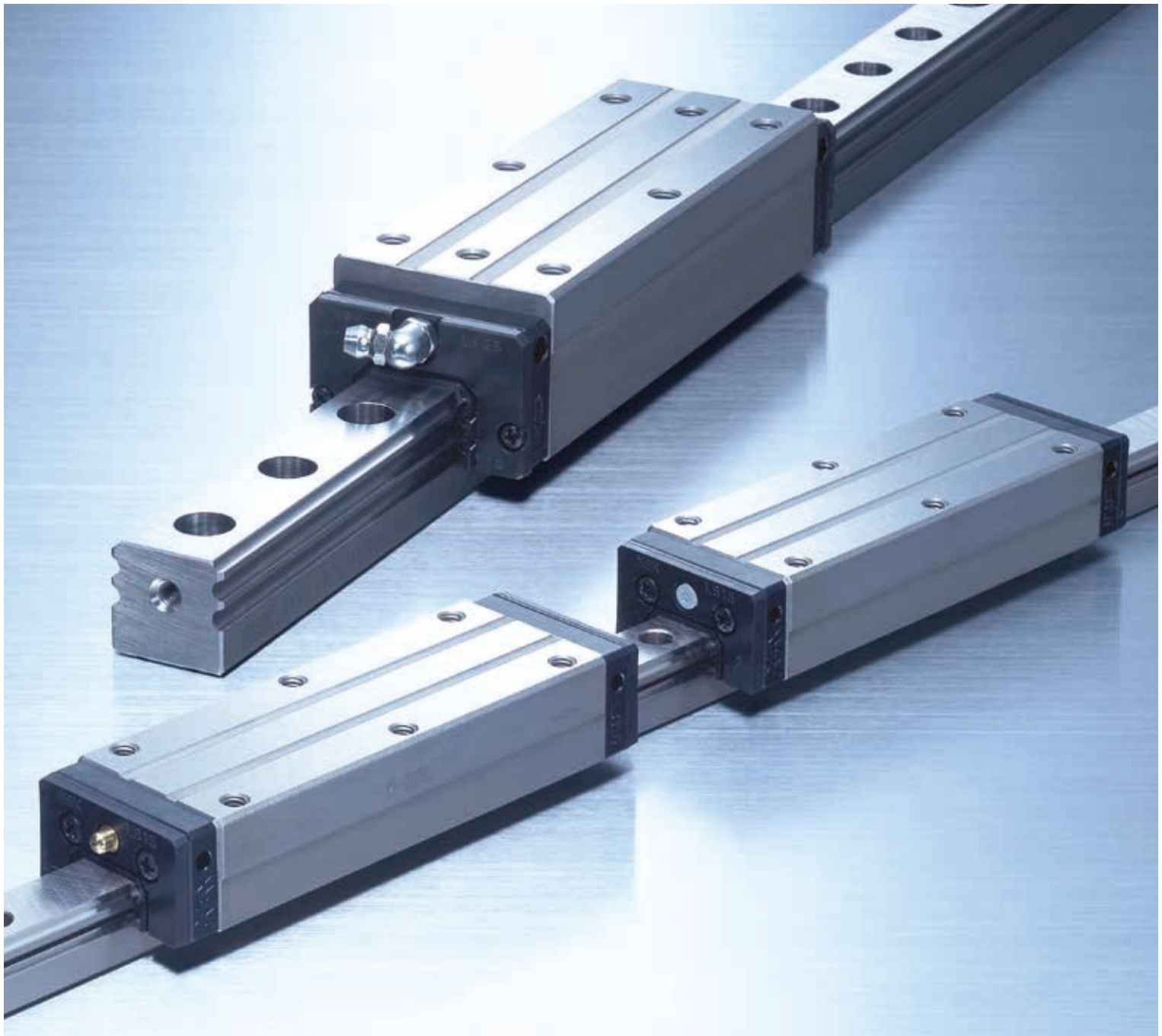


NSK Linear Guide™

High-Accuracy Series: HA/HS Models

Suitable for equipment ranging from machine tools to high-precision instruments—high-performance linear guides with premier motion accuracy



High motion accuracy, high rigidity, high load capacity realized NSK Linear Guide "High-Accuracy Series HA Model and HS Model"

Trends toward higher performance and enhanced quality of electronics equipment and precision instruments have been accelerating. At the same time, demand has been growing for highly precise production systems that manufacture such equipment and instruments. High-Accuracy Series achieves high motion accuracy, high rigidity and high load capacity while reducing frictional resistance.

"The High-Accuracy Series" is available for machine tools such as machining centers and high-precision lathes, as well as for high-precision instruments for manufacturing semi-conductors and liquid crystal displays, among other applications, all of which are required to meet the ever-increasing demand for higher accuracy. These linear guides are therefore well-suited for a broad variety of machinery and equipment that are expected to deliver high-level performance.



1. High motion accuracy

High motion accuracy is achieved in both narrow and wide ranges by adopting ultra-long ball slides and optimum design features for the ball recirculation component.

2. Ball passage vibration reduced to one-third of our conventional models

Tests show ball passage vibration has been reduced to one-third of our conventional models, dramatically improving table straightness.

3. Installation of rail with greater accuracy

Increased counterbore depth of the rail mounting hole reduces rail deflection, which is caused by bolt tightening when fixing the rail to the base component, to 50% or less. This feature restrains the pitching motion of ball slide whose frequency matches to the mounting hole pitch. In addition, the length of mounting hole pitch has been reduced by one-half of the conventional models, so the rail can be more accurately installed in position.

4. High rigidity and load capacity with lower friction

High rigidity, high load capacity and low friction are achieved by increasing the number of balls.

5. Compact design

Reduced body size enables more compact machinery.

Linear Guide
HA Model



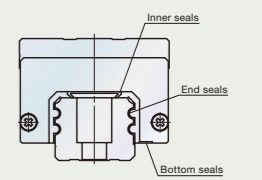
NSK Linear Guide, High-Accuracy Series



●Dust-resistant components

End seals, bottom seals, and inner seals are built-in as standard features, facilitating long-term machining capability with high accuracy.

