

# Standard-Lead Rolled Ball Screw

## Constant-Pressure Preload Type Ball Screw Model JPF

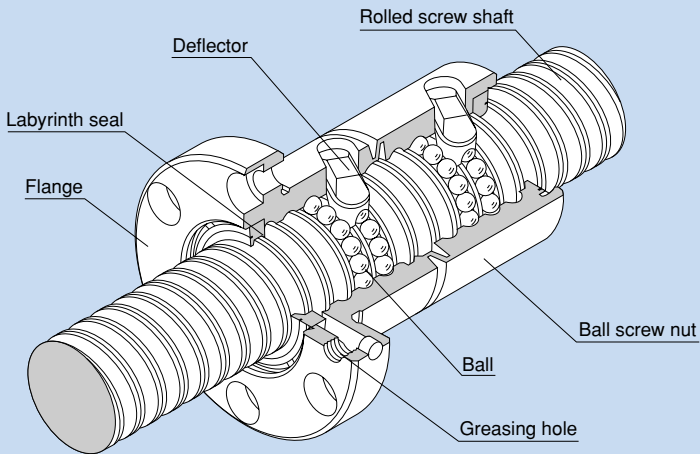


Fig. 1 Structure of Model JPF

## Structure and Features

With Constant-Pressure Preload Type Ball Screw model JPF, a phase difference is provided between the right and left threads of the ball screw nut, which are precision-ground, and a rolled screw shaft is installed into the ball screw nut. Since it adopts the constant-pressure preloading method based on a spring structure formed in the middle of the ball screw nut, model JPF is capable of absorbing a pitch error and eccentricity of the ball screw nut and the screw shaft. As a result, this model achieves no torque fluctuation and no backlash.

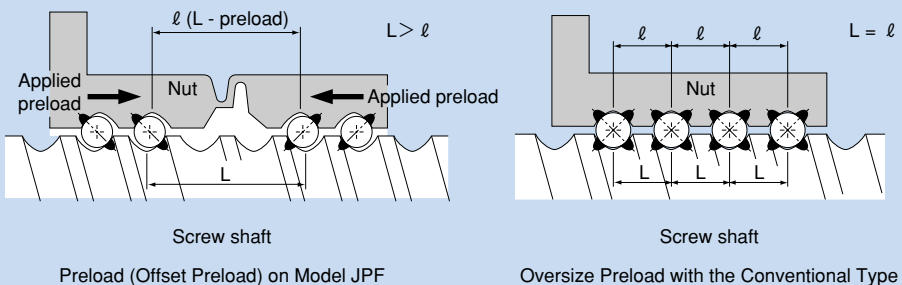


Fig. 2 Preloading Mechanisms

## ● No Backlash

The spring structure incorporated into the nut absorbs the pitch error between the ball screw nut and the screw shaft, the taper of the screw shaft and the eccentricity of the screw shaft, thus allowing zero-backlash to be achieved despite a low-price rolled shaft.

### Backlash Measurements

[Sample model]    JPF2505-6  
                         Shaft diameter: 25mm  
                         Lead:                5mm

[Measurement procedure]

- ① Mount model JPF onto a single-axis table.
- ② Place a laser displacement meter, and measure the table position at that time as the origin (reset the laser displacement meter to zero).
- ③ Apply an axial load to the table from the positive direction, then release the axial load and measure the table position at that time with the laser displacement meter.
- ④ Apply an axial load to the table from the negative direction, then release the axial load and measure the table position at that time with the laser displacement meter.

The maximum difference between the measurements obtained in steps ③ and ④ is regarded as the backlash.

[Measurements]

Table 1 Backlash Measurements

Unit: mm

Item	Position measurement
Origin	+0.0000
Load applied in the positive direction, then released	+0.0003
Load applied in the negative direction, then released	-0.0001
Backlash	0.0004

## ● Smooth Motion Even under a Preload

The spring structure incorporated in the nut provides a constant preload thereby to absorb the pitch error between the ball screw nut and the screw shaft, the taper of the screw shaft and the eccentricity of the screw shaft. Thus, smooth motion without a backlash is achieved.

