MOTION & CONTROL™

NSK

NSK Linear Guide™
High-Accuracy Series

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 High performance Linear Guide "High-Accuracy Series HA Type and HS Type"

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.

Features

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 onehalf 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.

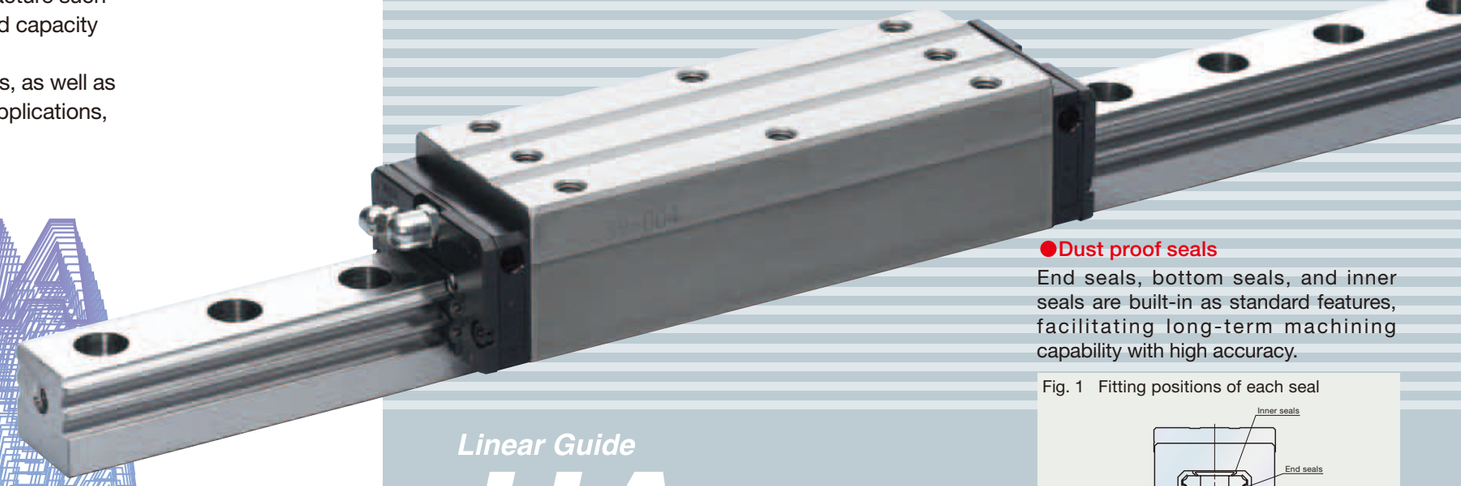
5. *Compact design*

Reduced body size enables more compact machinery.

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	● 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	

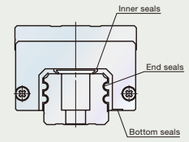
High-performance linear guides, High-Accuracy Series



