KLÜBER LUBRICATION

Lubricating oils for enclosed gear drives

Klüber solutions for gears of any size

Lubrication is our World

Contents

Increasing requirements for gear oils

Today, the manufacture of gears of all performance grades is characterized by demands for the transmission of ever growing power and torque while, at the same time, reducing size and weight.

This calls for new gear designs, new materials, improved surface treatment, modern production techniques as well as the application of mineral and synthetic high-performance lubricants.

To the same extent that the performance weight of the toothed gears is decreased, the service claims on the gear lubricants have increased. This particularly applies to their wear-reducing and anti-fretting effects as well as to their stability towards high gear temperatures.

The heat generated during operation must be removed via ever decreasing housing surfaces areas. This results in increasing operating temperatures which obviously affect the useful life of both the gear box and the lubricants.

Measures for reducing frictional losses on the various gear components help reduce the temperature of the gear. Experience has shown that the use of high-performance mineral and synthetic gear oils helps reduce power losses and operational temperatures.

Thus, in many cases, the installation or fitting of expensive cooling devices is no longer necessary.

For these reasons synthetic lubricating oils have gained importance in this field. Apart from reduced gear temperatures, considerably longer oil life can be achieved, depending on the requirements. For worm gears, this may mean lifetime lubrication.

For the technical designer, a higher permissible operating oil temperature means higher power can be transmitted on the same designed space.

The results can be measured in considerable energy and cost savings.

Furthermore, substantially longer oil life means substantially less lubricant consumption and smaller amounts of used oil. This means environmental protection and a reduction of disposal costs.

This guide is intended to help you find the most suitable gear lubricant, quickly and safely.

Selecting gear oils for newly installed gears

1. Determining the suitable lubricant type depending on the type of gear, operating oil temperature and load demands

Area of application: General machine building

Type of gear

– spur gears and straight bevel gears
– worm gears
– helical bevel gears – hypoid gear sets

Operating oil temperature (°C)

Oil sump temperature and/or temperature of the injected oil.

Load demands on gear

Classification as **low – medium – high**
For the determination of the load demands on gears, the application factor K_A can be used, which is calculated using tables 3 ... 6. The tables have been taken from DIN 3990 part 1, appendix A (12.87).

The selection of the suitable lubrication oil type is then made using table 2.

Example

Determination of the suitable oil type for the worm gear stage of a gear motor driving a loaded belt conveyor.

Operating conditions

Driving torque	$T_2 = 300$ Nm
Speed of the worm	$n_s = 350\,min^{-1}$
Centre distance	a = 63 mm
Drive	Electric motor
Expected oil temperature	approx. 85 °C

Determination of the load demands

After determination of the application factor K_A the load demand is taken from table 1. For K_A refer to tables 3, 4 and 5.

Operational mode of the drive/electric motor: **uniform**.

Operational mode of the driven machine/ loaded belt conveyor: **moderate shocks**.

According to table 3 it follows: **$K_A = 1.25$**
According to table 1 the load demand on the gear is **medium.**

Suitable oil type

The selection of the type of lubricating oil is made according to table 2. For the worm gear mentioned in the example, centre distance a = 63 mm, with an operating oil temperature of approx 85 °C and a medium load oil type **C = Klübersynth GH 6** is the suitable gear oil.

Table 1: Load demands on gears depending on the application factor K_A

Application factor K_A	1	> 1 to 1.5	>1.5
Load demands on gears	low	medium	high

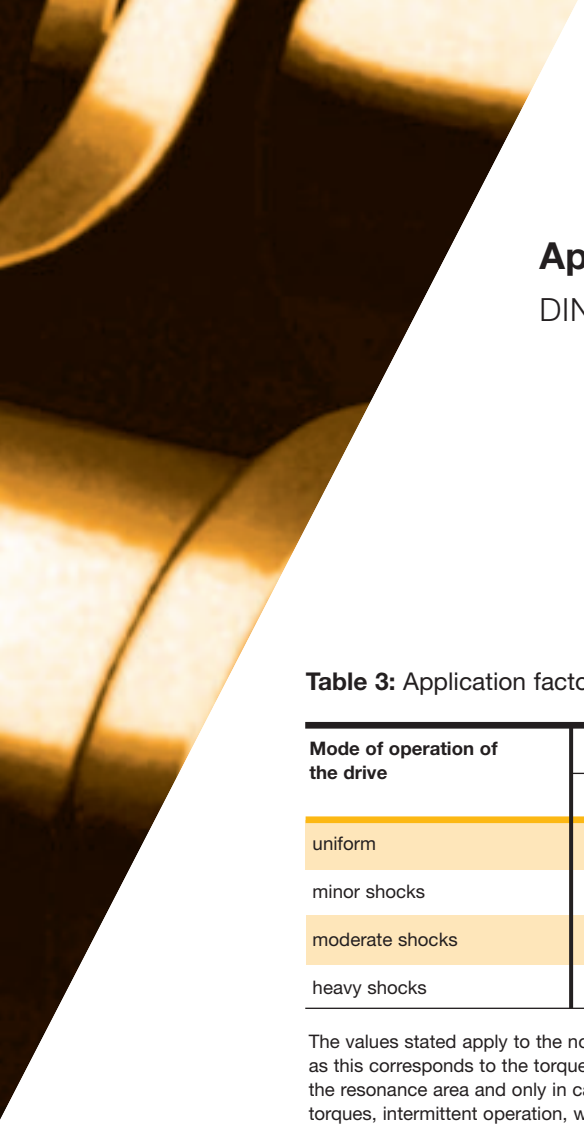
Table 2: Selection of the suitable gear oil depending on the operating temperature, type of gear and load demands

