SPACEA Series Ball Screws

Specifications and operating conditions

NSK's SPACEA Series ball screws are suitable for a wide range of special operating environments. The table on this page shows the principal specifications and operating conditions of NSK SPACEA Series ball screws.

Table 7 Principal specifications of SPACEA Series ball screws

Environment	Operating conditions	Ball screw specifications				For more technical data see page(s) ...
		Shaft / Nut	Balls	Recirculation components	Lubricant / Surface treatment	
Clean	Air, room temperature	Standard material	Standard material	Standard material	Clean Grease LG2, solid oil	3, 23, 24
		Martensite stainless steel	Martensite stainless steel	Austenite stainless steel	Clean Grease LG2, solid oil Fluoride Low-Temperature Chrome Coating	3, 23, 24
	Air-vacuum, room temperature				Fluorine grease	
	Air-vacuum, up to 200°C					
	Air-vacuum, up to 200°C, corrosive	Ceramics	Ceramics	Ceramics	Fluorine grease	
Vacuum	Air-vacuum, room temperature	Martensite stainless steel	Martensite stainless steel	Austenite stainless steel	Fluorine grease	
	Air-vacuum, up to 200°C					
	Air-vacuum, up to 300°C				Molybdenum disulfide	
	High vacuum, up to 500°C				Silver coating	25
Corrosive	Acid, alkaline, clean	Standard material	Standard material	Austenite stainless steel	Fluoride Low-Temperature	5, 31, 32
		Martensite stainless steel	Martensite stainless steel		Chrome Coating	5
		Precipitation hardened stainless steel	Precipitation hardened stainless steel		Fluorine grease	
	Strong acid, high alkaline, clean, non-magnetic	Ceramics	Ceramics			
Non-Magnetic	Air-vacuum, clean	Special austenite steel	Ceramics	Austenite stainless steel	Fluorine grease	
	Air-vacuum, up to 200°C, clean	Ceramics			Fluororesin	
High-Temperature	Air, up to 200°C	Standard material	Standard material	Austenite stainless steel	Fluorine grease	
	Air, up to 200°C, corrosive	Martensite stainless steel	Martensite stainless steel		Fluoride Low-Temperature Chrome Coating	31, 32
	Air, up to 500°C, corrosive	Ceramics	Ceramics		Fluoride Low-Temperature Chrome Coating Fluorine grease	31, 32
Low-Temperature	down to –270°C	Martensite stainless steel	Martensite stainless steel	Austenite stainless steel	Solid lubricant	
Radioactive	Air	Standard material	Standard material	Standard material	Radiation resistant grease	
		Martensite stainless steel	Martensite stainless steel	Austenite stainless steel		
Foreign particle contaminated	Dust, wood chips	Standard material	Standard material	Standard material	Solid oil	
	Water, under water	Martensite stainless steel	Martensite stainless steel	Austenite stainless steel		

Dimensions and operating environments

The table on this page shows the principal dimensions of NSK SPACEA Series ball screws and their suitability for various operating environments.

