MOTION & CONTROL
NSK

NSK Linear Guides
Miniature PU Series

Efficient operation led by smooth motion of steel balls, lightweight by 20% over the conventional products, and gentler tone. Miniature PU Series contributes to the cutting edge technologies from semiconductors to medical equipment.

Patent Pending

New development

New product

New Linear Guide with smoother motion. Lightweight and easy-to-handle configuration!

The new generation PU Series, continues the lineage of excellence from the NSK Miniature Linear Guide.

1 Features

1. Smoother motion
Improved materials and modified structure of the recirculation component facilitate 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. High sound quality
Steel ball collision is prevented by applying resin to the recirculation hole.

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
Corrosion resistant martensite stainless steel is used as a standard feature.

7. Easy to handle
A retainer prevents steel balls from dropping out even when the ball slide is removed from the rail.

8. Long-term maintenance-free
NSK K1® Lubrication unit can be attached to achieve a long-term maintenance free use.

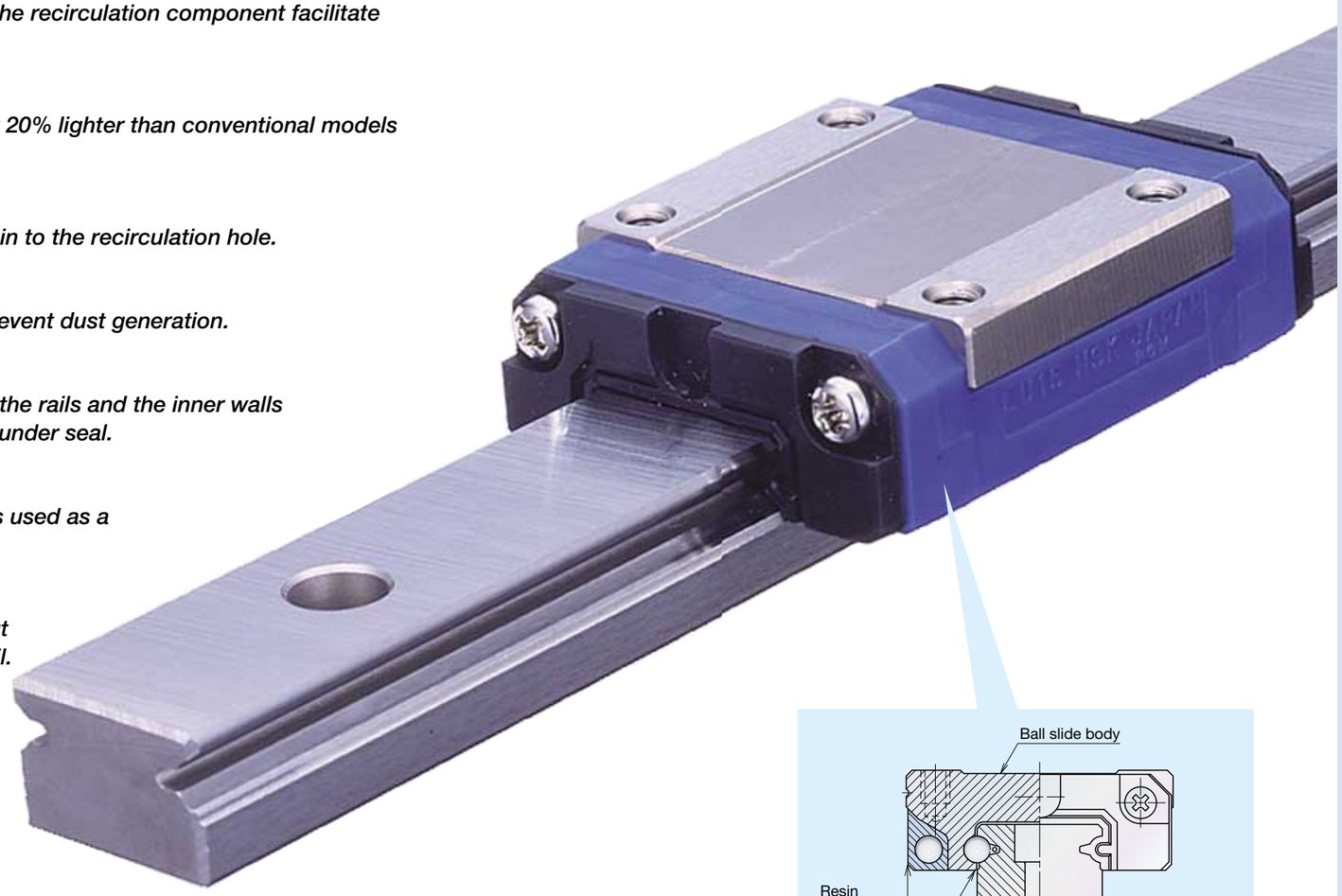

Fig. 1 Cross sectional front view

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

NSK Linear Guides Miniature PU Series

Smoother motion

Resin recirculation circuits create 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

