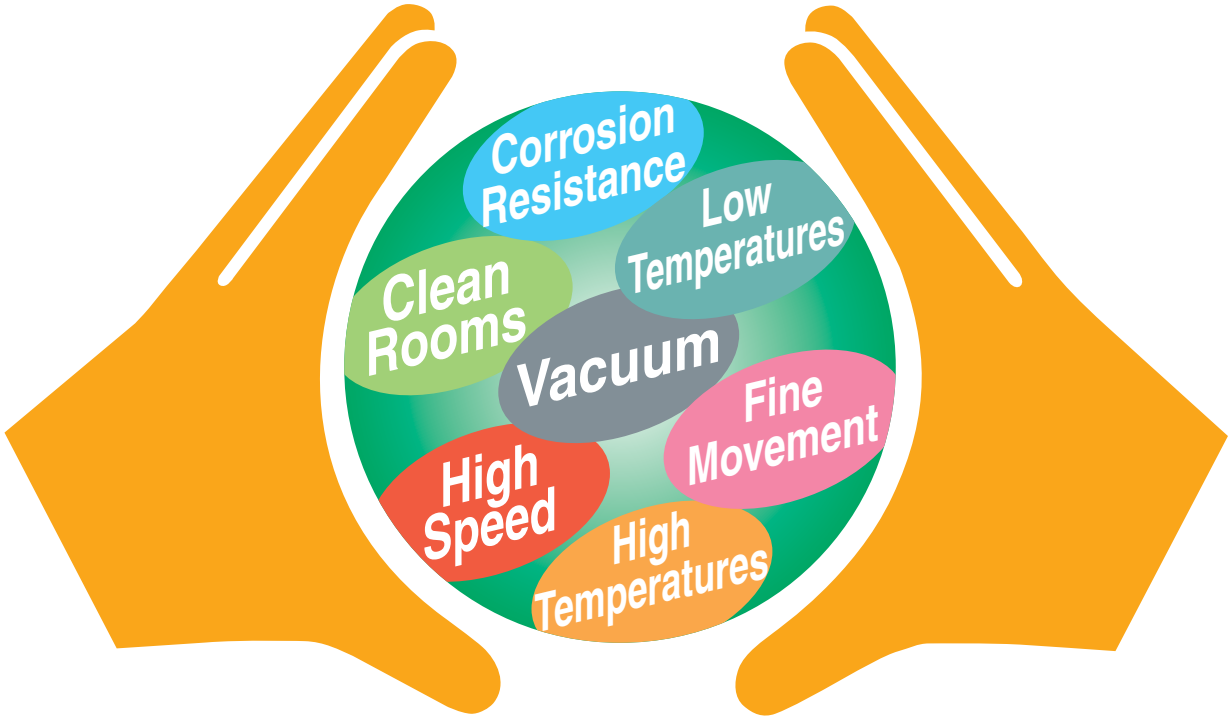
Special Environmental Specifications of THK Linear Motion Systems

The linear motion systems used in special environments such as semiconductor production systems, liquid crystal production systems, health care equipment and food processing machinery are the product of roughly 30 years of technology and a vast amount of experience.

This brochure provides an introduction to the special environmental specifications products created by taking full advantages of THK's proprietary Caged Ball Technology, materials technology, lubrication technology and surface treatment technology in order to effectively respond to the increasingly diversified needs of today.



1 Clean Rooms

In clean environments such as the environments found in clean rooms, it is necessary to reduce the generation of dust by linear motion systems as well as enhance rust preventive performance since rust preventive films cannot be used. In addition, depending on the degree of cleanliness of the clean room, it is also necessary to use a dust collector.

Generation of Dust from Linear Motion Systems

Measures against dust generation caused by splattering of grease:

THK AFE Grease and AFF Grease

Grease resulting in low generation of dust is used and is suitable for clean environments.

Measures against dust generation caused by production of metal wear fragments:

LM Guide with Ball Cage

The use of the LM Guide with Ball Cage reduces the level of metal wear fragments produced by eliminating friction between the balls, thereby making it possible to suppress the generation of dust.

Rust Prevention

Material countermeasures:

Stainless Steel LM Guide

This LM Guide uses martensite stainless steel that is effective in prohibiting rust.

High Corrosion Resistance LM Guide

The LM Rail uses austenite stainless steel resulting in a high degree of rust preventive effects.

Surface treatment countermeasures:

THK AP-C Treatment, AP-CF Treatment and AP-HC Treatment

Surface treatment (plating) of linear motion systems results in improved rust prevention capabilities.

2 Vacuum

In vacuum environments, it is necessary to select products having excellent rust prevention capabilities as countermeasures against dispersion of gases released from resins and splattering of grease since rust preventive oil cannot be used.

Measures against gas released from resins:

Stainless Steel LM Guide

Stainless steel is used for the material of the end plates of the LM block (through which plastic balls circulate) to reduce the levels of released gas.

Measures against grease splattering:

Vacuum Grease

When general-purpose grease is used in a vacuum environment, the oil component of the grease ends up dispersing resulting in a loss of lubricity. Consequently, vacuum grease is used that uses a fluorine-based oil having a low vapor pressure for the base oil.

Rust preventative countermeasures:

Stainless Steel LM Guide

The stainless steel LM Guide is used in vacuum environments due to its excellent rust preventative effects.

High-Temperature LM Guide

The high-temperature LM Guide is used in cases of being subjected to high temperatures such as during baking, etc. because of its excellent heat resistance and corrosion resistance.

3 Corrosion Resistance

Similar to the case of use in clean rooms, corrosion resistance is enhanced by selecting appropriate materials and surface treatment.

Material countermeasures:

Stainless Steel LM Guide
This LM Guide uses martensite stainless steel that is effective in prohibiting rust.

High Corrosion Resistance LM Guide
The LM Rail uses austenite stainless steel resulting in a high degree of rust preventative effects.

Surface treatment countermeasures:

THK AP-C Treatment, AP-CF Treatment and AP-HC Treatment
Surface treatment (plating) of linear motion systems results in improved rust prevention capabilities.

4 High Speed

In high-speed environments, an optimum lubrication method is required that suppresses the generation of heat during high-speed motion and improves the retention capabilities of the grease.

Measures against heat generation:

LM Guide with Ball Cage
Heat generation is reduced as a result of the ball cage eliminating friction between the balls. Moreover, since the retention capabilities of the grease are improved, a long service life and outstanding high-speed performance are achieved.

High-Speed Ball Screw with Ball Cage (DN value = 130,000)
The use of a ball cage realizes the ideal ball circulation structure, enabling high-speed feeding unable to be realized with conventional products.

THK AFG Grease
The use of grease capable of suppressing heat generation during high-speed use while also offering excellent lubricity makes it possible to achieve high-speed feeding.

Lubrication countermeasures:

Lubricator QZ
Lubricator QZ makes it possible to significantly extend lubrication maintenance intervals by compensating for lost oil. Since only the minimal amount of lubricating oil is applied to the rolling surface, the surroundings are not soiled resulting in a lubrication system that is environmentally friendly.

Special Environmental Specifications of THK Linear Motion Systems

5 High Temperatures

In high-temperature environments, the effects of dimensional changes caused by heat can become a problem. The High-Temperature LM Guide and High-Temperature Grease are used because they offer outstanding heat resistance and are subjected to minimal dimensional changes following heating and cooling.

Heat resistance:

High-Temperature LM Guide
This LM Guide offers outstanding heat resistance and is subjected to only minimal dimensional changes following heating and cooling.

Grease:

High-Temperature Grease
High-temperature grease is used because it causes only minor fluctuations in rolling resistance even during temperature changes from normal temperature to high temperatures.

6 Low Temperatures

Under low-temperature conditions, grease is used that results in minimal effects on plastic parts caused by low temperatures while also minimizing fluctuations in rust preventative countermeasures caused by temperature changes from normal to low temperatures as well as fluctuations in rolling resistance even at low temperatures.

Effects of low temperatures on plastic parts:

Stainless Steel LM Guide
Stainless steel is used for the material of the end plates of the LM block (through which plastic balls circulate).

Rust preventative countermeasures:

Surface treatment of the linear motion system results in enhanced rust preventative capabilities.

Grease:

THK AFC Grease is used that exhibits only minor fluctuations in rolling resistance even at low temperatures.

7 Fine movement

Extremely short strokes can cause oil films to be depleted and ineffective lubrication eventually leading to rapid wear. In cases such as this, a grease is selected that has excellent oil film strength and enables the oil film to be formed easily.

Grease:

THK AFC Grease
This urea-based grease offers excellent oil film strength and wear resistance.

