

ADDINOL[®]

THE ART OF OIL • SINCE 1936

➤ **ADDINOL Eco Gear**
The innovative solution for industrial gear sets





➤ **ADDINOL – German Quality since 1936** **Solutions for all lubrication-related challenges**

ADDINOL is one of the few companies in the German mineral oil industry acting independently of any large business group and has distributor partners on all continents in more than 90 countries. Our high-performance lubricants are design elements reflecting the most recent state-of-the-art. Development and production are carried out according to latest standards at the chemical site in Leuna in the heart of Germany. Our lubricants reveal their full performance in symbiosis with engines, drives, chains, bearings and hydraulic systems.

ADDINOL provides intelligent solutions which guarantee optimum lubrication and ensure responsibility towards the environment at the same time. Many of our high-performance lubricants increase energy efficiency of plants and engines considerably. They achieve significantly longer drain intervals compared to conventional products and extend the service life of the components lubricated.

ADDINOL – Improve the Performance!



Then and now – Research and development make up a vital part of the company's core competence.

➤ ADDINOL Eco Gear – High-performance gear oils setting standards

ADDINOL Eco Gear oils are state-of-the-art. They have been developed in close co-operation with leading institutes, gear and plant manufacturers – specifically tailored to the complex requirements of modern gears of all construction types.

ADDINOL Eco Gear GLS for highest loads

ADDINOL Eco Gear GLS is an industrial gear oil characterized by extraordinary load carrying capacity over long application intervals achieving the performance of an automotive transmission oil under highest loads. At the same time, the high-performance oil ensures reliable wear and corrosion protection. It is mainly used in gear units with planetary, bevel and hypoid gearing in high-performance applications such as wheelset drives in locomotives and railcars, low-floor drives as well as swivel and angular gear units for transporting cargo.

ADDINOL Eco Gear M and S with Surftec®, the effective formula against wear

ADDINOL Eco Gear M and S adapt to changing load conditions in the toothing and increase its load carrying capacity; they achieve a targeted prevention of micro-pitting and pitting and even re-smooth pre-damaged surfaces. ADDINOL Eco Gear M and S are applied

at high loads and preferably for toothings prone to micro-pitting. While ADDINOL Eco Gear M is ideal for mild climates and constant temperature conditions, ADDINOL Eco Gear S masters varying temperatures in a wide range. Preferred applications for the mineral oil based Eco Gear M are gears in steel industry, in mining and in cement industry. The synthetic Eco Gear S is applied successfully for instance in wind turbines, in mining and in extruder gears.

ADDINOL Eco Gear W with Advantec Formula for maximum energy efficiency

ADDINOL Eco Gear W has been developed for gears of the latest design as well as toothing and bearing surfaces of highest quality. Thanks to its extended temperature range and its improved pumpability it is perfectly fit for the use at low temperatures. Ideal applications are for example modern gears of wind turbines as well as extruders.



- ✓ **Wear protection**
- ✓ **Re-smoothing**
- ✓ **Highest performance**
- ✓ **Energy efficiency**
- ✓ **Reliable operation**
- ✓ **Cost reduction**

➤ ADDINOL Eco Gear – Tested and proven under practical conditions

In gears of cement, paper, plastics, steel or sugar industry, in units of ships or wind power plants –

the high-performance lubricants of the ADDINOL Eco Gear series convince by outstanding results.

Often, less is much more – ADDINOL Eco Gear S cuts temperature and extends service life

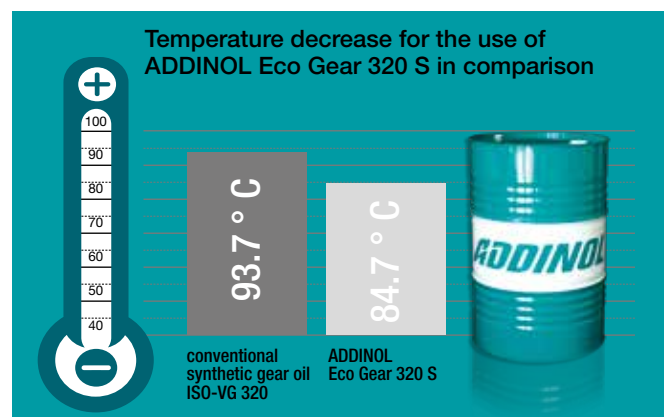


Operating life and prevailing temperatures influence the oil filling's ageing process. The valid rule of thumb says: oil ageing doubles with every temperature increase of 10 °C. Therefore, the reduction by every single degree Celsius counts! This is particularly important for gear oils which are meant to be applied over long

periods. The high-performance gear oils ADDINOL Eco Gear M and S contain selected antioxidants. In addition, they reduce oil temperature and delay the ageing process considerably thanks to the substance combination Surftec® and their extremely low friction coefficient.

The outstanding capacity of ADDINOL Eco Gear 320 S to reduce oil sump temperature could be proven in the practical application at a double belt drive of a continuous ContiRoll press line for chipboard production. In this application the development of oil sump temperatures at the belt drives has been recorded and compared for ADDINOL Eco Gear and one synthetic gear oil based on polyglycol. At the upper belt of the press line there are two planetary gears running parallel and with equal operating parameters.

The temperature was measured regularly and at various speeds. During the operation with the synthetic gear oil based on polyglycol the following temperatures were recorded at a speed of 870 mm/s: at the left upper drive 67 °C and at the right upper drive 69 °C. Few months after changing the left upper drive to ADDINOL Eco Gear 320 S, temperatures were analysed anew. Of course, both temperatures had increased because of the higher press line speed of 1,130 mm/s. However, the temperature of the left upper drive lubricated with ADDINOL Eco Gear measured 84.7 °C, whereas temperature of the right upper drive reached 93.7 °C. This means, ADDINOL Eco Gear had achieved an average temperature reduction of 7 to 9 °C compared to the synthetic gear oil based on polyglycol!



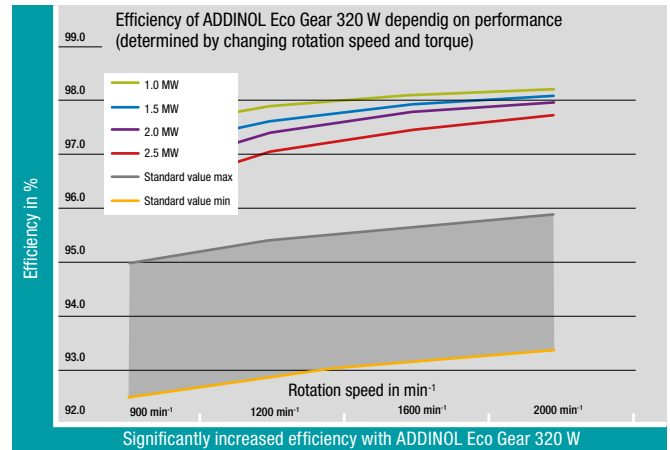
For exceptional loads – ADDINOL Eco Gear GLS

A large number of different applications place highest loads on the gears: high-performance dumper trucks, for instance, or the transport of cargo require full performance; final and axle drives of locomotives, streetcars and railcars also operate under high stress. Initial field tests and approval procedures have been started in many applications already and particularly in the field of wheelset and axle drives. These tests are designed for long periods and will require some time, but first intermediate results are available already and absolutely positive.



