RENOLIN

Product Program
Gear and Circulating Oils

LUBRICANTS.
TECHNOLOGY.
PEOPLE.

FUCHS

LUBRICANTS. TECHNOLOGY. PEOPLE.

We concentrate solely on high-quality lubricants and related specialties.

We develop innovative and holistic solutions for a wide variety of applications.

We value the high level of commitment of our employees and their trusting interaction with one another.

Facts and figures

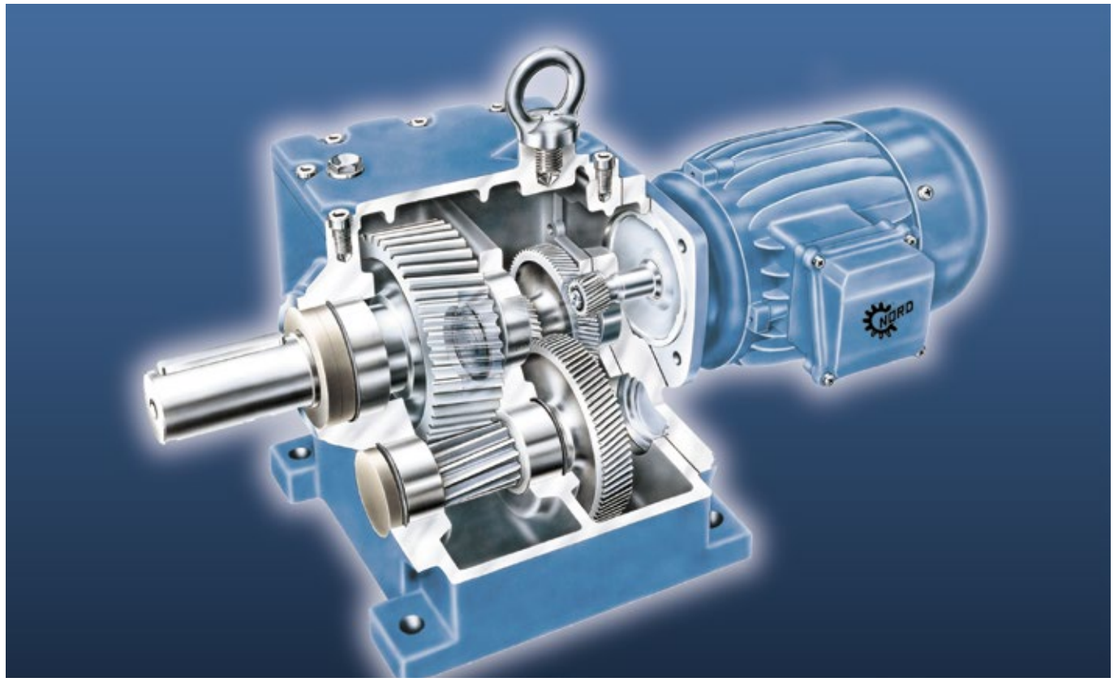
Company: FUCHS SCHMIERSTOFFE GMBH, a company of the FUCHS Group
Headquarters: Mannheim
Product range: A full range of more than 2,000 products and 6,000 articles
Certifications: DIN EN ISO 9001:2008, ISO/TS 16949:2009, DIN EN ISO 14001:2004 BS OHSAS 18001:2007, KTA 1401
References: Leading lubricant OEM for the German automotive industry

FUCHS has developed, produced and sold high-quality lubricants and related specialties for more than 85 years – for virtually all areas of application and sectors. With over 100,000 customers and 60 companies worldwide, the FUCHS Group is the leading independent supplier of lubricants.

A team of more than 800 specialists across Germany works to guarantee the satisfaction of our customers. Whatever their requirements, we have the ideal lubricant for their specific applications and processes. In our technology center we link interdisciplinary expertise in a quick and efficient way – and work on innovative lubricant solutions to meet the demands of today and tomorrow every single day.

FUCHS lubricants stand for performance and sustainability, for safety and reliability, for efficiency and cost savings. They represent a promise: technology that pays off.

An important design element – industrial gear oils



Gear oils for all applications
Germany is among the world's largest producers of drive technology and transmissions. Transmission oil is an important construction element in drive technology and is used in nearly all areas of application.

The demands placed on transmission oils have grown sharply. Further developments in the field of drive technology usually result in an increase in the power density of components: Greater performance must be transmitted in ever shorter times. At the same time, the components and transmissions are becoming ever smaller and more compact.

As one of the most important and complex machine elements, gear oil must be capable of handling these altered application conditions and requirement criteria. Oil volumes become smaller, oil circulation cycles become larger and the energy transferred to the lubricant increases.

This leads to an increase in the thermal and oxidative load on the lubricants. And in addition, the technical demands on industrial gear oils have changed dramatically over recent years – these have become significantly more stringent. New, complex bench tests with exact thresholds and extreme test conditions have been developed to better reflect the demands and problem areas in drive chains in test facilities.

Gear oils can be divided into two main groups according to their use:

- Lubricating, circulating and gear oils for industrial applications (stationary gear oils) as per DIN 51517, ISO 6743/6, AGMA 9005. design requirements – wind turbines and lubricants – ISO 61400/4
- Lubricating and gear oils for automotive applications, motor vehicle and commercial vehicle gear oils, automatic transmission fluids (ATFs) as per API GL 4, GL 5 etc.

