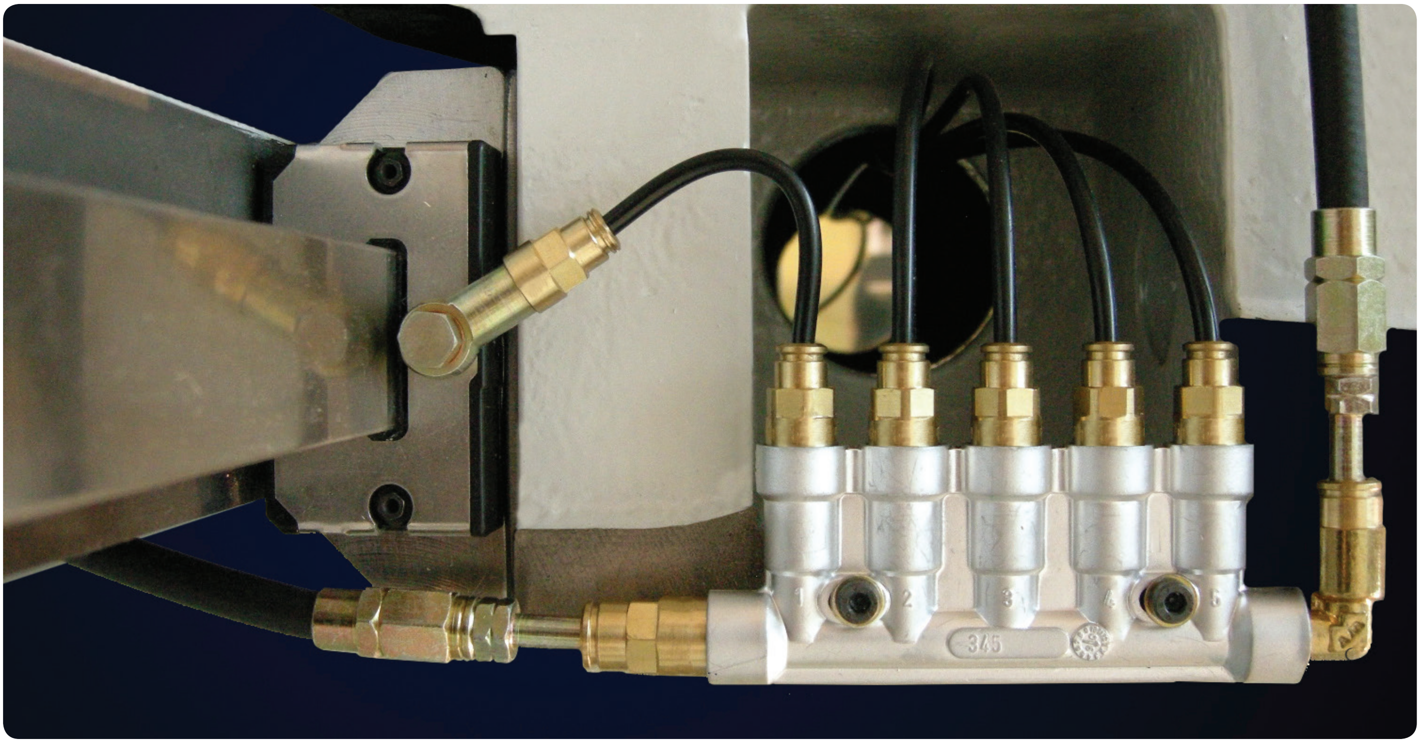
Transport of Lubricants in Centralized Lubrication Systems



The choice of a suitable lubricant for the respective application and the choice of the right lubrication system play decisive roles in the successful lubrication of bearings.

It is up to the user or manufacturer of the machine to choose the right lubricant and specify how often it is delivered and in what amounts.

This should be done with due attention being paid to the loads to be expected in operation and the resulting ambient conditions. The lubricant supplier will give the user support in the choice of a lubricant, with assistance also coming from the lubrication system's supplier in choosing an appropriate lubrication system.

The choice and specifications are also determined on the basis of financial and economic considerations.

Introduction

The lubricant, and this is often overlooked, is a design element. Only the right choice and combination of properties will provide an optimal result. While the tribological properties of lubricants may be largely known and described, the properties that impact their delivery are usually not. They are, however, elementary and must be considered not only for the choice of appropriate components for the centralized lubrication system but also for its configuration.