At full speed ahead, and in the wind – ADDINOL Eco Gear W increases efficiency of gears

Especially for toothings and bearings of highest surface quality ADDINOL has developed one completely new gear oil in close co-operation with leading manufacturers of gears and wind turbines. ADDINOL Eco Gear W with the innovative “Advantec Formula” is proven to increase efficiency of gears and thus to contribute to an increased efficiency altogether. Before ADDINOL Eco Gear 320 W was applied as first-fill-oil in Winery plants it had to undergo comprehensive tests in two gears. Also on the test bench the efficiency of both gears was measured and the results of the test run speak for themselves.



ADDINOL Eco Gear M – Practical test in one of the largest bucket wheel excavators of the world



evident toothing damages were discovered: not unusual considering the loads but the extent of the damages was quite critical. Obviously, the applied gearbox oil was not up to the typical loads prevailing in the excavator. Therefore, the gear was changed over to ADDINOL Eco Gear 460 M.

Whether the lubricant could prove the ascribed effect also in the gear of the bucket-wheel excavator was checked during the next inspection in spring 2007. The condition of the tooth flanks had not worsened further since the last inspection and the high-performance gear oil had stood its test. The sharp edges of previous pittings had been rounded-off, smoothing of the pittings had already started and the gear still runs stably and without any difficulties or interruptions. To be on the safe side, lubricant analyses are carried out in regular intervals – until today with positive results.

The world’s largest bucket wheel excavators are in operation in the open cast mining Garzweiler of the RWE Power AG in North Rhine-Westphalia. Each of these excavators mines 240,000 tons of coal per day or 240,000 m³ overburden. With 18 buckets the excavator digs into the ground and the coal. Each bucket holds more than 5.0 cubic metres. The large main gear of the bucket wheel is dimensioned accordingly and lubricated with 2,800 litres gear oil. The driven gear has 532 teeth. Loads placed on the gear are enormous: pushes and vibrations as well as dirt, coal dust and humidity pose extreme requirements. In the course of an inspection in September 2006

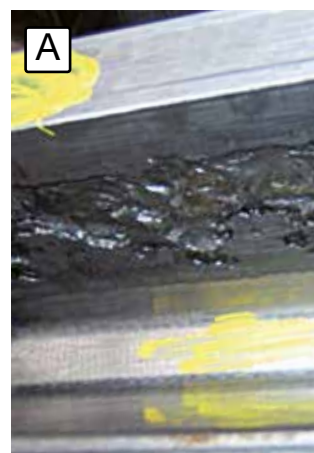


Photo A: Sharp edges and pittings before change



Photo B: Evident smoothing 5 months after changing to Eco Gear 460 M



➤ ADDINOL Eco Gear M and S with Surftec[®], the effective formula against wear



ADDINOL Eco Gear S is based on synthetic, ADDINOL Eco Gear M on mineral base oil components. Both high-performance gear oils contain the singular ADDINOL Surftec[®] technology. It adapts to changing load conditions in the toothing and increases its load carrying capacity significantly. Therefore, load carrying tooth flanks of the gear pairs are optimally protected against wear, material removal, pitting and fatigue even at increased loads. ADDINOL Eco Gear M and S are perfectly fit for hardened and ground gear teeth prone to micro-pitting under extreme loads as well as tempered surfaces. Even surfaces pre-damaged by micro-pitting and pitting are smoothed thanks to the PD-effect (Plastic Deformation); progressive metal abrasions are transformed into regressive ones.

The perfect lubrication

By using ADDINOL Eco Gear M and S friction coefficients are reduced considerably compared to conventional industrial gear oils. Lower oil sump temperatures confirm a significant improvement of efficiency alongside the respective energy saving potential.

The friction coefficient of ADDINOL Eco Gear is clearly lower than the value of conventional industrial gear oils type CLP. This brings about an enhanced efficiency of the gear, in particular under mixed and boundary friction conditions. ADDINOL Eco Gear minimises friction coefficients and has a concrete and prophylactic effect against wear. According to the Report of the FZG (Research Centre for Gears and Gear Unit Design at the Technical University of Munich) **the application of ADDINOL Eco Gear enables “efficiencies which are usually achieved with EHD (elastohydrodynamic) lubrication.” This means, ADDINOL Eco Gear almost reaches the ideal condition for lubrication.**

Thanks to the company Eisenbeiss in Austria for the illustration.

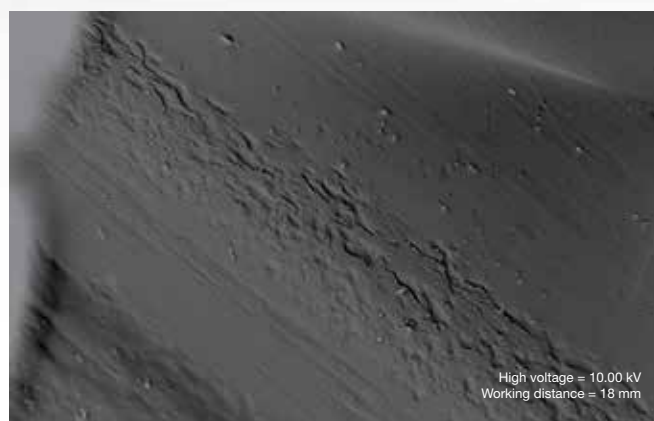
ADDINOL Eco Gear M and S re-smooth even pre-damaged surfaces

ADDINOL Eco Gear transforms progressive metal abrasions into decreasing ones. One typical example from practice: After some operating time unmistakable signs of wear occurred on tooth flanks of a wind power gear unit. The operator changed the plant from conventional gear oil to ADDINOL Eco Gear. After that, he precisely documented the changes. Imprints of the tooth flanks were analysed under a grid electron microscope by the test laboratory Lang (Nuremberg/Germany).



