

FUCHS Industrial Lubricants

RENEP

A complete product program



Slideway oils



FUCHS EUROPE SCHMIERSTOFFE GMBH

YOUR STRONG GLOBAL PARTNER



HOW WE EXCEL

We are a German company whose almost 600 employees manufacture and market a wide range of lubricants and derived specialties. The company, which was founded in 1931 as RUDOLF FUCHS, is located in Mannheim and is a 100% subsidiary of FUCHS PETROLUB AG, which is the largest independent lubricants manufacturer worldwide.

Our company's degree of specialisation and innovation is way above the industrial average in this field. The full product line includes almost 2,000 lubricants and derived specialties for all walks of life, industrial processes and applications. Our customer's success is also our success. Because partnership to us means passing-on benefits.

The advantage of a strong market presence: FUCHS is the largest independent manufacturer of lubricants in the world. The benefit of premium, innovative products from a full-line manufacturer: With a complete product line as well as tailor-made special solutions, FUCHS has a product for every application. The benefits of reliability: Certified according to DIN EN ISO 9001:2000 and ISO/TS 16949:2002, FUCHS has been continuously upgrading its highly specialised lubricants for decades.

And naturally, partnership for us also means providing our customers with competent support. With comprehensive marketing. With high-performance logistics. With the development of successful service concepts. And qualified consulting. Because together, we can achieve more.

FOR INDUSTRIAL LUBRICANTS



WHAT INCREASES THE VALUE OF OUR PRODUCTS

We develop lubricants: application-specific and tailor-made for our customer's processes. Together we look for the best lubricants for our customers. This cooperation is unique in terms of its form, scope and intensity. We call it **development partnership**. The success of our development partnerships is based on an important fact: FUCHS is not one of the oil-giants.

FUCHS is a multinational, independent lubricant manufacturer. Our independence is the difference. We are open to new solutions, open for visions – the prerequisites for innovations. And innovation is the defining characteristic of FUCHS. 70% of our products are less than five years old and the great majority of our products are individual solutions. Challenge us and see!



DIN EN ISO 9001:2000
ISO/TS 16949:2002
DIN EN ISO 14001:2004
REG.NR. 2476



Slideway oils.

For the lubrication of machine tool slideways, general lubricating oils.

The guides and slideways fitted to supports, tables and tool-holders are among the most important load-bearing elements of machine tools. Particular demands made on these slideways are high operational precision and high performance. The dimensional accuracy and surface finish of machined components is greatly influenced

by the stick-slip behaviour of slideways and guide rails. The slideway oil used is of particular importance to achieving optimum accuracy. To avoid chatter marks on component surfaces resulting from high surface pressures and slow feeds, a sufficiently adhesive lubricating film must be present on slideways and guides. This film must eliminate stick-slip, combat wear and avoid corrosion.

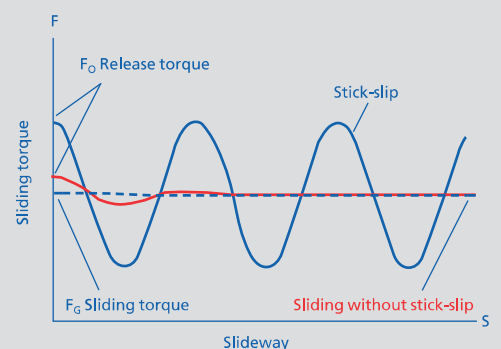
The cause of stick-slip is frictional vibration resulting from the constantly changing friction between the machine-tool toolholder – the tool and the work-piece – or slide and its slideway. The same applies to linear guide systems. When a machine tool slide is moved, high frictional and breakaway forces are created. The roughness peaks on both contacting surfaces, which can key into each other with increasing specific pressure, must ride up over each other and the breakaway forces must be overcome. Special slideway oils and their additives assist the formation of lubricant films on the surfaces. Chemically-active additives activate the metal surface, form anti-wear layers and reduce the coefficient of friction between the sliding surfaces. The adhesive properties of the slideway oil must be good enough to

withstand machine shut-downs as well as the influence of neat cutting oils and water-miscible cutting fluids. This stops the slideway oil from being squeezed out of the lubricant gap even at high pressures. Good adhesion and good wetting properties also avoid possible lubricant wash-out by the cutting fluid. This prevents the slideway from running dry, and prevents metal-to-metal contact between the roughness peaks. Special surface-active agents improve lubricant film stability, reduce the coefficient of friction and reduce frictional forces at the point of breakaway and during feed movement.



