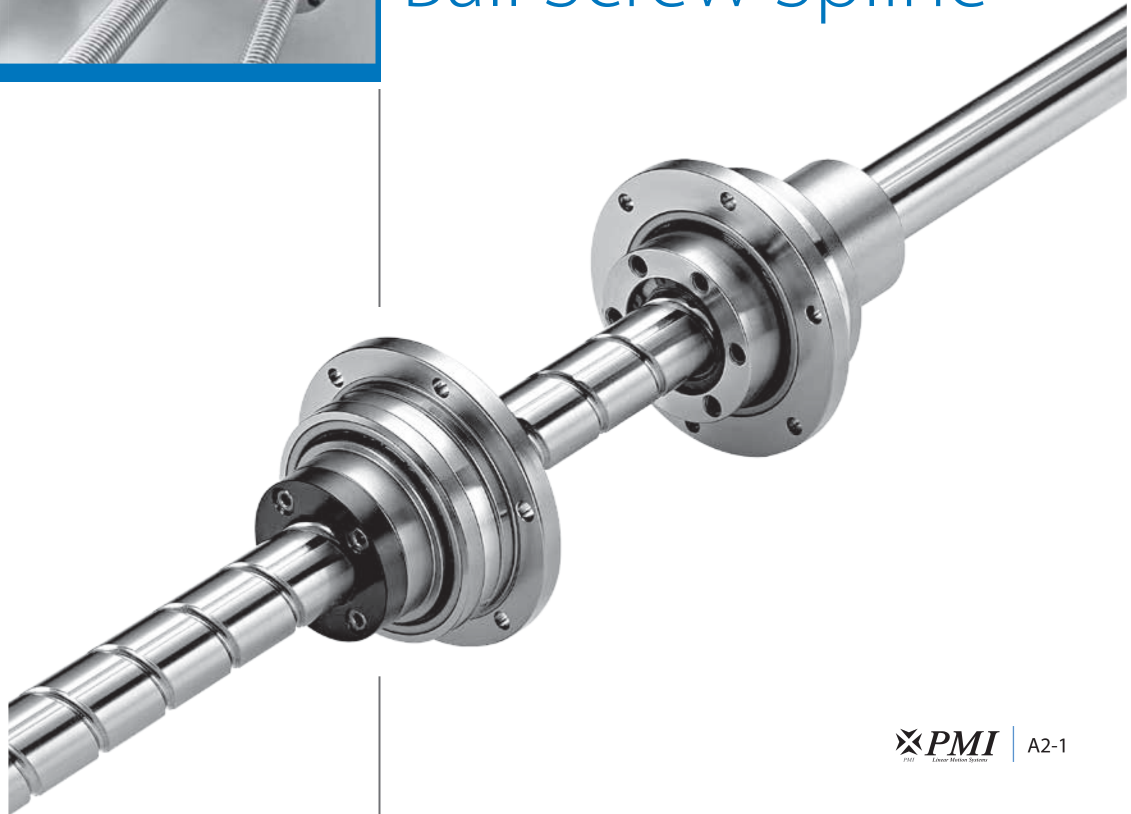
Precision Ball Screw Spline



Design Principle

The Precision Ball Screw Spline contains Ball Screw grooves and Ball Spline grooves that cross each other on a single shaft. The Precision Ball Screw Spline nut has a special designed support bearing directly set up on the outer ring of the nuts. The Precision Ball Screw Spline is capable of performing three modes of motion (rotational, linear and spiral) with a single shaft by rotating or stopping the spline nut.

Features

High Positioning Accuracy

The Ball Spline groove profile is designed Gothic arch. By applied preload, the backlash in the rotational direction is eliminated therefore having higher positioning accuracy.

Lightweight and Compact

Spline nut and the support bearing is integration structure. The Spline nut is designed lightweight. Therefore, the highly accurate and compact design is achieved.

Simple Installation

The balls recirculation in ball holder, prevent balls falling from the spline nut while assembling.

Support Bearing

The support bearing of the Ball Screw is designed a contact angle of 45°, thus it has higher axial rigidity, while Ball Spline has a contact angle of 45°, thus it has the average force of axial and radial direction.

Smooth Motion and Lower Noise

As the Ball Screw is adapting end cap recirculation structure, thus can be smooth motion with lower noise.