Special Environmental Specifications of Linear Motion Systems

Clean Rooms

- Measures against dust generation
- Rust preventative countermeasures

LM Guide with Caged Ball Technology

Applicable types: ***SHS*** ***SNR/SNS*** ***SSR*** ***SHW*** ***SRS***

Stainless Steel LM Guide

Applicable types: ***HSR*** ***SR*** ***SSR*** ***HR*** ***RSR*** ***SHW*** ***HRW*** ***RSH*** ***SRS***

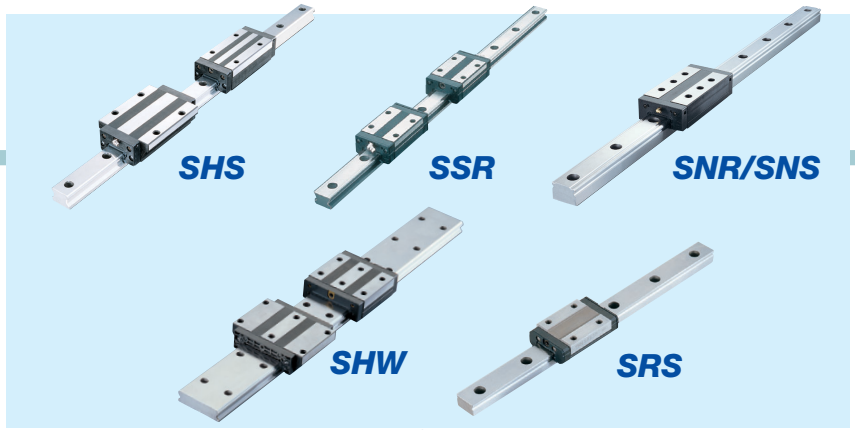
High Corrosion Resistance LM Guide

Applicable type: ***HSR-M2***

Surface Treatment

Grease

Clean Rooms



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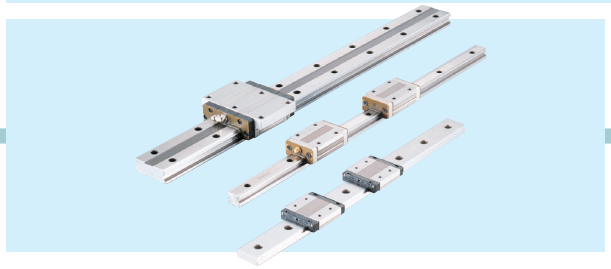

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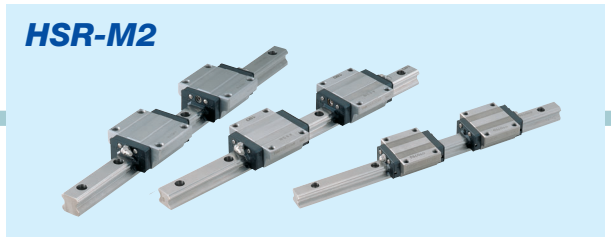
HSR-M2



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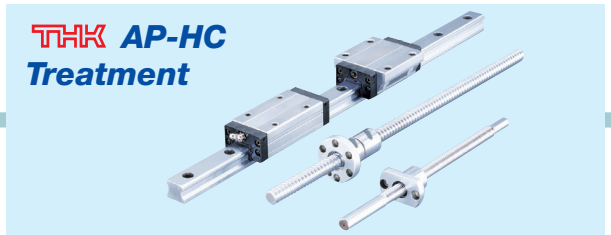
THK AP-HC Treatment



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THK AFF Grease

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THK AFE Grease

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Special Environmental Specifications of Linear Motion Systems

Vacuum

- Measures against released gases
- Measures against grease splattering
- Rust preventative countermeasures

High-Temperature LM Guide

Applicable types: ***HSR-M1*** ***RSR-M1*** ***SR-M1***

High Corrosion Resistance LM Guide

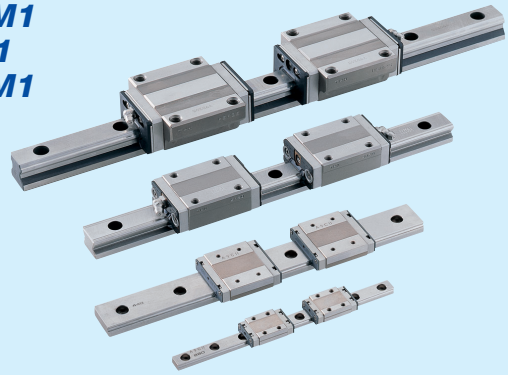
Applicable type: ***HSR-M2***

Stainless Steel LM Guide

Applicable types: ***HSR*** ***SR*** ***SSR*** ***HR*** ***RSR*** ***SHW*** ***HRW*** ***RSH*** ***SRS***

Vacuum Grease

HSR-M1
SR-M1
RSR-M1



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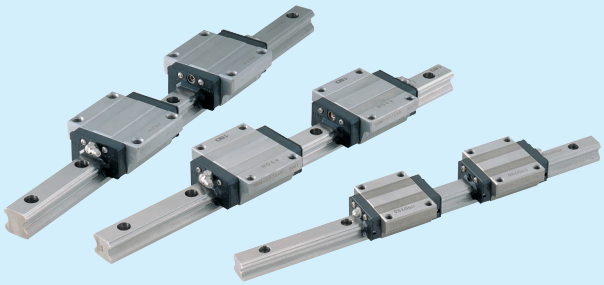
HSR-M2



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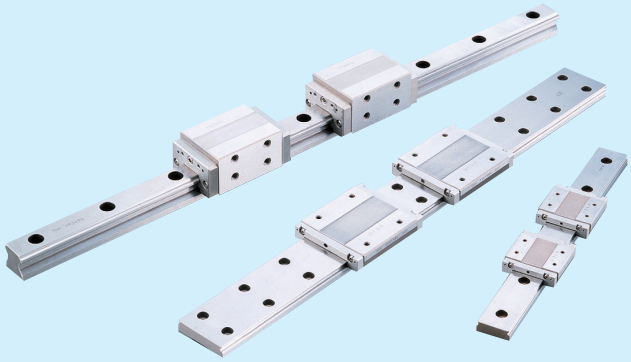

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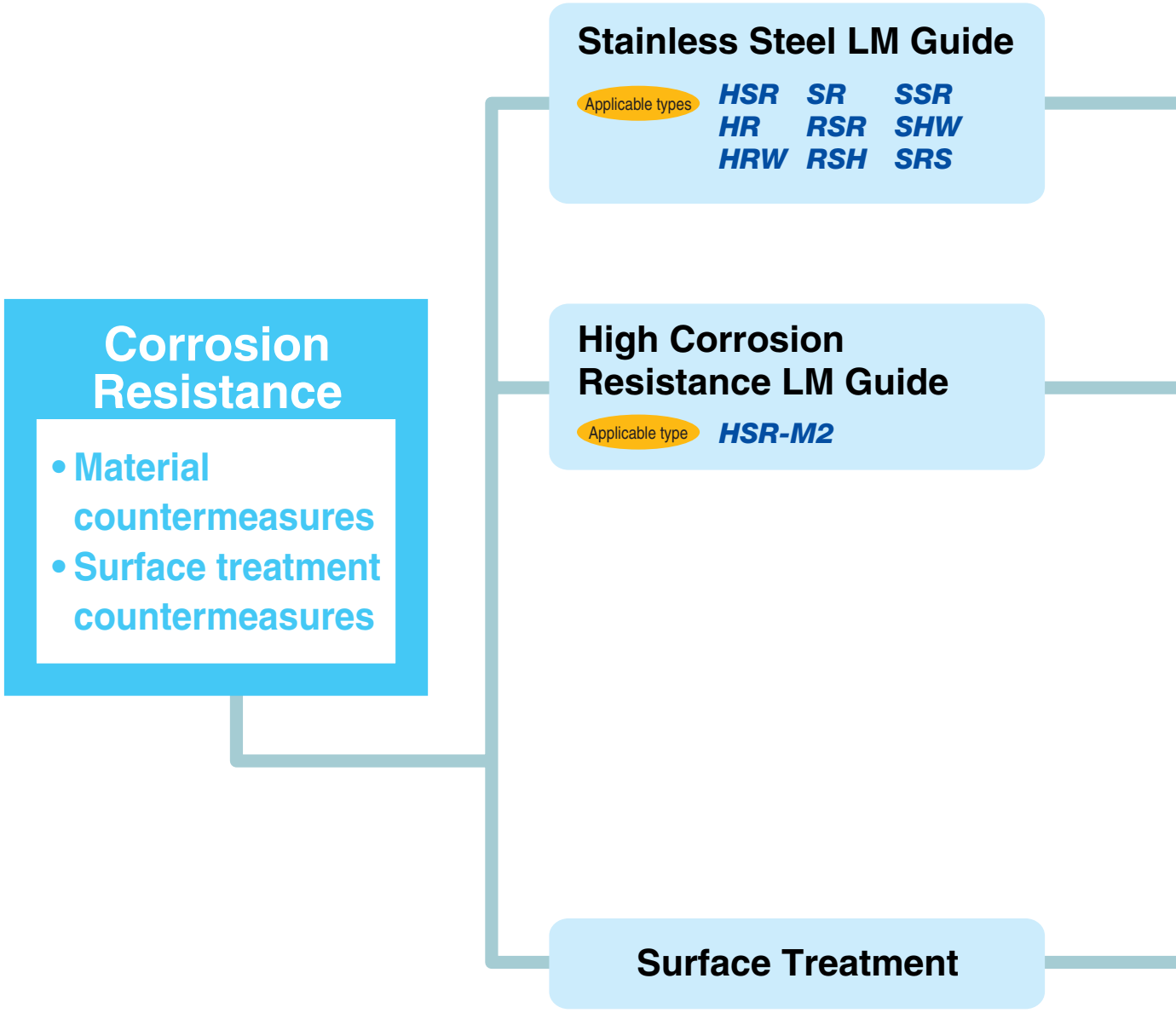
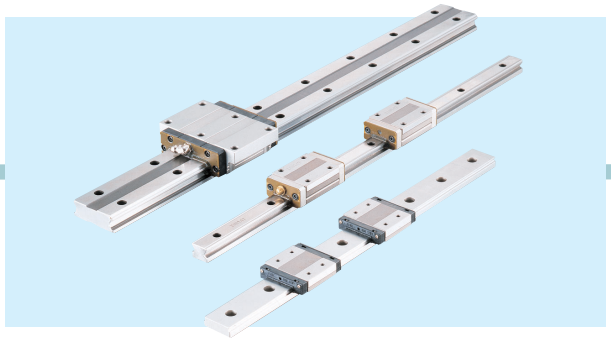
Special Environmental Specifications of Linear Motion Systems



