KLÜBER LUBRICATION

your global specialist

Customised solutions for more than food safety.

Speciality lubricants for the food-processing industry

Reduce contamination risks, increase efficiency

Manufacturers of food products know that a good recipe is key for a good product. This applies both to your products and to the operating materials used in your plant. Choosing lubricants based on a proven recipe pays off. The lubricant has to fit the philosophy of your production, your application and your products as its formulation is the prerequisite for a good product all-round. H1 lubricants from Klüber Lubrication meet these requirements.

Production with high-performance H1 lubricants

Lubricants for the food-processing industry are classified into different categories with specific requirements. The most important include:	
NSF H1	Lubricants for applications in which incidental contact with the food product can occur.
NSF H2	Lubricants which must not have contact with the food product.
NSF H3	Soluble oils which are used as anti-corrosion agent for hooks and knives. They have to be wiped off prior to use and must not have contact with the food product.
NSF 3H	Mould release agents which prevent adhesion of food products to hard surfaces such as baking tins, knives, etc.
NSF HT-1	Heat-carrier fluids which can have incidental contact with food products.
HACCP	Hazard Analysis and Critical Control Points. As far as lubricants are concerned, HACCP aims at excluding right from the start in a hazard analysis any occurrences which can induce contamination.
EHEDG	European Hygienic Equipment Design Group. An organisation aimed at ensuring food safety by improving hygienic engineering and planning in all areas of food processing.
ISO 21469	International standard for lubricants. This standard establishes hygiene requirements for the formulation, production and use of lubricants with incidental product contact.

Klüber Lubrication can provide the entire range of products for the food-processing industry that support you in complying with internal and external standards.

Certified hygiene for the entire process

ISO 21469 is the international standard for lubricants used in the food-processing industry. Klüber Lubrication was amongst the first few companies which were able to comply with the stringent requirements of this standard and has more certified production plants than any other company.

High-performance lubricants pay off

The investment in high-quality lubricants pays off by reducing maintenance and operating costs in the long run. We have the right solution for almost any application. If there is a part or component that you don't find in this brochure, just contact one of our specialists for advice.

We are where you are

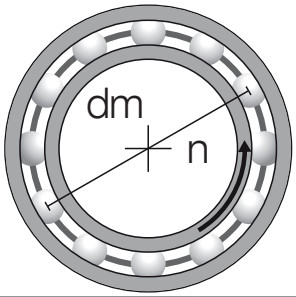
It is our aim to offer you speciality lubricants and service in constant high quality worldwide. We meet this aim through our worldwide network of production and sales companies, competent dealers, and last but not least, through our highly specialised experts who are ready to respond to your individual requirements.

Lubricating greases for rolling bearings, plain bearings and linear guides

Rolling bearings, plain bearings and linear guides in the food-processing industry are subject to extreme conditions, like water, steam, cleaning agents as well as high and low temperatures.

Choosing the righ lubricating grease is crucial for keeping maintenance costs low, ensuring food safety and avoiding unplanned machine stops.

Application	Product	NLGI grade DIN 51818	Service temperature range		Base oil viscosity	Speed factor* [mm × min^{-1}]	Base oil	Thickener	NSF H1 reg. number
			From [°C]	To [°C]	40 °C [mm²/s] approx.				
Temperatures up to 160 °C Low and medium speeds	Klüberfood NH1 94-301	1	–40	140	300	400,000	PAO	Calcium complex	140682
	Klüberfood NH1 94-402	1 – 2	–30	160	400	300,000	PAO	Calcium complex	139051
	Klüberfood NH1 74-401	1	–40	160	400	500,000	PAO	Polyurea	154567
	Klüberfood NH1 34-401	1	–30	140	400	500,000	PAO	Calcium complex	149161
	Klübersynth UH1 14-222	2	–25	120	260	400,000	PAO	Aluminium complex	128827
	Klübersynth UH1 64-1302	2	–10	150	1,300	100,000	PAO	Silicate	136697
Temperatures down to –50 °C High speeds	Klüberalfa BF 83-102	2	–50	200	110	1,000,000	PFPE	PTFE	139418
	Klübersynth UH1 14-31	1	–45	120	30	700,000	PAO, ester	Aluminium complex	056356
	Klüberfood NH1 94-51	1	–40	120	50	500,000	PAO	Calcium complex	158140
	Klüberfood NH1 94-52	2	–40	120	50	500,000	PAO	Calcium complex	160333
	Klübersynth UH1 14-151	1	–45	120	150	500,000	PAO	Aluminium complex	056354
	Klübersynth UH1 64-62	2	–40	140	65	500,000	PAO, ester	Silicate	136871
Temperatures up to 300 °C Low and medium speeds	BARRIERTA L 55/1	1	–40	260	420	300,000	PFPE	PTFE	129561
	BARRIERTA L 55/2	2	–40	260	420	300,000	PFPE	PTFE	129400
	Klüberalfa HPX 93-1202	2	–30	300	1,200	n.a.	PFPE	Solids	138460



* The speed factor is made up of the rpm at the operating point n in [min^{-1}] and the mean bearing diameter dm in [mm]. Lubricants that are suitable for high rpm are dynamically light, which prevents the lubricant film from rupturing at high speeds.
High: 500,000; medium: 300,000–400,000; low: < 300,000.

Ambient media

Cleaning agents, steam and hot water can be very aggressive towards lubricated rolling bearings, compromising the sealing capacity of the bearing. As a consequence, not only is the consumption of grease increased, but the lifetime of the lubricated component is shortened.

A water washout test evaluates the behaviour of a lubricant under dynamic conditions (DIN 51 807; ASTM D 1264). The test determines how much grease a jet of hot water (79 °C) can remove in 1 hour. Greases are rated according to performance as: #1 – less than 10 % removed, #2 – between 10 % and 30 % removed, and #3 – more than 30 % removed.

Klüber Lubrication rolling bearing greases mentioned in this brochure are rated #1 using stricter parameters, 3 hours duration and water at 90 °C. These greases provide excellent protection against media and offer lower consumption.

High-temperature greases

Components operating in hot environments, such as baking and cereal drying processing, cannot afford to fail. A production halt not only results in extra costs for spare parts and production, but also involves a considerable waste of heating energy.

Upper service temperatures for Klüber Lubrication bearing greases are defined according to the FE-9 test method (DIN 51 821, DIN 51 825), assuring reliable performance of the lubricant within the service range.

Greases like **BARRIERTA L 55/2** and **BARRIERTA L 55/1** combine excellent media resistance with thermal stability for temperatures up to 260 °C. They are preferred in the food industry by OEMs and operators looking for reliability and high performance.

Klüberalfa HPX 93-1202 can cope with even more severe conditions, being adequate to lubricate bearings subjected to 300 °C, anticipating future needs and promoting a much longer bearing and grease lifetimes.

Low-temperature greases

Both during production and when preserving foodstuffs, cold environments are an integral part of food manufacturing. Imagine the impact of a stoppage on a conveyor or electrical motor bearing operating inside a freezing tunnel at –40 °C.

Low-temperature stability is evaluated by a **flow pressure test (DIN 51 805)** and the **low-temperature torque test**. Generally, the temperature at which a flow pressure of 1,400 mbar is generated will be stated as the lowest service temperature of rolling bearing greases.

Low temperature torque test (ASTM D 1478)

For Klüber Lubrication rolling bearing greases, the low-temperature torque is also evaluated for dynamic conditions. The service temperature is then confirmed only if the starting torque is below 1,000 Nmm and running torque is below 100 Nmm.

Lubricating greases exhibiting a minimal consistency increase at low temperatures, for example **Klübersynth UH1 14-31, Klübersynth UH 14-151 and Klüberalfa BF 83-102,** provide excellent low-temperature stability, being adequate for operation down to –45 or –50 °C while maintaining low torques and flow pressures.

Friction torque and load-carrying capacity

Grease formulation has a very significant influence on friction torque and operating temperature. Additionally, the interaction between the thickener and the base oil when submitted to high loads can generate more torque and consequently greater energy consumption.

FAG-FE8 (DIN 51 819) tests are performed on lubricants subjected to high loads. The test runs for 500 hours for greases. Loads applied can vary from 5 to 100 kN and speeds from 7.5 to 6,000 rpm with different ball and roller bearing types.

Test results are the friction torque and the temperature curve, in addition to wear (mg) of the rolling elements.

Klüberfood NH1 34-401 has shown remarkably low friction torque operating at the FE8 test bench, which is three times lower than the best comparable competitor technology.

Changeover from industrial to H1 greases

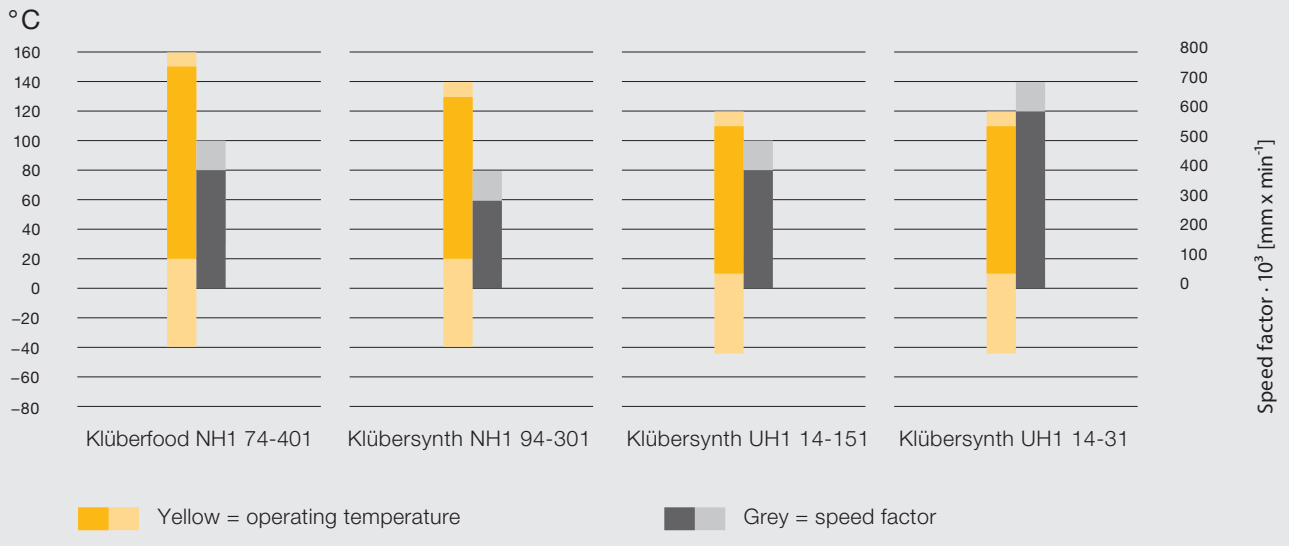
When changing from an industrial to H1 grease, for components where complete cleaning is not possible, you need to be aware of the remaining non-H1 grease.

