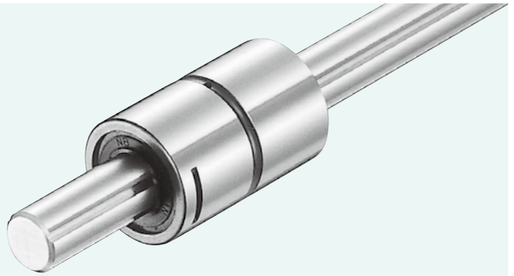
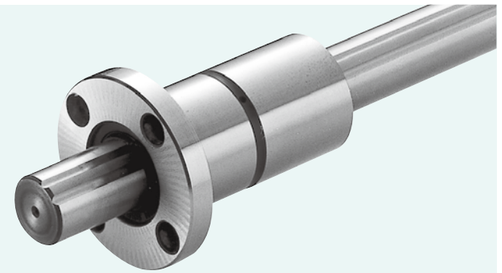
NB BALL SPLINE LINEUP

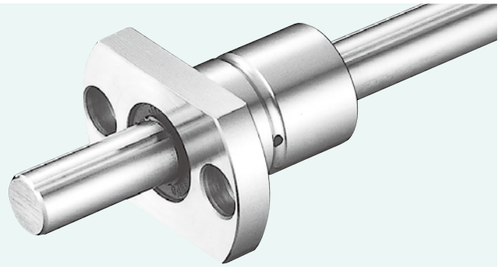
SSP type (cylindrical)



SSPM type (keyless)

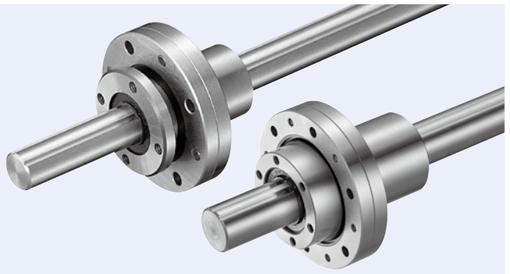


SSPF type (flange)

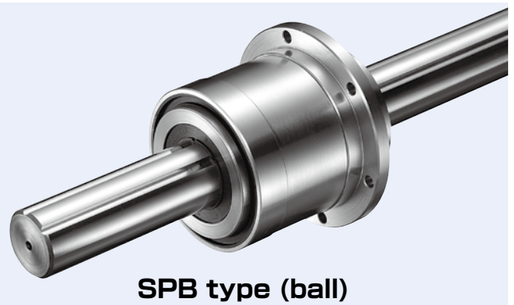


SSPT (two-side-cut flange)

NB ROTARY BALL SPLINE LINEUP



SPR type (roller)



SPB type (ball)

※Please contact NB for details.

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Specifications are subject to change without notice. No.9540 First Edition: May 21, 2012

NB

NEW

BALL SCREW SPLINE

SPBR type, SPBF type

ONE SINGLE AXIS MAKES POSITIONING, LINEAR AND ROTARY MOTION ALL POSSIBLE!!

NIPPON BEARING CO., LTD.