General classification of gear oils

Gear oils

Automotive transmission oils API GL4, GL5

Industrial gear oils

DIN 51517 (2004) / DIN 51502	ISO 67 43/6 und ISO 12925-1	»AGMA old« AGMA 9005/D94	»AGMA new« AGMA 9005/E02	Lubricants for foodstuff applications as per NSF
CL – RENOLIN DTA	CKB – R&O	R&O Oils AGMA 0-6: ISO VG 32 – 320	R&O Oils inhibited oils ISO VG 32 – > 3200	NSF H1 USP white oil
CLP – RENOLIN CLP	CKC – R&O, EP/AW	R&O Oils + with »low friction« AGMA 7 Comp. – 460 AGMA 8 Comp. – 680 AGMA 8A Comp. – 1.000	EP Oils anti-scuffing/ anti-wear oils ISO VG 32 – > 3200	NSF H1 PAO
CLP (D) – RENOLIN CLP PLUS	CKD – R&O, EP/AW, HT	EP Oils with R&O performance AGMA 2 EP – 9 EP ISO VG 68 – 1500	CP Oils compounded oils R&O with »low friction« ISO VG 100 – > 3200	
CLPF (D) – RENOLIN CLPF SUPER	CKE – CKB + friction reducer	Synthetic gear oils AGMA 0S – 8S ISO VG 32 – 680		
CLP-HC (PAO) – RENOLIN UNISYN CLP NEW: RENOLIN UNISYN XT	CKS – Synthetic R&O, LT, HT			
CLP-PG (PAG) – RENOLIN PG	CKT – Synthetic (AW/EP – high), LT, HT			
CLP-E (Ester) (biodegradable fluids) – PLANTOGEAR S GEARMASTER 320 ECO	NEW: RENOLIN PentoGear 320 WT			

The product ranges listed are available in various viscosity classes.

FUCHS industrial gear oils

FUCHS industrial gear oil, performance in line with ISO 6743-6, ISO 12925-1

Product name	CKB	CKC	CKD	CKE	CKS	CKT
	**R&O	**R&O AW/EP	**R&O AW/EP "higher temp."	**R&O "low friction"	**R&O "extreme temp."	**R&O AW/EP "extreme temp."
RENOLIN DTA/CL	●	–	–	–	–	–
RENOLIN CLP	–	●	●	–	–	–
RENOLIN CLP-PLUS*	–	●	●	–	–	–
RENOLIN CLP SUPER*	–	●	●	–	–	–
RENOLIN UNISYN CLP	–	●	●	●	–	–
RENOLIN PG	–	●	●	●	●	●
PLANTOGEAR S	–	●	●	●	–	–
RENOLIN UNISYN XT	–	●	●	●	–	–
RENOLIN HIGHGEAR*	–	●	●	●	–	–
RENOLIN HIGHGEAR SYNTH*	–	●	●	●	–	–
RENOLIN SYNGEAR HT	–	●	●	●	●	●
RENOLIN PentoGear 320 WT	–	●	●	●	–	

● Performance tests were passed
● Products for reducing friction with EP/AW additives
● Products with AW/EP additives for extreme operating temperatures

Oxidation test for CKC at 95 °C
Oxidation test for CKD at 121 °C
Oxidation test for CKT at 150 °C
Oxidation test for CKS at 150 °C
Oxidation test for CKE at 95 °C

* DD (Detergent/Dispersant) products
** R&O – R&O – Circulating oils with antioxidants and corrosion inhibitors AW/EP – Wear protection and high-pressure additives
"higher temp." – for high operating temperatures
"low friction" – low friction coefficients
"extreme temp." – for extreme operating temperatures

Lubricating Oils

ISO-L Symbol	Composition and properties
CKB	Refined mineral oils with oxidation stability, anticorrosion (ferrous and non-ferrous metal) and antifoam properties.
CKC	Refined mineral oils with oxidation stability, anticorrosion (ferrous and non-ferrous metal) and antifoam with enhanced extreme pressure and antiwear properties.
CKD	Lubricants with oxidation stability, anticorro- sion (ferrous and non-ferrous metal), antifoam, extreme pressure and antiwear properties, with enhanced thermal/oxidative stability that permits use at a higher temperature.
CKE	Lubricants with oxidation stability, anticorrosion (ferrous and non-ferrous metal) and antifoam properties, ensuring low coefficient of friction.
CKS	Lubricants with oxidation stability, antifriction and anticorros- ion (ferrous and non-ferrous metal) properties usable under extreme temperature conditions (low and high).
CKT	Lubricants with oxidation stability, antifriction and anti- corrosion (ferrous and non-ferrous metal) properties usable under extreme temperature conditions (low and high) and under high load.

Others

ISO-L Symbol	Composition and properties
CKG	Greases with extreme pressure and anti-wear properties.
CKH	Products usually of bituminous type with anti-corrosion properties.
CKJ	Products of CKH type with enhanced extreme-pressure and anti-wear properties.
CKL	Greases with improved extreme-pressure, anti-wear and anti-corrosion properties and improved thermal stability.
CKM	Products with improved anti-seizing properties that permit use under extreme load conditions, and products with anti-corrosion properties.

New mechanical tests for industrial gear oils – WEC white etching cracks

Over the last few months and years, there have been more and more discussions on failures of roller bearings, gear teeth and transmissions as a result of the damage phenomenon known in the market as „white etching cracks".

The damage observed led to this question:

To what extent do certain additives and gear oil formulations prevent or promote white etching cracks in roller bearings and gears?

This in turn led to development of a roller bearing bench test, as these machine elements are particularly susceptible to the WEC phenomenon. The FE8 pitting test as per VW-PV-1483 was used to investigate the WEC-phenomenon. The test was performed on axial cylinder roller bearings with an axial load of 60 kN at speeds of 350 and 750 rpm, at an oil temperature of 100°C and oil flow rate of 2 x 0.1 l/min.

The fatigue life of the bearing and the influence of the oil formula are determined and the occurrence of the WEC damage on the cylinder raceway/cylinder roller is investigated.

An ATI GL4 manual transmission oil was defined as the low reference oil and used to bring about WEC damage on the roller bearing raceway.

RENOLIN CLP, RENOLIN UNISYN CLP, RENOLIN UNISYN XT, RENOLIN PG and PLANTOGEAR S are used as the high reference oil. With the high reference RENOLIN industrial gear oils, ISO VG 100, a service life > 9 million revolutions was reached in this roller bearing test without any WEC-type damage occurring.

