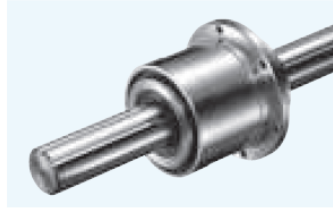
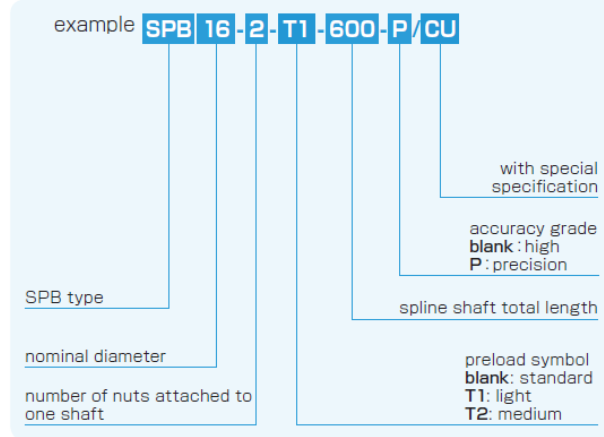


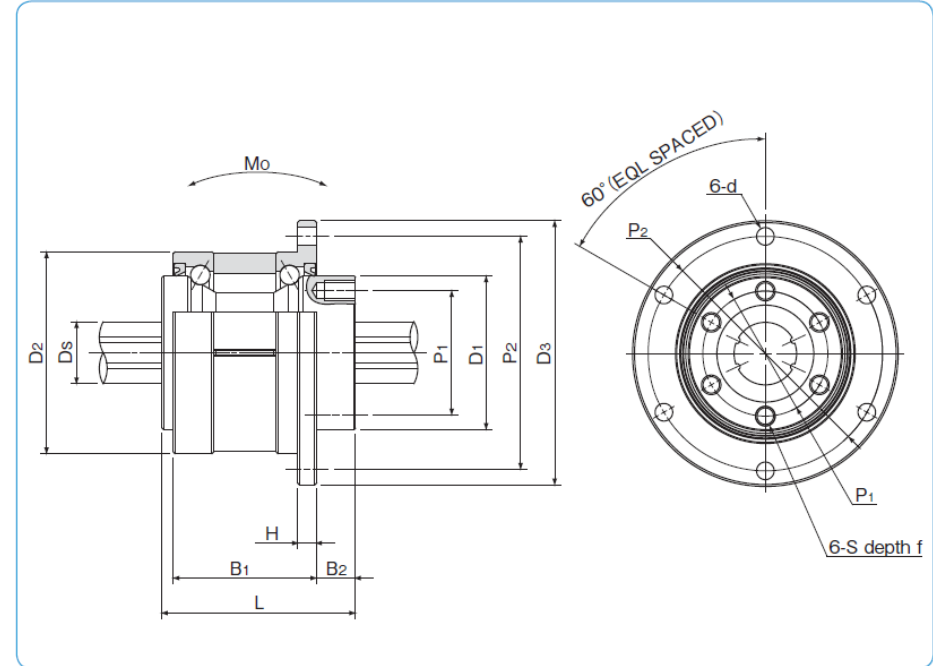
SPB TYPE



part number structure



part number	major dimensions						major dimensions of angular contact bearing							
	D _{1h7} tolerance	L	P ₁ P.C.D.	S	f	D ₂ tolerance	D ₃	H	B ₁	B ₂	P ₂ P.C.D.	d		
	mm	μm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		
SPB16	39.5	0	50	32	M5	8	52	0	68	5	37	10	60	4.5
SPB20	43.5	-25	63	36	M5	8	56	-7	72	6	48	12	64	4.5
SPB25	53	0/-30	71	45	M6	8	62	-7	78	6	55	13	70	4.5



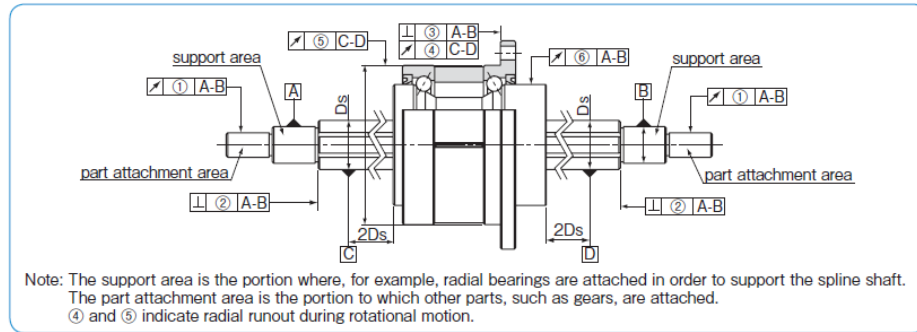
spline shaft D _s tolerance	rotary ball spline				angular contact bearings		allowable static moment M ₀ N·m	mass		* maximum revolutions rpm	size
	basic torque rating dynamic C _T N·m	static C _{0T} N·m	basic load rating dynamic C kN	static C ₀ kN	dynamic C kN	static C ₀ kN		nut kg	shaft kg/m		
16 0/-18	60	110	6.12	11.2	13.0	12.8	46	0.51	1.5	4,000	16
20 0	105	194	8.9	16.3	17.4	17.2	110	0.70	2.4	3,600	20
25 -21	189	346	12.8	23.4	22.1	22.5	171	0.91	3.7	3,200	25

*Maximum revolutions for grease lubrication. (please contact NB in case of oil lubrication.) 1kN≐102kgf 1N·m≐0.102kgf·m

ACCURACY OF SPB TYPE

The accuracy of SPB type is measured at the points shown in Figure B-29.

