

# AUTOL TOP 2000

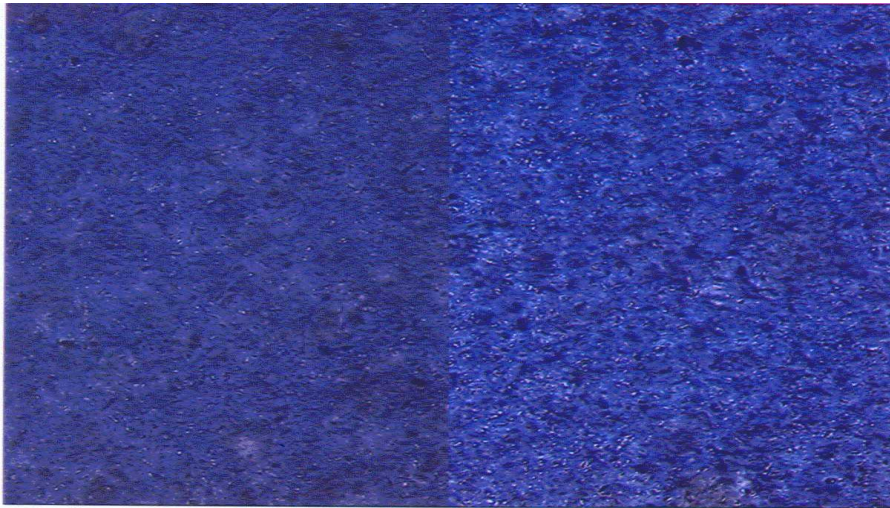
Special grease with a homogeneous structure for highest performance level



A documentation of Agip Schmiertechnik GmbH  
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## Structure analysis of AUTOL TOP 2000

(for the better representation of the structure the test had been especially coloured)



As the picture clearly shows the structure of Autol TOP 2000 is very even. This even structure is the requirement for the:

- qualification as long-time lubrication grease
- high mechanical stability
- constant lubrication properties
- neutral behaviour opposite materials (sealings, non-ferrous metal alloys and plastics)
- high resistance against salt-/water and cooling lubricant emulsions

**Greases**

**Autol TOP 2000**

KP 2 G-30

DIN 51 825 T.3

resistant to salt water  
extremely adhesive

**Super-Longtime-Grease** with a synthetic base oil for longer regreasing intervals.

Soap Basis		special Ca. soap
Temperature range	°C	-30 to +110
Drop point	°C	150
NLGI-class		2
Base oil viscosity at 40°C	mm <sup>2</sup> /s	approx. 800
Behaviour to Water		0-90
Corrosion protection properties (EMCOR-Test)		Corr. -grade. 0 and 0

**Autol TOP 2000** is a special grease with exceptional adhesive properties and very good extreme-pressure-properties - a real Super-Longtime-Grease suitable for very long regreasing intervals.

Under difficult conditions it reduces wear and is especially resistant to wash outs in the lubrication points. It is extremely resistant to salt water, cooling lubricants, plant preservatives and many lyes.

Due to its composition and if applied as directed, according to the manufacturers regulations, it is physiological harmless and therefore also suitable for the application as lubricant in the foodstuff industry.

**Applications:**

**Autol TOP 2000** is a high pressure grease for the lubrication of vehicles, industrial, constructional and agricultural machines. It is reliable as a "problem solver" at lubrication points with critical stress (shock loads, high humidity, salt water, high pressure with low relative movement, etc.) These are industrial robots, continuous transporters as well as for boats or winter service. Despite the high base oil viscosity the application in central lubricating systems is possible without problems.

For the use in wheel and axle bearings we recommend **AUTOL TOP 2000 High Temp.**

**Attention!** The highest short-time peak temperature permitted is +125°C.

Please observe the manufacturer's specifications when selecting products.

