

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

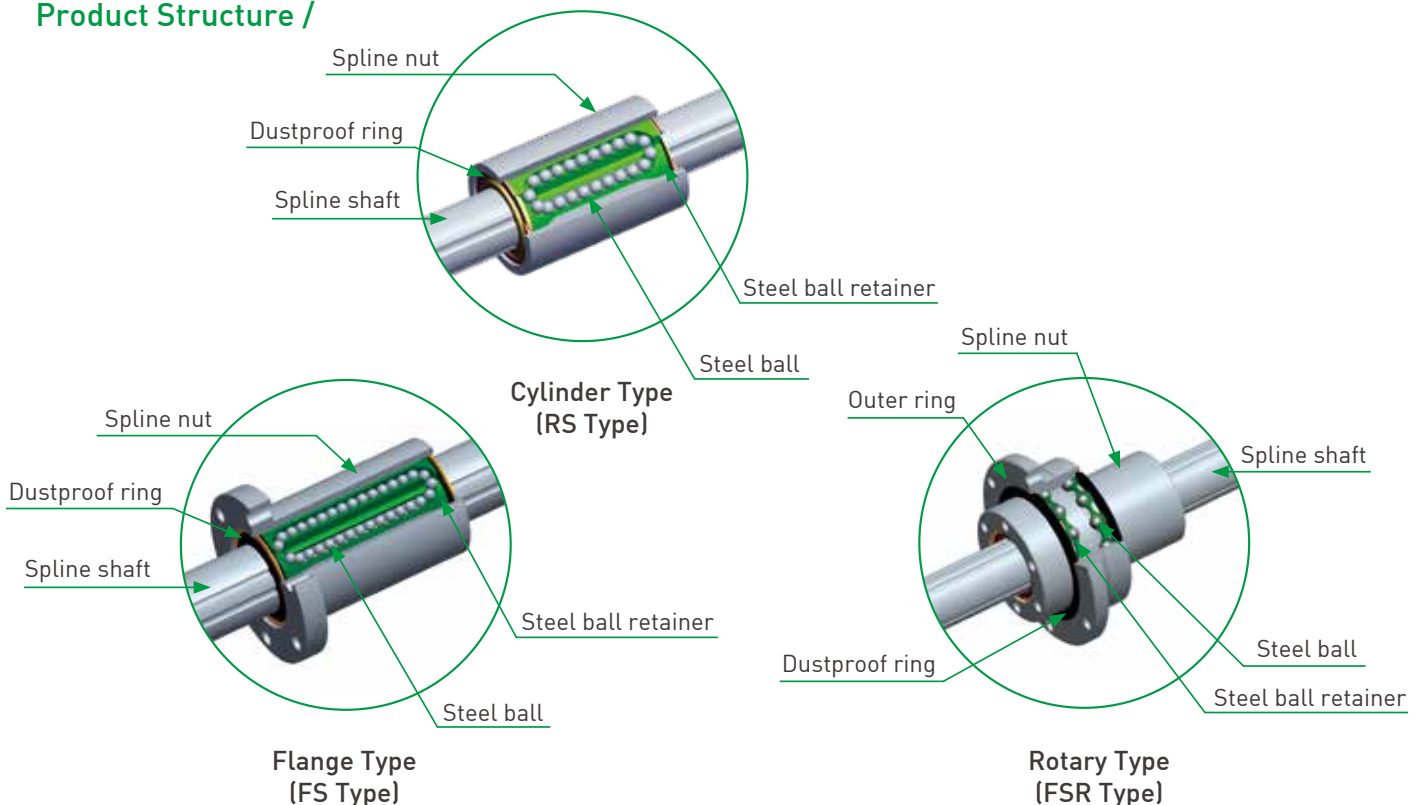
The ball spline retainer prevents the balls from falling out if the spline shaft is removed from the spline nut.

- 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.