Operating oil temperature [°C]	Type of gear	Area of application	Industrial gears			Environment	Food industry	
		Gear load	high	medium	low	low - high	high	medium
< – 25	Spur/bevel gear		B	B	B	–	–	E
	Worm gear		B	B	B	–	–	E
– 25 to 80	Spur/bevel gear		B	A	A	D	F	E
	Worm gear		C	C	B	D	F	E
0 to 120	Spur/bevel gear		C	B	B	D	F	E
	Worm gear		C	C	B	D	F	E
> 120 to 160	Spur/bevel gear		C	C	C	–	F	F
	Worm gear		C	C	C	–	F	F

Legend	
A	Klüberoil GEM 1- … N Series*
B	Klübersynth GEM 4- … N Series*
C	Klübersynth GH 6 Series*
D	Klübersynth GEM 2 Series
E	Klüberoil 4 UH1- … N Series*
F	Klübersynth UH1 6 Series*

LUBE seal

* Products of the Lube & Seal program. For further information please refer to www.klueber.com



Application factor K_A

DIN 3990 part 1, appendix A

Table 3: Application factor K_A

Mode of operation of the drive	Mode of operation of the driven machine			
	uniform	moderate shocks	medium shocks	heavy shocks
uniform	1.00	1.25	1.50	1.75
minor shocks	1.10	1.35	1.60	1.85
moderate shocks	1.25	1.50	1.75	2.0
heavy shocks	1.50	1.75	2.0	2.25 or higher

The values stated apply to the nominal torque of the driven machine, alternatively to the nominal torque of the driving motor, as far as this corresponds to the torque demand of the driven machine. The values stated only apply to machines which are not working in the resonance area and only in case of uniform power requirements. For applications with unusual loads, motors with high starting torques, intermittent operation, when operated under extreme, repeated shock loads, the gears should be checked for safety regarding static strength and endurance limit. For examples please refer to DIN 3990 part 6, page 9.

Table 4: Examples of drives with different modes of operation

Mode of operation	Drive
uniform	electric motor (e.g. d.c. motor), steam/gas turbine in uniform operation* (low, rarely occurring starting torques)**
minor shocks	steam turbine, gas turbine, hydraulic, electric motor (higher, more frequently occurring starting torques)**
moderate shocks	multi-cylinder combustion engine
heavy shocks	single-cylinder combustion engine

* Verified by vibrational tests and/or by experience with similar systems.
** Compare to service life curves ZNT; YNT of the material in DIN 3990 part 2 and part 3. Consideration of temporarily acting peak-load torques

Table 5: Industrial gears; examples of the mode of operation of the driven machine

Mode of operation	Driven machine
uniform	Power generators; uniformly loaded belt conveyors or apron conveyors; worm conveyors; light elevators; packing machines; feed drives of machine tools; fans; light centrifuges; centrifugal pumps; agitators and mixers for light liquids or materials with uniform density; cutters, presses; punches[1]; slewing gears; traversing mechanisms[2].
moderate shocks	Irregularly (e.g. with piece goods) loaded belt conveyors or apron conveyors; main drives of machine tools; heavy elevators; slewing gears of cranes; industrial and mine fans; heavy centrifuges; centrifugal pumps; agitators and mixers for viscous liquids or materials with irregular densities, piston pumps with several cylinders; metering pumps; extruders (in general); calenders; rotary kilns; rolling mills[3] (continuous zinc band, aluminium band as well as wire and bar rolling mills).
medium shocks	Extruders for rubber; mixers with intermittent operation for rubber and plastic materials, light-weight ball mills; wood processing (gate saws, turning lathes); break-down mills[3,4]; hoisting gears; single-cylinder piston pumps.
heavy shocks	Excavators (bucket wheel drives), chain and bucket drives, screen drives, shovel dredgers; heavy ball mills; rubber kneaders; crushers (stone, ore); iron and steelworks machines; heavy metering pumps; rotary drilling gears; brick moulding machines; bark peeling drums; peeling machines; cold strip mills[3,5]; briquetting presses; pan grinders.