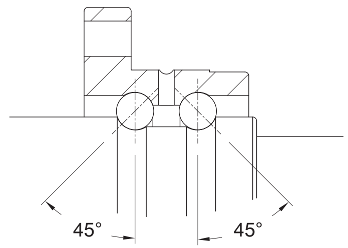


Fig.1 Model PBSA

Applications

SCARA robot, Assembly robot, Automatic loader, and Machining center's, ATC equipment.

Types and Features

Types of Precision Ball Screw Spline

Types of Precision Ball Screw Spline Model PBSA

Spline nut and the support bearing is integration structure.

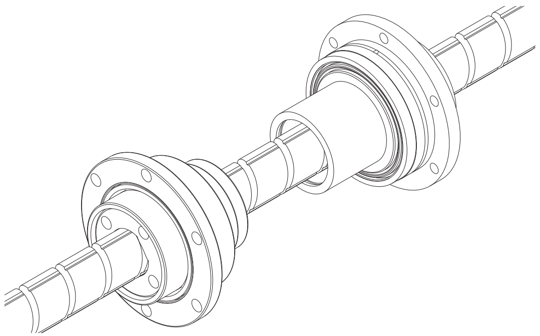


Fig.2 Types of Precision Ball Screw Spline Model PBSA

Product Explanation of Precision Ball Screw Spline

Nomenclature

PBSA-20-20-450-500-S-0.018

- PBSA — Nut Type
- 20 — Outside diameter.
- 20 — Lead
- 450 — Thread length
- 500 — Shaft length
- S — Type of shaft (S：Solid; H x Hollow)
- 0.018 — Accuracy Grade

Accuracy Standards

The Precision Ball Screw Spline is manufactured with the following specifications.

ƒBall Screw

Axial clearance x0 or less

Lead angle accuracy xC5

(For detailed specifications, see **Table 2[A1-6]**, **Table 3[A1-7]**)

ƒBall Spline

Clearance in the rotational direction x0 or less (FC xlight preload)

(For detail specifications, see Section **[B2-25]**)

