

B BLOCK Ball Screw

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B-1 Selection Guide to NSK Ball Screw

B-1-1 Features of NSK Ball Screws

(1) Quick delivery

Standard ball screws are for short lead time.

- Precision ball screws with finished shaft end
Compact FA Series, MA Type, FA Type, SA Type, KA Type
- Precision ball screws with blank shaft end
MS Type, FS Type, SS Type, HSS Type
- Ball screws for transfer equipment with finished shaft end
VFA Type, RMA Type
- Ball screws for transfer equipment with blank shaft end
RMS Type, R Series

(2) Competitive prices

NSK reduces cost by well-planned mass production of standardized items. We rank the best in the world production of ordered items. We are able to offer our products at competitive prices by producing similar items in the same production group.

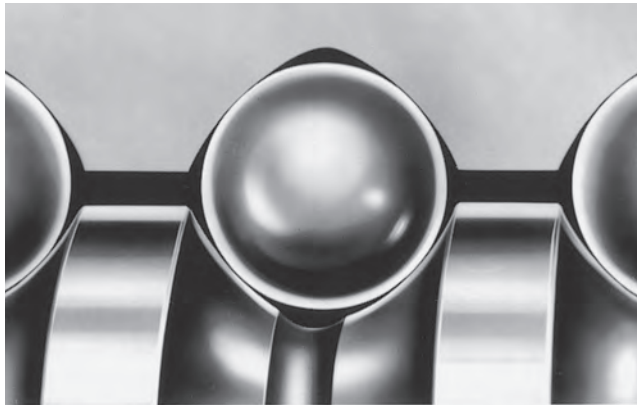


Fig. 1.1 Ball groove profile of NSK ball screw

(3) Unparalleled accuracy

NSK utilizes its unique grinding technique and measuring equipment for topnotch precision.

(4) Superb durability

NSK uses thoroughly purified alloy steel for superb durability.

(5) No backlash, and unparalleled rigidity

NSK ball screws use Gothic arch grooves as shown in Fig. 1.1 to minimize the clearance between the balls and grooves. Further, an application of preload makes no backlash possible. As providing controlled preload is easy, appropriate rigidity is obtained.

As the Gothic arch also minimizes the clearance between the balls and the grooves, the backlash is minimized without applying preload.

(6) Smooth movement assures high efficiency

When the circular-arc groove is used for the ball screws, balls are wedging into the grooves of ball nut and ball screw shaft. But this phenomenon does not happen in the Gothic arch groove. The Gothic arch groove, along with the low friction that is inherent nature of ball screw, is accountable for a smooth and highly efficient conversion of motion as shown in Fig. 1.2.

(7) Optimal units available

Utilizing bearing technology, NSK produces high quality support units (for light load type to be used for small equipment and heavy load type to be used for machine tools) which are exclusive for ball screws. These units are standardized.

NSK also offers quality-assured accessories such as lock nuts to tighten bearings, travel stoppers to prevent overrun, and sealing units to cool hollow shaft ball screws.

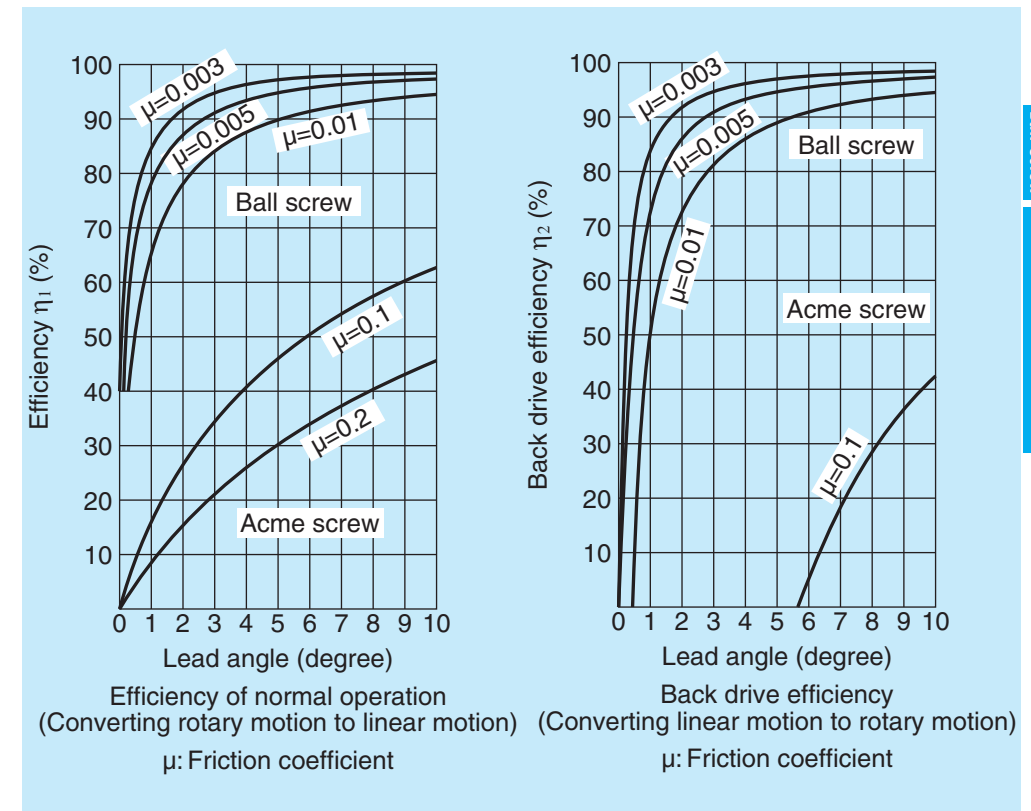


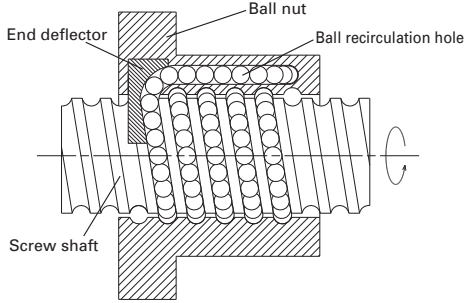
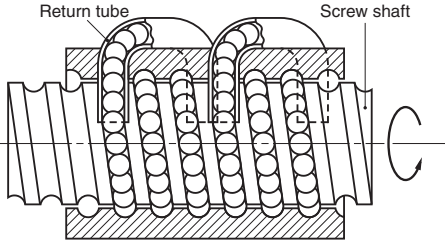
Fig. 1.2 Mechanical efficiency of ball screws

B-1-2 Structure of a Ball Screw

Balls are placed between the screw shaft and nut, and roll. This system is called a "ball screw." To keep the balls recirculating continually, this system requires a screw shaft, a nut, balls, and recirculation components as basic items. A ball screw has the following functions.

- (1) Converting motion: Changing rotary motion to linear motion (normal operation); Changing linear motion to rotary motion efficiently (back-drive operation).
- (2) Increasing power: A small torque is converted to a large thrust force.
- (3) Positioning: Sets accurate position in linear motion.

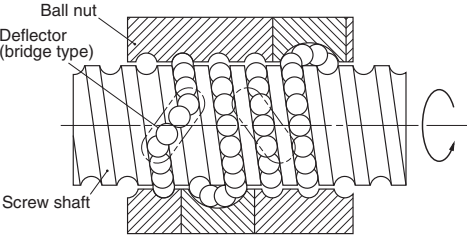
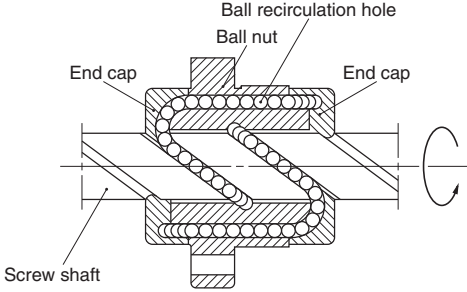
Table 2.1 Ball screw recirculation system

End deflector type	Ball return tube type
 [Structure] Balls are smoothly picked up in the tangential direction at the end of nut, and recirculated via a hole in the nut. If the balls are picked up at the middle of the nut, it is called middle deflector type. [Features] · Small nut outside diameter allows compact nut design. · Low noise, high speed.	 [Structure] Balls are recirculating through a pipe (ball return tube) of optimized size, bridging the start and end of recirculation. [Features] · Adapt to various specifications. (screw shaft diameter, lead)

B-1-2.1 Ball Recirculation System

A ball recirculation system is categorically most important, as well as the preload system, to classify the structure of ball screw.

As shown in **Table 2.1**, four types of ball recirculation system are used for the NSK ball screws.

Deflector (bridge) type	End cap type
 [Structure] Balls are recirculated by a horseshoe shaped deflector bridging the adjacent ball thread grooves. [Features] · Suitable for fine lead ball screws. · Small nut outside diameter, allows compact nut design.	 [Structure] Balls are picked up by an end cap placed at both ends of the nut, and recirculated via a hole through the nut. [Features] · Suitable for large lead ball screws. · Not universal due to complex recirculation structure.

B-1-2.2 Preload system

There are four systems to apply preload to NSK ball screws depending on the application.

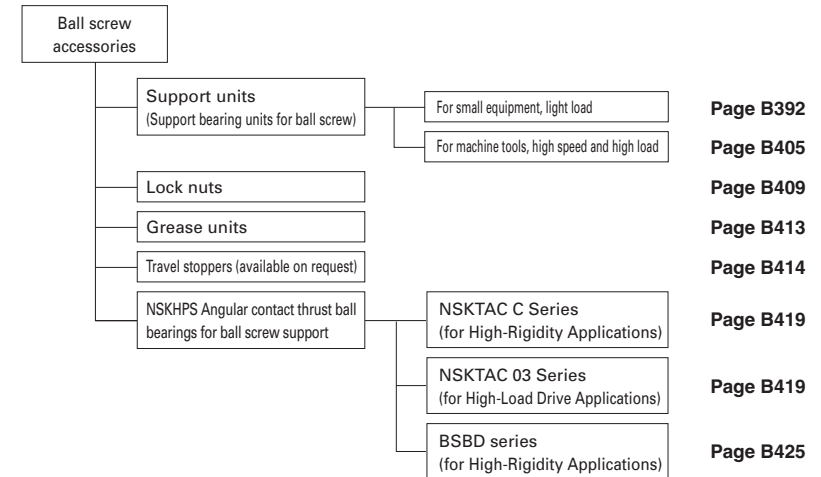
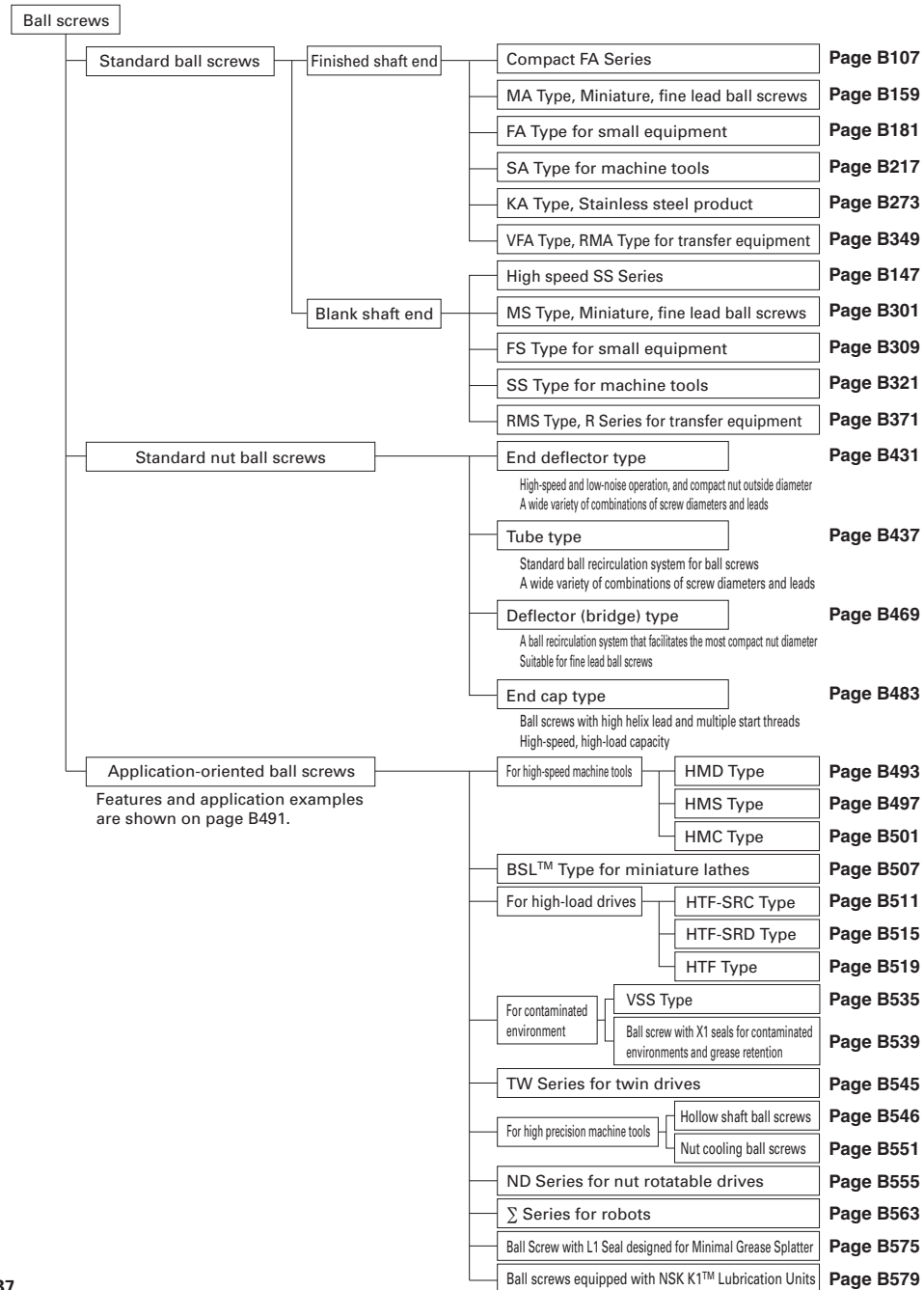
Table 2.2 Preload system for ball screws

Preload system	Double nut preload (D-Preload)	Offset preload (Z-Preload)
Structure		
Description	Uses two nuts, and inserts a spacer between them to apply the preload. In general, a spacer is thicker (by the deformation equivalent to the preload) than the actual space between two nuts. However, a thin spacer is inserted in some cases.	To apply preload, the lead near the center of the nut is offset by the volume equivalent to preload (α). This method is like to creating a preload system similar to the double nut preload (D-preload) by a single ball nut, thus enabling a compact nut design.
Nut length	Long	Medium
Torque characteristics	○	○
Rigidity	◎	◎

Preload system	Oversize ball preload (P-Preload)	Spring preloaded double nut (J-Preload)
Structure		
Description	Balls slightly larger than the ball groove space (over-size balls) are inserted to allow them to contact at four points. Provides better torque characteristics in the low torque range.	A spring is used as a spacer of D-Preload. Must be used with discretion in its varied rigidity by load direction.
Nut length	Short	Long
Torque characteristics	○	◎
Rigidity	○	△

B-1-3 Ball Screw Series

B-1-3.1 Ball Screw Classification



Lead classification

Classification	Lead ratio $K = \text{lead } l / \text{shaft diameter } d$
Fine	$K < 0.5$
Medium	$0.5 \leq K < 1$
High helix	$1 \leq K < 2$
Ultra high helix	$2 \leq K$

B-1-3.2 Product Externals

(1) Ball screws

● **Standard ball screws**

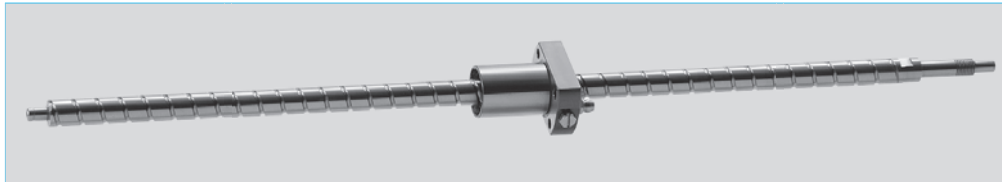


Fig. 3.1 Finished shaft end compact FA Series Page B107

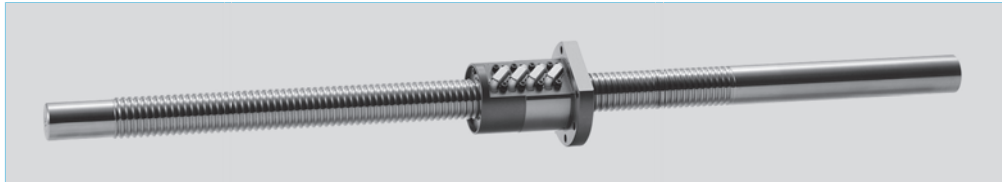


Fig. 3.2 Blank shaft end high-speed SS Series Page B147

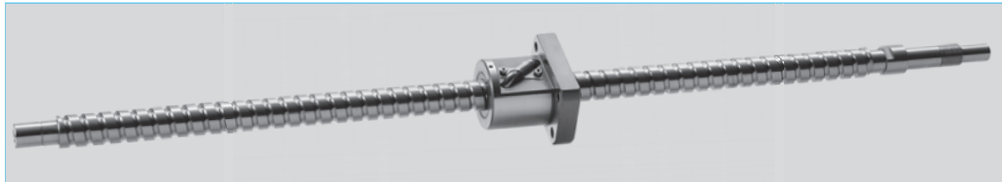


Fig. 3.3 Finished shaft end MA type, FA type and SA type Page B157

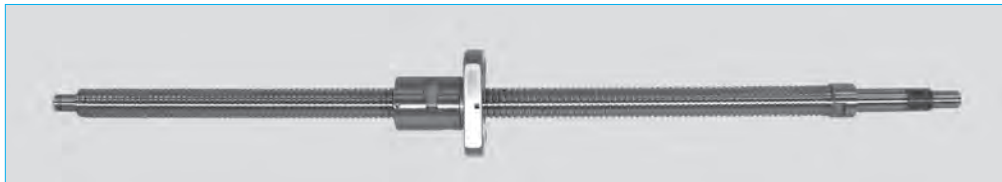


Fig. 3.4 Finished shaft end KA type Page B273

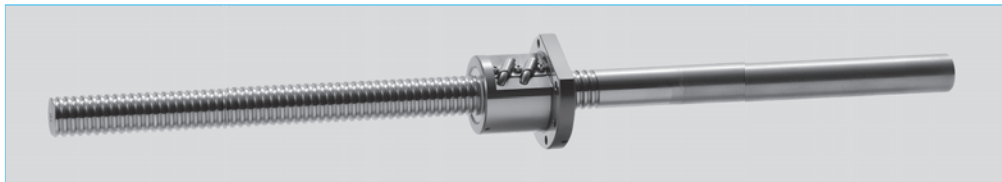


Fig. 3.5 Blank shaft end MS type, FS type and SS type Page B299

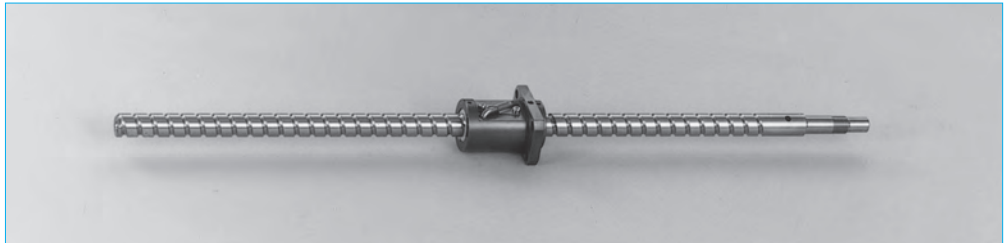


Fig. 3.6 Finished shaft end VFA type for transfer equipment Page B349

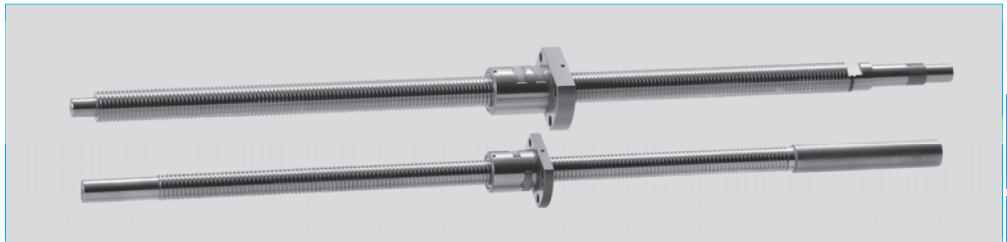


Fig. 3.7 Finished shaft end RMA type and blank shaft end RMS type for transfer equipment Page B349



Fig. 3.8 Blank shaft end R series for transfer equipment Page B349

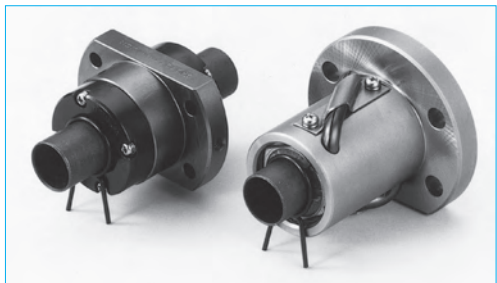


Fig. 3.9 R series nut assembly for transfer equipment Page B349

●Standard nut ball screws



Fig. 3.10 End deflector type Page B431

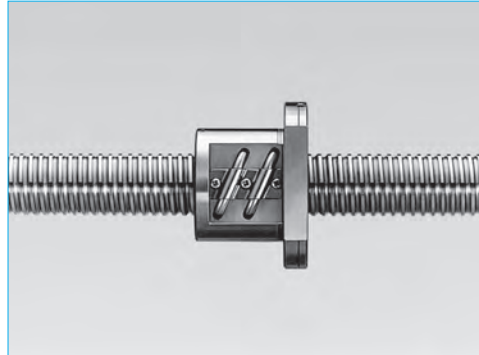


Fig. 3.11 Tube type Page B437

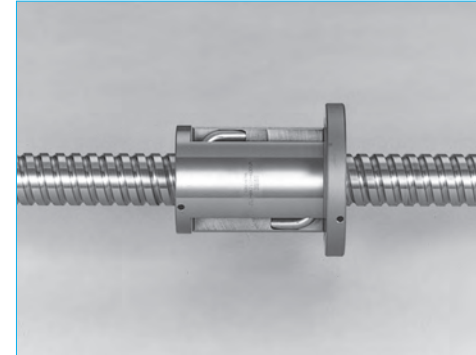


Fig. 3.16 HMC type for high-speed machine tools Page B501



Fig. 3.17 BSL™ type for miniature lathes Page B507

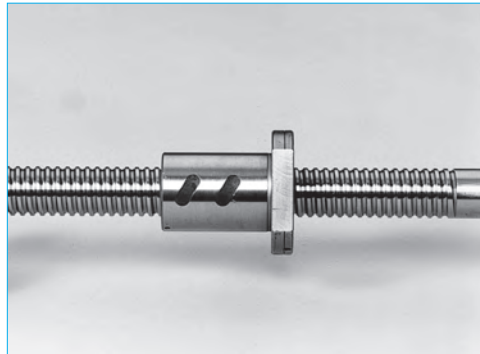


Fig. 3.12 Deflector (bridge) type Page B469

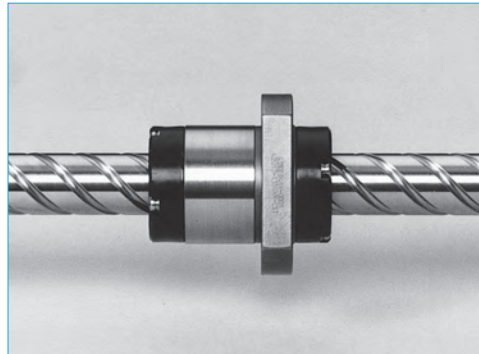


Fig. 3.13 End cap type Page B483

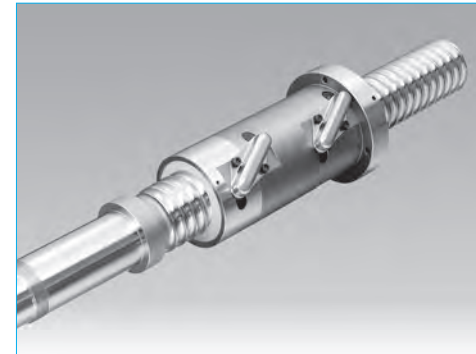


Fig. 3.18 HTF-SRC type for high-load drives Page B511

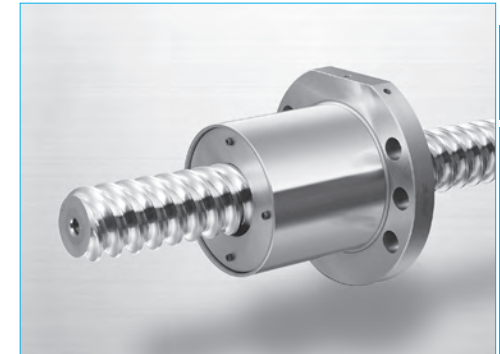


Fig. 3.19 HTF-SRD type for high-load drives Page B515

●Application-oriented ball screws



Fig. 3.14 HMD type for high-speed machine tools Page B493



Fig. 3.15 HMS type for high-speed machine tools Page B497

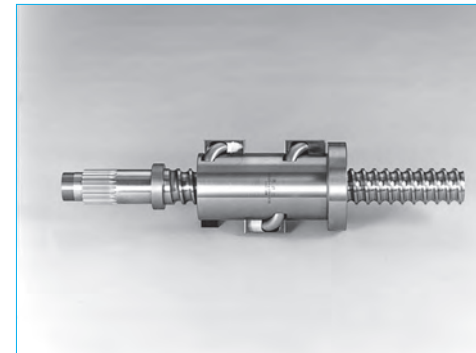


Fig. 3.20 HTF type for high-load drives Page B519

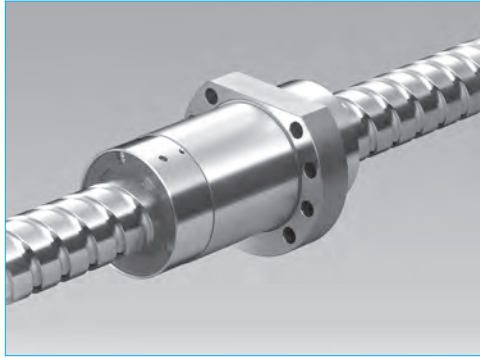


Fig. 3.21 VSS type for contaminated environments Page B535



Fig. 3.22 Ball screw with X1 seals for contaminated environments and grease retention Page B539

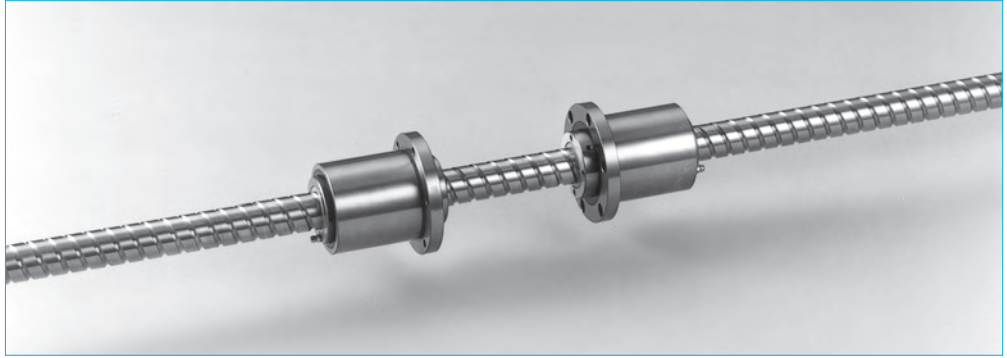


Fig. 3.26 ND series for nut-rotatable drives Page B555

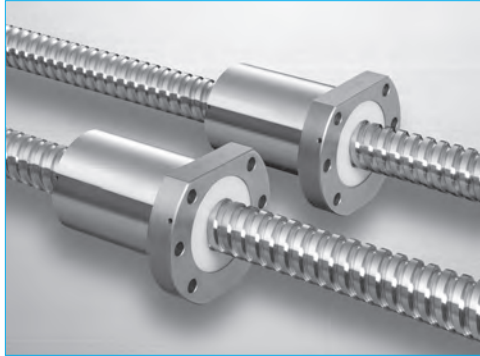


Fig. 3.23 TW series for twin-drive systems Page B545

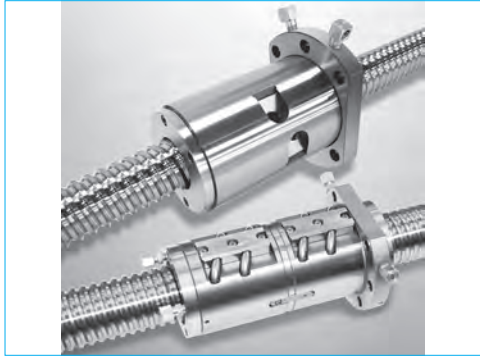


Fig. 3.24 Nut cooling ball screws for high precision machine tools Page B551

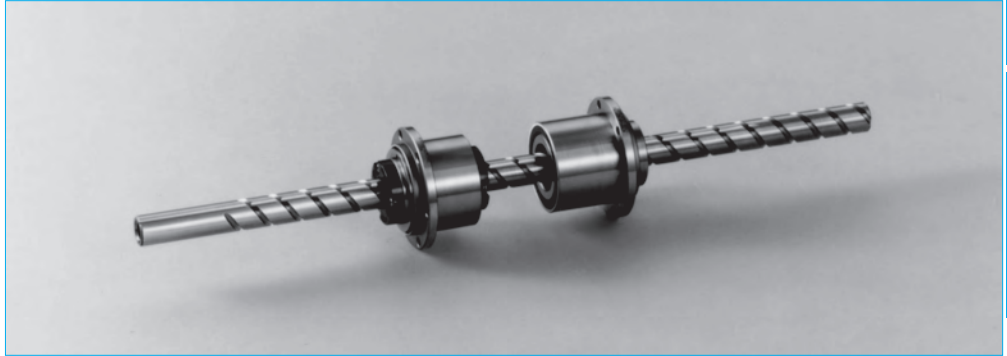


Fig. 3.27 Σ series for robots Page B563

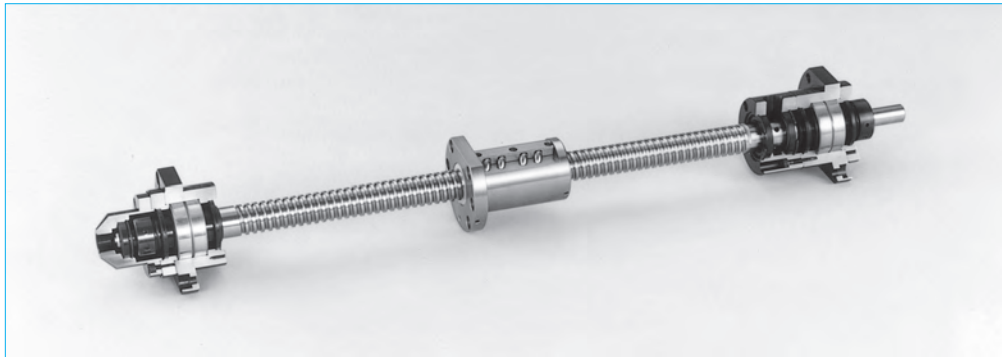


Fig. 3.25 Hollow shaft ball screws for high-precision machine tools Page B546



Fig. 3.28 Ball Screw with L1 Seal designed for Minimal Grease Splatter Page B575

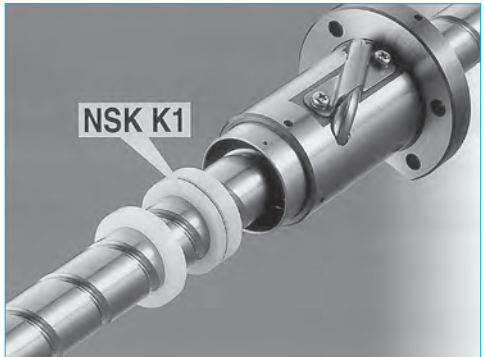


Fig. 3.29 Ball screws equipped with NSK K1™ lubrication units Page B579

(2) Standard accessories



Fig. 3.29 Support units Page B392
(for small equipment, light load)



Fig. 3.30 Support units Page B392
(for small equipment, light load, low-profile)



Fig. 3.35 Lock nuts for high load Page B410



Fig. 3.36 NSK hand grease pump unit Page D19



Fig. 3.31 Support kits for RMA and RMS types Page B401

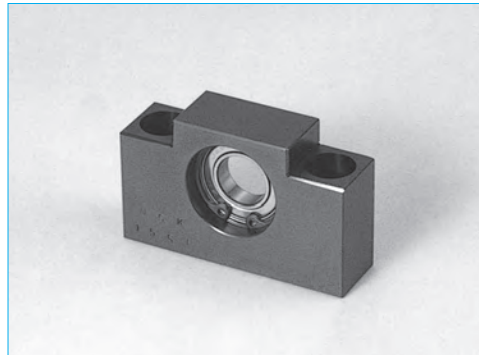


Fig. 3.32 Support unit for VFA type Page B402
(simple support side)



Fig. 3.37 NSK grease Page B413, D19

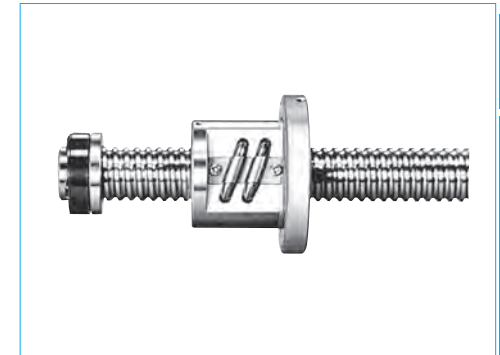


Fig. 3.38 Travel stoppers (by order) Page B414



Fig. 3.33 Support units Page B407
(for machine tools, high speed, heavy load)



Fig. 3.34 Lock nuts for light load Page B409



Fig. 3.39 Ball screw support bearings Page B419
NSKTAC C Series, NSK TAC 03 Series



Fig. 3.40 Ball screw support bearings Page B425
BSBD series

B-1-4 Procedures to Select Ball Screw

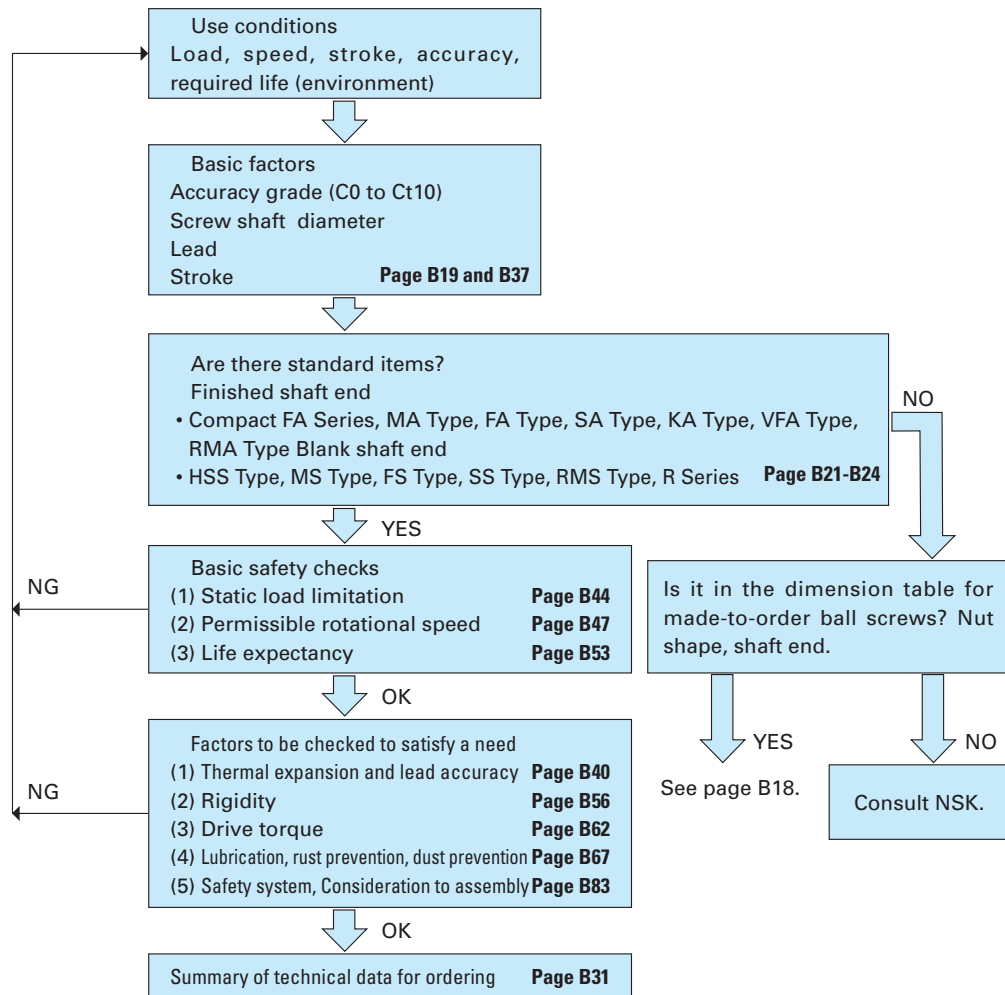
B-1-4.1 Flow Chart for Selection

When selecting a ball screw, you have to review a variety of use conditions and requirements such as applied loads, speeds, motion strokes, positioning accuracy, required life and operating environment. You require a multiple inspection because some of these conditions force a ball screw to have conflicting characteristics.

(1) Standard ball screw

The chart below is one of the selection procedures. To take advantage of prompt delivery and reasonable prices, this procedure focuses on the standardized ball screws.

NSK offers a ball screw selection program, and also has a service to select appropriate items using data file compiled by our knowledge and experience.

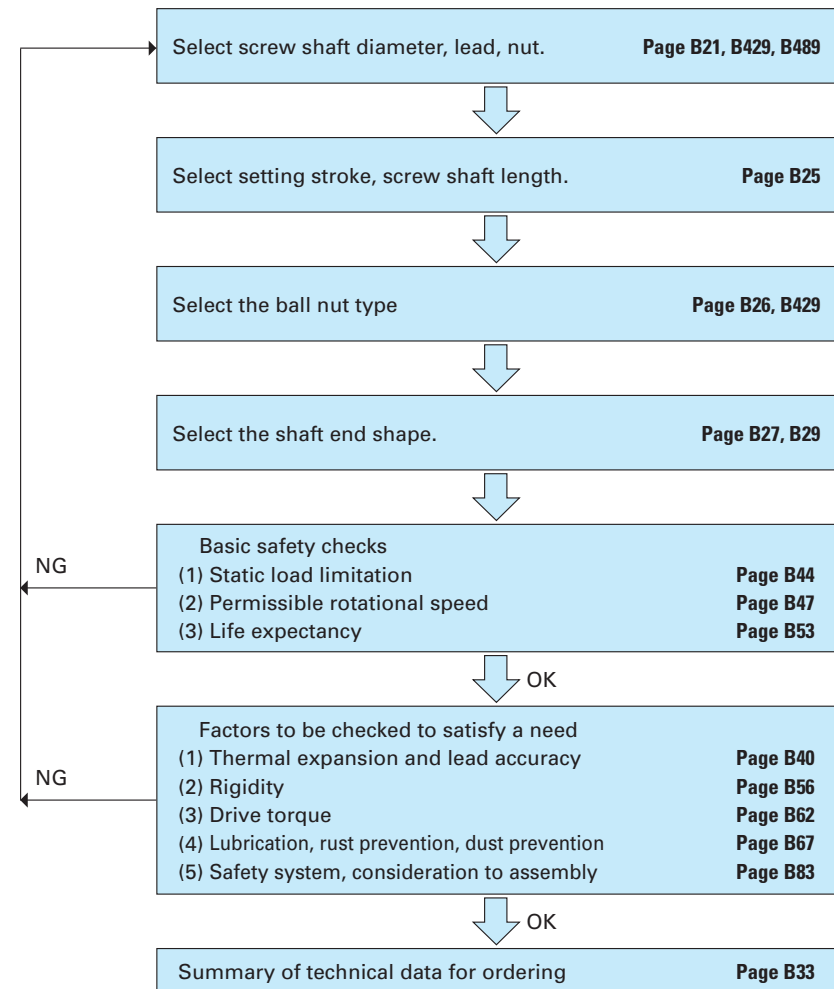


(2) Made-to-order ball screws

Dimensions and specifications can be decided individually for the application-oriented ball screws and standard nut ball screws. Procedures are as follows. Refer to the selection exercises on page B87.

Table 4.4 is "Combinations of screw shaft diameter and leads for basic type ball screw." Please consult

NSK if you require the types that are not listed in the table.



B-1-4.2 Accuracy Grades

Table 4.1 shows examples of how to select accuracy grade for a specific use. These practical cases are based on NSK's experience. The circles indicate the range of the accuracy grade in actual use. The double circles indicate accuracy grades most frequently used among the cases marked with the single circle. These

symbols help to select the accuracy grade of ball screws temporarily. To confirm whether a specific ball screw accuracy grade satisfies requirements in positioning accuracy in actual use, refer to "Technical Description" and "Mean travel deviation and travel variation." (page B38)

Table 4.1 Accuracy grades of ball screw and their application

Application	NC machine tools																			
	Lathes		Milling machines Boring machines		Machining centers		Drilling machines		Jig boring machines		Grinders		Electric discharge machines		Wire cuttings Electric discharge machines		Punch presses		Laser cutting machines	
Axis	X	Z	XY	Z	XY	Z	XY	Z	XY	Z	XY	Z	XY	Z	XY	Z	XY	XY	Z	
Accuracy grade	C0	○							○	○	○									
	C1	○	○		○				⊙	⊙	○	○	○		○	○				
	C2	○	○	○	○	○					⊙	○	○	○	⊙	○				
	C3	⊙	○	⊙	○	○	○				⊙	⊙	⊙	⊙	⊙	○	○	○	○	
	C5	⊙	⊙	⊙	⊙	⊙	⊙	⊙					⊙		⊙		⊙	⊙	⊙	⊙
	Ct7							○												⊙
	Ct10																			○

Application	Semiconductor/associated industry						Industrial robots						Steel mills equipment		Plastic injection molding machines		Three-dimensional coordinate measuring machines		Office machines		Image processing equipment		Nuclear power	
	General industrial machines, Machines for specific use		Lithographic machines	Chemical processing equipment	Wire bonders	Probers	Electric component mounted devices		Printed circuit board drilling machines		Cartesian type		Articulate type		SCARA type								Fuel rod controls	Aircrafts
Accuracy grade	C0		○			○											○		○					
	C1		⊙		⊙	⊙		○									⊙		⊙					
	C2				○	⊙	○	○									○							
	C3	○		○			○	⊙	○		○		○		○								○	○
	C5	⊙		○			⊙	○	⊙	○	⊙	○	○	○	○				○			⊙		⊙
	Ct7	⊙		⊙					○	⊙	○	○	⊙	○	⊙				⊙			○	⊙	
	Ct10	○		○						○					⊙	○			○				○	

B-1-4.3 Axial Play

Table 4.2 indicates the combinations of NSK ball screw accuracy grades and axial play. Select an axial play which satisfies the required accuracy in backlash, positioning and repeatability. Ranges of available ball thread effective length in relation to accuracy grade and axial play are shown in **Table 4.3**. Please note that if the effective length exceeds the

range, the axial play may become partially negative (preloaded condition).

For the axial play of Ct10 grade (ball screws for transfer equipment), refer to the R series dimension tables.

Table 4.2 Combinations of accuracy grades and axial play

Axial play Accuracy grade	Z	T	S	N	L
	0 mm (Preload)	0.005 mm or less	0.020 mm or less	0.050 mm or less	0.3 mm or less
C0	C0Z	C0T	—	—	—
C1	C1Z	C1T	—	—	—
C2	C2Z	C2T	—	—	—
C3	C3Z	C3T	C3S	—	—
C5	C5Z	C5T	C5S	C5N	—
Ct7	—	—	C7S	C7N	—

The combination codes shown in the table are NSK reference number.

Table 4.3 Maximum effective thread length in combination of accuracy grade and axial play

Unit: mm

Screw shaft diameter	Effective length of the screw thread (maximum)				
	Axial play T (0.005 mm or under)		Axial play S (0.020 mm or under)		
	C0 – C3	C5	C3	C5	Ct7
4 – 6	100	80	100	80	—
8 – 10	250	200	300	250	—
12 – 16	500	400	700	600	500
20 – 25	800	700	1 000	1 000	1 000
28 – 40	1 000	800	2 000	1 500	1 500
45 – 63	1 200	1 000	2 500	2 000	2 000
80 – 125	—	—	4 000	3 000	3 000

Note: Refer to **Table 4.8** (page B25) for the available length of screw shaft (maximum length). Also, axial play of code N does not become partial negative play if it is within the available range of effective ball thread length.

(1) Standard ball screw

Choose a screw shaft diameter and stroke based on the allowable space for ball screw installation. A lead should be set based on the required running speed, and should give some allowance to the maximum rotational speed of the motor.

Tables 4.4 and 4.5 show the combinations of ball screw shaft diameter and leads, and range of stroke. From these tables, select the closest values to the shaft diameter, lead, and stroke which had been selected previously. Also, confirm detailed specifications and sizes in "Dimensional table of standard ball screw" (page B105).

Table 4.4 Screw shaft diameter, lead and stroke of standard ball screw

Shaft dia.	Lead	Stroke													
		- 50	- 100	- 150	- 200	- 250	- 300	- 350	- 400	- 450	- 500	- 550	- 600	- 650	
4	1	○	○△												
6	1	○		○△■	○△	■□									
	8		●												
	12														
8	1		○△	○	○△	■□									
	1.5		○△	○	○△	■□									
	2		○△	○	○△	■□									
	10		●												
	15		●												
10	2			○△	○	○△	■□								
	2.5		○	○△	○	○△									
	4		○	○△	○	○△									
	5		●	●	●	●				●					
	10		●	●	●	●				●					
12	2		○	○	○△■	○	○△■□								
	2.5			○	○△	○	○△								
	5		●	●	●	●	●								
	10		●	●	●	●	●								
	20			●	●	●	●								
14	5			○	○	○	○	△	○	○	○△	○	△	○	
	8														
	10			●	●	●	●	●	●	●	●	●	●	●	
15	5			●	●	●	●	●	●	●	●	●	●	●	
	10			●	●	●	●	●	●	●	●	●	●	●	
	20			●	●	●	●	●	●	●	●	●	●	●	
	30			●	●	●	●	●	●	●	●	●	●	●	
16	2		○	○	○	○△	○	○	△						
	2.5		○	○	○	○△	○	○	△						
	16			○	○	○	○	○	○	○	○△	○	○	○	
	32				○	○	○	○	○	○	○△	○	○	○	
	4				●	●	△			●	△			●	
20	5				●	●	●	●		●	●			●	
	10				●	●	●	●		●	●			●	
	20					●		●		●	●		●	●	
	30					●		●		●	●		●	●	
	40									●	●		●	●	
	60									●	●		●	●	
25	4				○	○	△	○		○	○	○	△		
	5				●	●	△	●		●	●	●	△	○	
	6							●							
	10						○	○△	●		○	○	△	△	
	20										●		●	●	
	25											●	●	●	
	30												●	●	
28	5				○	○	○	○△	○	○	○	○△			
	6						○	○△			○	○△			
	5				○	○	○	○△	○	○	○	○△	○	○	
	8						○	○△			○	○△			
	10				○	○	○	○△	○△		○	○△	○△		
32	25														
	32														
	10							△				△			
	32														
36	10						○		○		○	△	○△		
40	5						○				○	△			
	8					○								○	
	10						○			○		△	○△		
	12												○		
	16														
45	20														
	10														
	12														
50	10									○	○		○	○	
	12														

Note: See **Table 4.5** for KA Type in stainless steel product.

Table 4.5 Screw shaft diameter, lead and stroke of KA type in stainless steel product

Unit: mm

Shaft dia.	Lead	Stroke								
		- 150	- 200	- 250	- 300	- 350	- 450	- 500	- 650	- 1 050
6	1	●								
8	1		●							
	2		●							
10	2			●						
	4	●				●				
12	2	●			●					
	5			●				●		
	10				●			●		
15	10						●		●	●
	20						●		●	●
16	2	●				●				
20	20						●		●	●

●mark; PSS type, USS type, FSS type: ○mark; MA type, FA type, SA type: ▲mark; HSS type
△mark; MS type, FS type, SS type: ✓mark; VFA type: ■mark; RMA type: □mark; RMS type

Unit: mm

[illegible]

Table 4.6 Screw shaft diameter, lead and standard screw shaft length of R Series Unit: mm

Screw shaft diameter	Lead	Standard screw shaft length									
		400	500	800	1 000	1 500	2 000	2 500	3 000	4 000	5 000
10	3	●		●							
	6	●		●							
12	8	●		●							
	12	●		●							
14	4		●		●						
	5		●		●						
15	20		●		●	●					
16	10		●		●	●					
	16		●		●	●					
	32		●		●	●					
18	8		●		●	●					
20	5		●		●		●				
	10		●		●		●				
	20		●		●		●				
	40		●		●	●					
25	5				●		●	●			
	10				●		●	●			
	25				●		●	●			
	50				●		●	●			
28	6				●		●	●			
32	10				●		●		●		
	32				●		●		●		
	64				●		●		●	●	
36	10				●		●		●		
40	10						●		●	●	
	40						●		●	●	
	80						●		●	●	●
45	12						●		●	●	
50	10						●		●	●	
	16						●		●	●	
	50						●		●	●	

(2) Made-to-order ball screws

Table 4.7 shows the combinations of screw shaft diameter and leads for made-to-order ball screws. For details, refer to the dimension tables from pages B429 and B489.

Table 4.7 Combinations of screw shaft diameter and leads for typical ball screw Unit: mm

Lead	0.5	1	1.5	2	2.5	3	4	5	6	8	10	12	14	15	16	20	25	30	32	36	40	50	60	64	80	100
4	D	D																								
6	D	D		D						S		S														
8	D	D	D	D							S			S												
10		D		D	D		T	S			S															
12		D		D	D	D	T	S,T			S,T					S,C		S								
14				D		D		T		T																
15								S			S,T					S,C		S			C					
16				D	D		T	T	T						T,C				C		C					
20				D			T	S,T D,B	T,D B	T	S,T				T	S,T C		S			S,C		S,C			
25				D			T	S,T D,B	T,D B	T,B	S,T D,B				T	S,T	S,T C	S				S,C		C		
28								T	T		T															
32				D			T	S,T D	T,D	T,D	S,T D,B V,F	S,T B			S,V	S,T V,N	T,N		S,T C,V N					S,C		
36								S,T	T		S,T F	S,F			S,H	S,H										
40				D				T,D	T,D	T,D	S,T D,F	S,T F			S,T H	S,H	S,T H,N	S,H	T,H N	H	S,T C,V N				S	
45											S,T F	S,T F			S,H	S,H	S,H	S,H	H	H						
50								T,D	T,D	T,D	S,T D,F	S,T D,F	F		S,T F	S,T D,H	S,T H,N	S,H	T,H N	T,N F	S,T C,V N				S	
55											T,F	F	F		F	H	H	H	H							
63									D	D	T,D	D,F	F		F	T,D F	F		F		T,F	T				
80											T,D	T,D	F		T,F	T,D F	F					F				
100											D	T,D			T,F	T,D F	F									
120															F	F	F									
125															T	T										
140																F	F	F	F							
160																	F	F	F							
200																	F	F	F							

T: Tube type
D: Deflector(bridge) type
C: End cap type

S: End deflector type
H: HMC type, HMD type
F: HTF-SRC, HTF-SRD, HTF type

N: ND Series
B: BSL type
V: VSS type

B-1-4.5 Manufacturing Capability for Screw Shaft

Table 4.8 shows the manufacturing capability for the screw shaft overall length for each accuracy grade. The capability of large ball screw whose shaft diameter exceeds 100 mm is limited due to the

weight (indicated by * asterisk in the table). Please consult NSK in such a case.

Also consult NSK if the screw shaft size you desire exceeds the size listed in **Table 4.8**.

Table 4.8 Manufacturing capability of screw shaft

Unit: mm

Accuracy grade Screw shaft diameter	C0	C1	C2	C3	C5	Ct7	Ct10
4	90	110	120	140	140	140	—
6	150	180	200	250	250	250	—
8	240	280	340	340	340	340	—
10	350	400	500	500	500	550	800
12	450	500	650	700	750	800	800
14	600	650	750	800	1 000	1 000	1 000
15	600	700	800	900	1 250	1 250	1 500
16	600	750	900	1 000	1 500	1 500	1 500
18	—	—	—	—	—	—	1 500
20	850	1 000	1 200	1 400	1 900	1 900	2 000
25	1 100	1 400	1 600	1 900	2 500	2 500	2 500
28	1 100	1 400	1 600	1 900	2 500	2 500	2 500
32	1 500	1 750	2 250	2 500	3 200	3 200	3 000 (4 000)
36	1 500	1 750	2 250	2 500	3 200	3 500	3 000
40	2 000	2 400	3 000	3 400	3 800	4 300	4 000 (5 000)
45	2 000	2 400	3 000	3 400	4 000	4 500	4 000
50	2 000	3 200	4 000	4 500	5 000	5 750	4 000
55	2 000	4 000	5 000	5 800	6 000	6 000	—
63	2 000	4 000	5 000	6 000	6 800	7 700	—
80	—	4 000	6 300	8 200	9 200	10 000	—
100	—	4 000	6 300	10 000	12 500	13 500	—
*120	—	—	—	—	—	13 500	—
*125	—	—	—	10 000	13 500	13 500	—
*140	—	—	—	—	—	10 000	—
*160	—	—	—	—	—	8 000	—
*200	—	—	—	—	—	5 000	—

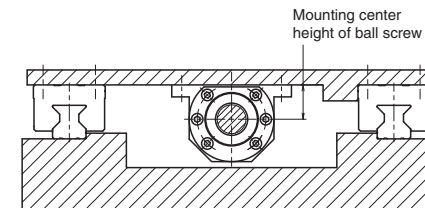
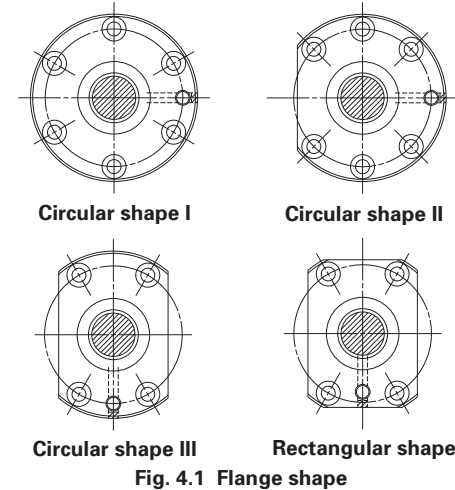
Notes: 1. Values in parentheses of Ct10 are applicable to the ultra high helix lead ($l/d \geq 2$). Refer to dimension tables on B385 and following pages for details.

2. Please note that the range for small leads (3 mm or under) are also limited by the screw length.

B-1-4.6 Outside Shapes of Ball Nut

(1) Flange shape

Fig. 4.1 shows the available flange shape. Select the appropriate shape according to the nut installation condition. (**Fig. 4.2**)



(2) Shapes of nut cross section

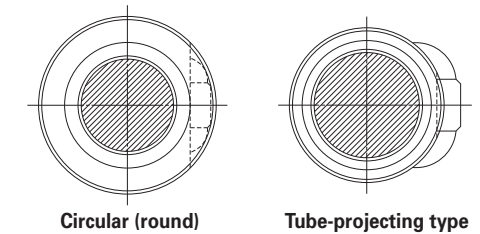
Cross-section of nuts are shown in **Fig. 4.3**. For detailed dimensions, refer to dimension table of nut.

① Circular (round)

The ball recirculation components are contained inside the circumference of the nut. It can be inserted in a round hole.

② Tube-projecting type

This shape is unique to the tube recirculation type. The nut outside diameter is small. However some recess must be given for housing because the ball recirculation tube protrudes from the circumference of the nut.



B-1-4.7 Shaft End Configuration

(1) Standard shaft end dimensions

Tables 4.9 and 4.10 show shaft end types for NSK standard support units.

Refer to the dimension tables below when designing shaft ends of standard ball screw.

