

your global specialist

Reducing maintenance costs with lubricants

Solutions for the rail industry





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Reducing maintenance costs with special lubricants from Klüber Lubrication

Clearing the line with high-quality specialty lubricants

Lubricants help to ensure that the complex interaction between the various different components in trains and related infrastructure continues to run smoothly. Whether it's for the maintenance of bogie components, doors or switches, choosing the right lubricant is crucial and can help to reduce operating costs while simultaneously increasing the availability and reliability of the modules.

Customised solutions for maximum benefit

Specialty lubricants made by Klüber Lubrication make a considerable difference:

For decades, the special requirements of rail industry users have been a central concern of our work. We collaborate with our customers to analyse the lubrication requirements of their components and use the resulting specifications as a basis for developing customised lubricants. In addition to high-quality, mineral oil-based lubricants, we also offer a comprehensive range of synthetic high-performance specialty lubricants as well as environmentally compatible and rapidly biodegradable lubricants to reduce your impact on natural resources. We help you to help the environment. What's more, our lubricants contribute to reducing life-cycle costs while increasing the reliability of your rail vehicles and infrastructure thanks to their large reserve capacity. They also enable longer maintenance intervals, reducing the amount of lubricant required.

We are where you are

Our aim is to offer you high-quality specialty lubricants and services around the globe along with the outstanding technical consulting competence for which Klüber Lubrication is known. We meet this aim through our worldwide network of development, production and sales companies, and through our highly specialised experts, who are always on hand to provide help and advice for any queries you might have. In this brochure, we have compiled a selection of specialty lubricants and listed them by modules and components for a clear overview. These lubricants have proven effective in trains and related infrastructure, with most of them being tried-and-tested over many years of use.

Gear lubrication

Rail vehicle gearboxes have to reliably withstand high stresses: high loads, high speeds, vibrations and extremely variable temperatures.

Klüber Lubrication has developed three high-performance gear oils specifically for the railway industry to enable your gearboxes

to fulfil these tasks. Thanks to their extraordinary performance capabilities, they fulfil different profiles of requirements. All our gear oils for trains are fully synthetic and based on polyalphaolefins (PAO):

	Pour point in °C	Kinematic viscosity at 40 °C in mm ² /s	Kinematic viscosity at 100 °C in mm ² /s	Viscosity index	Micropitting resistance	API GL 5 scuffing test
Klübersynth GE 4 75 W 90	-42	130	18	≥ 150	High Micropitting test ≥ 10	Passed
Klübersynth LEG 4 75 W 90	-60	90	14,5	≥ 170	High Micropitting test ≥ 10	Passed
Klübersynth GE 4 80 W 140	-30	250	30	≥ 150	High Micropitting test ≥ 10	Passed

There's '75 W 90', and then there's '75 W 90'

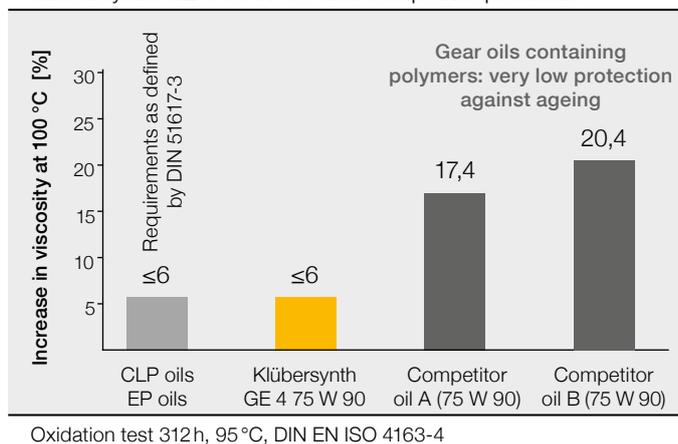
There is a wide variety of '75 W 90' gear oils. What are the differences between them, though? The fully synthetic gear oils from Klüber Lubrication have polyalphaolefin (PAO) base oils. They were developed especially for the requirements of the rail industry and do not contain viscosity improvers. What does that mean? Many commercially available '75 W 90' oils consist of base oils whose viscosity is adjusted with significant proportions of polymer-based viscosity improvers. These product concepts have been optimised with a view to meeting the requirements of the automotive industry. While they are reasonably priced, they have some major disadvantages compared to our product concept that does not use polymers.