The wide range of demands on lubricants has led to a barely manageable number of sometimes highly specialized lubricants. Lubricants are also adapted to the special demands of a lube task by way of their structure and through the admixture of special additives – ingredients that impart certain properties and optimize functions.

Deliverability

The general opinion that the deliverability of a lubricant can only be determined on the basis of its consistency or viscosity is outdated and no longer sufficient. Information on the consistency or viscosity will only help to arrive at a preliminary decision about the choice of a possible lubrication system. The way the lubricant and lubrication system behave during delivery can only be estimated. If there is a need for a high degree of availability and precision that also takes into account the special operating conditions and system properties, it is advisable to first arrange for a special laboratory test to determine a lubricant's functionality when used together with the lubrication system.

SKF Lubrication Systems Germany AG has tested a large number of lubricants over the decades, the focus being on their deliverability in centralized lubrication systems. If it is not possible to fall back on previous test results in the event of inquiries, SKF Lubrication Systems Germany AG also offers to perform such tests as a service to its customers.

General Remarks

Basically, a distinction is made in practice between lubricating oils and lubricating greases.[1)]

Lubricating oils are classified usually on the basis of their origin, such as:

- biogenic lubricants made of vegetable oils and animal fats
- mineral oils
- synthetic oils

Lubricating greases are mostly classified in accordance with the type of thickener used, which in the case of metal-based thickeners is also referred to frequently as a soap. A few commonly used thickening agents are:

- aluminum soap, aluminum complex soap
- barium soap, barium complex soap
- calcium soap, calcium complex soap
- lithium soap, lithium complex soap
- sodium soap, sodium complex soap
- PTFE
- inorganic thickeners (Bentonite)
- polyurea
- silica

1) *Table 9 to 13 show examples of SKF greases. Information on choosing a grease can also be found on the Internet at www.skf.com, in the product catalog or at www.mapro.skf.com*

Physical Properties

Viscosity of Oils

An oil's deliverability is largely affected by its viscosity. Temperature changes occurring while a centralized lubrication system is in operation ("cold" oil at the start, "hot" oil in operation) alter the viscosity of the lubricating oil being used. The change in viscosity depends on the type of oil. It is described by way of the so-called "temperature-dependence of viscosity". As a rule, oil becomes less viscous (i.e. more runny) with rising temperatures and more viscous (i.e. less runny) with falling temperatures. A distinction is made between kinematic and dynamic viscosity. The one is converted to the other using the density of the oil and the following formula.

Kinematic viscosity =
dynamic viscosity / density

The dimension (unit) of kinematic viscosity is mm^2/s, formerly cSt (centiStoke); for the dynamic viscosity it is mPa/s, formerly cP (centiPoise). The kinematic viscosity is normally given for 40 °C. But in the case of some manufacturers, it is also possible to find values for 100 °C.

The components selected for the centralized lubrication systems have to be able to reliably deliver the lubricating oil throughout the entire expected range of viscosity. The more viscous the oil, the higher the sheer forces during delivery and the greater the load on the pump used to deliver the lubricant. The same applies to the expected pressure losses in the delivery tubing that the pump has to work against. The amount of pressure lost depends here on the tubing's geometric dimensions, mainly its internal diameter, and on the spatial extent of the lubrication system, the amount/time of delivery and the oil's viscosity at the time of delivery. It also depends directly as well on the operating temperature at which the lubrication system runs.

Consistency of Lubricating Greases

In the case of lubricating greases, one does not speak of viscosity, since greases are not classified as "Newtonian fluids". In this case, one speaks of consistency, even though the lubricating grease, in addition to the thickener and additives, also consists in large part of oil. The percentage of oil depends on the consistency grade (NLGI grade) and ranges from roughly 70 % to about 95 %. As a consequence of changes in temperature, the viscosity of the oil naturally changes as well, meaning in this case the base oil, which consequently also changes the consistency of the lubricating greases. The greatest change in consistency, however, is caused by the thickening agent, which grows firmer with falling temperature. The consistency shows the degree of rigidity of the lubricating grease.