Accuracy grade xClass H

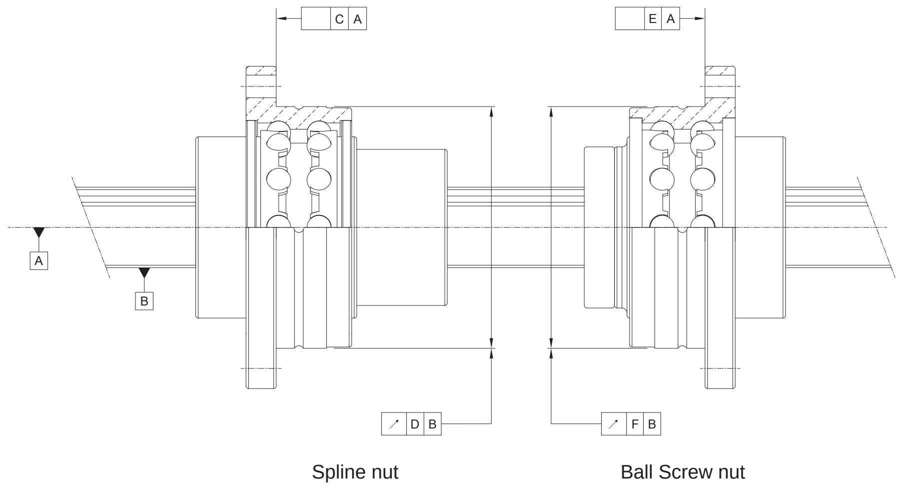


Fig.3 Model PBSA

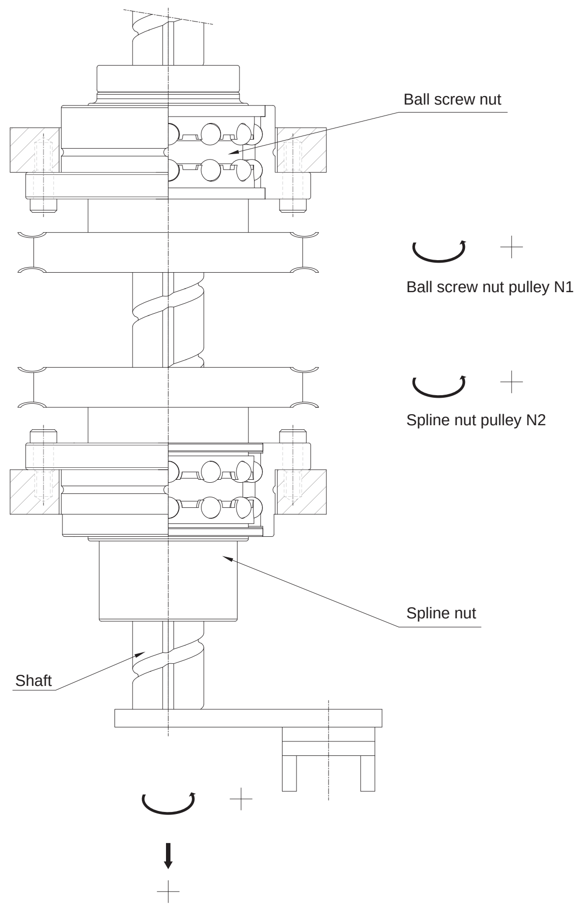
Table 1 Accuracy Standards

Unit: *mm*

Model No.	C	D	E	F
PBSA 1616	0.018	0.021	0.016	0.020
PBSA 2020	0.018	0.021	0.016	0.020
PBSA 2525	0.021	0.021	0.018	0.024

Action Patterns

Basic Actions

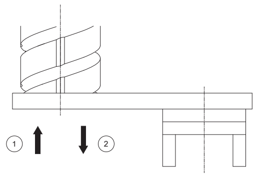
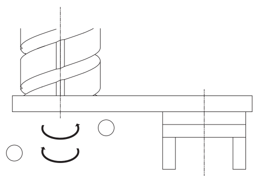
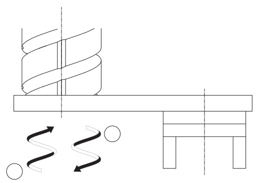


l Ball screw lead F*mm* G

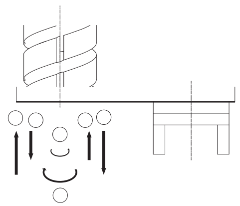
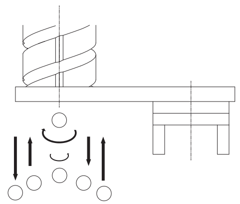
N_1 Ball screw nut rotational speed Fmin^{-1} G

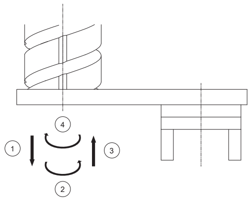
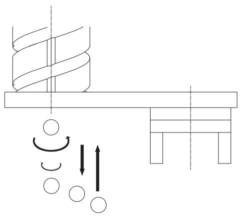
N_2 Spline nut rotational speed Fmin^{-1} G