To obtain the “H1 condition” as quickly as possible, relubrication intervals must be reduced, particularly after the grease changeover process.

The more frequently H1-registered grease is applied to the bearing, the sooner the old grease is squeezed out completely.

Hint:
Clean the grease nipples prior to applying new grease to ensure contaminants are not forced into the bearing.

Operating temperature and speed factor



The darker shade represents the optimal application area.

Grease miscibility

The following table indicates the general compatibility between oils and thickeners.

We recommend avoiding mixing different types of grease without prior evaluation. For further advice, please contact your Klüber Lubrication specialist.

Miscibility of base oils

	Mineral	PAO	Ester	PAG	Silicone	PFPE
Mineral	+	+	+	–	–	–
PAO	+	+	+	–	–	–
Ester	+	+	+	+	–	–
PAG	–	–	+	+	–	–
Silicone	–	–	–	–	+	–
PFPE	–	–	–	–	–	+

+ miscible **– not miscible**

Miscibility of thickeners*

		Metal soaps				Complex soaps					Other thickeners		
		Al	**Ca**	**Li**	**Na**	**Al**	**Ba**	**Ca**	**Li**	**Na**	**Bentonite**	**Polyurea**	**PTFE**
Metal soaps	**Al**	+	+/–	+	+/–	+	+/–	+	+	+/–	+	+	+
	Ca	+/–	+	+	+	+	+	+	+/–	+	+	+	+
	Li	+	+	+	–	+	+	+	+	–	+/–	+/–	+
	Na	+/–	+	–	+	+	+	+/–	+/–	+	–	+	+
Complex soaps	**Al**	+	+	+	+	+	+	+/–	+	+/–	+/–	+/–	+
	Ba	+/–	+	+	+	+	+	+/–	+/–	+	+	+/–	+
	Ca	+	+	+	+/–	+/–	+/–	+	+	+	+/–	+	+
	Li	+	+/–	+	+/–	+	+/–	+	+	+/–	+	+/–	+
	Na	+/–	+	–	+	+/–	+	+	+/–	+	–	+	+
Other thickeners	**Bentonite**	+	+	+/–	–	+/–	+	+/–	+	–	+	+	+
	Polyurea	+	+	+/–	+	+/–	+/–	+	+/–	+	+	+	+
	PTFE	+ +	+	+	+	+	+	+	+	+	+	+	+

+ miscible **+/– partially miscible** **– not miscible**
*** Base oils must be miscible**

Lubricating oils for gears and bearings

Special solutions by Klüber Lubrication help you achieve the goals of higher revenue with increased food safety and an improved ecological footprint. Our special gear oils ensure long maintenance intervals, high efficiency and lasting component protection, even at the gear's performance limits.

The following Klüber Lubrication gear oils are manufactured with fully synthetic bases to achieve the highest performance. They are used and recommended by the largest gear manufacturers. Our specialists will recommend the right oil for your requirements. Together we can lower your maintenance costs, energy consumption and CO_2 emissions.

Application	Product	Base oil	ISO VG DIN 51519	Service temperature range		Viscosity index ISO 2909	Energy saving	NSF H1 reg. number
				From [°C]	To [°C]			
Low temperatures [down to –45 °C]	Klüber Summit HySyn FG 32	PAO	32	–45	135	≥ 120	++	133733
	Klüberoil 4 UH1-15	PAO, ester	15	–45	110	≥ 120	++	136436
Normal temperatures [up to 120 °C]	Klüberoil 4 UH1-150 N	PAO, ester	150	–30	120	≥ 140	++	121172
	Klüberoil 4 UH1-220 N	PAO, ester	220	–30	120	≥ 140	++	121171
	Klüberoil 4 UH1-320 N	PAO, ester	320	–30	120	≥ 150	++	122841
	Klüberoil 4 UH1-460 N	PAO, ester	460	–30	120	≥ 150	++	121170
	Klüberoil 4 UH1-680 N	PAO, ester	680	–25	120	≥ 150	++	121169
High temperatures [up to 160 °C]	Klübersynth UH1 6-150	PAG	150	–35	160	≥ 210	+++	124437
	Klübersynth UH1 6-220	PAG	220	–30	160	≥ 220	+++	124438
	Klübersynth UH1 6-320	PAG	320	–30	160	≥ 220	+++	124439
	Klübersynth UH1 6-460	PAG	460	–25	160	≥ 220	+++	124440
	Klübersynth UH1 6-680	PAG	680	–25	160	≥ 240	+++	124441
	Klübersynth UH1 6-1000	PAG	1,000	–25	160	≥ 250	+++	147019

Klüberoil 4 UH1 N series is available in ISO VG from 32 to 680 and 1,500
Klübersynth UH1 6 series is available in ISO VG 100 to 1,000

++ Increased performance/benefit
+++ Optimum performance/benefit

Operating temperature

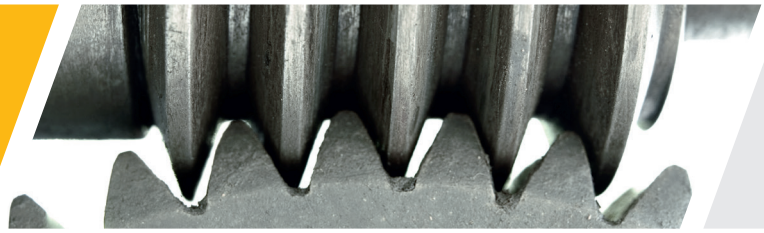
Industrial gears in the food industry operate in environments with temperatures between –40 and 80 °C.

However, the oil temperature can sometimes reach 150 °C depending on the type of gear and the application. The heat generated in a gear system (gear wheels, bearings and the lubricant) is one of the most important criteria for evaluating the gear's performance. Apart from design influences, oil temperatures mainly depend on the operating conditions.

It is important to ensure that the permissible temperature limits are not exceeded in individual gear components, the lubricant and the accessories.

Operating temperatures that are above average or temperature peaks often indicate malfunctions or incipient damage.

Hint:
When using mineral oil-based gear oils, an oil temperature of 75–80 °C should not be exceeded.



Benefits of synthetic gear oils from Klüber Lubrication

In addition to the wide service temperature range, synthetic gear oils offer many advantages compared to mineral oils:

- Oil change intervals are 3 to 5 times longer
- Higher wear protection
- Better cold start with the same nominal viscosity (ISO VG)
- May not require oil coolers due to reduced temperatures
- Reduced friction leads to lower energy costs

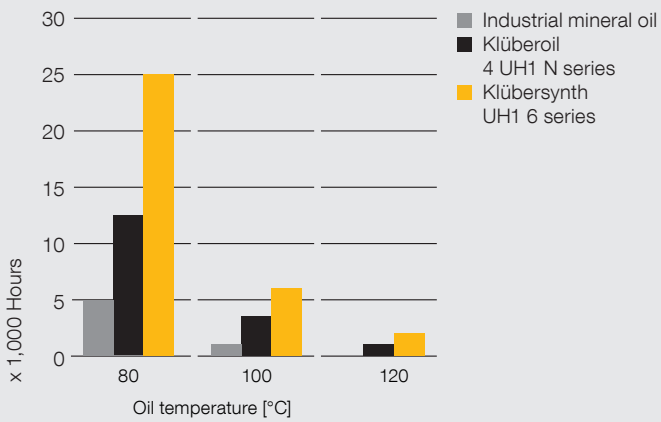
Comparison of viscosity indexes (VI)

Type of gear oil	VI, approx.
Mineral oil	85 to 100
Klüberoil 4 UH1 N series	135 to 160
Klübersynth UH1 6 series	210 to 270

Oil lifetime

The prolonged service life of synthetic lubricants and the consequent longer oil change intervals can reduce equipment downtime and save resources.

Typical oil service life



Behaviour in worm gearboxes

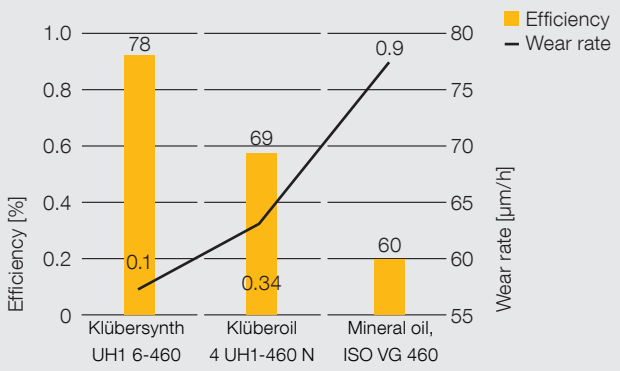
The following graph compares different base oils tested under the same conditions.

