Klübersynth GEM 4 - 32…680 N

Synthetic high-performance gear- and multipurpose oils

Benefits for your application

- **The oils meet the requirements according to DIN 51 517 – 03, CLP. Corresponding gears can be switched to Klübersynth GEM 4 N oils without prior consultation with the gear manufacturer provided the general application notes are observed.**
- **Klübersynth GEM 4 N oils offer a high scuffing load resistance. Gears are sufficiently protected against scuffing even at high peak loads.**
- **The oils' high micropitting resistance offers sufficient protection to gears that are subject to high loads and would normally be susceptible to this type of damage.**
- **Much longer service life than mineral oils due to the excellent ageing and oxidation resistance of the base oil; thus maintenance intervals can be extended and in certain cases even lifetime lubrication is possible.**
- **Owing to the wide service temperature range a single viscosity grade can cover both low and high temperatures in many applications.**
- **The optimum friction behaviour of the PAO base oil reduces power losses and improves efficiency.**
- **The good wear protection of both gears and rolling bearings ensures that the service life calculated for the lubricated components is achieved.**
- **The excellent viscosity-temperature behaviour supports the formation of a sufficient lubricating film even at elevated and high temperatures.**
- **Seals made of 72 NBR 902, 75 FKM 585 and 75 FKM 170055 are resistant to Klübersynth GEM 4 N oils. Leakage and contamination are prevented.**
- **Approved by Flender, SEW Eurodrive, Getriebebau Nord, Stöber Antriebstechnik, ZAE Antriebstechnik, David Brown, F.L. Smidth, etc.**

Description

Klübersynth GEM 4 N oils are gear- and multipurpose oils based on polyalphaolefin. They have a high resistance to scuffing and micropitting as laid down in FVA No. 54.

The good antiwear characteristics of the Klübersynth GEM 4 N oils were also proven for rolling bearings in the standard FAG FE 8 test rig for gear oils.

The Klübersynth GEM 4 N oils are particularly resistant to ageing and oxidation. They have a good viscosity-temperature behaviour and excellent low- and high-temperature characteristics.

They also offer good corrosion protection and are neutral towards most nonferrous metals, elastomers and interior paints that are commonly used in gear construction.

Application

The Klübersynth GEM 4 N oils were specially developed for the lubrication of spur-, bevel- and planetary gears that are subject to high

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loads. Such gears are frequently used in the wind-, steel-, mining- and sugar industries.

The Klübersynth GEM 4 N oils are also used for the lubrication of worm gears with steel/bronze material pairings.

They are also used for the lubrication of plain and rolling bearings, all kinds of toothed couplings, chains, guideways, joints, spindles and pumps, especially in applications where the equipment is exposed to elevated temperatures or pronounced temperature fluctuations.

Application notes

Klübersynth GEM 4 N oils can be applied by means of immersion, immersion circulation or injection.

The use of drip-feed oilers, brushes, oil cans or suitable automatic lubricating systems is also possible.

The low-viscosity varieties can also be applied using oil mist lubrication.

Klübersynth GEM 4 N oils are miscible with mineral oils. However, for the Klübersynth GEM 4 N oils to deliver their full performance, any residues of a previously used mineral oil should not exceed 5 % in quantity.

For use at permanent temperatures of 80 °C max., seals made of 72 NBR 902 may be used. For higher temperatures, seals made of 75 FKM 585 or 75 FKM 170055 should be chosen.

It should be noted that elastomers from one or several manufacturers can behave differently; therefore tests should be performed.

Viscosity selection

When determining the oil viscosity for gears, the manufacturer's instructions take priority.

In cases where there are no gear manufacturer's instructions, the viscosity can be selected in accordance with the enclosed worksheet "Klübersynth GEM 4 N oils – selection of oil viscosity for gears".

To determine the correct oil viscosity for bearings, please observe the bearing manufacturer's instructions.

For determining the actual viscosity, please refer to the enclosed viscosity-temperature diagram indicating the differing viscosity-temperature behavior of Klübersynth GEM 4 N oils as compared to mineral oils.