Fig. 1 Fitting positions of each seal



Linear Guide
HA Model

HA Model applications

The HA Model linear guides feature improved dust resistance and are ideal for such machines as machining centers, high-precision lathes and grinding machines, for which higher motion accuracy is required.

In addition, they are suitable for discharge machines because of their low friction and high rigidity.

●Low friction, compact size

●Dust-resistant components

As standard equipment, the ball slides have an end seal on both ends.

●Stainless steel models are also available

In order to flexibly meet a variety of needs, stainless steel models that are highly resistant to corrosion are also optionally available.

Linear Guide
HS Model

HS Model applications

The HS Model linear guides place special emphasis on lower frictional resistance and compactness and are therefore best suited for dicers, slicers and various manufacturing devices for semi-conductors and liquid crystal displays, for which high-grade accurate surface finish operations are required, including measuring instruments for making highly accurate measurements.

Table 1 Examples of High-Accuracy Series applications (based on actual results)

Application	Adverse effects from ball passage vibration	Advantages of High-Accuracy Series
Machining center, grinding machine, dicer, and slicer	Poor finish of worked surface	<ul style="list-style-type: none"> ● Ultra-long ball slides control posture changes which may be caused by ball passage vibration and rail waviness. ● Optimum design of ball recirculation components enables the ball to move smoothly and restrain ball passage vibration. ● Deep counterbore of mounting hole for rail contributes to reducing possible rail deformation and restricting pitching motion.
Coater (linear motion type)	Uneven coated surface of resist	
Plastics processing equipment	Flaw nearly twice as large as ball diameter in pitch occurs in worked surface	
High-precision table	Deterioration in motion accuracy of table	

Test results of ball passage vibration

Ball passage vibration can translate into posture changes in the ball slide which result from ball passage (circulation). In the High-Accuracy Series, this vibration has been substantially reduced to one-third of conventional models.

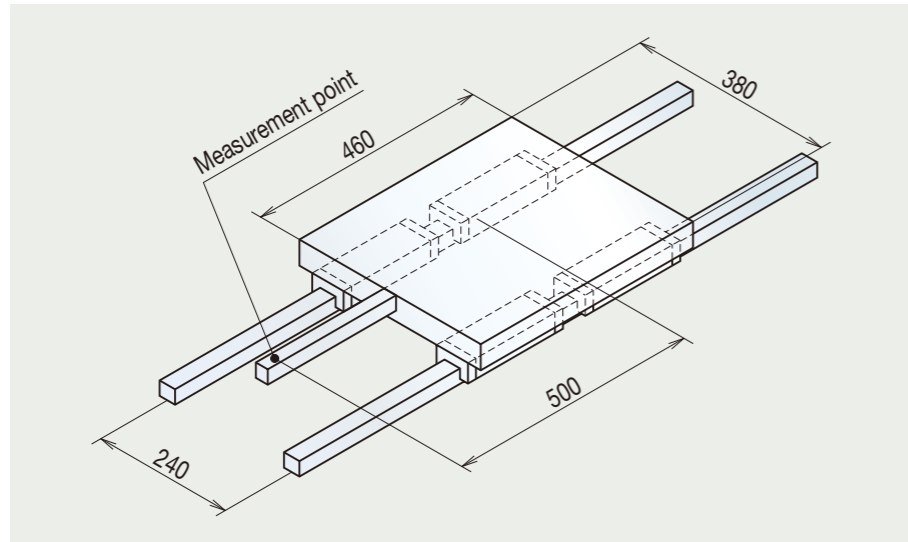
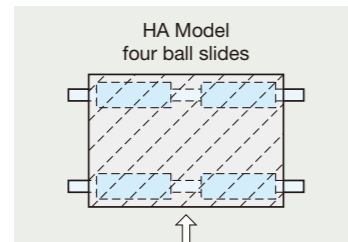


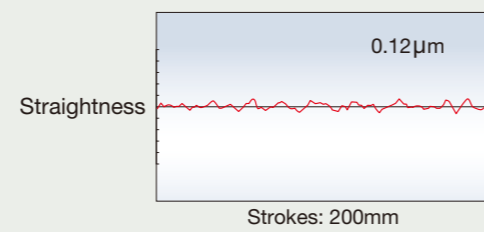
Fig. 2 Schematic view of measurement of ball passage vibration

HA Model

Model No.: HA30
Preload: Z3



The same table is used.



Conventional models

Model No.: LA30
Preload: Z3

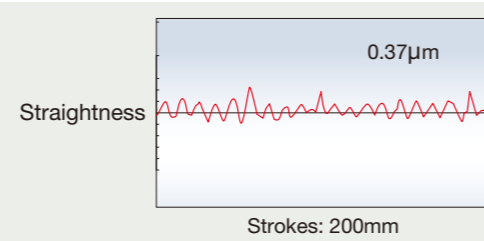
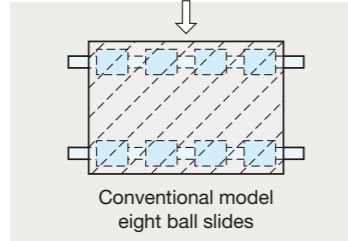
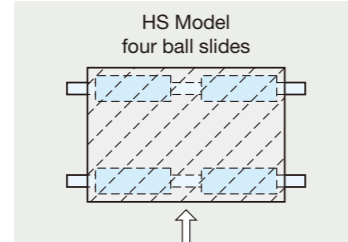


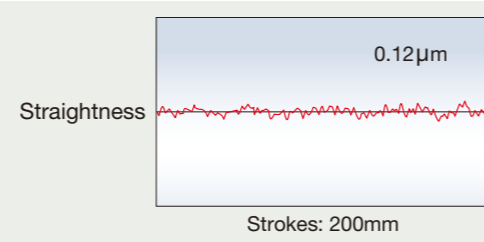
Fig. 3 Measurement results of HA Model and conventional models

HS Model

Model No.: HS30
Preload: Z1



The same table is used.



