Accessories for Lubrication

THK General Catalog

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* Please see the separate "B Product Specifications".

When using an LM system, it is necessary to provide effective lubrication. Without lubrication, the rolling elements or the raceway may be worn faster and the service life may be shortened.
A lubricant has effects such as the following.
(1) Minimizes friction in moving elements to prevent seizure and reduce wear.
(2) Forms an oil film on the raceway to decrease stress acting on the surface and extend rolling fatigue life.
(3) Covers the metal surface to prevent rust formation.
To fully bring out an LM system's functions, it is necessary to provide lubrication according to the conditions.
Even with an LM system with seals, the internal lubricant gradually seeps out during operation. Therefore, the system needs to be lubricated at an appropriate interval according to the conditions.

Types of Lubricants

LM systems mainly use grease or sliding surface oil for their lubricants.
The requirements that lubricants need to satisfy generally consist of the following.
(1) High oil film strength
(2) Low friction
(3) High wear resistance
(4) High thermal stability
(5) Non-corrosive
(6) Highly anti-corrosive
(7) Minimal dust/water content
(8) Consistency of grease must not be altered to a significant extent even after it is repeatedly stirred.

For lubricants that meet these requirements, see A-955.

Grease Lubrication

Greasing intervals vary depending on the conditions and environments. For normal use, we recommend greasing the system approximately every 100 km of travel distance.
Normally, replenish grease of the same group from the grease nipple or greasing hole provided on the LM system. Mixing different types of grease may deteriorate the system's performance, such as increased consistency.

Lubricant	Type	Brand name
Grease	Lithium-based grease (JIS No. 2) Urea-based grease (JIS No. 2)	AFA Grease (THK) see A-959 AFB-LF Grease (THK) see A-960 AFC Grease (THK) see A-961 AFE-CA Grease (THK) see A-963 AFF Grease (THK) see A-965 AFG Grease (THK) see A-968 Albania Grease No.2 (Showa Shell Sekiyu) Daphne Exponex Grease No.2 (Idemitsu) or equivalent

* Recommended greases vary according to the conditions and environment. See A-958 to A-969 for details.

Oil Lubrication

LM systems that require oil lubrication are shipped with only anti-rust oil applied. When placing an order, specify the required lubricant oil. If the LM system is to be mounted other than in horizontal orientation, part of the raceway may be poorly lubricated. Therefore, be sure to inform us of the mounting orientation of the LM system. (For details on mounting orientations, see A-58.)

- The amount of oil to be supplied varies with stroke length. For a long stroke, increase the lubrication frequency or the amount of oil so that an oil film reaches the stroke end of the raceway.
- In environments where a liquid coolant is spattered, the lubricant will be mixed with the coolant, and this can result in the lubricant being emulsified or washed away, causing significantly degraded lubrication performance. In such settings, apply a lubricant with high viscosity (kinematic viscosity: approx. 68 cst) and high emulsification-resistant, and adjust the lubrication frequency or the amount of the feed lubricant.
  For machine tools and similar devices that are subject to heavy loads and require high rigidity and operate at high speed, it is advisable to apply oil lubrication.
- Make sure that lubrication oil normally discharges from the ends of your lubrication piping, i.e., the oiling ports that connect to your LM system.

Lubricant	Type	Brand name
Oil	Sliding surface oil or turbine oil ISOVG32 to 68	Super Multi 32 to 68 (Idemitsu) Vactra No.2S (ExxonMobile) DT Oil (ExxonMobile) Tonner Oil (Showa Shell Sekiyu) or equivalent

Lubrication under Special Environments

For use under special conditions, such as continual vibrations, clean room, vacuum, low temperature and high temperature, normal grease may not be used in some cases. For lubricants that meet such conditions, contact THK.