### Rotation Torque Measurements

[Sample model] JPF2505-6G0+500LT  
 Shaft diameter: 25mm  
 Lead: 5mm  
 Stroke length: 450mm

[Measurement conditions]

Measurement method: Torque measurement machine  
 Rotation speed per minute: 100min<sup>-1</sup>  
 Lubrication method: Grease lubrication

[Measurement result]

Forward rotation: 0.07 to 0.10 N-m  
 Reverse rotation: 0.07 to 0.11 N-m

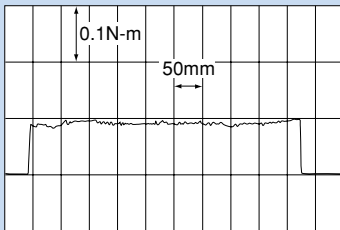


Fig. 3 Rotation Torque Measurements  
(Forward Rotation)

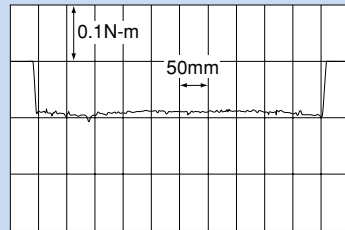


Fig. 4 Rotation Torque Measurements  
(Reverse Rotation)

## ● Highly Accurate Positioning Repeatability

Since model JPF has no axial clearance, using THK LM Guide on the guide surface will achieve highly accurate positioning repeatability without stick slip.

### Positioning Repeatability Measurements

[Sample model]    JPF2505-6  
Shaft diameter: 25mm  
Lead: 5mm  
Guide surface: LM Guide model SR25W

[Measurement procedure]

- ① Mount model JPF onto a single-axis table.
- ② Place a laser displacement meter.
- ③ Move the table 50 mm from the motor side, and reset the laser displacement meter to zero as the origin.
- ④ Move the table 50 mm toward the motor and move back the table 50 mm toward the motor. Measure the position of the table using the laser displacement meter.
- ⑤ Repeat steps ③ and ④ seven times.

Divide the maximum difference in the measurements above by two; the result obtained is the positioning repeatability.

[Measurement result]

Table 2 Positioning Repeatability Measurements

Unit: mm

Item	Position measurement
After 1 reciprocation	+0.0000
After 2 reciprocations	+0.0002
After 3 reciprocations	+0.0000
After 4 reciprocations	-0.0001
After 5 reciprocations	-0.0001
After 6 reciprocations	-0.0002
After 7 reciprocations	-0.0001
Positioning repeatability	±0.0002

## ● High Wobbling (Fluctuation/ $2\pi$ ) Accuracy

Since the screw shaft raceways are rolled with highly accuracy, high wobbling (fluctuation/ $2\pi$ ) accuracy is achieved although the screw shaft is rolled.

Wobbling (fluctuation/ $2\pi$ ): fluctuation in lead accuracy during one rotation of the screw shaft

### Wobbling (Fluctuation/ $2\pi$ ) Measurements

[Sample model]    JPF2505-6  
                           Shaft diameter: 25mm  
                           Lead: 5mm

[Measurement procedure]

- ① Mount model JPF onto a single-axis table.
- ② Place a laser displacement meter.
- ③ Move the table 50 mm from the motor side, and reset the laser displacement meter to zero as the origin.
- ④ Rotate the motor by 1/10 revolution (equivalent to 0.5 mm) at a time. Measure the difference between the position of the table and the designated value using the laser displacement meter.
- ⑤ Repeat step ④ until the motor rotates one revolution.

The fluctuation in the measurements above is the wobbling (fluctuation/ $2\pi$ ).

