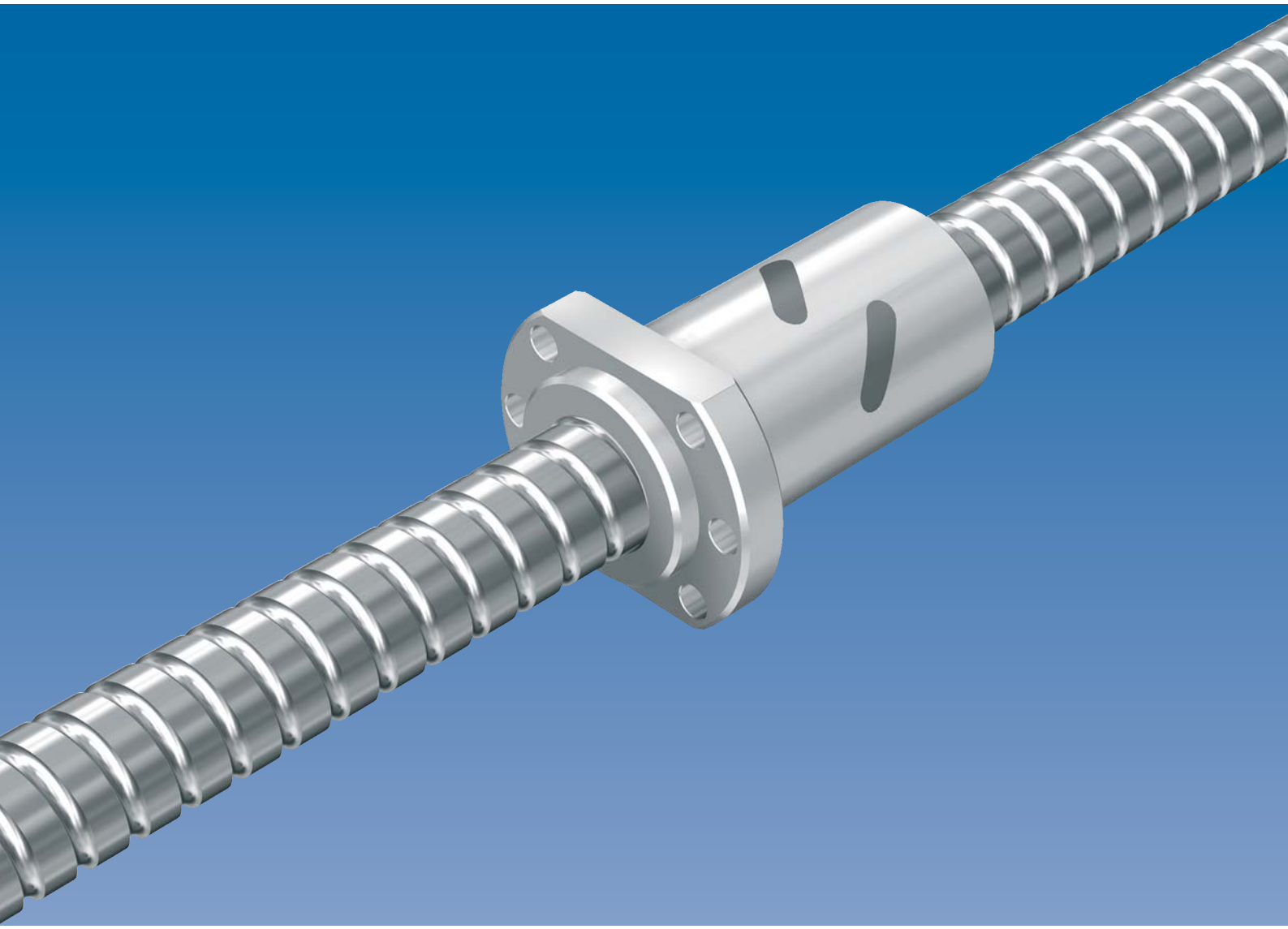
THK

The Mark of Linear Motion

DIN Standard Compliant Ball Screws

- Ball Screws According to ISO 3408 (DIN 69051)
- Preloaded or without Clearance

EBB/EPB



THK CO., LTD.
TOKYO, JAPAN

Catalogue No. 003-6EU

DIN Standard Compliant Ball Screws

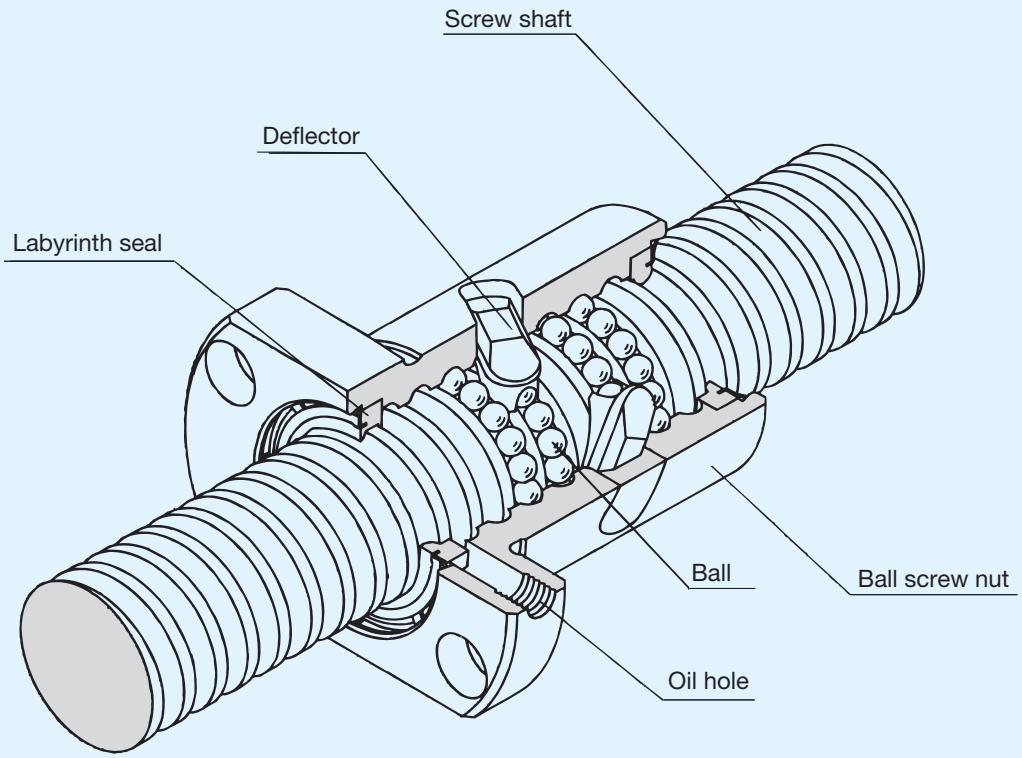


Fig. 1 Structure of a single nut with deflector

• DIN Standard Compliant Ball Screws

Ground ball screws are best suited for applications, where high axial rigidity is required. DIN standard compliant ball screws of the types EBB and EPB are cost-effective alternatives to ground ball screws.

These products match the accuracy grades of the standard ISO 3408 (DIN 69051).

Standard		ISO/DIN
Accuracy grade		Cp5R[1)]
Preload	Pitch offset Type EPB	0.05 Ca
	Ball selection Type EBB	Without clearance

1) The accuracy grade Cp5R of the ball screws are related to ISO 3408 (DIN 69051).

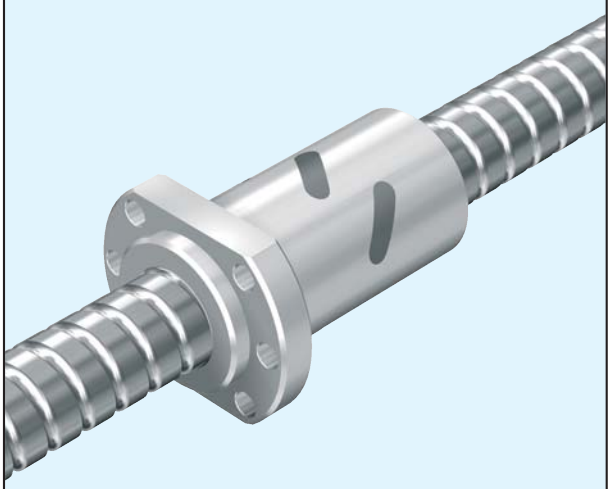
• Support Units and Screw Shafts with Finished Ends Available

DIN standard compliant ball screws of the types EBB and EPB can be delivered with support units and the approbriate shaft ends.

Product Overview

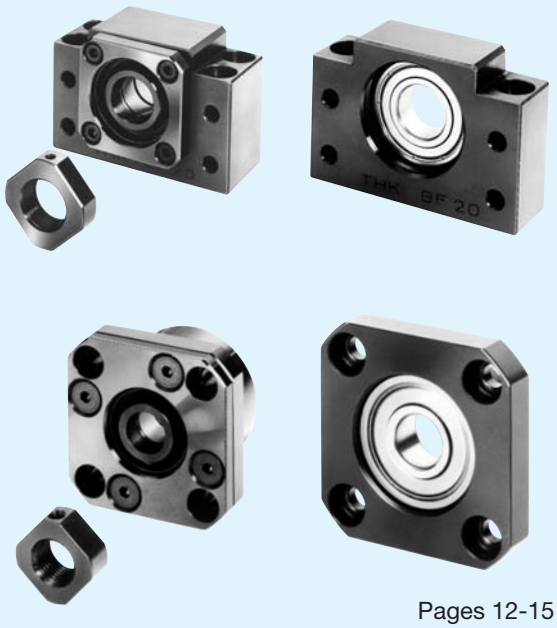
DIN Standard Compliant Ball Screws EPB/EBB (Form B)

Single nut
EBB: GT or G0 (without clearance)
EPB: G0 (without clearance)



