

We have the solution...

...the future has a name



HL
Lubricating grease for
rolling bearings subject to
high loads, high speeds,
high temperatures



Reg.-Nr. 17581-04

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**TURMOGREASE®
Li 802 EP**

Use Lubricants which are
Successfully Applied by the
Industry.



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

- long service life
- good running properties
- high operational reliability



TURMOGREASE® LI 802 EP for

- rolling bearings subject to high loads
- high temperatures up to +140 °C
- low up to high speeds
- low up to high bearing load
- the lubrication of various types and sizes of bearings

Advantages

- good protection against corrosion and ageing
- compatible with non-ferrous metals, NBR elastomers, PA 66-GF 25 plastics
- favourable noise behaviour
- good oxidation stability
- excellent load-carrying capacity
- suitable for application in critical types of rolling bearings
- service life of grease and the achievable bearing life is above average
- the multipurpose application allows to reduce the high number of different grease types actually used in many companies

The friction behaviour of small to medium-size deep groove ball bearings lubricated with **TURMOGREASE® Li 802 EP** is very good. Friction is generally low, the grease spreads within a relatively short time and grease losses in 2RSR bearings are comparatively low.

This grease meets the requirements of grease class J in accordance with FAG specifications, a fact proven in several tests.

Service temperature range:
-35 °C up to +140 °C, short time up to +160 °C

Suitable for the following rolling bearings:
Deep groove ball and cylindrical roller bearings
Speed factor $n \cdot d_m$ ($\text{min}^{-1} \cdot \text{mm}$)
up to 1 000 000 for P/C < 0.05
up to 1 000 for P/C < 0.5 up to +70 °C

Spherical and conical roller bearings
Speed factor $n \cdot d_m$ ($\text{min}^{-1} \cdot \text{mm}$)
up to 300 000 for P/C < 0.05
up to 1 000 for P/C < 0.3 up to +70 °C

Practical Application

This high-performance lubricating grease for high demands has successfully been used in construction machines, high-lifter trucks, tracklaying vehicles and also in spinning and grinding spindles. Furthermore, appliances and wheelset bearings exposed to high vibrations in rail vehicles and rotary stretchers are lubricated with this grease.

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.

Application in Rolling Bearings

Requirements

- proper bearing assembly
- sufficient lubricant quantity on all functional surfaces
- selection of appropriate rolling bearings (cage design and material, dimensional accuracy of the bearings and the surrounding components)
- Extremely low-speed bearings and their housings generally require a complete grease fill.
- At low and medium speeds (corresponding to $n \cdot d_m < 200\,000 \text{ min}^{-1} \cdot \text{mm}$) the bearings have to be completely filled with grease, the adjacent housing space, however, only to such an extent that the grease emerging from the bearing can be incorporated easily.
- In case of higher rotational speeds the bearings should only be filled to 40 - 60 % of the free bearing space. If the free space adjacent to the bearing is large, we recommend to use seals or shields to ensure that a sufficient grease quantity is retained in the bearing.

Relubrication Intervals

Relubrication quantities are indicated in **table 2, p. 5**. The relubrication interval t_f for favourable operating and ambient conditions is indicated in the **diagram 1, p. 5**. **Table 3, p. 5** shows the reducing factors f_1 to f_5 applicable in case of unfavourable operating and ambient conditions.

TURMOGREASE® Li 802 EP is a high-performance grease ensuring extended relubrication intervals: the upper limit of the wide curve shown in the **diagram 1, p. 5** is valid for this grease. To obtain the actual lubrication interval t_{fq} multiply the relubrication interval as given in the **diagram 1** with the reducing factors:

$$t_{fq} = t_f \cdot f_1 \dots f_5$$

In case of extremely high loads, it is absolutely necessary to control the presence of grease in the bearing; if a grease deficiency occurs, the lubricating intervals have to be reduced. The technical data of this grease including information on compatibility with sealing and cage materials are listed on **table 1, p. 4**.

Noise Test with FAG MGG 11

The noise behaviour was tested on an MGG 11 noise tester. The result (noise class II) is good, taking into consideration that the range from I to IV covers very good moderate results.