[Measurement result]

Table 3 Wobbling Accuracy Measurements

Unit: mm

Stroke position	Position error measurement
Origin	+0.0000
+0.500	+0.0002
+1.000	+0.0009
+1.500	+0.0015
+2.000	+0.0023
+2.500	+0.0021
+3.000	+0.0013
+3.500	+0.0004
+4.000	-0.0005
+4.500	-0.0002
+5.000	+0.0000
Wobbling	0.0028

## ● Absorbs Misalignment

Since the ball screw nut contacts the balls in DF (face-to-face duplex) configuration, the moment load on the ball screw nut caused by misalignment in mounting accuracy (e.g., perpendicularity of the flange mounting surface and misalignment between the LM Guide and the screw shaft) is minimized to suppress the torque fluctuation after assembly.

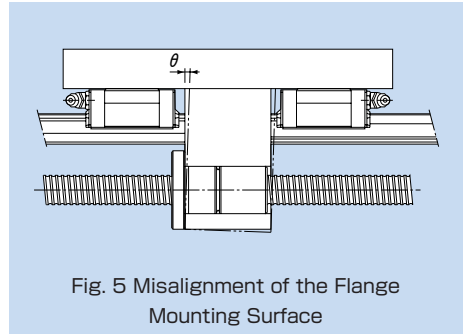


Fig. 5 Misalignment of the Flange Mounting Surface

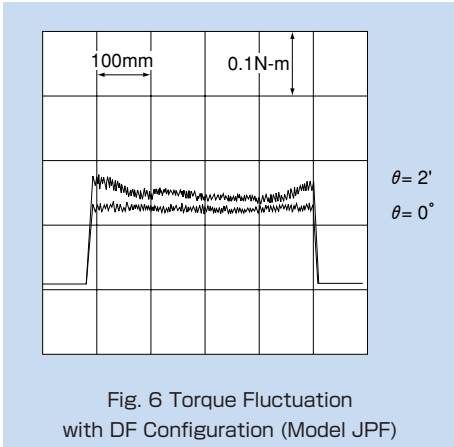


Fig. 6 Torque Fluctuation with DF Configuration (Model JPF)

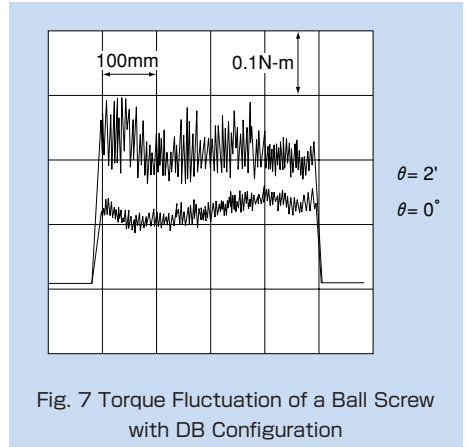
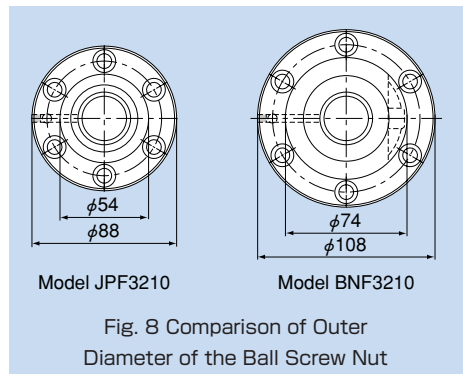


Fig. 7 Torque Fluctuation of a Ball Screw with DB Configuration

## ● Compact

The internal circulation structure using a deflector reduces the outer diameter of the ball screw nut to 70 to 80% of a return-pipe type Ball Screw.



