

## Description

The Klübersynth EG 4 oils are fully synthetic high-performance gear oils conforming to the demands of AGMA. They are also mineral oil miscible.

In addition to their excellent anti-corrosion and anti-wear properties, these oils are very resistant to ageing and oxidation and offer exceptional service at low temperatures. They also show a low tendency to foam. In the FZG test (A10/16,6R/90) a scuffing load capacity of GL 4 was achieved.

## Fields of application

The Klübersynth EG 4 oils are particularly suitable for lubricating friction points subject to high loads over a wide temperature range. The oils can be used to lubricate spur, bevel and worm gears.

Klübersynth EG 4 oils are stable under shear stress and offer excellent demulsifying properties. The oils react on the whole neutrally to common seal materials such as NBR or FPM and lacquers. Care should nevertheless be taken, as elastomers from different manufacturers can behave differently. Therefore the data given in the „compatibility with elastomers“ section should be used for reference purposes only. For this reason a compatibility test should always be carried out with the elastomers which are actually used.

## Application notes

The oils can be applied using the immersion, immersion circulation and injection methods. Total loss lubrication is possible with drip-feed, brush or oil feeder application. It is possible to apply the oils automatically, but attention should be paid to the maximum processable viscosity value in the manufacturer's instructions.

## Viscosity selection for rolling bearings and gears

To determine the correct oil viscosity please refer to the bearing manufacturer's instructions or worksheet 3 from the Society of Tribology (GfT).

The gear manufacturer's instructions always take priority when determining the oil viscosity for gears.

If instructions are not available from the gear manufacturer then the viscosity can be determined from the „Klübersynth EG 4 oils – Selection of oil viscosity for gears“ work sheet.

## Operating temperature range

Operating temperature values are reference values which have been established according to the lubricant structure, desired application and application engineering.

- Gear and chain lubrication by immersion:  
Klübersynth EG 4-150 /...220  
from approx. -35 °C to 140 °C  
Klübersynth EG 4-320 /...460  
from approx. -30 °C to 140 °C  
Klübersynth EG 4-680  
from approx. -25 °C to 140 °C  
Klübersynth EG 4-1000  
from approx. -15 °C to 120 °C

## Minimum shelf life

The minimum shelf life is approx. 36 months when stored carefully in a dry place and in closed original containers.

## Klübersynth EG 4 oils

- Synthetic high-performance gear oils
- Scuffing load capacity conforms to API GL 4
- Miscible with mineral oil
- Excellent corrosion protection
- Ageing resistance