Determination of the Application Range

The upper limit of the service temperature range was derived from the result of the FAG FE9 test run according to DIN 51821 at **+140 °C** with an operating time of **F₅₀ = 200 hours**, see **diagram 2, p. 6**.

A good standard grease on lithium base renders only a time of **F₅₀ = 147 h** at a temperature of **+120 °C**. Therefore, the application temperature of **TURMOGREASE® Li 802 EP** is by 20 °C higher than that of a usual standard grease.

The lower temperature limit was deducted from the flow pressure at -35 °C specified in DIN 51805. Owing to the low flow pressure of 1380 hPa as determined in the DIN test, relubrication is still possible at -35 °C.

The defined rolling bearing application range is based on results of the FAG FE8 test:

- At a low rotating speed and a high load the specified 500 operating hours were achieved without any failures and with only very little wear of bearing elements. This test was carried out with angular contact ball bearings at temperatures from +30 °C up to +40 °C as well as with taper roller bearings at a temperature of +60 °C. The detailed test results are shown in the **diagrams 3 and 4, p. 7**.
- The higher speed range was tested at speeds near the upper limit of the admissible speed factor using angular contact ball bearings at temperatures from +90 °C up to +120 °C, the result is shown in the **diagram 5, p. 8**, as well as taper roller bearings at +90 °C up to +120 °C, the result is shown in **diagram 6, p. 8**.

The test runs were evaluated by comparing the wear results with the requirements for lubricating greases of the FAG grease classification (= FAG specification).

For the evaluation it was decisive that the 500 hour tests were completed without failures and that wear was only moderate.

All test runs were repeated several times, i. e. the results can be considered reliable.

Even though these were short-period tests, they clearly showed that the suitability of **TURMOGREASE® Li 802 EP** for the indicated application range is above average.

Satisfactory operational results can be expected, when observing the indicated lubricating intervals. The test speed differed from the speed factor, due to the test bench; the higher speed factor was chosen as a result of referring field experiences.

Friction Behaviour

The friction behaviour was tested on an FAG R6 test rig. **Diagram 7, p. 9** shows the test results, whereby the quick distribution of grease is remarkable. This becomes obvious by the early reduction of friction over the running time.

The low friction in the steady-state condition and the moderate loss of grease show that this product is suitable for sealed and shielded bearings.

Table 1: Technical Data of TURMOGREASE® Li 802 EP

| Technical Data | TURMOGREASE® Li 802 EP | proved acc. to |
|--|--------------------------|----------------|
| Colour | brown | |
| Thickener | Lithium soap | |
| Base oil viscosity +40 °C/+100 °C (mm ² /s) | Mineral/Synth. 85/12.5 | DIN 51562 |
| Drop point (°C) | 190 | DIN ISO 2176 |
| Worked penetration 60 TT (mm/10) | 265 - 295 | DIN ISO 2137 |
| Water resistance +90 °C | 1 - 90 | DIN 51807T1 |
| SKF Emscor Corrosion protection | 0 - 0 | DIN 51802 |
| Oxidation resistance 100 h/+100 °C (bar) | 0.4 | DIN 51808 |
| Copper corrosion +120 °C | Rating 1 | DIN 51811 |
| Flow pressure at -35 °C (hPa) | 1380 | DIN 51805 |
| Oil separation (% by wt.) +40 °C/+100 °C | approx. 3.5/6 | DIN 51817 |
| Content of solid matters, particles 25 µm (mg) | < 5 | DIN 51813 |
| Behaviour towards NBR elastomer, 7 days at +100 °C | | |
| Change of Shore A hardness ± 15 SAH | +2 SAH | DIN 53505 |
| Tearing elongation 150 % | -19.8 % | DIN 53504 |
| Change of volume max. ± 10 % | -3.4 % | DIN 53521 |
| PA66-GF25 42 days at +120 °C | | |
| Tearing strength 130 N/mm ² | 184 N/mm ² | DIN EN 61 |
| Tearing elongation 2 % | +18.8 % | DIN EN 61 |
| Impact tenacity 20 MJ/mm ² | -17.8 MJ/mm ² | DIN 53453 |

