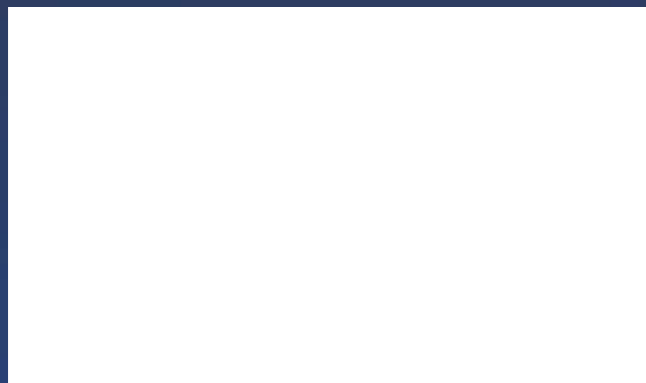


Innovative lubricants need experienced application engineers

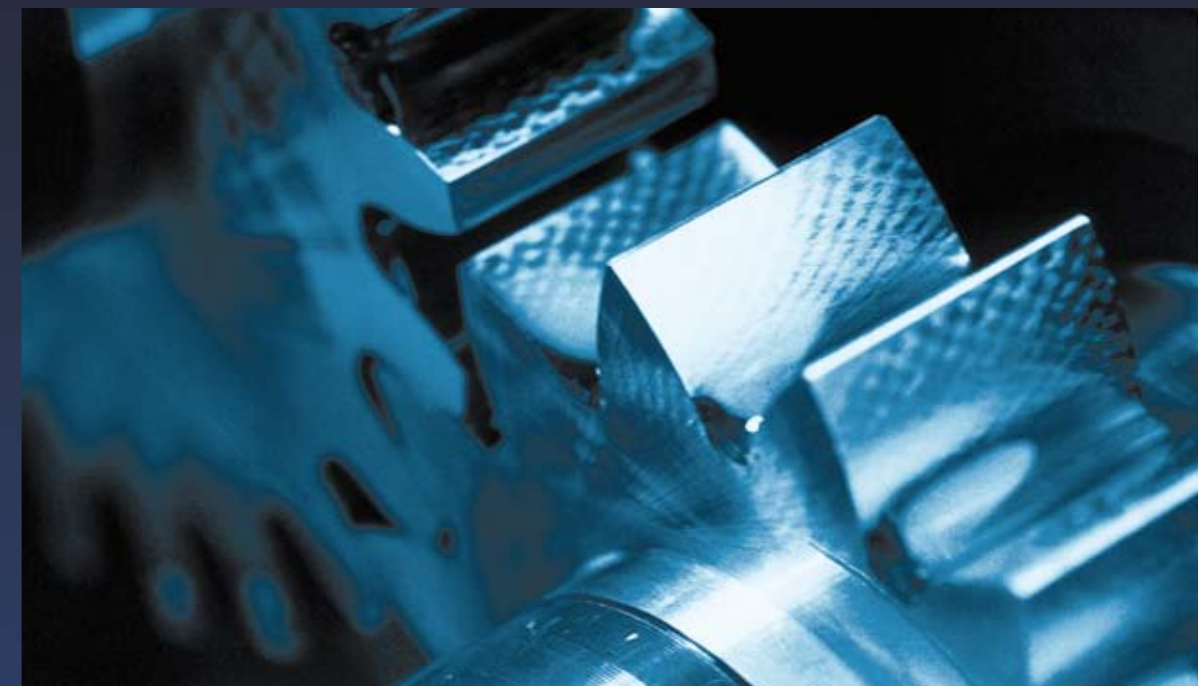
Every lubricant change should be preceded by expert consultation on the application in question. Only then the best lubricant system can be selected. Experienced FUCHS engineers will be glad to advise on products for the application in question and also on our full range of lubricants.



Contact:



Reduced friction, high efficiency – outstanding performance



Industrial gear oils and general lubricating oils

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07/2009 1.0



FUCHS EUROPE SCHMIERSTOFFE GMBH

YOUR STRONG GLOBAL PARTNER FOR INDUSTRIAL LUBRICANTS



HOW WE EXCEL

We are a German company whose almost 600 employees manufacture and market a wide range of lubricants and derived specialties. The company, which was founded in 1931 as RUDOLF FUCHS, is located in Mannheim and is a 100 % subsidiary of FUCHS PETROLUB AG, which is the largest independent lubricants manufacturer worldwide.

Our company's degree of specialisation and innovation is way above the industrial average in this field. The full product line includes almost 2,000 lubricants and derived specialties for all walks of life, industrial processes and applications. Our customer's success is also our success. Because partnership to us means passing-on benefits.

The advantage of a strong market presence: FUCHS is the largest independent manufacturer of lubricants in the world. The benefit of premium, innovative products from a full-line manufacturer: With a complete product line as well as tailor-made special solutions, FUCHS has a product for every application. The benefits of reliability: Certified according to DIN EN ISO 9001:2000 and ISO/TS 16949:2002, FUCHS has been continuously upgrading its highly specialised lubricants for decades.

And naturally, partnership for us also means providing our customers with competent support. With comprehensive marketing. With high-performance logistics. With the development of successful service concepts. And qualified consulting. Because together, we can achieve more.

WHAT INCREASES THE VALUE OF OUR PRODUCTS

We develop lubricants: application-specific and tailor-made for our customer's processes. Together we look for the best lubricants for our customers. This cooperation is unique in terms of its form, scope and intensity. **We call it development partnership.** The success of our development partnerships is based on an important fact: FUCHS is not one of the oil-giants.

FUCHS is a multinational, independent lubricant manufacturer. Our independence is the difference. We are open to new solutions, open for visions – the prerequisites for innovations. And innovation is the defining characteristic of FUCHS. 70 % of our products are less than five years old and the great majority of our products are individual solutions. Challenge us and see!



