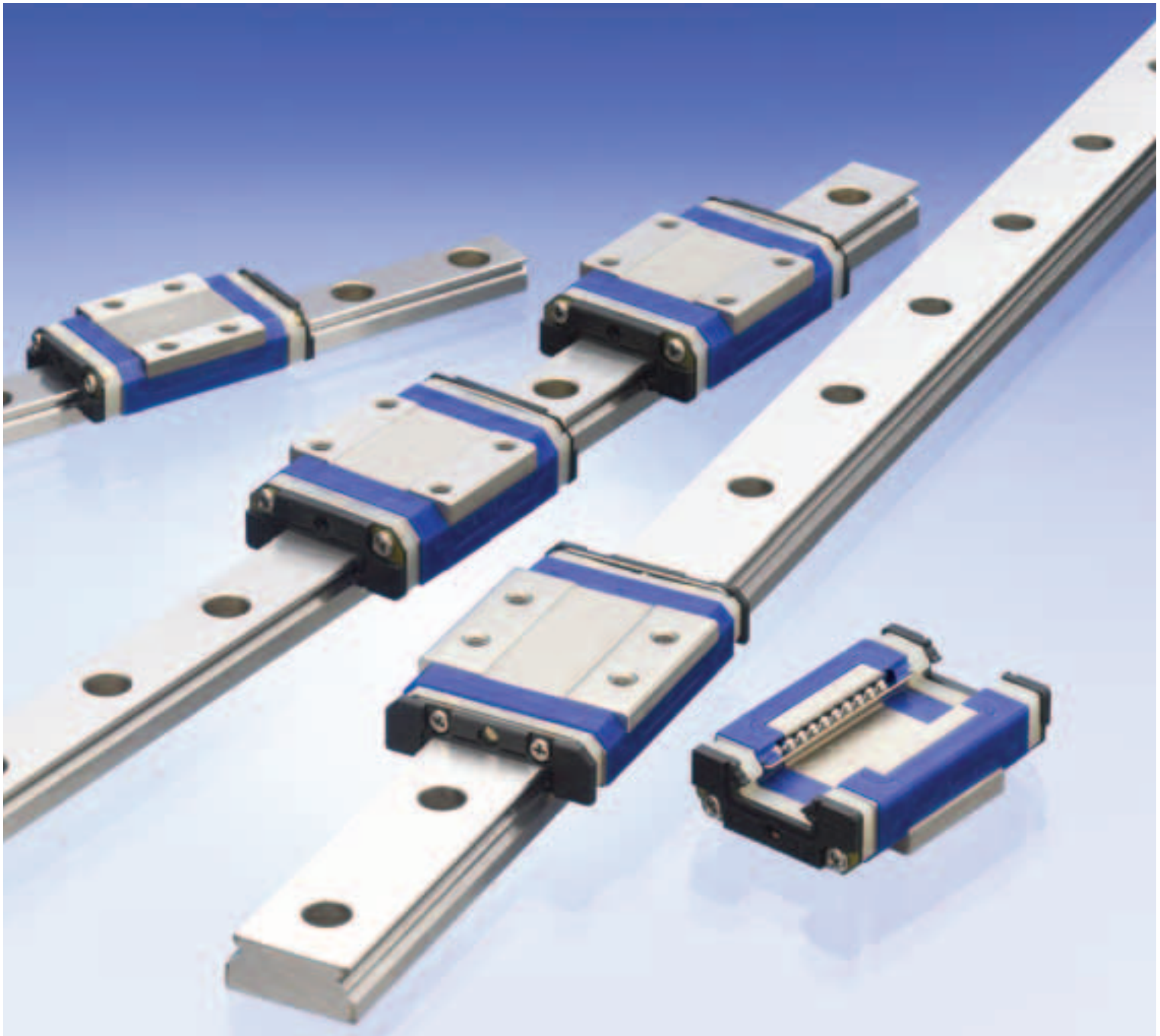
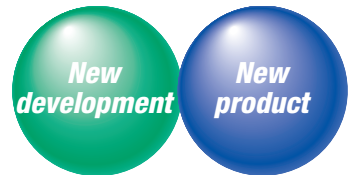


# NSK Linear Guides

## Miniature PU Series/PE Series

Smooth motion and nearly 20% lighter than conventional products, Miniature PU and PE Series support diverse applications, from semiconductor manufacturing devices to medical equipment.