[1] Nominal torque = maximum cutting, pressing, punching torque [2] Nominal torque = maximum starting torque
[3] Nominal torque = maximum rolling torque [4] Torque from current limitation [5] K_A up to 2.0 due to frequent band ruptures

Table 6: Industrial gears; examples of the mode of operation of the driven machine

Mode of operation	Driven machine
uniform	Radial compressors for air conditioners – for process gas; performance test bench; generator and exciter for base load or continuous load, paper mill main drive.
moderate shocks	Radial compressors for air and pipelines; axial compressors; centrifugal fans; generator and exciter for peak load; centrifugal pump (all types, except for those explicitly stated as follows); axially-flown rotary pump, all types; gear pump; paper industry; Jordan or refiner machine; paper machine auxiliary drive; pulp stock stamper.
medium shocks	Rotary lobe fans; radially-flown rotary lobe compressor; piston compressor (3 or more pistons); suction fans in industry and mining (large ones, with frequent starting procedures); boiler feed centrifugal pump, rotary lobe pump, piston pump (3 or more pistons).
heavy shocks	Reciprocating piston compressor (2 pistons); centrifugal pump (with surge tank); sludge pump; piston pump (2 pistons).

Lubricating oils for gears in general machine building

Spur gears | **Bevel gears** | **Worm gears** | **Hypoid gears***

Mineral oils / CLP gear oils – DIN 51 517 part 3

High-performance gear oil for normal temperatures and loads

A — **Klüberoil GEM 1- ... N series**

ISO VG 46 to 680
Service temperature range** depending on viscosity – 20 °C to 100 °C
High FZG scuffing load capacity > 12 provides protection at normal and increased loads.
High micro-pitting resistance protects from early fatigue failures
Good wear protection for rolling bearings prevents early rolling bearing failures
Dynamic sealing compatibility tests with NBR and FKM prove the protection against leakages due to incompatibility of oil and seal

Polyalphaolefin oils / CLP HC – DIN 51 517 part 3

Synthetic high-performance gear oil for low and increased temperatures as well as normal and increased loads

B — **Klübersynth GEM 4- ... N series**

ISO VG 32 to 680
Service temperature range** depending on viscosity – 50 °C to 140 °C
High FZG scuffing load capacity > 13 provides protection at normal and increased loads.
High micro-pitting resistance protects from early fatigue failures
Good wear protection for rolling bearings prevents early rolling bearing failures
Dynamic sealing compatibility tests with NBR and FKM prove the protection against leakages due to incompatibility of oil and seal

Polyalkylene glycol oils / CLP PG – DIN 51 517 part 3

Synthetic high-performance gear oil for high temperatures and increased loads

C — **Klübersynth GH 6 series**

ISO VG 32 to 1500
Service temperature range** depending on viscosity – 45 °C to 160 °C
High FZG scuffing load capacity > 13 provides protection at normal and increased loads.
High micro-pitting resistance protects from early fatigue failures
Good wear protection for rolling bearings prevents early rolling bearing failures
Dynamic sealing compatibility tests with NBR and FKM prove the protection against leakages due to incompatibility of oil and seal

Rapidly biodegradable ester/ CLP E – DIN 51 517 part 3

Rapidly biodegradable synthetic high-performance gear oil for normal and increased temperatures as well as normal and high loads

D — **Klübersynth GEM 2 series**

ISO VG 220 and 320
Service temperature range** depending on viscosity – 20 °C to 120 °C
High FZG scuffing load capacity > 13 provides protection at normal and increased loads.
High micro-pitting resistance protects from early fatigue failures
Good wear protection for rolling bearings prevents early rolling bearing failures
Dynamic sealing compatibility tests with NBR and FKM prove the protection against leakages due to incompatibility of oil and seal
In case of leakages the environmental impact is clearly smaller than with common gear oils

Food grade polyalphaolefin oil with H1 authorization

Synthetic high-performance gear oil with H1 authorization for low and increased temperatures as well as normal loads

E — **Klüberoil 4 UH1- ... N series**

ISO VG 32 to 1500
Service temperature range** depending on viscosity – 35 °C to 120 °C
High FZG scuffing load capacity > 12 provides protection at normal loads
Good wear protection for rolling bearings prevents early rolling bearing failures

Food grade polyalkylen glycol oils with H1 authorization

Synthetic high-performance gear oil with H1 authorization for normal and high temperatures as well as normal and high loads

F — **Klübersynth UH1 6 series**

ISO VG 100 to 680
Service temperature range** depending on viscosity – 35 °C to 120 °C
High FZG scuffing load capacity > 13 provides protection at normal and increased loads
High micro-pitting resistance protects from early fatigue failures
Good wear protection for rolling bearings prevents early rolling bearing failures

* API GL4 and GL5 oils on demand.