DIN EN ISO 9001:2000
ISO/TS 16949:2002
DIN EN ISO 14001:2004
REG.NR. 2476



A major engineering element – industrial gear oils.

Gear oils for all applications.

Germany is one of the world's leading manufacturers of drive trains and gearboxes. A gear oil represents an important engineering element in drive train technology and is used in almost all areas of application.

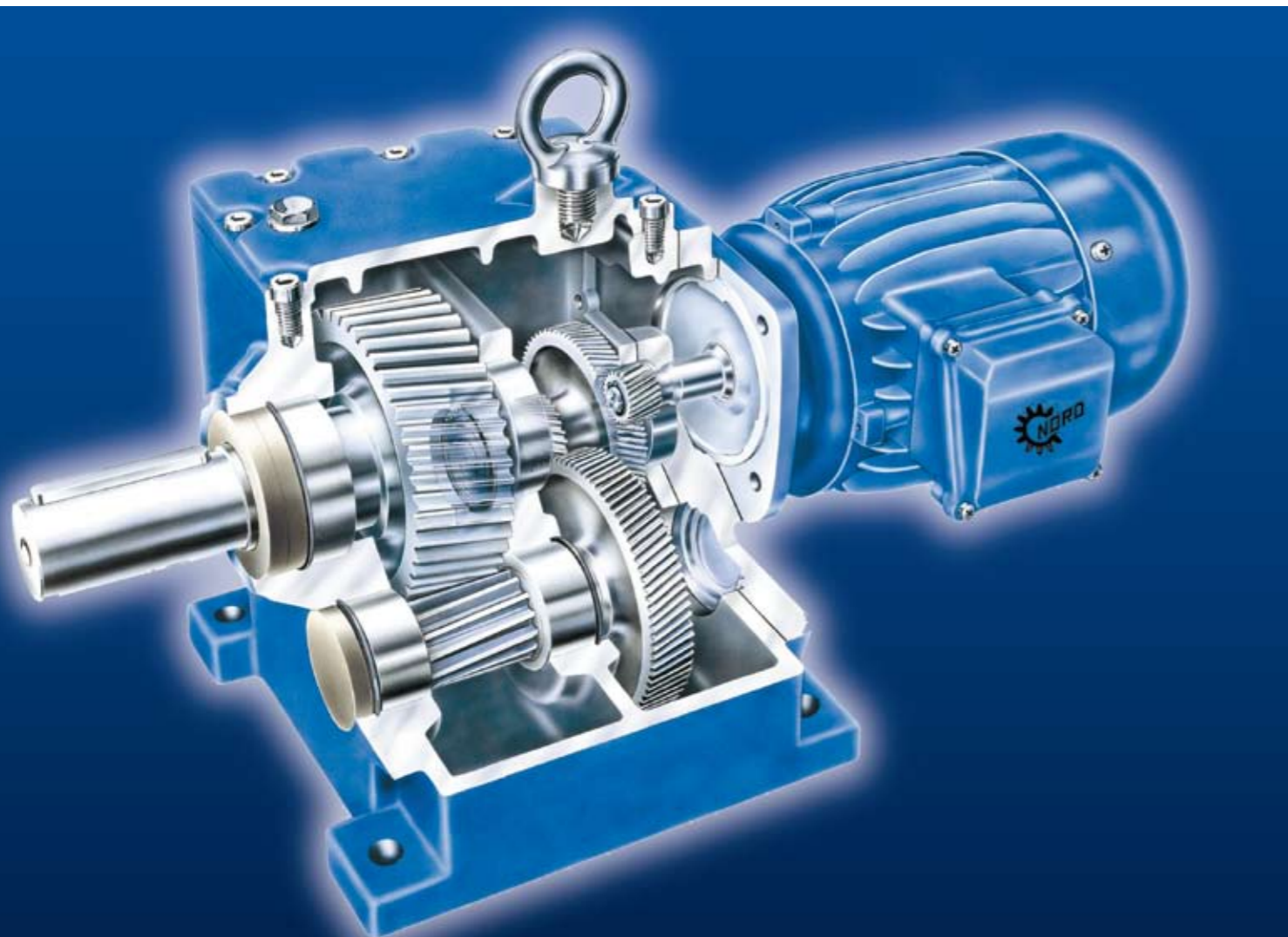
The demands made on gear oils have risen significantly. New developments in the field of drive train technology are mostly accompanied by increases in component performance: More performance or higher capacity needs to be transferred in ever shorter periods of time. At the same time, components and gearboxes become increasingly smaller and compact.

A gear oil, as one of the most important and complex engineering elements, must satisfy changing application conditions and performance requirements. Oil volumes get smaller, oil circulation cycles increase and the energy transferred to the lubricant increases. This leads to an increase in the