1. Oxidation stability

As the following diagram shows, when put under thermal stress, many gear oils containing polymers show clear signs of aging in the form of changes to the molecular structure of the polymer content, leading to higher viscosity – the oil becomes 'thicker'. In addition, if the proportion of polymer changes substantially, so do the properties of the oil. The following graph shows the change in viscosity under elevated oxidative stress. Requirements for CLP oils specify that viscosity must not increase by more than 6%. Our gear oils meet this requirement. In contrast, the viscosity of oils containing polymers often increases by 15–20%.

Ageing behaviour

Klübersynth GE 4 75 W 90 and competitor products



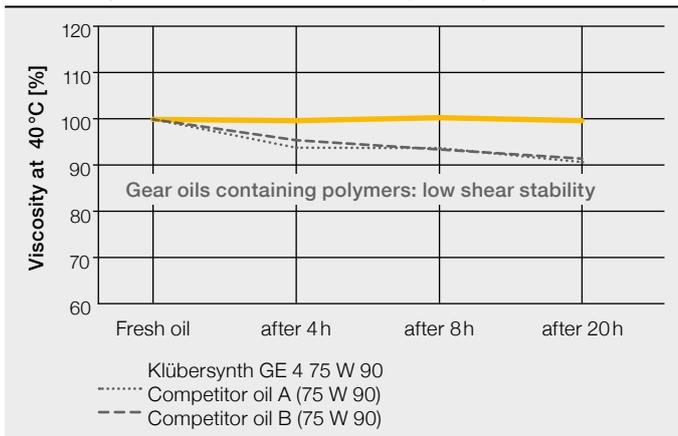
2. Shear stability

Besides their limited thermal stability, polymer-based viscosity improvers often show no pronounced shear stability. As shown in the diagram below, the shear forces acting inside a train gearbox tend to shear off the polymer contained within, leading to reduced viscosity – the oil becomes 'thinner'.



Shear stability

Klübersynth GE 4 75 W 90 and competitor products



Shear stability in four ball wear tester 1,450 rpm, 5,000 N, 60 °C, DIN 51350-6

The two effects of polymer-based viscosity improvers described under 1 and 2 impair the performance of gear oils. The longer the oils are in use, the more their performance characteristics change. The higher the oil sump temperature and shear stress, the greater the change in the oils with viscosity improvers. The oil designs used by Klüber Lubrication do not have these drawbacks.

What does that mean in practice?

Our train gear oils allow for much longer oil change intervals, as the oxidation and shear stability of our gear oils does not change or only changes very little. Our goal is to reduce the necessary number of oil changes by 50%.

That means you only need to change the oil every second time. What's more, we also carry out used oil analyses as part of this process to give you as much peace of mind as possible. That means reduced gear oil costs, increased work efficiency and, thanks to the reduced number of oil changes, increased availability of your trains.

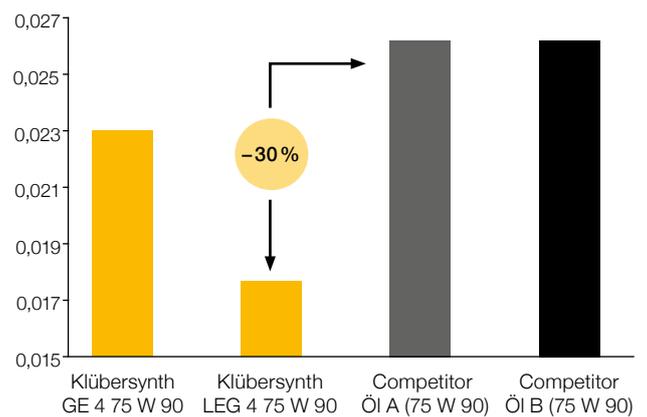
3. Friction coefficients

Klübersynth LEG 4 75 W 90 is the railway gear oil based on the latest technology from Klüber Lubrication. It is characterised by a combination of synthetic base oils with a unique additive system. A 30% lower friction coefficient helps to significantly reduce the oil sump temperature which, in turn, reduces gear strain and extends the oil life. In practice, this means a reduction of the oil sump temperature by between 3 and 10 °C.

