

your global specialist

## Economical lubrication for every component

Specialty lubricants for machine tools





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# Think economics from the start

Klüber Lubrication has the right solution for manufacturers and operators of machine tools.

## **Make the right lubrication decision in the design phase**

The machines you manufacture are expected to run efficiently, flexibly and continuously precisely producing – without breakdowns and unplanned downtimes. Klüber Lubrication supports you in meeting these requirements with lubricants suited to your needs. Benefit from our expertise during the machine design phase: the decisions you make during the development process determine about 70-85 % of the total machine life-cycle costs. Operators will appreciate it if you consider their expectations right from the start, including the right lubricant. We can offer you a product portfolio covering the complete range of operator requirements.

The lubricant is a crucial element for excellent machine tool performance and increased efficiency.

Specialty lubricants from Klüber Lubrication – most of them based on synthetic oils – will often not only lead to extended relubrication or oil change intervals, but enable lifetime lubrication at highest or continuously high loads as well.

## **A test house that is unrivalled worldwide**

When developing and testing our specialty lubricants we use the yardstick of your specific requirements. Our unique test facility offers more than 100 different test rigs for use by our experts. Many of these were developed at Klüber Lubrication for your specific testing requirements.

We enhance the significance of our tests with accompanying lubricant and surface analyses of test pieces and component specimens. After all, we know how important it is for you the lubricant demonstrates it will meet or even exceed the requirements at the testing stage.

The question whether we should rely on tried and tested, reliable products, or venture into new territory is settled in personal discussions with our customers.

## **Economic and efficient operation**

Operators have to find the best lubrication solution for their requirements if they want their machinery to be state-of-the-art in terms of lubrication engineering. We are pleased to advise you on extended maintenance intervals, lifetimes of machine components due to reduced operating temperatures or reduced external cost factors such as electrical energy.

If you have not used Klüber lubricants for your machine tools so far, our specialists will find a technically and economically convincing solution. A lubricant related solution such that the components of a machine tool operate both safely and precisely and you achieve more direct added value. For example, without additional rework costs due to wear of components and therefore also lubricant-related inaccurate positioning of workpieces or tools.

## **Global competence**

We are where you are. Our specialists will advise you wherever it is convenient for you. Consultations may focus on the selection of a suitable product, or the development of a solution tailored to your requirements.

“Made by Klüber Lubrication” stands for a consistent high quality level worldwide. We offer you products that are all made to the same high quality, legally compliant with the respective national regulations, no matter it is produced in Asia, Europe or the Americas.

# Lubrication of spindle bearings



Machine tool main spindles running at higher speeds enable even greater machining rates and shorter machining times per workpiece. However, these high speeds result in demanding operating conditions for rolling bearings. For example, spindle bearings are required to operate at high speed factors ( $n \times dm$ ) and run with reduced friction to keep bearing temperature low, and the bearings have to carry both radial and axial loads. Naturally, premature bearing failure should be prevented.

## Reliable at high speeds

ISOFLEX NBU 15 has been the yardstick for reliable machine tool spindle operation for decades. We have developed a new generation of high-speed greases, the Klüberspeed series, for speed factors up to  $2,500,000 \text{ mm} \times \text{min}^{-1}$ .

Our lubricants are made to match precisely the requirements of the machine tool industry. They protect machine components effectively against corrosion to increase their

service life, not least due to their excellent adhesion. They are resistant to water and cutting fluids. We are pleased to discuss and recommend the right lubricant from our product range, whether you are dealing with speed factors below  $600,000 \text{ mm} \times \text{min}^{-1}$  with high loads, or with those exceeding  $2,500,000 \text{ mm} \times \text{min}^{-1}$  for high-speed machining.

## Grease lubrication

There are now high-speed greases that can handle speeds previously only possible with oils. Speed factors of less than  $1,000,000 \text{ mm} \times \text{min}^{-1}$  have not posed a problem with tried-and-tested Klüber Lubrication products for years.

With highly advanced special greases, even speed factors above  $2,000,000 \text{ mm} \times \text{min}^{-1}$  can be accommodated. The advantage of grease lubrication is that it allows simpler machine design and easier assembly of the machine tool spindle. Our spindle bearing greases have proven to provide for-life lubrication in many practical applications.

Lubricating greases for high-speed rolling bearings are usually based on low-viscosity synthetic base oils with a few different but highly specialised thickeners.

## Oil lubrication

For even higher speed factors, oil lubrication is often used. You can encounter oil lubrication with the variants oil mist with the help of an atomizer and venturi nozzle, oil-air systems with transport of oil droplets with compressed air or oil jet lubrication with greater cooling effects.

Oil-air lubrication is most common. It is a minimum-quantity lubrication technique enabling extremely low oil consumption with tried-and-tested Klüber Lubrication products. It requires, however, the provision of compressed air, which incurs additional costs.

Experience has shown that a synthetic oil with elevated viscosity index delivers the most promising results in a viscosity class that provides the most fitting operating viscosity.

### Hint:

Please ask Klüber for support if questions arise like nozzle diameter and distance as well as spraying angle, target area, velocity to penetrate the surrounding air layer, quality of oil and air.

# How to select the right lubricating grease



## The speed factor (n × dm)

The speed factor for rolling bearings is given by the bearing speed n in [min<sup>-1</sup> or rpm] and the mean bearing diameter dm in [mm]. Moreover, the speed factor of a grease depends to a high degree on the base oil type, base oil viscosity, thickener and the type of rolling bearing to be lubricated.