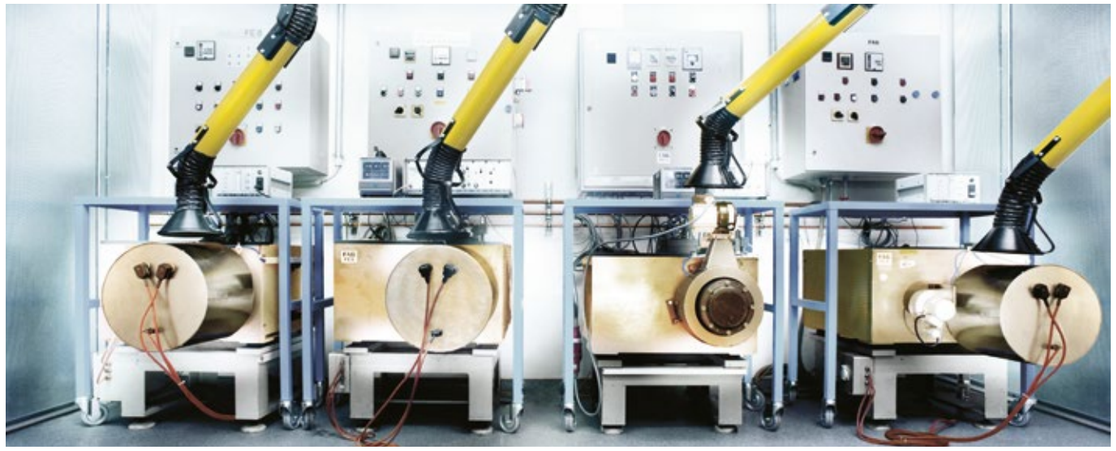
RENOLIN gear oil formulations were also investigated with various anticorrosion oils, metal working fluids and critical additive components added. The robustness of the formulations displays excellent wear protection characteristics and optimum protection with regard to the white etching cracks phenomenon.

Requirements of industrial gear oils
The demands made on industrial gear oils are increasing. Although the new DIN 51517 (dated 2006) only specifies a scuffing load carrying test in line with FZG A/8.3 90 and the roller bearing test FE8 in addition to the physical characteristics, many leading gear manufacturers' specifications contain additional requirements:

- More stringent scuffing load carrying test according to FZG A/16.6/140
- Micropitting test at 60°C and 90°C as per GFT, FVA I-IV, C/8.3/90 and C/8.3/60
- FE8 roller bearing wear test as per DIN 51819, Part 2 (and variations) – D/7.5/80-80
- FZG slow speed wear test
- FZG pitting test
- Load-carrying capacity as per Brugger
- Filtration behavior – dynamic tests
- Foaming behavior (e.g. Flender inhouse test)
- Low-temperature-behavior
- Cold flow properties
- etc.

These additional bench tests attempt to replicate the extreme conditions which gearboxes and gear oils are subject to and quantify the performance of the various formulations. FUCHS has state-of-the-art test rigs for the testing of industrial gear oils on which customer demands can be simulated. Close cooperation with the relevant DIN and ISO committees and working groups and intensive cooperation with the German research association for power transmission engineering (FVA) as well as renowned gear manufacturers and international customers results in a constant refinement and improvement of both standardized test procedures and FUCHS in-house bench tests.

For the power transmission engineering of today and tomorrow



Heavy-duty synthetic gear oils

Although mineral oil-based gear oils continue to dominate, synthetic oils are becoming increasingly popular in the rapidly growing power transmission engineering market. Synthetic gear oils already had a total market of 20% to 25% in 2014.

Compared to mineral oils, synthetic gear oils have a significantly longer life, generate lower service costs and excel in terms of reducing wear to gears and rolling bearings. They are more expensive than mineral oils but these higher costs are compensated by increased operating hours (lifetime two to three times longer), lower maintenance costs, wider operating temperature range (multigrade characteristics), lower disposal costs, better technical performance, lower component wear and improved energy efficiency.

FUCHS synthetic oils: A full range

FUCHS offers a comprehensive product range of mineral oil-based gear oils

- RENOLIN CLP – demulsifying
- RENOLIN CLP PLUS – detergent with AO booster
- RENOLIN AWD – »High Brugger« lubricating oils
- RENOLIN CLPF SUPER – black, containing MoS_2
- RENOLIN HighGear – flow-stabilizing/plastic deformation
- RENOLIN GEAR VCI – special corrosion protection

In addition, a complete range of fully synthetic gear oils have been developed and refined over recent years.

Products in the series

- RENOLIN UNISYN CLP – polyalphaolefin-based (PAO)
- RENOLIN PG – polyalkylene glycol-based (PAG)
- PLANTOGEAR S – saturated ester-based (E)
- RENOLIN HighGear Synth – polyalphaolefin-based (PAO)
- RENOLIN UNISYN GEAR VCI – polyalphaolefin-based (PAO)
- NEW: RENOLIN UNISYN XT
- NEW: RENOLIN PentoGear 320 WT – synthetic

make up a complete portfolio of new-generation synthetic gear oils boasting maximum technical performance.

FUCHS is a leading player in the field of power transmission engineering and its product range covers all industrial gear oil applications and performance levels. In addition, special grades are also available which were specially developed to meet specific customer demands.

The optimum gear oil for every application.
The optimum solution for every problem.

The ranges of fully synthetic gear oils

RENOLIN UNISYN CLP range

These synthetic polyalphaolefin-based gear oils are characterized by a high natural, shear-stable viscosity index. This provides effective lubrication at both high and low application temperatures (multi-grade lubricants).

Their compatibility with paints and elastomers is comparable with that of mineral oils. Compared to mineral oils, the service life of these oils is two to three times longer. RENOLIN UNISYN CLP displays exceptional wear-protection characteristics. As a result of their extremely low pour point, these oils display outstanding cold flow properties. They represent the most important group among synthetic gear oils.