Test conditions
Input speed: 350 min^{-1}
Output torque: 300 Nm
Test duration: 300 h

Test gear
Standard worm gear
Material, worm: steel 16MnCrS5
Material, wheel: GZ-CuSn12Ni

The results show a significant improvement in efficiency and reduction of wear when using food-grade synthetic oils from Klüber Lubrication

Efficiency and wear behaviour



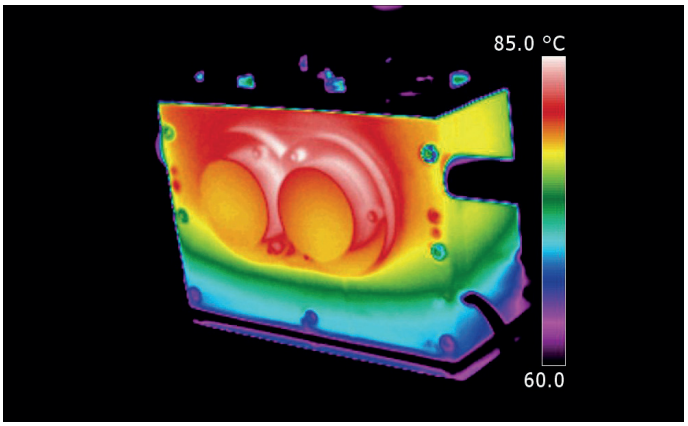
Efficiency determined on the Klüber Lubrication worm gear test rig

Gear oils' temperature behaviour in spur gears

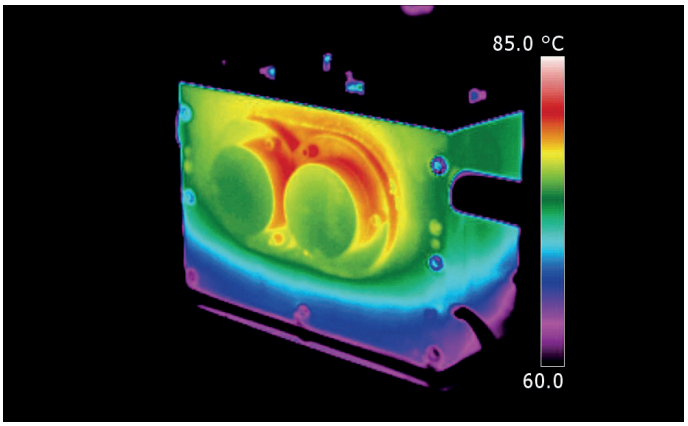
Most temperature behaviour comparisons are focused on worm gears. Changing over from mineral to synthetic base gear oils offers very good potential for temperature reduction in these types of gearboxes.

What about spur gears? The spur gear is the most-used type of gearbox in the food industry. At the same time, it is the gear application where it is most difficult to show improvements when comparing with mineral oils.

The synthetic gear oils made by Klüber Lubrication offer significantly higher efficiency than a standard gear oil based on mineral oil, resulting in a lower oil temperature even in spur gears, as shown in the thermal pictures.



Standard gear oil: mineral oil, ISO VG 220



Synthetic H1 gear oil from Klüber Lubrication: Klüberoil 4 UH1-220 N

Improved efficiency by reducing gear friction losses

Synthetic gear oils based on polyalphaolefin, ester or polyglycol show a considerably lower gear friction coefficient than mineral oils due to their particular molecular structure. The friction generated in gears with synthetic oils can be more than 30 % lower than with industrial EP mineral gear oil.

Even in spur gears, an oil temperature reduction from 85 °C with mineral oil to 80 °C with Klüber Lubrication synthetic gear oils based on PAO can be achieved. This results in a reduction of energy consumption, longer lifetime of the gearbox and less maintenance.

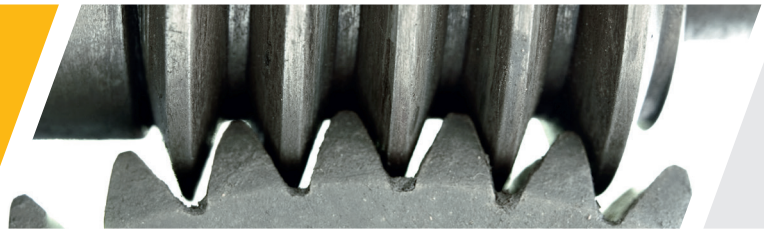
Due to the lower friction coefficients of synthetic gear oils, they help reduce gearing losses considerably and hence increase gear efficiency.

Particularly in gearboxes with a high proportion of sliding friction, e.g. worm or hypoid gears, a changeover from mineral to synthetic gear oils can lead to increases in efficiency of more than 20 %.

Friction coefficients of various gear oils determined on the twin-disk machine

	Friction coefficient		
	2 m/s	**4 m/s**	**8 m/s**
Mineral oil	0.060	0.050	0.040
Klüberoil 4 UH1 N series	0.040	0.030	0.020
Klübersynth UH1 6 series	0.020	0.014	0.011

Test conditions	
Hertzian pressure p_H	1,000 N/mm²
Slip	20 %
Oil injection temperature	90 °C
ISO VG	150

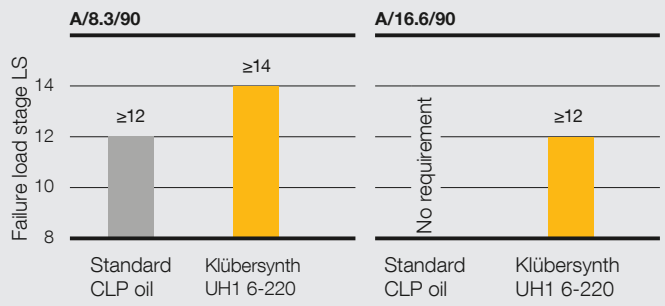


Reliability through protection for all gear components

The performance capability of high-performance gear oils refers to all the gear components to be lubricated, i.e. gear teeth, rolling bearings and radial shaft seals. Gear oils from Klüber Lubrication are developed to the highest standards in order to offer superior protection for your machinery.

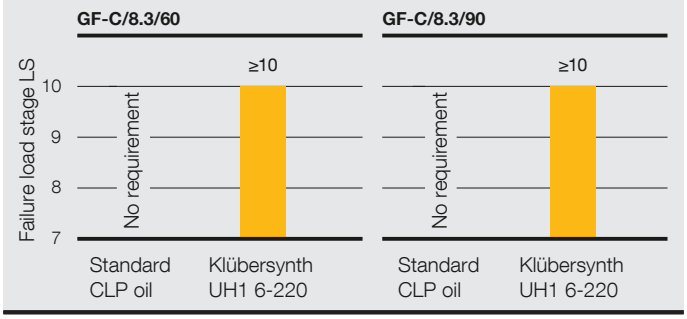
Gears – scuffing: The FZG scuffing test is generally undertaken to test the capability of gear oils to protect against scuffing damage. Load stage 12 of the FZG scuffing test is the minimum requirement for CLP oils. Klüber Lubrication's gear oils surpass this level, offering superior protection even under extreme shock load conditions.

FZG scuffing test (results)



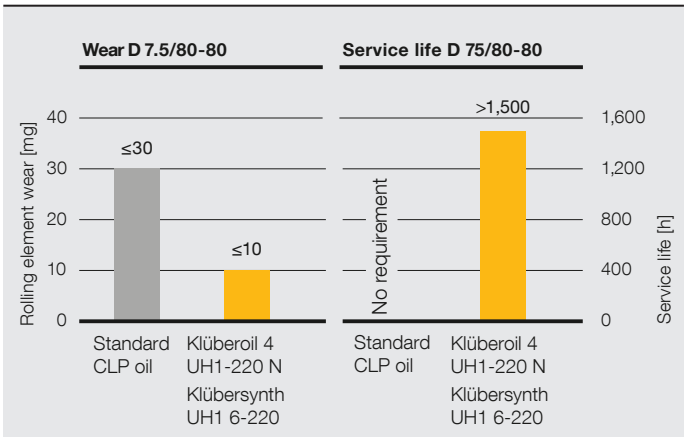
Gears – micropitting: The micropitting test according to FVA 54/7 has become the industry standard for assessing a gear oil's micropitting load-carrying capacity as low, medium or high. Klüber Lubrication's gear oils are classified as having high micropitting resistance.

FZG micropitting test (results)

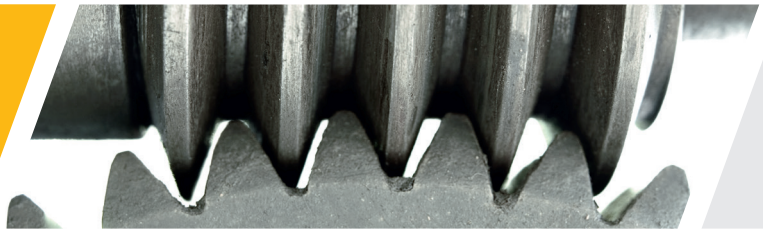


Bearings: Gear damage is often caused by high rolling bearing wear or premature fatigue of rolling bearings. The influence of high-performance gear oils on the wear behaviour of rolling bearings is measured in the FE8 wear test. Klüber Lubrication's gear oils surpass this test's minimum requirements for CLP oils, while also fulfilling the requirements of the FE8 lifetime test. Consequently, these rolling bearings can attain the service life projected by the bearing design engineer.

FE8 rolling bearing test (results)



stage require expensive cleaning and repair. Lube & Seal, the joint project between Freudenberg Sealing and Vibration Control Technology and Klüber Lubrication, has brought about perfect harmonisation of lubricant and seal. In this combination, Klüber Lubrication's high-performance gear oils enable continuous operation without premature seal failure.



Changeover from mineral to H1 PAO synthetic gear oil

Klüberoil 4 UH1 N series
Klüber Summit HySyn FG series

Every changeover from mineral to synthetic food-grade oil should be performed with great care. It may not be enough to simply drain the used mineral oil and fill in the new synthetic oil.

Older gears can be assumed to contain oil residues in the casing, the oil lines, etc., which might be dissolved by synthetic oils. If such residues are not removed, they may cause problems during operation.

Oil lines and filters may be clogged; seals, pumps and teeth damaged. By replacing approx. 10 % of the existing mineral oil fill with **Klüber Summit Varnasolv**, oil residues can be dissolved to make cleaning of the gear easier.