## Grease quantity

For lifetime lubrication, the grease quantity is typically determined by calculating the free bearing space. However, spindle bearings should only be partly filled (for guidance: approx. 20% of the free space, in extreme cases only up to approx. 10%), while different cage and bearing designs exist. Hence, calculations of the bearing free space are an approximation.

Formula for calculating free bearing space acc. to work-sheet 3 by the GfT (German Society for Tribology):

$$V \approx \left[ \frac{\pi}{4} \times B \times (D^2 - d^2) \times 10^{-9} - \frac{G}{7800} \right] m^3$$

The following applies:

V = free bearing space, d = bearing bore diameter [mm]  
 D = bearing outer diameter [mm], B = bearing width [mm]  
 G = bearing weight [kg]

If you wish to determine the free bearing space with full accuracy, you will have to turn to the bearing manufacturer. Then you can calculate the corresponding grease volume as a percentage of the free bearing space with the diagram shown below.

Both excessive and insufficient lubrication can have negative operational effects: too much grease, for example, can lead to higher starting and running torque or, in high-speed bearings, to overheating.

The following should be observed:

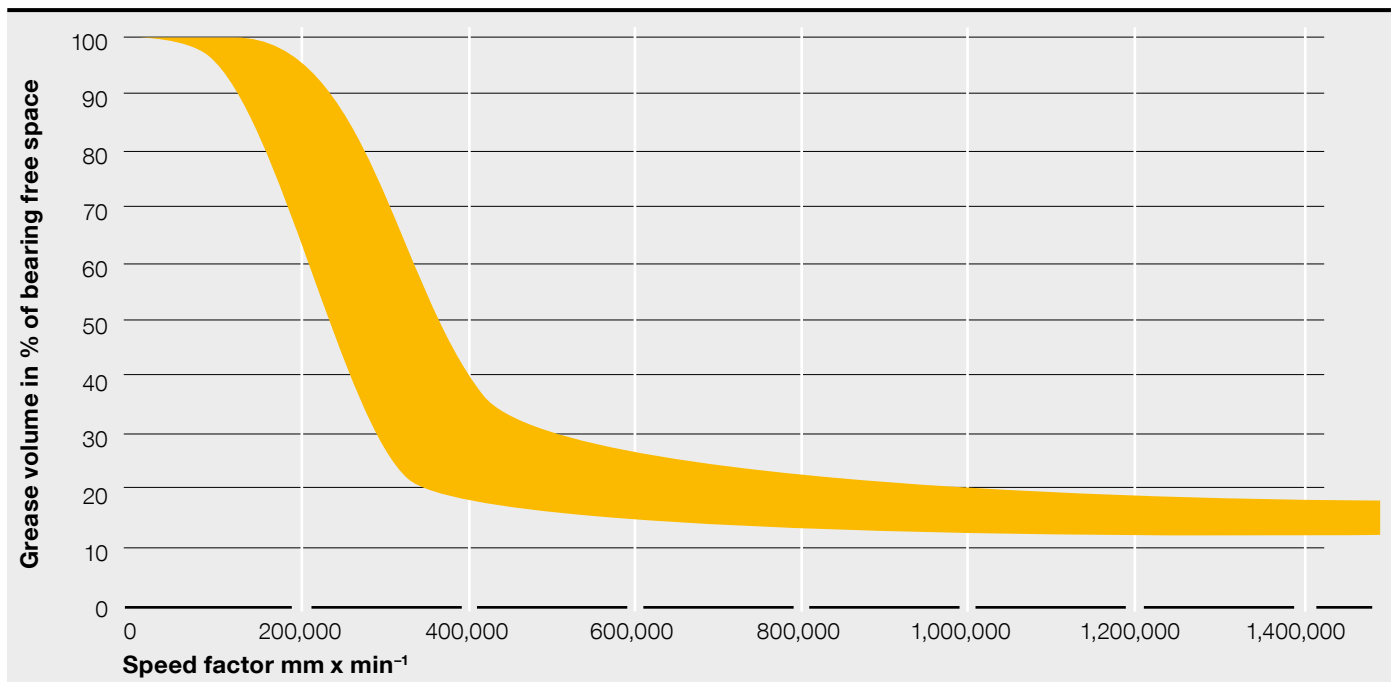
Low operating temperature equals long grease and bearing life  
 High-speed greases should not run at more than 80 °C, whereas a bearing temperature of 40–50 °C is desirable.

## Grease distribution run

Running-in of high-speed bearings is necessary in order to achieve a grease distribution that allows for operation at high speeds. Moreover, greased bearing performance can be enhanced by optimising the running-in procedure.

### Hint:

Please make sure to observe any information on spindle running-in provided by the spindle or bearing manufacturers.



The yellow area shows the grease volume in % of the bearing free space as a function of the speed factor

# Lubrication of holding and positioning devices: chuck systems and gears in rotary tables

It is important to make sure the correct lubricant is chosen for lubrication of the work holding chuck. After all, the principal task is to generate a constant defined clamping force for a high number of clamping cycles. If the clamping force decreases, tools or workpieces may come loose. This applies to all types of chuck designs – scroll, cam or spiral chucks.

Lubricating pastes have proven to be very useful in these applications as they adhere well to the friction points and provide sufficient lubricity even when applied as a very thin film. Most pastes have low-viscosity base oils, a thickener and additional solid lubricant particles.

