

NB BALL SPLINE LINEUP



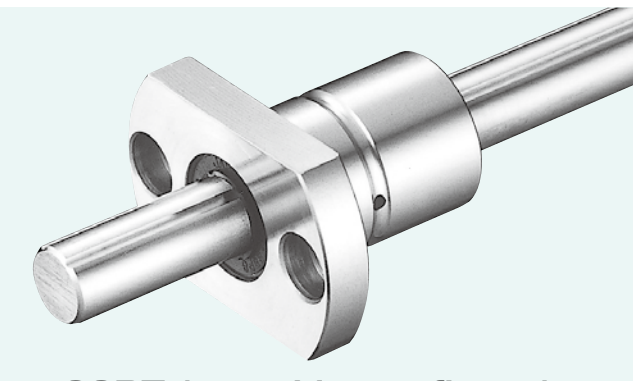
SSP type (cylindrical)



SSPM type (keyless)

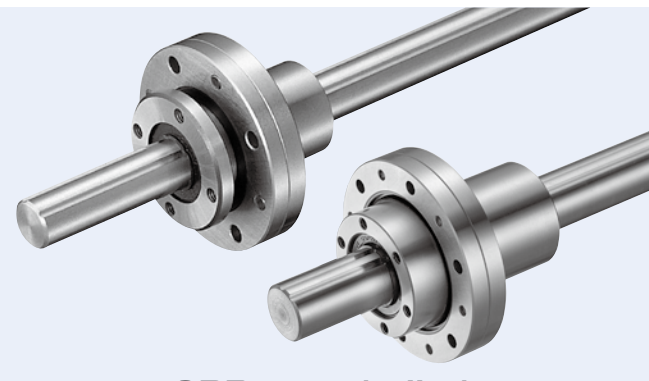


SSPF type (flange)

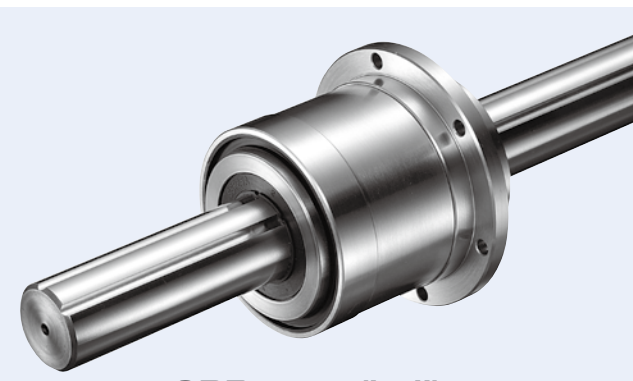


SSPT (two-side-cut flange)

NB ROTARY BALL SPLINE LINEUP



SPR type (roller)



SPB type (ball)

※Please contact NB for details.



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NB

NEW

BALL SCREW SPLINE

SPBR type, SPBF type

ONE SINGLE AXIS MAKES POSITIONING,
 LINEAR AND ROTARY MOTION

ALL POSSIBLE!!



NIPPON BEARING CO., LTD.