Fig. 48 Key to ball screw dimensions

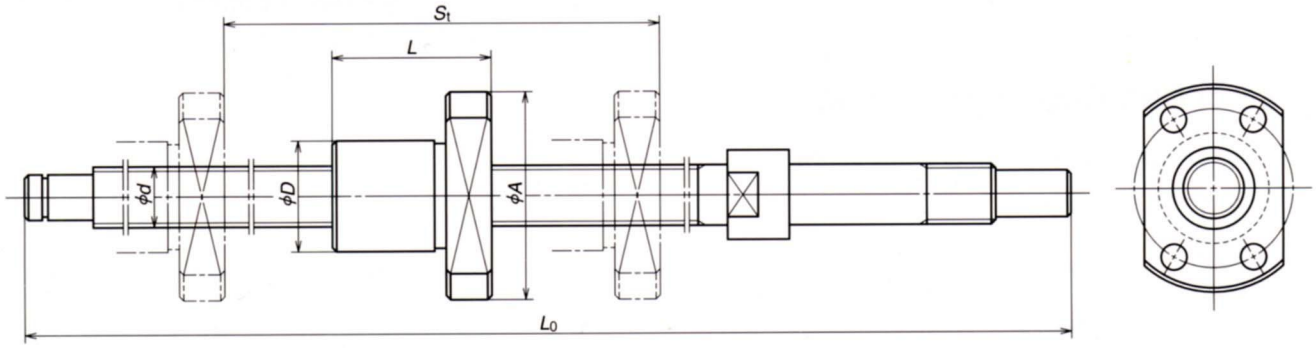


Table 8 Dimensions and operating environments of SPACEA Series ball screws

Series	Shaft diameter	Lead	Dimension (mm) Nut outer diameter D	Flange outer diameter A	Nut length L	Max. threaded length of shaft L0max	St	Basic Load rating (Dynamic) (N)	{kgf}	Suitability for special environments Clean	Vacuum	Corrosive	High temperature	Foreign particle contaminated
KA	6	1	12	24	21	174	100	470	48	○	○	○		
	8	1	14	27	21	248	150	545	55	○	○	○		
	8	2	16	29	28	248	150	1080	110	○	○	○		
	10	2	18	35	29	308	200	1210	125	○	○	○		
	10	4	26	46	34	430	300	2250	230	○	○	○		
	12	2	20	37	29	380	250	1360	140	○	○	○		
	12	5	30	50	40	580	450	3070	315	○	○	○		
	12	10	30	50	50	580	450	3070	315	○	○	○		
	15	10	34	57	51	1161	1000	5780	590	○	○	○		
	15	20	34	55	45	1161	1000	4150	425	○	○	○		
	16	2	25	44	40	461	300	2870	295	○	○	○		
	20	20	46	74	63	1208	1000	5760	585	○	○	○		
Made to order	10	2	22	39	29	308		1210	125	○	○	○	○	○
	10	4	26	46	34	430		2250	230	○	○	○	○	○
	12	2	24	41	29	380		1360	140	○	○	○	○	○
	12	5	30	50	40	580		3070	315	○	○	○	○	○
	12	10	30	50	50	580		3070	315	○	○	○	○	○
	15	10	34	57	51	1161		5780	590	○	○	○	○	○
	15	20	34	55	45	1161		4150	425	○	○	○	○	○
	16	2	30	49	40	461		2870	295	○	○	○	○	○
	20	20	46	74	63	1208		5760	585	○	○	○	○	○
	25	5	50	73	55	1800		13600	1380	○	○	○	○	○
	25	25	44	71	90	1800		8280	845	○	○	○	○	○
	32	5	58	85	106	2400		15100	1540	○	○	○	○	○
	32	32	51	85	109	2400		9450	965	○	○	○	○	○
	40	10	82	124	193	3000		42500	4340	○	○	○	○	○
	40	40	64	106	133	3000		15100	1530	○	○	○	○	○
	50	10	93	135	163	3500		47200	4820	○	○	○	○	○
	50	50	80	126	161	3500		22500	2290	○	○	○	○	○
	63	10	108	154	107	5000		51700	5270	○	○	○	○	○

SPACEA Series Ball Screws

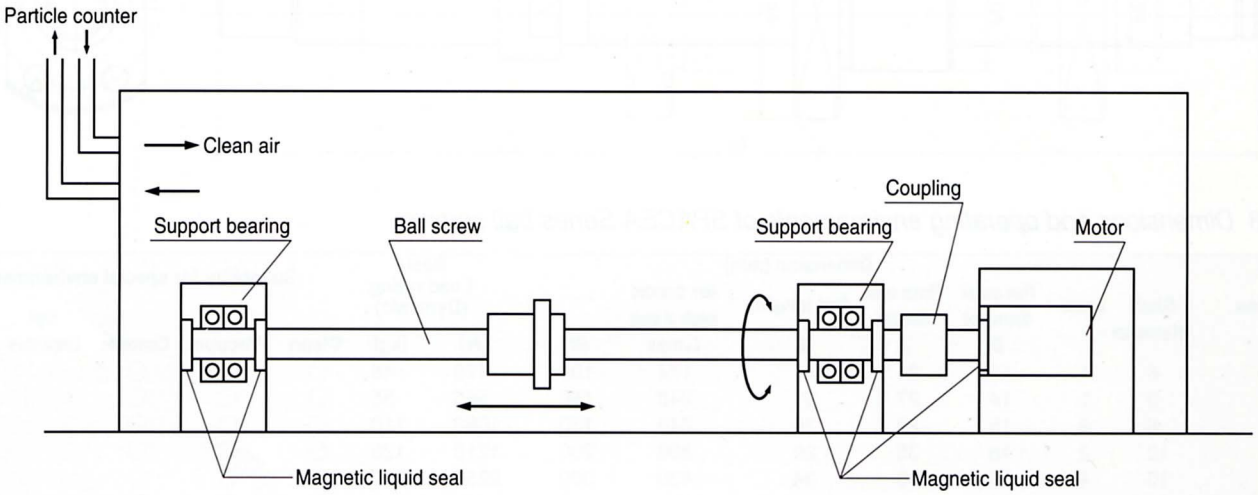
Lubrication technology in SPACEA Series ball screws

