SPACEA Series NSK Linear Guides

The SPACEA Series includes a range of NSK linear guides adapted to a wide variety of special operating conditions.

The table on this page shows the principal specifications and operating conditions of NSK Linear Guides in the SPACEA Series.

Table. 14 Specifications and operating conditions of SPACEA Series NSK Linear Guides

Environment	Operating conditions	NSK Linear Guide specifications				For more technical data see page(s)...
		Rail / Ball slides	Balls	Recirculation components	Lubricant / Surface treatment	
Clean	Air, room temperature	Standard material	Standard material	Standard material	Clean Grease LG2, K1 Seal	3, 4, 23, 24, 29,30
		Martensite stainless steel	Martensite stainless steel	Austenite stainless steel	Clean Grease LG2, K1 Seal Fluoride Low-Temperature Chrome Coating	3, 4, 23, 24, 29, 30, 31, 32
	Air-vacuum, room temperature				Fluorine grease	
	Air-vacuum, up to 200°C					
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	Water vapor, water	Martensite stainless steel	Martensite stainless steel	Austenite stainless steel		
	Acids, alkalis	Standard material	Standard material	Standard material	Fluoride Low-Temperature Chrome Coating	5, 31, 32
	Acids, alkalis, clean conditions	Martensite stainless steel	Martensite stainless steel	Austenite stainless steel	Fluoride Low-Temperature Chrome Coating Clean Grease LG2	3, 5, 23, 24, 31, 32
	Strong acids, strong alkalis				Fluoride Low-Temperature Chrome Coating Fluorine grease	5, 31, 32
	Organic solvents				Fluorine grease	
High-Temperature	Air, up to 150°C	Standard material	Standard material	Austenite stainless steel	ET 150 grease	
	Air, up to 200°C	Martensite stainless steel	Martensite stainless steel		Fluorine grease	
	Air, up to 200°C, corrosive				Fluoride Low-Temperature Chrome Coating Fluorine grease	5, 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	K1 Seal	3, 4, 29, 30
		Martensite stainless steel	Martensite stainless steel	Austenite stainless steel		
	Water, under water		Standard material	Standard material		
			Martensite stainless steel	Austenite stainless steel		

SPACEA Series NSK Linear Guides

Dimensions and operating environments

The tables on these two pages show the principal dimensions of SPACEA Series NSK Linear Guides and their suitability for various operating environments.

Fig. 57.1 Models LS-AL, LS-CL

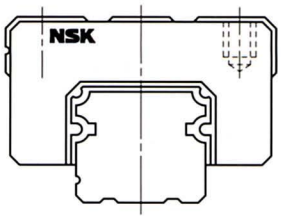


Fig. 57.2 Models LH-AN, LH-BN

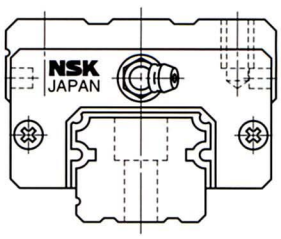


Fig. 57.3 Models LS-EL, LH-EL, LH-GL

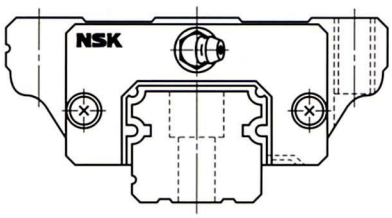
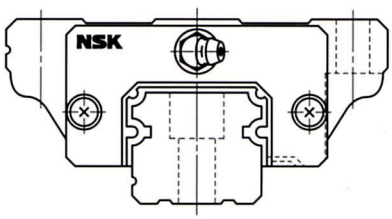


Fig. 57.4 Models LS-FL, LS-KL, LH-FL, LH-HL



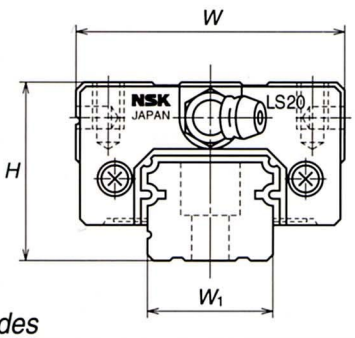


Table 15.1 Dimensions and operating environments of SPACEA Series NSK Linear Guides