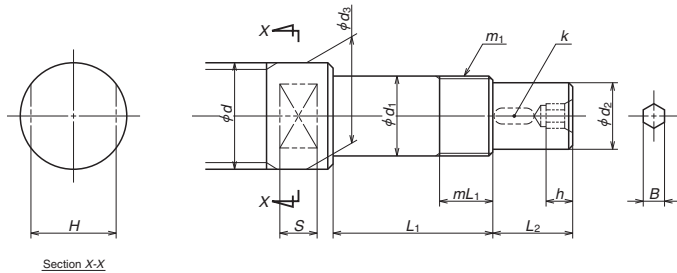


Fig. 4.4 Configuration of standard shaft end (drive side)

Table 4.9 Dimensions of shaft ends (drive side)

Unit: mm

Screw shaft diameter <i>d</i>	Bearing journal		Thread		Drive section			Seal section		Hexagon hole		Wrench flats		Support unit	
	Outside diameter	Length	Nominal spec.	Length	Outside diameter	Length	Key width	Outside diameter	Width across flats	Depth	Width across flats	Length	unit		
	<i>d</i> ₁	<i>L</i> ₁	<i>m</i> ₁	<i>mL</i> ₁	<i>d</i> ₂	<i>L</i> ₂	<i>k</i>	<i>d</i> ₃	<i>B</i>	<i>h</i>	<i>H</i>	<i>S</i>	Reference No.		
4	6	22.5	M6×0.75	7	4.5	7.5	—	9.5	—	—	8	4.5	WBK06-01A	WBK06-11	
6	6	22.5	M6×0.75	7	4.5	7.5	—	9.5	—	—	8	4.5	WBK06-01A	WBK06-11	
8	8	27	M8×1	9	6	10	—	11.5	—	—	10	5.5	WBK08-01A	WBK08-11	
10	8	27	M8×1	9	6	10	—	11.5	—	—	10	5.5	WBK08-01A	WBK08-11	
12	10	30	M10×1	10	8	15	—	14	—	—	12	6.5	WBK10-01A	WBK10-11	
14	12	30	M12×1	10	10	15	3	15	4	6	12	6.5	WBK12-01A	WBK12-11	
15	12	30	M12×1	10	10	15	3	15	4	6	12	6.5	WBK12-01A	WBK12-11	
16	12	30	M12×1	10	10	15	3	15	4	6	12	6.5	WBK12-01A	WBK12-11	
20	15	40	M15×1	15	12	20	4	19.5	5	7	17	8.5	WBK15-01A	WBK15-11	
	17	81	M17×1	23	12	29	4	20	5	7	22	10	WBK17DF-31H		
25	20	53	M20×1	16	15	27	5	25	6	8	22	10	WBK20-01	WBK20-11	
	20	81	M20×1	23	15	39	5	25	6	8	22	10	WBK20DF-31H		
28	20	53	M20×1	16	15	27	5	25	6	8	22	10	WBK20-01	WBK20-11	
	20	81	M20×1	23	15	39	5	28	6	8	24	12	WBK20DF-31H		
32	25	62	M25×1.5	20	20	33	6	32	8	10	27	12	WBK25-01W / WBK25-11		
	25	89	M25×1.5	26	20	51	6	32	8	10	27	12	WBK25DF-31H		
	25	104	M25×1.5	26	20	51	6	32	8	10	27	12	WBK25DFD-31H		
36	30	89	M30×1.5	26	25	61	8	36	10	12	30	13	WBK30DF-31H		
	30	104	M30×1.5	26	25	61	8	36	10	12	30	13	WBK30DFD-31H		
40	30	89	M30×1.5	26	25	61	8	40	10	12	—	—	WBK30DF-31H		
	30	104	M30×1.5	26	25	61	8	40	10	12	—	—	WBK30DFD-31H		
45	35	92	M35×1.5	30	30	63	8	45	12	14	—	—	WBK35DF-31H		
	35	107	M35×1.5	30	30	63	8	45	12	14	—	—	WBK35DFD-31H		
50	40	92	M40×1.5	30	35	78	10	50	14	18	—	—	WBK40DF-31H		
	40	107	M40×1.5	30	35	78	10	50	14	18	—	—	WBK40DFD-31H		

Note: Low-profile support unit is available for compact FA Series.

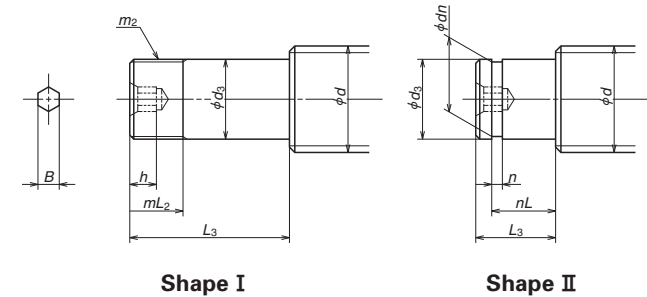


Fig. 4.5 Standard shaft end configuration (opposite to the drive side)

Table 4.10 Dimensions of shaft ends (opposite to the drive side)

Unit: mm

Screw shaft diameter d	Shape	Bearing journal		Thread for lock nut		Retainer ring groove		Hexagonal hole		Support unit	
		Outside diameter	Length	Nominal spec.	Length	Width	Groove diameter	Groove position	Width across flats	Depth	Reference No.
		d_1	L_1	m_2	mL_2	n	dn	nL	B	h	Numbers in parentheses are bearing reference number.
8	II	6	9	—	—	0.8	5.7	6.8	—	—	WBK08S-01
10	II	6	9	—	—	0.8	5.7	6.8	—	—	WBK08S-01
12	II	8	10	—	—	0.9	7.6	7.9	—	—	WBK10S-01
14	II	10	22(12)	—	—	1.15	9.6	9.15	4	6	WBK12S-01
15	II	10	22(12)	—	—	1.15	9.6	9.15	4	6	WBK12S-01
16	II	10	22(12)	—	—	1.15	9.6	9.15	4	6	WBK12S-01
20	II	15	25(13)	—	—	1.15	14.3	10.15	5	7	WBK15S-01
	II	20	19	—	—	1.35	19	15.35	6	8	WBK20S-01
25	I	20	53	M20x1	16	—	—	—	6	8	WBK20-01 WBK20-11
	I	20	81	M20x1	23	—	—	—	6	8	WBK20DF-31H
	II	20	19	—	—	1.35	19	15.35	6	8	WBK20S-01
28	I	20	53	M20x1	16	—	—	—	6	8	WBK20-01 WBK20-11
	I	20	81	M20x1	23	—	—	—	6	8	WBK20DF-31H
	II	25	20	—	—	1.35	23.9	16.35	8	10	WBK25S-01W
32	I	25	62	M25x1.5	20	—	—	—	8	10	WBK25-01W WBK25-11
	I	25	89	M25x1.5	26	—	—	—	8	10	WBK25DF-31H
36	II	25	20	—	—	1.35	23.9	16.35	10	12	(6205)
	I	25	89	M25x1.5	26	—	—	—	10	12	WBK25DF-31H
40	II	30	22	—	—	1.75	28.6	17.75	10	12	(6206)
	I	30	89	M30x1.5	26	—	—	—	10	12	WBK30DF-31H
45	II	35	25	—	—	1.75	33	18.75	12	14	(6207)
	I	35	92	M35x1.5	30	—	—	—	12	14	WBK35DF-31H
50	II	40	25	—	—	1.95	38	19.95	14	18	(6208)
	I	40	92	M40x1.5	30	—	—	—	14	18	WBK40DF-31H

(2) Shaft end configuration of R series ball screws for transfer equipment

Tables 4.11 and 4.12 show shaft end types for R Series.

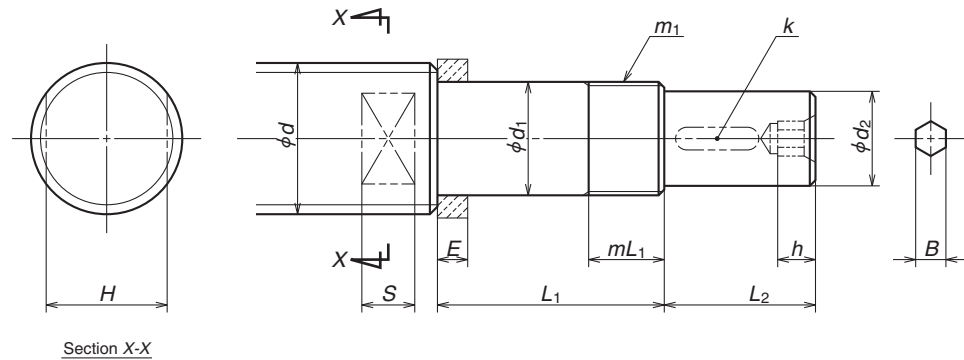


Fig. 4.6 R Series shaft end (drive side)

Table 4.11 Dimensions of R Series shaft ends (drive side)

Unit: mm

Screw shaft diameter d	Bearing journal		Thread for lock nut		Spacer	Drive section			Hexagonal hole		Wrench flat		Support unit	
	Outside diameter d_1	Length L_1	Nominal spec m_1	Length mL_1		Outside diameter d_2	Length L_2	Key width k	Width across flats B	Depth h	Width across flats H	Length S		
10	6	27	M6×0.75	7	5.0	4.5	7.5	—	—	—	8	4.5	WBK06-01A	WBK06-11
12	8	32	M8×1	9	5.5	6	10	—	—	—	10	5.5	WBK08-01A	WBK08-11
14	10	35	M10×1	10	5.5	8	15	—	—	—	12	6.5	WBK10-01A	WBK10-11
15	10	35	M10×1	10	5.5	8	15	—	—	—	12	6.5	WBK10-01A	WBK10-11
16	12	35	M12×1	10	5.6	10	15	3	4	6	12	6.5	WBK12-01A	WBK12-11
18	12	35	M12×1	10	5.6	10	15	3	4	6	12	6.5	WBK12-01A	WBK12-11
20	15	50	M15×1	15	10	12	20	4	5	7	17	8.5	WBK15-01A	WBK15-11
25	17	53	M17×1	17	7	15	27	5	6	8	22	10	WBK17-01A	—
	20	64	M20×1	16	11	15	27	5	6	8	22	10	WBK20-01	WBK20-11
28	20	64	M20×1	16	11	15	27	5	6	8	22	10	WBK20-01	WBK20-11
32	25	76	M25×1.5	20	14	20	33	6	8	10	27	12	WBK25-01W	WBK25-11
36	25	76	M25×1.5	20	14	20	33	6	8	10	27	12	WBK25-01W	WBK25-11
40	30	89	M30×1.5	26	—	25	61	8	10	12	—	—	WBK30DF-31H	—
45	35	92	M35×1.5	30	—	30	63	8	12	14	—	—	WBK35DF-31H	—
50	35	92	M35×1.5	30	—	30	63	8	12	14	—	—	WBK35DF-31H	—

Note: The dimension d_1 shall be smaller enough than the minor diameter of the ball screw thread to provide sufficient shoulder surface for the spacer.

Refer to "Precautions for Designing Ball Screw (page B83)".

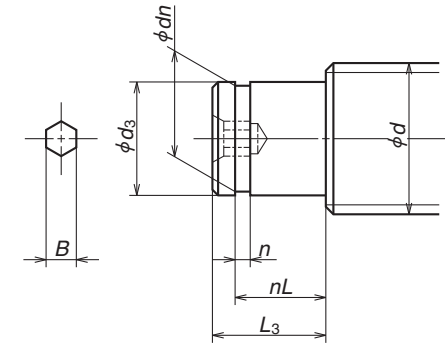


Fig. 4.7 Shaft end configuration of R Series (opposite to the drive side)

Table 4.12 Dimensions of R Series shaft ends (opposite to the drive side)

Unit: mm

Screw shaft diameter d	Bearing journal		Retaining ring groove		Hexagonal hole	Support unit	
	Outside diameter d_3	Length L_3	Width n	Groove diameter dn	Groove position nL		
10	6	9	0.8	5.7	6.8	—	WBK08S-01(606)
12	8	10	0.9	7.6	7.9	—	WBK10S-01(608)
14	10	12	1.15	9.6	9.15	4	WBK12S-01(6000)
15	10	12	1.15	9.6	9.15	4	WBK12S-01(6000)
16	10	12	1.15	9.6	9.15	4	WBK12S-01(6000)
18	10	12	1.15	9.6	9.15	4	WBK12S-01(6000)
20	15	13	1.15	14.3	10.15	5	WBK15S-01(6002)
25	17	16	1.15	16.2	13.15	6	WBK17S-01(6203)
	20	19	1.35	19	15.35	6	WBK20S-01(6204)
28	20	19	1.35	19	15.35	6	WBK20S-01(6204)
32	25	20	1.35	23.9	16.35	8	WBK25S-01W(6205)
36	25	20	1.35	23.9	16.35	8	WBK25S-01W(6205)
40	30	22	1.75	28.6	17.75	10	(6206)
45	35	23	1.75	33	18.75	12	(6207)
50	35	23	1.75	33	18.75	12	(6207)

B-1-5 When Placing Orders

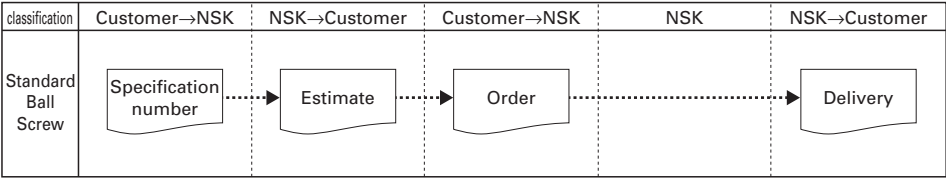
To avoid confusion, please use "reference number" or "specification number" when inquiring about desired ball screw specifications.

◇ **Reference number:**
Alpha-numeric codes are assigned to each ball screw. When placing order, please use this reference number.

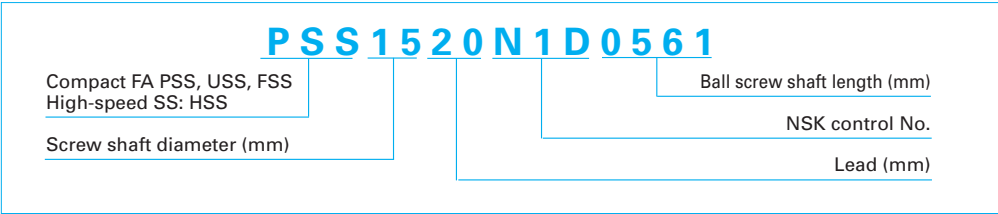
◇ **Specification number:**
Specification factors are identified by alpha-numeric codes. Codes are for easy explanation of your requirements. (If you do not use these numbers, please itemize your requirements.)

B-1-5.1 When Ordering Standard Ball Screws

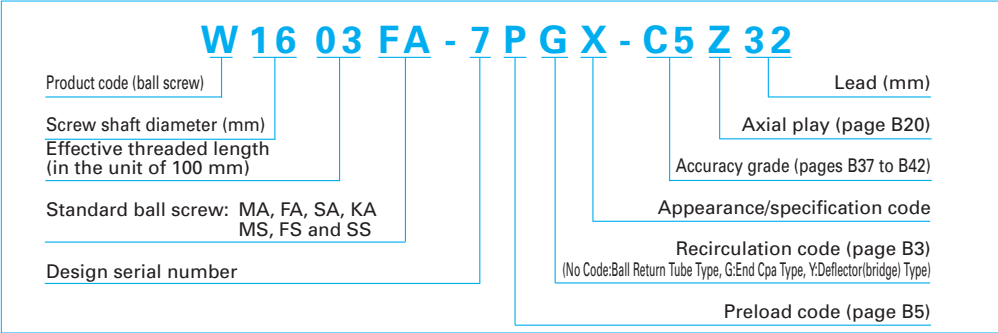
Find the reference number from the dimension table. Enter the reference number in the "Order Form by Fax" (page B34). Send the fax to your local NSK agency (branch office, sales office, or your local representative.). The following is the flow chart for ordering standard ball screws.



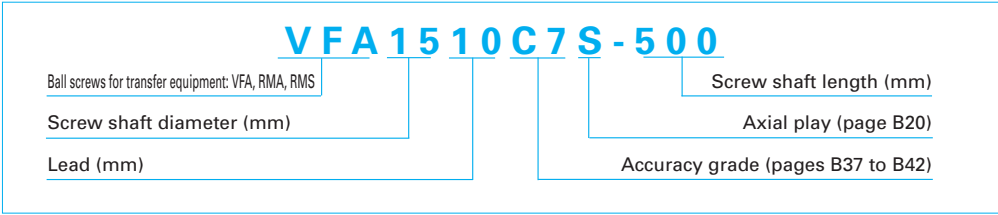
(1) Example of reference number for Standard ball screws Compact FA Series and high-speed SS Series



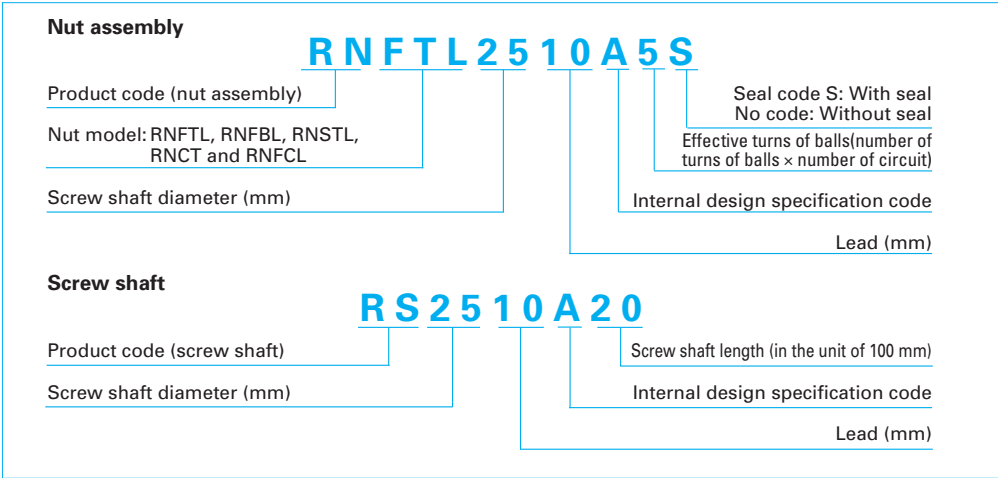
(2) Example of reference number of Standard ball screws



(3) Example of reference number of ball screws for transfer equipment with finished shaft end and blank shaft end

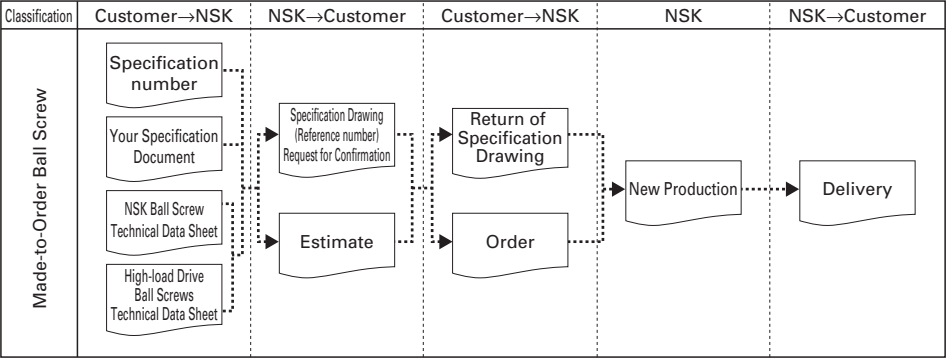


(4) Example of reference number of R series ball screws for transfer equipment



B-1-5.2 When Ordering Made-to-Order Ball Screws

If you would like to discuss technical points regarding specifications, use the NSK ball screw technical data sheet as an aid (page B36). For high-load drive ball screws, use the technical sheet on page B533 for NSK high-load drive ball screw. The following is the flow chart for ordering made-to-order ball screws.



(1) Example of specification number of made-to-order ball screw

DFT 5010-5 L C3 Z-850/1230

Nut model: D
Screw shaft diameter (mm): 50
Lead (mm): 10
Effective turns of balls (number of turns of balls × number of circuit): 5
Direction of turn: No code, right; L, left
Screw shaft length (mm): 850
Threaded length (mm): 1230
Accuracy grade (page B37 to B42): C3
Axial play (page B20): Z

(2) Example of reference number of made-to-order ball screw

W5012-26LD-C1Z10

Product code (Ball Screw): W
Screw shaft diameter (mm): 50
Effective threaded length (in the unit of 100 mm): 12
Design serial number: 26
Direction of turn: No code, right; L, left
Lead (mm): 10
Axial play (page B20): Z
Accuracy grade (page B37 to B42): C1
Ball screw specification/appearance: LD

Fax Order Form

(Make copies for future orders)

(1) Standard ball screw

Company name : _____ Date: Day Month Year

Address : _____ Telephone : _____

Name of person in charge : _____ Section : _____

Product name	Specification number	Quantity	Desired delivery date
Precision ball screw			
R Series ball screw Nut			
R Series ball screw Screw shaft			
Support unit			
Lock nut			
Grease unit			

Describe the shaft end configuration if processing is required (blank shaft end ball screw). In this case, specify which ball screw in the above list the shaft end shall be processed. Refer to pages B27 to B30 for shaft end configuration. These pages also show the reference number for support units.

Drive side

Opposite of drive side

NSK Ball Screw Technical Data Sheet (example)

(2) Made-to-order ball screw

Company name

Address

Person in charge

Machine which uses the ball screw

Drawing/rough sketch attached?

Date: Day Month Year

Telephone

Section

Application

Yes No

Use conditions

	Axial load	Rotational speed	Operating hours	Operating conditions	
Maximum load	9 000 N	20 min ⁻¹	15 %		Shaft rotation - Moving nut (Normal operation) Shaft rotation - Moving shaft Back drive operation
Load in normal use	4 000 N	360 min ⁻¹	60 %		Nut rotation - Moving nut Nut rotation - Moving shaft Oscillation
Minimum load	2 000 N	1 000 min ⁻¹	25 %		Degree of vibration shock Normal
Maximum rotational speed	1 000 min ⁻¹			Required life	20 000 h
Lubricant	Grease/oil (Brand name: NSK GRS AS2 Maker:)			Motor in use	Company A, Model 1
Seal	Yes No			Control system	Company B, Model 2 (resolution: 1µm)
Support bearing	Drive side 35TAC62DF Opposite to drive side 35TAC62DF				
Guide way	Rolling Sliding (RA451500GM2-P4Z3-II)				
Environment	Temperature (Normal temperature in degrees Celsius) Dust Humidity Gas Liquid (where?) Clean room In vacuum				
Schedule for prototype	Day	Month	Year (approx.)	Quantity used	Piece
Date, going in production/Quantity	/Month	/Year	/Lot	per machine	

Specification factors of the ball screw

Screw shaft diameter	50 mm	Direction of turn	right	Accuracy grade	C2	Screw shaft length	880 mm	Preload	3000 N
Lead	10 mm	Effective turns of balls		Axial play	0 mm	Overall shaft length	1 335 mm	Required torque	
Nut model	ZFT5010-10	Flange type	Circular I	Nut orientation	Same as shown in the dimension table Opposite				

Supplemental explanation/requests

NSK

NSK Ball Screw Technical Data Sheet (example)

(2) Made-to-order ball screw

Company name

Address

Person in charge

Machine which uses the ball screw

Drawing/rough sketch attached?

Date: Day Month Year

Telephone

Section

Application

Yes No

Use conditions

	Axial load	Rotational speed	Operating hours	Operating conditions	
Maximum load	N	min ⁻¹	%		Shaft rotation - Moving nut Normal operation Shaft rotation - Moving shaft Back drive operation
Load in normal use	N	min ⁻¹	%		Nut rotation - Moving nut Nut rotation - Moving shaft Oscillation
Minimum load	N	min ⁻¹	%		Degree of vibration shock
Maximum rotational speed	min ⁻¹			Required life	
Lubricant	Grease/oil (Brand name: Maker:)			Motor in use	
Seal	Yes No			Control system	(resolution:)
Support bearing	Drive side Opposite to drive side				
Guide way	Rolling Sliding ()				
Environment	Temperature (Normal temperature in degrees Celsius) Dust Humidity Gas Liquid (where?) Clean room In vacuum				
Schedule for prototype	Day	Month	Year (approx.)	Quantity used	Piece
Date, going in production/Quantity	/Month	/Year	/Lot	per machine	

Specification factors of the ball screw

Screw shaft diameter		Direction of turn		Accuracy grade		Screw shaft length		Preload	
Lead		Effective turns of balls		Axial play		Overall shaft length		Required torque	
Nut model		Flange type		Nut orientation	Same as shown in the dimension table Opposite				

Supplemental explanation/requests

B-2 Technical Description of Ball Screws

B-2-1 Accuracy

B-2-1.1 Lead Accuracy

The lead accuracy of NSK precision ball screws (C0 to C5 grades) conforms to the four characteristics specified in JIS Standards. These characteristics are expressed by codes ep , v_u , v_{300} , and $v_{2\pi}$.

Fig. 1.1 explains the definition of each characteristic, and shows allowable value of each. Leads are classified into two categories: C system for

positioning; Ct system for transportation. **Tables 1.2, 1.3 and 1.4** show tolerance of each characteristic. JIS B1192 sets C type and Cp type standards for positioning ball screws. NSK uses the specification of C type only. JIS B1192 specifies Ct1, 3, and 5 grade. NSK standards are integrated by C type only. Refer to **Table 1.2** for C type standard tolerance.

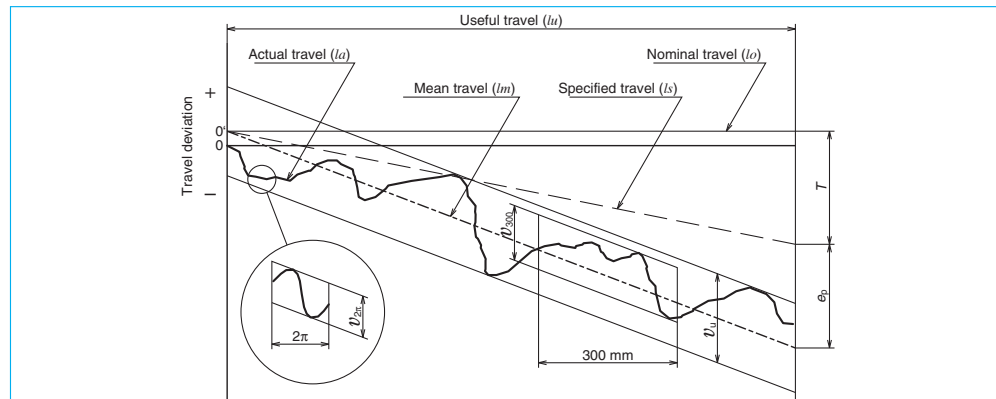


Fig. 1.1 Definition of lead accuracy

Table 1.1 Terminology in lead accuracy

Term	Code	Description	Tolerance
Specified travel	ls	The travel compensates the nominal travel for an elongation caused by an increase of temperature or load.	
Travel compensation	T	Value obtained by subtracting the specified travel from the nominal travel based on the useful travel. The value is to compensate for the errors caused by thermal deformation or deformation by load. This value is determined by tests and experience (see page B39).	
Actual travel	la	Actually measured travel	
Actual mean travel	lm	A straight line that demonstrates the direction of actual travel. This straight line is obtained from the curve that shows actual travel volume by least-squares method or by resembling approximation.	
Tolerance on specified travel	ep	Obtained by subtracting the specified travel from the actual mean travel.	Table 1.2
Travel variation	v_u v_{300} $v_{2\pi}$	Maximum range of the actual travel which is between the two straight lines drawn parallel to the actual mean travel. There are three categories as shown below. • Maximum range relative to the effective length of thread. • Maximum range relative to the length of 300 mm anywhere within the effective length of thread. • Maximum range which corresponds to any single rotation (2π rad.) within the effective length of thread.	Table 1.2 Table 1.3, 1.4 Table 1.3

Table 1.2 Tolerance on specified travel ($\pm ep$) and travel variation (v_u) of the positioning (C type) ball screws

Unit: μm

Accuracy grade			C0		C1		C2		C3		C5	
	over	or less	$\pm ep$	v_u	$\pm ep$	v_u	$\pm ep$	v_u	$\pm ep$	v_u	$\pm ep$	v_u
Effective thread length, mm	—	100	3	3	3.5	5	5	7	8	8	18	18
	100	200	3.5	3	4.5	5	7	7	10	8	20	18
	200	315	4	3.5	6	5	8	7	12	8	23	18
	315	400	5	3.5	7	5	9	7	13	10	25	20
	400	500	6	4	8	5	10	7	15	10	27	20
	500	630	6	4	9	6	11	8	16	12	30	23
	630	800	7	5	10	7	13	9	18	13	35	25
	800	1 000	8	6	11	8	15	10	21	15	40	27
	1 000	1 250	9	6	13	9	18	11	24	16	46	30
	1 250	1 600	11	7	15	10	21	13	29	18	54	35
	1 600	2 000			18	11	25	15	35	21	65	40
	2 000	2 500			22	13	30	18	41	24	77	46
	2 500	3 150			26	15	36	21	50	29	93	54
	3 150	4 000			30	18	44	25	60	35	115	65
	4 000	5 000					52	30	72	41	140	77
	5 000	6 300					65	36	90	50	170	93
	6 300	8 000							110	60	210	115
	8 000	10 000									260	140
	10 000	12 500									320	170

Table 1.3 Tolerance of travel variation relative to 300 mm (v_{300}) and one revolution ($v_{2\pi}$) of the positioning (C type) ball screws

Unit: μm

Accuracy grade	C0	C1	C2	C3	C5
v_{300}	3.5	5	7	8	18
$v_{2\pi}$	2.5	4	5	6	8

Note: to JIS B1192 standards. Values in other areas are NSK standards.

Table 1.4 Travel variation (v_{300}) relative to 300 mm of the transportation (Ct type) ball screws

Unit: μm

Accuracy grade	Ct7	Ct10
v_{300}	52	210

Note: Tolerance on specified travel (ep) of the transportation (Ct type) ball screws is calculated as follows.

$$ep = \pm \frac{l_u}{300} \times v_{300}$$

l_u : Effective length of the screw thread

Example of specifying lead accuracy

<Use Conditions>

Nut model: DFT4010-5
Stroke: 1 000 mm
Positioning accuracy: ± 0.035 mm/1 000 mm

<Calculation>

Obtain required lead accuracy of a ball screw under these conditions.

(1) Calculate the length of the thread

$$\text{Stroke} + \text{nut length} + \text{margin} = 1\,000 + 193 + 100 \\ = 1\,293 \text{ (mm)} \rightarrow 1\,300 \text{ mm}$$

(2) Calculate lead accuracy

From **Table 1.2**, obtain the tolerance on specified travel relative to the length of thread (1 300 mm).

C5 ... $\pm 0.054/1\,250 - 1\,600$

C3 ... $\pm 0.029/1\,250 - 1\,600$

(3) Determine lead accuracy

Positioning accuracy is: $\pm ep < \pm 0.035/1\,000$ mm

Accuracy grade: C3 grade $\pm ep = 0.029/\text{length of thread (1 300 mm)}$
 $v_u = 0.018$

B-2-1.2 Thermal Expansion and Target Value of Specified Travel

(1) Thermal expansion

Thermal expansion of screw shaft induces the degradation of positioning accuracy of the ball screws. Thermal expansion of a screw shaft is calculated as follows.

$$\Delta L_\theta = \rho \cdot \theta \cdot L \text{ (mm)} \dots\dots 1)$$

In this formula:

ΔL_θ : Thermal expansion (mm)

ρ : Thermal expansion coefficient ($12.0 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$)

θ : Average temperature rise of screw shaft (Celsius)

L : Length of screw shaft (mm)

The above formula indicates that when the temperature rises one degree Celsius, the screw shaft stretches 12 μm per meter. Ball screw generates more heat when it is used at high speed. This causes elongation of the screw shaft. Although the ball screw lead is ground into high precision, an elongated screw shaft due to high temperature rise may not satisfy required highly accurate positioning.

(2) Countermeasures against temperature rise

Countermeasures against temperature rise of the ball screw are:

Hollow shaft cooling or nut cooling ball screws are recommended for operation under high-speed and high-precision conditions.

(a) Suppress heat generation.

- Do not apply excessive preload to the ball screw and support bearing.
- Select appropriate lubricant and use it properly.
- Use higher helix ball screw lead to lower rotational speed.

(b) Use forced cooling.

- Feed liquid coolant into the hollow shaft cooling or nut cooling ball screws. - Refer to the information on hollow shaft ball screw for high accuracy machine tools in the section for application-oriented ball screws (pages B546 to B554).
- Cool screw shaft surface with lubricant oil or air.

(c) Avoid effects of temperature rise on positioning.

- Warm up the machine by high speed until the temperature rise of ball screw shaft saturates, then maintain it properly.
- Set pre-tension. (**Fig. 1.2**)
- Set the negative (minus) target value of specified travel.
- Employ the closed loop control system.

(3) How to determine specified travel

In general, the specified travel of ball screw is the same as the nominal travel. However, the specified lead of ball screw is sometimes set to negative (minus) or positive (plus) to adjust expansion by temperature rise during operation, or the elongation/contraction of the screw shaft by external load. For such occasion, specify travel compensation (T) when ordering the ball screw.

As an example, **Table 1.5** shows the travel compensation (T) for typical NC machine tools.

Table 1.5 Travel compensation (T) of specified travel for typical NC machine tools

Unit: mm		
Type of machine	Axis	Travel compensation (per 1 m)
NC lathes	X	- 0.02 — - 0.05
	Z	- 0.02 — - 0.03
Machining centers	X, Y	- 0.03 — - 0.04
	Z	Differs by structure

(4) How to determine pre-tension force

In order to absorb thermal expansion, pre-tension can be provided to the screw shaft at the time of installation. In this case, the pre-tension is usually equivalent to the expansion brought about by the temperature rise of 2 to 3°C.

Fig. 1.2 shows the bearing support structure in such occasion.

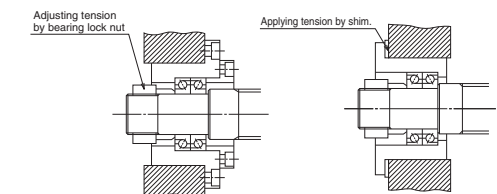


Fig. 1.2 Bearing structure to provide pre-tension

B-2-1.3 Mounting Accuracy and Tolerance of Ball Screws

The accuracy related to mount the ball screws is specified in the following seven characteristics (Fig. 1.3).

The tolerance is indicated in the specification drawing.

Detailed tolerances are specified by JIS B1192. For reference, **Table 1.6** shows standard values of "(7) Total run-out of the screw shaft axis (straightness of the screw shaft)". NSK sets stricter tolerance standards than JIS standards. For accuracy of the ball screw installation, refer to "Installation of Ball Screw (1) Centering of the units" (page B73).

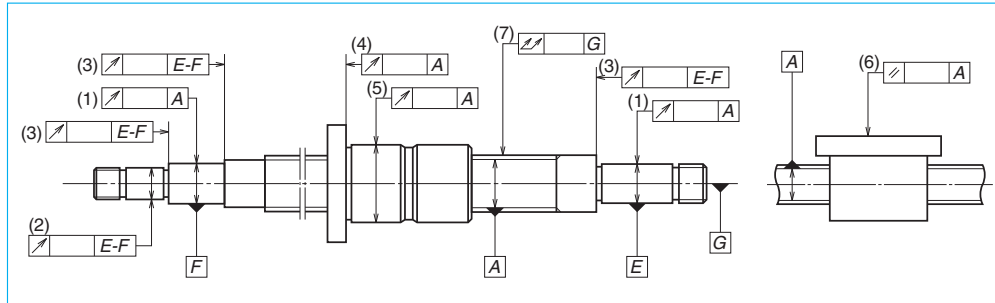


Fig. 1.3 Mounting accuracy of ball screw

- (1) Radial run-out of the support bearing seat relative to the axis of the ball thread of screw shaft.
- (2) Radial run-out of the other shaft ends section relative to the axis of the support bearing seat.
- (3) Radial run-out of the shoulder of support bearing seat relative to the axis of support bearing seat.
- (4) Radial run-out of the nut flange surface, or of the nut end datum surface, relative to the axis of screw shaft.
- (5) Radial run-out of the nut outside surface (cylindrical shape) to the axis of screw shaft.
- (6) Parallelism of the nut mounting surface to the screw shaft axis. (in case of flat mounting surface)
- (7) Total run-out of the screw shaft axis.

Table 1.6 Total run-out of the screw shaft axis

Unit: μm

Accuracy grade		C0							C1							
Nominal diameter (mm)	over	8	12	20	32	50	80	125	8	12	20	32	50	80	125	200
	or less	8	12	20	32	50	80	125	8	12	20	32	50	80	125	200
Overall length of screw shaft (mm)	—	125	15	15	15				20	20	15					
	125	200	25	20	20	15			30	25	20					
	200	315	35	25	20	20			40	30	25	20				
	315	400		35	25	20	15		45	40	30	25	20			
	400	500		45	35	25	20			50	40	30	25			
	500	630		50	40	30	20	15		60	45	35	25	20		
	630	800			50	35	25	20			60	40	30	25		
	800	1 000			65	45	30	25			75	55	40	30	25	
	1 000	1 250			85	55	40	30			95	65	45	35	30	
	1 250	1 600			110	70	50	40			130	85	60	45	35	
	1 600	2 000				95	65	45				120	80	55	40	
	2 000	2 500											100	70	50	
	2 500	3 150												130	90	
	3 150	4 000													120	

Unit: μm

Accuracy grade		C3								C5							
Nominal diameter (mm)	over	8	12	20	32	50	80	125	200	8	12	20	32	50	80	125	200
	or less	8	12	20	32	50	80	125	200	8	12	20	32	50	80	125	200
Overall length of screw shaft (mm)	—	125	25	25	20					35	35	35					
	125	200	35	35	25	20				50	40	40	35				
	200	315	50	40	30	30				65	55	45	40				
	315	400	60	50	40	35	25			75	65	55	45	35			
	400	500		65	50	40	30				80	60	50	45			
	500	630		70	55	45	35	30			90	75	60	50	40		
	630	800			70	55	40	35				90	70	55	45		
	800	1 000			95	65	50	40	30			120	85	65	50	45	
	1 000	1 250			120	85	60	45	35			150	100	75	60	50	
	1 250	1 600			160	110	75	55	40			190	130	95	70	55	
	1 600	2 000				140	95	70	50				170	120	85	65	
	2 000	2 500					120	85	60					150	110	80	
	2 500	3 150					160	110	75					200	140	95	
	3 150	4 000					220	150	100					260	180	120	
	4 000	5 000						200	130						240	160	
	5 000	6 300													310	210	
	6 300	8 000														280	
	8 000	10 000															370

B-2-1.4 Automatic Lead Accuracy Measuring System of NSK

In response to the demand for high precision in production technology, NSK is the first in the world that developed and uses "Lead Accuracy Measuring System (LAMS)." Lead accuracy is measured by the system that employs a laser interferometer measuring instrument and a personal computer.

Fig. 1.4 shows the lead accuracy measuring system. The inspection date of the ball screw is shown in Fig. 1.5. The laser interferometer measures either ball nut travel accuracy or lead accuracy of the ball thread. The data which are input into a computer are processed into four characteristics readings regarding lead accuracy. (See page B37.)

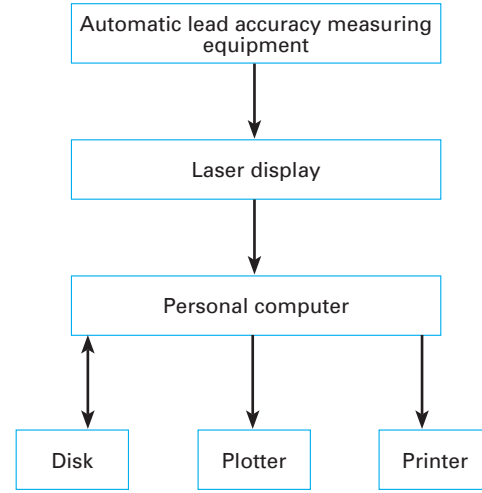


Fig. 1.4 Lead accuracy measuring system

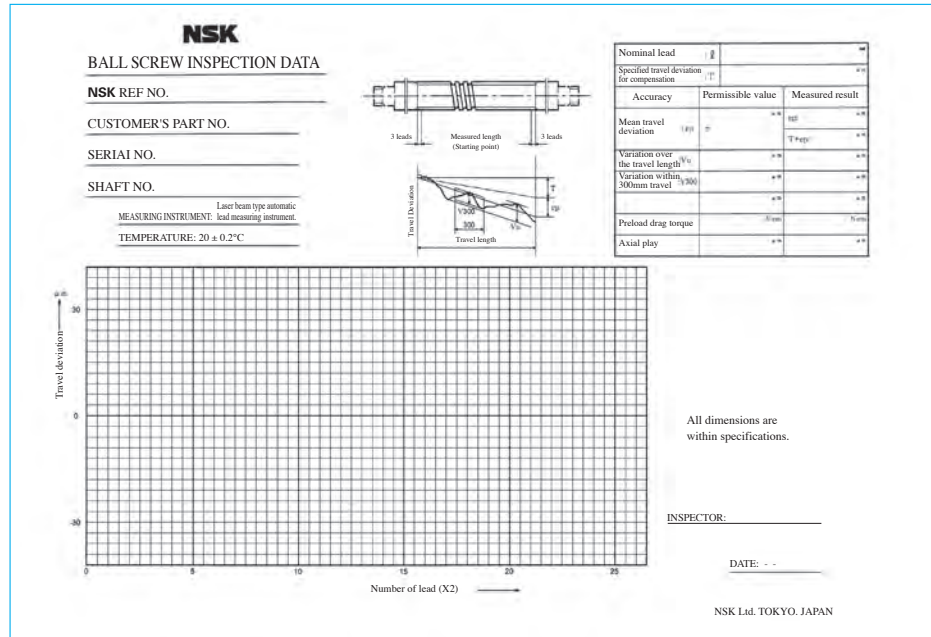


Fig. 1.5 Ball screw inspection data

B-2-2 Static Load Limitation

Ball screws, based on their function, will generally receive axial load only. Ball screw shafts in general are long, so it is necessary to consider 3 items below:

- Buckling load of the screw shaft
- Yielding of the screw shaft by tensional or compressive stress
- Permanent deformation at the ball contact points

B-2-2.1 Buckling Load

It is necessary to calculate whether the ball screw shaft is safe against buckling. Buckling load, i.e. permissible compressive load "P" to axial direction, is calculated as follows.

$$P = \alpha \times \frac{N \cdot \pi^2 \cdot E \cdot I}{L^2} = m \frac{d_r^4}{L^2} \times 10^4 \text{ (N)} \dots\dots(2)$$

In this formula:
 α : Safety factor ($\alpha = 0.5$)
 E : Elastic modulus ($E = 2.06 \times 10^5 \text{ MPa}$)
 I : Moment of inertia

$$I = \frac{\pi}{64} d_r^4 \text{ (mm}^4\text{)} \dots\dots(3)$$

d_r : Screw shaft root diameter (mm) (See the dimension table.)
 L : Unsupported length (mm) (See Figs. 4.1 and 4.2 'Supporting conditions of screw shaft and nut' on page B51.)
 m, N : Factors determined by the supporting condition of the ball screw shaft

Table 2.1 Factors of buckling load

Supporting condition	m	N
Fixed - Fixed support	19.9	4
Fixed - Simple support	10.0	2
Fixed support - Free	1.2	0.25
Simple - Simple support	5.0	1

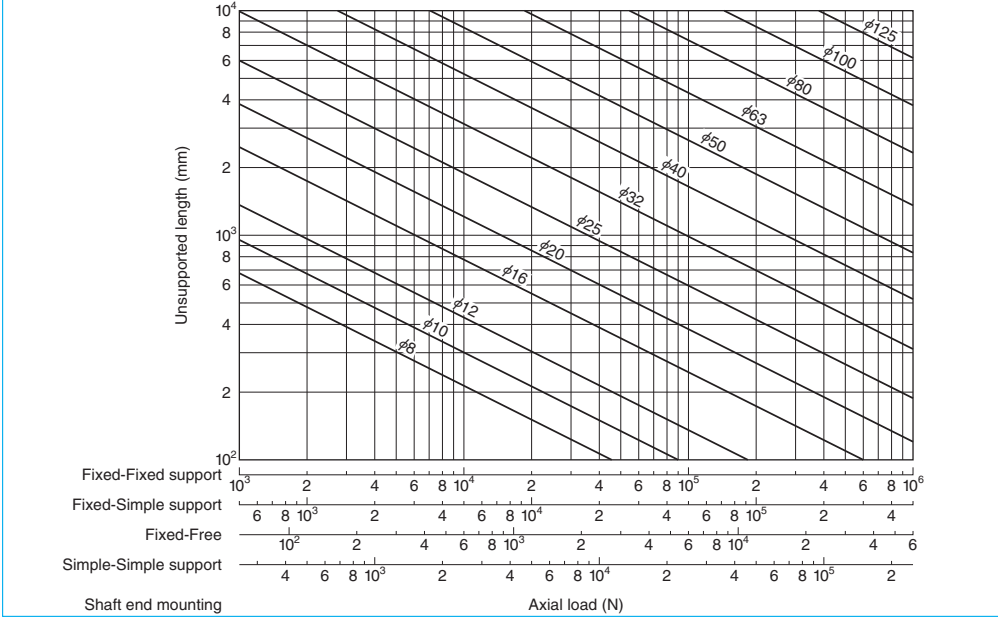


Fig. 2.1 Buckling load

<<Calculation example of buckling load>>

Calculate buckling load under the conditions in Fig. 2.2.

<Use conditions>

Nut model: DFT4010-5

Supporting condition is Fixed - Fixed support (From the supporting condition (ii) in Fig. 4.1 'Supporting conditions of screw shaft and nut' on page B51.)

Unsupported length $L = 2\,000$ mm

Screw shaft root diameter $d_r = 34.4$ mm (From the dimension table)

<Calculation>

Support condition is Fixed - Fixed support, from Table 2.1 on page B44

$$N = 4$$

$$m = 19.9$$

By formula 2) on page B44

$$P = m \frac{d_r^4}{L^2} \cdot 10^4 = 19.9 \times \frac{34.4^4}{2\,000^2} \times 10^4 = 69\,667 \text{ (N)}$$

Therefore,

Permissible buckling load $P = 69\,600$ N

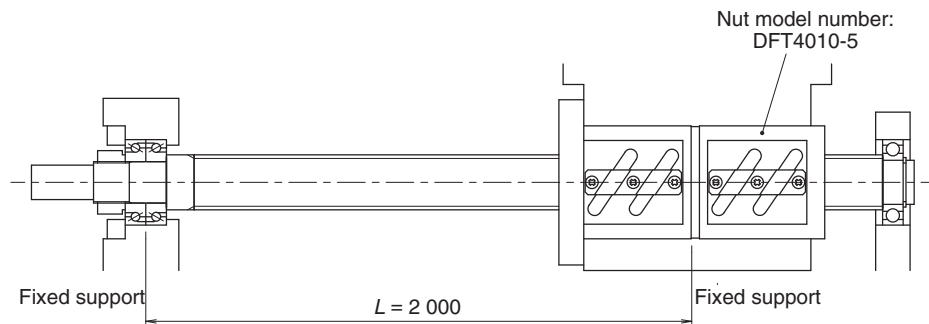


Fig. 2.2 Calculation example of buckling load

B-2-2.2 Yield by Tensional/Compressive Stress

It is necessary to consider permissible load in regards to the yield stress.

Permissible load "P" by tensional or compressive stress to screw shaft is

$$P = \sigma \cdot A = 1.15 d_r^2 \times 10^2 \text{ (N)} \quad \dots 4)$$

In this formula:

σ : Allowable stress (= 147 MPa)

A : Cross section area of a screw shaft using root diameter (mm²)

$$A = \frac{\pi}{4} \cdot d_r^2 \text{ (mm}^2\text{)} \quad \dots 5)$$

d_r : Screw shaft root diameter (mm)

<<Calculation example of yield load>>

Obtain load in respect to the allowable stress under the conditions in Fig. 2.2.

<Use conditions>

Nut model: DFT4010-5

Screw shaft root diameter $d_r = 34.4$ (mm)
(From the dimension table)

<Calculation>

By formula 4)

$$P = 1.15 d_r^2 \times 10^2 = 1.15 \times 34.4^2 \times 10^2 = 136\,086 \text{ (N)}$$

Therefore,

Permissible load $P = 136\,000$ N

B-2-2.3 Permanent Deformation at the Ball Contact Point

Exposed to an excessively heavy load in axial direction, the balls are squashed, and the ball rolling surface is dented. The deformations on these points do not perfectly restore to original shape after the load is removed. They are permanently disfigured. It is necessary to determine the limitation of this disfigurement to containing it within a certain range.

(1) Basic static load rating C_{0a}

Basic static load rating C_{0a} is a load to axial direction that results in the combined permanent deformation equal to 0.01% of the ball diameter at the contact points of ball and ball grooves of the screw shaft and nut.

(2) Calculation of permissible load by C_{0a}

P_0 (allowable axial direction load to limit the permanent deformation) is calculated using C_{0a} .

$$P_0 = \frac{C_{0a}}{f_s} \text{ (N)} \quad \dots 6)$$

In this formula, f_s : Static permissible load factor

Table 2.2 Static permissible load factor

At time of normal operation	1 - 2
With vibration impact	1.5 - 3

<<Calculation example of the maximum allowable load>>

Obtain the maximum allowable load to the ball groove section under conditions in Fig. 2.2.

<Use conditions>

Nut model: DFT4010-5

Basic static load rating $C_{0a} = 137\,000$ (N)
(From the dimension table)

Static permissible load factor $f_s = 2$
(normal operation, no vibration impact)

<Calculation>

By formula 6), the maximum allowable load of the ball groove section

$$P_0 = \frac{C_{0a}}{f_s} = \frac{137\,000}{2} = 68\,500 \text{ (N)}$$

B-2-3 Permissible Rotational Speed

Permissible rotational speed is determined by the feeding speed and ball screw lead. When selecting a ball screw, it is important to know the permissible rotational speed.

It is necessary to calculate two items below, and whichever smaller is the permissible rotational speed.

The lower of the following two factors, d·n and critical speed, will determine the overall permissible rotational speed of the ball screw.

- Critical speed which is the resonance vibration of the shaft.

- d·n value which is involved in damaging the ball recirculation components.

* Please consult NSK if the maximum rotational speed exceeds the criteria of maximum rotational speed on page B50, even both the critical speed of screw shaft rotation and the d·n value are in range of the allowable limit.

B-2-3.1 Critical Speed of the Screw Shaft

Calculate the critical speed which is the matching value of the ball screw rotational speed and the natural frequency of the screw shaft. The 80% of the critical speed is defined as the permissible rotational speed.

Calculate the critical speed of the screw shaft whether you use shaft rotation or nut rotation. Critical speed varies by the nut traveling position. Please consult NSK for detailed calculation.

If using a ball screw exceeding the critical speed, it is necessary to increase the natural frequency by using an intermediate support, etc. If using with nut rotation, it is possible to operate exceeding critical speed by installing a vibration energy absorbing system (optional, vibration control damper: patented by NSK) to the screw shaft. (Refer to "Nut rotatable drive ND Series" on page B555.)

Calculate the permissible rotational speed based on critical speed n_c as follows, taking in account "B-2-4 Supporting Conditions for Calculation of Buckling Load and Critical Speed" on page B51.

Fig. 3.1 shows the permissible rotational speeds against critical speed for each shaft diameter.

$$n_c = \alpha \times \frac{60\lambda^2}{2\pi L^2} \sqrt{\frac{E \cdot I \cdot g}{\gamma \cdot A}} \quad \dots 7)$$

$$= f \frac{d_r}{L^2} \times 10^7 \text{ (min}^{-1}\text{)} \quad \dots 7)$$

In this formula:

α : Safety factor ($\alpha = 0.8$)

E : Elastic modulus ($E = 2.06 \times 10^5 \text{ MPa}$)

I : Moment of inertia of area of screw shaft

$$I = \frac{\pi}{64} d_r^4 \text{ (mm}^4\text{)} \quad \dots 3)$$

d_r : Screw shaft root diameter (mm) (See the dimension table.)

g : Acceleration of gravity ($= 9.8 \times 10^3 \text{ mm/s}^2$)

γ : Specific weight ($\gamma = 7.65 \times 10^5 \text{ N/mm}^3$)

A : Cross section area of the screw shaft root diameter (mm²)

$$A = \frac{\pi}{4} \times d_r^2 \text{ (mm}^2\text{)} \quad \dots 5)$$

L : Unsupported length (mm) (See **Figs. 4.1**, and **4.2** "Supporting conditions of screw shaft and ball nut" on page B51)

f, λ : Factors determined by the supporting condition

Table 3.1 Coefficients of critical speed

Supporting condition	f	λ
Fixed - Simple support	15.1	3.927
Fixed - Fixed support	21.9	4.730
Fixed support - Free	3.4	1.875
Simple - Simple support	9.7	π

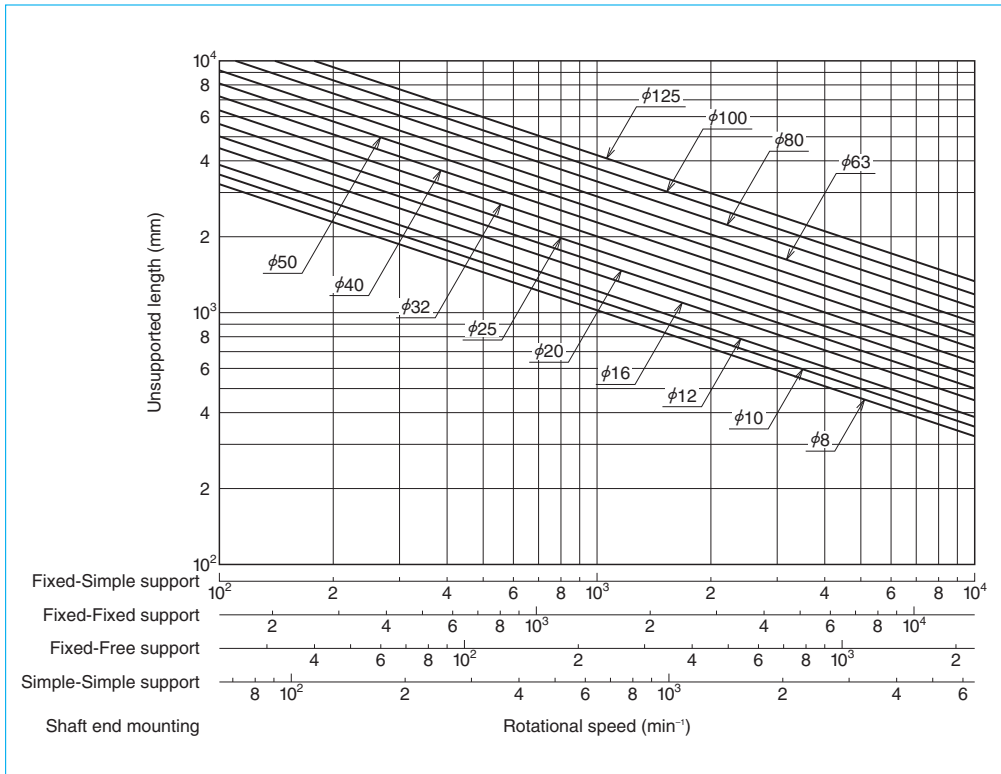


Fig. 3.1 Permissible rotational speeds vs. critical speeds

<<Calculation example of permissible rotational speed to the critical speed>>
Calculate the permissible rotational speed to the critical speed under conditions in **Fig. 3.2**.

<Use conditions>

Nut model: DFT4010-5

Supporting condition is Fixed - Simple support (From the supporting condition (ii) in **Fig. 4.1** "Supporting conditions of screw shaft and ball nut" on page B51.)

Unsupported length $L = 2\,000\text{ mm}$

Screw shaft root diameter $d_r = 34.4\text{ mm}$ (from the dimension table)

<Calculation>

Supporting condition is Fixed-Simple support, from **Table 3.1** on page B47

$$\lambda = 3.927$$

$$f = 15.1$$

By formula 7) on page B47, permissible rotational speed to critical speed is

$$n_c = f \frac{d_r}{L^2} \times 10^7 = 15.1 \times \frac{34.4}{2\,000^2} \times 10^7 = 1\,298.6\text{ (min}^{-1}\text{)}$$

$$n_c = 1\,290\text{ min}^{-1}\text{ or under}$$

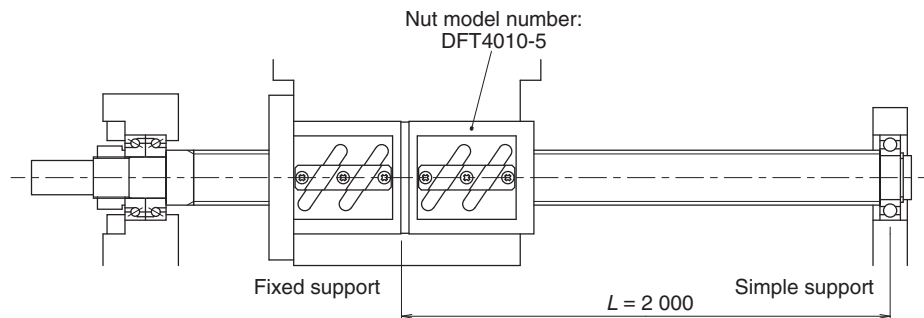


Fig. 3.2 Calculation example of permissible rotational speed to the critical speed

B-2-3.2 d·n Value

An increase of ball orbital speed increases the collision impact of balls to ball recirculation parts, and thus resulting in damage to them. For this reason, the permissible rotational speed is also limited by the d·n value (d, shaft diameter in millimeters; n, rotational speed per minutes).

Table 3.2 shows the allowable d·n value and the maximum rotational speed of ball screws.

Notes: 1. Special measure must be taken for high-speed specification products. Please consult NSK.

