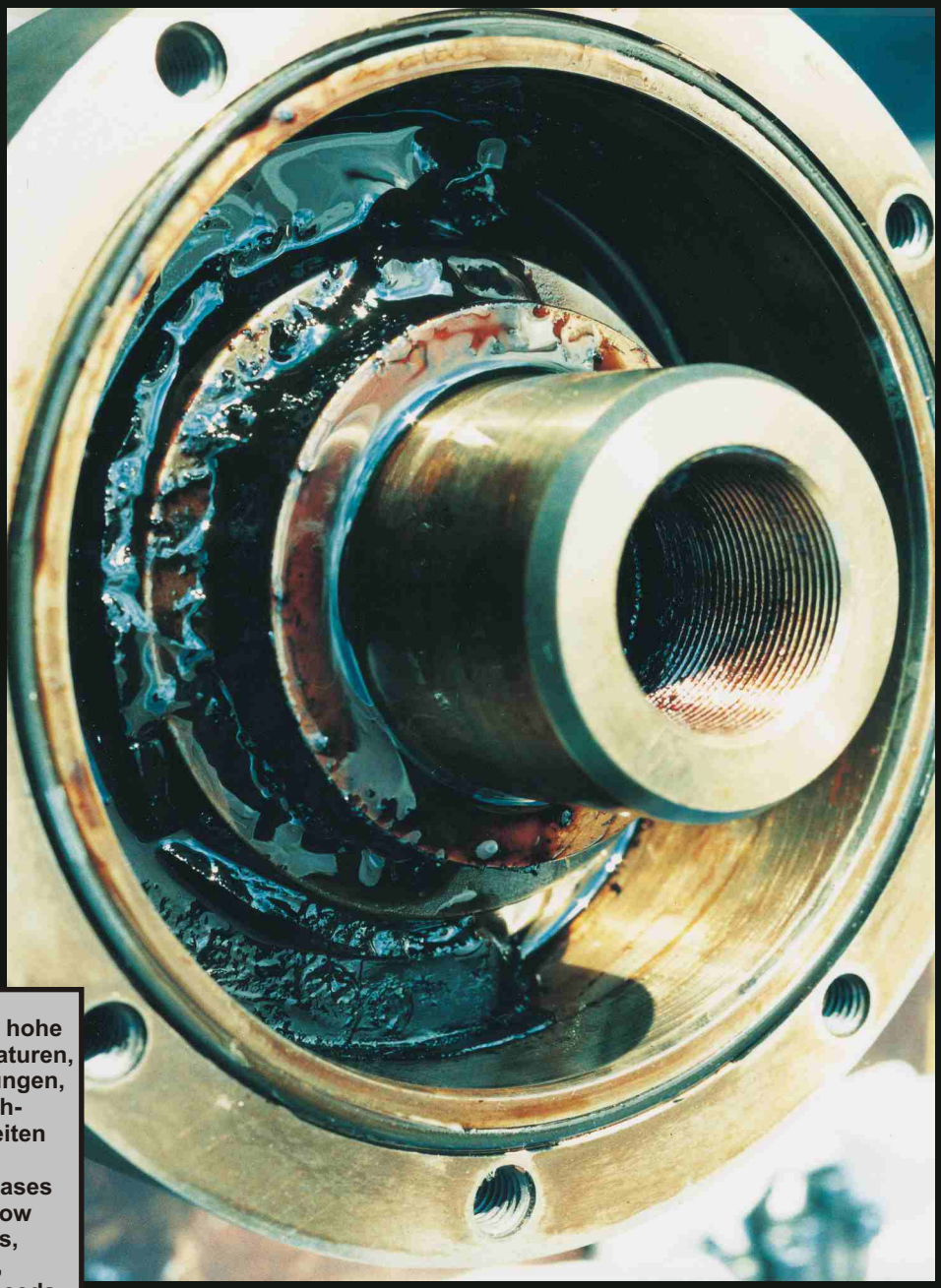
We have the solution...

...the future has a name

LUBCON®



Schmierfette für hohe und tiefe Temperaturen, für hohe Belastungen, für hohe Drehgeschwindigkeiten

Lubricating greases for high and low temperatures, high loads, high rotating speeds

CERTIFIED IQNet MANAGEMENT SYSTEM

QUALIFIZIERTES QM-SYSTEM DIN ISO 14001 Reg.-Nr. 17581-04

QUALIFIZIERTES QM-SYSTEM DIN ISO 9001 Reg.-Nr. 17581-04

Lubricating Greases for Rolling Bearings Subject to extreme Loads

Your Partner
for the Lubrication of Bearings

Make sure to use lubricants, which have been subjected to practise-related tests and approved by well-known manufacturers of rolling bearings.

This high efficiency of the **LUBCON lubricants** is proven by

- **long service life**
- **good running behaviour**
- **high operating reliability**



LUBCON offers special greases for rolling bearings subject to extreme loads. These greases ensure excellent running behaviour and satisfactory service life under certain load conditions.
Their extraordinary performance is achieved by using selected thickeners, thickener quantities, base oil types, base oil viscosity and special additives.

The service range of these lubricating greases was checked in numerous laboratory and practical tests with rolling bearings of various types and sizes.

The three most important operating parameters are:

- **high temperature**
- **high load**
- **high rotating speed**

These parameters are used as the basis to show various technical characteristics of **LUBCON high-performance greases**, test results and data about compatibility with plastics, resistance to water and aggressive media.

The tables on the next pages provide details about the various loads occuring in different bearing types. Please note that "Kula" refers to all types of ball bearings and to cylindrical roller bearings subject to radial loads.
"Kerola" refers to tapered roller bearings and spherical roller bearings subject to radial loads. The possible load for the indicated speed factors corresponds to P/C < 0.05. The load carrying capacity is higher at lower speed factors; see FE8 test results, or ask **LUBCON** for details.

Pages 14 to 17, which follow the tables, provide information on FE8 and FE9 test rigs. The standard test nomenclature used in the tables is explained in detail, which makes it possible to refer to certain test conditions. Together with the test details, it is thus easier to evaluate the running times obtained, for example, in FE9 tests.

