RENEP CGLP

High-performance slideway oils for machine tools, with excellent demulsification properties and extremely low friction coefficient

Description

The quality of machined components depends heavily on the accurate feed and accurate positioning provided by machine tool slideways with slideway oils playing an important role. Slideway oils must provide a stable, adhesive lubricating film in the presence of metalworking fluids even in micro-feed situations and when pressures are high. Good lubrication eliminates chattering and thus ripples on the surface of components caused by stick-slip.

RENEP CGLP oils were developed together with the Tribological Laboratory at the University of Darmstadt and the Laboratory for Tribology and Sliding Technologies (SKC-Technik). Carefully selected base oils and matched additives guarantee almost friction-free movement at the lubrication points. Special attention during development was also paid to compatibility with the water-miscible cutting fluids used in machine tools. Anti-corrosion agents and ageing (oxidation) inhibitors are effective at relatively low temperatures (working temperature = room temperature). EP and anti-wear additives guarantee long machine life and exceptionally good operational reliability.

The selected additive combinations create layers which have a low internal friction. Furthermore, polar surface-active substances form a stable, adhesive lubricating film. This reduces friction when movement starts, lowers the initial current consumption and optimizes the efficiency of the machine tool.

Advantages

- **Stable lubricating film**
- **Low coefficient of friction**
- **Avoidance of stick-slip**
- **Good EP properties and excellent protection against wear**
- **Excellent corrosion protection (steel and nonferrous metals)**
- **Good demulsification, optimum compatibility with water-miscible cutting fluids**
- **Excellent compatibility with plastic materials (slideway materials)**
- **No discoloration of the slideway material**

Specifications:

The products fulfill or exceed the requirements according to:

- DIN 51502, CGLP
- ISO 6743-13, GA and GB
- CGLP 68 and HLP 68

Inter alia approved by:

- Deckel-Maho
- Heller
- Hüller Hille
- Trumpf

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Application

To reduce the power consumption during slideway start-ups and feed situations, special attention must be paid to the lubricant between the sliding elements. Important parameters for the selection of the most suitable slideway oil are the cutting fluid, the slideway materials and the geometry of the lubrication grooves. The lubrication intervals must be matched to the machining operation and the design of the machine. Apart from the classic cast-cast, steel-cast and steel-plastic slideway materials, there is an increasing trend towards linear guides in machine tools. The RENEP CGLP series of products are also recommended for these machine elements. Moreover, RENEP CGLP 68 can also be used as a hydraulic oil according to DIN 51 524-2, ISO 6743-4. This product can thus perform the functions of a lubricant and a hydraulic oil.

The RENEP CGLP oils were developed with the relevant technical application requirements of slideway oils in mind. RENEP CGLP slideway oils were supplied to all leading machine tool and component manufacturers.

Stable lubricating film, low coefficient of friction, avoidance of stick-slip

The RENEP CGLP series of oils contain surface-active substances which reduce the coefficient of friction. Stick-slip at low speed and at high loads is effectively avoided. Various laboratory tests were performed to evaluate the sliding performance at slow feeds and high loads.

The SKC-Technik inclined tribometer test revealed very low friction coefficients. For the bearing material combination GG 25/SKC 3, the friction coefficient of RENEP CGLP 68 was 0.089 and 0.064 for RENEP CGLP 220.The static and dynamic coefficients of RENEP CGLP slideway oils were determined on the University of Darmstadt's tribotester. The low coefficients measured guarantee reliable and almost "friction-free" operation of machine tools.

The FUCHS "Sliding Friction Apparatus" was used to evaluate the performance of RENEP CGLP slideway oils in boundary friction conditions which are influenced by different cutting fluids and material combinations. No stick-slip occurred in the presence of high loads and water-miscible cutting fluids.

Good EP properties and excellent protection against wear

Apart from surface-active polar substances, RENEP CGLP oils contain chemically-active agents which start working at room temperatures. These additive systems perform at high loads and even when the slideway is almost dry, thus protecting slideways from wear and seizures. The often very thin lubrication film effectively protects sliding components from wear. Even if the oil feed is interrupted, chemically-active layers protect the slideway from micro-welding and seizures.