Series	Model No.	Height	Overall width	Dimension (mm) Ball slide length L		Rail width	Maximum rail length	Basic load rating (Dynamic)		Suitability for special environments				
		H	W	standard	with K1 Seal	W_1	L_0max	(N)	{kgf}	Clean	Vacuum	Corrosive	High-temperature	Foreign particle contaminated
LU	LU09AR	10	20	30	36.4	9	275	1470	150	○	○	○	○	○
	LU09TR	10	20	30	36.4	9	275	1470	150	○	○	○	○	○
	LU12AR	13	27	35.2	42.2	12	470	2160	220	○	○	○	○	○
	LU12TR	13	27	35.2	42.2	12	470	2160	220	○	○	○	○	○
	LU15AL	16	32	43.6	51.8	15	670	4300	440	○	○	○	○	○
LE	LE09AR	12	30	39.8	46.8	18	400	2450	250	○	○	○		○
	LE09TR	12	30	39.8	46.8	18	400	2450	250	○	○	○		○
	LE12AR	14	40	45	53	24	800	3550	360	○	○	○	○	○
	LE15AR	16	60	56.6	66.2	42	1000	6200	630	○	○	○	○	○
LW	LW17EL	17	60	51.4	61.6	33	1000	4200	430				○	○
	LW21EL	21	68	58.8	71.4	37	1600	4700	480				○	○
	LW27EL	27	80	74	86.6	42	2000	9800	1000					○
	LW35EL	35	120	108	123	69	2400	25700	2620					○
LS	LS15CL	24	34	40.4	50	15	1000	4550	465	○	○	○	○	○
	LS15AL	24	34	56.8	66.4	15	1000	6700	685	○	○	○	○	○
	LS15KL	24	52	40.4	50	15	1000	4550	465	○	○	○	○	○
	LS15FL	24	52	56.8	66.4	15	1000	6700	685	○	○	○	○	○
	LS15EL	24	52	56.8	66.4	15	1000	6700	685	○	○	○	○	○
	LS20CL	28	42	47.2	57.8	20	3500	6550	670	○	○	○	○	○
	LS20AL	28	42	65.2	75.8	20	3500	8900	910	○	○	○	○	○
	LS20KL	28	59	47.2	57.8	20	3500	6550	670	○	○	○	○	○
	LS20FL	28	59	65.2	75.8	20	3500	8900	910	○	○	○	○	○
	LS20EL	28	59	65.2	75.8	20	3500	8900	910	○	○	○	○	○
	LS25CL	33	48	59.4	70	23	3500	10600	1080	○	○	○	○	○
	LS25AL	33	48	81.4	92	23	3500	14400	1470	○	○	○	○	○
	LS25KL	33	73	59.4	70	23	3500	10600	1080	○	○	○	○	○
	LS25FL	33	73	81.4	92	23	3500	14400	1470	○	○	○	○	○
	LS25EL	33	73	81.4	92	23	3500	14400	1470	○	○	○	○	○
	LS30CL	42	60	67.4	79.4	28	3500	15900	1620	○	○	○	○	○
	LS30AL	42	60	96.4	108.4	28	3500	23400	2390	○	○	○	○	○
	LS30KL	42	90	67.4	79.4	28	3500	15900	1620	○	○	○	○	○
	LS30FL	42	90	96.4	108.4	28	3500	23400	2390	○	○	○	○	○
	LS30EL	42	90	96.4	108.4	28	3500	23400	2390	○	○	○	○	○
	LS35CL	48	70	77	90	34	3500	22100	2250					○
	LS35AL	48	70	108	121	34	3500	32500	3320					○
	LS35KL	48	100	77	90	34	3500	22100	2250					○
	LS35FL	48	100	108	121	34	3500	32500	3320					○
	LS35EL	48	100	108	121	34	3500	32500	3320					○

Fig. 57.5 Models LU-AR, LU-TR, LU-AL

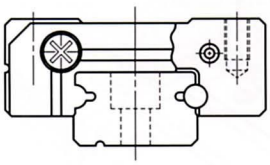


Fig. 57.6 Models LE-AR, LE-TR

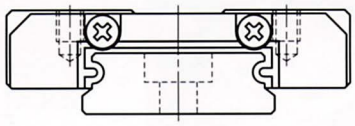
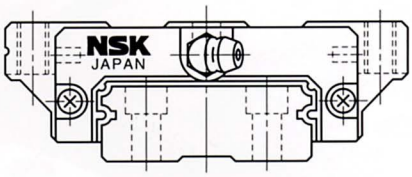