Patent Pending



**Easy-to-handle, lightweight design.**  
**NSK Miniature Linear Guide provides smoother motion with unprecedented lightness.**

The new generation PU Series/PE Series inherit the outstanding lineage of the NSK Miniature Linear Guides LU Series/LE Series. Resin ball recirculation components improve dynamic friction characteristics and create smoother motion with reduced noise intensity. High performance features enhanced dust-proofing, low dust generation, and high corrosion resistance. The new design supports a wide variety of applications.

Ergonomic, gentler tone and low dust generation. NSK Linear Guides Miniature PU Series (Interchangeable with the LU Series)

Ideal for wide, single-rail applications. NSK Linear Guides Miniature PE Series (Interchangeable with the LE Series)

**1 Features**

**1. Motion performance**

Newly designed recirculation component facilitates smooth circulation of steel balls.

**2. Lightweight**

The ball slide is fabricated to be approximately 20% lighter than conventional models by the application of resin to a part of its body.

**3. Reduced noise intensity**

Resin components applied in ball circulating circuits reduce collision noise between steel balls.

**4. Low dust generation**

The structure of the ball slide is designed to prevent dust generation.

**5. Excellent dust-proof**

The labyrinth structure adopted for the side of the rails and the inner walls of the ball slide allows effects equivalent to an under seal.

**6. High corrosion resistance**

High corrosion-resistant martensite stainless steel incorporated as a standard feature provides excellent resistance to corrosion.

**7. Easy to handle**

Safety design includes a retainer that prevents steel balls from dropping out of the ball slide even when the slide is removed from the rail.

**8. Long-term maintenance-free**

Equipped with NSK K1® Lubrication unit realizes long-term, maintenance-free use.

**New** Smoother motion with resin recirculation circuits.  
 Gentler tone and low dust generation.

NSK Linear Guides Miniature **PU Series**  
**PE Series**



**Smoother motion**

The resin ball recirculation component creates an optimal configuration allowing gentler contact with steel balls, resulting in improved dynamic friction characteristics and smoother motion.

Test conditions: Oil lubrication (VG68)  
 Operating speed: 1,000 mm/min  
 Load cell rated capacity: 5N

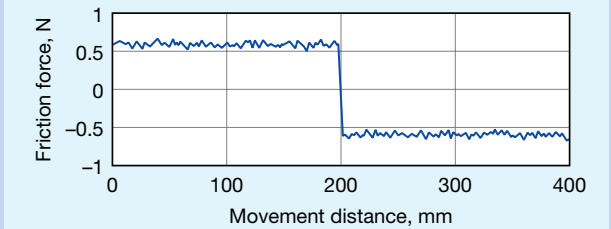


Fig. 1-1 Fluctuations in dynamic friction

**Low dust generation**

The PU Series/PE Series, with resin ball recirculation components, generates less dust than conventional metal ball recirculation components.

Test conditions: Grease lubrication (LG2)  
 Operating speed: 600 mm/min  
 Stroke: 200 mm