Corrosion Resistance



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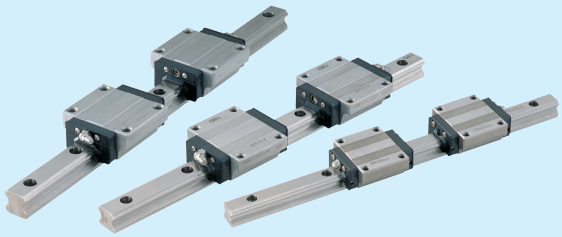
HSR-M2



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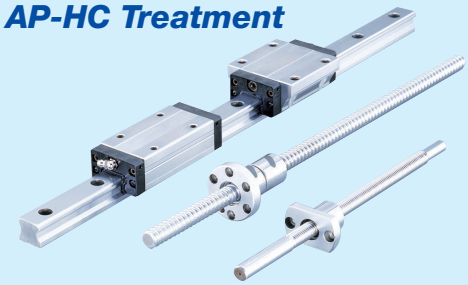
THK AP-HC Treatment



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THK AP-C Treatment

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THK AP-CF Treatment

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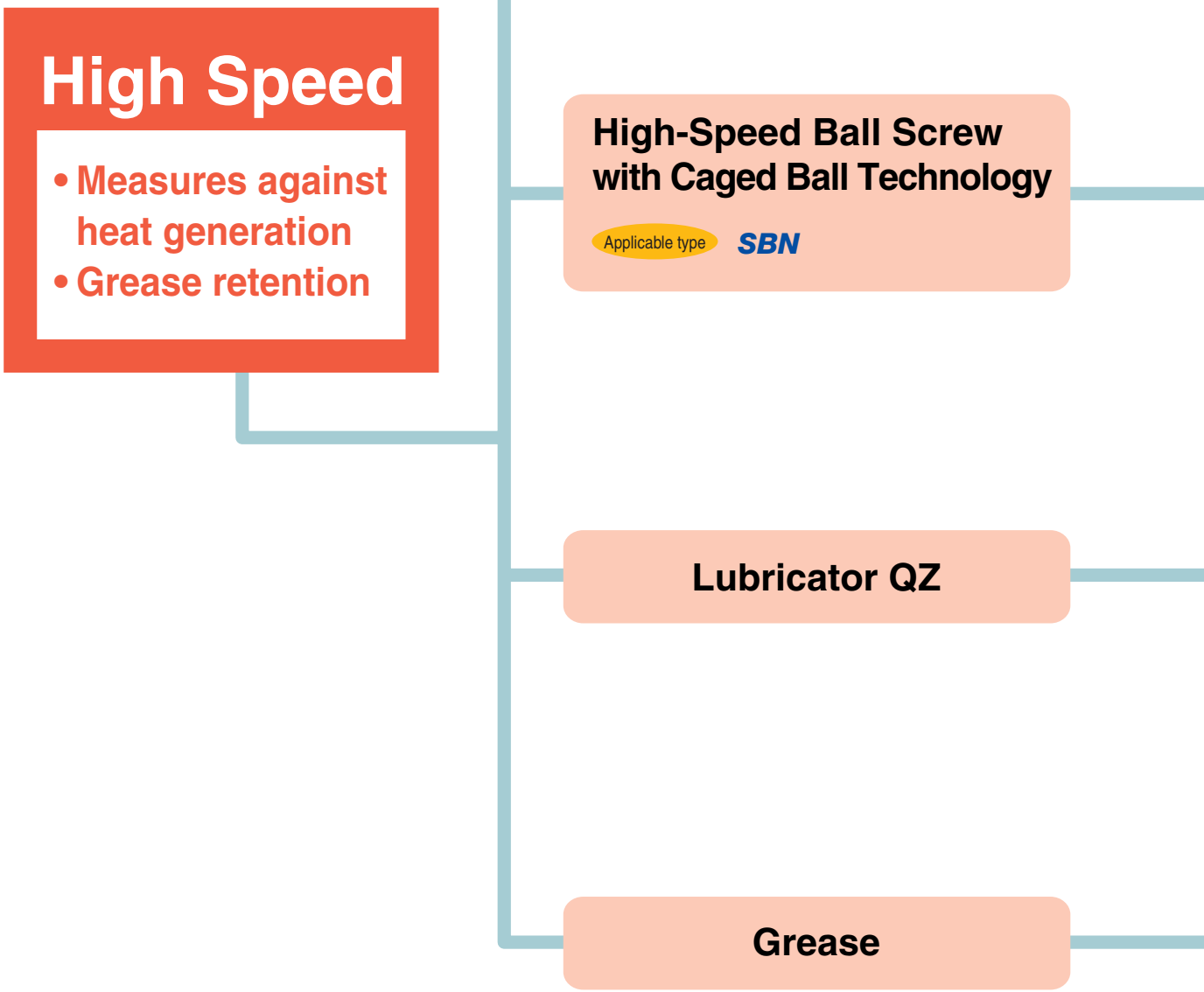
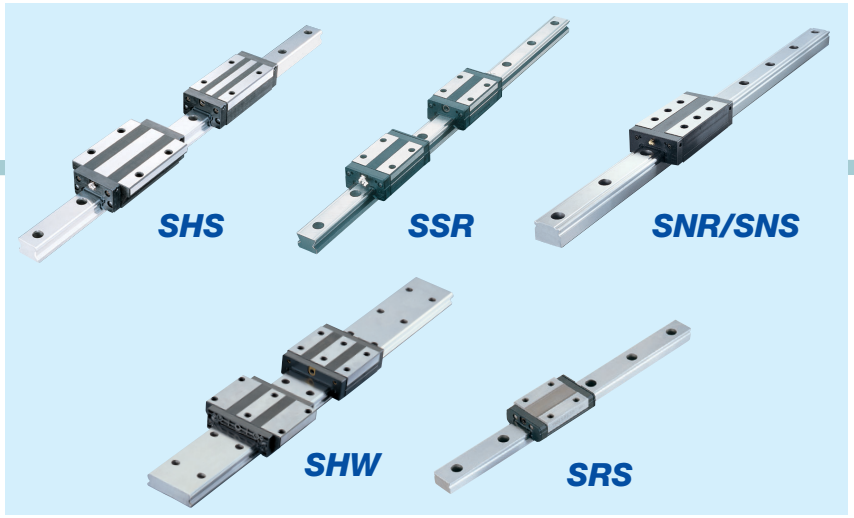
Special Environmental Specifications of Linear Motion Systems



High Speed



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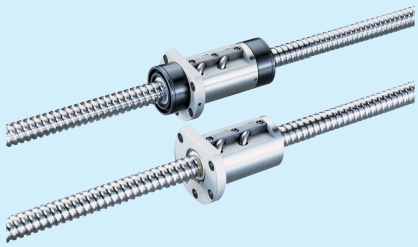
SBN



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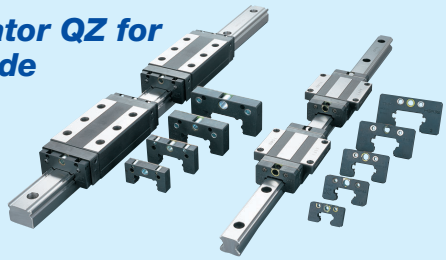
Lubricator QZ for LM Guide



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Lubricator QZ for Ball Screw

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THK AFG Grease

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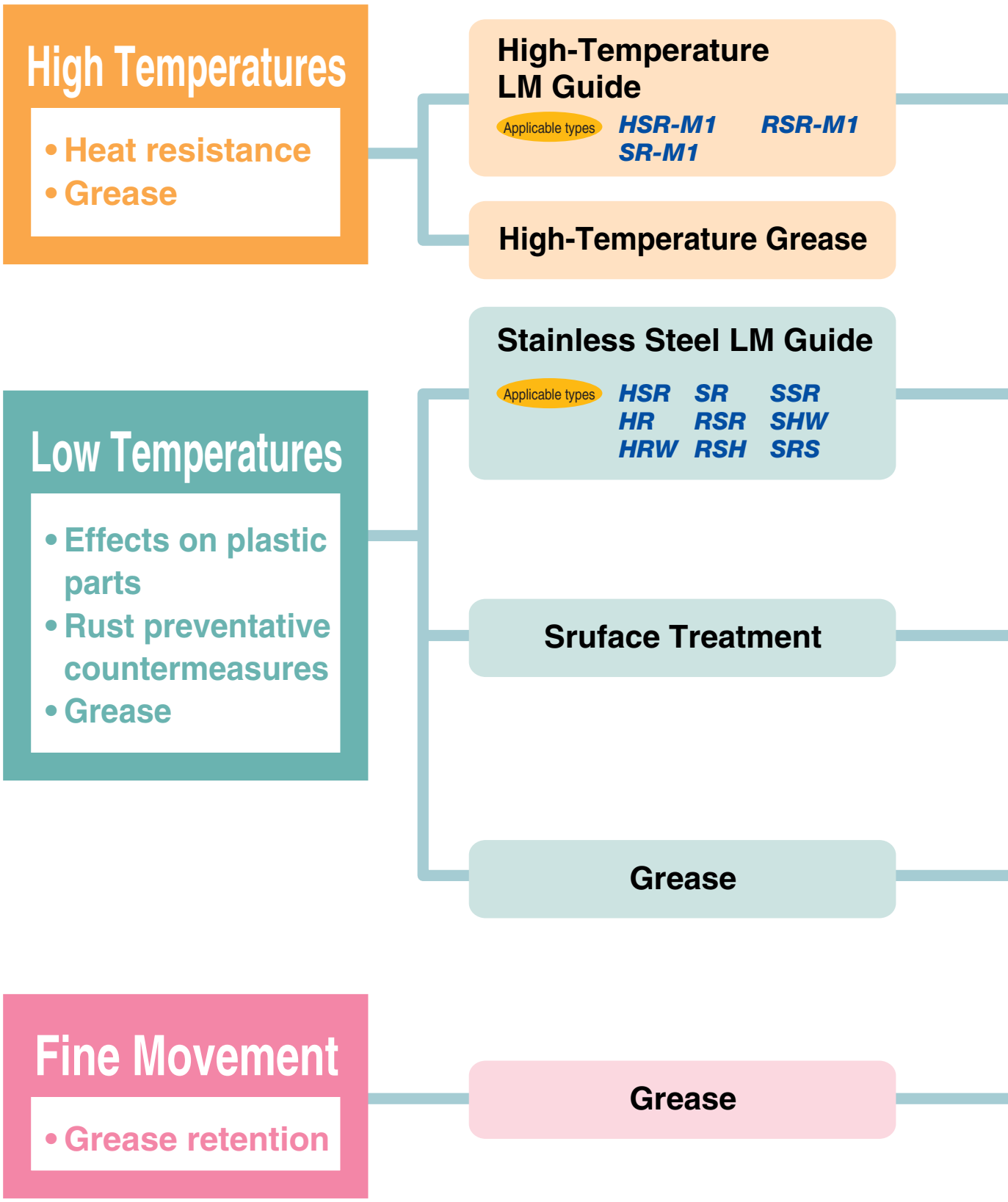
Special Environmental Specifications of Linear Motion Systems

