lubricants
- ▶ Multifunctional Dielectric/Coolant/ Lubricants

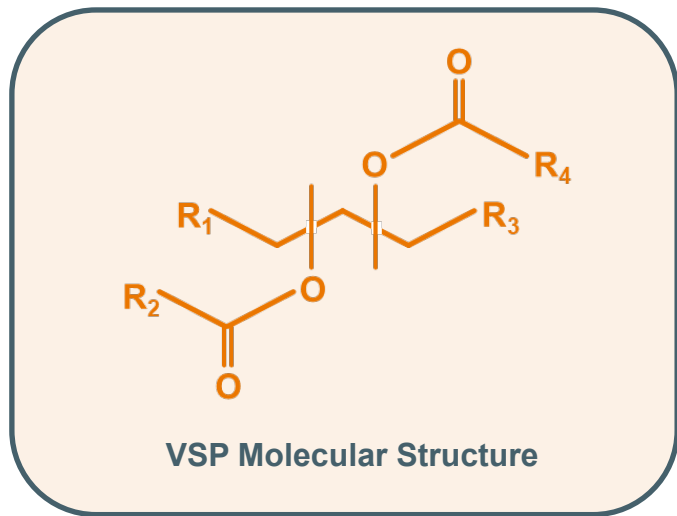


# A New Ester Technology is Now Available

## EsterTec® “VSP” Esters with Improved Performance

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

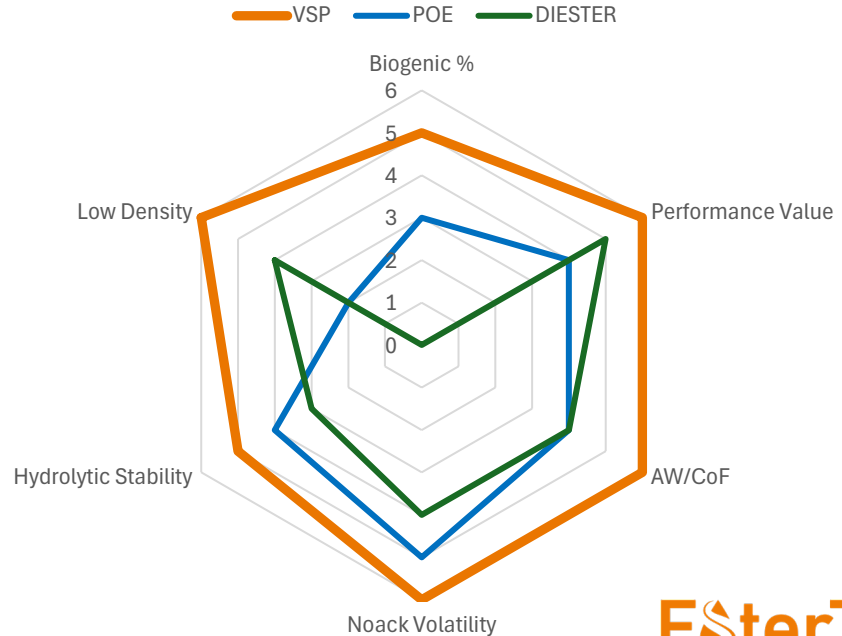
**EsterTec**  
synthetic esters



# All the Performance Advantages expected from a standard Diester or Polyol Ester, **Plus....**

## Equal or Better Performance Features:

- Pour Point
- Flash Point
- Foam Tendency
- Demulsibility
- Copper Corrosion
- Oxidative Stability
- Thermal Stability
- Specific Heat
- Thermal Conductivity
- Odor
- Color
- Clarity
- Miscibility with PAO
- Compatibility with Elastomers



**EsterTec**  
synthetic esters

# EsterTec “VSP” Esters for Value, Sustainability and Performance

## ► Reduced Friction and Wear

- Simplify formulations with reduced additive content (metalworking, automotive, industrial)
- EV lubricant/coolants need better EP/AW (EVs are heavier, higher and lower speed torque, new bearing designs)

## ► Excellent Hydrolytic Stability

- Metalworking emulsions
- ICE engine oils, H2ICE engine oils,
- HFO refrigeration compressor oils
- Paper machine oils

## ► Low Density

- Reduced weight in mobile systems (EV immersion coolants, UTHF, Mobile equipment HF)
- Freight cost savings on base oil and formulated product shipments

## ► 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)



# EsterTec 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, paint/coatings/elastomers
- ▶ Hot/Cold stability and compatibility
- ▶ Dielectric properties
- ▶ Thermal Conductivity