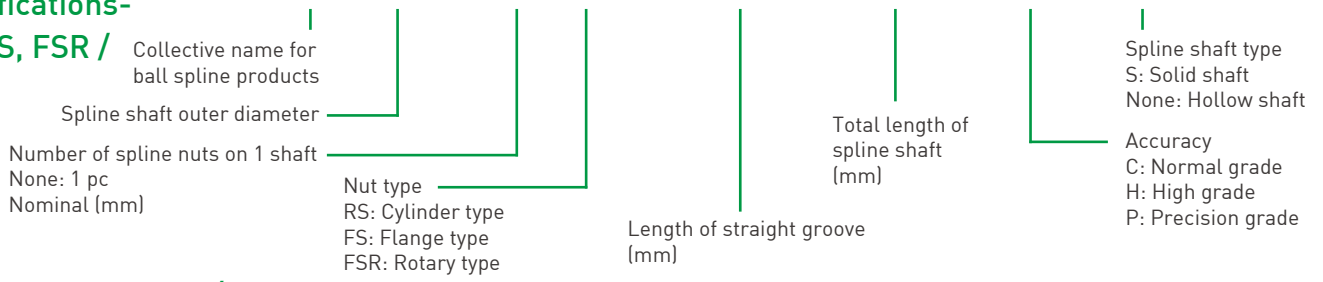
RS, FS, FSR Type

Product Structure /



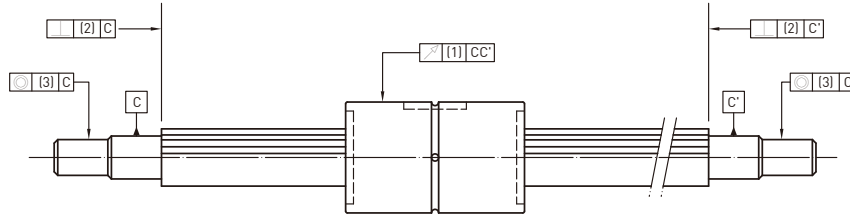
Description of specifications-
RS, FS, FSR /

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



Accuracy Indication /

RS Type



Runout(1)

Unit:µm

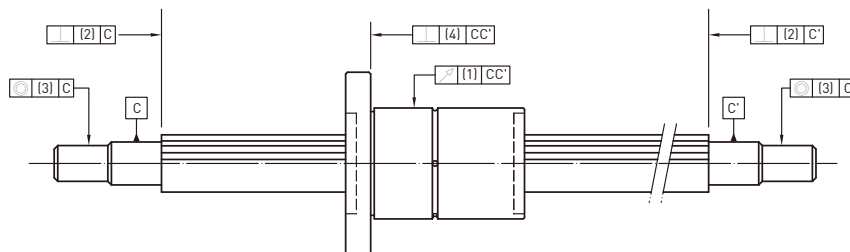
Nominal shaft diameter		13			16			20			25			32			
Total length of spline shaft	Above	Below	C	H	P	C	H	P	C	H	P	C	H	P	C	H	P
-	-	200	56	34	18	56	34	18	56	34	18	53	32	18	53	32	18
200	200	315	71	45	25	71	45	25	71	45	25	58	39	21	58	39	21
315	315	400	83	53	31	83	53	31	83	53	31	70	44	25	70	44	25
400	400	500	95	62	38	95	62	38	95	62	38	78	50	29	78	50	29
500	500	630	112			112			112			88	57	34	88	57	34
630	630	800										103	68	42	103	68	42
800	800	1000										124	83		124	83	

Geometric accuracy

Unit:µm

Nominal shaft diameter	Accuracy	Shoulder perpendicularity (2)			Shoulder concentricity (3)		
		C	H	P	C	H	P
13		27	11	8	46	19	12
16		27	11	8	46	19	12
20		27	11	8	46	19	12
25		33	13	9	53	22	13
32		33	13	9	53	22	13

FS Type



Runout(1)

