

# NSK Linear Guides™

## High-Accuracy Series

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



Patent Pending



# Realizing outstanding motion accuracy with high rigidity and load capacity – High-Accuracy Series high-performance linear guides, 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. NSK strives to always stay ahead of competition by providing the industry with products that keep pace with trends and needs of the times. Part of these products are the high-performance linear guides, High-Accuracy Series. The innovative design makes full use of NSK's world-class proprietary technologies to achieve 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.

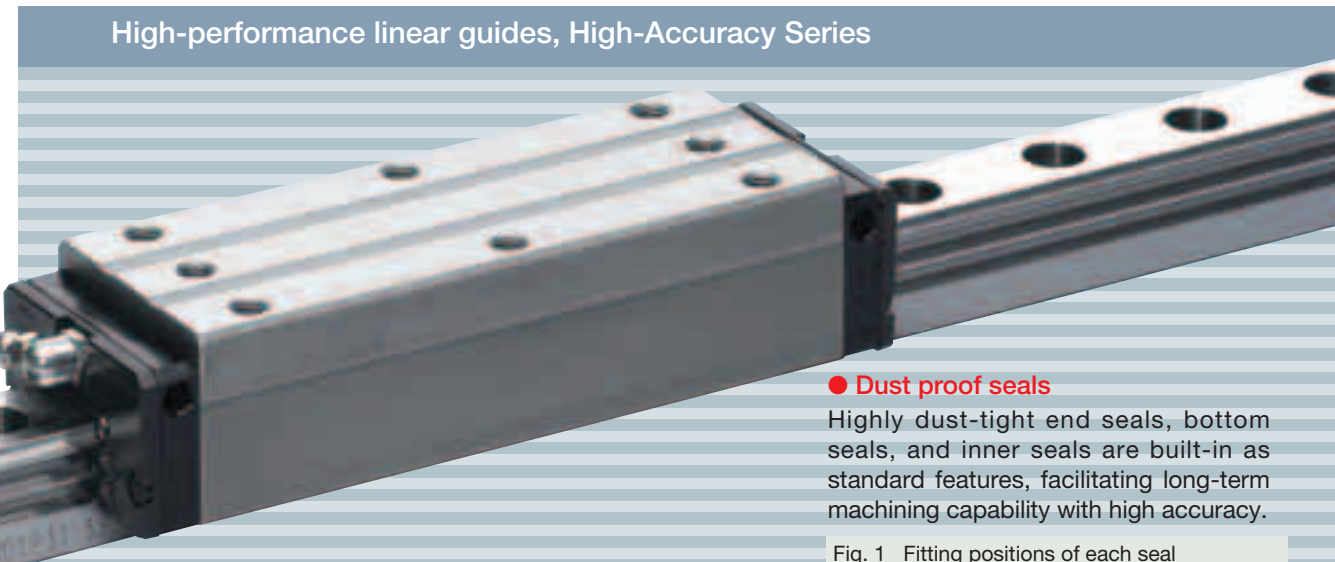
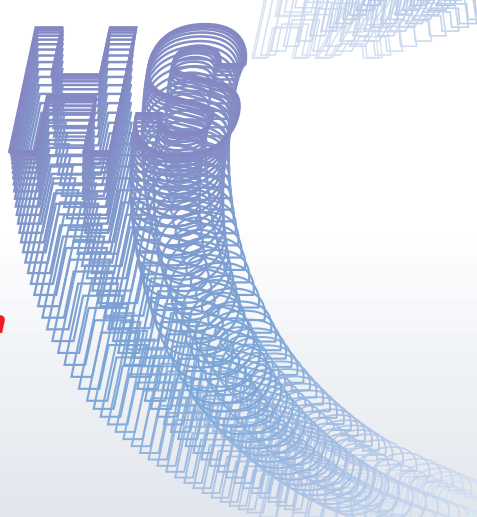
## 4. High rigidity and load capacity with lower friction

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.