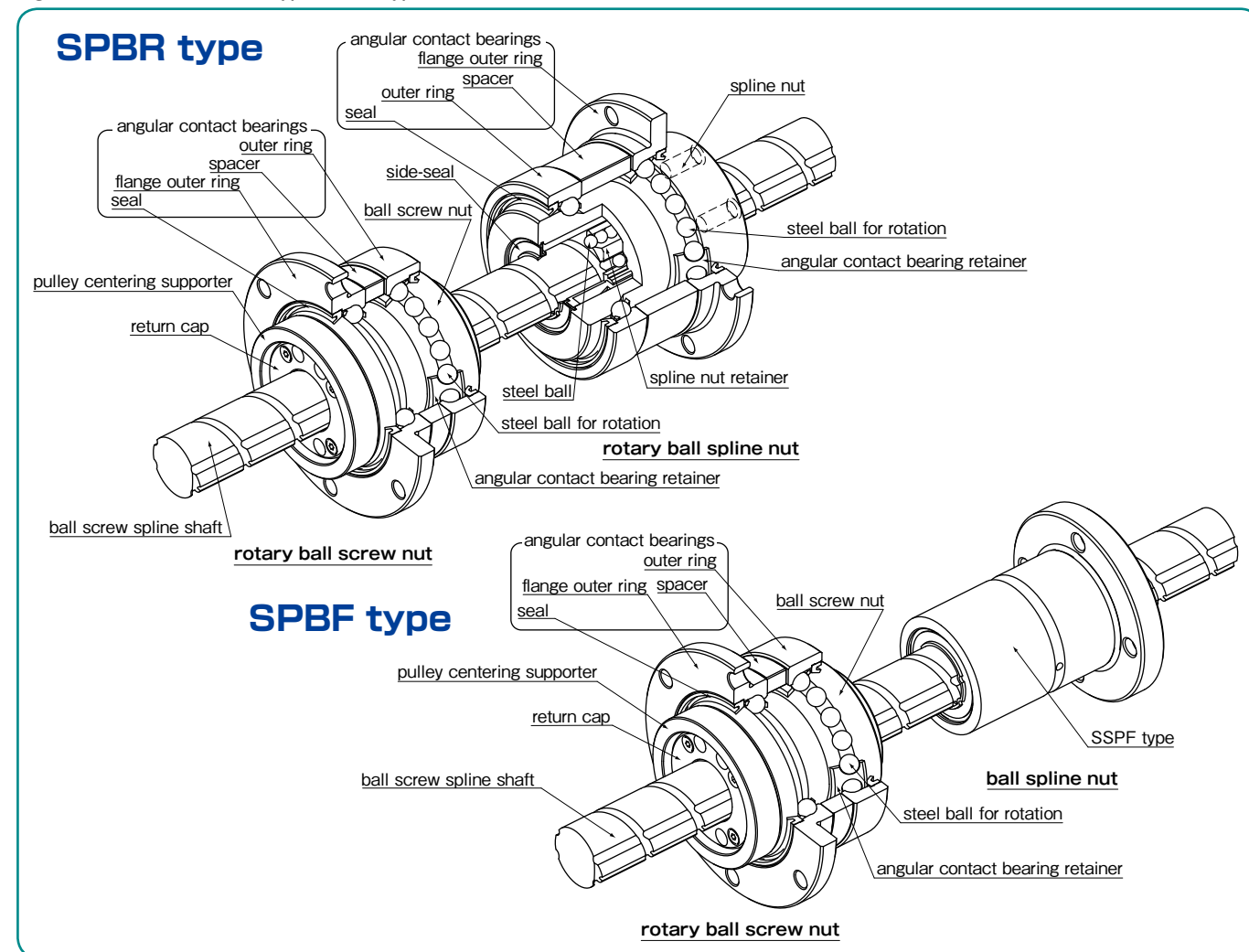
NB BALL SCREW SPLINE

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

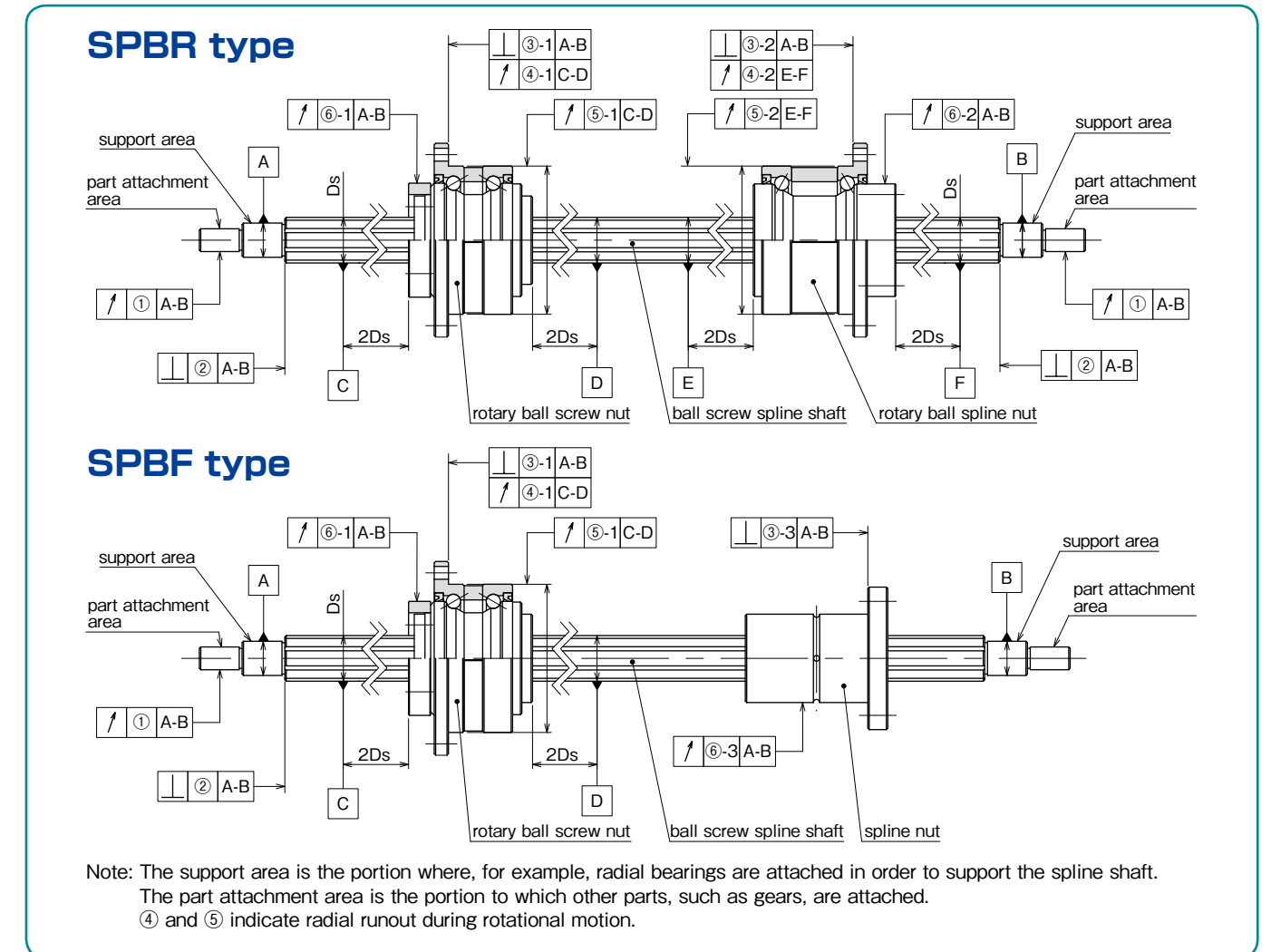


Table 1 Tolerance of Spline Shaft Groove Torsion (Max.)