Zschimmer & Schwarz

# PERFORMANCE DATA DETAILS

# EsterTec 2N-1416

# Performance Data

| Ester Class    |             | VSP              | Diester |      |      |     | Polyol Ester |        | Glyceryl Ester |
|----------------|-------------|------------------|---------|------|------|-----|--------------|--------|----------------|
|                | Test Method | EsterTec 2N-1416 | DIDA    | DINA | DIOA | DOA | TMP C7/8/10  | TMP-C7 | C8/10          |
| KV100, cSt     | ASTM D7042  | 3.6              | 3.6     | 3.1  | 2.7  | 2.3 | 4.0          | 3.4    | 4.0            |
| KV40, cSt      | ASTM D7042  | 16               | 14      | 11   | 9    | 8   | 18           | 14     | 15             |
| Pour Point, °C | ASTM D5950  | -60              | -60     | -60  | -60  | -50 | -65          | -65    | -15            |

|                            |            |       |       |       |       |       |       |       |       |
|----------------------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Density                    | ASTM D4052 | 0.896 | 0.920 | 0.923 | 0.930 | 0.925 | 0.950 | 0.963 | 0.950 |
| EsterTec Density Advantage | Δ          | ---   | 2.6%  | 2.9%  | 3.7%  | 3.1%  | 5.7%  | 7.0%  | 5.7%  |

|                               |            |      |      |      |      |      |      |      |      |
|-------------------------------|------------|------|------|------|------|------|------|------|------|
| 4-Ball Wear, mm*              | ASTM D4172 | 0.52 | 0.84 | 0.79 | 0.89 | 1.00 | 0.74 | 0.65 | 0.69 |
| Wear Protection Improvement** | Δ          | ---  | 78%  | 75%  | 80%  | 84%  | 71%  | 59%  | 65%  |

|                          |            |       |       |       |       |       |       |       |       |
|--------------------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Coefficient of Friction* | ASTM D4172 | 0.167 | 0.208 | 0.221 | 0.247 | 0.223 | 0.183 | 0.217 | 0.196 |
| CoF Decrease, %          | Δ          | ---   | 25%   | 32%   | 48%   | 34%   | 10%   | 30%   | 17%   |

|                     |            |    |     |     |     |     |    |     |    |
|---------------------|------------|----|-----|-----|-----|-----|----|-----|----|
| Noack Volatility, % | ASTM D6375 | 9% | 15% | 19% | 26% | 32% | 5% | 10% | 8% |
|---------------------|------------|----|-----|-----|-----|-----|----|-----|----|

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

\*\*Considering the Hertzian contact diameter of 0.43mm





# How does Density impact Product Cost?

| Product                  | Specific Gravity | Density, lb/gal | Density Difference | *Price, \$/lb | *Price, \$/gallon | \$/Gal % Difference |
|--------------------------|------------------|-----------------|--------------------|---------------|-------------------|---------------------|
| EsterTec VSP             | 0.890            | 7.43            |                    | 2.50          | 18.58             |                     |
| Standard Ester Example A | 0.941            | 7.85            | 5.7%               | 2.50          | 19.62             | +6%                 |
| Standard Ester Example B | 0.941            | 7.85            | 5.7%               | 3.00          | 23.55             | +27%                |
| Standard Ester Example C | 0.960            | 8.01            | 7.9%               | 3.50          | 28.04             | +51%                |

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



# EsterTec 2N-1418

# Performance Data

| Ester Class    | VSP               | Diester | Polyol Ester |           |      |             | Glyceryl |
|----------------|-------------------|---------|--------------|-----------|------|-------------|----------|
|                | EsterTec 2LN-1418 | DIDA    | TMP-C9       | TMP C8/10 | NGDC | TMP C7/8/10 | C8/10    |
| KV100, cSt     | 4.1               | 3.6     | 4.6          | 4.4       | 4.0  | 4.0         | 4.0      |
| KV40, cSt      | 18                | 14      | 21           | 20        | 18   | 18          | 15       |
| Pour Point, °C | -40               | -60     | -50          | -40       | 0    | -65         | -15      |

|                   |       |      |      |      |      |      |      |
|-------------------|-------|------|------|------|------|------|------|
| Density           | 0.893 | 0.92 | 0.94 | 0.94 | 0.90 | 0.95 | 0.95 |
| Density Advantage | ---   | 2.9% | 5.0% | 5.0% | 0.8% | 6.0% | 6.0% |

|                               |      |      |      |      |      |      |      |
|-------------------------------|------|------|------|------|------|------|------|
| 4-Ball Wear, mm*              | 0.50 | 0.84 | 0.77 | 0.65 | 0.72 | 0.74 | 0.69 |
| Wear Protection Improvement** | ---  | 83%  | 79%  | 68%  | 76%  | 77%  | 73%  |