Model JPF3210 Model BNF3210

Fig. 8 Comparison of Outer Diameter of the Ball Screw Nut

**Type**

**Constant-Pressure Preload Type Model JPF**

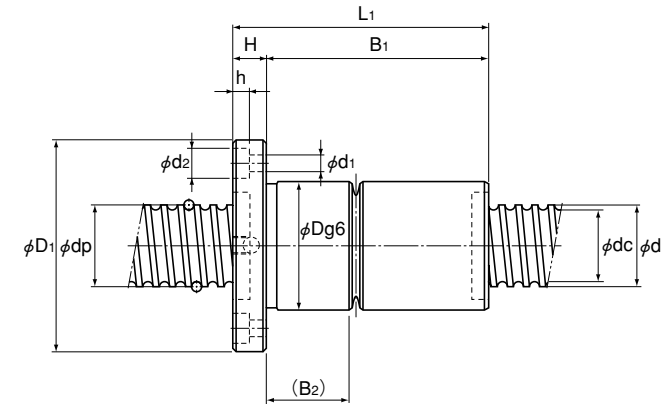
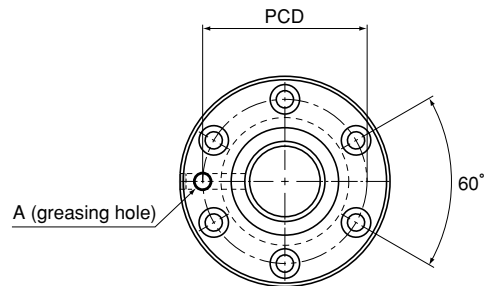


Axial clearance: 0 or less

# Model JPF

Constant-Pressure Preload Type Rolled Ball Screw

## k. Dimensions of the Ball Screw



Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Outer diameter D	Nut dimensions							Screw shaft inertial moment/mm <sup>2</sup> kg·cm <sup>2</sup> /mm	
						Ca kN	C <sub>0a</sub> kN		Flange diameter D <sub>1</sub>	Overall length L <sub>1</sub>	H	B <sub>1</sub>	B <sub>2</sub>	PCD	d <sub>1</sub> × d <sub>2</sub> × h		Greasing hole A
JPF 1404-4	14	4	14.4	11.5	2×1	2.8	5.1	26	46	52	10	42	16.5	36	4.5×8×4.5	M6	2.96×10 <sup>-4</sup>
JPF 1405-4		5	14.5	11.2	2×1	3.9	8.6	26	46	60	10	50	20	36	4.5×8×4.5	M6	2.96×10 <sup>-4</sup>
JPF 1605-4	16	5	16.75	13.5	2×1	3.7	8.2	30	49	60	10	50	19.5	39	4.5×8×4.5	M6	5.05×10 <sup>-4</sup>
JPF 2005-6	20	5	20.5	17.2	3×1	6	16	34	57	80	11	69	26.5	45	5.5×9.5×5.5	M6	1.23×10 <sup>-3</sup>
JPF 2505-6	25	5	25.5	22.2	3×1	6.9	20.8	40	66	80	11	69	26	51	5.5×9.5×5.5	M6	3.01×10 <sup>-3</sup>
JPF 2510-4		10	26.8	20.2	2×1	11.4	24.5	47	72	112	12	100	42	58	6.6×11×6.5	M6	3.01×10 <sup>-3</sup>
JPF 2805-6	28	5	28.75	25.2	3×1	7.3	23.9	43	69	80	12	68	25	55	6.6×11×6.5	M6	4.74×10 <sup>-3</sup>
JPF 2806-6		6	28.5	25.2	3×1	7.3	23.9	43	69	90	12	78	35	55	6.6×11×6.5	M6	4.74×10 <sup>-3</sup>
JPF 3210-6	32	10	33.75	27.2	3×1	19.3	49.9	54	88	135	15	120	53.5	70	9×14×8.5	M6	8.08×10 <sup>-3</sup>
JPF 3610-6	36	10	37	30.5	3×1	20.6	56.2	58	98	138	18	120	53.5	77	11×17.5×11	M6	1.29×10 <sup>-2</sup>
JPF 4010-6	40	10	41.75	35.2	3×1	22.2	65.3	62	104	138	18	120	53.5	82	11×17.5×11	PT 1/8	1.97×10 <sup>-2</sup>

**Note** The ball screw nut and the screw shaft of model JPF are not sold alone.

### Model number coding

**JPF2005-6 RR G0 +500L C7 T**

**1 2 3 4 5 6**

- 1 Model number
- 2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
- 3 Axial clearance symbol (see page k-15)
- 4 Overall screw shaft length (mm)
- 5 Accuracy symbol (see page k-8) (no symbol for class C10)
- 6 Symbol for rolled shaft