

Ball Spline



HIWIN Support



About HIWIN

Feature /

The HIWIN ball spline is a rolling guide component that consists of a spline nut, a spline shaft, steel balls, and a retainer. The spline nut moves linearly along the spline shaft with high precision by using steel balls rolling at an infinite cycle between the spline nut and the spline shaft. The ball spline has three sets of face-to-face, angular contact balls that allows the ball spline to withstand radial and torsional loads.

The balls are moved in a complete cycle utilizing a steel ball retainer. The optimized design of the retainer enables guidance with high speed, high acceleration, and deceleration. In addition, the encapsulation of the balls by the retainer makes it possible to withdraw the spline nut from the spline shaft without the balls falling out.

- Transmittable torque capacity

Compared with linear bearings, the ball in the rolling groove is in angular contact. This allows the spline nut and the spline shaft the capability to move with each other to achieve the function of transmitting torque.

- All-in-one structure

The spline nut and the outer ring are made in an all-in-one structure to achieve high precision and compact design for rotating flange-type ball splines.

- Easy to install

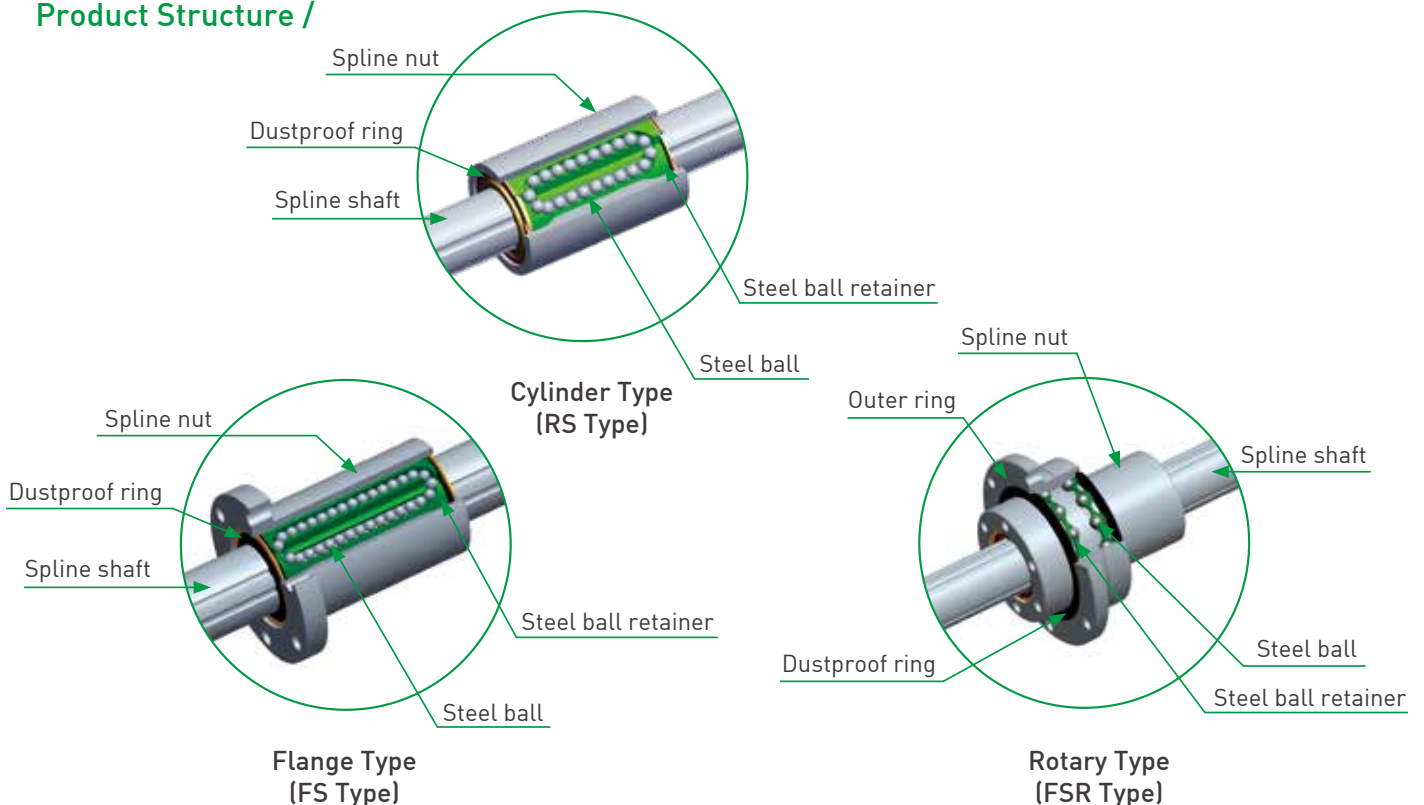
The ball spline retainer prevents the balls from falling out if the spline shaft is removed from the spline nut.