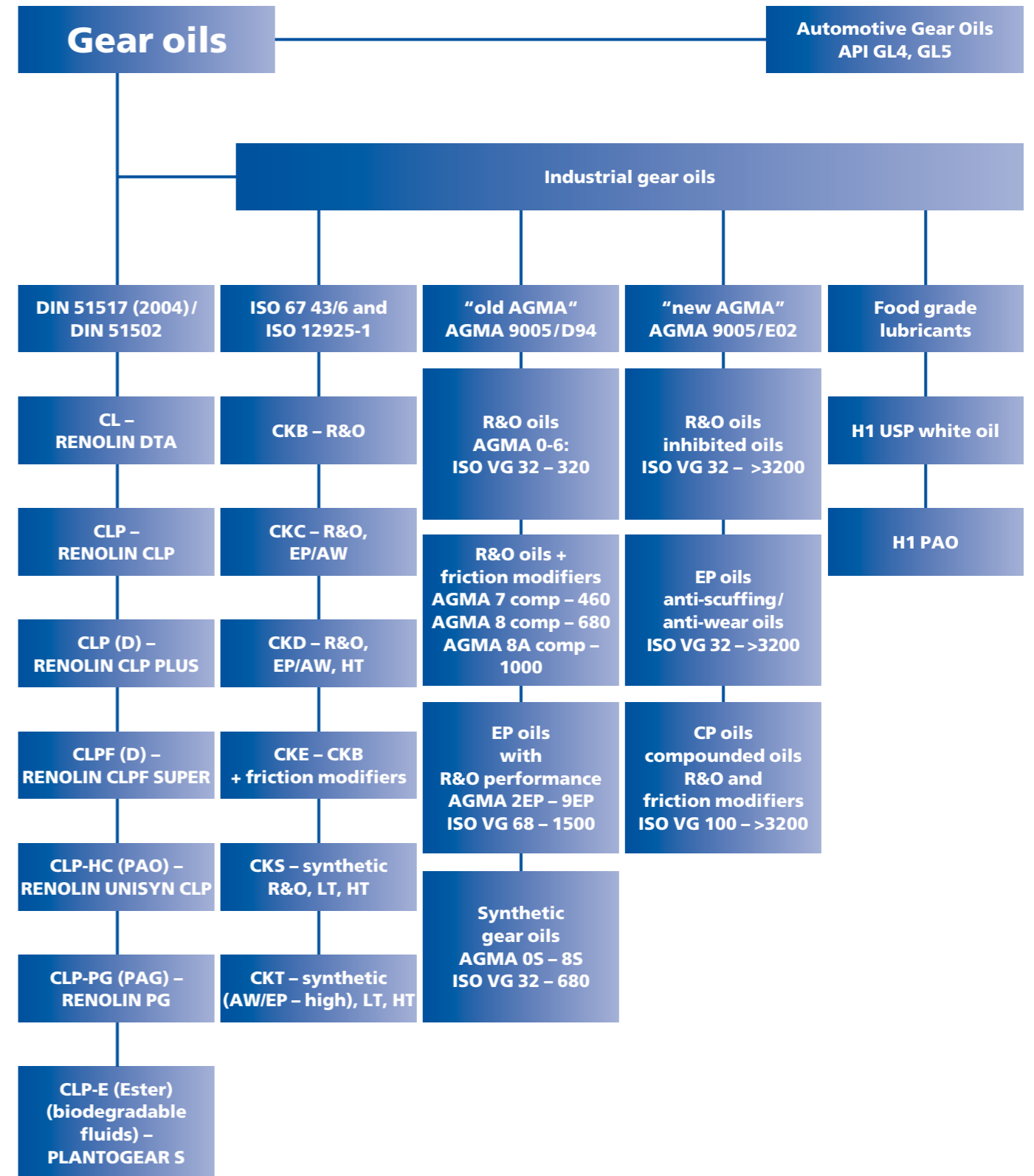
thermal and oxidative load on the lubricant. And in addition, the technical demands on industrial lubricants have changed dramatically over recent years – these have become more “stringent”. New, complex bench tests with exact thresholds have been developed to better reflect the demands and problem areas in drive trains and gears.

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

- General lubricating and gear oils for industrial applications (stationary gear oils) conforming to DIN 51 517, ISO 6743/6 and
- Lubricating and gear oils for automotive applications (mobile gear oils), commercial vehicle gear oils and Automatic Transmission Fluids conforming to API GL 4, GL 5, etc.



General classification of gear oils.



New AGMA standard – wind power gear oils: ICE 61400-4 WD3b 2008-12: draft

L = Anti oxidant, anti corrosion = R&O P = Anti-wear, extreme pressure = AW/EP (anti-scuffing, anti-wear, extreme pressure) D = Detergent/ Dispersant F = MoS₂ (black colour) HT = High Temperature LT = Low Temperature FM = Friction Modifier C = General lubricating oil

FUCHS industrial gear oils.

Reliable solutions for engineering and the environment.

FUCHS industrial gear oils, performance to 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 CLPF SUPER*	–	■	■	–	–	–
RENOLIN UNISYN CLP	–	■	■	■	–	–
RENOLIN PG	–	■	■	■	■	■
PLANTOGEAR S	–	■	■	■	–	–
RENOLIN HighGear*	–	■	■	■	–	–
RENOLIN HighGear Synth*	–	■	■	■	–	–
RENOLIN SynGear HT	–	■	■	■	■	■

- Performance tests have been passed
- Products which generate low friction containing EP/AW additives
- Products which contain AW/EP additives for extreme temperatures

- * DD (Detergent/Dispersant) products
- ** R&O: Lubricating oils with anti-oxidants and corrosion inhibitors
- AW/EP: Anti-wear and extreme pressure additives
- "Higher temp." – for high working temperatures
- "Low friction" – low friction coefficients
- "Extreme temp." – for extreme working 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

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, anticorrosion (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, antifricition and anticorrosion (ferrous and non-ferrous metal) properties usable under extreme temperature conditions (low and high).
CKT	Lubricants with oxidation stability, antifricition and anticorrosion (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.