Fig. 57.7 Models LW-EL



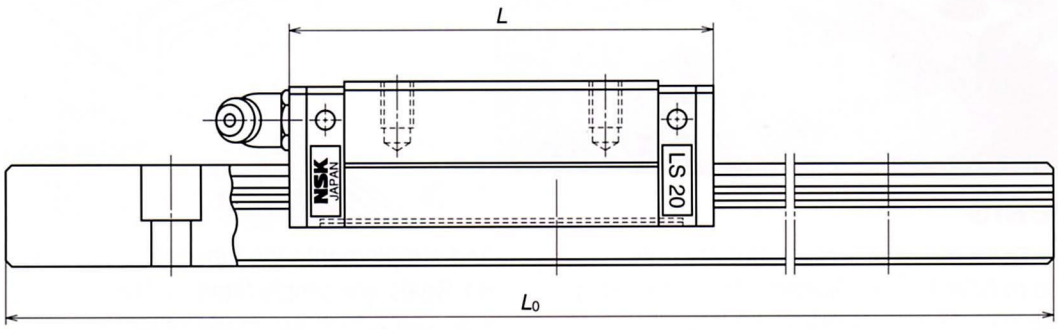


Table 15.2 Dimensions and operating environments of SPACEA Series NSK Linear Guides

Series	Model No.	Height	Overall width	Dimension (mm) Ball slide length L		Rail width	Maximum rail length	Basic load rating (Dynamic)		Suitability for special environments				
		H	W	standard	with K1 Seal	W_1	L_0max	(N)	{kgf}	Clean	Vacuum	Corrosive	High-temperature	Foreign particle contaminated
LH	LH20AN	30	44	69.8	80.4	20	3500	14200	1450	○	○	○	○	○
	LH20BN	30	44	91.8	102.4	20	3500	18200	1860	○	○	○	○	○
	LH20FL	30	63	69.8	80.4	20	3500	14200	1450	○	○	○	○	○
	LH20HL	30	63	91.8	102.4	20	3500	18200	1860	○	○	○	○	○
	LH20EL	30	63	69.8	80.4	20	3500	14200	1450	○	○	○	○	○
	LH20GL	30	63	91.8	102.4	20	3500	18200	1860	○	○	○	○	○
	LH25AN	40	48	79	90.6	23	3500	21000	2140	○	○	○	○	○
	LH25BN	40	48	107	118.6	23	3500	26900	2740	○	○	○	○	○
	LH25FL	36	70	79	90.6	23	3500	21000	2140	○	○	○	○	○
	LH25HL	36	70	107	118.6	23	3500	26900	2740	○	○	○	○	○
	LH25EL	36	70	79	90.6	23	3500	21000	2140	○	○	○	○	○
	LH25GL	36	70	107	118.6	23	3500	26900	2740	○	○	○	○	○
	LH30AN	45	60	85.6	97.6	28	3500	25700	2620	○	○	○	○	○
	LH30BN	45	60	124.6	136.6	28	3500	37500	3800	○	○	○	○	○
	LH30FL	42	90	98.6	110.6	28	3500	25700	2620	○	○	○	○	○
	LH30HL	42	90	124.6	136.6	28	3500	37500	3800	○	○	○	○	○
	LH30EL	42	90	98.6	110.6	28	3500	25700	2620	○	○	○	○	○
	LH30GL	42	90	124.6	136.6	28	3500	37500	3800	○	○	○	○	○
	LH35AN	55	70	109	122	34	4000	39000	3960				○	○
	LH35BN	55	70	143	156	34	4000	49500	5060				○	○
	LH35FL	48	100	109	122	34	4000	39000	3960				○	○
	LH35HL	48	100	143	156	34	4000	49500	5060				○	○
	LH35EL	48	100	109	122	34	4000	39000	3960				○	○
	LH35GL	48	100	143	156	34	4000	49500	5060				○	○
	LH45AN	70	86	139	154	45	3990	66000	6740				○	○
	LH45BN	70	86	171	186	45	3990	79500	8130				○	○
	LH45FL	60	120	139	154	45	3990	66000	6740				○	○
	LH45HL	60	120	171	186	45	3990	79500	8130				○	○
	LH45EL	60	120	139	154	45	3990	66000	6740				○	○
	LH45GL	60	120	171	186	45	3990	79500	8130				○	○
	LH55AN	80	100	163	178	53	3960	97500	9940				○	○
	LH55BN	80	100	201	216	53	3960	118000	12000				○	○
	LH55FL	70	140	163	178	53	3960	97500	9940				○	○
	LH55HL	70	140	201	216	53	3960	118000	12000				○	○
	LH55EL	70	140	163	178	53	3960	97500	9940				○	○
	LH55GL	70	140	201	216	53	3960	118000	12000				○	○