Tests performed with our pastes ALTEMP Q NB 50 and Klüberpaste ME 31-52 are proven to offer constant clamping forces over a large number of clamping tests, with low scatter of the results.

ALTEMP Q NB 50 and Klüberpaste ME 31-52 can also be used when installing friction connections such as annular springs and clamping sleeves, as well as positive connections such as bearing seats and profile guides.

## Hint:

Friction between the moving components of the clamping system can be reduced by applying a thin layer of paste – just thick enough to cover the surface.

For precise positioning of the workpiece - horizontally or vertically - there can be positioning tables installed with and without indexing. Thus, multiple setups are eliminated and work efficiency increases.

Especially in milling machines, rotary tables can be found in combination with linear motion units (see own chapter). Typically worm gears are used to drive these tables.

As these driving units are closed, oil lubrication is mostly applied. In order to have a reliable and longlasting accurate performance we prefer to fill in polyglycol based oils like the ones of the Klübersynth GH 6-range.



Steering a worm gear driven rotary table relies also on a stable lubrication of the bearings as well as proven compatibility with all seals..

# Lubrication of drilling and milling head gear units

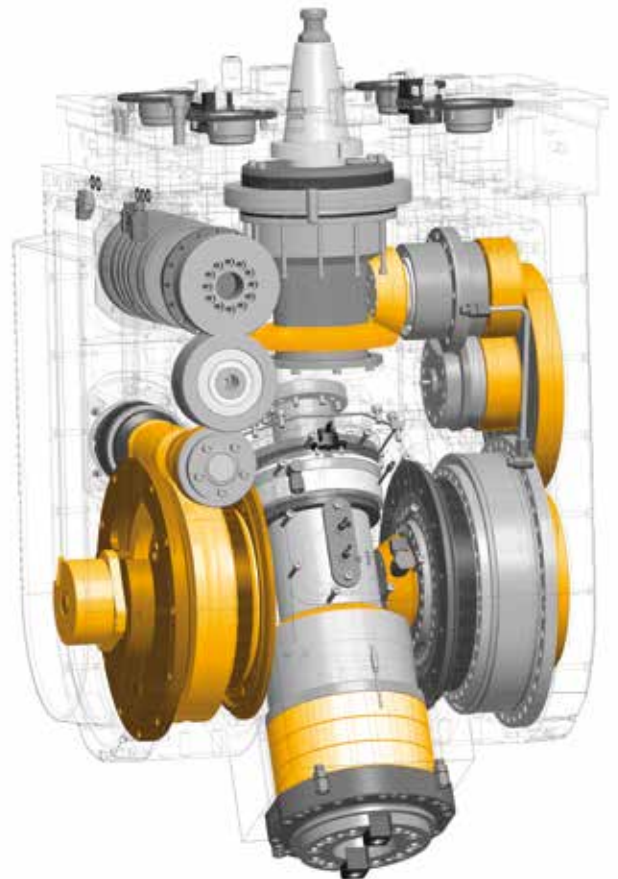
Drilling and milling head gears play a major part in transmitting the substantial forces and torques from the machine tool main spindle to the cutting tool. They are operated cyclically and at high speeds. Some of them run at peripheral speeds of more than 20 m/s.

The most important requirements to be met by these components are: reliable operation combined with long component life, and high peripheral speeds and high acceleration. Most units incorporate spur, bevel or spiral bevel gears. We are pleased to discuss with you optimised lubrication with you during the gearbox design stage. Depending on the individual technical requirements, different lubricants may prove preferable.

We offer you lubricants which

- are capable of dealing with strong acceleration and high peripheral speeds,
- have good adhesion and pressure absorption capacity for good wear protection,
- are resistant to water and cutting fluids for reliable operation,
- offer effective corrosion protection for longer component life.

In many cases, gear lubrication for drilling and milling heads will use the same grease as for spindle bearing lubrication since the bearings and gears normally share a common space. The use of the same or at least similar products offers the additional benefit of avoiding product confusion or lubricant incompatibility problems. Of course we see the aspect that grease lubrication enables simpler designs compared to oil lubrication.



With lubricants made by Klüber Lubrication, you can lubricate various parts of milling head gear units

## Hint:

Please remember to perform a grease distribution run and, if necessary, top up with lubricant. We would recommend using the same conditions as for the spindle bearings (page 4/5). The degree of grease filling can reach up to 70 to 80% depending on the particular application. It is important to avoid any leakages.

# Lubrication of linear motion units

In machine tools, workpieces and tools are positioned by means of linear motion units that convert a rotary motion to a linear one and thus basically enables multi-axle machine tools. These linear motion units consist of a variety of different components, of which the main components are:

1. Antifriction guideway as stationary linear rails with three different types:
  - a. Ball rail guides for a higher load capacity and rigidity as well as the optimum in accuracy.
  - b. Cam roller guides when a higher linear speed is needed.
  - c. Linear bushings as part of a hydrostatic e.g. Vee-form slideway provides an average load capacity, rigidity and accuracy, but are usually the least expensive. Here the mounting position defines the oil viscosity when not using a fluid grease.
2. Movable screw nut or slider and work or rotary table.  
The screw nut with recirculating balls or rollers or the slider is driven by the linear drive unit and guided by the guideway in order to move in turn the work or rotary table with the load.
3. Linear drive units with three different types:
  - a. Screw spindle drives with a fixed and a floating bearings at front and end.
  - b. Toothed belts that are operated by a pulley.
  - c. Linear motors to drive directly the work or rotary table.

