Klübersynth GEM 2-oils

Synthetic high-performance gear oils

Description

The Klübersynth GEM 2-oils are high-performance gear oils with a synthetic ester oil as base oil.
They achieve a scuffing load capacity > 13 in the FZG test, DIN 51354, T02 (A/16,6/90), which is better than the CLP requirements. Micropitting resistance in the FVA no. 54 micropitting test is > 10.
Klübersynth GEM 2-320 in particular was tested for rolling bearing lubrication. The FE 8 rolling bearing lubricant tester showed a rolling element wear of m_{W50} < 2 mg and a cage wear of m_{K50} < 20 mg (two test runs acc. to DIN 51819-03-D-7.5/80-80, no failure). Klübersynth GEM 2-320 also passed the SKF roller test (120°C/8 weeks).
The Klübersynth GEM 2-oils have good viscosity-temperature properties and a wide range of service temperatures. They offer good wear and corrosion protection as well as ageing and oxidation stability.
Biodegradability as shown in the CEC-L-33-A-93 test is > 70% after 21 days.

Applications

Klübersynth GEM 2-oils can be used for the lubrication of spur, bevel and worm gears and their associated machine elements such as sliding and rolling bearings. Furthermore, they are particularly suitable for applications where leaking or dripping lubricants may create hazards to the environment.

Application notes

Klübersynth GEM 2-oils can be applied by immersion, immersion circulation or injection. Other options include lubrication by drip-feed, brush, oil feeder or automatic systems.

Generally, Klübersynth GEM 2-oils are miscible with conventional mineral oils and polyalfaolefin oils. Note, however, that these oils may no longer be rapidly biodegradable when mixed with mineral or polyalfaolefin oil.
Therefore, we strongly recommend careful cleaning of the gear or the oil circulation system before changing to Klübersynth GEM 2-oils.

Ester-based synthetic lubricants can affect the functionality of rubber seals, depending on temperature and time of exposure. For permanent oil sump temperatures up to 80°C, you can use NBR seals (acrylonitrile-butadiene rubber). For higher temperatures, we suggest sealing materials based on FKM (fluoropolymers). Note that elastomer grades from the same or different manufacturers can behave differently. Therefore, the data listed below under "Compatibility with elastomers" should be seen as general approximations. Users should always run compatibility tests against the elastomers they actually work with.

When using Klübersynth GEM 2-oils, we suggest two-component paints (reaction lacquers) for coating.

All structural materials that will come into contact with your chosen lubricants should be tested for suitability, especially before starting series application.

Viscosity selection for rolling bearings and gears:

For correct oil viscosity selection, refer to the bearing manufacturers' specifications or worksheet 3 from the Society of Tribology (GfT).

To identify the appropriate oil viscosities for gears, primarily refer to the gear manufacturers' specifications.

Only when there are no gear manufacturers' specifications can viscosities be chosen with reference to the enclosed worksheet,

- Synthetic high-performance gear oils
- High scuffing load capacity
- Very good wear protection
- High micropitting resistance
- Excellent rolling bearing test results
- Rapidly biodegradable
- Good viscosity-temperature behaviour
- Wide operating temperature range

"Klübersynth GEM 2-oils – Gear oil viscosity selection".

Service temperature range:

Service temperatures are general approximations that depend on the lubricant's composition, intended use and application method. Lubricants change their consistency, apparent dynamic viscosity or viscosity depending on mechanical-dynamical load, time, pressure and temperature. These changes in product characteristics may affect the function of a component.

For immersion lubrication of gears and chains:

- Klübersynth GEM 2-220/320 approx. from - 30°C to +130°C

When using automatic systems, refer to the manufacturers' specifications for maximum viscosities that can be processed.

.

Klübersynth GEM 2-oils

Synthetic high-performance gear oils

Minimum shelf life

Minimum shelf life is approx. 36 months if the product is stored carefully in dry rooms and closed original packs.