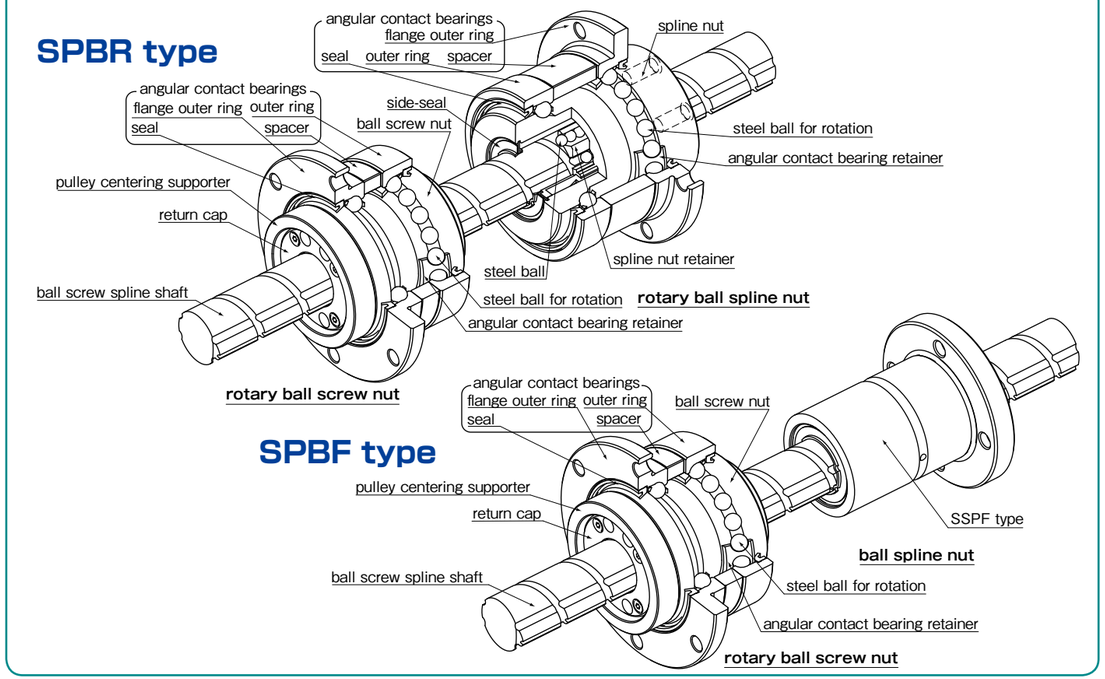
NB BALL SCREW SPLINE

SPBR type, SPBF type

STRUCTURE AND ADVANTAGES

The NB Ball Screw Spline consists of a high accuracy, high rigidity Ball Screw nut and Ball Spline nut attached to the ball screw spline shaft which has a screw groove and spline grooves.
SPBR type has a Rotary Ball Screw nut and Rotary Ball Spline nut.
Rotary Ball Screw nut is an integration of ball screw nut and angular contact bearings.
Rotary Ball Spline nut is an integration of ball spline nut and angular contact bearings.
SPBF type has a Rotary Ball Screw nut and a Ball Spline nut.
A single axis of the NB Ball Screw Spline can provide positioning, linear and rotary motion as well as combined spiral motion.
The typical applications are SCARA robot, assembly machine, loader, etc.

Figure 1 Structure of SPBR type, SPBF type



PRELOAD

The preload is properly adjusted for the ball screw nut, spline nut, and angular contact bearings.
Please contact NB for preload specification.