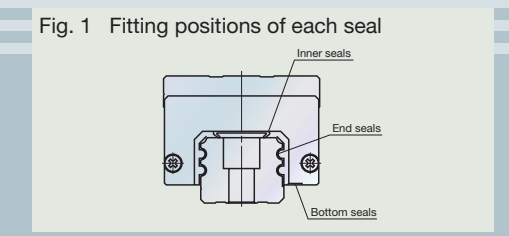
# Linear Guide



High-performance linear guides, High-Accuracy Series

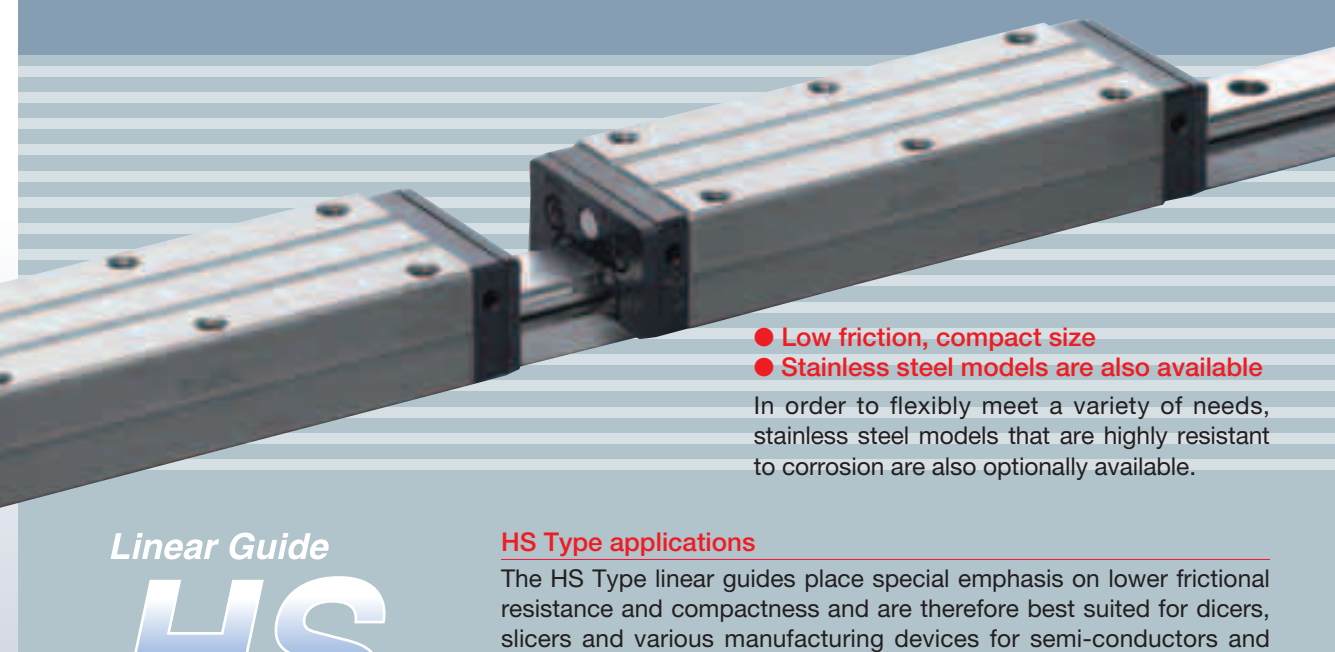
Linear Guide  
**HA** type

● **Dust proof seals**  
Highly dust-tight end seals, bottom seals, and inner seals are built-in as standard features, facilitating long-term machining capability with high accuracy.



### 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.



Linear Guide  
**HS** type

● **Low friction, compact size**  
● **Stainless steel models are also available**

### 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.

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"> <li>● Ultra-long ball slides control posture changes in bearing which may be caused by ball passage vibration and rail waviness.</li> <li>● Optimum design of ball recirculation components enables the ball to move smoothly and restrain ball passage vibration.</li> <li>● Deep counterbore of mounting hole for rail contributes to reducing possible rail deformation and restricting ball slide pitching motion.</li> </ul>
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.

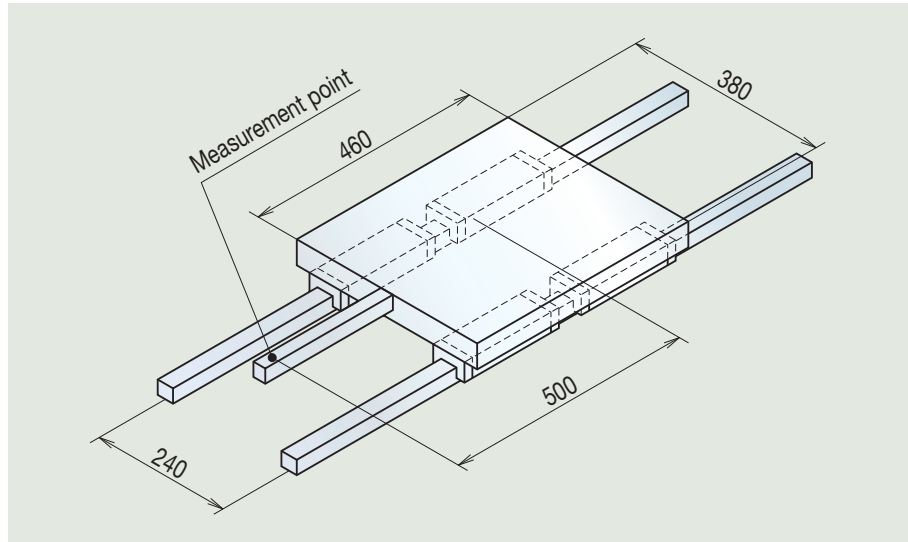
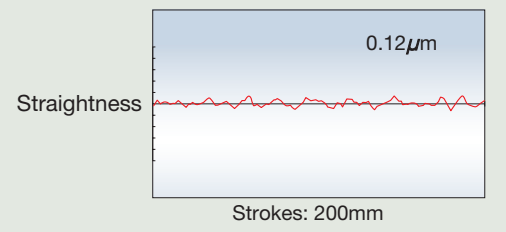
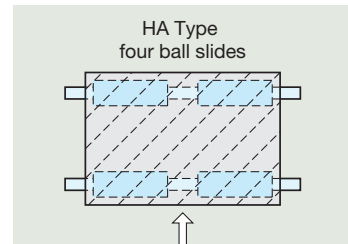


Fig. 2 Schematic view of measurement of ball passage vibration

HA Type

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



Conventional models

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

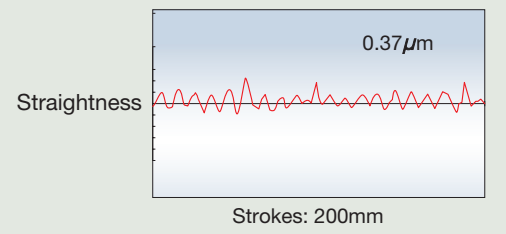
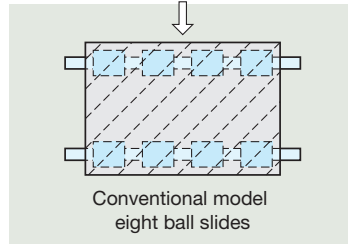
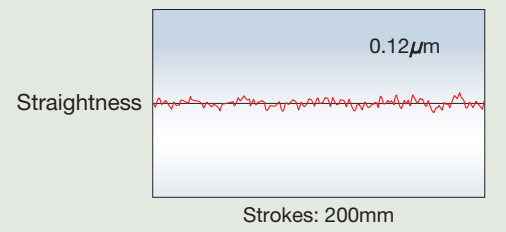
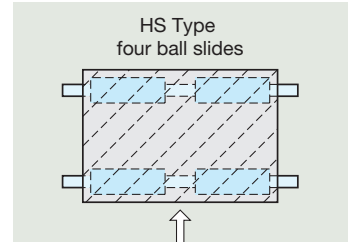