Conventional models

Model No.: LS30
Preload: Z1

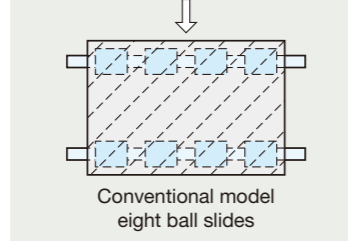


Fig. 4 Measurement results of HS Model and conventional models

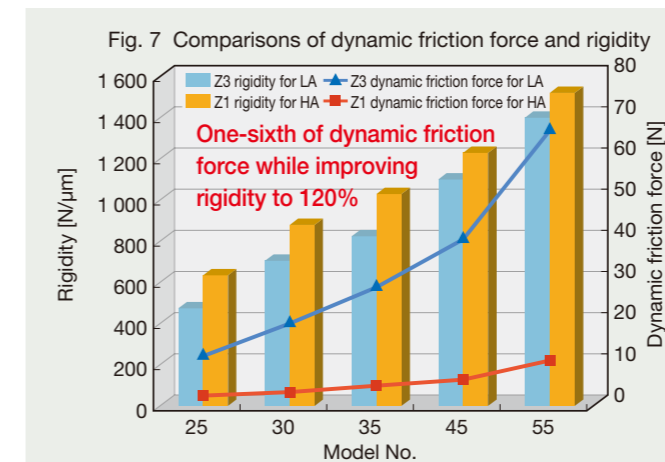
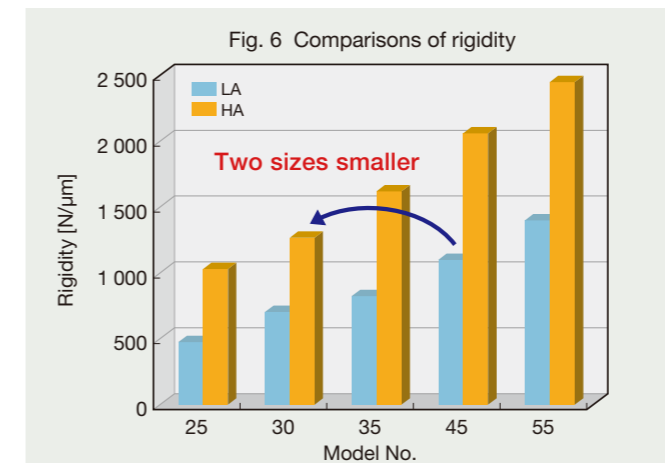
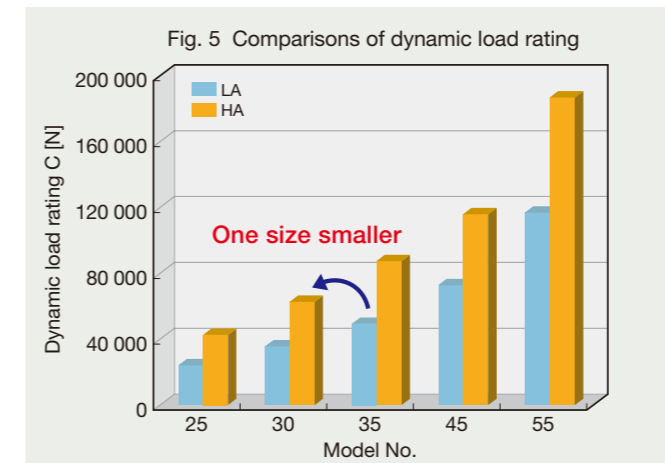
High rigidity and high load capacity with low friction

Substantially increasing the number of balls in both HA Model and HS Model achieves higher rigidity and load capacity as well as reduced frictional resistance, compared to our conventional models.

HA Model

For example, comparing HA Model with our conventional LA35,

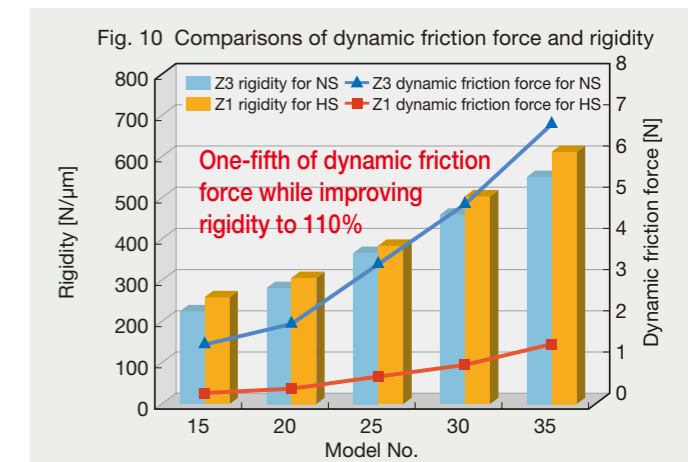
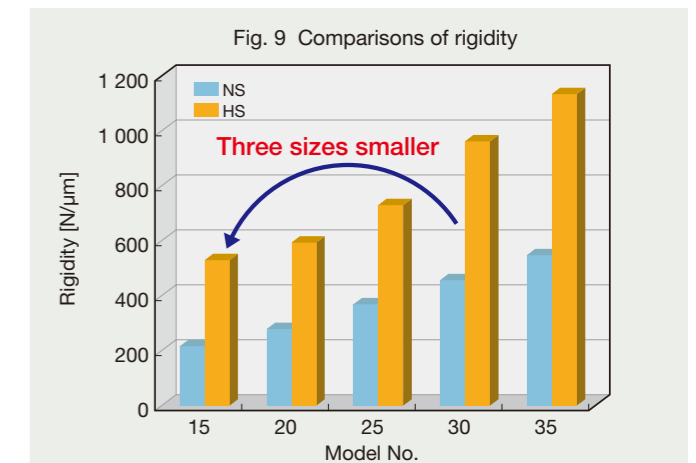
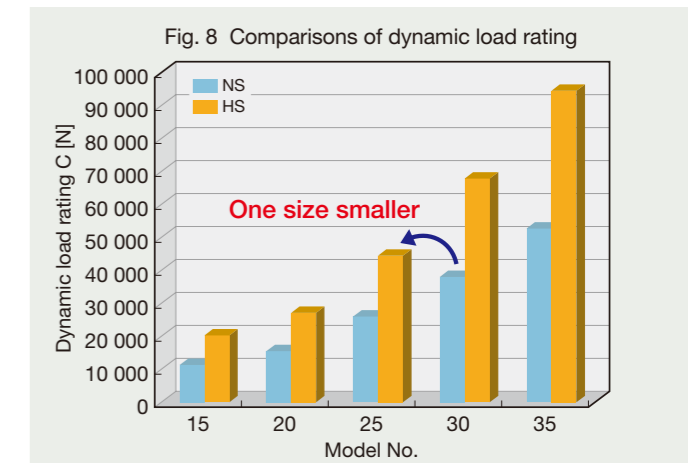
- HA30 : the same dynamic load rating, at one size smaller (Fig. 5)
- HA25 : the same rigidity, at two sizes smaller (Fig. 6)
- HA35 : 120% higher rigidity with one-sixth friction (Fig. 7)