In accordance with the classification developed by the U.S. National Lubricating Grease Institute (NLGI) drop "of the USA", lubricating greases are divided up into consistency grades in keeping with their penetration[1)]. When the temperature drops, the lubricant gets "harder", the fluidity worsens as a result and the power needed for its delivery rises accordingly. For the operation of a centralized lubrication system, one therefore has to expect higher hydraulic pressures during delivery and after the system's pressure is relieved (residual pressure = system pressure between two lube routines).

A change in consistency also occurs when oil separates from the thickener. That happens increasingly in the case of lubricants with an elevated tendency to separate. The separation of oil and thickener consequently results in hardened lubricant that leads to poorer flow properties, up to and including failure of the lubrication system.

Also, see the section covering the separation of oil on page 5.

Relaxation characteristics

Another important property affecting the use of a lubricant is its so-called relaxation characteristic. This is a value that is determined in the laboratory and permits conclusions about the lubricant's flow, with a special focus on the residual pressure and pressure relief response.

1) See Table 5

Chemical Properties

Materials

The components used in equipment and systems that come into contact with a lubricant can interact chemically with the lubricant. Primary attention is given in this respect to the design elements that serve as seals, e.g. O-rings, collars and rotary shaft seals. But the properties of plastics used in bodies, reservoirs and coats of paint can also be changed by the lubricant. So the fluids to be delivered have to be compatible with the materials used in the centralized lubrication systems. In case of doubt, information on the materials' resistance to the lubricant will have to be obtained from the lubricant's manufacturer since, as a rule, only the manufacturer knows confidental the chemical composition of the lubricants.

The materials used in the centralized lubrication systems made by SKF Lubrication Systems Germany AG are largely compatible to commonly used lubricants based on mineral oils. Suitable solutions are available on request for special lubricant bases like, for instance, synthetic and native esters as well as PAO, etc.

Ecology

Lubricants that get into the environment are harmful to flora and fauna, and they disturb and endanger the ecological balance. That is why rapidly biodegradable lubricants should be used in especially sensitive areas.

The centralized lubrication system's user is responsible not only for responsible handling of the lubricant but also for its purchase, storage, use and disposal.

Miscibility

It is especially necessary to pay attention to the miscibility of lubricating greases when switching to another type of grease. If incompatible greases are mixed with each other, it is possible for bearings to be damaged because, for instance, the consistency undergoes a great change and the grease escapes from the bearing assembly.

Lubricating greases with the same thickener and similar base oils can usually be mixed without any deleterious consequences, an example being lithium soap greases with a mineral base oil. But also greases with other thickeners like, for instance, calcium-complex and lithium-complex soap greases can in some cases be mixed with each other. Table 8 in the Appendix provides an overview of miscibility.

Surroundings

Lubricants are subject to a natural aging process whose speed and form is catalytically influenced by many environmental factors. Oxidation and temperature are the main factors accelerating the aging process. The influence of heat and the addition of oxygen, e.g. when the lubricant is sprayed with air or stirred, promote oxidation and thus the aging process. In addition, this process is accelerated by the presence of acidic reaction products, e.g. residue from combustion processes and/or traces of metal abrasion.
They also act catalytically and have an abrasive effect or lead to corrosive wear. When oil ages, acids are formed as well as deposits containing paint, resin and sludge that are mostly insoluble in oil, e.g. oil carbon. These residues can be deposited in the oil reservoirs and thus make the lubrication system or even the system to be lubricated malfunction. This is why reservoirs and system parts should be inspected on a regular basis.

Toxicology

Lubricants contain chemical elements and compounds that can be harmful to people and the environment. Harm can occur in many ways if lubricants are handled improperly. Examples are contact with the skin and inhalation of oil mist and aerosols (pay attention to MAC values!).

Always pay attention to the information in the lubricant manufacturer's safety data sheets and the operating instructions for the centralized lubrication system when handling, using and disposing of lubricants. Unpleasant odors can cause nausea wich may require medical attention.

Lubricant Requirements to Enhance Deliverability

Cleanliness

The lubricant has to be largely free of contaminants. In the case of oil, we recommend the use of filters with a fineness of 10 µm.

In the case of lubricating greases, filtration is problematic but not unusual. Pay attention to the information in DIN ISO 51825 as regards particle sizes and cleanliness.

No Entrapped Air

Air in the form of bubbles (i.e. undissolved gases) leads unavoidably to uncontrollable behavior and function slowdowns, up to and including malfunctions of the centralized lubrication system. Pressure build-up and relief times are lengthened, the response of control equipment is delayed.