## Pack sizes

19 l canister  
208 l drum

## Product characteristics

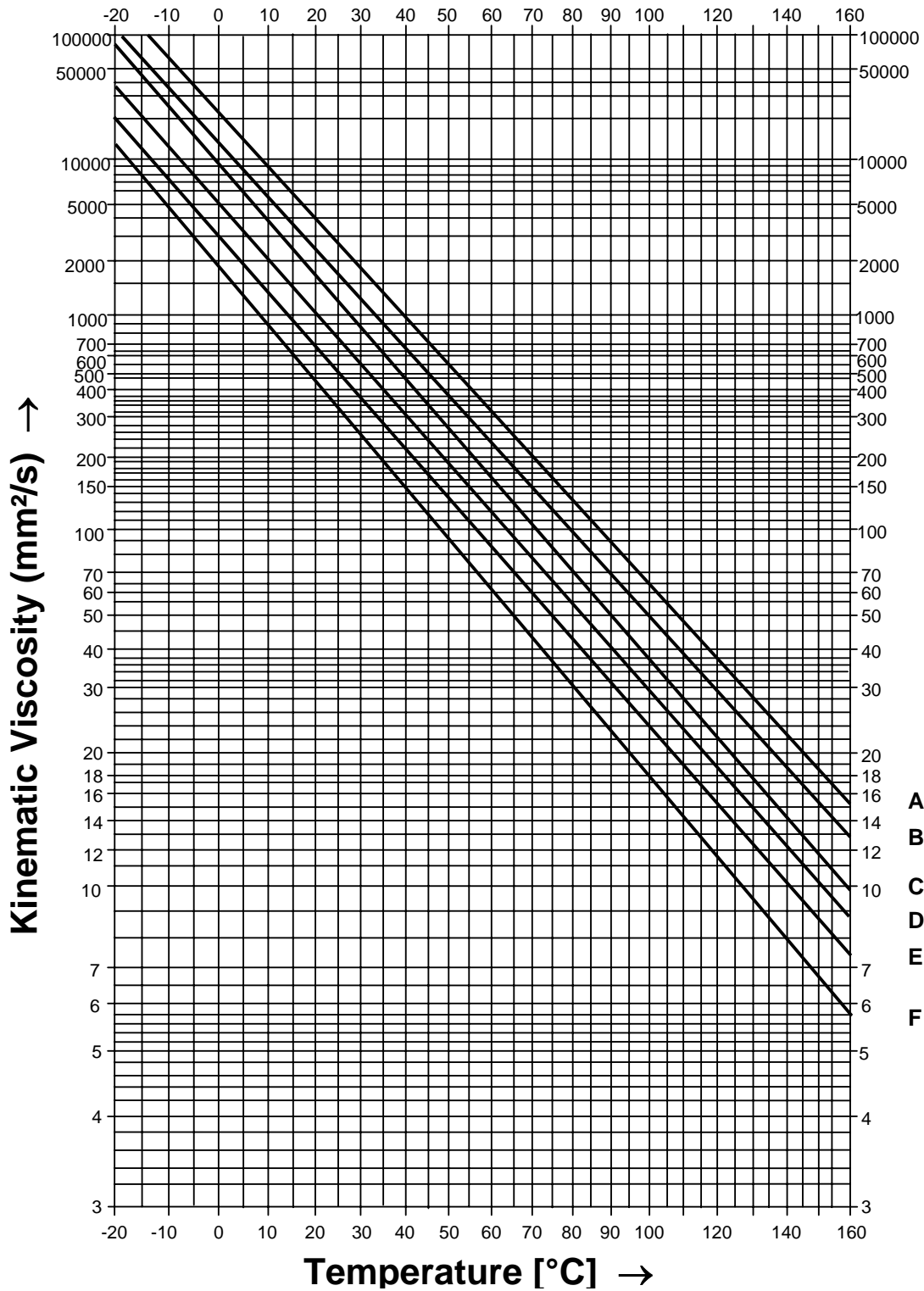
|  | Klübersynth EG 4-150 | Klübersynth EG 4-220 | Klübersynth EG 4-320 | Klübersynth EG 4-460 | Klübersynth EG 4-680 | Klübersynth EG 4-1000 |      |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|------|
| ISO VG<br>DIN 51 519   | 150                  | 220                  | 320                  | 460                  | 680                  | 1000                  |      |
| AGMA No.   | 4 EP                 | 5 EP                 | 6 EP                 | 7 EP                 | 8 EP                 | 8 A EP                |      |
| Density, DIN 51 757, at 20 °C<br>[g/cm <sup>3</sup> ], approx. | 0.87                 | 0.87                 | 0.87                 | 0.88                 | 0.89                 | 0.89                  |      |
| Kinematic viscosity<br>DIN 51562 [mm <sup>2</sup> /s], approx. | 40 °C                | 150                  | 220                  | 320                  | 460                  | 680                   | 1000 |
|  | 100 °C               | 18                   | 25.8                 | 30.9                 | 43.3                 | 53.4                  | 71.3 |
| Viscosity index<br>DIN ISO 2909                                | ≥ 130                | ≥ 130                | ≥ 130                | ≥ 130                | ≥ 130                | ≥ 130                 |      |
| Flash point<br>DIN ISO 2592 [°C]                               | ≥ 200                | ≥ 200                | ≥ 200                | ≥ 200                | ≥ 200                | ≥ 200                 |      |
| Pour point DIN ISO 3016 [°C]                                   | ≤ -390               | ≤ -36                | ≤ -36                | ≤ -36                | ≤ -30                | ≤ -24                 |      |

## Additional data: compatibility with elastomers

| Klübersynth EG 4-...                    | 150 | 220 | 320 | 460 | 680 | 1000 |
|---|-----|-----|-----|-----|-----|------|
| with 72 NBR 902<br>at 100 °C / 168 h    |     |     |     |     |     |      |
| change in volume %                      | < 3 | < 3 | < 3 | < 4 | < 4 | ---  |
| change in hardness<br>(Shore A) approx. | < 2 | < 2 | < 2 | < 2 | ± 1 | ---  |
| with 75 FKM 585<br>at 150 °C / 168 h    |     |     |     |     |     |      |
| change in volume %                      | < 2 | < 2 | < 2 | < 2 | < 2 | < 5  |
| change in hardness<br>(Shore A) approx. | < 3 | < 5 | ≤ 6 | < 5 | ≤ 6 | < 4  |

The a.m. values are based on our current knowledge and experience. They were determined by means of sampling tests. Owing to the many different elastomer compositions we recommend checking their compatibility with the component prior to series application.