- Lubricant circuit

By optimizing the design of the lubricant circuit, the grease is directed to where the balls are in circulation to improve the lubrication effect and increase the service life.

RS, FS, FSR Type

Product Structure /



Description of specifications- RS, FS, FSR /

SP 20 - 2 FS - 400 - 500 - C - S

Collective name for ball spline products
Spline shaft outer diameter (Unit mm)
Number of spline nuts on 1 shaft
None: 1 pc

Nut type
RS: Cylinder type
FS: Flange type
FSR: Rotary type

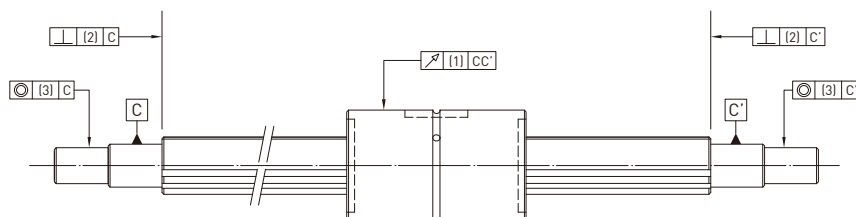
Length of straight groove
(Unit mm)

Total length of spline shaft
(Unit mm)

Spline shaft type
S: Solid shaft
None: Hollow shaft
Accuracy
C: Normal grade
H: High grade
P: Precision grade

Accuracy Indication /

RS Type



Runout(1)

Unit:μm

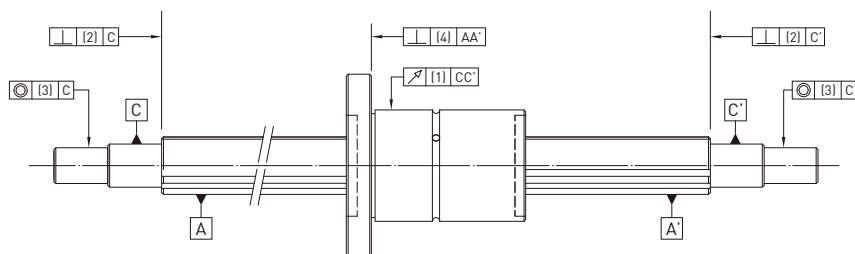
Nominal shaft diameter (mm)		13			16			20			25			32			
Total length of spline shaft (mm)	Above	Below	C	H	P	C	H	P	C	H	P	C	H	P	C	H	P
-		200	28	17	9	28	17	9	28	17	9	27	16	9	27	16	9
200		315	36	23	13	36	23	13	36	23	13	29	20	11	29	20	11
315		400	42	27	16	42	27	16	42	27	16	35	22	13	35	22	13
400		500	48	31	19	48	31	19	48	31	19	39	25	15	39	25	15
500		630	62	38	23	62	38	23	62	38	23	44	29	17	44	29	17
630		800	76	46	29	76	46	29	76	46	29	52	34	21	52	34	21
800		1000				85	58	38	85	58	38	62	42	26	62	42	26