Unit:µm

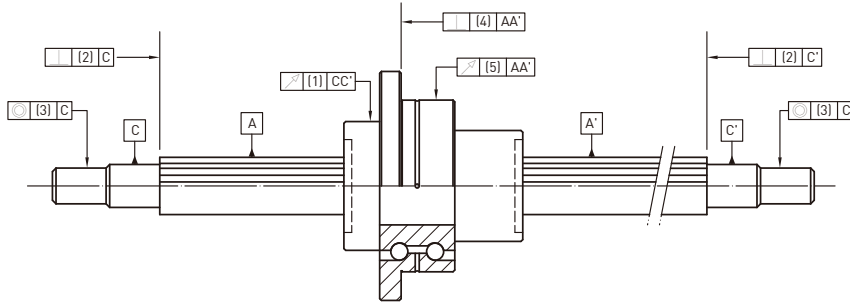
Nominal shaft diameter		13			16			20			25			32			
Total length of spline shaft	Above	Below	C	H	P	C	H	P	C	H	P	C	H	P	C	H	P
-	-	200	56	34	18	56	34	18	56	34	18	53	32	18	53	32	18
200	200	315	71	45	25	71	45	25	71	45	25	58	39	21	58	39	21
315	315	400	83	53	31	83	53	31	83	53	31	70	44	25	70	44	25
400	400	500	95	62	38	95	62	38	95	62	38	78	50	29	78	50	29
500	500	630	112			112			112			88	57	34	88	57	34
630	630	800										103	68	42	103	68	42
800	800	1000										124	83		124	83	

Geometric accuracy

Unit:μm

Nominal shaft diameter	Shoulder verticality (2)			Shoulder concentricity (3)			Verticality (4)		
	C	H	P	C	H	P	C	H	P
13	27	11	8	46	19	12	33	13	9
16	27	11	8	46	19	12	39	16	11
20	27	11	8	46	19	12	39	16	11
25	33	13	9	53	22	13	39	16	11
32	33	13	9	53	22	13	39	16	11

FSR Type



Runout(1)

Unit:μm

Nominal shaft diameter		16			20			25			32			
Total length of spline shaft	Above	Below	C	H	P	C	H	P	C	H	P	C	H	P
-	-	200	56	34	18	56	34	18	53	32	18	53	32	18
200	200	315	71	45	25	71	45	25	58	39	21	58	39	21
315	315	400	83	53	31	83	53	31	70	44	25	70	44	25
400	400	500	95	62	38	95	62	38	78	50	29	78	50	29
500	500	630	112			112			88	57	34	88	57	34
630	630	800							103	68	42	103	68	42
800	800	1000							124	83		124	83	

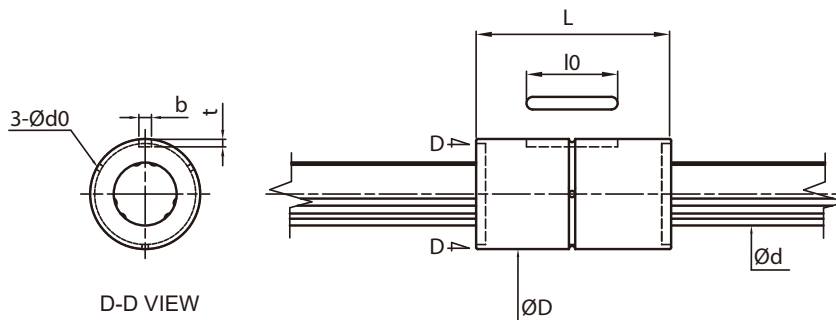
Geometric accuracy

Unit:μm

Nominal shaft diameter	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
16	27	11	8	46	19	12	26	18	15	31	21	18
20	27	11	8	46	19	12	26	18	15	31	21	18
25	33	13	9	53	22	13	27	21	18	31	21	18
32	33	13	9	53	22	13	27	21	18	31	21	18