| 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.)

| 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 | | | | | |

unit:μm

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

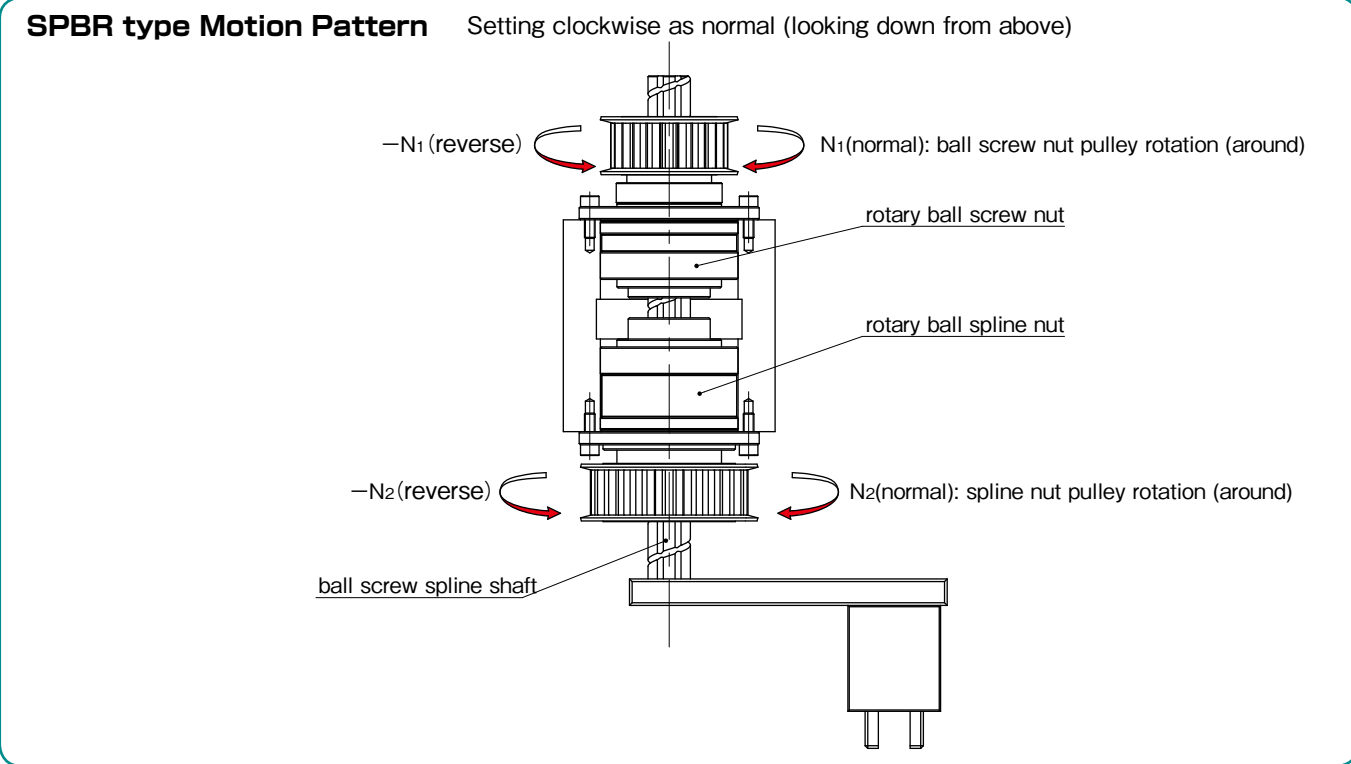
| part number | ④ lateral runout of flange mounting side | | ⑤ radial runout of outer ring | |
|-------------|--|-----|-------------------------------|-----|
| | ④-1 | ④-2 | ⑤-1 | ⑤-2 |
| SPBR16 | 8 | 8 | 9 | 9 |
| SPBR20 | | | 10 | 10 |
| SPBR25 | | | 10 | 10 |