Please note: According to DIN 51825 "Lubricating greases K – Properties and Requirements", the upper service temperature of a lubricant grease for rolling bearings requires 100 hours in an FE9 test under standard conditions (mounting position A, axial load 1500 N and speed 6000 min^{-1}). Extremely high speed factors of $n \cdot d_m \geq 1.000.000$ min^{-1} require a suitable bearing design, i. e. spindle bearings.



FAG MGG 11 noise tester (Archive)

This brochure only contains product information. For specific information please refer to our technical data and safety data sheets. The indications made represent the present state of development and knowledge of **LUBRICANT CONSULT GMBH**. Subject to change. The products are subject to severe controls of manufacture and comply in full with the specifications set forth by our company, but due to the multitude of different influencing factors, we cannot assume any warranty for the successful application in each individual case.
Therefore, we recommend to perform field tests. We strictly refuse any liability.

Lubricating Greases for Rolling Bearings Subject to Extreme Loads

High-temperature Lubricating Greases Tables 1 to 3, p. 5-7

LUBCON high-temperature greases for rolling bearings are fully synthetic high-quality products ensuring reliable longterm lubrication under high loads and speeds in different types of rolling bearings.
These greases are compatible with most seal and cage materials. Greases containing PTFE or polyurea thickener are resistant to alkalies and acids.

The product range is devided into **three different groups**:

- **High-temperature lubricating greases containing per-fluorinated base oils, table 1, p. 5**

These greases have excellent performance capabilities. Greases containing **lithium soap** thickener are suitable for all types of bearings. Relubrication is quite easy.

Greases with **polyurea** thickener are also suitable for all types of bearings and are extremely resistant to aggressive media.

Greases containing **PTFE** thickener are preferred for ball bearings – also for other bearing types when subject to moderate loads – and are also very resistant to aggressive media.

- **High-temperature lubricating greases containing fluorine-free base oils, table 2, p. 6**

These greases do not generate toxic vapours and have excellent performance capabilities.

- **High-temperature lubricating greases containing mixed base oils, table 3, p.7**

These greases show an excellent cost-benefit ratio and offer relatively good performance capabilities.

Lubricating Greases for Rolling Bearings Subject to High Loads, tables 4 to 7, p. 8-11

LUBCON lubricating greases for rolling bearings subject to high loads contain **mineral** or **synthetic** base oils of different viscosities.
This makes it possible to obtain good running performances, also at high temperatures and different speeds, in addition to high loads.
Greases containing **polyurea** thickener are resistant to alkalies and acids.

The product range is devided into four viscosity ranges. Greases with high-viscosity base oils are especially suitable for low-speed rolling bearings.

All **LUBCON greases** for rolling bearings subject to high loads contain high-quality additives, whose capability to form reactive layers (chemical lubrication) has been explicitly proven for the indicated temperature range.
These lubricating greases are compatible with most seal and cage materials.

Lubricating Greases for Highspeed Rolling Bearings Tables 8 and 9, p. 12 and 13

LUBCON lubricating greases for high-speed rolling bearings are based on **synthetic oils** with a moderate viscosity.
Lithium is mostly used as a thickener, which ensures the well-known advantages in almost any type of bearings.
The high quality of the used soap thickeners and base oils as well as the good adjustment of the selected additives provide the conditions for the proved high life-times, also at a extremely high rotating speed.

For further information please refer to the brochure **"Special Lubricants for Highspeed Rolling Bearings"**.

The greases containing a base oil with an especially low base oil viscosity, **table 8**, **p. 12**, of ν_{40} = 15 to 18 mm^2/s, are particularly suitable to very low temperatures and ensures an excellent friction behaviour in general.

TURMOGREASE® Li 802 EP, which contains a **mineral base oil**, has been well proven in large highspeed rolling bearings with a bore diameter of d > 50 mm.

All lubricating greases are compatible with most seal and cage materials.



High speed spindle bearing (SKF, D-Schweinfurt)

Table 1:
High-temperature Lubricating Greases with Perfluorinated Base Oils

Technical data	TURMOTEMP® LM 1502	TURMOTEMP® M 1502	TURMOTEMP® LP 5002	TURMOTEMP® II/400 RS 2	TURMOTEMP® LS 1002	TURMOTEMP® N 5002	SINTONO® MEGA 2
Base oil	PFPE	PFPE	PFPE	PFPE	PFPE	PFPE	PFPE
Thickener	Li special	PTFE	Li special	PTFE	Li special	PHS	PHS
Temp.-range (°C)	-60 … +240	-60 … +250	-30 … +260	-30 … +260	-60 … +240	-30 … +260	-30 … +260
Density at +20 °C (g/cm^3)	1.7	1.9	1.7	1.9	1.7	1.7	1.7
Consistency	2	2	2	2	2	2	2
Base oil viscosity DIN 51562 (mm^2/s) +40 °C/+100 °C	150/45	150/45	appr. 500/45	550/49	100/22	500/45	500/46.5
Drop point DIN ISO 2176 (°C)	> +250	- - *	> +250	- - *	> +250	> +250	> +250
Speed factor $n \cdot d_m$ ($min^{-1} \cdot mm$)	Kula 600 000 Kerola 300 000	Kula 600 000 Kerola 100 000	Kula 300 000 Kerola 150 000	Kula 350 000 Kerola 150 000	Kula 750 000 Kerola 300 000	Kula 300 000 Kerola 150 000	Kula 350 000 Kerola 150 000
Corrosion protection acc. to SKF Emcor DIN 51802	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0
Water resistance DIN 51807 pt.1	0 - 90	0 - 90	0 - 90	0 - 90	0 - 90	0 - 90	0 - 90
Resistance to bases and acids	no	yes	no	yes	no	no	yes
Compatibility with NBR, FKM, PTFE, EPDM a. PA 6.6	yes	yes	yes	yes	yes	yes	yes
FE9 test DIN 51821 F_{50} (h)	A/1.5/3000-240 256	A/1.5/3000-240 251	A/1.5/3000-220 > 100	A/1.5/3000-220 400	B/1.5/9000-200 > 100	A/1.5/3000-220 400	A/1.5/3000-200 1150
FE8 test DIN 51819 successful tests	- -	- -	048-1500/10-200 very low wear	048-1500/10-200 pronounced wear	- -	- -	048-1500/10-200 passed test runs
VKA welding force DIN 51350 T4 (N)	5000/5500	8500/9000	3000/3200	8500/9000	3000/3200	8500/9000	3000/3200
Start-torque ASTM D 1478 (mNm)	- -	- -	- -	184/-20 °C 31/+40 °C	52/-30 °C 22/+40 °C	- -	- -
Running-torque ASTM D 1478 (mNm)	- -	- -	- -	124/-20 °C 16/+40 °C	12/-30 °C <10/+40 °C	- -	- -

* According to **DIN ISO 2176** the dropping point for these products is not estimable, e. g. it is not melting, only above +150 °C an oil dropping point can occur.