Size Table /

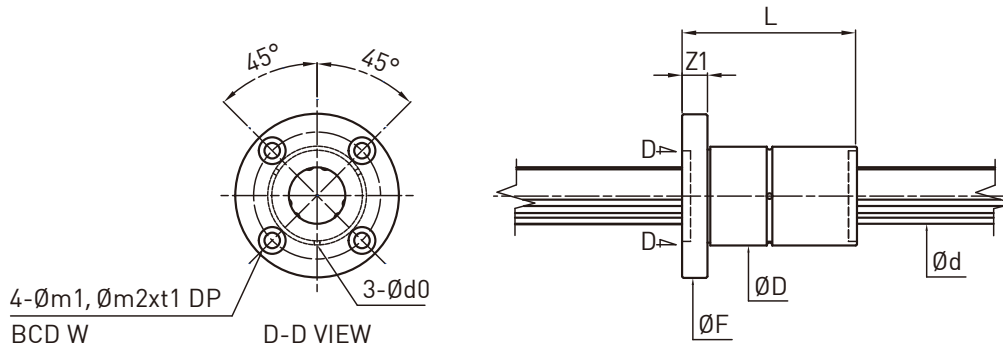
RS Type



Unit:mm

Nominal shaft diameter	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	L	b (H8)	t ₀ ^{+0.1}	l ₀	d ₀
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

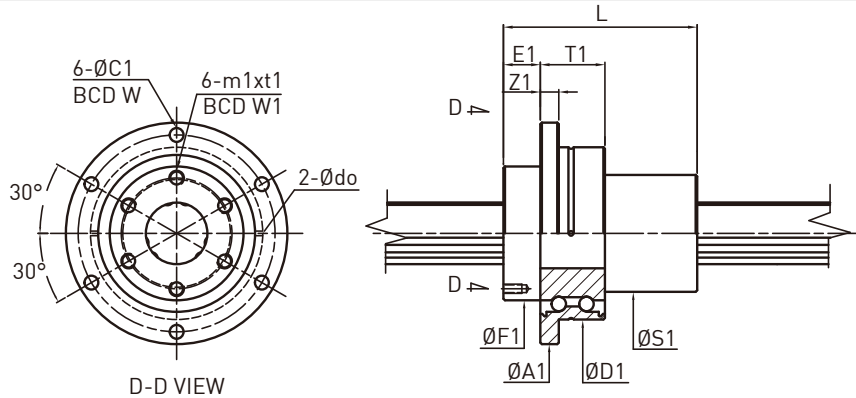
FS Type



Unit:mm

Nominal shaft diameter	Basic load rating		Basic torque load rating		Permission static moment MA (N-m)	Outer diameter D	Flange outer diameter F	Length L	Z1	Lubrication hole d0	W	m1	m2xt1
	C (kN)	Co (kN)	C _T (N-m)	C _{oT} (N-m)									
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