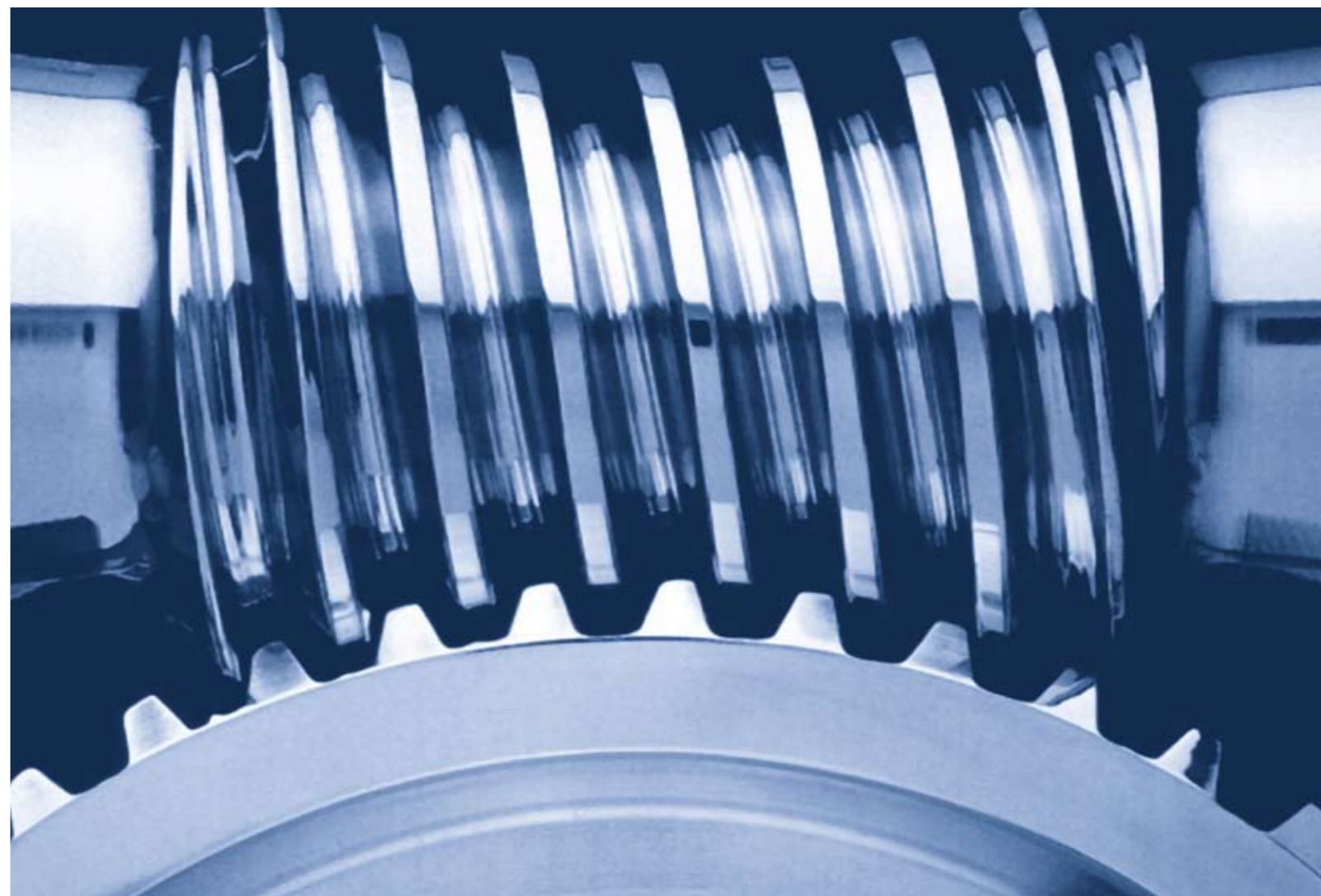
While the information and figures given here are typical of current production and confirm to specification, minor variations may occur. Subject to amendment. Edition 07/2009

Demands on industrial gear oils.

The demands made on industrial gear oils are increasing. Although the new DIN 51 517 (dated 2004) only specifies a scuffing test in line with FZG A/8,3/90 and the roller bearing test FE8 in addition to the physical characteristics, many gear manufacturer's specifications contain additional demands:

- Intensified scuffing test according to FZG A/16,6/140
- Micro-pitting test at 60 °C and at 90 °C according to GFT, FVA I-IV, C/8,3/90 and C/8,3/60
- FE8 roller bearing wear test in line with DIN 51 819, Part 3 (and variants) – D/7,5/80-80
- FZG low-speed wear test
- FZG pitting test
- Load-carrying capacity according to Brugger
- Filtration behaviour – dynamic test
- Foaming behaviour (e.g. Flender in-house test)
- Low temperature behaviour
- Low temperature flowability
- 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 advanced test rigs for the testing of industrial 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 drive train technology (FVA) and international customers results in a constant refinement and improvement of both standardized test procedures as well as FUCHS in-house bench tests.



For the drive trains of today and tomorrow.

Heavy duty synthetic gear oils.

Although mineral oil-based gear oils continue to dominate, synthetic oils are increasingly being used in the rapidly growing power transmission market. The market share of synthetic oils in 2007 totalled 15–20%. Compared to mineral oils, synthetic gear oils have a significantly longer life, generate lower service costs and offer excellent value for money in terms of reducing wear to gears and bearings. They are more expensive than mineral oils but these higher costs are compensated for by two-to-three times longer life, lower maintenance costs, wider application temperature range (multigrade characteristics), lower disposal costs, better technical performance and lower component wear.

FUCHS synthetic oils: A complete program

In addition to a comprehensive product program of mineral oil-based gear oils in the series

- RENOLIN CLP – demulsifying
- RENOLIN CLP PLUS – detergent with AO Booster
- RENOLIN AWD – “high Bruggen” lubrication oil
- RENOLIN CLPF SUPER – black colour with MoS₂
- RENOLIN HighGear – plastic deformation technology

a complete range of fully synthetic gear oils have been developed over recent years.

Products in the series

- RENOLIN UNISYN CLP – based on polyalphaolefins (PAO)
- RENOLIN PG – based on polyalkylene glycols (PAG)
- PLANTOGEAR S – based on saturated esters (E)
- RENOLIN HighGear Synth – based on polyalphaolefins (PAO) – plastic deformation technology

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

FUCHS is a leading player in the field of power transmission engineering and its product line satisfies 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 synthetic gear oil series.

■ RENOLIN UNISYN CLP series

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 about two-to-three times longer. RENOLIN UNISYN CLP offers outstanding wear protection properties. As a result of their extremely low pour-point, these oils display extraordinary cold flowing properties. And among synthetic gear oils, they represent the most important group.

RENOLIN UNISYN CLP 320 – approved wind turbine gear lubricant.