V Feed rate F*mm/min* G

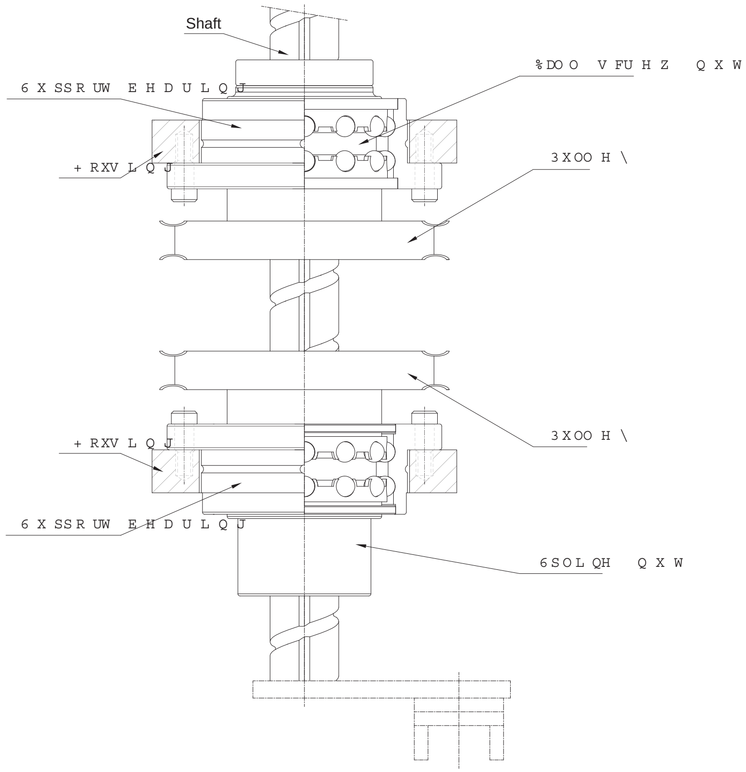
Motion		Action direction	Input: Ball screw pulley	Input: Ball spline pulley	Shaft motion: Vertical direction (speed)	Shaft motion: Rotational direction (rotation speed)
Vertical 	①	Vertical direction → down Rotational direction → 0	N_1 (Forward)	0	$V = N_1 \cdot l$ ($N_1 \neq 0$)	0
	②	Vertical direction → up Rotational direction → 0	$-N_1$ (Reverse)	0	$V = -N_1 \cdot l$ ($N_1 \neq 0$)	0
Rotation 	①	Vertical direction → 0 Rotational direction → forward	N_1	N_2 (Forward)	0	N_2 (Forward) ($N_1 = N_2 \neq 0$)
	②	Vertical direction → 0 Vertical direction → reverse	$-N_1$	$-N_2$ (Reverse)	0	$-N_2$ (Reverse) ($-N_1 = -N_2 \neq 0$)
Spiral 	①	Vertical direction → up Rotational direction → forward	0	N_2 ($N_2 \neq 0$)	$V = N_2 \cdot l$	N_2 (Forward)
	②	Vertical direction → down Rotational direction → reverse	0	$-N_2$ ($-N_2 \neq 0$)	$V = -N_2 \cdot l$	$-N_2$ (Reverse)

Extended Actions

Motion		Action direction	Input: Ball screw pulley	Input: Ball spline pulley	Shaft motion: Vertical direction (speed)	Shaft motion: Rotational direction (rotation speed)
Up down forward Up down reverse 	5	Vertical direction up	$-N_1$ (Reverse)	0	$V = -N_1$ fl ($N_1 \neq 0$)	0
	5 ˋ	Vertical direction down	N_1 (Forward)	0	$V = N_1$ fl ($N_1 \neq 0$)	0
	5 ˊ	Rotational direction forward	N_1	N_2 (Forward)	0	N_2 (Forward) ($N_1 = N_2 \neq 0$)
	5 ˆ	Vertical direction up	$-N_1$	0	$V = -N_1$ fl ($N_1 \neq 0$)	0
	5 ˜	Vertical direction down	N_1	0	$V = N_1$ fl ($N_1 \neq 0$)	0
	5 ¯	Rotational direction reverse	$-N_1$	$-N_2$ (Reverse)	0	$-N_2$ (Reverse) ($-N_1 = -N_2 \neq 0$)
down Up forward down Up reverse 	5	Vertical direction down	N_1	0	$V=N_1$ fl ($N_1 \neq 0$)	0
	5 ˋ	Vertical direction up	$-N_1$	0	$V=-N_1$ fl ($N_1 \neq 0$)	0
	5 ˊ	Rotational direction forward	N_1	N_2	0	N_2 ($N_1 = N_2 \neq 0$)
	5 ˆ	Vertical direction down	N_1	0	$V=N_1$ fl ($N_1 \neq 0$)	0
	5 ˜	Vertical direction up	$-N_1$	0	$V=-N_1$ fl ($N_1 \neq 0$)	0
	5 ¯	Rotational direction down	$-N_1$	$-N_2$	0	$-N_2$ ($-N_1 = -N_2 \neq 0$)