Fig. 3 Measurement results of HA Type and conventional models

HS Type

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



Conventional models

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

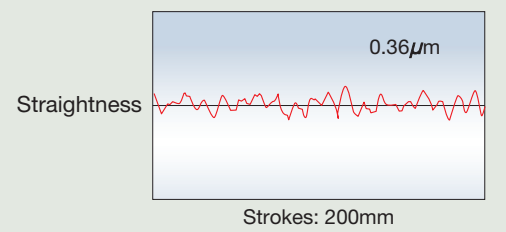
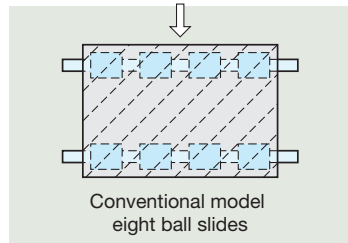


Fig. 4 Measurement results of HS Type and conventional models

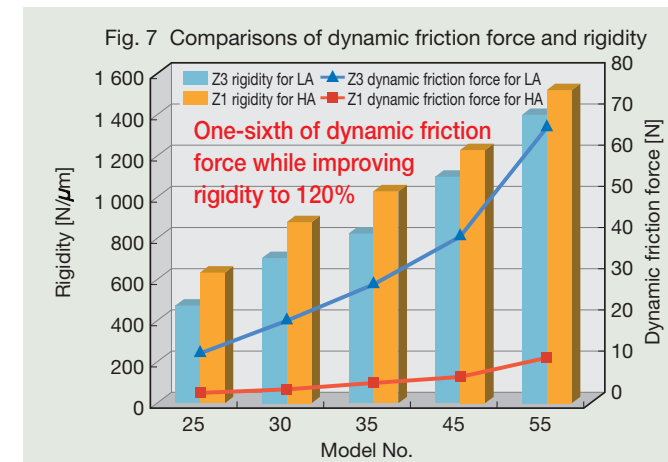
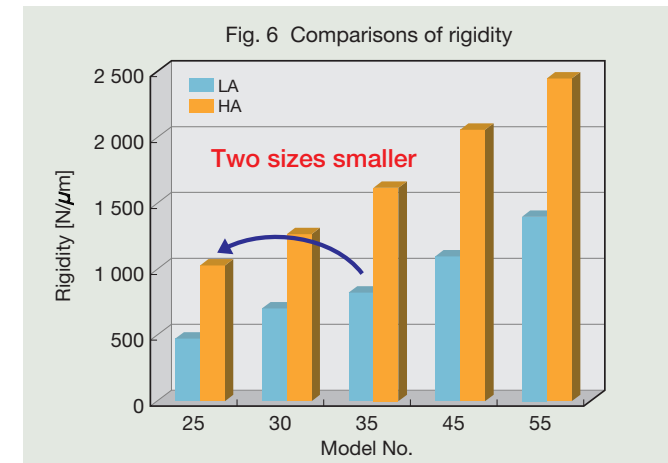
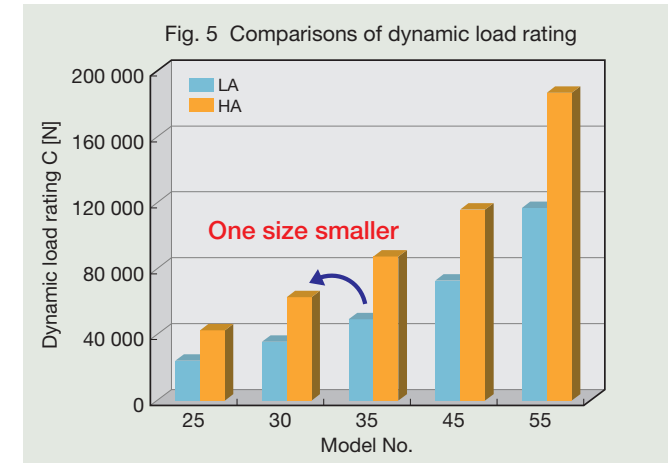
High rigidity and high load capacity with low friction

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, compared with LA35, the following HA models feature:

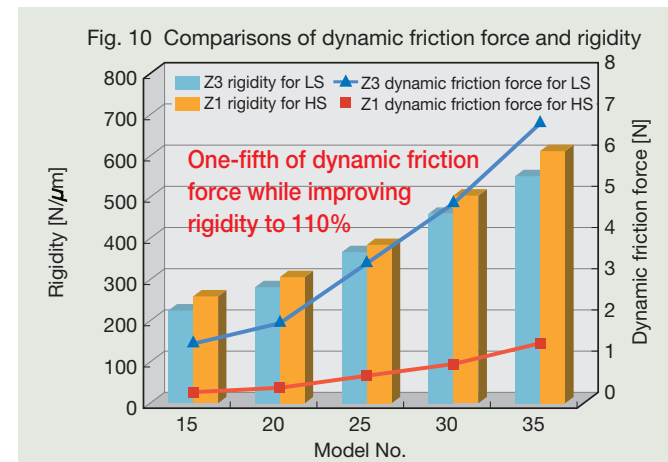
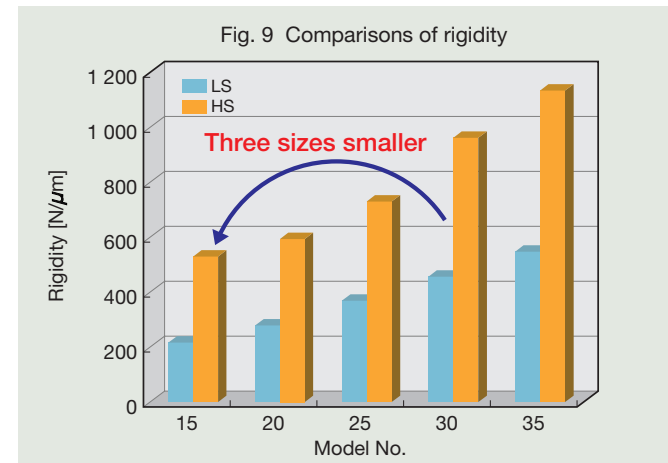
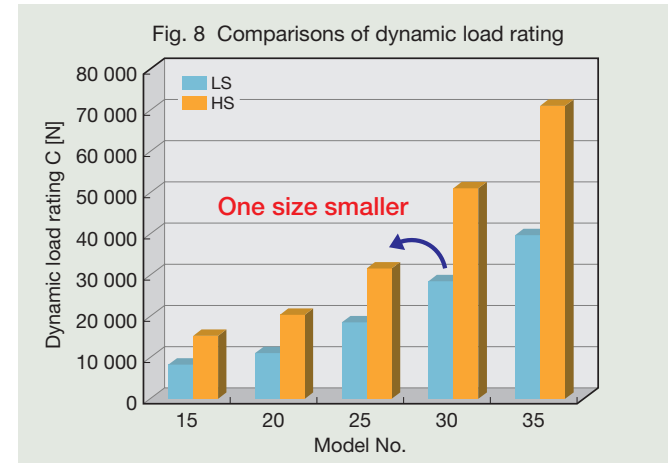
- the same dynamic load rating, at one size smaller (HA30)
- the same rigidity, at two sizes smaller (HA25)
- 120% higher rigidity with one-sixth friction (HA35)



HS Type

For example, compared with LS30, the following HS models feature:

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



## Accuracy standard and preload

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

Table 2 Accuracy standard unit:  $\mu\text{m}$

Accuracy grade	Ultra super precision P3	Super precision P4	High precision P5
Assembly height $H$	$\pm 10$	$\pm 10$	$\pm 20$
Variation of assembly height $H$ (All slides on a pair of rails)	3	5	7
Mounting width $W_2$ or $W_3$	$\pm 15$	$\pm 15$	$\pm 25$
Variation of mounting width $W_2$ or $W_3$ (All slides on datum rails)	3	7	10
Running parallelism of face C against face A	Refer to Table 3 for tolerance.		
Running parallelism of face D against face B	See Fig. 11 and Fig. 12.		

Fig. 11 Mounting width ( $W_2$ ) and running parallelism

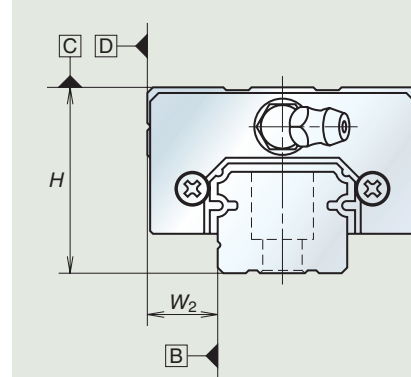


Table 3 Running parallelism tolerance unit:  $\mu\text{m}$

Accuracy grade	P3	P4	P5
Total rail length (mm)			
Over—200 or less	2	2	4
200—250	2	2.5	5
250—315	2	2.5	5
315—400	2	3	6
400—500	2	3	6
500—630	2	3.5	7
630—800	2	4.5	8
800—1 000	2.5	5	9
1 000—1 250	3	6	10
1 250—1 600	4	7	11
1 600—2 000	4.5	8	13
2 000—2 500	5	10	15
2 500—3 150	6	11	17
3 150—4 000	9	16	23

Fig. 12 Mounting width ( $W_3$ ) and running parallelism

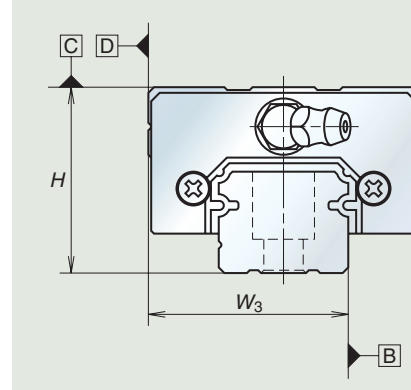


Table 4 Preload and rigidity

Model No.	Preload (N)		Rigidity (N/ $\mu\text{m}$ )	
	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

Model No.	Preload (N)		Rigidity (N/ $\mu\text{m}$ )	
	Slight preload (Z1)	Medium preload (Z3)	Slight preload (Z1)	Medium preload (Z3)
HS15	98	785	260	530
HS20	147	1 030	305	600
HS25	245	1 620	385	735
HS30	390	2 550	505	965
HS35	590	3 550	610	1 140

## Specification number

The specification number indicates main specifications through numbers and codes. The specification number is used until the final reference number, indicated in a specification drawing, is assigned upon confirming specifications with the user. The reference number consists of the specification code, the design serial number, and additional information as applicable.

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

Series code: HS  
Size No.: 30  
Rail length, mm: 1000  
Ball slide shape code: AL (Low square, EM: Flange)  
Material and surface treatment code: C (Special high-carbon steel)  
Accuracy grade: K5 (High precision)  
Preload code: 2 (Medium preload)  
Design serial number: \*\*  
Number of ball slides per rail: 1  
Rail type: II (Two rails (\*2))

(\*) Material and surface treatment code:  
C: Special high-carbon steel  
K: Stainless steel  
D: Special high-carbon steel + Surface treatment  
H: Stainless steel + Surface treatment

(\*) Surface treatment is provided by low-temperature black chrome plating (black surface coating by electrolytic protection against corrosion). Optional low-temperature chrome plating treatment that further improves anticorrosion properties by means of fluorocarbon resin coating is also available.