HS Model

For example, comparing HS Model with our conventional NS30,

- HS25 : the same dynamic load rating, at one size smaller (Fig. 8)
- HS15 : the same rigidity, at three sizes smaller (Fig. 9)
- HS30 : 110% higher rigidity with one-fifth friction (Fig. 10)



Accuracy standard and preload

Three accuracy grades are available: ultra precision P3, super precision P4, and high precision P5. Slight preload Z1 and medium preload Z3 are available for preload. Those can be selected for applications.

Table 2 Accuracy standard Unit: μm

Items	Accuracy grade	Ultra precision P3	Super precision P4	High precision P5
Mounting height H		± 8	± 10	± 20
Variation of height H (All ball slides on a set of rails)		3	5	7
Mounting width W_2 or W_3		± 10	± 15	± 25
Variation of W_2 or W_3 (All ball slides on reference rail)		3	7	10
Running parallelism of surface C to surface A	Refer to Table 3 for tolerance.			
Running parallelism of surface D to surface B	See Fig. 11 and Fig.12.			

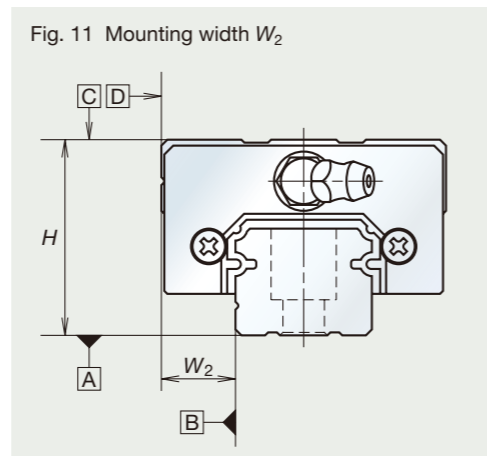


Table 3 Running parallelism Unit: μm

Rail length (mm)	Accuracy grade	P3	P4	P5
over—200 or less		2	2	3.5
200—250		2	2.5	4.5
250—315		2	2.5	5
315—400		2	3	5.5
400—500		2	3	6
500—630		2	3.5	6.5
630—800		2	4	7
800—1 000		2.5	4.5	7.5
1 000—1 250		3	5	8.5
1 250—1 600		3.5	5.5	9.5
1 600—2 000		4	6.5	11
2 000—2 500		4.5	7.5	12
2 500—3 150		5.5	8.5	13
3 150—4 000		6	9.5	14

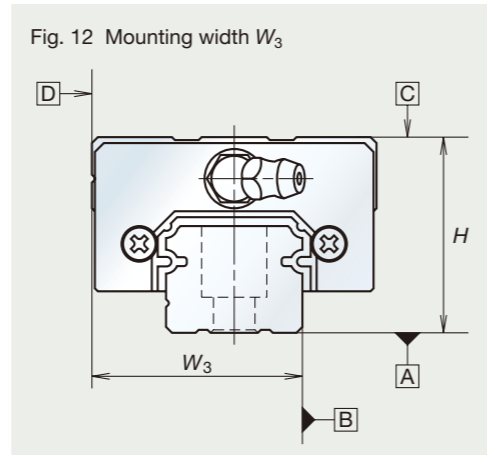


Table 4 Preload and rigidity HA Model

Model No.	Preload (N)		Rigidity (N/ μm)	
	Slight preload (Z1)	Medium preload (Z3)	Slight preload (Z1)	Medium preload (Z3)
HA25	735	2 990	635	1 030
HA30	1 030	4 400	880	1 270
HA35	1 470	6 100	1 030	1 620
HA45	1 960	8 150	1 230	2 060
HA55	3 150	13 100	1 520	2 450

* The rigidity of the HA Model is the same in the vertical direction and the horizontal direction.

HS Model

Model No.	Preload (N)		Rigidity (N/ μm)			
			Vertical direction		Lateral direction	
	Slight preload (Z1)	Medium preload (Z3)	Slight preload (Z1)	Medium preload (Z3)	Slight preload (Z1)	Medium preload (Z3)
HS15	98	785	260	530	173	355
HS20	147	1 030	305	600	212	415
HS25	245	1 620	385	735	263	505
HS30	390	2 550	505	965	345	665
HS35	590	3 550	610	1 140	415	780

Reference number

Reference numbers shall be set to individual when its specifications are finalized, and it is indicated on its specification drawing.

Please specify the reference number, except design serial number, to identify the product when requiring estimates, or inquiring about specifications.