SPACEA Series NSK Linear Guides

Lubrication and surface treatment of SPACEA Series NSK Linear Guides

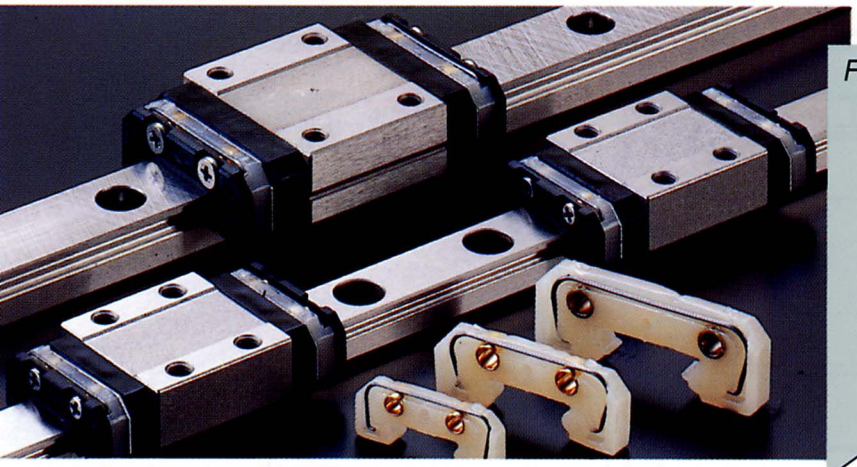
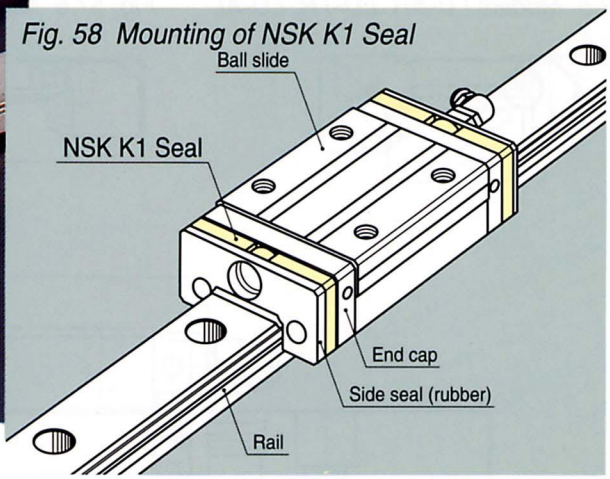


Fig. 58 Mounting of NSK K1 Seal



NSK K1 Seals

NSK K1 Seals are seals made of a revolutionary new material, and fitted to NSK Linear Guides. The material is a "porous synthetic resin" which contains a high proportion of lubricating oil. This oil is gradually exuded and supplements the lubrication of the linear guide. NSK K1 Seals are simply fitted on the inside of the standard side seal which are made of rubber.

Characteristics

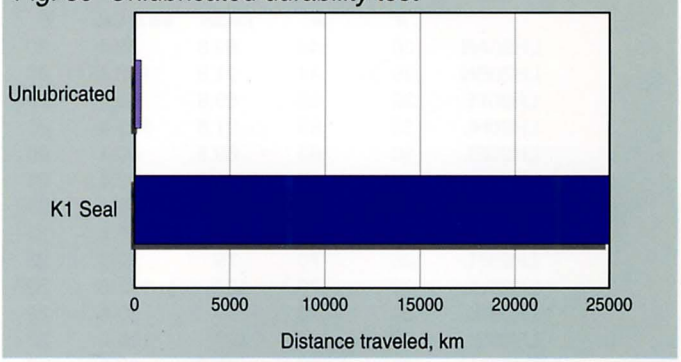
• High-speed unlubricated durability test

Fig. 59 shows the results of a test of linear guide durability at high speeds with no lubrication at all and with a K1 Seal. The unlubricated linear guide became unusable (damaged) in a short space of time, but the linear guide with the K1 Seal covered a distance of 25,000 km without mishap.

Conditions:

Linear guide:	LH30AN (preload Z1)
Speed:	200m/min.
Stroke:	1800 mm
Unlubricated:	fully degreased, no lubricant added
K1 Seal:	fully degreased, K1 Seal fitted