NSK Clean Grease LG2

NSK Clean Grease LG2 is used in NSK's Linear Guides, Ball Screws, Monocarriers, Robot Modules, Megathrust Motors, XY tables and a host of other products designed to low-dust specifications for use in clean rooms. Its outstanding performance has won widespread trust and praise among makers of semiconductor manufacturing equipment. In many areas, it outperforms the fluorine greases conventionally used in clean rooms.

Features of NSK Clean Grease LG2

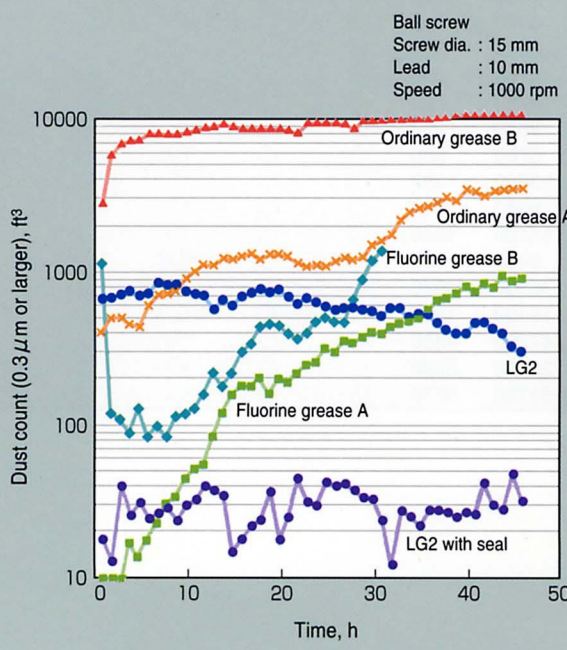
Fig. 49 Measuring the dust count of a ball screw



Feature 1: Outstanding low dust characteristics

LG2 offers stable dust characteristics for even longer than fluorine greases.

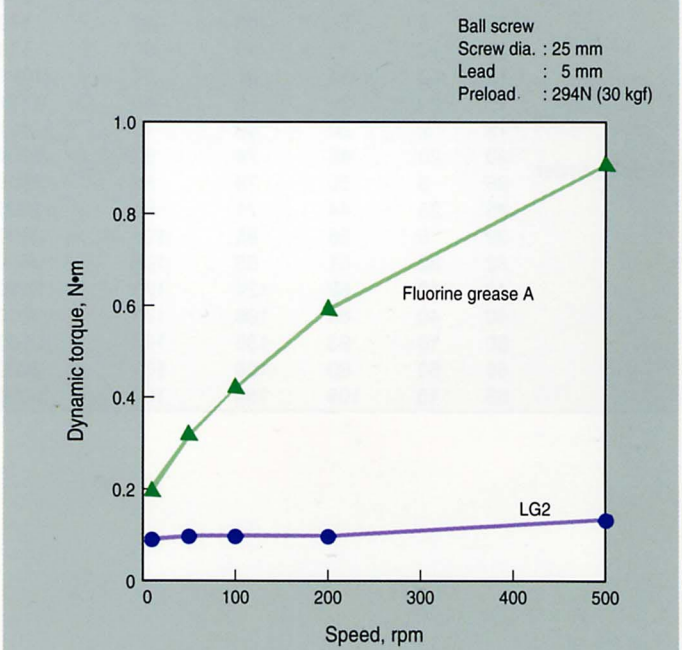
Fig. 50 Comparison of dust characteristics



Feature 2: Stable torque characteristics

LG2 greatly reduces the burden on motors running at high speeds: less than 20% of that of fluorine greases (ball screw at 500 rpm).