4. Low-temperature characteristics

The excellent low-temperature characteristics of Klübersynth LEG 4 75 W 90 (pour point below -60 °C) in comparison to normal synthetic gear oils also allow you to achieve a lower initial torque at low ambient temperatures while simultaneously protecting lubricated components. In climatic conditions below -40 °C, Klübersynth LEG 4 75 W 90 is the product of choice. However, this lubricant also shows excellent performance at operating temperature.

Friction behaviour under EHL conditions



Wheel bearing lubrication

Lubricants for use in freight car wheel bearings have to fulfil stringent requirements. Lubricating capacity must be ensured reliably across a wide temperature range, variable speeds and vibrations. Greases for train wheel bearings must also be certified as defined by DIN EN 12081 and DIN EN 12082 for use in Europe. The stringent approval tests for such certification involve a variety of individual tests to verify a lubricant concept's chemical and mechanical performance under the most challenging conditions.

Major factor influencing the total cost of ownership of a freight car

The total cost of ownership (TCO) of a freight car largely comes down to the service life of its components and subsequent maintenance intervals. A freight car must undergo maintenance several times throughout its service life. The maintenance and repair of wheelsets can be particularly expensive here. Lithium-saponified mineral oil greases are currently the most popular greases on the market, providing lubrication for up to approx. 600,000 km in vehicle mileage or eight years of use. Due to increasing tonnage and rising cost pressures, however, it is already clear that this sort of lubricant mileage will not be sufficient in the future. Sights are therefore shifting towards more heavy-duty lubricants that can provide lubrication for up to and over 1.2 million km in vehicle mileage. This requires a new, innovative product concept: **Klübersynth BHE 46-403**.

Heavy-duty, fully synthetic wheel bearing grease

Thanks to its improved viscosity and oil release behaviour, with Klübersynth BHE 46-403 it's possible to build up a completely separating lubricant film far more quickly.

This means significantly less wear and lower temperatures in the rolling bearing.

This special lubricant also provides great wear protection and resistance against oxidation and corrosion. The individual tests of DIN EN 12081 are exceeded here. Klübersynth BHE 46-403 also provided lubrication for more than 800,000 km as part of its test rig trial as defined by DIN EN 12082. Further tests and simulations show the potential for relubrication intervals of over 1.5



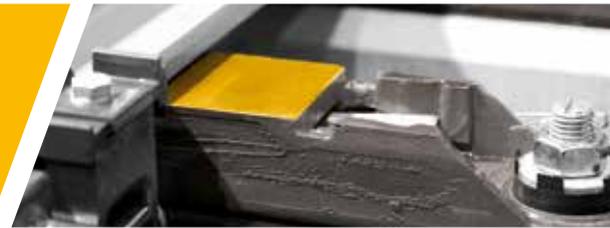
million km. Better yet, Klübersynth BHE 46-403 is also environmentally friendly, saving on both lubricant and CO₂ thanks to its increased running time and longer relubrication intervals.

Your technical benefits at a glance

By building up a load-bearing lubricating film more quickly, the specialty lubricant is able to separate friction components, functional surfaces and anti-friction bearing rollers from one another earlier on. This significantly reduces wear and subsequently **increases the bearing life**. The special additivation also provides for efficient corrosion protection as well as increased pressure and oxidation resistance, increasing the durability of the lubricant. In turn, Klübersynth BHE 46-403 allows you to implement **significantly extended maintenance intervals**.

What's more, thanks to this unique product concept using a combination of different base oils, it also guarantees this **high level of performance across a vast temperature range**. Klübersynth BHE 46-403's innovative lubricant concept allows for optimised resistance against friction which, in turn, **increases energy efficiency**. Of course, Klübersynth BHE 46-403 is **available worldwide**.