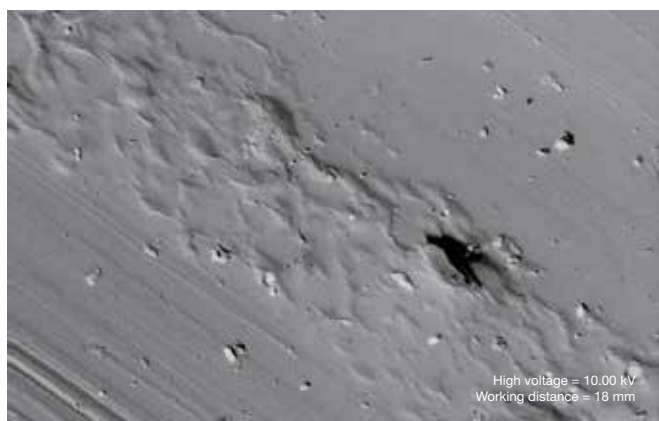
Picture 01: Gear before changing to ADDINOL Eco Gear

Pinion with extensive micro-pitting on tooth tip and tooth root after the operation with conventional gear oil.



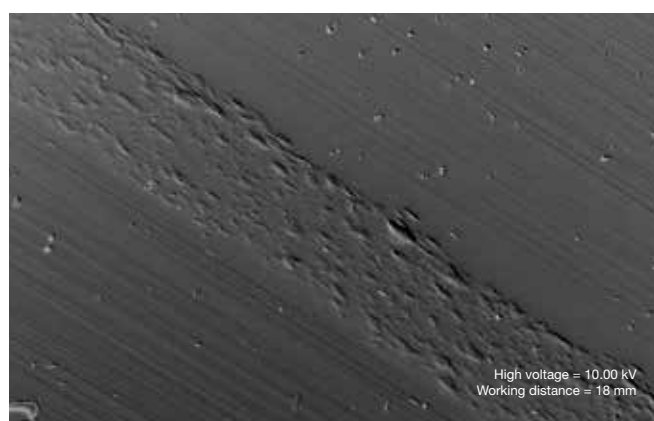
Picture 02: Shortly after changing

On the tooth flank imprint under the grid electron microscope roughness and pitting is clearly visible at the tooth root shortly after changing to ADDINOL Eco Gear 320 S. (scale: 1 mm)



Picture 03: Imprint of tooth flank some months later

The condition has improved significantly. Rounding and smoothing at damaged areas is clearly visible. (scale: 200 µm)



Picture 04: Improvement after more than 2 years

Almost perfectly smoothed and stabilised surface. New damages did not occur. (scale: 500 µm)



➤ ADDINOL Eco Gear W with Advantec Formula for maximum energy efficiency

The high-performance gear oil of the Eco Gear series, ADDINOL Eco Gear W, is based on the innovative “Advantec Formula”. It combines the advantages of carefully selected, novel synthetic base oil components and powerful additives.

With this formula, ADDINOL Eco Gear W is specifically designed for the effective protection of toothings and bearing surfaces of highest surface qualities. The high-performance gear oil reduces friction between friction partners and achieves a reduction of oil sump temperatures. By cutting the oil sump temperature, energy loss is reduced which in turn increases the efficiency of the gears.

Chart 1 depicts the efficiency of various synthetic high-performance gear oils common in the market according to FVA 345. The significantly reduced steady-state temperature* of ADDINOL Eco Gear 320 W becomes particularly obvious where the drive train is exposed to high loads.

Ideal for low temperatures

At low temperatures ADDINOL Eco Gear W scores even in two aspects. On the one hand, the product possesses an extremely low pour point (depending on the respective ISO VG between -55 °C and -48 °C). In addition, it displays excellent pumpability at low temperatures.

Due to its outstanding low-temperature viscosity (**see chart 2**) ADDINOL Eco Gear 320 W can be pumped and heated in the lubrication circuit faster even at pronounced sub-zero temperatures. The effective range of use at low temperatures is broadened by at least 5 °C compared to conventional synthetic gear oils. This characteristic pays off especially for plants at extreme cold and after longer idle periods.



No chances for water, air and foam

During operation the agitation and aeration of the lubricant is unavoidable. The fine air bubbles must be separated and released from the oil quickly because they impair the hydrodynamic lubricating film and entail the risk of cavitation. In the air and water separation test ADDINOL Eco Gear W achieves best results (**see chart 3**).

The release of introduced air causes foam on the lubricant's surface which is minimised for ADDINOL Eco Gear W by the help of special inhibitors and carefully selected base components. Even under the impact of water or heavy contamination a heightened foam formation is prevented effectively. In the Flender foam test ADDINOL Eco Gear 460 W also scores high.

Apart from excellent air separation ADDINOL Eco Gear W also achieves outstanding separation of water and this way reduces the danger of corrosion in the gear box.

* **steady-state temperature:** the temperature which occurs if heat input equals heat loss, variation must not exceed ± 2 K.

Test results speak for themselves

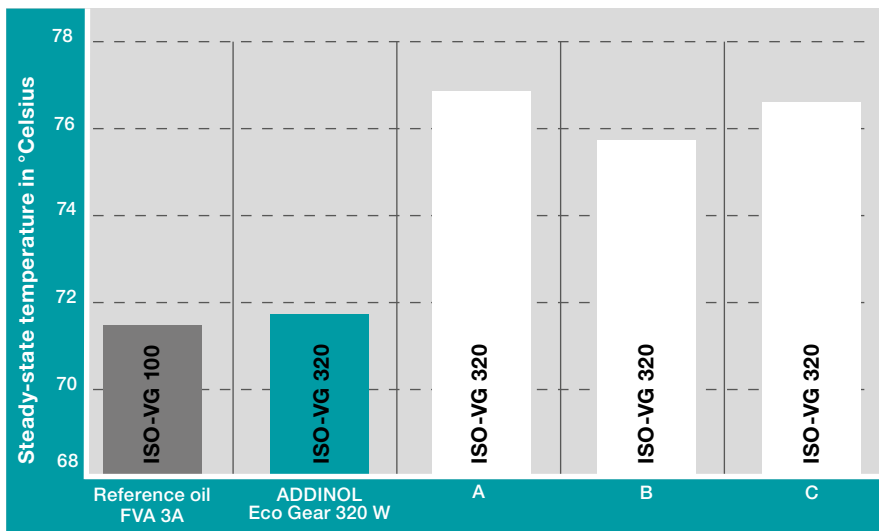


Chart 1: Comparison of steady-state temperature of synthetic gear oils of ISO-VG 320 according to FVA 345* at load stage 7

Compared to competitive products steady-state temperature of ADDINOL Eco Gear 320 W is 4 to 6 °C lower and almost reaches the level of the reference oil of the significantly lower ISO-VG 100.