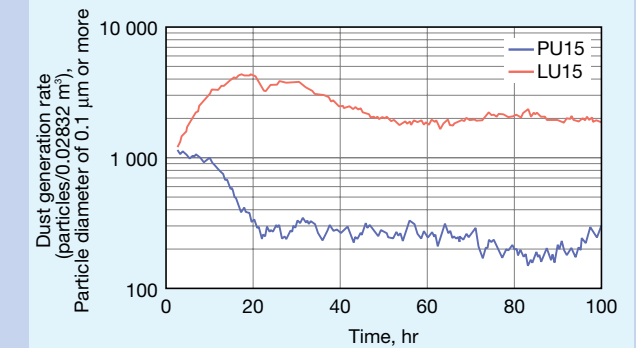


Fig. 1-2 Dust generation rate

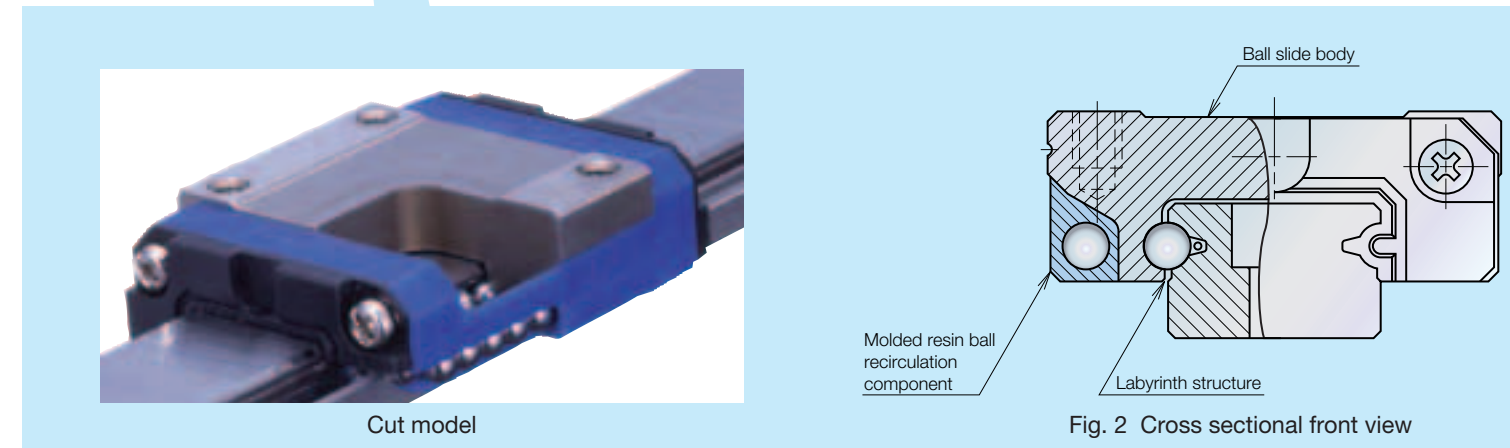


Fig. 2 Cross sectional front view

# For cutting-edge precision positioning table, from semiconductor manufacturing devices to medical equipment.

## –NSK Linear Guides Miniature PU Series/PE Series

### 2 Reference number

Reference numbers will be assigned to identify a linear guide after finalizing all specifications. These reference numbers will be shown on a specification drawing. Please specify the reference number to identify the product when ordering.

**Example:** **PU 15 0470 AL K 2 -\*\* P5 1**

Series name	PU	15	0470	AL	K	2	-**	P5	1
Size									
Rail length (mm)									
Ball slide shape code									
Material/surface treatment K: Stainless steel									
									0: Fine clearance (Z0), 1: Slight preload (Z1)
									Accuracy grade(*) PN: Normal, P6: Precision, P5: High precision, P4: Super precision (with NSK K1) KN: Normal, K6: Precision, K5: High precision, K4: Super precision
									Design serial number
									Number of ball slides per rail

(\*) PE Series is adaptable up to high precision grade P5.

### 3 Accuracy standard and preload

We offer four product accuracy grades(\*): Super precision grade P4, High precision grade P5, Precision grade P6, and Normal grade PN.

The preload has two different levels; slight preload Z1 and fine clearance Z0.

(\*) PE Series is adaptable up to high precision grade P5.

Table 1 Accuracy standard

Unit:  $\mu\text{m}$

Item	Accuracy grade			
	Super precision P4	High precision P5	Precision P6	Normal PN
Mounting height $H$	$\pm 10$	$\pm 15$	$\pm 20$	$\pm 40$
Variation of Mounting height $H$ (All slides on a pair of rails)	5	7	15	25
Mounting width dimension $W_2$ or $W_3$	$\pm 15$	$\pm 20$	$\pm 30$	$\pm 50$
Variation of Mounting width dimension $W_2$ or $W_3$ (All slides on datum rails)	7	10	20	30
Running parallelism of face C against face A	Shown in Table 2, Figs. 3 and 4.			
Running parallelism of face D against face B				