Pages 8-11

Support Units BK/BF & FK/FF



Pages 12-15

Screw Shaft Selection

Available Diameter/Lead Combinations

The tables below indicate the standard combinations of the screw shafts and leads.

Table 1 EBB/EPB Unit: mm

Screw shaft diameter	Lead	
	5	10
16	●	–
20	●	–
25	●	●
32	●	●
40	–	●
50	–	●

Limitations of Screw Shaft Lengths

Table 2 presents the maximum screw shaft lengths by the screw shaft diameter and axial clearance.

Table 2 Limitations of screw shaft lengths Unit: mm

Screw shaft diameter	Max. screw shaft length	
	GT	G0
16	1500	1500
20	2000	2000
25	2000	2000
32	3000	2000
40	3000	2000
50	3000	2000

EBB = GT (0 - 0,005 mm axial clearance)
G0 (without clearance)
EPB = G0 (without clearance)

DN Value

The permissible rotational speed of the ball screw should be determined based on the critical speed and DN value.

The permissible rotational speed determined based on the DN value can be calculated using the following equation.

• DIN standard compliant ball screws EBB/EPB

$$n = \frac{70{,}000}{d_p}$$

n : permissible rotational speed determined based on the DN value (min^{-1})
d_p : ball center-to-center diameter (presented in the dimension table P. 8 and 10) (mm)

For operating rotational speeds greater than n, high-speed ball screws are available. If you require these models, please contact THK.