Lubricating Interval and Relubrication Quantity

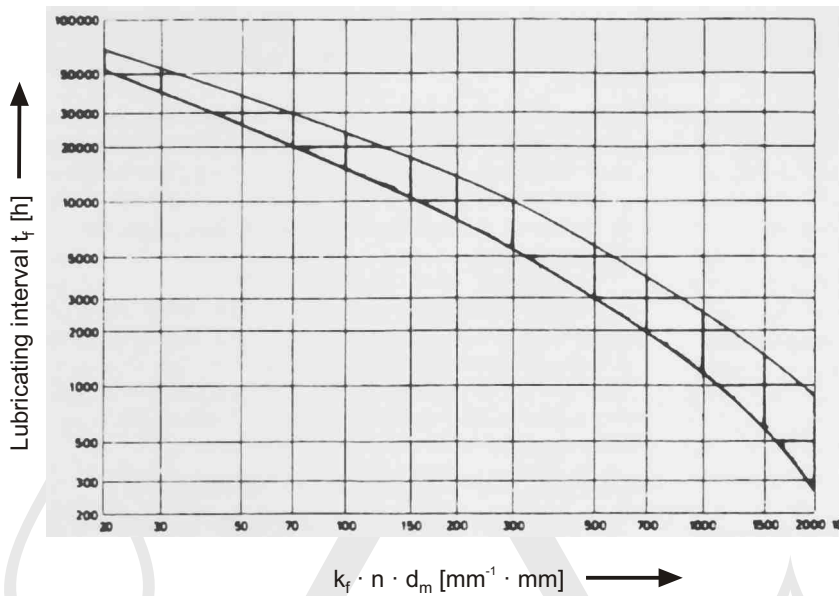


Diagram 1: Lubricating interval for favourable operating and environmental conditions

| Type of bearing | k_f |
|--|---|
| Deep groove ball bearing | single-row 0.9 ... 1.1 double-row 1.5 |
| Angular contact ball bearing | single-row 1.6 double-row 2 |
| Spindle bearing | $\alpha = 15^\circ$ 0.75 $\alpha = 25^\circ$ 0.9 |
| Four-point contact bearing | 1.6 |
| Spherical ball bearing | 1.3 ... 1.6 |
| Deep groove ball thrust bearing | 5 ... 6 |
| Angular contact ball thrust bearing double-row | 1.4 |

| Type of bearing | k_f |
|--|---|
| Cylindrical roller bearing | single-row 3 ... 3.5 double-row 3.5 full-row 25 |
| Thrust cylindrical roller bearing | 90 |
| Needle bearing | 3.5 |
| Conical roller bearing | 4 |
| Barrel-shaped roller bearing | 10 |
| Spherical roller bearing without flanges (»E«) | 7 ... 9 |
| Spherical roller bearing with centre flange | 9 ... 12 |

| Relubrication quantity m_1 for weekly or annual relubrication intervals | |
|--|-------|
| $m_1 = D \cdot B \cdot x$ [g] | |
| Relubrication interval | x |
| weekly | 0.002 |
| monthly | 0.003 |
| annual | 0.004 |
| Relubrication quantity m_2 for extremely short relubrication intervals | |
| $m_2 = (0.5 \dots 20) \cdot V$ [kg/h] | |
| Relubrication quantity m_3 before starting reoperation after a standstill of several years | |
| $m_3 = D \cdot B \cdot 0.01$ [g] | |
| V = free space in the bearing | |
| $\approx \frac{\pi}{4} \cdot B (D^2 - d^2) \cdot 10^{-9} - \frac{G}{7800}$ [m ³] | |
| d = diameter of the bearing bore [mm] D = outer diameter of the bearing [mm] B = bearing width [mm] G = bearing weight [kg] | |
| Table 2: Relubrication quantities | |