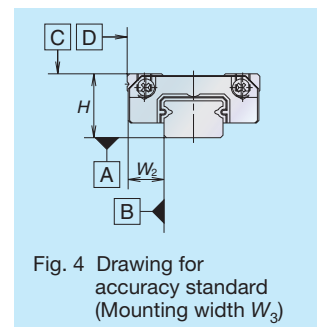
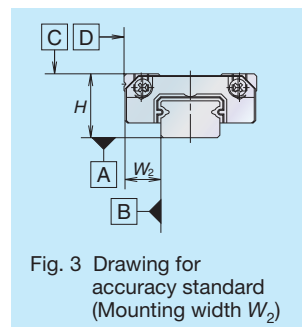


Table 2 Running parallelism tolerance

Unit:  $\mu\text{m}$

Rail length (mm)		Accuracy grade			
over	or less	P4	P5	P6	PN
	50	2	2	4.5	6
	50 ~ 80	2	3	5	6
	80 ~ 125	2	3.5	5.5	6.5
	125 ~ 200	2	4	6	7
	200 ~ 250	2.5	5	7	8
	250 ~ 315	2.5	5	8	9
	315 ~ 400	3	6	9	11
	400 ~ 500	3	6	10	12
	500 ~ 630	3.5	7	12	14
	630 ~ 800	4.5	8	14	16
	800 ~ 1000	5	9	16	18

Table 3 Preload and rigidity of PU Series

Style	Preload (N)		Rigidity (N / $\mu\text{m}$ )
	Slight preload (Z1)	Slight preload (Z1)	Slight preload (Z1)
PU05TR	0 ~ 3.2		17
PU07AR	0 ~ 8		22
PU09TR	0 ~ 10		30
PU12TR	0 ~ 17		33
PU15AL	0 ~ 33		45

Table 4 Preload and rigidity of PE Series

Style	Preload (N)		Rigidity (N / $\mu\text{m}$ )
	Slight preload (Z1)	Slight preload (Z1)	Slight preload (Z1)
PE05AR	0 ~ 28		45
PE07TR	0 ~ 29		46
PE09TR	0 ~ 37		61
PE12AR	0 ~ 40		63
PE15AR	0 ~ 49		66

## 4 Applications

- **Smoother motion and low dust generation**  
Liquid crystal manufacturing and printed circuit board manufacturing devices
- **Lightweight and low dust generation**  
Semiconductor manufacturing devices (mounter, die bonder, and exposure device)
- **Gentler tone and excellent dust proof features**  
Medical machinery and various precision devices

## 5 Height and corner configuration of the mount face

Figs. 5, 6 and Table 5, 6 show the shoulder height and corner radius dimensions, when fixing the linear guide horizontally by pushing it onto the shoulder (projected portion from the mount face) of the bed or table.

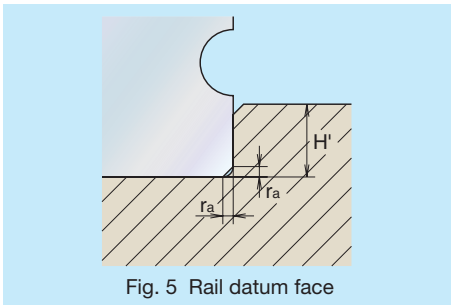


Fig. 5 Rail datum face

Table 5 Shoulder height and corner radius of the mount face (PU Series) Unit: mm

Model No.	Corner radius (Maximum)		Shoulder height	
	$r_a$	$r_b$	$H'$	$H''(*)$
PU05TR	0.2	0.2	0.7	2.3
PU07AR	0.2	0.3	1.2	2.4
PU09TR	0.3	0.3	1.9	2.5
PU12TR	0.3	0.3	2.5	3
PU15AL	0.3	0.5	3.5	4

(\*) $H''$  is the minimum recommended value.