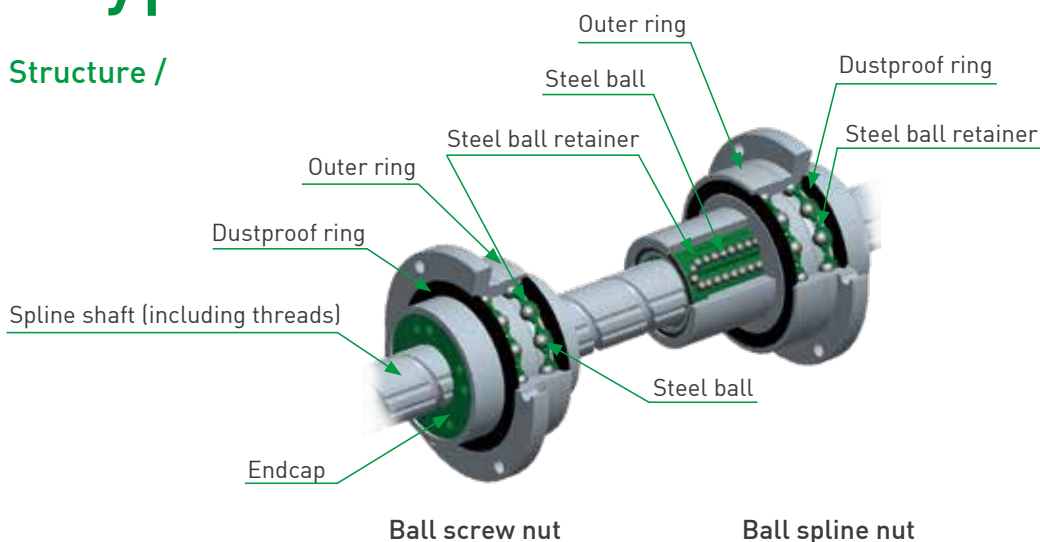


Unit:mm

Nominal shaft diameter	Basic load rating		Basic torque load rating		Permission static moment MA(N-m)	Outer diameter D1	Flange outer diameter A1	Total length L	F1	S1	T1	E1	Z1	W	W1	m1xt1	C1	Lubrication hole d0	Support bearing basic load rating	
	C(kN)	Co(kN)	C _T (N-m)	C _{oT} (N-m)															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 /



Ball screw nut

Ball spline nut

Description of specifications- FBR, FBL /

SP 20 - FBR - 400 - 500 - S

Collective name for ball spline products

Spline shaft outer diameter
Nominal (mm)

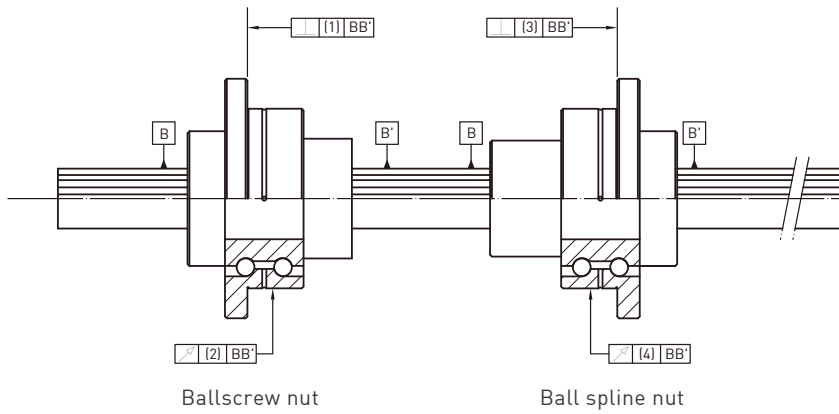
Nut type
FBR:Right thread
FBL:Left thread

Length of straight groove
(Unit mm)

Total length of spline shaft
(Unit mm)