Excellent corrosion protection for steel and nonferrous metals

During the development of RENEP CGLP slideway oils, special emphasis was placed on good corrosion protection. Even when water-miscible cutting fluids are used, no corrosion occurs on the slideways. The danger of corrosion in the form of black discoloration is also minimized.

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Good demulsification, optimum compatibility with water-miscible cutting fluids

Difficulties often arise when water-miscible cutting fluids mix with slideway oils. The lubricating film can be flushed off. The mixture of water-miscible cutting fluid and slideway oil can also alter the tribological characteristics of the lubricant. The result is an increase in the coefficient of friction and the current consumed by drive motors increases considerably. Mixtures of water-miscible cutting fluids and slideway oil can cause lacquering and the formation of deposits. These undesireable by-products often lead to slideway jamming or seizures.
To avoid such difficulties, slideway oils and cutting fluids should have good demulsification properties which are evaluated by a series of laboratory tests.

Demulsification behaviour of slideway oils and cutting fluids – SKC-Technik Test

Test description:

8 ml of oil and then 2 ml of a cutting fluid are poured into a 10 ml test tube. The concentration of the cutting fluid should be the manufacturer's recommended value for milling, as a rule, between 3 and 5%. The test tube is sealed and vigorously shaken before being intensively mixed by placing on a foam rubber-covered vibrating plate. The vibration time should be 30 seconds for VG 68 oils and 60 seconds for VG 220 oils. The test tube must not be horizontal to the vibrating plate but some-what inclined to ensure that both phases remain well mixed. The resulting mixture is visually evaluated after 1 hour, 1 day and after 7 days.

Stage 1: "Very good demulsification", i.e. both phases are completely separated.
Stage 2: Almost complete separation with no intermediate phase.
Stage 3: Contains an oil and an intermediate phase.
Stage 4: Contains an oil, emulsion and an intermediate phase, or an oil phase and an inter-mediate phase of > 30% volume.
Stage 5: Contains an emulsion and an intermediate phase.
Stage 6: Shows no demulsifying, i.e. the intermediate phase remains fully intact.

Stages 1 and 2 indicate that the cutting fluid – slide-way oil combination displays "good demulsifying properties".

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Demulsification behaviour of slideway oils and cutting fluids – DIN 51599 (modified)

Test description:

DIN 51599 originally served to test the demulsifying properties of hydraulic and/or lubricating oils in oil-water mixtures. It can be applied to all lubricating oils which come into contact with water and which should not form a stable emulsion. Demulsification according to this test measures the time required for an oil-water mixture to separate.

The test requires specific quantities of the oil to be tested and water to be thoroughly mixed. The time needed for the mixture to separate begins when all agitation ends. The modification to cover slideway oil - cutting fluid combinations is performed with these fluids.

Sample quantity:	39.5 ml of oil 39.5 ml of cutting fluid (at the concentration used, 3 - 5%)
Temperature:	Low viscosity oils up to 95 mm²/s: 54 °C or room temperature High viscosity oils greater than 95 mm²/s: 82 °C
Test duration:	15 minutes – to reach temperature 5 minutes – stirring or agitation Every 5 minutes for 1 hour – reading-off results

The evaluation is based on the volume of the separated

- Oil phase (mostly slightly cloudy)
- Cutting fluid phase
- Emulsion-mixture phase

measured at 5 minute intervals, set-out in a table. The evaluation is made in line with DIN 51848-1 (Test Fields, Repeatability and Comparability). Ideally, full separation should occur within 1 hour.

The modified DIN 51599 procedure is considered by R+D engineers to be the most important test for the development of slideway oils. All RENEP CGLP oils are compatible with all FUCHS cutting fluids. They all display excellent demulsifying properties and good friction coefficients when in mixtures.