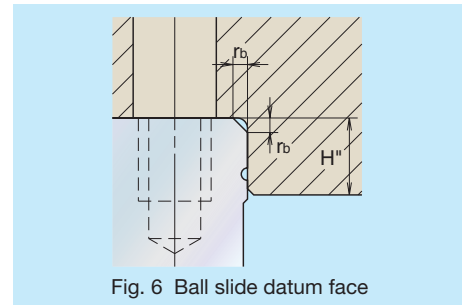


Fig. 6 Ball slide datum face

Table 6 Shoulder height and corner radius of the mount face (PE Series) Unit: mm

Model No.	Corner radius (Maximum)		Shoulder height	
	$r_a$	$r_b$	$H'$	$H''(*)$
PE05AR	0.2	0.2	1.1	2.5
PE07TR	0.2	0.3	1.7	3
PE09TR	0.3	0.3	3.5	2.8
PE12AR	0.3	0.3	3.5	3.2
PE15AR	0.3	0.5	3.5	4.1

(\*) $H''$  is the minimum recommended value.

## 6 Lubrication

**Selection of grease:** Table 7 below shows grease that is suitable for the PU Series/PE Series. We specify PS2 as the standard grease for NSK miniature linear guides.

Table 7 Grease list

Grease code	Thickener	Base oil	Base oil kinematic viscosity $\text{mm}^2/\text{s}$ (40°C)	Temperature range for use (°C)	Characteristic Application
PS2	Lithium type	Synthetic oil + Mineral oil	15	-50 to 110	<ul style="list-style-type: none"> <li>• Better low temperature and dynamic characteristics</li> <li>• Suitable for high speed and light load application</li> </ul>
LG2	Lithium type	Mineral oil + Synthetic hydrocarbon oil	30	-10 to 80	<ul style="list-style-type: none"> <li>• Low duct emission grease for clean room application</li> </ul>
LGU	Diurea type	Synthetic hydrocarbon oil	100	-30 to 120	<ul style="list-style-type: none"> <li>• Low dust emission grease for high temperature, clean room application</li> </ul>

## 7 Dust proofing

**Side seal:** Provided to both sides of the ball slide as a standard feature.

**Bottom seal function:** A labyrinth structure of the ball slide bottom face functions as sealing effect.

**NSK K1®:** Lubrication unit. Table 8 and 9 shows the related dimensions when attaching NSK K1®.

Table 8 Dimensions when attaching NSK K1® (PU Series)

Model No.	Unit: mm		
	Ball slide length when attaching two NSK K1s, $L$	Thickness of single NSK K1, $V_1$	Thickness of protection cover, $V_2$
PU05TR	24.4	2	0.5
PU07AR	29.4	2.5	0.5
PU09TR	36.4	2.7	0.5
PU12TR	42	3	0.5
PU15AL	51.2	3.5	0.6

Table 9 Dimensions when attaching NSK K1® (PE Series)

Model No.	Unit: mm		
	Ball slide length when attaching two NSK K1s, $L$	Thickness of single NSK K1, $V_1$	Thickness of protection cover, $V_2$
PE05AR	28.9	2	0.4
PE07TR	37.1	2.5	0.5
PE09TR	46.8	3	0.5
PE12AR	53	3.5	0.5
PE15AR	66.2	4	0.8

\* Ball slide length when attaching NSK K1® = ("Standard ball slide length") + ("Thickness of single NSK K1",  $V_1 \times$  Numbers of NSK K1s) + ("Thickness of protection cover",  $V_2 \times 2$ )

### 8 Interchangeability with LU Series/LE Series

The PU Series/PE Series is designed to be interchangeable with the LU Series/LE Series for its mounting dimensions and load ratings(\*).

Refer to Figs. 7, 8 and Table 10, 11 for more details.

(\*) Not including load rating of PU05 and PE05.

### 9 Handling precautions

- (1) Resin parts such as the end cap may become damaged when struck or hit.
- (2) Maximum operating temperature must be 80°C or below. Exceeding this limit may damage resin parts.
- (3) Maximum operating temperature must be 50°C (max. momentary 80°C) when attaching NSK K1®. Also, avoid exposure to organic solvents with a degreasing effect. Do not immerse in kerosene or rust preventative oil (with kerosene ingredients).