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Release torque



Guide, slideway, linear guide systems.

The most important characteristics of guides and slideways are:

- Low Friction
- No stick-slip at low feed speeds and high pressures
- Low wear and good protection against seizures and scuffing
- High stiffness, low play
- Good damping properties

As a rule, hydrodynamic, hydrostatic and roller guides are used in machine tools. Aerostatic and electromagnetic guides are only used for special applications.

The use of hydrostatic guides is falling but are still fitted to a great number of machine tools. These days, more and more hydrodynamic and roller guide systems (linear guides) are being used. The most common material combinations in hydrodynamic slideways are grey cast iron-grey cast iron, grey cast iron-plastic, grey cast iron-steel and steel-plastic. CGLP slideway oils according to DIN 51 502 and ISO 6743/13 are usually used for these material

combinations. Horizontal slideways are also lubricated with CGLP 68, HG 68 or G 68 slideway oils. Vertical slideways are lubricated with CGLP 220, HG 220 or G 220 slideway oils. In a number of cases, total-loss, central lubrication systems are used. Slideway oils are general lubricating oils with additives to improve oxidation resistance and corrosion protection. They also contain special AW and EP agents along with surface-active substances and some even contain tackiness improvers. When slideway oils are used in linear guide systems, the lubricants should form a barrier between the rollers in the contact zone (opposing movement of the rollers). In the contact area, the lubricant should also offer damping, especially at endpoints as well as protection against wear and seizures. The slideway oil should form an effective lubricating film almost instantaneously. Slideway oils for hydrodynamic slide-

ways and linear guides should display the following characteristics:

- Low static and dynamic friction coefficients
- Good compatibility with cutting fluids (chemical compatibility with water-based cutting fluids)
- Good compatibility with neat cutting oils
- Good demulsibility with emulsions, no slideway gumming
- Excellent corrosion protection
- Avoidance of stick-slip
- Compatibility with central lubrication equipment
- Good slideway adhesion
- Excellent wear-protection properties (EP and Anti-Wear performance)
- Good compatibility with slideway materials
- No discoloration of slideways (no corrosion effects)
- Good compatibility with hydraulic oils used
- Must satisfy the demands of hydraulic systems in combined hydraulic and slideway oil circuits (specific systems)

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Slideway oil without "tackifyer"



Slideway oil with "tackifyer"

Demulsifying properties of slideway oils and cutting fluids.

The demulsifying properties and the separating properties of slideway oil and cutting fluids are examined in a special laboratory test.

This test provides information on the compatibility or incompatibility of slideway oils and cutting fluids. Furthermore, it should examine the influences of the function of slideways and guides.

The cutting fluids to be tested are mixed with the corresponding slideway oils (80 % oil, 20 % cutting fluid, intensive stirring at room temperature) and then examined for demulsification and separation properties and evaluated in line with DIN 51 599.

The evaluation is performed visually after one hour (1h), after one day (1d) and after seven days (7d).

Stage 1 classifies the demulsibility as "very good", i.e. both phases are completely separated.

Stage 2 shows an almost complete separation with a small boundary phase.

Stage 3 contains one oil and one boundary phase.

Stage 4 contains the three phases; an oil, emulsion and boundary phase or one oil and one boundary phase > 30% vol.

Stage 5 contains one boundary and one emulsion phase.

Stage 6 shows no demulsifying, i.e. the boundary phase remains fully intact.

Evaluation

It can be assumed that combinations with the evaluation 1 or 2 have no negative effect on guide or slideway systems.

Combinations with the evaluation 3 can still be tolerated. Combinations with the evaluation 4 – 6 form large boundary phases in the forms described below. An increased formation of microorganisms can be recorded. Combinations with the evaluation 4 – 6 should not be used.

Note

The concentration of the cutting fluid has a major impact on demulsifying properties. Test temperature also influences demulsifying.