|                          |       |       |       |       |       |       |       |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|
| Coefficient of Friction* | 0.175 | 0.208 | 0.215 | 0.173 | 0.191 | 0.183 | 0.196 |
| CoF Decrease, %          | 8%    | 15%   | 3%    | 6%    | 12%   | 5%    | 8%    |

|                     |    |     |    |    |     |    |    |
|---------------------|----|-----|----|----|-----|----|----|
| Noack Volatility, % | 7% | 15% | 3% | 6% | 12% | 5% | 8% |
|---------------------|----|-----|----|----|-----|----|----|

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

\*\*Considering the Hertzian contact diameter of 0.43mm



# EsterTec 2G-1432

# Performance Data

| Ester Class    | VSP              | Diester | Polyol Ester |         |      |         |           |
|----------------|------------------|---------|--------------|---------|------|---------|-----------|
|                | EsterTec 2G-1432 | DTDA/1  | TMP-TO       | PE 4810 | NGDO | PE C7/9 | TMP C8/10 |
| KV100, cSt     | 7.0              | 5.4     | 9.4          | 6.1     | 5.8  | 5.0     | 4.4       |
| KV40, cSt      | 32               | 27      | 46           | 32      | 24   | 25      | 20        |
| Pour Point, °C | -42              | -60     | -40          | -5      | -30  | -55     | -40       |

|                            |       |       |       |      |       |       |      |
|----------------------------|-------|-------|-------|------|-------|-------|------|
| Density                    | 0.890 | 0.915 | 0.917 | 0.96 | 0.903 | 0.985 | 0.94 |
| EsterTec Density Advantage | ---   | 2.7%  | 2.9%  | 7.3% | 1.4%  | 9.6%  | 5.3% |

|                               |      |      |      |      |      |      |      |
|-------------------------------|------|------|------|------|------|------|------|
| 4-Ball Wear, mm*              | 0.63 | 0.75 | 0.77 | 0.58 | 0.72 | 0.81 | 0.65 |
| Wear Protection Improvement** | ---  | 38%  | 41%  | -33% | 31%  | 47%  | 9%   |

|                          |       |       |       |       |       |       |       |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|
| Coefficient of Friction* | 0.182 | 0.210 | 0.246 | 0.168 | 0.201 | 0.204 | 0.173 |
| CoF Decrease, %          | ---   | 15%   | 35%   | -8%   | 10%   | 12%   | -5%   |

|                     |    |    |    |    |    |    |    |
|---------------------|----|----|----|----|----|----|----|
| Noack Volatility, % | 1% | 7% | 1% | 1% | 5% | 5% | 4% |
|---------------------|----|----|----|----|----|----|----|

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

\*\*Considering the Hertzian contact diameter of 0.43mm



# EsterTec 7GX-1446

# Performance Data

| Ester Class    | VSP               | Polyol Ester |           |        | Aromatic     |
|----------------|-------------------|--------------|-----------|--------|--------------|
|                | EsterTec 7GX-1446 | TMP+C18      | PE + C5/9 | PE+2EH | Trimellitate |
| KV100, cSt     | 9                 | 9            | 7         | 6      | 8            |
| KV40, cSt      | 46                | 46           | 46        | 46     | 50           |
| Pour Point, °C | -40               | -40          | -40       | -15    | -50          |

|                            |       |       |       |       |       |
|----------------------------|-------|-------|-------|-------|-------|
| Density                    | 0.900 | 0.915 | 0.970 | 0.980 | 0.970 |
| EsterTec Density Advantage | ---   | 1.6%  | 7.2%  | 8.2%  | 7.2%  |

|                               |      |      |      |      |      |
|-------------------------------|------|------|------|------|------|
| 4-Ball Wear, mm*              | 0.61 | 0.77 | 0.89 | 0.95 | 0.99 |
| Wear Protection Improvement** | ---  | 47%  | 61%  | 65%  | 68%  |

|                          |       |       |       |       |       |
|--------------------------|-------|-------|-------|-------|-------|
| Coefficient of Friction* | 0.178 | 0.218 | 0.227 | 0.235 | 0.257 |
| CoF Decrease, %          | ---   | 22%   | 28%   | 32%   | 44%   |

|                     |      |    |    |    |    |
|---------------------|------|----|----|----|----|
| Noack Volatility, % | 1.5% | 3% | 3% | 6% | 4% |
|---------------------|------|----|----|----|----|

