SKF lubricants

Poor lubrication accounts for over 36% of premature bearing failures

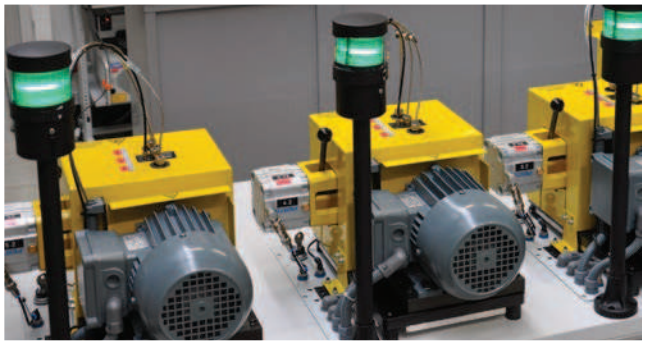
SKF lubricants offer major competitive advantages:

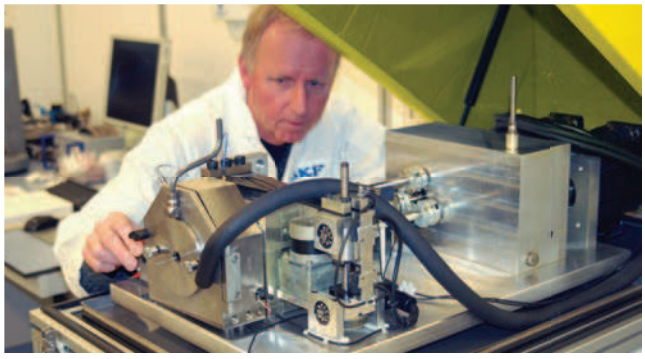
- Designed and tested to perform under real conditions
- Product data include specific test results enabling a better selection
- Strict quality control of every production batch helps ensure consistent performance
- Quality control allows SKF to offer a five–year shelf-life [1] from the date of production

Production processes and raw materials greatly influence grease properties and performance. It is virtually impossible to select or compare greases based only on their composition. Therefore, performance tests are needed to provide crucial information. In over 100 years, SKF has accrued vast knowledge about the interaction of lubricants, materials and surfaces.

This knowledge has led SKF, in many cases, to set industry standards in bearing lubricant testing. Emcor, ROF, ROF+, V2F, R2F and Bequiet are just some of the multiple tests developed by SKF to assess the performance of lubricants under bearing operating conditions. Many of them are widely used by lubricant manufacturers worldwide.

[1] SKF food grade and biodegradable lubricants offer a two-year shelf-life from the date of production.





SKF Engineering and Research Centre in the Netherlands

SKF lubricant selection

Selecting a grease can be a delicate process. SKF has developed several tools in order to facilitate the selection of the most suitable lubricant. The wide range of tools available includes those from easy-to-use application driven tables to advanced software allowing for grease selection based upon detailed working conditions.

The basic bearing grease selection chart provides you with quick suggestions on the most commonly used greases in typical applications.

Basic bearing grease selection		
Generally use if:		
Speed = M, Temperature = M and Load = M	LGMT 2	General purpose
Unless:		
Expected bearing temperature continuously >100 °C *(210 °F)*	LGHP 2	High temperature
Expected bearing temperature continuously >150 °C *(300 °F)*, demands for radiation resistance	LGET 2	Extremely high temperature
Low ambient –50 °C *(–60 °F)*, expected bearing temperature <50 °C *(120 °F)*	LGLT 2	Low temperature
Shock loads, heavy loads, frequent start-up / shut-down	LGEP 2	High load
Food processing industry	LGFP 2	Food processing
Biodegradable, demands for low toxicity	LGGB 2	Biodegradable

Note: – For areas with relatively high ambient temperatures, use LGMT 3 instead of LGMT 2
– For special operating conditions, refer to the SKF bearing grease selection chart

With additional information like speed, temperature, and load conditions, LubeSelect for SKF greases is the easiest way to select the right grease. For additional information, visit www.aptitudeexchange.com. Additionally, the SKF bearing grease selection chart provides you with a complete overview of SKF greases. The chart includes the main selection parameters, such as temperature, speed and load, as well as basic additional performance information.