Geometric accuracy

Unit:μm

Item	Accuracy	Shoulder perpendicularity (2)			Shoulder concentricity (3)		
		C	H	P	C	H	P
Nominal shaft diameter (mm)							
13		9	8	6	7	6	4
16		9	8	6	7	6	4
20		9	8	6	9	7	5
25		9	8	6	9	7	5
32		11	10	8	10	8	6

FS Type



Runout(1)

Unit:μm

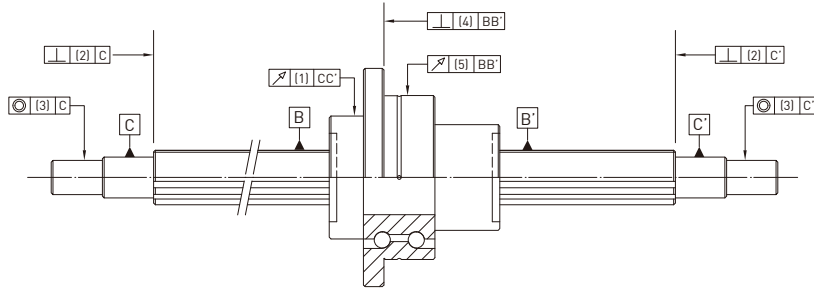
Nominal shaft diameter (mm)		13			16			20			25			32			
Total length of spline shaft (mm)	Above	Below	C	H	P	C	H	P	C	H	P	C	H	P	C	H	P
-		200	28	17	9	28	17	9	28	17	9	27	16	9	27	16	9
200		315	36	23	13	36	23	13	36	23	13	29	20	11	29	20	11
315		400	42	27	16	42	27	16	42	27	16	35	22	13	35	22	13
400		500	48	31	19	48	31	19	48	31	19	39	25	15	39	25	15
500		630	62	38	23	62	38	23	62	38	23	44	29	17	44	29	17
630		800	76	46	29	76	46	29	76	46	29	52	34	21	52	34	21
800		1000				85	58	38	85	58	38	62	42	26	62	42	26

Geometric accuracy

Unit:μm

Item	Shoulder verticality (2)			Shoulder concentricity (3)			Verticality (4)			
	C	H	P	C	H	P	C	H	P	
Nominal shaft diameter (mm)										
13	9	8	6	7	6	4	33	13	9	
16	9	8	6	7	6	4	39	16	11	
20	9	8	6	9	7	5	39	16	11	
25	9	8	6	9	7	5	39	16	11	
32	11	10	8	10	8	6	39	16	11	

FSR Type



Runout(1)

Unit:μm

Total length of spline shaft (mm)		16			20			25			32		
Above	Below	C	H	P	C	H	P	C	H	P	C	H	P
		-	200	28	17	9	28	17	9	27	16	9	27
200	315	36	23	13	36	23	13	29	20	11	29	20	11
315	400	42	27	16	42	27	16	35	22	13	35	22	13
400	500	48	31	19	48	31	19	39	25	15	39	25	15
500	630	62	38	23	62	38	23	44	29	17	44	29	17
630	800	76	46	29	76	46	29	52	34	21	52	34	21
800	1000	85	58	38	85	58	38	62	42	26	62	42	26