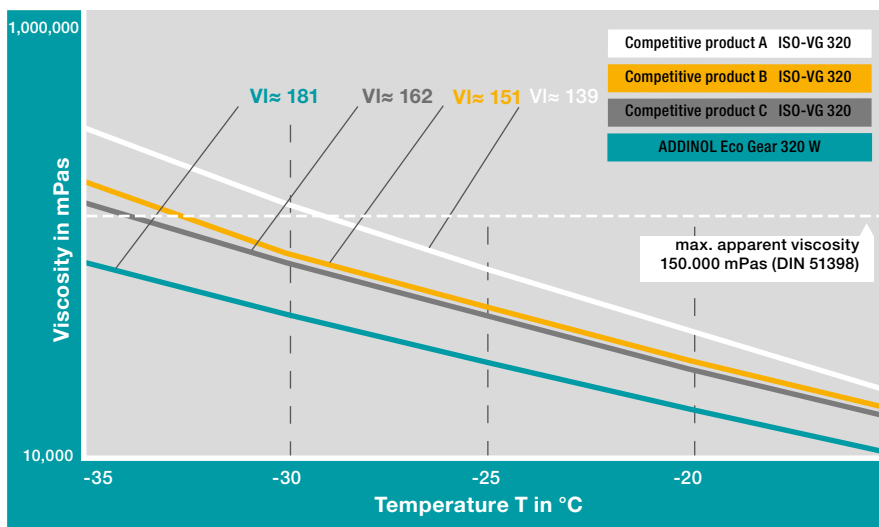


Chart 2: Dynamic low-temperature viscosity of synthetic gear oils according to Brookfield

Dynamic low-temperature viscosity according to Brookfield at -35 °C is at 96,000 mPa*s and significantly below the critical limit of 150,000 mPa*s.

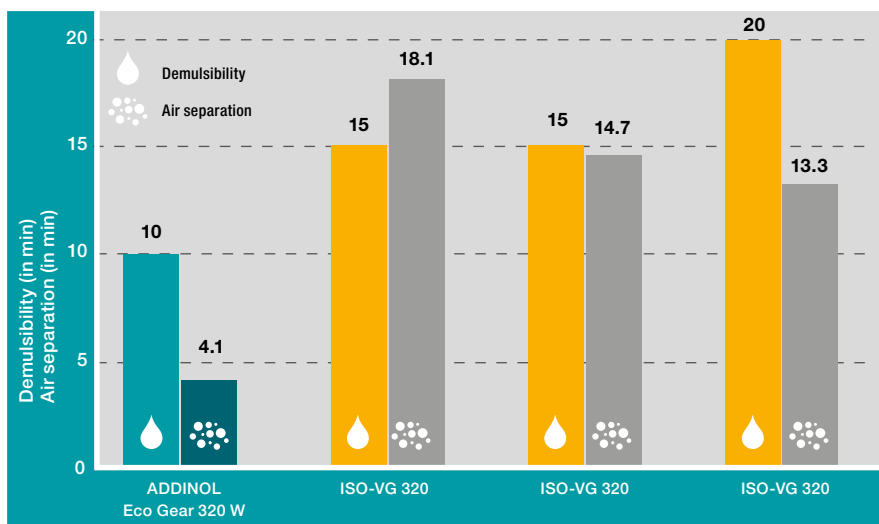


Chart 3: Demulsibility and air separation of synthetic gear oils according to DIN ISO 6614 (82 °C), DIN ISO 9120 (75 °C)

The comparison of demulsibility and air separation of conventional gear oils shows a significant improvement of the interface properties of ADDINOL Eco Gear 320 W by about 30 to 50 % compared to competitive products.

* Research Association Drive Technology, research project 345



➤ ADDINOL Eco Gear GLS – the power pack

The high-performance gear oils of the ADDINOL Eco Gear GLS series are based on high-quality synthetic base oils and a carefully selected additive package free of solid lubricants, silicones, zinc and ash. They have been designed for gears in heavy duty industrial applications where standard lubricants fail. These applications include gears with planetary, hypoid and bevel gear stages, gears with large offset as well as operations with cyclic direction changes, strong acceleration and extremely low relative movement.

ADDINOL Eco Gear GLS combines exceptional load carrying capacity typical of automotive transmission oils on API GL-5 level and longest service intervals required of industrial gear oils (**see Chart 4**).

Perfectly prepared for highest loads

The sophisticated formulation of the ADDINOL Eco Gear GLS range ensures highest scuffing load capacity at extreme loads. Based on superior wear characteristics (**see Chart 5**), ADDINOL Eco Gear GLS achieves exceptional stability even at high loads and temperatures typical of axle and wheelset drives. High and abrupt load peaks and high sliding proportions in the toothing are mastered without any problems, flash temperatures are reduced reliably.

Under these conditions, safe protection against fatigue damage and long gear lifetimes are crucial. The minimal wear scar diameter in the Four-Ball-Tester screening (**see Chart 6**) indicates durable protection against wear over a long time span. Abrasion and tribocorrosion are minimized effectively and loads caused by wear and contamination particles in the system are being reduced.

Ideal for a wide temperature range

The high-performance gear oils of the ADDINOL Eco Gear GLS range achieve a high and stable viscosity index of 165 across all viscosity classes (**see Chart 7**). The flat run of the viscosity-temperature curve guarantees optimum viscosity both at low and high temperatures. Therefore, a stable lubricating film and higher gear efficiency in a clearly extended temperature range are guaranteed when using ADDINOL Eco Gear GLS.

Chart 4: Comparison of synthetic industrial gear oils and automotive transmission oils

The comparative diagram clearly shows the product advantages of ADDINOL Eco Gear GLS compared to standard gear oils and premium products with regard to the special conditions of industrial gears under loads above average.

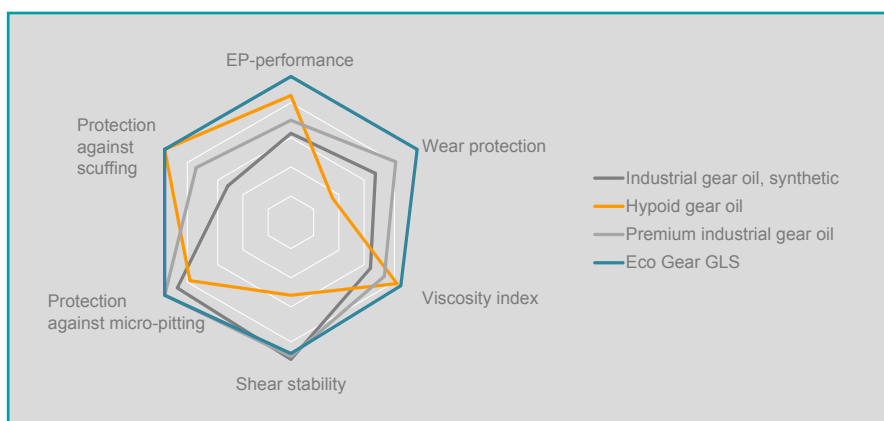


Chart 5: Load carrying capacity of synthetic gear oils

In the Four-Ball-Tester screening ADDINOL Eco Gear GLS does not only exceed the values of conventional, synthetic gear oils of all performance classes clearly, but achieves the load carrying capacity of heavy duty automotive transmission oils.

