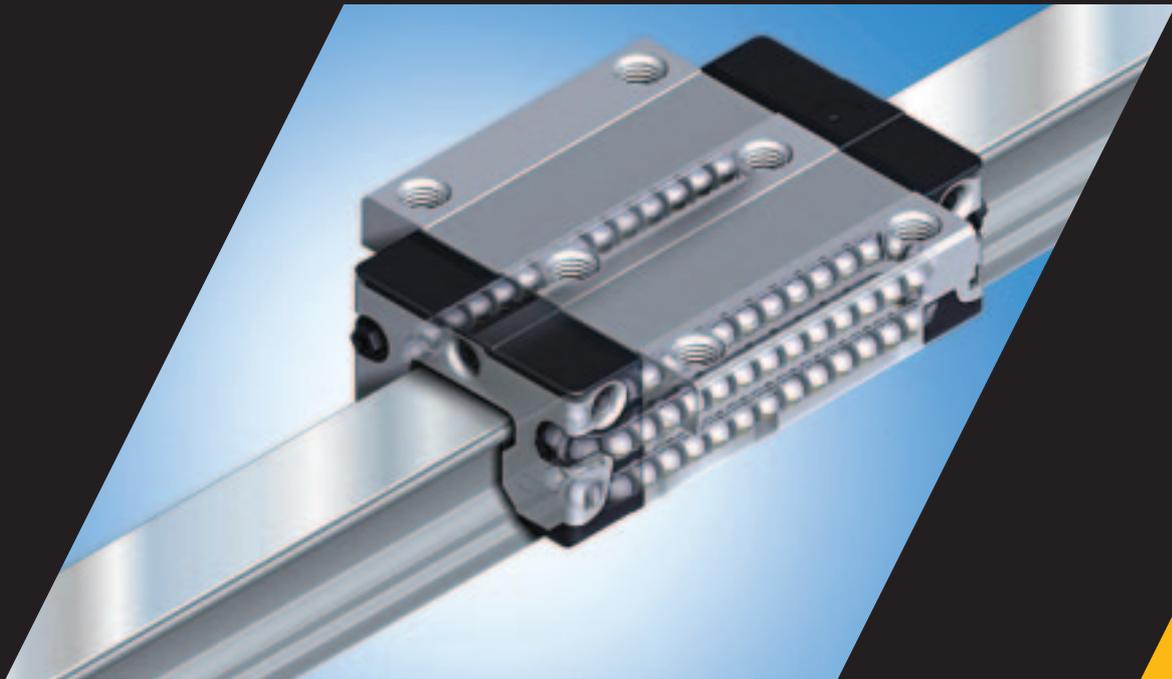


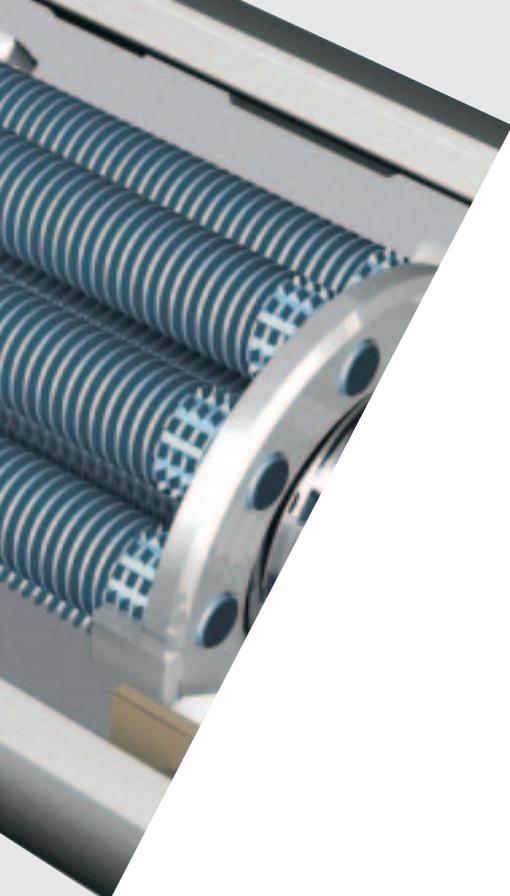
KLÜBER
LUBRICATION

Precision with Klüber Lubrication



Special lubricants ensure reliable,
productive and economical operation
of linear motion guides