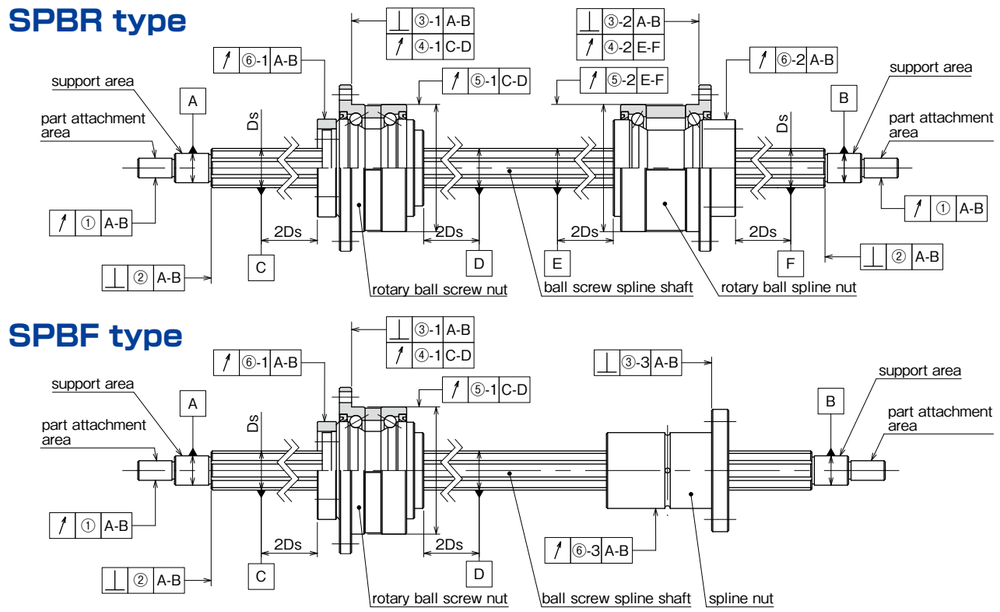
HANDLING PRECAUTION

Please do not adjust the spacer. The spacer is adjusted to give a proper spacing for the best preload condition.
Please do not remove the Rotary Ball Screw nut from the shaft. There is no ball-retainer in the Rotary Ball Screw nut.
Please use the pulley centering supporter when attaching the pulley to the return-cap.

ACCURACY

The NB Ball Screw Spline is measured for accuracy at the points shown in Figure 2.

Figure 2 Accuracy Measurement Points



Note: The support area is the portion where, for example, radial bearings are attached in order to support the spline shaft.
The part attachment area is the portion to which other parts, such as gears, are attached.
④ and ⑤ indicate radial runout during rotational motion.

Table 1 Tolerance of Spline Shaft Groove Torsion (Max.)

tolerance
13μm/100mm

The groove torsion is indicated per 100mm, arbitrarily set within the effective length of the spline shaft section.

Table 2 Grade of Ball Screw Groove

C5

Applied to lead angle accuracy only

Table 3 Tolerance Relative to Spline Support Area (Max.) unit:μm

part number	① radial runout of part attachment area	② perpendicularity of the end of the spline shaft section (when grinding is requested on the drawing)	③ perpendicularity of the flange		
			③-1	③-2	③-3
SPBR16,SPBF16	19	11	16	18	13
SPBR20,SPBF20					
SPBR25,SPBF25	22	13	18	21	16

Table 4 Radial Runout of Outer Surface of Rotary Spline Nut Relative to Spline Shaft Area (Max.) unit:μm

part number	④ lateral runout of flange mounting side		⑤ radial runout of outer ring	
	④-1	④-2	⑤-1	⑤-2
SPBR16	8	8	9	9
SPBR20			10	10
SPBR25				

Table 5 ⑥ Radial Runout of Spline Nut Relative to Spline Support Area (Max.) unit:μm

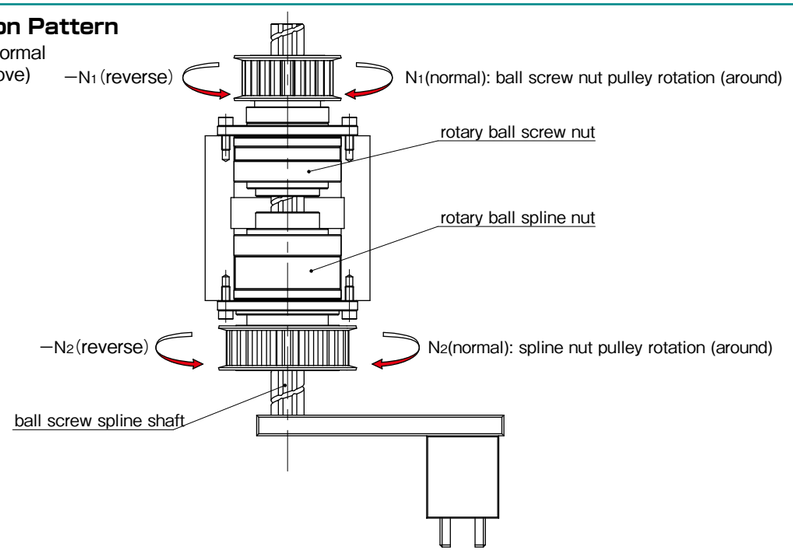
ball screw spline shaft total length(mm)		part number:SPBR,SPBF			
		⑥-1		⑥-2,-3	
greater than	or less	16	20,25	16	20,25
—	200	40	35	18	18
200	315	45	40	25	21
315	400	55	45	31	25
400	500	60	50	38	29
500	630	75	60	46	34
630	800	90	70	58	42
800	1,000	—	85	—	52

SPBR TYPE MOTION PATTERN

One set of SPBR type can handle linear, rotational, and spiral motion.