Preload and Rigidity

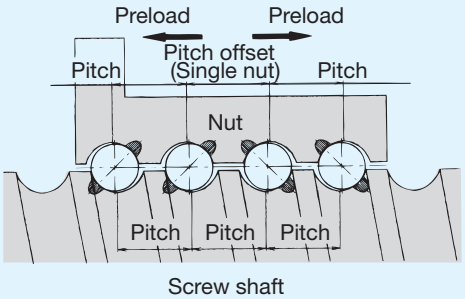
Preload

The preload eliminates the axial clearance of the ball screw and improves the rigidity.

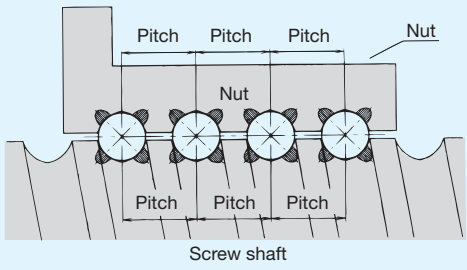
Preload methods

(A) Preload by pitch shift method: The pitch is shifted at the central part of the nut to create the requested preload.

(B) Without clearance by ball selection: The nut is filled with balls in a certain diameter to achieve the 4-point contact of the balls.



EPB



EBB

Accuracy Grades

Travel Variation and Travel Deviation

The accuracy grades of the DIN standard compliant ball screws are related to ISO 3408 (DIN 69051).

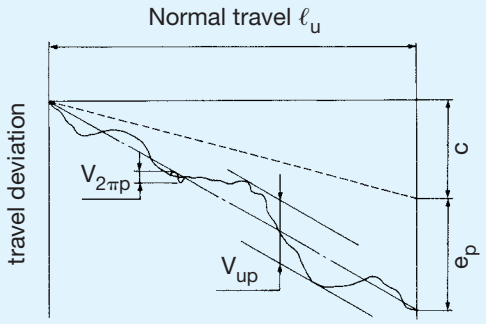


Figure 2 Permissible travel deviation and travel variation in relation to the nominal travel

Definitions according to DIN/ISO Standard:

e_p: Tolerance on specified travel. The difference between the maximum and minimum values of the permissible actual mean travel.

V_{up}: Permissible travel variation in relation to the nominal travel ℓ_u.

$V_{2\pi p}$: Permissible travel variation in relation to one rotation 2 π rad.

V_{300p}: Permissible travel deviation over 300 mm travel.

c: Travel compensation. The difference between the specified travel and nominal travel within the useful travel.

Table 3 Tolerance on specified travel ± e_p and permissible travel variation V_{up} in relation to the nominal travel ℓ_u for positioning ball screws.

Unit: µm

Standard		ISO/DIN Cp5R[1)]	
Normal travel ℓ_u [mm]		±e_p	V_{up}
over	to (incl.)		
-	315	23	23
315	400	25	25
400	500	27	26
500	630	32	29
630	800	36	31
800	1000	40	34
1000	1250	47	39
1250	1600	55	44
1600	2000	65	51
2000	2500	78	59
2500	3000	96	69

Table 4 Permissible travel variation in relation to one rotation $V_{2\pi p}$ and permissible travel variation over 300 mm travel V_{300p} for positioning ball screws.

Unit: µm

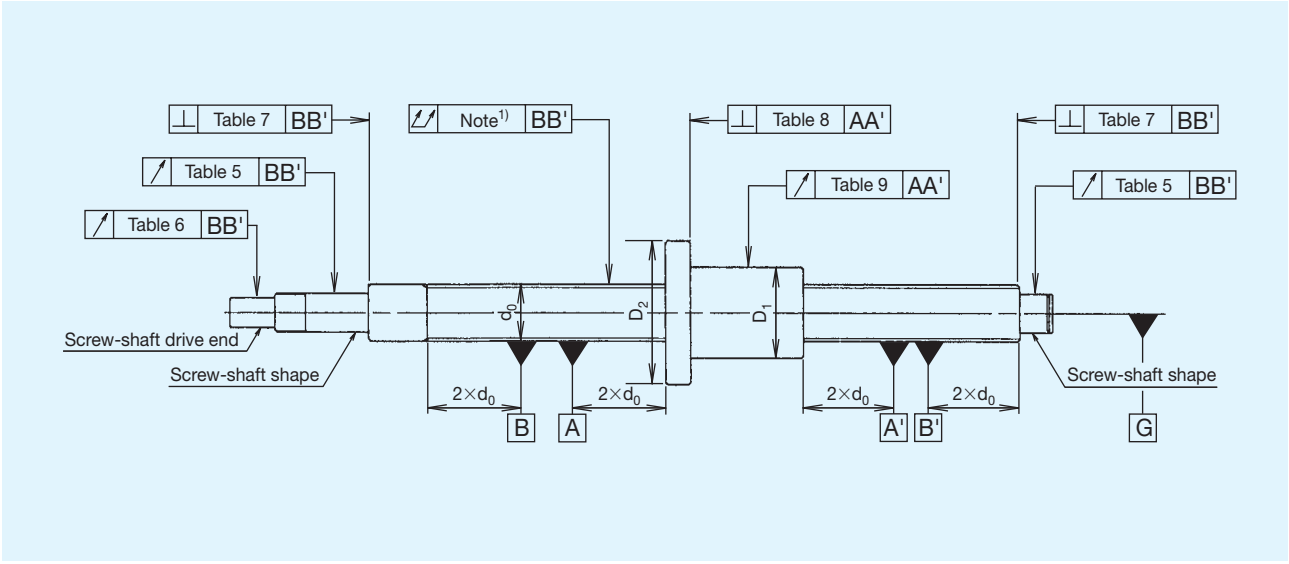
Standard	ISO/DIN Cp5R[1)]
V_{300p}	23
$V_{2\pi p}$	8

1) EBB/EPB: Positioning ball screws of the accuracy grade 5 according to ISO 3408 (DIN 69051)

Accuracy of the Mounting Section

The mounting surface accuracy of the DIN standard compliant ball screws according to DIN/ISO Standard.