Homogeneity

The lubricant must have an even consistency and must not split up into semifluid and solid phases.

Temperature Stability

The lubricant used must be deliverable and remain homogenous at all anticipaced operating temperatures in the centralized lubrication system.

Lubricant Additives

Solid additives, like graphite or molybdenum disulfide (MOS2), can lead to deposits in the lubricant reservoir, pump, valves and distributors. Greater wear, up to and including malfunctioning components, cannot be ruled out. It is necessary to make sure that there are only a certain number of additives in the lubricant and that these additives are so fine that they remain in suspension in the lubricant. Filters must not separate such additives. The following limits provide some guidelines:

particle size <= 3 µm, percentage <= 4 %

Other values can apply, depending on the components. In case of doubt, it will first be necessary to conduct laboratory tests.

Flow Pressure

The lubricant's flow pressure within the centralized lubrication system's expected operating temperature range has to amount to less than 700 mbars.

Viscosity

The oil viscosity within the centralized lubrication system's expected operating temperature range has to lie within the viscosity range approved for the selected unit. Normally, oils can be delivered within a viscosity range of 20 mm^2/s to 800 mm^2/s. Viscosities that deviate from this range are possible, depending on the unit.

Oil Separation ("Bleeding")

The lubricating grease should not exceed the separation limits defined by SKF. The FTG2 test procedure, developed and offered by SKF and described below, provides conclusive results on these limits.

Testing of Lubricants

As already mentioned, lubricant tests are offered and performed by SKF Lubrication Systems Germany AG, as a service. The tests are related exclusively to the deliverability of the lubricant in SKF centralized lubrication systems. The extent and type of tests depend, to begin with, on the consistency of the lubricant to be tested and on the lubrication system selected to deliver the lubricant.

A distinction is additionally made on the basis of the application, the properties of the selected components and the type of centralized lubrication system. The applications are roughly broken down according to industries, such as wind energy, railways (standard-gauge railways or trams), motor vehicles (commercial or off-road vehicles), and such which require minimal quantity lubrication.

Tables in the Appendix provide an overview of the sometimes special tests that are developed and performed by SKF Lubrication Systems Germany AG. They can be ordered by the customer. Corresponding order numbers can likewise be found in the tables.

It should also be mentioned that the tests listed there are only tests relating to the deliverability of the lubricants and that a large number of additional tests for analyses of lubricants and their usability can be performed in other SKF material laboratories. But that will not be discussed in this document.

Assistant in the Selection of an Appropriate Lubrication System

SKF centralized lubrication systems can deliver lubricants with the following consistencies, depending on the choice of components:

- oils with a service viscosity range from 2 mm²/s to 30,000 mm²/s
- lubricating greases with a consistency ranging from NLGI grade 000 to NLGI grade 5, depending on the effective flow pressure, i.e. the flow pressure prevailing during delivery.

That means appropriate lubrication systems are available for a wide range of applications. Selecting a suitable systems and components is assisted by giving due consideration to the respectively expected operating conditions, special lubricant properties and stability of the selected materials in contact with the lubricants' ingredients. Fundamental help with the choice of these components can be found in the product data sheets, catalogs and technical documents. In addition, the technical field service and office staff of SKF Lubrication Systems Germany AG are available to the customer for consultation and configuration of the installation.

Centralized Lubrication Systems for Oil

Deliverable
- mineral oil, oil based on synthetic ester or native ester [1)]

Types of centralized lubrication systems
- single-line systems with piston distributors
- circulating lubrication systems with progressive feeders
- circulating lubrication systems with metering valve distributors
- oil-air lubrication systems with mixing valves
- minimal quantity lubrication systems

Feed pumps / units
- gear pumps
- gerotor pumps
- piston pumps
- aerosol generators
- srew pumps

Lubricant distribution
- piston distributors
- progressive feeders
- metering valve distributors
- mixing valves

General limits on use in operation
- service viscosity ranging effectively from 20 mm²/s to 1000 mm²s [2)]
- individual types of units can deviate as described in the aquipment's technical data[3)]
- operating temperature range (standard) 5 °C to 40 °C [4)]
- operating temperature range (extended) -25 °C to 100 °C [5)]

