

Turning toward a better solution

NEXBASE 3080

Wind turbine
gear oil Formulation

NESTE
The only way is forward

NEXBASE® by Neste

– the quality leader

High performance industrial lubricants must excel under some of the most punishing conditions on earth. One particularly challenging sector is the gear oil formulated for large-scale wind turbines, which operate in harsh environmental conditions that severely stress the gearbox and lubricants.

Shock loads from wind buffets, slow speeds at the blade end and high speeds at the generator – combined with material compatibility needs – make selecting the right lubricant vital to long-term gearbox protection. As well, the remote locations of wind turbines and the challenges in servicing wind turbine gearboxes demand lubricants that exhibit exceptional durability and reliability in service.

New synthetic gear oil to protect gearboxes

Neste has an extensive global track record in the development of base oils for a wide range of uses. Now NEXBASE 3080 enables a new, synthetic solution to wind turbine lubrication and related industrial applications. Our testing proves that NEXBASE 3080 based Formulation 8175 provides proven, sustained gear protection that is very cost competitive with currently marketed synthetic oils.

Efficiency is essential for modern wind turbines

NEXBASE 3080 was formulated with the specific and often extreme demands of wind turbine operation in mind. Energy loss in the gearbox must be minimized – meaning that even slight enhancements in efficiency can be significant. In controlled testing, Formulation 8175 shows improved efficiency compared to other commercial wind turbine gear oils.

NEXBASE 3080 formulations deliver the best all-round solution:

- Highly cost competitive compared to PAO formulations
- Compatible with PAO based oils in the market to enable smooth oil changes
- Compatible across a wide range of sealants
- Excellent gear and bearing protection
- Excellent foam behavior
- Robust and global supply chain
- Supported by Neste's global organization
- Meets and surpasses critical leading industry technical requirements
- Enhanced thermal and oxidation stability delivers performance across large swings in temperature and loads

“ This industrial gear oil Formulation is a good example of how the oxidative and thermally stable group III base oils can deliver direct benefits in a cost effective way.”

- Mika Kettunen



Compatible with PAO based oils

NEXBASE 3080 based Formulation 8175 is compatible with PAO based oils already in the market. This means that using Formulation 8175 does not require special service practices when replacing a PAO based product.

It is compatible with the wide range of sealant materials typically used without the need for any additional esters.

NEXBASE 3080 formulations for industrial gear oils using poly(alkylmethacrylate) as thickener

High performing synthetic industrial gear oils with different viscosities can be blended using NEXBASE 3080 group III base oil in different ratios. A shear stable poly(alkylmethacrylate) is used as a thickener to yield exactly the right gear oil for your application.

COMPONENTS/PERFORMANCE		ISO CLASS 220	ISO CLASS 320 (1)	ISO CLASS 460	ISO CLASS 680
VISCOBASE® 11-522	%wt	37.0	45.1	51.5	58.5
NEXBASE® 3080	%wt	59.6	51.5	45.1	38.1
VISCOPLEX® 1-180	%wt	0.7	0.7	0.7	0.7
Additive package	%wt	2.7	2.7	2.7	2.7
Kinematic viscosity at 40°C	mm²/s	223.0	319.6	464.5	687.9
Kinematic viscosity at 100°C	mm²/s	27.7	37.0	48.8	65.5
VI		161	165	165	167
Pour point	°C	-39	-39	-36	-33
Kinematic viscosity at -10°C	mm²/s	7,058	11,815	19,239	33,394
Brookfield viscosity at -26°C	mPa•s	50,000	82,000	150,000	290,000
FZG failure load stage A/8.3/90		>14	>14	>14	>14

(1) Formulation 8175

Extensively tested and approved

NEXBASE 3080 wind turbine gear oil Formulation 8175 meets and surpasses critical industry technical requirements. It has, for example, been approved by Siemens MD for Flender gear units and this full approval is now available for ISO viscosity grades 320 to 680.

Similarly, testing by leading global bearing manufacturer Schaeffler/FAG included its demanding four-step test that's recognized as a benchmark for wind turbine applications. As a result they certified Formulation 8175 for use in wind turbine gearboxes.

Formulation 8175 meets these technical standards and is approved by these certifying bodies:

Standards

- DIN 51517-3
- ANSI/AGMA 9005-E02
- IEC 61400-4

Approvals

- SIEMENS MD (Flender, rev 15 for ISO 320 to 680)
- SCHAEFFLER/FAG
- MOVENTAS (for field trial)
- WINERGY (for field trial)

Excellent bearing protection

In-service bearing performance is predicted by industry recognized trials, including the DIN 51819-3 FE8 bearing test. This test evaluates a lubricant's ability to ensure protection under mixed friction conditions using a cylindrical roller thrust bearing. Standard conditions

employed in this test are an 80 kN axial load and a speed of 7.5 rpm for 80 hours; a wear limit of 30 mg roller weight loss is requested in industry standards such as the DIN 51517-3.

