

## RENOLIN PG

### Fully synthetic EP industrial gear oils based on special, selected polyglycols (PAG)

#### Description

The RENOLIN PG oils are fully synthetic industrial gear oils based on special, newly developed polyglycol base oils. Thus the RENOLIN PG products offer a very high oxidation and temperature stability. Polyglycols have a very good viscosity-temperature-behaviour (high natural, shear-stable VI) and can therefore be used within a wide temperature range (depending on the viscosity grade and the working conditions from - 35 °C up to 160 °C). Special additives adapted to these polyglycols further improve the good properties of the base oils – high wear protection, excellent corrosion protection also at the presence of condensation water, low foaming, very good compatibility with non-ferrous metals.

The excellent anti-wear properties could be proven in different tests with RENOLIN PG. The load stage > 14 was passed in the standard FZG test (FZG A/8.3/90), and the load stage > 12 was passed in the FZG test A/16.6/140 (high speed, high temperature FZG test). RENOLIN PG has a high micropitting resistance - load stage "high" - and a good pitting resistance. RENOLIN PG was tested in a special "low speed" FZG test (according to DGMK (Deutsche Wissenschaftliche Gesellschaft für Erdöl, Erdgas und Kohle e.V.) – FZG scuffing test) which RENOLIN PG passed with excellent results (wear category: "low" = excellent). This special test shows the excellent wear protection of RENOLIN PG at two different temperatures (90 °C and 120 °C) under mixed and boundary lubrication conditions. The lubricating film remains stable even at high pressures and under mixed friction conditions. Thus

#### Benefits / Advantages

- **Excellent wear protection**
- **High scuffing load carrying capacity**
- **High resistance to micropitting**
- **Excellent roller bearing wear protection (FE8)**
- **Increase of efficiency, reduction of temperature - low friction coefficient**
- **Excellent viscosity-temperature behaviour (high VI)**
- **For use at high and low operating temperatures**
- **High ageing stability**
- **Good corrosion protection**
- **Excellent air release**
- **Low foaming**

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#### Description (continued)

the friction coefficient is low, and a temperature reduction by up to 20 °C can be achieved compared with mineral oil-based lubricants.

Efficiency tests in a worm gear test rig demonstrated the high performance and the low friction coefficient which is especially of great importance for the use in worm gears. The results of RENOLIN PG in the FE8 roller bearing wear test were excellent. Tests in a special test rig at the University of Munich (FZG Institute – Forschungsstelle für Zahnräder und Getriebebau) led to excellent results regarding antiwear behaviour and efficiency.

#### Note

RENOLIN PG is not miscible and compatible with mineral oils, ester oils and polyalphaolefins. When changing between polyglycols from different manufacturers, the compatibility has to be checked. Before changing-over, it is recommended to clean the system and to flush with RENOLIN PG. The compatibility with elastomers, varnishes and coatings should also be checked before changing from mineral oil to polyglycols.

Use of RENOLIN PG in combination with oil gauge glasses made of polycarbonates and plexiglass might lead to stress-cracking corrosion under tension. The use of natural glass or polyamide materials is recommended.

The specifications of the roller bearing and gear manufacturers have to be observed. In general these oils should not be used for dynamic frictional contact with aluminium.

#### Application

The RENOLIN PG gear oils are mainly suitable for the lubrication of gear units and worm gears / roller bearings and friction bearings which are subject to high mechanical and thermal stress. Especially in applications with high sliding velocities (e.g. worm gear units) the RENOLIN PG oils offer advantages compared with mineral oil-based gear oils. Due to the high oxidation stability, the oil change intervals can be extended and the maintenance costs can be reduced also at higher operating temperatures. The use of RENOLIN PG in worm gears (steel-bronze pairing) leads to a significant reduction of friction and wear.

The RENOLIN PG products can also be used for paper machines, calenders, conveying machines and milling bearings. Peak temperatures of up to 200 °C are temporarily tolerable.

#### Specifications

The RENOLIN PG products fulfill and exceed the minimum requirements according to:

- DIN 51517-3: CLP-PG
- ISO 6743-6 and ISO 12925-1: CKC / CKD / CKE / (CKS) / CKSMP
- AGMA 9005/E02: EP

Among others, the RENOLIN PG products are approved by:

- Flender GmbH, BA 7300, table A
- Alpha Getriebebau
- SEW

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#### Recommendations / method of changing over from mineral oil-based fluids to RENOLIN PG

General recommendations / procedure in conjunction with the recommendations of the bearing and gear manufacturers (according to VDMA Guideline 24 569 and ISO CD 15380).