SPBR type Motion Pattern

Setting clockwise as normal
(looking down from above)



motion	input		output		
	ball screw nut	spline nut	motion direction	travel distance (linear direction)	revolution (rotational direction)
1. up・down	N_1 (normal)	0	①	$L=N_1 \cdot R$ (up)	0
	$-N_1$ (reverse)	0	②	$L=-N_1 \cdot R$ (down)	0
2. rotation	$N_1=N_2$ (normal) (normal)		①	0	N_2 (normal)
	$-N_1=-N_2$ (reverse) (reverse)		②	0	$-N_2$ (reverse)
3. spiral	0	N_2 (normal)	①	$L=N_2 \cdot R$ (down)	N_2 (normal)
	0	$-N_2$ (reverse)	②	$L=-N_2 \cdot R$ (up)	$-N_2$ (reverse)
	N_1 (normal)	N_2 (normal)	①	$L=(N_2-(\pm N_1)) \cdot R$ in case of $N_2-(\pm N_1)>0$ (down)	N_2 (normal)
			④	$L=(N_2-(\pm N_1)) \cdot R$ in case of $N_2-(\pm N_1)<0$ (up)	
	$-N_1$ (reverse)	$-N_2$ (reverse)	③	$L=(-N_2-(\pm N_1)) \cdot R$ in case of $-N_2-(\pm N_1)>0$ (down)	$-N_2$ (reverse)
			②	$L=(-N_2-(\pm N_1)) \cdot R$ in case of $-N_2-(\pm N_1)<0$ (up)	

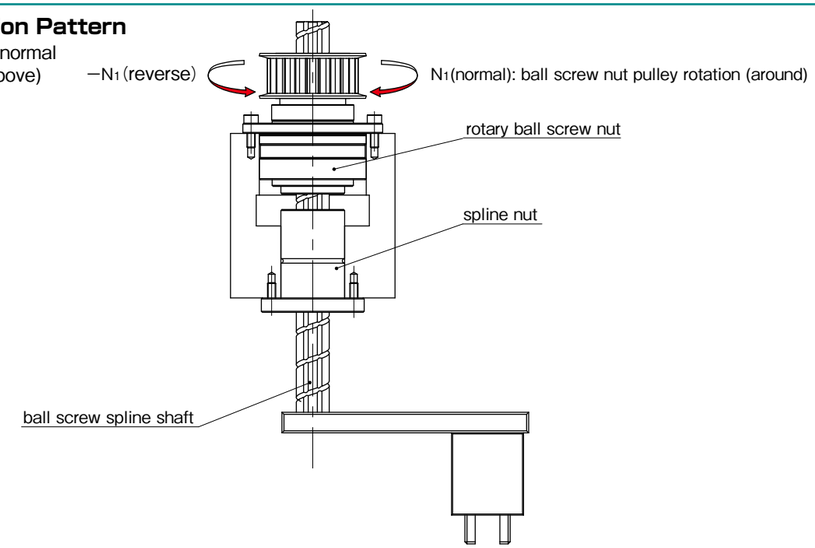
L : travel distance [mm] R : ball screw lead [mm] N_1 : ball screw nut pulley rotation (around) N_2 : ball spline nut pulley rotation (around)

SPBF TYPE MOTION PATTERN

SPBF type can handle linear motion.