Table1 Lubricants Used under Special Environments

Service environment	Lubricant characteristics	Brand name
High-speed moving parts	Grease with low torque and low heat generation	AFG Grease(THK) see A-968 AFA Grease(THK) see A-959 NBU15(NOK Kluba) Multemp (Kyodo Yushi) or equivalent
Vacuum	Fluorine based vacuum grease or oil (vapor pressure varies by brand) Note 1	Fomblin Grease (Solvay Solexis) Fomblin Oil (Solvay Solexis) Barrierta IEL/V (NOK Kluba) Isoflex(NOK Kluba) Krytox (Dupont)
Clean room	Grease with very low dust generation	AFE-CA Grease(THK) see A-963 (The above vacuum grease products also applicable) AFF Grease(THK) see A-965
Environments subject to microvibrations or microstrokes, which may cause fretting corrosion	Grease that easily forms an oil film and has high fretting resistance	AFC Grease(THK) see A-961
Environments subject to a spattering coolant such as machine tools	Highly anti-corrosive, refined mineral oil or synthetic oil that forms a strong oil film and is not easily emulsified or washed away by coolant Water-resistant grease Note 2	Super Multi 68 (Idemitsu) Vactra No.2S (ExxonMobile) or equivalent

Note1) When using a vacuum grease, be sure that some brands have starting resistances several times greater than ordinary lithium-based greases.
Note2) In an environment subject to a spattering water-soluble coolant, some brands of intermediate viscosity significantly decrease their lubricity or do not properly form an oil film. Check the compatibility between the lubricant and the coolant.
Note3) Do not mix greases with different physical properties.

Lubrication Methods

There are roughly three methods of lubricating LM systems: manual lubrication using a grease gun or manual pump; forced oiling with the aid of an automatic pump; and oil-bath lubrication.

Manual Lubrication

Generally, grease is replenished periodically, fed through a grease nipple provided on the LM system, using a grease gun. (Fig.1)
For systems that have many locations to be lubricated, establish a centralized piping system and periodically provide grease from a single point using a manual pump. (Fig.2)

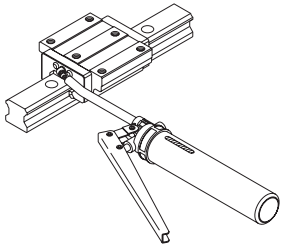


Fig.1 Lubrication Using a Grease Gun

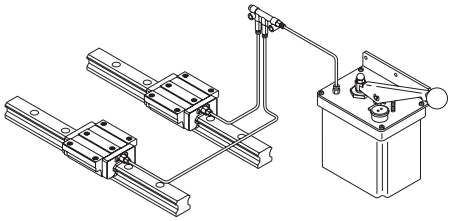


Fig.2 Lubrication through a Centralized Piping System

Note) When a centralized piping system is used, lubricant may not reach the pipe end due to the viscous resistance inside the pipe. Select the right type of grease while taking into account the consistency of the grease and the pipe diameter.

Forced Lubrication Method

In this method, a given amount of lubricant is forcibly fed at a given interval. Normally, the lubricant is not collected after use. (Fig.3)
Although a special lubrication system using a piping or the like needs to be designed, this method reduces the likelihood of forgetting to replenish lubricant.
This method is used mainly for oil lubrication. If using grease, it is necessary to examine the appropriate piping diameter and the required grease consistency.

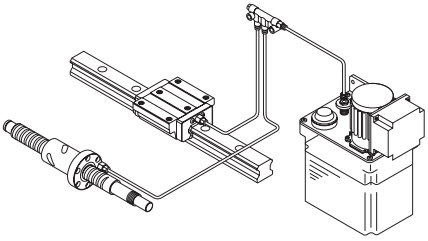


Fig.3 Forced Lubrication Method

Lubrication Accessory Series for LM Systems

THK provides a wide array of lubrication accessories such as grease, grease guns, grease nipples and plumbing fixtures available for various applications. (A-959 to A-970)

THK Original Grease

THK provides various types of THK original greaseneeded for the lubrication of LM systems. They are available for various conditions and environments.

[Table for Grease Selection]

Refer to the table below that allows you to select a type of grease according to the application of the LM system.

Also note that the color of the decorative package varies according to the type (both 70 g and 400 g).

Name of grease		AFA Grease	AFB-LF Grease	AFC Grease	AFE-CA Grease	AFF Grease	AFG Grease
Features		Long service life	All-purpose grease	High-speed/ micro-vibration grease	Grease for clean environment	Grease for clean environment	Grease for heat of Ball Screw
Base oil		high-grade synthetic oil	refined mineral oil	high-grade synthetic oil	high-grade synthetic oil	high-grade synthetic oil	high-grade synthetic oil
Consistency enhancer		Urea-based	Lithium-based	Urea-based	Urea-based	Lithium-based	Urea-based
Service Temperature Range (℃)		−45 to 160	−15 to 100	−54 to 177	−40 to 160 (200)	−40 to 120	−45 to 160
Applications	General industrial machinery	●	●	—	—	—	—
	Machine tool	—	●	●	—	—	●
	Semiconductor manufacturing equipment	—	●	●	●	●	—
	Special environments	—	—	●	●	●	●
Capacity	70g	●	●	●	●	●	●
	400g	●	●	●	●	●	●
Color of decorative package		Green	Orange	Mazarine	Lime green	Light blue	Blue
Reference page		A-959	A-960	A-961	A-963	A-965	A-968