## Summary of the typical values of AUTOL TOP 2000

Colour			green, fluorescent
Thickener, soap base			spec. Ca
NLGI-class			2
Density	at 20°C	g/m <sup>3</sup>	0,91 - 0,95
Base oil viscosity (DIN 51 562 T. 2) (Crude oil + synth. Polymer)	40°C 100°C	mm <sup>2</sup> /s mm <sup>2</sup> /s	800 70
Viscosity index (ISO 2909)			160
max. revolution depending on the bearing diameter	n x dm	Max.	300.000
Pen-Ruh/Walk (DIN ISO 2137)		1/10mm	265/295
prolonged Pen-Walk	105DH	1/10mm	under 30
Rolling stability, penetration loss	4 h	1/10mm	20
Yield pressure (DIN 51 805)	+ 20 °C	mbar	76
	0 °C	mbar	120
	- 10 °C	mbar	290
	- 20 °C	mbar	525
	- 30 °C	mbar	1200
Drop point (DIN ISO 2176)		°C	150
Behaviour against water DIN 51 807	3h/90 °C		0
Emcor (DIN 51 802)			0/0
Copper-corrosion (DIN 51811)			1
Oil separation (DIN 51 817 N)	7d/40 °C	%	1
FE 9 (DIN 51 821) F50	120 °C	h	130
FE 8 DIN 51819 T.2	nw at room temp., and F0 80kN	mg	1
Timken-Test, O.K. load (ASTM D - 2509)		lbs	55
VKA-welding load (DIN 51 350T. 4)		N	3000
VKA (DIN 51 350 T. 5 method D)	1h/300N	mm	0,5
solid foreign substances (DIN 51 813)	< 25 µ	mg	< 10
Ash (oxid)		%	1,3
Working temperature temperature limit for short working time		°C	-30 - +120 +125
Name	DIN 51 502 ISO 6743-9		KP 2 G-30 ISO-L-XCBHB2

## Summary of the test results and the implementation into the practice

Autol Top 2000 has shown its advantages opposite the widespread Li greases in the listed test series.

Since the test results cannot be transferred to the practice from a layperson, the test results are transferred to the practice in the following table.

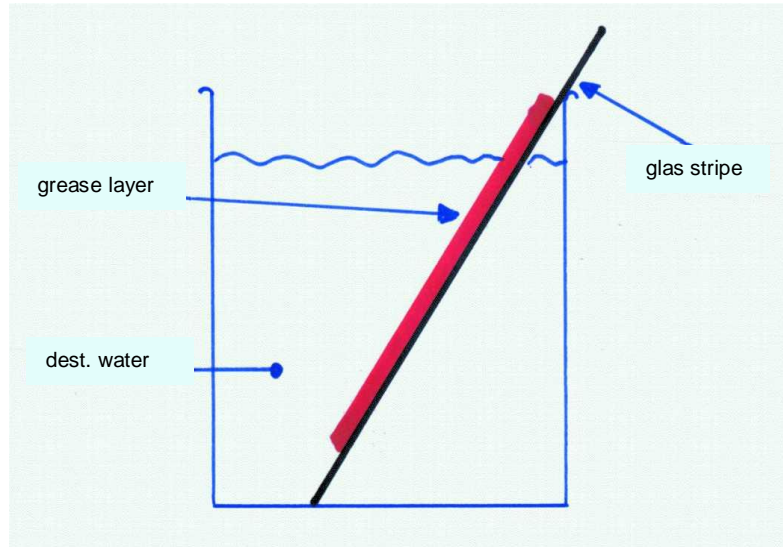
All achieved results make clear, that AUTOL TOP 2000 is a problem solver for many applications, but is also suitable for the general application.

<b>Rating</b>	<b>Result</b>	<b>Meaning for the practice</b>
<b>Water resistance</b> <ul style="list-style-type: none"> <li>• Static Test</li> <li>• Emcor Test (dynamic test)</li> </ul>	0 at 90°C 0 0 with distilled water 1-2 with artificial salt water	Autol TOP 2000 does not emulsify water. Therefore the bearing is also prevented from corrosion, when there is a water ingress during the storage. Even if water penetrates into the bearings there will be no corrosion. <u>Therefore AUTOL TOP 2000 has clear advantages:</u> <ul style="list-style-type: none"> <li>• at the application under humid operational conditions</li> <li>• best corrosion protection in connection with salt, salt water or other critical media such as cooling lubricant emulsions</li> </ul>
<b>Wear behaviour</b> <ul style="list-style-type: none"> <li>• Timken Test</li> <li>• VKA (four-ball-apparatus)</li> <li>• FE-8 Test</li> </ul>	55 lbs 3000 N welding load  1 mg rolling body wear	In all 3 prescribed wear tests for greases AUTOL TOP 2000 shows its superiority compared to Li and Li-EP greases. In the mixed friction area (Timken) as well as at the point load (VKA) or in the real bearing (FE-8) the values for Li greases are clearly exceeded. <u>These tests prove:</u> <ul style="list-style-type: none"> <li>• the suitability for roller and sliding bearings is made clear</li> <li>• the excellent values guarantee best lubrication over a long period</li> </ul>