Bearing operating parameters

Temperature

L	= Low	<50 °C	*(120 °F)*
M	= Medium	50 to 100 °C	*(120 to 230 °F)*
H	= High	>100 °C	*(210 °F)*
EH	= Extremely high	>150 °C	*(300 °F)*

Load

VH	= Very high	C/P <2
H	= High	C/P ~4
M	= Medium	C/P ~8
L	= Low	C/P ≥15

C/P = Load ratio — C = basic dynamic load rating, kN; P = equivalent dynamic bearing load, kN

Speed		for ball bearings
EH	= Extremely high	n d_m over 700 000
VH	= Very high	n d_m up to 700 000
H	= High	n d_m up to 500 000
M	= Medium	n d_m up to 300 000
L	= Low	n d_m below 100 000

Speed		for roller bearings SRB/TRB/CARB	CRB
H	= High	n d_m over 210 000	n d_m over 270 000
M	= Medium	n d_m up to 210 000	n d_m up to 270 000
L	= Low	n d_m up to 75 000	n d_m up to 75 000
VL	= Very low	n d_m below 30 000	n d_m below 30 000

n d_m = rotational speed, r/min x 0,5 (D+d), mm

SKF bearing grease selection chart

Grease	Description	Application examples	Temperature range [1] LTL	HTPL	Temp.	Speed
LGMT 2	General purpose industrial and automotive	Automotive wheel bearings Conveyors and fans Small electric motors	–30 °C (–20 °F)	120 °C (250 °F)	M	M
LGMT 3	General purpose industrial and automotive	Bearings with d>100 mm Vertical shaft or outer bearing ring rotation Car, truck and trailer wheel bearings	–30 °C (–20 °F)	120 °C (250 °F)	M	M
LGEP 2	Extreme pressure	Forming and press section of paper mills Work roll bearings in steel industry Heavy machinery, vibrating screens	–20 °C (–5 °F)	110 °C (230 °F)	M	L to M
LGWA 2	Wide temperature [4], extreme pressure	Wheel bearings in cars, trailers and trucks Washing machines Electric motors	–30 °C (–20 °F)	140 °C (285 °F)	M to H	L to M
LGGB 2	Biodegradable, low toxicity [3]	Agricultural and forestry equipment Construction and earthmoving equipment Water treatment and irrigation	–40 °C (–40 °F)	90 °C (195 °F)	L to M	L to M
LGFP 2	Food compatible	Food processing equipment Wrapping machines Bottling machines	–20 °C (–5 °F)	110 °C (230 °F)	M	M
LGFQ 2	Food compatible High load	Pellet presses Mills Mixers	–40 °C (–40 °F)	140 °C (285 °F)	L to H	VL to M
LGED 2	Food compatible High temperature Harsh environment	Bakery/brick oven equipment Glass industry Vacuum pumps	–30 °C (–20 °F)	240 °C (464 °F)	VH	L to M
LGBB 2	Wind turbine blade and yaw bearing grease	Wind turbine blade and yaw slewing bearings	–40 °C (–40 °F)	120 °C (250 °F)	L to M	VL
LGLT 2	Low temperature, extremely high speed	Textile and machine tool spindles Small electric motors and robots Printing cylinders	–50 °C (–60 °F)	110 °C (230 °F)	L to M	M to EH
LGWM 1	Extreme pressure, low temperature	Main shaft of wind turbines Centralised lubrication systems Spherical roller thrust bearing applications	–30 °C (–20 °F)	110 °C (230 °F)	L to M	L to M
LGWM 2	High load, wide temperature	Main shaft of wind turbines Heavy duty off road or marine applications Snow exposed applications	–40 °C (–40 °F)	110 °C (230 °F)	L to M	L to M
LGEM 2	High viscosity plus solid lubricants	Jaw crushers Construction machinery Vibrating machinery	–20 °C (–5 °F)	120 °C (250 °F)	M	VL
LGEV 2	Extremely high viscosity with solid lubricants	Trunnion bearings Support and thrust rollers on rotary kilns and dryers Slewing ring bearings	–10 °C (15 °F)	120 °C (250 °F)	M	VL
LGHB 2	EP high viscosity, high temperature [5]	Steel on steel plain bearings Dryer section of paper mills Work roll bearings and continuous casting in steel industry	–20 °C (–5 °F)	150 °C (300 °F)	M to H	VL to M
LGHP 2	High performance polyurea grease	Electric motors Fans, even at high speed High speed ball bearings at medium and high temperatures	–40 °C (–40 °F)	150 °C (300 °F)	M to H	M to H
LGET 2	Extreme temperature	Bakery equipment (ovens) Wafer baking machines Textile dryers	–40 °C (–40 °F)	260 °C (500 °F)	VH	L to M