Model number coding

●Type of packing···bellows cartridge

AFC + 70

70: Cartridge capacity (70 g / 400 g)

AFC: Type of grease (AFA Grease, AFB-LF Grease, AFC Grease, AFE Grease, AFF Grease, AFG Grease)

THK Original Grease
AFA Grease

- Base oil: high-grade synthetic oil
- Consistency enhancer: urea-based

AFA Grease is a high-grade, long-life grease developed with a urea-based consistency enhancer using a high-grade synthetic oil as the base oil.

[Features]

(1) Long service life
Unlike ordinary soap based grease for metal lubrication, AFA Grease excels in antioxidation stability and therefore can be used for a long period of time.

(2) Wide temperature range
The lubricating performance remains high over a wide range of temperatures from -45 ℃ to +160℃.
Even at low temperatures, AFA Grease requires only a low starting torque.

(3) High water resistance
AFA Grease is less vulnerable to moisture penetration than other types of grease because of its high water resistance.

(4) High mechanical stability
AFA Grease is not easily softened and demonstrates excellent mechanical stability even when used for a long period of time.

[Representative Physical Properties]

Test item		Representative value	Test method
Worked penetration (25℃, 60W)		285	JIS K 2220 7
Dropping point: ℃		261	JIS K 2220 8
Copper plate corrosion (B method, 100℃, 24h)		Accepted	JIS K 2220 9
Evaporation amount: mass% (99℃, 22h)		0.2	JIS K 2220 10
Oil separation rate: mass% (100℃, 30h)		0.5	JIS K 2220 11
Stability of oxidation: KPa (99℃, 100h)		80	JIS K 2220 12
Mixing stability (100,000 W)		329	JIS K 2220 15
Grease removal resistance during water rinse: mass% (38℃, 1h)		0.6	JIS K 2220 16
Low temperature torque: N-m (-20℃)	Start	0.17	JIS K 2220 18
	(revolutions)	0.07	
Anticorrosive test: (52℃, 48h)		Accepted	ASTM D1743-73
Service Temperature Limit (℃)		−45 to 160	—

[Rotation Torque Testing with Ball Screw Grease]

<Test method>
Apply 1 cc of grease to the LM Guide of KR4620A+640L and 2 cc to the Ball Screw (initial lubrication only), and then measure the torque at each motor rotation speed.
In torque measurement, output values on the driver torque monitor are used.

Comparative Table of Rotation Torque of Ball Screws by Grease — Unit: N-cm

Grease	Central value of dynamic viscosity CST (mm²/S)(40℃)	Dynamic viscosity range CST (mm²/S)(40℃)	Rotational speed			
			100min⁻¹	1000min⁻¹	2000min⁻¹	4000min⁻¹
AFA Grease	25	22.5 to 27.5	11.27	11.27	12.25	14.6
Grease of manufacturer I	130	117 to 143	14.6	23.13	31.16	43.12
Grease of manufacturer K	15.3	13.8 to 16.8	12.64	12.05	13.03	14.41
Lubricant VG32	32	28.8 to 35.2	11.17	10.78	13.43	14.7

Note) The values of the competitors' greases are that of low-torque greases.

THK Original Grease

AFB-LF Grease

- Base oil: refined mineral oil
- Consistency enhancer: lithium-based

AFB-LF Grease is a general-purpose grease developed with a lithium-based consistency enhancer using refined mineral oil as the base oil. It excels in extreme pressure resistance and mechanical stability.

[Features]

(1) High extreme pressure resistance
Compared with lithium-based greases available on the market, AFB-LF Grease has higher wear resistance and outstanding resistance to extreme pressure.

(2) High mechanical stability
AFB-LF Grease is not easily softened and demonstrates excellent mechanical stability even when used for a long period of time.

(3) High water resistance
AFB-LF Grease is a highly water resistant grease that is less vulnerable to moisture penetration and little decreases resistance to extreme pressure.