Fig. 59 Unlubricated durability test

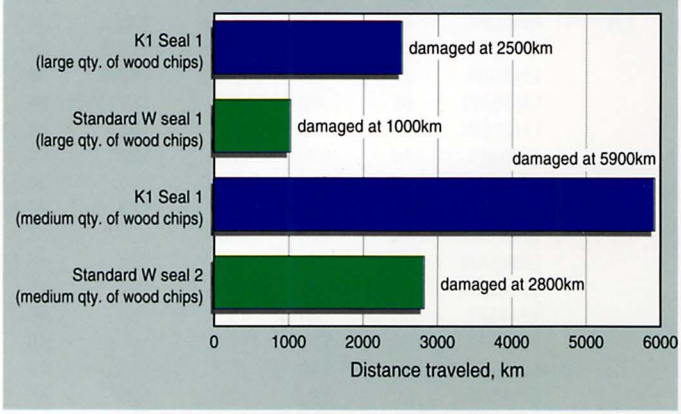


Wood chips durability test

Wood chips absorbs lubricating oil and is therefore a particularly difficult environmental condition (Fig. 60), but as is clear from Fig. 61 a linear guide with K1 Seals will have a service life twice as long as that of a linear guide fitted with double conventional seals.

Fig. 60 Durability test of linear guide exposed to wood chips

Fig. 61 Wood chips durability test



Conditions:

Linear guide:	LH30AN (preload Z1)
Speed:	24 m/min.
Stroke:	490 mm
Load:	490 N / bearing

Seal specifications/lubrication

Standard W seal: standard W seal + AV2 grease

K1 Seal: K1 Seal + standard seal + AV2 grease

Wood chips: 1 - large qty. of wood chips 2 - medium qty. of wood chips

Water immersion test

Once a week, NSK's research laboratories conduct a test in which an NSK Linear Guide is made to run continuously for 24 hours, totally immersed in water. The results of these tests are shown in Fig. 62. When the Linear Guide is not fitted with K1 Seals, the ball groove quickly becomes worn and the bearing fails, but when K1 Seals are fitted, wear is reduced to approximately 1/3 (see Table. 16) confirming that the seals provide a significant lubricating effect.

Conditions:

Linear guide:	LS30 stainless steel (preload Z1)
Speed:	24m/min.
Stroke:	400 mm
Load:	4700 N/bearing
Lubrication:	full pack of food processing machinery grease
(US made; typical characteristics:	
	consistency 280/basic oil viscosity: 580 (cSt)
Water immersion:	run once a week for 24 hours,
	fully immersed in water

Dust characteristics

Fig. 63 compares the dust characteristics of linear guides under various forms of lubrication. It reveals that the combination of K1 Seals with NSK Clean Grease LG2 has a dust-reducing effect equivalent to using vacuum grease.

Conditions:

Linear guide:	LS20
Speed:	36m/min.

Oil and chemical resistance

Table. 17 records the results of a test in which K1 Seals were immersed in chemicals and oils at 40°C. K1 Seals were found to be stable when in contact with grease and cutting lubricants, and use in combination with these substances presents no problems. However exposure to chemicals with degreasing properties (white kerosene, hexane, etc.) caused the surface of the seals to suffer a sharp loss of oil content suggesting that their lubricating effect may deteriorate under these conditions.

Fig. 62 Water immersion test

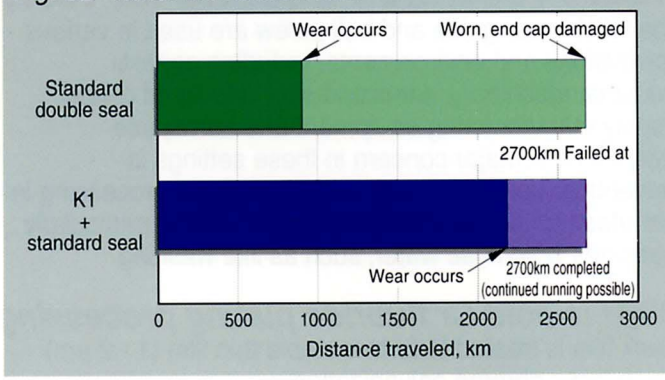


Table 16 Comparison of wear to ball grooves and balls (Unit: μm)

Lubrication	Ball slide groove	Rail groove	Balls
K1 Seal fitted	16~18	2~3	6~8
K1 Seal not fitted	30~45	9~11	17~25