●Dust proof seals

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

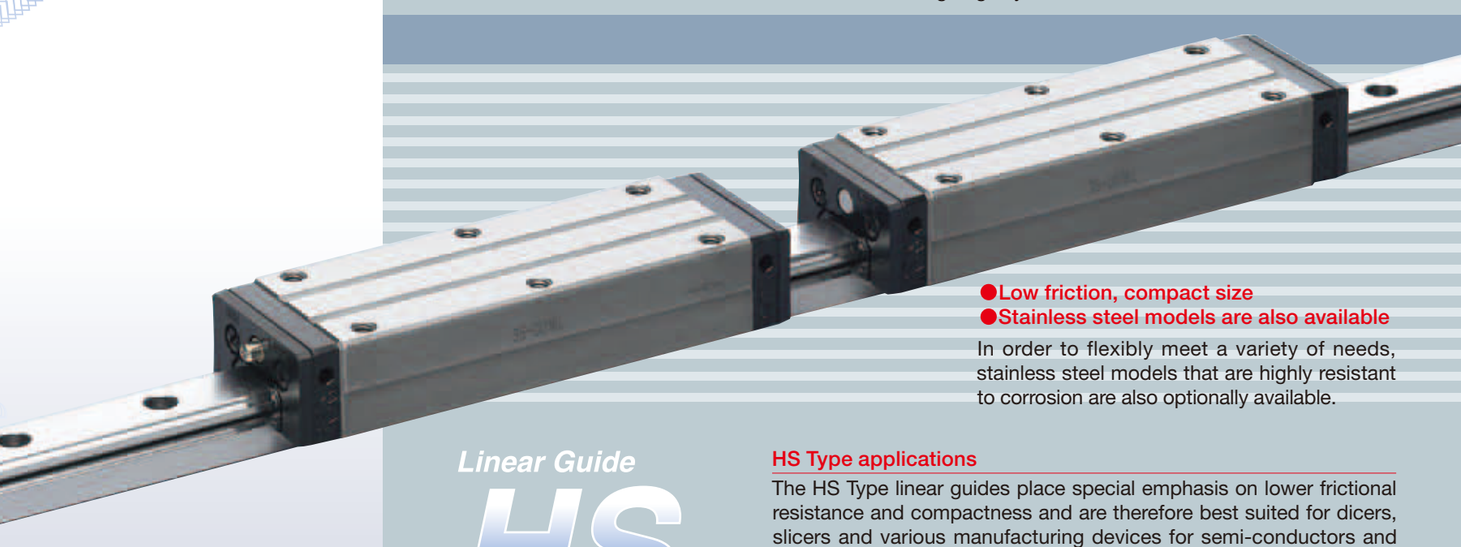
Fig. 1 Fitting positions of each seal



Linear Guide **HA** *type*

HA Type applications

The HA Type 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
●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** *type*

HS Type applications

The HS Type 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.

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.

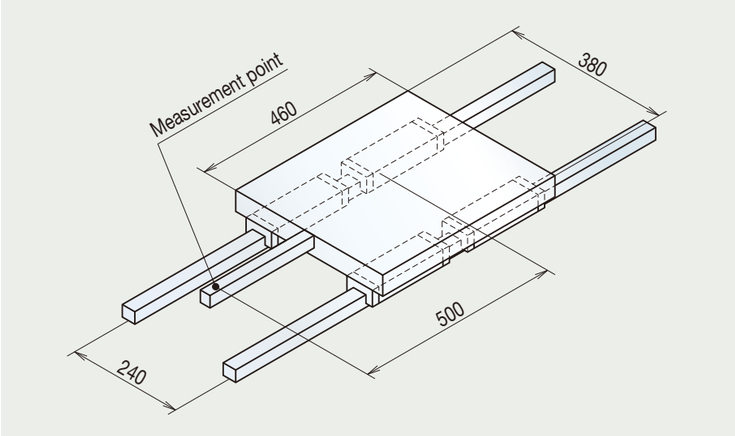
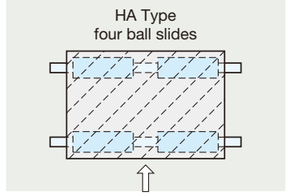


Fig. 2 Schematic view of measurement of ball passage vibration

HA Type

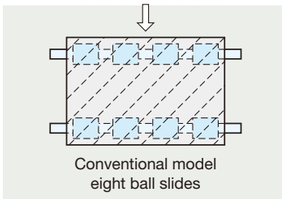
Model No.: HA30
Preload: Z3
Table dimensions: 460mm × 380mm



The same table is used.

Conventional models

Model No.: LA30
Preload: Z3
Table dimensions: 460mm × 380mm



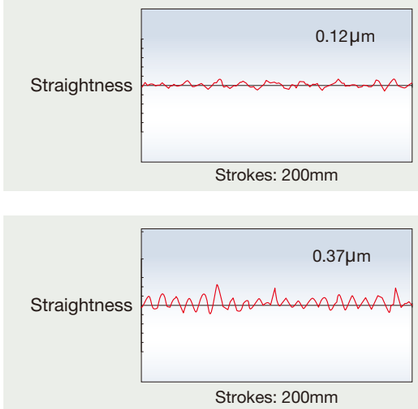
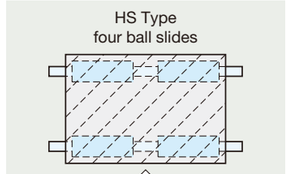


Fig. 3 Measurement results of HA Type and conventional models

HS Type

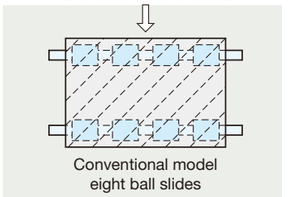
Model No.: HS30
Preload: Z1
Table dimensions: 460mm × 380mm



The same table is used.