Spline shaft type
S : Solid shaft
None: Hollow shaft

Geometric Accuracy /

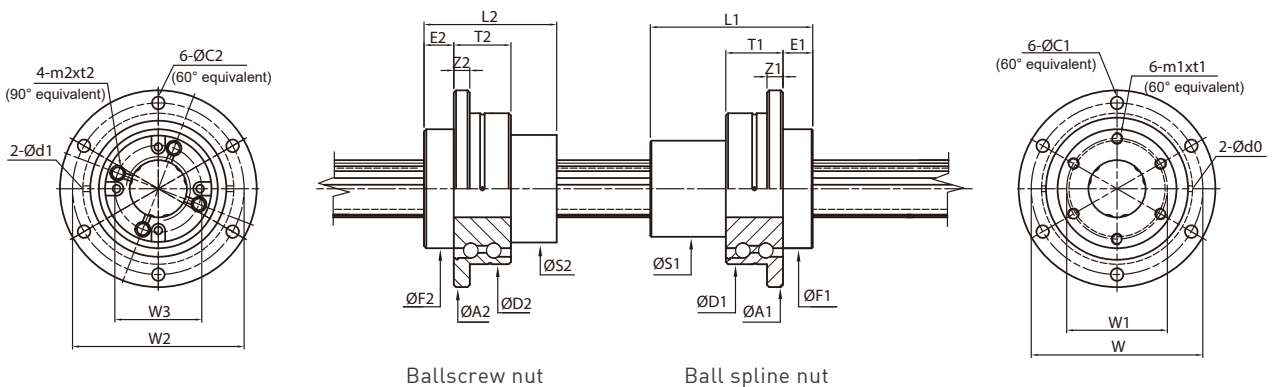


Unit:µm

Nominal diameter	Ballscrew nut		Ball spline nut	
	Verticality (1)	Runout (2)	Verticality (3)	Runout (4)
16	16	20	18	21
20	16	20	18	21
25	18	24	21	21
32	18	24	21	21