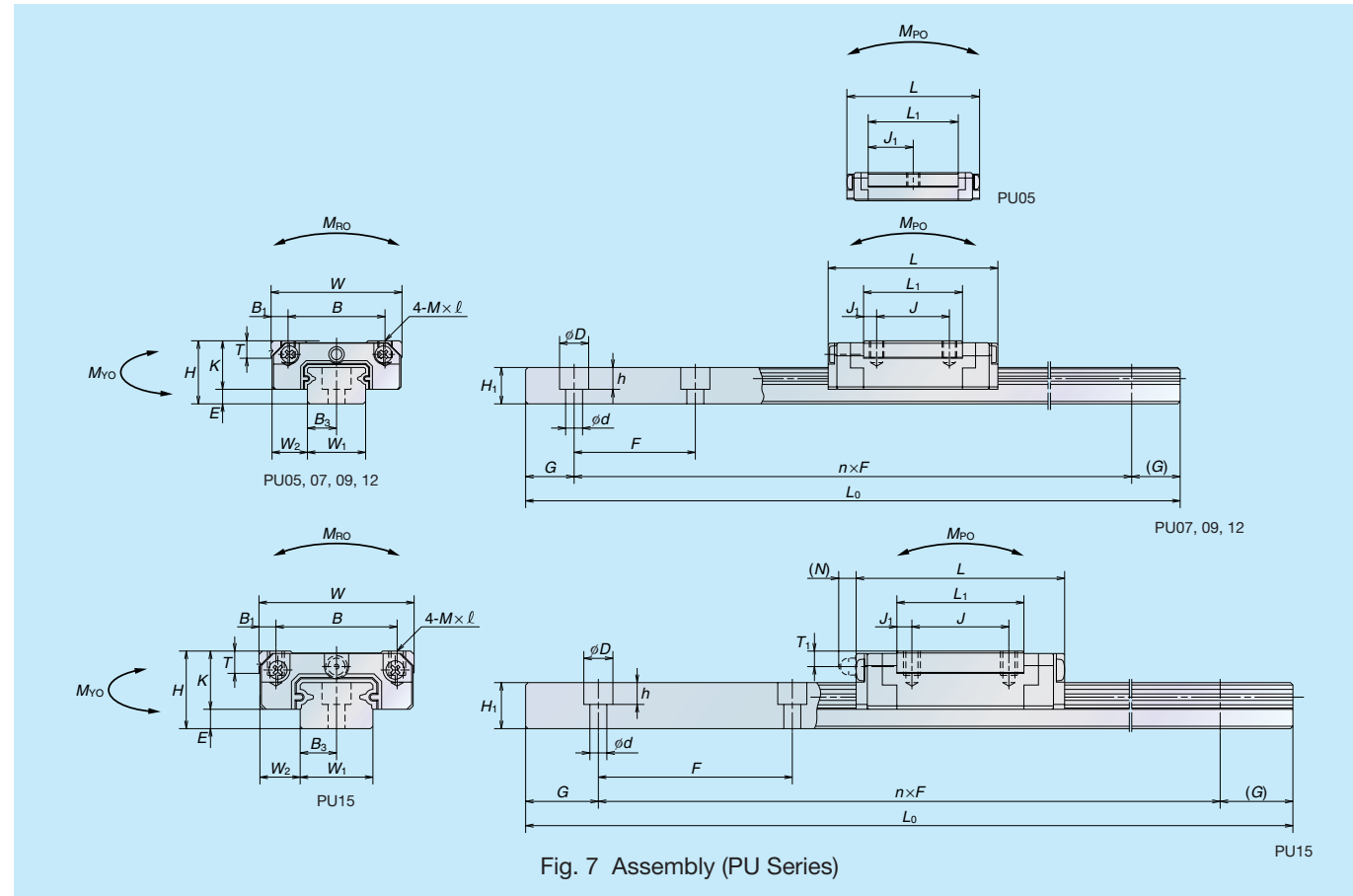


Fig. 7 Assembly (PU Series)