Lubrication of railway switches

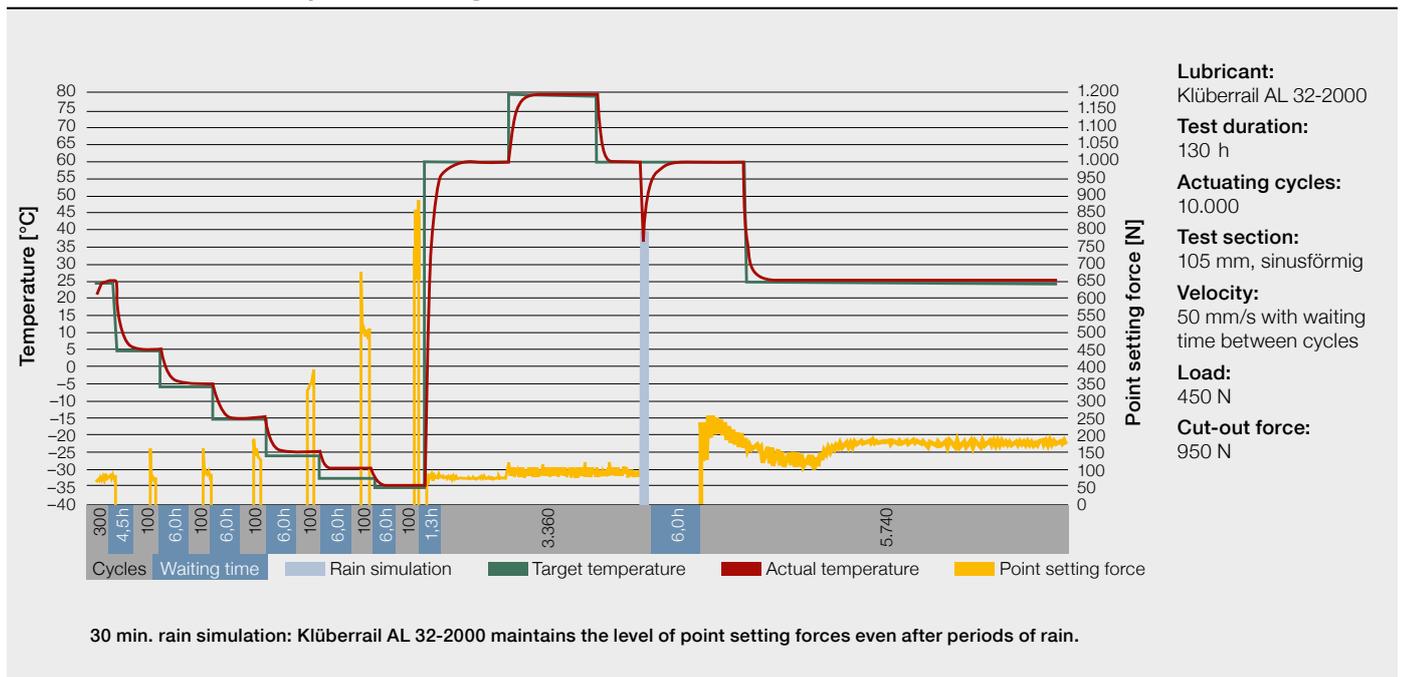


One of the most important maintenance tasks of infrastructure operators is ensuring that switch work flawlessly under all weather conditions. Appropriate high-performance lubricants for railway points increase the switch' reliability. They also have a positive impact on total costs thanks to prolonged relubrication intervals. A lubricant for railway switch must have certain characteristics to enable long relubrication intervals. These include a low friction coefficient, high corrosion and wear protection, biodegradability, good adhesion to the switch plate, very high water and UV resistance and easy application – even at low temperatures. As the lubricant for railway points comes into contact with the substrate, it must be biodegradable, so the challenge in developing our lubricants for railway switch was to combine these different requirements. We have succeeded in this, as all of our lubricants for railway switch are rapidly or completely biodegradable according to OECD standard 301 without compromising on performance.