(\*) Design serial number is appended to delivery reference number (model number), which in turn does not reflect the final number.

## Long-term, maintenance-free operation

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

Optional

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

HA Type				HS Type			
Model No.	Ball slide length equipped with two NSK K1, L	Thickness of NSK K1, $V_1$	Thickness of protection cover, $V_2$	Model No.	Ball slide length equipped with two NSK K1, L	Thickness of NSK K1, $V_1$	Thickness of protection cover, $V_2$
HA25	159.8	5.0	1.0	HS15	115.6	4.0	0.8
HA30	190.2	5.5	1.0	HS20	130.3	4.5	0.8
HA35	216.6	5.5	1.0	HS25	158.6	4.5	0.8
HA45	248.4	6.5	1.0	HS30	188.1	5.0	1.0
HA55	299.4	6.5	1.0	HS35	216.6	5.5	1.0

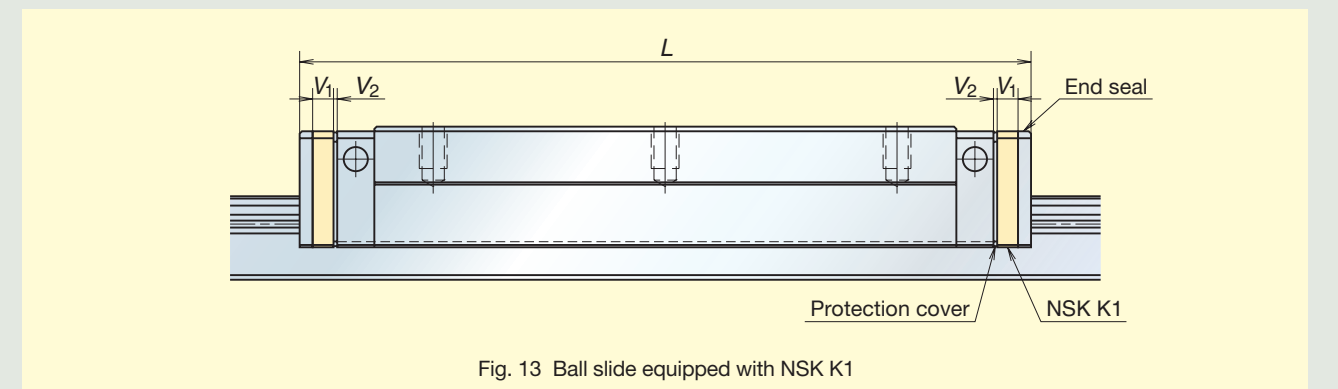


Fig. 13 Ball slide equipped with NSK K1

● Ball slide length equipped with NSK K1 = (Standard bearing length) + (Thickness of NSK K1,  $V_1 \times$  Number of NSK K1) + (Thickness of protection cover,  $V_2 \times 2$ )

## Pioneering in the industry with super-finished ball groove feature

The super-finished ball groove with a super-precision rolling groove is also available as an option for even higher accuracy.

(The super-finished ball groove can be applied for the ultra super precision P3 grade.)

Optional

## Precautions for proper use and handling

- Balls will fall out if a bearing is removed from the rail. Also, remember the bearing may shift and fall out if the rail is tilted without a stopper.
- Take appropriate safety measures against falling loads when mounting the bearing upside down (e.g., when using the bearing facing downward from a ceiling-mounted rail).
- Ensure that ambient temperature does not exceed 50°C (80°C, instantaneous) when installing NSK K1. In addition, do not allow the unit to come into contact with degreasing organic solvents.

Three HA Type linear guides are available in the High-Accuracy Series: AN Type, AL Type, and EM Type, any of which can be selected for specific applications.

