THK
The Mark of Linear Motion

Cost Effective Screw series

Ball Screws Compliant with the New Accuracy Standards

New Series CES (Pronounced "sees")

Simple-Nut Type **BIF**
Double-Nut Type **BNFN** (build to order)
Single-Nut Type **BNF** (build to order)

Achievements Made through Our Proprietary Precision Machining Technology:

- Superb cost effectiveness
- Accuracy grades Cp3/Cp5 - compliant with JIS B 1192-1997
- Below "0" (zero) clearance in the axial direction
- Shorter delivery time

THK CO., LTD.
TOKYO. JAPAN

CATALOG No.305E

Features

●Superb Cost Effectiveness

Our proprietary precision machining technology allows lower cost than conventional precision ball screws.

●Accuracy Grades Cp3/Cp5

The accuracies of the CES Series Ball Screws are controlled in accordance with JIS standard (JIS B 1192-1997), and the series support Cp3 and Cp5 grades.

●Below Zero Clearance in the Axial Direction

The CES Series Ball Screws achieve a clearance in the axial direction at or below zero, which is an essential property for high-precision positioning and high rigidity.
Even under a preload with a below zero clearance in the axial direction, each CES Series Ball Screw achieves motion as smooth as precision ball screws.

●Shorter Delivery Time

Our proprietary precision machining technology enables the products to be delivered in shorter time than conventional precision ball screws.

●Simple-Nut Type BIF

Model BIF, using an offset-preload nut, achieves a more compact design and smoother motion than double-nut types.

Models BNFN and BNF are manufactured to order.

Difference between the C and Cp specification

The C specification differs from the Cp specification in tolerance for accuracies of leads and other components.

Lead Accuracy

Tolerance for representative travel distances

The C and Cp specification share the same tolerance.

Tolerance for fluctuations

The Cp specification is designed to have the tolerance for fluctuations approx. 1.2 times greater than the C specification.

Tolerance for fluctuations in given 300mm

The Cp specification is designed to have the tolerance for fluctuations approx. 1.2 times greater than the C specification.

Tolerance for Fluctuation / 2π (drunkenness)

The C and Cp specification share the same tolerance.

Accuracy of the Mounting Section

Accuracy of various parts of the threaded shaft, and the measurement method of these parts has been changed.

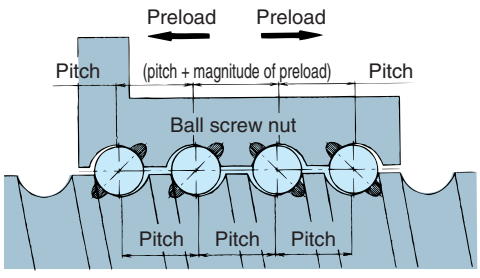
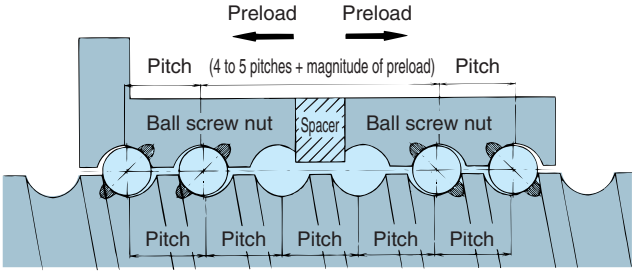
Accuracy of the mounting parts of nut, and the measurement method of these parts has been changed.

Accuracy of full eccentricity of axis of threaded shaft in radial direction, and the measurement method of these parts has been changed.

The C specification is designed to have the mounting section accuracy value slightly bigger than the Cp specification.

Construction and Features of Offset-Preload Type Model BIF

Simple-nut type model BIF is an offset-preload nut type ball screw. It uses a single ball screw nut, machined with a cutting-edge CNC precision nut grinder, to provide phases to the left and right screws to the center of the nut to achieve a clearance in the axial direction at or below zero (preloaded state).
Model BIF achieves a more compact design and smoother motion than the conventional double-nut type (which uses a spacer between the two nuts).