| | | | |
|---|-----------------------|--|------------------------|
| Influence of dust and moisture at the functional surfaces of the bearing | | Influence of high loads | |
| moderate | $f_1 = 0.7 \dots 0.9$ | P/C = 0.1 ... 0.15 | $f_4 = 1$ |
| strong | $f_1 = 0.4 \dots 0.7$ | P/C = 0.15 ... 0.25 | $f_4 = 0.7 \dots 1$ |
| very strong | $f_1 = 0.1 \dots 0.4$ | P/C = 0.25 ... 0.35 | $f_4 = 0.4 \dots 0.7$ |
| Influence of impact loads, vibrations and oscillations | | P/C = 0.35 ... 0.45 | $f_4 = 0.2 \dots 0.4$ |
| moderate | $f_2 = 0.7 \dots 0.9$ | P/C = 0.45 ... 0.6 | $f_4 = 0.05 \dots 0.2$ |
| strong | $f_2 = 0.4 \dots 0.7$ | P/C = >0.6 | $f_4 = < 0.05$ |
| very strong | $f_2 = 0.1 \dots 0.4$ | Influence of current streaming through the bearing | |
| Influence of increased bearing temperatures | | slight current | $f_5 = 0.5 \dots 0.7$ |
| moderate (up to +85 °C) | $f_3 = 0.7 \dots 0.9$ | strong current | $f_5 = 0.1 \dots 0.5$ |
| strong (up to +100 °C) | $f_3 = 0.4 \dots 0.7$ | | |
| very strong (up to +130 °C) | $f_3 = 0.1 \dots 0.4$ | | |
| Table 3: Reducing factors $f_1 \dots f_5$ for unfavourable operational and environmental conditions | | | |

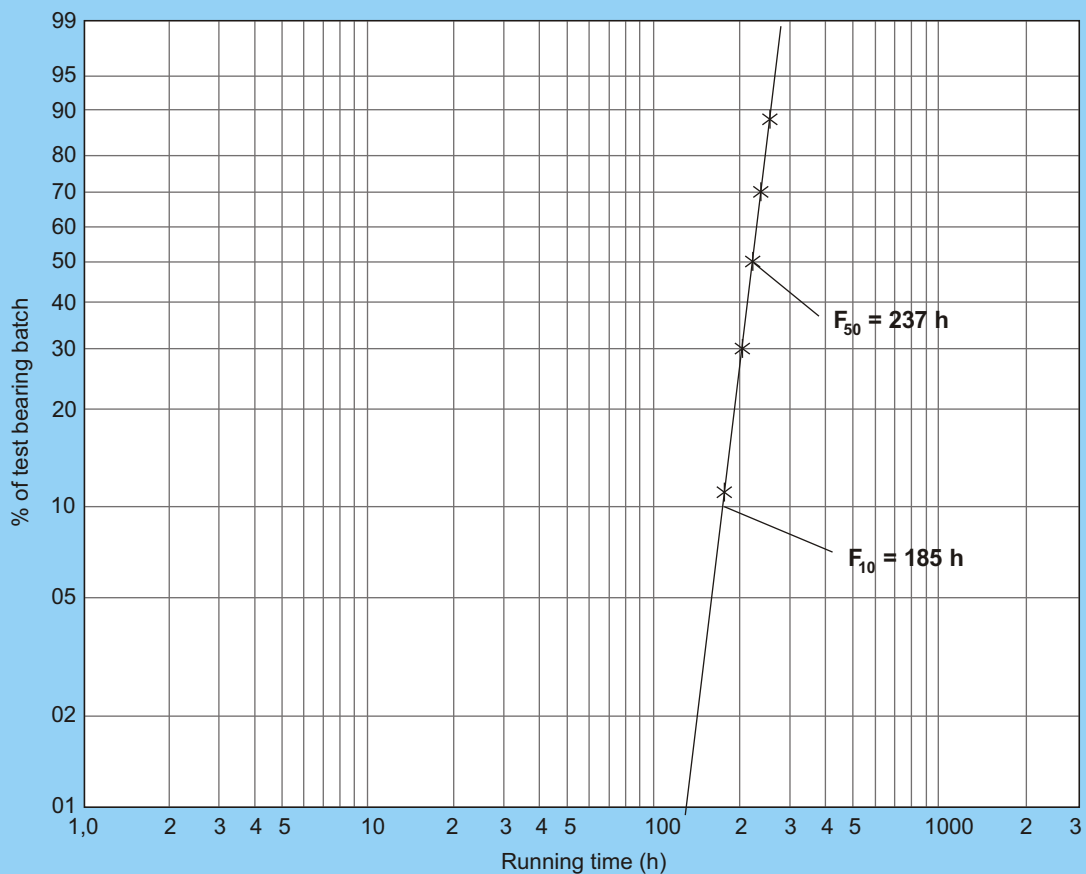


Diagram 2:

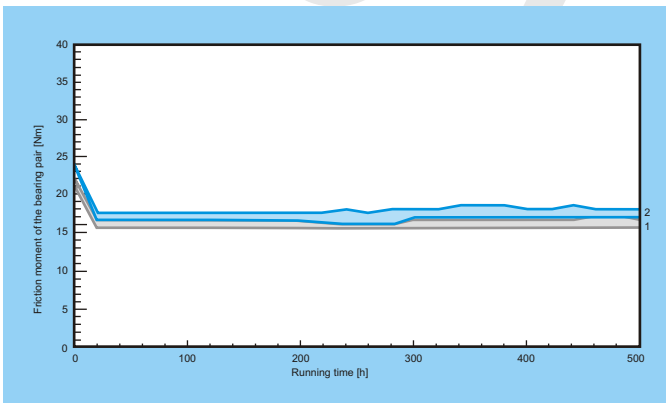
FE9 test run with angular contact ball bearing 529689 (\cong 7206 B), assembly A, i. e. open bearing; axial load $F_a = 1.5 \text{ kN}$; speed $n = 6000 \text{ min}^{-1}$; temperature $+140 \text{ }^\circ\text{C}$

Lubrication with **TURMOGREASE® Li 802 EP**

Grease service life of the bearings in h: determination in Weibull diagram of $F_{50} = 237 \text{ h}$; $F_{10} = 185 \text{ h}$

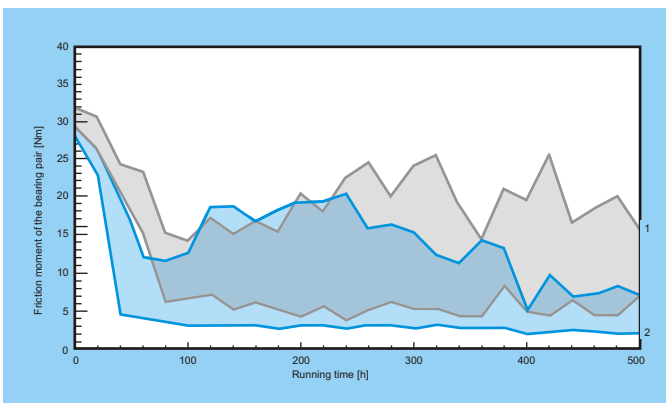
Requirements acc. to FAG and DIN 51825 $F_{50} = 100 \text{ h} \rightarrow$

Evaluation: very good



| Parameters | Test run 1 | Test run 2 | FAG requirement |
|---|----------------------------|----------------------------|--|
| Steady-state temperature in °C | 29 | 37 | ^S 30 ... 40 |
| Peak temperature in °C | 37 | 45 | 30 ... 40 |
| Wear in mg of - the rolling elements - the cage - the inner ring - the outer ring | 5/16 -- 5/9 13/18 | 8/11 -- 6/7 14/17 | < 35 <100 Evaluation: very good |
| Frictional behaviour over the time (see diagram left) | very smooth behaviour | very smooth behaviour | |

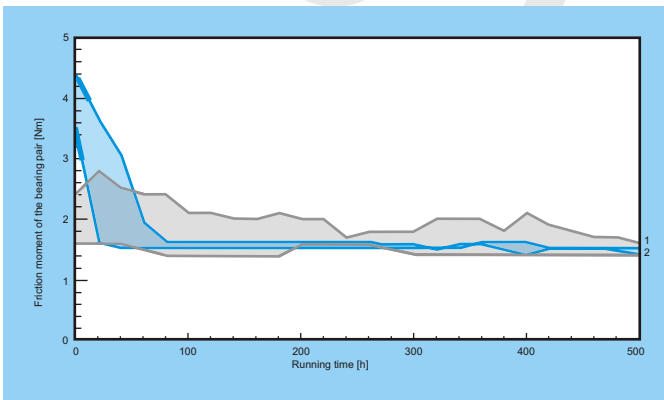
Diagram 3:
FE8 test run with angular contact ball bearing 536050 (\triangleq 7312 B); axial load $F_a = 80$ kN; speed $n = 7.5$ min⁻¹; time of operation 500 h
Lubrication with **TURMOGREASE® Li 802 EP**