Fig. 14 AN Type

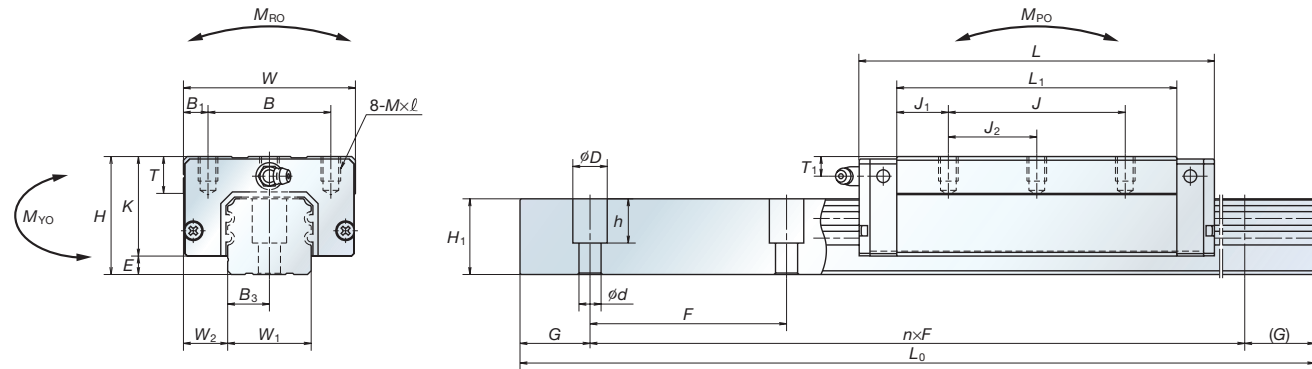


Fig. 15 AL Type

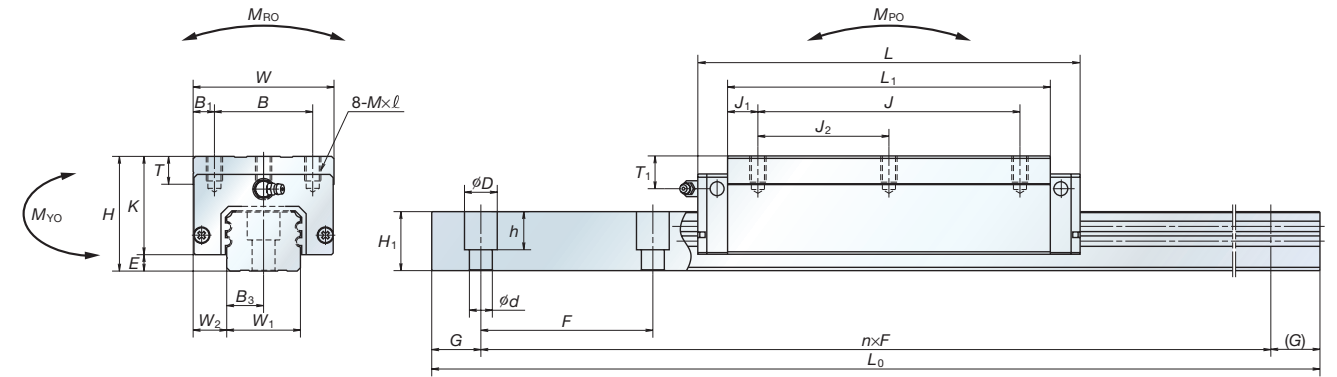


Fig. 16 EM Type

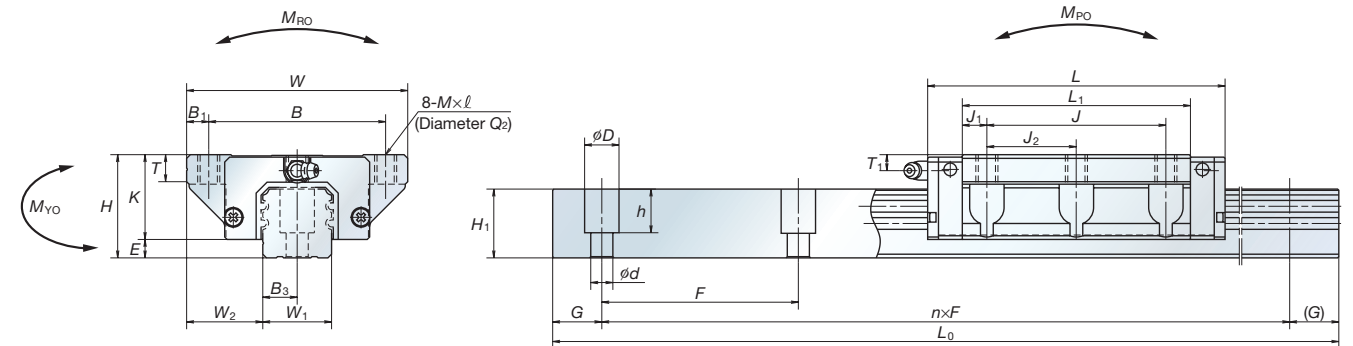


Table 6 Assembly dimensions for AN Type and AL Type

Model No.	Assembly dimension			Ball slide dimension											Rail dimension					Basic load rating					Ball diameter $D_W$	Weight								
	Height $H$	$E$	$W_2$	Width $W$	Length $L$	Hole position			Tapped hole $M \times \text{pitch} \times \ell$	$B_1$	$L_1$	$J_1$	$K$	$T$	Grease nipple			Rail width $W_1$	Rail height $H_1$	Bolt pitch $F$	Bolt hole $d \times D \times h$	$B_3$	$G$ (recommended)	Maximum length $L_0 \text{max}$		Dynamic $C$ (N)	Static $C_0$ (N)	Static moment (N-m)			Ball slide (kg)	Rail (kg/m)		
						$B$	$J$	$J_2$							Mounting hole	$T_1$	$N$								$M_{RO}$			$M_{PO}$	$M_{YO}$					
HA25AN	40	5.5	12.5	48	147.8	35	100	50	M6×1.0×10	6.5	126	13	34.5	12	M6×0.75	10	11	23	22	30	7×11×16.5	11.5	20	3 960	54 000	115 000	670	2 060	2 060	3.968	1.2	3.7		
HA30AN	45	7.5	16	60	177.2	40	120	60	M8×1.25×11	10	149	14.5	37.5	14	M6×0.75	9.5	11	28	28	40	9×14×21	14	20	4 000	79 500	166 000	1 140	3 550	3 550	4.762	1.8	5.8		
HA35AN	55	7.5	18	70	203.6	50	140	70	M8×1.25×12	10	173	16.5	47.5	15	M6×0.75	15	8	11	34	30.8	40	9×14×23.5	17	20	4 000	111 000	226 000	1 950	5 650	5 650	5.556	3.0	2.6	7.7
HA35AL	48																																	
HA45AN	70	10	20.5	86	233.4	60	160	80	M10×1.5×16	13	197	18.5	60	17	R <sub>C</sub> 1/8	20	10	13	45	36	52.5	14×20×27	22.5	22.5	3 990	147 000	295 000	3 700	8 450	8 450	6.350	6.0	5.0	12.0
HA45AL	60																																	
HA55AN	80	12	23.5	100	284.4	75	206	103	M12×1.75×18	12.5	245	19.5	68	18	R <sub>C</sub> 1/8	21	11	13	53	43.2	60	16×23×32.5	26.5	30	3 960	232 000	445 000	6 500	15 400	15 400	7.937	9.4	7.8	17.2
HA55AL	70																																	