[1] LTL = Low Temperature Limit
HTPL = High Temperature Performance Limit
[2] mm^2/s at 40 °C (105 °F) = cSt.
[3] LGGB 2 can withstand peak temperatures of 120 °C (250 °F)
[4] LGWA 2 can withstand peak temperatures of 220 °C (430 °F)
[5] LGHB 2 can withstand peak temperatures of 200 °C (390 °F)

Load	Thickener / Base Oil	NLGI	Base oil viscosity [2]	Vertical shaft	Fast outer ring rotation	Oscillating movements	Severe Vibrations	Shock load or frequent start up	Rust inhibiting properties	
L to M	Lithium soap / mineral oil	2	110	●			+		+	Wide applications greases
L to M	Lithium soap / mineral oil	3	125	+	●		+		●	Wide applications greases
H	Lithium soap / mineral oil	2	200	●		●	+	+	+	Wide applications greases
L to H	Lithium complex soap / mineral oil	2	185	●	●	●	●	+	+	Wide applications greases
M to H	Lithium-calcium soap / synthetic ester oil	2	110	●		+	+	+	●	Special requirements
L to M	Aluminium complex / medical white oil	2	150	●					+	Special requirements
L to VH	Complex calcium sulphonate/PAO	1–2	320	●	●	+	+	+	+	Special requirements
H to VH	PTFE / synthetic fluorinated polyether oil	2	460	●	●	+	●	●	●	Special requirements
M to H	Lithium complex soap / synthetic PAO oil	2	68			+	+	+	+	Special requirements
L	Lithium soap / synthetic PAO oil	2	18	●				●	●	Low temperatures
H	Lithium soap / mineral oil	1	200			+		+	+	Low temperatures
L to H	Complex calcium sulphonate / synthetic PAO oil / mineral oil	1–2	80	●	●	+	+	+	+	High loads
H to VH	Lithium soap / mineral oil	2	500	●		+	+	+	+	High loads
H to VH	Lithium-calcium soap / mineral oil	2	1020	●		+	+	+	+	High loads
L to VH	Complex calcium sulphonate / mineral oil	2	425	●	+	+	+	+	+	High loads
L to M	Di-urea / mineral oil	2–3	96	+			●	●	+	High temperatures
H to VH	PTFE / synthetic fluorinated polyether oil	2	400	●	+	+	●	●	●	High temperatures