This range also includes an approved wind turbine gear oil in the form of RENOLIN UNISYN CLP 320.

RENOLIN PG series

Products from the RENOLIN PG series are based on special polyalkylene glycols. They display very low friction coefficients in tribological conditions. Their high natural viscosity index makes them shear-stable. RENOLIN PG oils can be used at both high and low temperatures. RENOLIN PG oils are primarily used to lubricate steel/bronze worm gears and are recommended for applications subject to unfavorable friction conditions and very high temperatures (e.g. calender lubrication and paper machine oil). Its compatibility with components still needs to be verified. Polyglycols are neither miscible nor compatible with mineral oils.

PLANTOGEAR S series

The rapidly biodegradable PLANTOGEAR S series of oils are based on fully saturated, synthetic ester oils. They boast very low friction coefficients, a good load-carrying capacity and a high natural shear-stable viscosity index.

The polar structure of ester oils provides for good cleaning properties and dirt holding capacity. Furthermore, saturated esters display excellent thermal stability.

Products from the PLANTOGEAR S series can be used to clean gearboxes which have been contaminated with deposits and sludge.

The PLANTOGEAR S series has been awarded the European EEL Ecolabel.

GEARMASTER ECO 320 is an approved, biodegradable wind turbine gear oil.

A highlight of our latest research and development activities is our new RENOLIN HighGear series of gear oils. These contain special additive systems which form high-performance protective films on gear teeth and protect machine elements against wear, even under extreme loads, mixed friction conditions, high pressures, high specific contact pressures, at low speeds and when the surfaces of the teeth are damaged.

This is achieved by the use of synergistic additive combinations of mild sulfur carriers, surface-active phosphorous and zinc additives together with mineral oil-soluble molybdenum compounds.

This technology is also referred to as a plastic deformation (PD) reaction or surface roughness smoothing.

As opposed to the previously available technologies, RENOLIN HighGear was further developed in particular in terms of thermal and oxidation stability, long-term stability (to avoid sludge formation) and its excellent corrosion protection.

Smoothing effect of PD additives »HighGear« technology

Both mineral oil-based and polyalphaolefin-based products are thus available which fulfill the highest technical standards. The results of tests performed in extreme conditions and with pre-damaged machine elements in large-scale gearboxes (in underground mine conveyor drives) as well as spindle drives in forging presses confirm these outstanding characteristics.

RENOLIN Gear and circulating oils – an overview

RENOLIN DTA – demulsifying circulating, spindle and hydraulic oils

CL/HL oils (demulsifying)

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN DTA 2	Spindle, hydraulic and lubricating oils (machine oils) on the basis of selected base oils with additives to improve aging behavior and corrosion protection. All RENOLIN DTA products are DIN 51524-1 (HL) hydraulic oils and DIN 51517-2 (CL) circulating oils based on mineral oil, demulsifying (water-separating) and free of zinc. ISO 6743/4, HL, ISO 6743-6 and ISO 12925-1: CKB.	805	100	2.2	–	–	–27	For thermally-stressed bearings and hydraulic systems with peak temperatures of approx. 120 °C. General lubrication without specific wear protection requirements (without AW/EP). (Refer to product information 4-1292* for further details) Mineral oil-based
RENOLIN DTA 5		837	120	4.6	1.6	106	–40	
RENOLIN DTA 7		839	155	7.4	2.2	103	–27	
RENOLIN DTA 10		851	174	10	2.6	92	–27	
RENOLIN DTA 15		856	195	15	3.4	98	–27	
RENOLIN DTA 22		865	210	22	4.2	94	–27	
RENOLIN DTA 32		874	222	32	5.4	102	–24	
RENOLIN DTA 46		874	228	46	6.8	101	–24	
RENOLIN DTA 68		882	250	68	8.7	99	–18	
RENOLIN DTA 100		881	248	100	11.2	97	–18	
RENOLIN DTA 150		889	266	150	15.5	94	–15	
RENOLIN DTA 220		893	280	220	18.8	95	–12	
RENOLIN DTA 320		898	280	320	24.0	95	–12	
RENOLIN DTA 460		904	315	460	30.4	95	–12	
RENOLIN DTA 680		913	302	680	37.9	92	–12	

RENOLIN CLP – demulsifying EP / AW gear and circulating oils

CLP oils (demulsifying)

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN CLP 68	High-performance gear and circulating oils with good aging stability and additives to improve corrosion protection (also combat steel and non-ferrous metal corrosion caused by moisture). Outstanding anti-wear characteristics – good EP/AW performance, excellent scuffing load carrying capacity and protection against micropitting, excellent FE8 roller bearing wear protection, good demulsifying properties, very good foaming behavior, zinc-free and silicone oil-free. RENOLIN CLP oils fulfill and exceed the minimum requirements of CLP lubricating oils according to DIN 51517, Part 3 (2004), ISO 6743-6 and ISO 12925-1: CKC, CKD. US Steel 224, David Brown S1.53.10. Approved by leading gearbox manufacturers.	866	236	68	8.7	99	–24	Universal gear oils for industrial applications such as in bearings, joints, spur, bevel and worm gears and whenever the manufacturer recommends an oil of this type. (Refer to product information 4-1208* for further details) Mineral oil-based
RENOLIN CLP 100		890	240	100	11.2	98	–21	
RENOLIN CLP 150		894	250	150	14.5	96	–24	
RENOLIN CLP 220		896	260	220	18.9	96	–24	
RENOLIN CLP 320		900	255	320	24.0	95	–12	
RENOLIN CLP 460		901	270	460	30.4	95	–12	
RENOLIN CLP 680		918	270	680	36.8	88	–10	

* PI = Product-information
EP = Extreme pressure additives, to avoid wear and scuffi ng at high pressures and loads
AW = Anti-wear additives, to avoid wear in mixed friction areas

RENOLIN CLP PLUS – detergent EP/AW gear oils with improved oxidation stability

CLP-D oils (detergent)