Table 7 Assembly dimensions for EM Type

Model No.	Assembly dimension			Ball slide dimension											Rail dimension					Basic load rating					Ball diameter $D_W$	Weight							
	Height $H$	$E$	$W_2$	Width $W$	Length $L$	Hole position			Tapped hole $M \times \text{pitch} \times \ell$	Drill hole Diameter $Q_2$	$B_1$	$L_1$	$J_1$	$K$	$T$	Grease nipple			Rail width $W_1$	Rail height $H_1$	Bolt pitch $F$	Bolt hole $d \times D \times h$	$B_3$	$G$ (recommended)		Maximum length $L_0 \text{max}$	Dynamic $C$ (N)	Static $C_0$ (N)	Static moment (N-m)			Ball slide (kg)	Rail (kg/m)
						$B$	$J$	$J_2$								Mounting hole	$T_1$	$N$							$M_{RO}$				$M_{PO}$	$M_{YO}$			
HA25EM	36	5.5	23.5	70	147.8	57	100	50	M8×1.25×10	6.8	6.5	126	13	30.5	11	M6×0.75	6	11	23	22	30	7×11×16.5	11.5	20	3 960	54 000	11 500	670	2 060	2 060	3.968	1.6	3.7
HA30EM	42	7.5	31	90	177.2	72	120	60	M10×1.5×12	8.6	9	149	14.5	34.5	11	M6×0.75	6.5	11	28	28	40	9×14×21	14	20	4 000	79 500	166 000	1 140	3 550	3 550	4.762	2.6	5.8
HA35EM	48	7.5	33	100	203.6	82	140	70	M10×1.5×13	8.6	9	173	16.5	40.5	12	M6×0.75	8	11	34	30.8	40	9×14×23.5	17	20	4 000	111 000	226 000	1 950	5 650	5 650	5.556	3.8	7.7
HA45EM	60	10	37.5	120	233.4	100	160	80	M12×1.75×15	10.5	10	197	18.5	50	13	R <sub>C</sub> 1/8	10	13	45	36	52.5	14×20×27	22.5	22.5	3 990	147 000	295 000	3 700	8 450	8 450	6.350	6.6	12.0
HA55EM	70	12	43.5	140	284.4	116	206	103	M14×2×21	12.5	12	245	19.5	58	15	R <sub>C</sub> 1/8	11	13	53	43.2	60	16×23×32.5	26.5	30	3 960	232 000	445 000	6 500	15 400	15 400	7.937	11	17.2

Two HS Type linear guides are available in the High-Accuracy Series: AL Type and EM Type, any of which can be selected for specific applications.