The specific requirements to be met by these components are taxing. They are expected to run with maximum precision, reliability and smoothness. They also have to cope with high speeds, acceleration and vibrations.

Specialty lubricants made by Klüber Lubrication support your components in meeting these requirements. Furthermore they protect against wear also when subject to micro-movements, and due to reduced friction they facilitate machine starting. They provide high-performance corrosion protection, a good demulsifying ability, and a high resistance to media. In a contaminated environment, they provide additional sealing. They are compatible with common used plastics and elastomers as well as with other lubricants.

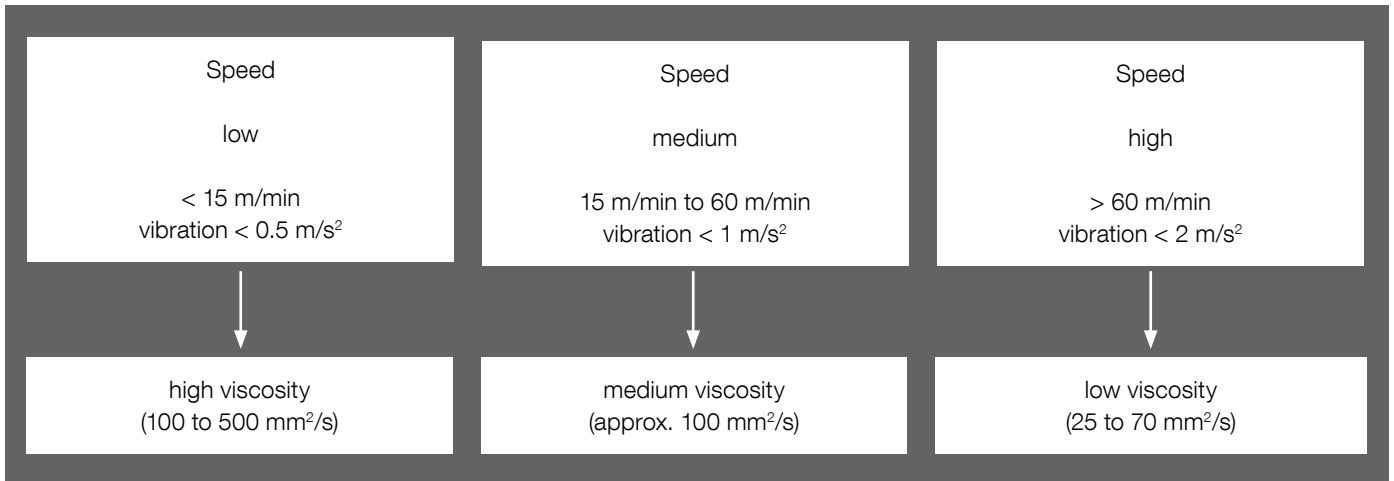


Klüber Lubrication offers the right lubricant for linear motion units of different sizes and types.





### Speed-viscosity ratio



Overview of tried-and-tested base oil viscosities for various linear speed conditions.

Each lubricant has a different composition selected to deal with varying complex requirements. Depending on the speeds and loads, different base oil viscosities are required. Different thickeners provide characteristics such as good adhesion to metal surfaces, good resistance and/or good damping. There are different lubricants with varying compositions to match every type of application.

Generally speaking, in order to prolong relubricating intervals a lubricating grease is preferred instead of a lubricating oil or fluid grease. This is even more valid when the linear motion unit is designed with a spindle drive and a screw nut a.o. due to the sealing effect.

**Hint:**

We recommend cleaning the guideway or ball screw using a lint-free cloth. The relubrication quantity is approx. 50% of the initial lubricant volume. As a rule, it is better to relubricate more often, but with smaller quantities.

Initial greasing is normally done by the OEM. Relubrication with a softer grease is then done by the operator, using centralised lubrication systems or lubricant dispensers. It is therefore vital, that the lubricants used for initial lubrication and relubrication be compatible with one another.

Stick-slip between surfaces of guideway units is particularly likely at slow speeds, when starting or slowing down, and at high surface pressure. In these cases, friction forces are strongest and may lead to «chatter marks» on the machined workpiece. To prevent stick-slip, we propose a lubricating grease containing a well defined ratio of solid lubricants as the solid lubricant particles contained are set in the surfaces of the guideway units, the contact ratio is increased and friction reduced.

Lubrication is even more effective when supplemented by e.g. high-quality LAMORA D slideway oils.

# Greases for the lubrication of spindle bearings

Application	Speed factor <sup>1)</sup> $n \times d_m$ [min <sup>-1</sup> x mm], approx.	Product	Base oil	Thickener	Corrosion protection (EMCOR test according to DIN 51802)
<b>Bearings in indirectly driven spindles</b>					
Spindle bearings with medium speeds	600,000	ISOFLEX TOPAS NB 152	Synthetic hydrocarbon oil	Barium complex soap <sup>2)</sup>	0
Spindle bearings with high speeds	1,600,000	ISOFLEX NBU 15	Ester oil/ synthetic hydrocarbon oil/mineral oil	Barium complex soap <sup>2)</sup>	≤ 1
Spindle bearings with very high speeds	2,500,000	Klüberspeed BF 72-22	Ester oil/ synthetic hydrocarbon oil	Polyurea	≤ 1
Spindle bearings with very high speeds	2,100,000	Klüberspeed BF 72-23	Ester oil/ synthetic hydrocarbon oil	Polyurea	≤ 1
<b>Bearings in directly driven spindles</b>					
Spindle bearings of motor spindles and/ or high loads	1,450,000	Klüberquiet BQ 72-52	Ester oil/ synthetic hydrocarbon oil	Polyurea	≤ 1
Spindle bearings of motor spindles and/or high temperatures	2,000,000	Klüberquiet BQ 74-73 N	Ester oil/ synthetic hydrocarbon oil	Polyurea	≤ 1

<sup>1)</sup> Speed factors are guide values which depend on the type and size of the rolling bearing and the local operating conditions, which is why they have to be confirmed in tests carried out by the user in each individual case.