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN CLP 46 PLUS	High-performance gear and circulating oils offering excellent wear protection, good EP performance and excellent corrosion protection. Carefully selected antioxidants guarantee good aging stability and special surface-active substances lower friction, which can reduce operating temperatures and increase efficiency. Special detergent/dispersant additives offer very good cleaning properties and dirt holding capacity. RENOLIN CLP PLUS oils have excellent foaming characteristics and offer good protection against micropitting. The RENOLIN CLP PLUS series of oils are free from zinc and silicone oil. RENOLIN CLP PLUS oils fulfill the minimum requirements of lubricating oils according to DIN 51 517, ISO 6743-6 and ISO 12925-1: CKC, CKD. CLP PLUS were developed specially for the extreme conditions in which mining industry conveyors operate and can increase service life in such conditions.	885	200	46	6.8	102	–27	Special gear oils for highly stressed mechanical industrial, spur, double-spur, bevel and worm gears. Long-life oils (tested for 30,000 hours in brown coal open pit mining conveyors and approved). Improved oxidation stability. (Refer to product information 4-1226* for further details)
RENOLIN CLP 68 PLUS		888	236	68	8.7	100	–27	
RENOLIN CLP 100 PLUS		891	240	100	11.2	97	–24	
RENOLIN CLP 150 PLUS		895	250	150	14.8	97	–24	
RENOLIN CLP 220 PLUS		899	260	220	18.9	96	–24	
RENOLIN CLP 320 PLUS		899	255	320	24.0	95	–18	
RENOLIN CLP 460 PLUS		904	270	460	30.2	94	–14	
RENOLIN CLP 680 PLUS		908	270	680	39.6	95	–17	

RENOLIN CLPF SUPER-EP / AW gear oils with MoS_2 (solid lubricant / black color)

CLP oils/black

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN CLPF 100 SUPER	EP gear oils with synergistic chemical EP/AW additives and physical MoS_2-based solid lubricant additives. The MoS_2-based solid lubricant additives cover a wide range of temperatures in mixed friction areas. They reduce friction and have a damping effect. Excellent wear protection in mixed friction areas, good dirt holding capacity (detergent effect), excellent foaming behavior, very good FE8 roller bearing wear protection, free from zinc and silicone oil. The RENOLIN CLPF SUPER series of oils surpass the minimum requirements of CLPD lubricating oils according to DIN 51517, Part 3 (2004) together with DIN 51 502, ISO 6743-6 and ISO 12925-1: CKC, CKD	891	240	100	11.2	98	–21	For highly-stressed gearboxes operating at low circumferential speeds and high loads, even when subject to shock loading, for noise reduction and for the lubrication of spindles and gearboxes in forging presses. (Refer to product information 4-1264* for further details) Mineral oil-based
RENOLIN CLPF 220 SUPER		901	260	220	18.8	95	–21	
RENOLIN CLPF 320 SUPER		900	255	320	24.0	95	–14	
RENOLIN CLPF 460 SUPER		911	270	460	30.4	95	–12	
RENOLIN CLPF 680 SUPER		922	270	680	36.8	88	–10	
RENOLIN CLPF 1500 SUPER		906	240	1.500	70.5	104	–12	

* PI = Product-information
EP = Extreme pressure additives, to avoid wear and scuffi ng at high pressures and loads
AW = Anti-wear additives, to avoid wear in mixed friction areas

RENOLIN AWD – detergent EP/AW gear oils with high Brugger performance

CLP-D oils/ high Brugger

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN AWD 68	Special gear and circulating oils when products with particularly good wear protection properties are required. Special additives reduce friction and form reaction layers which offer excellent wear protection in extreme mixed friction and load conditions. Brugger value >70 N/mm², excellent FE8 roller bearing wear protection, good dirt holding capacity (detergent dispersant), free from zinc and silicone oil, high additive reserves. The RENOLIN AWD series of oils surpass the minimum requirements of CLPD lubricating oils according to DIN 51517, Part 3 together with DIN 51502, ISO 6743-6 and ISO 12925-1: CKC, CKD. Approved by leading press manufacturers.	882	221	68	8.9	105	–24	For highly-stressed industrial gearboxes and circulating systems, especially when good load-carrying capacity in extreme mixed friction and load conditions is required. High Brugger value of >70 N/mm². Used in applications including press lines in the automotive industry. (Refer to product information 4-1060* for further details)
RENOLIN AWD 100		886	222	100	11.2	97	–24	
RENOLIN AWD 150		894	208	150	14.6	96	–12	
RENOLIN AWD 220		896	210	220	18.7	95	–12	

RENOLIN UNISYN CLP – fully synthetic, high-performance EP / AW gear oils based on polyalphaolefin (PAO)

CLP-HC oils/PAO-synthetic

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN UNISYN CLP 68	Fully-synthetic gear and circulating oils with excellent thermal and aging stability, very high viscosity index (shear-stable), outstanding low-temperature behavior, very good flow behavior at low temperatures, excellent air release properties and foaming behavior, good protection against micropitting, excellent FE8 performance, good demulsifying properties, free from zinc and silicone oil. The RENOLIN UNISYN CLP series of oils surpass the minimum requirements of CLP-HC gear oils according to DIN 51517, Part 3 together with DIN 51 502, ISO 6743-6 and ISO 12925-1: CKC, CKD, CKE, AISE 224, David Brown S1.53.101. Approved by leading gearbox manufacturers.	848	240	68	10.7	147	–56	For the lubrication of bearings and gearboxes which are subject to high thermal loads. RENOLIN UNISYN CLP oils are also suitable for lubricated-for-life applications and in gearboxes with extended oil change intervals. Miscible and compatible with mineral oils. Excellent low-temperature characteristics, high, shear-stable viscosity index. RENOLIN UNISYN CLP 320 is used in wind turbine gears worldwide and is an approved gear oil for wind turbines. (Refer to product information 4-1104* for further details)
RENOLIN UNISYN CLP 100		851	250	100	14.5	150	–53	
RENOLIN UNISYN CLP 150		853	250	150	19.6	150	–45	
RENOLIN UNISYN CLP 220		854	260	220	26.7	155	–42	
RENOLIN UNISYN CLP 320		860	260	320	35.0	155	–42	
RENOLIN UNISYN CLP 460		861	300	460	45.6	155	–39	
RENOLIN UNISYN CLP 680		862	300	680	62.2	160	–33	
RENOLIN UNISYN CLP 1000		864	300	1.000	84.0	165	–27	