Centralized Lubrication Systems Lubricating Grease

Deliverable
- Fluid greases conforming to NLGI Gr. 00 / 000

Type of systems
- single-line systems for fluid greases conforming to NLGI Gr. 00 / 000 with piston distributors
- lubrication systems with progressive feeders

Deliverable
- lubricating greases conforming to NLGI Gr. 0 / 1 / 2 / 3

Types of centralized lubrication systems
- single-line systems
- progressive systems
- dual-line systems

Feed pumps / units
- gear pump units
- piston pump units driven by pneumatic, hydraulic or electric power

Lubricant distribution
- progressive feeders
- dual-line distributors
- piston distributors

Limits on use in operation
- operating temperature range (standard) 5 °C to 40 °C [4)]
- operating temperature range (extended) -25 °C to 70 °C [5)]

1) The oil has to be compatible with the materials used in the centralized lubrication system. That applies especially to plastics (PA, PE, FKM) and sealing materials (NBR, FKM) that come into contact with the lubricant. In case of doubt, the lubricant manufacturer is the authority on the materials' to ask for information on the materials' stability.

2) The viscosity of oil changes in operation. It basically depends on the oil temperature (temperature-dependence of viscosity). Decisive for the use of oil in a centralized lubrication system is the viscosity range effectively arrived at during the lower and upper operating temperatures of the centralized lubrication system.

3) You can find information on the permissible equipment-related service viscosity ranges in the technical data of the respective types of equipment.

4) Deviating from this equipment operating temperature range is only permissible if approved by the equipment manufacturer.

5) The lubrication system's components for the "extended" operating temperature range always have to be chosen in cooperation with the lubrication system's manufacturer and the lubricant's manufacturer.

Table 1

Lubricants for delivery in centralized lubrication systems for commercial vehicles (ON/OFF-Road)

Lubricant	Lubricating greases NLGI Gr. 1 to 4	Lubricating greases NLGI Gr. 000 to 00
Feeders / distributors	Progressive / piston	Piston
Feed pumps	KFG / KFA	KFU / KFB
Order No.	**999-999-952**	**999-999-954**
Visual evaluation		
Entrapped air	*	●
Oil separation	*	●
Contamination	*	●
Plastic resistance		
Discoloring	*	●
Brittleness	*	●
Consistency		
Penetration (temperature range)	●	●
Tendency to separate		
Hardening / FTG2	●	❍
Flow pressure		
Pressure (temperature range)	●	❍
Sheer test		
Consistency stability	*	●
Pressure build-up		
Pressure/time response (temperat. range)	*	●
System test		
As specified (temperature range)	*	●
Function test		
As specified (temperature range)	*	●
Spray patterns		
Spray cone / quantity (temperat. range)	❍	❍
Delivery test		
Volume / time (temperature range)	●	●
Particle measurement		
Number / size	❍	❍
Result analysis		
Test Report	●	●

Test:

standard = ●
on request = *
not applicable = ❍

Table 2

Lubricants for Delivery in Centralized Lubrication Systems for Industrial Installations

Lubricant	Lubricating greases NLGI Gr. 1 to 4	Lubricating greases NLGI Gr. 000 to 00	Oils
Feeders / distributors	Progressive / piston	Piston	Piston
Feed pumps	KFG / KFA	KFU / KFB	MKU
Order No.	**999-999-953**	**999-999-955**	**999-999-95x**
Visual evaluation			
Entrapped air	*	●	❍
Oil separation	*	●	❍
Contamination	*	●	●
Plastic resistance			
Discoloring	*	●	*
Brittleness	*	●	*
Consistency			
Penetration (temperature range)	●	●	❍
Tendency to separate			
Hardening / FTG2	●	❍	❍
Flow pressure			
Pressure (temperature range)	●	❍	❍
Sheer test			
Consistency stability	*	●	❍
Pressure build-up			
Pressure/time response (temperat. range)	*	●	●
System test			
As specified (temperature range)	*	●	●
Function test			
As specified (temperature range)	*	●	●
Spray patterns			
Spray cone / quantity (temperat. range)	❍	❍	❍
Delivery test			
Volume / time (temperature range)	●	●	●
Particle measurement			
Number / size	❍	❍	❍
Result analysis			
Test Report	●	●	●