Pack sizes

20 l canister
200 l drum

Current material safety data sheets can be downloaded from our website www.klueber.com or requested from Klüber Lubrication

Product data

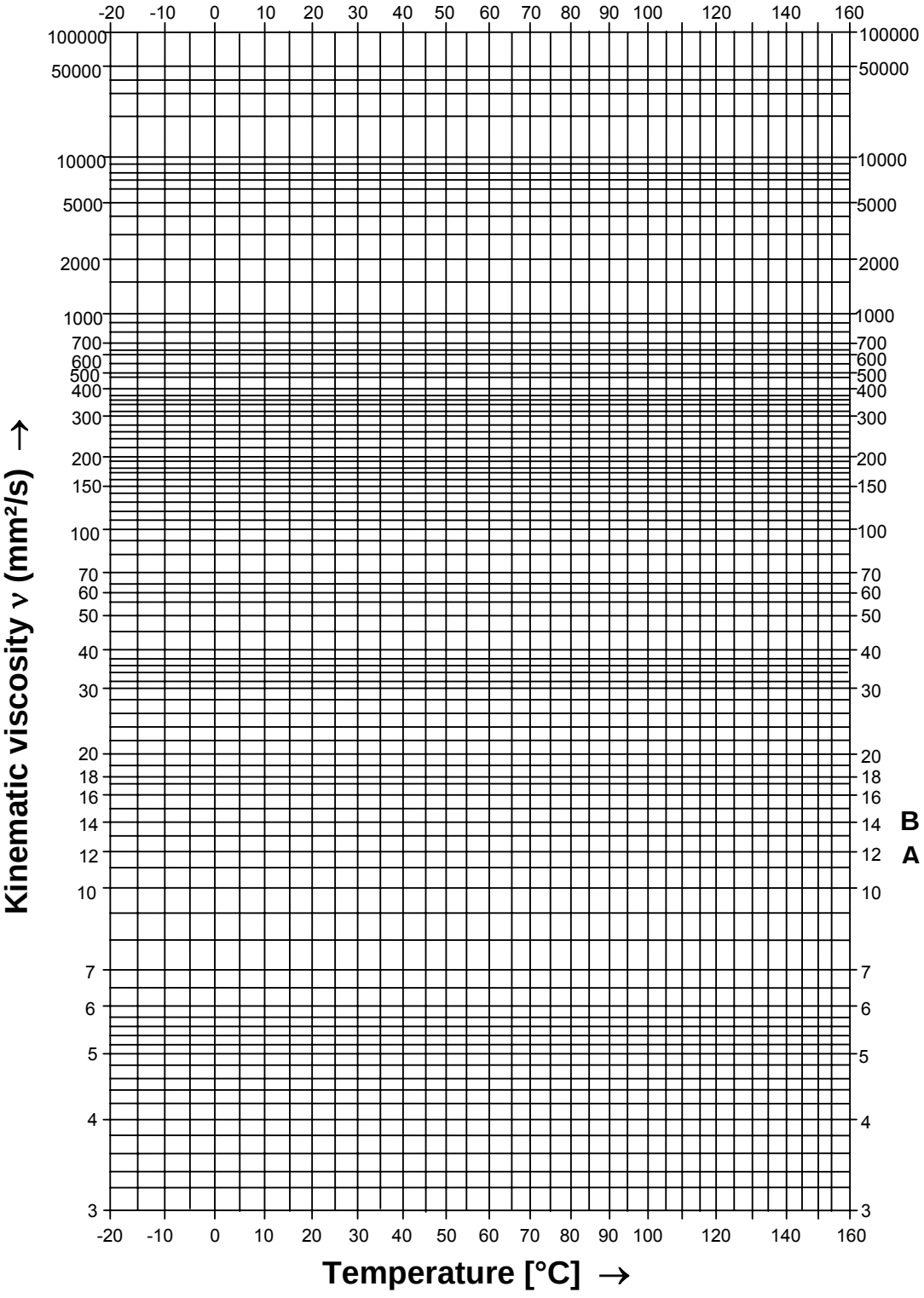
Klübersynth GEM 2-...		220	320
ISO VG DIN 51519		220	320
Density, DIN 51757, at 20°C, [g/cm³], approx.		0.95	0.95
Kinematic viscosity, DIN 51562 T01, Ubbelohde, [mm²/s], approx.	40°C	220	320
	100°C	27	35
Viscosity index, DIN ISO 2909, VI		150	150
Flash point, DIN EN ISO 2592, Cleveland, open crucible, [°C], approx.		270	270
Pourpoint, DIN ISO 3016, [°C]		≤ - 30	≤ - 30
Anti-corrosive properties of oils, DIN ISO 7120, method A, steel 24h/60°C		0-A	0-A