* PI = Product-information
EP = Extreme pressure additives, to avoid wear and scuffi ng at high pressures and loads
AW = Anti-wear additives, to avoid wear in mixed friction areas

RENOLIN PG – synthetic, high-performance EP / AW gear oils based on polyalkylene glycol (PAG)

CLP-PG oils / polyglycol

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN PG 32	Fully synthetic gear and circulating oils based on special polyalkylene glycols (PAG) for applications subject to extreme thermal loads. High oxidation and aging stability, high viscosity index (shear-stable), good viscosity-temperature behavior, excellent load-carrying capacity, low coefficients of friction, high FZG, good protection against micropitting, excellent FE8 performance, very good resistance to pitting. The RENOLIN PG series of oils surpass the minimum requirements of CLP-PG lubricating oils according to DIN 51517, Part 3 together with DIN 51502, ISO 6743-6 and ISO 129251: CKC, CKD, CKE, (CKS), CKT. Approved by leading gearbox manufacturers.	1,022	220	32	7.1	194	–54	For gearboxes operating in extreme thermal and mechanical conditions, such as worm gears and calender lubrication. Can also be used as compressor oils for process gases such as methane, ethane, propane, etc. Particularly suitable for steel/bronze sliding pairs in worm gears. Not miscible or compatible with mineral oils. (Refer to product information 4-1293* for further details)
RENOLIN PG 46		1,029	240	46	9.7	203	–48	
RENOLIN PG 68		1,035	240	68	13.85	212	–51	
RENOLIN PG 100		1,043	260	100	19.6	220	–48	
RENOLIN PG 150		1,051	260	145	27.0	224	–51	
RENOLIN PG 220		1,075	240	220	36.8	218	–33	
RENOLIN PG 320		1,075	240	320	54.4	237	–36	
RENOLIN PG 460		1,075	280	460	75.1	245	–36	
RENOLIN PG 680		1,075	280	680	110.3	261	–33	
RENOLIN PG 1000		1,075	280	1.000	162.0	281	–36	

PLANTOGEAR S – brapidly biodegradable, high-performance EP / AW gear oils based on saturated esters

CLP-E oils / synthetic esters

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
PLANTOGEAR 100 HVI** EU Ecolabel DE/027/177	Biodegradable, high-performance gear oils based on special saturated esters. Extremely high thermal and aging stability, high viscosity index (shear-stable), good viscosity-temperature behavior, for low-temperature applications, excellent cleaning power due to polar ester structure, reduced friction, excellent wear protection, good FZG scuffing load carrying capacity, good protection against micropitting, outstanding FE8 performance, rapidly biodegradable and self-cleaning. The PLANTOGEAR S series of oils surpass the minimum requirements of CLP-E lubricating oils according to DIN 51517, Part 3 together with DIN 51502, ISO 6743-6 and ISO 129251: CKC, CKD, CKE. The PLANTOGEAR S range has been awarded the European EEL Ecolabel. Approved by leading gearbox manufacturers.	927	>270	100	13.7	138	–33	For highly-stressed spur, bevel, planetary and worm gears, above all in areas where leakages could present a hazard to soil and the ground or surface water. For both high and low application temperatures. High, shear-stable viscosity index. Can be used as a cleaning fluid. GEARMASTER ECO 320 – rapidly biodegradable and approved wind turbine gear oil. (Refer to product information 4-1387* for further details)
PLANTOGEAR 150 HVI** EU Ecolabel DE/027/178		928	>270	150	19.1	145	–30	
PLANTOGEAR 220 S** EU Ecolabel DE/027/102		938	280	220	26.2	152	–30	
PLANTOGEAR 320 S** EU Ecolabel DE/027/103		943	280	320	35.1	155	–30	
PLANTOGEAR 460 S** EU Ecolabel DE/027/107		951	280	460	48.0	163	–30	
PLANTOGEAR 680 S** EU Ecolabel DE/027/108		958	280	680	66.0	170	–30	
GEARMASTER ECO 320		943	280	320	35.1	155	–33	

* PI = Product-information
EP = Extreme pressure additives, to avoid wear and scuffi ng at high pressures and loads
AW = Anti-wear additives, to avoid wear in mixed friction areas

** Ecolabel

RENOLIN Gear and circulating oils – an overview

RENOLIN HighGear – industrial gear oils based on the latest additive technology. Smoothing PD technology

PD technology, mineral oil, smoothing

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN HighGear 220	RENOLIN HighGear oils are based on selected mineral oil-based base oils. Synergistic additives guarantee the outstanding wear protection performance of these new high-tech gear oils. Highly effective tribo-protection layers reliably protect wetted machine components against wear. This new additive technology is also referred to as a smoothing PD (plastic deformation) reaction mechanism. These additives have a noticeable smoothing effect on surface roughness. ISO 6743-6 and ISO 12925-1: CKC, CKD, CKE.	895	255	220	19.2	96	–10	RENOLIN HighGear can be used both in new gearboxes (spur, bevel, planetary and worm gears) to reduce friction, wear and noise in extreme conditions as well as in pre-damaged gearboxes and machine components to increase service life. (Refer to product information 4-1093* for further details) Mineral oil-based
RENOLIN HighGear 320		903	>260	320	24.0	95	–12	
RENOLIN HighGear 460		904	>270	460	31.1	96	–9	