** 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.

Required viscosity of the lubricating oil

2. Determining the required lubricating oil viscosity

Mineral oils

If you have determined that you require a Type A lubricant (Klüberoil GEM 1- ... N), your next step must be to determine the required nominal viscosity at 40 °C according to DIN 51 509 part 1.

Synthetic oils

All the other gear oils determined from table 2 are synthetic gear oils, for which the viscosity selection procedure according to DIN 51 509 part 1 is not applicable. This standard applies only to mineral oils with a viscosity index (VI) of approx. 90 to 95 as it is based on their specific viscosity-temperature relation. Therefore, when using synthetic gear oils and selecting the viscosity without calculations, e.g. on the EHD theory etc., the different viscosity-temperature relation of synthetic oils versus mineral oils needs to be taken into account.

Since there are no standardized procedures for determining the viscosity when using synthetic oils, and since the common procedures are quite expensive, Klüber has developed diagrams for our synthetic gear oils with the help of which you can select the required ISO VG class in a simple and safe way.

The selection is made partly according to DIN 51 509. Here, the force-speed factor k_s/v according to DIN 51 509 part 1 needs to be calculated for the gear type to be considered. Depending on the result of that, the so-called Klüber viscosity index **KVZ** is then determined.

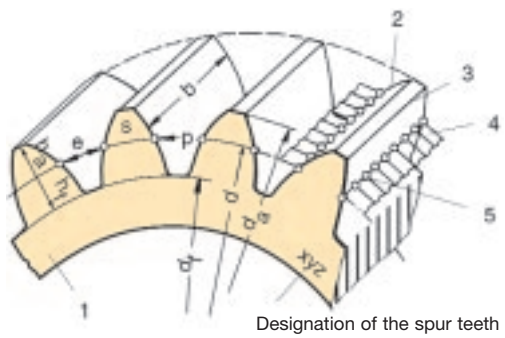
Using the KVZ and the operating oil temperature to be expected, the user can then directly select the required ISO VG class from the corresponding viscosity selection diagram of the selected Klüber product series.

During the preparation of the selection diagrams, the different viscosity-temperature behaviour of synthetic oils has already been taken into consideration.

Example

Example continued from page 4

- Lubricating oil type selected: Klübersynth GH 6, polyglycol oil
- Operating oil temperature to be expected: approx. 85 °C
- Force-speed factor k_s/v: 3428.6 N x min x m^2



Designation of the spur teeth (left or right flank)

Legend	
1	gear ring
2	left flank
3	right flank
4	reference cylinder (pitch cylinder)
5	right flank line
a	gear centre
b	face width
d	pitch circle
d_f	root circle
d_a	tip circle
e	space width
h_a	addendum
h_f	dedendum
p	pitch
s	tooth thickness in pitch circle

Determining the Klüber viscosity index, KVZ

Determination of the KVZ according to table 8 (worm gears). In the present case, the force-speed factor k_s/v was calculated using 3428.6 N x min x m^2. According to table 8, this results in a **KVZ of 8.**

Determining the viscosity grade

The selection of the required viscosity grade is performed using the viscosity selection diagram for **Klübersynth GH 6**, figure 1.
With the determined Klüber viscosity index KVZ 8 and the expected operating oil temperature of approx. 85 °C, the diagram suggests ISO VG 460 as the required viscosity grade, i.e. the required lubricant is **Klübersynth GH 6-460**.

Notes regarding the Klüber viscosity selection procedure

In the above example for determining the viscosity, the coordinate intersection of the KVZ 8 area and the operating oil temperature (85 °C) is located between the ISO VG curves 320 and 460, which means that the viscosity grade to be selected is not clearly defined. In such a case, the higher viscosity grade should always be selected, which is ISO VG 460 in this case.

Table 7: KVZ depending on the k_s/v factor for **spur gears and straight bevel gears**

Force-speed factor k_s/v [MPa x s x m^{-1}]	Klüber viscosity index
≤ 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

The selection of the viscosity grade according to our example always applies to **one** gear stage only. For multi-stage gearings, the viscosity selection needs to be made separately for each gear stage. It is important to select from the viscosity grades determined that grade which presents the most suitable compromise for a safe lubrication both of the gear and the other gear components to be lubricated e.g. bearings.