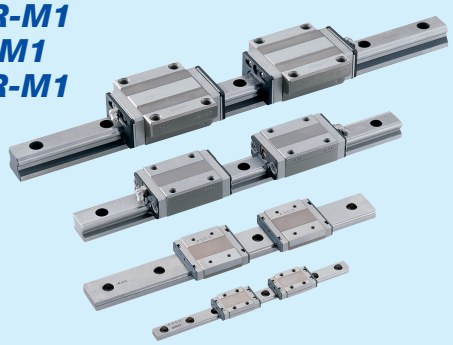


High Temperatures

Low Temperatures

Fine Movement

HSR-M1
SR-M1
RSR-M1



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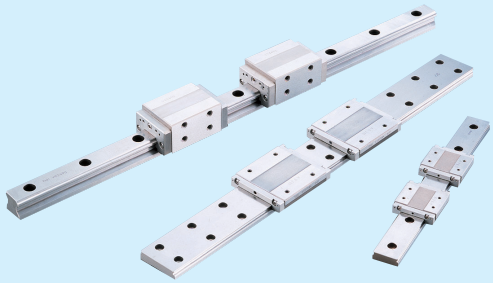

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THK **AP-CF Treatment**

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THK **AFC Grease**

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THK **AFC Grease**

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LM Guide with Caged Ball Technology

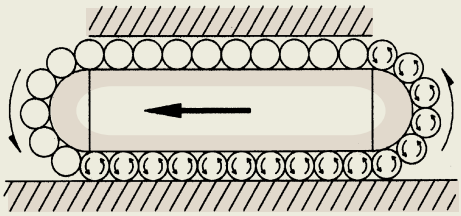
Clean Rooms

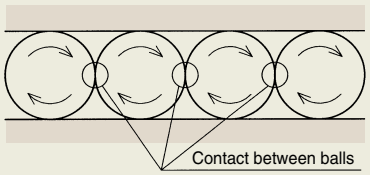
High Speed

The LM Guide with Ball Cage is able to demonstrate outstanding low dust generation performance due to the low level of production of metal wear fragments as a result of the ball cage eliminating friction between the balls.

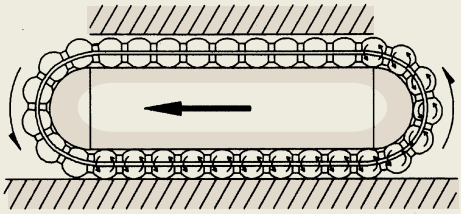
Friction Between Balls

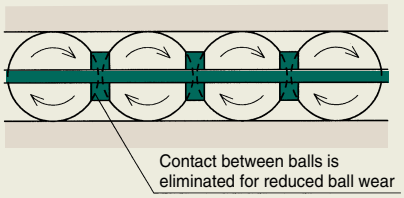
Conventional type
(without ball cage)



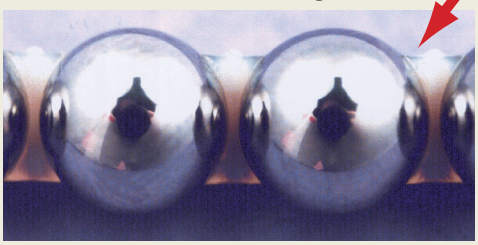


New type
(with a ball cage)





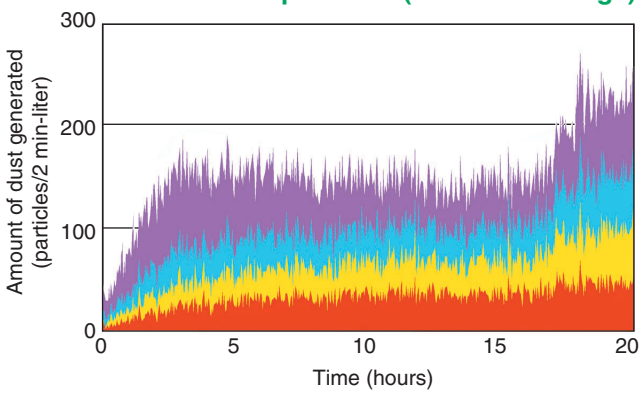
Contact state between balls and cage



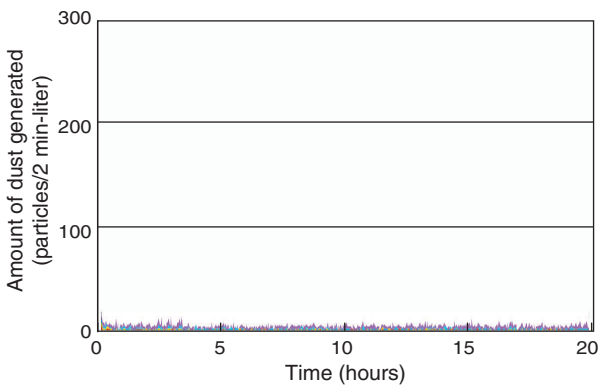
Low Dust Generation Data

Particle size (μm)
0.3 – 0.5
0.5 – 1.0
1.0 – 2.0
2.0 – 5.0
5.0 –

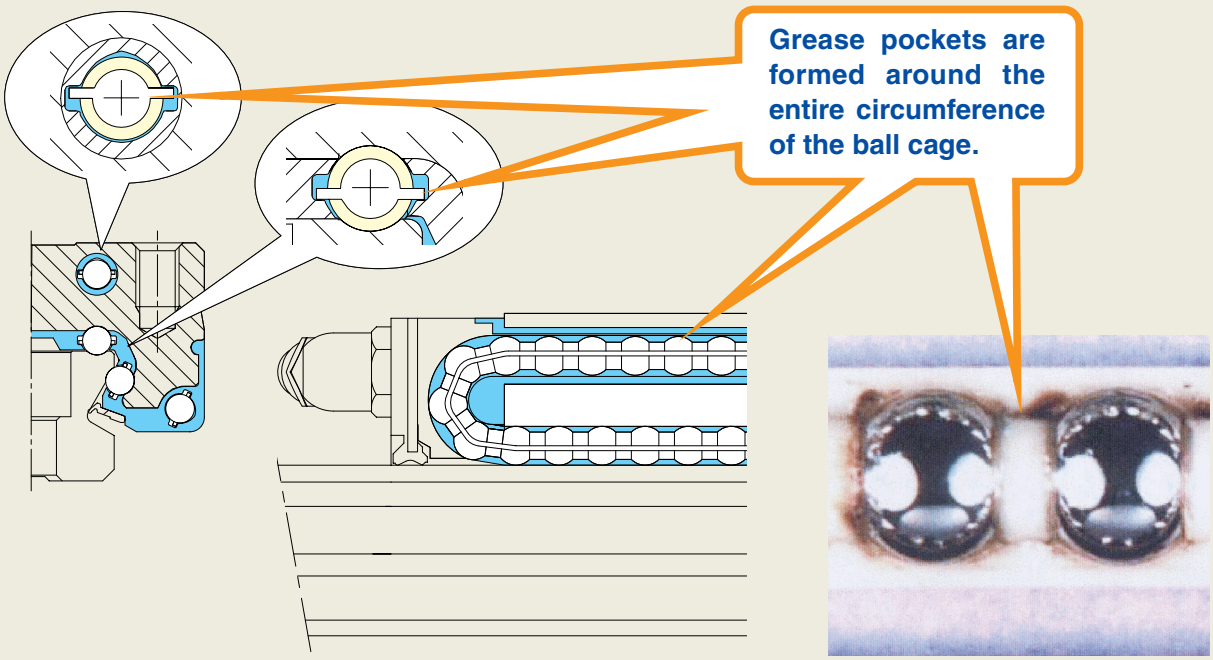
Conventional products (without ball cage)



SSR20 (with ball cage)



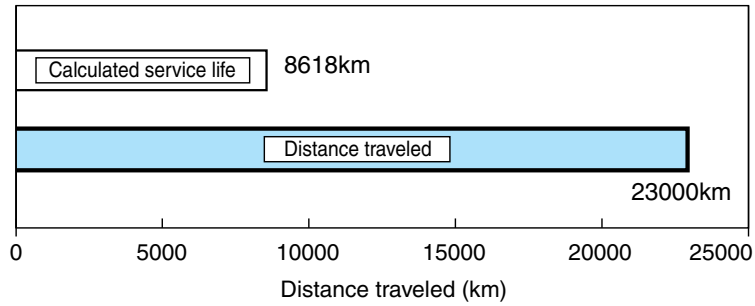
The use of ball cages reduces the generation of heat caused by friction between the balls, thereby improving grease retention capabilities and resulting in outstanding high-speed performance.