Size Table /

FBR Type

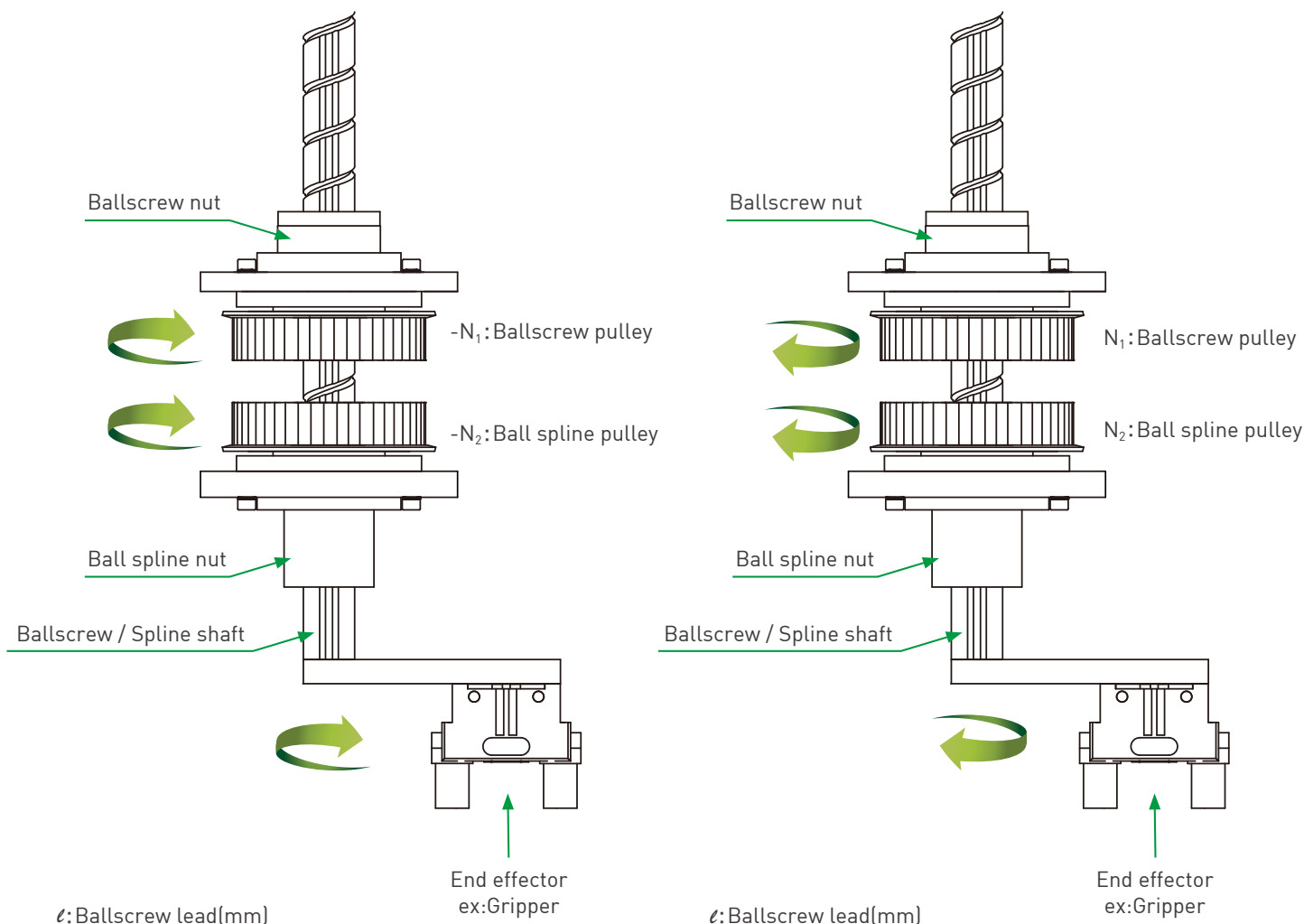


Unit:mm

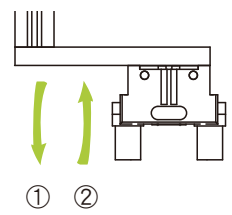
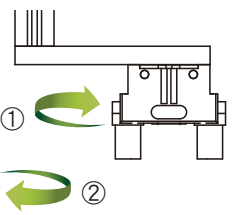
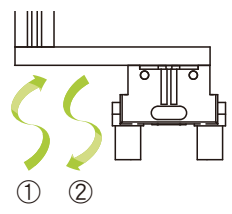
Model number	Specification			Ball screw nut												Support bearing basic load rating				
	Nominal outer diameter	Nominal inner diameter	Lead	Basic rated load		Outer diameter D2 g6	Flange outer diameter A2	Total length L2	F2 h7	S2	T2	E2	Z2	W2	W3	m2xt2	C2	Lubrication hole d1	Ca (kN)	Coa (kN)
				C(kN)	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

Model number	Ball spline nut													Support bearing basic load rating						
	Basic load rating		Basic torque load rating		Permissible static moment Ma(N-m)	Outer diameter D1	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 _r (N-m)	C _{0r} (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 /



ϵ : Ballscrew lead(mm)
 N_1 : Ballscrew pulley rotating speed (counterclockwise)(min⁻¹)
 N_2 : Ball spline pulley rotating speed (counterclockwise)(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				

Global Sales and Customer Service Site

HIWIN GmbH

OFFENBURG, GERMANY
www.hiwin.de
www.hiwin.eu
info@hiwin.de

HIWIN Schweiz GmbH

JONA, SWITZERLAND
www.hiwin.ch
info@hiwin.ch

HIWIN KOREA

SUWON • CHANGWON, KOREA
www.hiwin.kr
info@hiwin.kr

HIWIN JAPAN

KOBE • NAGOYA • TOKYO • TOHOKU •
NAGANO • SHIZUOKA • HOKURIKU •
HIROSHIMA • FUKUOKA • KUMAMOTO,
JAPAN
www.hiwin.co.jp
info@hiwin.co.jp

HIWIN s.r.o.

BRNO, CZECH REPUBLIC
www.hiwin.cz
info@hiwin.cz

HIWIN CHINA

SUZHOU, CHINA
www.hiwin.cn
info@hiwin.cn

HIWIN USA

CHICAGO, U.S.A.
www.hiwin.us
info@hiwin.com

HIWIN FRANCE

STRASBOURG, FRANCE
www.hiwin.fr
info@hiwin.de

Mega-Fabs Motion Systems, Ltd.

HAIFA, ISRAEL
www.mega-fabs.com
info@mega-fabs.com

HIWIN Srl

BRUGHERIO, ITALY
www.hiwin.it
info@hiwin.it

HIWIN SINGAPORE

SINGAPORE
www.hiwin.sg
info@hiwin.sg

HIWIN®

HIWIN TECHNOLOGIES CORP.

No. 7, Jingke Road,
Taichung Precision Machinery Park,
Taichung 40852, Taiwan
Tel: +886-4-23594510
Fax: +886-4-23594420
www.hiwin.tw
www.hiwin-support.com
business@hiwin.tw

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