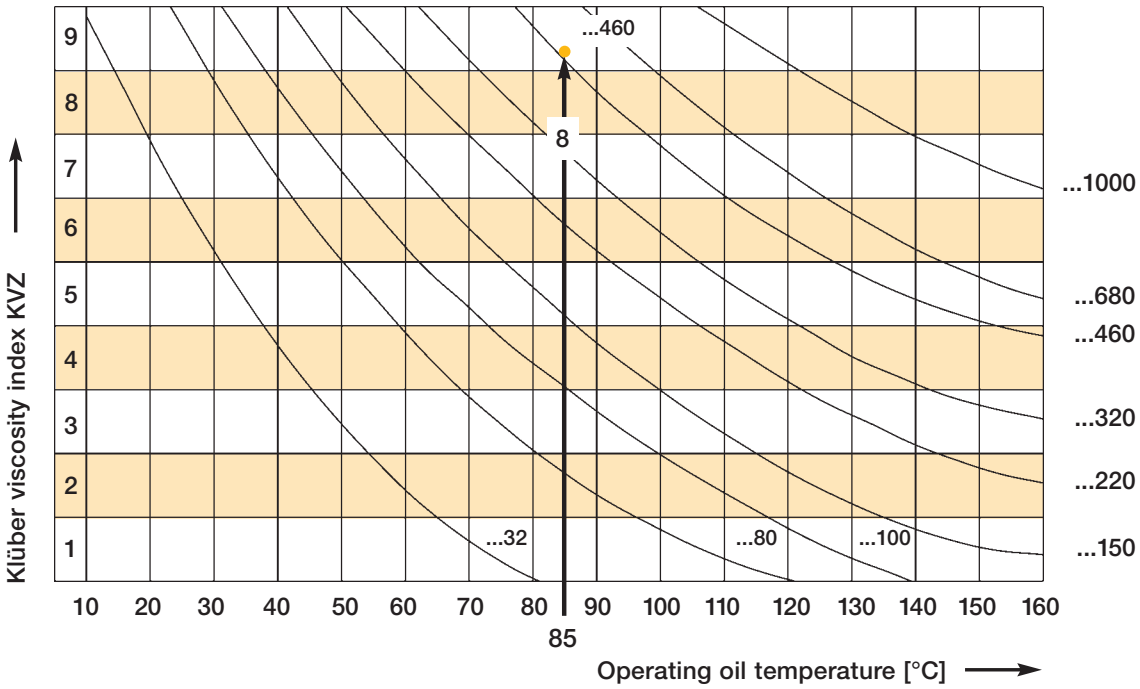
To ensure adequate lubricant supply in cold start or low ambient temperature situations, you may have to select a lower viscosity grade. Check the specific viscosities at the appropriate start temperature or test the components at the start temperatures expected.

Table 8: KVZ depending on the k_s/v factor for **worm gears**

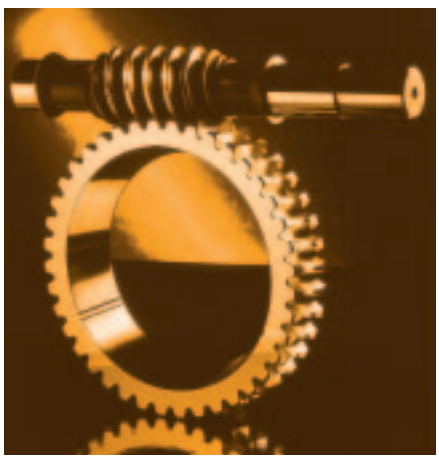
Force-speed factor k_s/v [N x min x m^{-2}]	Klüber viscosity index KVZ
≤ 60	5
> 60 to 400	6
> 400 to 1800	7
➔ > 1800 to 6000	➔ 8
> 6000	9

Viscosity selection diagram for Klübersynth GH 6-32 ... 1000

Figure 1: Viscosity selection diagram



Further viscosity selection diagrams can be obtained through the product information link under **www.klueber.com** or by mail free of charge.



Selecting gear oils

How to select gear oils for gears already installed

Maintenance

When refilling or exchanging oil, it is important that the oil chosen meets the specifications of the gear or plant manufacturer with regard to oil type, quality and viscosity requirements.

Lubricating oils from different manufacturers not only differ in their base oils, but also in their additives and thus have differing characteristics. So, mixing of such lubricants might result in quality losses not only of the wear protection characteristics, but also of the viscosity-temperature relation.

For this reason, the same oil type should always be used for refilling. If this is not possible, the instructions in the following paragraphs should absolutely be observed.