Fig. 63 Comparison of dust characteristics

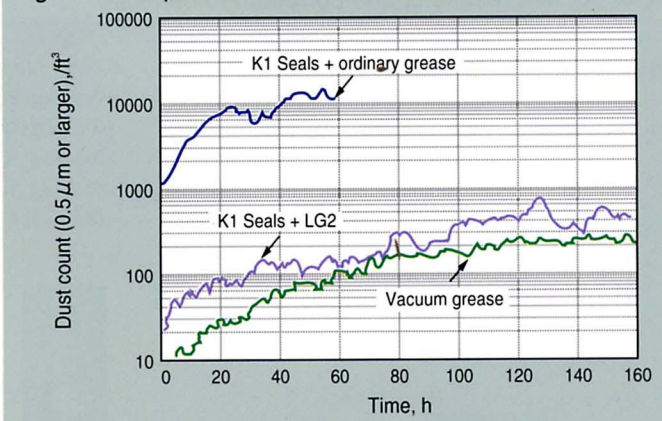


Table 17 Compatibility of K1 Seals with oils and chemicals

Chemical/oil	Compatibility
Cutting lubricants (water based, oil based)	A
Grease (mineral oil based, ester based)	A
Rust preventatives (without solvents)	A
Rust preventatives (with solvents)	B
White kerosene	B
Hexane	C

A: compatible
B: proceed with caution
(no problem if for short periods only)
C: incompatible

SPACEA Series NSK Linear Guides

Rust Prevention Coating for NSK Linear Guides® and Ball Screws

The NSK linear guide and ball screw are used in various applications and environments, including general industrial machinery, semiconductor and liquid crystal display manufacturing equipment and aerospace equipment. A major concern in these settings is preventing rust which may occur during wet processing in manufacturing equipment utilizing chemicals, particularly machines which use water, such as like washing machines and in various manufacturing stages of semiconductors and liquid crystal display. NSK applies a fluororesin coating as a surface treatment on electrolytic rustproofing black film (cold Cr fluoride plating) as the optimal rust prevention coating for linear guide and ball screws in such machines and equipment, with successful results. Experimental data supporting these findings is provided below.

What is cold Cr fluoride plating processing?

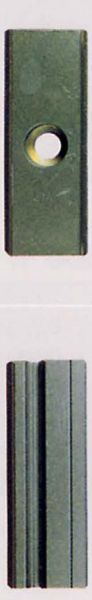
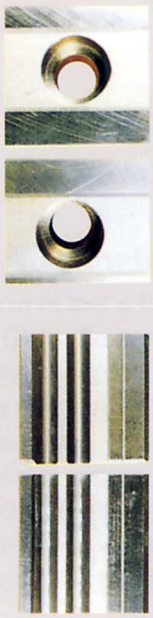
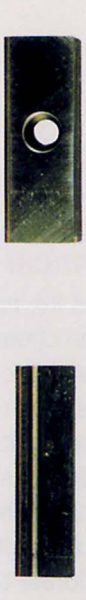
Black film is treated to form a stable thin film (1 - 2 μm) which lacks chrome galvanization.
In addition, a fluororesin coating is applied to this film to increase corrosion resistance.

- This low-temperature treatment with no hydrogen brittleness enables stable, accurate control.
- The thin film and resistance to corrosion reduces factors which might adversely affect the accuracy of parts.
- Very high durability on rolling surfaces compared with other surface treatments.
- Lower in price compared with other surface treatments and stainless products.