Our formulation demonstrated excellent performance in the test:

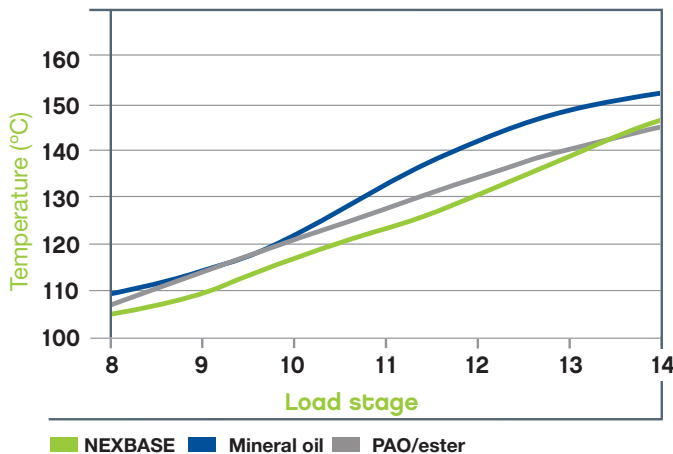
DIN 51819-3 FE8 bearing test results		
	Formulation 8175 @ 80 kN	Industry limit
Roller wear [mg]	3.5	30
Cage wear [mg]	28.5	–

Highest level of gear protection and superior efficiency

- Formulation 8175 reached the highest level of protection from micropitting (load stage 10) at both 60°C and 90°C in the FVA micropitting test.
- In the FZG scuffing test, NEXBASE 3080 formulation passed at maximum load stage at the standard and double speeds.
- Besides providing gear protection from fatigue and wear, tests also revealed that NEXBASE 3080 ran at lower temperatures than both mineral oil and PAO/ester formulations.

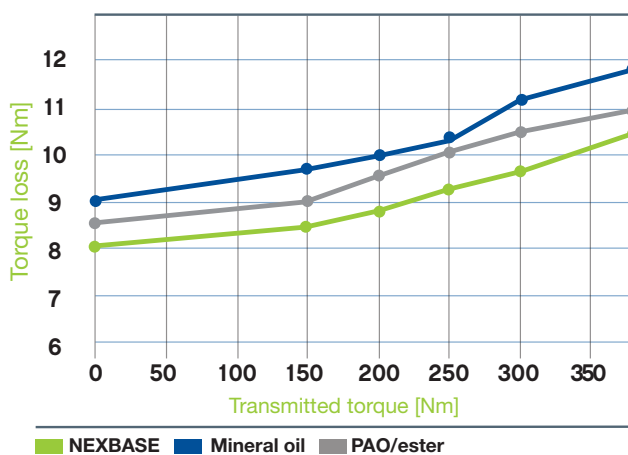
Cost effective
Compatible
Wear protection

LOAD CARRYING CAPACITY FZG A/8.3/90

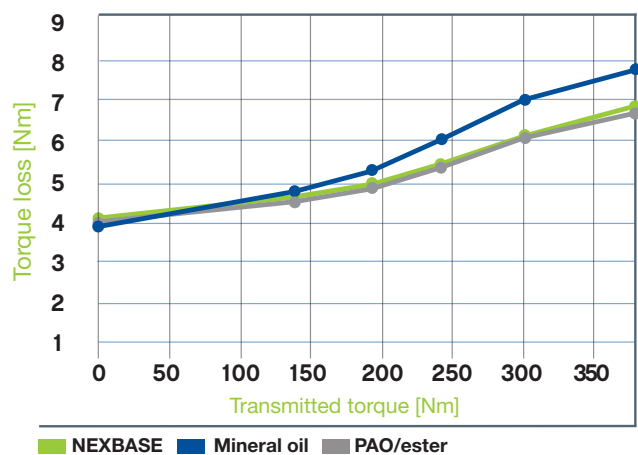


Screening in the FZG rig shows our wind turbine gear oil formulation has the benefit of lower torque losses than mineral oil and PAO/ester alternatives.

TORQUE LOSS IN FZG METHOD PV1456 AT 30°C



TORQUE LOSS IN FZG METHOD PV1456 AT 60°C



Tailored base oil solutions globally

Today's lubricants must be durable, and energy and cost efficient. Neste meets these requirements by offering leading lubricant blenders Group III base oils that are consistent in quality and guaranteed to deliver high-level performance.

Our extensive NEXBASE® formulation portfolio is created for our customers so that they can provide the best lubrication solutions for both OEM's and end users in different markets. NEXBASE® products have been developed to work reliably in all conditions.