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

| 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.

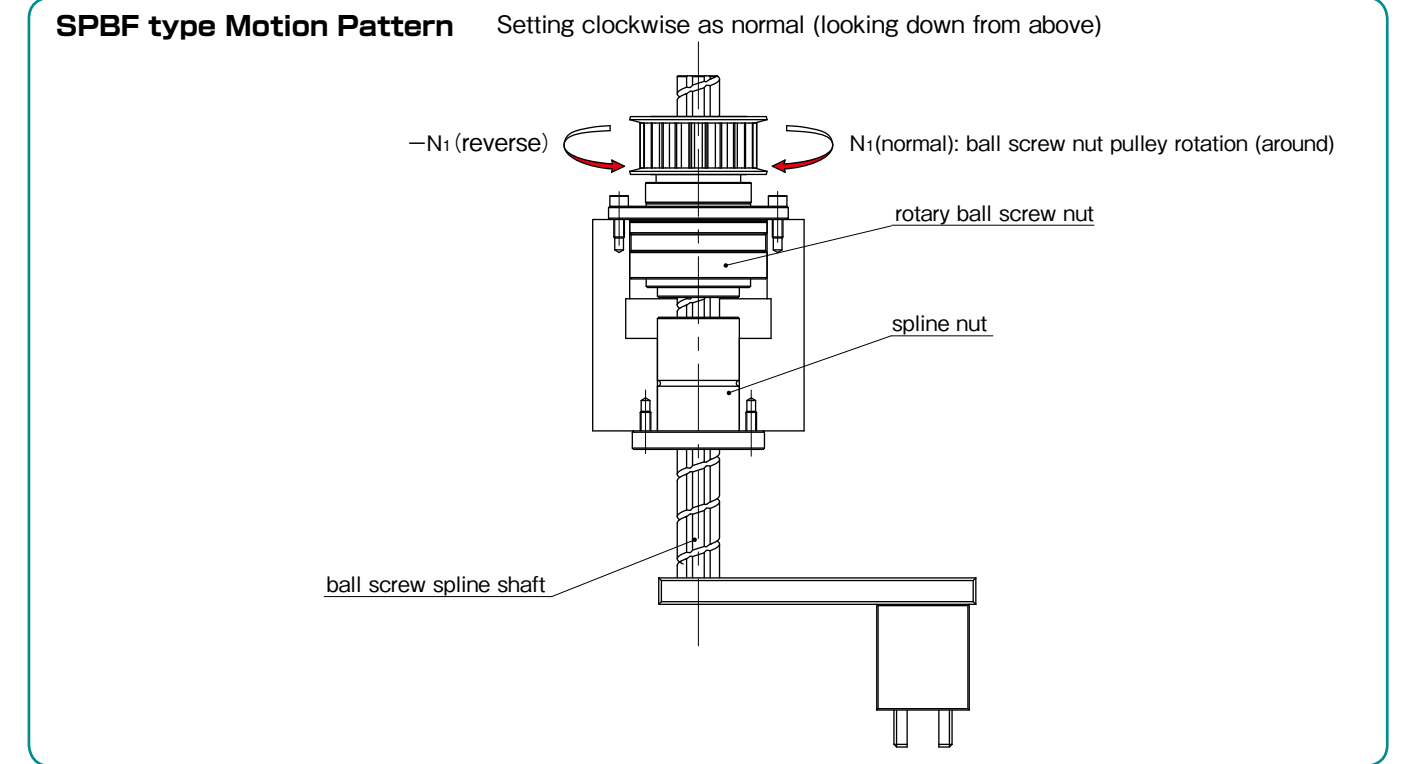


| motion | input | | output | | | |
|---------------------|---|------------------------------|------------------|--|---|------------------------------|
| | ball screw nut | spline nut | motion direction | travel distance (linear direction) | revolution (rotational direction) | |
| <p>1. up · down</p> | N ₁ (normal) | 0 | ① | L=N ₁ ·R (up) | 0 | |
| | -N ₁ (reverse) | 0 | ② | L=-N ₁ ·R (down) | 0 | |
| <p>2. rotation</p> | N ₁ =N ₂ (normal) (normal) | | ① | 0 | N ₂ (normal) | |
| | -N ₁ =-N ₂ (reverse) (reverse) | | ② | 0 | -N ₂ (reverse) | |
| <p>3. spiral</p> | 0 | N ₂ (normal) | ① | L=N ₂ ·R (down) | N ₂ (normal) | |
| | 0 | -N ₂ (reverse) | ② | L=-N ₂ ·R (up) | -N ₂ (reverse) | |
| | N ₁ (normal) | N ₂ (normal) | ① | L=(N ₂ - (±N ₁))·R | in case of N ₂ - (±N ₁)>0 (down) | N ₂ (normal) |
| | | | ④ | | in case of N ₂ - (±N ₁)<0 (up) | |
| | -N ₁ (reverse) | -N ₂ (reverse) | ③ | L=(-N ₂ - (±N ₁))·R | in case of -N ₂ - (±N ₁)>0 (down) | -N ₂ (reverse) |
| | | | ② | | in case of -N ₂ - (±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

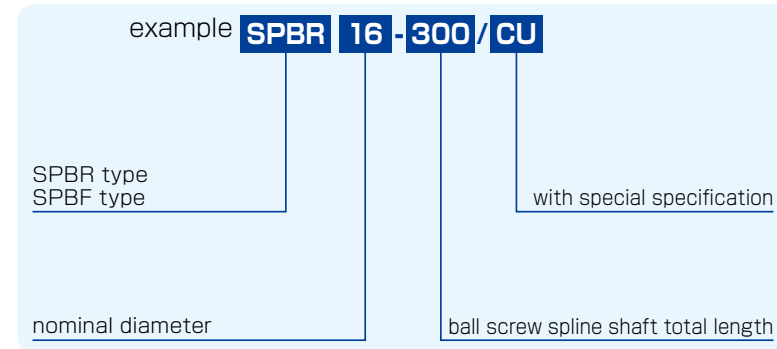
SPBF type can handle linear motion.



| motion | input | | output | |
|---------------------|------------------------------|------------|------------------|------------------------------------|
| | ball screw nut | spline nut | motion direction | travel distance (linear direction) |
| <p>1. up · down</p> | N ₁ (normal) | 0 | ① | L=N ₁ ·R (up) |
| | -N ₁ (reverse) | 0 | ② | L=-N ₁ ·R (down) |