RENOLIN HighGear Synth – industrial gear oils with the latest additive technology based on polyalphaolefin (PAO). Smoothing PD technology

PD technology, mineral oil, smoothing

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN HighGear SYNTH 320	RENOLIN HighGear Synth is based on synthetic polyalphaolefins (PAO). Special synergistic additives guarantee the outstanding wear protection performance of these new high-tech gear oils. Highly effective tribo-protection layers reliably protect wetted machine components against wear. RENOLIN HighGear Synth oils have a high, natural and shear-stable viscosity index and are suitable for both high and low temperature applications. Their high thermal and oxidation stability allow oil change intervals to be extended. ISO 6743-6 and ISO 12925-1: CKC, CKD, CKE.	876	220	320	31.2	135	–34	RENOLIN HighGear can be used both in new gearboxes (spur, bevel, planetary and worm gears) to reduce friction, wear and noise in extreme conditions as well as in pre-damaged gearboxes and machine components to increase service life. Synthetic PAO components help reduce friction, lower operating temperatures and can increase mechanical efficiency. Excellent low-temperature characteristics, high, shear-stable viscosity index. (Refer to product information 4-1096* for further details)
RENOLIN HighGear SYNTH 460		878	220	460	41.6	140	–27	
RENOLIN HighGear SYNTH 680		880	220	680	57.9	149	–27	

* PI = Product-information
EP = Extreme pressure additives, to avoid wear and scuffi ng at high pressures and loads
AW = Anti-wear additives, to avoid wear in mixed friction areas

RENOLIN MORGEAR – demulsifying circulating oils with mild anti-wear (AW) additives for applications in the steel industry

Lubrication of MORGOIL bearings

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN MORGEAR 100	High-performance circulating oils based on mineral oil, for the lubrication of MORGOIL bearings. Mild EP/AW additives guarantee good wear protection, synergistically acting additives ensure good aging stability and excellent demulsifying power (very good water separation ability). ISO 6743-6 and ISO 12925-1: CKB.	888	248	100	11.1	96	–19	For the lubrication of MORGOIL bearings. RENOLIN MORGEAR oils fulfill and surpass the requirements of DANIELI (Italy, 2000) and SMS (2005).
RENOLIN MORGEAR 220		895	255	226	19.2	96	–10	
RENOLIN MORGEAR 320		903	>260	320	24.0	95	–12	
RENOLIN MORGEAR 460		904	>270	470	31.1	96	–9	
RENOLIN MORGEAR 680		915	252	682	39.2	95	–7	

RENOLIN UNISYN XT – the latest generation of fully synthetic, polyalphaolefin-based industrial gear oils, very high viscosity index

Low-temperature gear oils

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN UNISYN XT 100	The RENOLIN UNISYN XT range is based on new, innovative polyalphaolefins and synthetic hydrocarbons. The viscosity index is extremely high: VI > 180. Furthermore, the cold flow properties are outstanding, and pour point values and low-temperature viscosities are extremely low. The RENOLIN UNISYN XT series displays excellent protection against micropitting, excellent FE8 performance and meets and exceeds CLP-HC as per DIN 51517-3 and ISO 12925 CKC, CKD, CKE. Approved by leading gearbox manufacturers (e.g. SIEMENS FLENDER).	850	238	100	15.3	162	–48	For the lubrication of bearings and gearboxes which are subject to high thermal loads. RENOLIN UNISYN XT has a very high viscosity index and guarantees a stable lubricating film. For lubrication of and use in gears with extended oil change intervals. Miscible and compatible with mineral oils. Surpasses the low-temperature properties of conventional PAOs, for high thermal and mechanical loads. Long lifetime.
RENOLIN UNISYN XT 150		850	238	150	21.4	168	–45	
RENOLIN UNISYN XT 220		860	242	220	29.4	174	–42	
RENOLIN UNISYN XT 320		860	242	320	40.2	179	–42	
RENOLIN UNISYN XT 460		860	242	460	54.5	188	–39	
RENOLIN UNISYN XT 680		860	244	680	75.5	192	–39	
RENOLIN UNISYN XT 1000		860	244	1000	101	195	–33	

* PI = Product-information
EP = Extreme pressure additives, to avoid wear and scuffi ng at high pressures and loads
AW = Anti-wear additives, to avoid wear in mixed friction areas

RENOLIN Gear and circulating oils – an overview

RENOLIN PentoGear 320 WT – industrial gear oil for wind energy plants and on the basis of unconventional base oils

Lubrication of wind energy plants

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN PentoGear 320 WT	RENOLIN PentoGear 320 WT is based on innovative synthetic base oils. RENOLIN PentoGear 320 WT surpasses the requirements of DIN 51517-3. Approved by SIEMENS FLENDER	892	> 220	320	37	165	–39	RENOLIN PentoGear 320 WT is a high-performance gear oil developed specially for use in the main gears of wind energy plants. RENOLIN PentoGear 320 WT is also suitable as a universally deployable industrial gear oil.

RENOLIN PENTOPOL M / B – synthetic gear and bearing oils for the aluminum industry, for aluminum rolling mills