Miscibility of different gear oil types

Gear oils on mineral oil basis

– e.g. Klüberoil GEM 1- ... N series – can be mixed with each other. The prescribed standard requirements, e.g. CLP etc. as well as the viscosity demands shall be met in any case. Mineral oils are miscible with synthetic lubricating oils based on polyalphaolefin (PAO) and ester. They are not miscible with polyglycol (PG).

Gear oils based on polyalphaolefin – PAO

e.g. Klübersynth GEM 4- ... N series may be mixed without hesitation with residues of mineral oil which cannot be removed by normal oil draining, up to approx. 5%, including oil tank and filter.

Mixture of gear oils based on other synthetic oils are not permitted. Polyalphaolefin gear oils of different manufacturers may be mixed, e.g. during oil refills. However, only small amounts of a different oil type should be refilled in order to avoid changes in the characteristics of the original gear oil.

Gear oils based on polyglycol – PG

e.g. Klübersynth GH 6 and Klübersynth UH1 6 oils may neither be mixed with mineral oils nor with gear oils based on other synthetic oils. Polyglycol oils of different manufacturers as well as the Klüber polyglycol gear oils may be mixed with each other. However, mixtures in larger mixing ratios should be avoided, in order not to change the characteristics of the original gear oil.

Food grade lubricants – H1 lubricants

e.g. Klüberoil 4 UH 1- ... N and the Klübersynth UH1 6 series are special gear oils for food and pharmaceutical industries. They meet the particularly high hygienic requirements of these branches of industry. They are used in gears in which an accidental contact between the product and the lubrication oil cannot be excluded.

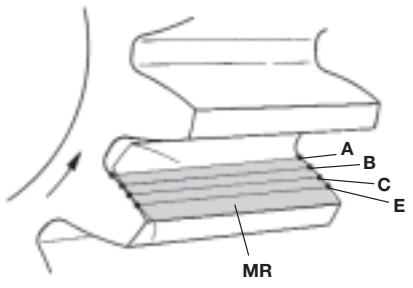
Food grade lubricants must have a certification according to USDA or NSF H1 and/or NSF 51. Under no circumstances may these lubricants be mixed with non-certified lubricants, since otherwise the certification will be null and void! Mixtures of different food grade lubricants are possible only if these lubricants have the same base oil type. However, mixtures in larger mixing ratios should be avoided in any case.

Rapidly biodegradable gear oils

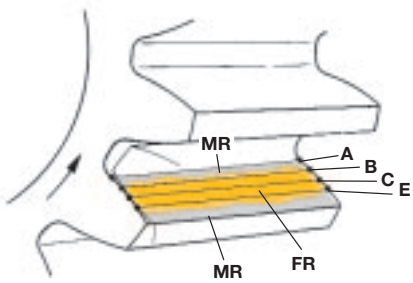
e.g. Klüberbio CA 2 and Klübersynth GEM 2 oils are special gear oils which are used in systems where leaking or dripping lubricants from unavoidable leakages may create hazards to the environment. If small quantities of a rapidly biodegradable gear oil get into the soil or a body of water, bacteria will transform them into compounds that are harmless to nature in quite a short time.

The Klüber products are tested regarding their biodegradability using the CEC L 33-A-94 testing method. Rapidly biodegradable gear oils must not be mixed with normal lubricating oils. Mixtures with rapidly biodegradable lubricating oils of other manufacturers are not advisable either, since normally it is not known which base oil was used.