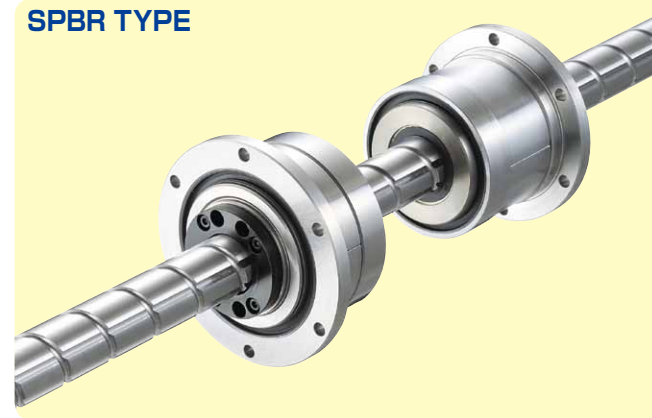
L : travel distance [mm] R : ball screw lead [mm] N₁ : ball screw nut pulley rotation (around)

part number structure

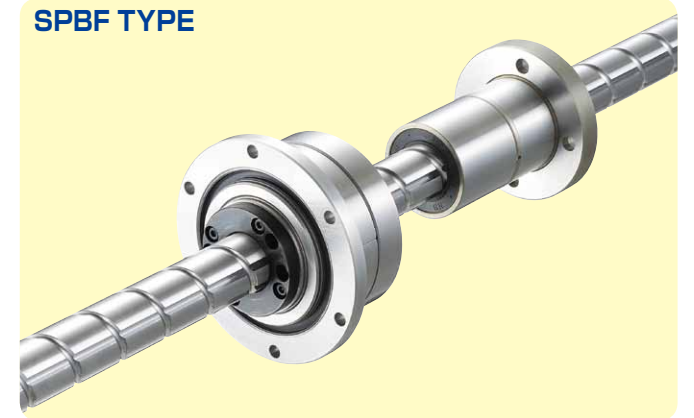


※ Side-seals and seals are attached as standard.