For more detailed information and test instructions see ISO 3408 (DIN 69051), part 3.



1) For the overall run-out of the screw shaft axis in the radial direction, refer to ISO 3408 (DIN 69051), part 3. See also tables 10 and 11.

Table 5 Radial run-out of the drive shaft in respect to BB' Unit: µm

Nominal diameter d_0 (mm)		ℓ (mm)	Radial run-out Cp5R
Over	Up to (incl.)		
6	20	80	20
20	50	125	25

Table 6 Radial run-out of the drive shaft in respect to BB' Unit: µm

Nominal diameter d_0 (mm)		ℓ (mm)	Coaxial deviation Cp5R
Over	Up to (incl.)		
6	20	80	8
20	50	125	10

Table 7 Perpendicularity of the bearing journal abutment face in respect to BB' Unit: µm

Nominal diameter d_0 (mm)		Axial run-out Cp5R
Over	Up to (incl.)	
6	63	5

Table 8 Perpendicularity of the flange mounting surface in respect to AA'

Unit: μm

Flange diameter D_2 [mm]		Perpendicularity Cp5R
Over	Up to (incl.)	
16	32	16
32	63	20
63	125	25

Table 9 Radial run-out of the outer diameter of the nut in respect to AA'

Unit: μm

Outer diameter D_1 [mm]		Run-out Cp5R
Over	Up to (incl.)	
16	32	16
32	63	20
63	125	25

Table 10 Measurement of radial run-out of the ball screw shaft outer diameter for ascertaining straightness related to BB' per length ℓ_5

Unit: μm

Nominal diameter d_0 [mm]		Refernce length ℓ_5 [mm]	Run-out Cp5R
Over	Up to (incl.)		
12	25	160	32
25	50	315	32

Table 11 Maximum radial run-out of the ball screw shaft diameter valid for $\ell_1 \geq 4\ell_5$

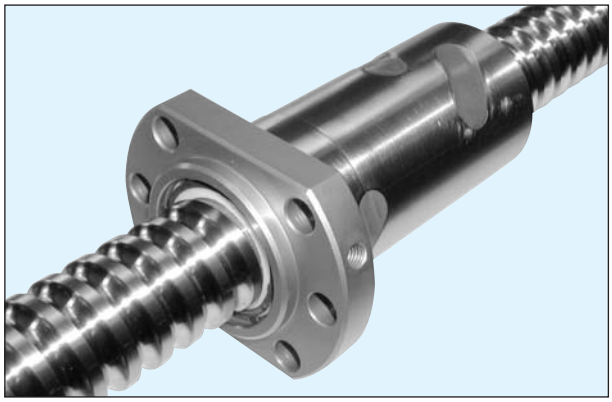
Unit: μm

$\frac{\ell_1}{d_0}$		Run-out (max.) Cp5R
Over	Up to (incl.)	
—	40	64
40	60	96

ℓ_1 = Effective screw shaft length [mm]
d_0 = Screw shaft outer diameter [mm]
ℓ_5 = Reference length [mm]

DIN Standard Compliant Ball Screw EBB

- **Single nut according to ISO 3408 (DIN 69051) with flange form B**
- **Without clearance by ball selection**



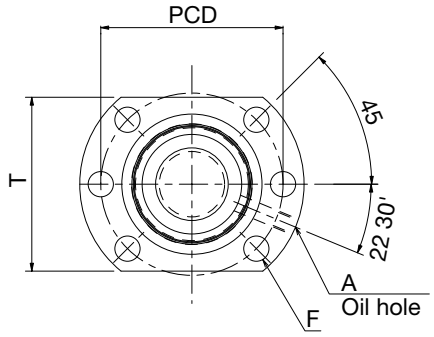
Model No.	Screw shaft diameter d	Lead ℓ	Ball center-to-center diameter d_p	Thread minor diameter d_3	No. of loaded circuits rows × turns	Basic load rating C_a [kN]	Basic load rating C_{0a} [kN]	Rigidity[1] K [N/μm]
EBB1605-4	16	5	16.75	13.1	4×1	11.9	17.4	210
EBB2005-3	20	5	20.75	17.1	3×1	10.6	17.3	200
EBB2505-3	25	5	25.75	22.1	3×1	12.1	22.6	250
EBB2510-3	25	10	26	21.6	3×1	15.9	27.0	250
EBB2510-4	25	10	26	21.6	4×1	20.9	37.6	330
EBB3205-3	32	5	32.75	29.2	3×1	13.9	30.2	300
EBB3205-4	32	5	32.75	29.2	4×1	17.8	40.3	400
EBB3205-6	32	5	32.75	29.2	6×1	25.1	60.4	600
EBB3210-3	32	10	33.75	26.4	3×1	32.1	52.2	300
EBB3210-4	32	10	33.75	26.4	4×1	41.3	69.7	390
EBB4010-3	40	10	41.75	34.4	3×1	37.3	69.3	380
EBB4010-4	40	10	41.75	34.4	4×1	47.6	92.4	500
EBB5010-4	50	10	51.75	44.4	4×1	54.3	120.5	610

[1] The rigidity values in the table represent spring constants obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (C_a). These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 C_a, the rigidity value (K_N) is obtained from the following equation.