Figure B-29 Accuracy Measurement Points



Tolerance of Spline Shaft Groove Torsion (Max.)

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

Table B-21 Tolerance of Spline Shaft Groove Torsion (Max.)

accuracy grade	high	precision (P)
tolerance	13 μm/100mm	6 μm/100mm

Table B-22 Tolerance Relative to Spline Support Area (Max.)

part number	①radial runout of part attachment area		②perpendicularity of the end of the spline shaft section (when grinding is requested on the drawing)		③perpendicularity of the flange	
	high-grade	precision-grade(P)	high-grade	precision-grade(P)	high-grade	precision-grade(P)
SPB16	19	12	11	8	18	13
SPB20						
SPB25	22	13	13	9	21	16

Table B-23 Radial Runout of Outer Surface of Rotary Spline Nut Relative to Spline Shaft Area(Max.) unit : μm

part number	④lateral runout of flange mounting side		⑤radial runout of outer ring	
	high-grade	precision-grade(P)	high-grade	precision-grade(P)
SPB16	18	13	21	16
SPB20				
SPB25	21	16		

Table B-24 ⑥Radial Runout of Spline Nut Relative to Spline Support Area(Max.) unit : μm

spline shaft total length (mm)		part number			
greater than	or less	SPB16		SPB20・25	
		high-grade	precision-grade(P)	high-grade	precision-grade(P)
—	200	34	18	32	18
200	315	45	25	39	21
315	400	53	31	44	25
400	500	62	38	50	29
500	630	75	46	57	34
630	800	92	58	68	42
800	1,000	115	75	83	52
1,000	1,250	153	97	102	65
1,250	1,600	195*	127*	130	85
1,600	2,000	—	—	171	116

*SPB16 shaft maximum length : 1,500mm

**Please contact NB for spline shafts exceeding 2000mm.

PRELOAD AND CLEARANCE

The amount of clearance and preload for the spline portion and the cross roller portion are expressed in terms of the clearance in the rotational direction and the clearance in the radial direction, respectively. Three levels of preload are available: standard, light (T1), and medium (T2).

Table B-25 Preload and Clearance in Rotational and Radial Direction unit: μm

	part number	standard	light (T1)	medium (T2)
linear motion	SPR 6	-2~+1	- 6~-2	-
	SPR 8			
	SPR10	-3~+1	- 8~-3	-13~- 8
	SPR13			
	SPR16			
	SPR20A	-4~+2	-12~-4	-20~-12
	SPR25A			
	SPR30A			
	SPR40A	-6~+3	-18~-6	-30~-18
	SPR50A			
SPR60A				
rotational motion	SPR 20	-4~+2	-12~-4	-20~-12
	SPR25			
	SPR30			
	SPR40	-6~+3	-18~-6	-30~-18
	SPR50			
	SPR60			
	SPR 6	-1~+3		
	SPR60			

Table B-26 Preload and Clearance in Rotational Direction(Linear Motion) unit: μm

part number	standard	light (T1)	medium (T2)
SPB16	-3~+1	- 8~-3	-13~- 8
SPB20	-4~+2	-12~-4	-20~-12
SPB25			

The preload is properly adjusted by the spacer for the angular contact bearings.

Table B-27 Preload and Operating Conditions

preload	symbol	operating conditions
standard	blank	minute vibration is applied. a precise motion is required. moment is applied in a given direction.
light	T1	light vibration is applied. light torsional load is applied. cyclic torque is applied.
medium	T2	shock/vibration is applied. over-hang load is applied. torsional load is applied.

HOLLOW SPLINE SHAFT

NB provides hollow shafts. It can be used for cable, air piping and weight reduction. Table B-28 shows a list of recommended inner diameter for hollow spline shaft (SUJ2).