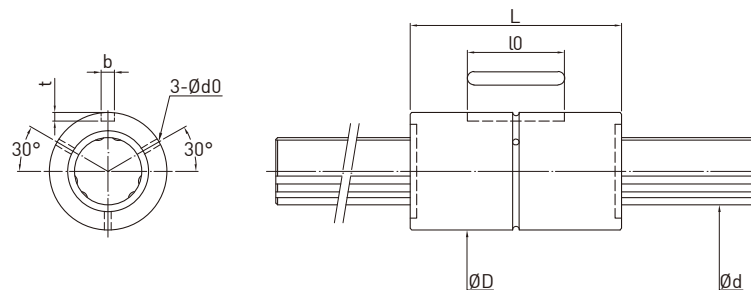
Geometric accuracy

Unit:μm

Item	Shoulder verticality (2)			Shoulder concentricity (3)			Outer ring verticality (4)			Outer ring runout (5)			
	C	H	P	C	H	P	C	H	P	C	H	P	
Nominal shaft diameter (mm)													
16	9	8	6	7	6	4	26	18	15	31	21	18	
20	9	8	6	9	7	5	26	18	15	31	21	18	
25	9	8	6	9	7	5	27	21	18	31	21	18	
32	11	10	8	10	8	6	27	21	18	31	21	18	

Size Table /

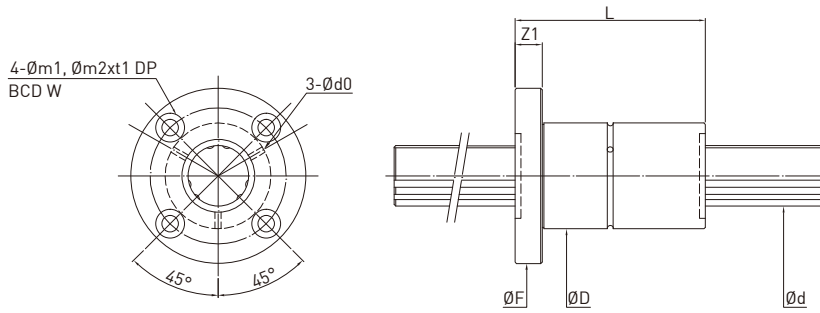
RS Type



Unit:mm

Nominal shaft diameter d	Basic load rating		Basic torque load rating		Permissible static moment	Outer diameter	Length	Keyway width	Keyway depth	Keyway length	Lubrication hole
	C (kN)	Co (kN)	C _T (N-m)	C _{oT} (N-m)	MA (N-m)	D g6	L	b H8	t ^{+0.1} ₀	l0	d0
13	4.07	5.99	5.98	10.88	19.6	24	36	3	1.5	15	1.5
16	7.2	13.5	32.1	34.4	67.6	31	50	3.5	2	17.5	2
20	10.4	20.0	57.8	63.2	118	35	63	4	2.5	29	2
25	15.4	27.5	106.5	108.8	210	42	71	4	2.5	36	3
32	20.5	34.4	181.5	173.1	290	49	80	4	2.5	42	3

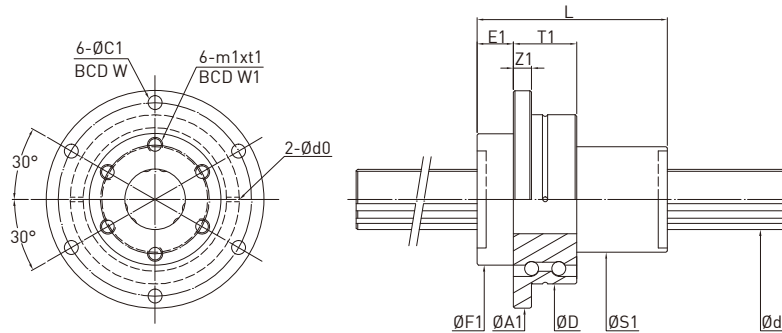
FS Type



Unit:mm

Nominal shaft diameter d	Basic load rating		Basic torque load rating		Permission static moment MA (N-m)	Outer diameter D g6	Flange outer diameter F	Length L	Z1	Lubrication hole	W	m1	m2x1
	C (kN)	Co (kN)	C _T (N-m)	C _{oT} (N-m)						d0			
13	4.07	5.99	5.98	10.88	19.6	24	44	36	7	1.5	33	4.5	8x4.4
16	7.2	13.5	32.1	34.4	67.6	31	51	50	7	2	40	4.5	8x4.4
20	10.4	20.0	57.8	63.2	118	35	58	63	9	2	45	5.5	9.5x5.4
25	15.4	27.5	106.5	108.8	210	42	65	71	9	3	52	5.5	9.5x5.4
32	20.5	34.4	181.5	173.1	290	49	77	80	10	3	62	6.6	11x6.5