<sup>2)</sup> Klüber Lubrication barium complex soaps have been registered as ELINCS substances for many years and are REACH-registered already today, ensuring they are fit for the future. Upon toxicological analysis, the special soap was rated as not dangerous for human health and the environment.

	<b>Worked penetration DIN ISO 2137 [0.1 mm]</b>	<b>Base oil viscosity DIN 51562 [mm<sup>2</sup>/s] at 40 °C (104 °F), approx.</b>	<b>Base oil viscosity DIN 51562 [mm<sup>2</sup>/s] at 100 °C (212 °F), approx.</b>	<b>Benefits and notes</b>
	265 to 295	100	14.5	<ul style="list-style-type: none"> <li>– Long component life due to high load-carrying capacity and corrosion protection</li> <li>– Long-term or for-life lubrication due to good resistance to water, cooling lubricants and ageing</li> </ul>
	265 to 295	21	4.5	<ul style="list-style-type: none"> <li>– Long component life due to high load-carrying capacity and corrosion protection</li> <li>– Long-term or for-life lubrication due to good resistance to water, cooling lubricants and ageing</li> <li>– Tried and tested for many years, especially in angular contact ball bearings</li> <li>– Numerous OEM recommendations</li> </ul>
	250 to 280	22	5	<ul style="list-style-type: none"> <li>– Longer component life due to good corrosion protection, running-in properties and grease distribution in the bearing</li> <li>– Good water and ageing resistance</li> <li>– Especially for angular contact ball bearings</li> </ul>
	220 to 250	22	5	<ul style="list-style-type: none"> <li>– Longer component life due to good corrosion protection, running-in properties and grease distribution in the bearing</li> <li>– Good water and ageing resistance</li> <li>– Especially for angular contact ball bearings</li> <li>– High consistency, particularly for vertical mounting positions</li> </ul>
	240 to 270	55	9	<ul style="list-style-type: none"> <li>– Superior performance with higher axial loads</li> <li>– High upper service temperature enables long lubricant oil and thus component life time</li> <li>– During life time the stable consistency contributes to stable grease behaviour</li> <li>– For the long-term and for-life lubrication of capped or sealed ball bearings</li> </ul>
	220 to 250	60	9.5	<ul style="list-style-type: none"> <li>– Wide service temperature range allows easy start even under difficult conditions</li> <li>– Longer component life due to good corrosion protection</li> <li>– For motor spindle bearings subject to elevated bearing temperatures, long-term or for-life lubrication</li> <li>– High consistency, particularly for vertical mounting positions</li> </ul>

## Oils for the lubrication of spindle bearings

Application	Product	Base oil	Copper corrosion DIN EN ISO 2160, 24 h/100 °C (212 °F)	Viscosity DIN 51562 [mm <sup>2</sup> /s] at 40 °C (104 °F), approx.	Viscosity DIN 51562 [mm <sup>2</sup> /s] at 100 °C (212 °F), approx.
Spindle bearing oil	CONSTANT	Synthetic hydrocarbon oil	1-100	32	6.0
	OY 32 K				
	OY 46 K				
Spindle bearing oil	OY 68 K	Synthetic hydrocarbon oil	1-100	46	8.0
	Klüber Summit				
	HySyn FG 15				
	HySyn FG 32				
Spindle bearing oil	HySyn FG 46	Synthetic hydrocarbon oil	1-100	68	10.5
	HySyn FG 68				
	HySyn FG 15				
Spindle bearing oil	HySyn FG 32	Synthetic hydrocarbon oil	1-100	15	3.5
	HySyn FG 46				
	HySyn FG 68				
	HySyn FG 15				

Application	Product	Base oil	Purity class, ISO 4406	Viscosity DIN 51562 [mm <sup>2</sup> /s] at 40 °C (104 °F), approx.	Viscosity DIN 51562 [mm <sup>2</sup> /s] at 100 °C (212 °F), approx.
Spindle bearing oil, ultra-fine filtered	Klübersynth	Synthetic hydrocarbon oil	15/13/10	32	6
	FB 4-32				
	FB 4-46				
Spindle bearing oil, ultra-fine filtered	FB 4-68	Synthetic hydrocarbon oil	15/13/10	46	7.6
	FB 4-32				



#### Benefits and notes

- Good load-carrying capacity ensures smooth running
  - Long component life due to good corrosion protection
  - Long component life due to low steady-state temperature of bearing
  - Low lubricant costs due to good resistance to oxidation and ageing
- 
- Low change in viscosity with alternating temperatures increases efficiency
  - Good environmental compatibility due to low evaporation rate
  - High process stability, e.g. due to good foaming behaviour and demulsifying ability