SPBF type Motion Pattern

Setting clockwise as normal
(looking down from above)



motion	input	output	
	ball screw nut	motion direction	travel distance (linear direction)
1. up・down	N_1 (normal)	①	$L=N_1 \cdot R$ (up)
	$-N_1$ (reverse)	②	$L=-N_1 \cdot R$ (down)

L : travel distance [mm] R : ball screw lead [mm] N_1 : ball screw nut pulley rotation (around)

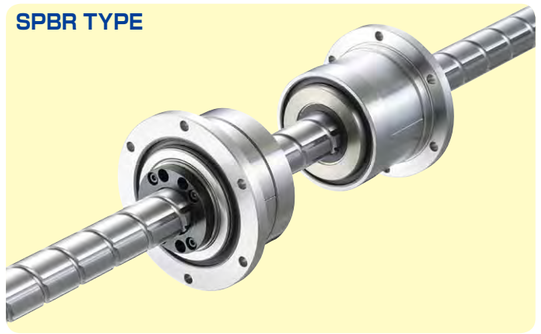
part number structure

example **SPBR 16 - 300 / CU**

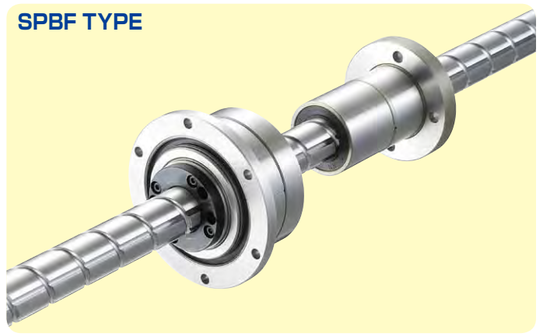
- SPBR type / SPBF type
- nominal diameter
- ball screw spline shaft total length
- with special specification

※ Side-seals and seals are attached as standard.

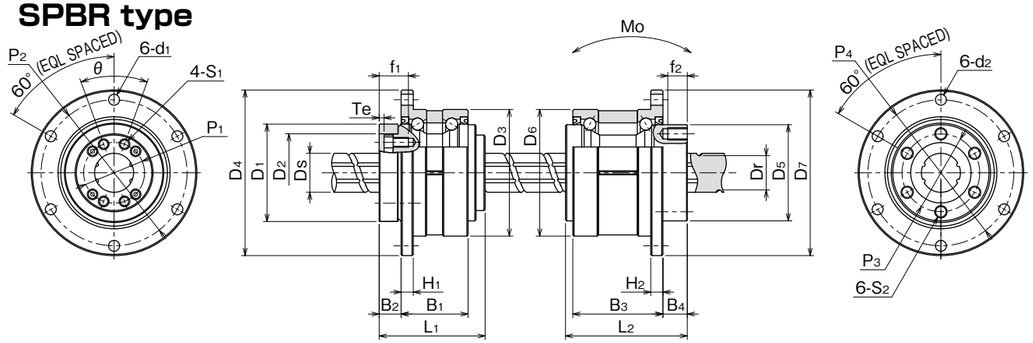
SPBR TYPE



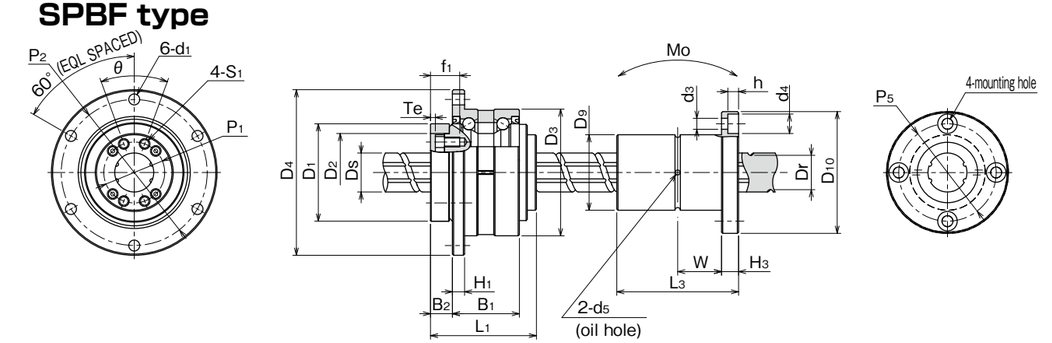
SPBF TYPE



SPBR type



SPBF type



ROTARY BALL SCREW NUT

part number	major dimensions										major dimensions of angular contact bearings						
	D1 h7	tolerance	D2 H7	tolerance	L1	P1 P.C.D.	θ	S1	f1	Te	D3	tolerance	D4	H1	B1	B2	P2 P.C.D.	d1
	mm	μm	mm	μm	mm	mm			mm	mm	mm	μm	mm	mm	mm	mm	mm	mm
SPBR16,SPBF16	40	0 −25	32	+25 0	43.5	25	40°	M4	12	2	52	0 −7	68	5	27.5	9	60	4.5
SPBR20,SPBF20	50		39		54	31	40°	M5	16	2	62		78	6	34	11	70	4.5
SPBR25,SPBF25	58	0/−30	47		65	38	40°	M6	19	3	72		92	8	43	12.5	81	5.5