The most important task of a high-performance lubricant for railway points is to ensure low switch setting forces for as long a period of time as possible. However, it is difficult to measure the setting forces on a real-life point over a longer period of

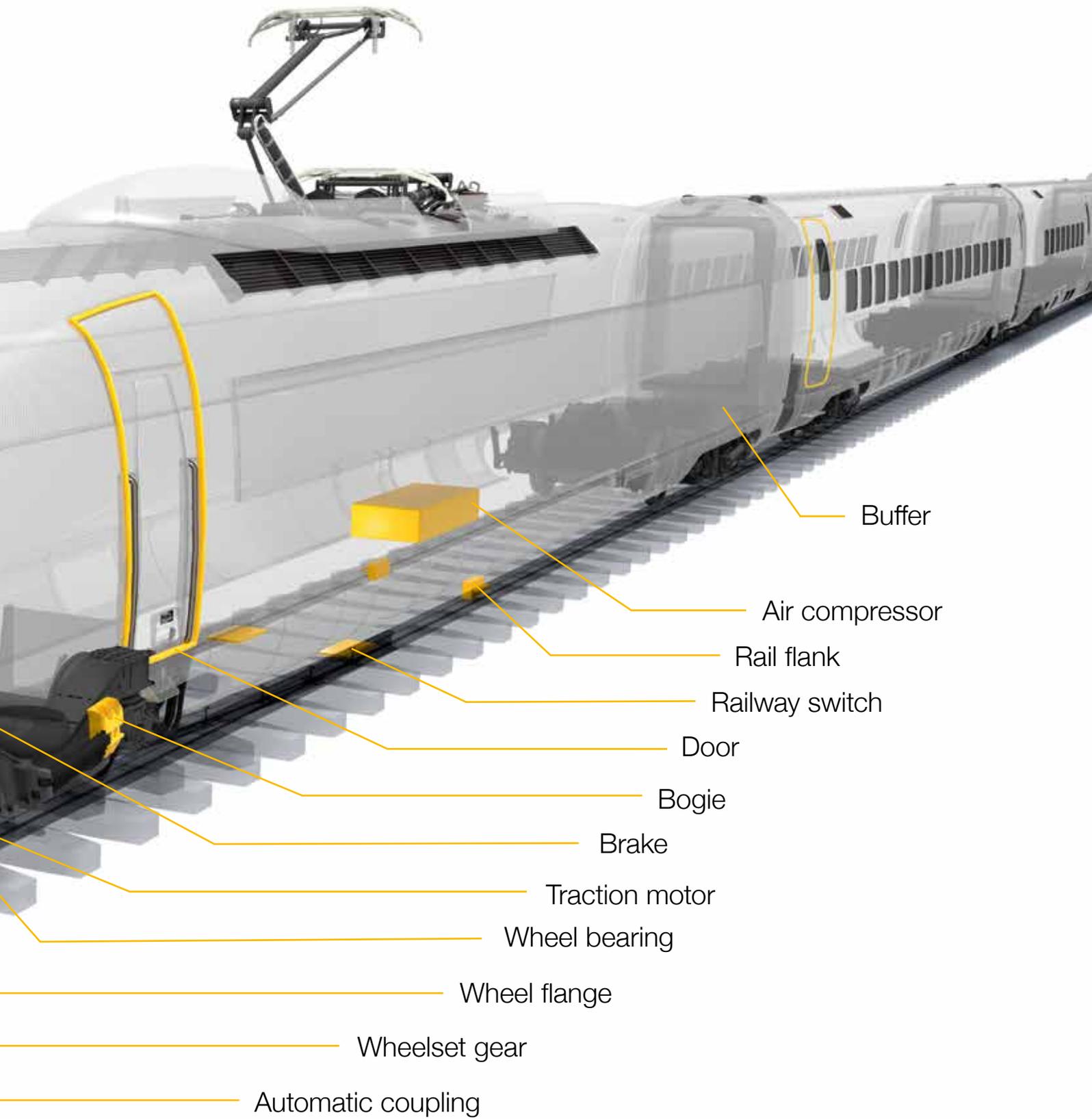
time. That's why we have developed a special test rig for our customers to simulate actual conditions and to measure the forces in each setting cycle. This allows various test cycles to be run which simulate the weather conditions of the seasons and different climate zones around the world. Our railway switch test rig can measure setting forces at different temperatures. The test rig can also be used to determine the influence of rain on setting forces with a 30-minute rain simulation. Tests have shown that friction forces increase only slightly under the influence of rain when using our lubricants for railway points, such as Klübrail AL 32-2000, which also offer very good corrosion protection. These excellent product characteristics have also convinced Deutsche Bahn. Both in laboratory tests and in an extensive field test, Klübrail AL 32-2000 prevailed over many other lubricants for railway points. Klübrail AL 32-2000 was confirmed for use by Deutsche Bahn in an approval certificate. In addition, Klübrail AL 32-2000 is also available as a spray. The spray version is particularly well suited for switch closures on otherwise low-maintenance roller switch and also works well on switch plates. The spray also comes in a neat and convenient container for easy transport for maintenance and repair teams.