#### Benefits and notes

- High oil purity: purity class 15/1310 acc. to ISO 4406
- Preferably for high-speed spindles (ISO VG 68 tested up to  $n \times d_m = 2,5 \cdot 10^6$  mm/min)

# Lubricants for clamping devices and for gear drives in rotary tables

Application	Product	Clamping force loss <sup>1)</sup> [%]	Base oil	Thickener	Solid lubricant	Four-ball wear test, welding load DIN 51350 pt. 04 [N]	Corrosion protection (EMCOR test) DIN 51802
Lubrication of work holding systems in machine tools	ALTEMP Q NB 50	< 15	Mineral oil	Barium complex soap <sup>2)</sup>	Inorganic	> 4,000	≤ 1
Lubrication of work holding systems in machine tools	Klüberpaste ME 31-52	< 10	Mineral oil	Calcium complex soap	Inorganic	> 4,000	≤ 1

<sup>1)</sup> Clamping force block KSP 160, 6 bar

<sup>2)</sup> Klüber Lubrication barium complex soaps have been registered as ELINCS substances for many years and are REACH-registered already today, ensuring they are fit for the future. Upon toxicological analysis, the special soap was rated as not dangerous for human health and the environment.

Application	Product	Base oil	Purity class, ISO 4406	Viscosity DIN 51562 [mm <sup>2</sup> /s] at 40 °C (104 °F), approx.	Viscosity DIN 51562 [mm <sup>2</sup> /s] at 100 °C (212 °F), approx.
Gears of rotary tables esp. worm gears	Klübersynth GH 6-220 (other viscosity classes depends on application)	Polyglycol	1	220	40



Worked penetra- tion DIN ISO 2137 [0.1 mm]	Base oil viscosity DIN 51562 [mm <sup>2</sup> /s] at 40 °C (104 °F), approx.	Base oil viscosity DIN 51562 [mm <sup>2</sup> /s] at 100 °C (212 °F), approx.	Benefits and notes
250 to 270	46	7	<ul style="list-style-type: none"> <li>- Improved economic efficiency of initial lubrication and relubrication due to good water- and media-resistance and hence long service life</li> <li>- Good wear and corrosion protection help to reduce assembly forces and screw torques and prevent tribo- and fretting corrosion</li> <li>- High pressure absorption capacity enables constant clamping forces and consequently ensures properly fixed tools or workpieces in machine tool chucks</li> <li>- Also available in NLGI 1 and as spray for easier re-lubricating in areas difficult to reach or constantly higher operating temperatures</li> </ul>
250 to 280	46	7	<ul style="list-style-type: none"> <li>- Reduced lubricant costs for initial and relubrication due to thin-film application</li> <li>- Good wear and corrosion protection help to reduce assembly forces and screw torques and prevent tribo- and fretting corrosion</li> <li>- High pressure absorption capacity enables constant clamping forces and consequently ensures properly fixed tools or workpieces in machine tool chucks</li> </ul>

Benefits and notes
<ul style="list-style-type: none"> <li>- Contributes to design with elevated efficiency ration resp. energy saving potential</li> <li>- shows with common used elastomers, e.g. rotary shaft shaft seals a proven compatibility</li> <li>- High scuffing protection and micropitting resistance</li> <li>- Numerous OEM recommendations</li> </ul>

# Greases for the lubrication of gears in drilling and milling heads

Application	Load-dependent max. circumferential speed in intermittent operation [m/s]	Product	Base oil	Thickener	Corrosion protection (EMCOR test) DIN 51802
Grease lubrication of gears in drilling and milling heads	< 4	Klübersynth G 34-130	Ester oil / synthetic hydrocarbon oil / mineral oil	Special calcium soap / polyurea	≤ 1
Grease lubrication of gears in drilling and milling heads	< 8	Klübersynth GE 46-1200	Polyalkylene glycol	Lithium soap	≤ 1
Grease lubrication of gears in drilling and milling heads	< 20	ISOFLEX NBU 15	Ester oil / synthetic hydrocarbon oil / mineral oil	Barium complex soap <sup>1)</sup>	≤ 1
Grease lubrication of gears in drilling and milling heads	> 20	ISOFLEX TOPAS NB 52	Synthetic hydrocarbon oil	Barium complex soap <sup>1)</sup>	0
Grease lubrication of gears in drilling and milling heads	> 20	ISOFLEX TOPAS NB 5051	Synthetic hydrocarbon oil	Barium complex soap <sup>1)</sup>	≤ 1
Grease lubrication of gears in drilling and milling heads	> 20	Klüberspeed BF 72-22	Ester oil / synthetic hydrocarbon oil	Polyurea	≤ 1

<sup>1)</sup> Klüber Lubrication barium complex soaps have been registered as ELINCS substances for many years and are REACH-registered already today, ensuring they are fit for the future. Upon toxicological analysis, the special soap was rated as not dangerous for human health and the environment.

## Hint:

As the gears of drilling and milling heads can be lubricated with the same grease as the spindle bearing, gear lubrication is an additional application of these products, which may not be explicitly mentioned in the product information leaflet.