2. Please consult NSK if the maximum rotational speed or the d·n value exceed the values on the table below, even both the critical speed of screw shaft and the d·n value are in ranges of the allowable limit.

Table 3.2 Criteria of allowable d·n value and maximum rotational speed

Ball screw recirculation system, Series/Type		Allowable d·n value		Criterion of permissible rotational speed [min ⁻¹]
		Standard	High-speed	
Standard ball screw	Ball screw for transfer equipment R series	50 000 or less	–	3 000
Standard nut ball screws	End-deflector type	180 000 or less	–	5 000
	Return tube type	70 000 or less	100 000 or less	3 000
	Deflector(bridge) type	84 000 or less	100 000 or less	3 000
	End cap type	80 000 or less	100 000 or less	3 000
Application-oriented ball screws	HMD type for high-speed machine tools	160 000 or less	–	4 000
	HMS type for high-speed machine tools	160 000 or less	–	5 000
	HMC type for high-speed machine tools	100 000 or less, 135 000 or less ^{*1}	–	3 750
	BSL type for miniature lathes	(180 000 or less)	–	4 000
	HTF-SRC type for high-load drives	140 000 or less, 160 000 or less ^{*1}	–	3 225
	HTF-SRD type for high-load drives	120 000 or less	–	2 400
	HTF type for high-load drives	50 000 or less, 70 000 or less ^{*1}	100 000 or less	3 125
	VSS type for contaminated environment	150 000 or less	–	3 000
	ND series nut-rotatable ball screws	70 000 or less	100 000 or less	3 000
	Σ series for robots	70 000 or less	–	3 000
	R series for transfer equipment	50 000 or less	–	3 000

*1) Please refer to the explanation of each ball screw for which two allowable d·n values are listed

- HMC type for high-speed machine tools: page B501
- HTF-SRC type for high-load drives: page B511
- HTF type for high-load drives: page B519

B-2-4 Supporting Conditions for Calculation of Buckling Load and Critical Speed

Figs. 4.1 and 4.2 are typical conditions in supporting ball screws. Use them as reference to calculate the buckling load and the critical speed.

Please consult NSK if it is necessary to scrutinize calculation due to use conditions, or if boundary conditions are not clear due to special installation.

[How to read the tables]

Example ii: A buckling load generates between the nut and the left bearings, indicating that the critical speed appears between the nut and the right bearing. Therefore, set L at the maximum stroke for each side. Calculate by applying support bearing conditions.

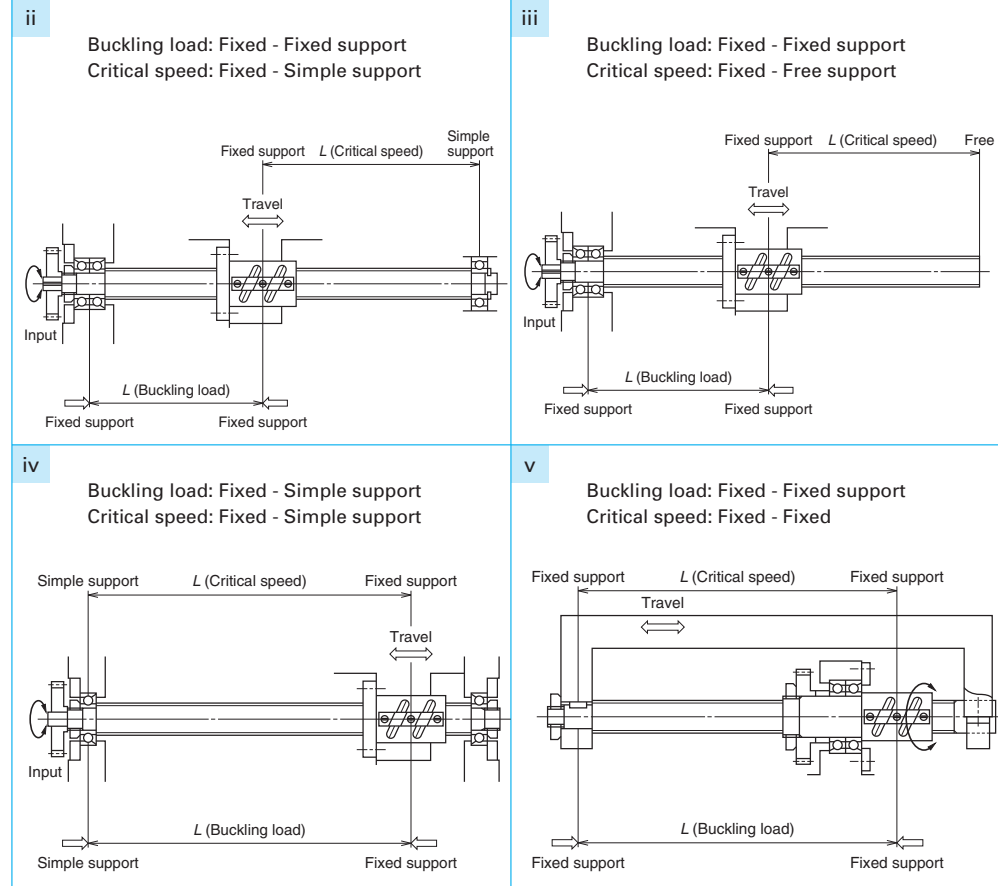


Fig. 4.1 Supporting conditions for screw shaft and ball nut

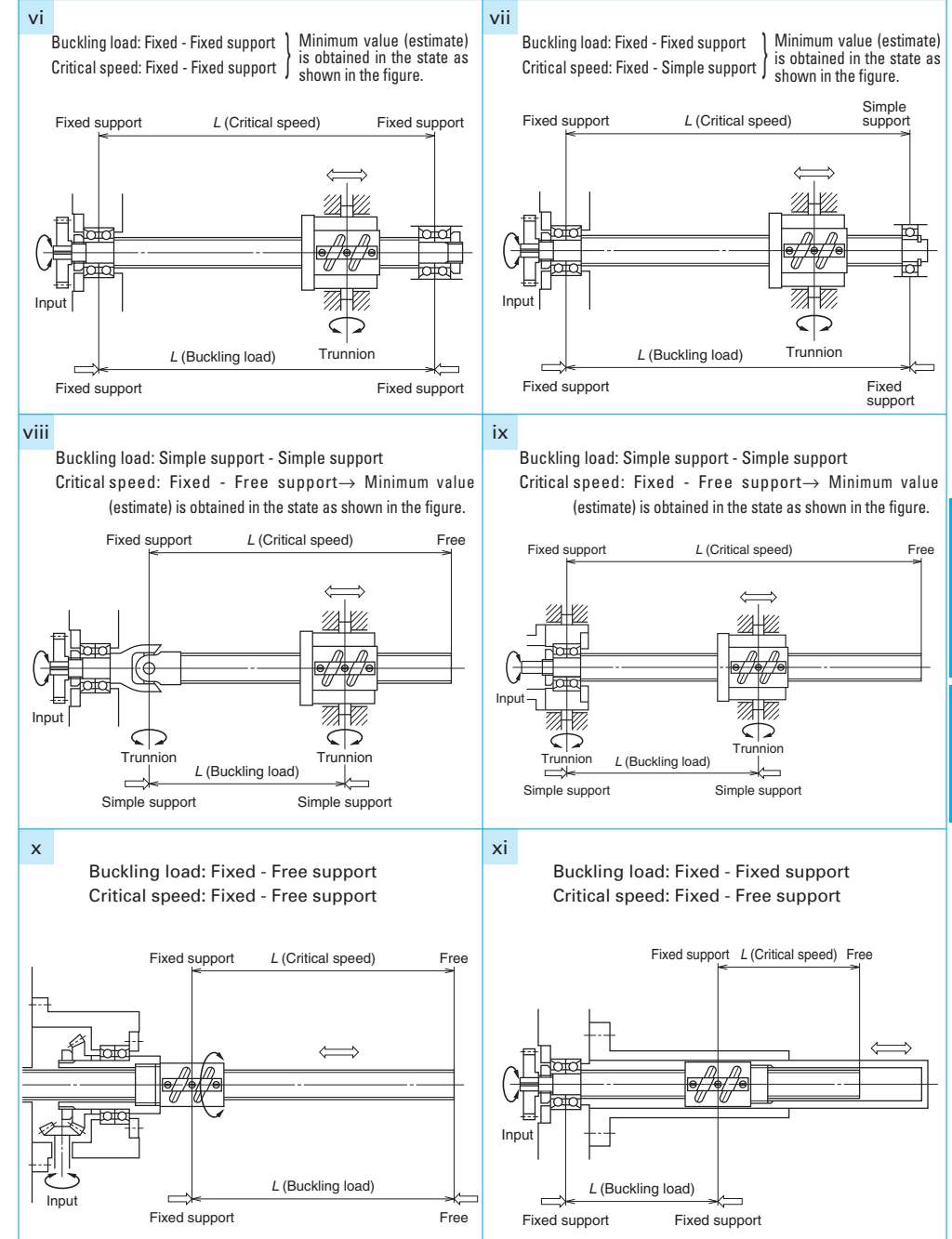


Fig. 4.2 Supporting conditions of screw shaft and ball nut

B-2-5 Life (Dynamic Load Limitation)

B-2-5.1 Life of Ball Screw

Although used in appropriate conditions and is ideally designed, the ball screw deteriorates after a certain operation period, and eventually becomes unusable. The period in this situation is the life of the ball screw. There are two life categories, "fatigue life" caused by flaking, and "life of accuracy" caused by deterioration in precision because of wear.

B-2-5.2 Fatigue Life

Fatigue life of a ball screw can be estimated by basic dynamic load rating (C_a) as is for the rolling bearings.

(1) Basic dynamic load rating C_a

Basic dynamic load rating is the axial load that allows a 90% of the group of the same ball screws to rotate 1 million times (10^6 rev) under the same condition without causing flaking by rolling contact fatigue.

(2) Fatigue life calculation

Fatigue life is defined as a total rotation number in general. It is sometimes indicated by total rolling hours or total running distance. Fatigue life is obtained by the following formula.

$$L = \left(\frac{C_a}{F_a \cdot f_w} \right)^3 \cdot 10^6 \quad \dots 8)$$

$$L_t = \frac{L}{60n} \quad \dots 9)$$

$$L_s = \frac{L \cdot l}{10^6} \quad \dots 10)$$

In this formula:

L : Rating fatigue life (rev)

L_t : Life in hours (h)

L_s : Life by running distance (km)

C_a : Basic dynamic load rating (N)

F_a : Axial load (N)

n : Rotational speed (min^{-1})

l : Lead (mm)

f_w : Load factor (Coefficient by operating condition)

Load factor f_w for operating conditions is shown in Table 5.1.

Table 5.1 Load coefficient f_w

Smooth operation without impact	1.0 – 1.2
Normal operation	1.2 – 1.5
Operation associated with impact or vibration	1.5 – 3.0

Setting too long fatigue life requires larger ball screw, and is not economical. Below are the general target values of operating life for machines. (reference)

Table 5.2 General target values of fatigue life

Machine tools	20 000 hours
Industrial machines	10 000 hours
Automatic control system	15 000 hours
Measuring equipment	15 000 hours

(3) Mean load

If the axial load often varies, calculate life by obtaining the mean load, which gives the equivalent fatigue life under this varying load conditions.

(a) When the load and the rotational speed shift stepwise
Obtain the mean load F_m by the formula below.
Obtain mean rotational speed N_m by the formula below as Table 5.3 and Fig. 5.1.

$$F_m = \left(\frac{F_1^3 \cdot n_1 \cdot t_1 + F_2^3 \cdot n_2 \cdot t_2 + \dots + F_n^3 \cdot n_n \cdot t_n}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n} \right)^{\frac{1}{3}} \quad \dots 11)$$

$$N_m = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}{t_1 + t_2 + \dots + t_n} \quad \dots 12)$$

Table 5.3 Stepwise operation condition

Axial load (N)	Rotational speed (min^{-1})	Hours of use, or ratio of hours of use
F_1	n_1	t_1
F_2	n_2	t_2
:	:	:
F_n	n_n	t_n

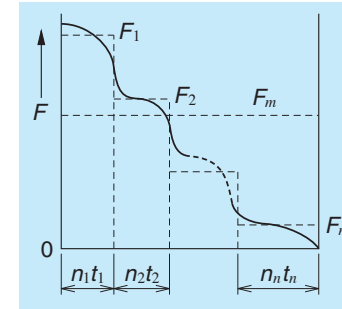


Fig. 5.1 Stepwise load variation

(b) When the rotational speed is constant, and the load changes linearly, obtain approximate value of the mean load F_m by the formula below.

$$F_m = \frac{1}{3} (F_{\min} + 2F_{\max}) \quad \dots 13)$$

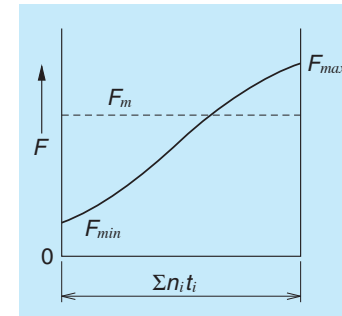


Fig. 5.2 Linear load change

(c) When the rotational speed is constant, and the load changes in a sinusoidal pattern, obtain approximate value of the mean load F_m by the formula below.

$$\text{When the sine curve is Fig. (a)} \quad F_m \doteq 0.65 F_{\max} \quad \dots 14)$$

$$\text{When the sine curve is Fig. (b)} \quad F_m \doteq 0.75 F_{\max} \quad \dots 15)$$

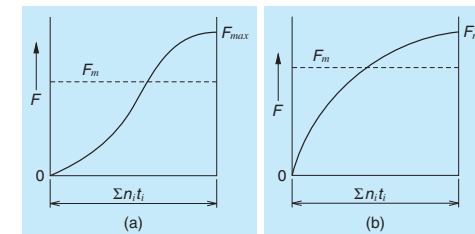


Fig. 5.3 Load changes in sinusoidal pattern

(4) Affect of mounting misalignment

If moment load or radial load is applied to the ball screw, it adversely affects ball screw function, and shortens life. Watch for eccentric load that induces moment or radial load.

Fig. 5.4 shows a calculation example of fatigue life when moment load is applied to the ball screw. In this figure, the value of the rigidity of mounting ball screw sections (screw shaft, support bearing, guide, etc.) is set at infinity. In actual use, deformation is absorbing the moment load in various areas, and the moment load that generates between the screw shaft and nut is abated.

In general, the following values are recommended as control values for precision grade.

Misalignment in inclination $\dots 1/2\ 000$ or less
Eccentricity $\dots 20\ \mu\text{m}$ or less

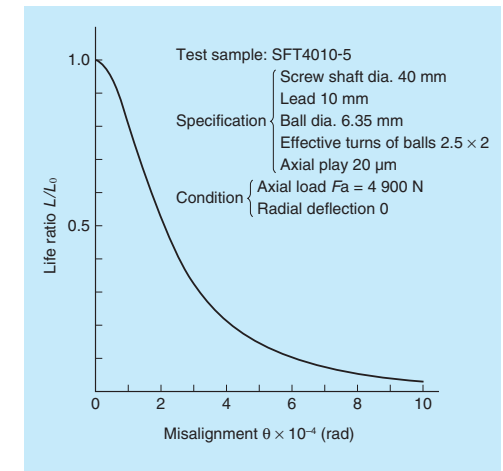


Fig. 5.4 Affects of misalignment

(5) Effects of heavy load and short stroke

If the ball screw is used under heavy load and short strokes, such as for the drive of plastic injection molding machine and of press machines, the fatigue life may become significantly shorter than the rated fatigue life which is calculated in B-2-5.2.

This decreased life occurs because the heavy load generates large stress (surface pressure) in the contact points of balls and ball grooves of the screw shaft and the nut, adversely affecting the life.

The axial load F_{amax} during operation and the size of strokes, which affect fatigue life, can be obtained by the following formula. In such case, the life calculation should take into account the size of the surface pressure as well as the size of the stroke. Please consult with NSK.

$$F_{amax} \geq 0.10C_{0a} \quad \dots 16) \\ S \leq 4$$

In this formula:

F_{amax} : Maximum load to axial direction during drive (N)

C_{0a} : Basic static load rating (N)

S : Stroke (rev)

$$S = \frac{L_s}{l}$$

L_s : Stroke distance (mm)

l : Lead (mm)

*1) Axial load : The load is applied to the axial direction when screw shaft and the nut of ball screw are rotating relatively each other. The rotational speed is irrelevant.

B-2-5.3 Ball Screw and Hardness

Table 5.4 indicates the hardness of NSK standard ball screw.

Table 5.4 Ball screw materials and their hardness

Component	Heat treatment method	Hardness (HRC)
Screw shaft	Carburizing	58 or over
	Induction hardening	58 or over
Nut	Carburizing	58 or over

Note: NSK manufactures special material ball screws for special environments (stainless steel: SUS440C, SUS630). NSK also furnishes protective surface treatment (refer to page D5). Please consult NSK for such request.

B-2-5.4 Wear Life

Wear of materials, as is the case for other mechanical components, is significantly affected by use conditions, lubrication conditions and other factors. It is difficult to estimate its volume, and measuring requires various tests and field data.

NSK has the data of wear accumulated through abundant experience. Please contact NSK for inquiry pertaining to the wear.

B-2-6 Preload and Rigidity

B-2-6.1 Elastic Deformation of Preloaded Ball Screw

(1) Position preload (D, Z, and P preload)

The concept of double nut preload ball screw is shown in Fig. 6.1.

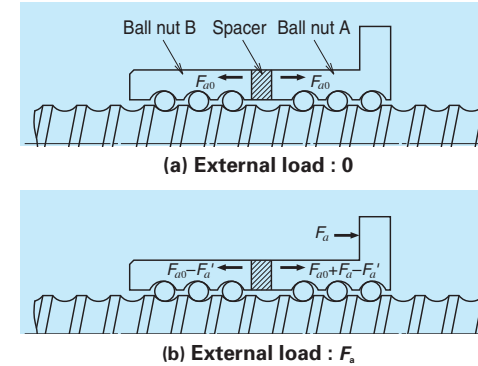


Fig. 6.1 Position preload (double-nut)

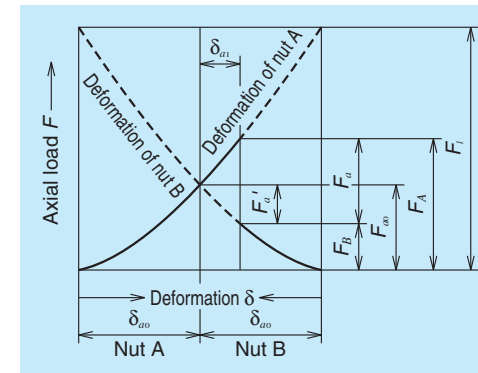


Fig. 6.2 Deformation of A and B nut (position preload)

Elastic deformation of Nut A and B is already given at time of assembly by the amount of δ_{a0} by preload F_{a0} . When the external load F_a is added to Nut A, the elastic deformation δ_a and δ_b of each Nut A and B change as shown in Fig. 6.2,

$$\delta_a = \delta_{a0} + \delta_{a1} \quad \delta_b = \delta_{a0} - \delta_{a1}$$

At this time, the load to each Nut A and B are:

$$F_A = F_{a0} + F_a - F_a'$$

$$F_B = F_{a0} - F_a'$$

It shows that the load applied to Nut A is

affected by Nut B and reduced by the amount of F_a' . Thereby, the elastic deformation of Nut A becomes smaller. This effect continues until the elastic deformation by the external load becomes δ_{a0} , and the preload by Nut B disappears.

Assuming that the load when the preload is absorbed is F_l , the relationship between the axial load and the elastic deformation is as follows (refer to Fig. 6.2).

$$\delta_{a0} = K \cdot F_{a0}^{2/3} \quad 2\delta_{a0} = K \cdot F_l^{2/3} \\ (K: \text{Invariable number}) \\ \left[\frac{F_l}{F_{a0}} \right]^{2/3} = \frac{2\delta_{a0}}{\delta_{a0}} = 2 \\ F_l = 2^{3/2} \times F_{a0} \div 3F_{a0}$$

For this reason, the preload should be about 1/3 of the maximum axial load. However, please note that if the preload of about 1/3 of the maximum axial load exceeds 8% of C_a , which is the criterion of the maximum preload, the ball screw may adversely increase heat generation and / or may shortens its lifetime.

Fig. 6.3 shows two types of elastic deformation curves: one is by the ball screw with preload, the other without preload. When an axial load which is about three times as large as the preload is applied, the deformation of the preloaded ball screw is 1/2 of the deformation of the ball screw without preload.

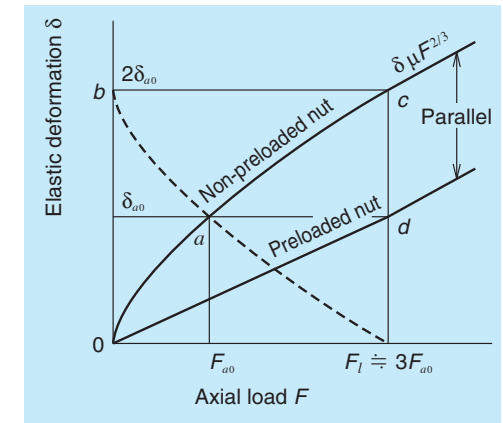


Fig. 6.3 Deformation of preloaded ball nut (position preload)

(2) Constant pressure preload (J preload: preloaded by spring)

Fig. 6.5 shows an elastic deformation of a ball screw which is preloaded with "constant pressure." The rigidity of the preload spring is sufficiently smaller than the nut rigidity. Therefore, the deformation of the spring becomes nearly parallel to the abscissa axis. For this reason, the elastic deformation by the preload with constant pressure changes along the deformation curve by Nut A. In order to take advantage of the characteristics of the preload with constant pressure, the major external load should be applied in the directions shown by an arrow in Fig. 6.4.

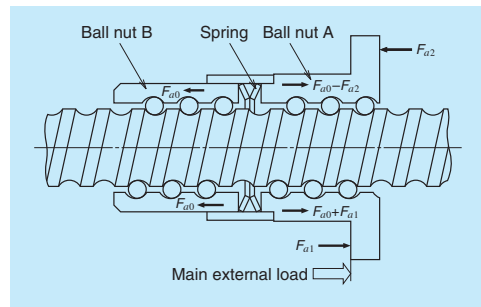


Fig. 6.4 Constant pressure preload (double nut)

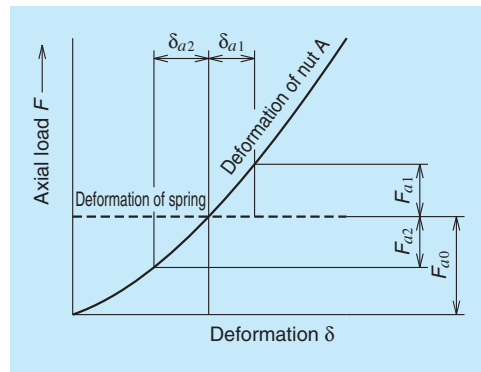


Fig. 6.5 Deformation curve of constant pressure preloaded nut

B-2-6.2 Rigidity of the Feed Screw System

A low rigidity around the feed screw mounting area causes lost motion. To improve the positioning accuracy of precision machines such as NC machine tools, it requires a good balance in axial rigidities of composing parts of the feed screw system. Also should examine torsional rigidities of the feed screw system.

(1) Axial rigidity of the feed screw system K_T

Elastic deformation and rigidity of the feed screw system can be obtained by the following formula.

$$\delta = \frac{F_s}{K_T} \quad \text{..... 17)}$$

$$\frac{1}{K_T} = \frac{1}{K_s} + \frac{1}{K_N} + \frac{1}{K_B} + \frac{1}{K_H} \quad \text{..... 18)}$$

In this formula:

δ : Volume of axial elastic deformation of the feed screw system (μm)

F_s : Axial load to the feed screw system (N)

K_T : Axial rigidity of the feed system (N/ μm)

K_s : Axial rigidity of the screw shaft (N/ μm)

K_N : Axial rigidity of the nut (N/ μm)

K_B : Axial rigidity of the support bearing (N/ μm)

K_H : Axial rigidity of the nut and bearing mounting section (N/ μm)

(2) Axial rigidity of the screw shaft: K_s

(a) In case of: Fixed support - Free (axial direction)

$$K_s = \frac{A \cdot E}{x} \times 10^{-3} \quad \text{..... 19)}$$

In this formula:

K_s : Axial rigidity of the screw shaft (N/ μm)

A : Cross section area of the screw shaft (mm^2)

$$A = \frac{\pi}{4} d_r^2$$

d_r : Screw shaft root diameter (mm)

E : Elastic modulus ($E = 2.06 \times 10^5 \text{ MPa}$)

x : Distance between points of load application (mm)

(b) In case of: Fixed – Fixed support (axial direction)

$$K_s = \frac{A \cdot E \cdot L}{x (L - x)} \times 10^{-3} \quad \text{..... 20)}$$

In this formula:

K_s : Axial rigidity of the screw shaft (N/ μm)

L : Unsupported length (mm)

x : Axial deformation is maximum at position $x = L/2$.

Axial rigidity of the screw shaft can be obtained by the following formula.

$$K_s = \frac{4A \cdot E}{L} \times 10^{-3} \quad \text{..... 21)}$$

<<Calculation example of axial rigidity (1)>>

Obtain axial rigidity of the screw shaft under the condition in Fig. 6.6.

<Use conditions>

Nut model: DFT 4010-5

From Fig. 6.6: Supporting condition ;

Fixed support --Free (axial direction)

Distance between points of load application

$$x = 1\,200 \text{ mm}$$

Screw shaft root diameter (from the dimension table)

$$d_r = 34.4 \text{ mm}$$

<Calculation>

By formula 19), axial rigidity K_s is :

$$A = \frac{\pi}{4} d_r^2 = \frac{3.14}{4} \times 34.4^2 = 929.4 \text{ (mm}^2\text{)}$$

$$K_s = \frac{A \cdot E}{x} \times 10^{-3} = \frac{929.4 \times 2.06 \times 10^5}{1\,200} \times 10^{-3} = 159 \text{ (N/}\mu\text{m)}$$

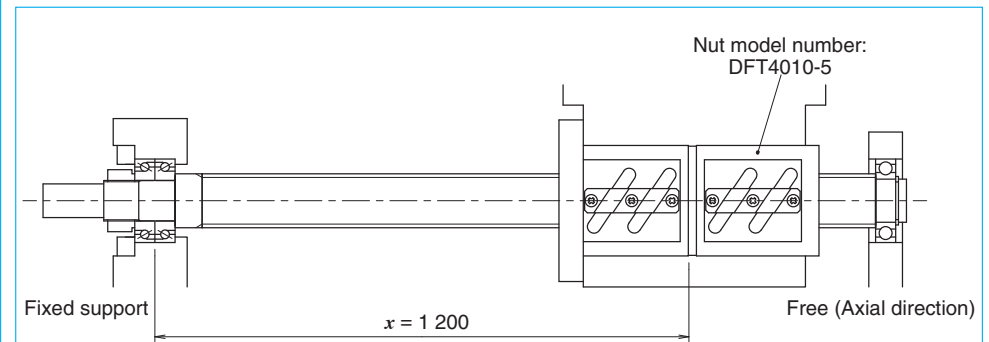


Fig. 6.6 Calculation example of axial rigidity of the screw shaft (1)

<<Calculation example of axial rigidity (2)>>

Obtain axial rigidity of the screw shaft under the conditions in Fig. 6.7.

<Use conditions>

Nut model: DFT 4010-5

From Fig. 6.7: Supporting condition:

Fixed - Fixed support (axial direction)

$L = 1\,200\text{ mm}$

Distance between points of load application:

Screw root diameter (from the dimension table)

$dr = 34.4\text{ mm}$

<Calculation>

By formula 21), axial rigidity K_s is :

$$A = \frac{\pi}{4} dr^2 = \frac{3.14}{4} \times 34.4^2 = 929.4\text{ (mm}^2\text{)}$$

$$K_s = \frac{4A \cdot E}{L} \times 10^{-3} = \frac{4 \times 929.4 \times 2.06 \times 10^5}{1\,200} \times 10^{-3} = 638\text{ (N/}\mu\text{m)}$$

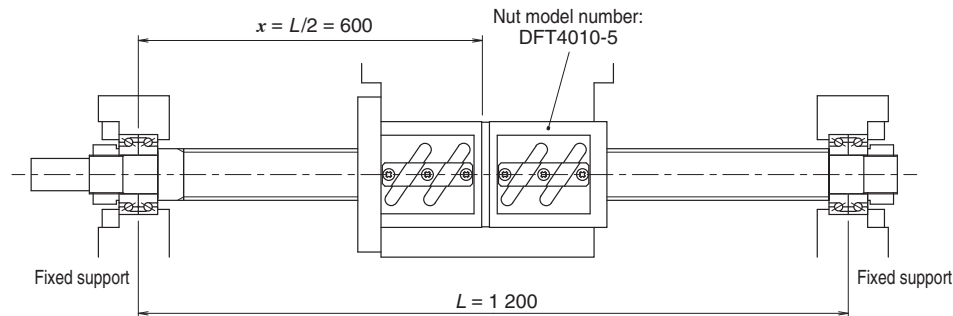


Fig. 6.7 Calculation example of axial rigidity of the screw shaft (2)

(3) Axial rigidity of the ball nut : K_N

(a) Rigidity of the nut with axial play

Theoretical rigidity value K is shown in the dimension table. The value K is obtained from the elastic deformation between screw grooves and balls when an axial load equivalent to 30% of the basic dynamic load rating C_a is applied. The criterion for the ball nut rigidity is 80% of the value listed in the table taking into consideration of deformation of the ball nut, etc. The rigidity value K_N is obtained by the following formula when the axial load " F_a " is not 30% of " C_a ".

$$K_N = 0.8 \times K \left(\frac{F_a}{0.3 C_a} \right)^{1/3} \text{ (N/}\mu\text{m)} \quad \dots 22$$

In this formula:

K : Rigidity value in dimension tables (N/μm)

F_a : Axial load (N)

C_a : Basic dynamic load rating (N)

<<Calculation example of axial rigidity (3)>>

Obtain axial rigidity of the nut under the following conditions.

<Use conditions>

Nut model: SFT 4010-5

Axial load: $F_a = 6\,000\text{ N}$

F_a = Rigidity at 0.3 C_a $K = 741\text{ N/}\mu\text{m}$
(from the dimension table)

<Calculation>

By formula 22), axial rigidity K_N is :

$$\begin{aligned} K_N &= 0.8 \times K \left(\frac{F_a}{0.3 C_a} \right)^{1/3} \\ &= 0.8 \times 741 \times \left(\frac{6\,000}{0.3 \times 61\,200} \right)^{1/3} \\ &= 408\text{ (N/}\mu\text{m)} \end{aligned}$$

(b) Rigidity of preloaded ball nut

Theoretical rigidity K of preloaded ball nut under an axial load is shown in each dimension table. The K is obtained from the elastic deformation of the ball rolling surface and the balls when: a preload which is equivalent to 10% of the basic dynamic load rating C_a (5% in case of the P-preload [single-nut oversize ball preload system]) is applied. The criterion for calculation of nut rigidity is 80% of the value listed in the table taking into consideration of deformation of the ball nut, etc. Rigidity K_N is obtained by the following formula when preload " F_{a0} " is not 10% (or 5%) of " C_a ".

$$K_N = 0.8 \times K \left(\frac{F_{a0}}{\varepsilon \cdot C_a} \right)^{1/3} \text{ (N/}\mu\text{m)} \quad \dots 23$$

In this formula:

K : Rigidity in the dimension tables (N/μm)

F_{a0} : Preload (N)

ε : Basic factor to calculate rigidity ($\varepsilon = 0.1$. For

P-preload use percentage of the preload to basic dynamic load rating. e.g. 0.03 for BSS and 0.015 for VSS.)

<<Calculation example of axial rigidity of the screw shaft (4)>>

Obtain axial rigidity of the nut under the following conditions.

<Use conditions>

Nut model : DFT 4010-5

Preload : $F_{a0} = 4\,000\text{ N}$

Rigidity K when $F_{a0} = \varepsilon C_a$: $K = 1\,454\text{ N/}\mu\text{m}$
(from the dimension table on page B457)

Basic factor to calculate rigidity when D Preload: $\varepsilon = 0.1$

<Calculation>

By formula 23)

$$\begin{aligned} K_N &= 0.8 \times K \left(\frac{F_{a0}}{\varepsilon \cdot C_a} \right)^{1/3} \\ &= 0.8 \times 1\,454 \times \left(\frac{4\,000}{0.1 \times 61\,200} \right)^{1/3} \\ &= 1\,009\text{ (N/}\mu\text{m)} \end{aligned}$$

The criterion of the preload to ball screw

Nut rigidity increases by a larger preload volume. But an excessive preload shortens life, and generates heat. Set the maximum preload about at 0.08 C_a (0.03 for P-Preload). **Table 6.1** shows the criteria for preload for different applications.

Table 6.1 Criteria of preload

Ball screw application	Preload (relative to dynamic load rating C_a)
Robots, material handling systems, etc.	Axial play or under 0.01 C_a
Semiconductor manufacturing systems, etc. That require highly accurate positioning	0.01 C_a – 0.03 C_a
Medium- high-speed machine tools for cutting	0.03 C_a – 0.05 C_a
Low to medium-speed systems that require especially high rigidity	0.05 C_a – 0.07 C_a

(4) Axial rigidity of support bearing: K_b

The rigidity (K_b) of the bearing used for ball screw support is shown in the dimension table of bearing. See page B415 for ball screw support bearings, NSKTAC C series and B425 for BSBD series.

(5) Axial rigidity of the ball nut and bearing mounting section: K_n

As the rigidity of mounting section has a profound effect on positioning accuracy, we recommend incorporating high rigidity of the mounting sections of ball nut and support bearings into the design at the early stage of designing the machine.

(a) Torsional rigidity of the feed screw system

Major torsion factors in the rotating system that bring about error in positioning accuracy are given three points below.

- Torsional deformation of the screw shaft
- Torsional deformation of the joint section
- Torsional deformation of the motor

The value of the effect of torsional strain to positioning accuracy is smaller than axial deformation. However, check the effect when

designing equipment that requires high positioning accuracy.

(b) Suppress thermal error

It is necessary to minimize the thermal error for ever increasing demand for positioning accuracy give three points below.

- Suppress heat
- Forced cooling
- Avoid effect of temperature rise

Refer to "Measures against thermal expansion" on page B40.

B-2-7 Friction Torque and Drive Torque

Operations that use ball screw drives require a motor torque which is equivalent to the total of following two:

- Friction torque, i.e. the friction of the ball screw itself
- Drive torque which is required for operation

B-2-7.1 Friction Torque

(1) Starting friction torque (breakaway torque)

A high torque is necessary to start a ball screw. This is called "starting friction torque" or

"breakaway torque." This torque is 2 to 2.5 times larger than the dynamic (friction) torque due to preload which is described below. The starting friction torque quickly diminishes once the ball screw begins to move.

(2) Dynamic friction torque (dynamic friction torque due to preload)

When a ball screw is moving, two types of torque generate: the dynamic friction torque due to preload and the friction torque associated with ball recirculation. JIS B1192 sets the standard of dynamic friction torque due to preload, which is the total of these two torque types. They are defined in **Fig. 7.2**.

The dynamic friction torque due to preload is calculated by the following formula. When the screw shaft is rotated as **Fig. 7.1** in the following measuring conditions, measure the nut holding power F and then multiple the distance of action line L which is perpendicular to the direction of the power F .

$$T_p = F \cdot L \quad \dots 24)$$

- Measuring rotational speed 100 min⁻¹
- Viscosity of lubrication is ISO VG 68 as prescribed in JIS K 2009.
- Remove Seals.

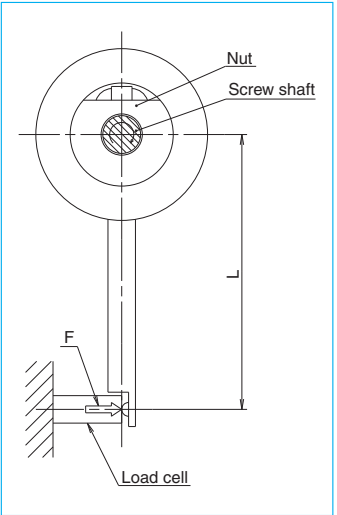


Fig. 7.1 Preload dynamic torque measuring method

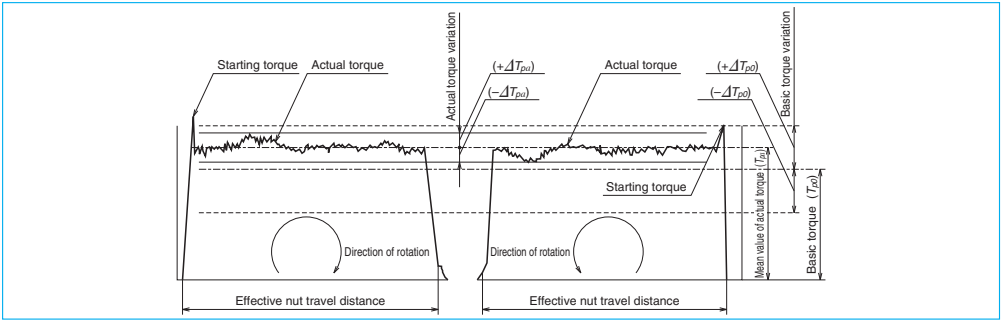


Fig. 7.2 Definitions of dynamic preloaded drag torque

(3) Calculation of basic torque

The basic torque of preloaded ball screw T_{p0} can be obtained by the following formula.

$$T_{p0} = K \frac{F_{a0} \cdot l}{2\pi} \div 0.014 F_{a0} \sqrt{d_m \cdot l} \quad (\text{N} \cdot \text{cm}) \quad \dots 25)$$

In this formula:

F_{a0} : Preload (N)

l : Lead (cm)

K : Torque coefficient of ball screw

$$K = \frac{0.05}{\sqrt{\tan \beta}}$$

β : Lead angle (deg.)

d_m : Ball pitch circle diameter (cm)

Allowable values of torque variation rate relative to basic torque are regulated as shown in **Table 7.1**.

B-2-7.2 Drive Torque

(1) Operating torque of a ball screw

(a) Normal drive

The torque when converting rotational motion to linear motion (normal operation) is obtained by the following formula.

$$T_a = \frac{F_a \cdot l}{2\pi \cdot \eta_1} \quad (\text{N} \cdot \text{cm}) \quad \dots 26)$$

In this formula:

T_a : Normal operation torque (N · cm)

F_a : Axial load (N)

l : Lead (cm)

η_1 : Normal efficiency ($\eta_1 = 0.9$ to 0.95)

(b) Back-drive operation

The torque when converting linear motion to rotational motion (back-drive operation) is obtained by the following formula.

$$T_b = \frac{F_a \cdot l \cdot \eta_2}{2\pi} \quad (\text{N} \cdot \text{cm}) \quad \dots 27)$$

In this formula:

T_b : Reverse operation torque (N · cm)

η_2 : Reverse efficiency ($\eta_2 = 0.9$ to 0.95)

(c) Dynamic drag torque of the preloaded ball screw
the operation torque of preloaded ball screw can be obtained by Formula 25).

(2) Drive torque of the motor

(a) Drive torque at constant speed

The torque which is necessary to drive a ball screw at constant speed resisting to external loads can be obtained by the following formula.

$$T_1 = (T_a + T_{pmax} + T_u) \times \frac{N_1}{N_2} \quad \dots 28)$$

In this formula:

T_a : Drive torque at constant speed

$$T_a = \frac{F_a \cdot l}{2\pi \cdot \eta_1} \quad \dots 26)$$

F_a : Axial load (N)

The value of F_a in **Fig. 7.3** is:

$$F_a = F + \mu \cdot m \cdot g$$

F : Such as cutting force to axial direction (N)

μ : Friction coefficient of the guide way

m : Volume of the traveling section (table mass plus work mass kg)

g : Gravitational acceleration (9.80665 m/s^2)

T_{pmax} : Upper limit of the dynamic friction torque of ball screw (N · cm)

T_u : Friction torque of the support bearing (N · cm)

N_1 : Number of teeth in Gear 1

N_2 : Number of teeth in Gear 2

Generally, though it depends on the type of motor, T_1 shall be kept under 30% of the motor rating torque.

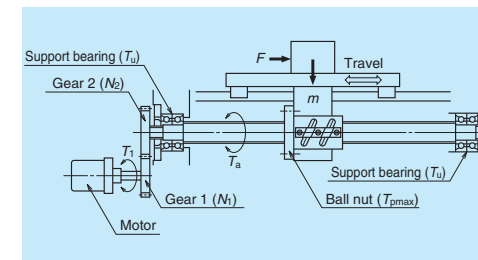


Fig. 7.3 Driving mechanism of ball screw

(b) Drive torque at acceleration

Accelerating the ball screw resisting axial load requires the maximum torque in an operation. Drive torque necessary for this occasion can be obtained by the following formula.

$$T_2 = T_1 + J \cdot \dot{\omega} \quad \dots 29)$$

$$J = J_M + J_{G1} \left(\frac{N_1}{N_2} \right)^2 \left[J_{G2} + J_S + m \left(\frac{l}{2\pi} \right)^2 \right] \quad (\text{kg} \cdot \text{m}^2) \quad \dots 30)$$

In this formula:

T_2 : Maximum drive torque at time of acceleration (N · m)

$\dot{\omega}$: Motor's angular acceleration (rad/s^2)

J : Moment of inertia applied to the motor ($\text{kg} \cdot \text{m}^2$)

J_M : Moment of inertia of the motor ($\text{kg} \cdot \text{m}^2$)

J_{G1} : Moment of inertia of Gear 1 ($\text{kg} \cdot \text{m}^2$)

J_{G2} : Moment of inertia of Gear 2 ($\text{kg} \cdot \text{m}^2$)

J_S : Moment of inertia of the screw shaft ($\text{kg} \cdot \text{m}^2$)

When selecting a motor, it is necessary to examine the maximum torque of the motor relative to the drive torque T_2 at the time of acceleration of ball screw.

For the calculation of the moment of inertia of a cylindrical object (ball screw, gear, etc.), please refer to the formula below.

Formula for the moment of inertia of a cylindrical object

$$J = \frac{\pi \cdot \gamma}{32} D^4 \cdot L \quad (\text{kg} \cdot \text{cm}^2) \quad \dots 31)$$

In this formula:

γ : Material density (kg/cm^3)

D : Diameter of the cylindrical object (cm)

L : Length of the cylindrical object (cm)

Table 7.1 Range of allowable values of torque variation rates (Source: JIS B 1192)

Basic torque (N · cm)		Effective length of the screw thread (mm)										
		4 000 or under								Over 4 000 and 10 000 or under		
		Slenderness ratio ⁽¹⁾ : 40 or less				Slenderness ratio ⁽¹⁾ : More than 40 and 60 or less				—		
		Accuracy grade				Accuracy grade				Accuracy grade		
Over	Incl.	C0	C1	C2, 3	C5	C0	C1	C2, 3	C5	C1	C2, 3	C5
20	40	±30%	±35%	±40%	±50%	±40%	±40%	±50%	±60%	—	—	—
40	60	±25%	±30%	±35%	±40%	±35%	±35%	±40%	±45%	—	—	—
60	100	±20%	±25%	±30%	±35%	±30%	±30%	±35%	±40%	—	±40%	±45%
100	250	±15%	±20%	±25%	±30%	±25%	±25%	±30%	±35%	—	±35%	±40%
250	630	±10%	±15%	±20%	±25%	±20%	±20%	±25%	±30%	—	±30%	±35%
630	1 000	—	±15%	±15%	±20%	—	—	±20%	±25%	—	±25%	±30%

Notes: 1. Slenderness ratio: The value obtained by dividing the length of the screw thread section of screw shaft (mm) by diameter of the screw shaft (mm).
2. NSK independently sets torque standards which are under 20 N · cm.

B-2-8 Even Load Distribution in Ball Nut (In Case of Ball Screws for High-Load Drive)

Generally, the distribution of loaded balls in a ball nut is three-dimensionally asymmetric, thus resulting in uneven load distribution to the balls and ball nut. NSK has taken the measures for even load distribution to the balls by an optimal arrangement of the position of ball recirculation circuits. Additionally, a heavier load results in a measurable axial deformation of the screw

shaft and the ball nut, thus further increasing the unevenness of load distribution. We have lessened the unevenness of load distribution to the balls by arranging the load acting point of the ball nut and the screw shaft opposite to each other. The relation between loading points and load distribution is shown in **Fig. 8.1**, while **Table. 8.1** shows the result of load distribution analysis.

Table. 8.1 The result of equalization of load distribution

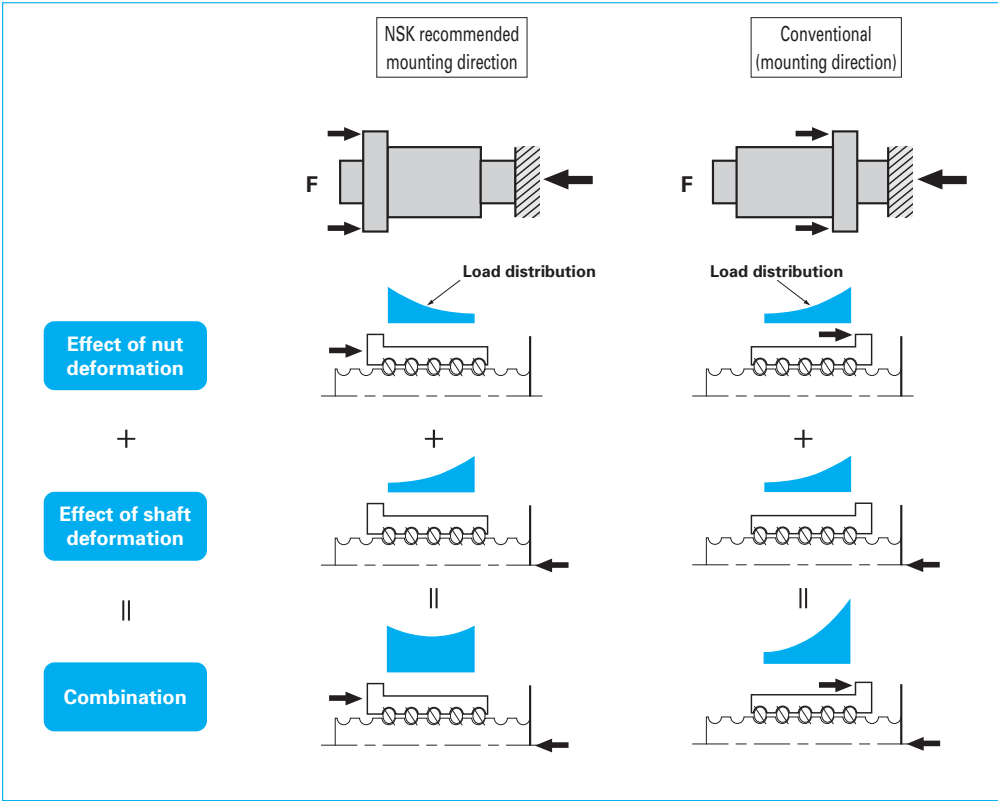
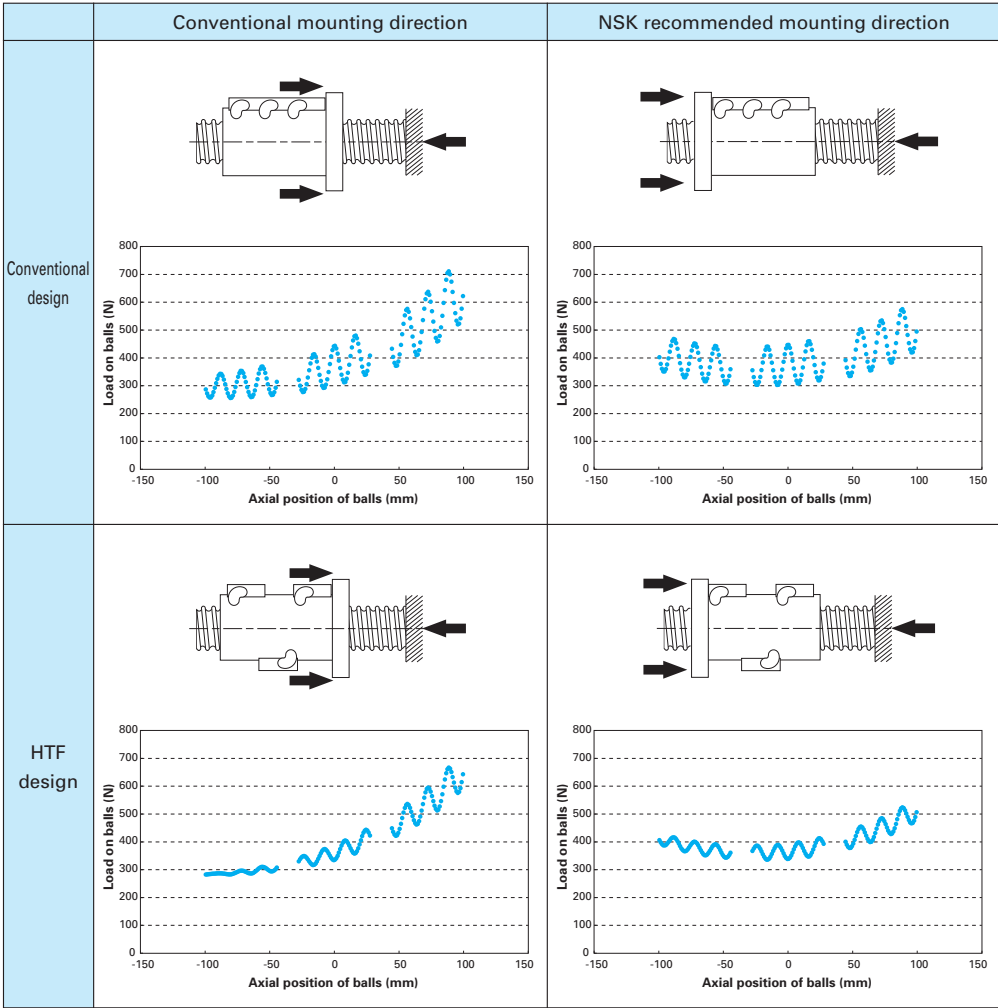


Fig. 8.1 The relationship between acting point of load and load distribution

B-2-9 Lubrication of Ball Screw

Lithium soap-based grease with base oil viscosity of 30 to 140 mm²/s (40°C) is recommended for grease lubrication and oil of ISO VG 32 to 100 for oil lubrication.

In general, a lubricant with low base oil viscosity is recommended where a ball screw is used for high-speed operation, and thus requires reducing thermal elongation of the screw shaft.

On the other hand, a lubricant with high base oil viscosity is recommended for a low-speed, high-temperature operation, or a high-load and oscillating operation.

Please consult NSK about greases for high-load drives and high-temperature applications.

NSK markets "NSK Grease Unit" as the standard series products for a variety of applications. NSK Grease Unit for ball screw lubrication includes:

- 1) Various types of grease in the bellows-tube which can be instantly attached to the grease pump
- 2) Hand grease pump which is compact and easy to use
- 3) Nozzles

Table 9.1 shows NSK greases, and names of other ball screw greases.

Table 9.2 explains checking points in lubrication and standard intervals between replenishments. It is important to wipe off old grease from the screw shaft prior to applying new grease. Page D16 also explains in detail concerning the replenishing methods.

Table 9.1 Grease for ball screw

Product name	Thickener	Base oil	Base oil viscosity mm ² /s (40°C)	Range of temperature for use (°C)	Application
NSK Grease AS2	Lithium type	Mineral oil	130	-10 – 110	For general use at high load
NSK Grease PS2	Lithium type	Synthetic oil combined with Synthetic hydrocarbon oil	15.9	-50 – 110	For light load
NSK Grease LR3	Lithium type	Synthetic oil	30	-30 – 130	For high-speed medium load
NSK Grease LG2	Lithium type	Mineral oil combined with Synthetic hydrocarbon oil	32	-20 – 70	For clean environment
NSK Grease NF2	Urea composite type	Synthetic hydrocarbon oil	26	-40 – 100	For fretting resistant

*Refer to page D13 for the nature of NSK greases.

Table 9.2 Checking lubricant and intervals of replenishment

Lubricating method	Checking intervals	Check points	Replenish/replacing interval
Intermittent automatic oil supply	Once a week	Remaining volume, contamination	Supply oil when checking (depending on the tank volume)
Grease	2 – 3 months after start of use	Clean, foreign matters	Generally once a year (replenish when necessary)
Oil bath	Every day, when start to work	Oil level	Specify according to oil consumption

B-2-10 Dust Prevention for Ball Screw

If foreign matters enter inside the ball nut, all screw grooves and balls wear rapidly, or the ball screw may malfunction due to the damage of groove and/or ball recirculation system. Use bellows or telescopic pipes (**Fig. 10.1**) to keep foreign matters from entering into the feed

screw system. Install these items so as to shut foreign matters completely from the ball screw. Also it is even more effective to add seals on the ball nut as shown in **Figs. 10.2 to 10.7**. We provide seals in **Table 10.1**.

Table 10.1 Seal

	Sealing capability	Torque	Heat	grease retention	Application
Thin plastic seal	○	○	○	○	End deflector type, HMD type, BSL type
Plastic seal	×	◎	◎	×	Tube type, Deflector(bridge) type (Seal is not put on the lead of 1mm or smaller.)
Wiper seal	○	×	×	○	
X1 seal	◎	○	○	◎	HMS type, HMD type
High performance seal	◎	○	○	○	VSS type
Brush-seal	△	○	○	△	For R Series (Seal for those with the shaft diameter of 14 mm or less is plastic seal.)

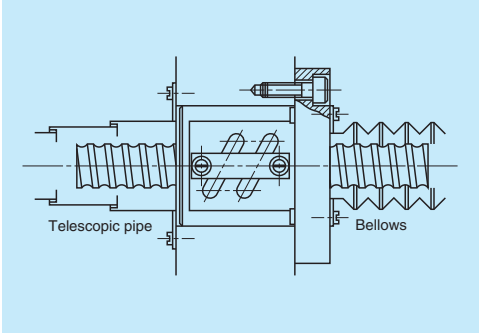


Fig. 10.1 Dust prevention by telescopic pipe and bellows

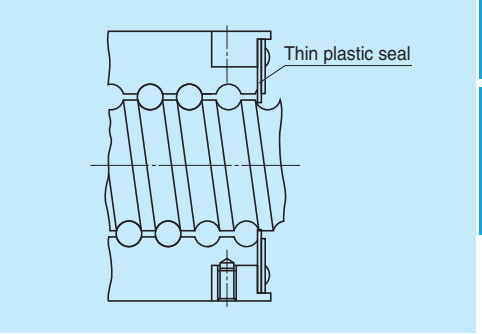


Fig. 10.2 Thin plastic seal

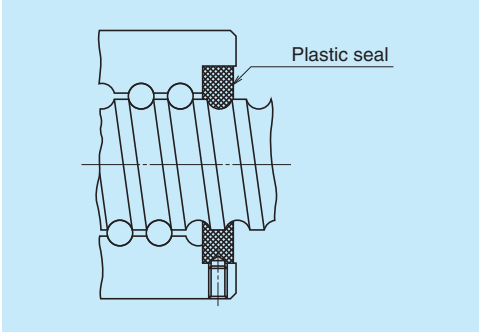


Fig. 10.3 Plastic seal

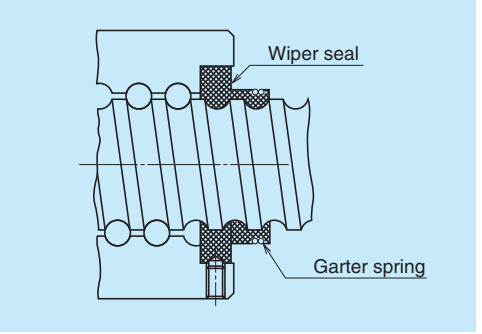


Fig. 10.4 Wiper seal

B-2-11 Rust Prevention and Surface Treatment of Ball Screws

(1) Stainless steel ball screw

KA type ball screws made of stainless steel are available. Please consult NSK for a custom made stainless steel ball screw.

(2) Types of surface treatment

The following are common types of treatment.

- Low temperature chrome plating
 - Used to prevent corrosion and light reflection, and for cosmetic purpose.
- Fluoride low temperature chrome plating
 - Fluoroplastic coating is provided following the low temperature chrome plating.
 - Resistance to corrosion is higher than low temperature chrome plating.
- Hard chrome plating
 - Very hard coating provides high resistance to both wear and corrosion.
- Electroless nickel plating
 - Creates a film of consistent thickness on complex shaped items.
 - For corrosion prevention.

(3) Recommended surface treatment

Among the surface treatments mentioned above, we recommend "Low temperature chrome plating" and "fluoride low temperature chrome plating" for rust prevention because of the result of humidity chamber test for antirust characteristics.

However, never apply any organic solvent for degreasing because it has adverse effect on antirust characteristics.

Table 11.1 Surface treatment length

	Applicable length
Low temperature chrome plating	5 m or less
Fluoride low temperature chrome plating	4 m or less

Refer to "1.3 Rust Prevention and Surface Treatment" (page D5) for the results of humidity chamber test.