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

\*\*Considering the Hertzian contact diameter of 0.43mm



# EsterTec 7GX-1468

# Performance Data

| Ester Class    | VSP               | Polyol Ester |             |         |         |
|----------------|-------------------|--------------|-------------|---------|---------|
|                | EsterTec 7GX-1468 | PE+C18       | DPE + C5/10 | PE+C5/9 | Complex |
| KV100, cSt     | 11                | 12           | 10          | 8.6     | 11      |
| KV40, cSt      | 68                | 67           | 68          | 68      | 68      |
| Pour Point, °C | -40               | -20          | -40         | -30     | -15     |

|                            |       |       |       |       |      |
|----------------------------|-------|-------|-------|-------|------|
| Density                    | 0.915 | 0.926 | 0.990 | 0.960 | 0.98 |
| EsterTec Density Advantage | ---   | 1%    | 8.2%  | 4.9%  | 7.1% |

|                               |      |      |      |      |      |
|-------------------------------|------|------|------|------|------|
| 4-Ball Wear, mm*              | 0.73 | 0.69 | 0.82 | 0.95 | 0.89 |
| Wear Protection Improvement** | ---  | -20% | 38%  | 29%  | 35%  |

|                          |       |       |       |       |       |
|--------------------------|-------|-------|-------|-------|-------|
| Coefficient of Friction* | 0.178 | 0.184 | 0.212 | 0.207 | 0.243 |
| CoF Decrease, %          | ---   | 39%   | 42%   | 33%   | 36%   |

|                     |     |     |    |    |    |
|---------------------|-----|-----|----|----|----|
| Noack Volatility, % | <1% | <1% | 2% | 4% | 1% |
|---------------------|-----|-----|----|----|----|

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

\*\*Considering the Hertzian contact diameter of 0.43mm



# EsterTec 8LX-14100

# Performance Data

| Ester Class                   | VSP                | Polyol Ester |            |         |
|-------------------------------|--------------------|--------------|------------|---------|
|                               | EsterTec 8LX-14100 | DPE+C18      | DPE + C5/9 | Complex |
| KV100, cSt                    | 14                 | 18           | 12         | 14      |
| KV40, cSt                     | 100                | 110          | 100        | 100     |
| Pour Point, °C                | -35                | -25          | -35        | -30     |
| Density                       | 0.925              | 0.930        | 0.990      | 0.950   |
| EsterTec Density Advantage    | ---                | 0.5%         | 6.6%       | 2.6%    |
| 4-Ball Wear, mm*              | 0.78               | 0.85         | 0.82       | 0.87    |
| Wear Protection Improvement** | ---                | 17%          | 10%        | 20%     |
| Coefficient of Friction*      | 0.198              | 0.205        | 0.222      | 0.220   |
| CoF Decrease, %               | ---                | 4%           | 12%        | 11%     |
| Noack Volatility, %           | 1%                 | 1%           | 1%         | 1%      |

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

\*\*Considering the Hertzian contact diameter of 0.43mm



# EsterTec 8LX-14150

# Performance Data

| Ester Class    | VSP                | Polyol Ester |             |         |
|----------------|--------------------|--------------|-------------|---------|
|                | EsterTec 8LX-14150 | DPE+C5/9     | DPE + C5/12 | Complex |
| KV100, cSt     | 18                 | 18           | 19          | 20      |
| KV40, cSt      | 150                | 160          | 170         | 150     |
| Pour Point, °C | -30                | -30          | -25         | -30     |

|                            |       |       |       |       |
|----------------------------|-------|-------|-------|-------|
| Density                    | 0.935 | 0.980 | 0.970 | 0.962 |
| EsterTec Density Advantage | ---   | 4.8%  | 3.7%  | 2.9%  |

|                               |      |      |      |      |
|-------------------------------|------|------|------|------|
| 4-Ball Wear, mm*              | 0.80 | 0.90 | 0.88 | 0.85 |
| Wear Protection Improvement** | ---  | 27%  | 22%  | 12%  |

|                          |       |       |       |       |
|--------------------------|-------|-------|-------|-------|
| Coefficient of Friction* | 0.180 | 0.246 | 0.232 | 0.200 |
| CoF Decrease, %          | ---   | 37%   | 29%   | 11%   |

|                     |     |     |     |     |
|---------------------|-----|-----|-----|-----|
| Noack Volatility, % | <1% | <1% | <1% | <1% |
|---------------------|-----|-----|-----|-----|

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

\*\*Considering the Hertzian contact diameter of 0.43mm



# 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             | 0.10               | 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







# Questions?

Discover More at: [www.estertec.com](http://www.estertec.com)



ZSCHIMMER & SCHWARZ