Lubrication is our World



Contents

Page

Lubricants lined up for smooth operation	3
From plain bearings to load rollers: an overview of linear types	4
How lubricants must perform – and how to find the right one	5
Oil / fluid grease lubrication	6
Grease lubrication	8
Dry lubrication	10
Initial grease lubrication	11
Grease relubrication	12
Relubrication or lifetime lubrication?	12
Miscibility of thickeners	13
Miscibility of base oils	13
Product overview: Lubricating greases for linear motion guides and threaded spindles	14
Product overview: Fluid greases for linear motion guides and ballscrews	15
Product overview: Lubricating oils for linear motion guides and ballscrews	15
Request for Information	17
Technical Questionnaire	18

We would like to thank the companies Bosch Rexroth AG, THK, Schneeberger, SKF and SNR for kindly supporting us with pictures.

Lubricants lined up for smooth operation

It all sounds so simple in theory: A carriage is used to move a certain mass straight along a path, i.e. perform linear motion. It has rollers running in a grooved guide rail. In practice, however, this straightforward principle will soon reach its limits. Reliability, productivity and economy – they all depend on utmost precision!

Linear motion guides are found in machine tools, machining centres, manufacturing robots, measurement and control systems as well as in medical diagnostic scanners. Accurate straightness and evenness of all components is a prerequisite of their correct function. Other crucial factors are accurate positioning, repetitive accuracy and wear-free operation under high load, shock loading and short reciprocating movements. Quiet running is expected at high speed and acceleration as well as good resistance to radiation and aggressive media.

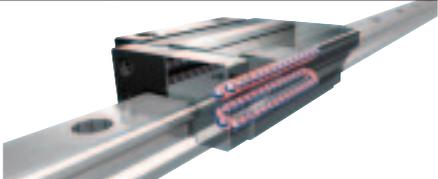
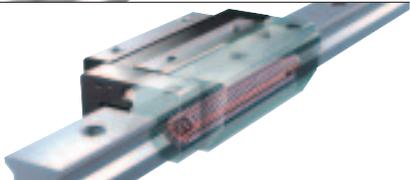
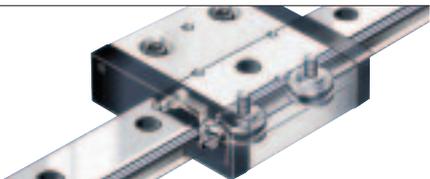
These are taxing requirements. As the field of automation is continuously developing, producing ever more linear drives and guideways, these requirements will continue to become yet more demanding – for the components as well as for the lubricants used.

This brochure aims to provide the reader with an overview of lubricating methods and hints for practice. It is to assist you to make the right lubricant selection, meeting common application criteria for the various components subject to difficult operating conditions. With special lubricants made by Klüber Lubrication, linear systems can

do their job over many years. Innovative developments help to attain longer relubrication intervals or even lifetime lubrication.

Thanks to our experience in the development and manufacture of lubricants, the know-how of our application engineers and consulting at our local sales offices we make selection of the right lubricant to optimise your linear motion guide or linear drive an easy task. To commence this process we request you complete the technical questionnaire on the final page of this brochure. As you will discover: Klüber Lubrication will bring even more precision to your technology!

From plain bearings to load rollers: an overview of linear types

Sliding motion	Rolling motion	Example
Linear guides and guidance systems		
Linear plain bearings / sliding bushes	Linear ball bearings / shaft guides, ball bushings	
Profiled rails with sliding layer	Profiled rails with recirculating balls	
	Profiled rails with recirculating rollers	
Flat guides / guide rails with sliding layer	Flat cage guides / longitudinal guides with balls, needles or rollers	
	Roller guides	
Drive systems		
Trapezoidal screw drives	Ball screw drives	
	Roller screw drives	
Combined drive and guidance systems		
Robots, linear tables, linear modules, tooth-and-rack guides, electrical lifting cylinders		

How lubricants must perform – and how to find the right one

The choice of lubricant has a strong impact on the service life and performance of linear motion guides. The consequence of a starved lubrication regime resulting in the development of tribocorrosion may be as severe as total component failure. To avoid this, we will provide you with the right lubricant, which must ensure the following:

- ❑ Lowest torque when starting up the system, i.e. under mixed-friction conditions
- ❑ Wear protection of the linear motion guide components
- ❑ Noise-dampening effect at high speeds
- ❑ Good corrosion protection when exposed to aggressive media
- ❑ Sealing effect protecting the components against contamination