ball screw spline shaft Ds	lead	root diameter Dr	ball screw basic load rating dynamic Ca	ball screw basic load rating static Coa	angular contact bearings basic load rating dynamic CaR	angular contact bearings basic load rating static CoaR	※ maximum revolutions	moment of inertia for the nut	moment of inertia for the ball screw shaft	mass nut	mass shaft	ball screw nut maximum revolutions based on Dm·N	size
mm	mm	mm	kN	kN	kN	kN	rpm	kg·cm²	kg·cm²/mm	kg	kg/m	rpm	
16	16	13.4	4.62	8.59	11.1	22.2	4,000	0.60	4.43×10^{-4}	0.45	1.47	4,179	16
20	20	17.2	5.77	12.2	14.4	30.5	3,200	1.75	1.12×10^{-3}	0.76	2.33	3,414	20
25	25	21.9	8.62	19.2	18.2	39.8	2,800	3.86	2.74×10^{-3}	1.26	3.65	2,692	25

ROTARY BALL SPLINE NUT

part number	major dimensions						major dimensions of angular contact bearings							ball spline basic torque rating dynamic	ball spline basic torque rating static	ball spline basic load rating dynamic	ball spline basic load rating static	angular contact bearings basic load rating dynamic	angular contact bearings basic load rating static	※ maximum revolutions	allowable static moment	moment of inertia	mass nut
	D5 h7 h7	tolerance	L2	P3 P.C.D.	S2	f2	D6	tolerance	D7	H2	B3	B4	P4 P.C.D.	d2	CT	COT	C	Co	CR	COR		Mo		
	mm	μm	mm	mm		mm	mm	μm	mm	mm	mm	mm	mm	mm	N·m	N·m	kN	kN	kN	kN	rpm	N·m	kg·cm²	kg
SPBR16	39.5	0 −25	50	32	M5	8	52	0 −7	68	5	37	10	60	4.5	60	110	6.12	11.2	13.0	12.8	4,000	46	0.63	0.51
SPBR20	43.5		63	36	M5	8	56		72	6	48	12	64	4.5	105	194	8.9	16.3	17.4	17.2	3,600	110	1.10	0.70
SPBR25	53	0/−30	71	45	M6	8	62		78	6	55	13	70	4.5	189	346	12.8	23.4	22.1	22.5	3,200	171	2.14	0.91

・Please select the smallest maximum revolutions (rpm) in case that more than one portion rotate at the same time.
※Maximum revolutions for grease lubrication.
・Moment of inertia is calculated excluding the angular contact bearings.

BALL SPLINE NUT

part number	major dimensions									basic torque rating		basic load rating		allowable static moment	moment of inertia	mass nut
	D9 h6	tolerance	L3	tolerance	D10	H3	P5 P.C.D.	d3×d4×h	W	d5	dynamic CT	static COT	dynamic C	static Co	Mo		
	mm	μm	mm	mm	mm		mm	mm	mm	mm	N·m	N·m	kN	kN	N·m	kg·cm²	kg
SPBF16	31	0 −16	50	0 −0.2	50	7	40	4.5×8×4.4	18	2	60	110	6.12	11.2	46	0.52	0.2
SPBF20	35		63		58	9	45	5.5×9.5×5.4	22.5	2	105	194	8.9	16.3	110	1.11	0.33
SPBF25	42		71	0/−0.3	65	9	52	5.5×9.5×5.4	26.5	3	189	346	12.8	23.4	171	2.01	0.45