[Representative Physical Properties]

Test item	Representative value	Test method
Worked penetration (25℃, 60W)	275	JIS K 2220 7
Dropping point: ℃	193	JIS K 2220 8
Copper plate corrosion (B method, 100℃, 24h)	Accepted	JIS K 2220 9
Evaporation amount: mass% (99℃, 22h)	0.36	JIS K 2220 10
Oil separation rate: mass% (100℃, 24h)	0.6	JIS K 2220 11
Stability of oxidation: KPa (99℃, 100h)	15	JIS K 2220 12
Mixing stability (100,000 W)	345	JIS K 2220 15
Timken load capacity: N	200	JIS K 2220 20
Grease removal resistance during water rinse: mass% (38℃, 1h)	1.8	JIS K 2220 16
Anticorrosive test: (52℃, 48h)	Accepted	ASTM D1743-73
Service Temperature Limit (℃)	– 15 to 100	—

THK Original Grease

AFC Grease

- Base oil: high-grade synthetic oil
- Consistency enhancer: urea-based

AFC Grease has high fretting-corrosion resistance due to a special additive and a urea-based consistency enhancer using a high-grade synthetic oil as the base oil.

[Features]

(1) High fretting-corrosion resistance
AFC Grease is designed to be highly effective in preventing fretting corrosion.

(2) Long service life
Unlike ordinary soap based grease for metal lubrication, AFC Grease excels in antioxidation stability and therefore can be used for a long period of time. As a result, maintenance work is reduced.

(3) Wide temperature range
Since a high-grade synthetic oil is used as the base oil, the lubricating performance remains high over a wide range of temperatures from -54 ℃ to +177 ℃.

[Representative Physical Properties]

Test item		Representative value	Test method
Worked penetration (25℃, 60W)		288	JIS K 2220 7
Dropping point: ℃		269	JIS K 2220 8
Copper plate corrosion (B method, 100℃, 24h)		Accepted	JIS K 2220 9
Evaporation amount: mass% (177℃, 22h)		7.9	JIS K 2220 10
Oil separation rate: mass% (177℃, 30h)		2	JIS K 2220 11
Stability of oxidation: MPa (99℃, 100h)		0.065	JIS K 2220 12
No. of contaminants: pieces/cm^3 25 to 75 μm 75μm or more		3700	JIS K 2220 13
Mixing stability (100,000 W)		341	JIS K 2220 15
Grease removal resistance during water rinse: mass% (38℃, 1h)		0.6	JIS K 2220 16
Low temperature torque: N-m (−54℃)	Start	0.63	JIS K 2220 18
	(revolutions)	0.068	
Anticorrosive test: (52℃, 48h)		Accepted	ASTM D1743-73
Vibration test (200h)		Accepted	—
Service Temperature Limit (℃)		−54 to 177	—

[Test Data on Fretting-corrosion Resistance]

● **Test Data on AFC Grease (Comparison of Raceway Conditions)**

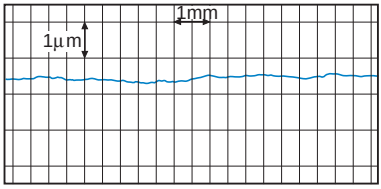
The test data in the figure shows the result of comparing AFC Grease with an ordinary bearing grease.

<Test conditions>

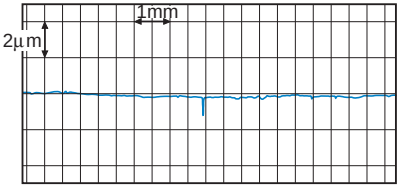
Item	Description
Stroke	3mm
Number of strokes per minute	200min^{-1}
Total number of strokes	2.88×10^5 (24 hours)
Surface pressure	1118MPa
Grease quantity	12g/1LM block (replenished every 8 hours)

AFC Grease

Before travel

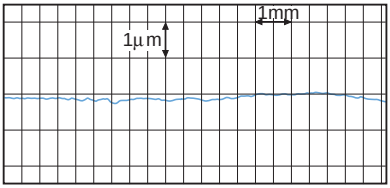


After travel (no fretting corrosion observed)

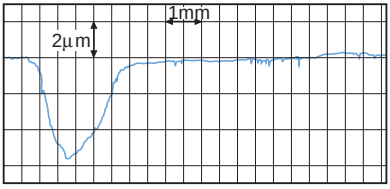


General-purpose bearing grease

Before travel

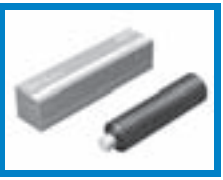


After travel (fretting corrosion observed)



THK Original Grease

AFE-CA Grease



- Base oil: high-grade synthetic oil
- Consistency enhancer: urea-based

AFE-CA Grease uses urea as a consistency enhancer and a high-grade synthetic oil as the base oil. It has low dust generative characteristics and is therefore a suitable grease for clean room environments.