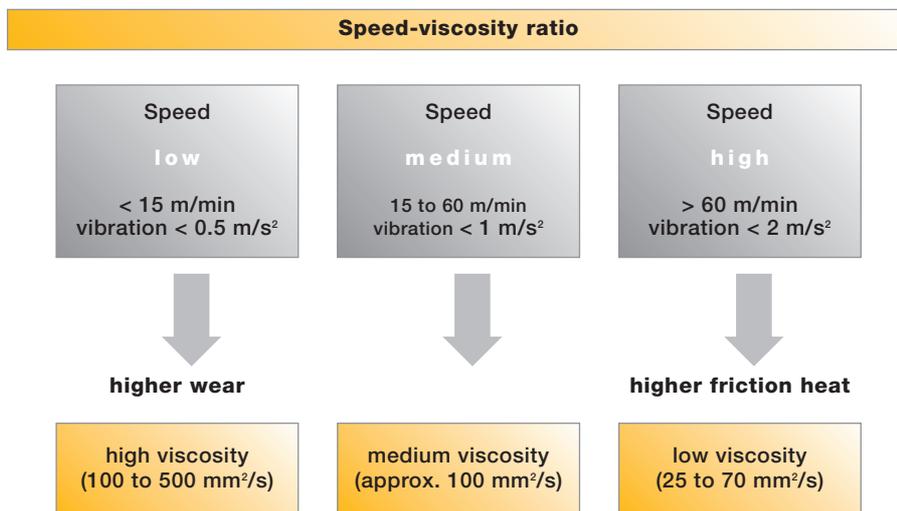
There are different design types of linear motion guides and ballscrews for differing applications and their varying requirements. Tribologically, one differentiates between sliding-contact and rolling-contact guideways (table 1). In complex linear systems as are found in handling gears, automation units and robots, a combination of guideways and drives are used to control in all three axes x,y,z. When choosing a lubricant for such applications, the lubrication point that is the most difficult under tribological aspects is taken as the yardstick. This may be, for instance, a vertically mounted component, a ballscrew (carrying a higher load than the profiled ball guideways in machine tools) or the presence of machine swarf or coolants. Whatever demands and influences exist, Klüber will be pleased to assist you with lubricant selection.

A suitable lubricant and all the know-how needed for each application

Klüber's self-image is not solely that of a developer, manufacturer and supplier of high-performance lubricants, but also of a specialist consultant who actively participates in the provision of individualised, customer-specific lubricant recommendations (offered as an additional service free of charge). This also includes support with the design and development of lubricant reservoirs for linear motion guides. Besides a wide range of oils and greases, Klüber Lubrication also offers "dry lubrication" technology solutions: Bonded coatings may be used to improve the sliding friction of linear guideway seals made of plastic or elastomers. Klüber will supply the lubricant chosen for your application in the type of container desired; special pack sizes or customer-labelling is also available on request.

Selecting the right viscosity

Based on our many years of experience, the following overview is to assist with the selection of tried-and-tested base oil viscosities for the various speed conditions.



Oil / fluid grease lubrication

Oil lubrication is often selected on equipment where other machine elements are lubricated in this manner via use of a centralised lubricating system.

Whilst fairly complex in design, this type of lubrication method offers nevertheless a number of benefits, provided adequate care is dedicated

	Linear type	Application / requirement	Selection criterion
Lube oil	all	Corrosion protection	
Lube oil	Rolling motion guides	Universal	high speed
Lube oil	Rolling motion guides	Universal	medium speed
Lube oil	Rolling motion guides	Universal	low speed
Lube oil	Rolling motion guides	Universal	low speed
Lube oil	Sliding motion guides	Universal	high and medium speed
Lube oil	Sliding motion guides	Universal	low speed
Lube oil	all	Food-processing and pharmaceuticals industries	
Lube oil	all	Rapidly biodegradable	

	Linear type	Application / requirement	NLGI class
Fluid grease	all	Universal, low speed	NLGI 00/000
Fluid grease	all	Universal, medium speed	NLGI 00
Fluid grease	all	Universal, high speed	NLGI 0/00
Fluid grease	all	Elevated temperatures	NLGI 0/00
Fluid grease	all	High load / micromovements / vibration	NLGI 00/000
Fluid grease	all	High load / micromovements / vibration	NLGI 0
Fluid grease	all	Food-processing and pharmaceuticals industry	NLGI 00
Fluid grease	all	Rapidly biodegradable	NLGI 0/00

to the aspect of sealing. Lubricant supply is continuous, which effectively prevents lubricant starvation and consequently component failure. The oil flow rate is normally quite high, which

means that heat is dissipated from the friction point and contaminants are reliably removed.