Table 2:
High-temperature Lubricating Greases with Fluorine-free Base Oils

Technical data	THERMOPLEX® LPE 552	THERMOPLEX® LME 552	TURMOGREASE® NBI 300 P	TURMOGREASE® NBI 300 BP
Base oil	Ester/PFPE	Ester/PFPE	Ester/PFPE	Ester/PFPE
Thickener	Li special	Li special	PU	PU
Temp.-range (°C)	-40 … +200 (220)	-40 … +200 (220)	-40 … +180 (200)	-40 … +200 (220)
Density at +20 °C (g/cm^3)	1.15	1.15	1.2	1.2
Consistency	2	2	2	2
Base oil viscosity DIN 51562 (mm^2/s) +40 °C/+100 °C	55/11	55/12	100/18	100/18
Drop point DIN ISO 2176 (°C)	> +250	> +230	> +250	> +250
Speed factor $n \cdot d_m$ ($min^{-1} \cdot mm$)	Kula 1 300 000 Kerola 300 000	Kula 1 300 000 Kerola 300 000	Kula 750 000 Kerola 200 000	Kula 750 000 Kerola 200 000
Corrosion protection acc. to SKF Emcor DIN 51802	0 - 0	0 - 0	0 - 0	0 - 0
Water resistance DIN 51807 pt.1	0 - 90	0 - 90	0 - 90	0 - 90
Resistance to bases and acids	no	no	yes	yes
Compatibility with NBR, FKM, PTFE, EPDM a. PA 6.6	yes	yes	yes	yes
FE9 test DIN 51821 F_{50} (h)	A/1.5/6000-160 > 500	A/1.5/6000-180 > 500	A/1.5/6000-180 900	A/1.5/6000-200 530
FE8 test DIN 51819 successful tests	- -	- -	- -	- -
VKA welding force DIN 51350 T4 (N)	3200/3400	3200/3600	3000/3200	3000/3200
Start-torque ASTM D 1478 (mNm)	- -	- -	- -	968/-40 °C
Running-torque ASTM D 1478 (mNm)	- -	- -	- -	717/-40 °C

Table 3:
High-temperature Lubricants with Mixed Base Oils

Technical data	THERMOPLEX® 2 HPL	THERMOPLEX® I/300	THERMOPLEX® TMP 703 HT	TURMOGREASE® Hitemp 300 A	TURMOGREASE® NBI 300	TURMOGREASE® Hitemp 2 WSHB
Base oil	Ester	Ester	Ester	PPE/Ester	Ester	Polyphenylether
Thickener	Li	Na complex	PU	PU	PU	PU
Temp.-range (°C)	-40 … +160	-35 … +200 (220)	-40 … +200	-20 … +220 (240)	-40 … +180 (200)	0 … +260 (280)
Density at +20 °C (g/cm^3)	0.97	0.9	0.984	1.14	0.97	1.15
Consistency	2	2/3	2/3	2	2	2
Base oil viscosity DIN 51562 (mm^2/s) +40 °C/+100 °C	55/9	50/9	70/9.6	100/11	100/14	120/20
Drop point DIN ISO 2176 (°C)	> +180	> +250	> +250	> +250	> +250	> +300
Speed factor $n \cdot d_m$ ($min^{-1} \cdot mm$)	Kula 1 000 000 Kerola 300 000	Kula 1 000 000 Kerola 300 000	Kula 1 000 000 Kerola 300 000	Kula 650 000 Kerola 300 000	Kula 750 000 Kerola 300 000	Kula 650 000 Kerola 300 000
Corrosion protection acc. to SKF Emcor DIN 51802	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0
Water resistance DIN 51807 pt.1	1 - 90	1 - 90	1 - 80	0 - 90	1 - 80	0 - 90
Resistance to bases and acids	no	no	no	yes	yes	yes
Compatibility with NBR, FKM, PTFE, EPDM a. PA 6.6	yes	yes	yes	yes, except NBR	yes	yes, except NBR
FE9 test DIN 51821 F_{50} (h)	A/1.5/6000-140 > 1200	C/1.5/6000-180 240	A/1.5/6000-200 177.40	B/1.5/6000-180 468	A/1.5/6000-180 > 300	B/1.5/3000-180 602
FE8 test DIN 51819 successful tests	- -	- -	- -	- -	- -	- -
VKA welding force DIN 51350 T4 (N)	2800/3000	4200/4400	4200/4400	3000/3200	2400/2600	2200/2400
Start-torque ASTM D 1478 (mNm)	130/-40 °C	- -	465/-40 °C	- -	- -	- -
Running-torque ASTM D 1478 (mNm)	19.5/-40 °C	- -	107/-40 °C	- -	- -	- -

Table 4:
Lubricating Greases for Rolling Bearings Subject to High Loads ν_{40} = 50 - 60 mm²/s