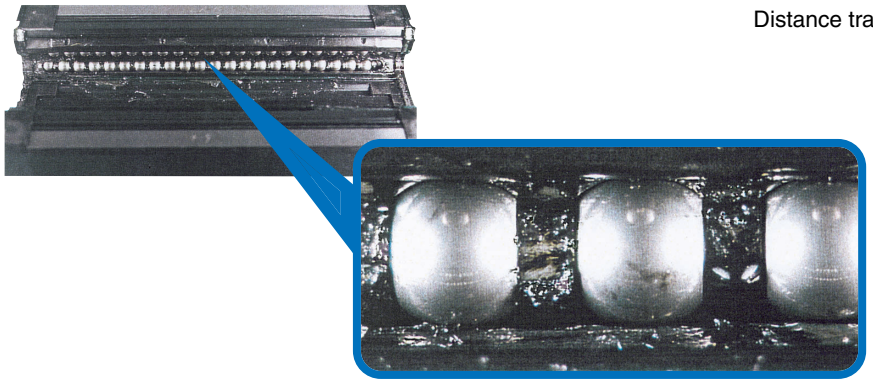


Grease retention status after travel
(SHS45LV: load durability test)

■High-Speed Durability Test Results

Sample : SHS65LVSS
Speed : 200 m/min
Stroke : 2500 mm
Lubrication : Initial sealing of grease only
Acting load : 34.5 kN
Acceleration : 1.5 G





Grease remains on the balls and there are no abnormalities observed in the balls or grease.

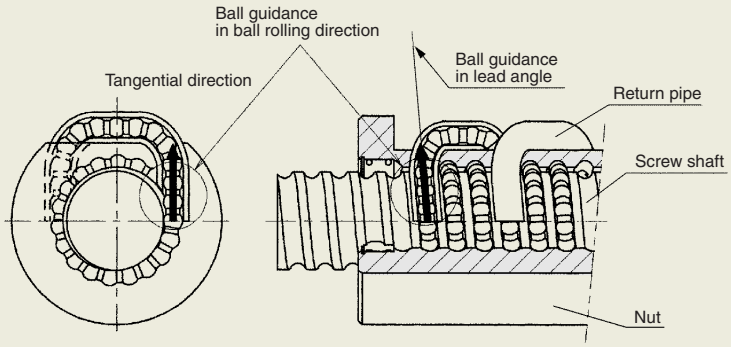
Detailed illustration of ball cage

High-Speed Ball Screw with Caged Ball Technology

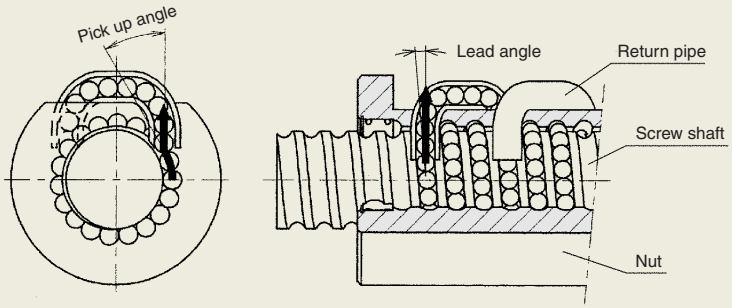
High Speed

Since the return pipe of the SBN type does not have a lip so that the balls are picked up in the tangential direction, a flexible ball track is maintained resulting in the ideal form of circulation. In addition, since the design of the return pipe and ball cage enables these parts to have adequate strength, **they can be used at a DN value of 130,000**.

SBN Type



Conventional Type



The use of ball cages in the SBN type results in smooth ball circulation and is the ideal form of ball circulation for accommodating high speeds, resulting in outstanding high-speed performance and load durability.

■High-Speed Durability Test

Conditions

Sample	SNB3210-7
Speed	3900 (min^{-1}) (DN value: 130,000)
Stroke	400 mm
Lubricant	AFG grease
Amount applied	12 cm^3 (applied every 1000 km)
Load	1.73 kN
Acceleration	1 G

Results

No abnormalities after 3000 km of travel (still running)

■Load Durability Test

Conditions

Sample	SBN3210-7
Speed	1500 (min^{-1})
Stroke	300 mm
Lubricant	AFG grease
Amount applied	12 cm^3 (applied every 1000 km)
Load	17.3 kN
Acceleration	0.5 G

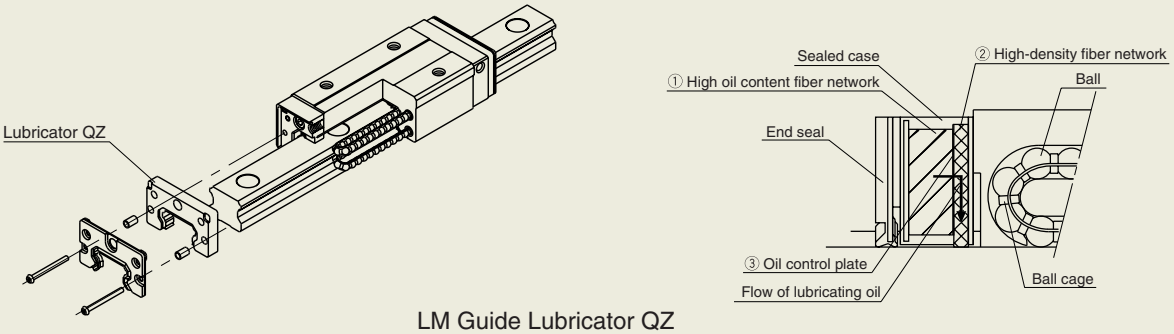
Results

Traveled 2.5 times the estimated service life

Lubricator QZ

High Speed

The LM Guide and Ball Screw lose a small amount of grease during the course of travel. The Lubricator QZ is a revolutionary new lubrication system that supplies an appropriate amount of lubricating oil at the appropriate locations, thereby enabling it to compensate for any oil lost over a long period of time. Installation of the Lubricator QZ on the LM Guide with Ball Cage or High-Speed Ball Screw with Ball Cage, demonstrating excellent grease retention capabilities, results in even further enhanced lubrication performance.



LM Guide Lubricator QZ

Since the Lubricator QZ supplies an optimal amount of lubricating oil at appropriate locations, lubricating oil can be used without waste.

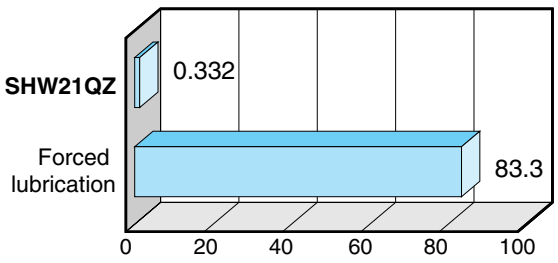
Comparison of Amount of Lubricating Oil Used After Travelling 5000 km

Lubricator QZ oil content: 0.166 cm^3/sheet x 2 sheets = 0.332 cm^3

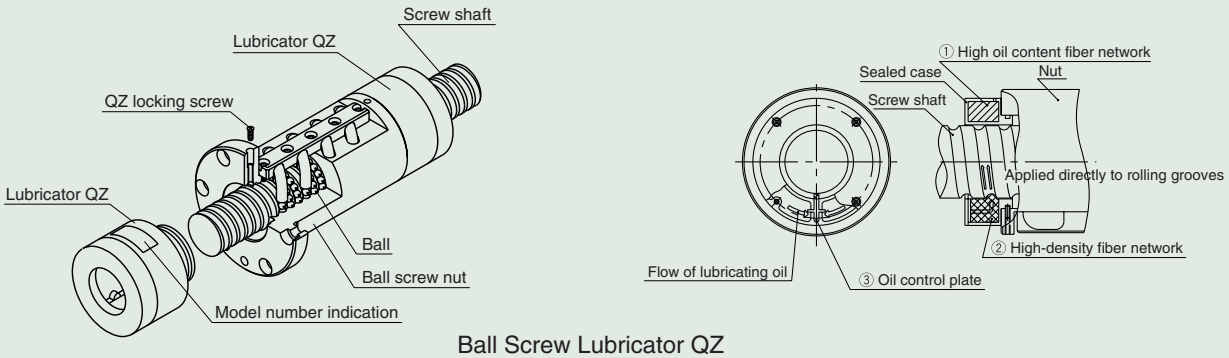
Comparison

Forced lubrication: 0.03 cm^3/6 min x 16667 min = 83.3 cm^3

Amount of lubricating oil used is 1/250 that of forced lubrication.



Test conditions: 300 m/min

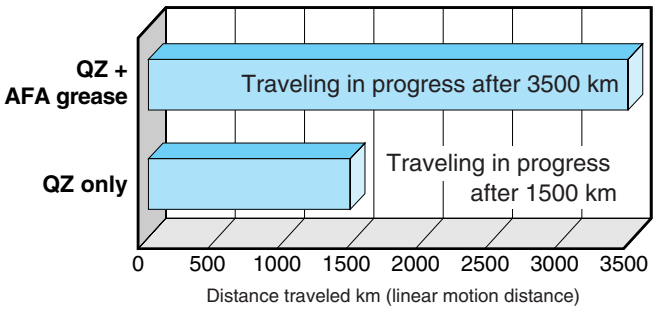


Ball Screw Lubricator QZ

Significant Extension of Maintenance Intervals

Since lubricating oil is continued to be supplied for a long time, maintenance intervals can be extended considerably.