[Features]

(1) Low dust generation
Compared with vacuum greases in conventional use, AFE-CA Grease generates less dust and therefore is ideal for use in clean rooms.

(2) Long service life
Unlike ordinary soap based grease for metal lubrication, AFE-CA Grease excels in antioxidation stability and therefore can be used for a long period of time. As a result, maintenance work is reduced.

(3) High chemical stability
AFE-CA Grease has high resistance to chemicals, NO_x and radiation.

[Representative Physical Properties]

Test item		Representative value	Test method
Worked penetration (25℃, 60W)		260	JIS K 2220 7
Dropping point: ℃		240<	JIS K 2220 8
Copper plate corrosion (100℃, 24h)		Accepted	JIS K 2220 9
Evaporation amount: mass% (99℃, 22h)		0.1	JIS K 2220 10
Oil separation rate: mass% (100℃, 24h)		0.8	JIS K 2220 11
Stability of oxidation: KPa (99℃, 100h)		20	JIS K 2220 12
No. of contaminants: pieces/cm^3	75μm or more	0	JIS K 2220 13
	125μm or more	0	
Mixing stability (100,000 W)		311	JIS K 2220 15
Low temperature torque: N-m (-20℃)	Start	0.130	JIS K 2220 18
	(revolutions)	0.078	
Apparent viscosity: Pa・s (-10℃, $10S^{-1}$)		230	JIS K 2220 19
Bearing rust prevention: (52℃, 48h)		#1	ASTM D1743-73
Service Temperature Limit (℃)		−40 to 180	—

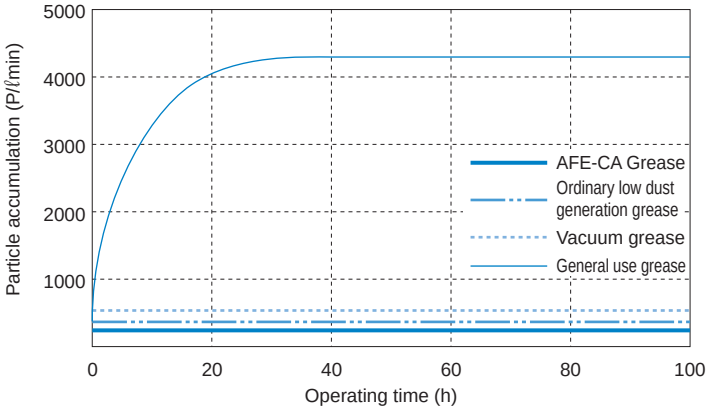
[Test Data on Low Dust Generative Characteristics]

● Test Data on AFE-CA Grease (Comparison of Particle Accumulation)

The test data in the figure shows the result of comparing particle accumulation between AFE-CA Grease with another grease.

<Test conditions>

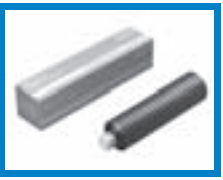
Item	Description
Sample model No.	THK KR4610
Screw Ball rotational speed	1000min^{-1}
Stroke	210mm
Grease quantity	2 cc in both the Ball Screw and the LM Guide
Flow rate during measurement	1ℓ/min
Measuring instrument	Dust counter
Particle size	0.5μm



THK Original Grease

AFF Grease

●Base oil: high-grade synthetic oil
●Consistency enhancer: lithium-based



AFF Grease uses a high-grade synthetic oil, lithium-based consistency enhancer and a special additive. It achieves stable rolling resistance, low dust generation and high fretting resistance, at a level that conventional vacuum greases or low dust generation greases have not reached.

[Features]

(1) Stable rolling resistance
Since the viscous resistance is low, the rolling resistance fluctuation is also low. Thus, superb conformity is achieved at low speed.