Minimum shelf life

The minimum shelf life is approx. 36 months if the product is stored in its unopened original container in a dry, frost-free place.

Pack sizes

20 l canister
200 l drum

Material safety data sheets

Material safety data sheets can be downloaded or requested via our website www.klueber.com. You may also obtain them through your contact person at Klüber Lubrication.

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Product data

Klübersynth GEM 4- …	32N	46N	68N	100N	150N	220N	320N	460N	680N
ISO VG DIN 51 519	32	46	68	100	150	220	320	460	680
Density, DIN 51 757, at 15 °C, [kg/m³], approx.	840	840	850	850	850	850	850	850	860
Kinematic viscosity, DIN 51 561 pt. 01 at 40 °C, [mm²/s], approx. at 100 °C, [mm²/s], approx.	32 6	46 8	68 11	100 14	150 20	220 27	320 36	460 47	680 62
Viscosity index, DIN ISO 2909	≥135	≥140	≥140	≥150	≥150	≥155	≥155	≥160	≥160
Flash point COC, DIN ISO 2592, [°C]	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200
Pour point, DIN ISO 3016, [°C], approx.	-50	-40	-40	-40	-40	-40	-35	-30	-30
Foaming characteristics, ASTM D 892, sequence I, II und III, [ml]	≤ 100/10								
Copper corrosion, DIN EN 2160, 3h/ 100 °C, corrosion degree	1-100								
Corrosion protection on steel, DIN ISO 7120	0 – A								
Ageing characteristics, ASTM D 2893, increase in viscosity, [%]	< 6								
FZG gear test rig, A/8.3/90, DIN ISO 14635-01, scuffing load stage	≥ 12				≥14				
Rolling bearing test rig FE 8, D 7,5/80-80, DIN 51 819-3, wear of rolling elements, [mg] wear of cage [mg]]	< 20 < 150								
Service temperature range*, [°C]	-50 to 140	-40 to 140					-30 to 140		

* Service temperatures are guide values which depend on the lubricant's composition, the intended use and the application method. Lubricants change their consistency, apparent dynamic viscosity or viscosity depending on the mechano-dynamical loads, time, pressure and temperature. These changes in product characteristics may affect the function of a component.

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Miscibility of base oils

	Mineral oil	Synth. hydro-carbon	Ester oil	Poly-glycol	Silicone oil (methyl)	Perfluoro-alkyl ether	Silicone oil (phenyl)	Poly-phenyl ether oil
Mineral oil	+	+	+	–	–	–	+/–	+
Synthetic hydrocarbon	+	+	+	–	–	–	–	+
Ester oil	+	+	+	+	–	–	+	+
Polyglycol	–	–	+	+	–	–	–	–
Silicone oil (Methyl)	–	–	–	–	+	–	+/–	–
Perfluoro-alkyl ether	–	–	–	–	–	+	–	–
Silicone oil (Phenyl)	+/–	–	+	–	+/–	–	+	+
Poly-phenyl ether oil	+	+	+	–	–	–	+	+

Legend: + miscible +/– partially miscible – not miscible

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Worksheet “Selection of oil viscosity for gears”

The manufacturer’s instructions on oil viscosity take priority in any case. If the viscosity is not calculated e. g. on the basis of the EHD theory, it can be selected in accordance with this worksheet. Selection is based on DIN 51 509 Pt 1, “Selection of lubricants for toothed gears”. All information in this worksheet applies only to Klübersynth GEM 4 - N oils. The differing viscosity-temperature and viscosity-pressure behaviour of these synthetic oils as compared to mineral oils has been taken into account.

The correct viscosity must be selected independently for any gear stage, and a compromise is required for multi-stage gears. The selection of the correct viscosity in accordance with this worksheet is based on the oil’s expected operating temperature, i.e. the oil sump temperature or the temperature of the injected oil. This temperature is calculated by determining the gear’s thermal economy, taking into account the produced losses, or, in the case of gears already installed, by measuring the temperature. It might be required to select a lower viscosity to ensure lubricant supply during a cold start and at low ambient temperatures. In the individual case it is necessary to check the viscosity at the existing starting temperature (especially in the case of oil circulation lubrication), or to test the components at the expected starting temperature (especially in the case of immersion lubrication).