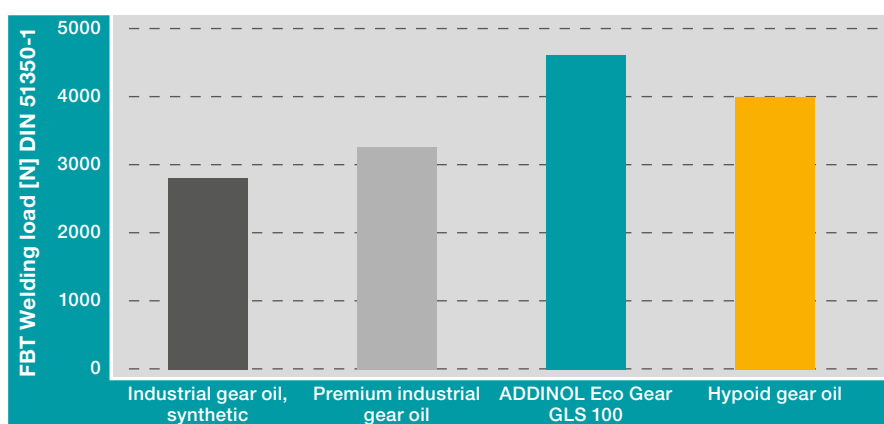


Chart 6: Wear coefficients of synthetic gear oils compared

In the Four-Ball-Tester screening (endurance test) ADDINO Eco Gear GLS achieves best results. Tested automotive transmission oils achieve a wear scar diameters between 0.5 and 0.8 mm, the wear coefficient of ADDINOL Eco Gear GLS is even below.

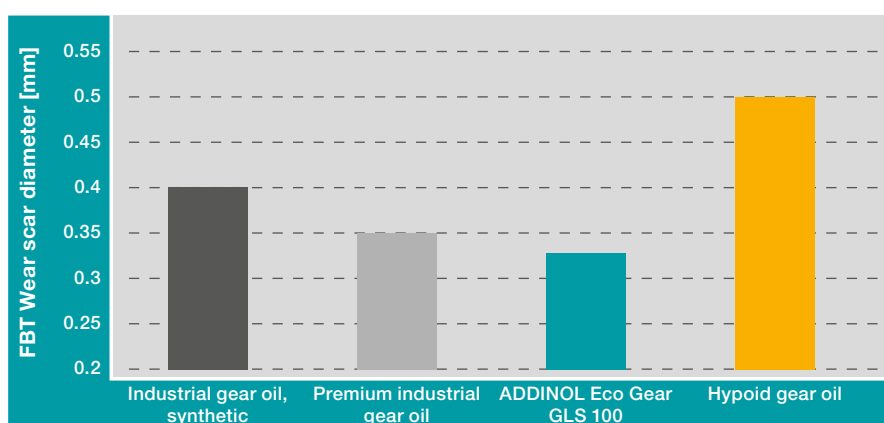
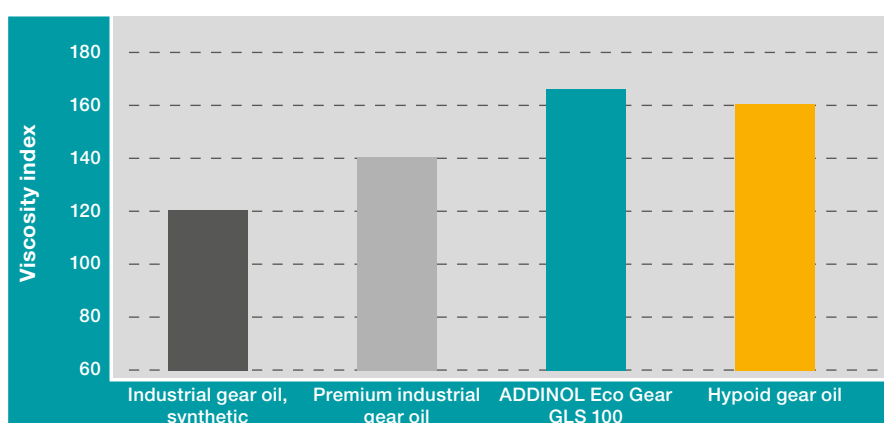


Chart 7: Viscosity index compared

Starting from ISO VG 100, the gear oils of the GLS range achieve a stable viscosity index and ensure reliable multi-grade characteristics. This way, reliable start behaviour and a higher EHD-share at higher temperatures are achieved.



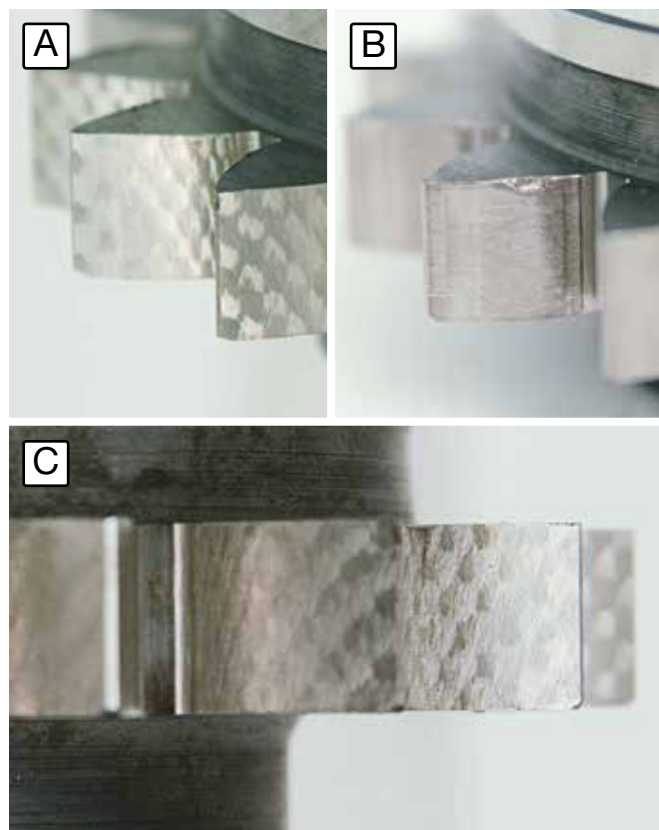
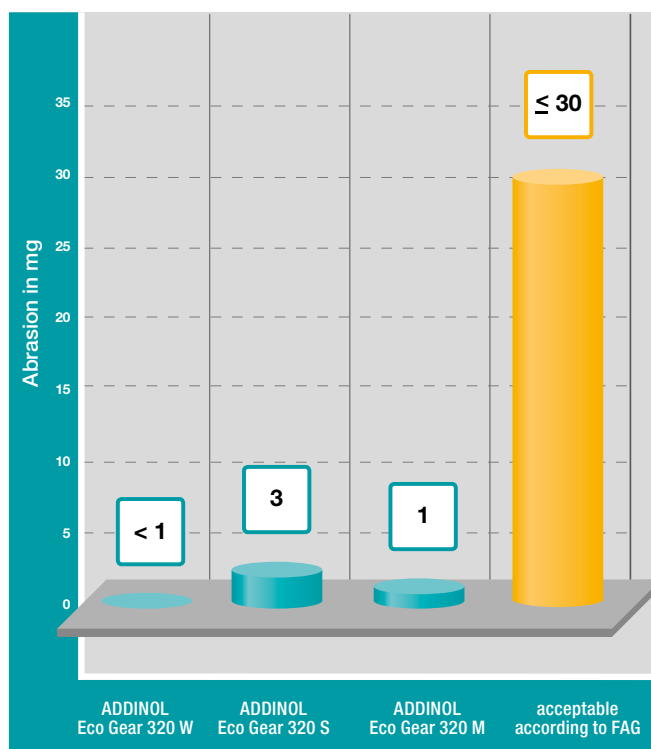
Best results for ADDINOL Eco Gear in internationally recognized test procedures