■ RENOLIN PG series

RENOLIN PG series products 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 drives and are

recommended for applications subject to unfavourable friction conditions and very high temperatures (e.g. calendar lubrication and paper-making machines). Compatibility with machine components must be tested prior to use. Polyglycols are neither miscible nor compatible with mineral oils.

■ PLANTOGEAR S series

The rapidly biodegradable PLANTOGEAR S series of oils are based on saturated ester oils. These offer very low friction coefficients, good load-carrying capacity and a high, naturally shear-stable viscosity index.

Moreover, the polar structure of ester oils provides for good detergent and dispersant properties. And finally, ester oils display excellent thermal stability.

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

GEARMASTER 320 ECO – approved wind turbine gear lubricant.

■ RENOLIN HighGear/HighGear Synth

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 extreme loads, boundary friction conditions, high pressures, high specific tooth flank loads, low speeds and when contact faces are damaged.

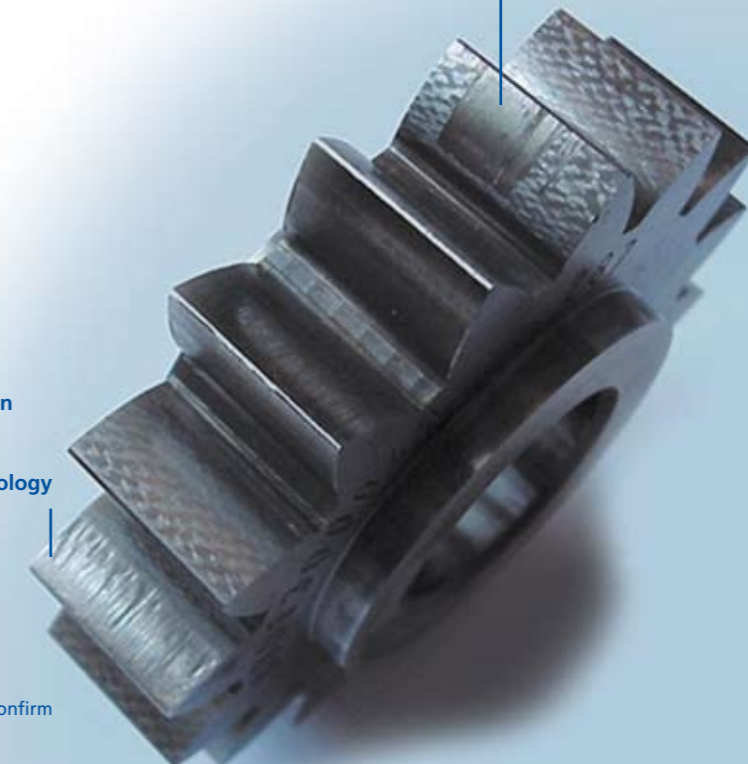
This is achieved by the use of synergic additive combinations of mild sulphur carriers, surface-active phosphorous and zinc additives together with mineral oil-soluble molybdenum compounds. This technology is also referred to as a Plastic Deformation (PD) reaction or surface roughness smoothing.

As opposed to the previously available technologies, RENOLIN HighGear was further developed in terms of thermal and oxidation stability, long-term stability (to avoid sludge formation) and corrosion protection. Both mineral oil- and polyalphaolefin-based products are thus available which fulfil the highest technical standards. The results of tests performed in extreme conditions and with worn machine elements in large-scale gearboxes (in underground mine conveyor drives) as well as spindle drives in forging presses confirm these outstanding characteristics.



Plastic deformation effect = surface smoothing „HighGear” technology

Wear on the surface = scuffing, scoring



Special lubricating oils and industrial gear oils – an overview.

RENOLIN DTA – demulsifying general lubricating, spindle and hydraulic oils



Product name	Description	Density at 15 °C kg/m ³	Flash point Cleveland °C	Kinematic viscosity at 40 °C mm ² /s	Kinematic viscosity at 100 °C mm ² /s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN DTA 2	Spindle, hydraulic and general machine lubricants containing selected base oils and additives to improve ageing behaviour and corrosion protection. RENOLIN DTA series products are hydraulic and general lubricating oils according to DIN 51 524-1 (HL) and DIN 51 517-2 (CL), mineral oil-based, demulsifying and zinc-free. ISO 6743/4, HL, ISO 6743-6 and ISO 12925-1: CKB.	805	100	2,2	–	–	-27	For thermally stressed bearings and hydraulics with peak temperatures of about 120 °C. General lubrication without specific anti-wear specifications (no AW/EP). (For further information, see PI 4-1292*) Mineral oil-based (selected base oils)
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 high performance EP/AW gear oils and general lubricating oils



Product name	Description	Density at 15 °C kg/m ³	Flash point Cleveland °C	Kinematic viscosity at 40 °C mm ² /s	Kinematic viscosity at 100 °C mm ² /s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN CLP 68	High performance, gear oils and general lubricating oils with good ageing stability and additives to improve corrosion protection (combat ferrous and nonferrous metal corrosion caused by moisture). Outstanding anti-wear characteristics – good EP/AW performance, excellent protection against scuffing and micro-pitting, excellent FE8 roller bearing wear protection, good demulsifying properties, very good foaming suppression, zinc- and silicone oil-free. RENOLIN CLP oils fulfil and surpass the minimum requirements of lubricating oils. CLP according to DIN 51 517, Part 3 (2004), ISO 6743-6 and ISO 12925-1: CKC, CKD. US Steel 224, David Brown 51.53.10. Approved by leading gearbox manufacturers.	886	236	68	8,7	99	-24	Universal gear oils for all industrial applications such as in bearings, knuckles, spur, bevel and worm drives and whenever the manufacturer recommends a Type CLP oil. (For further information, see PI 4-1208*) Mineral oil-based (selected base oils)
RENOLIN CLP 100		890	240	100	11,2	98	-24	
RENOLIN CLP 150		894	250	150	14,5	94	-24	
RENOLIN CLP 220		896	260	220	18,9	96	-24	
RENOLIN CLP 320		900	255	320	24,0	95	-14	
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 seizures and scuffing at high pressures and loads
AW = Anti wear additives, to avoid wear in boundary friction conditions