Example: **HS 30 1000 AL C 2 - * * K5 1**

Model name	Size	Rail length (mm)	Ball slide shape code	(*) Material/surface treatment code	Preload code	Design serial number	Number of ball slides per rail
			AN: Square (HA only), AL: Low square, EM: Flange	C: Special high-carbon steel K: Stainless steel D: Special high-carbon steel with surface treatment H: Stainless steel with surface treatment	1: Slight preload 3: Medium preload		
				Accuracy code			
				Without NSK K1/K1-L		P3: Ultra precision, P4: Super precision, P5: High precision	
				With NSK K1		K3: Ultra precision, K4: Super precision, K5: High precision	
				With NSK K1-L		L3: Ultra precision, L4: Super precision, L5: High precision	

(* 1) Stainless steel is only applicable in the HS Model. Surface treatment is provided by low temperature chrome plating (electrolytic rust prevention black treatment). In addition, low temperature chrome plating treatment that further improves anticorrosion properties by means of fluoroplastic coating is also available as an option.

Long-term, maintenance-free operation

The NSK K1 lubrication unit for HA model and the NSK K1-L lubrication unit for HS Model can be installed to ensure long-term, maintenance-free operation.

Optional

Table 5 Dimensions of linear guides equipped with NSK K1 lubrication unit for HA Model Unit: mm

Model No.	Standard ball slide length	Ball slide length with two NSK K1 installed L	Thickness of single NSK K1 V_1	Protective cover thickness V_2
HA25	147.8	159.8	5.0	1.0
HA30	177.2	190.2	5.5	1.0
HA35	203.6	216.6	5.5	1.0
HA45	233.4	248.4	6.5	1.0
HA55	284.4	299.4	6.5	1.0

Table 6 Dimensions of linear guides equipped with NSK K1-L lubrication unit for HS Model Unit: mm

Model No.	Standard ball slide length	Ball slide length with two NSK K1-L installed L	Thickness of single NSK K1-L V_1
HS15	106	115.6	4.8
HS20	119.7	130.3	5.3
HS25	148	158.6	5.3
HS30	176.1	188.1	6
HS35	203.6	216.6	6.5

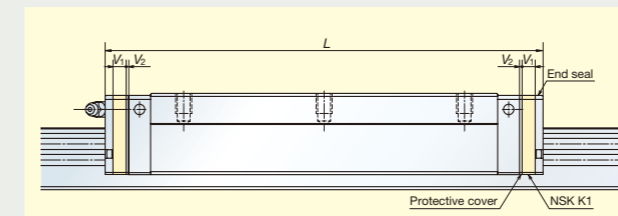


Fig. 13 Ball slide equipped with NSK K1 for HA Model

Slide length when equipped with NSK K1 = (standard ball slide length) + (V_1 thickness of single K1 unit) \times (number of K1 units) + (V_2 thickness of the protective cover) $\times 2$.

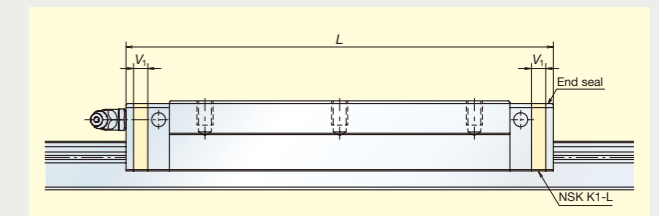


Fig. 14 Ball slide equipped with NSK K1-L for HS Model

Slide length when equipped with NSK K1-L = (standard ball slide length) + (V_1 thickness of single NSK K1-L unit) \times (number of K1-L units).

Precautions for proper use and handling

- Balls fall out if the ball slide is removed from the rail. Also note that the ball slide may fall off as the rail is inclined.
- When using the ball slide in an upside-down state (e.g. the rail is installed upside-down on the ceiling in which the ball slide faces downward), take measures including installing a safety device to prevent falling.
- The temperature of the place where linear guides are used should not exceed 80°C.
- When installing NSK K1 or NSK K1-L, the temperature of the place where linear guides are used should not exceed 50°C (80°C, instantaneous). Please avoid contacting NSK K1 with organic solvent that remove oil or leaving it in white kerosene or rust preventive oil that contains white kerosene.