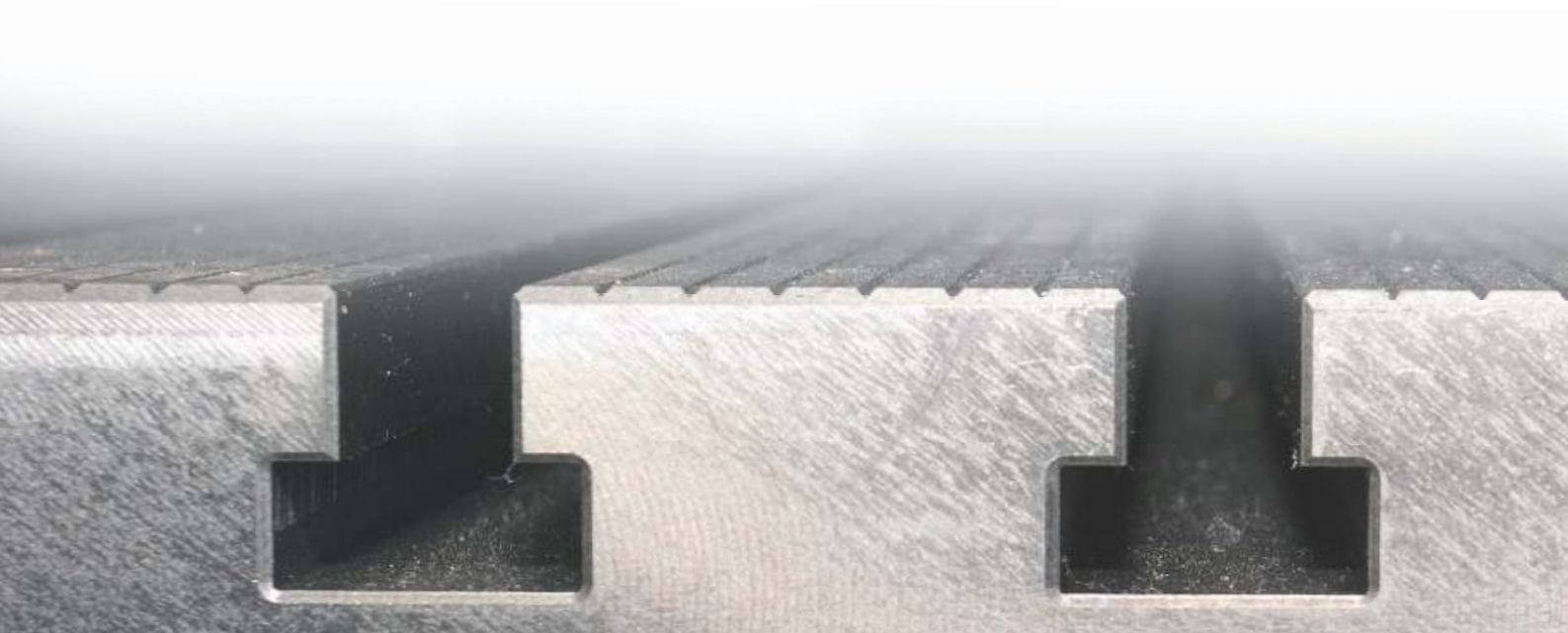


Slideway oil demulsifying



Slideway oil emulsifying

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Further testing possibilities – compatibility tests: oil – cutting fluid emulsion.

A mixture of slideway or hydraulic or gear oil and cutting fluid emulsion is subject to a demulsification test. The following parameters of the emulsion (which may be contaminated with oil) are tested:

- Concentration (stability)
- PH value (corrosion)
- Conductivity (drag-in of contaminants)
- Sulfide potential (odour problems)