FSR Type

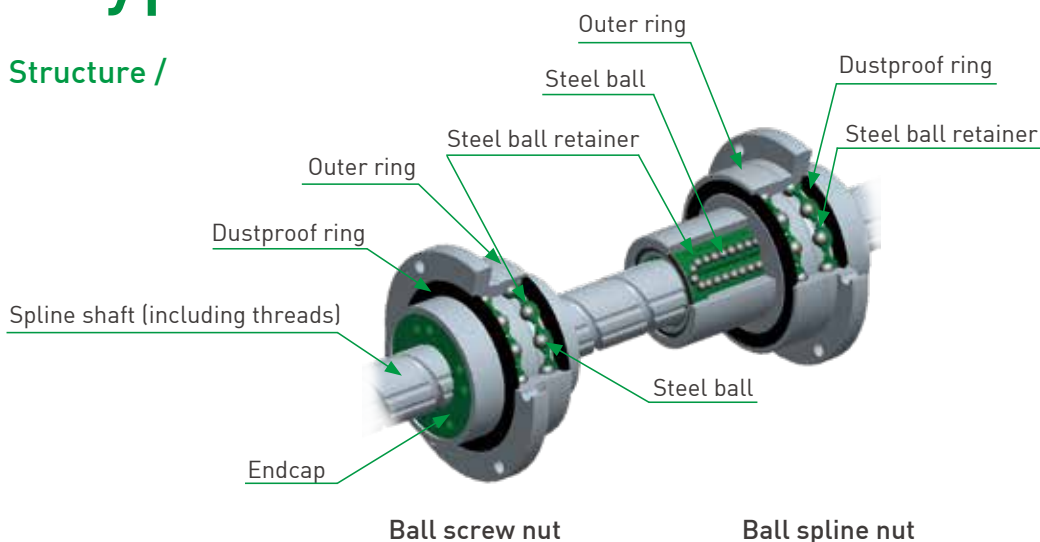


Unit:mm

Nominal shaft diameter d	Basic load rating		Basic torque load rating		Permission static moment MA (N-m)	Outer diameter D g6	Flange outer diameter A1	Total length L	F1 h7	S1	T1	E1	Z1	W	W1	m1x1	C1	Lubrication hole	Support bearing basic load rating	
	C(kN)	Co(kN)	C _T (N-m)	C _{oT} (N-m)														d0	Ca(kN)	Coa(kN)
16	7.2	13.5	32.1	34.4	67.6	48	64	50	36	31	21	10	6	56	30	M4x6	4.5	1.5	9.3	11.5
20	10.4	20.0	57.8	63.2	118	56	72	63	43.5	35	21	12	6	64	36	M5x8	4.5	1.5	9.8	13.3
25	15.4	27.5	106.5	108.8	210	66	86	71	52	42	25	13	7	75	44	M5x8	5.5	2.5	13.1	22
32	20.5	34.4	181.5	173.1	290	78	103	80	63	52	25	17	8	89	54	M6x10	6.6	2.5	13.7	25.2

FBR Type

Product Structure /



Description of specifications- FBR, FBL /

SP 20 - FBR - 400 - 500 - S

Collective name for ball spline products

Spline shaft outer diameter
(Unit mm)

