

Point of Selection

Accuracy of the Ball Screw

Example: When a preload of 3,000 N is provided to the Ball Screw model BIF4010-10G0 + 1500LC3 with a thread length of 1,300 mm (shaft diameter: 40 mm; ball center-to-center diameter: 41.75 mm; lead: 10 mm), the preload torque of the Ball Screw is calculated in the steps below.

■Calculating the Reference Torque

β : Lead angle

$$\tan\beta = \frac{\text{lead}}{\pi \times \text{ball center-to-center diameter}} = \frac{10}{\pi \times 41.75} = 0.0762$$

F_{a0} : Applied preload=3000N

Ph : Lead = 10mm

$$T_p = 0.05 (\tan\beta)^{-0.5} \frac{F_{a0} \cdot Ph}{2\pi} = 0.05 (0.0762)^{-0.5} \frac{3000 \times 10}{2\pi} = 865 \text{ N}\cdot\text{mm}$$

■Calculating the Torque Fluctuation

$$\frac{\text{thread length}}{\text{screw shaft outer diameter}} = \frac{1300}{40} = 32.5 \leq 40$$

Thus, with the reference torque in Table14 being between 600 and 1,000 N·mm, effective thread length 4,000 mm or less and accuracy grade C3, the coefficient of torque fluctuation is obtained as $\pm 30\%$.

As a result, the torque fluctuation is calculated as follows.

$$865 \times (1 \pm 0.3) = 606 \text{ N}\cdot\text{mm} \text{ to } 1125 \text{ N}\cdot\text{mm}$$

■Result

Reference torque : 865 N·mm

Torque fluctuation : 606 N·mm to 1125 N·mm

Table14 Tolerance Range in Torque Fluctuation

Reference torque N·mm		Effective thread length												
		4000mm or less											Above 4,000 mm and 10,000 mm or less	
		$\frac{\text{thread length}}{\text{screw shaft outer diameter}} \leq 40$						$40 < \frac{\text{thread length}}{\text{screw shaft outer diameter}} < 60$						—
		Accuracy grades						Accuracy grades						Accuracy grades
Above	Or less	C0	C1	C3	C5	C7	C0	C1	C3	C5	C7	C3	C5	C7
200	400	±30%	±35%	±40%	±50%	—	±40%	±40%	±50%	±60%	—	—	—	—
400	600	±25%	±30%	±35%	±40%	—	±35%	±35%	±40%	±45%	—	—	—	—
600	1000	±20%	±25%	±30%	±35%	±40%	±30%	±30%	±35%	±40%	±45%	±40%	±45%	±50%
1000	2500	±15%	±20%	±25%	±30%	±35%	±25%	±25%	±30%	±35%	±40%	±35%	±40%	±45%
2500	6300	±10%	±15%	±20%	±25%	±30%	±20%	±20%	±25%	±30%	±35%	±30%	±35%	±40%
6300	10000	—	—	±15%	±20%	±30%	—	—	±20%	±25%	±35%	±25%	±30%	±35%

Selecting a Screw Shaft

Maximum Manufacturing Length of the Screw Shaft

Table15 shows the maximum manufacturing lengths of precision ball screws by accuracy grade, Table16 shows the maximum manufacturing lengths of precision ball screws compliant with DIN standards by accuracy grade, and Table17 shows the maximum manufacturing lengths of rolled ball screws by accuracy grade.

If the shaft dimensions exceed the maximum manufacturing lengths in Table15, Table16, or Table17, contact THK.

Table15 Maximum Manufacturing Length of Precision Ball Screws by Accuracy Grade

Unit: mm

Screw shaft outer diameter	Overall screw shaft length					
	C0	C1	C2	C3	C5	C7
4	90	110	120	120	120	120
6	150	170	210	210	210	210
8	230	270	340	340	340	340
10	350	400	500	500	500	500
12	440	500	630	680	680	680
13	440	500	630	680	680	680
14	530	620	770	870	890	890
15	570	670	830	950	980	1100
16	620	730	900	1050	1100	1400
18	720	840	1050	1220	1350	1600
20	820	950	1200	1400	1600	1800
25	1100	1400	1600	1800	2000	2400
28	1300	1600	1900	2100	2350	2700
30	1450	1700	2050	2300	2570	2950
32	1600	1800	2200	2500	2800	3200
36	2000	2100	2550	2950	3250	3650
40	2000	2400	2900	3400	3700	4300
45	2000	2750	3350	3950	4350	5050
50	2000	3100	3800	4500	5000	5800
55	2000	3450	4150	5300	6050	6500
63	2000	4000	5200	5800	6700	7700
70	2000	4000	6300	6450	7650	9000
80	2000	4000	6300	7900	9000	11000
100	2000	4000	6300	11000	11000	11000

*For ball screw models HBN-V, HBN-K (KA), HBN, and SBKH, the standard maximum length of the screw shaft is 3000 mm.
For lengths greater than this, please contact THK.
For details, refer to **A15-294**.

Table16 Maximum Manufacturing Length of Precision Ball Screws (DIN Standard-Compliant Ball Screws)

Unit: mm

Shaft diameter	Ground shaft			CES shaft			
	C3	C5	C7	Cp3	Cp5	Ct5	Ct7
16	1050	1100	1400	1050	1100	1100	1400
20	1400	1600	1800	1400	1600	1600	1800
25	1800	2000	2400	1800	2000	2000	2400
32	2500	2800	3200	2500	2800	2800	3200
40	3400	3700	4300	3400	3700	3700	4300
50	4500	5000	5800	—	—	—	—
63	5800	6700	7700	—	—	—	—

Table17 Maximum Manufacturing Length of Rolled Ball Screws
by Accuracy Grade

Unit: mm

Screw shaft outer diameter	Overall screw shaft length		
	C7	C8	C10
6 to 8	320	320	—
10 to 12	500	1000	—
14 to 15	1500	1500	1500
16 to 18	1500	1800	1800
20	2000	2200	2200
25	2000	3000	3000
28	3000	3000	3000
30	3000	3000	4000
32 to 36	3000	4000	4000
40	3000	5000	5000
45	3000	5500	5500
50	3000	6000	6000

For details, refer to **A15-294**.