● = Suitable + = Recommended

	LGMT 2	LGMT 3	LGEP 2	LGWA 2	LGGB 2	LGFP 2	LGFQ 2
DIN 51825 code	K2K-30	K3K-30	KP2G-20	KP2N-30	KPE 2K-40	K2G-20	KP1/2N-40
NLGI consistency class	2	3	2	2	2	2	1–2
Thickener	Lithium	Lithium	Lithium	Lithium complex	Lithium/ calcium	Aluminium complex	Complex calcium sulphonate
Colour	Red brown	Amber	Light brown	Amber	Off white	Transparent	Brown
Base oil type	Mineral	Mineral	Mineral	Mineral	Synthetic (Ester)	Medical white oil	Synthetic (PAO)
Operating temperature range	–30 to +120 °C *(–20 to +250 °F)*	–30 to +120 °C *(–20 to +250 °F)*	–20 to +110 °C *(–5 to +230 °F)*	–30 to +140 °C *(–20 to +285 °F)*	–40 to +90 °C *(–40 to +195 °F)*	–20 to +110 °C *(–5 to +230 °F)*	–40 to +140 °C *(–40 to +284 °F)*
Dropping point DIN ISO 2176	>180 °C *(>355 °F)*	>180 °C *(>355 °F)*	>180 °C *(>355 °F)*	>250 °C *(>480 °F)*	>170 °C *(>340 °F)*	>250 °C *(>480 °F)*	>300 °C *(>570 °F)*
Base oil viscosity							
40 °C, mm²/s	110	125	200	185	110	150	320
100 °C, mm²/s	11	12	16	15	13	15,3	30
Penetration DIN ISO 2137							
60 strokes, 10^{-1} mm	265–295	220–250	265–295	265–295	265–295	265–295	280–310
100 000 strokes, 10^{-1} mm	+50 max. (325 max.)	280 max.	+50 max. (325 max.)	+50 max. (325 max.)	+50 max. (325 max.)	+30 max.	+30 max.
Mechanical stability							
Roll stability, 50 hrs at 80 °C, 10^{-1} mm	+50 max.	295 max.	+50 max.	+50 max. change	+70 max.		–20 to +30 max.
V2F test	'M'	'M'	'M'	'M'	(350 max.)		
Corrosion protection							
Emcor: – standard ISO 11007	0–0	0–0	0–0	0–0	0–0	0–0 [1]	0–0
– water washout test	0–0	0–0	0–0	0–0 [1]			
– salt water test (100% seawater)	0–1 [1]		1–1 [1]				0–0
Water resistance							
DIN 51 807/1, 3 hrs at 90 °C	1 max.	1 max.[1]	1 max.	1 max.	0 max.	1 max.	1 max.
Oil separation							
DIN 51 817, 7 days at 40 °C, static, %	1–6	1–3	2–5	1–5	0,8–3	1–5	3 max.
Lubrication ability							
R2F, running test B at 120 °C	Pass	Pass	Pass	Pass, 100 °C *(210 °F)*	Pass, 100 °C *(210 °F)* [1]		Pass
R2F, cold chamber test, –30 °C, +20 °C							
Copper corrosion DIN 51 811	2 max. 110 °C *(230 °F)*	2 max. 130 °C *(265 °F)*	2 max. 110 °C *(230°F)*	2 max. 100 °C *(210°F)*		1 max. 120 °C *(250 °F)*	1b max. 100 °C *(210°F)*
Rolling bearing grease life							
ROF test		1 000 min.,			>300,	1 000,	
L_{50} life at 10 000 r/min., hrs		130 °C *(265 °F)*			120 °C *(250 °F)*	110 °C *(230 °F)* [1]	
EP performance							
Wear scar DIN 51350/5, 1 400 N, mm			1,4 max.	1,6 max.	1,8 max.		1 max.
4–ball test, welding load DIN 51350/4, N			2 800 min.	2 600 min.	2 600 min.	1 100 min.	>4 000
Fretting corrosion							
ASTM D4170 FAFNIR test at +25 °C mg			5,7 [1]				0,8 [1]
Low temperature torque							
IP186, starting torque, m Nm [1]	98, –30 °C *(–20 °F)*	145, –30 °C *(–20 °F)*	70, –20 °C *(–5 °F)*	40, –30 °C *(–20 °F)*		137, –30 °C *(–20 °F)*	369, –40° C *(–40°F)*
IP186, running torque, m Nm [1]	58, –30 °C *(–20 °F)*	95, –30 °C *(–20 °F)*	45, –20 °C *(–5 °F)*	30, –30 °C *(–20 °F)*		51, –30 °C *(–20 °F)*	223, –40 °C *(–40°F)*