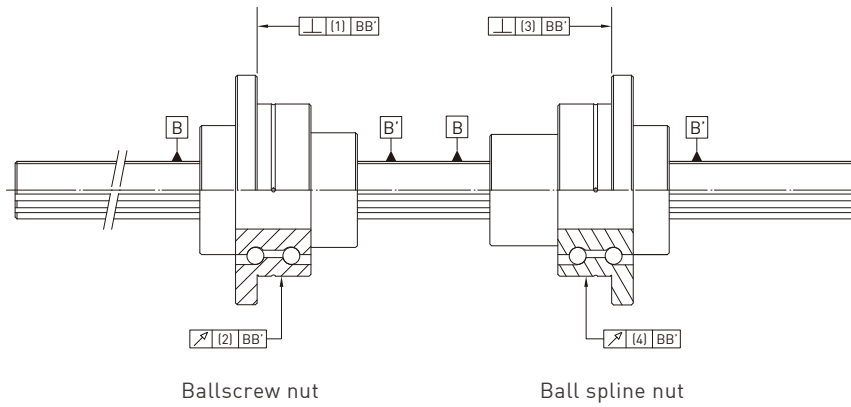
Nut type
FBR:Right thread
FBL:Left thread

Total length of spline shaft
(Unit mm)

Spline shaft type
S : Solid shaft
None: Hollow shaft

Length of straight groove
(Unit mm)

Geometric Accuracy /

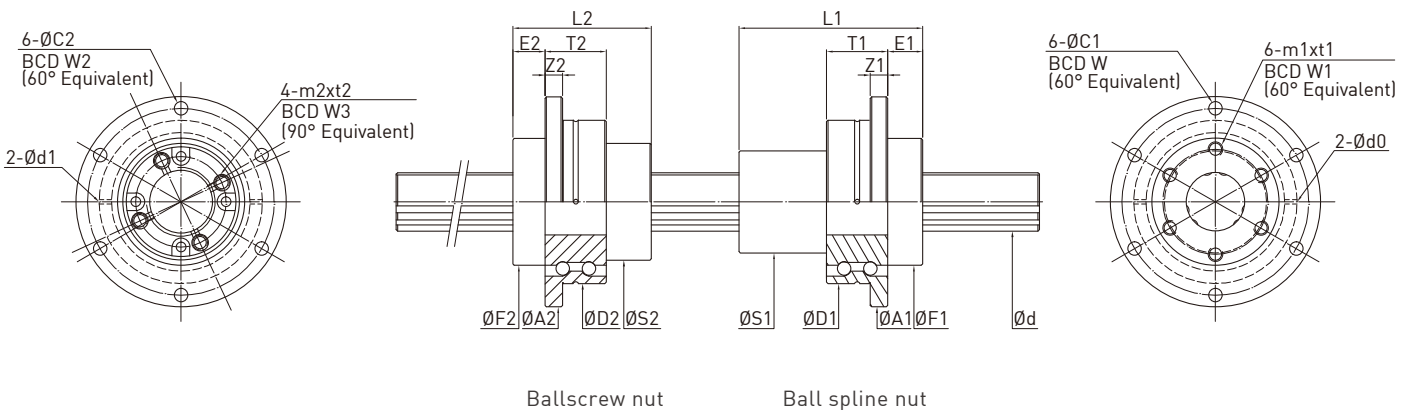


Unit:μm

Nominal diameter	Ballscrew nut		Ball spline nut	
	Verticality (1)	Runout (2)	Verticality (3)	Runout (4)
16	16	16	18	21
20	16	16	18	21
25	18	18	21	21
32	18	18	21	21