Offset-Preload Type Model BIF	Double-nut Type Model BNFN
 Screw shaft	 Screw shaft
With the offset-preload type, preload is regulated through adjustment of the ball diameter, not by adjusting the shim thickness. This eliminates variations in the contact angle, which is the most important property, and achieves high rigidity, smooth rotation and significantly minimal Fluctuation / 2π (drunkcnness)	With the double-nut type, there are variations in the contact angle because the nut will lean depending on the flatness of the spacer and on the perpendicularity of the nut. This prevents uniform ball contact, affects stable rotation and deteriorates Fluctuation / 2π (drunkcnness) in particular.

Lead Accuracy

The accuracies of the CES Series Ball Screws are controlled in accordance with JIS standard (JIS B 1192-1997).

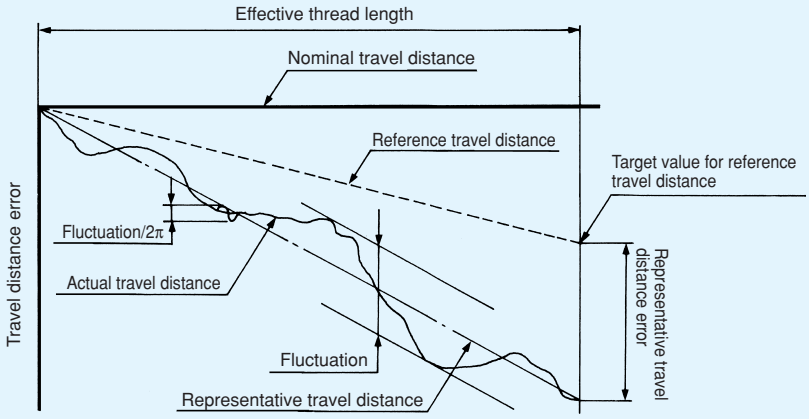


Fig. 1. Technical Terms on Travel Distance

Actual travel distance

Error in travel distance measurements of the actual Ball Screw

Reference travel distance

Normally, it is the same as the nominal travel distance. The nominal travel distance can intentionally be modified according to the intended use.

Target value for reference travel distance

In manufacturing a Ball Screw, its reference travel distance can be set smaller or greater than the normal value given a possible tension applied to prevent the screw shaft from running out or a possible expansion/contraction caused by an external load or temperature change. If such an adjustment is required, specify a target value for the reference travel distance.

Representative travel distance

A straight line representing the tendency of the actual travel distance is obtained from the actual travel distance curve using the least-squares method

Representative travel distance error (positive or negative)

A difference between the representative travel distance and the reference travel distance

Fluctuation

The peak-to-peak value of the actual travel distance (interval between two tangential lines parallel to the representative travel distance line)

Fluctuation/300

Fluctuation per 300mm of the thread length of a given portion

Fluctuation/2μ (drunkenness)

Fluctuation within a turn of the screw shaft

Table 1. Representative Travel Distance Error and Fluctuation (Tolerance)

Unit : μm

Accuracy grade		Cp3		Cp5	
Effective thread length (mm)		Representative travel distance error	Fluctuation	Representative travel distance error	Fluctuation
Above	Below				
—	315	12	12	23	23
315	400	13	12	25	25
400	500	15	13	27	26
500	630	16	14	32	29
630	800	18	16	36	31
800	1000	21	17	40	34
1000	1250	24	19	47	39
1250	1600	29	22	55	44
1600	2000	35	25	65	51
2000	2500	41	29	78	59
2500	3150	50	34	96	69
3150	4000	62	41	115	82
4000	5000	76	49	140	99
5000	6300	—	—	170	119

Table 2. Fluctuation per 300mm of Thread Length and per Turn of the Screw Shaft (Tolerance)