Test:

standard = ●
on request = *
not applicable = ❍

Table 3

Lubricants for Delivery in Centralized Lubrication Systems for Railways and Trams

Lubricant	Lubricating greases NLGI Gr. 000 to 00	
Feeders / distributors	Spray nozzles	
Feed pumps	PF100... / SP8	BF4.5 / SP9
Order No.	**999-999-956**	**999-999-957**
Visual evaluation		
Entrapped air	*	*
Oil separation	●	●
Contamination	●	●
Plastic resistance		
Discoloring	❍	❍
Brittleness	❍	❍
Consistency		
Penetration (temperature range)	●	●
Tendency to separate		
Hardening / FTG2	❍	❍
Flow pressure		
Pressure (temperature range)	●	●
Sheer test		
Consistency stability	❍	❍
Pressure build-up		
Pressure/time response (temperat. range)	●	●
System test		
As specified (temperature range)	●	●
Function test		
As specified (temperature range)	●	●
Spray patterns		
Spray cone / quantity (temperat. range)	●	●
Delivery test		
Volume / time (temperature range)	●	●
Particle measurement		
Number / size	●	❍
Result analysis		
Test Report	●	●

Test:

standard = ●
on request = *
not applicable = ❍

Table 4

Lubricants for Delivery in Minimal Quantity Lubrication Systems
for Industrial Applications

Lubricant	**Oils**
MQL unit	Vario
Order No.	**999-999-5xx**
Visual evaluation	
Entrapped air	❍
Oil separation	❍
Contamination	●
Plastic resistance	
Discoloring	❍
Brittleness	❍
Consistency	
Penetration (temperature range)	❍
Tendency to separate	
Hardening / FTG2	❍
Flow pressure	
Pressure (temperature range)	❍
Sheer test	
Consistency stability	❍
Pressure build-up	
Pressure/time response (temperat. range)	❍
System test	
As specified (temperature range)	●
Function test	
As specified (temperature range)	●
Spray patterns	
Spray cone / quantity (temperat. range)	●
Delivery test	
Volume / time (temperature range)	●
Particle measurement	
Number / size	●
Result analysis	
Test Report	●

Test:

standard = ●
not applicable = ❍

Table 5

NLGI classification of lubricating greases

NLGI Grade	Worked Penetration (10^{-1} mm)	Consistency at Room Temperature
000	445 - 475	Very fluid
00	400 - 430	Fluid
0	355 - 385	Semifluid
1	310 - 340	Very soft
2	265 - 295	Soft
3	220 - 250	Relatively stiff
4	175 - 205	Stiff
5	130 - 160	Very stiff
6	85 - 115	Block grease

Table 6

Example designation of a lubricating grease to DIN 51825

Example	KP[1]	2	G	–20

KP = Lubricating greases with mineral oil and EP ingredients

2 = NLGI Grades

G = Letter upper service temperature, reaction to water

–20 = Lower service temperature

[1] alternatives:
- *K = Lubricating greases for the lubrication of rolling and plain bearings with mineral oil as the base oil and thickener*
- *KF = Lubricating greases with mineral oil and solid lubricant additives*
- *KPF= Lubricating greases with mineral oil, EP ingredients and solid lubricant additives*
- *KE = Lubricating greases with ester oil as the base oil*

Table 7

Additional classification letters for lubricating greases

Letter	Upper Service Temperature (°C)	Reaction to Water to DIN 51807
C	+60	0 - 40 bis 1 - 40
D	+60	2 - 40 bis 3 - 40
E	+80	0 - 40 bis 1 - 40
F	+80	2 - 40 bis 3 - 40
G	+100	0 - 90 bis 1 - 90
H	+100	2 - 90 bis 3 - 90
K	+120	0 - 90 bis 1 - 90
M	+120	2 - 90 bis 3 - 90
N	+140	on appointment with the customer and SKF
P	+160	on appointment with the customer and SKF
R	+180	on appointment with the customer and SKF
S	+200	on appointment with the customer and SKF
T	+220	on appointment with the customer and SKF
U	>+220	on appointment with the customer and SKF