Size Table /

FBR Type

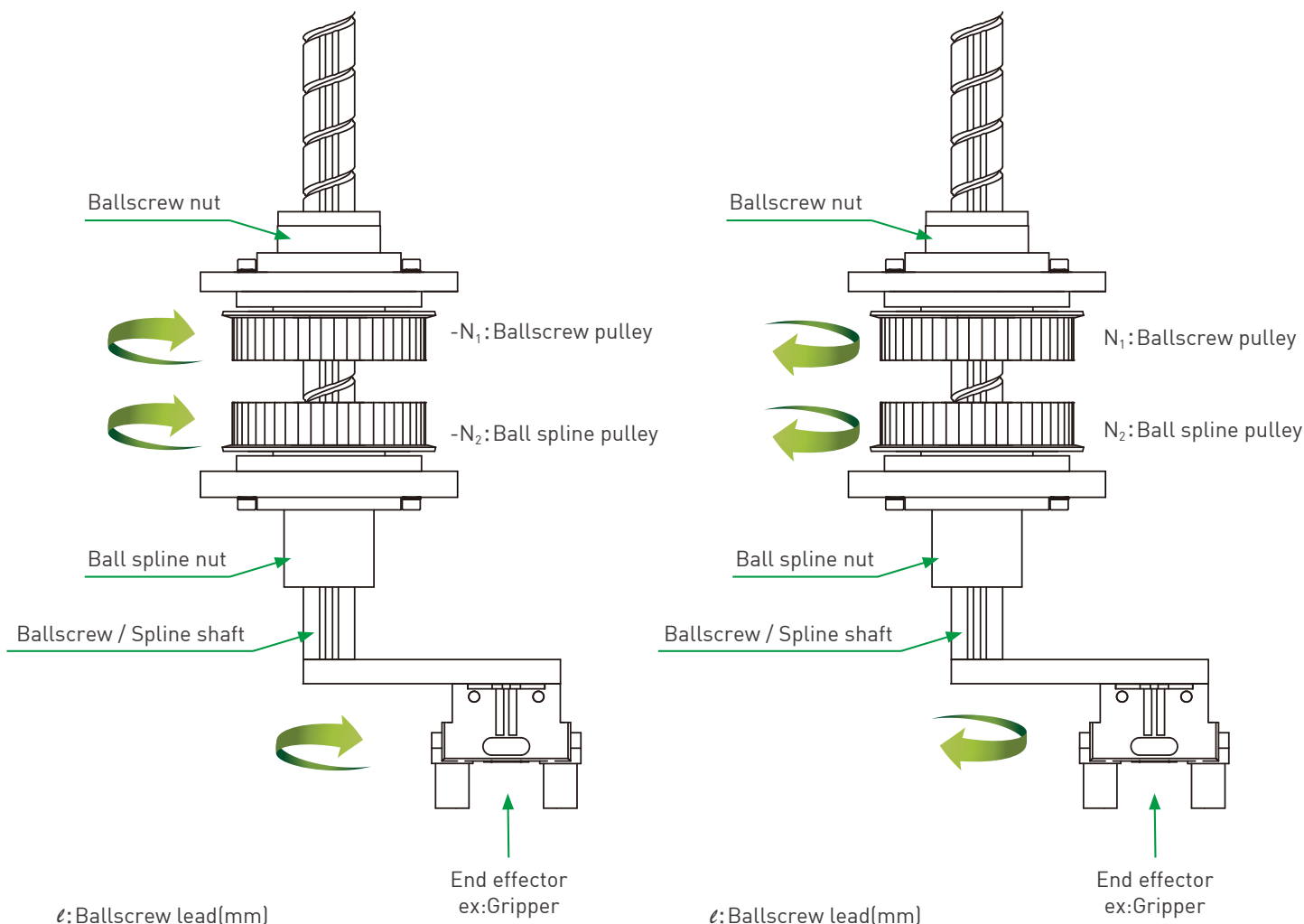


Unit:mm

Nominal shaft diameter d	Specification			Ballscrew nut												Support bearing basic load rating				
	Nominal outer diameter	Nominal inner diameter	Lead	Basic rated load		Outer diameter D2 g6	Flange outer diameter A2	Total length L2	F2 h7	S2	T2	E2	Z2	W2	W3	m2xt2	C2	Lubrication hole d1	Ca (kN)	Coa (kN)
				C(kN)	Co(kN)															
16	16	11	16	5.88	9.6	48	64	40	36	32	21	10	6	56	25	M4x8	4.5	1.5	9.3	11.5
20	20	14	20	7.96	14	56	72	46	43.5	40	21	11	6	64	31	M5x8	4.5	1.5	9.8	13.3
25	25	18	25	11.9	21.9	66	86	58	52	47	25	13	7	75	38	M6x12	5.5	2.5	13.1	22
32	32	23	32	16.2	29.8	78	103	72	63	58	25	14	8	89	48	M6x10	6.6	2.5	13.7	25.2

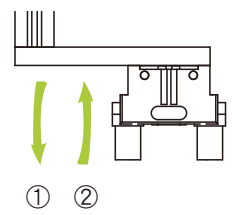
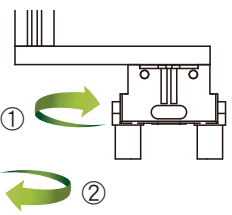
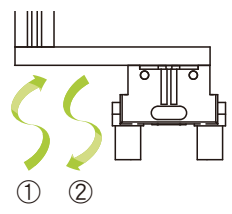
Nominal shaft diameter d	Ball spline nut													Support bearing basic load rating						
	Basic load rating		Basic torque load rating		Permissible static moment Ma(N-m)	Outer diameter D1 g6	Flange outer diameter A1	Total length L1	F1 h7	S1	T1	E1	Z1	W	W1	m1xt1	C1	Lubrication hole d0	Ca (kN)	Coa (kN)
	C(kN)	Co(kN)	C _T (N-m)	C _{oT} (N-m)																
16	7.2	13.5	32.1	34.4	67.6	48	64	50	36	31	21	10	6	56	30	M4x6	4.5	1.5	9.3	11.5