Fig. 14 AL Type

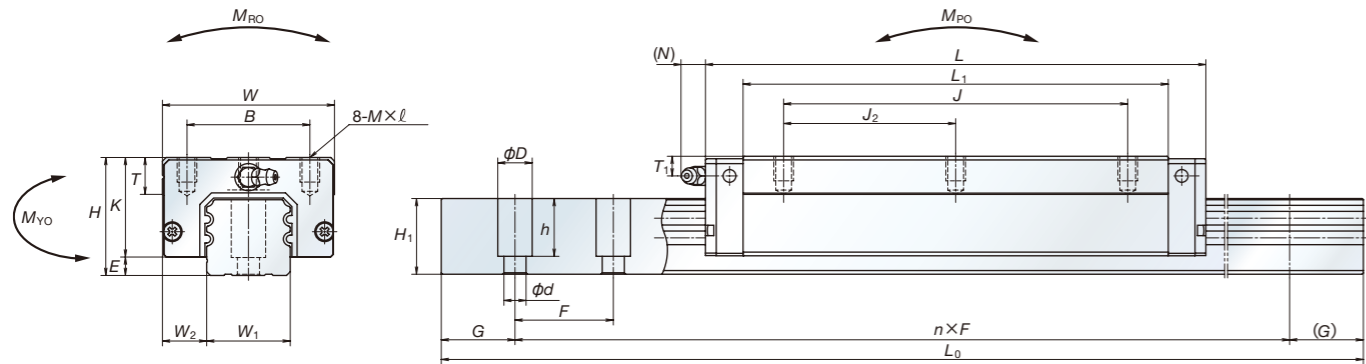


Fig. 15 AN Type

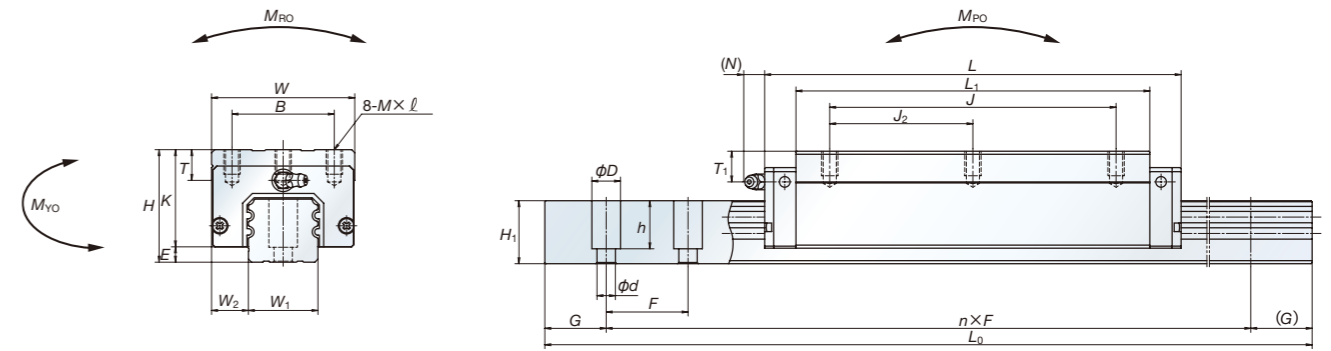


Fig. 16 EM Type

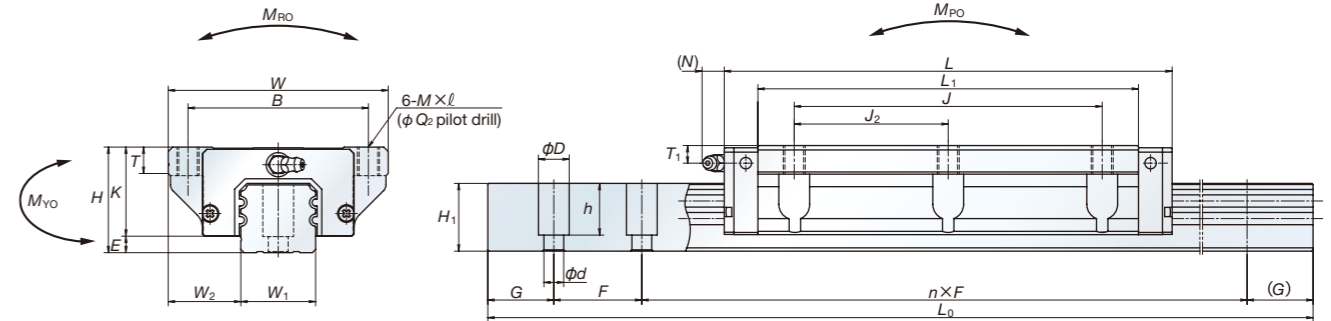


Table 6 Assembly dimensions for AN Type and AL Type

Model No.	Assembly			Ball slide											Rail					Basic load rating								Weight			
	Height	E	W ₂	Width	Length	Mounting hole					L ₁	K	T	Grease fitting			Width	Height	Pitch	Mounting bolt hole	G	Maximum length	Dynamic		Static	Static moment (N·m)				Ball slide	Rail
						H	E	W ₂	W	L				B	J	J ₂							M × pitch × l	Hole size		T ₁	N	d × D × h	(reference)		
HA25AN	40	5.5	12.5	48	147.8	35	100	50	M6×1×10	126	34.5	12	M6×0.75	10	11	23	22	30	7×11×16.5	20	3 960	54 000	43 000	115 000	670	2 060	10 100	2 060	10 100	1.2	3.7
HA30AN	45	7.5	16	60	177.2	40	120	60	M8×1.25×11	149	37.5	14	M6×0.75	9.5	11	28	28	40	9×14×21	20	4 000	79 500	63 500	166 000	1 140	3 550	17 400	3 550	17 400	1.8	5.8
HA35AN	55	7.5	18	70	203.6	50	140	70	M8×1.25×12	173	47.5	15	M6×0.75	15	11	34	30.8	40	9×14×23.5	20	4 000	111 000	88 000	226 000	1 950	5 650	27 100	5 650	27 100	3.0	7.7
HA35AL	48																														
HA45AN	70	10	20.5	86	233.4	60	160	80	M10×1.5×16	197	60	17	Rc1/8	20	13	45	36	52.5	14×20×27	22.5	3 990	147 000	117 000	295 000	3 700	8 450	40 500	8 450	40 500	6.0	12.0
HA45AL	60										50			10																5.0	
HA55AN	80	12	23.5	100	284.4	75	206	103	M12×1.75×18	245	68	18	Rc1/8	21	13	53	43.2	60	16×23×32.5	30	3 960	232 000	184 000	445 000	6 500	15 400	75 000	15 400	75 000	9.4	17.2
HA55AL	70								M12×1.75×16		58			11																7.8	

Notes: 1) The HA Model does not have a ball retainer. Be aware that the balls fall out when a ball slide is withdrawn from the rail.

2) The basic load rating comply with the ISO standard. (ISO 14728-1, 14728-2)

C₅₀: the basic dynamic load rating for 50 km rated fatigue life C₁₀₀: the basic dynamic load rating for 100 km rated fatigue life