<p><b>Stable structure at simultaneous suitability for central lubricating systems</b></p> <ul style="list-style-type: none"> <li>• FE-9 Test</li> <li>• SRV Test</li> <li>• Flow pressure</li> </ul>	<p>safe lubrication at 120°C favourable friction value (0,11) 1000 mbar at -30°C</p>	<p>A stable grease structure ensures a safe long-time lubrication and is a significant requirement for the suitability in central lubricating systems. Especially important is the high viscosity of the bifunctional base oil of approx. 800 mm<sup>2</sup>/s and the simultaneous good transportability at low temperatures.</p> <p><b><u>This means for the practice:</u></b></p> <ul style="list-style-type: none"> <li>• a thick lubrication film also protects at shock loads and vibrations</li> <li>• best suitability for slideways</li> <li>• good transportability at low temperatures or long pipes</li> </ul>
<p><b>Favourable behaviour against:</b></p> <ul style="list-style-type: none"> <li>• Elastomers and sealings</li> <li>• high stability against cooling lubricant emulsions and solutions</li> <li>• extreme adhesive properties</li> </ul>	<p>multiple tested</p> <p>tested at increased temperatures and over long periods</p> <p>clearly noticeable</p>	<p>These properties round off the exceptional position of <b>AUTOL TOP 2000</b> in the market.</p> <ul style="list-style-type: none"> <li>• also under severe operational conditions it allows a safe lubrication</li> <li>• it is a problem solver in many areas of the machine industry</li> <li>• it is multiple recommended by manufacturers</li> <li>• it is a <b>Myth</b> under the greases on the market</li> </ul>

**On the following pages the tests are shortly described and the results of AUTOL TOP 2000 are compared with available results of Li greases. These results make the difference to standard greases very clear.**

## Water resistance (statically) DIN 51 807 T1



This test is made to prove how the greases behave under static circumstances when getting in contact with distilled water at different temperatures.  
 A glass strip with a trace of the grease is placed in a container and soaked in distilled water.  
 After 3 hours (temperature 40 or 90°C) the change of the sample is examined.

### Degree of Examination

0 (no change)

1 (small change)

2 (moderate change)

3 (strong changes)

### Examination Criteria

no visible change

slightly lighter appearance of the grease surface

start of disintegration / slimy surface (white-yellow), clouded water

disintegration, usually with oil separation and build up of an emulsion

	<b>Autol TOP 2000</b>	Lithium-EP-Grease	Lithium-EP-Grease with MOS <sub>2</sub>
typical value	0 at 90°C	1 at 90°C	1 at 90°C

## Corrosion Protection Characteristic (Emcor-Test) DIN 51 802



This test is used to show the corrosion protection characteristics of greases in the presence of water under working conditions.

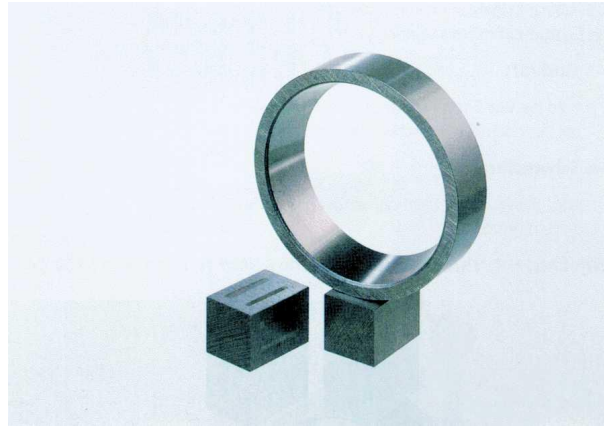
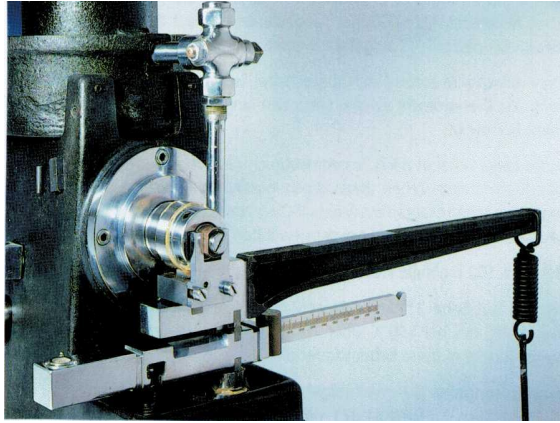
The EMCOR treatment examines greases in self-aligning ball bearings while adding water. Each bearing is filled with 10 g of grease. Each lower plastic bearing with 20 ml of water.