Compatibility with elastomers

Klübersynth GEM 2-...	220	320
72 NBR 902 at 100°C/168h, change in volume, [%], approx. change in hardness (Shore A), approx.	 5 - 4	 5 - 4
75 FKM 585 at 150°C/168h, change in volume, [%], approx. change in hardness (Shore A), approx.	 3 - 1	 3 - 1

Klüber Lubrication München KG
Geisenhausenerstraße 7, 81379 München, Deutschland
☎ +49 89 7876-0, Telefax +49 89 7876-333, www.klueber.com

Temperature-viscosity diagram



A) Klübersynth GEM 2-220
B) Klübersynth GEM 2-320

Worksheet: Gear oil viscosity selection

The manufacturer's specifications for oil viscosities always have priority. If there is no viscosity calculation, e.g. on the basis of the EHD theory, viscosities for Klüber GEM 2-oils can also be selected with reference to this worksheet. Selection is based on DIN 51509 T01, "Selection of lubricants for toothed gears". All information contained in this worksheet is valid only for the application of Klübersynth GEM 2-oils. The worksheet takes account of the fact that the viscosity-temperature properties of these synthetic oils are different from those of mineral oils.

Suitable viscosities must be selected separately for each gear stage; multi-stage gears will require a compromise. Viscosity selection by the present worksheet must allow for the expected operating oil temperature. By operating oil temperature we mean the oil sump temperature or the temperature of the injected oil. In identifying the expected operating oil temperature, you need to make allowance for the losses by calculating the thermal economy of the gear or if it is already installed by measuring the temperature. For adequate lubricant supply in cold start or low ambient temperature situations, you may have to select a lower viscosity. Check the specific viscosities at the appropriate start temperature (especially with oil circulation lubrication) or test the components at the expected start temperature (especially with immersion lubrication).

The required nominal viscosity of Klübersynth GEM 2-oils for a gear stage is determined by means of the Klüber viscosity index and the expected oil operating temperature; refer to the diagram shown on the last page of this worksheet.

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 up to 0.08	2
> 0.08 up to 0.3	3
> 0.3 up to 0.8	4
> 0.8 up to 1.8	5
> 1.8 up to 3.5	6
> 3.5 up to 7.0	7
> 7.0	8

v = Peripheral speed at the reference circle [m/s]
K_S = Rolling pressure after 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, Part 2. For a rough calculation: $Z_H^2 \cdot Z_\varepsilon^2 \approx 3$
*2 Note: Approximations for K_A are listed in DIN 3990, Part 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
Application factor:	K_A = 1
Peripheral speed:	v = 4 m/s
Rolling pressure after Stribeck:	K_S = 2.2 MPa
Force-speed factor:	K_S/v = 0.55 $\frac{MPa \cdot s}{m}$
Klüber viscosity index resulting from table 1:	KVZ = 4
Expected oil sump temperature:	≈ 90°C

For this application, we selected Klübersynth GEM 2-220 (see diagram on p. 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
≤ 60	5
> 60 up to 400	6
> 400 up to 1,800	7
> 1800 up to 6,000	8
> 6,000	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 torque [Nm]
n_1 = Worm speed [min^{-1}]
a = Centre distance [m]
K_A = Application factor
Note: Approximations for K_A are listed in DIN 3990, Part 6.

Example 2: Worm gear stage of a gear motor driving a circular conveyor

Drive:	Electric motor
Output torque:	T_2 = 300 Nm
Worm speed:	n_1 = 1,500 min^{-1}
Centre distance:	a = 0.08 m
Application factor:	K_A = 1
Force-speed factor	K_S/v = 390.6 N·min·m^{-2}
Klüber viscosity index acc. to table 2:	KVZ = 6
Expected oil sump temperature:	≈ 85°C

For this application, we selected Klübersynth GEM 2-320 (see diagram on p. 4).

Viscosity selection diagram