To prevent damage, the gear or enclosed systems should be flushed with the new synthetic oil after the old oil has been drained, ideally at operating temperature.

Flushing should be repeated once or twice to ensure that most of the mineral oil residues are removed and food safety is not impaired.

The food-grade gear oil that was used for flushing must not be used for lubrication afterwards. However, it can be kept for further flushing operations. Prior to filling with the fresh synthetic oil, the oil filters or filter elements should be replaced.

Changeover from mineral oil to polyglycol (PAG)

Klübersynth UH1 6 series

Polyglycol food-grade oils are neither miscible with mineral oils, nor other synthetic gear oils.

Polyglycols from different manufacturers are miscible. However, their content should be kept as low as possible in order to avoid affecting the properties of the original gear oil.

When using polyglycol food-grade oils, make sure you know the materials of your seals, paints and inspection glasses in order to rule out undesirable interaction with the lubricant.

Due to incompatibility of the bases, flushing is always recommended, even when the general condition of the mineral oil is good.

Our specialists can always provide you with specific instructions for the replacement of gear oils.

Hint:
Hot oil will facilitate the draining procedure as viscosity is lower at higher temperatures. You will be able to drain the used oil faster and retain a minimal quantity inside the gearboxes.

Lubricating greases for use in gearboxes and centralised lubricating systems

Gears sometimes require greases for lubrication; they come in the form of compact units with lifetime lubrication, or they are conventional gearboxes facing other kinds of challenges. Greases applied in such gear conditions or in centralised lubrication systems must be soft enough to be pumped through narrow pipes leading to the friction points.

The following table sets out a selection of soft greases which are recommended for centralised lubrication systems in beverage filling machines or compact gearboxes lubrication. E.g.: **Klübersynth UH1 14-151** for PS.C units from SEW.

Application	Product	NLGI grade DIN 51818	Base oil	Thickener	Service temperature range		Base oil viscosity	NSF H1 reg. number
					From [°C]	To [°C]	40 °C [mm²/s] approx.	
Gears and centralised lubricating systems	Klübersynth UH1 14-151	1	PAO, ester	Aluminium complex	–45	120	150	056354
	Klübersynth UH1 14-1600	00	PAO, ester	Aluminium complex	–45	120	160	136695
	Klüberfood NH1 94-6000	000	PAO	Calcium complex	–45	120	60	143372
Multipurpose lubricating grease	Klüberfood NH1 94-120	0	PAO	Calcium-complex	–45	140	120	154193
	PARALIQ GA 3400	00	White mineral oil	Aluminium complex	–45	110	235	137942

Lubricating oils for compressors and vacuum pumps

Whether you are compressing ammonia (NH_3) and carbon dioxide (CO_2) for keeping food cool, or adding carbon dioxide (CO_2) to your beverages, or even compressing air for blowing beverage bottles, compressors are key elements for food production and preserving, they are necessary in the daily life of every food processing plant.

Mechanical failures can lead to serious production and revenue losses. Therefore, choosing the right compressor oil is vital. Have you ever imagined how lubricants can influence your operating costs? Or how lubricants can reduce your energy consumption? The lubricant is a relatively small investment which can make a big difference. Here are some good reasons why you should optimise the performance of your compressors with lubricants from Klüber Lubrication.

Air compressor and vacuum pump food-grade oils

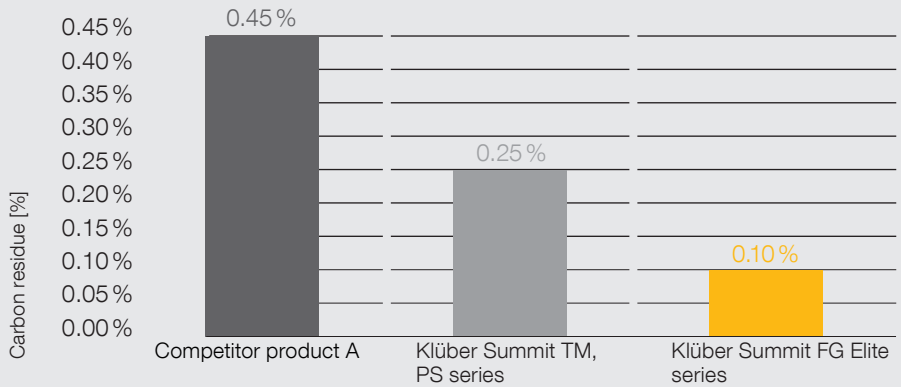
Application requirement	Product	Base oil	ISO VG DIN 51519	Viscosity Index	Flash point [°C]	Pour point [°C]	NSF H1 reg. number
Rotary screw type air compressors*	Klüber Summit FG Elite 32	PAO	32	≥ 130	≥ 220	≤ –51	159549
	Klüber Summit FG Elite 46	PAO	46	≥ 130	≥ 250	≤ –40	150874
Rotary screw type air compressors and vacuum pumps*	Klüber Summit FG Elite 68	PAO	68	≥ 120	≥ 250	≤ –35	159550
Reciprocating air compressors and vacuum pumps*	Klüber Summit FG Elite 100	PAO	100	≥ 120	≥ 250	≤ –36	159547
Reciprocating air compressors*	Klüber Summit FG Elite 150	PAO	150	≥ 120	≥ 250	≤ –39	159548

* Up to 8,000 hours changing intervals. The indicated oil change intervals are guide values which are based on practical experience. They depend on the intended use, the application method and the technical condition of the compressor.

Less oxidation residues

Klüber Summit Food Grade compressor products (FG Elite Series) reduce oxidation residues on compressor parts (e.g. pistons and valves) for an extended compressor lifetime.

Conradson Test*



* ASTM D 189

Energy saving

Energy is a major factor in air compressor operating costs. Synthetic lubricants from Klüber Lubrication offer a significant economic advantage by improving thermal and mechanical efficiency. They exhibit lower coefficients of friction, high thermal stability and superior heat-transfer ability. These inherent properties reduce friction and result in reduced power consumption and lower operating temperatures for your compressor.

Field studies have also documented that a 3 % to 5 % efficiency improvement can be expected from synthetic lubricants. When multiplied over the lifetime of your compressor, this can mean energy savings that will significantly reduce your energy costs.

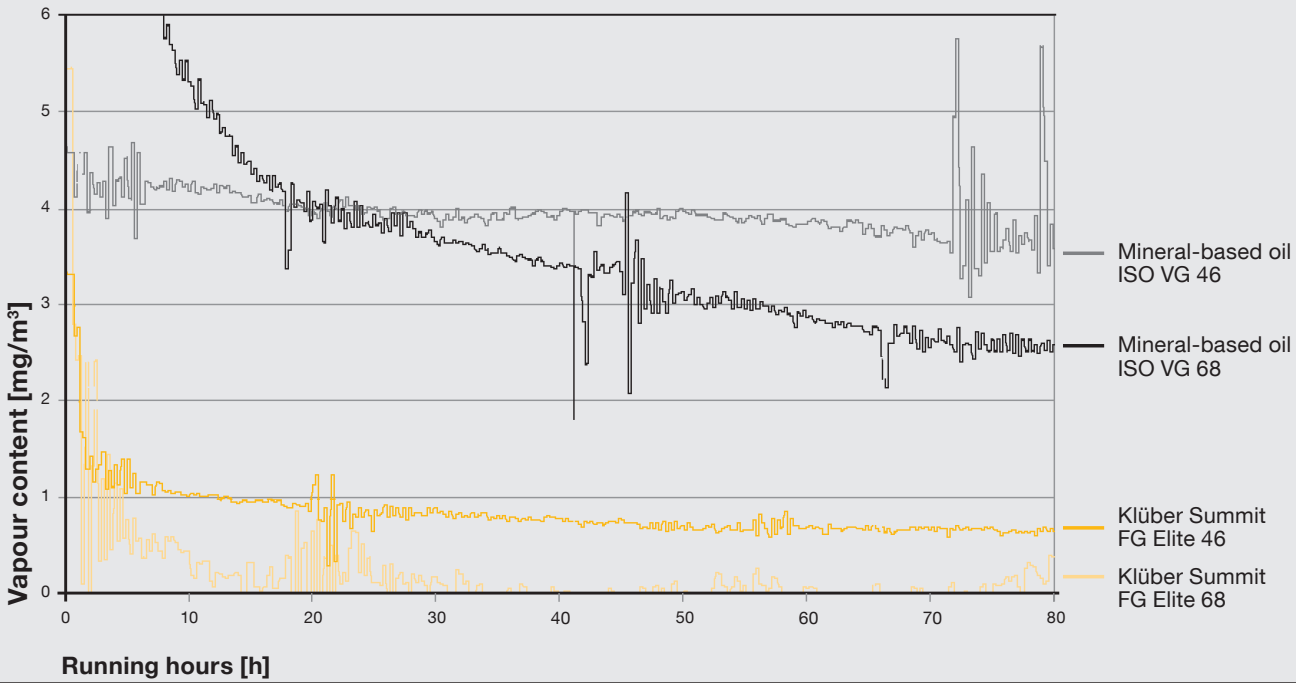
Your benefits:
- Reduced power consumption
- Improved thermal efficiency
- Improved mechanical efficiency
- Reduced friction

Lubricant changeover from mineral oils

When switching from mineral oil to a synthetic Klüber Summit food-grade oil, please bear in mind that the air compressor may contain oxidation residues that could affect the service life of the fresh Klüber Summit food-grade oil. The compressor should be cleaned using **Klüber Summit Varnasolv** conditioner.

After switching to Klüber Summit food-grade oil, it is recommended that you determine the oil change interval with an oil analysis or the Klüber Summit TAN Kit after approx. 500 to 1,000 operating hours.