Review of experimental data

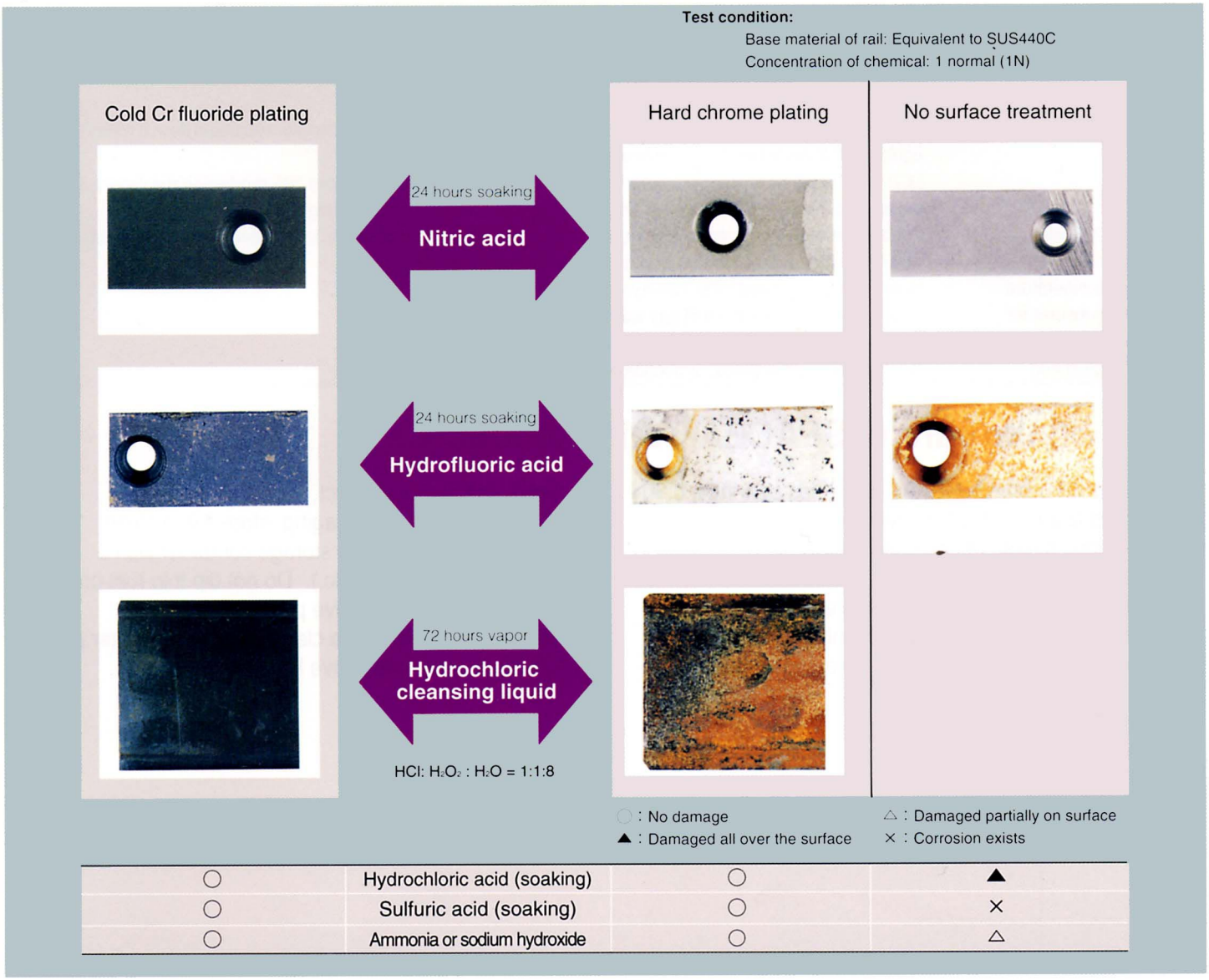
Table 18 test results of anti-corrosion to humidity

Rust condition — A: No rust, B: Discoloration, but no rust, C: Spot rust, D: Light rust, E: Totally rusted

Characteristic	Sample	Cold Cr fluoride plating	Hard chrome plating	Electrolysis nickel plating	Equivalent material to SUS440C	Standard product
Rust condition	Upper face	(Grinding) B	(Grinding) B	(Grinding) A	(Grinding) C	(Grinding) D
	Side face	(Grinding) A	(Grinding) A	(Grinding) A	(Grinding) C	(Grinding) E
	Bottom face	(Grinding) A	(Grinding) A	(Grinding) A	(Grinding) C	(Grinding) E
	End face	(Cutting) A	(Cutting) C	(Cutting) A	(Cutting) C	(Cutting) E
	Chamfer, Grinding off	(Drawing) A	(Drawing) D	(Drawing) A	(Drawing) C	(Drawing) E
Rustproofing capability	<Test condition> • Testing machine: Dabaiespeck High temperature and high humidity vessel • Temperature: 70°C • Relative humidity: 95% • Time: 96 hours To/from the setting condition of temperature and humidity Rise time: 5 hours Fall time: 2 hours					
	Film thickness	5 μm	0.5 – 7 μm	10 μm	—	—

Test results of anti-corrosion to chemical exposure

Fig. 64 test results anti-corrosion to chemical exposure



○	Hydrochloric acid (soaking)	○	▲
○	Sulfuric acid (soaking)	○	×
○	Ammonia or sodium hydroxide	○	△