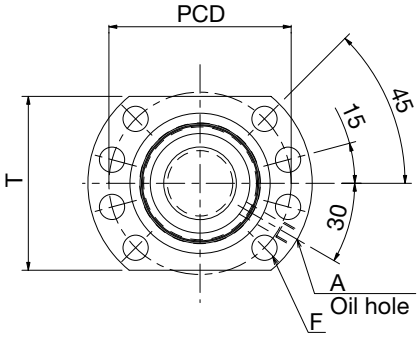
$$K_N = K \cdot \left(\frac{F_a}{0{,}3 \cdot C_a} \right)^{\frac{1}{3}}$$

K : Rigidity value in the dimensional table.

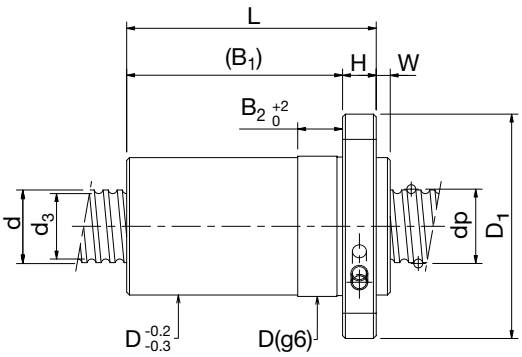
F_a : Axial load



Drilling template 1



Drilling template 2



Unit: mm

Nut dimensions											Oil hole	Screw shaft inertial moment per mm
Outer diameter D	Flange diameter D_1	Overall length L	H	B_1	B_2	W	T	PCD	F	Drilling template	A	[kg·cm²/mm]
28	48	50	10	40	10	5	40	38	5.5	1	M6×1	5.05×10^{-4}
36	58	45	10	35	10	5	44	47	6.6	1	M6×1	1.23×10^{-3}
40	62	45	10	35	10	5	48	51	6.6	1	M6×1	3.01×10^{-3}
40	62	75	10	65	16	5	48	51	6.6	1	M6×1	3.01×10^{-3}
40	62	80	10	70	16	5	48	51	6.6	1	M6×1	3.01×10^{-3}
50	80	47	12	35	10	5	62	65	9	1	M6×1	8.08×10^{-3}
50	80	52	12	40	10	5	62	65	9	1	M6×1	8.08×10^{-3}
50	80	62	12	50	10	5	62	65	9	1	M6×1	8.08×10^{-3}
50	80	77	12	65	16	5	62	65	9	1	M6×1	8.08×10^{-3}
50	80	89	12	77	16	5	62	65	9	1	M6×1	8.08×10^{-3}
63	93	79	14	65	16	5	70	78	9	2	M8×1	1.97×10^{-2}
63	93	89	14	75	16	5	70	78	9	2	M8×1	1.97×10^{-2}
75	110	91	16	75	16	5	85	93	11	2	M8×1	4.82×10^{-2}

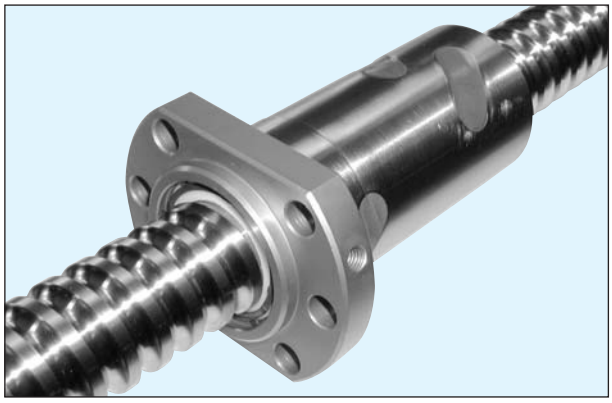
Model Number Coding

EBB 32 05 – 4 RR GT + 1200L Cp5R
(1) (2) (3) (4) (5) (6) (7) (8)

(1) Nut
(2) Screw shaft outer diameter (mm)
(3) Lead (mm)
(4) Number of circuits (rows × turns)
(5) Seals (RR: labyrinth seals attached to both sides)
(6) Symbol for preload
GT = 0 to 0.005 mm axial clearance
G0 = without clearance
(7) Screw shaft total length (mm)
(8) Accuracy

DIN Standard Compliant Ball Screw EPB

- **Single nut according to ISO 3408 (DIN 69051) with flange form B**
- **Preload by pitch offset**

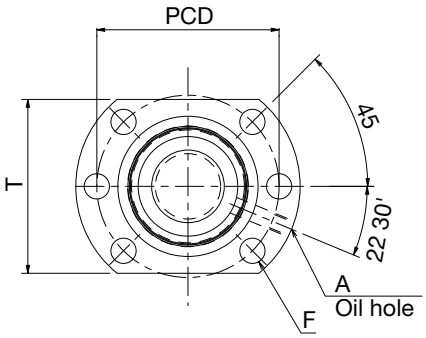


Model No.	Screw shaft diameter D	Lead ℓ	Ball center-to-center diameter D_p	Thread minor diameter D_3	No. of loaded circuits rows × turns	Basic load rating C_a [kN]	Basic load rating C_{0a} [kN]	Rigidity[1] K [N/μm]
EPB1605-6	16	5	16.75	13.1	3×1	9.3	13.1	320
EPB2005-6	20	5	20.75	17.1	3×1	10.6	17.3	310
EPB2505-6	25	5	25.75	22.1	3×1	12.1	22.6	490
EPB2510-4	25	10	26	21.6	2×1	11.3	18.0	330
EPB3205-6	32	5	32.75	29.2	3×1	13.9	30.2	620
EPB3205-8	32	5	32.75	29.2	4×1	17.8	40.3	810
EPB3210-6	32	10	33.75	26.4	3×1	32.1	52.2	600
EPB4010-6	40	10	41.75	34.4	3×1	15.4	69.3	750
EPB4010-8	40	10	41.75	34.4	4×1	47.6	92.4	1000
EPB5010-8	50	10	51.75	44.4	4×1	54.3	120.5	1230

[1] The rigidity values in this table indicate spring constants obtained from the load and elastic displacement under a preload of 10% of the basic dynamic load rating C_a, and an axial load F_a that is three times that of the preload F_{a0}. As these values do not take into account the rigidity of the parts involved in the nut installation, take 80% of the values given in this table as a general guideline.
If the preload F_{a0} differs from 0.1 C_a, the rigidity K_N can be calculated using the following equation:

$$K_N = K \bullet \left(\frac{F_{a0}}{0.1\ C_a} \right)^{\frac{1}{3}} \bullet 0.8$$

If the ball screw is not preloaded, please consult for the rigidity value.