NOTE: When lubricating linear motion guides with oils, please bear in mind

that the oil tends to flow from the linear guide system far more rapidly than grease. To combat this eventuality a continuous supply of oil provided to the upper part of the guide is advisable.

Product	Remarks
Klübersynth MZ 4-17	good compatibility with lubricants, also for initial lubrication
Klüberoil GEM 1-46 N	CLP gear oil with good wear and corrosion protection
Klüberoil GEM 1-68 N	CLP gear oil with good wear and corrosion protection
Klüberoil GEM 1-220 N	CLP gear oil with good wear and corrosion protection
Klüberoil GEM 1-46 N	CLP gear oil with good wear and corrosion protection
LAMORA D 68	CGLP slideway oil with good demulsifying behaviour towards cooling lubricants, also tried and tested with plastic guides
LAMORA D 220	CGLP slideway oil with good demulsifying behaviour towards cooling lubricants, also tried and tested with plastic guides
Klüberoil 4 UH1-68 N	registered as NSF H1, good ageing and wear protection, also available in other viscosities
Klüberbio C 2-46	low water hazard ensures unharmed environment, at the same time high performance, also available with ISO VG 100 as Klüberbio CA 2-100

Product	Remarks
MICROLUBE GB 00	with high-pressure and antiwear additives, without solid lubricants
CENTOPLEX GLP 500	good pressure absorption capacity
ISOFLEX TOPAS NCA 5051	low base oil viscosity for low friction and smooth running
ISOFLEX TOPAS NCA 5051	synthetic base oil with good resistance to ageing
MICROLUBE GB 00	with high-pressure and antiwear additives, without solid lubricants
MICROLUBE GB 0	with high-pressure and antiwear additives, without solid lubricants
Klübersynth UH1 14-1600	USDA H1 approval, good corrosion and wear protection
Klüberbio GM 32-2200	low water hazard ensures unharmed environment, at the same time good wear protection and resistance to water

Grease lubrication

Because of a trend towards minimum-quantity lubrication, longer lubrication intervals and simplified design there is

increasing demand for special lubricating greases offering high performance and good corrosion protection. Bene-

Lubricant type – grease

Linear type	Application / requirement	Selection criterion
Rolling motion guides primarily with balls	Universal	Low speed
Rolling motion guides primarily with balls	Universal	Medium speed
Rolling motion guides primarily with balls	Universal	High speed
Miniature guides	Universal	
Roller screw drives	Universal	
Trapezoidal thread drives	Plastic nut	High speed
Trapezoidal thread drives	Plastic nut	Medium speed
Trapezoidal thread drives	Plastic nut	Low speed
Trapezoidal thread drives	Metal nut	High speed
Trapezoidal thread drives	Metal nut	Medium speed
Trapezoidal thread drives	Metal nut	Low speed
Trapezoidal thread drives	Sintered metal nut	
Sliding motion guides	Universal	High speed
Sliding motion guides	Universal	Medium speed
Sliding motion guides	Universal	Low speed
All	Smooth running	High accelerations and speeds
All	Smooth running	High accelerations and speeds
All	Micromovement / vibration	Normal load
All	Micromovement / vibration	High load
All	High load	
All	High temperature	Not in high vacuum, UV light, aggressive media
All	High temperature	For high vacuum, UV light, aggressive media
All	Clean room production/semi-conductor, LCD, HDD production	Ambient temperature up to 60°C, not in high vacuum or aggressive radiation
All	Clean room production/semi-conductor, LCD, HDD production	High-temperature range, under high vacuum, UV radiation
All	Ultra-high vacuum	High-temperature range, UV radiation
All	Food-processing and pharmaceuticals industry	
All	Rapidly biodegradable for a clean environment	

fits: grease lubrication offers better emergency running characteristics,

better noise dampening and a reliable sealing effect.