Technical data	THERMOPLEX® I/300	TURMOGREASE® HPN 682	THERMOPLEX® L 552	TURMOGREASE® HLB	THERMOPLEX® 2 TML
Base oil	Ester	Ester	Ester	Ester	Ester
Thickener	Na complex	PU	Li special	Li special	Li
Temp.-range (°C)	-35 … +200 (220)	-40 … +180 (200)	-40 … +180 (200)	-40 … +180 (200)	-10 … +140 (160)
Density at +20 °C (g/cm³)	0.9	- -	0.95	- -	0.98
Consistency	2/3	2	2	2	2
Base oil viscosity DIN 51562 (mm²/s) +40 °C/+100 °C	55/9	68/10	55/9	52/- -	55/9
Drop point DIN ISO 2176 (°C)	> +250	> +250	> +230	> +220	> +180
Speed factor $n \cdot d_m$ ($min^{-1} \cdot mm$)	Kula 1 000 000 Kerola 300 000	Kula 1 300 000 Kerola 300 000	Kula 1 000 000 Kerola 300 000	Kula 1 300 000 Kerola 300 000	Kula 1 300 000 Kerola 300 000
Corrosion protection acc. to SKF Emcor DIN 51802	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0
Water resistance DIN 51807 pt.1	1 - 90	0 - 90	1 - 80	1 - 80	1 - 90
Resistance to bases and acids	no	no	no	no	no
Compatibility with NBR, FKM, PTFE, EPDM a. PA 6.6	yes	yes	yes	yes	yes
FE9 test DIN 51821 F_{50} (h)	C/1.5/6000-180 240	A/1.5/6000-180 816.67	A/1.5/6000-160 > 800	- -	- -
FE8 test DIN 51819 successful tests	- -	- -	- -	- -	- -
VKA welding force DIN 51350 T4 (N)	4200/4400	2800/3000	2600/2800	- -	2600/2800
Start-torque ASTM D 1478 (mNm)	- -	316/-30 °C 543/-40 °C	- -	- -	- -
Running-torque ASTM D 1478 (mNm)	- -	42/-30 °C 68/-40 °C	- -	- -	- -

Table 5:
Lubricating Greases for Rolling Bearings Subject to High Loads ν_{40} = 80 - 100 mm²/s

Technical data	TURMOGREASE® Li 802 EP	TURMOGREASE® L 802 EP plus	TURMOGREASE® CAN 1002	TURMOGREASE® GVK 2 TF
Base oil	Min/PAO	Min/Synth. KW	Min/PAO	synth./anorg.
Thickener	Li	Li special	Ca/PU	- -
Temp.-range (°C)	-35 … +140 (160)	-35 … +140	-40 … +160	-25 … +250
Density at +20 °C (g/cm^3)	0.87	- -	0.92	1.28
Consistency	2	2/3	2	2
Base oil viscosity DIN 51562 (mm^2/s) +40 °C/+100 °C	82/12.5	85/- -	100/- -	- -/- -
Drop point DIN ISO 2176 (°C)	> +190	> +250	> +220	- -
Speed factor $n \cdot d_m$ ($min^{-1} \cdot mm$)	Kula 1 000 000 Kerola 300 000	Kula 1 000 000 Kerola 300 000	Kula 800 000 Kerola 300 000	- -
Corrosion protection acc. to SKF Emcor DIN 51802	0 - 0	0 - 0	0 - 0	0 - 0
Water resistance DIN 51807 pt.1	1 - 90	- -	- -	- -
Resistance to bases and acids	no	no	no	yes
Compatibility with NBR, FKM, PTFE, EPDM a. PA 6.6	yes	yes	yes	yes
FE9 test DIN 51821 F_{50} (h)	A/1.5/6000-140 235	A/1.5/6000-140 533	- -	- -
FE8 test DIN 51819 successful tests	050-7.5/80-30 050-6000/5-90 048-3000/10-100 048-75/50-45	- -	- -	- -
VKA welding force DIN 51350 T4 (N)	2000/2200	- -	- -	> 3200
Start-torque ASTM D 1478 (mNm)	- -	- -	- -	- -
Running-torque ASTM D 1478 (mNm)	- -	- -	- -	- -

Table 6:
Lubricating Greases for Rolling Bearings Subject to High Loads ν_{40} = 150 - 250 mm²/s

Technical data	TURMOGREASE® CAN 2502 WKA	TURMOGREASE® LC 1802 EP	TURMOGREASE® N 1501 K	TURMOGREASE® N 2	TURMOGREASE® NM 3	TURMOGREASE® CAK 2502
Base oil	SHC	Min	SHC	Ester/PAO	Min.	Min
Thickener	Ca	Li-Ca	PU	PU	PU	Ca complex
Temp.-range (°C)	-55 … +100	-55 … +100	-40 … +160	-40 … +160 (220)	-30 … +160 (180)	-30 … +150 (160)
Density at +20 °C (g/cm³)	0.80	0.91	0.86	0.87	- -	1.0
Consistency	1/2	2	2	2	3	2
Base oil viscosity DIN 51562 (mm²/s) +40 °C/+100 °C	150/14	185/17	155/20	150/19	155/14.9	250/22
Drop point DIN ISO 2176 (°C)	> +140	> +180	> +245	> +250	> +250	> +300
Speed factor $n \cdot d_m$ ($min^{-1} \cdot mm$)	Kula 750 000 Kerola 300 000	- -	- -	Kula 600 000 Kerola 200 000	- -	Kula 400 000 Kerola 100 000
Corrosion protection acc. to SKF Emcor DIN 51802	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0
Water resistance DIN 51807 pt.1	0 - 90	0 - 90	0 - 90	0 - 90	0 - 90	0 - 90
Resistance to bases and acids	no	no	yes	yes	yes	yes
Compatibility with NBR, FKM, PTFE, EPDM a. PA 6.6	yes	yes	yes	yes	yes	yes
FE9 test DIN 51821 F_{50} (h)	- -	- -	A/1.5/6000-140 > 500	A/1.5/6000-140 > 500	- -	A/1.5/3000-150 > 100
FE8 test DIN 51819 successful tests	- -	- -	- -	- -	- -	050-7.5/80-30 050-7.5/80-120
VKA welding force DIN 51350 T4 (N)	3400/3600	- -	2800/3000	2800/3000	- -	2800/3000
Start-torque ASTM D 1478 (mNm)	163/-40 °C	- -	- -	- -	- -	- -
Running-torque ASTM D 1478 (mNm)	57/-40 °C	- -	- -	- -	- -	- -

Table 7:
Lubricating Greases for Rolling Bearings Subject to High Loads $\nu_{40} = \geq$ 400 mm²/s