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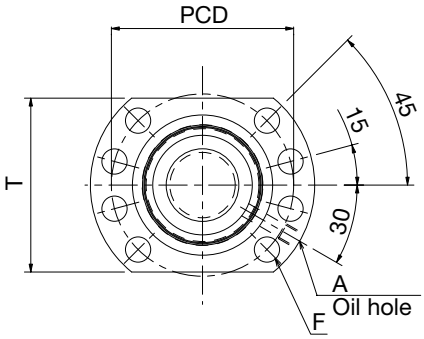
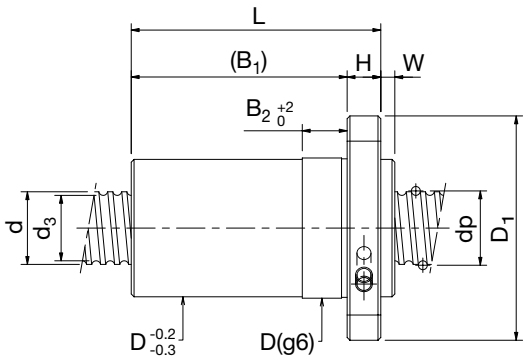


Drilling template 2



Unit: mm

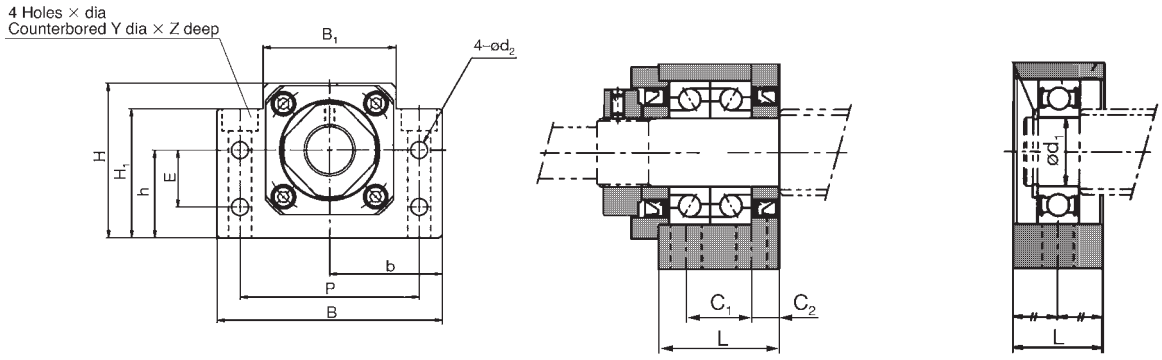
Nut dimensions											Oil hole	Screw shaft inertial moment per mm
Outer diameter D	Flange diameter D_1	Overall length L	H	B_1	B_2	W	T	PCD	F	Drilling template	A	[kg · cm²/mm]
28	48	60	10	50	10	5	40	38	5.5	1	M6×1	5.05×10^{-4}
36	58	61	10	51	10	5	44	47	6.6	1	M6×1	1.23×10^{-3}
40	62	61	10	51	10	5	48	51	6.6	1	M6×1	3.01×10^{-3}
40	62	80	10	70	16	5	48	51	6.6	1	M6×1	3.01×10^{-3}
50	80	62	12	50	10	5	62	65	9	1	M6×1	8.08×10^{-3}
50	80	73	12	61	10	5	62	65	9	1	M6×1	8.08×10^{-3}
50	80	107	12	95	10	5	62	65	9	1	M6×1	8.08×10^{-3}
63	93	109	14	95	16	5	70	78	9	2	M8×1	1.97×10^{-2}
63	93	133	14	119	16	5	70	78	9	2	M8×1	1.97×10^{-2}
75	110	135	16	119	16	5	85	93	11	2	M8×1	4.82×10^{-2}

Model Number Coding

EPB 32 05 – 6 RR G0 + 1200L Cp5R
(1) (2) (3) (4) (5) (6) (7) (8)

(1) Nut
(2) Screw shaft outer diameter (mm)
(3) Lead (mm)
(4) Number of circuits (rows × turns)
(5) Seals (RR: labyrinth seals attached to both sides)
(6) Symbol for preload
G0 = preload
(7) Screw shaft total length (mm)
(8) Accuracy

Ball Screw Support Units Type BK/BF (Base Mounting Type)



Fixed BK

Supported BF

Unit: mm

Shaft diameter	Body sizes				Datum ±0.02 ±0.02		Fixing holes						Fixed bearing unit (BK)							Supported bearing unit (BF)				
															Axial direction							Radial direction		
d	B	H	B_1	H_1	b	h	E	P	d_2	X	Y	Z		L	Dyn. load rat. C_a[kN]	Permissible Load [kN]	Rigidity [N/μm]	C_1	C_2		d_1	Dyn. load rating C[kN]	Basic load rating C_0[kN]	L
16	60	43	35	32,5	30	25	18	46	5.5	6.6	11	1.5	**BK12**	25	6.66	3.25	88	13	6	**BF12**	10	4.55	1.96	20
20	70	48	40	38	35	28	18	54	5.5	6.6	11	6.5	**BK15**	27	7.6	4	100	15	6	**BF15**	15	5.6	2.84	20
25	86	64	50	55	43	39	28	68	6.6	9	14	8.5	**BK17**	35	13.7	5.85	125	19	8	**BF17**	17	9.6	4.6	23
32	88	60	52	50	44	34	22	70	6.6	9	14	8.5	**BK20**	35	12.7	7.55	140	19	8	**BF20**	20	9.4	5.05	26
40	128	89	76	78	64	51	33	102	11	14	20	13	**BK30**	45	28	16.3	195	23	11	**BF30**	30	19.5	11.3	32
50	160	110	100	90	80	60	37	130	14	18	26	17.5	**BK40**	61	44.1	27.1	270	33	14	**BF40**	40	29.1	17.8	37

Note: For BK units specify J1, J2 or J3 machining. For BF units specify K machining.

