Klüberoil® 4 UH 1-32 N … 1500 N oils

Synthetic lubricating oils for the food-processing and pharmaceutical industries

Description

Klüberoil 4 UH 1-32…1500 N oils are lubricants for the food processing and pharmaceutical industry. They meet the requirements of the German law governing food products and associated ancillaries (LMBG, sec. 5, para 1, sentence 1) and the US requirements set forth in the "Guidelines of sec. 21 CFR 178.3570 of FDA regulations" and are in line with the requirements of NSF H1 registration.
Klüberoil 4 UH 1-68…1500 N oils meet the CLP requirements. When tested on the FZG gear test rig according to DIN 51 354, part 2, A/8,3/90, the oils showed a scuffing load of > 12 and a specific loss of weight of < 0.2 mg/kWh.

Especially formulated for use in the food-processing and pharmaceutical industries, these lubricating oils exhibit good antiwear and EP properties as well as excellent low-temperature characteristics.

The corrosion protection properties of these oils are very good as is their ageing and oxidation stability. They also have a high resistance to shear and do not foam.

Application

Klüberoil 4 UH 1 oils are used for the lubrication of friction points in food-processing and pharmaceutical machinery. They are especially suitable for the lubrication of spur, bevel and worm gears, bearings, spindles and joints, as well as of lift, drive and conveyor chains at low temperatures.

Application notes

When used in gears, Klüberoil 4 UH 1 oils may be applied by immersion, immersion circulation or injection. Drip-feed lubrication (e.g. for chains) and application by brush or oil can is also possible.

Klüberoil 4 UH 1 oils are miscible with mineral oils and polyalfaolefin oils. However, we recommend cleaning the oil circulation system or flushing it with the new oil prior to using Klüberoil 4 UH 1 for the first time. Especially with a view to the H1 requirements in the food-processing industry, any mixing of Klüberoil 4 UH 1 oils with non-food-grade lubricants should be avoided.

For permanent temperatures at the seal edge up to 100 °C, NBR seals (acrylonitrile-butadiene rubber) may be used. For higher temperatures, it is safer to use FKM seals (fluorinated rubber) instead. It should be noted that elastomers from one or several manufacturers can behave differently. Therefore the data given in the "compatibility with elastomers" table should be used for reference purposes only. A compatibility test should always be carried out with the elastomers which are actually used.

Viscosity selection for rolling bearings and gears

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

For determining the correct viscosity for gears, the manufacturer's instructions take priority.

Only in cases where there are no gear manufacturer's instructions, the viscosity can be selected in accordance with the enclosed worksheet "Klüberoil 4 UH 1 oils – selection of oil viscosity for gears".

Service temperature range*:

- ISO VG 32 to 100
  approx. - 35 °C to approx. 120 °C
- ISO VG 150 to 460
  approx. - 30 °C to approx. 120 °C
- ISO VG 680 to 1500
  approx. - 25 °C to approx. 120 °C

Klüberoil 4 UH 1 32 N…1500 N

- Synthetic oils for the food-processing and pharmaceutical industries
- NSF H1 registration
- Wide operating temperature range
- Excellent ageing and oxidation stability
- Good wear protection
- High scuffing load capacity
- Good corrosion protection
- Neutral towards seals and paints
- The higher viscosity variants fulfill CLP requirements

When used for loss lubrication, the lubricant may be exposed to higher temperatures, depending on the relubrication intervals. We will be pleased to provide samples for testing.

** Service temperature range:*

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

Minimum shelf life

The minimum shelf life is approx. 24 months if the product is stored in the original closed container in a dry place.

Pack sizes

400 ml spray can (ISO VG 1500)
5 l canister
20 l canister
200 l drum

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Product data

Klüberoil 4 UH 1- …	32 N	46 N	68 N	100 N	150 N	220 N	320 N	460 N	680 N	1500 N
ISO VG DIN 51 519	32	46	68	100	150	220	320	460	680	1500
Density, DIN 51 757, at 20 °C, g/ml, approx.	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.86	0.86	0.89
Kinematic viscosity, DIN 51 562 T01 at 40 °C, mm^2/s, approx. at 100 °C, mm^2/s, approx.	 32 6	 46 8	 68 11	 100 14	 150 19	 220 26	 320 35	 460 47	 680 65	 1500 125
Viscosity index, DIN ISO 2909, approx.	140	140	140	140	150	150	150	150	150	180
Flash point, DIN ISO 2592, °C	> 220	> 220	> 220	> 220	> 220	> 220	> 220	> 220	> 220	> 220
Pour point, DIN ISO 3016, °C, approx.	< -35	< -35	< -35	< -35	< -30	< -30	< -30	< -30	< -25	< -25

Compatibility with elastomers

Klüberoil 4 UH 1- …	32 N	46 N	68 N	100 N	150 N	220 N	320 N	460 N	680 N	1500 N
towards 72 NBR 902, at 100 °C / 168 h change in volume, %, approx. change in hardness (Shore A), approx.	 + 1 0	 – –	 + 1 0	 – –	 – –	 + 2 0	 – –	 + 2 – 1	 – –	 – –
towards 75 FKM 585, at 150 °C / 168 h change in volume, %, approx. change in hardness (Shore A) approx.	 + 1 – 1	 – –	 + 1 – 1	 – –	 – –	 + 1 – 1	 – –	 + 1 – 1	 – –	 – –

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Selection of oil viscosity for gears

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 51509, pt. 1 "Selection of lubricants for toothed gears". All information in this worksheet applies only to Klüberoil 4 UH 1 – 32 N ... 1500 N oils. The differing viscosity-temperature behaviour of these synthetic oils as compared to mineral oils has been taken into account.

The correct viscosity must be selected independently for every 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 viscosity grade of the Klüberoil 4 UH 1 – 32 N ... 1500 N oils required for a gear stage is determined by means of the Klüber viscosity index and the expected oil operating temperature using the diagram of the last page.

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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 $K_S/v \left[\frac{MPa \cdot s}{m}\right]$	Klüber viscosity index KVZ
≤ 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/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, 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
$Z_H^2 \cdot Z_\varepsilon^2$:	≈ 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 Klüberoil 4 UH 1 – 220 N in accordance with the diagram on page 4.

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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 $\left[\frac{N \cdot min}{m^2}\right]$	Klüber viscosity index
≤ 60	5
> 60 to 400	6
> 400 to 1800	7
> 1800 to 6000	8
> 6000	9

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: 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 torque:	T_2 = 300 Nm
Worm speed:	n_1 = 500 min^{-1}
Centre distance:	a = 0.08 m
Application factor:	K_A = 1
Force-speed factor	$K_S/v = K_S / v = 1171.9 \frac{N \cdot min}{m^2}$
Klüber viscosity index acc. to table 2:	KVZ = 7
Expected oil sump temperature:	≈ 85 °C

For this application Klüberoil 4 UH 1 – 460 N was selected in accordance with the diagram on page 4.

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Synthetic lubricating oils for the food-processing and pharmaceutical industries
Selection of oil viscosity for gears