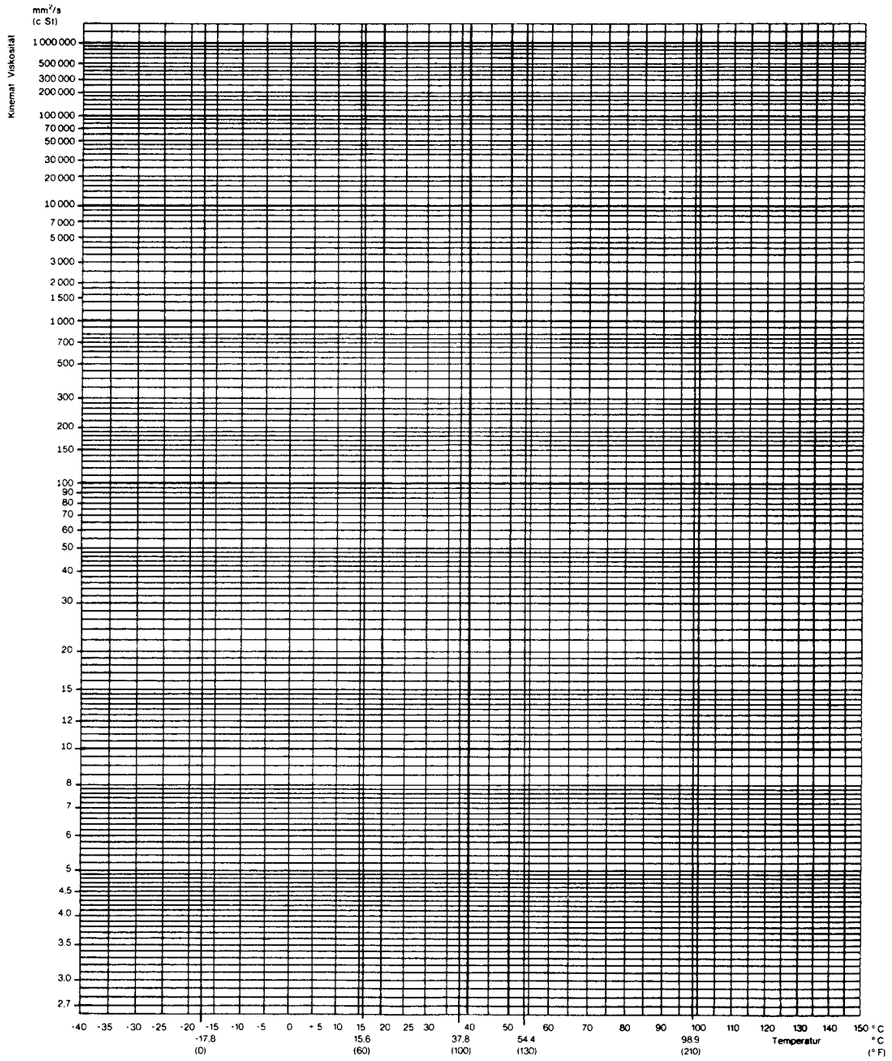
Gear oil for the aluminum industry

Product name	Description	Density at 15 °C [kg/m³]	FLP. Cleveland [°C]	Kin.Visc. at 40 °C [mm²/s]	Kin.Visc. at 100 °C [mm²/s]	VI Viscosity index	Pour-point [°C]	Main application area
RENOLIN PENTOPOL M 77	The RENOLIN PENTOPOL series is based on selected synthetic components in connection with synergistic additives. The RENOLIN PENTOPOL series was developed for the lubrication of machines, bearings and gears in the aluminum industry. The products have very good compatibility with aluminum and are preferred non-staining products for the aluminum industry. Moreover, the product prevents the formation of hot spots on the aluminum surface.	995	200	77	14	185	–45	For lubricating bearings, gears and machines in the aluminum industry, in aluminum roll stands and in aluminum rolling mills. Zinc-free and ash-free aluminum non-staining fluids.
RENOLIN PENTOPOL M 175		995	> 240	175	29	206	–39	
RENOLIN PENTOPOL B 150		998	230	150	26	205	< –45	

Special gear and circulating oils – NEW

Product name	Description
RENOLIN UNISYN CLP PA	Fully synthetic, newly developed polyalphaolefin-based high-performance paper machine oils. Excellent demulsifying power (very good water separation ability), good aging stability, excellent wear protection, excellent corrosion protection, long lifetime. Fulfills the paper machine oil requirements of SKF, FAG and VOITH.
RENOLIN PA	Mineral oil-based gear oil with the latest additive technology for the special requirements of lubricating bearings and discs in paper machines; very good demulsifying properties, excellent corrosion protection and wear protection.
RENOLIN SynGear 220 HT	Fully synthetic high-temperature EP industrial gear oil based on selected polyalkylene glycols, extreme high-temperature stability, low evaporation loss, high wear protection, high thermal and oxidative stability, for lubrication of calenders in the paper and foils industries, CKC / CKD / CKT gear oil according to ISO 6743 / 6.
RENOLIN GEAR VCI **RENOLIN UNISYN GEAR VCI**	Special anticorrosion oil based on mineral oil or polyalphaolefin (PAO), reliable long-time corrosion protection guaranteed both in the oil phase and vapor phase, fulfills and surpasses the requirements of CLP industrial gear oils, good wear protection, high scuffing load carrying capacity, good compatibility with gear oils.

Viscosity-temperature diagram



Note
The information contained in this product information is based on the experience and know-how of FUCHS SCHMIERSTOFFE GMBH in the development and manufacturing of lubricants and represents the current state-of-the-art. The performance of our products can be influenced by a series of factors, especially the specific use, the method of application, the operational environment, component pre-treatment, possible external contamination, etc. For this reason, universally-valid statements about the function of our products are not possible. Our products must not be used in aircrafts/spacecrafts or their components, unless such products are removed before the components are assembled into the aircraft / spacecraft. The information given in this product information represents general, non-binding guidelines. No warranty expressed or implied is given concerning the properties of the product or its suitability for any given application.

We therefore recommend that you consult a FUCHS SCHMIERSTOFFE GMBH application engineer to discuss application conditions and the performance criteria of the products before the product is used. It is the responsibility of the user to test the functional suitability of the product and to use it with the corresponding care.

Our products undergo continuous improvement. We therefore retain the right to change our product program, the products, and their manufacturing processes as well as all details of our product information sheets at any time and without warning, unless otherwise provided in customer-specific agreements. With the publication of this product information, all previous editions cease to be valid.

FUCHS Industrial Lubricants

Innovative lubricants need experienced application engineers

Every lubricant change should be preceded by expert consultation on the application in question. Only then the best lubricant system can be selected. Experienced FUCHS engineers will be glad to advise on products for the application in question and also on our full range of lubricants.

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