20	10.4	20.0	57.8	63.2	118	56	72	63	43.5	35	21	12	6	64	36	M5x8	4.5	1.5	9.8	13.3
25	15.4	27.5	106.5	108.8	210	66	86	71	52	42	25	13	7	75	44	M5x8	5.5	2.5	13.1	22
32	20.5	34.4	181.5	173.1	290	78	103	80	63	52	25	17	8	89	54	M6x10	6.6	2.5	13.7	25.2

FBR Type Ball Spline Motion Diagram /



-N₁: Ballscrew pulley rotating speed (counterclockwise)(min⁻¹)
 -N₂: Ball spline pulley rotating speed (counterclockwise)(min⁻¹)

N₁: Ballscrew pulley rotating speed (clockwise)(min⁻¹)
 N₂: Ball spline pulley rotating speed (clockwise)(min⁻¹)

Work mode	Motion direction	Input		Shaft motion	
		Ballscrew pulley	Ball spline pulley	Vertical (speed)	Rotating direction (speed)
	Vertical→downward	N_1 (Forward)	0	$V=N_1 \times \ell$ ($N_1 \neq 0$)	0
	Rotating direction→0				
	Vertical→Upward	$-N_1$ (Reverse)	0	$V=-N_1 \times \ell$ ($N_1 \neq 0$)	0
	Rotating direction→0				
	Vertical→0	N_1	N_2 (Forward)	0	N_2 ($N_1=N_2 \neq 0$)
	Rotating direction→Forward				
	Vertical→0	$-N_1$	$-N_2$ (Reverse)	0	$-N_2$ ($-N_1=-N_2 \neq 0$)
	Rotating direction→Reverse				
	Vertical→Upward	0	N_2 ($N_2 \neq 0$)	$V=N_2 \times \ell$	N_2 (Forward)
	Rotating direction→Forward				
	Vertical→Downward	0	$-N_2$ ($-N_2 \neq 0$)	$V=-N_2 \times \ell$	$-N_2$ (Reverse)
	Rotating direction→Reverse				

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