Technical data	TURMOGREASE® DSV 2 EP	TURMOGREASE® CAK 4003	TURMOGREASE® NM 4602	TURMOGREASE® N 4602	TURMOGREASE® ALN 4602	TURMOGREASE® CAN 4603
Base oil	partly synthetic	Min	Min	Ester/PAO	PAO	PAO
Thickener	- -	Ca complex	PU	PU	Al complex	Ca special
Temp.-range (°C)	-30 … +150 (200)	-20 … +160 (200)	-20 … +160 (200)	-30 … +180 (200)	-30 … +180 (200)	-25 … +180 (200)
Density at +20 °C (g/cm³)	- -	1.03	0.9	0.91	- -	0.92
Consistency	- -	3	2	2	2	2
Base oil viscosity DIN 51562 (mm²/s) +40 °C/+100 °C	400/26	396/28	460/32	460/44	460/- -	460/- -
Drop point DIN ISO 2176 (°C)	> +190	> +300	> +250	> +250	> +220	> +220
Speed factor $n \cdot d_m$ ($min^{-1} \cdot mm$)	Kula - - Kerola 300 000	Kula 300 000 Kerola 100 000	Kula 300 000 Kerola 100 000	Kula 300 000 Kerola 150 000	Kula 220 000 - -	Kula 300 000 - -
Corrosion protection acc. to SKF Emcor DIN 51802	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0
Water resistance DIN 51807 pt.1	1 - 80	0 - 90	0 - 90	0 - 90	- -	- -
Resistance to bases and acids	no	yes	yes	yes	yes	yes
Compatibility with NBR, FKM, PTFE, EPDM a. PA 6.6	yes	yes	yes	yes	yes	yes
FE9 test DIN 51821 F_{50} (h)	A/1.5/3000-150 172	A/1.5/3000-150 > 100	A/1.5/3000-140 > 100	A/1.5/3000-140 > 300	- -	- -
FE8 test DIN 51819 successful tests	048-3000/10-120	good suitability for oscillating motions	050-7.5/80-30 050-7.5/80-80	050-7.5/80-30 050-7.5/80-120	- -	- -
VKA welding force DIN 51350 T4 (N)	2000/2200	5000/5200	2600/2800	3200/3400	- -	- -
Start-torque ASTM D 1478 (mNm)	- -	- -	- -	- -	- -	- -
Running-torque ASTM D 1478 (mNm)	- -	1350/-20 °C	- -	- -	- -	- -

Table 8:
Lubricating Greases for Highspeed Rolling Bearings $\nu_{40} = \geq 25\ mm^2/s$

Technical data	TURMOGREASE® Highspeed L 252	TURMOGREASE® LC 252	THERMOPLEX® ALN 252 EP	THERMOPLEX® LME 252
Base oil	Ester/PAO	SHC/Ester	Ester/SHC	PFAE/Ester
Thickener	Li spezial	Li-Ca	Al complex	Li special
Temp.-range (°C)	-50 … +120 (140)	-45 … +120 (140)	-50 … +140	-40 … +160 (180)
Density at +20 °C (g/cm^3)	0.94	0.93	0.93	1.01
Consistency	2/3	2	2	2
Base oil viscosity DIN 51562 (mm^2/s) +40 °C/+100 °C	25/6	25/5.8	25/- -	30/7.2
Drop point DIN ISO 2176 (°C)	> +250	> +180	> +180	> +230
Speed factor $n \cdot d_m$ ($min^{-1} \cdot mm$)	Kula 2 200 000 Kerola 300 000	Kula 1 800 000 Kerola 300 000	Kula 1 600 000 Kerola 300 000	Kula 1 800 000 Kerola 300 000
Corrosion protection acc. to SKF Emcor DIN 51802	0 - 0	0 - 0	0 - 0	0 - 0
Water resistance DIN 51807 pt.1	1 - 90	1 - 90	1 - 80	1 - 80
Resistance to bases and acids	no	yes	no	no
Compatibility with NBR, FKM, PTFE, EPDM a. PA 6.6	yes	yes	yes	yes
FE9 test DIN 51821 F_{50} (h)	A/1.5/6000-120 > 400	A/1.5/6000-120 > 100	- -	- -
FE8 test DIN 51819 successful tests	050-6000/5-90	- -	- -	- -
VKA welding force DIN 51350 T4 (N)	2200/2400	2400/2600	2200/2400	2600/2800
Start-torque ASTM D 1478 (mNm)	131/-50 °C	- -	- -	- -
Running-torque ASTM D 1478 (mNm)	106/-50 °C	- -	- -	- -

Table 9:
Lubricating Greases for Highspeed Rolling Bearings ν_{40} = 15 - 18 mm²/s

Technical data	TURMOGREASE® Highspeed L 182	TURMOGREASE® LC 302 EP	THERMOPLEX® Li 302	THERMOPLEX® 2 TML spezial
Base oil	Ester/SHC	Ester	Ester	Ester
Thickener	Li special	Li-Ca	Li	Li
Temp.-range (°C)	-70 … +120 (140)	-50 … +150	-50 … +150 (160)	-70 … +130 (150)
Density at +20 °C (g/cm^3)	0.94	0.955	0.955	0.94
Consistency	2	2	2	2
Base oil viscosity DIN 51562 (mm^2/s) +40 °C/+100 °C	18/4.5	30/8.3	30/7.4	20/6
Drop point DIN ISO 2176 (°C)	> +250	> +170	> +170	> +170
Speed factor $n \cdot d_m$ ($min^{-1} \cdot mm$)	Kula 2 500 000 Kerola 200 000	Kula 1 800 000 Kerola 200 000	Kula 1 800 000 Kerola 200 000	Kula 1 600 000 Kerola 200 000
Corrosion protection acc. to SKF Emcor DIN 51802	0 - 0	0 - 0	0 - 0	0 - 0
Water resistance DIN 51807 pt.1	1 - 90	0 - 90	0 - 90	1 - 90
Resistance to bases and acids	no	no	no	no
Compatibility with NBR, FKM, PTFE, EPDM a. PA 6.6	yes	yes	yes	yes
FE9 test DIN 51821 F_{50} (h)	A/1.5/6000-120 > 200	A/1.5/6000-150 222.45	- -	A/1.5/6000-100 1000 * A/1.5/6000-120 150
FE8 test DIN 51819 successful tests	- -	- -	- -	- -
VKA welding force DIN 51350 T4 (N)	2200/2400	2600/2800	- -	2600/2800
Start-torque ASTM D 1478 (mNm)	265/-40 °C	265/-30 °C 447/-40 °C	- -	184/-50 °C 410/-60 °C 1022/-70 °C
Running-torque ASTM D 1478 (mNm)	26/-40 °C	23.6/-30 °C 43.7/-40 °C	- -	22/-50 °C 47/-60 °C 279/-70 °C

* Test stopped, all test heads ok, therefore only the declaration of the F_{10} value is possible

FE9 Lubricant Test in acc. with DIN 51821

Purpose:

Determination of the lubricating grease's service life at increased temperatures under practice-related conditions.