Product	Remarks
Klüberplex BE 31-222	Lubricating grease, good adhesion and sealing effect
Klüberplex BE 31-102	Lubricating grease, good adhesion and sealing effect
ISOFLEX NCA 15	Lubricating grease, good adhesion and sealing effect
ISOFLEX TOPAS AK 50	Fluid grease, NLGI 0 for easy application
Klüberplex BEM 41-132	Good lubricity in linear contact
ISOFLEX TOPAS L 32 N	Good compatibility with plastics
POLYLUB GLY 151	Good compatibility with plastics
POLYLUB GLY 801	Good compatibility with plastics
ISOFLEX TOPAS L 32 N	Smooth running due to low base oil viscosity
Klüberplex BEM 41-132	Good wear protection for long relubrication intervals
Klüberplex BE 11-462	High pressure absorption capacity
CONSTANT GLY 2000	Impregnating fluid for sintered metal nut
ISOFLEX TOPAS L 32 N	Smooth running due to low base oil viscosity
Klüberplex BEM 41-132	Good wear protection for long relubrication intervals
Klüberplex BE 11-462	High pressure absorption capacity
ISOFLEX NCA 15	Frequently for lubrication of machine tool spindles
ISOFLEX TOPAS NCA 52	Long-term lubricating grease resistant to ageing
Klüberplex BEM 34-132	Tried and tested grease for protection against tribocorrosion
MICROLUBE GL 261	Tried and tested grease for protection against tribocorrosion, contains EP additives
Klüberlub BEM 41-122	Lubricating grease containing white solid lubricants as reactants
Klübersynth HB 72-102	Low-cost alternative to PFPE oils
BARRIERTA L 55/2	Low evaporation rate
Klübersynth BEM 34-32	Primarily supplied in small pack sizes suitable for clean room environments for relubrication
BARRIERTA I EL- 102	Low evaporation rate
Klüberalfa HX 83-302	Extremely low evaporation rate
Klübersynth UH1 14-222	Meets USDA H1 requirements
Klüberbio M 72-82	Low water hazard ensures unharmed environment; good water resistance, high pressure absorption capacity

Dry lubrication

There are certain extreme operating conditions that forbid the use of a “wet” lubrication regime. The most

obvious example is outer space, where applications involving very short sliding distances are found for experiments

	Linear type	Component	Selection criterion
Bonded coating	Ball screw drives	Threaded spindle	Ultra-high vacuum
Electroplated coating	Ball screw drives	Threaded spindle	Ultra-high vacuum

In the following text are some “lubrication hints” that may help to facilitate your everyday work.

- ❑ For delivery of oils and fluid greases via centralised lubrication equipment NLGI grades 00 and 000 are normally used.
- ❑ Centralised lubrication is also feasible for greases K according to DIN 51825 of NLGI classes 0/1/2, however this should be discussed prior to use with the manufacturers of the lubricant and the lubricating system to eradicate problems such as oil separation or pumping resistance as found in long feed lines of small bore dimensions.
- ❑ NLGI grade 2 greases can be applied to the lubricating nipple of a linear motion guide by means of a pressure grease gun. If the component has no lubricating nipples, the grease can be brushed directly onto the sliding surfaces of shaft, spindle or rail. If an even, thin grease film is desired, a solvent may be added to the grease for dispersion. Klüber Lubrication can supply ready-to-use grease dispersions of this type.
- ❑ Another option is continuous minimum-quantity relubrication by means of a lubricant dispenser.
- ❑ Special lubricant containers are available for miniature guides with lubricating holes – e.g. mini grease guns.

and operation under ultra-high vacuum. Depending on the individual requirements, it may

make sense to combine self-lubricating plastic materials or a bonded-coating with oil or grease

lubrication to improve emergency-running properties.

Product	Remarks
UNIMOLY C 220	approx. 10 µm sliding layer containing MoS ₂
WOLFRATHERM G 11 RC	approx. 5 µm sliding layer containing MoS ₂

For information on the coating of elastomers and thermoplastics, please ask for our technical brochure on this subject or request technical consulting.

Initial grease lubrication

- ❑ Aspects to consider at an early stage are compatibility of the lubricant with anticorrosion agents, sealing and plastic cage materials (see also under www.klueber.com, service section: Which lubricant for which elastomer?)
 - ❑ Components should be protected against dust and foreign matter; clean parts, if necessary.
 - ❑ Ensure sufficient lubricant distribution.
- linear guide system should be operated using a long stroke length under low load conditions to ensure optimum lubricant distribution and minimum friction. The fill quantity is specified by the linear motion guide manufacturer and is normally approx. 50% of the component's free space. For high speeds, it may be as low as 30% of the available free space.*

NOTE: Following initial lubrication, the



Grease relubrication

- ❑ We recommend cleaning the guide rail or spindle with a lint-free cloth prior to relubrication.
- ❑ The relubrication quantity is approx. 50% of the initial lubrication quantity.
- ❑ Frequent relubrication is desirable, i.e. application of small quantities at shorter intervals.
- ❑ If a different lubricant is used for relubrication purposes, compatibility with the original lubricant should be determined. Greases used for relubrication should match the previous grease's basic composition (base oil type, thickener, base oil viscosity, NLGI class). Please check with the grease manufacturer.