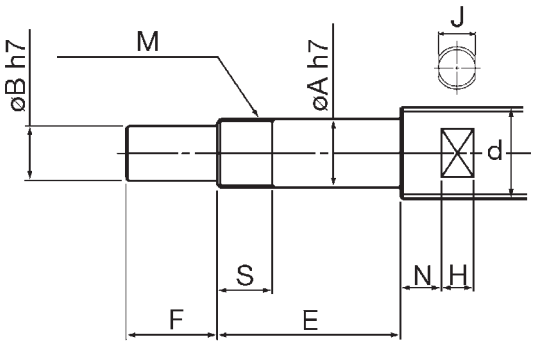
Example: **EBB3205 - 4RRGT + 1200LCp5R - J2K**[1)]

End machining for supported BF 20

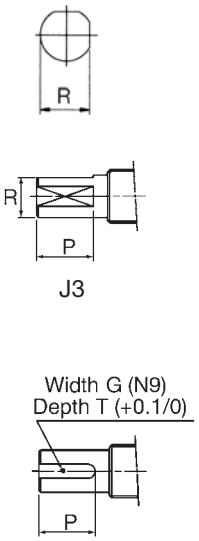
End machining for fixed BK 20

[1)] End machining for precision ball screw:
Type J2: Fixed bearing unit for BK20
Type K : Supported bearing unit for BF20

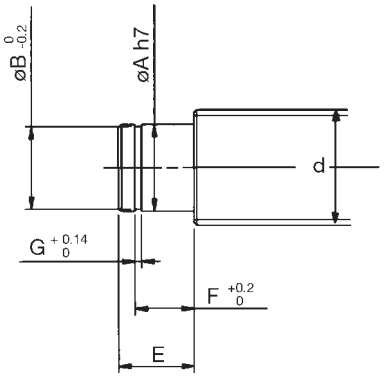
End Machining for BK/BF



Type J1



J2



Type K

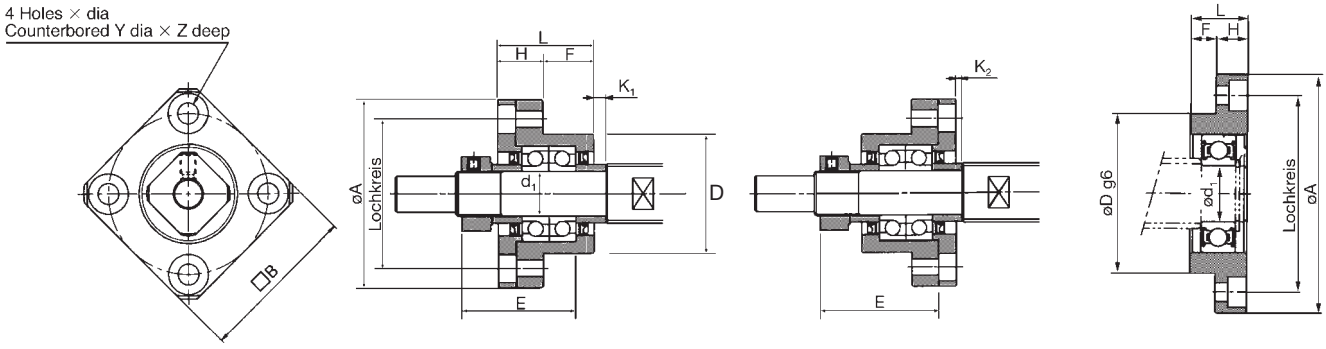
Unit: mm

Shaft diameter	Fixed	Type J						Type J1			Type J2			Type J3	
d	BK	A	B	E	F[1)]	M	S	J	N	H	G	T	P	R	P
16	BK12	12	10	39	15	M12 × 1	14	13	6	8	3	1.8	12	9.5	12
20	BK15	15	12	40	20	M15 × 1	12	16	6	9	4	2.5	16	11.3	16
25	BK17	17	15	53	23	M17 × 1	17	18	7	10	5	3.0	21	14.3	21
32	BK20	20	17	53	25	M20 × 1	15	27	9	13	5	3.0	21	16	21
40	BK30	30	25	72	38	M30 × 1.5	25	32	10	15	8	4.0	32	23.5	32
50	BK40	40	35	98	50	M40 × 1.5	35	41	14	19	10	5.0	45	33	45

Supported	Type K				
BF	A	E	B	F	G
BF12	10	11	9.6	9.15	1.15
BF15	15	13	14.3	10.15	1.15
BF17	17	16	16.2	13.15	1.15
BF20	20	16	19.0	13.35	1.35
BF30	30	21	28.6	17.75	1.75
BF40	40	23	38.0	19.95	1.95

[1)] Drive end length F may be customer specified to suit drive coupling. If not specified the length in the table will be used.