<b>Worked penetration DIN ISO 2137 [0.1 mm]</b>	<b>Base oil viscosity DIN 51562 [mm<sup>2</sup>/s] at 40 °C (104 °F), approx.</b>	<b>Base oil viscosity DIN 51562 [mm<sup>2</sup>/s] at 100 °C (212 °F), approx</b>	<b>Benefits and notes</b>
355 to 385	130	16	<ul style="list-style-type: none"> <li>– Good protection against corrosion for long component life</li> <li>– Good resistance to water and ageing, long-term lubrication</li> <li>– Low consistency allows application by means of automatic metering systems</li> </ul>
400 to 430	120	20	<ul style="list-style-type: none"> <li>– Longer component life due to good load-carrying capacity</li> <li>– Longer component life due to good wear protection (FZG &gt; 12)</li> <li>– Low consistency allows application by means of automatic metering systems, e.g. for spiral bevel gears</li> </ul>
265 to 295	21	4.5	<ul style="list-style-type: none"> <li>– Longer component life due to good load-carrying capacity</li> <li>– Good resistance to water and ageing, long-term lubrication</li> <li>– Tried and tested for many years</li> </ul>
265 to 295	30	6	<ul style="list-style-type: none"> <li>– Longer component life due to good load-carrying capacity and corrosion protection</li> <li>– Good resistance to water and ageing, long-term or for-life lubrication</li> </ul>
385 to 415	30	6	<ul style="list-style-type: none"> <li>– Dynamically light grease for high accelerations, e.g. for spiral bevel gears</li> <li>– Longer component life due to corrosion protection</li> <li>– Good resistance to water and ageing, long-term or for-life lubrication</li> </ul>
250 to 280	22	5	<ul style="list-style-type: none"> <li>– Longer component life due to good corrosion protection, running-in properties and good grease distribution in the gear</li> <li>– Good resistance to water and ageing, long-term lubrication</li> </ul>

# Corrosion protection

## Anticorrosion fluid with double effect

Application	Product	Corrosion protection properties of oils DIN ISO 7120, steel 24 h/60 °C (140 °F)	Base oil	Thickener
For intermediate corrosion prevention or enhancing protecting and lubricating effect of given lubricants esp. on steel surface	Klübersynth BZ 44-4000	No rust	Synthetic hydrocarbon oil/mineral oil	Lithium soap

## Anticorrosion oil

Application	Product	Fog test, FTMS 791C-4001.3, NaCl solution 5 %, 35 °C (95 °F)/72 h, based on DIN 51358, Degree of corrosion	Base oil	Kinematic viscosity, DIN 51562 pt. 01, [mm <sup>2</sup> /s] at 40 °C (104 °F), approx.
For intermediate corrosion prevention or enhancing protecting and lubricating effect of given lubricants esp. on steel surface	Klübersynth MZ 4-17	≤ 1	Synthetic hydrocarbon oil/ester oil	20

### Hint:

When using one of these anticorrosion products as an intermediate corrosion preventing agent and afterwards a compatible lubricating grease is applied then you can save the washing step!



**Benefits and notes**

- Longer component life due to good resistance to water and corrosion protection
- Compatible with many lubricating greases
- Increasing the given corrosion protecting as well as lubricating effect with matching additives
- Proven preventive effect against False Brinelling failures

**Benefits and notes**

- Good corrosion protection, also when exposed to salt water
- No residue formation, no gumming but solving effect of old residues
- Free from solvents
- Compatible with lubricants, also applicable for initial lubrication, e.g. in linear guides
- Also available as a spray

# Greases for the lubrication of spindle drives and guideway units

Application	Linear speed [m/min]	Product	Base oil	Thickener	Worked penetration DIN ISO 2137 [0.1 mm]
Initial lubrication	< 15	MICROLUBE GL 262	Mineral oil	Special lithium soap	265 to 295
Initial lubrication	15 – 60	Klüberplex BEM 34-132	Synthetic hydrocarbon oil/ mineral oil	Special calcium soap	265 to 295
Initial lubrication	15 – 60	Klüberplex BE 31-102	Mineral oil	Special calcium soap	265 to 295
Initial lubrication	> 60	ISOFLEX NBU 15	Ester oil/ synthetic hydrocarbon oil/ mineral oil	Barium complex soap <sup>1)</sup>	265 to 295

<sup>1)</sup> Klüber barium complex soaps have been registered as ELINCS substances for many years and are REACH-registered already today, ensuring they are fit for the future. Upon toxicological analysis, the special soap was rated as not dangerous for human health and the environment



	Base oil viscosity DIN 51562 [mm <sup>2</sup> /s] at 40 °C (104 °F), approx.	Base oil viscosity DIN 51562 [mm <sup>2</sup> /s] at 100 °C (212 °F), approx.	Benefits and notes
	280	20	<ul style="list-style-type: none"> <li>- Especially for high loads and vibrations</li> <li>- Long relubrication intervals due to good wear protection</li> <li>- Higher consistency for vertical mounting positions.</li> <li>- For relubrication MICROLUBE GL 261 with a softer consistency</li> <li>- Relubrication via grease nipple/grease gun</li> </ul>
	130	16	<ul style="list-style-type: none"> <li>- Longer component life due to very good tribocorrosion protection, even when exposed to micro-movements</li> <li>- Long relubrication intervals due to good wear protection</li> <li>- Longer service life due to good media resistance</li> <li>- Relubrication via grease nipple/grease gun</li> </ul>
	100	12	<ul style="list-style-type: none"> <li>- Tried and tested for many years</li> <li>- Longer component life due to good wear protection and media resistance</li> <li>- Longer service life due to good sealing effect and adhesion</li> <li>- Relubrication via grease nipple/grease gun</li> </ul>
	21	4.5	<ul style="list-style-type: none"> <li>- Smooth running effect even under difficult conditions, therefore lower increase of temperature</li> <li>- Longer component life due to good protection against wear and corrosion</li> <li>- Longer service life due to high resistance to water and cooling lubricants</li> <li>- Product streamlining because also suitable for spindle bearings, gears in drilling and milling heads</li> <li>- Relubrication via grease nipple/grease gun</li> </ul>