Fig. 17 AL Type

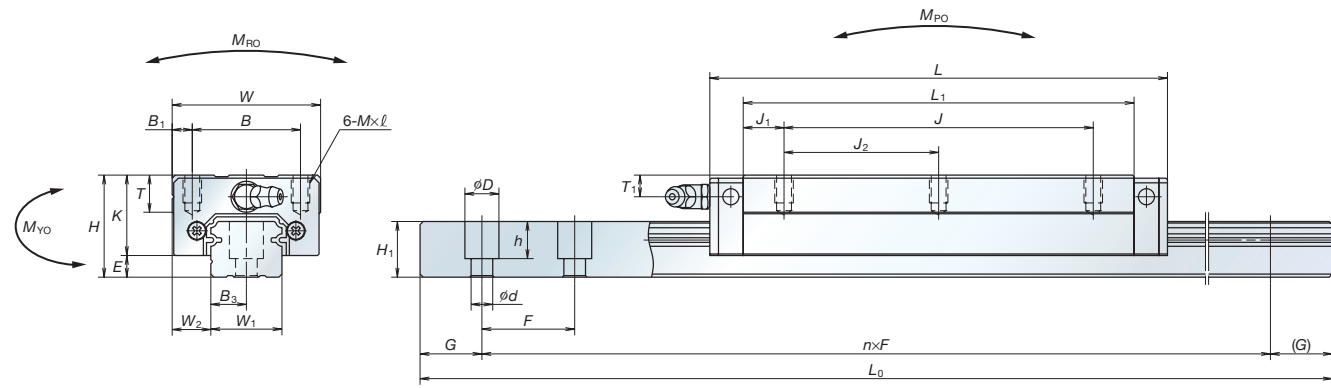


Fig. 18 EM Type

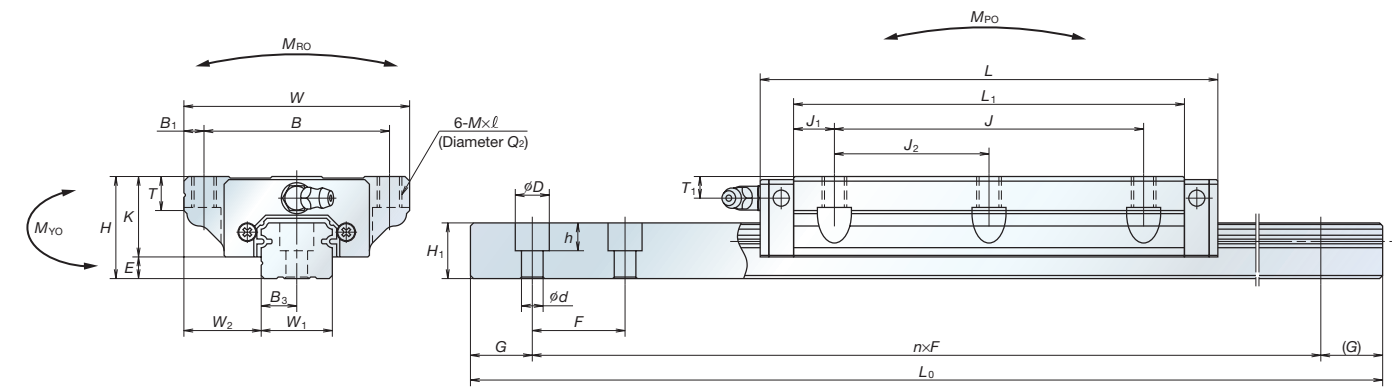


Table 8 Assembly dimensions for AL Type

Model No.	Assembly dimension			Ball slide dimension													Rail dimension						Basic load rating					Ball diameter		Weight		
	Height H	E	W <sub>2</sub>	Width W	Length L	Hole position			Tapped hole M×pitch×ℓ	B <sub>1</sub>	L <sub>1</sub>	J <sub>1</sub>	K	T	Grease nipple			Rail width W <sub>1</sub>	Rail height H <sub>1</sub>	Bolt pitch F	Bolt hole d×D×h	B <sub>3</sub>	G (recommended)	Maximum length L <sub>0</sub> max	Dynamic C (N)	Static C <sub>0</sub> (N)	Static moment (N·m)			D <sub>w</sub>	Ball slide (kg)	Rail (kg/m)
						B	J	J <sub>2</sub>							Mounting hole	T <sub>1</sub>	N										M <sub>RO</sub>	M <sub>PO</sub>	M <sub>YO</sub>			
HS15AL	24	4.6	9.5	34	106	26	60	30	M4×0.7×6	4	89.2	14.6	19.4	10	ϕ3	6	3	15	12.5	30	(*) 3.5×6×8.5 4.5×7.5×8.5	7.5	20	2 000 (1 700)	15 300	40 000	199	395	335	2.778	0.34	1.4
HS20AL	28	6	11	42	119.7	32	80	40	M5×0.8×7	5	102.5	11.25	22	12	M6×0.75	5.5	11	20	15.5	30	6×9.5×10.5	10	20	3 960 (3 500)	20 400	52 000	350	590	495	3.175	0.52	2.3
HS25AL	33	7	12.5	48	148	35	100	50	M6×1×9	6.5	126.4	13.2	26	12	M6×0.75	7	11	23	18	30	7×11×12	11.5	20	3 960 (3 500)	32 000	78 000	605	1 090	910	3.968	0.85	3.1
HS30AL	42	9	16	60	176.1	40	120	60	M8×1.25×12	10	150.7	15.35	33	13	M6×0.75	8	11	28	23	40	7×11×16	14	20	4 000 (3 500)	51 500	127 000	1 190	2 120	1 780	4.762	1.7	4.8
HS35AL	48	10.5	18	70	203.6	50	140	70	M8×1.25×12	10	175.6	17.8	37.5	14	M6×0.75	8.5	11	34	27.5	40	9×14×20	17	20	4 000 (3 500)	71 500	172 000	1 980	3 350	2 820	5.556	2.5	7.0

(\*) The standard rail mounting bolt hole for HS15 is specified as the hole for M3 (3.5×6×8.5). Please contact us to request a different hole for M4 (4.5×7.5×8.5). Dimensions in parentheses apply to stainless steel models.

Table 9 Assembly dimensions for EM Type

Model No.	Assembly dimension			Ball slide dimension													Rail dimension						Basic load rating					Ball diameter		Weight			
	Height H	E	W <sub>2</sub>	Width W	Length L	Hole position			Tapped hole M×pitch×ℓ	Drill hole Diameter Q <sub>2</sub>	B <sub>1</sub>	L <sub>1</sub>	J <sub>1</sub>	K	T	Grease nipple			Rail width W <sub>1</sub>	Rail height H <sub>1</sub>	Bolt pitch F	Bolt hole d×D×h	B <sub>3</sub>	G (recommended)	Maximum length L <sub>0</sub> max	Dynamic C (N)	Static C <sub>0</sub> (N)	Static moment (N·m)			D <sub>w</sub>	Ball slide (kg)	Rail (kg/m)
						B	J	J <sub>2</sub>								Mounting Hole	T <sub>1</sub>	N										M <sub>RO</sub>	M <sub>PO</sub>	M <sub>YO</sub>			
HS15EM	24	4.6	18.5	52	106	41	60	30	M5×0.8×7	4.4	5.5	89.2	14.6	19.4	8	ϕ3	6	3	15	12.5	30	(*) 3.5×6×8.5 4.5×7.5×8.5	7.5	20	2 000 (1 700)	15 300	40 000	199	395	335	2.778	0.45	1.4
HS20EM	28	6	19.5	59	119.7	49	80	40	M6×1.0×9 (M6×1.0×9.5)	5.3	5	102.5	11.25	22	10	M6×0.75	5.5	11	20	15.5	30	6×9.5×10.5	10	20	3 960 (3 500)	20 400	52 000	350	590	495	3.175	0.67	2.3
HS25EM	33	7	25	73	148	60	100	50	M8×1.25×10 (M8×1.25×11.5)	6.8	6.5	126.4	13.2	26	11 (12)	M6×0.75	7	11	23	18	30	7×11×12	11.5	20	3 960 (3 500)	32 000	78 000	605	1 090	910	3.968	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	9	150.7	15.35	33	11 (15)	M6×0.75	8	11	28	23	40	7×11×16	14	20	4 000 (3 500)	51 500	127 000	1 190	2 120	1 780	4.762	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	9	175.6	17.8	37.5	12 (15)	M6×0.75	8.5	11	34	27.5	40	9×14×20	17	20	4 000 (3 500)	71 500	172 000	1 980	3 350	2 820	5.556	3.4	7.0

(\*) The standard rail mounting bolt hole for HS15 is specified as the hole for M3 (3.5×6×8.5). Please contact us to request a different hole for M4 (4.5×7.5×8.5). Dimensions in parentheses apply to stainless steel models.