Rain simulation on railway switch test rig



Perfectly equipped with
our specialty lubricants





Buffer

Air compressor

Rail flank

Railway switch

Door

Bogie

Brake

Traction motor

Wheel bearing

Wheel flange

Wheelset gear

Automatic coupling

Drive and brake

	Module	Application
	Wheelset gear	Gear teeth and bearings
	Traction motor bearings	Permanent operating temperature > 100 °C Permanent operating temperature < 100 °C
	Curved gear coupling	Grease lubricated Oil lubricated
	Brake	Bolts, bushing, slideways

Top-selling product	Benefits
Klübersynth GE 4 75 W 90	<ul style="list-style-type: none"> - Much longer oil change intervals due to high ageing and shear stability - Fully synthetic gear oil with high temperature resistance and specially developed additive package - Meets API GL5 requirements for high scuffing resistance - Approved by important gear manufacturers like Voith Turbo, Wateeuw, Siemens Traction Gears, Deutsche Bahn, Stadler and SKODA ELECTRIC
Klübersynth LEG 4 75 W 90	<ul style="list-style-type: none"> - Significantly reduced friction coefficient - Fully synthetic gear oil for low-temperature applications, pour point < - 60 °C - Meets API GL5 requirements for high scuffing resistance - Much longer oil change intervals due to high ageing and shear stability
Klübersynth GE 4 80 W 140	<ul style="list-style-type: none"> - Much longer oil change intervals due to high ageing and shear stability - Fully synthetic gear oil with high temperature resistance and specially developed additive package - Meets API GL5 requirements for high scuffing resistance
Klübersynth BHP 72-102	<ul style="list-style-type: none"> - Very high performance at high bearing temperatures - Very long relubrication intervals - Successfully used by international OEMs like Bombardier, TSA, VEM, Skoda Electric and operators
ISOFLEX TOPAS L 152	<ul style="list-style-type: none"> - Prolonged relubrication intervals - Good thermal stability - Low initial torques at low temperatures - Long-standing practical experience; successfully used by international OEMs and operators
Klübersynth BE 44-2001	<ul style="list-style-type: none"> - Increased grease life due to improved load-carrying capacity under high dynamic loads - Reliable formation of lubricating film even at high operating temperatures - Good low-temperature properties - Long relubrication intervals
Klübersynth MEG 4-460	<ul style="list-style-type: none"> - Very good wear protection - High shear stability for reliable formation of lubricating film - Excellent ageing and oxidation resistance
STABURAGS NBU 30 PTM	<ul style="list-style-type: none"> - Easy dismantling of fastening elements, even after a long period of use - Very adhesive assembly grease - Protects against tribocorrosion - Very good resistance to water and media - Good corrosion protection - With friction coefficients from 0.09 to 0.14, it meets DIN 25201 requirements - Also available as a spray

Bogie

	Module	Application
	Bogie	<p>Screw and bolt connections</p> <hr/> <p>Screw and bolt connections made of stainless</p>
	Wheel	Wheel flange
	Axles	Press wheel onto axle
	Axles	Axle bearing
	Wheel bearing cup	Assembly of wheelset bearing