[1] Typical value

Special requirements

Wide applications greases

LGED 2	LGBB 2	LGLT 2	LGWM 1	LGWM 2	LGEM 2	LGEV 2	LGHB 2	LGHP 2	LGET 2
KFK2U-30	KP2G-40	K2G-50	KP1G-30	KP2G-40	KPF2K-20	KPF2K-10	KP2N-20	K2N-40	KFK2U-40
2	2	2	1	1–2	2	2	2	2–3	2
PTFE	Lithium complex	Lithium	Lithium	Complex calcium sulphonate	Lithium	Lithium/ calcium	Complex calcium sulphonate	Di–urea	PTFE
Off white	Yellow	Beige	Brown	Yellow	Black	Black	Brown	Blue	Off white
Synthetic (fluorinated polyether)	Synthetic (PAO)	Synthetic (PAO)	Mineral	Synthetic (PAO)/ Mineral	Mineral	Mineral	Mineral	Mineral	Synthetic (fluorinated polyether)
–30 to +240 °C *(–22 to +464 °F)*	–40 to +120 °C *(–40 to +250 °F)*	–50 to +110 °C *(–60 to +230 °F)*	–30 to +110 °C *(–20 to +230 °F)*	–40 to +110 °C *(–40 to +230 °F)*	–20 to +120 °C *(–5 to +250 °F)*	–10 to +120 °C *(15 to 250 °F)*	–20 to +150 °C *(–5 to +300 °F)*	–40 to +150 °C *(–40 to +300 °F)*	–40 to +260 °C *(–40 to +500 °F)*
>300 °C *(>570 °F)*	>200 °C *(390 °F)*	>180 °C *(>355 °F)*	>170 °C *(>340 °F)*	>300 °C *(>570 °F)*	>180 °C *(>355 °F)*	>180 °C *(>355 °F)*	>220 °C *(>430 °F)*	>240 °C *(>465 °F)*	>300 °C *(>570 °F)*
460 42	68	18 4,5	200 16	80 8,6	500 32	1 020 58	425 26,5	96 10,5	400 38
265–295 271 [1]	265–295 +50 max.	265–295 +50 max.	310–340 +50 max.	280–310 +30 max	265–295 325 max.	265–295 325 max.	265–295 –20 to +50 (325 max.)	245–275 365 max.	265–295 –
	+50 max.			+50 max.	345 max. 'M'	+50 max. 'M'	–20 to +50 change 'M'	365 max.	±30 max. 130 °C *(265 °F)*
0–0 [1]	0–0 0–1 [1]	0–1	0–0 0–0	0–0 0–0 0–0 [1]	0–0 0–0	0–0 0–0 [1] 0–0 [1]	0–0 0–0 0–0 [1]	0–0 0–0 0–0	1–1 max.
1 max.	1 max.	1 max.	1 max.	1 max.	1 max.	1 max.	1 max.	1 max.	0 max.
	4 max, 2.5 [1]	<4	8–13	3 max.	1–5	1–5	1–3, 60 °C *(140 °F)*	1–5 [1]	13 max. 30 hrs 200 °C *(390 °F)*
				Pass, 140 °C *(285 °F)* Pass, Pass	Pass, 100 °C *(210 °F)*		Pass, 140 °C *(285 °F)*	Pass	
1 max. 100 °C *(210 °F)* [1]	1 max. 120 °C *(250 °F)*	1 max. 100 °C *(210 °F)*	2 max. 90 °C *(>195 °F)*	2 max. 100 °C *(210 °F)*	2 max. 100 °C *(210 °F)*	1 max. 100 °C *(210 °F)*	2 max. 150 °C *(300 °F)*	1 max. 150 °C *(300 °F)*	1 max. 150 °C *(300 °F)*
>700 at 220 °C *(430 °F)*		>1 000, 20 000 r/min. 100 °C *(210 °F)*		1 824 [1], 110 °C *(230 °F)*			>1 000, 130 °C *(265 °F)*	1 000 min. 150 °C *(300 °F)*	>1 000 [1] at 220 °C *(428 °F)*
8 000 min.	0,4 [1] 5 500 [1]	2 000 min.	1,8 max. 3 200 min. [1]	1,5 max. [1] 4 000 min. [1]	1,4 max. 3 000 min.	1,2 max. 3 000 min.	0,86 [1] 4 000 min.		8 000 min.
	0–1 [1]		5,5 [1]	5,2 / 1,1 at –20 °C *(–5 °F)* [1]			0 [1]	7 [1]	
	313, –40 °C *(–40 °F)* 75, –40 °C *(–40 °F)*	32, –50 °C *(–60 °F)* 21, –50 °C *(–60 °F)*	178, 0 °C *(32 °F)* 103, 0 °C *(32 °F)*	249, –40 °C *(–40 °F)* 184, –40 °C *(–40 °F)*	160, –20 °C *(–5 °F)* 98, –20 °C *(–5 °F)*	96, –10 °C *(14 °F)* 66, –10 °C *(14 °F)*	250, –20 °C *(–5 °F)* 133, –20 °C *(–5 °F)*	1 000, –40 °C *(–40 °F)* 280, –40 °C *(–40 °F)*	