Oil content in the compressed air at 100 °C [mg/m³]



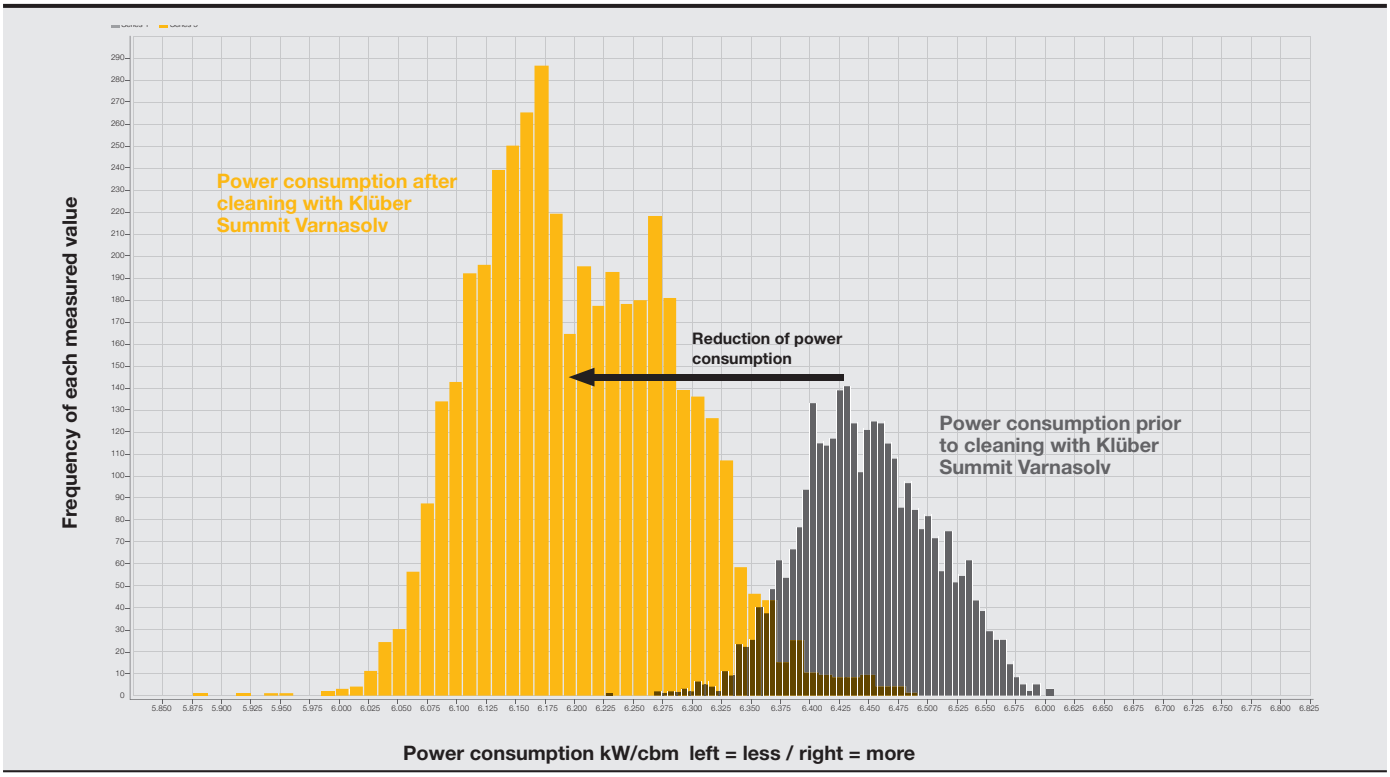
Klüber Lubrication products have a lower oil vapour content in the compressed air for less oil consumption, better efficiency and longer lifetime. Downstream refinery requires less maintenance due to reduced residual oil content in the compressed air, with filter lifetime increasing as a result.

Klüber Summit Varnasolv
Air compressor varnish cleaner

Klüber Summit Varnasolv is a concentrated conditioner fluid containing synthetic ester oil and cleaning additives. It is miscible with mineral oils, synthetic hydrocarbons, ester oils and polyglycol. **Klüber Summit Varnasolv** was developed especially for cleaning rotary screw compressors, vane compressors, hydraulic systems, gears and other oil circulating systems.

Mineral oil-based compressor oils can cause lacquer-like residues and carbon build-up in oil-injected screw-type and rotary vane compressors that may form deposits in the entire oil circuit.

This often results in increased energy consumption, increased temperature, clogged oil lines and filters, and high maintenance costs and downtime. **Klüber Summit Varnasolv** is a fluid cleaning concentrate designed to dissolve sticky residues, varnish and carbon build-up during operation and keep them suspended in the oil. The compressor unit does not have to be dismantled for cleaning purposes. The oil containing the residues is drained during the oil change and the compressor is filled with fresh oil. **Klüber Summit Varnasolv** is added to the oil fill at a concentration of 10 % (1 l **Klüber Summit Varnasolv** to 10 l oil fill) after a sufficient amount of oil has been drained from the system. The compressor unit is then operated for 40 to 60 h, ideally at an operating oil temperature of 70–80 °C. Oil filters and separators should be replaced afterwards and the compressor filled with fresh oil. Cleaning the compressor increases its efficiency.



The field test shows that power consumption decreased by 5 % on average when using Klüber Summit Varnasolv

Refrigeration compressor oils

Refrigeration compressors are responsible for most of the energy consumption in some food production facilities.

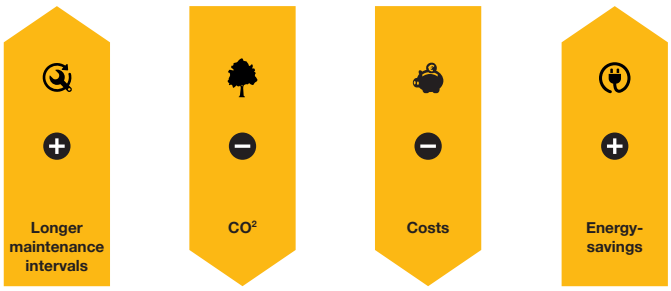
The use of high-performance compressor oils from Klüber Lubrication allows you to reduce your energy costs and increase the general reliability of your plant.

Manufactured with much less sulphur content, they produce a smaller gas reaction (e.g. ammonia), cleaner filters and coalescers, and also greater heat transfer efficiency with low oil carryover.

The list below sets out the recommended refrigeration oils according to the application requirement.

Application	Product	Base oil	ISO VG DIN 51519	Viscosity Index	Flash point [°C]	Pour point [°C]	NSF H1 reg. number
Screw-type refrigeration compressors operating with ammonia and CO_2	Klüber Summit R 100	PAO	32	≥ 120	≥ 230	≤ –60	134117
	Klüber Summit R 150	PAO	46	≥ 130	≥ 230	≤ –55	150873
	Klüber Summit R 200	PAO	68	≥ 130	≥ 240	≤ –51	134122
Reciprocating refrigeration compressors	Klüber Summit R 300	PAO	100	≥ 138	≥ 240	≤ –39	134123
Refrigeration compressors operating with ammonia and dry evaporation	Klüber Summit RPS 52	PAG	52	≥ 200	≥ 210	≤ –34	146736
Refrigeration compressors operating with ammonia	Klüber Summit RHT FG 68	White mineral oil		≥ 90	≥ 230	≤ –33	153518
	Klüber Summit RHT 68	Mineral	68	≥ 90	≥ 240	≤ –39	

Your advantages when using the right lubricant.
Obtain concrete savings and an evidence on site

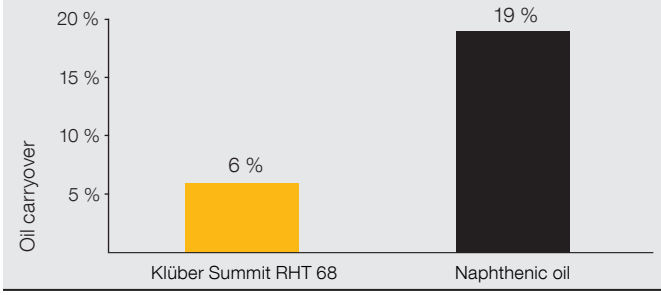


Hint:
Klüber Summit R and Klüber Summit RHT series are also suitable for lubricating ammonia pumps. Please check the equipment manual to select the correct viscosity.

Klüber Summit RHT 68 primarily focuses on ammonia, but can also be used with other refrigerants, for example R 22. It is a hydrotreated API group II oil, which means this product is very inert and will not react with ammonia. A very low content of sulphur results in no formation of sludge or varnish.

Less evaporation loss = less oil consumption

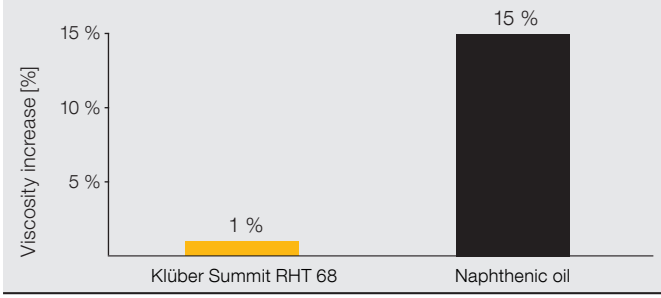
Noack Volatility (DIN 51581)



50 % less oil carryover when compared to conventional naphthenic oil

Less change in viscosity = less residue formation = longer oil lifetime

% in viscosity increase at 40 °C after 3,000 hours



Practical experience shows that oil filters in ammonia installations working with the RHT 68 series can last up to 10,000 hours

Klüber Summit R series, due to its very low pour point, is suitable for extremely low temperatures at the compressor evaporator (–60 °C, depending on the viscosity). It prevents the accumulation of frozen oil residues at the evaporator and maximises the heat exchange. R series is also used in CO_2 systems or ammonia-CO_2 cascade systems, when ammonia is used to cool down CO_2 gas, or to internally lubricate ammonia pumps.

Klüber Summit RPS 52, unlike mineral oils and polyalphaolefins, is miscible with ammonia, thus the oil entrained in the refrigeration cycle is recycled to the compressor together with the refrigerant. Therefore, it is no longer necessary to have oil catches in the refrigeration cycle, like in the case of non-miscible oils. Our experience gained in practice has shown that Klüber Summit RPS 52 can be used for evaporating temperatures as low as –40 °C depending on the operating conditions.