Fig. 65 Test results of durability to surface treatment

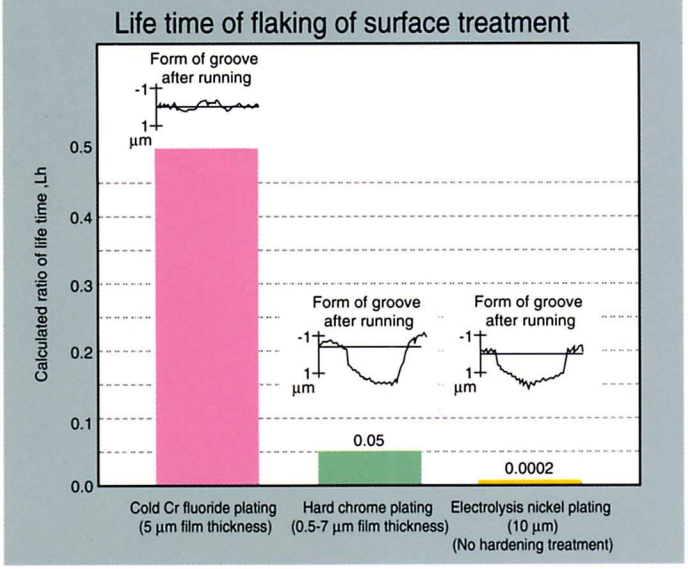


Table 19 Total evaluation

	Available length	Rustproofing capability	Stability of quality	Durability	Cost
Cold Cr fluoride plating	◎ (4m)	◎	○	◎	◎
Hard chrome plating	△ (2m)	○	×	△	△
Electrolysis nickel plating	◎ (4m)	◎	△	×	△
Equivalent material to SUS440C	○ (3.5m)	○	◎	◎	△

◎: Superior
○: No problem for use
△: Not as good
×: Problem réstricting use

Applications of SPACEA Series products

The table below lists some of the major applications of SPACEA Series products.

Applications of the SPACEA Series

Series	Applications
Clean	LCD panel production machinery, semiconductor production machinery, hard disk production machinery, food processing machinery, pharmaceutical production machinery
Vacuum	Space exploration equipment, vacuum devices, stepping motors for vacuum use, electronic device manufacturing equipment, X-ray tubes, turbo molecular drag pumps
Corrosion resistant	LCD panel production machinery, semiconductor production machinery, hard disk production machinery, food processing machinery, hot dipping tanks, film production machinery, cleaning equipment
K1 Seals	Food processing machinery, wood working machinery, cleaning machinery, iron & steel processing machinery
Non-magnetic	Semiconductor production equipment, medical diagnostic equipment
High temperature	Heat treatment furnace roller conveyors, kiln cars
Low temperature	Liquid fuel turbo pumps, liquid gas submerged pumps
Radiation resistant	Nuclear reactors, fusion reactors, accelerators
High speed	Machine tools, jet engines, turbochargers

Notes on the care of SPACEA Series products

To get the most from your SPACEA Series bearings, ball screws and linear guides for special operating environments, please observe the following precautions:

- The product is fully degreased before being wrapped in humidity-resistant packaging. To limit the risk of corrosion, etc. do not open the packaging until you are ready to use the product.
- After opening the packaging, store it in a clean dessicator or other dry storage container with a desiccant (silica gel, etc.). Do not dip it in rust preventor or wrap it in anticorrosive paper.
- Handle the product in a clean location and wear plastic gloves or other protective handwear.

System requirements form

In preparation for ordering NSK SPACEA Series bearings, you may wish to note your system requirements on this form. All the information you give us will help to ensure that the components selected provide the optimum performance for your needs. If you would like more detailed information, please contact your NSK representative at one of our worldwide offices listed on the back cover.
Please contact NSK for assistance in selecting SPACEA Series ball screws and linear guides.

Your name _____

Department _____

Company _____

Address _____

Phone _____

Fax _____

Model number /dimensions	Basic model number			If model ordered is special size (d x D x B)		
				Ø x Ø x		
Equipment for which bearing will be used	1. New equipment	2. Experience of use with similar equipment		3. Replacement purposes		
	Type (model No.)	Capacity		Number used per machine		
Location used		1. Free side	2. Fixed side	3. Horizontal axis	4. Vertical axis	5. Diagonal axis
Operating conditions	Rotation mode	1. Inner ring turns 2. Outer ring turns 3. Inner and outer rings turn 4. Continuous 5. Intermittent 6. Fluctuating 7. Reversing 8. Sudden acceleration 9. Vibration 10. Other ( ):				
	Speed (rpm)	Minimum	Normal (continious)	Maximum		
	Loading (N)		Maximum load	Normal load (continious)		
	Radial					
	Axial					
	Type of load	1. Vibration 2. Shock 3. Fluctuation 4. Moment 5. Other ( ):				
	Temperature (°C)	Bearing, ball screw or NSK linear Guide		Ambient		
	Environment	1. Air 2. Air- vacuum 3. Vacuum 4. Other ( ):				
		Cleanliness				
		Pressure: Pa				
		Corrosive gases	F-based	Cl-based	Br-based	Other ( ):
		Corrosive liquids	Acid	Alkaline	Other ( ):	
Current specifications	Material	Inner ring:	Outer ring:	Balls:	Cage:	
	Lubricant:					
	Other:					
	Frequency of replacement:					
Diagram of installation site or other appropriate information						