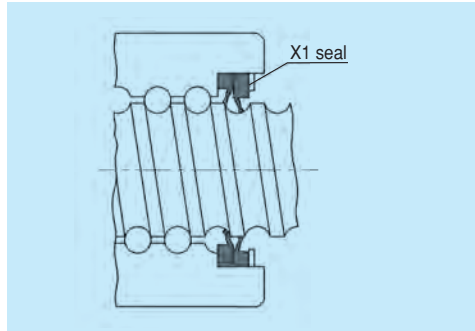


Fig. 10.5 X1 seal

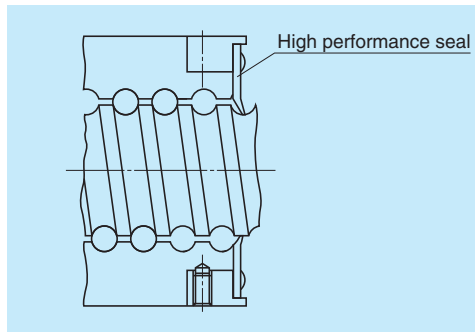


Fig. 10.6 High performance seal

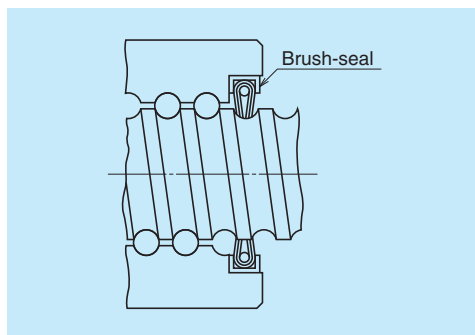


Fig. 10.7 Brush-seal for R Series

B-2-12 Ball Screw Specifications for Special Environments

B-2-12.1 Clean Environments

NSK manufactures NSK Clean Grease "LG2" and "LGU" for NSK linear guides, ball screws, and Monocarriers which are used under normal temperature and pressure in a clean room.

The LG2 and LGU grease are far more superior in stable torque characteristics than the vacuum grease which has been used as a countermeasure against dust generation. The LG2 and LGU also have a sufficient durability and dust prevention capability.

Features of "LG2" and "LGU"

- (a) Generates less dust than prevailing vacuum greases and general greases. Cleanliness is enhanced by simply switching the grease to the LG2 or the LGU.
- (b) Has extremely low and stable torque characteristics. It is ideal for high-speeds operation.
- (c) Unlike prevailing vacuum greases, the LG2 and LGU have a nature similar to general grease. Its effect is long-lasting, and sufficiently durable. They greatly contribute to minimize the frequency of maintenance.
- (d) They have an equal capability in rust prevention as general grease, and also are reliable.

When using NSK linear guides, ball screws, or Monocarriers in a clean environment, request the LG2 or LGU as a packed lubricant prior to delivery. NSK also makes bellows-tubes which contain 80 grams of the LG2 or LGU. The tube is easy to use, and is ideal for maintenance (refer to pages B413 and D19). Wash to remove adipose substances prior to use.

Refer to page D8 for their detailed nature, functions and characteristics of LG2 and LGU.

B-2-12.2 Measures for Use Under Vacuum

NSK developed MoS₂ / WS₂ spattering and dry-filmed ball screws for equipment to be used in space. NSK also makes soft-metal film (gold and silver) ball screws to be used in a vacuum environment for semiconductor and liquid crystal display processing equipment.

Lubricants widely used for ball screws in a high vacuum are:

- Vacuum grease which uses base oil of low vapor pressure.
- Solid lubricants such as MoS₂, WS₂ used mainly for equipment in space.
- Solid lubricants by soft-metal such as gold, silver, or lead film.

When used for semiconductor and liquid crystal display manufacturing equipment, the oil of the vacuum grease evaporates and causes environmental contamination. Also, it hinders creation of a super high vacuum. MoS₂ in the state of solid lubricant generates a large volume of dust, and Mo is unsuitable for semiconductors and reformed surface. Therefore, it is not suitable for the processing machines for semiconductor and liquid crystal display.

NSK recommends solid lubricant ball screws with a long life. These ball screws are treated with special silver film by NSK's unique processing technology, and can be used in a super-high vacuum. However, because of a solid lubricant, the film may peel off and stick to surface of ball grooves repeatedly, causing the torque to rise momentarily on some occasions. The drive motor should be of large capacity to handle this drastic variation of torque.

Refer to page D7 for the test data of ball screws for vacuum.

For ball screw specifications for special environments, refer to page D2.

B-2-13 Noise and Vibration

B-2-13.1 Consideration to Lowering Noise

As the machine operates at higher speeds, noise levels tend to increase. Covering the nut section is insufficient to lower noise. NSK has abundant data (NSK Motion & Control Technical Journal No.4, etc.), and offers advice to users regarding selecting ball screw.

To lower noise level in general, the following points should be taken into consideration.

- Use as a large lead as possible to reduce rotational speed.
- Use a ball screw with smaller outer diameter as possible.

(It often requires designing for critical dimensions, mandating special specification. Please consult NSK.)

For reference, noise levels by ball screws alone are plotted below. The formula for calculation is also shown below.

(a) Average value at measuring distance of 400 mm

$$\text{dB (A)} = 25.2 \{ \log_{10} (D_w \cdot d_m \cdot n \times 10^{-5}) \} + 63.9 \quad \dots 32)$$

(b) Upper limit at measuring distance of 400 mm

Average value + 6 dB (A)

D_w : Ball diameter (mm)

d_m : Ball pitch circle dia. (mm)

n : Rotational speed (min^{-1})

If measuring distance is 1 m, the average noise level is: Various noise levels minus 8 dB (A).

<<Example of calculation of noise levels>>

<Use conditions>

Nut model: DFT4010-5

From the dimension table: $D_w = 6.350$

$d_m = 41$

Maximum rotational speed: $2\,000\text{ min}^{-1}$

<Calculation>

By formula 34):

$$\begin{aligned} \text{dB (A)} &= 25.2 \{ \log_{10} (D_w \cdot d_m \cdot n \times 10^{-5}) \} + 63.9 \\ &= 25.2 \{ \log_{10} (6.350 \times 41 \times 2\,000 \times 10^{-5}) \} + 63.9 \\ &= 82\text{ dB (A)} \end{aligned}$$

The average value of noise level by ball screws alone at maximum rotational speed (measuring distance 400 mm) is 82 dB (A). Upper limit is: 82 dB (A) + 6 dB (A) = 88 dB (A). If the measuring distance is 1 m, the average value of noise level is 74 dB (A), and upper limit is 80 dB (A).

When installed, the noise of ball screw becomes higher by the noise of the machine and characteristics of machine vibration.

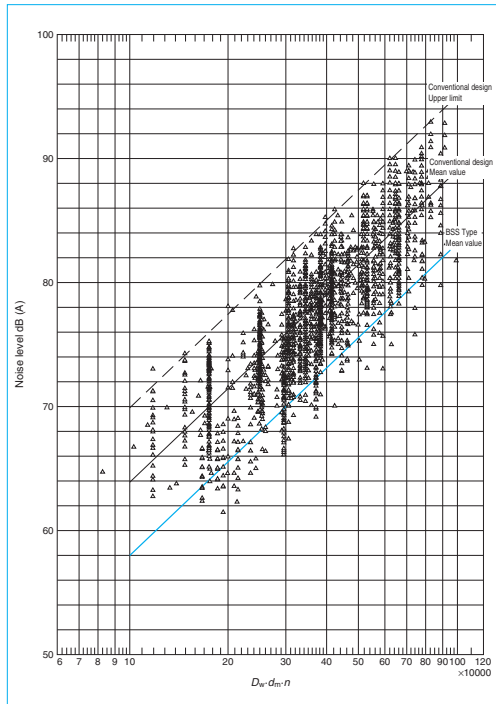
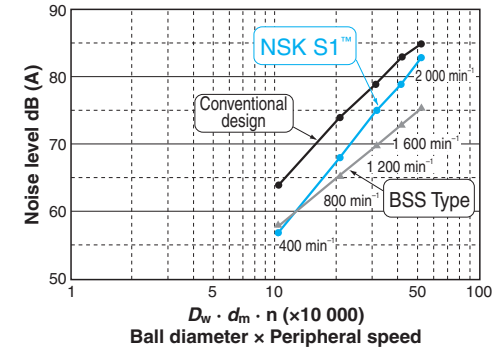


Fig. 13.1 Noise levels of ball screws

By using NSK S1, the noise is reduced and softened compared to conventional ball screws. The BSS type will furthermore reduce and soften the noise.



B-2-13.3 Consideration to Ball Screw Support System

A ball screw has low radial rigidity because its support span is longer compare to its shaft diameter. It has only small damping capacity, requiring as much support rigidity as possible through design.

A simplified support bearing system to cut costs invites noise and vibration problems. Therefore, the necessity of consideration to the ball screw support system of both shaft ends is increasingly becoming important as the speed of machines is ever-increasing.

If one shaft end must be left unfixed without support bearing due to structural reasons, noise and vibration problems may occur. These problems are related to the natural vibration frequency of the screw shaft on the unsecured end. This problem can be averted by installing an impact damper to the shaft end (Fig. 13.2). Please consult NSK for details.

B-2-13.2 Consideration to Operational Characteristics

Smooth motion is achieved by using spacer balls on conventional ball return tube type ball screws. By using NSK S1 the smoothness is further improved. The BSS type will achieve the smoothness equivalent to ball screws with NSK S1.

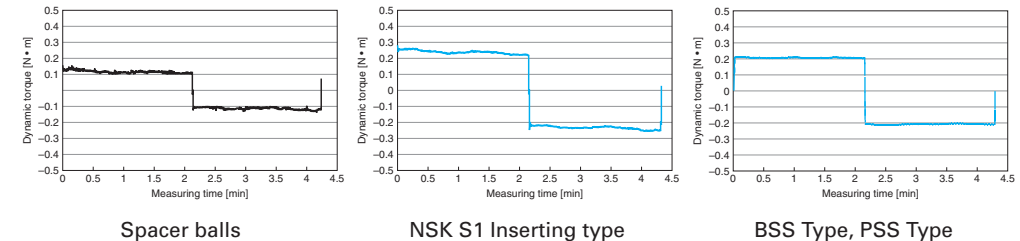
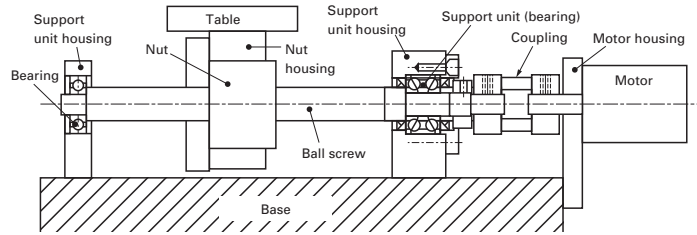


Fig. 13.2 Impact damper (Applied for patent)

B-2-14 Installation of Ball Screw

The following simplified component drawing shows a representative example of a single-axis table.



The screw shaft of the ball screw is supported by a nut and bearings, and it is driven by a motor. It is critically important to complete the centering work to ensure the predetermined operation life, functionality and accuracy of the ball screw. In general, the following accuracy is recommended for precision-class applications.

Inclination of center line: 1/2000 or less (Target: 1/5000 or less)

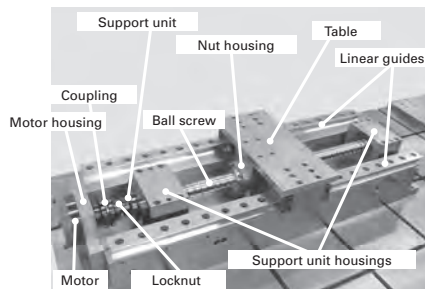
Eccentricity: 0.020 mm or less

The following problems could occur if an installation error negatively affected the ball screw:

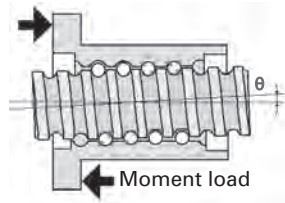
- (1) Effects on durability:
 - Lowered flaking life or wearing life.
- (2) Effects on torque characteristics:
 - Increased friction torque or torque variations.
- (3) Effects on feed rate:
 - Decreased accuracy in motion.

Overall View of Assembled Body

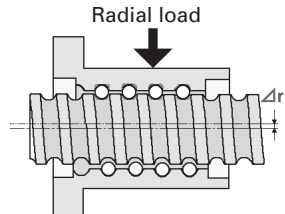
Explanations of the assembling procedure are given below, using the single-axis table as an example: In this explanation, two different installation procedures are provided: one for machine tools, where high installation accuracy is required, and another for general industrial machinery.



<Inclination of center line>

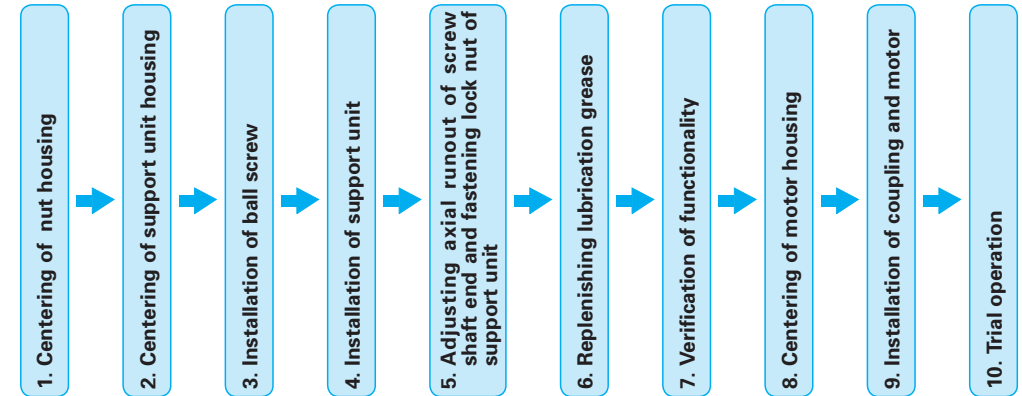


<Eccentricity>



B-2-14.1 Installation Procedure for Machine Tools, Where High Installation Accuracy Is Required

The single-axis table shall be installed according to the following procedure:

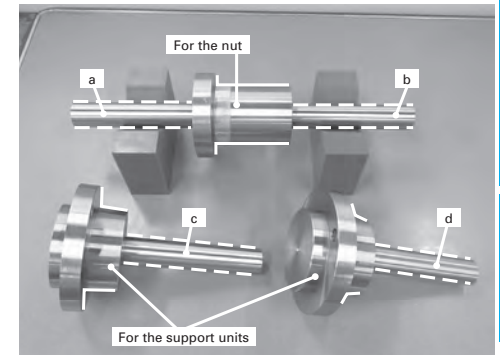


I. Jigs required for installation

Test bars:

(For the nut: one piece; for the support units: two pieces)

⇒ For centering and measurement of axial runout. The portions onto which the housing is installed (marked with the solid line) and the portions subject to measurement (a, b, c and d, marked with the broken line) shall be finished to high precision.



II. Installation of assembled body

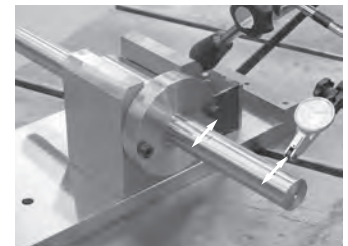
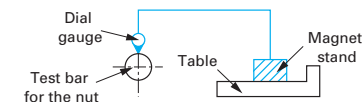
1. Centering of nut housing

1-1

Turn the table over and mount the nut housing and test bar for the nut onto it.

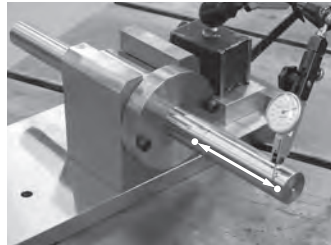
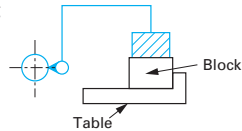
Set up a magnet stand with a dial gauge attached, taking the rear side of the table as reference. Measure two spots at the top of the test bar for the nut by moving the magnetic stand around to check the inclination in the vertical direction.

If inclination of center line is observed, adjust the surfaces on which the nut housing is installed.



1-2

Fix the magnetic stand, with the dial gauge attached, onto a block. While pressing the block toward the reference surface of the table, move the magnet stand around. Measure the side surface of the test bar for the nut, check the inclination in the horizontal direction. If inclination of center line is observed, adjust the portion where the nut housing is installed onto the table.

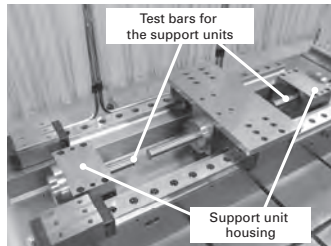


2. Centering of support unit housing

Install the linear guides onto a machine base, and then install the table, which has already been centered. (For installation of linear guides, please refer to A67 of CAT. No. 9008.)

2-1

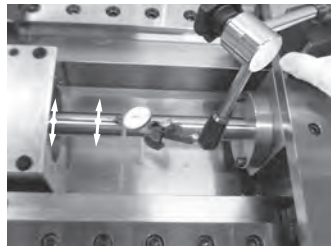
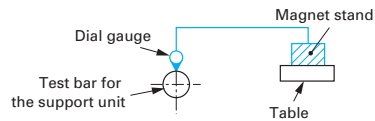
Install the test bar for the support unit onto the support unit housing.



2-2

Install the magnet stand, with the dial gauge attached, using the table as reference. While moving the table, measure the two spots at the top of the test bar for the motor-side support unit to check the inclination in the vertical direction. If inclination of center line is observed, adjust the mounting surfaces of the support unit housing.

Follow the same procedure for the opposite side of the motor.

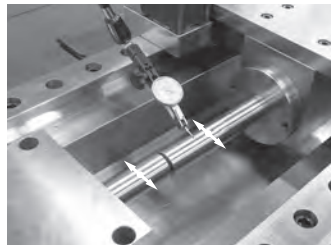
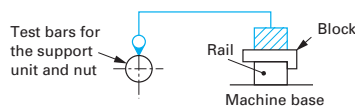


2-3

Fix the magnet stand, with the dial gauge attached, onto a block, and install the block onto the top surface of the linear guide rail. Measure the top points of the test bar for the nut and the support unit to check for eccentricity in the vertical direction.

If eccentricity is observed, adjust the mounting surface of the support unit housing.

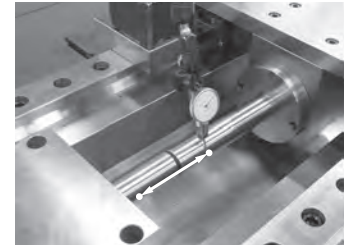
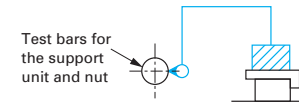
Follow the same procedure for the opposite side of the motor.



2-4

Fix the magnet stand, with the dial gauge attached, onto a block. While pressing the block toward the top surface of the linear guide rail as reference and moving it, take measurements of the side surfaces of the test bars for the nut and support unit to check for eccentricity in the horizontal direction. If eccentricity is observed, adjust the mounting surface of the support unit housing.

Follow the same procedure for the opposite side of the motor.

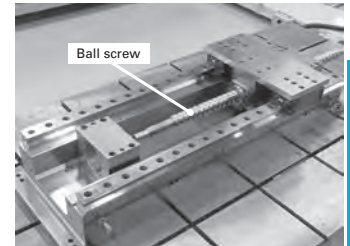


3. Installation of ball screw

Remove all test bars from the housing.

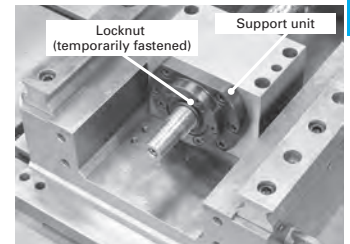
Clean the outside diameter surface of the nut and the inside diameter surface of the housing using a cloth, and install the ball screw.

Apply grease to spots with metal-to-metal contact to avoid any scratches or dents. While doing this, be careful not to drop the ball screw or hit it with anything, which might cause malfunction. If the housing must be removed in order to mount the ball screw, use a positioning pin so that the housing can be mounted back in its original position.



4. Installation of support unit

Insert the screw shaft into the support unit housing and mount the support units on both shaft ends. Fix the motor-side support unit to the housing. Fasten the locknut temporarily. Follow the same procedure for the opposite side of the motor.



5. Adjusting axial runout of screw shaft end and fastening lock nut of support unit

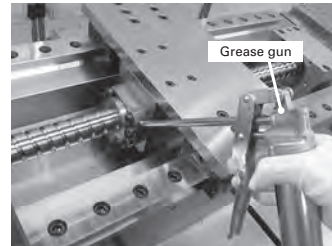
Bring the dial gauge into contact with the top of the shaft end. Then, while rotating the screw shaft, measure the runout of the shaft end. While adjusting the shaft end runout, fasten the locknut to attain the required fastening torque.

Follow the same procedure for the opposite side of the motor.



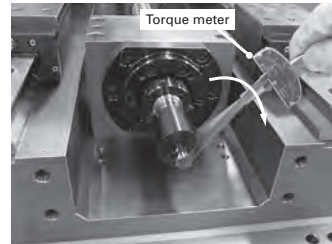
6. Replenishing lubrication grease

Wipe away the antirust oil from the empty ball screw, to which grease has not been applied, and supply grease through the grease hole to fill the inside. (Supply the grease while rotating the ball screw in the direction that moves grease toward the inside of the nut. This will lubricate the ball screw evenly.)
If you use a ball screw already filled with grease, it is not necessary to add more.



7. Verification of functionality

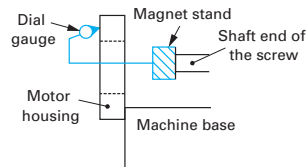
To check whether the ball screw has been installed accurately, verify its functionality. Measure the driving torque with a torque meter over the entire movable range of the screw. Confirm (including by touch) that there are no abnormalities.



8. Centering of motor housing

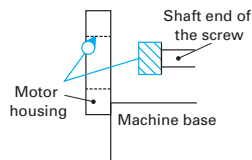
8-1

Install the motor housing, and mount the dial gauge onto the shaft end of the ball screw. Rotate the screw shaft to check the inclination of the motor housing, with the stylus of the dial gauge in contact with the end face of the motor housing. If inclination of the end surface of the motor housing is observed, adjust the mounting surface of the motor housing.



8-2

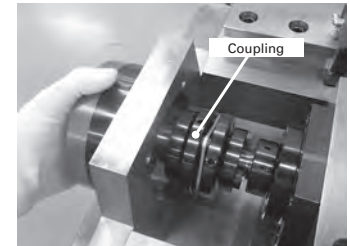
Set up the dial gauge onto the end face of the ball screw. Rotate the screw shaft to check eccentricity, with the stylus touching the inside diameter surface of the motor housing. If eccentricity is observed, adjust it by installing the motor housing appropriately.



9. Installation of coupling and motor

Mount the coupling onto the shaft end of screw, and install motor.

Fasten the bolts of the coupling to connect the shaft end with motor shaft.



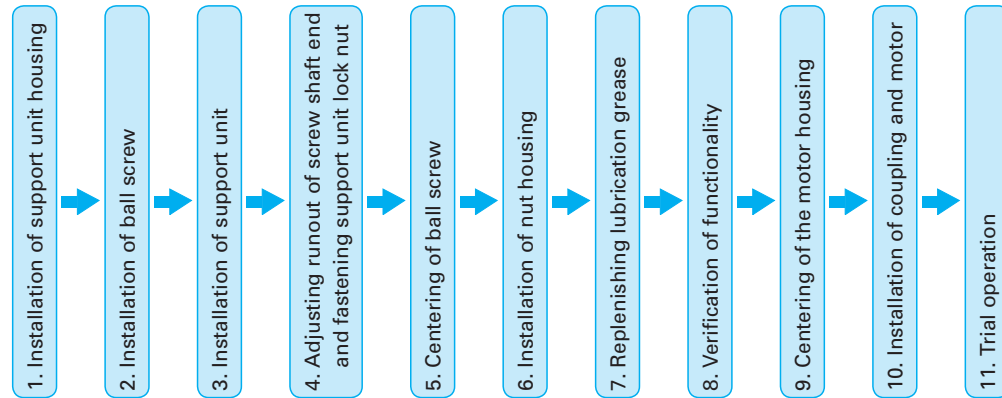
10. Trial operation

At the beginning, run the assembly at low speed to check for vibrations and noise. Then, run it at moderate speed, and finally at high speed and check for abnormalities. Then run it continuously for approximately two hours, carry out a running-in operation and at the same time check for any abnormalities. During this running-in operation, the excessive grease inside of the nut is pushed out of the nut. Wipe it away.

B-2-14.2 Installation Procedure for General Industrial Machinery

In this procedure, the ball screw is installed with the accuracy required for the linear guide. The centering of nut and table are adjusted by installing the nut housing appropriately. Since no test bars are required and the inside diameter of the nut housing does not need to be fit with the nut, the ball screw can be installed relatively easily and cheaply.

The installation procedure used for the single-axis table is shown below:



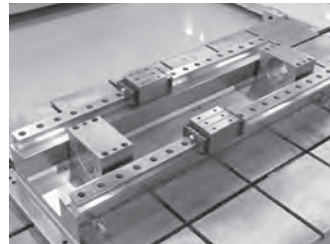
I. Installation of assembled body

1. Installation of support unit housing

Install the linear guide onto the machine base.

(For installation procedure for linear guide, please refer to A67, CAT. No. 9908.)

Place the support unit housing at the predetermined position and fasten it temporarily.

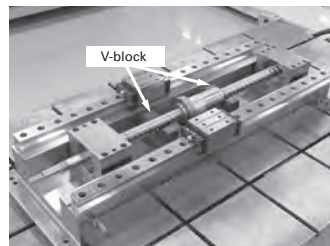


2. Installation of ball screw

Clean the outside diameter surface of the nut and the inside diameter surface of the housing using a cloth, and install the ball screw.

Apply grease to spots with metal-to-metal contact to avoid scratches and dents. While doing this, be careful not to drop the ball screw or hit it with anything, which might cause malfunction.

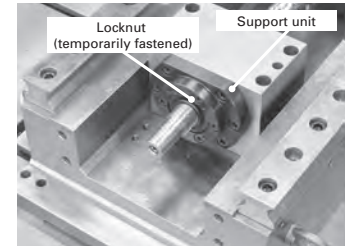
Conduct this task using a V-block to prevent scratches and dents.



3. Installation of support unit

Insert the screw shaft into support unit housing and mount support units on both shaft ends. Fix the motor-side support unit to the housing. Fasten the locknut temporarily.

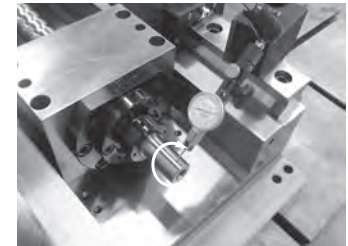
Follow the same procedure for the opposite side of the motor.



4. Adjusting runout of screw shaft end and fastening support unit locknut

Bring the dial gauge into contact with the top of the shaft end. Then, while rotating the screw shaft, measure the runout of the shaft end. While adjusting the shaft end runout, fasten the locknut to attain the required fastening torque.

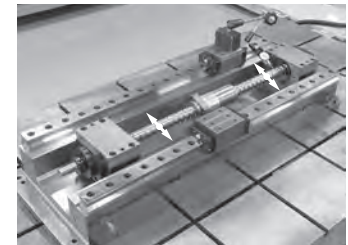
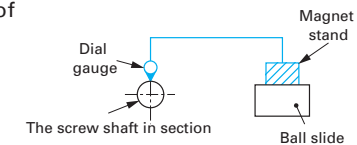
Follow the same procedure for the opposite side of the motor.



5. Centering of ball screw

5-1

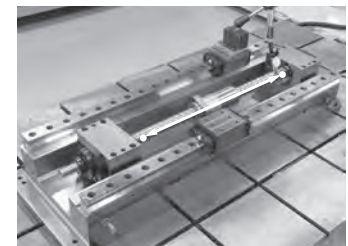
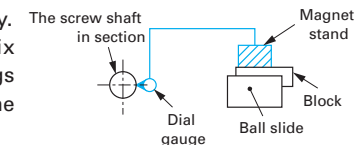
Set up a magnet stand with a dial gauge attached, using the ball slide of the linear guide as reference. Measure the top of the screw shaft in the vicinity of the support unit housing both on the motor and opposite sides to check the inclination in the vertical direction. If inclination of center line is observed, adjust the mounting surface of the support unit housing.



5-2

Fix the magnet stand, with the dial gauge attached, onto a block. While pressing the block toward the ball slide of the linear guide, move the block. Measure the side surface of the screw shaft in the vicinity of the support unit housing both on the motor and opposite sides to check the inclination in the horizontal direction. If inclination of center line is observed, adjust by installing support unit housing appropriately.

After the adjustment, fix the support unit housings of the motor side and the opposite side.

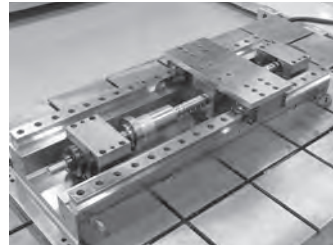


6. Installation of nut housing

6-1

Temporarily fasten the nut housing onto the table, and fasten the table, using the ball slide of the linear guide as reference surface.

To minimize the bending of the screw shaft caused by the self-weight of the nut, move the nut toward the support unit housing at the shaft end.

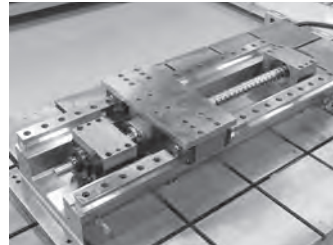


6-2

Move the table toward the nut, and fasten the nut to the nut housing.

Loosen the bolts that fasten the table to the nut housing, and re-fasten them.

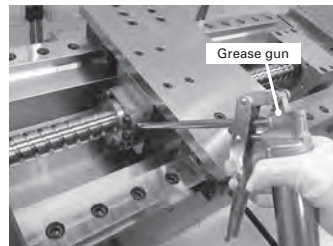
Loosen the bolts that fasten the nut housing and the nut, and re-fasten them.



7. Replenishing lubrication grease

Wipe away the antirust oil from the empty ball screw, to which grease has not been applied, and supply grease through the grease hole to fill the inside. (Supply grease while rotating the ball screw in the direction that moves grease toward the inside of the nut. This will lubricate the ball screw evenly.)

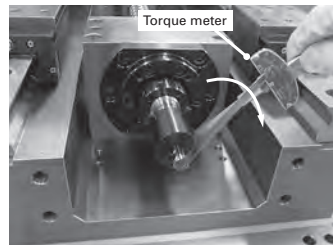
If you use a ball screw already filled with grease, it is not necessary to add more.



8. Verification of functionality

To check whether the ball screw has been installed accurately, verify its functionality. Measure the driving torque with a torque meter over the entire movable range of the screw.

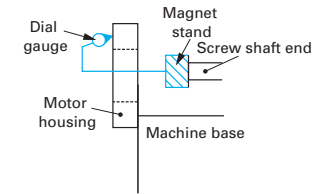
Confirm (including by touch) that there are no abnormalities.



9. Centering of motor housing

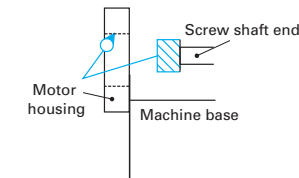
9-1

Install the motor housing, and mount the dial gauge onto the end face of the ball screw. Rotate the screw shaft to check the inclination of the motor housing, with the stylus of the dial gauge in contact with the end face of the motor housing. If inclination of center line is observed, adjust the mounting surface of the motor housing.



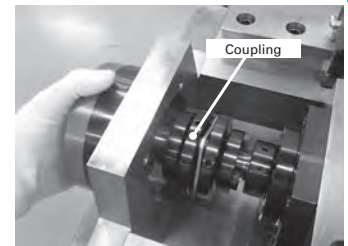
9-2

Set up the dial gauge onto the end face of the screw shaft. Rotate the screw shaft to check eccentricity, with the stylus touching the inside-diameter surface of the motor housing. If eccentricity is observed, adjust it by installing the motor housing appropriately.



10. Installation of coupling and motor

Mount the coupling onto the shaft end, and install the motor. Fasten the bolts of the coupling to connect the shaft end with the motor shaft.



11. Trial operation

At the beginning, run the assembly at low speed to check for vibrations and noise. Then, run it at moderate speed, and finally at high speed and check for abnormalities. Then run it continuously for approximately two hours, carry out a running-in operation and at the same time check for any abnormalities. During this running-in operation, the excessive grease inside of the nut is pushed out of the nut. Wipe it away.

B-2-15 Precautions for Designing Ball Screw

B-2-15.1 Safety System

As shown in the illustration on page B352, a stopper is installed in some cases to prevent the nut from overrunning due to malfunction of the safety system of the machine itself, or human error during operation.

The travel stopper should be installed at a place where it will not come into contact with the nut when the nut reaches the designed stroke end.

An impact absorbing travel stopper (NSK patent, refer to page B414) is available at NSK.

B-2-15.2 Design Cautions to Assembling Ball Screw

(1) Cutting through the thread screw to the end

For some recirculation system, such as the deflector(bridge) type, end cap type, S1 specification (High-Load drive ball screws etc.) and a part of end deflector type, one end of the thread screw should be cut through to the end of the major diameter. This is necessary to assemble the ball nut to the screw shaft (**Fig. 15.1**).

In this case, the shaft end diameter, to where this "cut-through thread" is made, should be 0.2 mm or smaller than the ball groove root diameter " d_r ". (See the dimension table.) A similar precaution is required when it is absolutely necessary to remove the nut from the screw shaft in order to install the ball screw to the machine. Also, in case using the cut-through end as the shoulder of the support bearing, make certain that a sufficient amount of the effective flat surface is left from the root diameter. If it is insufficient, the bearing cannot be installed perpendicularly to the bearing seat. (**Fig. 15.2**)

(2) Designing the screw shaft end and the nut mounting area

When installing a ball screw to the machine, avoid a design which makes it necessary to separate the nut from the screw shaft as shown in **Fig. 15.3**. If separated, the balls may fall out. The separation may also deteriorate the ball screw accuracy, or may damage the ball screw. If separating them is unavoidable, please furnish NSK with the component which is to be installed between the nut and screw shaft. NSK will install the component prior to delivery.

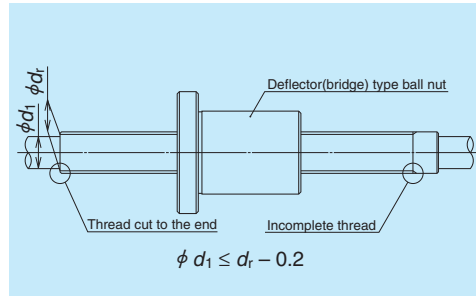


Fig. 15.1 Shaft end of a deflector (bridge) recirculation system ball screw

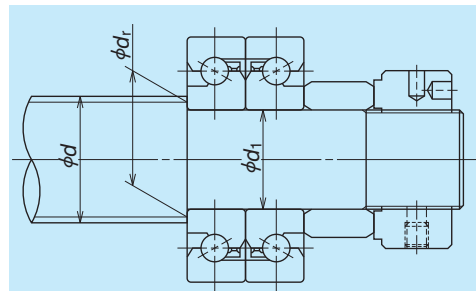


Fig. 15.2 Support bearing and end face (shoulder) for installation

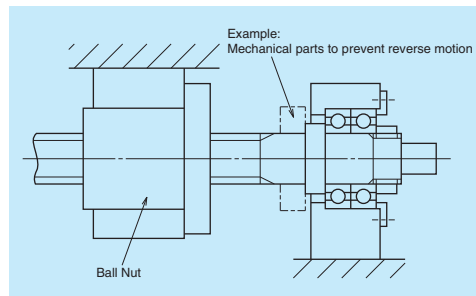


Fig. 15.3 Nut and ball screw are required to be separated when installing in this structure.

(3) Removing the nut from the screw shaft at the time of assembly

If it is unavoidable, use an arbor (**Fig. 15.4**), keeping the balls in the nut. In this case, the outside diameter of the arbor should be approximately 0.2 mm to 0.4 mm smaller than the ball groove root diameter " d_r ".

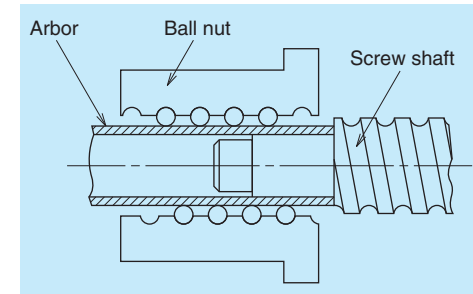


Fig. 15.4 Arbor to install and remove nut

(4) Centering of the ball nut when installing

When installing the nut as shown in **Fig. 15.5**, provide a space between the housing and the nut body diameter, allowing the centering to be performed.

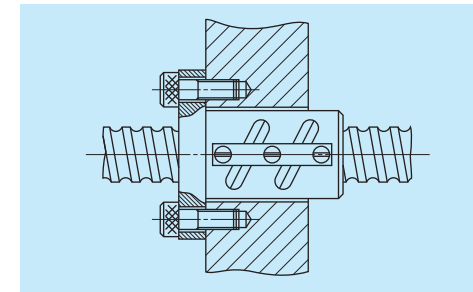


Fig. 15.5 Fixing a ball nut by flange

(5) Preventing the thread screw of nut from loosening

When installing and securing the nut to the housing at the thread screw section, as in the case for RNCT type of R Series ball screws, apply an agent which prevents the nut from loosening.

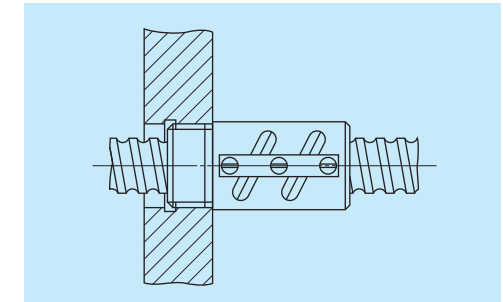


Fig. 15.6 Fixing a ball nut with thread screw

(6) Installation of brush-seal to the nut

If a brush-seal is installed at the thread screw side of the nut similar to the RNCT type which comes with a thread screw, the brush-seal should be secured as shown in **Fig. 15.7**.

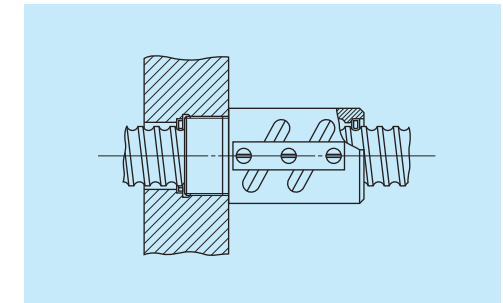


Fig. 15.7 Installation of brush-seal to a ball nut with thread screw

B-2-15.3 Effective Stroke of Ball Screw

When hardened by the induction hardening, the hardness of a ball screw may be slightly low at both ends of the screw section. Consider this low hardness prior to determining the length of effective stroke. Please consult NSK for details.

B-2-15.4 Matching after Delivery

When, after the delivery of a ball screw, you require drill knock pin hole on the screw shaft end, or at the nut mounting area, please inform NSK on the position and size of the hole. NSK will take a measure and protect designated spots from heat treatment prior to delivery to make subsequent machining easy.

B-2-15.5 "NSK K1™" Lubrication Unit

When using the NSK K1 lubrication unit, be aware of the operating temperature and chemicals that come to contact the unit for keeping the K1's best performance.

Temperature range for use:

Maximum temperature; 50°C

Momentary maximum temperature; 80°C

Chemicals that should not come to contact:

Do not leave the K1 unit in organic solvent, white kerosene such as hexane, thinner which removes oil, and rust preventive oil which contains white kerosene.

Water-type cutting oil, oil-type cutting oil, grease such as mineral-type AS2 and ester-type PS2 do not damage the K1 unit.

B-2-16 Shaft End Machining

You require to machine shaft ends in the following three occasions.

- * Precision ball screws with blank shaft end.
- * Ball screws in R Series with blank shaft end (see page B349).
- * Additional machining of a completed ball screw

The following are the summaries of machining of these shaft ends. For details, please contact NSK.

(1) Machining of blank shaft ends of precision ball screws

(a) Cutting screw shaft

Use a cutting whetstone or the like to cut the shaft, leaving stock for turning. Keep the nut in the assembled state to the screw shaft, and open only one side of the plastic wrapping bag, expose only the shaft end section to be machined, and then cut the screw shaft. This prevents foreign matters from entering to the ball screw section. Do the same for other machining.

(b) Precautions in cutting shaft end

Outside of the screw shaft is ground with precision (excluding R Series). There is a center hole in the ends. Use them for centering. Do not rotate the shaft quickly or stop it suddenly, or the nut might move along the shaft. We recommend securing the nut with tape. To machine a very long shaft, apply work rests to the screw shaft surface to suppress vibration (especially caused by critical speed).

(c) Turning by lathe

Cut to the length, turn shaft end steps, turn thread screw, and provide the center hole. Refer to JIS B1192 which sets standards for the shaft end accuracy.

(d) Processing by grinding

Apply the same precautions as for cutting for centering, securing nut, and work rest. Grind sections where the bearings and a "Spann ring" are installed.

e) Milling processing

Process keyways and tooth seats for lock washers.

(f) Deburring, washing, and rust prevention
Wash with clean white kerosene after processing. Apply lubricant for immediate use. For later use, apply rust preventive agent.

Note: Contact NSK if nut is accidentally removed.

B-2-17 Ball Screw Selection Exercise

Drill 1: High-speed transporting system

1. Design conditions

Table mass : $m_1 = 40 \text{ kg}$
 Mass of the transporting item : $m_2 = 20 \text{ kg}$
 Maximum stroke : $S_{\max} = 700 \text{ mm}$
 Rapid traverse speed : $V_{\max} = 1\,000 \text{ mm/sec}$ (60 m/min)
 Positioning accuracy : $\pm 0.05/700 \text{ mm}$ (0.005 mm/pulse)
 Repeatability : $\pm 0.005 \text{ mm}$
 Required life : $L_t = 25\,000 \text{ h}$ (5 years)
 Guide way (rolling) : $\mu = 0.01$ (friction coefficient)
 Drive motor : AC servo motor
 $(N_{\max} = 3\,000 \text{ min}^{-1})$

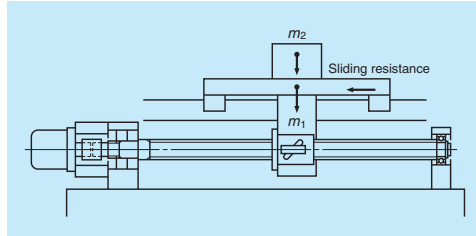


Fig. 16.1 System appearance

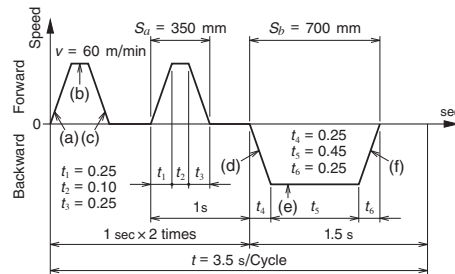


Fig. 16.2 Operating condition

2. Selection of basic factors

(1) Selection of accuracy grade and axial play

According to Table 4.1 "Accuracy grades of ball screw and their application" on page B19, the accuracy grade of ball screws for Cartesian type industrial robots is C5 to Ct10.

From the following conditions in design, the axial play should be 0.005 mm or less.

Repeatability : $\pm 0.005 \text{ (mm)}$

Resolution : 0.005 mm/pulse

According to Table 4.2 "Combinations of accuracy grades and axial play" on page B20, you will require the accuracy grade C5 to satisfy the axial play of 0.005 mm or less. Therefore select the accuracy grade C5, and the axial play of 0 mm (Z-preload).

(2) Selection of lead

Calculate the lead l based on maximum speed of AC servo motor and the rapid traverse speed $V_{\max}$.

$$l \geq \frac{V_{\max}}{N_{\max}} = \frac{1\,000 \times 60}{3\,000} = 20 \text{ (mm)}$$

Select a lead l of 20 mm or larger.

(3) Selection of screw shaft diameter

According to the Table 4.4 "Shaft diameter, lead and stroke of standard ball screw" on page B21, the screw shaft diameter d which has a lead l larger than 20 mm should be in the range of 15 mm to 32 mm. Select the smallest 15 mm.

(4) Selection of stroke

From the Table 4.4 "Screw shaft diameter, lead, and stroke of standard ball screw" on page B21, a ball screw with shaft diameter (d) of 15 mm and lead (l) of 20 mm meets maximum stroke of 700 mm, therefore it is possible to select from the standard ball screws. The primary selection is as follows:

Primary selection:

Shaft diameter : 15 (mm)
 Lead : 20 (mm)
 Stroke : 700 (mm)
 Accuracy grade : C5
 Axial play : Z

3. Confirmation of standard ball screw

In consideration of delivery time and price, select from the standard ball screws with finished shaft ends.

Primary candidate: W1507FA-3PG-C5Z20

4. Basic safety check

Let's examine the primary candidate.

(1) Allowable axial load

[1] Calculation of allowable axial load

From Fig. 16.2: Acceleration α_1 at accelerating / decelerating is:

$$\alpha_1 = \frac{V_{\max}}{t_1} = \frac{1\,000}{0.25} = 4\,000 \text{ (mm/s}^2\text{)} = 4 \text{ (m/s}^2\text{)}$$

Axial load F_1 is:

(At the time of acceleration (a)(d))

$$\begin{aligned} F_1 &= \mu (m_1 + m_2) \times g + (m_1 + m_2) \times \alpha_1 \\ &= 0.01 \times (40 + 20) \times 9.80665 + (40 + 20) \times 4 \\ &= 246 \text{ (N)} \end{aligned}$$

(At the time of constant speed (b)(e))

$$\begin{aligned} F_2 &= \mu (m_1 + m_2) \times g = 0.01 \times (40 + 20) \times 9.80665 \\ &= 6 \text{ (N)} \end{aligned}$$

(At the time of deceleration (c)(f))

$$\begin{aligned} F_3 &= -\mu (m_1 + m_2) \times g + (m_1 + m_2) \times \alpha_1 \\ &= -0.01 \times (40 + 20) \times 9.80665 + (40 + 20) \times 4 \\ &= 234 \text{ (N)} \end{aligned}$$

Thus, the maximum axial load P is 246 N.

[2] Buckling load

W1507FA-3PG-C5Z20 has the support length of 804 mm ("La" as per the dimension table on page B193), and must support maximum axial load (P) of 246 (N). The supporting condition of screw shaft is "Fixed - Simple", and the supporting condition of ball nut is "Fixed". Due to the direction of the load, the whole ball screw supporting condition is "Fixed - Fixed" support (Factor $m = 19.9$).

From formula 2) on page B44:

$$\begin{aligned} d &\geq \left[\frac{P \cdot L_a^2}{m} \times 10^{-4} \right]^{1/4} = \left[\frac{246 \times 804^2}{19.9} \times 10^{-4} \right]^{1/4} \\ &= 5.3 \text{ (mm)} \end{aligned}$$

W1507FA-3PG-C5Z20 has the dimension (dr) of 12.2 mm as per the dimension chart (page B193) and therefore meets the condition.

Result: Acceptable

(2) Allowable rotational speed

The permissible rotational speed listed in the dimension table is $3\,000 \text{ min}^{-1}$. Since the motor maximum rotational speed is $3\,000 \text{ min}^{-1}$, the operation is in the range of permissible rotational speed.

Result: Acceptable

(3) Checking life expectation

[1] Mean load F_m and mean rotational speed N_m
 From the calculation of axial load, rotational speed N_i and the operating time t_i is:

(At the time of acceleration (a)(d))

$$F_1 = 246 \text{ (N)}$$

$$N_1 = \frac{n}{2} = \frac{3\,000}{2} = 1\,500 \text{ (min}^{-1}\text{)}$$

$$t_a = 2 \times t_1 + t_4 = 0.75 \text{ (s)}$$

(At the time of constant speed (b)(e))

$$F_2 = 6 \text{ (N)}$$

$$N_2 = 3\,000 \text{ (min}^{-1}\text{)}$$

$$t_b = 2 \times t_2 + t_5 = 0.65 \text{ (s)}$$

(At the time of deceleration (c)(f))

$$F_3 = 234 \text{ (N)}$$

$$N_3 = 1\,500 \text{ (min}^{-1}\text{)}$$

$$t_c = 2 \times t_3 + t_6 = 0.75 \text{ (s)}$$

Calculation result is shown in Table 16.1

Table 16.1 Axial load and rotational speed

Operating condition	Axial load (N)	Rotational speed (mean) (min ⁻¹)	Operating time (s)
(a) (d)	$F_1 = 246$	$N_1 = 1\,500$	$t_a = 0.75$
(b) (e)	$F_2 = 6$	$N_2 = 3\,000$	$t_b = 0.65$
(c) (f)	$F_3 = 234$	$N_3 = 1\,500$	$t_c = 0.75$

From the formulas 11) and 12) on page B53:

$$\begin{aligned} F_m &= \left[\frac{F_1^3 \cdot N_1 \cdot t_a + F_2^3 \cdot N_2 \cdot t_b + F_3^3 \cdot N_3 \cdot t_c}{N_1 \cdot t_a + N_2 \cdot t_b + N_3 \cdot t_c} \right]^{1/3} \\ &= 195 \text{ (N)} \end{aligned}$$

$$\begin{aligned} N_m &= \frac{N_1 \cdot t_a + N_2 \cdot t_b + N_3 \cdot t_c}{t} \\ &= 1\,200 \text{ (min}^{-1}\text{)} \end{aligned}$$

[2] Calculation of life expectancy

At the basic dynamic load rating C_a of W1507FA-3PG-C5Z20 (Clearance Z) is 5 660 N (as per the dimension table on page B193), from the formulas 8) and 9) on page B53:

$$L_t = \left(\frac{C_a}{F_m \cdot f_w} \right)^3 \times \frac{1}{60 N_m} \times 10^6$$

$$= \left(\frac{5\,660}{195 \times 1.2} \right)^3 \times \frac{1}{60 \times 1\,200} \times 10^6$$

$$\doteq 196\,500$$

The ball screw satisfies the required life.

Result: Acceptable

5. Check for other requirements

(1) Accuracy and axial play

As per the dimension table on page B180 and **Table 1.2** for the permissible value of lead accuracy on page B38:

According to **Table 1.2**:

Accuracy grade: C5

$$e_p = \pm 0.035/800 \text{ (mm)}$$

$$v_u = 0.025 \text{ (mm)}$$

This grade satisfies the required positioning accuracy of $\pm 0.05/700$ mm.

The checking of axial play is omitted here since it is explained in "2. Selection of basic factors."

(2) Drive torque

Required specifications are as follows.

Motor rotational speed: 3 000 min⁻¹

Time to reach maximum speed: Less than 0.25 sec

[1] Load (converted to the motor axis)

Using the formula 30) and 31) on page B64, calculate the moment of inertia whereas γ is the material density of the ball screw.

(Screw shaft)

$$J_b = \frac{\pi \cdot \gamma \cdot D^4 \cdot L}{32} = \frac{\pi \times 7.8 \times 10^{-3}}{32} \times 1.5^4 \times 80$$

$$= 0.31 \text{ (kg} \cdot \text{cm}^2)$$

(Moving part)

$$J_w = m \times \left(\frac{l}{2\pi} \right)^2 = 60 \times \left(\frac{2}{2\pi} \right)^2$$

$$= 6.1 \text{ (kg} \cdot \text{cm}^2)$$

(Coupling)

$$J_c = 0.25 \text{ (kg} \cdot \text{cm}^2) \cdots \text{Temporary}$$

(As a whole)

Moment of inertia of the ball screw J_L is:

$$J_L = J_b + J_w + J_c$$

$$= 0.31 + 6.1 + 0.25$$

$$= 6.7 \times 10^{-4} \text{ (kg} \cdot \text{m}^2)$$

[2] Driving torque

We assume that WBK12-01 compact light load type is used as recommended for W1507FA-3PG-C5Z20, and the moment of inertia of motor (J_M) is 3.1 (kg · cm²) (3.1 × 10⁻⁴ kg · m²).

(At the time of constant speed)

The torque which is necessary to drive the ball screw at a constant speed resisting to external loads is: per formula 28) on page B64

$$T_1 = T_a + T_{pmax} + T_u$$

In this formula, T_a is the drive torque at constant speed, T_{pmax} is the upper limit of the dynamic friction torque of ball screw, and T_u is the friction torque of the support bearings.

From the chart on pages B193 and B400, (T_{pmax}) is 7.8 (N · cm) and (T_u) is 2.1 (N · cm) respectively.

$$T_a = \frac{F_a \cdot l}{2\pi\eta_1}$$

Using formula 26) on page B63, the drive torque at a constant speed T_1 is:

$$T_1 = \frac{F_a \cdot l}{2\pi \cdot \eta_1} + T_{pmax} + T_u$$

$$= \frac{6 \times 2}{2\pi \times 0.9} + 7.8 + 2.1$$

$$= 12 \text{ (N} \cdot \text{cm)} = 0.12 \text{ (N} \cdot \text{m)}$$

(At the time of acceleration)

The drive torque necessary for accelerating the ball screw resisting axial load can be calculated by the formula 29) on page 64.

$$T_2 = T_1 + J \cdot \frac{2\pi \cdot n}{60t_1}$$

$$= T_1 + (J_L + J_M) \cdot \frac{2\pi \cdot n}{60t_1}$$

$$= 0.12 + (6.7 \times 10^{-4} + 3.1 \times 10^{-4}) \frac{2\pi \times 3\,000}{60 \times 0.25}$$

$$= 1.35 \text{ (N} \cdot \text{m)}$$

(At the time of deceleration)

Similarly at the time of acceleration.

$$T_3 = T_1 - J \cdot \frac{2\pi \cdot n}{60t_3}$$

$$= T_1 - (J_L + J_M) \cdot \frac{2\pi \cdot n}{60t_3}$$

$$= 0.12 - (6.7 \times 10^{-4} + 3.1 \times 10^{-4}) \frac{2\pi \times 3\,000}{60 \times 0.25}$$

$$= -1.11 \text{ (N} \cdot \text{m)}$$

[3] Selection of motor

Selection conditions are as follows.

Maximum rotational speed: $N_M \geq 3\,000 \text{ (min}^{-1})$

Motor rating torque: $T_M \geq T_{rms} \text{ (N} \cdot \text{m)}$

(T_{rms} : Effective torque)

Moment of inertia of the motor: $J_M > J_L/3$ or more

Form above: select an AC servo motor with the following specifications.

Motor specifications:

Rating power output: $W_M = 300 \text{ (W)}$

Maximum rotational speed:

$$N_M = 3\,000 \text{ (min}^{-1})$$

Rating torque: $T_M = 1 \text{ (N} \cdot \text{m)} = 1 \times 10^2 \text{ (N} \cdot \text{cm)}$

Moment of inertia: $J_M = 3.1 \times 10^{-4} \text{ (kg} \cdot \text{m}^2)$
 $= 3.1 \text{ (kg} \cdot \text{cm}^2)$

[4] Check on effective torque

Effective torque T_{rms} can be calculated as follows:

$$T_{rms} = \sqrt{\frac{T_2^2 \times t_a + T_1^2 \times t_b + T_3^2 \times t_c}{t}}$$

$$= \sqrt{\frac{1.35^2 \times 0.75 + 0.12^2 \times 0.55 + 1.11^2 \times 0.75}{3.5}}$$

$$= 0.81$$

Thus the condition of " $T_M \geq T_{rms}$ " is cleared.

[5] Check on time to reach maximum speed

The time required to reach the rapid traverse speed can be calculated as follows. Whereas $T_M' = 2 \times T_M$:

$$t_a = \frac{(J_L + J_M) \times 2\pi \cdot n}{(T_M' - T_1)} \times 1.4$$

$$= \frac{(6.7 \times 10^{-4} + 3.1 \times 10^{-4}) \times 2\pi \times 3\,000}{(2 \times 1 - 0.12) \times 60} \times 1.4$$

$$= 0.23$$

Thus the ball screw meets the requirement of "0.25 sec or less".