The performance and capacity of industrial gear oils are assessed by the help of a series of internationally accepted test procedures. The high-performance gear oils of the ADDINOL Eco Gear range achieve outstanding results in these.

FE-8 Roller bearing test

The FE-8 test bench has been designed by the company FAG in Schweinfurt and is used for analysing the wear protection capacity of lubricating oils and greases under conditions similar to practice according to DIN 51819. On the basis of weight loss of bearing components (in particular rolling elements) and a visual appraisal the aptitude of the lubricating oils and greases is evaluated.

Chart: FE-8 Roller bearing test – Rolling element of 4 bearings
– Test with various gear oils at 80 °C / 80 h / 7.5 min⁻¹ / 100 N



Highest load stages in the FZG Scuffing Load Test

In the Scuffing Load Test of the FZG Institute the load carrying capacity of a lubricant is tested on a special test rig. At defined rotational speeds and temperatures the limiting stress capacity of gear oils is analysed. The gear wheels used during this test are examined for scuffing and marks after the test run both visually and by the help of measuring procedures.

A tooth flank with cross-grinding (**initial condition see detail A**) was tested with conventional industrial gear oil of the CLP type – strong scuffing is obvious (**see detail B**). The other side of the gear wheel was tested with ADDINOL Eco Gear under the same method. This tooth flank does not show any damages (**see detail C**). With ADDINOL Eco Gear the gear wheel was running almost without any wear. The initial grinding surface pattern is fully preserved.

Method	Load stages ADDINOL Eco Gear
FZG Test A/8.3/90 (ISO 14635-1)	≥ 14
FZG Test A/16.6/120 (ISO 14635-1)	≥ 12

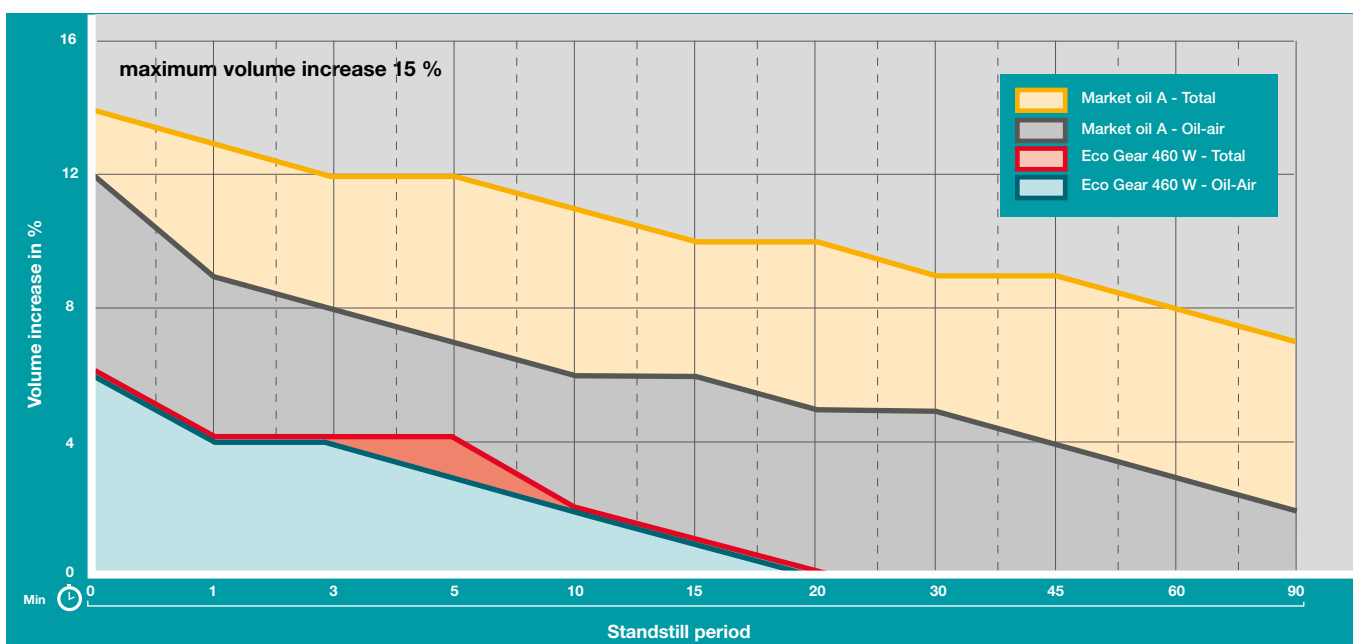
For detailed overview please see product tables at the end of the folder.



Outstanding oxidation stability in the ageing test

In this test lubricants are exposed to an accelerated ageing process (according to DIN EN ISO 13438) under the impact of oxygen at a temperature of 130 °C and over a time span of 192 hours. Compared to competitive products (left and middle on the photo), ADDINOL Eco Gear (right) does not form any hard, varnish-like residues.