Lubrication of metal can seaming machines

The lubricant must protect the gearing and other moving parts of the can seaming equipment using recirculated oil. The lubricant must also be able to hold water, juice, syrups and other contaminants in suspension, allowing for easy removal by the filtration process.

Can seaming oils

Application	Product	ISO VG DIN ISO 3448	Base oil	Service temperature range		Kinematic viscosity, DIN 51562	NSF H1 reg. number
				From [°C]	To [°C]	40 °C [mm²/s] approx.	
Can seaming machines, total loss lubrication or recirculating systems with water separation by filtering	Klüberfood NH1 M 4-100 N	100	PAO	–30	135	100	157537
	Klüberfood NH1 M 4-150 N	150	PAO	–30	135	150	157541
	Klüberfood NH1 M 4-220 N	220	PAO	–30	135	220	157543
	Klüberfood NH1 M 4-100 NE	100	PAO	–30	150	100	157540
	Klüberfood NH1 M 4-150 NE	150	PAO	–30	150	150	157542
	Klüberfood NH1 M 4-220 NE	220	PAO	–30	150	220	157540

Can seaming greases

Application	Product	Speed factor [mm × min^{-1}]	NLGI grade DIN 51818	Service temperature range		Base oil viscosity	Base oil	Thickener	NSF H1 reg. number
				From [°C]	To [°C]	40 °C [mm²/s] approx.			
Seaming rollers	Klübersynth UH1 14-151	500,000	1	–45	120	150	PAO	Aluminium complex	056354
	Klübersynth UH1 64-62	500,000	2	–40	150	65	PAO	Silicate	136871
	Klüberfood NH1 94-51	500,000	1	–40	120	50	PAO	Calcium-complex	158140
	Klüberfood NH1 94-52	500,000	2	–40	120	50	PAO	Calcium complex	160333
	Klübersynth UH1 14-222	500,000	2	–25	120	260	PAO	Aluminium-complex	128827
	Klüberfood NH1 94-301	400,000	1	–40	140	300	PAO	Calcium-complex	140682

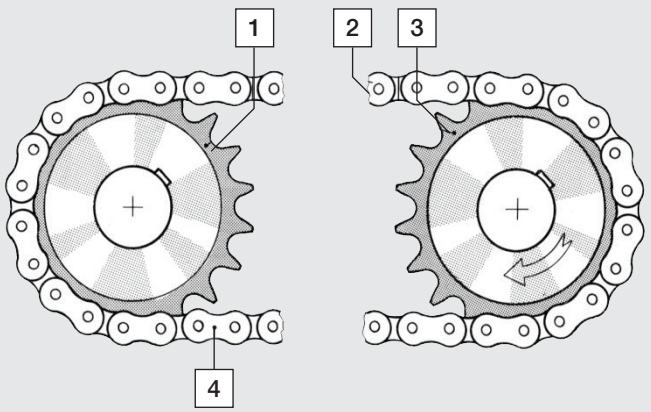
Lubricants for chains

As a food producer, you are certain to be using chains in your production process for transferring power, driving or controlling machinery, lifting operations or, most commonly, transporting foodstuffs.

In addition to the challenges resulting from the design of this machine element, you should consider the environment in which the chain is operating.

Chains are often used in the food industry to drive conveyor systems in very hot areas (bakery ovens or beverage can manufacturing), very cold areas (freezing tunnels in the meat industry, ice cream production and other frozen foods) or through high-humidity areas such as in proofer ovens or pasta and cereal dryers.

Schematic view of a chain drive

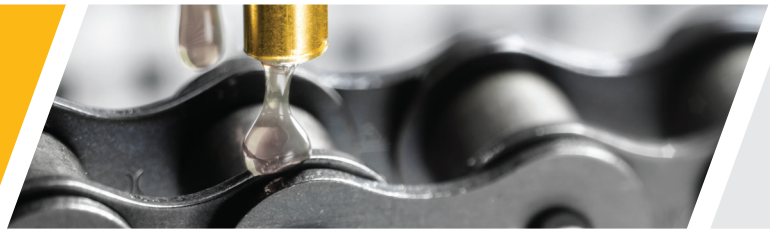


1 Driven sprocket
2 Loaded strand
3 Driving sprocket
4 Return strand

Chains are versatile design elements used in the transmission of power. They consist of a series of identical - usually metal - links. There are various types of chains to cover different requirements, for example roller chains, pin chains and bushing chains. A chain performs a very complex movement, resulting in a permanent state of mixed friction. The tribo-system needs a special lubricant to meet all the technical requirements.

Each application requires a reliable lubrication solution to deal with the listed requirements; the lubricants must also ensure safety in the production areas, as in some cases contact with foodstuffs cannot be avoided.

We offer an extensive list of products for chain lubrication, customised to suit your specific requirements for initial lubrication or relubrication.



Lubricants for chains

Application	Product	Kinematic viscosity, DIN 51562	Service temperature range		Base oil	Viscosity Index	NSF H1 reg. number
		40 °C [mm²/s] approx.	From [°C]	To [°C]			
Extreme temperatures [up to 650 °C*]	Klüberfood NH1 CH 6-120 SUPREME	120	–30	650	PAG + solids	n.a.	153014
High temperatures [up to 250 °C]	Klüberfood NH1 CH 2-460	460	–20	250	Ester	≥ 95	151665
	Klüberfood NH1 CH 2-75 Plus	75	–20	250	Ester	≥ 120	146429
	Klüberfood NH1 CH 2-220 Plus	220	–20	250	Ester	≥ 105	146427
	Klüberfood NH1 CH 2-260 Plus	260	–15	250	Ester	≥ 90	146428
	Klüberfood NH1 C 6-150	150	–20	160	PAG	≥ 210	133720
Low temperatures [down to –45 °C]	Klüber Summit HySyn FG 32	32	–45	135	PAO	≥ 120	133733
	Klüberoil 4 UH1-15	15	–45	110	PAO, ester	≥ 120	136436
Medium temperatures [up to 160 °C]	Klüberoil 4 UH1-460 N	460	–30	120	PAO, ester	≥ 150	121170
	Klüberfood NH1 CHT 6-220	220	–30	160	PAG	≥ 200	139201
No drip-off	Klüberfood NH1 CX 4-220	220	–40	85	PAO, ester	n.a.	150529
	Klüberfluid NH1 4-68 Foam Spray	68	–35	120	PAO, ester	n.a.	148259
	Klübersynth NH1 CM 4-100 Spray	100	–35	180	PAO	120	158097
	Klüberoil 4 UH1-1500 N Spray	1,500	–20	120	PAO, ester	≥ 180	130064
Dry wax for initial lubrication**	Klüberplus SK 02-295	n.a.	–40	120	n.a.	n.a.	136216
Sugar solvent e.g. pasta driers	Klüberfood NH1 1-17	n.a.	–40	60	White mineral oil	n.a.	138125
	Klüberfood NH1 6-10	12	0	60	PAG	n.a.	138556
	Klüberfood NH1 6-180	170	–15	80	PAG	n.a.	138575
Humid areas	Klüberfood NH1 C 8-80	80	–30	120	PAO, white mineral oil	≥ 90	142053
Conveyor belts	Klüberfood NH1 C 4-58	46	–40	135	PAO	n.a.	144464

* Dry lubrication
** For further information about wax lubrication, please contact our specialists.

Thermal stability and wear protection at high temperatures

When operating at high temperatures, chain oils must offer good thermal stability for preserving the components and increasing the lifetime of the chain, even under extreme conditions (e.g. load and speed).

The products Klüberfood NH1 CH 2-220 Plus and Klüberfood NH1 CH 2-260 Plus demonstrate excellent thermal stability and wear protection.

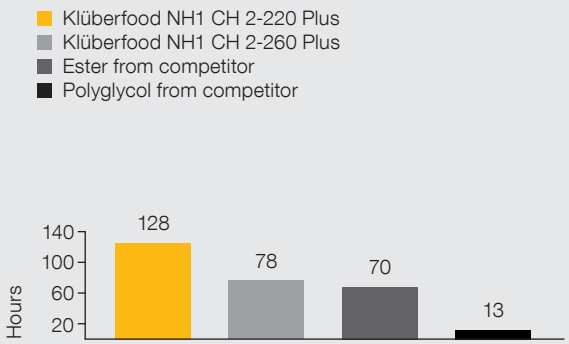
Thermal stability is measured using a dish test and carbonisation tests; the main objectives are to evaluate the ageing behaviour and oxidation resistance of the lubricant according to the temperature.

Wear protection is measured by a specific high-temperature chain test rig, simulating real working conditions. It compares the time necessary to achieve a certain elongation of the chains by using different lubricating oils.

Klüber Lubrication chain test rig

This test rig allows an evaluation of high-temperature chain oils under reproducible conditions similar to actual use. Since the thermal and the mechanical load are the critical parameters, this test mainly determines the effect of temperature on the chain oil's antiwear behaviour.

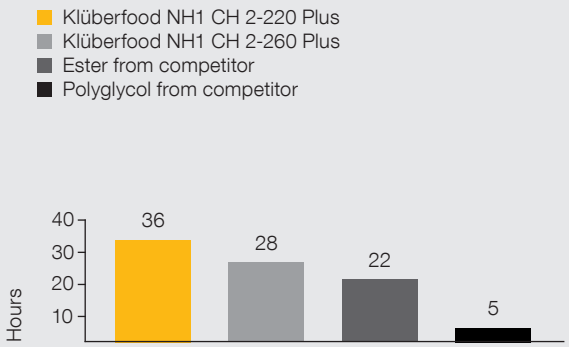
Operating time at 180 °C

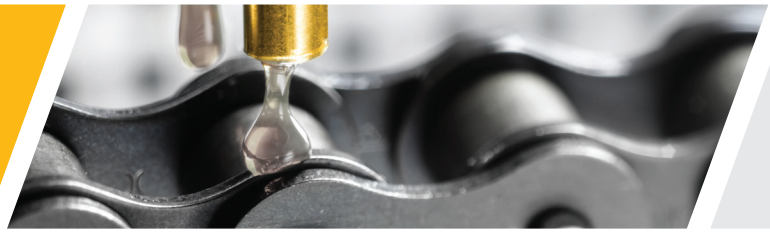


Test conditions
Temperature: 180 and 220 °C
Speed: 0.5 m · min^{-1}
Load: weight of approx. 2,600 N

The objective is to measure the operating time at the above-mentioned conditions to achieve an elongation of 0.1 % in the roller chain.