Top-selling product	Benefits
STABURAGS NBU 30 PTM	<ul style="list-style-type: none"> - Easy dismantling of screws, even after a long period of use - Protects against tribocorrosion - Very good resistance to water and media - Good corrosion protection - With friction coefficients from 0.09 to 0.14, it meets DIN 25201 requirements - Also available as a spray
DUOTEMPI PMY 45	<ul style="list-style-type: none"> - With friction coefficients from 0.09 to 0.14, it meets DIN 25201 requirements - Easy dismantling of screw connections, even after a long period of use - Good corrosion protection - Very good resistance to water and media
Klüberail LEA 62-2000	<ul style="list-style-type: none"> - Sprayable fluid grease - Very good adhesion meaning lubricant is not flung off the wheel flange, even at high speeds - Good protection against wear - Good resistance to water - Environmentally compatible; rapidly biodegradable acc. to OECD 301F
ALTEMP Q NB 50	<ul style="list-style-type: none"> - Uniform pressing-on of the wheel due to high pressure absorption capacity - Low friction coefficient allows for reduction of assembly forces - Clean operation due to light colour of lubricant - Good resistance to water and media - Protects against tribocorrosion
Klübersynth BHE 46-403	<ul style="list-style-type: none"> - Long relubrication intervals of 800,000 km and more - Excellent wear protection for axle loads of up to 25 t - High oxidation stability - Good reserve capacities - Optimised ageing characteristics with a continuous lubricating film - Mechanical stability of the lubricant even when exposed to water - Can be used within a wide temperature range - Certified as defined in DIN EN 12081 and DIN EN 12082 (on the test rig) with wheel bearing types WJ/ WJP
UNIMOLY C 220 spray plus STABURAGS NBU 30 PTM	<ul style="list-style-type: none"> - Protects against tribocorrosion - Good corrosion protection - Discharging of voltage potentials - Very good resistance to water and media - Easy release of screws, even after a long period of use

Cars and connectors

	Module	Application
	<p>Door</p>	<p>Elastomer sealing on door frame</p> <hr/> <p>Linear guides, drive spindles</p> <hr/> <p>Functional surfaces, latches, springs, star wheels, mounting rails, torsion springs</p>
	<p>Automatic coupling</p>	<p>Couplings, coupling heads, main bolts, coupling rods, electronic couplings, etc.</p>
	<p>Buffer</p>	
	<p>Screw coupling</p>	
	<p>Air compressor</p>	

Top-selling product	Benefits
BARRIERTA L 25 DL	<ul style="list-style-type: none"> - Ensures low door opening and closing forces across a wide range of temperatures - Lubricant film is not washed off by rain or condensed water - Minimises the effects of sunlight to increase seal durability - Compatible with EPDM and silicone seals - Free of silicone meaning no paint-wetting impairment when refinishing car body parts
ISOFLEX LDS 18 SPEZIAL A	<ul style="list-style-type: none"> - Dynamically light long-term grease with excellent wear protection - Good corrosion protection - Good resistance to water - Low friction coefficients at high speeds
ISOFLEX TOPAS NB 52	<ul style="list-style-type: none"> - Fully synthetic long-term grease with good wear protection - Very good resistance to water and media - Good low-temperature behaviour - Good oil retention, even at high temperatures; no dripping off - Successfully used by international OEMs and operators - Also available as a spray
ISOLFEX TOPAS NCA 52	<ul style="list-style-type: none"> - Keeps movements smooth even at low temperatures down to - 50 °C - Good corrosion protection - Very good wear protection
Klüberbio AG 39-602	<ul style="list-style-type: none"> - Good adhesion and water resistance - Does not drip off even at high temperatures - Very good wear protection - Excellent corrosion protection - Significantly longer relubrication intervals - Environmentally compatible; rapidly biodegradable according to OECD 301
Klüberplex AG 11-462	<ul style="list-style-type: none"> - Excellent adhesion - Very good water resistance - Good corrosion protection - Longer relubrication intervals - Available as spray for easy application
Klüber Summit SH 46,68	<ul style="list-style-type: none"> - Fully synthetic oil for longer relubrication intervals - High evaporation stability - Low formation of oxidation residues in the oil circuit
Klüber Summit Ultima 46,68	<ul style="list-style-type: none"> - Fully synthetic oil with much longer relubrication intervals - High evaporation stability providing clean (oil-free) compressed air - Low formation of oxidation residues in the oil circuit



Infrastructure

	Module	Application
	Railway switch	Switch slide plates, point closure and adjustment rod system Switch lock and adjustment rod system
	Rail	Rail flank, stationary lubricating system
	Electrical contacts	No thermal stress With thermal stress
	Escalators	Gears
	Outdoor escalators	Chain
	Indoor escalators	Chain