Relubrication or lifetime lubrication?

This chapter provides information on the factors influencing the lubricant life and relubrication intervals in your application.

In general terms, the lubricants used for linear motion guides are the same as those selected for rolling and plain bearings. Tribologically, these components are closely related, however there is one fundamental difference: Linear motion guides require far more lubricant than a rotating bearing. This is due to the fact that the lubricant in a linear bearing system is spread across the guide rail during motion. Furthermore, the beginning and end of each stroke takes place under mixed-friction conditions, which encourages wear. This makes shorter relubrication intervals necessary for linear movements. Intervals can be extended, however, if improved seals are used and if a highly adhesive special lubricant is chosen.

Shorter relubrication intervals can be expected with extreme operating conditions:

- ❑ High load $C/P < 20$;
C = basic dynamic load rating in N;
P = equivalent dynamic load in N
- ❑ Short strokes; micro-movements
- ❑ High temperatures $> 70\text{ °C}$
- ❑ Aggressive media or radiation
- ❑ Insufficient sealing

A general formula to calculate the relubrication intervals in linear motion guides does not yet exist. Factors like the type of linear guide used, variations in design, the quality of sealing and operating conditions must be considered, all of which makes the determination of correction factors a difficult task.

For this reason, Klüber Lubrication offers used-lubricant analyses. In cooperation with the equipment operator, tests are performed in the test bay and in the field, which allow an estimation to be made on the grease service life. In the automotive industry, for example, comprehensive tests are conducted to find out if a required service life of 15 years can be attained.

Miscibility of thickeners

Base oil must also be miscible

Legend

+	miscible
+/-	partially miscible
-	not miscible

	Metal soap greases				Complex soap greases					Greases		
	Al	Ca	Li	Na	Al	Ba	Ca	Li	Na	Bentonite	Polyurea	PTFE
Metal soap greases	Al	+/-	+	+/-	+	+/-	+	+	+/-	+	+	+
	Ca	+/-		+	+	+	+	+/-	+	+	+	+
	Li	+	+		-	+	+	+	+	-	+/-	+
	Na	+/-	+	-		+	+	+/-	+/-	+	-	+
Complex soap greases	Al	+	+	+	+		+	+/-	+	+/-	+/-	+
	Ba	+/-	+	+	+	+		+/-	+/-	+	+/-	+
	Ca	+	+	+	+/-	+/-	+/-	+	+	+/-	+	+
	Li	+	+/-	+	+/-	+	+/-	+		+/-	+/-	+
	Na	+/-	+	-	+	+/-	+	+	+/-		-	+
Greases	Bentonite	+	+	+/-	-	+/-	+	+/-	+	-	+	+
	Polyurea	+	+	+/-	+	+/-	+/-	+	+/-	+	+	+
	PTFE	++	+	+	+	+	+	+	+	+		

Miscibility of base oils

	Mineral oil	Synthetic HC	Ester oil	Polyglycol	Silicone oil (methyl)	Perfluoroalkyl ether	Silicone oil (phenyl)	Polyphenyl ether oil
Mineral oil	+	+	+	-	-	-	+/-	+
Synthetic HC	+	+	+	-	-	-	-	+
Ester oil	+	+	+	+	-	-	+	+
Polyglycol	-	-	+	+	-	-	-	-
Silicone oil (methyl)	-	-	-	-	+	-	+/-	-
Perfluoroalkyl ether	-	-	-	-	-	+	-	-
Silicone oil (phenyl)	+/-	-	+	-	+/-	-	+	+
Polyphenyl ether oil	+	+	+	-	-	-	+	+

Since base oils and thickeners may vary considerably in their composition, this table can only provide basic orientation. The information it contains is based on our general experience and knowledge.