Typical friction areas on tooth flanks

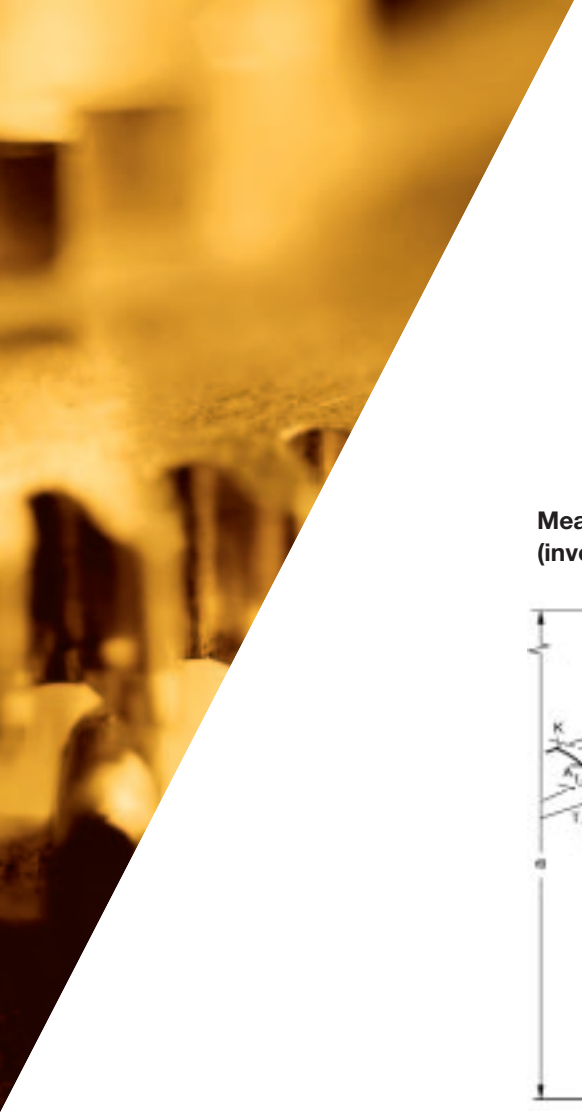


a) low pitch line velocity



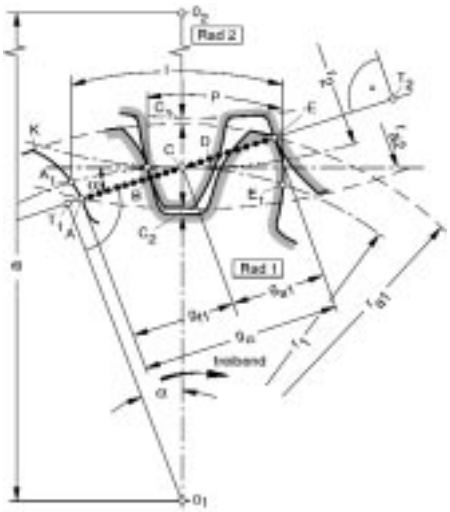
b) high pitch line velocity

Legend	
A ... E	contact points according to DIN 3980
A	starting point of contact
B	inside individual contact point on the driving gear, outside individual contact point on the driven gear
C	pitch point
D	outside individual contact point on the driving gear, inside individual contact point on the driven gear
E	end point of contact
FR	fluid friction
MR	mixed friction



Changeover from mineral oil to synthetic oil lubrication

Measurements of the spur teeth (involute gear)



Legend	
a	centre distance
c	tip clearance
gα	length of path of contact A - B - C
α	action angle
p	pitch
A	start of contact
B	inside individual contact point: leading gear is just leaving the contact area (point E)
C	pitch point
D	outside individual contact point: trailing gear is just entering the contact area. For gear 2, B is the outside individual contact point

Compared to mineral oils, synthetic gear oils provide clear advantages, not only from the technical, but also from the economical and ecological point of view. The main benefits are:

- Reduction of the power loss thanks to a decrease of friction
- Increased gear efficiency
- Lower operating temperatures
- 3 to 5 times longer oil life depending on the base oil type
- Energy cost savings
- Cost savings regarding maintenance and disposal
- Higher power can be transmitted as oil withstands higher operating temperatures

Which synthetic oil type is suited best for a changeover should not be decided by the end user alone. On principle, this should always be agreed together with the gear and/or equipment manufacturer. The selection diagrams 1 to 3 provide a general overview of the synthetic gear oils offered by Klüber as well as their main fields of application.

Changeover to polyalphaolefin (PAO) oils

Klübersynth GEM 4- .... N and
Klüberoil 4 UH1 ... N oils

PAO oils – lubricating oils based on synthetic hydrocarbon oils – have a chemical structure similar to that of mineral oils. As a rule, their compatibility with seal materials and lacquers corresponds to that of mineral oils. They also should be disposed of or recycled in the same way and they may be mixed with mineral oil residues. With selected base oils and accordingly matched additives, PAO oils are also suitable for producing lubricants such as the Klüberoil 4 UH 1- ... N oils for use in the food and pharmaceutical industries. However, in order to avoid a nullification of the food law certification of such lubricants, food grade lubricants must never be mixed with non-certified mineral oils.

The required product information is available on **www.klueber.com** or can be requested to be sent by mail free of charge.

Changeover to polyglycol (PG) oils

Klübersynth GH 6 and
Klübersynth UH1 6 oils

When changing over to PG oils – lubricating oils based on polyglycols – the materials used for seals, paints and inspection glasses should be known in order to reliably exclude any interaction between these and the lubricating oil.

To make use of the high performance of the Klüber PG oils right from the beginning and to avoid gear damage and its consequences, you should read our product information for the appropriate PG lubricating oil series carefully and follow the corresponding instructions.

With selected base oils and accordingly matched additives, PG oils are also suitable for producing lubricants such as the Klübersynth UH1 6 oils for use in the food and pharmaceutical industries. However, in order to avoid a nullification of the food law certification of such lubricants, food grade lubricants must never be mixed with non-certified lubricants.