High loads

Low temperatures

High temperatures

SKF oils for food processing industry

Grease	Description	Application examples	Base oil	Temperature range [1] LTL	HTPL
LFFH 46	Food grade hydraulic oil	Presses and oil circulating systems	PAO	–60 °C (–76 °F)	140 °C (284 °F)
LFFH 68	Food grade hydraulic oil	Presses and oil circulating systems	PAO	–50 °C (–58 °F)	140 °C (284 °F)
LFFG 220	Food grade gear oil	Enclosed gear boxes as in filling machines or conveyor lines	PAO	–40 °C (–40 °F)	140 °C (284 °F)
LFFG 320	Food grade gear oil	Enclosed gear boxes as in filling machines or conveyor lines	PAO	–35 °C (–31 °F)	140 °C (284 °F)
LFFM 80	Food grade chain oil	High humidity applications as proof ovens and pasta driers	Mineral /ester	–30 °C (–22 °F)	120 °C (248 °F)
LHFP 150	Food grade chain oil	General chain lubrication as in confectionery industries and fruit and vegetable processing.	PAO/ester	–30 °C (–22 °F)	120 °C (248 °F)
LFFT 220	Food grade chain oil	High temperature applications as bakery ovens	Ester	0 °C (32 °F)	250 °C (482 °F)
LDTS 1	Food grade dry film lubricant	Conveyors in bottling lines using PET, carton, glass or can packages	Mineral/PTFE	–5 °C (25 °F)	60 °C (140 °F)

SKF lubricants for non bearing applications

Grease	Description	Application examples	Thickener/Base Oil	Temperature range [1] LTL	HTPL
LMCG 1	Grid and gear coupling grease	Grid and gear couplings Flexible heavy duty grid and gear coupling	Polyethylene / mineral	0 °C (32 °F)	120 °C (248 °F)
LGLS 0	Low temperature chassis grease	Plain bearings and chassis sliding surfaces. Centralized lubrication systems	Anhydrous calcium / mineral	–40 °C (–40 °F)	100 °C (212 °F)
LHMT 68	SKF Chain Oil	ideal for medium temperatures and dusty environments	Mineral	–15 °C (5 °F)	90 °C (194 °F)
LHHT 265	SKF Chain Oil	ideal for high load and/or high temperature conditions	PAO/ester	–15 °C (5 °F)	250 °C (482 °F)

[1] LTL = Low Temperature Limit
HTPL = High Temperature Performance Limit

Understanding grease technical data

Some basic knowledge is required to understand the technical data so that you can select the proper grease. This is an excerpt of the main terms mentioned in SKF grease technical data.

Consistency

A measure of the stiffness of a grease. A proper consistency must ensure that the grease stays in the bearing without generating too much friction. It is classified according to a scale developed by the NLGI (National Lubricating Grease Institute). The softer the grease, the lower the number. Grease for bearings are typically NLGI 1, 2 or 3. The test measures how deep a cone falls into a grease sample in tenths of mm.

Classification of greases by NLGI consistency number

NLGI number	ASTM worked penetration (10^{-1} mm)	Appearance at room temperature
000	445–475	very fluid
00	400–430	fluid
0	355–385	semi-fluid
1	310–340	very soft
2	265–295	soft
3	220–250	medium hard
4	175–205	hard
5	130–160	very hard
6	85–115	extremely hard

Temperature range

Comprehends the suitable working range of the grease. It goes between the low temperature limit (LTL) and the high temperature performance limit (HTPL). LTL is defined as the lowest temperature at which the grease will allow the bearing to be started up without difficulty. Below this limit, starvation will occur and cause a failure. Above HTPL, the grease will degrade in an uncontrolled way so that grease life cannot be determined accurately.

Dropping point

Temperature at which a grease sample, when heated, will begin to flow through an opening according to DIN ISO 2176. It is important to understand that this point is considered to have limited significance for performance of the grease as it is always far above HTPL.

Viscosity

A measure of a fluid's resistance to flow. For lubricants, a proper viscosity must guarantee an adequate separation between surfaces without causing too much friction. According to ISO standards, it is measured at 40 °C *(105 °F)*, as viscosity changes with temperature. Values at 100 °C *(210 °F)* allow calculation of the viscosity index, e.g. how much the viscosity will decrease when temperature rises.

Mechanical stability

The consistency of bearing greases should not significantly change during its working life. Three main tests are normally used to analyse this behaviour:

- Prolonged penetration
  The grease sample is subjected to 100 000 strokes in a device called a grease worker. Then, the penetration is measured. The difference against penetration at 60 strokes is reported as the change in 10^{-1} mm.
- Roll stability
  A grease sample is placed in a cylinder with a roller inside. The cylinder is then rotated for 72 or 100 hours at 80 or 100 °C *(175 or 210 °F)* (the standard test demands just 2 hours at room temperature). At the end of the test period, once the cylinder has cooled to room temperature, the penetration of the grease is measured and the change in consistency is reported in 10^{-1} mm.
- V2F test
  A railway axlebox is subjected to vibration shocks of 1 Hz from a bouncing hammer producing an acceleration level between 12–15 g. After 72 hours at 500 r/min., the grease leaked from the housing through the labyrinth seal is collected in a tray. If it weighs less than 50 g, a rating of 'm' is granted, otherwise it is rated as 'fail'. Afterwards, the test is continued for another 72 hours at 1 000 r/min. If less than 150 grams of grease leaked after completion of both tests, then a rating of 'M' is given.