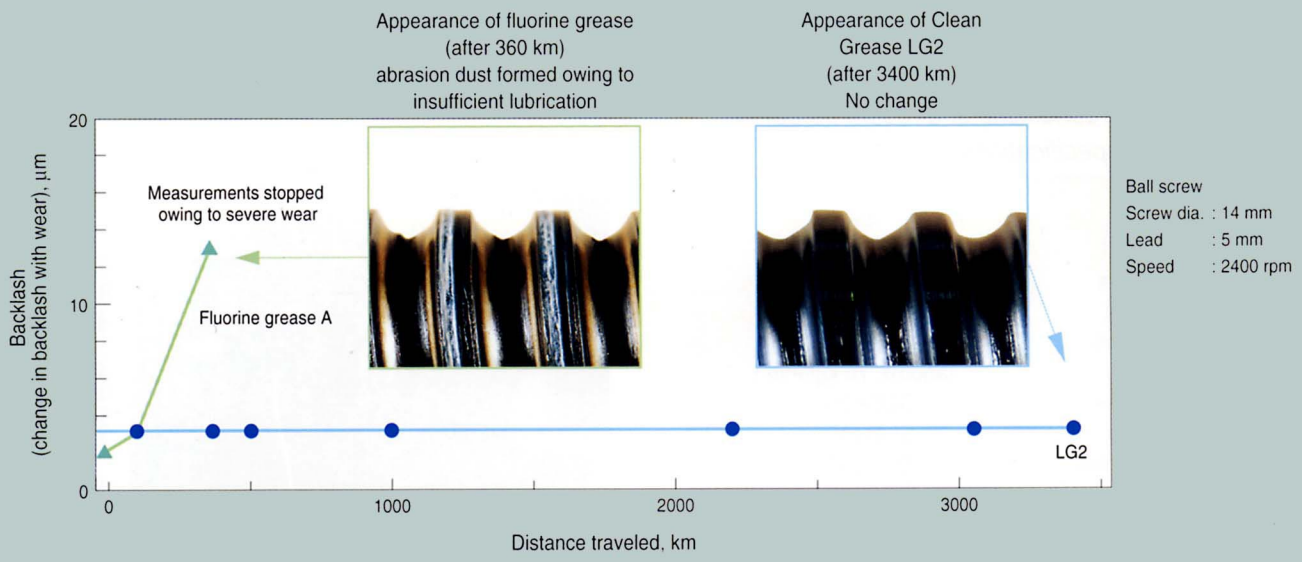
Fig. 51 Comparison of torque characteristics



Feature 3: Long life

LG2 lasts over 10 times longer than fluorine greases and has a service life equivalent to that of ordinary greases, allowing longer maintenance intervals.

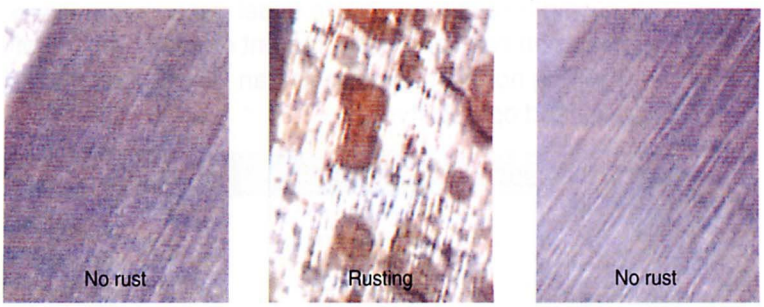
Fig. 52 Durability test of ball screw



Feature 4: Superior rust prevention

LG2 has the rust prevention capability of conventional greases which is far higher than that of fluorocarbon greases.

Fig. 53 Ball screw rust prevention test
(test conditions: 96 hours at humidity 95%, temperature 70°C)



Clean Grease LG2 | Fluorine grease A | Ordinary grease B

Table 9 Bearing rust prevention test

Type	Rust level after 7 days
NSK Clean Grease LG2 LG2	No rust
Fluorine grease B	Rusting
Test conditions	• 19 mg injected into 695 bearing • temperature 90°C, humidity 60%
Evaluation method:	microscope observation

Overall evaluation of Clean Grease LG2

NSK Clean Grease LG2 clearly outperforms conventional greases in many areas. The table below shows an overall evaluation of its performance.