Table 7 Assembly dimensions for EM Type

Model No.	Assembly			Ball slide											Rail					Basic load rating								Weight				
	Height	E	W ₂	Width	Length	Mounting hole					L ₁	K	T	Grease fitting			Width	Height	Pitch	Mounting bolt hole	G	Maximum length	Dynamic		Static	Static moment (N·m)				Ball slide	Rail	
						H	E	W ₂	W	L				B	J	J ₂							M × pitch × l	Q ₂		Hole size	T ₁	N	d × D × h			(reference)
HA25EM	36	5.5	23.5	70	147.8	57	100	50	M8×1.25×10	6.8	126	30.5	11	M6×0.75	6	11	23	22	30	7×11×16.5	20	3 960	54 000	43 000	115 000	670	2 060	10 100	2 060	10 100	1.6	3.7
HA30EM	42	7.5	31	90	177.2	72	120	60	M10×1.5×12	8.6	149	34.5	11	M6×0.75	6.5	11	28	28	40	9×14×21	20	4 000	79 500	63 500	166 000	1 140	3 550	17 400	3 550	17 400	2.6	5.8
HA35EM	48	7.5	33	100	203.6	82	140	70	M10×1.5×13	8.6	173	40.5	12	M6×0.75	8	11	34	30.8	40	9×14×23.5	20	4 000	111 000	88 000	226 000	1 950	5 650	27 100	5 650	27 100	3.8	7.7
HA45EM	60	10	37.5	120	233.4	100	160	80	M12×1.75×15	10.5	197	50	13	Rc1/8	10	13	45	36	52.5	14×20×27	22.5	3 990	147 000	117 000	295 000	3 700	8 450	40 500	8 450	40 500	6.6	12.0
HA55EM	70	12	43.5	140	284.4	116	206	103	M14×2×18	12.5	245	58	15	Rc1/8	11	13	53	43.2	60	16×23×32.5	30	3 960	232 000	184 000	445 000	6 500	15 400	75 000	15 400	75 000	11	17.2

Notes: 1) The HA Model does not have a ball retainer. Be aware that the balls fall out when a ball slide is withdrawn from the rail.

2) The basic load rating comply with the ISO standard. (ISO 14728-1, 14728-2)

C₅₀: the basic dynamic load rating for 50 km rated fatigue life C₁₀₀: the basic dynamic load rating for 100 km rated fatigue life