Ball screw	BIF2505-5
Rotational speed	3000 min^{-1}
Stroke	500 mm
Load	0.46 kN

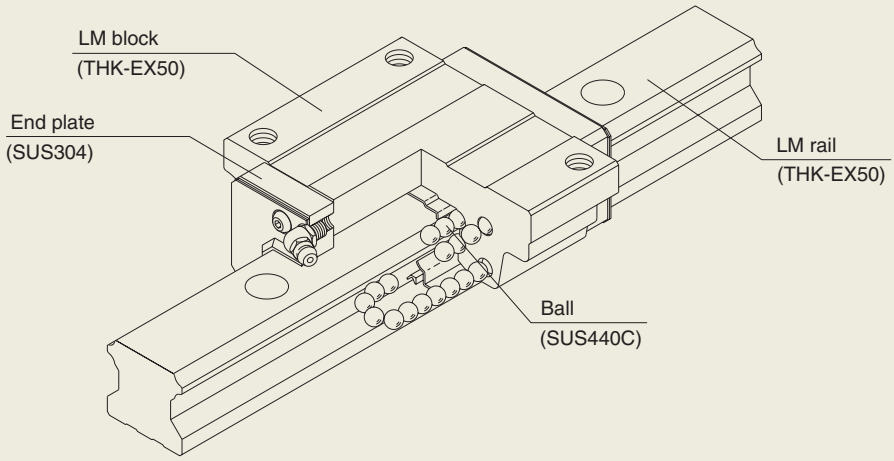


Stainless Steel LM Guide

Clean Rooms · Vacuum · Corrosion Resistance · Low Temperatures

Stainless Steel LM Guide delivers outstanding corrosion resistance as a result of using martensite stainless steel. In addition, heat treatment to a level of HRC58 or higher results in a long service life, enabling it to withstand high loads.

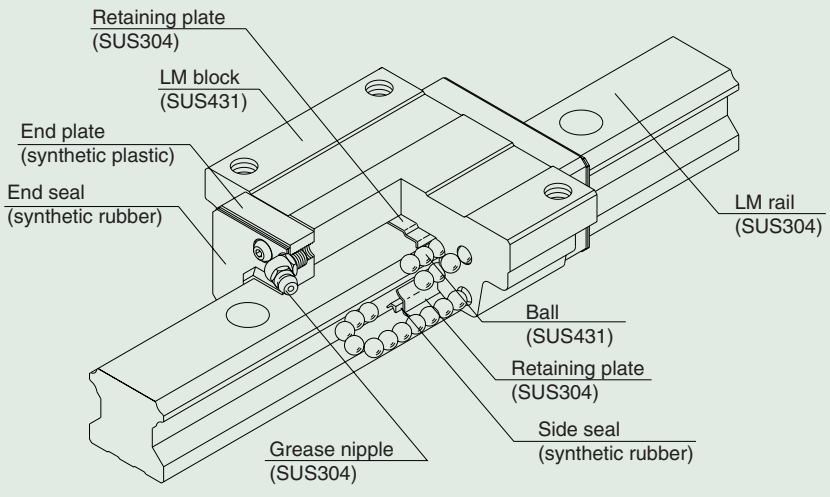
Although plastic end plates are used in ordinary environments, when used in a vacuum environment, SUS304 (austenite stainless steel) is used for the end plates to reduce the level of released gases. SUS304 materials are characterized by low oxidation and low levels of released gases.

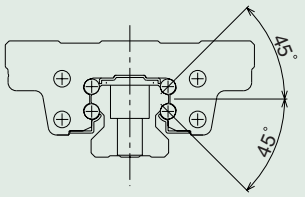


High Corrosion Resistance LM Guide

Clean Rooms · Vacuum · Corrosion Resistance

Austenite stainless steel SUS304, offering excellent corrosion resistance, is used for the LM rail, wile SUS431, offering the highest level of corrosion resistance among martensite stainless steel materials, is used for the LM block and balls. The result is a significant improvement in corrosion resistance over conventional stainless steel (SUS440C).





Structure of the Type HSR-M2A High Corrosion Resistance LM Guide

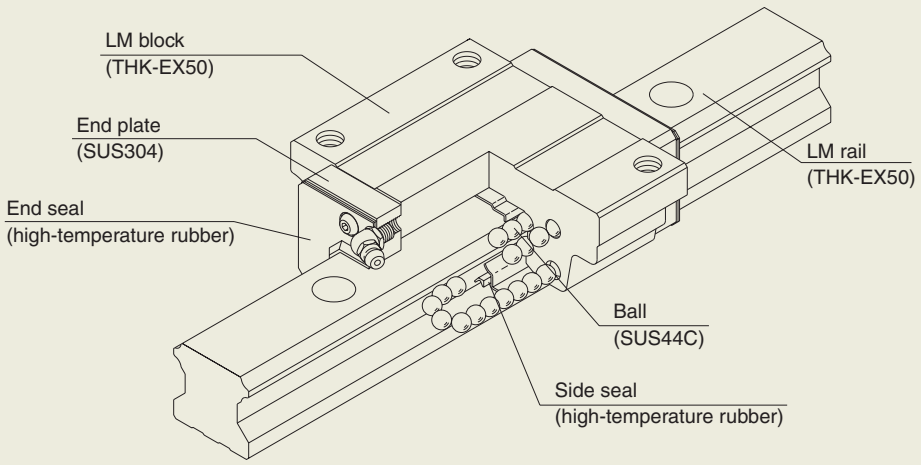
High-Temperature LM Guide

Vacuum

High Temperatures

The LM block and LM rail are made of THK-EX50 martensite stainless steel additionally treated for dimensional stability to minimize the effects of heat on dimensional changes.

SUS304 austenite stainless steel is used for the end plates for enhanced heat resistance.



Thermal Characteristics of LM Rail and LM Block Materials

Spceific heat capacity	: 0.481J/(g·K)
Coefficient of thermal conductivity	: 20.67W/(m·K)
Mean coefficient of linear expansion	: 11.8 × 10⁻⁶/°C

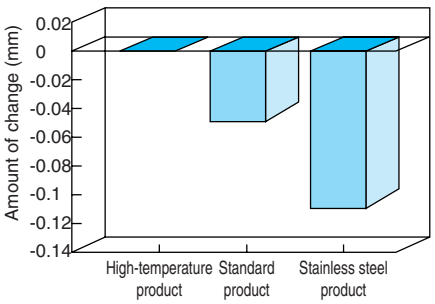
Structure and Materials of High-Temperature LM Guide (Type HSR)

■Dimensional Stability Data

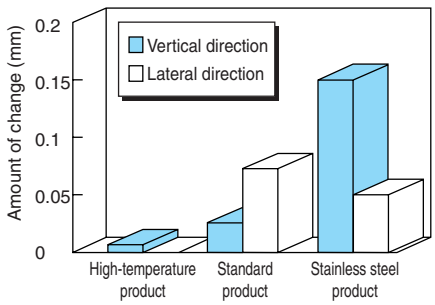
Dimension stabilization treatment makes it possible to reduce dimensional changes following heating and cooling to extremely low levels.

- Total length and curvature data indicate the amount of change when from normal temperature to 150°C for 100 hours followed by cooling to normal temperature.
- HSR25 + 580L high-temperature, standard and stainless steel products were used for the samples.

Total length of LM rail



Curvature of LM rail

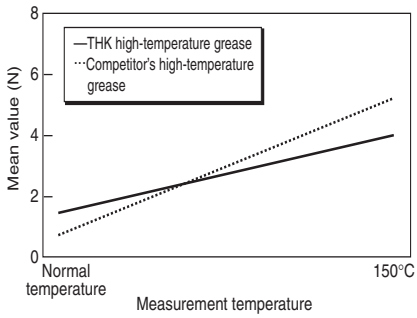


■Grease-Induced Rolling Resistance Data

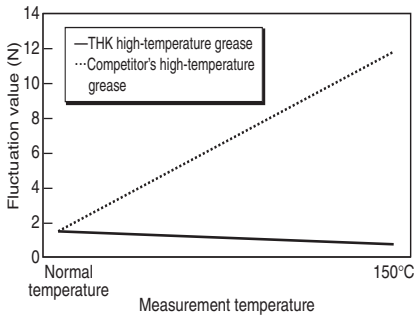
High-temperature grease is used that minimizes changes and fluctuations (catching) in rolling resistance caused by the grease even when the temperature changes from normal temperature to high temperature.

HSR25M1R1C1 is used as the sample for the above data.

Mean value



Fluctuation value



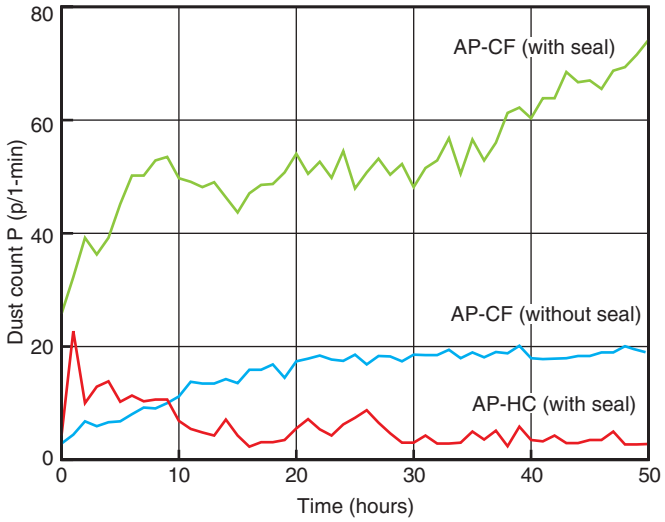
Surface Treatment

Clean Rooms | Corrosion Resistance | Low Temperatures

THK AP-HC Treatment

THK AP-HC treatment is equivalent to hard chrome plating, and allows for corrosion resistance nearly equivalent to that of martensite stainless steel.
In addition, since surface treatment is performed that results in the formation of a film having a hardness of 700 HV or more, dust generation is reduced while offering outstanding wear resistance.