Superior foaming characteristics in the Flender Foam Test (ISO-VG 460)



Excessive foam formation and poor gas release of dispersed air have a negative impact on the load carrying capacity of gear wheels and bearings. Therefore, gear oils are tested on their foaming and gas release behaviour. During the Flender Foam Test a gear pair runs in the oil to be tested and entrains air into the lubricant. By this method the behaviour of oils concerning aeration, the formation of oil-air-dispersions and surface foam and their minimization can be checked quickly and in step with actual practice. The trend is recorded in a chart depicting the behaviour in relation to the time span; the graphs of the oil-air-dispersion and of the surface foam are recorded above the standstill period. The percentaged volume increase of an oil one minute after stopping the testing instrument (oil-air-dispersion + foam) is judged as follows:

- up to 5% good foaming characteristics
- up to 10% satisfactory foaming characteristics
- up to 15% still tolerated foaming characteristics
- more than 15% unacceptable foaming characteristics

The high-performance lubricants of the ADDINOL Eco Gear range did not show any volume increase 20 minutes after air was entrained any more.

...and beyond

Apart from these testing methods leading gear manufacturers demand several further tests and place highest requirements on:

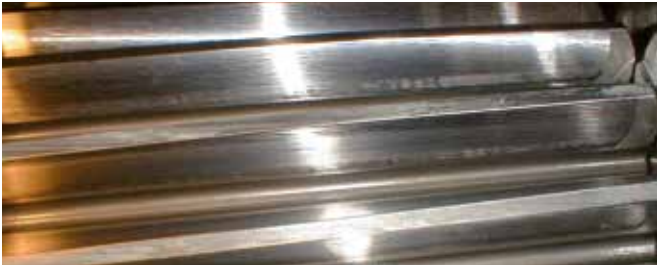
- Corrosion protection towards steel and non-ferrous metals
- Demulsibility
- Compatibility with elastomers
- Compatibility with paints.

In all these tests ADDINOL Eco Gear achieves best results.

➤ SOS Gear damage – ADDINOL Eco Gear M and S could help out.

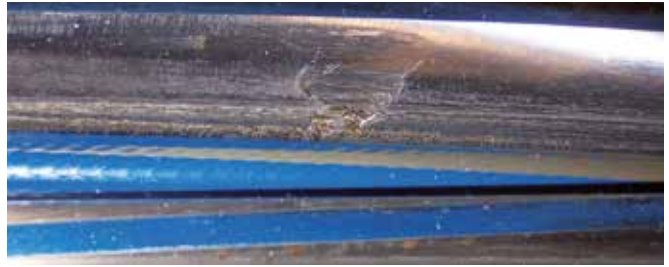
Conventional gear lubricants do not actively work against wear. Under aggravated operating conditions the formation of micro-pitting, pitting, sharp edges or even nicks might occur. This brings about the risk of a gear breakdown and thus frequently also a standstill of production. Often pre-damaged gears can continue operation thanks

to the change to the high-performance gear oils ADDINOL Eco Gear M and S – some of these at least until a respective aggregate for replacement is available, many even over years, as our examples show.



Pinion shaft of a gear in a cement mill

Before changing over to ADDINOL Eco Gear micro-pitting occurred on the tooth root. After changing over the damage progress was stopped.



Pinion of the drive of a potash press, hardened and ground toothing

Micro-pitting and subsequent damage, pre-damaged area was ground and the operation of the pinion was continued.



Wheel of the intermediate level of a large press gear, highly quenched and tempered toothing

Advanced pitting formation was stabilised and stopped thanks to ADDINOL Eco Gear.



Bevel pinion of the gear of a lifting unit of the 1950s

In spite of large pittings the plant could continue operation over several months during which a new pinion was manufactured.



Bevel pinion of a bowl mill gear, hardened and ground toothing

Because of a faulty adjustment the loads were placed on a fourth of the toothing only. After re-adjustment the tooth contact pattern improved significantly. Afterwards stabilisation with ADDINOL Eco Gear.



Driven gear in a rolling mill, hardened and ground toothing

Pitting on almost all tooth flanks. They have been re-smoothed by ADDINOL Eco Gear.



➤ On the safe side with ADDINOL

ADDINOL – individual and competent advice

The applications advice service for our customers is one of our core competences. After all, we do not only aim at providing the suited products in highest quality for the respective application but also want to provide maximum service around their use.

ADDINOL Analyses service

The application of ADDINOL Eco Gear high-performance gear oils is accompanied by sound technical support and comprehensive analyses service. With the help of our tried and proven ADDILAB analysis tool, operators and maintenance engineers get all the information on oil and plant condition quickly and clearly at a glance; the most important values are depicted in charts. The analyses results do not only provide information on viscosity, neutralisation number, additive level and ageing stability but also evaluate parameters such as wear elements and contaminants, which permits conclusions on the maintenance condition of the plant. By trend analysis, a continuous monitoring of the parameters over a long course of time is possible. That way, potential disturbances and damages can be detected at an early stage.

The analyses are carried out by an independent, acknowledged laboratory, professional monitoring as well as detailed assessment is realised by our experts in Leuna. Based on the analysis results they determine the individual oil operating time for the plant in question and allow maximum service lives in line with the respective OEM requirements. That way warranty claims are maintained while ensuring the reliable planning of maintenance and downtimes for oil changes.

Approved by leading gear manufacturers

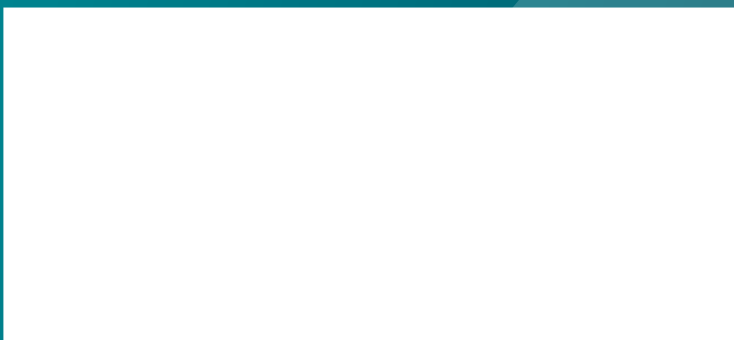
High-performance gear oils of the ADDINOL Eco Gear series have been approved by internationally leading gear manufacturers. In addition to national and international standards, gear oils have to meet specific requirements of gear and plant manufacturers which are increasingly individual. An approval is preceded by comprehensive tests on performance, suitability and compatibility with all materials used in and around the gear unit. Please contact us for detailed information – we are happy to assist you!