Fig. 17 AL Type

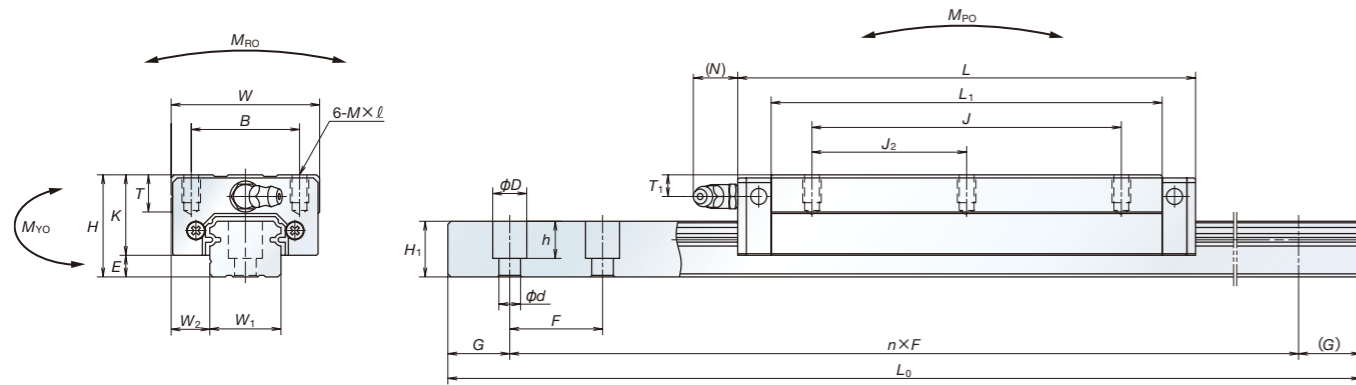


Fig. 18 EM Type

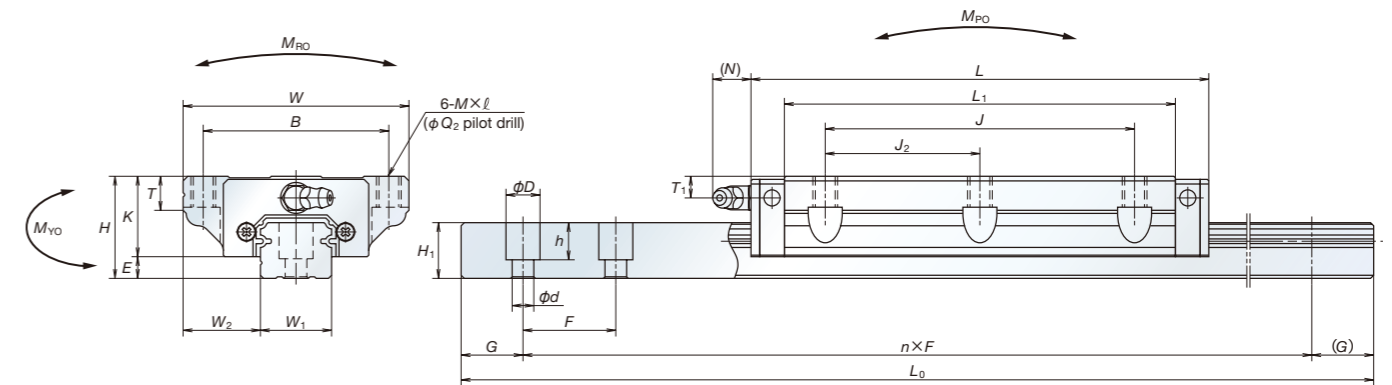


Table 8 Assembly dimensions for AL Type

Model No.	Assembly			Ball side										Rail					Basic load rating						Weight						
	Height	E	W ₂	Width	Length	Mounting hole				L ₁	K	T	Grease fitting			Width	Height	Pitch	Mounting bolt hole	G	Maximum length	³⁾ Dynamic		Static	Static moment (N·m)				Ball slide	Rail	
						H	E	W ₂	B				J	J ₂	M × pitch × l							Hole size	T ₁		N	d × D × h	(reference)	L _{0max}			[50km]
	H	E	W ₂	W	L	B	J	J ₂	M × pitch × l	L ₁	K	T	Hole size	T ₁	N	W ₁	H ₁	F	d × D × h	(reference)	L _{0max}	C ₅₀ (N)	C ₁₀₀ (N)	C ₀ (N)	M _{RO}	One slide	Two slides	One slide	Two slides	(kg)	(kg/m)
HS15AL	24	4.6	9.5	34	106	26	60	30	M4 × 0.7 × 6	89.2	19.4	10	φ3	6	3	15	12.5	30	*4.5 × 7.5 × 8.5 3.5 × 6 × 8.5	20	2 000 (1 300)	20 500	16 300	40 000	199	395	1 990	335	1 670	0.34	1.4
HS20AL	28	6	11	42	119.7	32	80	40	M5 × 0.8 × 7	102.5	22	12	M6 × 0.75	5.5	11	20	15.5	30	6 × 9.5 × 10.5	20	3 960 (3 500)	27 300	21 600	52 000	350	590	2 930	495	2 460	0.52	2.3
HS25AL	33	7	12.5	48	148	35	100	50	M6 × 1 × 9	126.4	26	12	M6 × 0.75	7	11	23	18	30	7 × 11 × 12	20	3 960 (3 500)	44 500	35 000	78 000	605	1 090	5 450	910	4 600	0.85	3.1
HS30AL	42	9	16	60	176.1	40	120	60	M8 × 1.25 × 12	150.7	33	13	M6 × 0.75	8	11	28	23	40	7 × 11 × 16	20	4 000 (3 500)	68 000	54 000	127 000	1 190	2 120	10 600	1 780	8 850	1.7	4.8
HS35AL	48	10.5	18	70	203.6	50	140	70	M8 × 1.25 × 12	175.6	37.5	14	M6 × 0.75	8.5	11	34	27.5	40	9 × 14 × 20	20	4 000 (3 500)	94 500	75 000	172 000	1 980	3 350	16 600	2 820	13 900	2.5	7.0

Notes: 1) The HS Model does not have a ball retainer. Be aware that balls fall out when the ball slide is withdrawn from the rail.
2) External appearance of stainless steel ball slides differ from those of carbon steel ball slide.

3) The basic load rating comply with the ISO standard. (ISO 14728-1, 14728-2)
C₅₀: the basic dynamic load rating for 50 km rated fatigue life C₁₀₀: the basic dynamic load rating for 100 km rated fatigue life
The basic static load rating shows static permissible load.
4) Parenthesized dimensions are applicable to stainless steel products.
*) Standard rail mounting bolt hole for HS15 is specified as hole for M4 (4.5 × 7.5 × 8.5). Please contact us to request a different hole for M3 (3.5 × 6 × 8.5).

Table 9 Assembly dimensions for EM Type

Model No.	Assembly			Ball side										Rail					Basic load rating						Weight							
	Height	E	W ₂	Width	Length	Mounting hole				L ₁	K	T	Grease fitting			Width	Height	Pitch	Mounting bolt hole	G	Maximum length	³⁾ Dynamic		Static	Static moment (N·m)				Ball slide	Rail		
						H	E	W ₂	B				J	J ₂	M × pitch × l							Q ₂	Hole size		T ₁	N	d × D × h	(reference)			L _{0max}	[50km]
	H	E	W ₂	W	L	B	J	J ₂	M × pitch × l	Q ₂	L ₁	K	T	Hole size	T ₁	N	W ₁	H ₁	F	d × D × h	(reference)	L _{0max}	C ₅₀ (N)	C ₁₀₀ (N)	C ₀ (N)	M _{RO}	One slide	Two slides	One slide	Two slides	(kg)	(kg/m)
HS15EM	24	4.6	18.5	52	106	41	60	30	M5 × 0.8 × 7	4.4	89.2	19.4	8	φ3	6	3	15	12.5	30	*4.5 × 7.5 × 8.5 3.5 × 6 × 8.5	20	2 000 (1 300)	20 500	16 300	40 000	199	395	1 990	335	1 670	0.45	1.4
HS20EM	28	6	19.5	59	119.7	49	80	40	M6 × 1 × 9 (M8 × 1.25 × 11.5)	5.3	102.5	22	10	M6 × 0.75	5.5	11	20	15.5	30	6 × 9.5 × 10.5	20	3 960 (3 500)	27 300	21 600	52 000	350	590	2 930	495	2 460	0.67	2.3
HS25EM	33	7	25	73	148	60	100	50	M8 × 1.25 × 10 (M8 × 1.25 × 11.5)	6.8	126.4	26	11 (12)	M6 × 0.75	7	11	23	18	30	7 × 11 × 12	20	3 960 (3 500)	44 500	35 000	78 000	605	1 090	5 450	910	4 600	1.3	3.1
HS30EM	42	9	31	90	176.1	72	120	60	M10 × 1.5 × 12 (M10 × 1.5 × 14.5)	8.6	150.7	33	11 (15)	M6 × 0.75	8	11	28	23	40	7 × 11 × 16	20	4 000 (3 500)	68 000	54 000	127 000	1 190	2 120	10 600	1 780	8 850	2.4	4.8
HS35EM	48	10.5	33	100	203.6	82	140	70	M10 × 1.5 × 13 (M10 × 1.5 × 14.5)	8.6	175.6	37.5	12 (15)	M6 × 0.75	8.5	11	34	27.5	40	9 × 14 × 20	20	4 000 (3 500)	94 500	75 000	172 000	1 980	3 350	16 600	2 820	13 900	3.4	7.0

Notes: 1) The HS Model does not have a ball retainer. Be aware that balls fall out when the ball slide is withdrawn from the rail.
2) External appearance of stainless steel ball slides differ from those of carbon steel ball slide.

3) The basic load rating comply with the ISO standard. (ISO 14728-1, 14728-2)
C₅₀: the basic dynamic load rating for 50 km rated fatigue life C₁₀₀: the basic dynamic load rating for 100 km rated fatigue life
The basic static load rating shows static permissible load.
4) Parenthesized dimensions are applicable to stainless steel products.
*) Standard rail mounting bolt hole for HS15 is specified as hole for M4 (4.5 × 7.5 × 8.5). Please contact us to request a different hole for M3 (3.5 × 6 × 8.5).

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