Product overview: Lubricating greases for linear motion guides and threaded spindles

Designation	Application
BARRIERTA I EL- 102	High-temperature grease for use under high-vacuum, UV light, aggressive media at medium speeds
BARRIERTA L 55/2	High-temperature grease for use under vacuum, UV light, aggressive media at low speeds
ISOFLEX TOPAS L 32 N	Trapezoidal thread drives / sliding motion guides, for high speeds
ISOFLEX TOPAS NCA 52	Smooth-running grease for high accelerations and speeds, good ageing resistance
ISOFLEX NCA 15	Smooth-running grease also for low temperatures, high accelerations and speeds
Klüberalfa HX 83- 302	Grease for ultra-high vacuum, good resistance to media, extremely low outgassing for use in clean-room production
Klüberbio M 72- 82	Rapidly biodegradable, excellent resistance to water and pressure absorption capacity
Klüberlub BEM 41-122	Grease for high loads
Klüberplex BE 11- 462	Trapezoidal thread drives / sliding motion guides, for low speed
Klüberplex BE 31-102	Universal grease for use at medium speeds offering good sealing and adhesion
Klüberplex BE 31-222	Universal grease for use at low speeds offering good sealing and adhesion
Klüberplex BEM 34-132	Lubricating grease for micromovement / vibration
Klüberplex BEM 41-132	Lubricating grease for high loads, especially roller elements
Klübersynth BEM 34-32	Smooth running grease for high acceleration and speed, offering good ageing resistance, clean-room production
Klübersynth HB 72- 102	Synthetic high-temperature and long-term grease
Klübersynth UH 1 14-222	Lubricating grease for food-processing and pharmaceuticals industries
MICROLUBE GL 261	Lubricating grease for micromovements and high loads
POLYLUB GLY 151	Trapezoidal thread drives / sliding motion guides made of plastic, for low temperatures and high speed
POLYLUB GLY 801	Trapezoidal thread drives / sliding motion guides made of plastic, for low speed

Please observe notes on page 16.

Product overview: Fluid greases for linear motion guides and ballscrews

Designation	Application
CENTOPLEX GLP 500	Universal fluid grease
CONSTANT GLY 2000	Impregnating fluid for sinter-bronze nuts in trapezoidal thread spindles
ISOFLEX TOPAS AK 50	Fluid grease primarily for miniature motion guides
ISOFLEX TOPAS NCA 5051	Fluid grease for elevated temperature and speed, good ageing resistance
Klüberbio GM 32-2200	Fluid grease, rapidly biodegradable
Klübersynth UH 1 14-1600	Fluid grease for food-processing and pharmaceuticals industry
MICROLUBE GB 0	Fluid grease for high loads, micromovements / vibration
MICROLUBE GB 00	Fluid grease for high loads, micromovements / vibration

Product overview: Lubricating oils for linear motion guides and ballscrews

Designation	Application
Klüberbio C 2- 46	Rapidly biodegradable lubricating oil
Klüberoil GEM 1 68 N	Universal lubricating oil
Klüberoil 4 UH 1-68N	Lubricating oil for food-processing and pharmaceuticals industries
Klübersynth MZ 4-17	Lubricating and anticorrosive oil
LAMORA D 68	Universal lubricating oil and machine tool slideway oil

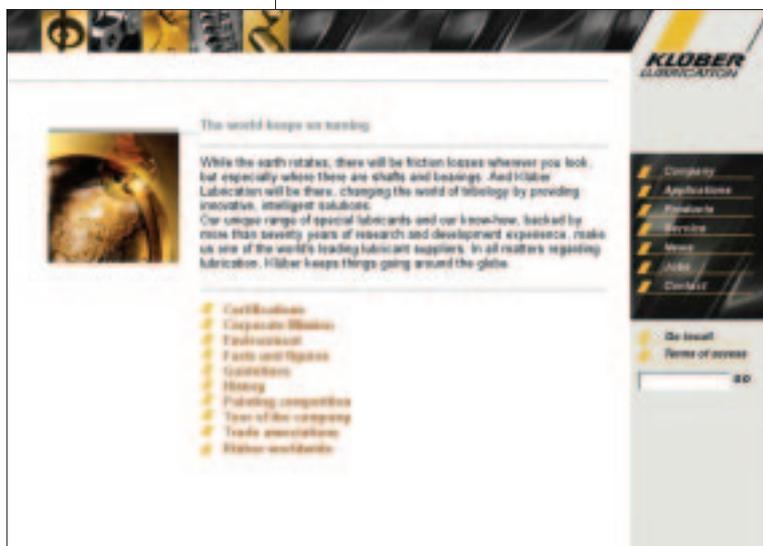
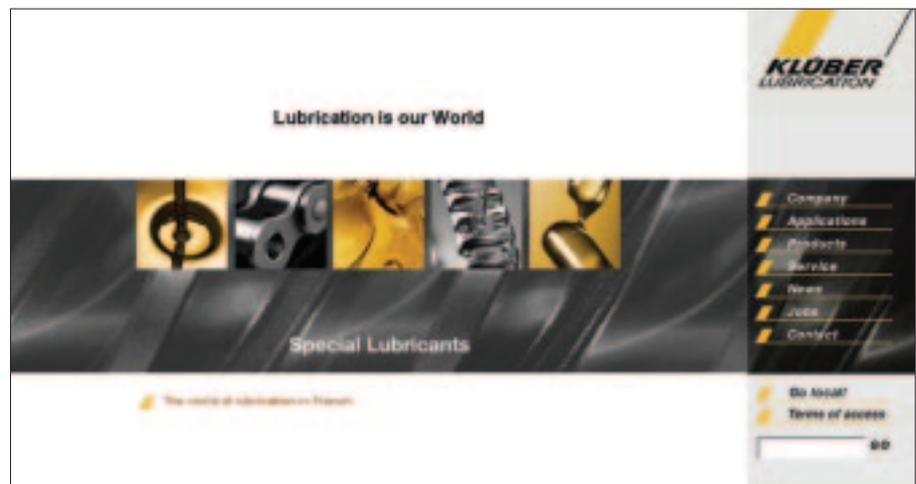
Please observe notes on page 16.