Characteristics of THK AP-HC Treatment



Test Conditions
LM guide model numbers :
SSR20WF + 280LF (AP-CF with seal)
SSR20UUF + 280LF (AP-CF without seal)
SSR20UUF + 280LF (AP-HC with seal)
Injected grease : THK AFE Grease
Amount applied : 1 cc (1 block)
Speed : 30 m/min (max)
Stroke : 200 mm
Measurement flow rate : 1 liter/min
Clean room volume : 1.7 liters (acrylic case)
Measuring instrument : Dust counter
Measured particle size : 0.3 µm and above

THK AP-HC treatment results in high surface hardness and offers excellent wear resistance. The large amount of wear occurring in the initial portion of the graph is considered to be attributed to initial wear of the end seals.

Note: THK AP-HC treatment (equivalent to hard chrome plating)
THK AP-CF treatment (equivalent to black chrome plating + fluororesin coating)

■ THK AP-C Treatment

THK AP-C treatment consists of black film treatment for the purpose of improving corrosion resistance. It is used in applications requiring rust prevention since it is priced lower than stainless steel LM guides.

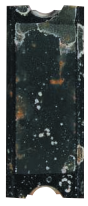
■ THK AP-CF Treatment

THK AP-CF treatment consists of compound surface treatment in which a special fluororesin is coated into a black film. Since this treatment results in complete coverage of metal surfaces, it offers a high degree of rust prevention and is suitable in cases requiring a high level of corrosion resistance. Moreover, since the fluororesin constitutes a chemically stable film, it also offers outstanding contamination resistance.

Surface treatment	Rust prevention capabilities	Wear resistance	Surface hardness	Sealing	Appearance
AP-HC	○	◎	◎	◎	Metallic gloss
AP-C	◎	△	△	△	Black gloss
AP-CF	◎	○	△	○	Black gloss

◎ (Superior)

Cycled saltwater spraying test
Sprayed solution : 1% NaCl solution
Cycle : Spraying for 6 hours followed by drying for 6 hours
Temperature conditions : During spraying : 35°C
During drying : 60°C

Test material / Time	Austenite stainless steel	Martensite stainless steel	THK AP-HC	THK AP-C	THK AP-CF
Before testing					
After 6 hours					
After 24 hours					
After 96 hours					

THK AFF Grease

Clean Rooms

THK AFF Grease is a high-grade synthetic oil that uses a lithium-based thickener and special additives to realize the perfect balance of stable rolling resistance, low dust generation and flaking resistance not possible with conventional vacuum grease and low dust generation grease.

The use of THK AFF Grease results in improved uniform velocity characteristics of the precision positioning units used in semiconductor and liquid crystal production systems as well as improved response during micro-step feeding. Moreover, due to its excellent flaking resistance to minute vibrations (fine movement wear performance), the intervals between lubrication times can be extended resulting in a reduction in maintenance costs.

Typical Properties of AFF Grease

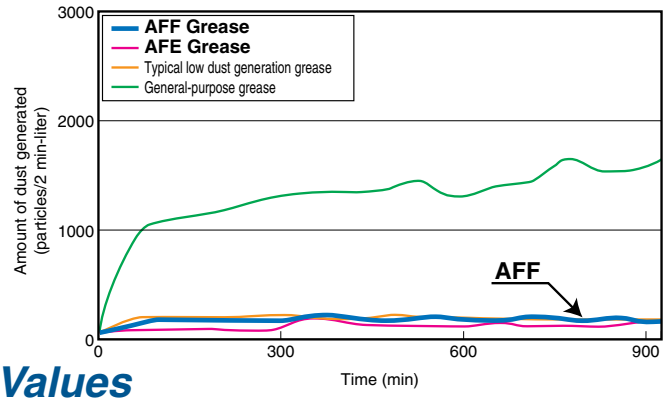
Test item		Typical property values	Testing method
Working temperature range (°C)		–40 - 120	—
Mixing consistency (25°C, 60 W)		315	JIS K2220 5.3
Dropping point : °C		216	JIS K2220 5.4
Copper plate corrosion (100°C, 24h)		Passing	JIS K2220 5.5
Evaporation : mass% (99°C, 22h)		0.43	JIS K2220 5.6
Oil separation : mass% (100°C, 24h)		0.57	JIS K2220 5.7
Oxidation stability : kPa (99°C, 100h)		39	JIS K2220 5.8
Impurities : quantity/cm² 25 µm or larger 75 µm or larger 125 µm or larger		0 0 0	JIS K2220 5.9
Mixture stability (100,000 W)		329	JIS K2220 5.11
Low-temperature torque : N-m (–20°C)	Starting	0.22	JIS K2220 5.14
	Running	0.04	
Apparent viscosity : Pa-s (–10°C, $10S^{-1}$)		3400	JIS K2220 5.15
Timken load resistance performance : N		88.2	JIS K2220 5.16
Four-ball test (fused load) : N		3089	ASTM D2596
Anti-fletching performance : mg		3.8	Complies with ASTM D4170
Bearing rust prevention : (52°C, 48h)		#1	ASTM D1743

Low Dust Generation Characteristics

Test Conditions

Item	Description
Model used	SR20W + 280LP
Amount of grease injected	1 cm³/1 LM block (initial injection only)
Air supply volume	500 cm³/min
Measuring instrument	Particle counter
Measured particle size	0.3 µm and above
Speed	30 m/min
Stroke	200 mm

Operating Time and Dust Generation



Stable Rolling Resistance Values

Test Conditions

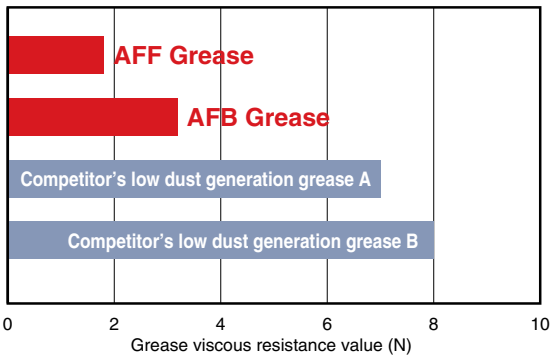
Item	Description
Model used	HSR25A1C1 + 580LP
Amount of grease injected	3 cm³/1 LM block (initial injection only)
Speed	10 mm/s

(23°C)

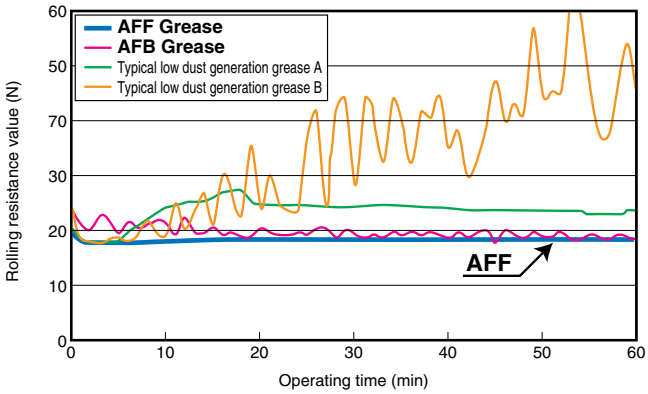
Test Conditions

Item	Description
Model used	HSR35RC0 + 440LP
Amount of grease injected	4 cm³/1 LM block (initial injection only)
Speed	1 mm/s
Stroke	3 mm

Grease Viscous Resistance Values



Low-Speed Rolling Resistance Values



THK AFE Grease

Clean Rooms

THK AFE Grease uses for its base oil a high-grade synthetic oil along with a urea-based thickener for outstanding low dust generation characteristics.

Since THK AFE Grease is able to accommodate a wide temperature range from low temperatures to high temperatures, and generates lower levels of dust than vacuum grease and typical low dust generation grease conventionally used for low dust generation, it is optimal for the LM guide, ball screws and various other units of semiconductor and liquid display production systems. In addition, it also contributes to reduced maintenance costs by being able to significantly extend the service life of LM systems.