(2) Low dust generation
AFF Grease generates little dust, making itself an ideal grease for use in clean rooms.

(3) Fretting resistance
Since AFF Grease is highly resistant to wear from microvibrations, it allows the greasing interval to be extended.

[Representative Physical Properties]

Test item		Representative value	Test method
Worked penetration (25℃, 60W)		315	JIS K 2220 7
Dropping point: ℃		216	JIS K 2220 8
Copper plate corrosion (100℃, 24h)		Accepted	JIS K 2220 9
Evaporation amount: mass% (99℃, 22h)		0.43	JIS K 2220 10
Oil separation rate: mass% (100℃, 24h)		0.57	JIS K 2220 11
Stability of oxidation: MPa (99℃, 100h)		39	JIS K 2220 12
No. of contaminants: pieces/cm³ 25 μm or more 75μm or more 125μm or more		0 0 0	JIS K 2220 13
Mixing stability (100,000 W)		329	JIS K 2220 15
Low temperature torque: N-m (-20℃)	Start	0.22	JIS K 2220 18
	(revolutions)	0.04	
Apparent viscosity: Pa・s (-10℃, 10S⁻¹)		3400	JIS K 2220 19
Timken load capacity: N		88.2	JIS K 2220 20
4-ball testing (burn-in load): N		3089	ASTM D2596
Fretting resistance: mg		3.8	ASTM D4170 compliant
Bearing rust prevention: (52℃, 48h)		#1	ASTM D1743-73
Service Temperature Limit (℃)		−40 to 120	—

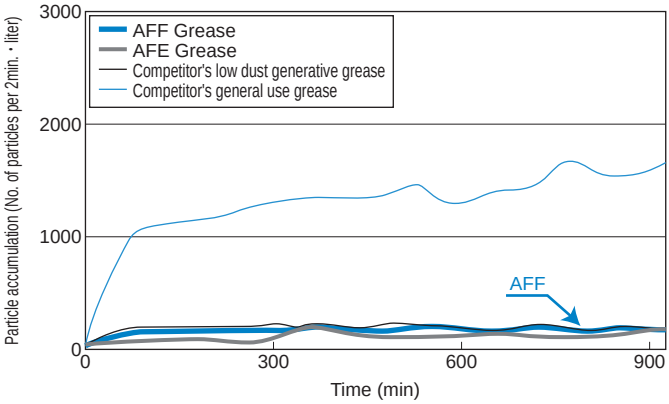
[Test Data on Low Dust Generative Characteristics]

● **Test Data on AFF Grease (Comparison of Particle Accumulation)**

The test data in the figure shows the result of comparing particle accumulation between AFF Grease with another grease.

<Test conditions>

Item	Description
Model No.	SR20W1+280LP
Grease quantity	1cm³/ LM block (initial lubrication only)
Amount of air supplied	500cm³/min
[Measurement instrument]	Particle counter
Diameter of particle measured	0.3μm or more
Feeding speed	30m/min
Stroke	200mm



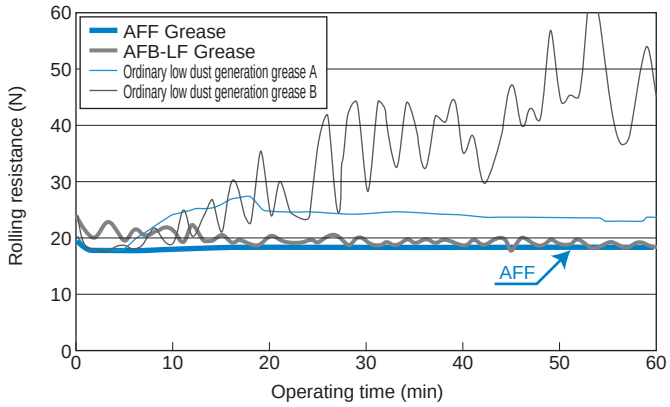
[Rolling Resistance Characteristics at Low Speed]

● Rolling Resistance at Low Speed

The data in the figure represent the test results of comparing rolling resistances at low speed between AFF Grease and other greases.

<Test conditions>

Item	Description
Model No.	HSR35RC0+440LP
Grease quantity	4cm³/ LM block (initial lubrication only)
Feeding speed	1mm/s
Stroke	3mm



THK Original Grease

AFG Grease

●Base oil: high-grade synthetic oil
●Consistency enhancer: urea-based

AFG Grease is a high-grade grease for Ball Screws that uses a high-grade synthetic oil as the base oil and a urea-based consistency enhancer. It excels in low heat generation and supports a wide temperature range from low to high temperature.