Top-selling product	Benefits
Klüberraill AL 32-2000 Klüberraill AL 32-2000 spray	<ul style="list-style-type: none"> - Environmentally compatible; rapidly biodegradable acc. to OECD 301F - Small setting forces of switches even at low temperatures - Good resistance to water - Good corrosion protection - Long relubrication intervals - Very good application with portable spray equipment, with a brush or as a spray
Klüberraill AL 32-2000 spray	<ul style="list-style-type: none"> - Easy to apply - Perfect for roller-supported switches - All service teams can carry a spray bottle - Environmentally compatible; rapidly biodegradable acc. to OECD 301F - Good resistance to water - Good corrosion protection - Long relubrication intervals
Klüberraill AE 62-21	<ul style="list-style-type: none"> - Good adhesion - Lubricant does not fling off the rotating wheel - Good pumpability in lubrication system - Environmentally compatible; rapidly biodegradable acc. to OECD 301F
Klüberlectric KR 44-402	<ul style="list-style-type: none"> - Reduces plug-in and switching forces - Reduces tribocorrosion - Very good corrosion protection of copper, tin and silver surfaces - Excellent ageing and oxidation resistance for significantly longer service life - Good compatibility with plastics
BARRIERTA L 55/2	<ul style="list-style-type: none"> - Very good thermal stability - Reduces switching forces - Excellent ageing and oxidation resistance for significantly longer service life - Good compatibility with plastics
Klübersynth GH 6	<ul style="list-style-type: none"> - Very high wear protection - Reduces friction and temperatures - Excellent scuffing load capacity - Excellent ageing and oxidation resistance
Klüberoil C 1-150	<ul style="list-style-type: none"> - Good corrosion and wear protection - Noise dampening - Good creeping and penetration properties - Good resistance to media and salt water, water-repellent
Klüberbio EG 2-100	<ul style="list-style-type: none"> - Good corrosion and wear protection - Good creeping and penetration properties - Long-lasting lubricating effect and low oil consumption - Fully biodegradable in accordance with OECD 301 F - Can be mixed with mineral oil and PAO - Made from $\geq 90\%$ renewable raw materials - European eco-label
HOTEMP 2000	<ul style="list-style-type: none"> - Fully synthetic chain oil - Very good adhesion - Good creeping and penetration properties - Smooth, noise-dampening chain operation - Long-lasting lubricating effect and low oil consumption



Production and workshops

Application	Function	Product	Benefits
Screws, chains, locks, hinges, control cables	Lubricating oil, preservation, rust remover, cutting oil	QUIETSCH-EX	<ul style="list-style-type: none"> - Infiltrates and repels water - Creeps into very small gaps thanks to good creeping properties - Good corrosion protection - Clean cuts when drilling and sawing - Non-destructive dismantling of rusted components
Machine tool	Assembly paste	ALTEMP Q NB 50	<ul style="list-style-type: none"> - Long service life due to good water and media resistance - Prevents tribocorrosion and fretting rust - Reduces assembly forces and screw torques
Machines, enclosures, components	Corrosion protection	Klübersynth MZ 4-17	<ul style="list-style-type: none"> - For preservation and initial lubrication at the same time - Good corrosion protection - No residue formation, no gumming - Free from solvents - Available also as spray for easy application
Rolling and plain bearings, gear rims, racks	Universal lubricating grease	MICROLUBE GL 261 Klüberplex BEM 41-132	<ul style="list-style-type: none"> - Optimum lubricating effect in the boundary friction regime - Reduced frictional resistance and reduced component temperature - Reduced wear due to excellent lubricity - Increased service life of rolling bearings due to good wear protection characteristics also under vibration conditions - Good protection against fretting rust and corrosion
Spindle bearings	Lubricating grease	ISOFLEX NBU 15	<ul style="list-style-type: none"> - Bearings in indirectly driven spindles - Longer component life due to high load-carrying capacity and corrosion protection - High resistance to water and cooling lubricants - High ageing resistance for long-term and lifetime lubrication - For speed factors up to 1,600,000 mm · min⁻¹
Drilling and milling head gearboxes	Lubricating grease	ISOFLEX TOPAS NB 52	<ul style="list-style-type: none"> - Longer component life due to high load-carrying capacity and corrosion protection - High resistance to water and cooling lubricants - High ageing resistance for long-term and lifetime lubrication



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