Unit : μm

Accuracy grade	Cp3	Cp5
Fluctuation/300	12	23
Fluctuation/2π	6	8

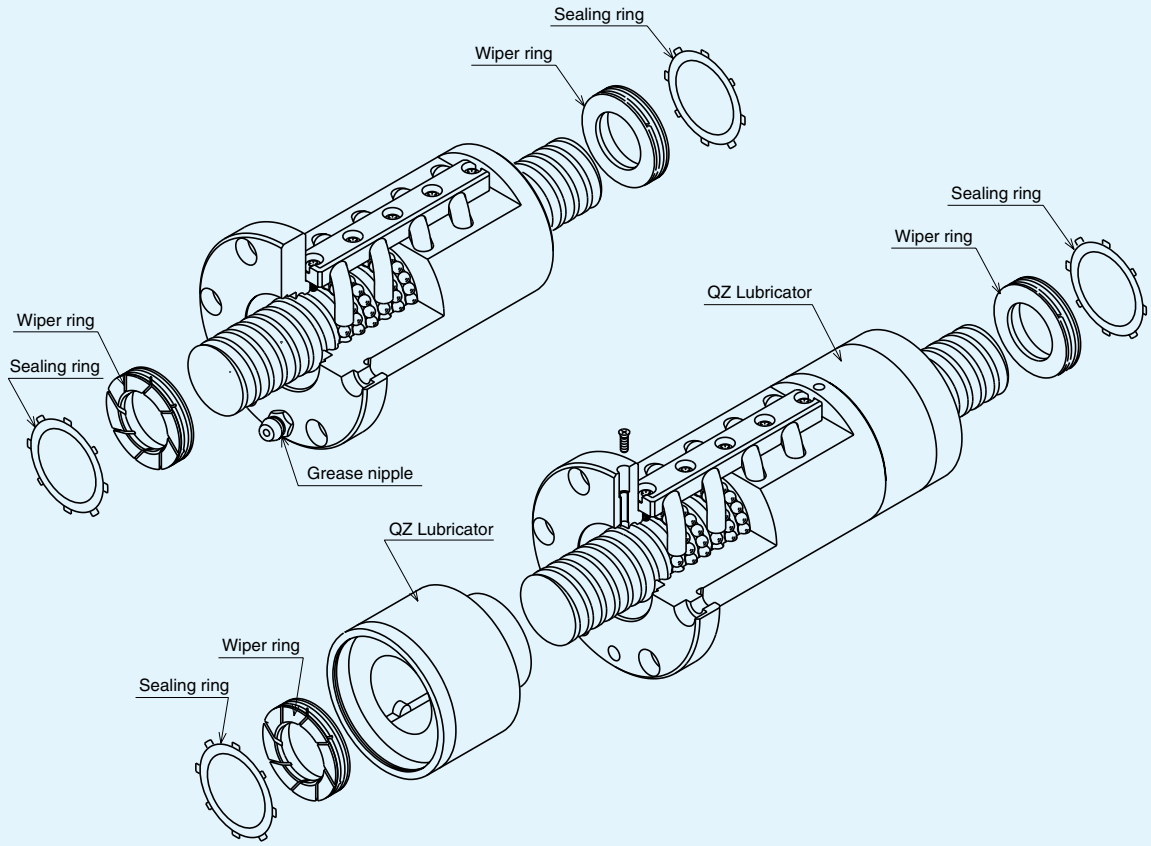


Fig. 2. Structural Drawings of QZ Lubricator and Wiper Ring

QZ Lubricator

QZ Lubricator is a new lubrication system capable of supplying the optimal amounts of lubricating oil where the oil is required.

●**Allows significantly extended maintenance intervals**

With ordinary grease lubrication of the Ball Screw, a small amount of oil is lost as the screw system runs. Attaching QZ Lubricator supplements the lost oil over a long term, thus to significantly extend maintenance intervals.