Do you wish
more detailed information on our product range?

Do you need
material safety data sheets on the products mentioned?

Then order them
using the request form overleaf or by surfing on our
web address: www.klueber.com



Request for Information

Klüber Lubrication München KG
Geisenhausenerstraße 7
81379 München
Deutschland

Fax no.: +49 89 7876-333

Sender:

Company _____

Name _____

Position _____

Street _____

City _____

Phone _____

Fax _____

E-mail _____

Please send me more Information **about the following product(s):**

Please quote a price for:

Product: _____

Quantity: _____

Please give me a call about the following:

Application: _____

Product: _____

Please call me for an appointment

Technical questionnaire for linear motion guides/threaded spindles

Sender:

Company _____

 Name _____
 Position _____
 Street _____
 City _____
 Phone _____
 Fax _____
 E-mail _____

1. Application

Machine / Equipment _____

Manufacturer _____

2. Linear guides/spindle details

Type _____

Size _____

Designation _____

Manufacturer _____

Material	at the component
Special steel	_____
Plastic	_____

_____ Type of seal*

_____ Denomination of seal

Mounting position:*
 Horizontal Vertical Tilted

3. Operating conditions*

max. speed: _____ m/s

max. acceleration: _____ m/s²

Stroke: _____ mm

Static load: _____ kN

Dynamic load: _____ kN

Load per surface unit: _____ N/mm²

Impact load (N) _____
 or load-time-diagram in sketch form

Temperature [°C]	estimated		measured	
	min.	max.	min.	max.
Temperature at friction point				
Ambient temperature				

Ambient influences: (type, concentration, temperature, pressure)

- Liquid _____
- Vapour _____
- Gas _____
- Dust _____
- Other media _____

Daily service time: _____ h

Others _____

4. Additional lubricant requirements

- Low-noise operation
- High degree of purity
- Very low friction torque
- Customer specification
- Compliance with lubricant chart (encl.)
- Food-grade registration as NSF H1**

Others _____

5. Lubrication details

_____ Lubricant currently used

Type of lubrication:

- Lifetime lubrication [h]
 Actual: _____
 Desired: _____
- Lubrication interval [h]
 Actual: _____
 Desired: _____
- Relubrication quantity [g/h]
 Actual: _____
 Desired: _____

- Manual Automatic

_____ Lubricating equipment

_____ Lubricant lines (dimensions, pressure, material, type of distributor)

Current lubrication interval [g/h] _____

_____ Desired lubrication interval (g/h)

_____ Annual lubricant consumption

_____ Other factors

* Minimum information required
 ** National Sanitation Foundation

Publisher:
Klüber Lubrication München KG

Copyright:
Klüber Lubrication München KG

Reprints, total or in part, are permitted if source is indicated and voucher copy is forwarded.

9.36 e
Edition 08.04

The data in this brochure 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 technical brochure at any time without notice.

We are where you are.

Klüber Lubrication – the world market leader in speciality lubricants

- 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.



Klüber Lubrication München KG
A company of the Freudenberg Group

www.klueber.com