| Parameters | Test run 1 | Test run 2 | FAG requirement |
|---|----------------------------------|----------------------------------|--|
| Steady-state temperature in °C | 45 | 35 | ^S 60 |
| Peak temperature in °C | 77 | 60 | 60 |
| Wear in mg of - the rolling elements - the cage - the inner ring - the outer ring | 18/23 52/69 15/13 13/13 | 24/25 44/47 32/28 16/13 | < 35 <100 Evaluation: very good |
| Frictional behaviour over the time (see diagram left) | Running-in not yet finished | Running-in almost finished | |

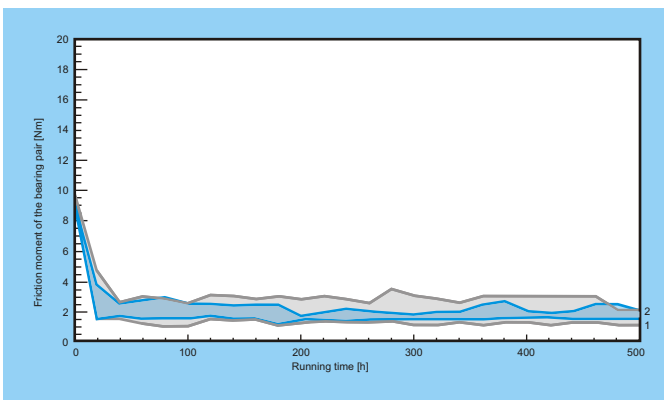
Diagram 4:
FE8 test run with taper roller bearing 536048 (\triangleq 31312); axial load $F_a = 50$ kN; speed $n = 75$ min⁻¹; time of operation 500 h
Lubrication with **TURMOGREASE® Li 802 EP**

FAG FE8 Test Run



| Parameters | Test run 1 | Test run 2 | FAG requirement |
|---|-----------------------------|----------------------------------|--|
| Steady-state temperature in °C | 90 | 84 | S ≤120 |
| Peak temperature in °C | 125 | 132 | 120 |
| Wear in mg of - the rolling elements - the cage - the inner ring - the outer ring | 6/7 -- 1/8 2/6 | 0/0 -- 0/0 0/0 | < 35 <100 Evaluation: very good |
| Frictional behaviour over the time (see diagram left) | Running-in not yet finished | Running-in finished, very smooth | |

Diagram 5:
FE8 test run with angular contact ball bearing 536050 TVP (\cong 7312 B with plastic cage); axial load $F_a = 5 \text{ kN}$; speed $n = 6000 \text{ min}^{-1}$; time of operation 500 h;
Lubrication with **TURMOGREASE® Li 802 EP**



| Parameters | Test run 1 | Test run 2 | FAG requirements |
|---|------------------------------|----------------------------|--|
| Steady-state temperature in °C | 100 | 95 | 120 |
| Peak temperature in °C | 116 | 110 | 120 |
| Wear in mg of - the rolling elements - the cage - the inner ring - the outer ring | 14/11 15/11 4/4 1/2 | 10/8 43/9 4/1 0/1 | < 35 <100 Evaluation: very good |
| Frictional behaviour over the time (see diagram left) | Running-in finished | Running-in finished | |

Diagram 6:
FE8 test run with taper roller bearing 536048 (\cong 31312); axial load $F_a = 10 \text{ kN}$; speed $n = 3000 \text{ min}^{-1}$; time of operation 500 h
Lubrication with **TURMOGREASE® Li 802 EP**