From the above, use W1507FA-3PG-C5Z20

Drill 2: Processing table for special machines

1. Design conditions

Table mass: $m_1 = 1\,000\text{ kg}$
 Mass of the work: $m_2 = 600\text{ kg}$
 Maximum stroke: $S_{\max} = 1\,000\text{ mm}$
 Maximum speed: $V_{\max} = 15\,000\text{ mm/min}$
 Positioning accuracy: $\pm 0.035/1\,000\text{ mm (no load)}$
 * Attitude accuracy of the table and thermal displacement are not included in the accuracy requirement of the ball screw.
 Repeatability: $\pm 0.005\text{ mm (no load)}$
 Lost motion: $0.020\text{ mm (no load)}$
 Required life expectancy: $L_t = 20\,000\text{ h}$
 ($16^{\text{h}} \times 250^{\text{days}} \times 10^{\text{years}} \times 0.5^{\text{rate of operation}}$)
 Guide way (sliding): $\mu = 0.15$
 (friction coefficient)
 Processing: Milling and drilling
 Drive motor: AC servo motor
 ($N_{\max} = 2\,000\text{ min}^{-1}$)

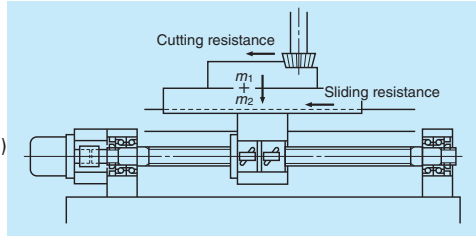


Fig. 16.3 System appearance

Table 16.2 Operating conditions

Operation	Axial load (N)		Feed speed (mm/min)	Use time ratio (%)
	Cutting resistance	Sliding resistance		
Rapid traverse	0	2 354	15 000	30
Light/medium cutting	4 000	2 354	500	50
Heavy cutting	8 000	2 354	100	20

* Sliding resistance: $F_r = \mu (m_1 + m_2) g = 0.15 \times (1\,000 + 600) \times 9.80665 = 2\,354\text{ (N)}$

* Ignore the inertia force at the time of acceleration/deceleration because their time rate is negligibly short.

2. Selection of basic factors

(1) Selection of accuracy grade and axial play

The proper accuracy grade for machining centers should be in the range from C1 to C5 according to "Table 4.1 Accuracy grades of ball screws and their applications" on page B19. Assuming the nut length is 200 mm and margin stroke is 100 mm, the shaft length L_0 is obtained as follows:

$$L_0 = \text{Maximum stroke} + \text{nut length} + \text{margin} \\ = 1\,000 + (200) + (100) = 1\,300$$

From "Table 1.2 Tolerance on specified travel and travel variation of the positioning ball screws" on page B38, the accuracy factors which satisfy the required function are:

Accuracy C3 grade

$$e_p = \pm 0.029/1\,600\text{ (mm)}$$

$$v_u = 0.018\text{ (mm)}$$

Considering the importance of lost motion, select the Z code (axial play 0 mm and less) for the axial play.

(2) Selection of lead

From the maximum rotational speed of AC servo motor $N_{\max}$ and rapid traverse speed of table $V_{\max}$, lead l is:

$$l \geq \frac{V_{\max}}{N_{\max}} = \frac{15\,000}{2\,000} = 7.5\text{ (mm)}$$

A larger lead l would be beneficial for a higher feed speed. But from the view of the control system (resolution), the lead l is limited to 8 mm or 10 mm.

(3) Selection of screw shaft diameter

According to Table 4.4 "Screw shaft diameter, lead and stroke of standard ball screw" on page B21, the screw shaft diameter with the lead of 8 mm or 10 mm are in the range of 10 mm to 50 mm. Placing more importance on rigidity than to the volume of lost motion, select a relatively large size in the range of 32 mm to 50 mm.

(4) Selection of stroke

Select 1 000 mm, the maximum stroke as specified in the design condition.

Primary selection:

Standard ball screw

Shaft diameter: 32, 36, 40, 45, 50 mm

Lead: 8, 10 mm

Stroke: 1 000 mm

grade: C3

Axial play code: Z

3. Confirmation of standard ball screw

Giving consideration to delivery time and price, select a standard ball screw.

At the primary selection of C3 grade is not found in the standard ball screws. Let us check for application-oriented ball screws whether there is a C3 grade among ball screw.

4. Confirmation of made-to-order ball screw

Because standard ball screws do not meet the accuracy grade requirement, we will consider made-to-order ball screws which are based on standard ball screws but with accuracy grade of C3.

Second selection:

Made-to-order ball screw

Shaft diameter: 32, 36, 40, 45, 50 mm

Lead: 8, 10 mm

Stroke: 1 000 mm

Accuracy grade: C3

Axial play: Z

5. Selection of screw shaft diameter, lead, and nut

(1) Dynamic load rating

Obtain required load carrying capacity for each lead through load conditions. From Table 16.2 "Operating conditions" on page B91, calculate the rotation speed N_i as shown in Table 16.3.

$$N_i \geq \frac{V_i}{l}$$

Table 16.3 Load conditions

Operating condition	Axial load (N)	Rotations per minute (min^{-1})		Use time ratio (%)
		$l = 8$	$l = 10$	
Rapid traverse	$F_1 = 2\,354$	$N_1 = 1\,875$	$N_1 = 1\,500$	$t_1 = 30$
Light/medium cutting	$F_2 = 6\,354$	$N_2 = 62.5$	$N_2 = 50$	$t_2 = 50$
Heavy cutting	$F_3 = 10\,354$	$N_3 = 12.5$	$N_3 = 10$	$t_3 = 20$

By using the formulas 11) and 12) on page B53, calculate the mean load F_m and the mean rotational speed N_m as shown below.

$$F_m = \left(\frac{F_1^3 \cdot N_1 \cdot t_1 + F_2^3 \cdot N_2 \cdot t_2 + F_3^3 \cdot N_3 \cdot t_3}{N_1 \cdot t_1 + N_2 \cdot t_2 + N_3 \cdot t_3} \right)^{1/3}$$

$$N_m = \frac{N_1 \cdot t_1 + N_2 \cdot t_2 + N_3 \cdot t_3}{t}$$

Table 16.4 Mean load and mean rotational speed

Lead (mm)	8	10
Mean load F_m (N)	3 122	3 122
Mean rotational speed N_m (min^{-1})	596	477

Required dynamic load rating C_a is:

Using the formulas 8) and 9) on page B53, calculate the required dynamic load rating.

$$C_a \geq (60 N_m \cdot L_t)^{1/3} \cdot F_m \cdot f_w \times 10^{-2} (N)$$

Whereas required life expectancy $L_t = 20\,000$ (h), load coefficient $f_w = 1.2$ (refer to page B53),

$$l = 8 \text{ (mm)} \dots\dots\dots C_a \geq 33\,500 \text{ (N)}$$

$$l = 10 \text{ (mm)} \dots\dots\dots C_a \geq 31\,100 \text{ (N)}$$

(2) Selection of the nut

Due to the requirement on the lost motion, the nut will be selected as follows emphasizing the importance of system rigidity.

Table 16.5 shows the dynamic load rating of each specification.

- Standard nut ball screw, tube type
- Model: ZFT or DFT (pages B439 to B468)
- Number of turns of balls: Select from 2.5 turns 2 circuits or 2.5 turns 3 circuits

From **Table 16.5** select item that meets required dynamic load rating C_a as follows:

Third selection: In the range surrounded by the dotted lines ☐ in **Table 16.5**

Table 16.5 Dynamic load rating of each specification

Screw shaft diameter (mm)	Dynamic load rating C_a : (N)			
	Lead 8 mm		Lead 10 mm	
	2.5 turns 2 circuits	2.5 turns 3 circuits	2.5 turns 2 circuits	2.5 turns 3 circuits
32	37 300	—	54 500	—
36	—	—	58 000	—
40	41 100	—	61 200	—
45	—	—	65 800	93 300
50	45 700	64 800	68 100	96 500

(3) Permissible rotational speed

[1] Critical speed

Check if the rapid traverse speed of 15 000 mm/min (V_{max}) clears the critical speed. Ball screw rotational speed at each lead N is:

$$l = 8 \text{ (mm)} \dots\dots\dots N = 1\,875 \text{ (min}^{-1}\text{)}$$

$$l = 10 \text{ (mm)} \dots\dots\dots N = 1\,500 \text{ (min}^{-1}\text{)}$$

From the formula 7) on page B47, screw shaft root diameter to meet critical speed requirement is:

$$d \geq \frac{N \cdot L_a^2}{f} \times 10^{-7} \text{ (mm)}$$

In this formula, unsupported length L_a is:

$$L_a = \text{Maximum stroke} + \text{nut length}/2 + \text{shaft end extra length}$$

$$= 1\,000 + 100 + 200 = 1\,300 \text{ (mm)}$$

Supporting condition of the screw shaft is Fixed - Fixed support, and that of the ball nut is Fixed. Therefore, supporting condition is Fixed - Fixed support (Factor $f = 21.9$)

$$l = 8 \text{ (mm)} \dots\dots d_r \geq 14.5 \text{ (mm)}$$

$$l = 10 \text{ (mm)} \dots\dots d_r \geq 11.6 \text{ (mm)}$$

[2] $d \cdot n$ value

From **Table 3.2** on page B50, as the $d \cdot n$ is 70 000 or less, screw shaft diameters to meet the $d \cdot n$ are:

$$d \leq \frac{70\,000}{N} \text{ (mm)}$$

$$l = 8 \text{ (mm)} \dots\dots\dots d \leq 37.3 \text{ (mm)}$$

$$l = 10 \text{ (mm)} \dots\dots\dots d \leq 46.7 \text{ (mm)}$$

Based on nut specifications (pages B439 to B468) select an item that meets screw shaft root diameter (d_r) and screw shaft diameter (d).

* Please consult NSK if the $d \cdot n$ value is necessary to exceed 70 000.

Fourth selection: In the range surrounded by the solid-lines in **Table 16.5**

(4) Rigidity of the ball screw system

Set the lost motion of the ball screw system (screw shaft, nut and support bearings) at 80% of the specified value. Then calculate the system rigidity. The criterion lost motion is:

$$20 \text{ (}\mu\text{m)} \times 0.8 = 16 \text{ (}\mu\text{m)}$$

At this time, the one-way elastic deformation ΔL of the major factors of ball screw system shall be less than the half of above criterion.

$$\Delta L \leq 8 \text{ (}\mu\text{m)}$$

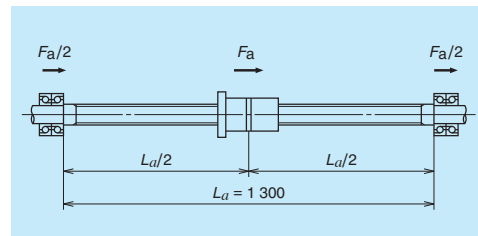


Fig. 16.3 Unsupported length

[1] Rigidity of the screw shaft K_s

Calculate the rigidity at the center of screw shaft where the axial deformation becomes the largest. Because the supporting condition of screw shaft is Fixed - Fixed support, the rigidity as per the formula 21) on page B58:

$$K_s = \frac{\pi \cdot d_r^2 \cdot E}{L_a} \times 10^{-3} \text{ (N/mm)}$$

At here E is the elastic modulus. From the formula 17) on page B57, the elastic deformation of the screw shaft ΔL_s is:

$$\Delta L_s = \frac{F_a}{K_s} = \frac{F_a \cdot L_a}{\pi \cdot d_r^2 \cdot E} \times 10^3 \text{ (}\mu\text{m)}$$

The sliding resistance F_a is:

$$F_a = \mu (m_1 + m_2) = 0.15 \times (1\,000 + 600) = 2\,354 \text{ (N)}$$

Table 16.7 shows the rigidity of screw shaft K_s and the elastic deformation ΔL_s .

[2] Rigidity of the ball nut K_N

Set about 1/3 of the maximum axial load as the preload value F_{a0} .

$$F_{a0} = \frac{F_{max}}{3} = \frac{10\,354}{3} = 3\,452 \rightarrow 3\,500 \text{ (N)}$$

From the formula 23) on page B60, the rigidity of the ball nut K_N is:

$$K_N = 0.8 \times K \left(\frac{F_{a0}}{\varepsilon \cdot C_a} \right)^{1/3} = 0.8 \times K \left(\frac{3\,500}{0.1 \cdot C_a} \right)^{1/3} \text{ (N/}\mu\text{m)}$$

K : Theoretical rigidity

From the formula 17) on page B58, elastic deformation of the ball nut ΔL_N is:

$$\Delta L_N = \frac{F_a}{K_N} = \frac{2\,354}{K_N}$$

Table 16.7 shows the rigidity of ball nut K_N and the elastic deformation ΔL_N .

[3] Rigidity of the support bearing K_B

The bearings are Ball screw support bearings NSK TAC C series. We specify the model number of support bearing unit for each shaft diameter as shown in **Table 16.6** (refer to page B415).

Table 16.6 Bearing code

Screw shaft diameter (mm)	Bearing code
32	25TAC62CDF
36	25TAC62CDF
40	30TAC62CDF
45	35TAC72CDF

Refer to page B422 for the rigidity K_B of each bearing unit (axial spring modulus). Elastic deformation of bearing ΔL_B is:

$$\Delta L_B = \frac{F_a}{2K_B}$$

Table 16.7 shows the rigidity of support bearing K_B and the elastic deformation ΔL_B .

Table 16.7 Rigidity and elastic deformation

Nut model number	Screw shaft		Nut		Support bearing		Total ΔL
	K_s	ΔL_s	K_N	ΔL_N	K_B	ΔL_B	
DFT3210-5	347	6.8	843	2.8	850	1.4	11.0
DFT3610-5	460	5.1	898	2.6			9.1
DFT4010-5	589	4.0	966	2.4	1 030	1.1	7.7
DFT4510-5	772	3.0	1 054	2.2			6.3
DFT4510-7.5			1 381	1.7			5.8

Choose the most economical ball screw system which meets the requirement of one-way deformation (ΔL) of 8 μm or less.

The selected ball screw:

Nut model number: DFT4010-5

Shaft diameter: 40 (mm)

Lead: 10 (mm)

Dynamic load rating: 61 200 (N)

6. Decision of screw shaft length

DFT4010-5 ball nut has the length of 193 mm, and thus the unsupported length of screw shaft L_a should be:

$$L_a = \text{Maximum stroke} + \text{nut length} + \text{margin} = 1\,000 + 193 + 100 = 1\,293 \rightarrow 1\,300 \text{ mm}$$

7. Checking basic safety

(1) Permissible axial load

Calculate the buckling load for conditions shown in **Fig. 16.4** with P of 10 354 (N) and L_1 of 1 210 (mm).

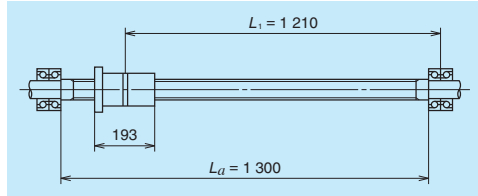


Fig. 16.4 Examination of buckling load

Supporting condition is Fixed - Fixed support, and from the calculation formula 2) on page B44, the screw shaft diameter d , to prevent buckling is

$$d_i \geq \left(\frac{P \cdot L_1^2}{m} \times 10^4 \right)^{1/4}$$

$$= \left(\frac{10\,354 \times 1210^2}{19.9} \times 10^4 \right)^{1/4} = 16.6 \text{ (mm)}$$

From the specification of DFT4010-5 ball nut (page B457), the root diameter of screw shaft d , is 34.4 mm and thus meets the above condition.

Result: Acceptable

(2) Permissible rotational speed

[1] Critical speed n

From the critical speed calculation formula 7) on page B47:

$$n = f \cdot \frac{d_i}{L_1^2} \times 10^7 = 21.9 \times \frac{34.4}{1210^2} \times 10^7$$

$$\doteq 5\,140$$

The maximum rotational speed (N_{max}) of 1 500 min^{-1} is less than the critical speed, and thus meets the requirement.

Result: Acceptable

[2] $d \cdot n$ value

The $d \cdot n$ value is:

$$d \cdot n = 40 \times 1\,500 = 60\,000$$

From **Table 3.2** on page B50, the $d \cdot n$ of tube type ball nut is 70 000 or less, and meets the requirement.

Result: Acceptable

(3) Life L_i

The dynamic load rating C_a is 61 200 N (see dimension table on page B457), and from the formulas 8) and 9) on page B53 the life expectancy is:

$$L_i = \left(\frac{C_a}{f_w \cdot F_m} \right)^3 \times 10^6 \times \frac{1}{60 \cdot N_m}$$

$$\doteq 152\,000$$

The above result satisfies the required life of 20 000 (h).

Result: Acceptable

8. Check whether the following factors satisfy requirements

(1) Checking accuracy

[1] Positioning accuracy

The positioning accuracy of $\pm 0.035/1\,000$ mm, and therefore, from **Table 1.2** "Tolerance of specified travel and travel variation" on page B38 the positioning accuracy is:

Accuracy grade : C3

$$e_p = \pm 0.029/1\,600 \text{ (mm)}$$

$$v_u = 0.018 \text{ (mm)}$$

and thus meets the required positioning accuracy.

[2] Measures against thermal expansion

Provide pre-tension force equivalent to the elongation of 3°C temperature rise, taking in consideration of the load carrying capacity of bearings. Also, adjust the travel compensation for the specified travel equivalent to 3°C temperature rise (refer to page B40).

(a) Thermal elongation : ΔL_0

From the formula 1) on page B40:

$$\Delta L_0 = \rho \cdot \theta \cdot L_a = 12.0 \times 10^{-6} \times 3 \times 1\,300$$

$$= 0.047 \text{ (mm)}$$

(b) Pre-tension force : F_0

$$F_0 = \Delta L_0 \cdot K_s = \frac{\Delta L_0 \cdot E \cdot \pi \cdot d_i^2}{4L_a}$$

$$= \frac{0.047 \times 2.06 \times 10^5 \times \pi \times 34.4^2}{4 \times 1\,300}$$

$$\doteq 6\,922 \rightarrow 6\,900 \text{ (N)}$$

Travel compensation : $-0.047/1\,300$ (mm)

Pre-tension force : 6 900 (N)

Tension (elongation) volume : 0.047 (mm)

[3] Selection of support bearing

Assuming that the ratio of basic dynamic load rating of support bearing (C_a) and pre-tension force (F_0) is ε , select a bearing which generally satisfies the following:

$$\varepsilon = F_0/C_a < 0.20$$

Design the bearing supporting configuration to which pre-tension force is applied in such way that the axial load is supported by the duplex combination or a more multiple condition. Please consult NSK when one bearing must sustain the pre-tension load.

Table 16.8 Comparison of dynamic load rating and pre-tension force

Bearing reference number	C_a (N)	ε
30TAC62CDF	29 200	0.23
30TAC62CDFD	47 500	0.14

Selected support bearing: 30TAC62CDFD

(2) Checking drive torque of motor

⟨Required specifications⟩

• Motor rotational speed: 1 500 min^{-1}

• Time to reach maximum speed: 0.16 sec or less
(At the time of rapid traverse)

[1] Load (converted to the motor load)

Calculate the moment of inertia of ball screw.

From the formulas 30) and 31) on page B64, moment of inertia of ball screw parts J are calculated the load as follows, whereas γ is material density and ball screw shaft length L_0 is 1 550 mm.

(Screw shaft)

$$J_0 = \frac{\pi \cdot \gamma}{32} D^4 \cdot L_0 = \frac{\pi \times 7.8 \times 10^3}{32} \times 4^4 \times 155$$

$$= 30 \text{ (kg} \cdot \text{cm}^2)$$

(Moving part)

$$J_w = m \times \left(\frac{l}{2\pi} \right)^2 = 1\,600 \times \left(\frac{1}{2\pi} \right)^2$$

$$= 40 \text{ (kg} \cdot \text{cm}^2)$$

(Coupling)

$$J_c = 10 \text{ (kg} \cdot \text{cm}^2) \cdots \text{assumed}$$

(Total)

$$J_L = J_0 + J_w + J_c = 30 + 40 + 10$$

$$= 80 \text{ (kg} \cdot \text{cm}^2) \rightarrow 80 \times 10^{-4} \text{ (kg} \cdot \text{m}^2)$$

[2] Driving torque

The required torque to drive a ball screw resisting to external loads T_i can be obtained by the formula 28) on page B64:

$$T_i = T_A + T_p + T_u$$

In this formula, T_A is drive torque at constant speed, T_p is dynamic friction torque, and, T_u is friction torque of the support bearings. From the formula 26) and 25) on page B63, T_A and T_p are:

$$T_A = \frac{F_a \cdot l}{2\pi \eta_1}$$

$$T_p = 0.014 F_{a0} \sqrt{d_m \cdot l}$$

$$\eta_1 = 0.9$$

Refer to the starting torque value in **Table** on page B422:

T_u is:

$$T_u = (16 \times 1.35) + (16 \times 1.35) = 43.2 \text{ (N} \cdot \text{cm)}$$

So, the required drive torque during rapid traverse T_{11} and heavy cutting T_{13} are:

(At the time of rapid traverse)

$$T_{11} = T_{A1} + T_{P1} + T_{U1}$$

$$= \frac{2\,354 \times 1}{2\pi \times 0.9} + 0.014 \times 3\,500 \sqrt{4.1 \times 1} + 43.2$$

$$= 559 \text{ (N} \cdot \text{cm)} \rightarrow 559 \times 10^{-2} \text{ (N} \cdot \text{m)}$$

(At the time of heavy cutting)

$$T_{12} = T_{A2} + T_{P2} + T_{U2}$$

$$= \frac{10\,354 \times 1}{2\pi \times 0.9} + 0.014 \times 3\,500 \sqrt{4.1 \times 1} + 43.2$$

$$= 1\,973 \text{ (N} \cdot \text{cm)} \rightarrow 1\,973 \times 10^{-2} \text{ (N} \cdot \text{m)}$$

[3] Selection of the motor

⟨Selection conditions⟩

Maximum rotational speed: $N_M \geq 1\,500 \text{ (min}^{-1})$

Motor rating torque: $T_M > T_1 \text{ (N} \cdot \text{m)}$

Moment of inertia of the motor: $J_M > J_L/3 \text{ (kg} \cdot \text{m}^2)$

Based on the above, select AC servo motor as follows.

Motor specifications

Rating power output: $W_M = 1.8$ (kW)

Maximum rotational speed:

$$N_M = 1\,500 \text{ (min}^{-1}\text{)}$$

Rating torque: $T_M = 22.5$ (N · m)
 $= 22.5 \times 10^2$ (N · cm)

Moment of inertia: $J_M = 190 \times 10^{-4}$ (kg · m²)
 $= 190$ (kg · cm²)

[4] Checking the time to reach maximum speed:

Required time to reach rapid traverse speed can be calculated as follows (whereas $T_M' = 2 \times T_M$):

$$t_a = \frac{(J_L + J_M) \times 2\pi \times N}{(T_M' - T_L) \times 60} \times 1.4$$

$$= \frac{(80 \times 10^{-4} + 190 \times 10^{-4}) \times 2\pi \times 1\,500}{(2 \times 22.5 - 559 \times 10^{-2}) \times 60} \times 1.4$$

$$= 0.15 \text{ (sec)}$$

Thus the time meets the requirement 0.16 sec or less.

Drill 3: Cartesian type robot Z axis (vertical axis)

1. Design conditions

Mass of the traveling item : $m = 300$ kg
 Maximum travel : $S_{\max} = 1\,500$ mm
 Rapid traverse speed : $V_{\max} = 10\,000$ mm/min
 Repeatability : 0.3 mm
 Required life : $L_t = 24\,000$ h
 (16 hours $\times$ 300 days $\times$ 5 years)

Screw shaft supporting condition :

Fixed -- Simple support

Nut: Flanged single nut

Guide way (rolling) : $\mu = 0.01$ (friction coefficient)

Drive motor : AC servo motor ($N_{\max} = 1\,000$ min⁻¹)

Environment : Slightly dusty

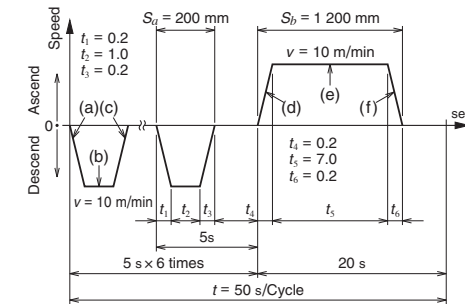


Fig. 16.6 Operating condition

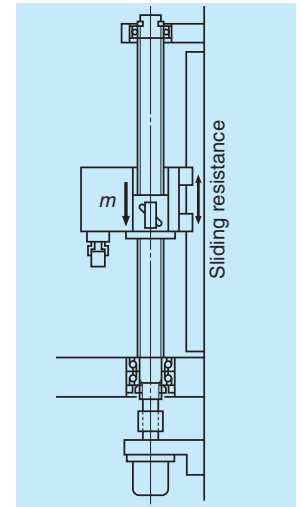


Fig. 16.5 System appearance

2. Selection of basic factors

(1) Selection of accuracy grade

Although this application is not listed in **Table 4.1** "Accuracy grades of ball screw and their application" on page B19, the possibility is to use a ball screw for transfer equipment R series, because the required repeatability is 0.3 mm that is not very high.

(2) Selection of lead

From the maximum rotational speed of AC motor:

$$l \geq \frac{V_{\max}}{N_{\max}} = \frac{10\,000}{1\,000} = 10 \text{ (mm)}$$

Select a lead 10 mm or over.

(3) Selection of screw shaft diameter

According to the **Table 4.6** "Shaft diameter, lead and standard screw length of R Series" on page B23, the shaft diameters whose lead is 10 mm or over are in the range of 12 mm to 50 mm.

(4) Selection of stroke

From the **Table 4.6** "Screw shaft diameter, lead and standard screw shaft length of R series" on page B23, it is possible to select from R series because the diameter d of 15 mm to 50 mm and lead l of 10 mm will meet the required maximum stroke of 1500 mm.

Primary selection : R Series ball screw for transfer equipment
Screw shaft diameter : 15 – 50 (mm)
Lead : 10 (mm)
Stroke : 1 500 (mm)

3. Confirmation of standard ball screw

Select from a flanged single nuts of R Series ball screws for transfer equipment.

Second selection : R Series ball screw for transfer equipment
Screw shaft diameter : 16, 20, 25, 32, 36
40, 50 (mm)
Lead : 10 (mm)
Stroke : 1 500 (mm)

4. Decision of screw length

Screw length L_o is:

$$L_o = \text{Stroke} + \text{nut length} + \text{margin} + \text{shaft end length} \\ = 1\,500 + 100 + 100 + 200 = 1\,900 \text{ (mm)}$$

Normally, the overall screw shaft length L_o less than or equal to 70 times of screw shaft diameter d is recommended.

Therefore, screw shaft diameter d is:

$$d \geq \frac{L_o}{70} = \frac{1\,900}{70} = 27.1 \text{ (mm)}$$

Third selection : R Series ball screw for transfer equipment
Shaft diameter: 32, 36, 40, 45, 50 (mm)
Lead: 10 (mm)
Stroke: 1 500 (mm)

5. Checking basic safety

(1) Allowable axial load

[1] Calculation of allowable axial load
Accelerating/decelerating time is:

$$\alpha = \frac{V}{60 t} = \frac{10 \times 10^3}{60 \times 0.2} = 833 \text{ (mm/s}^2\text{)} \\ = 0.833 \text{ (m/s}^2\text{)} \\ t = t_1 = t_3 = t_4 = t_6$$

$$\begin{aligned} \text{(a), (f)} \quad \cdots \cdots F_1 &= mg - m\alpha \\ &= 300 \times 9.80665 - 300 \times 0.833 \\ &= 2\,690 \text{ (N)} \\ \text{(b), (e)} \quad \cdots \cdots F_2 &= mg = 2\,940 \text{ (N)} \\ \text{(c), (d)} \quad \cdots \cdots F_3 &= mg + m\alpha = 3\,190 \text{ (N)} \end{aligned}$$

[2] Buckling load

For condition in Fig. 16.7, use values below.

$$P = 3\,190 \text{ N}, L_1 = 1\,600 \text{ mm}$$

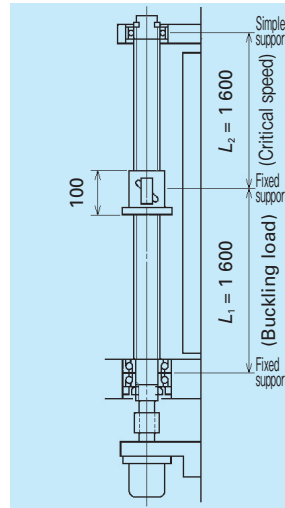


Fig. 16.7 Inspecting for buckling load and critical speed

From the formula 2) on page B44:

$$d_i \geq \left(\frac{P \cdot L_1^2}{m} \times 10^{-4} \right)^{1/4} \\ = \left(\frac{3\,190 \times 1\,600^2}{19.9} \times 10^{-4} \right)^{1/4} = 14.2 \text{ (mm)}$$

(2) Checking permissible rotational speed

[1] Critical speed

Use values below.

$$n = 1\,000 \text{ (min}^{-1}\text{)}, L_2 = 1\,600 \text{ (mm)}$$

From the formula 7) on page B47:

$$d_i \geq \frac{n \cdot L_2^2}{f} \times 10^{-7} = \frac{1\,000 \times 1\,600^2}{15.1} \times 10^{-7} \\ = 17 \text{ (mm)}$$

[2] $d \cdot n$ value

From Table 3.2 on page B50:

$$d \leq \frac{50\,000}{n} = \frac{50\,000}{1\,000} \\ = 50 \text{ (mm)}$$

* Please consult NSK when the $d \cdot n$ value exceeds 50 000.

(3) Checking life (dynamic load rating)

Determine the required load carrying capacity from load conditions of Table 16.9.

Table 16.9 Load conditions

Operating condition	Axial load (N)	Rotational speed (mean) (min ⁻¹)	Use time (s)
(a) ₁ (f)	$F_1 = 2\,690$	$N_1 = 500$	$t_a = 1.4$
(b) ₂ (e)	$F_2 = 2\,940$	$N_2 = 1\,000$	$t_b = 13.0$
(c) ₃ (d)	$F_3 = 3\,190$	$N_3 = 500$	$t_c = 1.4$

Calculate mean load F_m and mean rotational speed N_m from the formulas 11) and 12) on page B53:

Required load carrying capacity is:

$$F_m = \left(\frac{F_1^3 \cdot N_1 \cdot t_a + F_2^3 \cdot N_2 \cdot t_b + F_3^3 \cdot N_3 \cdot t_c}{N_1 \cdot t_a + N_2 \cdot t_b + N_3 \cdot t_c} \right)^{1/3} \\ = 2\,940 \text{ (N)}$$

$$N_m = \frac{N_1 \cdot t_a + N_2 \cdot t_b + N_3 \cdot t_c}{t} \\ = 288 \text{ (min}^{-1}\text{)}$$

From the formulas 8) and 9) on page B53:

$$C_a \geq (60 N_m \cdot L_1)^{1/3} \cdot F_m \cdot f_w \times 10^{-2} \text{ (N)} \\ = (60 \times 288 \times 24\,000)^{1/3} \times 2\,940 \times 1.2 \times 10^{-2} \\ = 26\,300 \text{ (N)}$$

(4) Checking static load rating

$$C_{0a} = F_{\max} \times f_s = 3\,190 \times 2 \\ = 6\,380 \text{ (N)}$$

In consideration of expense, select a ball screw shaft as follows.

Fourth selection : R Series ball screw for transfer equipment

Shaft diameter : 32 (mm)
Lead : 10 (mm)
Stroke :
Turns of balls and circuit number : 2.5 × 2
Screw length : 2 000 (mm)
Basic dynamic load rating : 35 700 (N)

6. Selection of nut

Select a "standard nut with a flange and a built-in brush seals" based on the environmental conditions.

Selected ball screw:

Nut assembly RNFTL3210A5S
Screw shaft RS3210A20

B-2-18 Reference

"NSK Motion & Control (technical journal)" was compiled to introduce NSK products and its technologies. You will find data summaries which are imperative in selecting ball screws in this catalog. If you need detailed technical data, other than described in this catalog, please refer

to "NSK Motion & Control" technical journal. For inquiries and orders, please contact NSK branch offices, sales offices, and representatives assigned at various locations.

Table 17.1 NSK Motion & Control (technical journal) : Issues relating to ball screws (1980-)

Issue No.	Date of Publication	Articles related to Ball Screws
No.4	Jun. 1998	Recent Technical Trends in Ball Screws
No.8	May. 2000	Ball Screw with Rotating Nut and Vibration Damper
No.9	Oct. 2000	WFA Standard-Stock Ball Screws
No.10	Apr. 2001	High Performance Seals for Ball Screws
No.11	Oct. 2001	Development of NSK S1 Series Ball Screws and Linear Guides
No.11	Oct. 2001	Low Inertia Series of Nut Rotatable Ball Screws
No.13	Oct. 2002	Development of HTF Series Ball Screws for High Load Drive Application
No.13	Oct. 2002	High Lead Precision Rolled Ball Screws
No.14	May. 2003	High Speed and Low Noise Ball Screws HMC-B02 Series
No.15	Dec. 2003	Clean Support Units for Ball Screws
No.16	Aug. 2004	Development of High Speed and Low Noise Ball Screws
No.18	Aug. 2005	S3 Ball Screws: Super Low Noise Ball Screws for Automation Equipment
No.19	Sep. 2006	High-Speed and Low-Noise Ball Screw for Standard Stock - Compact FA Series
No.21	Dec. 2007	V1 Series of Ball Screws for Contaminated Environments HTF-SRC Series of Ball Screws for High-Speed and High-Load Applications
No.22	Mar. 2011	Technological Trends of Ball Screws for Industrial Machinery BSL Series of Ball Screws for Small Lathes HTF-SRD Series of Long-Lead Ball Screws for High-Speed and Heavy-Load Applications
No.23	Jun. 2013	TW Series of Ball Screws for Twin-Drive Systems HMD Series of Ball Screws for High-Speed Machine Tools
No.24	Dec. 2014	Ball Screw for Motorcycle Brake Systems
No.25	Sep. 2015	HMS Series of Ball Screws for High-Speed Machine Tools Miniature Large-Lead Series of High-Speed, Low-Noise Ball Screws
No.26	Apr. 2016	Development of a Nut Cooling Ball Screw Ball Screws with X1 Seals for Machine-Tool Applications HTF-SRE Large, High-Speed, High-Load Capacity Ball Screws
No.27	Nov. 2016	Strategy for Frictional Behavior Control in Ball Screws Ball Screws with Minimal Grease-Splatter L1 Seals
No.28	Jun. 2017	Ultra-Large Ball Screws

B-2-19 Guide to Technical Services

(1) CAD data

■Web page

<http://www.jp.nsk.com/app01/en/ctrgr/>

■CD-ROM

CAT. No. 7110

(3D data: Intermediate format or native,

2D date: DXF)

Catalog No.7110 (CD-ROM) contains precision machine components and rolling bearings.

Standard Ball Screws

- Finished shaft end (Compact FA series, MA type, FA type, SA type, KA type, and RMA type)

- Blank shaft end (MS type, FS type, and SS type)

Standard nut ball screws

- End deflector type

Standard support units

(2) Telephone consultation with NSK engineers

This catalog contains technical explanation for each section. However, some descriptions and explanations may be insufficient due to page limitation, etc. To amend this shortcoming, NSK offers telephone assistance. NSK engineers are pleased to help you. Our local offices are listed in the last part of this catalog. Call local NSK office or representative in your area.

(3) Additional machining (processing) some part of standard ball screws in stock

NSK processes standard ball screw blank shaft end. NSK also cuts linear guide rails to required length for you. Service is available at NSK processing factories throughout the world. Requests are taken by branch offices and agencies.

B-2-20 Precautions When Handling Ball Screws

Ball screws are precision products. They require careful handling as described below.



Confirm lubrication

Lubrication

(1) Confirm the state of lubrication before use. Insufficient lubrication causes loss of ball screw functions in a short period.

(2) Do not apply any lubrication if grease is already applied to the ball screws. Remove dust or swarf if they stuck to the greased surface during handling. Wipe the surface with clean white kerosene, and then apply the same type of new lubricant before use. Avoid using different types of grease at the same time.

Consult NSK for special oil lubricant if it is required to your application.

(3) Check the grease after two to three months of operation. Wipe off the old grease if it is excessively contaminated, and apply sufficient volume of a fresh coat of grease. After the initial check, check and replenish the grease approximately every year. Check more often if environment requires.

Note: Refer to pages B67 and D13 for lubrication.



Do not disassemble



Do not reassemble



Watch out for falling objects



Handle with care



Do not apply shock

Handling

(1) Never disassemble the ball screw. It invites dust to enter, and lowers precision, or may cause an accident.

(2) Once the ball screw is disassembled for some reason, the user should never reassemble the ball screw by himself. Loss of ball screw function is apt to occur if a mistake is made. Please send the ball screw to NSK for repair or re-assembly. It will be reworked at the minimum service charge.

(3) The ball screw shaft or nut may fall off due to its own weight. Watch out for such falling object. If it falls, the ball groove or ball recirculation component may be damaged and their function might be lost. Make certain to return such item to NSK for check. There will be the minimum charge for this service.

(4) If the recirculation component, the shaft outside, or the ball groove is scratched or damaged by impact, recirculation operation becomes deficient, and may cause a loss of function.

Note: Refer to page B73 for assembling components.



Prevent dust



Rotational speed limitation



Do not overrun



Temperature limitation

Precautions in use

(1) Ball screws should be used in a clean environment. Use a dust cover to keep dust and swarf from entering into the system. Insufficient dust protection causes not only the ball screw function to deteriorate but also brings about damage to the recirculation components if dust plugs the system. This may result in more serious accident such as a fall of the table.

(2) For rotational speed in operation, refer to the applicable section in this catalog which describes permissible rotational speeds, or to specification drawing furnished by NSK. Exceeding permissible rotational speed damages recirculation components, and may cause the table to fall. A precaution system such as a safety nut is recommended in vertical use of ball screw. Please consult NSK for safety system.

(3) Overrunning ball nut (removed from the ball thread) causes the balls to fall out, damages recirculation components, and dent ball groove, resulting in insufficient operation. Continued use under such conditions may cause premature wear, and damages recirculation components. For these reasons, avoid overrun by all means. If overrun occurs, please request NSK to check. There will be a minimum charge for this service.

(4) Ball screws are designed to be used at a temperature of less than 80°C. Do not operate at temperatures higher than this limit. Use at a higher temperature may damage recirculation and seal components. Please consult NSK if it is necessary to use at a temperature higher than the limit.

When using NSK K1 lubrication unit, the operating temperature should be 50°C or less. (Momentary maximum temperature in use: 80°C)

Note: Please read page B83 before designing.



Store in the correct position

Storage

(1) Store in the original NSK package. Do not unwrap or tear the inner wrapping if it is not necessary. This allows dust to enter and rust to set in, and may deteriorate functions.

(2) The following position is recommended when storing ball screws.

- ① Keep in the NSK original package, and place it flat.
- ② Place flatly on supports; store in a clean area.
- ③ Hang vertically in a clean place.

B-3 Ball Screw Dimension Table

1. Compact FA Series	B107
2. High-Speed SS Series	B147
3. Finished Shaft End	B157
MA Type, Miniature, Fine Lead	B159
FA Type for Small Equipment	B181
SA Type for Machine Tools	B217
4. Finished Shaft End	
KA Type Stainless Steel Product	B273
5. Blank Shaft End	B299
MS Type, Miniature, Fine Lead	B301
FS Type for Small Equipment	B309
SS Type for Machine Tools	B321
6. Ball Screws for Transfer Equipment	B349
7. Accessories	B389

B-3-1 Dimension Table and Reference Number of Standard Ball Screws

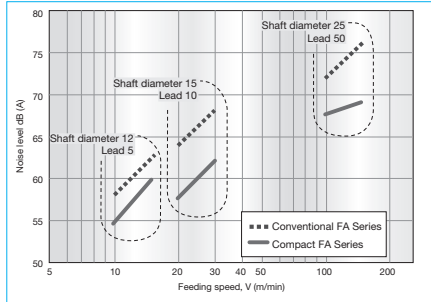
B-3-1.1 Compact FA Series PSS Type, USS Type, and FSS Type

1. Features

In order to respond quickly to a wide range of needs, NSK keeps end-deflector recirculation system ball screws, which offer high-speed and low-noise operation and compact design, in standard inventories as the Compact FA Series. The exceptionally high performance ball screws are ready for use in a variety of fields such as semiconductor manufacturing equipment, LCD manufacturing equipment, chip mounting equipment, measuring apparatus, food and medical equipment, and automotive manufacturing equipment.

●Quieter sound

The operating noise level of ball screws has been reduced by 6 dB(A), about half of what is sensed by the ear.



(Microphone was positioned at a distance of 400 mm for all noise levels)

Fig. 1 Comparison of noise level

●Compact

The outside diameter of the ball nut is as much as 30% smaller than those of existing NSK products. This contributes to more compact design of all sorts of equipment and devices such as low-profile positioning stages.

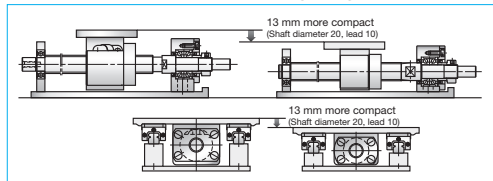


Fig. 2 Comparison of FA Type and Compact FA Series PSS Type

●High speed

The permissible rotational speed up to 5 000 min⁻¹. This capability dramatically expands the range of service conditions.

Please refer to the dimension tables for details of the permissible rotational speed.

●A grease fitting is provided as a standard equipment
The new ball screw type is equipped with a grease fitting (M5 × 0.8) as a standard equipment. Two lubrication ports are provided to facilitate easy maintenance.

●Storage seal

Compact, thin plastic seal is available. Nut outside diameter is compact compare with the return tube recirculation system.

●Low-profile design

The low-profile support units especially compatible with the compact FA Series are available for a superb space-saving design.

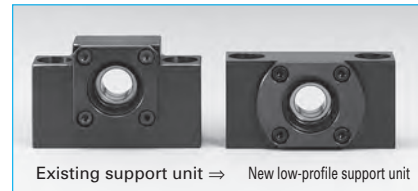


Fig. 3 Comparison of support units

●Low dust generation LG2 grease (USS Type)

The dust count is approximately 1/100 that of the existing FA series. It is suitable for applications in clean environments.

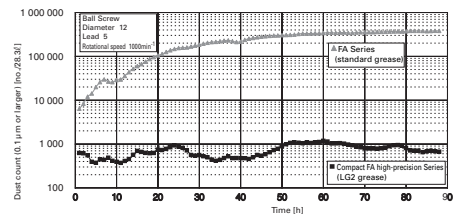


Fig. 4 Comparison of dust count

●Easy stroke setting (FSS Type)

Flexible stroke setting with fixed-simple support by means of mounting support unit (simple support side) directly onto ball screw thread outside diameter. Proprietary support unit (simple support side) is available from NSK.

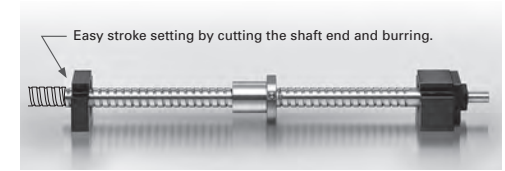


Fig. 5 Flexible stroke setting

2. Order of the dimension table

For each type, it is arranged in order from small diameter to large.

3. Dimension tables

Dimension tables show shapes/sizes as well as specification factors of each shaft diameter/lead combination. Tables also contain data as follows:

●Stroke

Nominal stroke: A reference for your use.

Maximum stroke: The limit stroke that the nut can move. The figure is obtained by subtracting the nut length from the effective threaded length (L₁).

●Lead accuracy

PSS Type, C5 grade; USS Type, C3 grade; FSS Type, Ct7 grade

T: Travel compensation

e_p: Tolerance on specified travel

v_u: Travel variation

See "Technical Description: Lead Accuracy" (page B37) for the details of the codes.

●Permissible rotational speed

d · n: Limited by the relative peripheral speed between the screw shaft and the nut.

Critical speed: Limited by the natural frequency of a ball screw shaft. Critical speed depends on the supporting condition of screw shaft.

The lower of the two criteria, the d · n and critical speed, will determine the overall permissible rotational speed of the ball screw. For details, see "Technical Description: Permissible Rotational Speed" (page B47).

4. Other

The seal of the ball screw and end deflector are made of synthetic resin. Consult NSK when using our ball screws under extreme environments or in special environments, or if using special lubricant or oil.

The NSK K1 cannot be mounted to the compact FA Series.

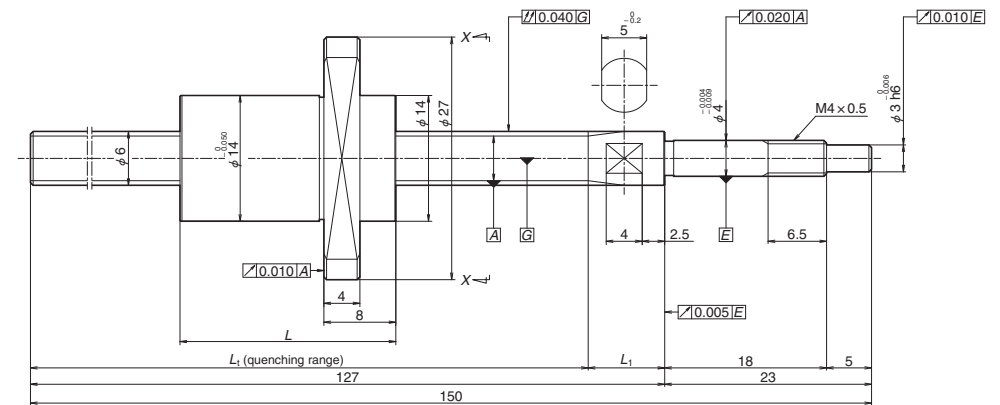
For special environments, see pages B70 and D2. For lubrications, see pages B67 and D13.

Note: For details of standard stock products, contact NSK.

Table 1 Combinations of screw shaft diameter and lead

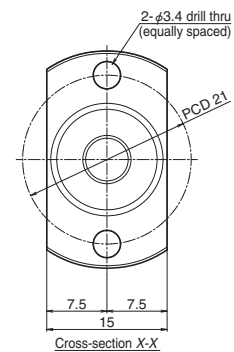
Lead	5	8	10	12	15	20	25	30	40	50	60
Screw shaft diameter											
6		B109		B109							
8			B111		B111						
10	B113 B133		B113								
12	B115 B135		B115 B139			B115		B115			
15	B117 B137		B117 B141			B119 B141		B119			
20	B121		B121 B143			B123 B143		B123	B125		B125
25	B127		B127 B145			B129 B145	B129 B145	B131		B131	

Compact FA PSS Type



Ball screw No.	Screw shaft diameter <i>d</i>	Lead <i>l</i>	Effective turns of balls	Basic load ratings (N)		Maximum stroke	Nut length <i>L</i>	Screw shaft dimensions	
				Dynamic <i>C_a</i>	Static <i>C_{0a}</i>			<i>L_t</i>	<i>L_i</i>
PSS0608NAD0150	6	8	2	690	805	102.5	16	118.5	8.5
PSS0608NBD0150			4	1 480	1 940	94.5	24	118.5	8.5
PSS0612NAD0150		12	2	665	800	97.0	20	117	10
PSS0612NBD0150			4	1 430	1 970	85.0	32	117	10

Notes: 1. Contact NSK if permissible rotational speed is to be exceeded.

**NSK**

Screw shaft ø6

Lead 8, 12

Unit: mm

Ball screw specification	
Ball diameter/screw shaft root diameter	1.2 / 4.9
Ball circle dia.	6.2
Accuracy grade/axial play	C5 / 0.005 or less
Factory-packed grease	NSK grease PS2

Recommended

**For drive side
(Fixed)**

WBK04-01M (square)
WBK04-11M (round)

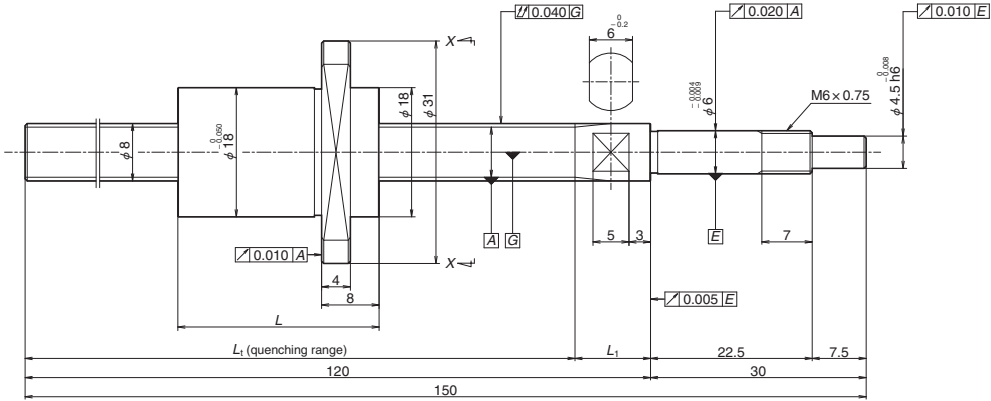
Unit: mm

Lead accuracy			Dynamic preload torque (N·cm)	Mass (kg)	Permissible rotational speed (min ⁻¹) *1	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Target value <i>T</i>	Error <i>e_p</i>	Variation <i>v_u</i>					
0	0.020	0.018	~0.5	0.06	5 000	0.2	0.1
				0.06		0.3	0.2
				0.06		0.2	0.1
				0.07		0.3	0.2

2. Service temperature range is 0 to 80°C.

2. Service temperature range is 0 to 55 °C.
3. Use of NSK support unit is recommended. Refer to page B389 for details.

Compact FA PSS Type



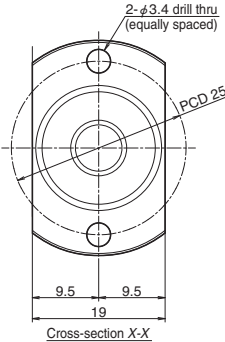
Ball screw No.	Screw shaft diameter <i>d</i>	Lead <i>l</i>	Effective turns of balls	Basic load ratings (N)		Maximum stroke	Nut length <i>L</i>	Screw shaft dimensions	
				Dynamic <i>C_a</i>	Static <i>C_{0a}</i>			<i>L₁</i>	<i>L₁</i>
PSS0810NAD0150	8	10	2	1 150	1 420	91.5	18	109.5	10.5
PSS0810NBD0150			4	2 470	3 430	81.5	28	109.5	10.5
PSS0815NAD0150		15	2	1 130	1 430	85.0	22	107	13
PSS0815NBD0150			4	2 410	3 520	70.0	37	107	13

Notes: 1. Contact NSK if permissible rotational speed is to be exceeded.

Screw shaft ø8

Lead 10, 15

Unit: mm



Ball screw specification	
Ball diameter/screw shaft root diameter	1.588 / 6.6
Ball circle dia.	8.3
Accuracy grade/axial play	C5 / 0.005 or less
Factory-packed grease	NSK grease PS2

Recommended

For drive side (Fixed)	
WBK06-01M (square)	
WBK06-11M (round)	

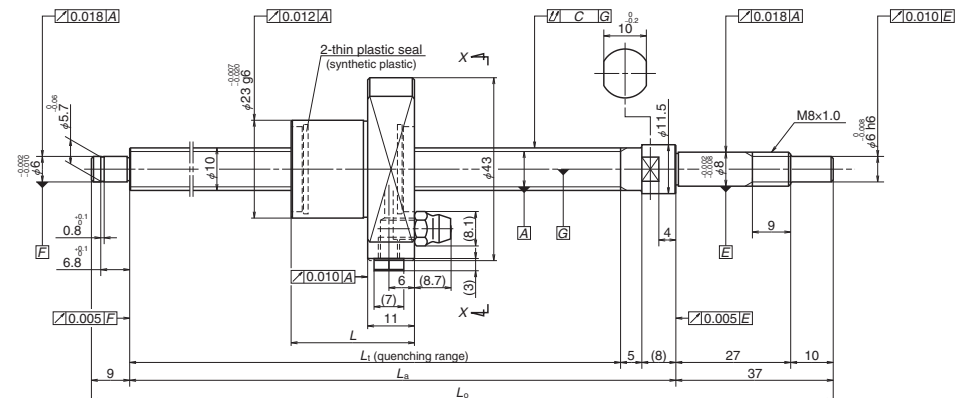
Unit: mm

Lead accuracy			Dynamic preload torque (N·cm)	Mass (kg)	Permissible rotational speed (min ⁻¹) *1	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Target value <i>T</i>	Error <i>e_p</i>	Variation <i>v_u</i>					
0	0.020	0.018	~0.5	0.09	5 000	0.4	0.2
				0.11		0.5	0.3
				0.1		0.4	0.2
				0.12		0.6	0.3

2. Service temperature range is 0 to 80°C.
3. Use of NSK support unit is recommended. Refer to page B389 for details.

Compact FA PSS Type

(Medium, High helix lead)



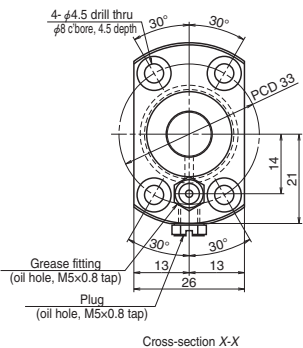
Nut model: BSS

NSK

Screw shaft ø10

Lead 5, 10

Unit: mm



Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	2.000 / 8.2
Ball circle dia.	10.3
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease PS2

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01B (low-profile, square)	WBK08S-01B (low-profile, square)
WBK08-11 (round)	
WBK08-11B (round, high load)	

Ball screw No.	Screw shaft diameter <i>d</i>	Lead <i>l</i>	Basic load ratings (N)		Stroke		Nut length <i>L</i>	Screw shaft dimensions		
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	Nominal	Max.		<i>L_t</i>	<i>L_a</i>	<i>L_o</i>
PSS1005N1D0171	10	5	3 420	4 840	50	78	29	112	125	171
PSS1005N1D0221					100	128		162	175	221
PSS1005N1D0321					200	228		262	275	321
PSS1005N1D0421					300	328		362	375	421
PSS1005N1D0521					400	428		462	475	521
PSS1010N1D0221	10	10	2 290	2 980	100	125	32	162	175	221
PSS1010N1D0321					200	225		262	275	321
PSS1010N1D0421					300	325		362	375	421
PSS1010N1D0521					400	425		462	475	521

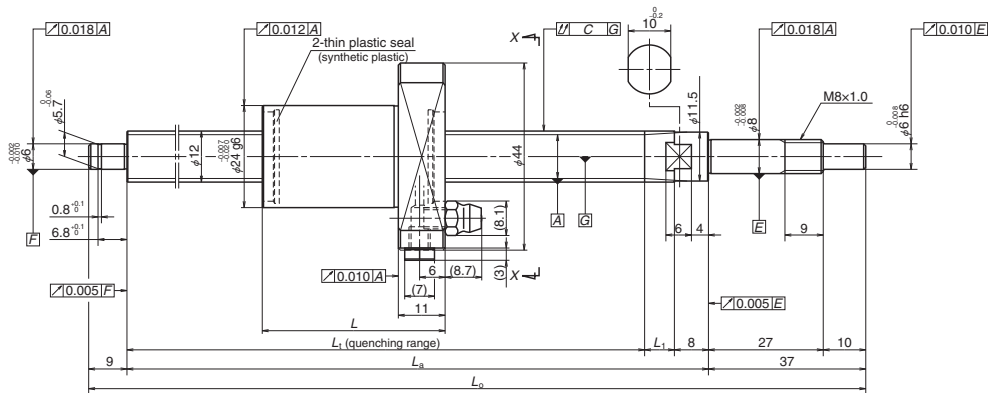
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

Lead accuracy			Shaft run-out <i>C</i>	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min ⁻¹) *2	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Target value <i>T</i>	Error <i>e_p</i>	Variation <i>v_u</i>				Fixed-Simple		
0	0.020	0.018	0.030	0.7 – 3.3	0.3	5 000	0.8	0.4
	0.020	0.018	0.045	0.7 – 3.3	0.3			
	0.023	0.018	0.060	0.6 – 4.3	0.3			
	0.025	0.020	0.070	0.6 – 4.3	0.4			
	0.027	0.020	0.085	0.4 – 4.9	0.5	5 000	0.7	0.4
	0.020	0.018	0.045	0.7 – 3.3	0.3			
	0.023	0.018	0.060	0.6 – 4.3	0.4			
	0.025	0.020	0.070	0.6 – 4.3	0.4			
	0.027	0.020	0.085	0.4 – 4.9	0.5			

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

Compact FA PSS Type

(Fine, Medium, High helix lead)



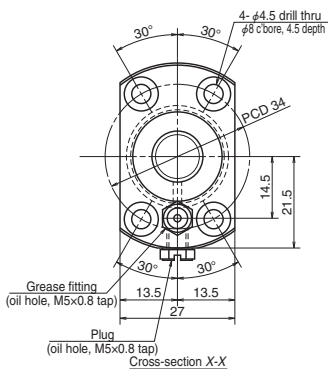
Nut model: BSS

NSK

Screw shaft $\phi 12$

Lead 5, 10, 20, 30

Unit: mm



Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	2.000 / 10.2
Ball circle dia.	12.3
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease PS2

Recommended support unit

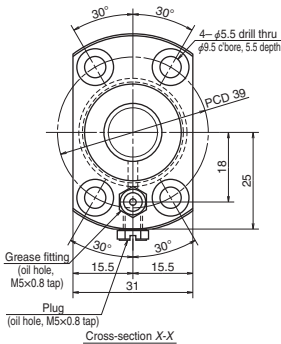
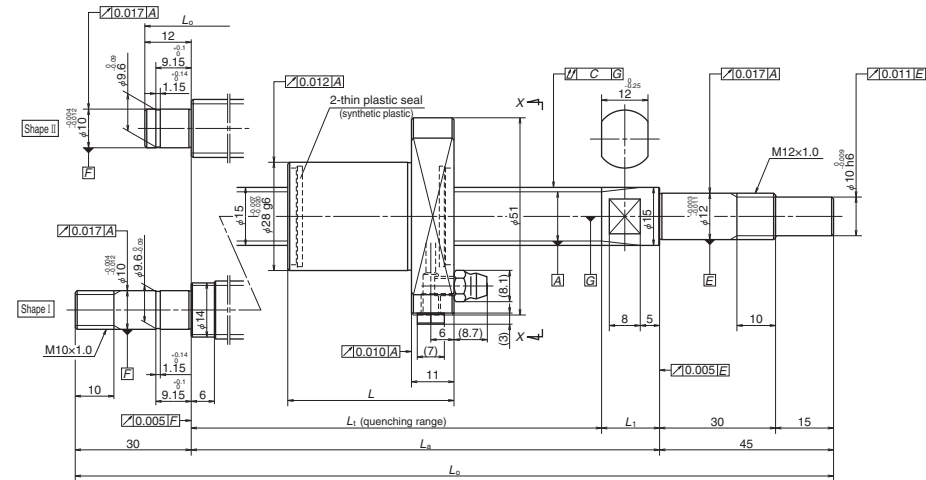
For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01B (low-profile, square)	WBK08S-01B (low-profile, square)
WBK08-11 (round)	
WBK08-11B (round, high load)	

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N)		Stroke		Nut length L	Screw shaft dimensions			
			Dynamic C_a	Static C_{0a}	Nominal	Max.		L_1	L_a	L_0	L_1
PSS1205N1D0171	12	5	3 750	5 810	50	75	30	110	125	171	7
PSS1205N1D0221					100	125		160	175	221	
PSS1205N1D0321					200	225		260	275	321	
PSS1205N1D0421					300	325		360	375	421	
PSS1205N1D0521					400	425		460	475	521	
PSS1205N1D0621					500	525		560	575	621	
PSS1210N1D0221	12	10	3 760	5 780	100	112	43	160	175	221	7
PSS1210N1D0321					200	212		260	275	321	
PSS1210N1D0421					300	312		360	375	421	
PSS1210N1D0521					400	412		460	475	521	
PSS1210N1D0621					500	512		560	575	621	
PSS1220N1D0271		20	2 330	3 600	100	153	50	208	225	271	9
PSS1220N1D0371					200	253		308	325	371	
PSS1220N1D0471					300	353		408	425	471	
PSS1220N1D0571					400	453		508	525	571	
PSS1220N1D0671		30	2 190	3 650	500	553	70	608	625	671	14
PSS1230N1D0271					100	128		203	225	271	
PSS1230N1D0371					200	228		303	325	371	
PSS1230N1D0471					300	328		403	425	471	
PSS1230N1D0571					400	428		503	525	571	
PSS1230N1D0671					500	528		603	625	671	

Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

Lead accuracy			Shaft run-out C	Dynamic preload torque (N-cm) *1	Mass (kg)	Permissible rotational speed (min ⁻¹) *2	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Target value T	Error e_p	Variation v_u				Fixed-Simple		
0	0.020	0.018	0.030	0.7 – 3.3	0.3	5 000	1.0	0.5
	0.020	0.018	0.045	0.7 – 3.3	0.3			
	0.023	0.018	0.060	0.6 – 4.3	0.4			
	0.025	0.020	0.070	0.6 – 4.3	0.5			
	0.027	0.020	0.085	0.6 – 4.3	0.6			
	0.030	0.023	0.085	0.4 – 4.9	0.7			
	0.030	0.023	0.085	0.4 – 4.9	0.7			
	0.023	0.018	0.045	1.4 – 4.5	0.4	5 000	1.2	0.6
	0.023	0.018	0.060	0.9 – 4.9	0.5	5 000		
	0.027	0.020	0.070	0.9 – 4.9	0.6	5 000		
	0.030	0.023	0.085	0.6 – 5.9	0.7	5 000		
	0.030	0.023	0.110	0.6 – 5.9	0.8	4 480		
	0.023	0.018	0.045	1.4 – 4.5	0.5	5 000	1.5	0.8
	0.023	0.018	0.060	0.9 – 4.9	0.6	5 000		
	0.027	0.020	0.070	0.9 – 4.9	0.7	5 000		
	0.030	0.023	0.085	0.6 – 5.9	0.7	5 000		
	0.030	0.023	0.110	0.6 – 5.9	0.8	4 720		

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.



Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	2.778 / 12.6
Ball circle dia.	15.5
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease LR3

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	(Simple)
WBK12-01B (low-profile, square)	WBK10-01B (low-profile, square)	WBK12S-01B (low-profile, square)
WBK12-11 (round)	WBK10-11 (round)	

Ball screw No.	Screw shaft diameter	Lead	Basic load ratings (N)		Stroke		Nut length	Screw shaft dimensions			
	<i>d</i>		<i>l</i>	Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	Nominal		Max.	<i>L_t</i>	<i>L_a</i>	<i>L_o</i>
PSS1505N1D0211	15	5	6 410	10 100	50	103	30	139	154	211	15
PSS1505N1D0261					100	153		189	204	261	
PSS1505N1D0361					200	253		289	304	361	
PSS1505N1D0461					300	353		389	404	461	
PSS1505N1D0561					400	453		489	504	561	
PSS1505N1D0661					500	553		589	604	661	
PSS1505N1D0761					600	653		689	704	761	
PSS1510N1D0261		10	6 530	10 200	100	140	43	189	204	261	15
PSS1510N1D0361					200	240		289	304	361	
PSS1510N1D0461					300	340		389	404	461	
PSS1510N1D0561					400	440		489	504	561	
PSS1510N1D0661					500	540		589	604	661	
PSS1510N1D0761					600	640		689	704	761	
PSS1510N1D0879					700	740		789	804	879	
PSS1510N1D0979	800				840	889		904	979		
PSS1510N1D1179				1 000	1 040		1 089	1 104	1 179		

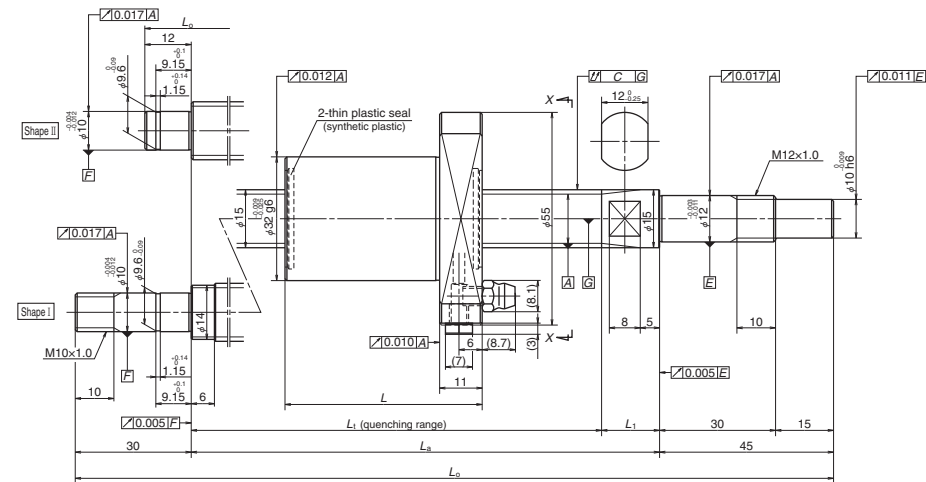
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

Left shaft end (opposite driven side)	Lead accuracy			Shaft run-out <i>C</i>	Dynamic preload torque (N-cm) *1	Mass (kg)	Permissible rotational speed (min ⁻¹) *2		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
	Target value <i>T</i>	Error <i>e_p</i>	Variation <i>v_u</i>				Fixed-Simple	Fixed-Fixed		
II	0	0.020	0.018	0.035	0.2 – 6.9	0.5	5 000	—	2.0	1.0
		0.020	0.018	0.035	0.2 – 6.9	0.5	5 000			
		0.023	0.018	0.045	0.2 – 6.9	0.6	5 000			
		0.025	0.020	0.050	0.4 – 9.8	0.8	5 000			
		0.027	0.020	0.060	0.4 – 9.8	0.9	5 000			
		0.030	0.023	0.075	0.4 – 9.8	1.0	5 000			
		0.035	0.025	0.075	0.4 – 11.8	1.1	4 130			
II		0.020	0.018	0.035	0.6 – 7.4	0.6	5 000	—	2.0	1.0
II		0.023	0.018	0.045	0.6 – 7.4	0.7	5 000			
II		0.025	0.020	0.050	0.4 – 9.8	0.8	5 000			
II		0.027	0.020	0.060	0.4 – 9.8	1.0	5 000			
II		0.030	0.023	0.075	0.4 – 9.8	1.1	5 000			
II		0.035	0.025	0.075	0.4 – 11.8	1.2	4 210			
I		0.035	0.025	0.095	0.4 – 11.8	1.4	3 190	4 410		
I		0.040	0.027	0.095	0.4 – 11.8	1.5	2 500	3 470		
I		0.046	0.030	0.120	0.4 – 11.8	1.7	1 650	2 320		

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

Compact FA PSS Type

(Medium, High helix lead)



Nut model: BSS

NSK

Screw shaft $\phi 15$

Lead 20, 30

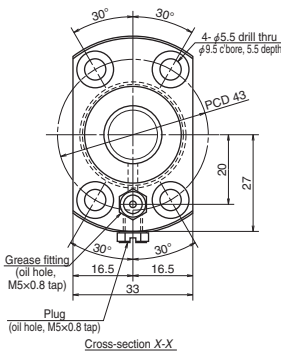
Unit: mm

Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	3.175 / 12.2
Ball circle dia.	15.5
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease LR3

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	(Simple)
WBK12-01B (low-profile, square)	WBK10-01B (low-profile, square)	WBK12S-01B (low-profile, square)
WBK12-11 (round)	WBK10-11 (round)	



Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N)		Stroke		Nut length L	Screw shaft dimensions			
			Dynamic C_a	Static C_{0a}	Nominal	Max.		L_1	L_a	L_o	L_1
PSS1520N1D0261	15	20	5 660	8 700	100	129	51	186	204	261	18
PSS1520N1D0361					200	229		286	304	361	
PSS1520N1D0461					300	329		386	404	461	
PSS1520N1D0561					400	429		486	504	561	
PSS1520N1D0661					500	529		586	604	661	
PSS1520N1D0761					600	629		686	704	761	
PSS1520N1D0879					700	729		786	804	879	
PSS1520N1D0979					800	829		886	904	979	
PSS1520N1D1179					1 000	1 029		1 086	1 104	1 179	
PSS1530N1D0311		30	5 500	8 580	100	153	71	230	254	311	24
PSS1530N1D0411					200	253		330	354	411	
PSS1530N1D0511					300	353		430	454	511	
PSS1530N1D0611					400	453		530	554	611	
PSS1530N1D0711					500	553		630	654	711	
PSS1530N1D0811					600	653		730	754	811	
PSS1530N1D0929					700	753		830	854	929	
PSS1530N1D1029					800	853		930	954	1 029	
PSS1530N1D1229					1 000	1 053		1 130	1 154	1 229	

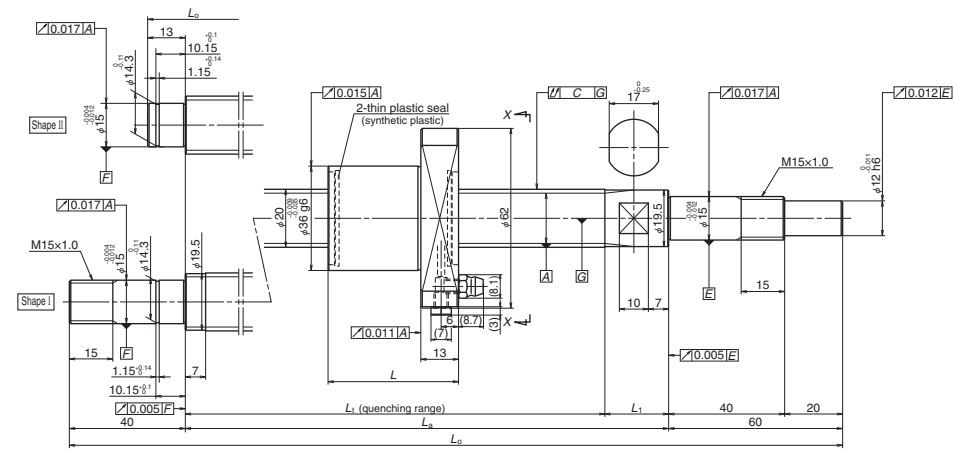
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

Left shaft end (opposite driven side)	Lead accuracy			Shaft run-out C	Dynamic preload torque (N-cm) *1	Mass (kg)	Permissible rotational speed (min ⁻¹) *2		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
	Target value T	Error e_p	Variation v_u				Fixed-Simple	Fixed-Fixed		
II	0	0.020	0.018	0.035	0.8 – 8.8	0.7	5 000	—	2.8	1.4
II		0.023	0.018	0.045	0.8 – 8.8	0.8	5 000	—		
II		0.025	0.020	0.050	0.8 – 10.8	0.9	5 000	—		
II		0.027	0.020	0.060	0.8 – 10.8	1.1	5 000	—		
II		0.030	0.023	0.075	0.8 – 10.8	1.2	5 000	—		
II		0.035	0.025	0.075	0.8 – 13.8	1.3	4 170	—		
I		0.035	0.025	0.095	0.8 – 13.8	1.5	3 150	4 310		
I		0.040	0.027	0.095	0.8 – 13.8	1.6	2 460	3 390		
I		0.046	0.030	0.120	0.8 – 13.8	1.9	1 620	2 260		
II		0.023	0.018	0.035	1.2 – 9.3	0.8	5 000	—	3.4	1.7
II		0.025	0.020	0.050	0.8 – 10.8	1.0	5 000	—		
II		0.027	0.020	0.060	0.8 – 10.8	1.1	5 000	—		
II		0.030	0.023	0.060	0.8 – 10.8	1.2	5 000	—		
II		0.030	0.023	0.075	0.8 – 13.8	1.4	5 000	—		
II		0.035	0.025	0.095	0.8 – 13.8	1.5	3 770	—		
I		0.040	0.027	0.095	0.8 – 13.8	1.6	2 880	3 910		
I		0.040	0.027	0.120	0.8 – 13.8	1.8	2 310	3 110		
I		0.046	0.030	0.120	0.8 – 13.8	2.0	1 540	2 100		

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

Compact FA PSS Type

(Fine, Medium lead)



Nut model: BSS

NSK

Screw shaft ø20

Lead 5, 10

Unit: mm

Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	3.175 / 17.2
Ball circle dia.	20.5
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease LR3

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	(Simple)
WBK15-01B (low-profile, square)	WBK15-01B (low-profile, square)	WBK15S-01B (low-profile, square)
WBK15-11 (round)	WBK15-11 (round)	

Ball screw No.	Screw shaft diameter <i>d</i>	Lead <i>l</i>	Basic load ratings (N)		Stroke		Nut length <i>L</i>	Screw shaft dimensions			
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	Nominal	Max.		<i>L_t</i>	<i>L_a</i>	<i>L_o</i>	<i>L₁</i>
PSS2005N1D0323	20	5	10 400	18 500	150	191	31	228	250	323	22
PSS2005N1D0373					200	241		278	300	373	
PSS2005N1D0473					300	341		378	400	473	
PSS2005N1D0573					400	441		478	500	573	
PSS2005N1D0673					500	541		578	600	673	
PSS2005N1D0773					600	641		678	700	773	
PSS2005N1D0873					700	741		778	800	873	
PSS2005N1D1000					800	839		878	900	1 000	
PSS2010N1D0387	20	10	10 200	18 600	200	241	45	292	314	387	22
PSS2010N1D0487					300	341		392	414	487	
PSS2010N1D0587					400	441		492	514	587	
PSS2010N1D0687					500	541		592	614	687	
PSS2010N1D0787					600	641		692	714	787	
PSS2010N1D0887					700	741		792	814	887	
PSS2010N1D1014					800	839		892	914	1 014	
PSS2010N1D1214					1 000	1 039		1 092	1 114	1 214	
PSS2010N1D1414					1 200	1 239		1 292	1 314	1 414	

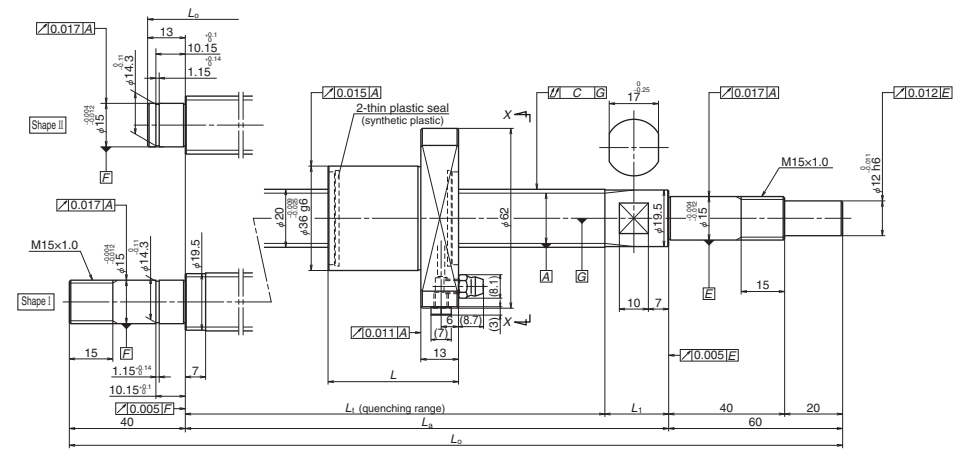
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

Left shaft end (opposite driven side)	Lead accuracy			Shaft run-out <i>C</i>	Dynamic preload torque (N-cm) *1	Mass (kg)	Permissible rotational speed (min) ⁻¹ *2		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
	Target value <i>T</i>	Error <i>e_p</i>	Variation <i>v_u</i>				Fixed-Simple	Fixed-Fixed		
II	0	0.023	0.018	0.045	0.6 – 7.4	1.0	5 000	—	3.4	1.7
II		0.023	0.018	0.045	0.6 – 7.4	1.1	5 000	—		
II		0.025	0.020	0.050	0.6 – 7.4	1.3	5 000	—		
II		0.027	0.020	0.060	0.4 – 9.8	1.5	5 000	—		
II		0.030	0.023	0.075	0.4 – 9.8	1.7	5 000	—		
II		0.035	0.025	0.075	0.4 – 9.8	1.9	5 000	—		
II		0.035	0.025	0.095	0.4 – 9.8	2.2	4 410	—		
I		0.040	0.027	0.095	0.4 – 11.8	2.4	3 450	4 710		
II		0.023	0.018	0.045	1.2 – 9.3	1.2	5 000	—	3.2	1.6
II		0.025	0.020	0.050	1.2 – 9.3	1.4	5 000	—		
II		0.027	0.020	0.060	0.8 – 10.8	1.7	5 000	—		
II		0.030	0.023	0.075	0.8 – 10.8	1.9	5 000	—		
II		0.035	0.025	0.075	0.8 – 10.8	2.1	5 000	—		
II		0.035	0.025	0.095	0.8 – 10.8	2.4	4 330	—		
I		0.040	0.027	0.120	0.8 – 13.8	2.6	3 400	4 640		
I		0.046	0.030	0.120	0.8 – 13.8	3.1	2 250	3 110		
I		0.054	0.035	0.160	0.8 – 13.8	3.6	1 600	2 220		

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

Compact FA PSS Type

(High helix lead)



Nut model: BSS

NSK

Screw shaft $\phi 20$

Lead 20, 30

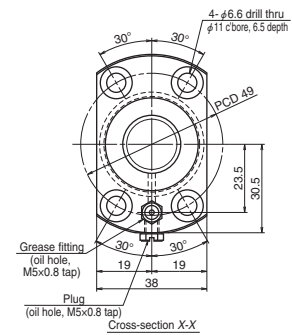
Unit: mm

Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	3.175 / 17.2
Ball circle dia.	20.5
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease LR3

Recommended support unit

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK15-01B (low-profile, square)	WBK15-01B (low-profile, square)	WBK15S-01B (low-profile, square)
WBK15-11 (round)	WBK15-11 (round)	



Unit: mm

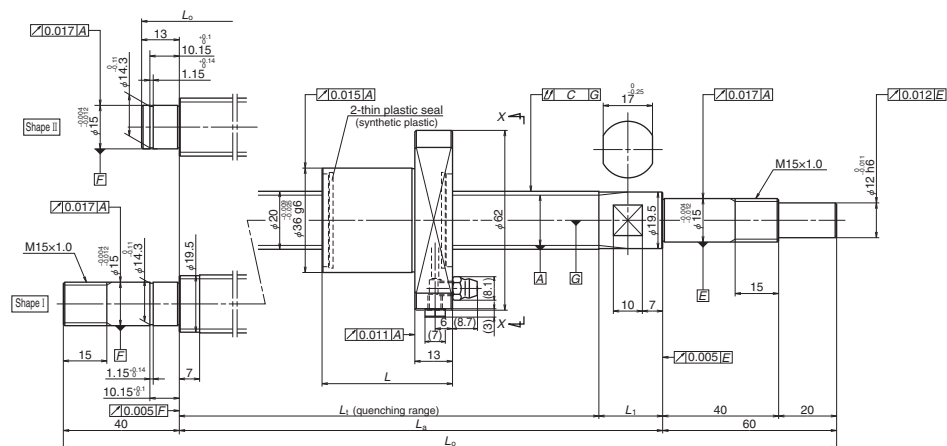
Ball screw No.	Screw shaft diameter <i>d</i>	Lead <i>l</i>	Basic load ratings (N)		Stroke		Nut length <i>L</i>	Screw shaft dimensions			
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	Nominal	Max.		<i>L_t</i>	<i>L_a</i>	<i>L_o</i>	<i>L₁</i>
PSS2020N1D0508	20	20	6 790	11 800	300	353	54	413	435	508	22
PSS2020N1D0608					400	453		513	535	608	
PSS2020N1D0708					500	553		613	635	708	
PSS2020N1D0808					600	653		713	735	808	
PSS2020N1D0908					700	753		813	835	908	
PSS2020N1D1035					800	851		913	935	1 035	
PSS2020N1D1235					1 000	1 051		1 113	1 135	1 235	
PSS2020N1D1435					1 200	1 251		1 313	1 335	1 435	
PSS2020N1D1835					1 600	1 651		1 713	1 735	1 835	
PSS2030N1D0408		30	6 550	11 800	200	228	74	308	335	408	27
PSS2030N1D0508					300	328		408	435	508	
PSS2030N1D0608					400	428		508	535	608	
PSS2030N1D0708					500	528		608	635	708	
PSS2030N1D0808					600	628		708	735	808	
PSS2030N1D0908					700	728		808	835	908	
PSS2030N1D1035					800	826		908	935	1 035	
PSS2030N1D1235					1 000	1 026		1 108	1 135	1 235	
PSS2030N1D1435					1 200	1 226		1 308	1 335	1 435	

Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

Left shaft end (opposite driven side)	Lead accuracy			Shaft run-out	Dynamic preload torque	Mass	Permissible rotational speed [min ⁻¹] ^{*)}		Internal spatial volume of nut	Standard volume of grease replenishing
	Target value	Error	Variation				Fixed-Simple	Fixed-Fixed		
	<i>T</i>	<i>e_p</i>	<i>v_u</i>				<i>C</i>	(N-cm) ^{*)}		
II	0	0.027	0.020	0.060	1.4 – 11.8	1.6	5 000	—	3.2	1.6
II		0.030	0.023	0.060	1.4 – 11.8	1.8	5 000	—		
II		0.030	0.023	0.075	1.4 – 11.8	2.0	5 000	—		
II		0.035	0.025	0.095	1.4 – 11.8	2.3	5 000	—		
II		0.040	0.027	0.095	0.8 – 13.8	2.5	4 150	—		
I		0.040	0.027	0.120	0.8 – 13.8	2.8	3 270	4 470		
I		0.046	0.030	0.120	0.8 – 13.8	3.3	2 180	3 010		
I		0.054	0.035	0.160	0.8 – 13.8	3.8	1 550	2 170		
I		0.065	0.040	0.200	0.8 – 13.8	4.7	900	1 270		
II		0.023	0.018	0.050	1.6 – 9.8	1.4	5 000	—	4.6	2.3
II		0.027	0.020	0.060	1.4 – 11.8	1.7	5 000	—		
II		0.030	0.023	0.060	1.4 – 11.8	1.9	5 000	—		
II		0.030	0.023	0.075	1.4 – 11.8	2.1	5 000	—		
II		0.035	0.025	0.095	1.4 – 11.8	2.4	5 000	—		
II		0.040	0.027	0.095	0.8 – 13.8	2.6	4 310	—		
I		0.040	0.027	0.120	0.8 – 13.8	2.9	3 380	4 570		
I		0.046	0.030	0.120	0.8 – 13.8	3.4	2 240	3 070		
I		0.054	0.035	0.160	0.8 – 13.8	3.9	1 590	2 200		

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

(Ultra high helix lead)



Ball screw No.	Screw shaft diameter <i>d</i>	Lead <i>l</i>	Basic load ratings (N)		Stroke		Nut length <i>L</i>	Screw shaft dimensions			
			Dynamic <i>C_s</i>	Static <i>C_{0a}</i>	Nominal	Max.		<i>L_i</i>	<i>L_s</i>	<i>L_o</i>	<i>L_i</i>
PSS2040N1D0658	20	40	6 380	11 600	400	455	92	553	585	658	32
PSS2040N1D0758					500	555		653	685	758	
PSS2040N1D0858					600	655		753	785	858	
PSS2040N1D0958					700	755		853	885	958	
PSS2040N1D1085					800	853		953	985	1 085	
PSS2040N1D1285					1 000	1 053		1 153	1 185	1 285	
PSS2040N1D1485					1 200	1 253		1 353	1 385	1 485	
PSS2040N1D1885					1 600	1 653		1 753	1 785	1 885	
PSS2040N1D2285					2 000	2 053		2 153	2 185	2 285	
PSS2060N1D0708		60	5 680	11 800	400	458	129	593	635	708	42
PSS2060N1D0808					500	558		693	735	808	
PSS2060N1D0908					600	658		793	835	908	
PSS2060N1D1008					700	758		893	935	1 008	
PSS2060N1D1135					800	856		993	1 035	1 135	
PSS2060N1D1335					1 000	1 056		1 193	1 235	1 335	
PSS2060N1D1535					1 200	1 256		1 393	1 435	1 535	
PSS2060N1D1935	1 600				1 656	1 793		1 835	1 935		
PSS2060N1D2335	2 000				2 056	2 193		2 235	2 335		

Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

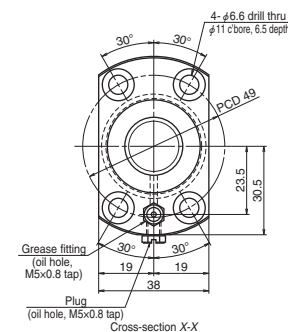
Nut model: BSS

NSK

Screw shaft ø20

Lead 40, 60

Unit: mm



Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	3.175 / 17.2
Ball circle dia.	20.5
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease LR3

Recommended support unit

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK15-01B (low-profile, square)	WBK15-01B (low-profile, square)	WBK15S-01B (low-profile, square)
WBK15-11 (round)	WBK15-11 (round)	

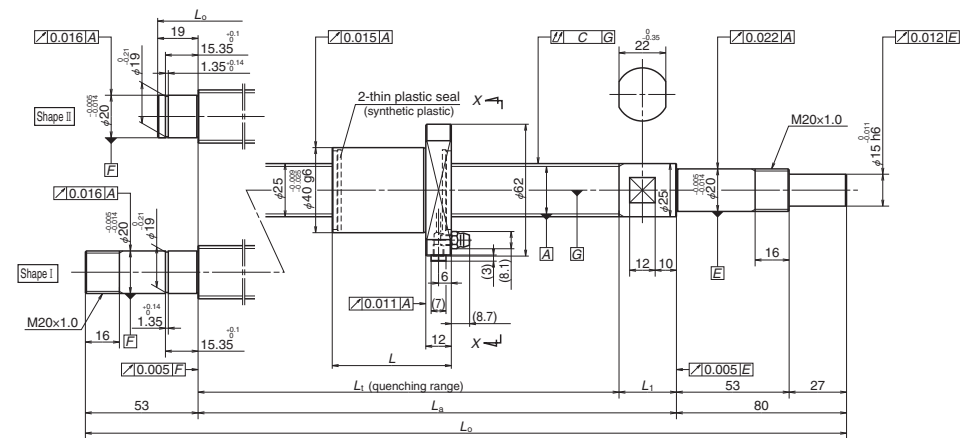
Unit: mm

Left shaft end (opposite driven side)	Lead accuracy			Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min ⁻¹) *2		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
	Target value	Error	Variation				Fixed-Simple	Fixed-Fixed		
	T	e _p	v _u							
II	0	0.030	0.023	0.075	2.2 – 12.8	2.1	5 000	—	5.3	2.7
II		0.035	0.025	0.075	2.2 – 12.8	2.4	5 000	—		
II		0.035	0.025	0.095	2.2 – 12.8	2.6	5 000	—		
II		0.040	0.027	0.095	1.8 – 14.8	2.8	3 940	—		
I		0.040	0.027	0.120	1.8 – 14.8	3.1	3 120	4 190		
I		0.046	0.030	0.160	1.8 – 14.8	3.6	2 100	2 850		
I		0.054	0.035	0.160	1.8 – 14.8	4.1	1 500	2 070		
I		0.065	0.040	0.200	1.8 – 14.8	5.1	880	1 230		
I		0.077	0.046	0.240	1.8 – 14.8	6.0	580	810		
II		0.030	0.023	0.075	2.7 – 13.8	2.4	5 000	—	7.0	3.5
II		0.035	0.025	0.095	2.7 – 13.8	2.6	5 000	—		
II		0.035	0.025	0.095	2.7 – 13.8	2.9	4 830	—		
II		0.040	0.027	0.120	1.8 – 14.8	3.1	3 740	—		
I		0.040	0.027	0.120	1.8 – 14.8	3.4	2 980	3 920		
I		0.046	0.030	0.160	1.8 – 14.8	3.9	2 020	2 700		
I		0.054	0.035	0.160	1.8 – 14.8	4.4	1 460	1 970		
I	0.065	0.040	0.200	1.8 – 14.8	5.4	860	1 180			
I	0.077	0.046	0.240	1.8 – 14.8	6.3	570	790			

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

Compact FA PSS Type

(Fine lead)



Nut model: BSS

NSK

Screw shaft $\phi 25$

Lead 5, 10

Unit: mm

Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	3.175 / 22.2
Ball circle dia.	25.5
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease LR3

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N)		Stroke		Nut length L	Screw shaft dimensions			
			Dynamic C_a	Static C_{0a}	Nominal	Max.		L_1	L_a	L_o	L_1
PSS2505N1D0349	25	5	11 500	23 500	150	185	32	223	250	349	27
PSS2505N1D0399					200	235		273	300	399	
PSS2505N1D0499					300	335		373	400	499	
PSS2505N1D0599					400	435		473	500	599	
PSS2505N1D0699					500	535		573	600	699	
PSS2505N1D0899					700	735		773	800	899	
PSS2505N1D0999					800	835		873	900	999	
PSS2505N1D1233					1 000	1 027		1 073	1 100	1 233	
PSS2510N1D0549		10	15 000	32 400	300	361	56	423	450	549	27
PSS2510N1D0649					400	461		523	550	649	
PSS2510N1D0749					500	561		623	650	749	
PSS2510N1D0849					600	661		723	750	849	
PSS2510N1D0949					700	761		823	850	949	
PSS2510N1D1049					800	861		923	950	1 049	
PSS2510N1D1283					1 000	1 053		1 123	1 150	1 283	
PSS2510N1D1883					1 600	1 653		1 723	1 750	1 883	

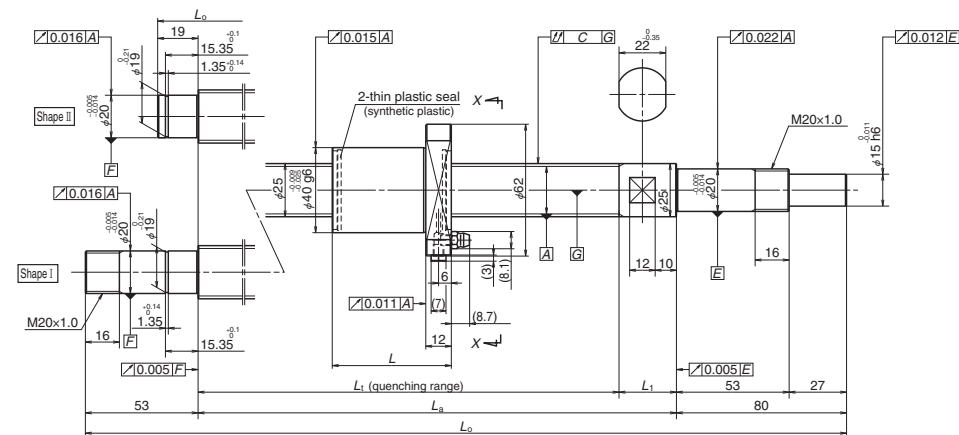
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

Left shaft end (opposite driven side)	Lead accuracy			Shaft run-out C	Dynamic preload torque (N-cm) *1	Mass (kg)	Permissible rotational speed (min ⁻¹) *2		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
	Target value T	Error e_p	Variation v_u				Fixed-Simple	Fixed-Fixed		
II	0	0.023	0.018	0.035	1.2 – 9.3	1.5	5 000	—	4.4	2.2
II		0.023	0.018	0.035	1.2 – 9.3	1.6	5 000	—		
II		0.025	0.020	0.040	1.2 – 9.3	2.0	5 000	—		
II		0.027	0.020	0.045	1.2 – 9.3	2.3	5 000	—		
II		0.030	0.023	0.055	0.8 – 10.8	2.7	5 000	—		
II		0.035	0.025	0.065	0.8 – 10.8	3.4	5 000	—		
II		0.040	0.027	0.065	0.8 – 10.8	3.7	4 490	—		
I		0.046	0.030	0.080	0.8 – 13.8	4.5	2 960	4 060		
II		0.027	0.020	0.045	3.1 – 11.8	2.4	5 000	—	4.7	2.4
II		0.030	0.023	0.055	2.2 – 12.8	2.7	5 000	—		
II		0.030	0.023	0.055	2.2 – 12.8	3.1	5 000	—		
II		0.035	0.025	0.065	2.2 – 12.8	3.5	5 000	—		
II		0.040	0.027	0.065	2.2 – 12.8	3.8	5 000	—		
II		0.040	0.027	0.080	2.2 – 12.8	4.2	4 120	—		
I		0.046	0.030	0.100	1.8 – 14.8	5.0	2 760	3 790		
I		0.065	0.040	0.130	1.8 – 14.8	7.2	1 150	1 620		

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

Compact FA PSS Type

(Medium, High helix lead)



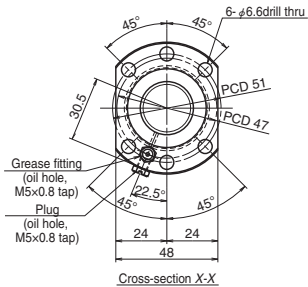
Nut model: BSS

NSK

Screw shaft ø25

Lead 20, 25

Unit: mm



Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	3.175 / 22.2
Ball circle dia.	25.5
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease LR3

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Ball screw No.	Screw shaft diameter <i>d</i>	Lead <i>l</i>	Basic load ratings (N)		Stroke		Nut length <i>L</i>	Screw shaft dimensions			
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	Nominal	Max.		<i>L₁</i>	<i>L_a</i>	<i>L₀</i>	<i>L₁</i>
PSS2520N1D0729	25	20	7 650	14 800	500	544	54	604	630	729	26
PSS2520N1D0829					600	644		704	730	829	
PSS2520N1D0929					700	744		804	830	929	
PSS2520N1D1029					800	844		904	930	1 029	
PSS2520N1D1263					1 000	1 036		1 104	1 130	1 263	
PSS2520N1D1463					1 200	1 236		1 304	1 330	1 463	
PSS2520N1D1863					1 600	1 636		1 704	1 730	1 863	
PSS2520N1D2263					2 000	2 036		2 104	2 130	2 263	
PSS2525N1D0779		25	7 490	14 600	500	581	63	650	680	779	30
PSS2525N1D0879					600	681		750	780	879	
PSS2525N1D0979					700	781		850	880	979	
PSS2525N1D1079					800	881		950	980	1 079	
PSS2525N1D1313					1 000	1 073		1 150	1 180	1 313	
PSS2525N1D1513					1 200	1 273		1 350	1 380	1 513	
PSS2525N1D1913					1 600	1 673		1 750	1 780	1 913	
PSS2525N1D2313					2 000	2 073		2 150	2 180	2 313	

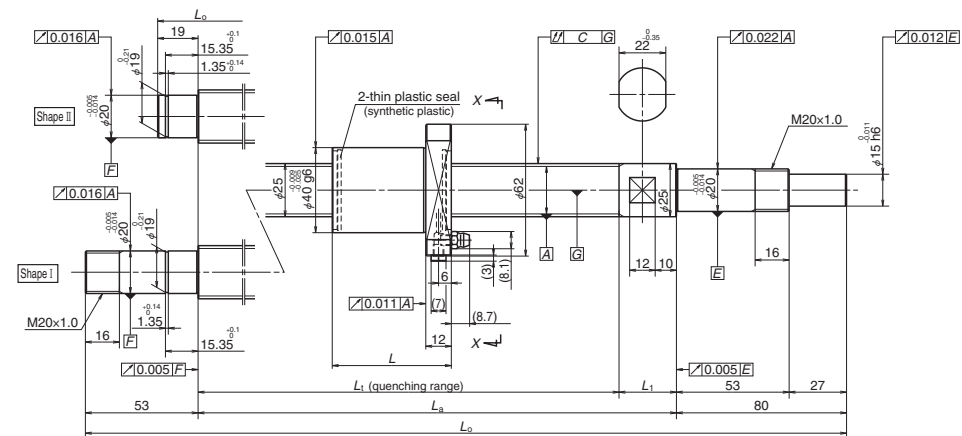
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

Left shaft end (opposite driven side)	Lead accuracy			Shaft run-out <i>C</i>	Dynamic preload torque (N-cm) *1	Mass (kg)	Permissible rotational speed (min ⁻¹) *2		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
	Target value <i>T</i>	Error <i>e_p</i>	Variation <i>v_u</i>				Fixed-Simple	Fixed-Fixed		
II	0	0.030	0.023	0.055	2.2 – 12.8	3.1	5 000	—	3.9	2.0
II		0.035	0.025	0.065	2.2 – 12.8	3.4	5 000	—		
II		0.040	0.027	0.065	2.2 – 12.8	3.8	5 000	—		
II		0.040	0.027	0.080	2.2 – 12.8	4.2	4 280	—		
I		0.046	0.030	0.100	1.8 – 14.8	5.0	2 850	3 920		
I		0.054	0.035	0.100	1.8 – 14.8	5.8	2 030	2 820		
I		0.065	0.040	0.130	1.8 – 14.8	7.3	1 180	1 650		
I		0.077	0.046	0.170	1.8 – 14.8	8.8	770	1 080		
II		0.035	0.025	0.055	2.7 – 13.8	3.3	5 000	—	4.3	2.2
II		0.035	0.025	0.065	2.7 – 13.8	3.7	5 000	—		
II		0.040	0.027	0.065	2.7 – 13.8	4.1	4 910	—		
II		0.040	0.027	0.080	2.7 – 13.8	4.4	3 910	—		
I		0.046	0.030	0.100	1.8 – 14.8	5.3	2 640	3 620		
I		0.054	0.035	0.100	1.8 – 14.8	6.0	1 900	2 630		
I		0.065	0.040	0.130	1.8 – 14.8	7.5	1 120	1 570		
I		0.077	0.046	0.170	1.8 – 14.8	9.1	740	1 040		

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

Compact FA PSS Type

(High helix, Ultra high helix lead)



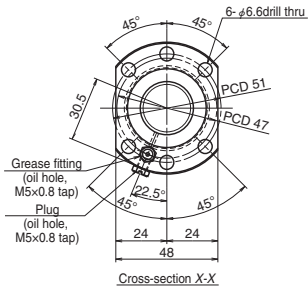
Nut model: BSS

NSK

Screw shaft ø25

Lead 30, 50

Unit: mm



Ball screw specification

Preload type	Oversize ball preload (P-preload)
Ball diameter/screw shaft root diameter	3.175 / 22.2
Ball circle dia.	25.5
Accuracy grade/axial play	C5 / 0
Factory-packed grease	NSK grease LR3

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Ball screw No.	Screw shaft diameter <i>d</i>	Lead <i>l</i>	Basic load ratings (N)		Stroke		Nut length <i>L</i>	Screw shaft dimensions			
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	Nominal	Max.		<i>L₁</i>	<i>L_a</i>	<i>L₀</i>	<i>L₁</i>
PSS2530N1D0779	25	30	7 490	14 600	500	570	74	650	680	779	30
PSS2530N1D0879					600	670		750	780	879	
PSS2530N1D0979					700	770		850	880	979	
PSS2530N1D1079					800	870		950	980	1 079	
PSS2530N1D1313					1 000	1 062		1 150	1 180	1 313	
PSS2530N1D1513					1 200	1 262		1 350	1 380	1 513	
PSS2530N1D1913					1 600	1 662		1 750	1 780	1 913	
PSS2530N1D2313					2 000	2 062		2 150	2 180	2 313	
PSS2550N1D0829		50	6 910	14 700	500	570	114	690	730	829	40
PSS2550N1D0929					600	670		790	830	929	
PSS2550N1D1029					700	770		890	930	1 029	
PSS2550N1D1129					800	870		990	1 030	1 129	
PSS2550N1D1363					1 000	1 062		1 190	1 230	1 363	
PSS2550N1D1563					1 200	1 262		1 390	1 430	1 563	
PSS2550N1D1963					1 600	1 662		1 790	1 830	1 963	
PSS2550N1D2363					2 000	2 062		2 190	2 230	2 363	

Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.

Left shaft end (opposite driven side)	Lead accuracy			Shaft run-out <i>C</i>	Dynamic preload torque (N-cm) *1	Mass (kg)	Permissible rotational speed (min ⁻¹) *2		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
	Target value	Error	Variation				Fixed-Simple	Fixed-Fixed		
	<i>T</i>	<i>e_p</i>	<i>v_u</i>							
II	0	0.035	0.025	0.055	2.7 – 13.8	3.4	5 000	—	5.5	2.8
II		0.035	0.025	0.065	2.7 – 13.8	3.7	5 000	—		
II		0.040	0.027	0.065	2.7 – 13.8	4.1	4 980	—		
II		0.040	0.027	0.080	2.7 – 13.8	4.5	3 960	—		
I		0.046	0.030	0.100	1.8 – 14.8	5.3	2 670	3 650		
I		0.054	0.035	0.100	1.8 – 14.8	6.1	1 920	2 650		
I		0.065	0.040	0.130	1.8 – 14.8	7.6	1 130	1 580		
I		0.077	0.046	0.170	1.8 – 14.8	9.1	740	1 040		
II		0.035	0.025	0.065	5.4 – 17.6	3.8	5 000	—	7.7	3.9
II		0.035	0.025	0.065	5.4 – 17.6	4.1	5 000	—		
II		0.040	0.027	0.080	5.4 – 17.6	4.5	4 750	—		
II		0.040	0.027	0.080	5.4 – 17.6	4.9	3 790	—		
I		0.046	0.030	0.100	4.1 – 19.6	5.8	2 570	3 470		
I		0.054	0.035	0.100	4.1 – 19.6	6.5	1 860	2 540		
I		0.065	0.040	0.130	4.1 – 19.6	8.0	1 100	1 520		
I		0.077	0.046	0.170	4.1 – 19.6	9.6	730	1 020		

4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

(Medium lead)



Screw shaft ø10

Lead 5

Unit: mm

Recommended support unit	
For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01C (square, clean)	WBK08S-01C (square, clean)
WBK08-11C (round, clean)	WBK08S-01B (low-profile, square)
WBK08-01B (low-profile, square)	
WBK08-11 (round)	

f
SSN

4. Use of NSK support unit is recommended. See page B389 for details.

(Fine lead)



Unit: mm



Recommended support unit

Unit: mm

Lead accuracy			Shaft run-out <i>C</i>	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min ⁻¹) *2	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Target value <i>T</i>	Error <i>e_o</i>	Variation <i>V_o</i>						
0	0.010	0.008				0.035		
	0.012	0.008	0.045	0.2–2.0	0.3			
	0.016	0.012	0.070	0.2–3.0	0.7			

4. Use of NSK support unit is recommended. See page B389 for details.

(Fine lead)



Unit: mm



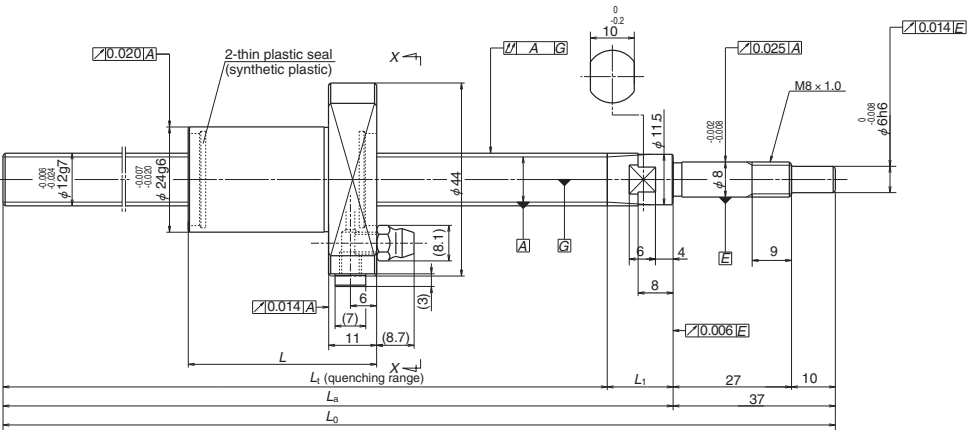
Recommended support unit

Unit: mmf
US

4. Use of NSK support unit is recommended. See page B389 for details.

Compact FA FSS Type

(Medium lead)



Ball screw No.	Screw shaft diameter <i>d</i>	Lead <i>l</i>	Basic load ratings (N)		Stroke		Nut length <i>L</i>	Screw shaft dimensions			
			Dynamic <i>C_d</i>	Static <i>C_{0s}</i>	Nominal	Max.		<i>L₁</i>	<i>L₂</i>	<i>L₃</i>	<i>L₄</i>
FSS1210N1D0400	12	10	3 760	5 780	250	287	43	348	363	400	15
FSS1210N1D0600					450	487		548	563	600	
FSS1210N1D0900					750	787		848	863	900	

Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Service temperature range is 0 to 80°C.
3. Use of NSK support unit is recommended. See page B389 for details.

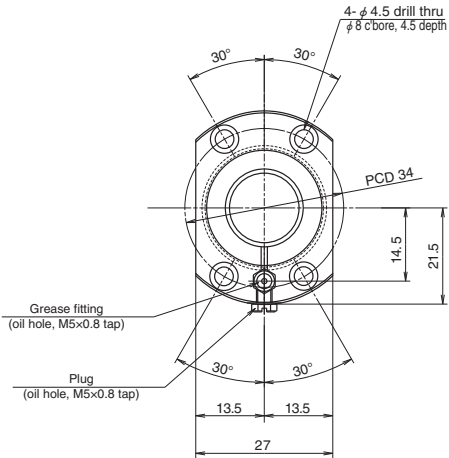
Nut model: BSS

NSK

Screw shaft $\phi 12$

Lead 10

Unit: mm



Ball screw specification

Ball diameter/screw shaft root diameter	2.000 / 10.2
Accuracy grade/axial play	Ct7 / 0.010 or less
Factory-packed grease	NSK grease LR3

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01B (low-profile, square)	WBK12SF-01B (low-profile, square)

Unit: mm

Lead accuracy			Shaft run-out <i>C</i>	Dynamic preload torque (N·cm)	Mass (kg)	Permissible rotational speed (min ⁻¹) *5	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Target value <i>T</i>	Error <i>e_p</i>	Variation <i>V₃₀₀</i>				Fixed-Simple		
0	0.120	0.052	0.080	—	0.5	5 000	1.0	0.5
	0.195		0.120		0.7	5 000		
	0.310		0.180		1.0	2 300		

4. The stroke and permissible rotational speed shown in the table are the values when the support unit recommended by NSK is used and Fixed-Supported (ball screw mounting method) is selected.
5. Permissible rotational speed varies when using cut screw shaft. It is necessary to calculate two items below, and whichever smaller is the permissible rotational speed.
- *Critical speed which is the resonance vibration of the shaft (page B47).
- *Maximum rotational speed 5 000 min⁻¹

(Medium, High helix lead)



Screw shaft ø15

Lead 10, 20

Unit: mm

Recommended support unit	
For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01B (low-profile, square)	WBK15SF-01B (low-profile, square)



Nut dimensions								Shaft run-out C	Dynamic preload torque (N·cm)	Mass (kg)	Permissible rotational speed (min ⁻¹) ^{a)}	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
L	D ₁	D ₂	W	B	C	E	G				Fixed-Simple		
43	28	51	39	18	31	25	15.5	0.070	—	0.9	5 000	2.0	1.0
								0.125		1.7	2 300		
								0.200		2.3	1 020		
51	32	55	43	20	33	27	16.5	0.070	—	1.0	5 000	2.8	1.4
								0.125		1.7	2 260		
								0.200		2.3	1 000		

3. Use of NSK support unit is recommended. See page B389 for details.

*Maximum rotational speed 5 000 min⁻¹

(Medium, High helix lead)



Unit: mm

**Recommended support unit**Unit: mmB144

(Fine, Medium, High helix lead)

**NSK**

Lead 10, 20, 25

Unit: mm



Recommended support unit

Unit: mm

Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N-cm of torque is added due to thin plastic seals.
2. Service temperature range is 0 to 80°C.
3. Use of NSK support unit is recommended. See page B389 for details.

4. The stroke and permissible rotational speed shown in the table are the values when the support unit recommended by NSK is used and Fixed-Supported (ball screw mounting method) is selected.
5. Permissible rotational speed varies when using cut screw shaft. It is necessary to calculate two items below, and whichever smaller is the permissible rotational speed.
- *Critical speed which is the resonance vibration of the shaft (page B47).
- *Maximum rotational speed 5 000 min⁻¹

B-3-1.2 High Speed SS Series HSS Type

◆ Features

The HMS and HMD series, originally developed for machine tools, are an addition to NSK's lineup of standard ball screws. They have a wide range of applications, from general machines to high performance machines such as those requiring high speed and precision.

● High speed

The new recirculation system that utilizes NSK's high speed and low noise technology more than doubles the $d \cdot n$ value from 70 000 to 160 000.

To extend the range of the lead to 20mm, high speed operation of over 60m/min. is possible.

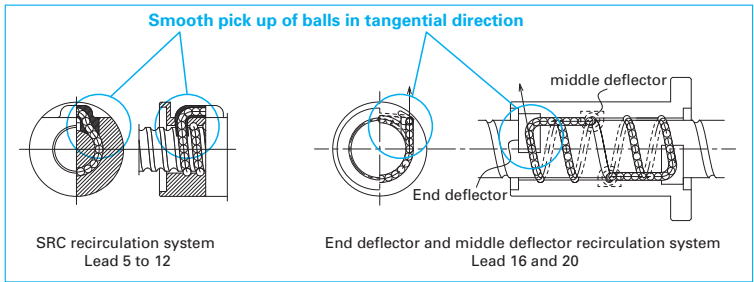


Fig 1 Ball recirculation system

Table 1 Allowable feed speed of combinations of shaft diameter and lead

shaft diameter [mm]	Lead [mm]	5	10	12	16	20
32		25m/min	50m/min			
40			40m/min	48m/min	64m/min	80m/min
45			35m/min			
50			32m/min	38m/min		

* Allowable speed needs to be calculated. See the permissible rotational speed in the dimensions table.

● Low noise and vibrations

Compared to our conventional products, the average noise level has been reduced by more than 6dB(A), reducing the number of colliding balls and recirculation parts thanks to high speed, low noise technology.

The vibration level of the nut has also been reduced drastically.

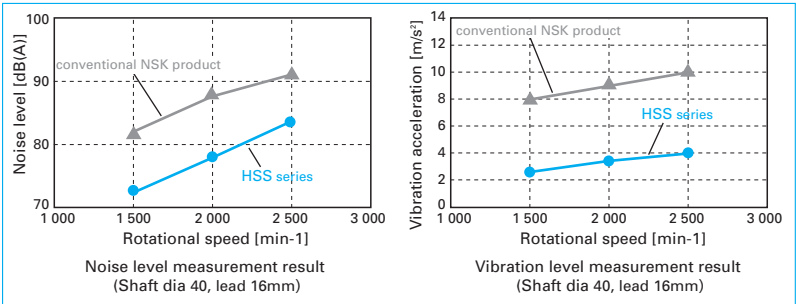


Table 2

● Installation

Installation dimension are the same as those of a conventional SS series.

● Compact

Achieved high-level stiffness and high load capacity equivalent to that of double nut preload by changing the double nut preload to the offset preload of a single nut, and compact sized nut. Adopted thin seals axially and shorten nut length.

● Blank shaft ends

The blank shaft ends can be customized according to customers' requests. See page B27 in NSK's recommended design when drawing up plans for a shaft end. The support units available on page B389 in the case of NSK's recommended design. See "Technical Description: Shaft End Processing" (page B86) for procedures of shaft end processing and precautions.

● Oil supply

2 oil holes, M6×1.0, are provided in the nut flange periphery are the end of the nut flange. A plug is standardly screwed into the periphery of the nut flange.

◆ Specifications

● Accuracy grade and axial play

The available standard accuracy grade and axial play are show in Table 2.

Table 2 Accuracy grade and axial play

Accuracy grade	C5
Axial play	0 mm (preloaded)

● Dimension tables

Shape dimensions and specifications are listed for every shaft diameter and lead. See Table 3, the "List of pages".

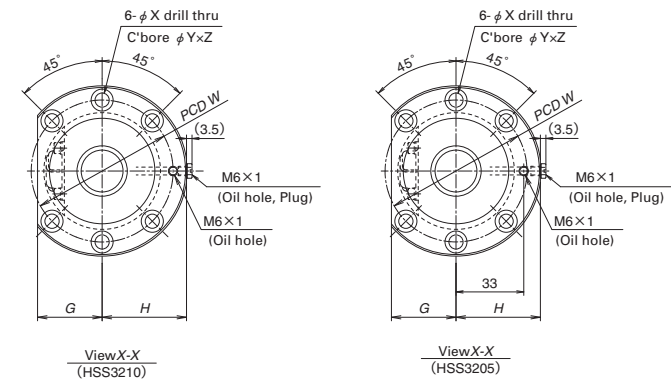
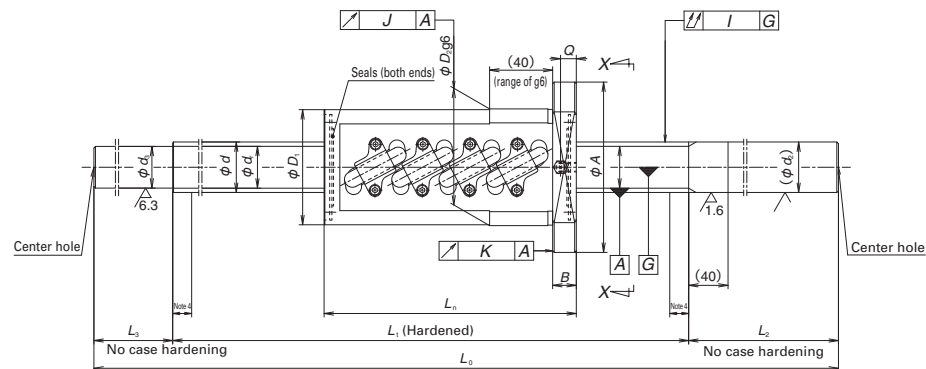
◆ Other

The seal of the ball screw and recirculation parts are made of synthetic resin. Consult NSK when using the ball screws under extreme environments or special environments, or using special lubricant or oil.

For special environments, see pages B70 and D2. See pages B67 and D13 for lubricants.