Table 10 Evaluation of Clean Grease LG2

Characteristic	LG2	Fluorine grease	Ordinary grease
Dust count	A	B	D
Torque	A	C	B
Durability	A	D	A
Rust prevention	A	D	A

Note: A: Good B: Good-Poor
C: Poor-Very Poor D: Very Poor

SPACEA Series Ball Screws

Ball screws with silver coating

SPACEA Series ball screws can be coated with soft metal as a solid lubricant (silver coating). These products are designed for use in semiconductor manufacturing equipment, surface improvement devices and other machinery used under vacuum conditions.

Durability tests under vacuum conditions

Testing devices and conditions

The two tables below describe the specifications of the ball screw and the test conditions of a recent durability test of SPACEA Series ball screws.

Table 11 Ball screw specifications

Shaft diameter		2mm
Lead		4mm
Ball diameter		2.381mm
No. of turns x circuits		2.5 x 1
Axial load (Preload)		29.4N{3kgf}
Max. contact pressure (Max. preload)		approx. 690 Pa (approx. 70 kgf/mm^2)
Material	Screw	SUS630
	Nut	SUS440C
	Ball tube	SUS304
	Balls	SUS440C
Solid lubricant		Special silver coating

Table 12 Test conditions

Speed	300rpm
Vacuum	1.3×10^{-5}~1.3×10^{-6}Pa (10^{-7}~10^{-8}torr)
Stroke	160mm

Fig. 54 Vacuum testing device

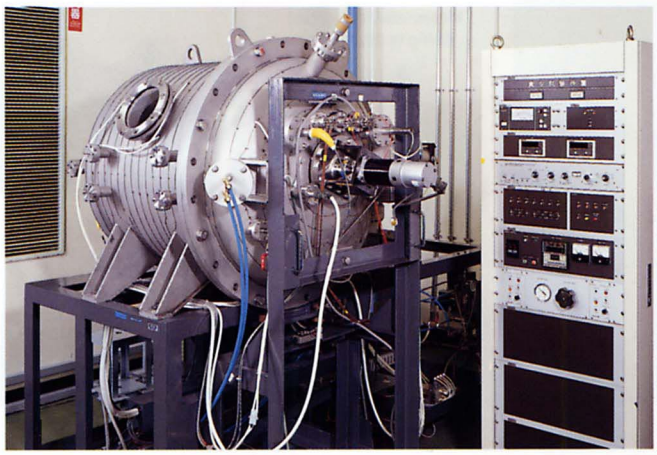


Fig. 55 Schematic drawing of test rig

Method of evaluation

A bearing using a solid lubricant is considered to have reached the end of its service life when the deterioration of the solid lubricant leads to a sharp rise in friction. For this reason, the evaluation of the torque and life of a ball screw using a solid lubricant life under vacuum conditions was based on constant measurement of torque in the ball screw during normal operation and an investigation of its durability and operability.

Results of tests

The results of the torque test are shown in Fig. 56, those of the durability test in Table. 13.

Fig. 56 Result of torque test

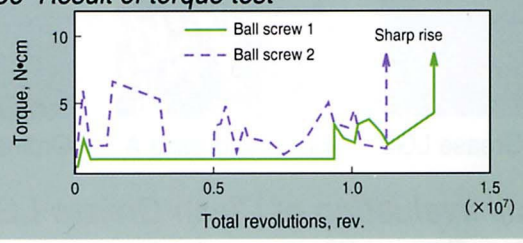


Table 13 Durability of ball screw

		Ball screw 1	Ball screw 2
Service life	Total revolutions, rev.	1.35×10^7	1.13×10^7
	Total distance traveled, km	54.0	45.2
	Total running time, h	750	628

Note: Total running time assumes steady running at 300 rpm.

• Ball screw 1 results

The torque remained fairly stable until around 1 x 10^7 rev but thereafter the characteristics deteriorated somewhat and at approximately 1.35 x 10^7 rev torque rose sharply, suggesting that the service life of the ball screw was at an end.

• Ball screw 2 results

The torque was slightly higher than with ball screw 1, and slightly less stable. During the test, the torque momentarily rose sharply several times (to several N•cm). This is probably due to the soft metal of the coating (silver) shifting repeatedly. Finally, the torque rose sharply at 1.13 x 10^7 rev, and the service life was judged to be at an end.

Overall evaluation

The above test results indicate that if the load on the ball screw is of the order of 29.4 N {3 kgf}, service life will be at least 1 x 10^7 rev. Since the soft metal coating tends to shift several times leading to momentary sharp rises in torque before the ball screw reaches the end of its service life, it seems advisable to select a drive motor with ample spare torque capacity.