The test takes one week at room temperature and has a fixed cycle: 8 hrs. run (r.p.m. 80 min<sup>-1</sup>), 16 hrs. rest, 8 hrs. run, 16 hrs. rest, 8 hrs. run, last rest 108 hrs.

After the test the corrosion grade of the outer ring tracks is examined compared to samples according to DIN, in grades of 1 to 5 (1 = no corrosion / 5 = heavy corrosion).

	<b>Autol TOP 2000</b>	<b>Lithium-EP- Grease</b>	<b>Lithium-EP- Grease with MOS<sub>2</sub></b>
Emcor Test with salt water	1-2	4-5	4-5
Normal-Emcor	0-0	0-1	0-1

## Timken-Test      DIN 51 434



With the help of this machine, developed by the American roller bearing manufacturer Timken, abrasion tests for EP greases can be conducted. The test takes 10 minutes - without heating.

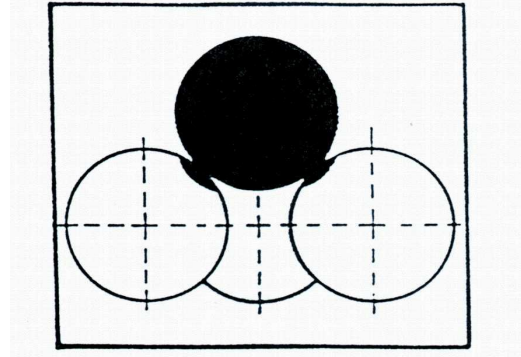
For the test a rectangular steel block (67 RC hardness) is installed on the outer ring of a roller bearing, which is screwed to a motor shaft and then pressed under continuous lubrication.

The shaft rotates at 800 min<sup>-1</sup>. The pressure is built up with discs of different weights via a level system.

As test result the O.K. load is shown in lbs.

	<b>Autol TOP 2000</b>	Lithium-EP-Grease	Lithium-EP-Grease with MOS <sub>2</sub>
typical value	55 lbs	30-45 lbs	45-55 lbs

## Shell-Four-Ball-Apparatus    DIN 51 350



This method is used to test the welding load (welding of balls) and the characteristic value of wear (size of spherical caps) of EP greases.

The system consists of one rotating ball (1450 min<sup>-1</sup>) which slides on three fixed balls under different loads.

The loads are increased in steps until the four-ball-system is welding. Each step takes 60 sec.

Examination possibilities:

O.K. Load	is the last step before the welding load
Welding load	load step, where the welding takes place
Spherical caps diameter	Measuring of the spherical cap diameter takes place after a continuous run of 1 hour with a fixed load
	Treatment C:        150 N
	Treatment D:        300 N
	Treatment E:        1000 N (duration 60 sec)
	The spherical cap diameter is measured in mm.

	<b>Autol TOP 2000</b>	Lithium-EP-Grease	Lithium-EP-Grease with MOS <sub>2</sub>
Welding load (typical value)	3000 N	2400-2600 N	3000-3400 N

# FAG-roller-bearing-grease-apparatus FE 8 DIN 51 819-T.2



FE-8 test apparatus



Probe for the FE-8 test apparatus

With the FE-8 test apparatus the lubrication grease influence on the friction and wear behaviour of roller bearings under influence of temperature, bearing load and turning speed is tested.

The test is run under defined load, number of revolutions and temperature until the bearing exceeds a specific limit friction moment due to lack of lubrication or the strived stress period of 500 hrs. is achieved.

The wear parameters of the test bearings are indicated in Milligram (mg).