1. Drain the existing lubricating oil while warm.
2. Carefully drain all circuit components, pipes, pumps, and if necessary, clean mechanically. Pipes should be drained and cleaned with the help of air. Make sure that the system is free of any residual fluid.
3. Elastomers (seals, pipes and hoses), filter materials, zinc-coated components, paints, all inner materials which are normally compatible with mineral oil should be checked with regard to their compatibility with polyalkylene glycol.
4. A flushing and cleaning procedure is recommended to reduce any residual mineral oil content. The system should be filled with the minimum oil volume which is necessary to operate the system. The cleaning and flushing time depends on the conditions of the whole system (e.g. contamination with ageing products, contamination with oxidation layers, dirt, water, etc.).

5. After the cleaning and flushing procedure the fluid should be drained off – if necessary clean mechanically. Refill the unit with fresh RENOLIN PG.
6. Mineral oil has a lower specific density than RENOLIN PG. Residual mineral oil will lie on top of the surface of the tank. This mineral oil can then be absorbed from the surface.
7. It is recommended to check the filters of the unit after some days. RENOLIN PG has a high polarity. Contaminants, ageing products from former mineral oil will be absorbed by RENOLIN PG. These contaminants can be filtered out in the system filters.

The recommendations of the manufacturer of the system / unit should be observed regarding the oil change intervals. The condition of the used oil can be checked by oil analyses.

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#### Typical data:

Product name	RENOLIN PG				Test method
	68	100	150		
Properties	Unit				
ISO VG		68	100	150	DIN 51519
Kinematic viscosity					DIN EN ISO 3104
at 40 °C	mm <sup>2</sup> /s	68	100	145	
at 100 °C	mm <sup>2</sup> /s	13.8	19.6	27.0	
Viscosity index	-	212	220	224	DIN ISO 2909
Density at 15 °C	kg/m <sup>3</sup>	1035	1043	1051	DIN 51757
Colour	ASTM	0.5	0.5	0.5	DIN ISO 2049
Flashpoint, Cleveland open cup	°C	240	260	260	DIN ISO 2592
Pourpoint	°C	-48	-48	-48	DIN ISO 3016
Neutralisation number	mgKOH/g	0.2	0.2	0.2	DIN 51558-1
Copper corrosion	degree of corr.		1 – 100 A 24		DIN EN ISO 2160
Steel corrosion	degree of corr.		0 – A		DIN ISO 7120
Scuffing and scoring test FZG A/8.3/90	failure load stage	> 12	> 12	> 14	DIN ISO 14635-1
FZG A/16.6/90	failure load stage	-	-	> 14	DIN ISO 14635-1
Micropitting load capacity C/8.3/90	GF class		GFT high, >10		FVA 54/I-IV
FE-8 roller bearing test, D-7.5/80-80					DIN 51819-3
Wear roller element	mg		< 5		
Wear cage material	mg		< 30		

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#### Typical data:

Product name	RENOLIN PG			Test method	
	220	320	460		
Properties	Unit				
ISO VG		220	320	460	DIN 51519
Kinematic viscosity					DIN EN ISO 3104
at 40 °C	mm <sup>2</sup> /s	220	320	460	
at 100 °C	mm <sup>2</sup> /s	36.8	54.4	75.1	
Viscosity index	-	220	237	245	DIN ISO 2909
Density at 15 °C	kg/m <sup>3</sup>	1075	1075	1075	DIN 51757
Colour	ASTM	0.5	0.5	0.5	DIN ISO 2049
Flashpoint, Cleveland open cup	°C	240	240	280	DIN ISO 2592
Pourpoint	°C	-33	-33	-33	DIN ISO 3016
Neutralisation number	mgKOH/g	0.2	0.2	0.2	DIN 51558-1
Copper corrosion	degree of corr.	1 – 100 A 24			DIN EN ISO 2160
Steel corrosion	degree of corr.	0 – A			DIN ISO 7120
Scuffing and scoring test FZG A/8.3/90	failure load stage		> 14		DIN ISO 14635-1
FZG A/16.6/90	failure load stage		> 12		DIN ISO 14635-1
Micropitting load capacity C/8.3/90	GF class		GFT high, >10		FVA 45/I-IV
FE-8 roller bearing test, D-7.5/80-80					DIN 51819-3
Wear roller element	mg		< 5		
Wear cage material	mg		< 30		
DGMK – FZG low speed wear C/0.05/90:120/MS12, test procedure 1, 2 and 3			Wear category: low 23.7 mg total wear		DGMK – FZG (low speed wear test)