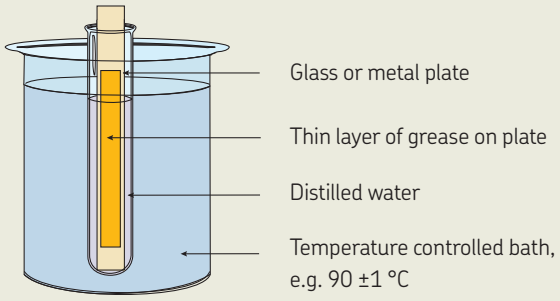
Corrosion protection

Corrosive environments demand special properties for rolling bearing greases. During the Emcor test, bearings are lubricated with a mixture of grease and distilled water. At the end of the test, a value between 0 (no corrosion) and 5 (very severe corrosion) is given. Salt water, instead of distilled water or continuous water flow (washout test), can be used to make the test more severe.

Water resistance

A glass strip is coated with the candidate grease, which is placed into a water-filled test tube. The test tube is immersed in a water bath for three hours at a specified test temperature. The change in the grease is visually evaluated and reported as a value between 0 (no change) and 3 (major change) along with the test temperature.

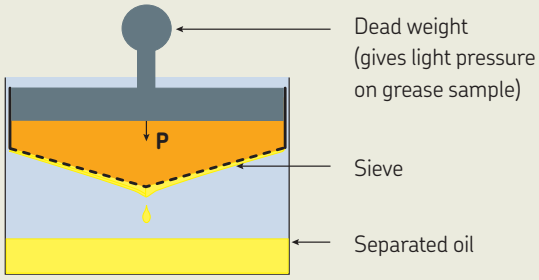
Water resistance test



Oil separation

Lubricating greases release oil when stored for long periods of time or when used in bearings as a function of temperature. The degree of oil separation will depend upon the thickener, base oil and manufacturing method. In the test, a cup is filled with a given quantity of grease (and is weighed before the test) and a 100 gram weight is placed on top of the grease. The complete unit is placed into an oven at 40 °C *(105 °F)* for one week. At the end of the week, the amount of oil which has leaked through the sieve, is weighed and reported as a percentage of weight loss.

Oil separation test



Lubrication ability

The R2F test assesses the high temperature performance and lubricating ability of a grease. A shaft with two spherical roller bearings in their respective housings is driven by an electric motor. The bearings are run under load, the speed may be varied and heat can be applied. The test method is carried out under two different conditions after which the wear of the rollers and the cage is measured. Test A is conducted at ambient temperature and a "pass" rating means that the grease can be used to lubricate large bearings at normal operating temperatures and also in low vibrating applications. Test B runs at 120 °C *(250 °F)* and a "pass" rating indicates suitability for large bearings at high temperatures.

Copper corrosion

Lubricating greases should protect copper alloys used in bearings from corrosive attack while in service. To assess these properties, a copper strip is immersed in the grease sample and placed in an oven. The strip is then cleaned and the degradation is observed. The result is rated by a numerical system and a rating above 2 indicates poor protection.

Rolling bearing grease life

The R0F and R0F+ tests determine the grease life and its high temperature performance limit (HTPL). Ten deep groove ball bearings are fitted into five housings and filled with a given quantity of grease. The test is undertaken at a pre-determined speed and temperature. Axial and radial loads are applied and the bearings run to failure. The time to failure is recorded in hours and a Weibull life calculation is made to establish the grease life. This information can then be used to determine re-lubrication intervals in an application.

Extreme pressure (EP) performance

The 4-ball weld load test rig uses three steel balls held in a cup. A fourth ball is rotated against the three balls at a given speed. A starting load is applied and increased at pre-determined intervals until the rotating ball seizes and welds to the stationary balls. Values above 2 600 N are typically expected in EP grease. Under the 4-ball wear scar test, SKF applies 1 400 N (standard test uses 400 N) on the fourth ball during 1 minute. The wear on the three balls is measured and values below 2 mm are considered as appropriate values for EP greases.