H Conventional models

Model No.: LS30
Preload: Z1
Table dimensions: 460mm × 380mm



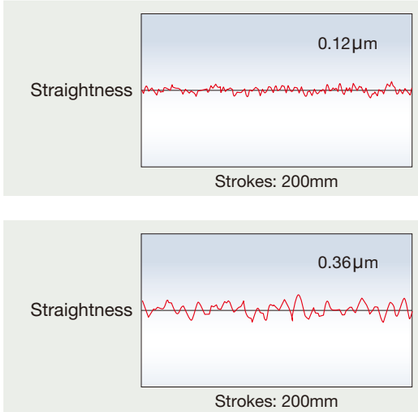


Fig. 4 Measurement results of HS Type and conventional models

High rigidity and high load capacity with low friction

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

HA Type

For example, comparing HA type 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)

Fig. 5 Comparisons of dynamic load rating

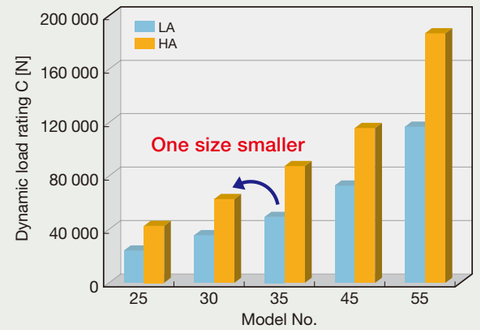


Fig. 6 Comparisons of rigidity

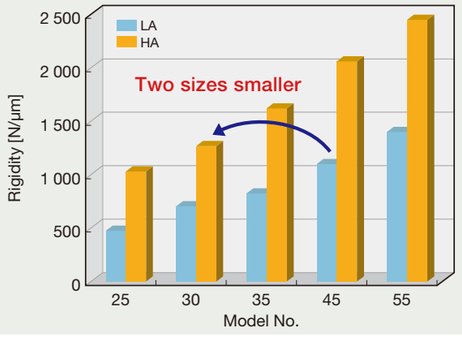
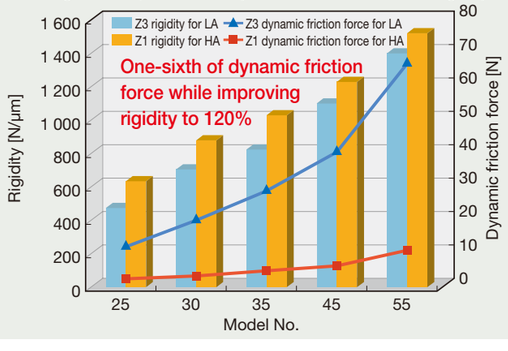


Fig. 7 Comparisons of dynamic friction force and rigidity



HS Type

For example, comparing HS type 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)