Test rig:

See sectional drawing, **fig. 1**, **p. 15**.

The test rig contains 5 test units with rolling bearings being used as the test elements. The test bearing (3) is axially loaded by means of disk springs (6) and heated with the resistance heating unit (10) of the test head (11). The shaft is driven by a change-pole electric motor (9). The mounting space is usually equipped with a protective lid (12). The heat insulation cover is located above the heating (13).

The test bearing (3) can be operated in different mounting positions:
Position A: The test bearing is installed without a disk on either side, the grease can freely emerge from the bearing. This is the most frequently used mounting position.
Position B: The bearing is equipped with a shield on both sides with a gap facing the rotating shaft.
Position C: Same as B, however instead of a front shield there is an angular ring positioned between the test bearing and the housing space. This ring can incorporate some further lubricating grease, thus generating a depot effect.

Test method:

Angular contact ball bearings type FAG Z-No. 529689 are installed in the 5 units of the test rig. They are loaded axially with a force of F_a = 1.5/3/4.5 kN and are operated at the specified test speed of n = 3000/6000 min^{-1}.
The required temperature of θ_b = 120-200 °C is achieved by means of the resistance heating unit. The test is continued until the bearings require at least the double steady-state moment for operation due to insufficient lubricity of the grease.

Test result:

The test is carried out with a minimum of 5 new test bearings. The individual running time results are entered into a Weibull diagram, see **diagram 1**, **p. 15**.
The ordinate axis shows the failure probability. The running time is measured in hours and shows the time the bearings operated under load. The test results are indicated as F_{10} und F_{50} running times.

Nomenclature of tests and results:

Test DIN 51821-02-A/1.5/6000-160

- Mounting position
- Axial Load F_a in kN
- Test speed n in min^{-1}
- Test temperature θ_b in °C

F_{10} = 33 h → Grease life with a 10 % failure probability
F_{50} = 112 h → Grease life with a 50 % failure probability

FE8 Lubricant Test in acc. with DIN 51821

Purpose:

Determination of the impact of a lubricating grease on the friction and wear behaviour of rolling bearings operating under moderate to high steady-state temperatures, high loads, low speeds, as well as moderate bearing loads and high speeds.

Test rig:

The FE8 test rig consists of a drive unit and a test head, see **fig. 2**, **p. 16**.
The shaft of the drive unit (1) is supported by two auxiliary bearings (2) and is driven by an electric motor and a gear at the specified speed n. The test head is connected with the drive unit via the tapered seat of the test shaft (7). The test head contains the test bearings (3).
The axial bearing load F is applied by means of disk springs (4). A heat insulation cover with heating elements is required for tests at increased temperatures. A pulley guides the rope used for friction force measurement.

Test method:

The test is carried out with two test bearings, angular contact ball bearing 7312B.536050 or tapered roller bearing 31312A.536048. It is conducted with the desired load, speed and temperature until the bearing exceeds a predefined friction moment due to insufficient lubrication, or until the desired life of 500 hours is achieved.
Table 10, **p. 16** shows the possible and well-proven combinations of test conditions. The weight loss of the rolling elements and the cages is used to evaluate the antiwear properties.
The friction curve of the test bearings, shown as a function of the running time, provides information about the friction behaviour.

Test result:

The grease test comprises at least 2 test runs. The friction curve obtained in the test is shown as a function of the running time, see **diagram 2**, **p. 17**. The friction values of the bearings are entered in a table. The wear figures of the rolling elements and the cages are entered in a Weibull diagram.
Then, the values for a 50 % wear probability, and the average friction moments during start-up and for steady-state operation are determined.
A "passed" result refers to the requirements specified by one or several important operators.

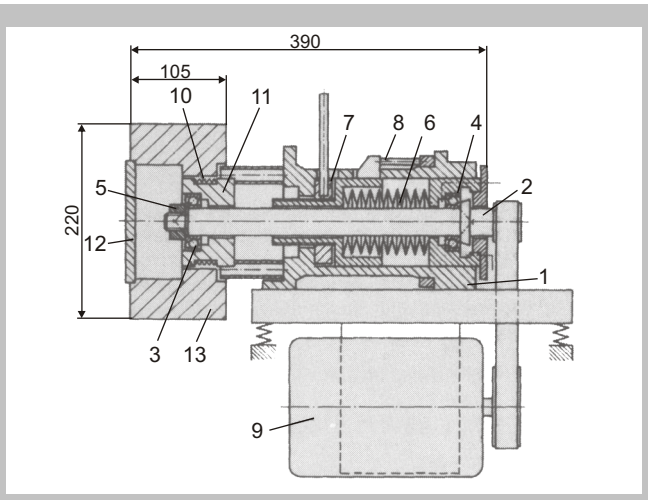
Standard nomenclature of tests and results:

Test DIN 51819-2-7312B.536050 - 7.5 / 80 - 137

- Test bearing
- Test speed n in min^{-1}
- Axial load F_a in kN
- Test temperature θ_b in °C

Results of the individual values in **diagram 2**, **p. 17**:

m_{W50} = 19 mg → rolling element wear with a 50 % wear probability
m_{K50} = 8 mg → cage wear with a 50 % wear probability
M_{rs} = 26 Nm → average friction moment during start-up
M_{rb} = 11.5 Nm → average friction moment during steady-state oper



1 Test rig housing
2 Shaft
3 Test bearing
4 Auxiliary bearing
5 Shaft nut
6 Disk springs
7 Tensioning device
8 Stop
9 Electric motor
10 Electric resistance heating
11 Test head
12 Protective lid
13 Heat insulation cover