Ball Screw Support Units Type FK/FF (Flange Mounting Type)



Fixed FK

Supported FF

Unit: mm

Shaft diameter	Body sizes & Fixing holes							Fixed bearing unit (FK)											Supported bearing unit (FF)						
																Axial direction							Radial direction	
d	Dg6	A	PCD	B	X	Y	Z		d_1	L	H	F	E	K_1	K_2	Dyn. load rat. C_a[kN]	Permissible Load [kN]	Rigidity [N/μm]		d_1	L	H	F	Dyn. load rat. C[kN]	Basic load rating C_0[kN]
16	36	54	44	44	4.5	8	4	**FK12**	12	27	10	17	29.5	0.5	-0.5	6.66	3.25	88	**FF12**	10	15	7	8	4.55	1.96
20/25	40	63	50	52	5.5	9.5	6	**FK15**	15	32	15	17	36	4.0	2.0	7.6	4	100	**FF15**	15	17	9	8	5.6	2.84
32	57	85	70	68	6.6	11	10	**FK20**	20	52	22	30	50	1.0	-3.0	17.9	9.5	170	**FF20**	20	20	11	9	12.8	6.65
40	75	117	95	93	11	17.5	15	**FK30**	30	62	30	32	61	3.0	-9.0	28	16.3	195	**FF30**	30	27	18	9	19.5	11.3

Note: For FK units specify H1, H2 or H3 machining. For FF units specify K machining.

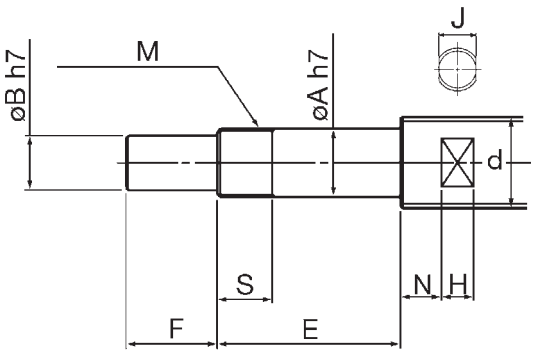
Example: **EBB3205 - 4RRGT + 1200LCp5R - H2K**[1)]

End machining for supported FF 20

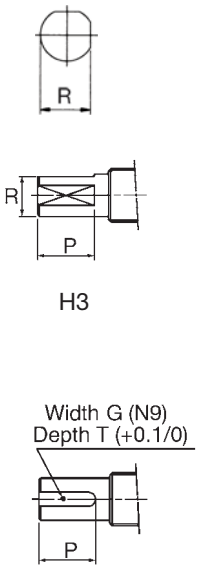
End machining for fixed FK 20

[1)] End machining for precision ball screw:
Type H2: Fixed bearing unit for FK20
Type K : Supported bearing unit for FF20

End Machining for FK/FF

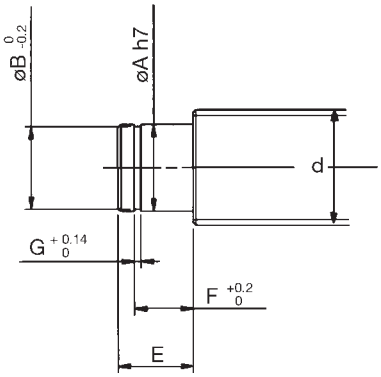


Type H1



H3

H2



Type K

Unit: mm

Shaft diameter	Fixed	Type H						Type H1			Type H2			Type H3	
d	FK	A	B	E	F[1)]	M	S	J	N	H	G	T	P	R	P
16	FK12	12	10	36	15	M12 × 1	11	13	6	8	3	1.8	12	9.5	12
20	FK15	15	12	49	20	M15 × 1	13	16	6	9	4	2.5	16	11.3	16
25	FK15	15	12	49	20	M15 × 1	13	18	7	10	4	2.5	16	11.3	16
32	FK20	20	17	64	25	M20 × 1	17	27	9	13	5	3.0	21	16	21
40	FK30	30	25	72	38	M30 × 1.5	25	32	10	15	8	4.0	32	23.5	32

Supported	Type K				
FF	A	E	B	F	G
FF12	10	11	9.6	9.15	1.15
FF15	15	13	14.3	10.15	1.15
FF15	15	13	14.3	10.15	1.15
FF20	20	19	19.0	15.35	1.35
FF30	30	21	28.6	17.75	1.75

[1)] Drive end length F may be customer specified to suit drive coupling. If not specified the length in the table will be used.

DIN Standard Compliant Ball Screws EBB & EPB

Precautions During Use

- **Handling**

  Since the ball screw is a precision component, dropping or subjecting it to strong impacts can result in damage or changes in function. In addition, since the balls will come out if the ball screw nut is disengaged from the screw shaft (ball screw section), please handle with care.

- **Assembly**

  If components are forcibly driven onto the screw shaft or nut, indentations may be formed in the rolling surface. Adequate caution is therefore required so as not to allow excessive force to be applied to the screw shaft and ball screw nut during part assembly.

  If the screw shaft support and nut section are off-center or shifted out of position, the service life of the product may be shortened considerably. Adequate caution is therefore required with respect to assembled part accuracy and assembly accuracy.

- **Coolant**

  When this product is used in an environment in which there is the risk of coolant or other similar substance entering the nut section, please consult with THK since product function may be impaired depending on the type of coolant.

- **Operating Temperature Range**

  Since the ball screw uses a special resin, avoid using at temperatures above 80°C.

- **Lubrication**

  Although the ball screw can be used as is since it contains grease (with the exception of special cases), please replenish the grease prior to shipment following trial operation at your firm.

  In the case of using in special environments, such as using in locations constantly subjected to the effects of vibrations, or using in a clean room, vacuum or under extremely low or high temperatures, ordinary grease may not be able to be used. In such cases, please inquire to THK.

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06/2008 Printed in Belgium

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