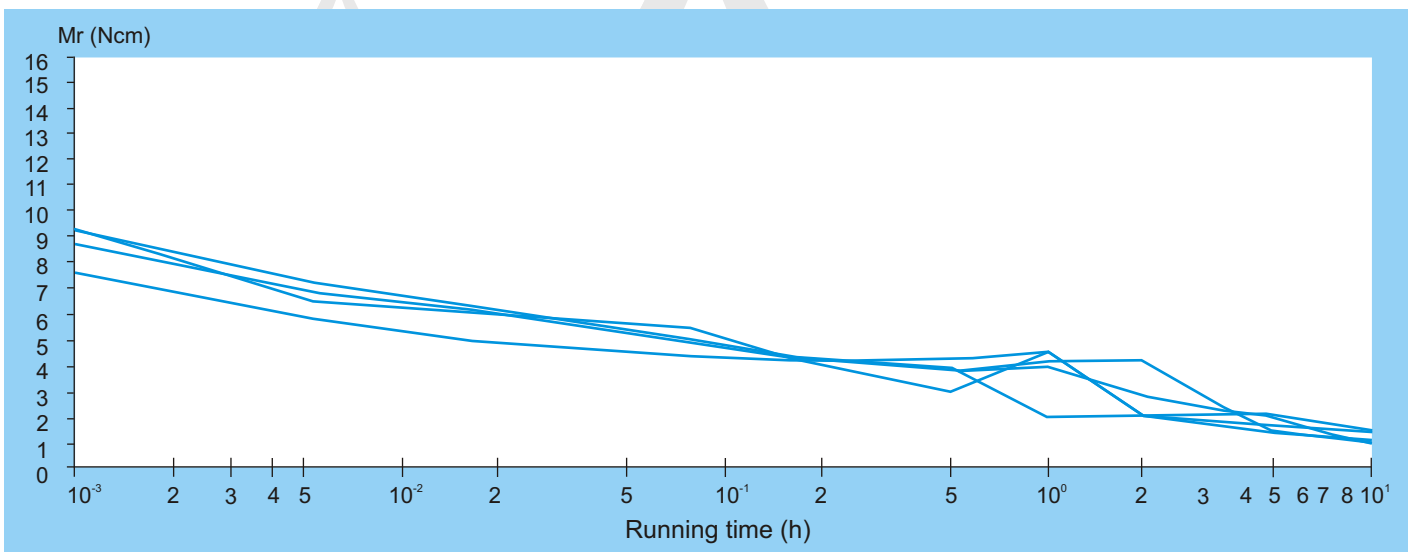


Diagram 7:
R6 test run with deep groove ball bearing 6203.2ZR.C3; preservation of the test bearing with Fuchs TX 10A; axial load $F_a = 179$ N; radial load $F_r = 23$ N; speed $n = 7500$ min⁻¹; running time 10 h
Lubrication with **TURMOGREASE® Li 802 EP**
Steady-state temperature +28 ... +30 °C; peak temperature +40 °C; grease loss 50 mg

Lubricating Greases for Rolling Bearings

TURMOGREASE® Li 802 EP; often used lubricating grease for rolling bearings subject to high loads, proved successful for many applications. Modified versions with tailor-made formulations provide an extended range of performance for specific applications:

| Special application | V ₄₀ (mm ² /s) | Name of grease |
|--|--------------------------------------|------------------------|
| Temperature -35 °C up to +140 °C, speed factor $n \cdot d_m$ (min ⁻¹ · mm) ≤ 1 000 000 | 85 | TURMOGREASE® Li 802 EP |
| Temperature -25 °C up to +140 °C, water resistant, speed factor $n \cdot d_m$ (min ⁻¹ · mm) ≤ 1 000 000 | 85 | TURMOGREASE® LC 802 EP |
| Favourable for impact loads, vibrations | 200 | TURMOPLEX® 2 MF |
| Favourable also for high impact loads, vibrations, temperature up to +170 °C | 400 ... 500 | TURMOPLEX® BN 5002 |
| Temperature up to +140 °C, water resistant, favourable for bearings with rolling outer ring | 400 ... 500 | TURMOGREASE® CAK 4003 |
| Favourable for extremely high impact loads | 1000 | TURMOPLEX® L 220 |



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