Table 8

Miscibility of thickeners

	Lithium	Calcium	Sodium	Lithium complex	Calcium complex	Sodium complex	Barium complex	Aluminum complex	Bentonite	Polyurea	Calcium sulfonate complex
Lithium	●	❍	–	●	–	❍	❍	–	❍	❍	●
Calcium	❍	●	❍	●	–	❍	❍	–	❍	❍	●
Sodium	–	❍	●	❍	❍	●	●	–	❍	❍	–
Lithium complex	●	●	❍	●	●	❍	❍	●	–	–	●
Calcium complex	–	–	❍	●	●	❍	–	❍	❍	●	●
Sodium complex	❍	❍	●	❍	❍	●	●	–	–	❍	❍
Barium complex	❍	❍	●	❍	–	●	●	●	❍	❍	❍
Aluminum complex	–	–	–	●	❍	–	●	●	–	❍	–
Bentonite	❍	❍	❍	–	❍	–	❍	–	●	❍	–
Polyurea	❍	❍	❍	–	●	❍	❍	❍	❍	●	●
Calcium sulfonate complex	●	●	–	●	●	❍	❍	–	–	●	●

Mixture permissible = ●   Mixture not permissible = –   Test required = ❍

Table 9

Basic choice of grease (lubricating greases available from SKF)

For standard applications	**LGMT 2**	**Multipurpose grease**
Exceptions:		
Operating temperatures in continuous operation above 100 °C	LGHP 2	High-temperature grease
Operating temperatures in continuous operation above 150 °C	LGET 2	High-temperature grease
Low ambient temperature, down to -50 °C, expected operating temperature below 50 °C	LGLT 2	Low-temperature grease
Shock loads, high loads, frequent starting and braking	LGEP 2	High pressure grease
For applications in the foodstuffs industry	LGFP 2	Grease compatible with foodstuffs
When high demands are made on environmental compatibility	LGGB 2	Biodegradable grease

Please note:
– At relatively high ambient temperatures, it is advisable to use LGMT 3 instead of LGMT 2.
– For special operating conditions, see the SKF lubricating grease selection table 13.

Table 10

Bearing Operating Data

Operating temperature			
L	= low	<50 °C	
M	= medium	50 bis 100 °C	
H	= high	> 100 °C	
EH	= extremely high	> 150 °C	
Speed coefficient for ball bearings		**($n \times d_m$) [min^{-1}]**	
EH	= extremely high	over 700 000	
VH	= very high	up to 700 000	
H	= high	up to 500 000	
M	= medium	up to 300 000	
L	= low	below 100.000	
Speed coefficient for		**cylindrical roller bearings ($n \times d_m$) [min^{-1}]**	**Remaining roller bearings ($n \times d_m$) [min^{-1}]**
H	= high	over 210 000	over 270 000
M	= medium	up to 210 000	up to 270 000
L	= low	up to 75 000	up to 75 000
VL	= very low	below 30 000	below 30 000
Load			
VH	= very high	P > 0,15 C	
H	= high	0,1 C <P <= 0,15 C	
M	= normal	0,05 C < P <= 0,1 C	
L	= light	P <= 0.05 C	

Table 11

SKF Lubricating Grease Selection Table

SKF lub. grease	Description	Operating temperature	Speed	Load
LGMT 2	Multipurpose grease for industry and automotive engineering	M	M	L to M
LGMT 3	Multipurpose grease for industry and automotive engineering	M	M	L to M
LGEP 2	High-pressure grease	M	L to M	M
LGFP 2	Lubricating grease compatible with food	M	M	L to M
LGEM 2	High-viscosity grease with solid lubricant additives	M	VL	H toVH
LGEV 2	Extremely high viscosity, solid lubricant additives	M	VL	H to VH
LGLT 2	Low-temperature grease, high-speed grease	L to M	M to EH	L
LGGB 2	Biodegradable, low toxicity	L to M	L to M	M to H
LGWM 1	High-pressure grease, low-temperature grease	L to M	L to M	H
LGWA 2	Lubricating grease for a broad temperature range, high-pressure grease	M to M	L to M	H
LGHB 2	High-viscosity grease, high-pressure grease, high-temperature grease	M to H	VL to M	H to VH
LGHP 2	Heavy-duty grease	M to H	M to H	L to M
LGET 2	Rolling bearing grease for extreme temperatures	VH	L to M	H to VH

Table 12

SKF Lubricating Grease Selection Table (recommended = ● suitable = ❍ not suitable = –)