[Features]

(1) Low heat generation
Since the viscous resistance is low, the grease generates only a minimal level of heat even during high-speed operation.

(2) Low viscosity
Since the viscosity is low, a stable rotational torque is achieved.

(3) Wide temperature range
Maintains a high level of lubricity in a wide temperature range of -45℃ to +160℃.

(4) Long service life
AFG Grease is not easily softened and excels in antioxidation stability even after a long-term operation.

(5) Water resistance
AFG Grease is a highly water resistant grease that is less vulnerable to moisture penetration and little decreases resistance to extreme pressure.

[Representative Physical Properties]

Test item		Representative value	Test method
Worked penetration (25℃, 60W)		285	JIS K 2220 5.3
Dropping point: ℃		261	JIS K 2220 5.4
Copper plate corrosion (100℃, 24h)		Accepted	JIS K 2220 5.5
Evaporation amount: mass% (99℃, 22h)		0.2	JIS K 2220 5.6
Oil separation rate: mass% (100℃, 24h)		0.5	JIS K 2220 5.7
Stability of oxidation: MPa (99℃, 100h)		0.029	JIS K 2220 5.8
Mixing stability (100,000 W)		329	JIS K 2220 5.11
Grease removal resistance during water rinse: mass% (38℃, 1h)		0.6	JIS K 2220 5.12
Low temperature torque: N-m (-20℃)	Start	0.439	JIS K 2220 5.14
	(revolutions)	0.049	
Anticorrosive test: (52℃, 48h)		1,1,1	ASTM D1743
Service Temperature Range (℃)		−45 to 160	—

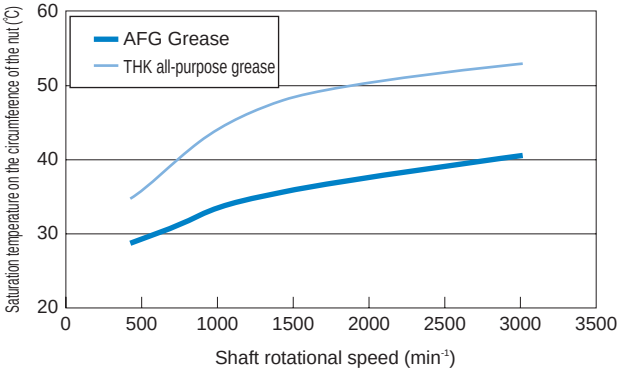
[Test Data on Low Heat Generation Characteristics]

● **Test Data on AFG Grease (Comparison of Heat Generation)**

The test data in the figure represent the results of comparing heat generation between AFG Grease and other greases.

<Test conditions>

Item	Description
Shaft diameter/lead	32/10mm
Feeding speed	67 to 500mm/s
Shaft rotation speed	400 to 3000 min^{-1}
Stroke	400mm
Grease quantity	$12cm^3$
Temperature measurement point	Nut circumference



Lubrication Equipment

Grease Gun Unit MG70

●For detailed dimensions, see B-864.

Grease Gun Unit MG70 is capable of lubricating small to large types of LM Guides by replacing dedicated nozzles (attached). For small LM Guides, MG70 is provided with dedicated attachments. The user can select from these attachments according to the model number and the installation space.
MG70 has a slit window, allowing the user to check the remaining amount of grease.
It is equipped with a bellows cartridge that can hold 70 g of grease and is replaceable without smirching your hand. It supports a wide range of grease products, including AFA Grease, AFB-LF Grease, AFC Grease and AFE-CA Grease, to meet varied conditions. This enables you to make a selection according to the area requiring grease. (See A-959 to A-969.)
Since the grease to be used is sold separately, you must purchase it separately.

Accessories for Lubrication

Special Plumbing Fixtures

●For detailed dimensions, see B-865.

For centralized greasing and oil lubrication, special plumbing fixtures are available from THK. When ordering an LM system, specify the model number, mounting orientation and piping direction. We will ship the LM system attached with the corresponding fixture.

Accessories for Lubrication

Grease Nipple

●For detailed dimensions, see B-866.

THK provides various types of grease nipples needed for the lubrication of LM systems.