Table B-28 Recommended Inner Diameter for Hollow Spline Shaft

part number	outer diameter Ds mm	inner diameter d mm	second moment of inertia I mm ⁴	cross-sectional coefficient Z mm
SPR 6	—	6	2	58.3
SPR 8	—	8	3	186
SPR10	—	10	4	448
SPR13	—	13	6	1,260
SPR16	SPB16	16	8	2,780
SPR20A	SPB20	20	10	6,860
SPR25A	SPB25	25	15	15,400

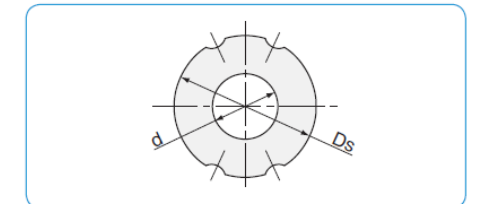
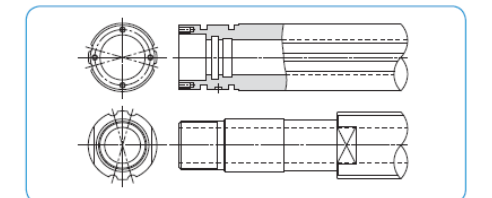


Figure B-30 Examples of Shaft-end Machining

SPECIAL REQUIREMENTS

NB provides customization such as shaft-end machining, spline nut machining, and surface treatment per customer requests. Please contact NB for the inner diameter of SPR20~SPR60.



MOUNTING

The flange attachment screws of SPR type have been pre-adjusted for smooth rotary movement and should never be loosened. Shock loading to the flange assembly should be avoided as this can degrade the accuracy of movement and deteriorate the overall performance.

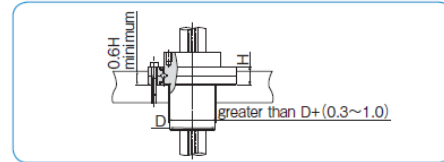
The spacer of SPB type is properly adjusted to produce the best preload condition. Shock loading to the spacer should be avoided as this can change the preload condition and deteriorate the accuracy.

Please fix the mounting screws diagonally. The recommended torque values for medium-hardness steel screws are listed in Table B-29.

SPR Type

When the flange of SPR type is to be used with a faucet joint (as shown in Figure B-31) the housing bore should be machined to a tolerance of H7 and to a minimum depth of 60% of the flange thickness. If only a light load is applied to the SPR in operation, the flange can be used without a pilot end.

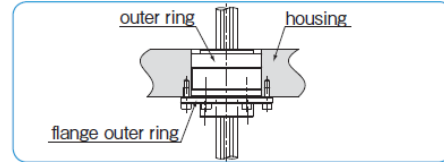
Figure B-31 SPR type Mounting Method



SPB Type

The housing bore for the SPB type should be machined to a tolerance of H7 and keep the enough depth so that the outer ring is inside the housing. If not, the outer ring may drop off.

Figure B-32 SPB type Mounting Method



Insertion of Spline Shaft

When inserting the spline shaft into the rotary ball spline nut, ensure that the ball elements do not drop out. This is done by aligning the raceway grooves of the shaft with the rows of ball elements and the seal-lip of the nut. Then carefully insert the spline shaft through the spline nut.

Table B-29 Recommended Torque unit : N·m

mounting screw	M2	M2.5	M3	M4	M5	M6	M8
recommended torque	0.4	0.9	1.4	3.2	6.6	11.2	27.6

(for alloy steel screw)

LUBRICATION

Since NB rotary ball spline nuts are equipped with seals at both the spline portion and the rotational portion, the lubricant is retained for an extended period of time. The spline nut is prelubricated with lithium soap based grease prior to shipment for immediate use. Please relubricate with a similar type of grease periodically depending on the operating conditions.

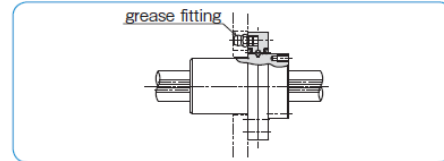
Low dust generation grease is available from NB standard grease. (refer to page Eng-39)

However, an oil lubricant is recommended for high-speed applications. A grease fitting or machining oil holes is optional (Figure B-33~35), please contact NB for details.

SPR Type

A grease fitting for rotational portion and machining oil hole for spline portion are optional.

Figure B-33 Example of Installed Grease Fitting



SPB Type

Rotational portion has an oil hole as a standard. For lubrication, it is recommended to mount a grease fit or oil hole to housing. Machining oil hole for spline portion is available. Please contact NB.

Figure B-35 SPB type Oil Hole

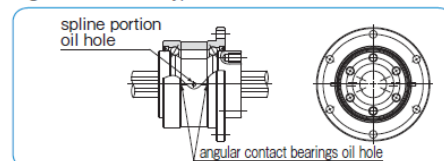
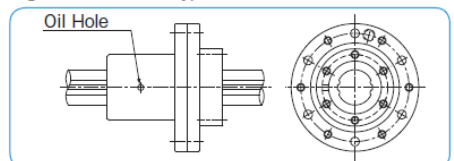


Figure B-34 SPR type Oil Hole



OPERATING CONDITIONS

The performance of the rotary ball spline is affected by the operating conditions of the application. The operating conditions should therefore be carefully taken into consideration.

Operating Temperature

Resin retainers are used in the rotary ball spline, so the operating temperature should never exceed 80°C.

Dust Prevention

Foreign particles or dust in the rotary ball spline nut affects the motion accuracy and shortens the life time. Standard seals will perform well for dust prevention under normal operating conditions, however, in a harsh environment it is necessary to attach bellows or protective covers.

APPLICATION EXAMPLES