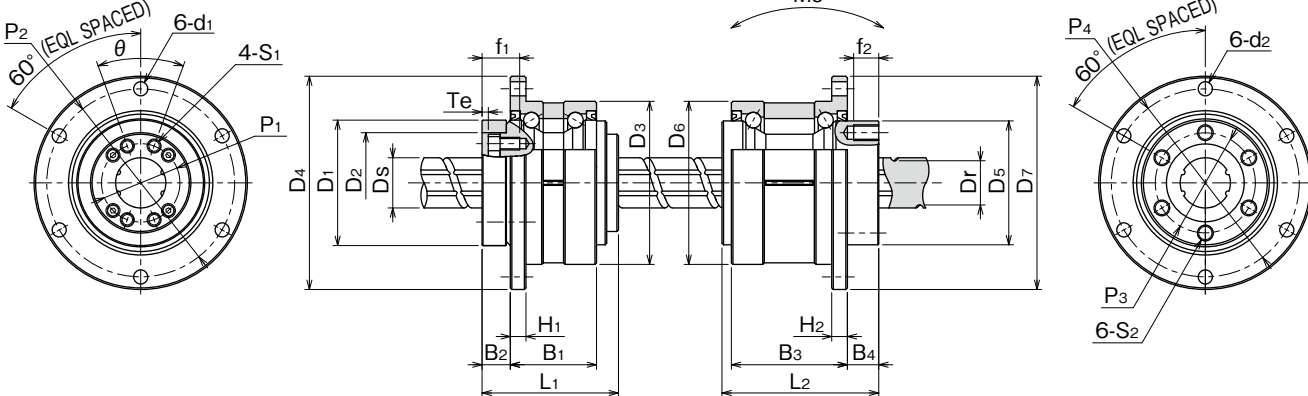
SPBR TYPE



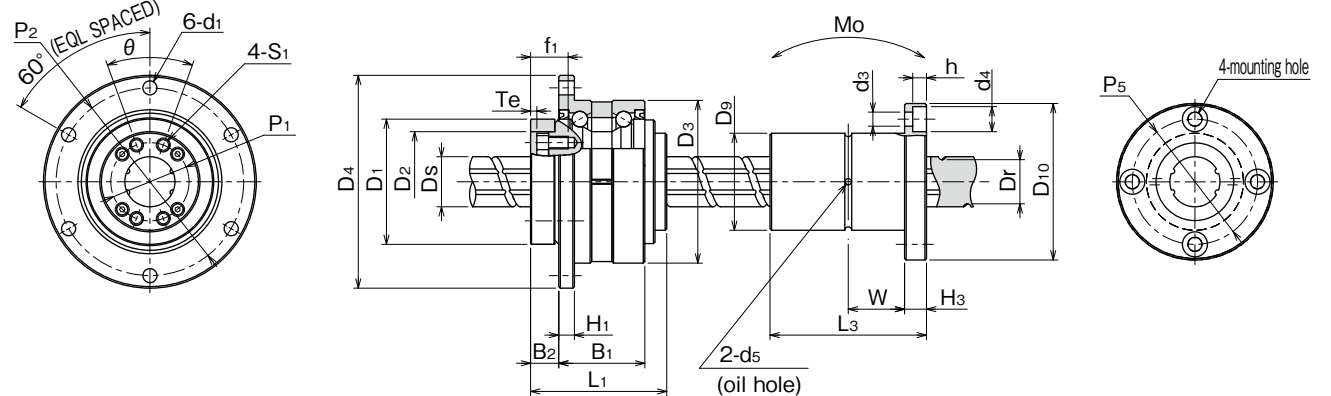
SPBF TYPE



SPBR type



SPBF type



ROTARY BALL SCREW NUT

| part number | major dimensions | | | | | | | | | | major dimensions of angular contact bearings | | | | | | |
|---------------|------------------|-----------|-----------|------|----|----------|----|----|----|----|--|----|------|------|----|-----|--------|
| | D1 h7 | D2 H7 | | L1 | P1 | θ | S1 | f1 | Te | D3 | D4 | H1 | B1 | B2 | P2 | d1 | |
| | | tolerance | tolerance | | | | | | | | | | | | | | P.C.D. |
| SPBR16,SPBF16 | 40 | 0 | 32 | 43.5 | 25 | 40° | M4 | 12 | 2 | 52 | 68 | 5 | 27.5 | 9 | 60 | 4.5 | |
| SPBR20,SPBF20 | 50 | -25 | 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 | |

ROTARY BALL SPLINE NUT

| part number | major dimensions | | | | | | major dimensions of angular contact bearings | | | | | | ball spline | | | | angular contact bearings | | | allowable static moment Mo | moment of inertia | mass nut |
|-------------|------------------|----|----|----|----|----|--|----|----|----|----|-----|---------------------|--------|-------------------|--------|--------------------------|--------|---------------------|----------------------------|-------------------|----------|
| | D5 h7 | L2 | P3 | S2 | f2 | D6 | D7 | H2 | B3 | B4 | P4 | d2 | basic torque rating | | basic load rating | | basic load rating | | maximum revolutions | | | |
| | | | | | | | | | | | | | dynamic | static | dynamic | static | dynamic | static | | | | |
| SPBR16 | 39.5 | 50 | 32 | M5 | 8 | 52 | 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 | 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 screw spline shaft Ds | lead | root diameter Dr | ball screw basic load rating | | angular contact bearings basic load rating | | | moment of inertia for the nut | moment of inertia for the ball screw shaft | mass | | ball screw nut maximum revolutions based on Dm·N | size |
|----------------------------|------|------------------|------------------------------|--------|--|--------|-----------------------|-------------------------------|--|------|-------|--|------|
| | | | dynamic | static | dynamic | static | ※ maximum revolutions | | | nut | shaft | | |
| | | | Ca | Coa | CaR | CoaR | rpm | | | kg | kg/m | | |
| 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 |

BALL SPLINE NUT

| part number | D9 h6 | | L3 | | D10 | H3 | P5 | d3×d4×h | W | d5 | basic torque rating | | basic load rating | | allowable static moment Mo | moment of inertia | mass nut |
|-------------|-----------|-----------|-----------|-----------|-----|----|--------|-------------|------|----|---------------------|--------|-------------------|--------|----------------------------|--------------------|----------|
| | tolerance | tolerance | tolerance | tolerance | | | | | | | dynamic | static | dynamic | static | | | |
| | mm | μm | mm | mm | mm | mm | P.C.D. | mm | mm | mm | N·m | N·m | C | Co | N·m | kg·cm ² | kg |
| SPBF16 | 31 | 0 | 50 | 0 | 50 | 7 | 40 | 4.5×8×4.4 | 18 | 2 | 60 | 110 | 6.12 | 11.2 | 46 | 0.52 | 0.2 |
| SPBF20 | 35 | -16 | 63 | -0.2 | 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 | 0/-0.3 | 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 |