Fig. 8 Comparisons of dynamic load rating

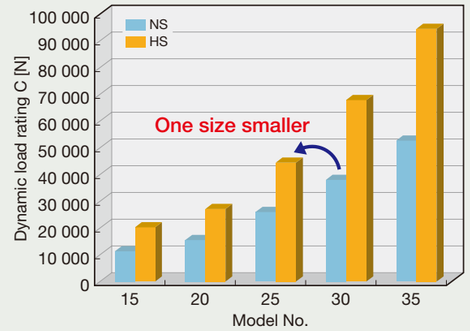


Fig. 9 Comparisons of rigidity

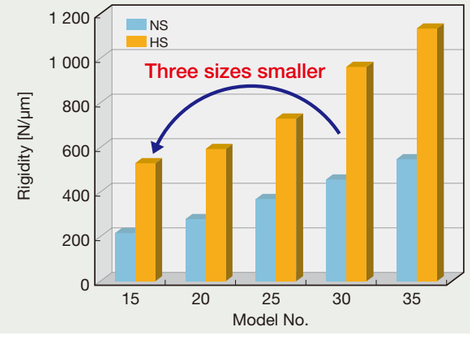
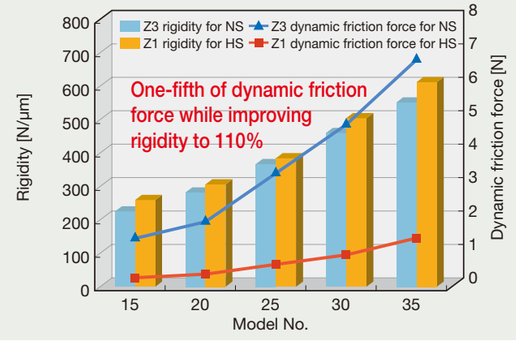


Fig. 10 Comparisons of dynamic friction force and rigidity



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. See Fig. 11 and Fig.12.		
Running parallelism of surface D to surface B			

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

Fig. 11 Mounting width W_2

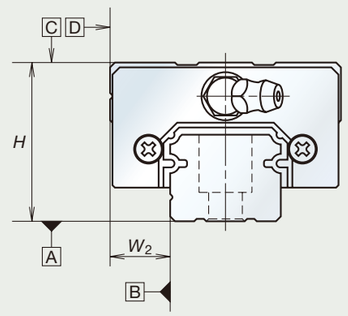


Fig. 12 Mounting width W_3

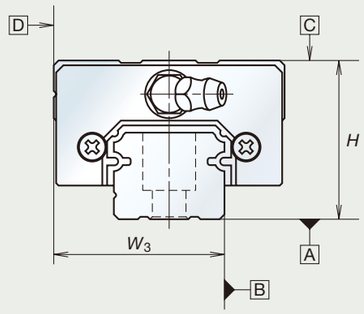


Table 4 Preload and rigidity

HA Type

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 type is the same in the vertical direction and the horizontal direction.

HS Type

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

- HS: Series name
- 30: Size
- 1000: Rail length (mm)
- AL: Ball slide shape code (AN: Square(HA only), AL: Low square, EM: Flange)
- C: (*1) Material/surface treatment code (C: Special high-carbon steel, K: Stainless steel, D: Special high-carbon steel with surface treatment, H: Stainless steel with surface treatment)
- 2: Number of ball slides per rail
- * *: Design serial number
- K5: Accuracy code (Without NSK K1: P3: Ultra precision, P4: Super precision, P5: High precision; With NSK K1: K3: Ultra precision, K4: Super precision, K5: High precision)
- 1: Preload code (1: Slight preload 3: Medium preload)

(*1) Stainless steel is only applicable in the HS series. 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

Optional

The NSK K1™ lubrication unit can be installed to ensure long-term, maintenance-free operation.

Table 5 Dimensions of linear guides equipped with NSK K1 lubrication unit

HA Type

Unit: mm

Model No.	Standard ball slide length	Ball slide length installed with two NSK K1, L	Per NSK K1 thickness 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

HS Type

Unit: mm

Model No.	Standard ball slide length	Ball slide length installed with two NSK K1, L	Per NSK K1 thickness V_1	Protective cover thickness V_2
HS15	106	115.6	4.0	0.8
HS20	119.7	130.3	4.5	0.8
HS25	148	158.6	4.5	0.8
HS30	176.1	188.1	5.0	1.0
HS35	203.6	216.6	5.5	1.0

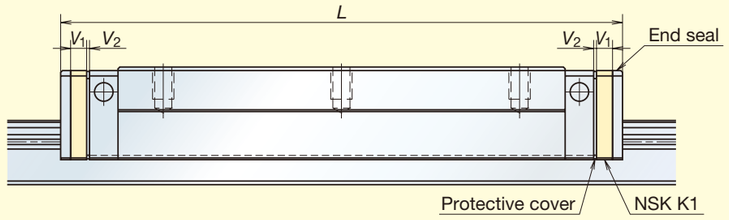


Fig. 13 Ball slide equipped with NSK K1

● Ball slide length equipped with NSK K1 = (Standard ball slide length) + (Thickness of NSK K1, V_1 × Number of NSK K1) + (Thickness of the protective cover, V_2 × 2)