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Typical properties:

Product name		**RENEP CGLP**			
		68	**150**	**220**	
Lubricating oil type acc. to DIN 51502 acc. to DIN 51524 acc. to ISO 6743-4 acc. to ISO 6743-6		 CGLP 68 HLP 68 HM 68 CKC 68	 CGLP 150 HM 150 CKC 150	 CGLP 220 CKC 220	
Properties	**Unit**				**Test method**
Kinematic viscosity at 40 °C at 100 °C	 mm^2/s mm^2/s	 68 8.6	 150 14.6	 220 19	DIN EN ISO 3104
Viscosity index		99	96	96	DIN ISO 2909
Density at 15 °C	kg/m^3	877	892	895	DIN 51757
Flashpoint, Cleveland open cup	°C	220	230	240	DIN ISO 2592
Pourpoint	°C	-24	-12	-15	DIN ISO 3016
Neutralisation number	mgKOH/g	0.6	0.5	0.5	DIN 51558-1
Demulsification at 54 °C	min	10	-	-	DIN ISO 6614
Demulsification at 82 °C	min	-	10	15	DIN ISO 6614
Air release at 50 °C	min	13	-	-	DIN ISO 9120
Air release at 75 °C	min	-	10	12	DIN ISO 9120
Foaming, Seq. I: 24 °C Seq. II: 93.5 °C Seq. III: 24 °C after 93.5 °C	 ml ml ml	 0/0 10/0 10/0	 10/0 0/0 5/0	 0/0 0/0 0/0	ASTM D 892
Copper corrosion	degree of corrosion	1-100 A3	1-100 A3	1-100 A3	DIN EN ISO 2160
Steel corrosion - method A: distilled water	degree of corrosion	0-A (pass)	0-A (pass)	0-A (pass)	DIN ISO 7120

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Properties	**Unit**				**Test method**
Ageing: neutralisation number increase after 1000 h	mgKOH/g	< 2	< 2	< 2	DIN 51587
FZG mechanical gear test rig FZG A/8.3/90	failure load stage	 12	 12	 12	DIN ISO 14635-1
Rotary vane pump test, loss of weight from ring from vane	 mg mg	 < 120 < 30	 < 120 < 30	 < 120 < 30	DIN 51389-2
Timken OK load	lb.	60	55	55	ASTM 2783
Coefficient of friction SKC3 – GG25 GG25 – GG25		 0.089 0.248	 - -	 0.064 0.143	SKC-Technik inclined tribometer
Static coefficient Mo-P500/steel GGG 60	1 mm/min	0.044 0.119	- -	0.044 0.119	Darmstadt tribotester
Effect on SRE-NBR 1 seal material acc. to DIN 53538-1 at 100 °C +/- 1 °C after 7 days +/- 2 hours, relative volume change change in Shore A hardness	 % Shore	 +6 –3	 +5 -2	 +5 -2	DIN 53521 together with DIN 53505

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Demulsification behaviour of RENEP CGLP and FUCHS cutting fluids

– SKC-Technik, Germany

Product name	Mixture ratio (Vol. %)	Concentration (%)	Evaluation after		
			1 hour (Level)	1 day (Level)	7 days (Level)
ECOCOOL R-AFC 1515 RENEP CGLP 68	20% 80%	5	1 h: 2	1 d: 1	7 d: 1
ECOCOOL R-GRINDSTAR RENEP CGLP 68	20% 80%	5	1 h: 2	1 d: 1	7 d: 1
ECOCOOL FB 1001 RENEP CGLP 68	20% 80%	5	1 h: 2	1 d: 1	7 d: 1
ECOCOOL R-TN 2525 HP RENEP CGLP 68	20% 80%	5	1 h: 2	1 d: 1	7 d: 1
ECOCOOL R-2030 MB RENEP CGLP 68	20% 80%	5	1 h: 1	1 d: 1	7 d: 1
ECOCOOL R-2510 N RENEP CGLP 68	20% 80%	5	1 h: 2	1 d: 1	7 d: 1
ECOCOOL R-AFC 1515 RENEP CGLP 220	20% 80%	5	1 h: 1	1 d: 1	7 d: 1
ECOCOOL FB 1001 RENEP CGLP 220	20% 80%	5	1 h: 1	1 d: 1	7 d: 1
ECOCOOL R-TN 2525 HP RENEP CGLP 220	20% 80%	5	1 h: 2	1 d: 2	7 d: 1
ECOCOOL R-2030 MB RENEP CGLP 220	20% 80%	5	1 h: 1	1 d: 1	7 d: 1

RENEP CGLP 150 shows the same behaviour like RENEP CGLP 220.

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