# Greases for the lubrication of spindle drives and guideway units

Application / requirement	Linear speed [m/min]	Product	Base oil	Thickener	Worked penetration DIN ISO 2137 [0.1 mm]
Relubrication via central lubrication systems/lubricant dispenser	< 15	MICROLUBE GL 261	Mineral oil	Special lithium soap	310 to 340
Relubrication via central lubrication systems/lubricant dispenser	< 15	Klüberlub BE 71-501	Mineral oil	Polyurea/ solid lubricant	310 to 340
Relubrication via central lubrication systems/lubricant dispenser	< 15	MICROLUBE GB 0 MICROLUBE GB 00	Mineral oil	Lithium soap/ silicate	355 to 385 430 to 475
Relubrication via central lubrication systems/lubricant dispenser	15–60	Klüberplex BEM 41-141	Synthetic hydrocarbon oil/mineral oil	Special lithium soap	310 to 340
Relubrication via central lubrication systems/lubricant dispenser	> 60	ISOFLEX TOPAS NB 5051	Synthetic hydrocarbon oil	Barium complex soap <sup>1)</sup>	385 to 415

<sup>1)</sup> Klüber barium complex soaps have been registered as ELINCS substances for many years and are REACH-registered already today, ensuring they are fit for the future. Upon toxicological analysis, the special soap was rated as not dangerous for human health and the environment.



Base oil viscosity DIN 51562 [mm <sup>2</sup> /s] at 40 °C (104 °F), approx.	Base oil viscosity DIN 51562 [mm <sup>2</sup> /s] at 100 °C (212 °F), approx.	Benefits and notes
290	20	<ul style="list-style-type: none"> <li>- Longer service life due to very good wear protection</li> <li>- For high loads or micro-movements</li> <li>- Also for initial lubrication</li> </ul>
490	32	<ul style="list-style-type: none"> <li>- Longer service life due to very good wear protection</li> <li>- For high loads or micro-movements</li> <li>- Also for initial lubrication</li> </ul>
590 (calculated) 700 (calculated)	31.5 (calculated) 35 (calculated)	<ul style="list-style-type: none"> <li>- Longer service life due to very good wear protection</li> <li>- For high loads or micro-movements</li> <li>- Also for initial lubrication</li> </ul>
130	14	<ul style="list-style-type: none"> <li>- Long service life due to good ageing resistance</li> <li>- Longer service life due to good wear protection, even when exposed to vibrations</li> <li>- Longer availability due to good corrosion protection</li> <li>- Also for initial lubrication</li> </ul>
30	6	<ul style="list-style-type: none"> <li>- Smooth running even under difficult conditions, therefore lower increase of temperature</li> <li>- Longer component life due to good corrosion and wear protection</li> <li>- Longer service life due to good adhesion as well as resistance to water and cooling lubricants</li> <li>- Also for initial lubrication</li> </ul>

# Oils and fluid greases for the lubrication of guideway profile or flat rails and of slideways

## Special oils for continuous lubrication

Application	Product	Base oil	ISO viscosity grade, DIN 51562 pt. 01, ISO VG
Antifriction guideways	Klüberoil	Mineral oil	
	GEM 1-68 N		68
	GEM 1-100 N		100
	GEM 1-220 N	220	
Slideways	LAMORA	Mineral oil	
	D 68		68
	D 220		220

## Fluid greases for continuous lubrication

Application / requirement	Product	Base oil	Thickener	Worked penetration DIN ISO 2137 [0.1 mm]
Antifriction guideways	MICROLUBE GB 00	Mineral oil	Lithium soap/ silicate	430 to 475
Slideways	Centoplex GLP 500	Mineral oil	Lithium soap	700 to 800 acc. to Klein
	Isoflex Topas NB 5051	Synthetic hydrocarbon oil	Barium complex soap	385 to 415



**Benefits and notes**

- CLP gear oils with good wear and corrosion protection
- Viscosity depending on speed
- Also applicable as circulation oil

- CGLP slideway oils with good demulsifying effect on cooling lubricants, also proven for plastic guideways
- Viscosity depending on vertical (D 220) or horizontal (D 68) installation

Base oil viscosity DIN 51562 [mm <sup>2</sup> /s] at 40 °C (104 °F), approx.	Base oil viscosity DIN 51562 [mm <sup>2</sup> /s] at 100 °C (212 °F), approx.	Benefits and notes
700 (calculated)	35 (calculated)	<ul style="list-style-type: none"> <li>- Longer service life due to very good wear protection</li> <li>- For high loads and/or micro-movements</li> <li>- Also for spindle drives and guideway units</li> </ul>
110	9	<ul style="list-style-type: none"> <li>- For lubrication via central lubrication systems/lubricant dispenser</li> <li>- Also for single line lubrication system designed for oils</li> </ul>
30	6	<ul style="list-style-type: none"> <li>- Smooth running even under difficult conditions, therefore lower increase of temperature</li> <li>- Longer component life due to good corrosion and wear protection</li> <li>- Longer service life due to good adhesion as well as resistance to water and cooling lubricants</li> <li>- Also for spindle drives and guideways units</li> </ul>





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