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



Product name	Description	Density at 15 °C kg/m ³	Flash point Cleveland °C	Kinematic viscosity at 40 °C mm ² /s	Kinematic viscosity at 100 °C mm ² /s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN CLP 46 PLUS	High performance gear and general lubricating oils offering excellent wear protection, good EP performance and excellent corrosion protection. Carefully selected anti-oxidants guarantee good ageing stability and special surface-active substances lower friction which can reduce operating temperatures and increase efficiency. Special detergent/dispersant additives offer good cleaning and dirt transportation properties. RENOLIN CLP PLUS oils have excellent foaming characteristics and offer good protection against micro-pitting. The RENOLIN CLP PLUS series of oils are zinc- and silicone oil-free. RENOLIN CLP PLUS oils fulfil the minimum demands made on lubricating oils according to DIN 51 517, ISO 6743-6 and ISO 12925-1: CKC, CKD, CLP PLUS products were specially developed 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 industrial, spur, double-spur, bevel and worm drives. Long-life oils (tested for 30,000 hours in open-cast lignite mining conveyors and approved). Improved oxidation stability. (For further information, see PI 4-1292*)
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		904	255	320	24,0	95	-18	
RENOLIN CLP 460 PLUS		908	270	460	30,2	94	-14	
RENOLIN CLP 680 PLUS		908	270	680	39,6	95	-17	

RENOLIN CLPF SUPER high performance EP/AW gear oils with MoS₂ (solid lubricants / black colour)



Product name	Description	Density at 15 °C kg/m ³	Flash point Cleveland °C	Kinematic viscosity at 40 °C mm ² /s	Kinematic viscosity at 100 °C mm ² /s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN CLPF 100 SUPER	EP gearbox oils with synergistic chemical EP/AW additives and physical MoS ₂ -based solid lubricants. The MoS ₂ -based solid lubricants are physically effective and cover a wide range of temperatures in boundary friction conditions. They reduce friction and have a damping effect. Excellent wear protection in boundary friction conditions, good dirt suspension properties (detergent effect), low foaming, very good FE8 roller bearing wear protection as well as zinc- and silicone oil-free. The RENOLIN CLPF SUPER series of oils surpass the minimum requirements of CLPD lubricating oils according to DIN 51 517, 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 speeds and high loads, even when subject to shock loading, for noise reduction and for the lubrication of spindles and gearboxes in forging presses. (For further information, see PI 4-1292*) 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		923	240	1.500	61,1	90	-12	

* PI = Product information
EP = Extreme pressure additives, to avoid wear seizures and scuffing at high pressures and loads
AW = Anti wear additives, to avoid wear in boundary friction conditions

CL/HL oils (demulsifying)

CLP-D oils (detergent/dispersant)

CLP oils (demulsifying)

CLPF oils / black colour (detergent/dispersant)

Special lubricating oils and industrial gear oils – an overview.

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



Product name	Description	Density at 15°C kg/m³	Flash point Cleveland °C	Kinematic viscosity at 40°C mm²/s	Kinematic viscosity at 100°C mm²/s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN AWD 68	Special gearbox and general lubricating oils when products with particularly good wear protection are required. Special additives reduce friction and form reactive layers which offer excellent wear protection in extreme boundary friction and load conditions. Brugger value >70 N/mm², excellent FE8 roller bearing wear protection, good detergent/dispersant properties, zinc- and silicone oil-free and high additive reserves. The RENOLIN AWD series of oils surpass the minimum requirements of CLPD lubricating oils according to DIN 51 517, Part 3 together with DIN 51 502, ISO 6743-6 and ISO 12925-1: CKC, CKD. Recommended by leading press manufactures, high wear protection in extreme mix friction conditions.	882	221	68	8,9	105	-24	For highly-stressed industrial gearboxes and lubricating systems especially when good EP performance in extreme boundary friction and load conditions are required. High Brugger value of >70 N/mm². (For further information, see PI 4-1060*)
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 PG – synthetic, high performance EP/AW gear oils based on polyalkylene glycols (PAG)



Product name	Description	Density at 15°C kg/m³	Flash point Cleveland °C	Kinematic viscosity at 40°C mm²/s	Kinematic viscosity at 100°C mm²/s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN PG 32	Fully synthetic gear and general lubrication oils based on special polyalkylene glycols (PAG) for applications subject to extreme thermal loads. High oxidation and ageing stability, high viscosity index (shear-stability), good viscosity-temperature behaviour, excellent EP performance, low coefficients of friction, high FZG, good protection against micro-pitting and good FE8 performance. The RENOLIN PG series of oils surpass the minimum requirements of CLP-PG lubricating oils according to DIN 51 517, Part 3 together with DIN 51 502, ISO 6743-6 and ISO 12925-1: 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 in worm gears and calenders. Can also be used as a compressor oil for process gases such as methane, ethane, propane, etc. Particularly suitable for steel/ bronze bearings in worm gears. Not miscible or compatible with mineral oils. (For further information, see PI 4-1293*)
RENOLIN PG 46		1.029	240	46	9,7	203	-48	
RENOLIN PG 68		1.035	240	68	13,8	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	-36	
RENOLIN PG 320		1.075	240	320	54,4	237	-39	
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	