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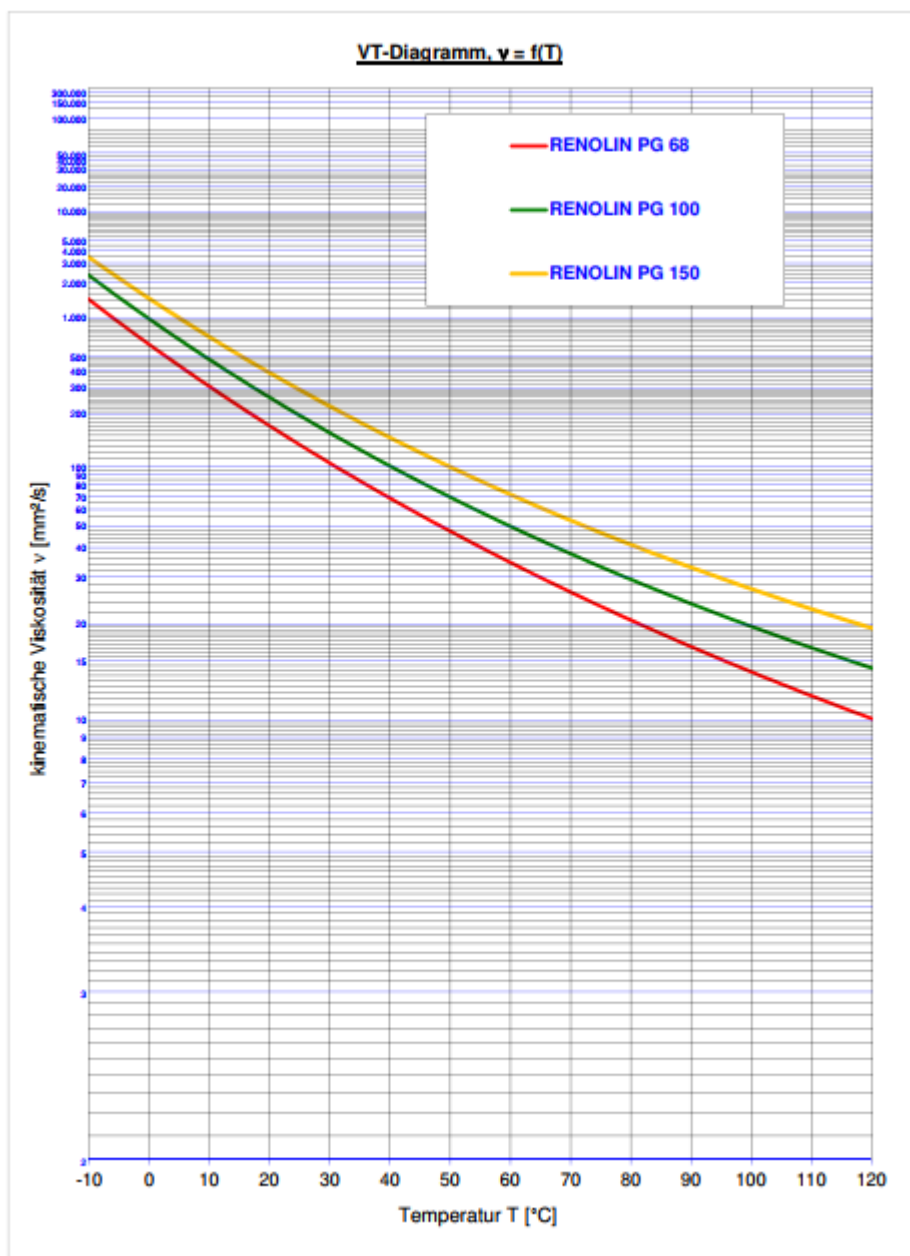
### Fully synthetic EP industrial gear oils based on special, selected polyglycols (PAG)

#### Typical data:

Product name	RENOLIN PG				Test method
	680	1000	1500		
Properties	Unit				
ISO VG	680	1000	1500		DIN 51519
Kinematic viscosity					DIN EN ISO 3104
at 40 °C	mm <sup>2</sup> /s	680	1000	1500	
at 100 °C	mm <sup>2</sup> /s	110.3	162	240	
Viscosity index	-	261	281	300	DIN ISO 2909
Density at 15 °C	kg/m <sup>3</sup>	1075	1075	1078	DIN 51757
Colour	ASTM	0.5	0.5	0.5	DIN ISO 2049
Flashpoint, Cleveland open cup	°C	280	280	280	DIN ISO 2592
Pourpoint	°C	-33	-33	-18	DIN ISO 3016
Neutralisation number	mgKOH/g	0.2	0.2	0.2	DIN 51558-1
Copper corrosion	degree of corr.		1 – 100 A	24	DIN EN ISO 2160
Steel corrosion	degree of corr.	0 – A	0 – A	0 – A	DIN ISO 7120
Scuffing and scoring test FZG A/8.3/90	failure load stage		> 14		DIN ISO 14635-1
FZG A/16.6/90	failure load stage		> 12		DIN ISO 14635-1
Micropitting load capacity C/8.3/90	GF class		GFT high, >10		FVA 54/ I-IV
FE-8 roller bearing test, D-7.5/80-80					DIN 51819-3
Wear roller element	mg		< 5		
Wear cage material	mg		< 30		
DGMK – FZG low speed wear C/0.05/90:120/MS12, test procedure 1, 2 and 3			Wear category: low		DGMK – FZG (low speed wear test)
			23.7 mg total wear		