Fig. 1:
Sectional drawing of an FE9 test rig

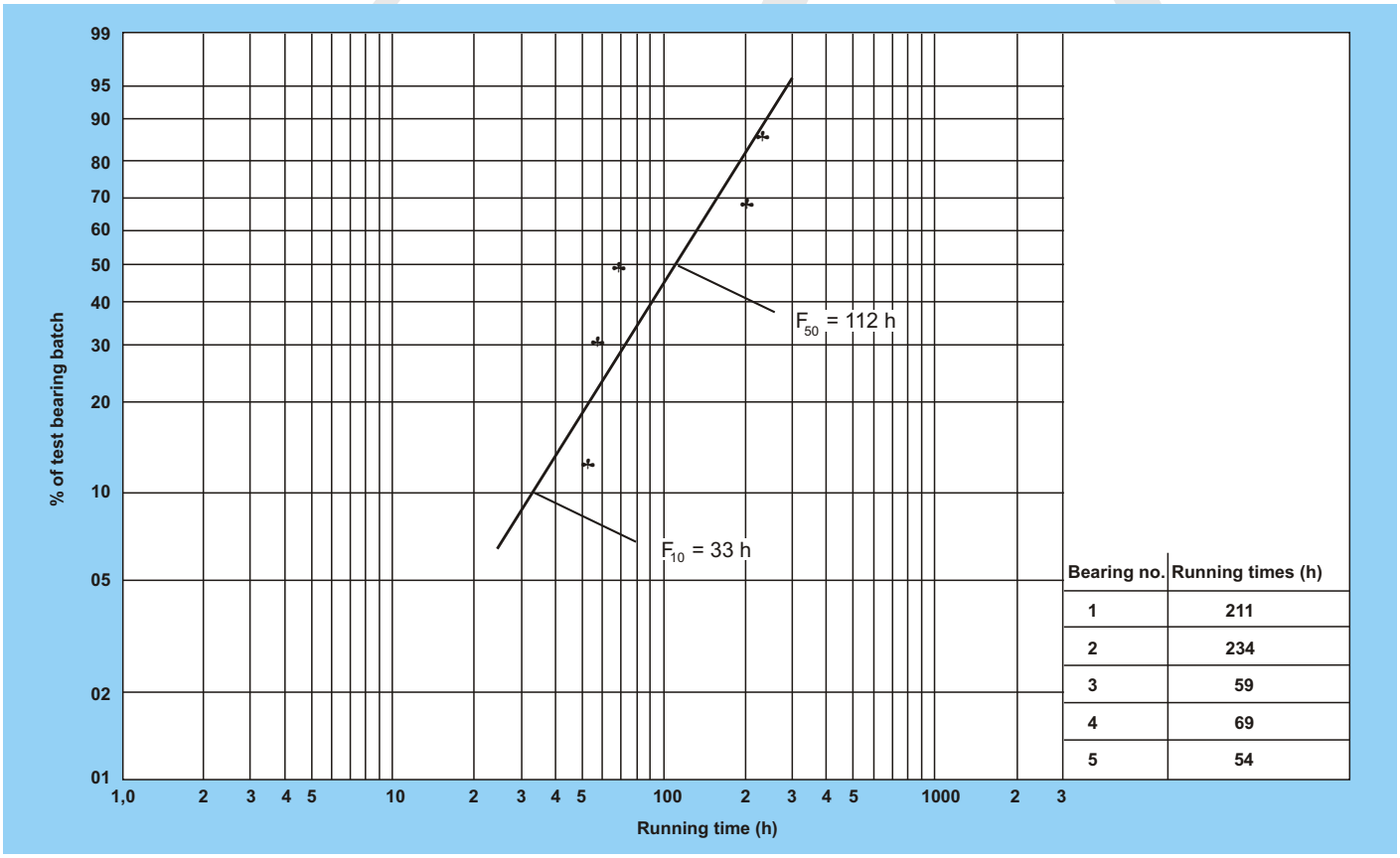
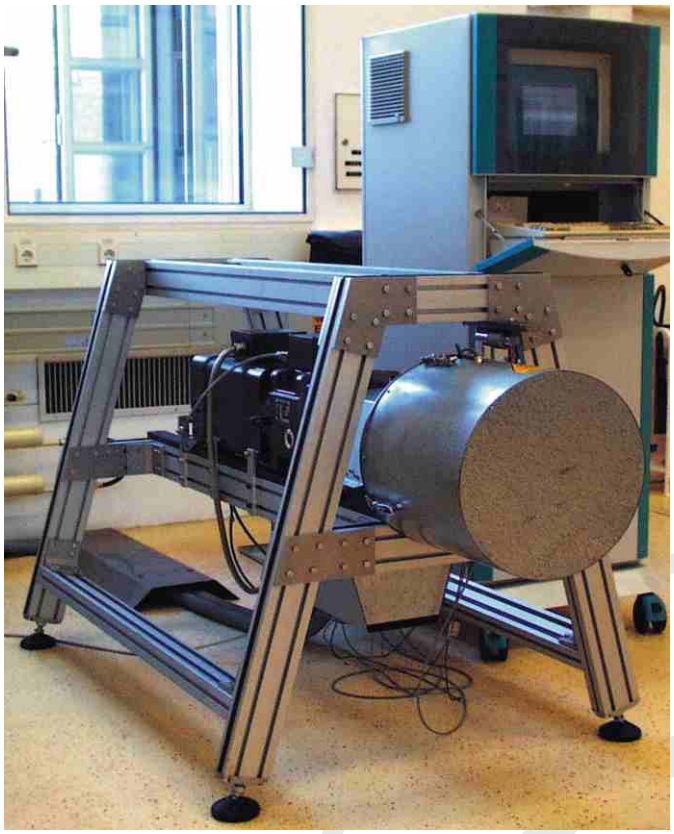


Diagram 1:
FE9 test run with angular contact ball bearings 529689 (≙7206 B), mounting type A, i. e. open bearing
Axial load F_a = 1.5 kN; speed n = 6000 min^{-1}; temperature 160 °C
Lubrication with **THERMOPLEX® 2 TML**
Service life of the grease in the test bearings in h: according to the Weibull diagram F_{50} = 112 h; F_{10} = 33 h
Requirement in acc. with FAG and DIN 51825 $F_{50} \geq 100$ h →
Evaluation: fully meets the requirements