Motion		Action direction	Input		Shaft motion	
			Ball screw pulley	Ball spline pulley	Vertical direction (speed)	Rotational direction (rotation speed)
Down → forward → up → reverse 	①	Vertical direction → down	N_1	0	$V=N_1 \cdot l$ $(N_1 \neq 0)$	0
	②	Rotationa direction → forward	N_1	N_2	0	N_2 $(N_1 = N_2 \neq 0)$
	③	Vertical direction → up	$-N_1$	0	$V=-N_1 \cdot l$ $(N_1 \neq 0)$	0
	④	Rotational direction → reverse	$-N_1$	$-N_2$	0	$-N_2$ $(-N_1 = -N_2 \neq 0)$
Down → up → reverse → forward 	①	Vertical direction → down	N_1	0	$V=N_1 \cdot l$ $(N_1 \neq 0)$	0
	②	Vertical direction → up	$-N_1$	0	$V=-N_1 \cdot l$ $(N_1 \neq 0)$	0
	③	Rotational direction → reverse	$-N_1$	$-N_2$	0	$-N_2$ $(-N_1 = -N_2 \neq 0)$
	④	Rotational direction → forward	N_1	N_2	0	N_2 $(N_1 = N_2 \neq 0)$

Example of Assembly

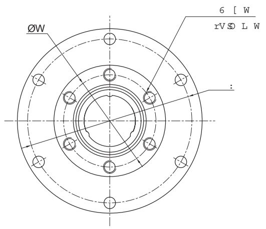


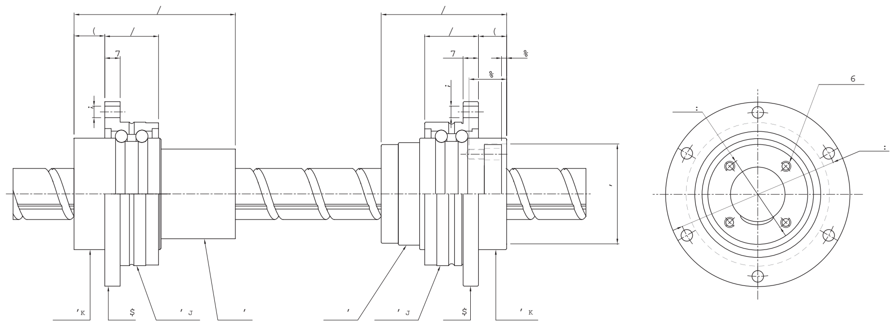
Example of installing the ball screw nut input pulley and the spline nut input pulley inside the housing and the maximum stroke can be achieved.

PBSA

PBSA

Product
PRECISION BALL SCREW SPLINE
Specifications | Precision Ball Screw Spline





Ball Spline

Shaft diameter	Inner diameter	Basic load rating		Basic torque rating		Static permissible moment M_A (N・m)	Nut diameter		L	X	W1	A	$D1_{g6}$	T	L1	W	S×t	E	Support bearing basic load rating		Mass	
		Ca (kN)	Co (kN)	C_T (N・m)	C_{OT} (N・m)		D_{h7}	D2											Ca (kN)	Co (kN)	Nut (kg)	Shaft (kg/m)
16	11	6.9	12.4	31.4	34.3	60	36	31	50	4.5	56	64	48	6	21	30	M4×0.7P×6	10	6.74	6.36	0.33	0.83
20	14	10.1	17.8	56.8	55.8	120	43.5	35	63	4.5	64	72	56	6	21	36	M5×0.8P×8	12	7.49	8.16	0.48	1.25
25	18	15.2	25.3	105	103	180	52	42	71	5.5	75	86	66	7	25	44	M5×0.8P×8	13	9.45	10.65	0.75	1.85

Ball Screw

Screw size			Effective turns Circuit×Row	Basic load rating		Nut diameter	L2	X1	W2	A1	$D4_{g6}$	D5	D6	T1	L3	W3	S1	B	B1	E1	Support bearing basic load rating		Mass	
O.D.	Inner diameter	Lead		Ca (kN)	Co (kN)	$D3_{h7}$															Ca (kN)	Co (kN)	Nut (kg)	Shaft (kg/m)
16	11	16	1.8×1	3.8	6.8	36	40	4.5	56	64	48	32	32	6	21	25	M4×0.7P	2.5	13	10	6.74	6.36	0.31	0.83
20	14	20	1.8×1	5.9	12.2	43.5	49	4.5	64	72	56	39	39	6	21	31	M5×0.8P	2	13	11	7.49	8.16	0.48	1.25
25	18	25	1.8×1	8.9	19.1	52	55	5.5	75	86	66	47	47	7	25	38	M6×1P	3	17	13	9.45	10.65	0.66	1.85