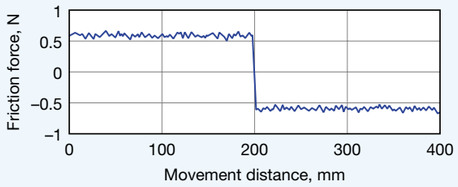

Fig. 2-1 Fluctuations in dynamic friction

Reduced noise level

Metal-to-metal contact between the ball and the circulation hole is eliminated, and therefore the causal factors of noise are reduced. Optimized ball groove profile and soundproof design are also equipped.

Low dust generation

The PU series, with resin recirculation holes, generates less dust than conventional metal recirculation holes.

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

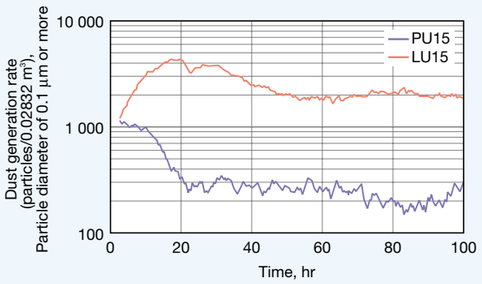

Fig. 2-2 Dust generation rate

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

2 Specification number

Key specifications are indicated by the combination of codes and numbers in the specification number, which is generated when the customer and NSK define specifications and is used until the reference number (recorded on the approval drawings of the product) is designated. The reference number consists of the specification number and the design number.

Example: **PU 15 0470 AL K 2 - P5 Z1 - II**

- Series name
- Size
- Rail length (mm)
- Ball slide TR: #09, #12
  AL: #15
- Material/surface treatment K: Stainless steel
- Number of ball slides per rail
- II refers to a set of two rails; no code refers to one
- Preload Z0: Fine clearance
  Z1: Slight preload
- 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

3 Accuracy standard and preload

We offer four product accuracy grades: Super precision grade P4, High precision grade P5, Precision grade P6, Normal grade PN.
The preload has two different levels; slight preload Z1 and fine clearance Z0.

Table 1 Accuracy standard Unit: μm

Item \ Accuracy grade	Super precision P4	High precision P5	Precision P6	Normal PN
Mounting height *H*	±10	±15	±20	±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	±15	±20	±30	±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 Running parallelism of face D against face B	Shown in Table 2, Figs. 3 and 4.			

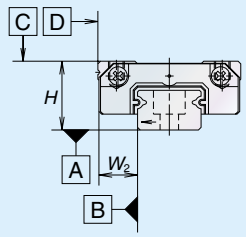

Fig. 3 Drawing for accuracy standard (Mounting width W_2)

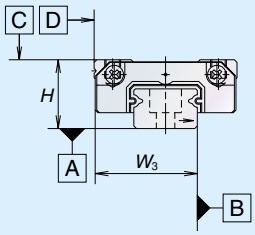

Fig. 4 Drawing for accuracy standard (Mounting width W_3)

Table 2 Running parallelism tolerance Unit: μm

Rail length (mm) over	or less	Accuracy grade 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

Style	Preload (N)	Rigidity (N /μm)
	Slight preload (Z1)	Slight preload (Z1)
PU09TR	0—10	30
PU12TR	0—17	33
PU15AL	0—33	45

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

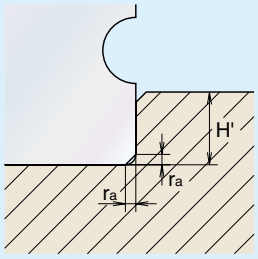

Fig. 5 Rail datum face

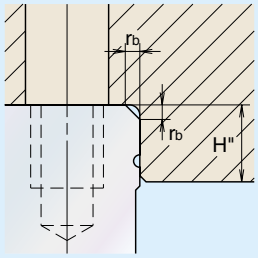

Fig. 6 Ball slide datum face

Table 4 Shoulder height and corner radius of the mount face

Unit: mm

Model No.	Corner radius (Maximum)		Shoulder height	
	r_a	r_b	H'	H"(*)
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.

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

6 Lubrication

Specifications of lubrication ports are shown in Table 5. Syringe-type injectors (available in stores) can be used to supply grease.

Table 5 Lubrication methods Unit: mm

Model No.	Diameter of grease supply hole	Replenishing methods
PU09TR	ø1.9	With injectors (Recommended tip diameter of ø1.83)
PU12TR	ø2.5	With injectors (Recommended tip diameter of ø2.40)
PU15AL	ø3	With injectors (Recommended tip diameter of ø2.40), or with nozzles for injection grease nipple of ø3 (*)

(*): For drive-in type grease nipple of ø3, lubrication can be applied with a dedicated nozzle (NSK HGP NZ3) at the rail end.