Fretting corrosion

Vibrating or oscillating conditions are typical causes for fretting corrosion. Under the FAFNIR test, two thrust ball bearings are loaded and subjected to oscillation. The wear on each bearing is then measured. A wear below 7 mg indicates good fretting protection.

Thickener compatibility chart

	Lithium	Calcium	Sodium	Lithium complex	Calcium complex	Sodium complex	Barium complex	Aluminium complex	Clay (Bentonite)	Common polyurea [1]	Calcium sulphonate complex
Lithium	+	●	–	+	–	●	●	–	●	●	+
Calcium	●	+	●	+	–	●	●	–	●	●	+
Sodium	–	●	+	●	●	+	+	–	●	●	–
Lithium complex	+	+	●	+	+	●	●	+	–	–	+
Calcium complex	–	–	●	+	+	●	–	●	●	+	+
Sodium complex	●	●	+	●	●	+	+	–	–	●	●
Barium complex	●	●	+	●	–	+	+	+	●	●	●
Aluminium complex	–	–	–	+	●	–	+	+	–	●	–
Clay (Bentonite)	●	●	●	–	●	–	●	–	+	●	–
Common polyurea [1]	●	●	●	–	+	●	●	●	●	+	+
Calcium sulphonate complex	+	+	–	+	+	●	●	–	–	+	+

Base oil compatibility chart

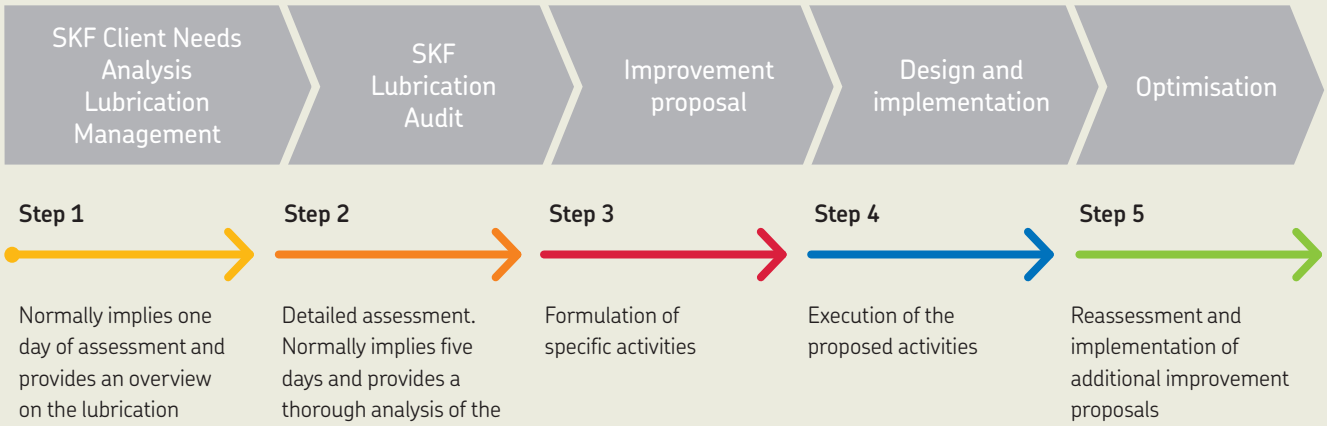
	Mineral/PAO	Ester	Polyglycol	Silicone: Methyl	Silicone: Phenyl	Polyphenylether	PFPE
Mineral/ PAO	+	+	–	–	+	●	–
Ester	+	+	+	–	+	●	–
Polyglycol	–	+	+	–	–	–	–
Silicone: Methyl	–	–	–	+	+	–	–
Silicone: Phenyl	+	+	–	+	+	+	–
Polyphenyl-ether	●	●	–	–	+	+	–
PFPE	–	–	–	–	–	–	+

+ = Compatible
● = Test required
– = Incompatible

[1] SKF high performance, high temperature bearing grease LGHP 2 is not a common polyurea type grease. It is a di-urea bearing grease, which has successfully been tested for compatibility with lithium and lithium complex thickened greases i.e. LGHP 2 is compatible with such greases.

Lubrication management

Just as asset management takes maintenance to a higher level, a lubrication management approach allows lubrication to be seen from a wider point of view. This approach helps to effectively increase machine reliability at a lower overall cost.



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PUB MP/P8 13238/2 EN · January 2018