**Test conditions:**

Test bearing: 7312B.536050  
 Load: 80 kN  
 Temperature: room temperature

	<b>Autol TOP 2000</b>	Lithium-EP grease	Lithium-EP grease with MOS <sub>2</sub>
Rolling body wear	1 mg	5 to 100 mg depending on manufacturer	not suitable for these bearings

## FAG-Wheel Bearing Test Apparatus FE 9 DIN 51 350



The testing of lubricants on the wheel bearing test apparatus is to establish the lubricant usable life (upper permanent working temperature limit according to DIN 51825) at higher temperatures under practical test conditions.

The test apparatus contains 5 test equipments which are filled with the test grease. In the shell of every test equipment the shaft is arranged on two axially loaded wheel bearings, the test bearing and a supporting bearing.

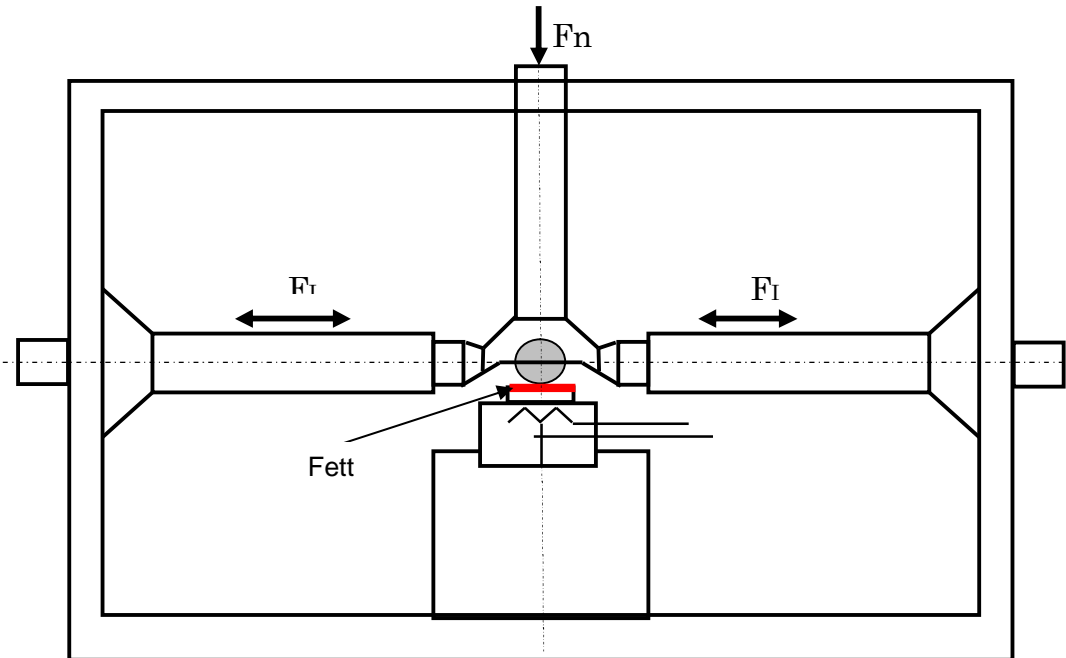
The test strength is adjusted with saucer springs. The test head is surrounded by an electrical resistance heating, which is covered by a hot top.

Every bearing turns off automatically after the lubrication collapses, one by one. Out of the 5 determined values (length of stress) the average lifetime  $F_{50}$  at the chosen temperature will be established.

The test is passed according to DIN 51 825 if the average lifetime  $F_{50}$  reaches a level higher than 100 hours at the chosen test temperature.

	<b>Autol TOP 2000</b>	Lithium-EP- Grease	Lithium-EP- Grease with MOS <sub>2</sub>
Test temperature ( $F_{50} > 100$ h)	120°C	manufacturers specification	manufacturers specification