Table 3 Combinations of screw shaft diameter and lead

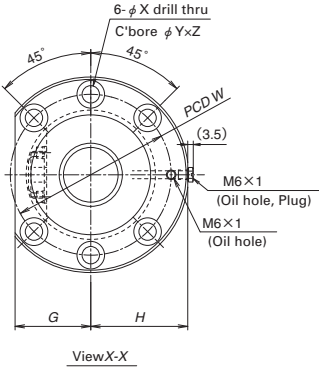
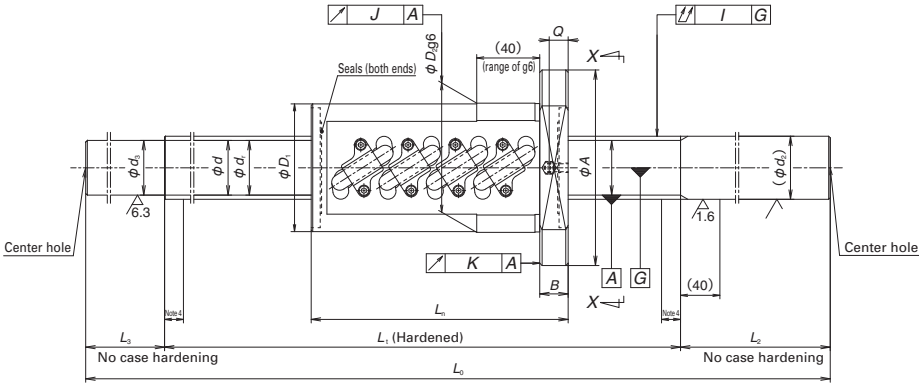
Screw shaft diameter [mm]	Lead [mm]	5	10	12	16	20
32		B149	B149			
40			B151	B151	B153	B153
45			B155			
50			B155	B155		



Reference No.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective balls turns	Basic load rating(N)		Preload	Dynamic friction torque, median (N·cm)	Ball nut dimensions							
						Tune × Circuits	Dynamic	Static			Diamete		Flange				Overall length	
											D_1	D_2	A	G	H	B		
HSS3205N1D0650	32	5	3.175	32.5	29.2	2.5X2	21 800	56 000	920	17.0	57	58	85	32	42	13	89	71
HSS3205N1D0950																		
HSS3205N1D1250																		
HSS3205N1D1550																		
HSS3205N1D1850																		
HSS3210N1D0850	32	10	6.350	33.0	26.4	2.5X2	54 500	110 000	2 310	59.5	73	74	108	41	53.5	15	160	90
HSS3210N1D1050																		
HSS3210N1D1450																		
HSS3210N1D1850																		
HSS3210N1D2250																		

- Notes:
1. Service temperature range is 0 to 60°C.
 2. Use of NSK support unit is recommended. See page B389 for details.
 3. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
 4. Imperfect hardened areas for one lead exists on both ends of a screw. Exercise care when stroke setting.
 5. Permissible rotational speed: Calculated values obtained from the critical speed between the threaded length and NSK's recommended shaft end design. See page B27.

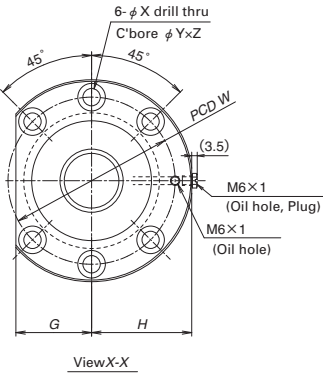
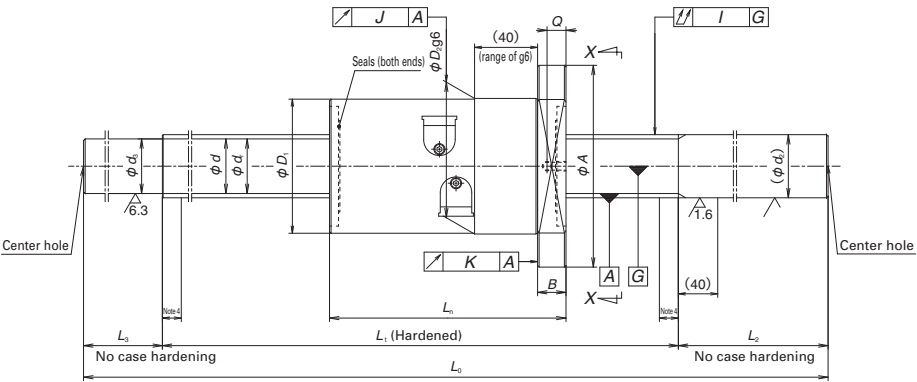
				Screw shaft dimension							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed (min ⁻¹)		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)	
Bolt hole			Oil hole	Threaded length		Shaft end, right			Shaft end, left			Overall length	Travel compensation	Deviation	Variation	Shaft straightness		Radial run-out	Installation			
X	Y	Z	Q	L _t	d ₂	L ₂	d ₃	L ₃	L ₀	T	e _p	V _u	I	J	K	Fixed-Free support	Fixed-Fixed support					
6.6	11	6.5	8	400		200		50	650	-0.010	0.025	0.020	0.055	0.019	0.013	5.2	5 000	5 000	10	5		
				600		250		100	950	-0.014	0.030	0.023	0.065			7.0	5 000	5 000				
				900	32	250	29.2	100	1 250	-0.022	0.040	0.027	0.080			8.7	5 000	5 000				
				1 150		300		100	1 550	-0.028	0.046	0.030	0.100			10.5	3 500	4 700				
				1 450		300		100	1 850	-0.035	0.054	0.035	0.130			12.2	2 200	2 900				
				9	14	8.5	10	500		250		100	850			-0.012	0.027	0.020			0.065	0.019
700		250		100				1 050	-0.017	0.035	0.025	0.080	10.0	5 000	5 000							
1 050	32	300	26.4	100				1 450	-0.025	0.046	0.030	0.100	12.2	4 100	5 000							
1 450		300		100				1 850	-0.035	0.054	0.035	0.130	14.3	2 100	2 800							
1 850		300		100				2 250	-0.045	0.065	0.040	0.170	16.5	1 200	1 700							



Reference No.	Screw shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective balls turns	Basic load rating(N)		Preload (N)	Dynamic friction torque, median (N·cm)	Ball nut dimensions								
						Tune × Circuits	Dynamic <i>C_a</i>	Static <i>C_{0a}</i>			Diamete				Flange			Overall length <i>L_n</i>	
											<i>D₁</i>	<i>D₂</i>	<i>A</i>	<i>G</i>	<i>H</i>	<i>B</i>			
HSS4010N1D0950	40	10	6.350	41.0	34.4	2.5X2	61 200	137 000	2 600	74.5	81	82	124	47	61.5	18	163	102	
HSS4010N1D1450																			
HSS4010N1D2100																			
HSS4010N1D2900																			
HSS4012N1D1450	40	12	7.144	41.5	34.1	2.5X2	71 700	154 000	3 050	96.0	85	86	128	48	63.5	18	187	106	
HSS4012N1D2100																			
HSS4012N1D2900																			

Notes: 1. Service temperature range is 0 to 60°C.
2. Use of NSK support unit is recommended. See page B389 for details.
3. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
4. Imperfect hardened areas for one lead exists on both ends of a screw. Exercise care when stroke setting.
5. Permissible rotational speed: Calculated values obtained from the critical speed between the threaded length and NSK's recommended shaft end design. See page B27.

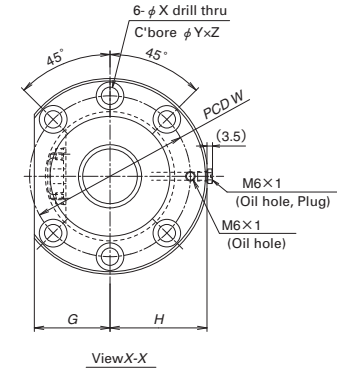
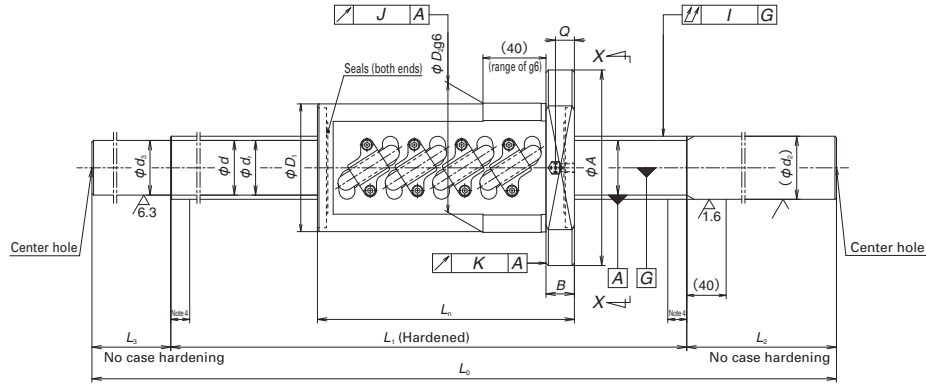
				Screw shaft dimension						Lead accuracy				Run-out			Mass	Permissible rotational speed (min ⁻¹)		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)						
Bolt hole			Oil hole	Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out		Installation											
X	Y	Z	Q		L ₁	d ₂	L ₂	d ₃						L ₃	L ₀	T		e _p	V _u			I	J	K	(kg)	Fixed-Free support	Fixed-Fixed support
11	17.5	11	12	600	250	100	950	-0.014	0.030	0.023	0.050	0.025	0.015	13.5	4 000	4 000	52	26									
				1 050	300	100	1 450	-0.025	0.046	0.030	0.070			17.9	4 000	4 000											
				1 600	350	150	2 100	-0.039	0.054	0.035	0.110			23.5	2 200	3 000											
				2 400	350	150	2 900	-0.058	0.077	0.046	0.140			30.5	900	1 300											
11	17.5	11	12	1 050	300	100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	19.1	4 000	4 000	67	34									
				1 600	350	150	2 100	-0.039	0.054	0.035	0.110			24.8	2 200	3 000											
				2 400	350	150	2 900	-0.058	0.077	0.046	0.140			31.8	900	1 300											



Reference No.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective balls turns	Basic load rating(N)			Dynamic friction torque, median (N·cm)	Ball nut dimensions						
	d	l	D_w	d_m	d_r	Tune x Circuits	Dynamic	Static	Preload		Diamete		Flange				Overall length
							C_d	C_{os}	(N)		D_1	D_2	A	G	H	B	L_n
																	W
HSS4016N1D1450	40	16	7.144	41.5	34.1	3.7X1	66 900	131 000	2 850	104.0	85	86	128	48	63.5	18	160
HSS4016N1D2100																	
HSS4016N1D2900																	
HSS4020N1D1450	40	20	7.144	41.5	34.1	3.7X1	66 500	131 000	2 850	116.5	85	86	128	48	63.5	18	192
HSS4020N1D2100																	
HSS4020N1D2900																	

Notes: 1. Service temperature range is 0 to 60°C.
2. Use of NSK support unit is recommended. See page B389 for details.
3. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
4. Imperfect hardened areas for one lead exists on both ends of a screw. Exercise care when stroke setting.
5. Permissible rotational speed: Calculated values obtained from the critical speed between the threaded length and NSK's recommended shaft end design. See page B27.

				Screw shaft dimension							Lead accuracy			Run-out			Mass	Permissible rotational speed (min ⁻¹)		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Bolt hole			Oil hole	Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out	Installation						
					X	Y	Z	Q										L ₁	d ₂		
11	17.5	11	11	1 050	40	300	34.1	100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	19.2	4 000	4 000	40	20	
				1 600		350		150	2 100	-0.039	0.054	0.035	0.110			25.0	2 200	3 000			
				2 400		350		150	2 900	-0.058	0.077	0.046	0.140			32.2	900	1 300			
11	17.5	11	11	1 050	40	300	34.4	100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	20.3	4 000	4 000	47	24	
				1 600		350		150	2 100	-0.039	0.054	0.035	0.110			26.2	2 200	3 000			
				2 400		350		150	2 900	-0.058	0.077	0.046	0.140			33.5	900	1 300			



Reference No.	Screw shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective balls turns	Basic load rating(N)		Preload (N)	Dynamic friction torque, median (N·cm)	Ball nut dimensions							
						Tune × Circuits	Dynamic <i>C_a</i>	Static <i>C_{oa}</i>			Diamete		Flange			Overall length <i>L_n</i>		
											<i>D₁</i>	<i>D₂</i>	<i>A</i>	<i>G</i>	<i>H</i>			<i>B</i>
HSS4510N1D1450	45	10	6.350	46.0	39.4	2.5X2	65 800	157 000	2 710	82.0	87	88	132	50	65.5	18	163	110
HSS4510N1D2100																		
HSS4510N1D2900																		
HSS5010N1D1450	50	10	6.350	51.0	44.4	2.5X2	68 100	174 000	2 880	92.0	92	93	135	51	67	18	163	113
HSS5010N1D1850																		
HSS5010N1D2350																		
HSS5010N1D2900																		
HSS5012N1D1450	50	12	7.938	51.5	43.2	2.5X2	91 500	218 000	3 880	136.5	99	100	146	55	72.5	22	193	122
HSS5012N1D2100																		
HSS5012N1D2900																		

- Notes: 1. Service temperature range is 0 to 60°C.
 2. Use of NSK support unit is recommended. See page B389 for details.
 3. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
 4. Imperfect hardened areas for one lead exists on both ends of a screw. Exercise care when stroke setting.
 5. Permissible rotational speed: Calculated values obtained from the critical speed between the threaded length and NSK's recommended shaft end design. See page B27.

				Screw shaft dimension						Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed (min ⁻¹)		Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Bolt hole			Oil hole	Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out	Installation					
X	Y	Z	Q	L ₁	d ₂	L ₂	d ₃	L ₃	L ₀	T	e _p	V _u	I	J	K	Fixed-Free support	Fixed-Fixed support			
11	17.5	11	12	1 050		300		100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	22.0	3 500	3 500	58	29
				1 600	45	350	39.4	150	2 100	-0.039	0.054	0.035	0.110			29.2	2 500	3 400		
				2 400		350		150	2 900	-0.058	0.077	0.046	0.140			38.2	1 100	1 500		
11	17.5	11	12	1 050		300		100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	26.3	3 200	3 200	64	32
				1 450		300		100	1 850	-0.035	0.054	0.035	0.090			31.9	3 200	3 200		
				1 850	50	350	44.4	150	2 350	-0.045	0.065	0.040	0.110			38.8	2 100	2 900		
				2 400		350		150	2 900	-0.058	0.077	0.046	0.140			46.5	1 200	1 700		
14	20	13	12	1 050		300		100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	28.5	3 200	3 200	99	50
				1 600	50	350	43.2	150	2 100	-0.039	0.054	0.035	0.110			37.3	2 800	3 200		
				2 400		350		150	2 900	-0.058	0.077	0.046	0.140			48.2	1 200	1 600		

B-3-1.3 Finished Shaft End MA type, FA type, SA type

1. Order of the dimension tables

The tables begin with the smallest shaft diameter of each MA, FA, and SA type ball screws, and proceeds to the larger sizes. If ball screws have the same shaft diameter, those with smaller leads appear first. Page numbers of shaft diameter and lead combinations are shown in Table 1.

2. Dimension tables

Dimension tables show shapes/sizes as well as specification factors of each shaft diameter/lead combination. Tables also contain data as follows:

●Stroke

Nominal stroke: A reference for your use.
Maximum stroke: The limit stroke that the nut can move. The figure is obtained by subtracting the nut length from the effective threaded length (L_1).

●Lead accuracy

Lead accuracy is either C3 or C5 grades
 T : Travel compensation
 e_p : Tolerance on specified travel
 v_u : Travel variation
See "Technical Description: Lead Accuracy"

Table 1 Combinations of screw shaft diameter and lead

Lead (mm) Screw shaft diameter (mm)	1	1.5	2	2.5	4	5	6
4	B159						
6	B161						
8	B163	B165	B167				
10			B169	B171	B181		
12			B173	B175		B183	
14						B187	
15							
16			B177	B179		B195	
20					B217	B219	
25					B221	B223	B225
28						B229 B231	B233 B235
32						B237 B239	B241 B243
36							
40						B255	
45							
50							

(page B37) for the details of the codes.

●Permissible rotational speed

$d \cdot n$: Limited by the relative peripheral speed between the screw shaft and the nut.

Critical speed: Limited by the natural frequency of a ball screw shaft. Critical speed depends on the supporting condition of screw shaft.

The lower of the two criteria, the $d \cdot n$ and critical speed, will determine the overall permissible rotational speed of the ball screw. For details, see "Technical Description: Permissible Rotational Speed" (page B47).

3. Other

The seal of the ball screw, ball recirculating deflector, and end cap are made of synthetic resin. Consult NSK when using our ball screws under extreme environments or in special environments, or if using special lubricant or oil. For special environments, see pages B70 and D2. For lubricants, see pages B67 and D13.

Note: For details of standard stock products, contact NSK.

8	10	12	16	20	25	32	40	50
	B185							
B189	B191			B193				
			B197			B199		
	B201			B203			B205	
	B227			B207	B209			B211
B245	B247 B249				B213	B215		
	B251 B253							
B257	B259 B261	B263 B265						
	B267							
	B269 B271							

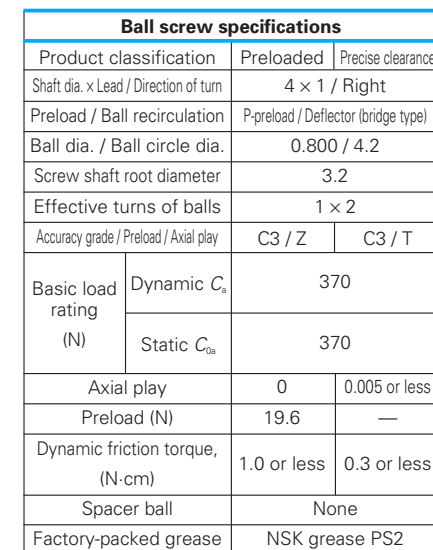
(Fine lead)



Screw shaft ø4

Lead 1

Unit: mm



**For drive side
(Fixed)**

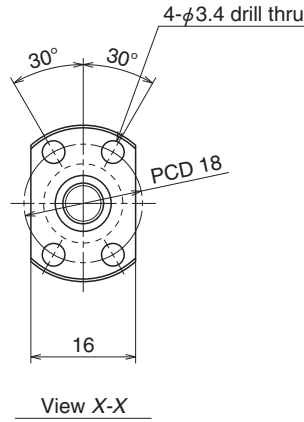
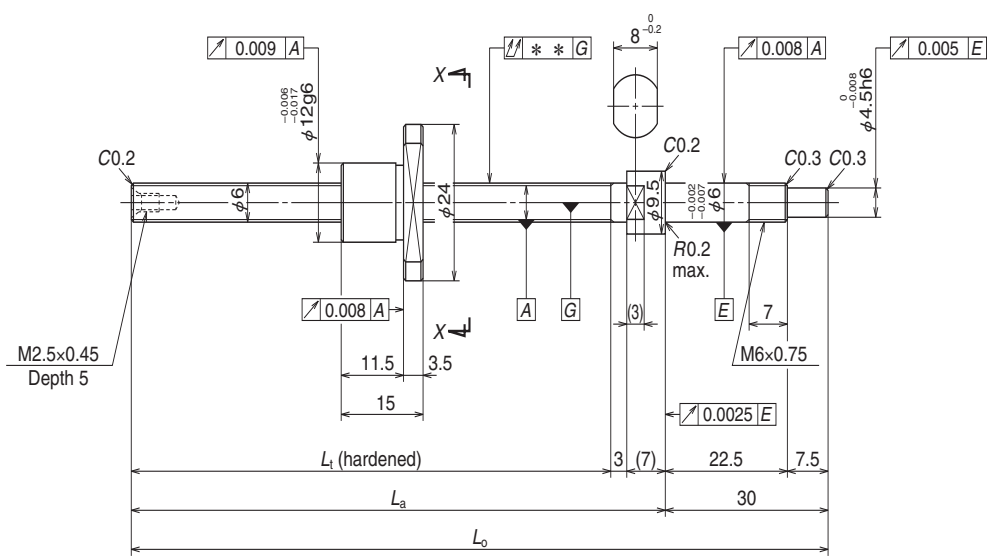
WBK06-01A (square)

WBK06-11 (round)

Unit: mm

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
								Supporting condition
L_t	L_a	L_o	T	e_p	v_u			Fixed - Free
44	55	85	0	0.008	0.008	0.015	0.024	3 000
64	75	105	0	0.008	0.008	0.020	0.026	3 000
94	105	135	0	0.008	0.008	0.025	0.028	3 000

B159



Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	6 × 1 / Right	
Preload / Ball recirculation	P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.	0.800 / 6.2	
Screw shaft root diameter	5.2	
Effective turns of balls	1 × 3	
Accuracy grade / Preload / Axial play	C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	680
	Static C _{0a}	920
Axial play	0	0.005 or less
Preload (N)	24.5	—
Dynamic friction torque, (N·cm)	1.3 or less	0.3 or less
Spacer ball	None	
Factory-packed grease	NSK grease PS2	

Recommended support unit

For drive side (Fixed)
WBK06-01A (square)
WBK06-11 (round)

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (MPFD)	Precise clearance (MSFD)		
W0600MA-1PY-C3Z1	W0600MA-2Y-C3T1	40	50
W0601MA-1PY-C3Z1	W0601MA-2Y-C3T1	70	80
W0601MA-3PY-C3Z1	W0601MA-4Y-C3T1	100	110

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
L _t	L _a	L _o	T	e _p	v _u			Supporting condition
65	75	105	0	0.008	0.008	0.015	0.039	3 000
95	105	135	0	0.008	0.008	0.020	0.045	3 000
125	135	165	0	0.010	0.008	0.025	0.051	3 000

- Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Ball nut does not have seal.
4. Contact NSK if the permissible rotational speed is to be exceeded.

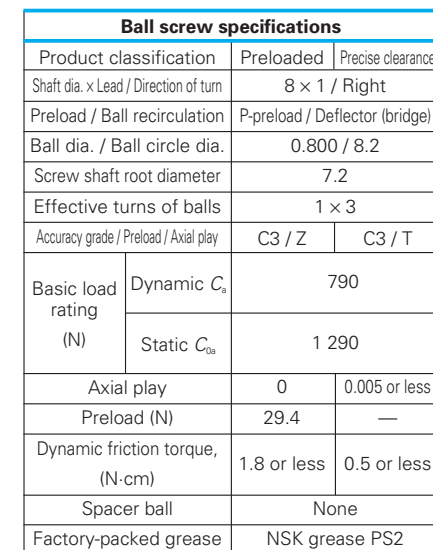
(Fine lead)



Screw shaft ø8

Lead 1

Unit: mm



Recommended support unit

WIA

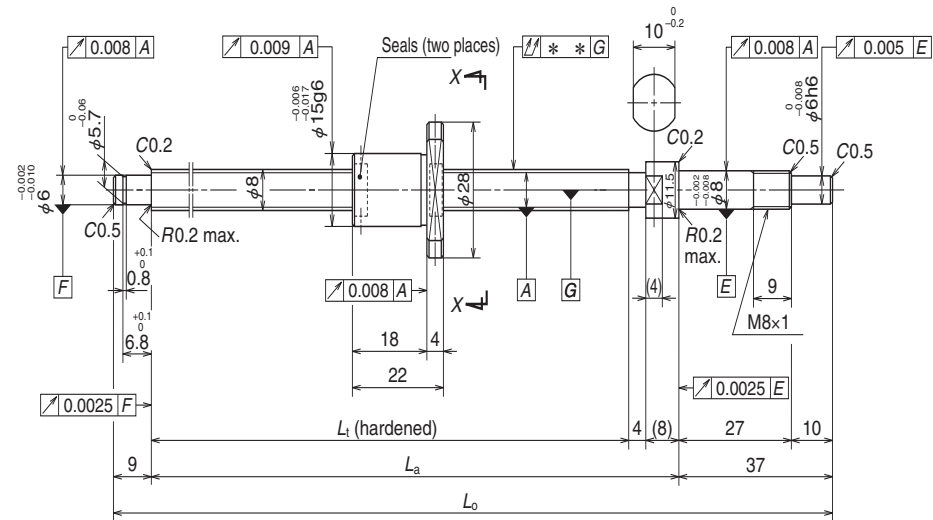
Unit: mm

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min-1)
L_t	L_a	L_o	T	e_p	v_u			Supporting condition
								Fixed - Simple support
80	92	138	0	0.008	0.008	0.025	0.073	3 000
110	122	168	0	0.010	0.008	0.030	0.084	3 000
140	152	198	0	0.010	0.008	0.030	0.095	3 000
190	202	248	0	0.010	0.008	0.035	0.11	3 000

B163

Finished shaft end MA Type

(Fine lead)



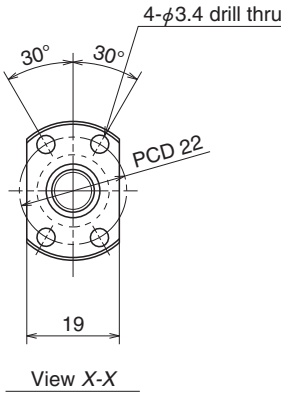
Nut models: MPFD, MSFD

NSK

Screw shaft ø8

Lead 1.5

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		8 × 1.5 / Right	
Preload / Ball recirculation		P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.		1.000 / 8.3	
Screw shaft root diameter		7.0	
Effective turns of balls		1 × 3	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	1 270	
	Static C _{0a}	1 970	
Axial play		0	0.005 or less
Preload (N)		49.0	—
Dynamic friction torque, (N·cm)		2.0 or less	0.5 or less
Spacer ball		None	
Factory-packed grease		NSK grease PS2	

Recommended support unit

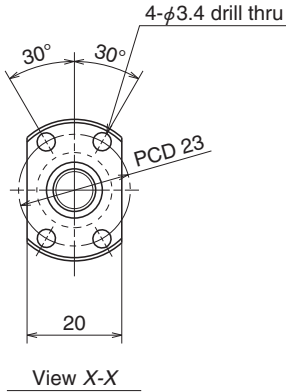
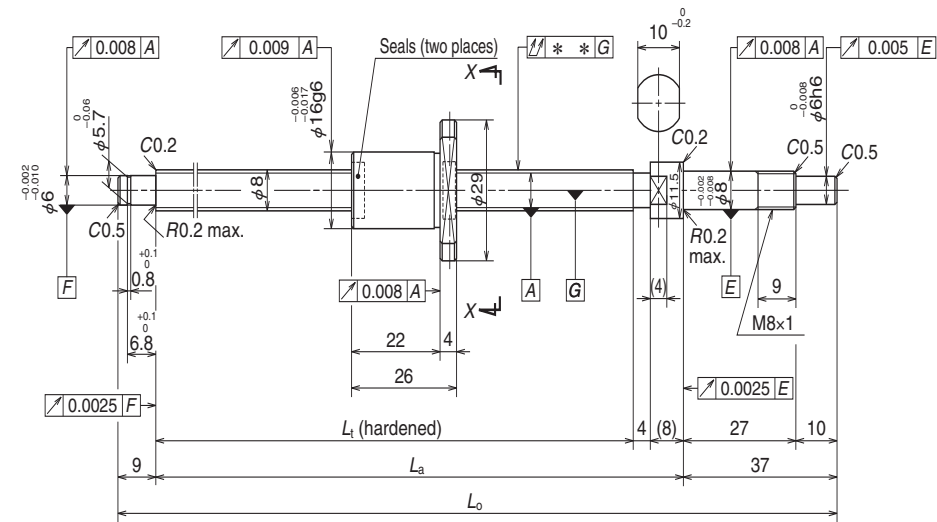
For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01A (square)	WBK08S-01 (square)
WBK08-11 (round)	

Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (MPFD)	Precise clearance (MSFD)		
W0800MA-3PY-C3Z1.5	W0800MA-4Y-C3T1.5	40	53
W0801MA-5PY-C3Z1.5	W0801MA-6Y-C3T1.5	70	83
W0801MA-7PY-C3Z1.5	W0801MA-8Y-C3T1.5	100	113
W0802MA-3PY-C3Z1.5	W0802MA-4Y-C3T1.5	150	163

- Notes:
1. We recommend NSK support unit. See page B389 for details.
 2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
 3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
L _t	L _a	L _o	T	e _p	v _u			Supporting condition
80	92	138	0	0.008	0.008	0.025	0.082	3 000
110	122	168	0	0.010	0.008	0.030	0.093	3 000
140	152	198	0	0.010	0.008	0.030	0.10	3 000
190	202	248	0	0.010	0.008	0.035	0.12	3 000



Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	8 x 2 / Right	
Preload / Ball recirculation	P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.	1.200 / 8.3	
Screw shaft root diameter	6.9	
Effective turns of balls	1 x 3	
Accuracy grade / Preload / Axial play	C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	1 560
	Static C _{0a}	2 200
Axial play	0	0.005 or less
Preload (N)	49.0	—
Dynamic friction torque, (N·cm)	2.0 or less	0.5 or less
Spacer ball	None	
Factory-packed grease	NSK grease PS2	

Recommended support unit

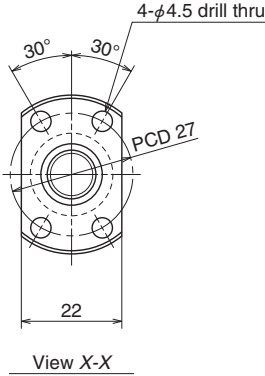
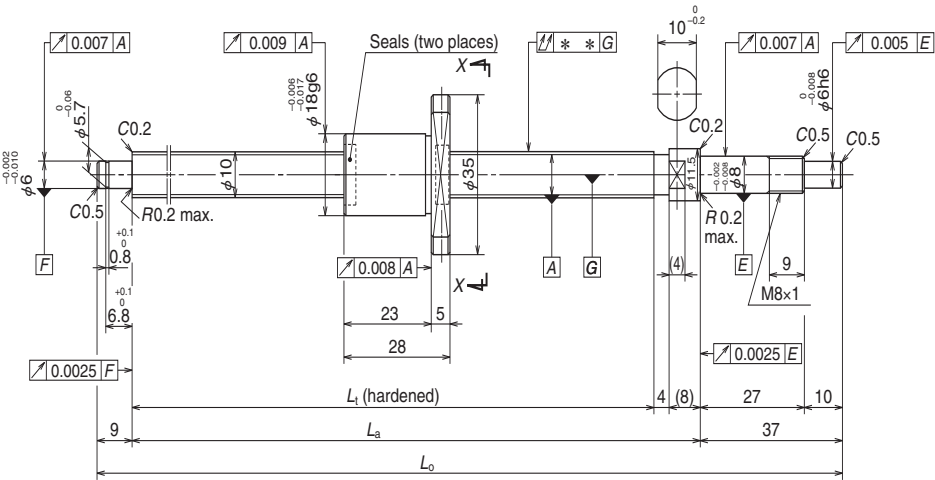
For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01A (square)	WBK08S-01 (square)
WBK08-11 (round)	

Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (MPFD)	Precise clearance (MSFD)		
W0800MA-5PY-C3Z2	W0800MA-6Y-C3T2	40	49
W0801MA-9PY-C3Z2	W0801MA-10Y-C3T2	70	79
W0801MA-11PY-C3Z2	W0801MA-12Y-C3T2	100	109
W0802MA-5PY-C3Z2	W0802MA-6Y-C3T2	150	159

- Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
L _t	L _a	L _o	T	e _p	v _u			Supporting condition
80	92	138	0	0.008	0.008	0.025	0.09	3 000
110	122	168	0	0.010	0.008	0.030	0.10	3 000
140	152	198	0	0.010	0.008	0.030	0.11	3 000
190	202	248	0	0.010	0.008	0.035	0.13	3 000



Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	10 x 2 / Right	
Preload / Ball recirculation	P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.	1.200 / 10.3	
Screw shaft root diameter	8.9	
Effective turns of balls	1 x 3	
Accuracy grade / Preload / Axial play	C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	1 800
	Static C _{0a}	2 970
Axial play	0	0.005 or less
Preload (N)	58.8	—
Dynamic friction torque, (N·cm)	0.1 – 2.4	0.5 or less
Spacer ball	None	
Factory-packed grease	NSK grease PS2	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01A (square)	WBK08S-01 (square)
WBK08-11 (round)	

Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (MPFD)	Precise clearance (MSFD)		
W1001MA-1PY-C3Z2	W1001MA-2Y-C3T2	50	67
W1001MA-3PY-C3Z2	W1001MA-4Y-C3T2	100	117
W1002MA-1PY-C3Z2	W1002MA-2Y-C3T2	150	167
W1002MA-3PY-C3Z2	W1002MA-4Y-C3T2	200	217

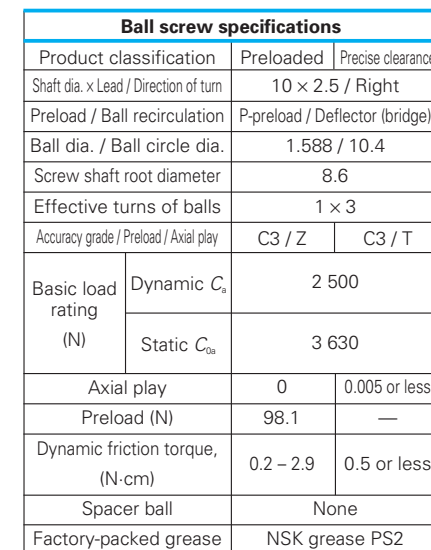
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
L _t	L _a	L _o	T	e _p	v _u			Supporting condition
								Fixed - Simple support
100	112	158	0	0.008	0.008	0.020	0.13	3 000
150	162	208	0	0.010	0.008	0.030	0.16	3 000
200	212	258	0	0.010	0.008	0.030	0.19	3 000
250	262	308	0	0.012	0.008	0.030	0.22	3 000

(Fine lead)



Unit: mm



For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01A (square)	WBK08S-01 (square)
WBK08-11 (round)	

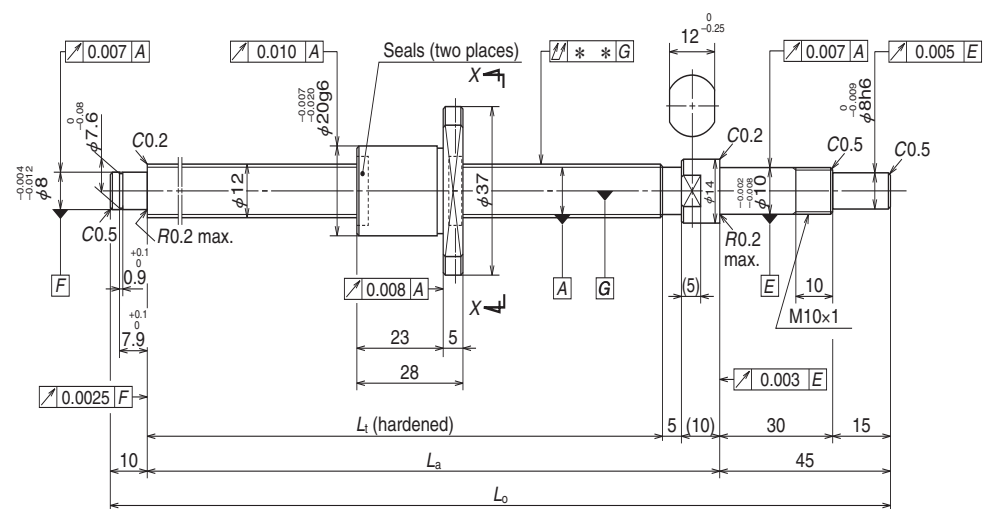
Unit: mm

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
L_t	L_a	L_o	T	e_p	v_u			Supporting condition
100	112	158	0	0.008	0.008	0.020	0.14	3 000
150	162	208	0	0.010	0.008	0.030	0.17	3 000
200	212	258	0	0.010	0.008	0.030	0.20	3 000
250	262	308	0	0.012	0.008	0.030	0.23	3 000

B171

Finished shaft end MA Type

(Fine lead)



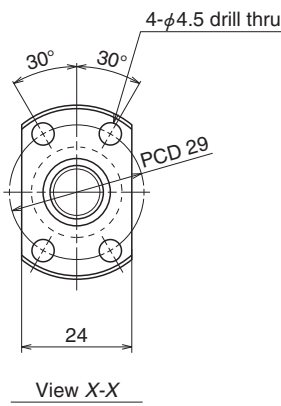
Nut models: MPFD, MSFD

NSK

Screw shaft ø12

Lead 2

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		12 x 2 / Right	
Preload / Ball recirculation		P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.		1.200 / 12.3	
Screw shaft root diameter		10.9	
Effective turns of balls		1 x 3	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	1 960	
	Static C _{0a}	3 620	
Axial play		0	0.005 or less
Preload (N)		98.1	—
Dynamic friction torque, (N·cm)		0.4 – 3.4	1.0 or less
Spacer ball		None	
Factory-packed grease		NSK grease PS2	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK10-01A (square)	WBK10S-01 (square)
WBK10-11 (round)	

Unit: mm

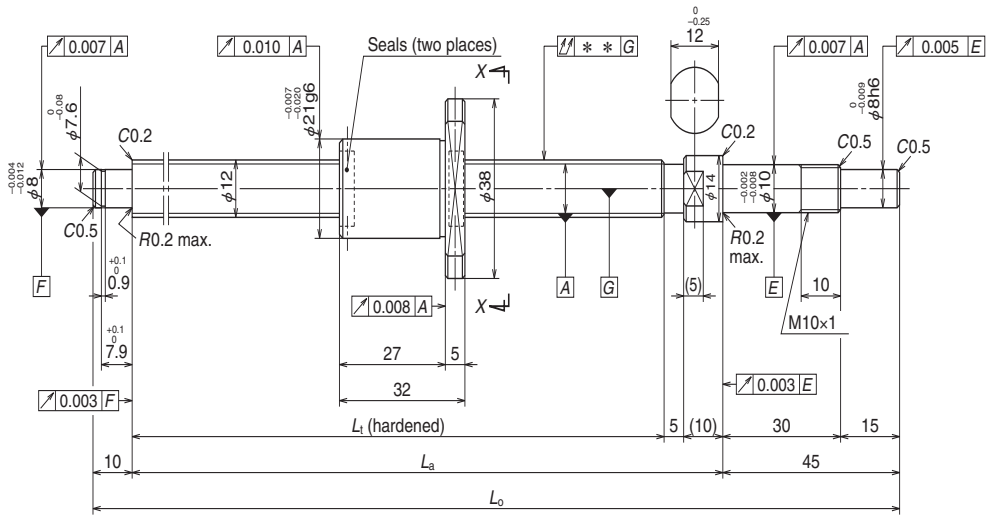
Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (MPFD)	Precise clearance (MSFD)		
W1201MA-1PY-C3Z2	W1201MA-2Y-C3T2	50	75
W1201MA-3PY-C3Z2	W1201MA-4Y-C3T2	100	125
W1202MA-1PY-C3Z2	W1202MA-2Y-C3T2	150	175
W1202MA-3PY-C3Z2	W1202MA-4Y-C3T2	200	225
W1203MA-1PY-C3Z2	W1203MA-2Y-C3T2	250	275

- Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
L _t	L _a	L _o	T	e _p	v _u			Supporting condition
								Fixed - Simple support
110	125	180	0	0.010	0.008	0.020	0.20	3 000
160	175	230	0	0.010	0.008	0.030	0.24	3 000
210	225	280	0	0.012	0.008	0.030	0.28	3 000
260	275	330	0	0.012	0.008	0.040	0.32	3 000
310	325	380	0	0.012	0.008	0.040	0.36	3 000

Finished shaft end MA Type

(Fine lead)



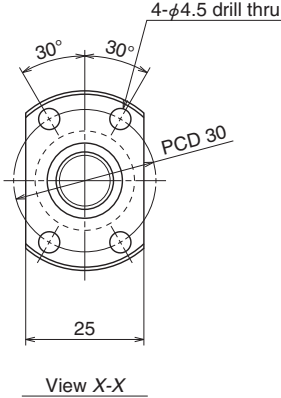
Nut models: MPFD, MSFD

NSK

Screw shaft ø12

Lead 2.5

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		12 x 2.5 / Right	
Preload / Ball recirculation		P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.		1.588 / 12.4	
Screw shaft root diameter		10.6	
Effective turns of balls		1 x 3	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	2 790	
	Static C _{0a}	4 530	
Axial play		0	0.005 or less
Preload (N)		98.1	—
Dynamic friction torque, (N·cm)		0.4 – 3.4	1.0 or less
Spacer ball		None	
Factory-packed grease		NSK grease PS2	

Recommended support unit

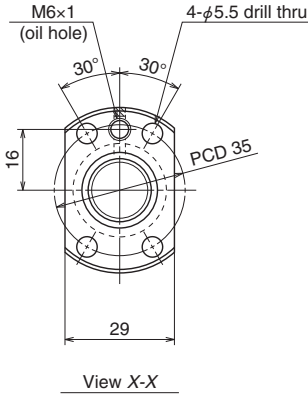
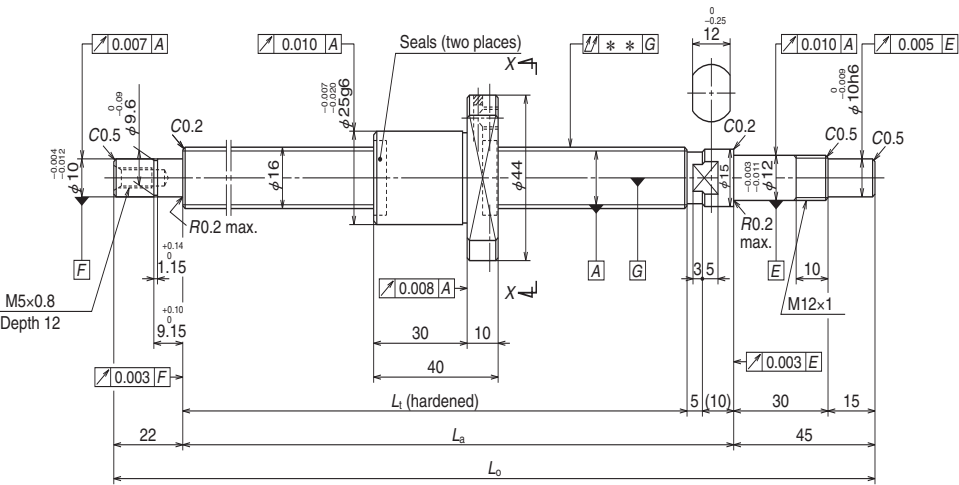
For drive side (Fixed)	For opposite to drive side (Simple)
WBK10-01A (square)	WBK10S-01 (square)
WBK10-11 (round)	

Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (MPFD)	Precise clearance (MSFD)		
W1201MA-5PY-C3Z2.5	W1201MA-6Y-C3T2.5	50	71
W1201MA-7PY-C3Z2.5	W1201MA-8Y-C3T2.5	100	121
W1202MA-5PY-C3Z2.5	W1202MA-6Y-C3T2.5	150	171
W1202MA-7PY-C3Z2.5	W1202MA-8Y-C3T2.5	200	221
W1203MA-3PY-C3Z2.5	W1203MA-4Y-C3T2.5	250	271

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
L _t	L _a	L _o	T	e _p	v _u			Supporting condition
								Fixed - Simple support
110	125	180	0	0.010	0.008	0.020	0.21	3 000
160	175	230	0	0.010	0.008	0.030	0.25	3 000
210	225	280	0	0.012	0.008	0.030	0.29	3 000
260	275	330	0	0.012	0.008	0.040	0.33	3 000
310	325	380	0	0.012	0.008	0.040	0.37	3 000

- Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.



Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	16 x 2 / Right	
Preload / Ball recirculation	P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.	1.588 / 16.4	
Screw shaft root diameter	14.6	
Effective turns of balls	1 x 4	
Accuracy grade / Preload / Axial play	C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	4 150
	Static C _{0a}	8 450
Axial play	0	0.005 or less
Preload (N)	147	—
Dynamic friction torque, (N·cm)	0.5 – 4.9	1.5 or less
Spacer ball	None	
Factory-packed grease	NSK grease PS2	
Internal spatial volume of nut (cm ³)	1.6	
Standard volume of grease replenishing (cm ³)	0.8	

Recommended support unit

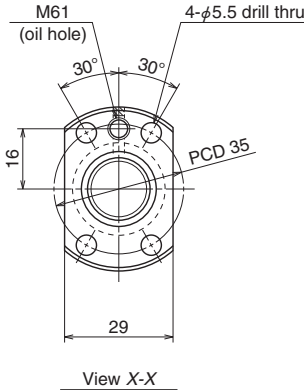
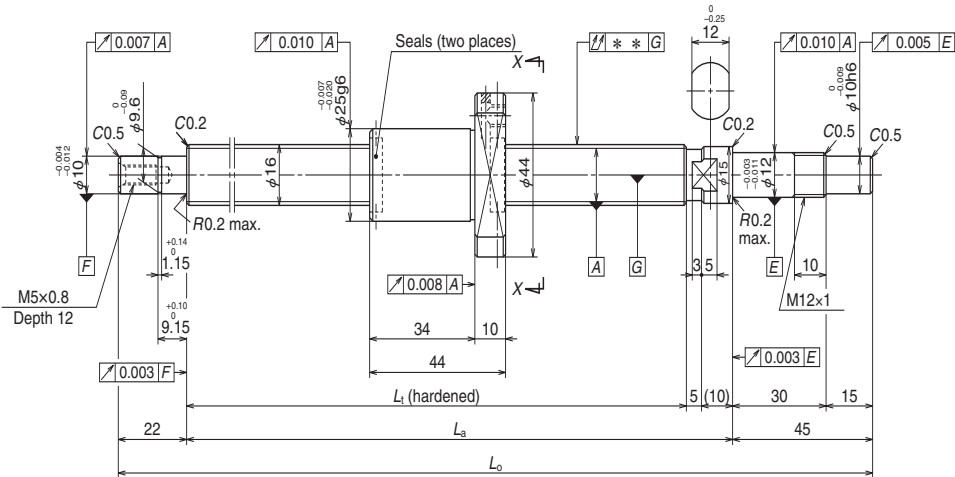
For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (MPFD)	Precise clearance (MSFD)		
W1601MA-1PY-C3Z2	W1601MA-2Y-C3T2	50	93
W1601MA-3PY-C3Z2	W1601MA-4Y-C3T2	100	143
W1602MA-1PY-C3Z2	W1602MA-2Y-C3T2	150	193
W1602MA-3PY-C3Z2	W1602MA-4Y-C3T2	200	243
W1603MA-1PY-C3Z2	W1603MA-2Y-C3T2	300	343

- Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.
4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
L _t	L _a	L _o	T	e _p	v _u			Supporting condition	
								Fixed - Simple support	Fixed - Fixed
139	154	221	0	0.010	0.008	0.020	0.41	3 000	3 000
189	204	271	0	0.010	0.008	0.020	0.48	3 000	3 000
239	254	321	0	0.012	0.008	0.030	0.55	3 000	3 000
289	304	371	0	0.012	0.008	0.030	0.62	3 000	3 000
389	404	471	0	0.013	0.010	0.035	0.77	3 000	3 000



Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	16 × 2.5 / Right	
Preload / Ball recirculation	P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.	1.588 / 16.4	
Screw shaft root diameter	14.6	
Effective turns of balls	1 × 4	
Accuracy grade / Preload / Axial play	C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	4 150
	Static C _{0a}	8 440
Axial play	0	0.005 or less
Preload (N)	147	—
Dynamic friction torque, (N·cm)	0.5 – 4.9	1.5 or less
Spacer ball	None	
Factory-packed grease	NSK grease PS2	
Internal spatial volume of nut (cm ³)	1.6	
Standard volume of grease replenishing (cm ³)	0.8	

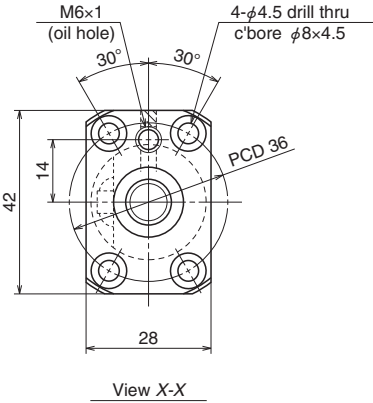
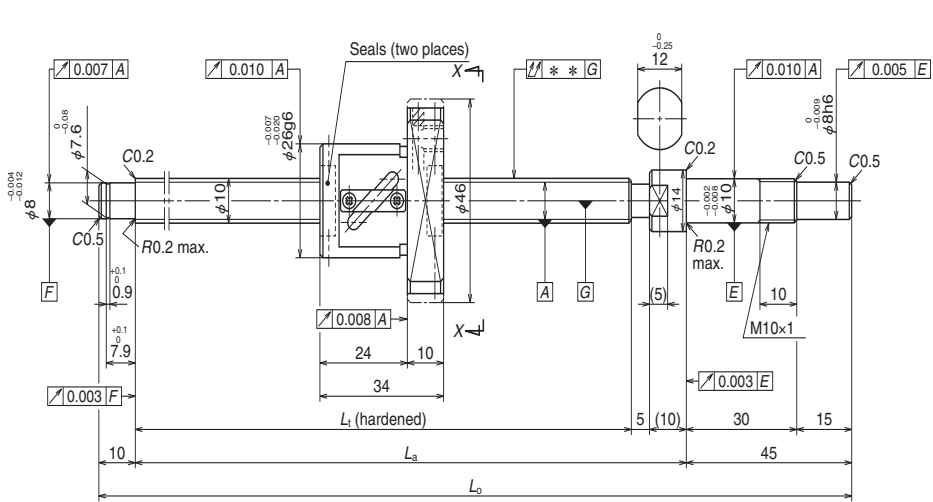
Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (MPFD)	Precise clearance (MSFD)		
W1601MA-5PY-C3Z2.5	W1601MA-6Y-C3T2.5	50	89
W1601MA-7PY-C3Z2.5	W1601MA-8Y-C3T2.5	100	139
W1602MA-5PY-C3Z2.5	W1602MA-6Y-C3T2.5	150	189
W1602MA-7PY-C3Z2.5	W1602MA-8Y-C3T2.5	200	239
W1603MA-3PY-C3Z2.5	W1603MA-4Y-C3T2.5	300	339

- Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if permissible rotational speed is to be exceeded.
4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
L _t	L _a	L _o	T	e _p	v _u			Supporting condition	
								Fixed - Simple support	Fixed - Fixed
139	154	221	0	0.010	0.008	0.020	0.42	3 000	3 000
189	204	271	0	0.010	0.008	0.020	0.49	3 000	3 000
239	254	321	0	0.012	0.008	0.030	0.57	3 000	3 000
289	304	371	0	0.012	0.008	0.030	0.64	3 000	3 000
389	404	471	0	0.013	0.010	0.035	0.79	3 000	3 000



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		10 × 4 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		2.000 / 10.3	
Screw shaft root diameter		8.2	
Effective turns of balls		2.5 × 1	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	2 020	3 210
	Static C _{0a}	2 210	4 420
Axial play		0	0.005 or less
Preload (N)		98.1	—
Dynamic friction torque, (N·cm)		0.5 – 3.9	1.0 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease PS2	
Internal spatial volume of nut (cm ³)		0.8	
Standard volume of grease replenishing (cm ³)		0.4	

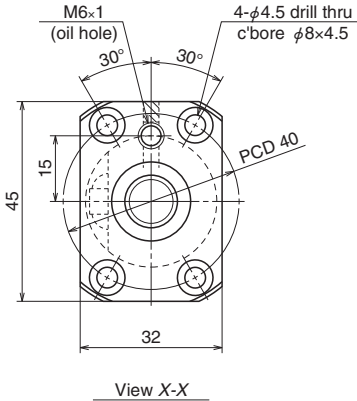
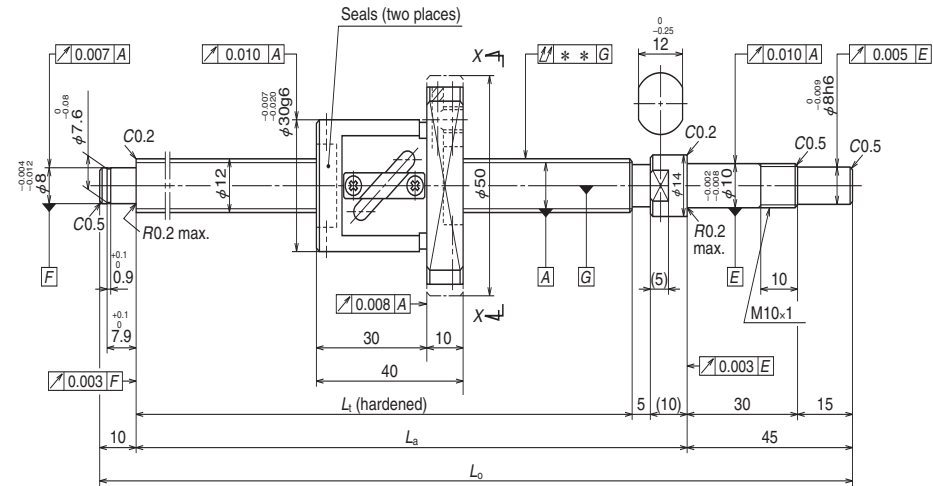
Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK10-01A (square)	WBK10S-01 (square)
WBK10-11 (round)	

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (PFT)	Precise clearance (SFT)		
W1001FA-1P-C3Z4	W1001FA-2-C3T4	50	69
W1001FA-3P-C3Z4	W1001FA-4-C3T4	100	119
W1002FA-1P-C3Z4	W1002FA-2-C3T4	150	169
W1002FA-3P-C3Z4	W1002FA-4-C3T4	200	219
W1003FA-1P-C3Z4	W1003FA-2-C3T4	250	269
W1003FA-3P-C3Z4	W1003FA-4-C3T4	300	319

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
L _t	L _a	L _o	T	e _p	v _u			Supporting condition
								Fixed - Simple support
110	125	180	0	0.010	0.008	0.020	0.26	3 000
160	175	230	0	0.010	0.008	0.030	0.28	3 000
210	225	280	0	0.012	0.008	0.030	0.31	3 000
260	275	330	0	0.012	0.008	0.040	0.34	3 000
310	325	380	0	0.012	0.008	0.040	0.37	3 000
360	375	430	0	0.013	0.010	0.050	0.39	3 000

Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if permissible rotational speed is to be exceeded.



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		12 x 5 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		2.381 / 12.3	
Screw shaft root diameter		9.8	
Effective turns of balls		2.5 x 1	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	2 770	4 390
	Static C _{0a}	3 130	6 260
Axial play		0	0.005 or less
Preload (N)		98.1	—
Dynamic friction torque, (N·cm)		1.0 – 4.4	1.0 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease PS2	
Internal spatial volume of nut (cm ³)		1.2	
Standard volume of grease replenishing (cm ³)		0.6	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK10-01A (square)	WBK10S-01 (square)
WBK10-11 (round)	

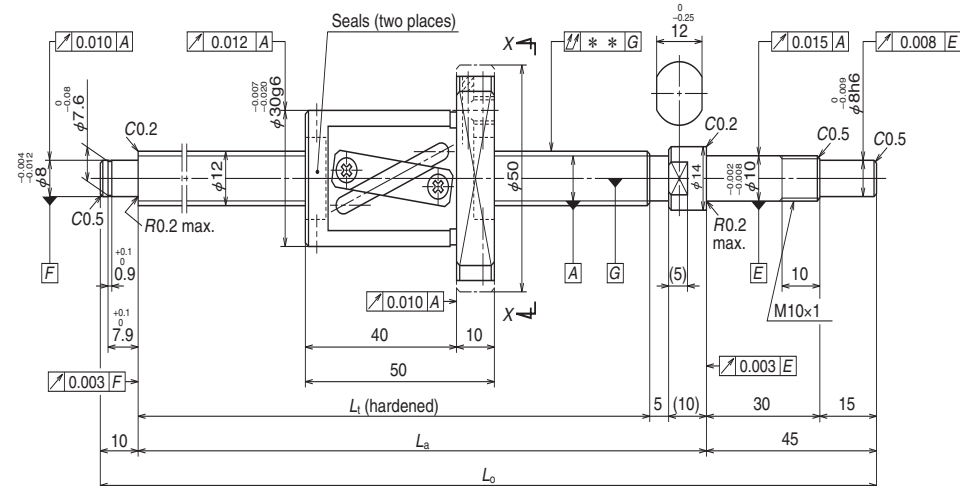
Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (PFT)	Precise clearance (SFT)		
W1201FA-1P-C3Z5	W1201FA-2-C3T5	50	63
W1201FA-3P-C3Z5	W1201FA-4-C3T5	100	113
W1202FA-1P-C3Z5	W1202FA-2-C3T5	150	163
W1202FA-3P-C3Z5	W1202FA-4-C3T5	200	213
W1203FA-1P-C3Z5	W1203FA-2-C3T5	250	263
W1204FA-1P-C3Z5	W1204FA-2-C3T5	350	363
W1205FA-1P-C3Z5	W1205FA-2-C3T5	450	463

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
								Supporting condition
L _t	L _a	L _o	T	e _p	v _u			Fixed - Simple support
110	125	180	0	0.010	0.008	0.020	0.35	3 000
160	175	230	0	0.010	0.008	0.030	0.38	3 000
210	225	280	0	0.012	0.008	0.030	0.42	3 000
260	275	330	0	0.012	0.008	0.040	0.46	3 000
310	325	380	0	0.012	0.008	0.040	0.50	3 000
410	425	480	0	0.015	0.010	0.050	0.58	3 000
510	525	580	0	0.016	0.012	0.065	0.66	3 000

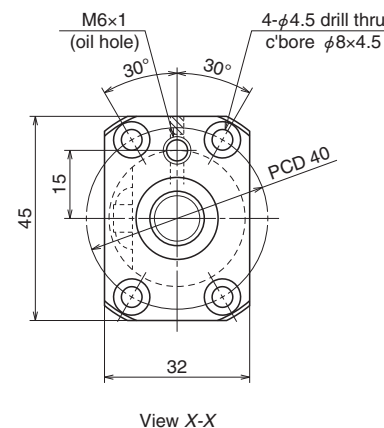
Notes: 1. We recommend NSK support unit. See page B389 for details.
 2. Use of NSK grease PS2 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
 3. Contact NSK if permissible rotational speed is to be exceeded.