Operating time at 220 °C

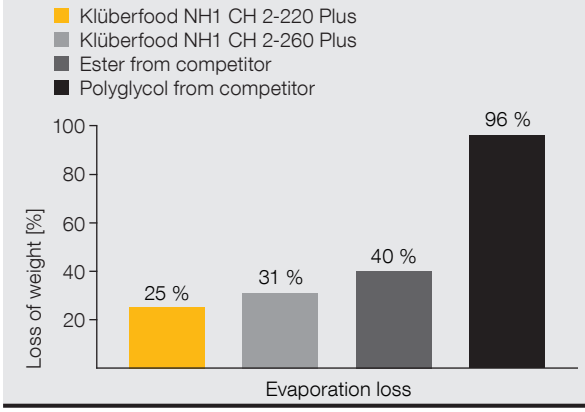




Dish test (evaporation loss)

The test shows the oil weight loss by evaporation after 24 hours at 250 °C.

Loss of weight [%] by evaporation at high temperatures



Klüber Lubrication high-temperature chain oils show 22 % to 37 % lower evaporation losses when compared to the best competitor product.

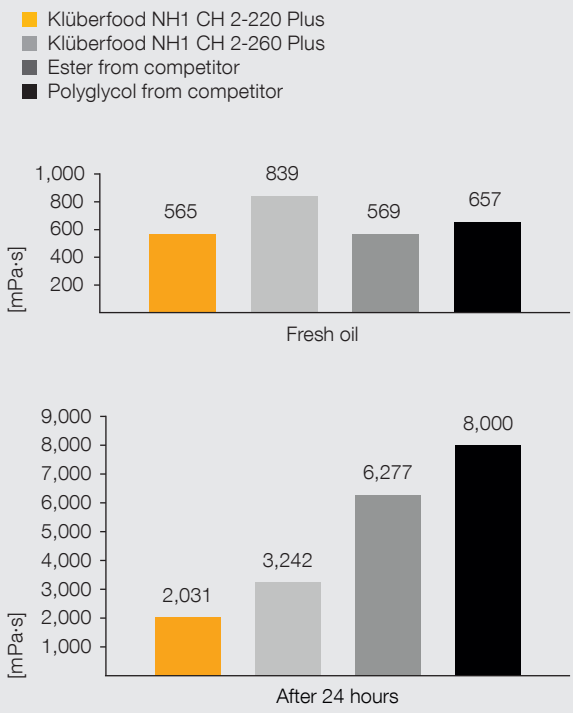
Less evaporation losses lead to lower oil consumption and longer relubrication intervals.

Test is performed using a capped dish simulating the chain's working conditions

Dish test (dynamic viscosity)

This test complements the evaporation loss test. It measures the increase in dynamic viscosity before and after the test.

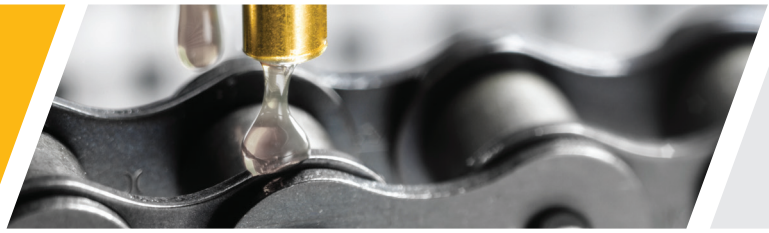
Dynamic viscosity increase of the residual oil at high temperatures



Both Klüber Lubrication high-temperature chain oils show the lowest increase in dynamic viscosity after 24 hours testing.

The increase in dynamic viscosity over time is undesirable as it makes it difficult for the new oil to flow correctly between the pins and keep the chain well lubricated.

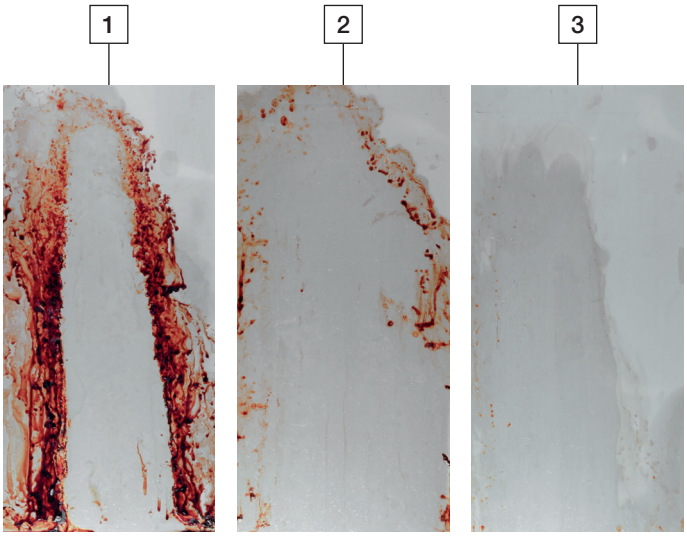
The lower increase of dynamic viscosity allows better oil penetration, therefore longer lifetime of the chain.



Carbonisation test

Oil is kept heated constantly at 240 °C and applied on a metal polished surface (30 ml per hour in small drops). The objective is to evaluate the condition of the metal surface after 48 hours.

A cleaner surface means the oil created less residues, therefore cleaning is less frequently required



1 – Competitor product, ester-based
2 – Klüberfood NH1 CH 2-220 Plus
3 – Klüberfood NH1 CH 2-260 Plus

The polyglycol competitor product did not pass the test.

Hydraulic and pneumatic lubricants

Following the advance of technology, hydraulic systems, working independently to generate movements in several machines or integrated into food machinery, have increased the demand for high-performance fluids.

Nowadays the role of hydraulic fluids goes beyond the transmission of power – they need to cope with different working temperatures, smaller systems with higher pressure, good compatibility with seals and paints and, additionally, contribute to energy saving and maintenance cost savings.

Below is a selection of fully synthetic H1 hydraulic fluids specially designed for the food industry.

Hydraulic fluids

Application	**Product**	**Marking acc. to** DIN 51502	**Base oil**	**Service temperature range**		**Material compatibility**	**NSF H1 reg. number**
				From [°C]	**To [°C]**		
High-pressure hydraulic systems	Klüberfood 4 NH1-32	HLP 32	PAO	–45	135	Neoprene NBRE, FPM and PTFE. Nylon (polyamide) and PVC. Acrylic and epoxy resin based paints	137442
	Klüberfood 4 NH1-46	HLP 46	PAO	–40	135		137443
	Klüberfood 4 NH1-68	HLP 68	PAO	–40	135		137444
	Klüberfood 4 NH1-100	HLP 100	PAO	–35	135		137441

Lubricants for automatic lubricators and pneumatic systems

We offer you special H1 oils for lubricators in two viscosities. These oils can be used for pneumatic installations, such as compressed air tools, compressed air conditioners, air systems in packaging machines and air pipes, or to extend the lifetime of friction points, including cylinders, valves and tappets.

Application	**Product**	**ISO VG** DIN 51 519	**Base oil**	**NSF H1 reg. number**
Lubricators	Klüber Summit HySyn FG 15	15	PAO	129191
	PARALIQ P 12	22	White minreal oil	056374

Application	**Product**	**Base oil**	**Seal types**	**Compatibility**	**NSF H1 reg. number**
Special grease for pneumatic cylinders	Klüberfood NH1 34-401	PAO	Damping seal, piston seal, rod seal	Not compatible with EPDM	149161

Products for mechanical seals, assembly and maintenance

Maintenance products

Requirement	Product	Upper service temperature [°C]	NSF
Corrosion protection	Klüberfood NH1 K 32	80	H1-138106
	Klüberfood NH1 K 32 Spray	80	H1-130873
Water displacement	Klüberfood NH1 4-002 Spray	50	H1-143558
Cleaner & degreaser	Klüberfood NK1 Z 8-001 Spray	-	K1/K3-143557
Solvent	Klüberfluid NH1 1-002*	-	H1/K1 - 139165
Rust removers	Klüber DEGRIPPANT NH1 Spray	-	148148

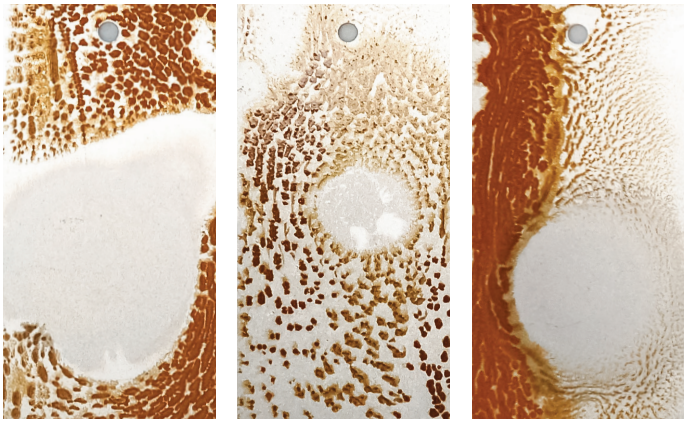
* Can be mixed with PARALIQ 91, PARALIQ P 68 and PARALIQ P 40 at various ratios.

Water displacement properties

Machines in the food industry that are susceptible to water washdown must be given protection against corrosion and water accumulation on metal surfaces.