A leader in more sustainable solutions

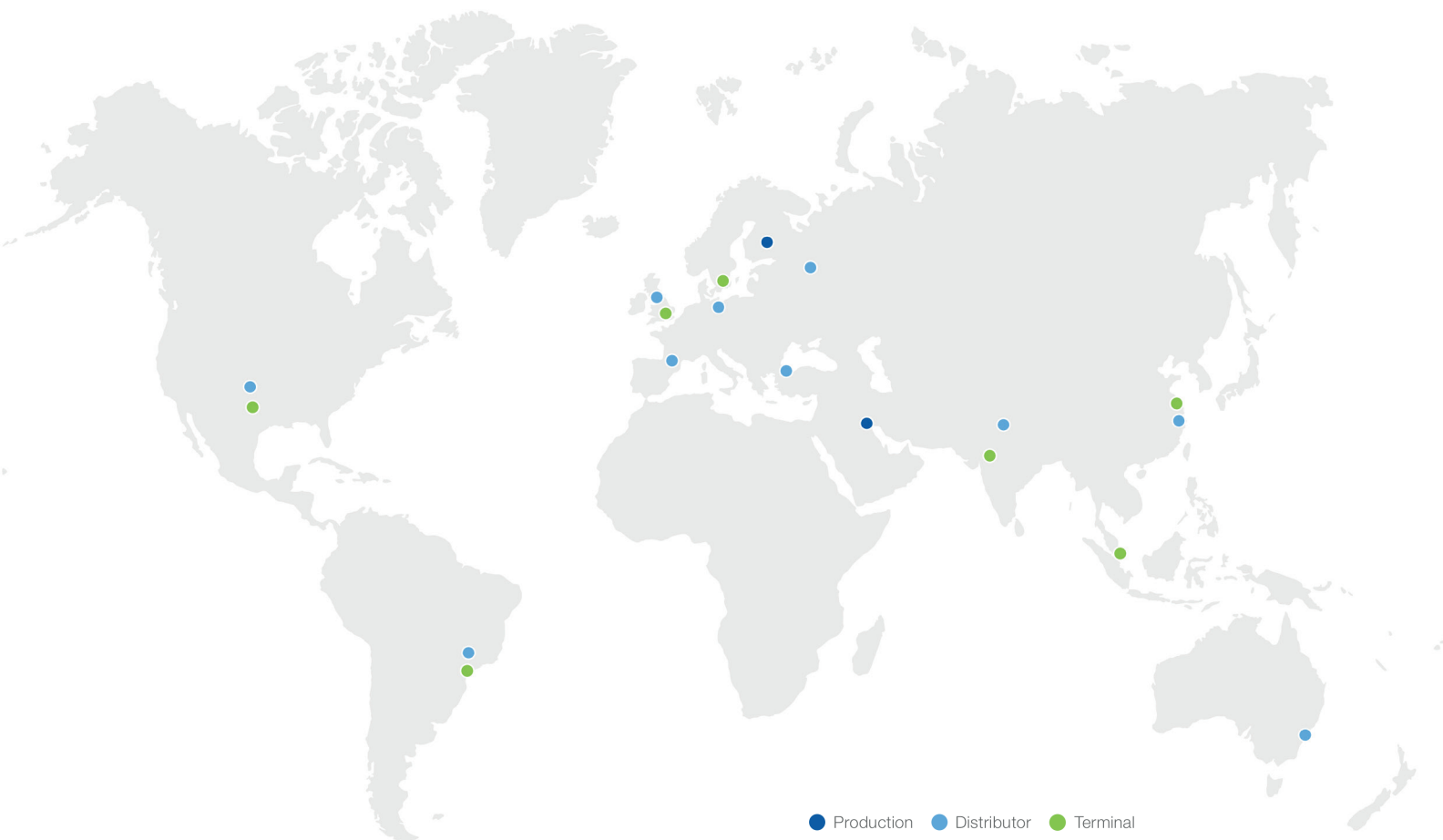
Every day, Neste does more with less. As we continue to pioneer the oil industry, we keep on rethinking conventional models. We make the most of existing resources and search out new, low-carbon feedstocks from materials like waste and residues. We are already the world's largest producer of renewable diesel and we are seeing interesting growth opportunities outside the fuel market as well.

Neste is a pioneer in oil refining and renewable solutions. We provide our customers with premium-quality products for cleaner traffic and industrial products based on world-class research. Our sustainable operations have received recognition in the Dow Jones Sustainability World Index and the Global 100 list of the world's most sustainable companies, among others. Cleaner traffic, energy and life are moved forward by about 5,000 professionals.

More information:

neste.com

neste.com/baseoils



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- Mika Kettunen



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