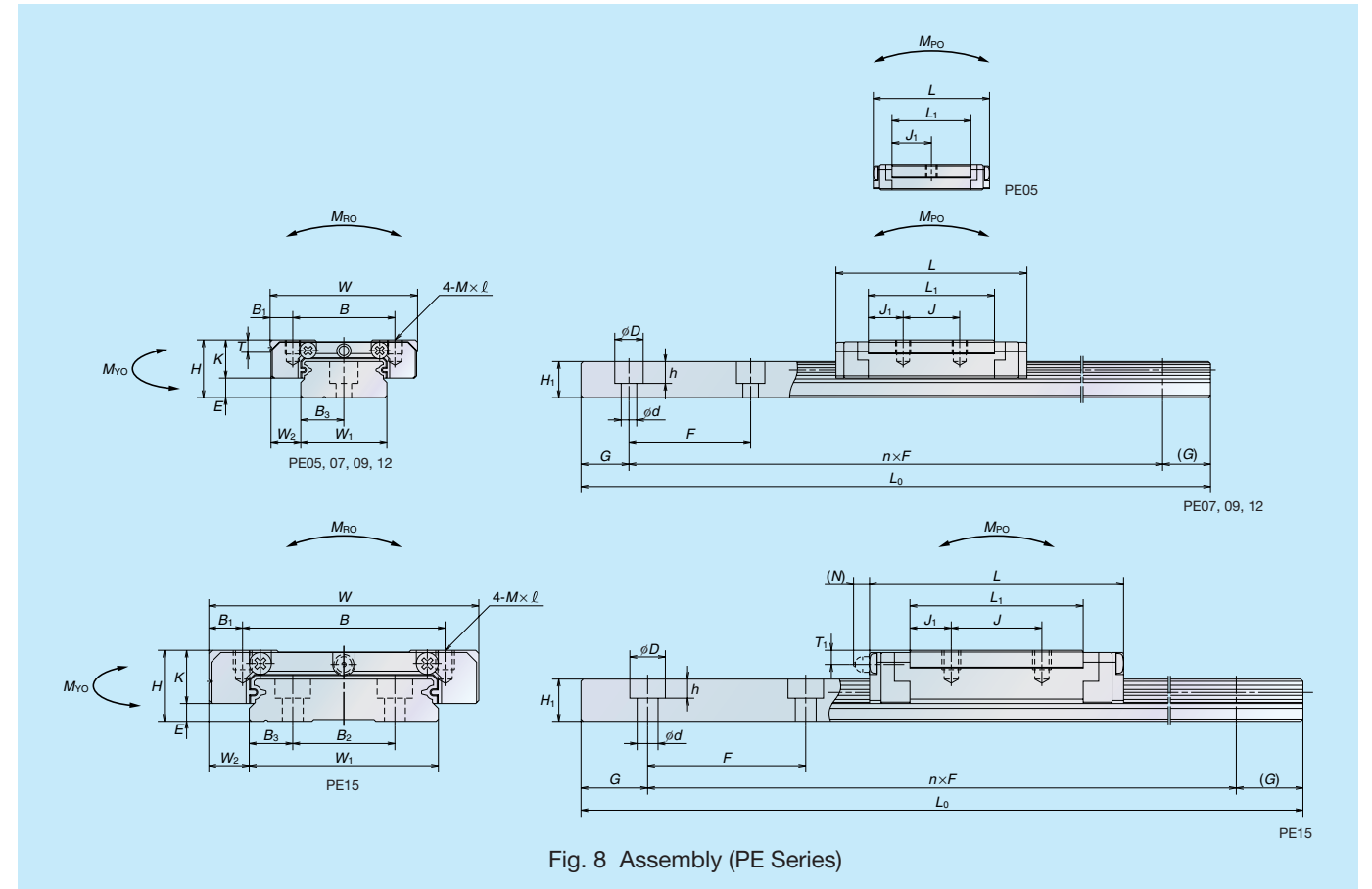


Fig. 8 Assembly (PE Series)

Table 10 Dimensions (PU Series)