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, 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

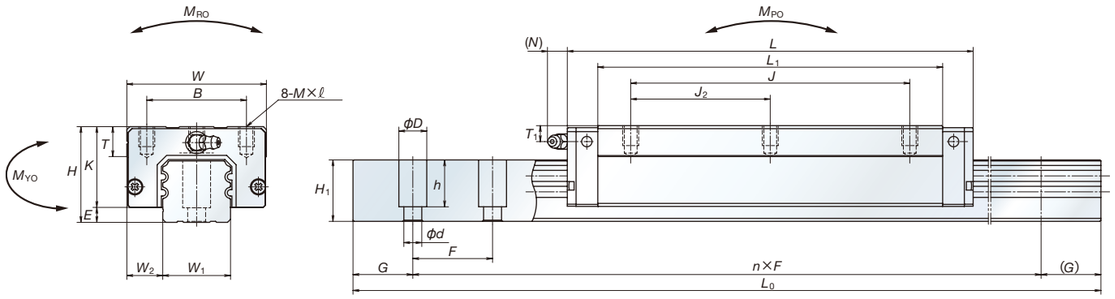


Fig. 15 AN Type

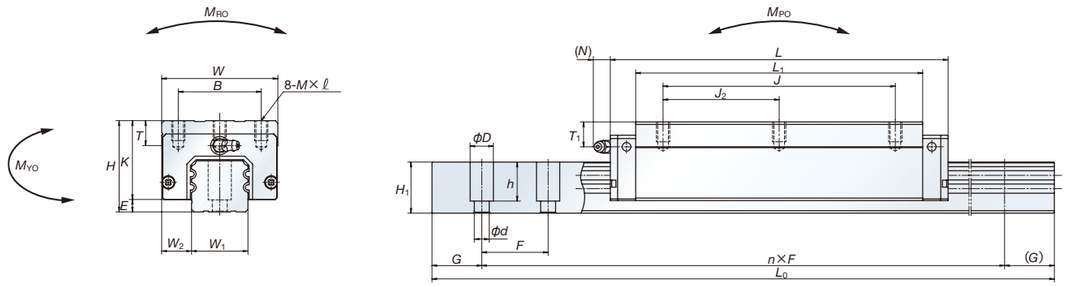


Fig. 16 EM Type

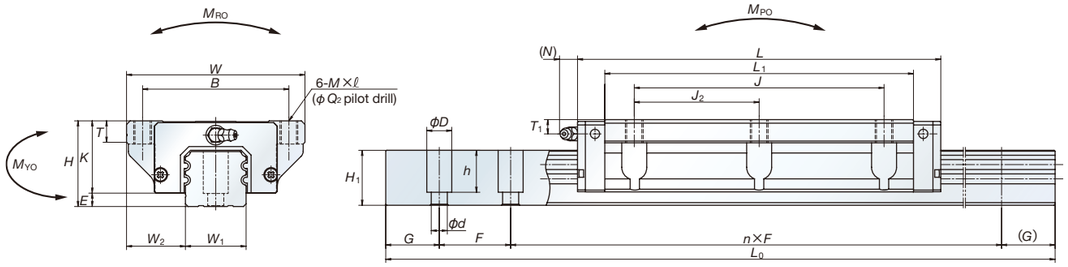


Table 6 Assembly dimensions for AN Type and AL Type

Unit: mm

Model No.	Assembly			Ball slide										Rail						Basic load rating								Weight	
	Height			Width	Length	Mounting hole							Grease fitting			Width	Height	Pitch	Mounting bolt hole	G	Maximum length	[2]Dynamic		Static	Static moment (N·m)					Ball slide	Rail
																						[50km]	[100km]			M_{PO}		M_{YO}			
	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)
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								M8×1.25×10		40.5			8																2.6	
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 Series 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)
C_{50} : the basic dynamic load rating for 50 km rated fatigue life C_{100} : the basic dynamic load rating for 100 km rated fatigue life