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



Product name	Description	Density at 15°C kg/m³	Flash point Cleveland °C	Kinematic viscosity at 40°C mm²/s	Kinematic viscosity at 100°C mm²/s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN UNISYN CLP 68	Fully-synthetic gear and general lubricating oils with excellent thermal and ageing stability, very high viscosity index (shear-stable), outstanding low temperature characteristics, good cold-flowing properties, very good air release, low foaming, good protection against micro-pitting, good FE8 performance, good demulsifying as well as zinc- and silicone oil-free. The RENOLIN UNISYN CLP series of oils surpass the minimum requirements of CLP-HC gear oils according to DIN 51 517, 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 suitable for lubricated-for-life applications and in gearboxes with extended drain intervals. Miscible and compatible with mineral oils. Excellent low temperature characteristics, high, shear-stable viscosity index. RENOLIN UNISYN CLP 320 "Wind Power" gear oil, fulfill and surpass the requirements of important bearing and gear manufacturers. RENOLIN UNISYN is recommended for wind turbine gear sets worldwide. (For further information, see PI 4-1104*)
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	

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



Product name	Description	Density at 15°C kg/m³	Flash point Cleveland °C	Kinematic viscosity at 40°C mm²/s	Kinematic viscosity at 100°C mm²/s	Viscosity index VI	Pour-point °C	Main application area
PLANTOGEAR 100 S	Biodegradable, high-performance gear oils based on special saturated esters. Extremely high thermal and ageing stability, high viscosity index (shear stability), good viscosity-temperature behaviour for low temperature applications, excellent cleaning power due to polar ester structures, low friction, excellent wear protection, good FZG performance, good protection against micro-pitting, 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 51 517, Part 3 together with DIN 51 502, ISO 6743-6 and ISO 12925-1: CKC, CKD, CKE. Approved by leading gearbox manufacturers.	936	>280	100	15,8	170	-51	For highly-stressed spur, bevel, planetary and worm drives and especially applications which may be affected by contact with water. For both high and low application temperatures. High, shear-stable viscosity index. Can be used as a flushing fluid. GEARMASTER 320 ECO high performance biodegradable wind power gear oil, based on saturated ester oil, recommended for wind turbine gear sets worldwide. (For further information, see PI 4-1227*)
PLANTOGEAR 150 S		943	>280	150	21,1	165	-45	
PLANTOGEAR 220 S		951	>280	220	27,4	160	-48	
PLANTOGEAR 320 S		958	270	335	37,2	159	-45	
PLANTOGEAR 460 S		957	>280	460	48,5	164	-42	
PLANTOGEAR 680 S		956	>280	680	66,6	171	-39	
PLANTOGEAR 1000 S		956	>280	1.000	92,2	180	-42	
GEARMASTER 320 ECO		958	270	335	37,2	160	-45	

* PI = Product information
EP = Extreme pressure additives, to avoid wear seizures and scuffing at high pressures and loads
AW = Anti wear additives, to avoid wear in boundary friction conditions

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CLP-D oils / high Brugger values

CLP-PG oils / polyglycol

CLP-HC oils / PAO-synthetic

CLP-E oils / synthetic esters

Special lubricating oils and industrial gear oils – an overview.

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



Product name	Description	Density at 15°C kg/m ³	Flash point Cleveland °C	Kinematic viscosity at 40°C mm ² /s	Kinematic viscosity at 100°C mm ² /s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN HighGear 220	<p>Synergetic additive combinations guarantee the outstanding wear protection performance of these new hightech gear oils. Highly-effective, tribo-protection layers 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.</p> <p>ISO 6743-6 and ISO 12925-1: CKC, CKD, CKE.</p>	902	210	220	18,9	97	-21	<p>RENOLIN HighGear can be used in both new gearboxes (spur, bevel, planetary and worm drives) to reduce friction, wear and noise in extreme conditions as well as in worn gearboxes and machine components to increase service life.</p> <p>Mineral oil-based</p>
RENOLIN HighGear 320		907	220	320	24,1	96	-15	
RENOLIN HighGear 460		913	215	460	30,4	95	-15	
PD – Plastic Deformation Technology								

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



Product name	Description	Density at 15°C kg/m ³	Flash point Cleveland °C	Kinematic viscosity at 40°C mm ² /s	Kinematic viscosity at 100°C mm ² /s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN HighGear Synth 320	<p>Based on synthetic polyalphaolefins (PAO). Special synergetic additives in these hightech gear oils offer outstanding anti-wear performance. Highly-effective, tribo-protection layers 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 oxidative stability allow oil change intervals to be extended.</p> <p>ISO 6743-6 and ISO 12925-1: CKC, CKD, CKE.</p>	876	220	320	31,2	135	-34	<p>RENOLIN HighGear can be used in both new gearboxes (spur, bevel, planetary and worm drives) to reduce friction, wear and noise in extreme conditions as well as in worn 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 and high, shear-stable viscosity index.</p>
RENOLIN HighGear Synth 460		878	220	460	41,6	140	-27	
RENOLIN HighGear Synth 680		880	220	680	57,9	149	-27	
Synthetic PD – Plastic Deformation Technology								

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



Product name	Description	Density at 15°C kg/m ³	Flash point Cleveland °C	Kinematic viscosity at 40°C mm ² /s	Kinematic viscosity at 100°C mm ² /s	Viscosity index VI	Pour-point °C	Main application area
RENOLIN MORGEAR 100	<p>High-performance lubricating and circulating oils based on mineral oil, for the lubrication of MORGOIL bearings, mild AW additives guarantee excellent wear protection, synergistically acting additives protect against corrosion and guarantee excellent oxidation stability, excellent demulsibility (very good water separation properties).</p> <p>ISO 6743-6 and ISO 12925-1: CKB.</p>	888	248	100	11,1	96	-19	<p>For the lubrication of MORGOIL bearings, RENOLIN MORGEAR oils fulfill and surpass the requirements of DANIELI (Italy, 2000) and SMS (2005).</p>
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	

Special lubricating- and industrial gear oils **NEW**

Product name	Description
RENOLIN UNISYN CLP 220 PA	Fully synthetic, "newly developed" high-performance paper machine oil based on polyalphaolefin, excellent demulsibility (very good water separation properties), high oxidation stability, excellent wear protection, excellent corrosion protection (steel and yellow metal materials), long lifetime, fulfils the requirements of companies like SKF, FAG and VOITH for paper machine oils.
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, gear oil CKC/CKD/CKT according to ISO 6743/6.
RENOLIN CLP 460 VCI	Special corrosion protection oil based on mineral oil, long-term corrosion protection in the oil and in the vapor phase is guaranteed, fulfils and surpasses the requirements of CLP industrial gear oils, high wear protection, high scuffing protection, good compatibility with industrial gear oils.