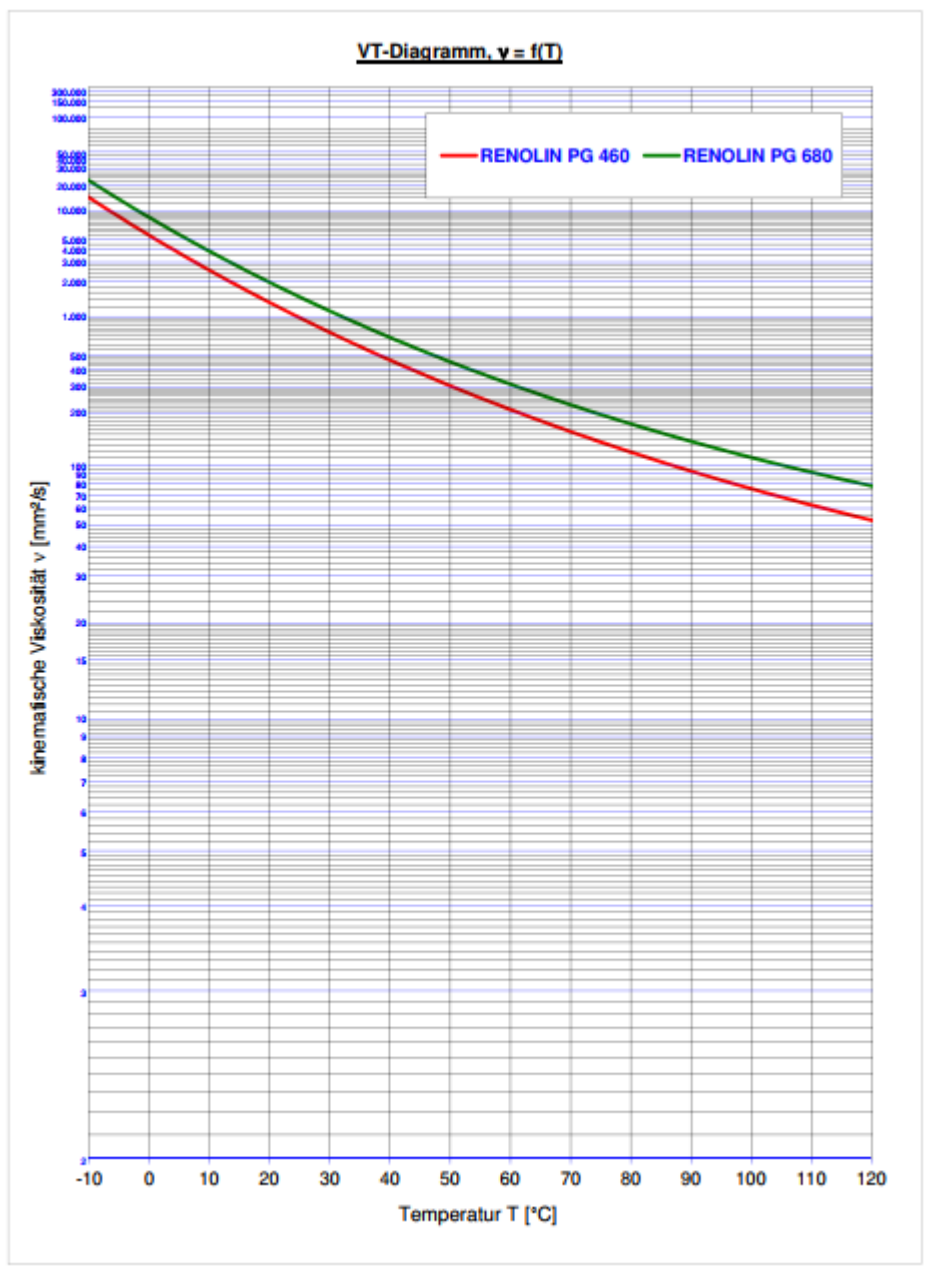
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