The required viscosity grade of the Klübersynth GEM 4 – N oils for a gear stage is determined by means of the required Klüber viscosity index and the oil’s expected operating temperature using the diagram on the last page.

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Determination of the Klüber viscosity index for a spur gear stage:

The required Klüber viscosity index for a spur gear stage is calculated using the force-speed factor in accordance with table 1.

Table 1:

Force-speed factor $K_S/v \left[\frac{MPa \cdot s}{m}\right]$	Klüber viscosity index KVZ
≤ 0,02	1
> 0,02 bis 0,08	2
> 0,08 bis 0,3	3
> 0,3 bis 0,8	4
> 0,8 bis 1,8	5
> 1,8 bis 3,5	6
> 3,5 bis 7,0	7
> 7,0	8

v = Peripheral speed at the reference circle [m/s]
K_S = Rolling pressure acc. to Stribeck [N/mm², MPa]

$$K_S = \frac{F_t}{b \cdot d_1} \cdot \frac{U+1}{U} \cdot Z_H^2 \cdot Z_\varepsilon^2 \cdot K_A \left[N/mm^2, MPa \right]$$

F_t = Nominal peripheral force [N]
b = Tooth width [mm]
d_1 = Diameter of reference circle [mm]
U = Gear ratio = Z_2/Z_1; $Z_2 > Z_1$
Z_H = Distribution factor [*1]
Z_ε = Contact ratio [*1]
K_A = Application factor [*2]

[*1] Note: Determination of Z_H and Z_ε according to DIN 3990 Pt 2. For a rough calculation $Z_H^2 \cdot Z_\varepsilon^2 \approx 3$.
[*2] Note: Guide values for K_A are listed in DIN 3990 Teil 6.

Example 1: Single-stage spur gear driving a fan

Drive:	Electric motor
Nominal peripheral force:	F_t = 3000 N
Tooth width:	b = 25 mm
Diameter of reference circle:	d_1 = 230 mm
Gear ratio:	U = 2,5
$Z_H^2 \cdot Z_\varepsilon^2$:	≈ 3
	K_A = 1
Peripheral speed:	v = 4 m/s
Rolling pressure acc. to Stribeck:	K_S = 2,2 MPa
Force-speed factor:	K_S/v = 0,55 $\frac{MPa \cdot s}{m}$
Acc. to table 1, Klüber viscosity index:	KVZ = 4
Expected oil sump temperature:	≈ 90 °C

For this application we selected Klübersynth GEM 4 - 220 N in accordance with the diagram on page 4).

Determination of the Klüber viscosity index for a worm gear stage:

The required Klüber viscosity index for a worm gear stage is calculated in accordance with table 2.

Table 2:

Force-speed factor $K_S/v \left[\frac{N \cdot min}{m^2}\right]$	Klüber viscosity index KVZ
≤ 60	5
> 60 bis 400	6
> 400 bis 1800	7
> 1800 bis 6000	8
> 6000	9

$$\text{Force-speed factor } K_S/v = \frac{T_2}{n_1 \cdot a^3} \cdot K_A \left[\frac{N \cdot min}{m^2}\right]$$

T_2 = Output moment [Nm]
n_1 = Worm speed [min^{-1}]
a = Center distance [m]
K_A = Application factor
Note: Guide values for K_A are listed in DIN 3990 Pt 6.

Example 2:

Worm gear stage of a gear motor driving a circular conveyor

Antriebsmaschine:	Elektromotor
Output moment:	T_2 = 300 Nm
Worm speed:	n_1 = 500 min^{-1}
Center distance:	a = 0,08 m
Application factor:	K_A = 1
Force-speed factor:	$K_S / v = 1171{,}9 \frac{N \cdot min}{m^2}$
Klüber viscosity index acc. to table 2:	KVZ = 7
Expected ol sump temperature:	≈ 85 °C

For this application Klübersynth GEM 4 – 460 N was selected in accordance with the diagram on page 4.

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Viscosity-temperature diagram