Model No.	Assembly			Ball slide													Rail					Basic load rating (*)					Ball diameter D <sub>w</sub>	Weight			
	Height H	E	W <sub>2</sub>	Width W	Length L	Mounting tap hole			B <sub>1</sub>	L <sub>1</sub>	J <sub>1</sub>	K	T	Grease fitting			Width W <sub>1</sub>	Height H <sub>1</sub>	Pitch F	Mounting bolt hole d x D x h	B <sub>3</sub>	G (recommended)	Maximum length L <sub>0max</sub>	Dynamic C(N)	Static C <sub>0</sub> (N)	Static moment (N·m)			Ball slide (g)	Rail (g/100mm)	
						B	J	M x Pitch x l						Port diameter	T <sub>1</sub>	N										M <sub>R0</sub>	M <sub>P0</sub>	M <sub>Y0</sub>			
PU05TR	6	1	3.5	12	19.4	8	—	M2x0.4x1.5	2	11.4	5.7	5	2.3	—	—	—	5	3.2	15	2.3x3.3x0.8	2.5	5	210	520	775	2	1	1	1	3	11
PU07AR	8	1.5	5	17	23.4	12	8	M2x0.4x2.4	2.5	13.3	2.65	6.5	2.45	—	—	—	7	4.7	15	2.4x4.2x2.3	3.5	5	375	1 090	1 370	5	3	3	1.5875	8	23
PU09TR	10	2.2	5.5	20	30	15	10	M3x0.5x3	2.5	19.6	4.8	7.8	2.6	—	—	—	9	5.5	20	3.5x6x4.5	4.5	7.5	600	1 490	2 150	10	6	6	1.5875	16	35
PU12TR	13	3	7.5	27	35	20	15	M3x0.5x3.5	3.5	20.4	2.7	10	3.4	—	—	—	12	7.5	25	3.5x6x4.5	6	10	800	2 830	3 500	21	11	11	2.3812	32	65
PU15AL	16	4	8.5	32	43	25	20	M3x0.5x5	3.5	26.2	3.1	12	4.4	φ3	3.2	(3.3)	15	9.5	40	3.5x6x4.5	7.5	15	1 000	5 550	6 600	50	26	26	3.175	59	105

(\*)The basic load rating complies with ISO standards.

Table 11 Dimensions (PE Series)

Model No.	Assembly			Ball slide													Rail					Basic load rating (*)					Ball diameter D <sub>w</sub>	Weight			
	Height H	E	W <sub>2</sub>	Width W	Length L	Mounting tap hole			B <sub>1</sub>	L <sub>1</sub>	J <sub>1</sub>	K	T	Grease fitting			Width W <sub>1</sub>	Height H <sub>1</sub>	Pitch F	Mounting bolt hole d x D x h	B <sub>3</sub>	G (recommended)	Maximum length L <sub>0max</sub>	Dynamic C(N)	Static C <sub>0</sub> (N)	Static moment (N·m)			Ball slide (g)	Rail (g/100mm)	
						B	J	M x Pitch x l						Port diameter	T <sub>1</sub>	N										M <sub>R0</sub>	M <sub>P0</sub>	M <sub>Y0</sub>			
PE05AR	6.5	1.4	3.5	17	24.1	13	—	M2.5x0.45x1.5	2	16.4	8.2	5.1	2.5	—	—	—	10	4	20	3x5x1.6	5	7.5	150	690	1 160	6	3	3	1	10	34
PE07TR	9	2	5.5	25	31.1	19	10	M3x0.5x2.8	3	20.9	5.45	7	3	—	—	—	14	5.2	30	3.5x6x3.2	7	10	600	1 580	2 350	17	7	7	1.5875	22	55
PE09TR	12	4	6	30	39.8	21	12	M3x0.5x3	4.5	26.6	7.3	8	2.8	—	—	—	18	7.5	30	3.5x6x4.5	9	10	800	3 000	4 500	37	17	17	2	34	95
PE12AR	14	4	8	40	45	28	15	M3x0.5x4	6	31	8	10	3.2	—	—	—	24	8.5	40	4.5x8x4.5	12	15	1 000	4 350	6 350	71	29	29	2.3812	63	140
PE15AR	16	4	9	60	56.6	45	20	M4x0.7x4.5	7.5	38.4	9.2	12	4.1	φ3	3.2	(3.3)	42	9.5	40	4.5x8x4.5	9.5	15	1 200	7 600	10 400	207	59	59	3.175	130	275

(\*)The basic load rating complies with ISO standards.