●**Environmentally friendly lubrication system**

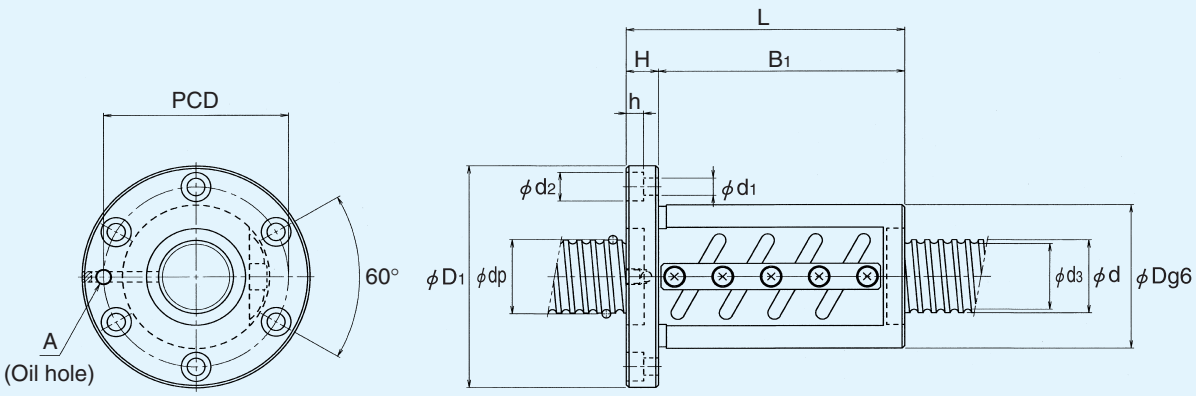
QZ Lubricator supplies the right amount of oil to the right place through a highly oil impregnated net, making itself an environmentally friendly lubrication system that does not waste oil.

Wipe Ring

Wiper Ring uses a special resin with high water resistance that elastically contacts the outer periphery of the screw shaft and the raceway to remove foreign matter with 8 slits.

●Prevents foreign matter from entering the ball screw nut.
●Contacts the screw shaft at a constant pressure to minimize heat generation.
●Highly wear-resistant, impact-resistant and chemical-resistant.
●When used in combination with QZ Lubricator for the Ball Screw, it achieves long-term, maintenance-free operation even under harsh environments.

Specification Table for Simple-Nut Type Model BIF



Model No.	Screw shaft outer diameter d (mm)	Lead ℓ (mm)	Ball center-to-center diameter dp (mm)	Thread minor diameter d3 (mm)	Number of loaded circuits Rows X revolutions	Basic load rating		Rigidity K* (N/μm)
						Ca (kN)	Coa (kN)	
BIF1605-5	16	5	16.75	13.2	1×2.5	7.4	13.9	330
BIF2505-3	25	5	25.75	22.2	1×1.5	6.0	13.1	280
BIF2505-5			25.75	22.2	1×2.5	9.2	22.0	470
BIF3210A-5	32	10	33.75	26.4	1×2.5	26.1	56.2	640
BIF3610-5	36	10	37.75	30.5	1×2.5	27.6	63.3	700
BIF3610-10			37.75	30.5	2×2.5	50.1	126.4	1350
BIF4012-5	40	12	42.0	34.1	1×2.5	33.9	79.2	770
BIF4012-10			42.0	34.1	2×2.5	61.6	158.8	1490

*Note: Each rigidity value in the table indicates the spring constant based on the load and the elastic displacement when applying a preload (10% of the basic load rating) and applying a load in the axial direction 3 times greater than the preload. This value does not include the rigidity of any component related to the nut-mounting section. As a guide, generally 80% of the value in the table will apply.

If the preload (Fa0) differs from 0.1Ca, the rigidity (K_N) is obtained in the following equation:

$$K_N = K\left(\frac{Fa0}{0.1Ca}\right)^{\frac{1}{3}}$$

K: rigidity in the specification table

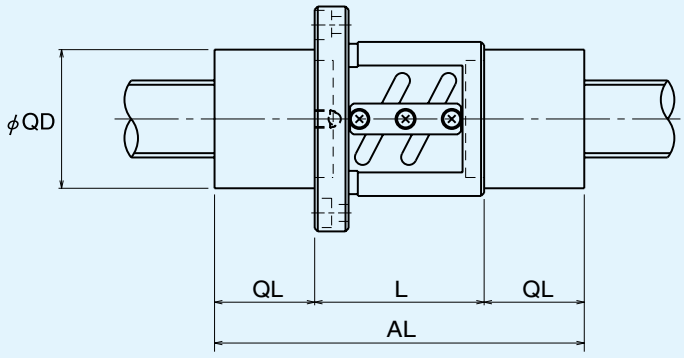


Table 3. Dimensions with QZ Lubricator Attached

Unit : mm

Model No.	QZ length	QZ outer diameter	Overall length with QZ attached
	QL	QD	AL
BIF1605-5	36*	31	128
BIF2505-3	32.5	45	117
BIF2505-5			120
BIF3210A-5	31	73	162
BIF3610-5	33	64	177
BIF3610-10			237
BIF4012-5	38	66	195
BIF4012-10			267

* Including the collar length

Symbols in parentheses indicate units

Nut dimensions (mm)								Screw shaft inertial moment/mm ($kg \cdot cm^2/mm$)
Outer diameter D	Flange diameter D_1	Overall length L	H	B_1	PCD	$d_1 \times d_2 \times h$	Oil hole A	
40	60	56	10	46	50	4.5×8×4.5	M6×1	5.05×10^{-4}
50	73	52	11	41	61	5.5×9.5×5.5	M6×1	3.01×10^{-3}
50	73	55	11	44	61	5.5×9.5×5.5	M6×1	3.01×10^{-3}
74	108	100	15	85	90	9×14×8.5	M6×1	8.08×10^{-3}
75	120	111	18	93	98	11×17.5×11	M6×1	1.29×10^{-2}
75	120	171	18	153	98	11×17.5×11	M6×1	1.29×10^{-2}
84	126	119	18	101	104	11×17.5×11	M6×1	1.97×10^{-2}
84	126	191	18	173	104	11×17.5×11	M6×1	1.97×10^{-2}

Model No. Coding

BIF2505-5 ① QZ ② RR ③ G0 ④ + 1200L ⑤ Cp3 ⑥ R ⑦

①Model No. ②With QZ Lubricator (no symbol when QZ Lubricator is not attached)
③Seal symbol (RR: labyrinth seal at both ends; WW: Wiper Ring at both ends)
④Clearance symbol in the axial direction (all G0 for model BIF) ⑤Overall screw shaft length (in mm)
⑥Accuracy symbol (Cp3, Cp5) ⑦Series symbol

THK CES Series Ball Screws

Type BIF, BNFN and BNF

⚠ Precautions on Use

●Permissible rotation speed

- At high rotation speed, the frequency nears the Ball Screw's natural frequency to cause resonance and cause the screw system to become inoperable. Therefore, it is necessary to use the Ball Screw at the resonance point (critical speed). In addition, the Ball Screw is also restricted in DN value (product of rotation speed and ball center-to-center diameter) regardless of how it is mounted. Be sure to take into account these two points. (Permissible DN value of the CES Series Ball Screw: 70,000.)

●Precautions in handling the product

- The Ball Screw is a precision product and its functions may be affected if it is dropped or struck. If the ball screw nut comes off the screw shaft, balls will drop out. Use much care in handling the product.

●Mounting a part

- Forcibly hammering a part onto/into the screw shaft or the nut may cause an indentation on the raceway. Be sure not to impose an excessive force on the screw shaft or the ball screw nut when mounting these parts.
- Misaligning or tilting the supporting section of the ball shaft and the ball screw nut section may drastically shorten the service life. Use much care in the accuracy of parts to be mounted and their mounting accuracy.

●Coolant

- Entry of a coolant into the ball screw nut may cause early fracture. Protect the Ball Screw with a cover or the likes to prevent a coolant from directly contacting the product.

●Service temperature range

- The Ball Screw uses a special resin. Do not use the product at temperature above 80°C.

●Lubrication

- Since the Ball Screw contains grease (except in special circumstances), it can be used immediately. If you test-operate the product, replenish grease before shipment.
- Ordinary grease may not be used when the product is used in a special environment such as an area subject to extremes of temperature or continuous vibration, a clean room, or a vacuum environment. If the product is to be used in a special environment, please contact THK.

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