## Temperature - Viscosity - Diagram



A) Klübersynth EG 4-1000  
 B) Klübersynth EG 4-680  
 C) Klübersynth EG 4-460

D) Klübersynth EG 4-320  
 E) Klübersynth EG 4-220  
 F) Klübersynth EG 4-150

# Klübersynth® EG 4 oils

Synthetic high-performance gear oils



The data in this product information is based on our general experience and knowledge at the time of printing and is intended to give information of possible applications to a reader with technical experience. It constitutes neither an assurance of product properties nor does it release the user from the obligation of performing preliminary tests with the selected product. We recommend contacting our Technical Consulting Staff to discuss your specific application. If required and possible we will be pleased to provide a sample for testing. Klüber products are continually improved. Therefore, Klüber Lubrication reserves the right to change all the technical data in this product information at any time without notice.



Klüber Lubrication, a member of the Freudenberg group

# Klübersynth EG 4 Oils

Synthetic high performance gear oils

## 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 EG 4 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 operation 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 to the Klübersynth EG 4 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 of the last page.

## Klübersynth EG 4 Oils: Selection of oil viscosity for gears

### 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 $K_S/v$ $\left[ \frac{\text{MPa} \cdot \text{s}}{\text{m}} \right]$ | Klüber viscosity index<br>KVZ |
|--|-------------------------------|
| $\leq 0.02$  | 1                             |
| $> 0.02$ to 0.08   | 2                             |
| $> 0.08$ to 0.3  | 3                             |
| $> 0.3$ to 0.8   | 4                             |
| $> 0.8$ to 1.8   | 5                             |
| $> 1.8$ to 3.5   | 6                             |
| $> 3.5$ to 7.0   | 7                             |
| $> 7.0$  | 8                             |

|              |   |  |
|--------------|---|--|
| $v$          | = | Peripheral speed at the reference circle [m/s]   |
| $K_S$        | = | Rolling pressure acc. to Stribeck [N/mm <sup>2</sup> , MPa]  |
| $K_S$        | = | $\frac{F_t}{b \cdot d_1} \cdot \frac{U+1}{U} \cdot Z_H^2 \cdot Z_\epsilon^2 \cdot K_A$ [N/mm <sup>2</sup> , MPa] |
| $F_t$        | = | 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  |
| $Z_\epsilon$ | = | Contact ratio <sup>*1</sup>  |
| $K_A$        | = | Application factor <sup>*2</sup>   |

\*1 Note: Determination of  $Z_H$  and  $Z_\epsilon$  according to DIN 3990, Pt. 2. For a rough calculation:  $Z_H^2 \cdot Z_\epsilon^2 \approx 3$

\*2 Note: Guide values for  $K_A$  are listed in DIN 3990, Pt. 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:                              | $U = 2.5$   |
| $Z_H^2 \cdot Z_\epsilon^2$ :             | $\approx 3$   |
| $K_A$ :                                  | 1   |
| Peripheral speed:                        | $v = 4$ m/s   |
| Expected oil sump temperature:           | $\approx 90$ °C   |
| Rolling pressure acc. to Stribeck:       | $K_S = 2.2$ MPA   |
| Force-speed factor:                      | $K_S/v = 0.55 \frac{\text{MPa} \cdot \text{s}}{\text{m}}$ |
| Acc. to table 1, Klüber viscosity index: | KVZ = 4   |

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

## Klübersynth EG 4 Oils: Selection of oil viscosity for gears

### 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 $K_S/v$ $\left[ \frac{\text{N} \cdot \text{min}}{\text{m}^2} \right]$ | Klüber viscosity index KVZ |
|--|----------------------------|
| $\leq 60$  | 5                          |
| $> 60$ to 400  | 6                          |
| $> 400$ to 1800  | 7                          |
| $> 1800$ to 6000   | 8                          |
| $> 6000$   | 9                          |

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

$T_2$  = Output moment [Nm]

$n_1$  = Worm speed [ $\text{min}^{-1}$ ]

$a$  = 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

|   |   |
|---|---|
| Drive:                                  | Electric motor  |
| Output moment:                          | $T_2 = 300 \text{ Nm}$  |
| Worm speed:                             | $n_1 = 500 \text{ min}^{-1}$                                  |
| Center distance:                        | $a = 0.08 \text{ m}$  |
| Application factor:                     | $K_A = 1$   |
| Force-speed factor:                     | $K_S/v = 1171.9 \frac{\text{N} \cdot \text{min}}{\text{m}^2}$ |
| Klüber viscosity index acc. to table 2: | $\text{KVZ} = 7$  |
| Expected oil sump temperature:          | $\approx 85 \text{ }^\circ\text{C}$                           |

For this application Klübersynth EG 4-680 was selected in accordance with the diagram on page 4.

# Klübersynth EG 4 Oils: Selection of oil viscosity for gears

Viscosity Selection Chart