The required product information is available on **www.klueber.com** or can be requested to be sent by mail free of charge.

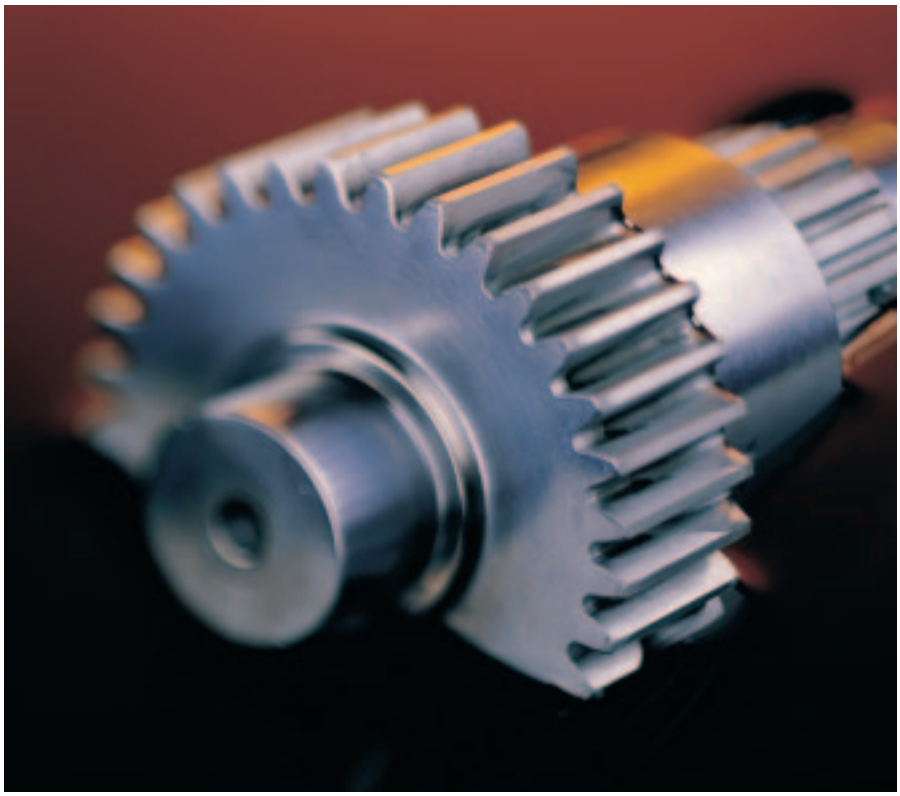
Changeover to ester oils

Klüberbio CA 2 and
Klübersynth GEM 2 oils

When changing over to ester-based Klüberbio lubricating oils, the materials used for seals, paints and inspection glasses should be known in order to reliably exclude any interaction between these and the lubricating oil.

To make use of the special characteristics of the Klüberbio oils right from the beginning and to avoid gear damage and its consequences, you should read our product information for the appropriate Klüberbio oils carefully and follow the corresponding instructions.

The required product information is available on **www.klueber.com** or can be requested to be sent by mail free of charge.



How to proceed with oil changes

The changeover from mineral oil to synthetic oil should be performed with utmost care. It might perhaps be not enough to only drain off the used mineral oil and refill new synthetic oil.

Particularly when dealing with older gear units, it can be assumed that oil residues have collected in the gearbox, in oil pipings etc., which may be dissolved and separated by all types of synthetic oils.

If such residues are not removed, they may lead to gear damage during later operation. Oil pipings and filters will be clogged, seals, pumps and gears will get damaged. In order to avoid damage, you should first drain the oil at operating temperature, if possible, and then flush the gear or closed lubricating system using the synthetic oil type to be filled later. When switching over to food grade lubricants or bio-lubricating oils such as Klüberoil 4 UH1- … N oils or Klüberbio oils, the flushing process should be repeated once or twice in order to ensure that all mineral oil residues, which might affect the special characteristics (food grade safety, rapid biodegradability) of such lubricating oils, have been removed.

The synthetic oil used for flushing must not be used for lubrication afterwards, however, it may be kept and used for further flushing processes. Note that prior to filling in the fresh synthetic oil, the oil filter(s) and filter inserts need to be exchanged.

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9.3.1 e
Edition 03.08, replaces edition 04.05

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- subsidiaries in over 30 countries
- more than 1,700 staff
- products available worldwide

Klüber Lubrication offers expert tribological solutions.
Through our worldwide presence, we meet customers' needs reliably and on time.
We supply tailor-made speciality lubricants to customers from nearly all branches of industry and around the world – oils, greases, bonded coatings, pastes and many more. Over 75 years of experience, industry-specific know-how, and exceptional test facilities all help to optimise our solutions.

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