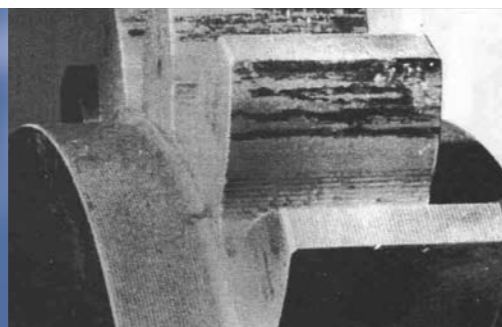
* PI = Product information
 EP = Extreme pressure additives, to avoid wear seizures and scuffing at high pressures and loads
 AW = Anti wear additives, to avoid wear in boundary friction conditions

PD technology, mineral oil-based, smoothing

Lubrication of MORGOIL bearings

PD technology, PAO-based, smoothing

Competence in R&D and in mechanical test field.



Micro-pitting test. Influence of lubricants and additives on micro-pitting



FE8 roller bearing test – Set-up

FUCHS R&D Labs



Foaming behaviour of industrial gear oils (start and running conditions) according to Flender



FE8 roller bearing



FZG Gear test rig to test the load carrying capacity of EP/AW gear oils and lubricating oils



FZG test rig to determine the friction coefficients and efficiency of industrial gear oils



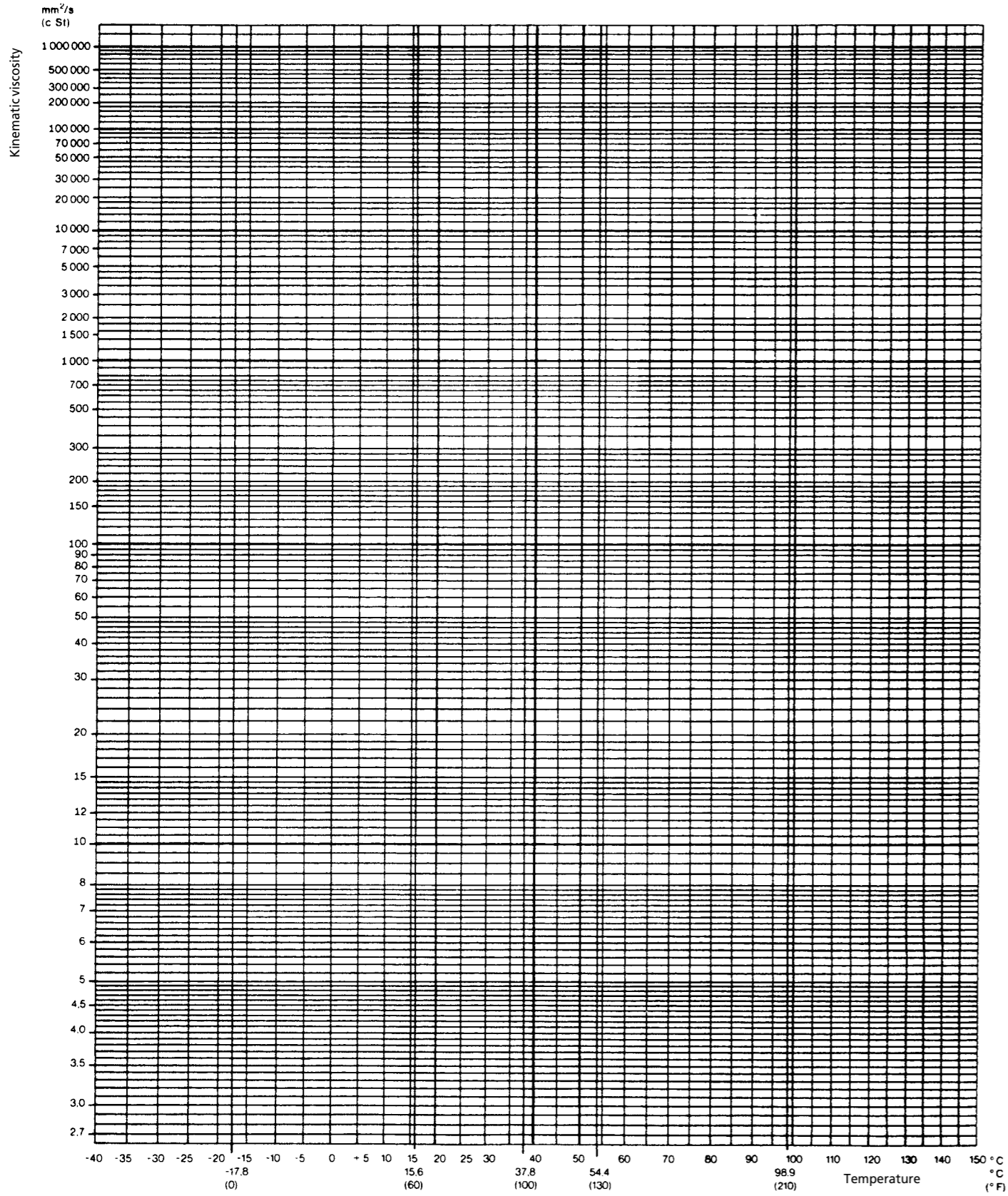
Test rig for Automotive Lubricants



FE8 roller bearing test failure

Viscosity-temperature diagramm.

Notes



A large grid area for taking notes, consisting of a 20x20 grid of squares.