SKF lubri-cating grease	Vertical shaft	High-speed outer ring	Slewing motions	Strong vibrations	Shock loads or frequent starting procedures	Quiet run	Low friction	Corrosion protection
LGMT 2	❍	–	–	●	–	–	❍	●
LGMT 3	●	❍	–	●	–	–	❍	❍
LGEP 2	❍	–	❍	●	●	–	–	●
LGFP 2	❍	–	–	–	–	–	❍	●
LGEM 2	❍	–	●	●	●	–	–	●
LGEV 2	❍	–	●	●	●	–	–	●
LGLT 2	❍	–	–	–	❍	●	●	❍
LGGB 2	❍	–	●	●	●	–	❍	❍
LGWM 1	–	–	●	–	●	–	–	●
LGWA 2	❍	❍	❍	❍	●	–	❍	●
LGHB 2	❍	●	●	●	●	–	–	●
LGHP 2	●	–	–	●	❍	●	❍	●
LGET 2	❍	●	●	❍	❍	–	–	❍

Table 13

SKF Lubricating Grease Selection Table

SKF grease	Temperature range [1] LTL [°C]	HTPL [°C]	Thickener / base oil	Kinematic viscosity of base oil [mm²/s] bei 40 °C
LGMT 2	-30 (-22 °F)	120 (250 °F)	Lithium soap / Mineral oil	110
LGMT 3	-30 (-22 °F)	120 (250 °F)	Lithium soap / Mineral oil	120
LGEP 2	-20 (-4 °F)	110 (230 °F)	Lithium soap / Mineral oil	200
LGFP 2	-20 (-4 °F)	110 (230 °F)	Aluminum complex soap / Medical white oil	130
LGEM 2	–20 (–4 °F)	120 (250 °F)	Lithium soap / Mineral oil	500
LGEV 2	–10 (–14 °F)	120 (250 °F)	Lithium-calcium soap / Mineral oil	1 020
LGLT 2	–50 (–58 °F)	110 (230 °F)	Lithium soap / Mineral oil	18
LGGB 2	–40 (–40 °F)	90 [2] (194 °F)	Lithium-calcium soap / Mineral oil	110
LGWM 1	–30 (–22 °F)	110 (230 °F)	Lithium soap / Mineral oil	200
LGWA 2	–30 (–22 °F)	140 [3] (284 °F)	Lithium complex soap / Mineral oil	185
LGHB 2	–20 (–4 °F)	150 [4] (302 °F)	Calcium–sulfonate complex soap / Mineral oil	400
LGHP 2	–40 (–40 °F)	150 (302 °F)	Polyurea / Mineral oil	96
LGET 2	–40 (–40 °F)	260 (500 °F)	PTFE Synthetic oil (fluorinated polyether)	400

1) More information on appropriate temperature ranges on request
2) LGGB 2 is briefly usable up to 120 °C
3) LGWA 2 is briefly usable up to 220 °C
4) LGHB 2 is briefly usable up to 200 °C

Table 14

Recommended operating temperature for SKF centralized lubrication systems

SKF grease	Operating temperature [°C]
LEPP 2	> –15
LGEM 2	< 40, > –15
LGEV 2	< 40, > –15
LGFB 2	> 0
LGFL 1	< 40, > –25
LGFP 2	> –15
LGGB 2	> –25
LGHB 2	> –15
LGHP 2	> –15
LGMT 2	< 40, > –25
LGMT 3	< 40, > –15
LGWA 2	< 40, > –25
LGWM 1	< 40, > –25

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Important product usage information
All products from SKF may be used only for their intended purpose as described in this brochure and in any instructions. If operating instructions are supplied with the products, they must be read and followed.
Not all lubricants are suitable for use in centralized lubrication systems. SKF does offer an inspection service to test customer supplied lubricant to determine if it can be used in a centralized system. SKF lubrication systems or their components are not approved for use with gases, liquefied gases, pressurized gases in solution and fluids with a vapor pressure exceeding normal atmospheric pressure (1013 mbars) by more than 0.5 bar at their maximum permissible temperature.
Hazardous materials of any kind, especially the materials classified as hazardous by European Community Directive EC 67/548/EEC, Article 2, Par. 2, may only be used to fill SKF centralized lubrication systems and components and delivered and/or distributed with the same after consulting with and receiving written approval from SKF.

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