Injector (example)

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 6 shows the related dimensions when attaching NSK K1®.

Table 6 Dimensions when attaching NSK K1® Unit: mm

Model No.	Ball slide length when attaching two NSK K1s, L	Thickness of single NSK K1, V_1	Thickness of protection cover, V_2
PU09TR	36.4	2.7	0.5
PU12TR	42	3	0.5
PU15AL	51.2	3.5	0.6

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

8 Interchangeability with LU Series

The PU Series is designed to be interchangeable with the LU Series (LU09TR, LU12TR and LU15AL) for its mounting dimensions and load ratings.
Refer to Figs. 7, 8 and Table 7 for more details.

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).

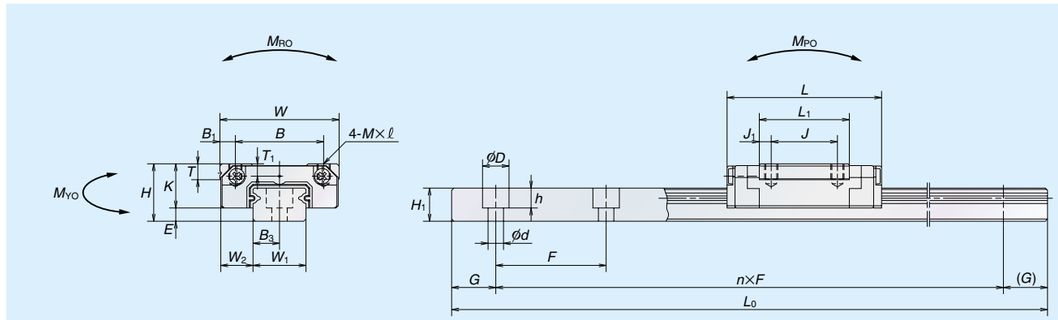

Fig. 7 Assembly (PU09TR and PU12TR)

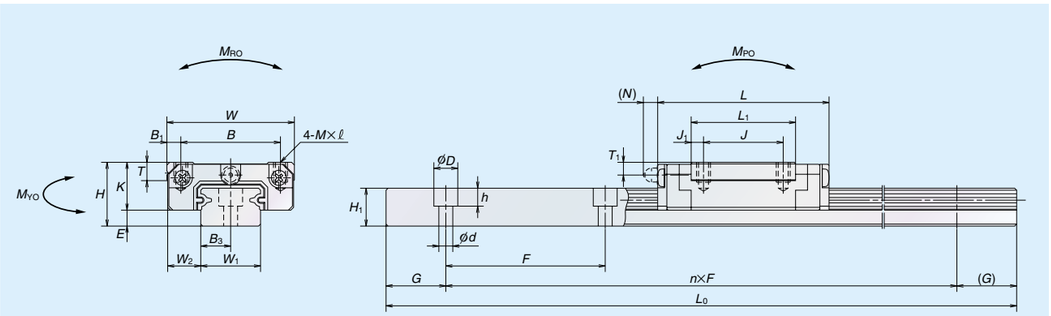

Fig. 8 Assembly (PU15AL)

Table 7 Dimensions Unit: mm

Model No.	Assembly			Ball slide												Rail							Basic load rating					Ball diameter	Weight	
	Height			Width	Length	Mounting tap hole			B_1	L_1	J_1	K	T	Lubrication port			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	M×Pitch×ℓ						Port diameter	T_1	N	W_1	H_1	F	d×D×h	B_3	(recommended)	L_{0max}	C(N)	C_0(N)	M_{R0}	M_{P0}	M_{Y0}	D_W	(g)	(g/100 mm)
PU09TR	10	2.2	5.5	20	30	15	10	M3×0.5×3	2.5	19.6	4.8	7.8	2.6	ø1.9	2.3	—	9	5.5	20	3.5×6×4.5	4.5	7.5	600	1 180	1 770	9	5	5	1.587	16.4	35
PU12TR	13	3	7.5	27	35	20	15	M3×0.5×3.5	3.5	20.4	2.7	10	3.4	ø2.5	2.8	—	12	7.5	25	3.5×6×4.5	6	10	800	2 160	2 450	22	12	12	2.381	32.2	65
PU15AL	16	4	8.5	32	43	25	20	M3×0.5×5	3.5	26.2	3.1	12	4.4	ø3	3.2	(3.3)	15	9.5	40	3.5×6×4.5	7.5	15	1 000	4 300	4 500	42	22	22	3.175	58.9	105