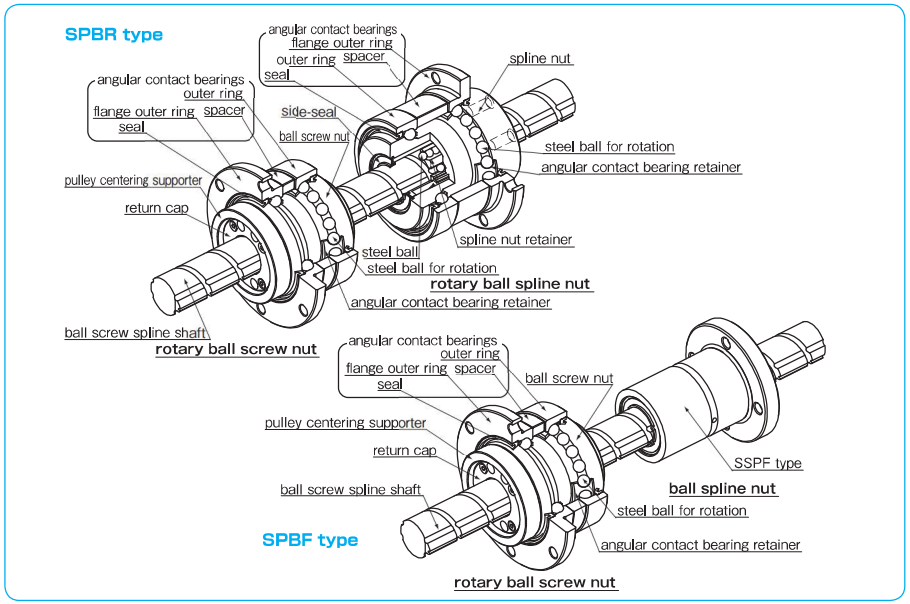
BALL SCREW SPLINE

STRUCTURE AND ADVANTAGES

The NB Ball Screw Spline consists of a highly accurate and highly rigid 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 B-46 Structure of SPBR type, SPBF type



PRELOAD

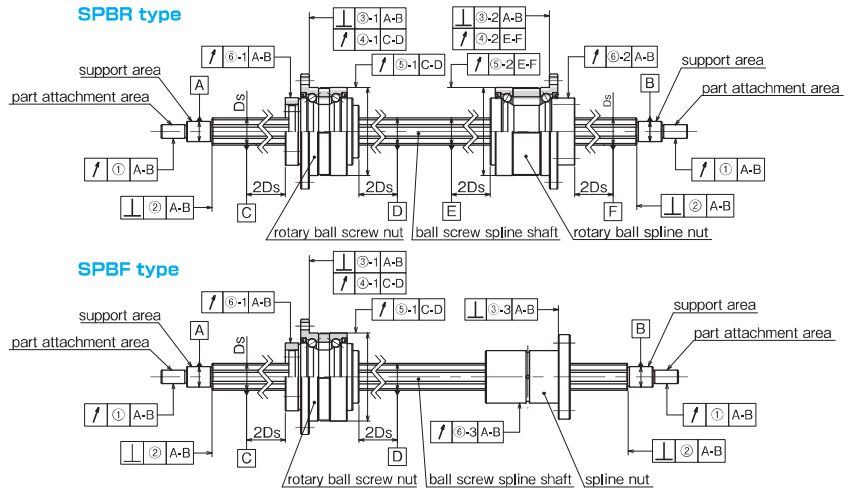
The preload is properly adjusted for the ball screw nut, spline nut, and angular contact bearings.
Please contact NB for preload specification.

USE AND HANDLING PRECAUTIONS

- Please do not adjust the spacer. The spacer is adjusted to provide 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 B-47.
Figure B-47 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 B-35 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 B-36 Grade of Ball Screw Groove

C5
Applied to lead angle accuracy only

Table B-37 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 B-38 Radial Runout of Outer Surface of Rotary Spline Nut Relative to Spline Shaft Area (Max.) unit: μm

part number	④ radial 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				

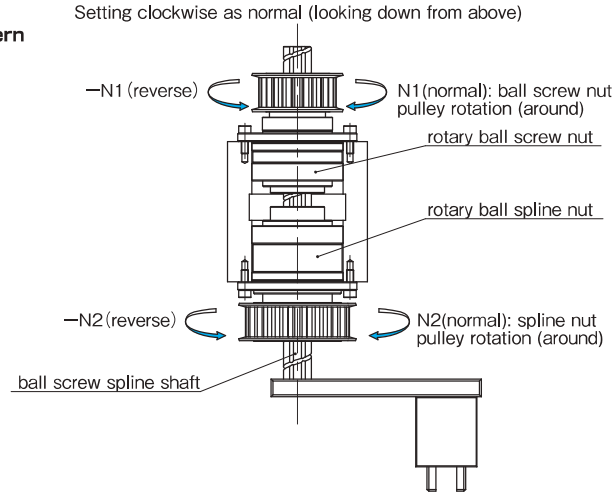
Table B-39 Radial Runout of Spline Nut Relative to Spline Support Area (Max.) unit: μm

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	120	85	75	52

SPBR TYPE MOTION PATTERN

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

SPBR type Motion Pattern



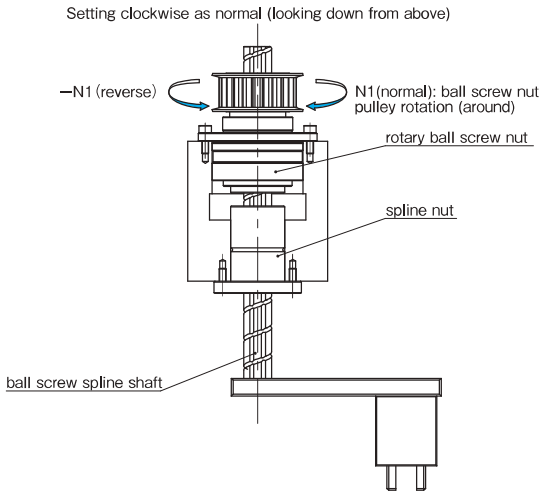
motion	input		output			
	ball screw nut	spline nut	motion direction	travel distance (linear direction)		revolution (rotational direction)
1.up・down	N_1 (normal)	0	①	$L=N_1 \cdot R$ (up)		0
	$-N_1$ (reverse)	0	②	$L=-N_1 \cdot R$ (down)		0
2.rotation	$N_1=N_2$ (normal)	(normal)	①	0		N_2 (normal)
	$-N_1=-N_2$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

L : travel distance [mm] R : ball screw lead [mm] N1 : ball screw nut pulley rotation (around) N2 : ball spline nut pulley rotation (around)

SPBF TYPE MOTION PATTERN

SPBF type can handle linear motion.

SPBF type Motion Pattern



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] N1 : ball screw nut pulley rotation (around)

STANDARD AND MAXIMUM LENGTH

Standard and maximum length of NB ball screw spline shaft are shown in Table B-40.

Table B-40 Standard and Maximum Length of SPBR Type unit : mm

size	standard length			maximum length
16	300	500	1,000	1,000
20	300	500	1,000	
25	300	500	1,000	

・Please contact NB for shaft lengths exceeding maximum length.