To investigate water displacing properties and subsequent corrosion, a thin film of water is spread on the metal surface and then a drop of oil is applied.

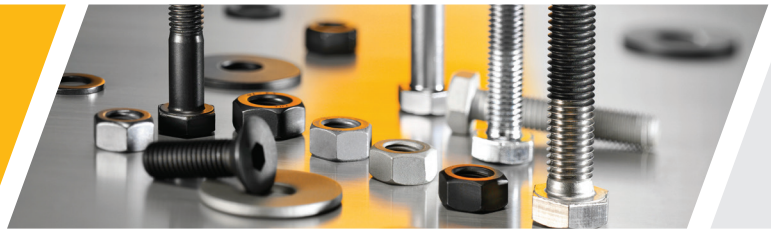
The result above shows that Klüberfood NH1 4-002 was able to displace a higher amount of water when compared to other products, even those without H1 approval.



Klüberfood NH1 4-002 | H1 compared product | Non-H1 water displacer

Assembly pastes

Application	Product	Base oil	Thick-ener	Service temperature range		Base oil viscosity	Four-ball tester welding load DIN 51350 [N]	NSF H1 reg. number
				From [°C]	To [°C]	40 °C [mm²/s]		
Low and normal temperatures	Klüberpaste UH1 84-201	PAO	PTFE	–45	120	200	> 3,000	136305
High temperatures	Klüberpaste UH1 96-402	PAG	Silicate	–30	1,200	360	> 2,500	056338
	Klüberpaste UH1 96-402 Spray	PAG	Silicate	–30	1,200	360	> 2,500	144396



Barrier fluids for mechanical seals

Application	Product	Base oil	Service temperature range		NSF H1 reg. number
			From [°C]	To [°C]	
Mechanical seals	Klüberfluid NH1 4-005	PAO	–45	150	143373
	Klüber Summit HySyn FG 15	PAO	–45	135	129191
	PARALIQ P 12	White mineral oil	–10	120	056374

Heat transfer fluids

Application	Product	Base oil	Service temperature range		Maximum oil film tempera-ture [°C]	Heat capacity [kJ/kg K] at 300 °C	Base oil viscosity*	NSF HT1
			From [°C]	To [°C]			40 °C [mm²/s] approx.	
Process of heating with closed systems in the food industry	Klüberfood NHT1 1-18	White mineral oil	-3	330	≤ 343	3,45	19	156393
	Klüberfood NHT1 1-39	hydro-treated mineral oil	0		340	3,08	42	156394

*Lower base oil viscosity allows: 1. Faster start-ups, even at low temperature 2. Higher flow speed, reducing the degradation level of the fluid at heating unit
**High thermal conductivity even at high temperatures 0.13 and 0.12 W /m K approx. between 100 and 300 °C.

Other products

Application	Product	Base oil	Base oil viscosity*	Pour point [°C]	Flash point [°C]	NSF H1 reg. number
			40 °C [mm²/s] approx.			
Multipurpose oils	PARALIQ 91 PARALIQ 91 Spray	Ester oil	14	≤ 5	> 230	056380 056380
	PARALIQ P 12	White mineral oil	21	≤ 12	> 180	056374
	PARALIQ P 40	White mineral oil	70	≤ 20	> 200	056379
Rubber and plastic, elastomer parts of vending machines	UNISILKON TK 002/500 UNISILKON TK 002/1000	Methyl silicone oil	400 1,000	≤ 50 ≤ 45	> 300	113764 142117
	UNISILKON M 2000 Spray		1,000	≤ 50	> 300	056386

Lubricants for valves and fittings

Valves and fittings are complex tribological systems and to minimise wear of such components, the lubricant has to be compatible with many materials. Moreover, the lubricant must not affect the mechanodynamical properties of valves and fittings, i.e. has to offer excellent compatibility with the materials used. Of course, lubricants used for drinking water valves also have to comply with local guidelines.

The right lubricant provides high media resistance in a wide range of applications. It ensures tightness of the system and prevents undesirable mixing. A lubricant also proves its quality when it offers the operator good tactile properties in installatons with hot and cold water or in pressurised boiler systems and with water temperatures of up to 130 °C. Other important features are compliance with food laws and neutral behaviour towards e.g. beer froth.

Our certified speciality lubricants are designed to meet your individual requirements, ensuring your valves and fittings operate reliably for their entire lifetime.

Application	Product	Elastomer compat-ibility	NLGI grade	Base oil	Thickener	Service temperature range		NSF H1 reg. num-ber
						From [°C]	To [°C]	
Beverage valves and fittings	Klübersynth UH1 64-2403	NBR	3	PAO	Silicate	–10	140	056363
	PARALIQ GTE 703	NBR, EPDM, FPM	3	Silicone	PTFE	–50	150	056372
Beverage valves and fittings, in sterile environments	Klüberfood NH1 87-703		3	Silicone	PTFE	–45	150	155194
Beverage, drinking water and heating valves	UNISILKON L 250 L	EPDM, NBR	3	Silicone	PTFE	–45	160	141714
	UNISILKON LCA 3801	NBR, EPDM, VMQ	1	Silicone	Calcium	–40	140	146027
	Klüberbeta VR 87-883	EPDM, NBR	3	Silicone	PTFE	–40	160	156353
	UNISILKON L 641 N	EPDM, FKM	3	Silicone	PTFE	–40	160	156436
Universal applications requiring a soft grease	Klüberbeta VR 67-3500	NBR, EPDM, FPM	0	Silicone	PTFE	–40	140	144018

KlüberEfficiencySupport

Services by Klüber Lubrication - your success from one tool box

KlüberEfficiencySupport

EfficiencyManager Online Service Portal

KlüberEnergy Energy efficiency	KlüberMaintain Maintenance optimisation	KlüberMonitor Higher productivity	KlüberRenew Component efficiency
			
Service for optimum energy efficiency of your lubricant application. Reports on concrete savings.	Support for your lubricant management and maintenance programmes/TPM with regard to lubricants and the associated maintenance activities.	We recommend optimisations to increase your productivity on the basis of tribological analyses of your application and bench tests.	Services for extending the life of your costly wear parts in large gear drives or chains supported by associated training.

KlüberCollege – People Efficiency

The methodology was developed by Klüber Lubrication, is tried-and-tested and consists of a multi-stage, systematic approach. We identify your requirements together with you at an early stage to discover potential for optimisation.

The results can be displayed by means of our maintenance software **EfficiencyManager**, which is used by our specialists to efficiently handle the processes relevant for production. The EfficiencyManager is an online portal combining all services offered by Klüber Lubrication and ensuring transparency among the ever more complex requirements in a smart factory.

As the EfficiencyManager works on mobile devices, you can access your data anywhere, anytime, and include unplanned occurrences on site, for example repairs or trouble-shooting. Thus, with just one tool you have all your relevant resources under control and are fit for audits.

1) TPM: Total Productive Maintenance

The right lubricant at the right place at the right time

Systems for automatic lubrication

We at Klüber Lubrication understand ourselves as a solution provider. We not only supply high-performance oils and greases, but also “intelligent packages” for automatic lubrication of your machines and components. Selected lubricants covering a wide range of typical applications are available in automatic lubricant dispensers for single-point lubrication. These tried-and-tested systems based on electromechanical or electrochemical technology are available with standard, long-term or high-pressure greases, standard or high-temperature chain oils and special oils and greases for the food-processing industry. We are also able to supply other lubricants in automatic dispensers on request and for higher order volumes, provided they have been tested and approved for use – please contact your Klüber Lubrication consultant for details.

Your benefits at a glance

Profitability

Continuous production processes and predictable maintenance intervals reduce production losses to a minimum. Consistently high lubricant quality ensures continuous, maintenance-free long-term lubrication for high plant availability. Continuous supply of fresh lubricant to the lubrication points keeps friction low and reduces energy costs.

Lubrication with Klübermatic can reduce costs by up to 25 %

Safety

Longer lubrication intervals reduce the frequency of maintenance work and the need for your staff to work in danger zones. Lubrication systems from Klüber Lubrication can therefore considerably reduce occupational safety risks in work areas that are difficult to access.

Lubrication with Klübermatic can decrease the risk of accidents by up to 90 %

Reliability

Automatic lubrication systems from Klüber Lubrication ensure reliable, clean and precise lubrication around the clock. Plant availability is ensured by continuous relubrication of the application.

Lubrication with Klübermatic may help to prevent up to 55 % of rolling bearing failures

From low-cost to high-tech – automatic systems for all requirements

Klüber Lubrication offers you the following technological solutions:
– freely adjustable lubrication increments between 1 and 12 months
– range of speciality lubricants
– self-contained or machine-controlled lubrication systems (time control with programmable controller)
– combination of tried-and-tested Klüber Lubrication lubricants with proven automatic lubricant dispensers

Klübermatic FLEX	Klübermatic NOVA	Klübermatic STAR VARIO	Klübermatic STAR CONTROL
			
Flexible use – and for lubrication points with high requirements	For applications subject to wide temperature fluctuations	Precise and adjustable lubricant metering	Externally controlled single-point relubrication

The data in this document is based on our general experience and knowledge at the time of publication 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 field tests with the product selected for a specific application. All data are guide values which depend on the lubricant's composition, the intended use and the application method. The technical values of lubricants change depending on the mechanical, dynamical, chemical and thermal loads, time and pressure. These changes may affect the function of a component. We recommend contacting us to discuss your specific application. If possible we will be pleased to provide a sample for testing on request. Products from Klüber Lubrication are continually improved. Therefore, Klüber Lubrication reserves the right to change all the technical data in this document at any time without notice.

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Klüber Lubrication – your global specialist

Innovative tribological solutions are our passion. Through personal contact and consultation, we help our customers to be successful worldwide, in all industries and markets. With our ambitious technical concepts and experienced, competent staff we have been fulfilling increasingly demanding requirements by manufacturing efficient high-performance lubricants for more than 90 years.

www.klueber.com

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