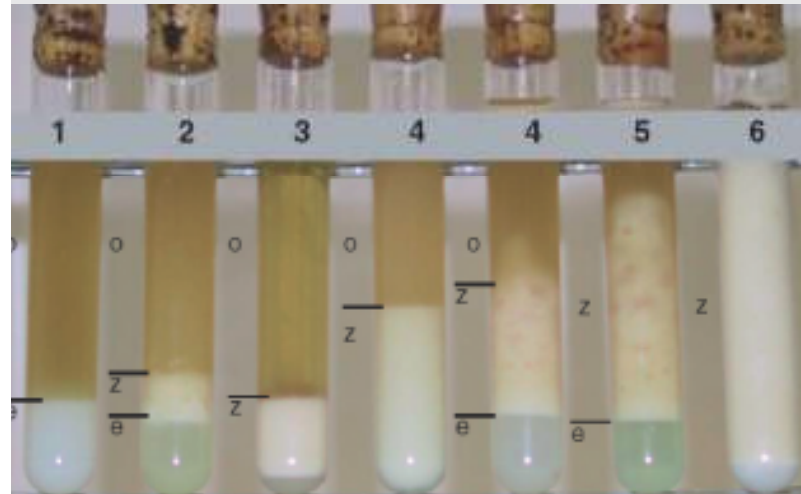
The emulsion data is compared with data from a freshly-mixed emulsion. Ideally, deviations should be minimal.

While concentration changes indicate possible stability problems, pH changes can result in corrosion and possible skin compatibility problems. Conductivity changes are also an indicator of dragged-in impurities and thus lower stability and deviations in sulphide potential can result in odour problems.

These tests can also be conducted at a ratio of 1:1 (e.g. 125 ml slideway oil to 125 ml cutting fluid).

Again, the pH value of the oil and emulsion phases should be determined before and after the test. Ideally, any pH value deviation should be as small as possible.

In addition, a shift or a drop in concentration and the conductivity before and after the test should be recorded and again any deviations should be as small as possible.



The images show the evaluation stages 1 – 6 (e = emulsion, o = oil, z = boundary phase).

The boundary phase z appears in various states: foam (1d) – stable foam – precipitation / flocculation – creamy residue).



Determining the static coefficient of friction with an inclined tribometer.

The test apparatus, manufactured by the company SKC Gleittechnik in 96472 Rödental/Germany, uses the inclined plane principle. The inclined plane is formed by a bar, containing a slideway in which suitably machined strips of the mating materials are fitted. The slideway is raised at a constant angular velocity with the aid of a hydraulic piston. The slider is fitted at each end with two specimens of the materials to be tested. Taking into account the 90° vee-geometry, this produces a pressure of 10 N/cm² which can be increased up to 40 N/cm² with extra weights.

Test procedure

When the slider has moved a distance of 20 microns, a limit switch stops the upward movement of the inclined plane. Also the plotter, which up to this point, made a stiction vs. travel plot, is switched over to travel vs. time. A computer connected via an interface converts the angle reached to the coefficient of friction using the formula (90° vee slideway):

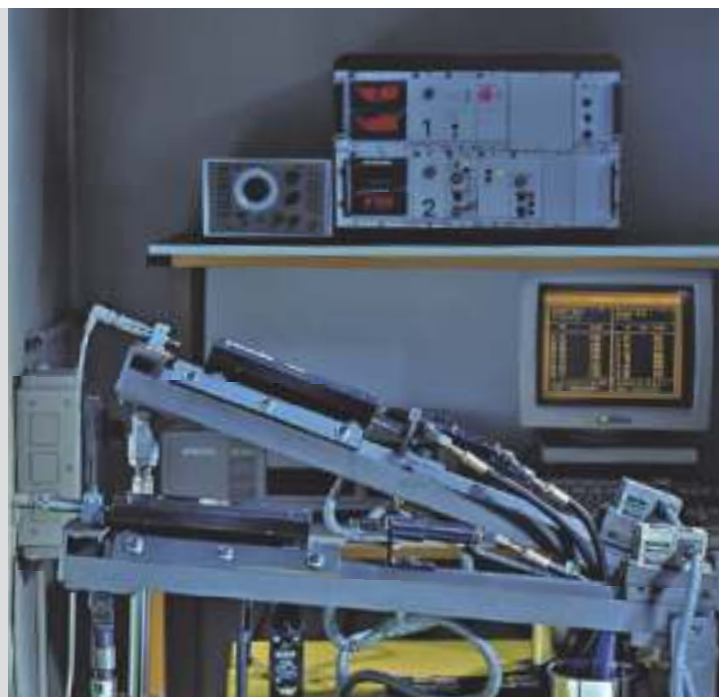
$$f_0 = \tan \alpha \times \sin 45^\circ$$

After the test has been repeated ten times, a mean value and standard deviation are determined. The coefficient of friction f_0 is shown in the results together with the mating materials, the sliding speed and the slideway oil used.