## Oscillating-Friction-Wear Apparatus SRV

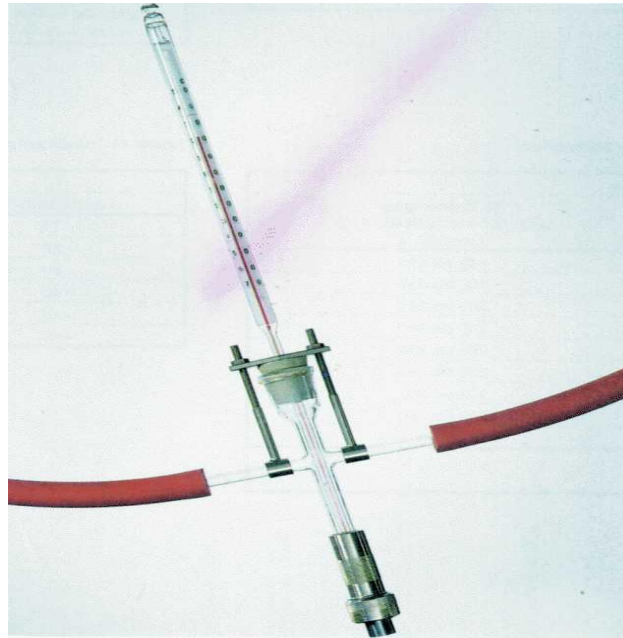


The lubricant is examined with the help of a friction system, which consists of steel balls and steel surfaces. The contact surface is lubricated with the test lubricant once before the test. While the ball is oscillating and sliding the friction number  $f$  is measured for a known load. The examination is explained in details in DIN 51 834 part 1 and part 2.

A low friction value that stays steady over the test period is judged positively.

	<b>Autol TOP 2000</b>	Lithium-EP- Grease	Lithium-EP- Grease with MOS <sub>2</sub>
Friction value	0,11	0,13	0,11

## Permanent Pressure      DIN 51 805



The permanent pressure measures the pressure (in mbar), which is needed to press a grease out of a standardized-test-nozzle.

The permanent pressure is mainly used to name a minimum application temperature, which may not exceed a value of 1400 mbar, according to DIN 51 825.

The test nozzle filled with the grease is connected to a pressure source and the pressure measuring device.

At a chosen temperature the pressure is increased by a certain amount (depending on the permanent pressure) for as long as it takes the grease rope to tear apart or until the pressure gas escapes, so that a further increase of gas pressure is not possible.

The lower the pressure at a chosen temperature the better is the behaviour at low temperatures.

	<b>Autol TOP 2000</b>	Lithium-EP-Grease	Lithium-EP-Grease with MOS <sub>2</sub>
typical value at -30°C	1000 mbar	1400 – 1600 mbar	1400 to 1600 mbar

## Elastomer compatibility DIN 53 521

The elastomer compatibility is a very important feature. Generally the limiting value for the change in volume is max + 5% and for the change of hardness  $\pm 5$  ShoreA at 168 hours and 70°C.

This numbers only have to be announced by the manufacturer on request according to DIN 51 825.

Material	length of test	Temperature	change in volume Vol.%
POR 90+5	168 h	70°C	0
PBTB	168 h	100°C	+0,4
PETB	168 h	100°C	+1,7
POM	168 h	100°C	+2,5
TPE	168 h	100°C	+5,0
Viton 41 VI/576	100 h	100°C	+0,2
NBR 70	100 h	50°C	-1,1
Polyester	168 h	100°C	+0,24

Summary of the current test results of AUTOL TOP 2000

## Compatibility with cooling lubricants-emulsions and -solutions

For the test there had been two water miscible EP-cooling lubricants with crude oil and one crude oil free EP-cooling lubricant blended in different concentrations up to 20%, then they have been mixed with AUTOL TOP 2000 with a concentration of 5%.

<b>Stress</b>	<b>duration</b>	<b>Result</b>
mechanical stress in the Shell-Roller	24 hours at 60°C	no changes in comparison with the reference sample (5% water blended with TOP 2000)
statically long-term test	8 weeks	no changes in comparison with the reference sample (5% water blended with TOP 2000)

## **Approvals/Letters of reference:**

- Fa. Lettinger -Tannery
- Kässbohrer Pistenbully
- Schöffbräu Brauerei (bottle filling Klöckner-Holstein-Seitz Typ VVF188/16SV16KK)
- ABB Industrieroboter
- INA (Production area)
- VOLVO (wheel bearing - Chassis grease)
- Deutsche Bahn AG
- Essener Verkehrsgesellschaft (Straßen- und Schienenfahrzeuge)
- Arnold Hospital beds
- Kickert Schließanlagen
- LINCOLN Centralized grease systems
- BEKAmox Centralized grease systems
- U&P-Division Oseberg (Oilproducing Installation, Northsea)

### **Source:**

all pictures are from the brochure "Schmierfette - Arten, Eigenschaften, Prüfungen"  
Siebert GmbH, Mönchengladbach