Typical Properties of AFE Grease

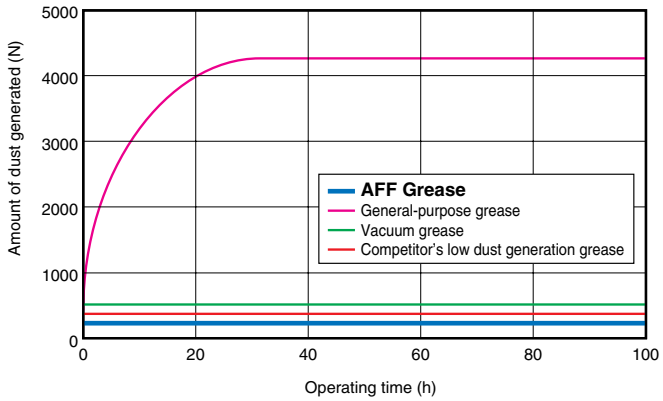
Test item and conditions	AFE Grease
Mixing consistency (25°C, 60 W)	280
Dropping point : °C	260<
Oil separation : (150°C, 24h) %	1.8
Oxidation stability : (99°C, 100h) MPa	0.01
Bearing rust resistance : (52°C, 48h)	#1
Base oil kinematic viscosity : cm^3/S (cSt) 100°C	12.8 (12.8)
Appearance	Light brown consistency
Working temperature range	–40°C - +200°C

■Low Dust Generation Characteristics

Test Conditions

Item	Description
Model used	Type KR4610
Ball screw rotating speed	1000min^{-1}
Stroke	210mm
Amount of grease injected	Screw, guide: 2 cc each
Measurement flow rate	1 liter/min
Measuring instrument	Dust counter
Particle size	0.5 μm and above

LM System Operating Time and Dust Generation



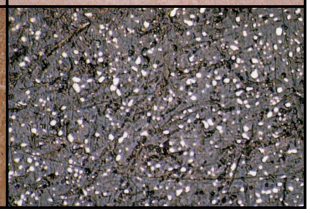
■Long Service Life Characteristics

Test Conditions

Item	Conditions
Model used	HSR25A
Speed	30m/min
Loaded	4.9kN
Amount of grease injected	1 cc/groove (initial injection only)

Surface Status of Balls After Traveling

Magnification: 200X

Name \ Distance traveled	290km	440km
THK AFE Grease	Hardly any color change or damage	Hardly any color change or damage
Typical low dust generation grease		

THK AFG Grease

High Temperatures

THK AFG Grease uses for its base oil a high-grade synthetic oil along with a urea-based thickener for outstanding low dust generation characteristics. It also reduces heat generation during high-speed use while offering excellent oxidation stability.

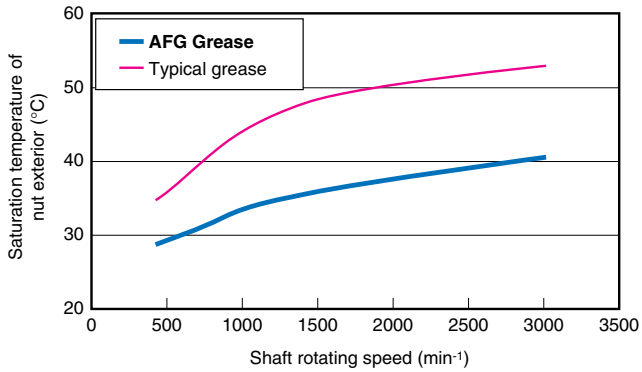
Typical Properties of AFG Grease

Test item		Typical values	Testing method
Mixing consistency (25°C, 60 times)		285	JIS K2220 5.3
Dropping point : °C		261	JIS K2220 5.4
Copper plate corrosion (Method B, 100°C, 24h)		Passing	JIS K2220 5.5
Evaporation : mass% (99°C, 22h)		0.20	JIS K2220 5.6
Oil separation : mass% (100°C, 24h)		0.50	JIS K2220 5.7
Oxidation stability : Mpa (99°C, 100h)		0.029	JIS K2220 5.8
Mixture stability (100,000 times)		329	JIS K2220 5.11
Rinsing resistance : mass% (38°C, 1 h)		0.6	JIS K2220 5.12
Low-temperature torque : N-m (–54°C)	Starting	0.439	JIS K2220 5.14
	Running	0.049	
Rust prevention test : (52°C, 48h)		1,1,1	ASTM D1743

Low Heat Generation Characteristics

Test Conditions

Item	Description
Shaft diameter/lead	32/10mm
Speed	67 - 500mm/s
Shaft rotating speed	400 - 3000min^{-1}
Stroke	400mm
Amount of grease injected	12cm^3
Temperature measurementlocation	Nut exterior



Ball Screw High-Speed Durability Test

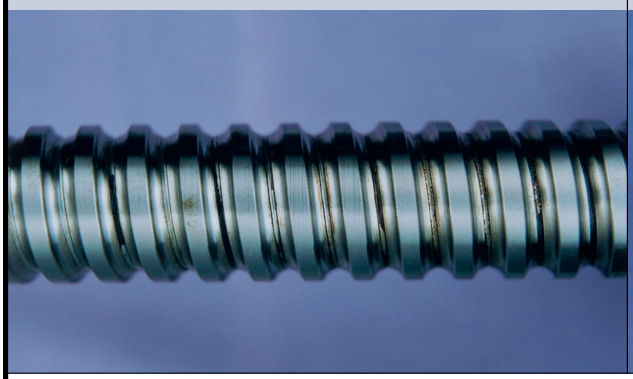
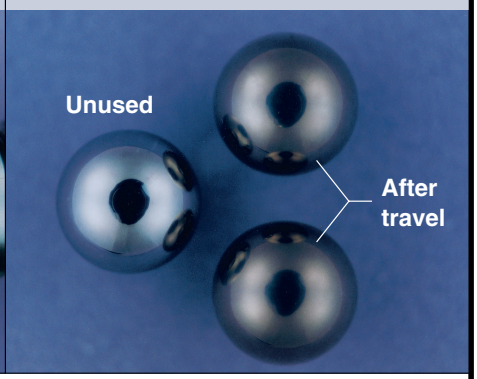
Combining with a ball screw with ball cage enabled use at ultra-high speeds at a DN value of 130,000.

Test Conditions

Item	Description
Shaft diameter/lead	32/10mm
Max. rotating speed	3900 min^{-1} (DN value: 130,000)
Stroke	400 mm
Acceleration	9.8 m/s^2

[Lubrication Conditions]

Lubricant : THK AFG Grease
Injection volume : 12 cm^3
(initial injection only)

Appearance of shaft traveled region after traveling for 1000 km	Appearance of balls after traveling for 1000 km
	

There are no abnormalities observed.

THK AFC Grease

Low Temperatures

Fine Movement

THK AFC Grease uses a high-grade synthetic oil for its base oil along with a urea-based thickener and special additives to realize extremely outstanding flaking and corrosion resistance.

Since AFC Grease also offers excellent oxidation stability, the intervals between lubrication times can be extended resulting in a reduction in maintenance costs as compared with typical metallic soap-based grease.

Typical Properties of AFC Grease

Test item		Typical values
Mixing consistency (25°C, 60 W)		288
Dropping point : °C		269
Copper plate corrosion (Method B, 100°C, 24h)		Passing
Evaporation : (Method B, 177°C, 22h)		7.9
Oil separation : (177°C, 30h)		2.0
Oxidation stability : (99°C, 100h) MPa		0.031
Impurities : quantity/cm^2	25-75 µm	370
	75 µm or larger	0
Mixture stability (100,000 times)		3.41
Rinsing resistance : (38°C, 1 h) %		0.6
Low-temperature torque :	Starting	0.439
N-m (–54°C)	Running	0.049
Bearing rust prevention : (52°C, 48h)		1,1,1
Vibration test : (200 hr)		Passing
Working temperature range (°C)		–52°C - +177°C

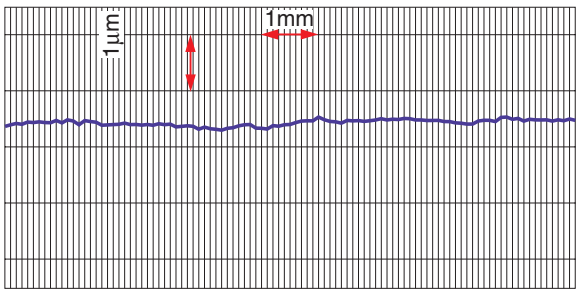
Flaking and Corrosion Resistance Test Data

Test Conditions

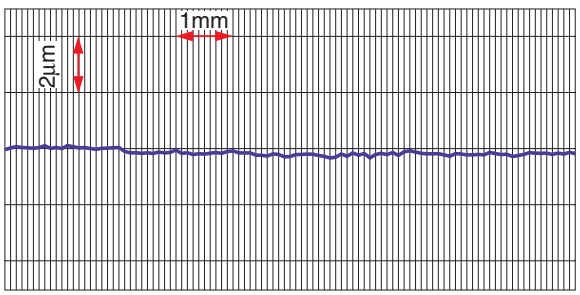
Item	Description
Stroke	3 mm
Strokes/min	200 min^{-1}
Total strokes	2.88 x 10^5 (24 hours)
Bearing pressure	1118MPa
Amount of grease injected	12 g/unit (supplied every 8 hours)

AFC Grease

Before travel

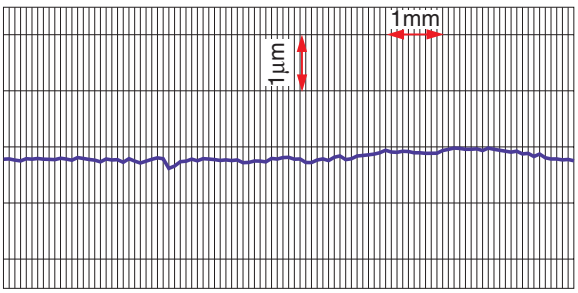


After travel

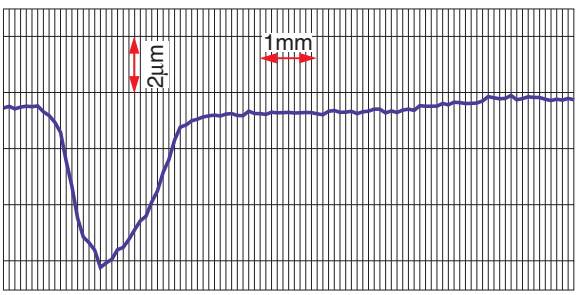


General-purpose grease

Before travel



After travel



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Smooth Silent Ecological

Special Environmental Specifications of THK Linear Motion Systems

Clean Rooms | Vacuum | Corrosion Resistance | High Speed | High Temperatures | Low Temperatures | Fine Movement

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TOKYO. JAPAN

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