Evaluation

The coefficients of friction should be as low as possible and remain at a low, stable level. To compare the coefficients of friction, other major criteria and properties of the slideway oil should be examined, especially wear protection and demulsibility. The evaluation of slideway oils should also consider the compatibility with the cutting fluid emulsion used. It is recommended that an overall evaluation of the slideway oil-cutting fluid-machine tool parameters is undertaken.

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Demulsibility of RENEP slideway oils with ECOCOOL cutting fluids.

Valuation : Demulsibility/separation behaviour after 1 hour , after 1 day, after 7 days.

Name of the cutting fluid	Name of the slideway oil	Conz. (%)	after 1 h, stage	after 1 d, stage	after 7 d, stage
ECOCOOL 2516 BF	RENEP 5 K	8	1*	1*	1*
ECOCOOL SCIP	RENEP CGLP 68	5	1*	1*	1*
ECOCOOL SCIP	RENEP CGLP 220	5	1*	1*	1*
ECOCOOL SCIP	RENEP 2 K	5	1*	1*	1*
ECOCOOL SCIP – HD	RENEP CGLP 68	5	1*	1*	1*
ECOCOOL SCIP – HD	RENEP CGLP 220	5	1*	1*	1*
ECOCOOL SCIP – HD	RENEP 2 K	5	1*	1*	1*
ECOCOOLI 2506 B	RENEP CGLP 68	3	1*	1*	1*
ECOCOOL 2506 B	RENEP CGLP 68	5	1*	1*	1*
ECOCOOL 2506 S	RENEP CGLP 68	3	1*	1*	1*
ECOCOOL 2215 BF – FAG	RENEP CGLP 68	3	1*	1*	1*
ECOCOOL 2215 BF – FAG	RENEP KN 68	3	2**	1*	1*
ECOCOOL 2215 BF – FAG	RENEP KN 68	5	2**	1*	1*
ECOCOOL 2516	RENEP CGLP 68	3	1*	1*	1*
ECOCOOL 2516	RENEP CGLP 68	5	2**	1*	1*
ECOCOOL 2215 BF	RENEP CGLP 68	3	1*	1*	1*
ECOCOOL 2215 BF	RENEP CGLP 68	5	1*	1*	1*
ECOCOOL 2506 S	RENEP CGLP 68	3	1*	1*	1*

*Stage 1: Very good demulsibility

**Stage 2: Good demulsibility

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The perfect slideway oil for application.

■ RENEP CGLP

High-performance slideway oils for all machine tools offering excellent demulsibility, good chemical compatibility with cutting fluids, outstanding wear protection and low coefficients of friction.

RENEP CGLP products are highly-advanced slideway oil formulations for machine tools and all slideways and linear guide systems. Specially selected additives guarantee high lube film stability, lowest possible friction coefficients (to avoid stick-slip), high wear protection and excellent demulsibility with water-based cutting fluids. CGLP products ensure that a load-bearing and protective lubricating film is formed.

They do not stain or discolour the slideways and protect against scuffing and corrosion. In addition, RENEP CGLP 68 can be used as a fully-functional hydraulic oil.

RENEP CGLP SERIES of products are advanced and universally-applicable lubricants for the latest generation of slideways and linear guide systems.

Noteworthy features of the RENEP CGLP SERIES of products are:

- Extremely low friction coefficients (static and dynamic)
- Excellent Anti-Stick-Slip behaviour
- Excellent demulsibility with water-based cutting fluids
- Outstanding adhesion on metal and plastic surfaces
- Very good corrosion protection, combats staining of the surface
- Avoids gumming and the formation of cutting fluid deposits

■ RENEP KN

RENEP KN SERIES products are highly-tacky, demulsifying, universal and advanced slideway oils. Special surface-active additives guarantee good product adhesion. The tackifiers in RENEP KN products are highly-stable and display excellent compatibility with water-based cutting fluids.