ADDINOL®

THE ART OF OIL • SINCE 1936

ADDINOL high-performance lubricants in more than 90 countries and on all continents.

handed over by:



ADDINOL Lube Oil GmbH
High-performance lubricants

Am Haupttor, D- 06237 Leuna
Phone: +49 (0)3461 - 845 - 111
Fax: +49 (0)3461 - 845 - 555
E-Mail: info@addinol.de



www.addinol.de

ADDINOL Eco Gear: Product values

Eco Gear GLS – Specifications and typical product data

Feature	Test conditions	Unit	GLS 100	GLS 150	GLS 220	GLS 320	GLS 460	GLS 680	Method acc. to
ISO Viscosity Grade			100	150	220	320	460	680	DIN ISO 3448
Application temperature		°C	-35 up to +120						
Density	at 15°C	kg/m ³	878	883	890	894	898	900	DIN 51757
Viscosity	at 40°C	mm ² /s	103	149	220	319	445	650	ASTM D 7042
	at 100°C	mm ² /s	16	21	28	37	48	62	
Viscosity index			165				160		DIN ISO 2909
Flash point	COC	°C	> 235						DIN EN ISO 2592
Pour point		°C	-45				-40	-38	ASTM D 7346
FE8 Roller Bearing Lubricant Test	wear of roller bearing	mg	m _{w50} < 5						DIN 51819
Corrosion protection on steel			passed						DIN ISO 7120
Corrosivity on copper	at 135 °C, 3h	corr.level	1						DIN ISO 2160
FZG-Test A/8.3/90		Load stage	≥ 14						ISO 14635-1
FZG-Test A/16.6/120		Load stage	≥ 14						ISO 14635-1
FZG-Test A10/16.6R/120		Load stage	≥ 10						ISO 14635-2
FZG-Test S-A10/16,6R/90		Load stage	≥ 10						FVA-Nr. 243
Micro-pitting test C/8.3/90 und C/8,3/60	at 60°C / 90°C	Load stage	≥ 10						FVA Nr. 54
Foaming characteristics	at 24°C	ml / ml	0 / 0						ASTM D 892
	at 93.5°C	ml / ml	0 / 0						
	at 24°C after 93.5°C	ml / ml	0 / 0						
VKA Welding Load		N	4.200				4.400		DIN 51350-2

Eco Gear W – Specifications and typical product data

Feature	Test conditions	Unit	150 W	220 W	320 W	460 W	Method according to	
ISO Viscosity Grade			150	220	320	460	DIN ISO 3448	
Application temperature		°C	-35 up to +120			-30 up to +120		
Density	at 15°C	kg/m ³	852	854	854	855	DIN 51757	
Viscosity	at 40°C	mm ² /s	155	225	302	455	ASTM D 7042	
	at 100°C	mm ² /s	22.6	30.6	38.5	55.5		
Viscosity index			174	178	181	190	DIN ISO 2909	
Flash point	COC	°C	> 240					DIN EN ISO 2592
Pour point		°C	-55	-51		-48		ASTM D 7346
FE8 Roller Bearing Lubricant Test	wear of roller bearing	mg	m _{w50} < 5					DIN 51819
Corrosion protection on steel			passed					DIN ISO 7120
Corrosivity on copper	at 100°C, 3h	corr.level	1					DIN ISO 2160
Micro-pitting test	at 60°C / 90°C	load stage	≥ 10 (high)					FVA Nr. 54
FZG test A/8.3/90		load stage	≥ 14					ISO 14635-1
FZG test A/16.6/120		load stage	≥ 12					ISO 14635-1
Foaming characteristics	at 24°C	ml/ml	0 / 0				ASTM D 892	
	at 93.5°C	ml/ml	0 / 0					
	at 24°C after 93.5°C	ml/ml	0 / 0					
Dynamic low-temperature viscosity, Brookfield	at -30°C	mPa*s	20,800	38,200	45,000	85,000	DIN 51398	
Relative viscosity decrease KRL/100h	Delta V ₄₀	%	1.0	0.8		2.2	DIN 51350-6	

Eco Gear M – Specifications and typical product data

Feature	Test conditions	Unit	100 M	150 M	220 M	320 M	460 M	680 M	Method according to
ISO Viscosity Grade			100	150	220	320	460	680	DIN ISO 3448
Application temperature		°C	-10 up to +100						
Density	at 15°C	kg/m ³	884	893	896	903	910	908	DIN 51757
Viscosity	at 40°C	mm ² /s	100	150	220	315	450	660	ASTM D 7042
	at 100°C	mm ² /s	11.5	16	19.5	24	29	39	
Flash point	COC	°C	240	235	240	250	245	240	DIN EN ISO 2592
Pour point		°C	-30	-27	-21	-15	-15	-15	ASTM D 7346
FE8 Roller Bearing Lubricant Test	wear of roller bearing	mg	m _{w50} < 5						DIN 51819
Corrosion protection on steel			passed						DIN ISO 7120
Corrosivity on copper	at 100°C, 3h	corr.level	1						DIN ISO 2160
Micropitting test	at 60°C / 90°C	load stage	≥ 10 (high)						FVA Nr. 54
FZG-test A/8.3/90		load stage	≥ 14						ISO 14635-1
FZG-test A/16.6/120		load stage	≥ 12						ISO 14635-1
FZG-test A10/16.6R/120		load stage	≥ 10						ISO 14635-2
Foaming characteristics	at 24°C	ml/ml	0 / 0						ASTM D 892
	at 93,5°C	ml/ml	0 / 0						
	at 24°C after 93.5°C	ml/ml	0 / 0						
VKA Welding Load		N	3,200	3,400			3,600		DIN 51350-2

Eco Gear S – Specifications and typical product data

Feature	Test conditions	Unit	68 S-T	150 S	220 S	320 S	460 S	680 S	Method according to
ISO Viscosity Grade			68	150	220	320	460	680	DIN ISO 3448
Application temperature		°C	-40 up to +120	-30 up to +120, short-term up to +150					
Density	at 15°C	kg/m ³	849	869	876	880	884	890	DIN 51757
Viscosity	at 40°C	mm ² /s	69	149	220	315	450	680	ASTM D 7042
	at 100°C	mm ² /s	10.7	18.5	24.5	33	40	51	
Flash point	COC	°C	250	238	240	245	235	230	DIN EN ISO 2592
Pour point		°C	-50	-41	-42	-43	-40	-38	ASTM D 7346
FE8 Roller Bearing Lubricant Test	wear of roller bearing	mg	m _{w50} < 5						DIN 51819
Corrosion protection on steel			passed						DIN ISO 7120
Corrosivity on copper	at 100°C, 3h	corr.level	1						DIN ISO 2160
Micropitting test	at 60°C / 90°C	load stage	≥ 10 (high)						FVA Nr. 54
FZG-test A/8.3/90		load stage	≥ 14						ISO 14635-1
FZG-test A/16.6/120		load stage	≥ 12						ISO 14635-1
FZG-test A10/16.6R/120		load stage	≥ 10						ISO 14635-2
Foaming characteristics	at 24°C	ml/ml	0 / 0						ASTM D 892
	at 93.5°C	ml/ml	0 / 0						
	at 24°C after 93.5°C	ml/ml	0 / 0						
VKA Welding Load		N	3,000	3,400		3,600			DIN 51350-2