Table 7 Assembly dimensions for EM Type

Unit: mm

Model No.	Assembly			Ball slide												Rail						Basic load rating								Weight	
	Height			Width	Length	Mounting hole								Grease fitting									[2]Dynamic		Static	Static moment (N·m)					Ball slide	Rail
																							[50km]	[100km]			M_{PO}		M_{YO}			
	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)
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 Series 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)
C_{50} : the basic dynamic load rating for 50 km rated fatigue life C_{100} : the basic dynamic load rating for 100 km rated fatigue life

Fig. 17 AL Type

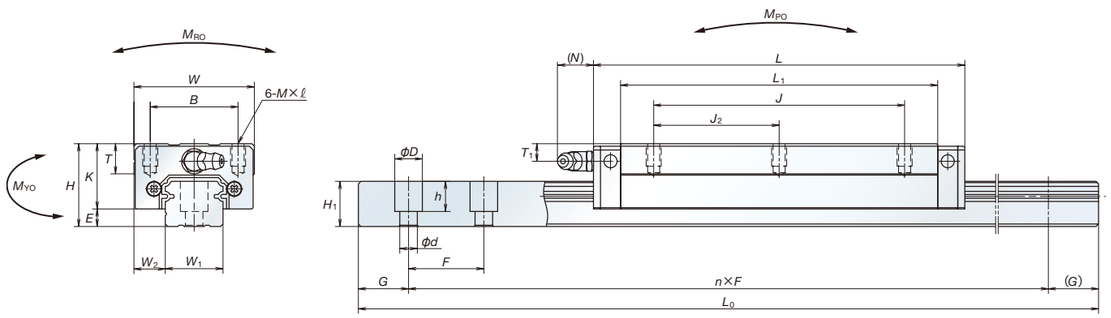


Fig. 18 EM Type

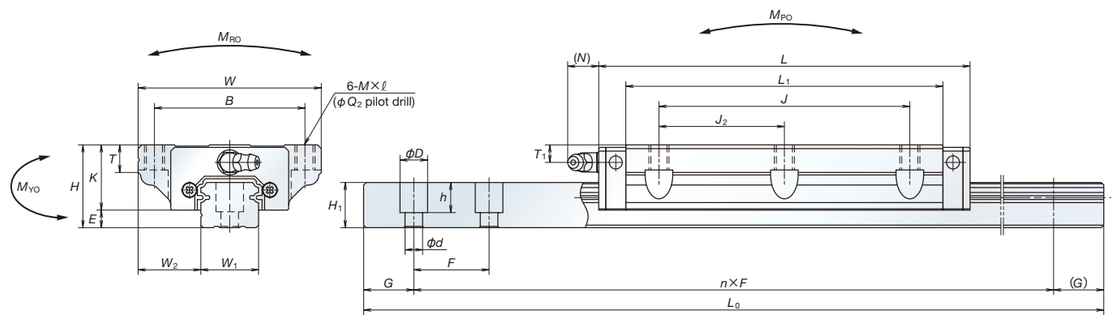


Table 8 Assembly dimensions for AL Type

Unit: mm

Model No.	Assembly			Ball slide										Rail					Basic load rating								Weight	
	Height			Width	Length	Mounting hole							Grease fitting			Width	Height	Pitch	Mounting bolt hole	G	Maximum length	[3]Dynamic		Static		Static moment (N·m)				Ball slide	Rail
																						[50km]	[100km]			M_{PO}		M_{YO}			
	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 Series 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)
C_{50} : the basic dynamic load rating for 50 km rated fatigue life C_{100} : 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

Unit: mm

Model No.	Assembly			Ball slide											Rail					Basic load rating								Weight	
	Height			Width	Length	Mounting hole								Grease fitting			Width	Height	Pitch	Mounting bolt hole	G	Maximum length	[3]Dynamic		Static		Static moment (N·m)				Ball slide	Rail
																						[50km]	[100km]			M_{PO}		M_{YO}			
	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 (M6×1×9.5)	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 Series 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)
C_{50} : the basic dynamic load rating for 50 km rated fatigue life C_{100} : 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).