RENEP KN products are universally applicable in slideway and linear guide systems.

Outstanding features of the RENEP KN SERIES are:

- Excellent adhesion provided by special additives which increase the adhesion to metal and plastic surfaces – “tacky effect”
- Very good anti-Stick-Slip behaviour, low friction coefficients
- Good demulsibility with water-based cutting fluids

- Good compatibility with cutting oils
- Combats gumming and deposits
- Good corrosion protection

■ RENEP K

Universal slideway oils for the machine tool industry with powerful detergent and dispersant properties.

RENEP K SERIES products are universal products suitable for all slideway applications. They offer good adhesion, good EP performance, good anti-wear properties and pronounced corrosion protection. RENEP K SERIES products display good compatibility with slide materials, very good ageing and oxidation stability and reliably combat stick-slip. RENEP K products are formulated to be detergent and dispersant slideway oils with powerful cleaning properties and good compatibility with cutting oils and water-based fluids. RENEP K products keep the surface clean and avoid the formation of residues.

Outstanding features of the RENEP K SERIES are:

- Excellent wetting properties
- Good Anti-Stick-Slip behaviour
- High detergency/dispersancy
- Good compatibility with neat cutting oils
- Good corrosion protection

■ PLANTOLUBE CGLP S

PLANTOLUBE CGLP S SERIES products are fully-synthetic, environmentally-responsible slideway oils based on synthetic esters.

PLANTOLUBE CGLP S products are carefully matched to the whole range of rapidly biodegradable hydraulic and gear oils. PLANTOLUBE CGLP S products are fully compatible with the environmentally-harmless range of FUCHS of PLANTO products. They offer good protection against seizing, wear, corrosion and display excellent stability. Due to the polarity of esters, PLANTOLUBE CGLP S products have good wetting properties and good “natural” cleaning properties.

The outstanding features of the PLANTOLUBE CGLP S SERIES are:

- Excellent wetting properties
- Excellent Anti-Stick-Slip properties
- Very low friction coefficient
- Good compatibility with other PLANTO products
- Good corrosion protection

RENEP slideway oils – an overview of selected technical data

Product name	Density at +15°C Kg/m ³	Flashpoint, Cleveland °C	Kinematic viscosity at +40°C	Pour-point °C	Friction coefficient SKC3-GG25	Friction coefficient GG25-GG25
RENEP CGLP 68	879	+220	68	-24	0.083	0.122
RENEP CGLP 220	895	+240	220	-15	0.084	0.143
RENEP KN 68 (Tacky)	880	+220	68	-29	0.086	0.130
RENEP KN 220 (Tacky)	895	+238	220	-17	0.092	0.130
RENEP 2 K	882	+230	68	-27	0.111	0.204
RENEP4 K	885	+240	100	-24	0.118	0.189
RENEP 5 K	900	+248	220	-12	0.125	0.155
PLANTOLUBE CGLP 68 S	928	+304	69	-48	0.08	0.123
PLANTOLUBE CGLP 220 S	950	+280	220	-48	0.092	0.129

RENEP slideway oils – properties in comparison

Some important properties in comparison	Coefficients of friction	Demulsification with water-based cutting fluids	Adhesion "tackiness"	Wear protection "scuffing protection"
RENEP CGLP SERIES	Extremely low +++	Extremely good +++	Very good, without "tackifier" ++	Very high protection FZG A/8,3/90:12 +++
RENEP KN SERIES	Extremely low +++	Very good ++	Extremely good, with "tackifier" +++	Very high protection FZG A/8,3/90:12 +++
RENEP K SERIES	Very low ++	Emulsifying DD – performance	Very good, without "tackifier" ++	High protection FZG A/8,3/90:11 ++
PLANTOLUBE CGLP SERIES	Extremely low +++	Very good ++	Very good, without "tackifier" ++	Very high protection FZG A/8,3/90:12 +++

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FUCHS Industrial Lubricants

Innovative lubricants need experienced application engineers

Every lubricant change should be preceded by expert consultation on the application in question. Only then can the best lubricant system be selected. Experienced FUCHS engineers will be glad to advise on products for the application in question and also on our full range of lubricants.



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