1 Shaft of drive unit
2 Auxiliary bearings of drive unit
3 Test bearing
4 Disk springs
5 Spacer
6 Pulley
7 Test head shaft
8 Bearing support, drive end
9 Bearing support, disk end
10 Test head housing
11 Cover

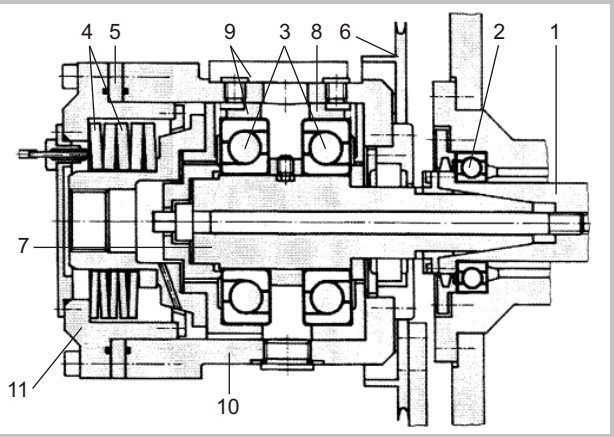


Fig. 2:
Schematic drawing of FE8 test head

Angular contact ball bearing 7312B.536050 permis. θ_b = +120 °C	Angular contact ball bearing 7312B.536050MP permis. θ_b = +200 °C	Tapered roller bearing 31312A.536048 permis. θ_b = +200 °C	Running-in conditions for tapered roller bearings	Speed n in min^{-1}	Load F_a in kN
I x I	**I x I**			**7.5**	**80**
x	x	x	-	75	80
		I x I	-	**75**	**50**
		x	F_a/2 over 24 h	750	20
		x	n/2 over 24 h	1500	10
x	x	**I x I**	n/2 over 24 h	**3000**	**10**
x	x			4500	5

Table 10:
Combinations of test bearings, speeds and loads for an FE8 test, and running-in conditions for tapered roller bearings. Important combinations marked as **I x I**.





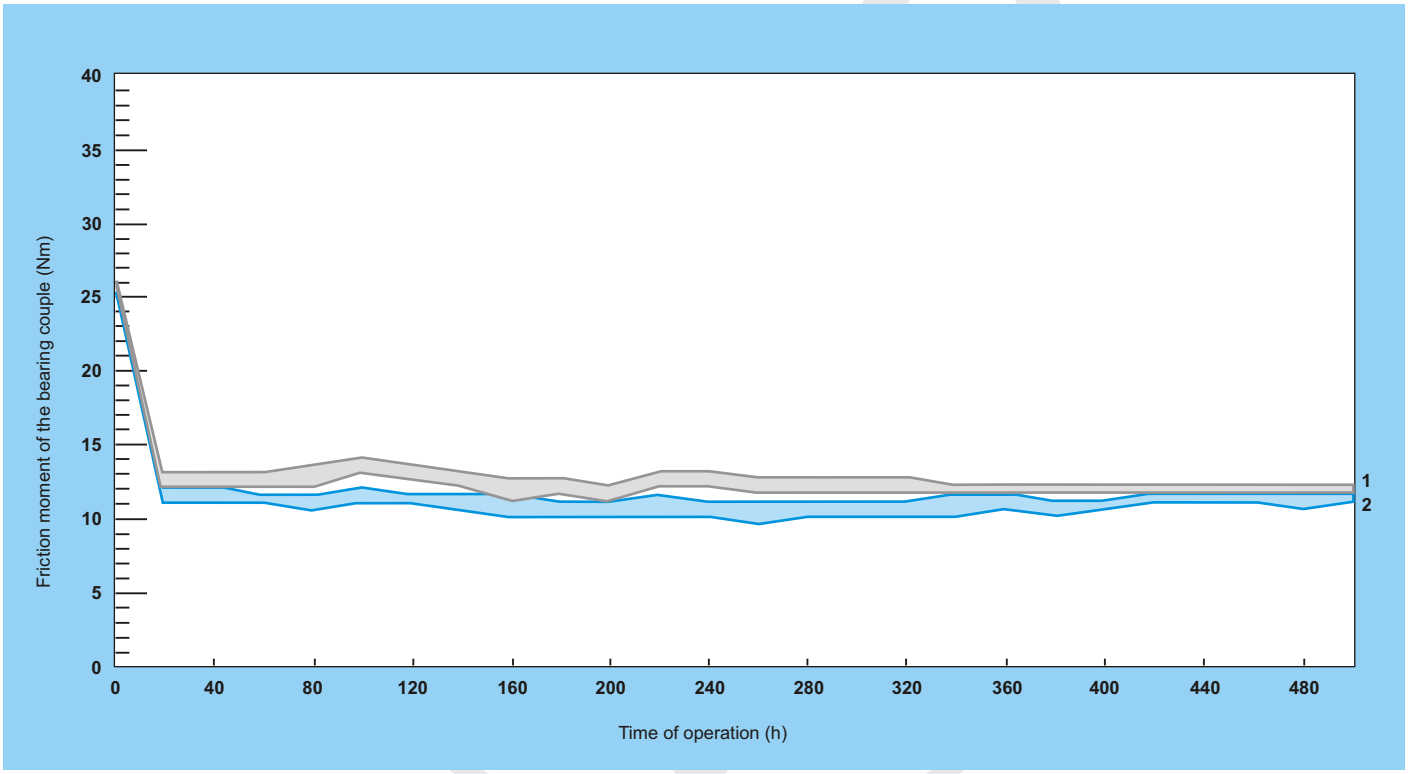


Diagram 2:
FE8 test run with angular contact ball bearing 536050 JP (≙7312 B); thrust load F_a = 80 kN; speed n = 7.5 min^{-1}; running time 500 h
Lubrication with **THERMOPLEX® 2 TML**

Parameters	Test run 1	Test run 2	FAG requirements
Steady-state temperature in °C	139	136	
Peak temperature in °C	143	141	
Wear in mg of - the rolling elements - the cage - the inner ring - the outer ring Frictional behaviour over the time (see diagram above)	 22/22 7/7 24/11 45/32 Running-in finished, very smooth	 17/15 9/9 25/25 76/52 Running-in finished, very smooth	 < 35 **Evaluation: very good**