(Medium lead)

**NSK**

Lead 10

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		12 × 10 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		2.381 / 12.5	
Screw shaft root diameter		10.0	
Effective turns of balls		2.5 × 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C _n	2 790	4 430
	Static C _{0n}	3 220	6 430
Axial play		0	0.005 or less
Preload (N)		98.1	—
Dynamic friction torque, (N·cm)		1.0 – 4.9	1.5 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease LR3	
Internal spatial volume of nut (cm ³)		1.4	
Standard volume of grease replenishing (cm ³)		0.7	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK10-01A (square)	WBK10S-01 (square)
WBK10-11 (round)	

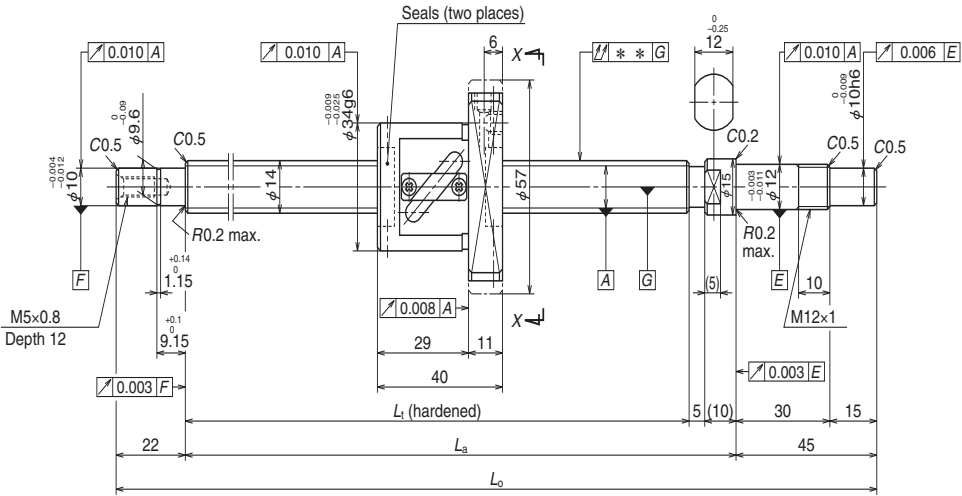
Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W1201FA-5P-C5Z10	W1201FA-6-C5T10	100	103
W1202FA-5P-C5Z10	W1202FA-6-C5T10	150	153
W1203FA-3P-C5Z10	W1203FA-4-C5T10	250	253
W1204FA-3P-C5Z10	W1204FA-4-C5T10	350	353
W1205FA-3P-C5Z10	W1205FA-4-C5T10	450	453

Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min-1)
L_t	L_a	L_o	T	e_p	v_u			Supporting condition
								Fixed - Simple support
160	175	230	0	0.020	0.018	0.035	0.43	3 000
210	225	280	0	0.023	0.018	0.035	0.47	3 000
310	325	380	0	0.023	0.018	0.050	0.56	3 000
410	425	480	0	0.027	0.020	0.060	0.64	3 000
510	525	580	0	0.030	0.023	0.075	0.72	3 000

Finished shaft end FA Type
 (Fine lead)



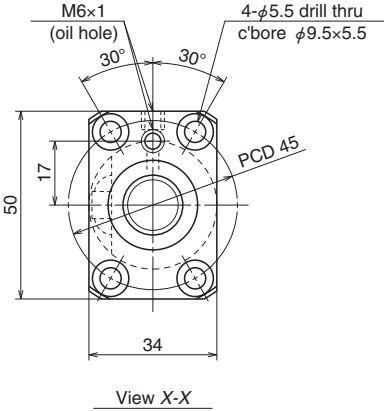
Nut models: PFT, SFT

NSK

Screw shaft ø14

Lead 5

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		14 x 5 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		3.175 / 14.5	
Screw shaft root diameter		11.2	
Effective turns of balls		2.5 x 1	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	5 020	7 970
	Static C _{0a}	5 970	11 900
Axial play		0	0.005 or less
Preload (N)		147	—
Dynamic friction torque, (N·cm)		1.5 – 6.9	2.0 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease LR3	
Internal spatial volume of nut (cm ³)		2.2	
Standard volume of grease replenishing (cm ³)		1.1	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Unit: mm

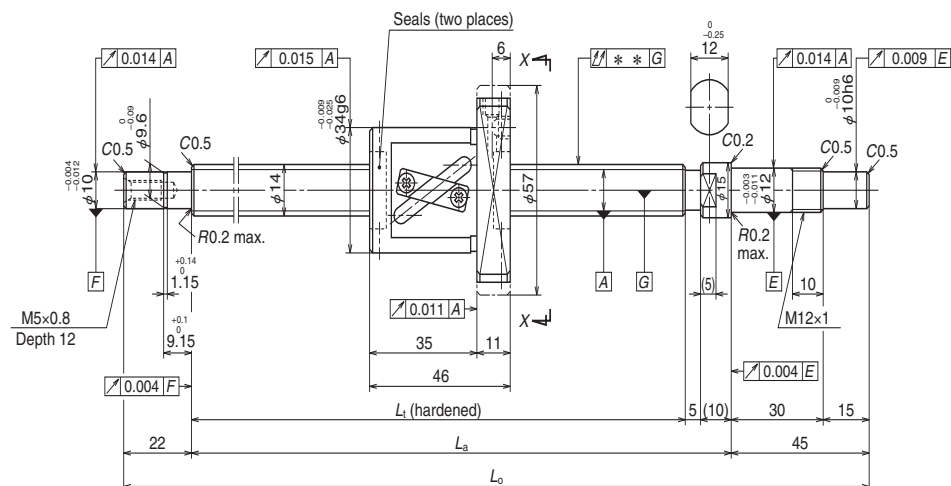
Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (PFT)	Precise clearance (SFT)		
W1401FA-1P-C3Z5	W1401FA-2-C3T5	100	143
W1402FA-1P-C3Z5	W1402FA-2-C3T5	150	193
W1403FA-1P-C3Z5	W1403FA-2-C3T5	250	293
W1404FA-1P-C3Z5	W1404FA-2-C3T5	350	393
W1405FA-1P-C3Z5	W1405FA-2-C3T5	450	493
W1406FA-1P-C3Z5	W1406FA-2-C3T5	600	643

- Notes:
1. We recommend NSK support unit. See page B389 for details.
 2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
 3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
								Fixed - Simple support	Fixed - Fixed
L _t	L _a	L _o	T	e _p	v _u				
189	204	271	0	0.010	0.008	0.020	0.52	3 000	3 000
239	254	321	0	0.012	0.008	0.030	0.57	3 000	3 000
339	354	421	0	0.013	0.010	0.035	0.67	3 000	3 000
439	454	521	0	0.015	0.010	0.045	0.77	3 000	3 000
539	554	621	0	0.016	0.012	0.045	0.87	3 000	3 000
689	704	771	0	0.018	0.013	0.055	1.0	3 000	3 000

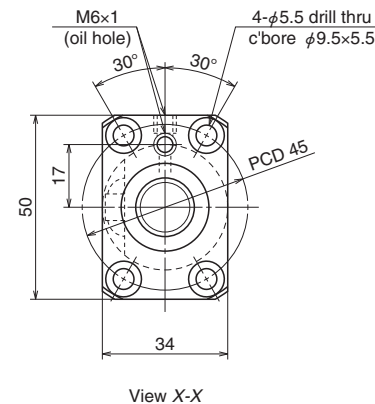
- Notes:
4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
 5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

(Medium lead)



Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W1401FA-3P-C5Z8	W1401FA-4-C5T8	100	137
W1402FA-3P-C5Z8	W1402FA-4-C5T8	150	187
W1402FA-5P-C5Z8	W1402FA-6-C5T8	200	237
W1403FA-3P-C5Z8	W1403FA-4-C5T8	250	287
W1403FA-5P-C5Z8	W1403FA-6-C5T8	300	337
W1404FA-3P-C5Z8	W1404FA-4-C5T8	350	387
W1404FA-5P-C5Z8	W1404FA-6-C5T8	400	437
W1405FA-3P-C5Z8	W1405FA-4-C5T8	450	487
W1405FA-5P-C5Z8	W1405FA-6-C5T8	500	537
W1406FA-3P-C5Z8	W1406FA-4-C5T8	550	587
W1406FA-5P-C5Z8	W1406FA-6-C5T8	600	637
W1407FA-1P-C5Z8	W1407FA-2-C5T8	700	737

Nut models: LPFT, LSFT



For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		14 x 8 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		3.175 / 14.5	
Screw shaft root diameter		11.2	
Effective turns of balls		2.5 x 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C _a	4 960	7 880
	Static C _{0a}	5 920	11 800
Axial play		0	0.005 or less
Preload (N)		147	—
Dynamic friction torque, (N·cm)		1.5 – 7.8	2.4 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease LR3	
Internal spatial volume of nut (cm ³)		2.1	
Standard volume of grease replenishing (cm ³)		1.1	

NSK

Screw shaft ø14

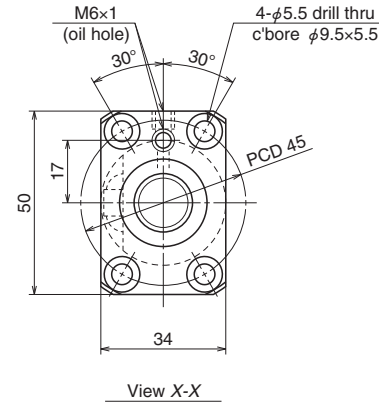
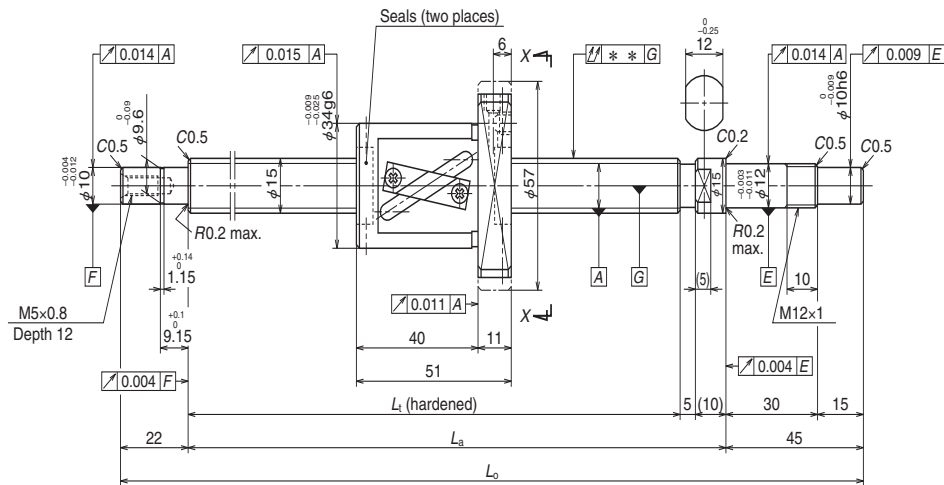
Unit: mm

Lead 8

Unit: mm

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
<i>L_i</i>	<i>L_a</i>	<i>L_o</i>	<i>T</i>	<i>e_p</i>	<i>v_u</i>			Fixed - Simple support	Fixed - Fixed
189	204	271	0	0.020	0.018	0.025	0.56	3 000	3 000
239	254	321	0	0.023	0.018	0.035	0.61	3 000	3 000
289	304	371	0	0.023	0.018	0.035	0.67	3 000	3 000
339	354	421	0	0.025	0.020	0.040	0.72	3 000	3 000
389	404	471	0	0.025	0.020	0.040	0.78	3 000	3 000
439	454	521	0	0.027	0.020	0.050	0.83	3 000	3 000
489	504	571	0	0.027	0.020	0.050	0.88	3 000	3 000
539	554	621	0	0.030	0.023	0.050	0.94	3 000	3 000
589	604	671	0	0.030	0.023	0.065	0.99	3 000	3 000
639	654	721	0	0.035	0.025	0.065	1.0	3 000	3 000
689	704	771	0	0.035	0.025	0.065	1.1	3 000	3 000
789	804	871	0	0.035	0.025	0.085	1.2	2 830	3 000

Notes: 4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).



Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	15 × 10 / Right	
Preload / Ball recirculation	P-preload / Return tube	
Ball dia. / Ball circle dia.	3.175 / 15.5	
Screw shaft root diameter	12.2	
Effective turns of balls	2.5 × 1	
Accuracy grade / Preload / Axial play	C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	5 130
	Static C_{0a}	6 420
Axial play		0
Preload (N)		147
Dynamic friction torque, (N·cm)		1.5 – 7.8
Spacer ball		Yes
Factory-packed grease		NSK grease LR3
Internal spatial volume of nut (cm ³)		2.3
Standard volume of grease replenishing (cm ³)		1.2

Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W1501FA-1P-C5Z10	W1501FA-2-C5T10	100	132
W1502FA-1P-C5Z10	W1502FA-2-C5T10	150	182
W1502FA-3P-C5Z10	W1502FA-4-C5T10	200	232
W1503FA-1P-C5Z10	W1503FA-2-C5T10	250	282
W1503FA-3P-C5Z10	W1503FA-4-C5T10	300	332
W1504FA-1P-C5Z10	W1504FA-2-C5T10	350	382
W1504FA-3P-C5Z10	W1504FA-4-C5T10	400	432
W1505FA-1P-C5Z10	W1505FA-2-C5T10	450	482
W1505FA-3P-C5Z10	W1505FA-4-C5T10	500	532
W1506FA-1P-C5Z10	W1506FA-2-C5T10	550	582
W1506FA-3P-C5Z10	W1506FA-4-C5T10	600	632
W1507FA-1P-C5Z10	W1507FA-2-C5T10	700	732
W1508FA-1P-C5Z10	W1508FA-2-C5T10	800	832
W1510FA-1P-C5Z10	W1510FA-2-C5T10	1 000	1 032

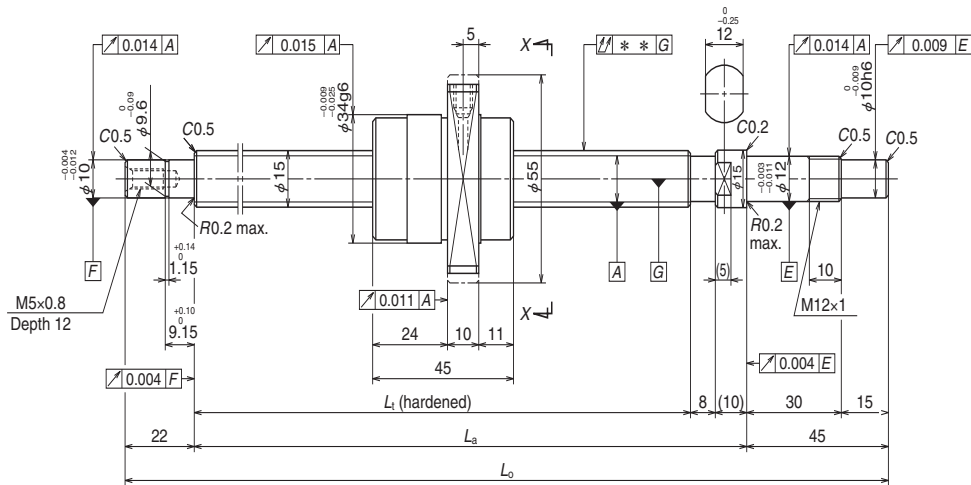
- Notes: 1. We recommend NSK support unit. See page B389 for details.
 2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
 3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L_t	L_a	L_o	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
189	204	271	0	0.020	0.018	0.025	0.61	3 000	3 000
239	254	321	0	0.023	0.018	0.035	0.67	3 000	3 000
289	304	371	0	0.023	0.018	0.035	0.74	3 000	3 000
339	354	421	0	0.025	0.020	0.040	0.80	3 000	3 000
389	404	471	0	0.025	0.020	0.040	0.86	3 000	3 000
439	454	521	0	0.027	0.020	0.050	0.93	3 000	3 000
489	504	571	0	0.027	0.020	0.050	1.0	3 000	3 000
539	554	621	0	0.030	0.023	0.050	1.1	3 000	3 000
589	604	671	0	0.030	0.023	0.065	1.1	3 000	3 000
639	654	721	0	0.035	0.025	0.065	1.2	3 000	3 000
689	704	771	0	0.035	0.025	0.065	1.2	3 000	3 000
789	804	871	0	0.035	0.025	0.085	1.4	3 000	3 000
889	904	971	0	0.040	0.027	0.085	1.5	2 430	3 000
1 089	1 104	1 171	0	0.046	0.030	0.110	1.8	1 600	2 250

- Notes: 4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
 5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

Finished shaft end FA Type

(Medium lead)



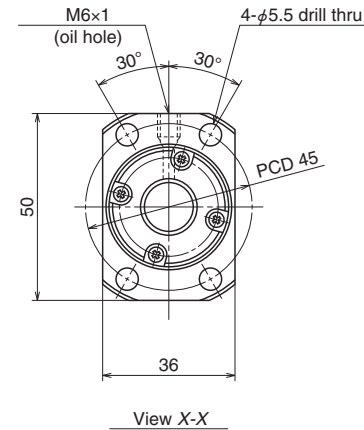
Nut models: UPFC, USFC

NSK

Screw shaft ø15

Unit: mm

Lead 20



Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	15 × 20 / Right	
Preload / Ball recirculation	P-preload / End cap	
Ball dia. / Ball circle dia.	3.175 / 15.5	
Screw shaft root diameter	12.2	
Effective turns of balls	1.7 × 1	
Accuracy grade / Preload / Axial play	C5 / Z	C5 / T
Basic load rating (N)	Dynamic C _a	4 320
	Static C _{0a}	5 800
Axial play		0
Preload (N)		147
Dynamic friction torque, (N·cm)		1.5 – 7.8
Spacer ball		Yes
Factory-packed grease		NSK grease LR3
Internal spatial volume of nut (cm ³)		1.9
Standard volume of grease replenishing (cm ³)		1.0

Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (UPFC)	Precise clearance (USFC)		
W1501FA-3PG-C5Z20	W1501FA-4G-C5T20	100	135
W1502FA-5PG-C5Z20	W1502FA-6G-C5T20	150	185
W1502FA-7PG-C5Z20	W1502FA-8G-C5T20	200	235
W1503FA-5PG-C5Z20	W1503FA-6G-C5T20	250	285
W1503FA-7PG-C5Z20	W1503FA-8G-C5T20	300	335
W1504FA-5PG-C5Z20	W1504FA-6G-C5T20	350	385
W1504FA-7PG-C5Z20	W1504FA-8G-C5T20	400	435
W1505FA-5PG-C5Z20	W1505FA-6G-C5T20	450	485
W1505FA-7PG-C5Z20	W1505FA-8G-C5T20	500	535
W1506FA-5PG-C5Z20	W1506FA-6G-C5T20	550	585
W1506FA-7PG-C5Z20	W1506FA-8G-C5T20	600	635
W1507FA-3PG-C5Z20	W1507FA-4G-C5T20	700	735
W1508FA-3PG-C5Z20	W1508FA-4G-C5T20	800	835
W1510FA-3PG-C5Z20	W1510FA-4G-C5T20	1 000	1 035

Notes: 1. We recommend NSK support unit. See page B389 for details.

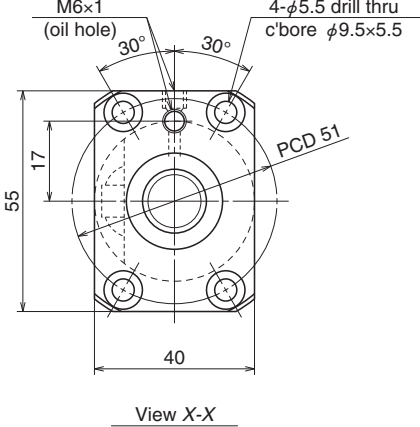
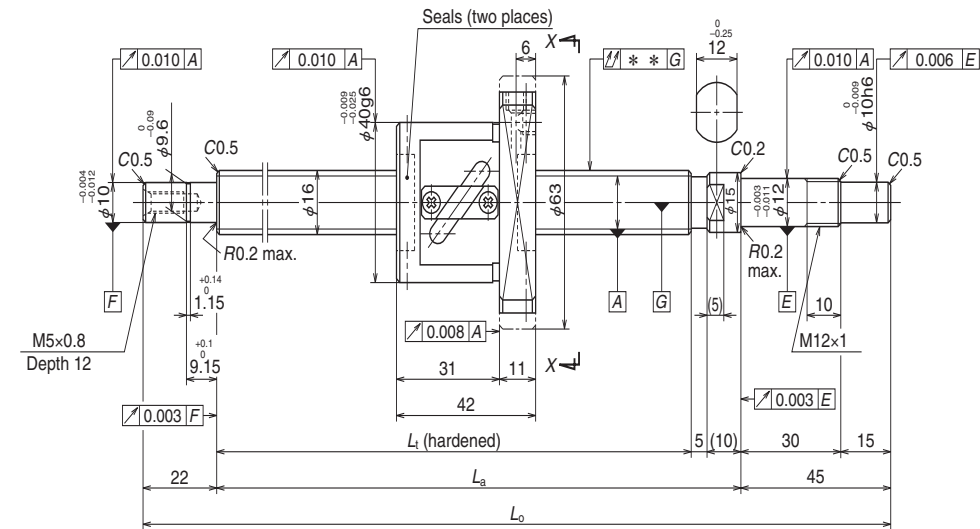
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L _t	L _a	L _o	T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
186	204	271	0	0.020	0.018	0.025	0.61	3 000	3 000
236	254	321	0	0.023	0.018	0.035	0.68	3 000	3 000
286	304	371	0	0.023	0.018	0.035	0.75	3 000	3 000
336	354	421	0	0.025	0.020	0.040	0.81	3 000	3 000
386	404	471	0	0.025	0.020	0.040	0.88	3 000	3 000
436	454	521	0	0.027	0.020	0.050	0.95	3 000	3 000
486	504	571	0	0.027	0.020	0.050	1.0	3 000	3 000
536	554	621	0	0.030	0.023	0.050	1.1	3 000	3 000
586	604	671	0	0.030	0.023	0.065	1.1	3 000	3 000
636	654	721	0	0.035	0.025	0.065	1.2	3 000	3 000
686	704	771	0	0.035	0.025	0.065	1.3	3 000	3 000
786	804	871	0	0.035	0.025	0.085	1.4	3 000	3 000
886	904	971	0	0.040	0.027	0.085	1.5	2 440	3 000
1 086	1 104	1 171	0	0.046	0.030	0.110	1.8	1 610	2 240

Notes: 4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.

5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		16 × 5 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		3.175 / 16.5	
Screw shaft root diameter		13.2	
Effective turns of balls		2.5 × 1	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C _a	5 430	8 620
	Static C _{0a}	6 890	13 800
Axial play		0	0.005 or less
Preload (N)		147	—
Dynamic friction torque, (N-cm)		1.5 – 7.8	2.0 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease LR3	
Internal spatial volume of nut (cm ³)		2.6	
Standard volume of grease replenishing (cm ³)		1.3	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (PFT)	Precise clearance (SFT)		
W1601FA-1P-C3Z5	W1601FA-2-C3T5	100	141
W1602FA-1P-C3Z5	W1602FA-2-C3T5	200	241
W1603FA-1P-C3Z5	W1603FA-2-C3T5	300	341
W1604FA-1P-C3Z5	W1604FA-2-C3T5	400	441
W1606FA-1P-C3Z5	W1606FA-2-C3T5	600	641
W1608FA-1P-C3Z5	W1608FA-2-C3T5	800	841

- Notes:
1. We recommend NSK support unit. See page B389 for details.

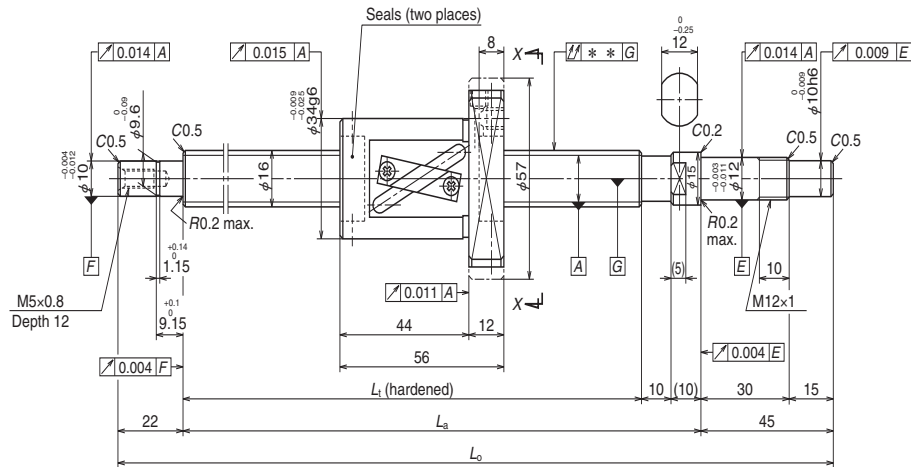
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L _t	L _a	L _o	T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
189	204	271	0	0.010	0.008	0.020	0.70	3 000	3 000
289	304	371	0	0.012	0.008	0.030	0.83	3 000	3 000
389	404	471	0	0.013	0.010	0.035	0.97	3 000	3 000
489	504	571	0	0.015	0.010	0.045	1.1	3 000	3 000
689	704	771	0	0.018	0.013	0.055	1.4	3 000	3 000
889	904	971	0	0.021	0.015	0.075	1.6	2 570	3 000

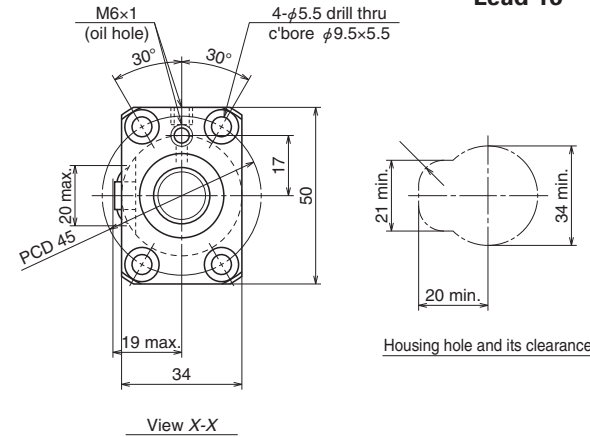
- Notes:
4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.

5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).



Screw shaft ø16

Lead 16



Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	16 x 16 / Right	
Preload / Ball recirculation	P-preload / Return tube	
Ball dia. / Ball circle dia.	3.175 / 16.75	
Screw shaft root diameter	13.4	
Effective turns of balls	1.5 x 1	
Accuracy grade / Preload / Axial play	C5 / Z	C5 / T
Basic load rating (N)	Dynamic C _a	4 180
	Static C _{0a}	5 390
Axial play	0	0.005 or less
Preload (N)	147	—
Dynamic friction torque, (N·cm)	1.5 – 7.8	2.4 or less
Spacer ball	Yes	None
Factory-packed grease	NSK grease LR3	
Internal spatial volume of nut (cm ³)	2.1	
Standard volume of grease replenishing (cm ³)	1.1	

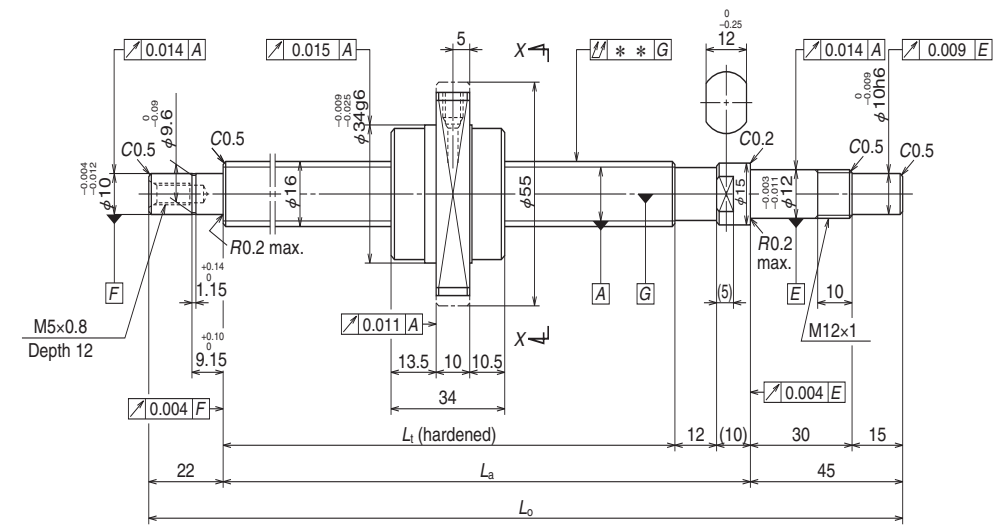
Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W1601FA-3P-C5Z16	W1601FA-4-C5T16	100	122
W1602FA-3P-C5Z16	W1602FA-4-C5T16	150	172
W1602FA-5P-C5Z16	W1602FA-6-C5T16	200	222
W1603FA-3P-C5Z16	W1603FA-4-C5T16	250	272
W1603FA-5P-C5Z16	W1603FA-6-C5T16	300	322
W1604FA-3P-C5Z16	W1604FA-4-C5T16	350	372
W1604FA-5P-C5Z16	W1604FA-6-C5T16	400	422
W1605FA-1P-C5Z16	W1605FA-2-C5T16	450	472
W1605FA-3P-C5Z16	W1605FA-4-C5T16	500	522
W1606FA-3P-C5Z16	W1606FA-4-C5T16	550	572
W1606FA-5P-C5Z16	W1606FA-6-C5T16	600	622
W1607FA-1P-C5Z16	W1607FA-2-C5T16	700	722
W1608FA-3P-C5Z16	W1608FA-4-C5T16	800	822
W1610FA-1P-C5Z16	W1610FA-2-C5T16	1 000	1 022

- Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L _t	L _a	L _o	T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
184	204	271	0	0.020	0.018	0.025	0.69	3 000	3 000
234	254	321	0	0.023	0.018	0.035	0.77	3 000	3 000
284	304	371	0	0.023	0.018	0.035	0.84	3 000	3 000
334	354	421	0	0.025	0.020	0.040	0.92	3 000	3 000
384	404	471	0	0.025	0.020	0.040	0.99	3 000	3 000
434	454	521	0	0.027	0.020	0.050	1.1	3 000	3 000
484	504	571	0	0.027	0.020	0.050	1.1	3 000	3 000
534	554	621	0	0.030	0.023	0.050	1.2	3 000	3 000
584	604	671	0	0.030	0.023	0.065	1.3	3 000	3 000
634	654	721	0	0.035	0.025	0.065	1.4	3 000	3 000
684	704	771	0	0.035	0.025	0.065	1.4	3 000	3 000
784	804	871	0	0.035	0.025	0.085	1.6	3 000	3 000
884	904	971	0	0.040	0.027	0.085	1.7	2 720	3 000
1 084	1 104	1 171	0	0.046	0.030	0.110	2.0	1 790	2 480

- Notes: 4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

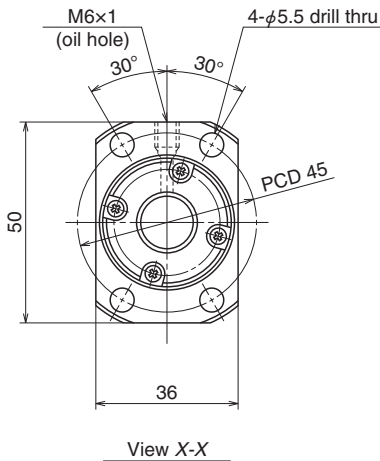
Finished shaft end FA Type
 (Ultra high helix lead)



Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (UPFC)	Precise clearance (USFC)		
W1603FA-7PGX-C5Z32	W1603FA-8GX-C5T32	300	342
W1605FA-5PGX-C5Z32	W1605FA-6GX-C5T32	500	542
W1608FA-5PGX-C5Z32	W1608FA-6GX-C5T32	800	842
W1612FA-1PGX-C5Z32	W1612FA-2GX-C5T32	1 200	1 242

- Notes:
1. We recommend NSK support unit. See page B389 for details.
 2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
 3. Ball nut does not have seal.
 4. Contact NSK if the permissible rotational speed is to be exceeded.

Nut models: UPFC, USFC



Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
L _t	L _a	L _o	T	e _p	v _u			Supporting condition	
								Fixed - Simple support	Fixed - Fixed
382	404	471	0	0.025	0.020	0.040	0.90	3 000	3 000
582	604	671	0	0.030	0.023	0.065	1.2	3 000	3 000
882	904	971	0	0.040	0.027	0.085	1.7	2 670	3 000
1 282	1 304	1 371	0	0.054	0.035	0.150	2.3	1 250	1 740

- Notes:
5. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
 6. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

NSK

Screw shaft ø16

Lead 32

Unit: mm

Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	16 x 32 / Right	
Preload / Ball recirculation	P-preload / End cap	
Ball dia. / Ball circle dia.	3.175 / 16.75	
Screw shaft root diameter	13.4	
Effective turns of balls	0.7 x 2	
Accuracy grade / Preload / Axial play	C5 / Z	C5 / T
Basic load rating (N)	Dynamic C _a	4 800
	Static C _{0a}	7 510
Axial play	0	0.005 or less
Preload (N)	118	—
Dynamic friction torque, (N·cm)	1.5 – 9.8	2.4 or less
Spacer ball	None	
Factory-packed grease	NSK grease LR3	
Internal spatial volume of nut (cm ³)	2.0	
Standard volume of grease replenishing (cm ³)	1.0	

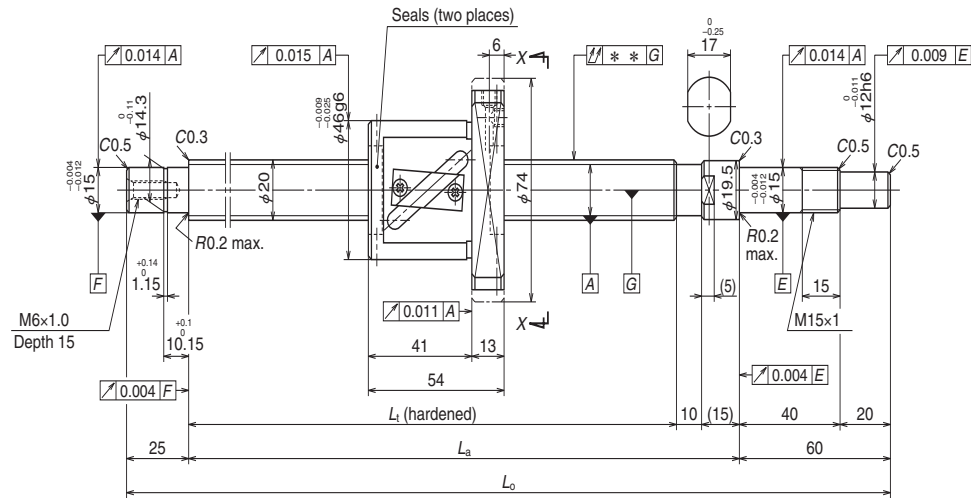
Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Unit: mm

Finished shaft end FA Type

(Medium lead)



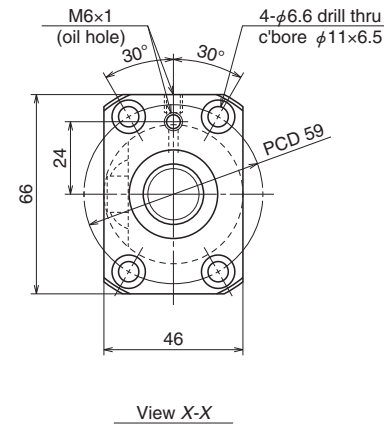
Nut models: LPFT, LSFT

NSK

Screw shaft ø20

Lead 10

Unit: mm



Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK15-01A (square)	WBK15S-01 (square)
WBK15-11 (round)	

Ball screw specifications

Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		20 x 10 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		3.969 / 21	
Screw shaft root diameter		16.9	
Effective turns of balls		2.5 x 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	8 350	13 300
	Static C_{0a}	11 000	21 900
Axial play		0	0.005 or less
Preload (N)		196	—
Dynamic friction torque, (N-cm)		2.0 – 11.8	2.9 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease LR3	
Internal spatial volume of nut (cm ³)		4.7	
Standard volume of grease replenishing (cm ³)		2.4	

Unit: mm

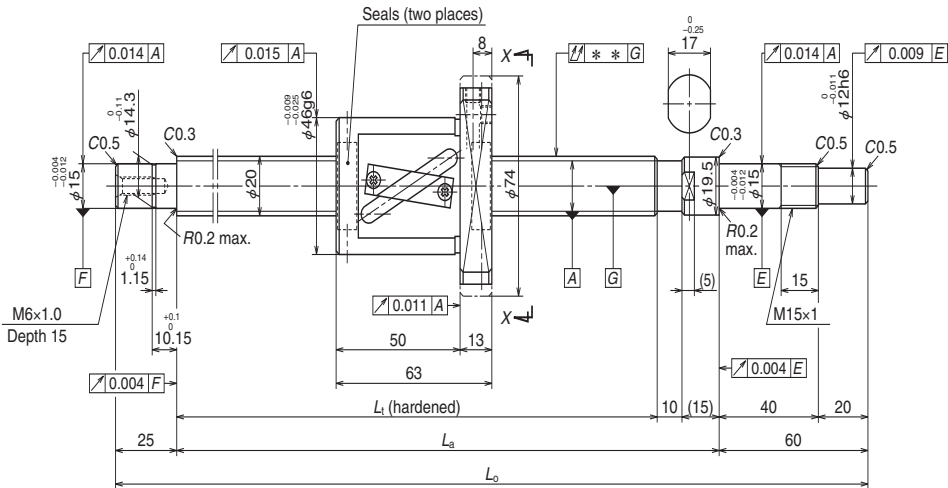
Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W2002FA-1P-C5Z10	W2002FA-2-C5T10	200	229
W2003FA-1P-C5Z10	W2003FA-2-C5T10	300	329
W2004FA-1P-C5Z10	W2004FA-2-C5T10	400	429
W2005FA-1P-C5Z10	W2005FA-2-C5T10	500	529
W2006FA-1P-C5Z10	W2006FA-2-C5T10	600	629
W2007FA-1P-C5Z10	W2007FA-2-C5T10	700	729
W2008FA-1P-C5Z10	W2008FA-2-C5T10	800	829
W2009FA-1P-C5Z10	W2009FA-2-C5T10	900	929
W2010FA-1P-C5Z10	W2010FA-2-C5T10	1 000	1 029
W2011FA-1P-C5Z10	W2011FA-2-C5T10	1 100	1 129
W2012FA-1P-C5Z10	W2012FA-2-C5T10	1 200	1 229

- Notes:
1. We recommend NSK support unit. See page B389 for details.
 2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
 3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L_t	L_a	L_o	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
289	314	399	0	0.023	0.018	0.035	1.4	3 000	3 000
389	414	499	0	0.025	0.020	0.040	1.6	3 000	3 000
489	514	599	0	0.027	0.020	0.050	1.9	3 000	3 000
589	614	699	0	0.030	0.023	0.065	2.1	3 000	3 000
689	714	799	0	0.035	0.025	0.065	2.3	3 000	3 000
789	814	899	0	0.035	0.025	0.085	2.5	3 000	3 000
889	914	999	0	0.040	0.027	0.085	2.8	3 000	3 000
989	1 014	1 099	0	0.040	0.027	0.110	3.0	2 710	3 000
1 089	1 114	1 199	0	0.046	0.030	0.110	3.2	2 220	3 000
1 189	1 214	1 299	0	0.046	0.030	0.150	3.4	1 860	2 570
1 289	1 314	1 399	0	0.054	0.035	0.150	3.7	1 580	2 190

- Notes:
4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
 5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

Finished shaft end FA Type
(High helix lead)



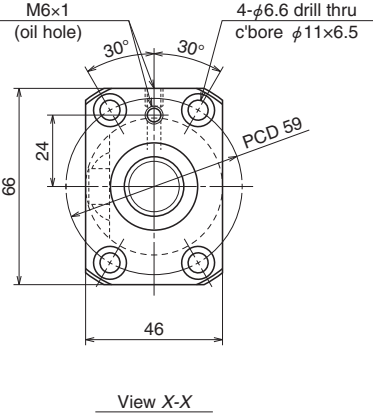
Nut models: LPFT, LSFT

NSK

Screw shaft ø20

Lead 20

Unit: mm



Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK15-01A (square)	WBK15S-01 (square)
WBK15-11 (round)	

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		20 x 20 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		3.969 / 21	
Screw shaft root diameter		16.9	
Effective turns of balls		1.5 x 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C _a	6 250	8 190
	Static C _{0a}	8 760	13 100
Axial play		0	0.005 or less
Preload (N)		196	—
Dynamic friction torque, (N·cm)		2.0 – 11.8	2.9 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease LR3	
Internal spatial volume of nut (cm ³)		4.2	
Standard volume of grease replenishing (cm ³)		2.1	

Unit: mm

Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W2003FA-3P-C5Z20	W2003FA-4-C5T20	200	241
W2004FA-3P-C5Z20	W2004FA-4-C5T20	300	341
W2005FA-3P-C5Z20	W2005FA-4-C5T20	400	441
W2006FA-3P-C5Z20	W2006FA-4-C5T20	500	541
W2007FA-3P-C5Z20	W2007FA-4-C5T20	600	641
W2008FA-3P-C5Z20	W2008FA-4-C5T20	700	741
W2009FA-3P-C5Z20	W2009FA-4-C5T20	800	841
W2010FA-3P-C5Z20	W2010FA-4-C5T20	900	941
W2011FA-3P-C5Z20	W2011FA-4-C5T20	1 000	1 041
W2012FA-3P-C5Z20	W2012FA-4-C5T20	1 100	1 141
W2015FA-1P-C5Z20	W2015FA-2-C5T20	1 400	1 441

Notes:

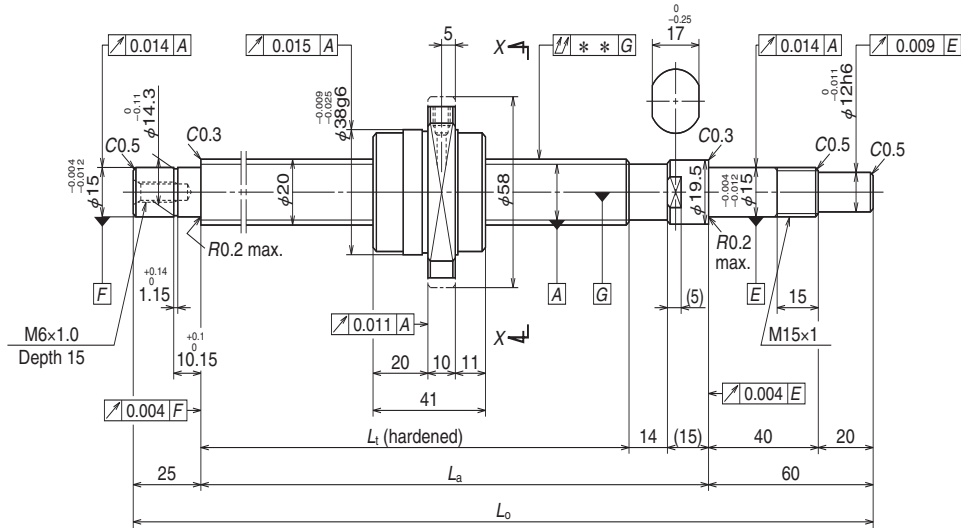
1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L _t	L _a	L _o	T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
310	335	420	0	0.023	0.018	0.040	1.6	3 000	3 000
410	435	520	0	0.027	0.020	0.050	1.8	3 000	3 000
510	535	620	0	0.030	0.023	0.050	2.0	3 000	3 000
610	635	720	0	0.030	0.023	0.065	2.3	3 000	3 000
710	735	820	0	0.035	0.025	0.085	2.5	3 000	3 000
810	835	920	0	0.040	0.027	0.085	2.7	3 000	3 000
910	935	1 020	0	0.040	0.027	0.110	3.0	3 000	3 000
1 010	1 035	1 120	0	0.046	0.030	0.110	3.2	2 630	3 000
1 110	1 135	1 220	0	0.046	0.030	0.110	3.4	2 160	2 970
1 210	1 235	1 320	0	0.046	0.030	0.150	3.7	1 810	2 500
1 510	1 535	1 620	0	0.054	0.035	0.180	4.4	1 150	1 610

Notes:

4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

Finished shaft end FA Type
 (Ultra high helix lead)



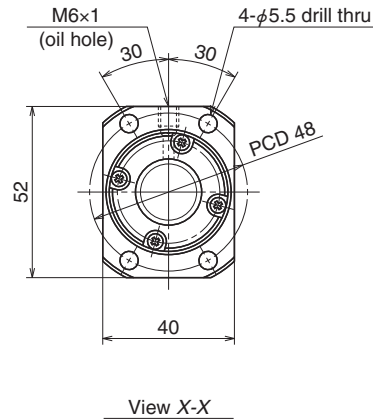
Nut models: UPFC, USFC

NSK

Screw shaft ø20

Lead 40

Unit: mm



Ball screw specifications		
Product classification	Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn	20 x 40 / Right	
Preload / Ball recirculation	P-preload / End cap	
Ball dia. / Ball circle dia.	3.175 / 20.75	
Screw shaft root diameter	17.4	
Effective turns of balls	0.7 x 2	
Accuracy grade / Preload / Axial play	C5 / Z	C5 / T
Basic load rating (N)	Dynamic C _a	5 410
	Static C _{0a}	9 360
Axial play	0	0.005 or less
Preload (N)	148	—
Dynamic friction torque, (N-cm)	2.0 – 11.8	2.9 or less
Spacer ball	None	
Factory-packed grease	NSK grease LR3	
Internal spatial volume of nut (cm ³)	2.8	
Standard volume of grease replenishing (cm ³)	1.4	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK15-01A (square)	WBK15S-01 (square)
WBK15-11 (round)	

Unit: mm

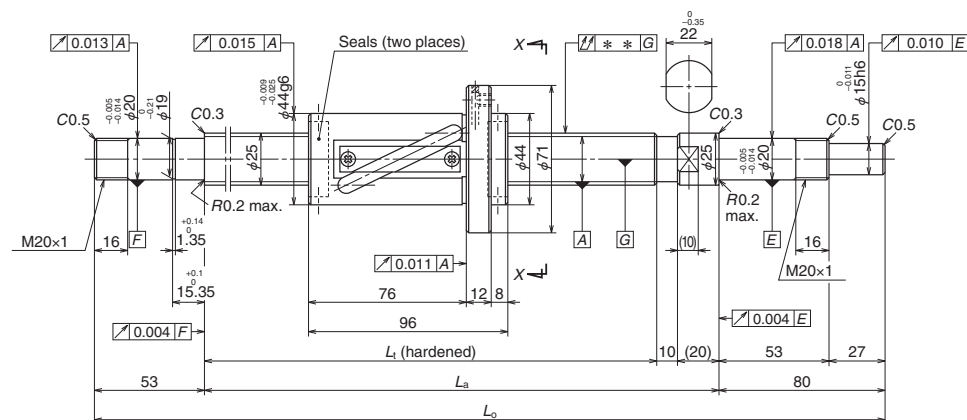
Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (UPFC)	Precise clearance (USFC)		
W2005FA-5PGX-C5Z40	W2005FA-6GX-C5T40	400	459
W2007FA-5PGX-C5Z40	W2007FA-6GX-C5T40	600	659
W2009FA-5PGX-C5Z40	W2009FA-6GX-C5T40	800	859
W2011FA-5PGX-C5Z40	W2011FA-6GX-C5T40	1 000	1 059
W2013FA-1PGX-C5Z40	W2013FA-2GX-C5T40	1 200	1 259
W2017FA-1PGX-C5Z40	W2017FA-2GX-C5T40	1 600	1 659

- Notes:
1. We recommend NSK support unit. See page B389 for details.
 2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
 3. Ball nut does not have seal.
 4. Contact NSK if the permissible rotational speed is to be exceeded.

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
L _t	L _a	L _o	T	e _p	v _u			Supporting condition	
								Fixed - Simple support	Fixed - Fixed
506	535	620	0	0.030	0.023	0.050	1.7	3 000	3 000
706	735	820	0	0.035	0.025	0.085	2.2	3 000	3 000
906	935	1 020	0	0.040	0.027	0.110	2.7	3 000	3 000
1 106	1 135	1 220	0	0.046	0.030	0.110	3.1	2 210	3 000
1 306	1 335	1 420	0	0.054	0.035	0.150	3.6	1 570	2 160
1 706	1 735	1 820	0	0.065	0.040	0.230	4.6	910	1 270

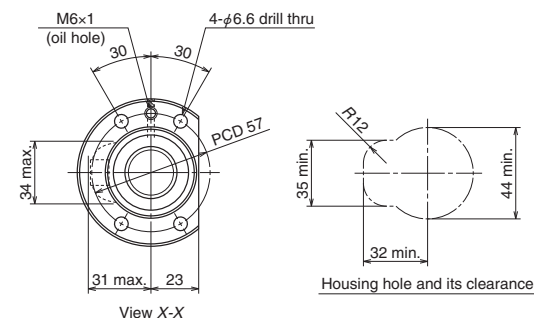
- Notes:
5. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
 6. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

(Medium lead)



Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W2507FA-1P-C5Z20	W2507FA-2-C5T20	600	640
W2509FA-1P-C5Z20	W2509FA-2-C5T20	800	840
W2511FA-1P-C5Z20	W2511FA-2-C5T20	1 000	1 040
W2513FA-1P-C5Z20	W2513FA-2-C5T20	1 200	1 240
W2515FA-1P-C5Z20	W2515FA-2-C5T20	1 400	1 440
W2517FA-1P-C5Z20	W2517FA-2-C5T20	1 600	1 640
W2521FA-1P-C5Z20	W2521FA-2-C5T20	2 000	2 040

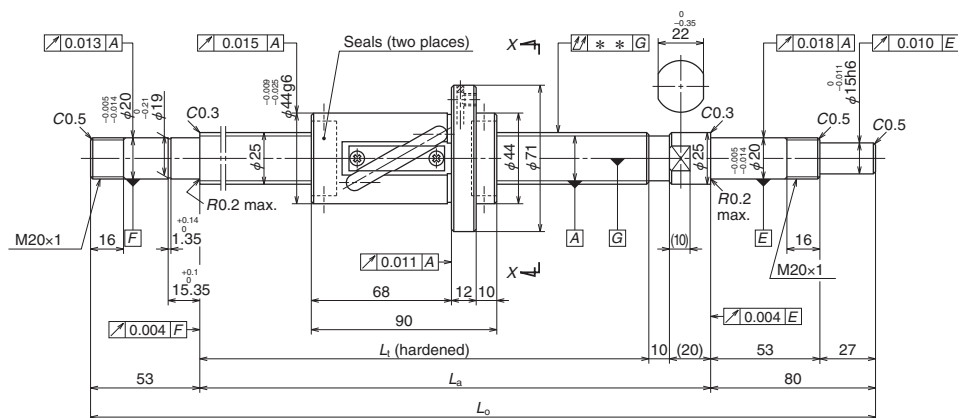
Nut models: LPFT, LSFT



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		25 × 20 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		4.762 / 26.25	
Screw shaft root diameter		21.3	
Effective turns of balls		2.5 × 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C _a	11 700	18 600
	Static C _{0a}	16 300	32 600
Axial play		0	0.005 or less
Preload (N)		343	—
Dynamic friction torque, (N·cm)		3.9 – 24.5	4.9 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease LR3	
Internal spatial volume of nut (cm ³)		12	
Standard volume of grease replenishing (cm ³)		6	

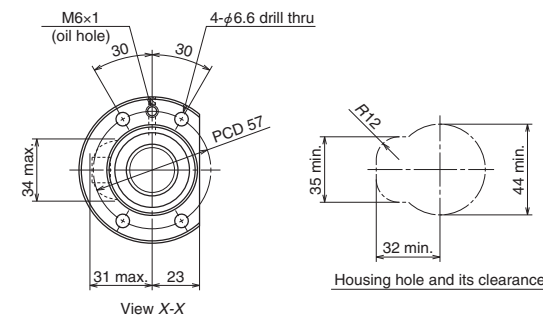
For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L _t	L _a	L _o	T	e _p	u _i			Fixed - Simple support	Fixed - Fixed
750	780	913	0	0.035	0.025	0.055	4.0	2 800	2 800
950	980	1 113	0	0.040	0.027	0.070	4.7	2 800	2 800
1 150	1 180	1 313	0	0.046	0.030	0.090	5.4	2 590	2 800
1 350	1 380	1 513	0	0.054	0.035	0.090	6.2	1 860	2 550
1 550	1 580	1 713	0	0.054	0.035	0.120	6.9	1 400	1 940
1 750	1 780	1 913	0	0.065	0.040	0.120	7.6	1 090	1 520
2 150	2 180	2 313	0	0.077	0.046	0.160	9.1	720	1 000



Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W2507FA-3P-C5Z25	W2507FA-4-C5T25	600	646
W2509FA-3P-C5Z25	W2509FA-4-C5T25	800	846
W2511FA-3P-C5Z25	W2511FA-4-C5T25	1 000	1 046
W2513FA-3P-C5Z25	W2513FA-4-C5T25	1 200	1 246
W2515FA-3P-C5Z25	W2515FA-4-C5T25	1 400	1 446
W2517FA-3P-C5Z25	W2517FA-4-C5T25	1 600	1 646
W2521FA-3P-C5Z25	W2521FA-4-C5T25	2 000	2 046

Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.



Ball screw specifications		
Product classification		Preloaded Precise clearance
Shaft dia. x Lead / Direction of turn		25 × 25 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		4.762 / 26.25
Screw shaft root diameter		21.3
Effective turns of balls		1.5 × 1
Accuracy grade / Preload / Axial play		C5 / Z C5 / T
Basic load rating (N)	Dynamic C _a	8 970 11 700
	Static C _{0a}	13 100 19 700
Axial play		0 0.005 or less
Preload (N)		294 —
Dynamic friction torque, (N·cm)		3.9 – 24.5 4.9
Spacer ball		Yes None
Factory-packed grease		NSK grease LR3
Internal spatial volume of nut (cm ³)		7.5
Standard volume of grease replenishing (cm ³)		3.8

Recommended support unit

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Unit: mm

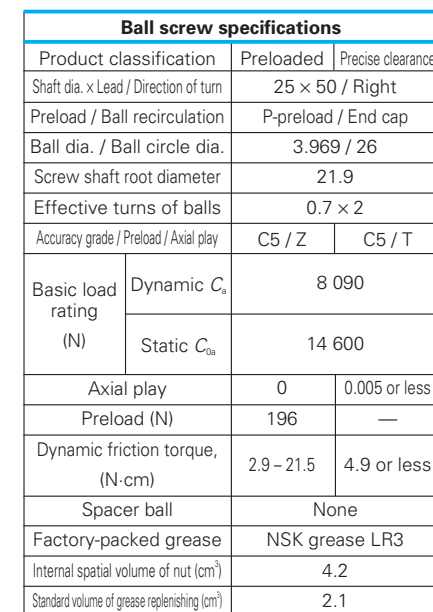
Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
<i>L</i> _t	<i>L</i> _a	<i>L</i> _o	<i>T</i>	<i>e</i> _p	<i>v</i> _u			Fixed - Simple support	Fixed - Fixed
750	780	913	0	0.035	0.025	0.055	4.0	2 800	2 800
950	980	1 113	0	0.040	0.027	0.070	4.7	2 800	2 800
1 150	1 180	1 313	0	0.046	0.030	0.090	5.4	2 580	2 800
1 350	1 380	1 513	0	0.054	0.035	0.090	6.2	1 850	2 550
1 550	1 580	1 713	0	0.054	0.035	0.120	7.0	1 400	1 930
1 750	1 780	1 913	0	0.065	0.040	0.120	7.7	1 090	1 510
2 150	2 180	2 313	0	0.077	0.046	0.160	9.1	710	1 000

(Ultra high helix lead)

**NSK**

Lead 50

Unit: mm



For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Unit: mm

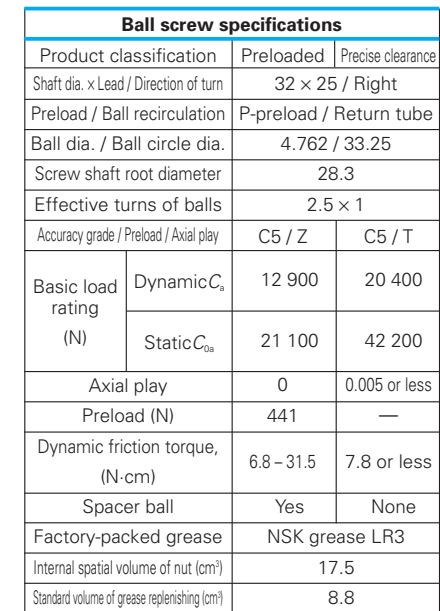
Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L_t	L_a	L_o	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
844	880	1 013	0	0.040	0.027	0.070	4.1	2 800	2 800
1 144	1 180	1 313	0	0.046	0.030	0.090	5.3	2 600	2 800
1 644	1 680	1 813	0	0.065	0.040	0.120	7.2	1 250	1 720
2 144	2 180	2 313	0	0.077	0.046	0.160	9.1	730	1 010

B211

(Medium lead)



Unit: mm



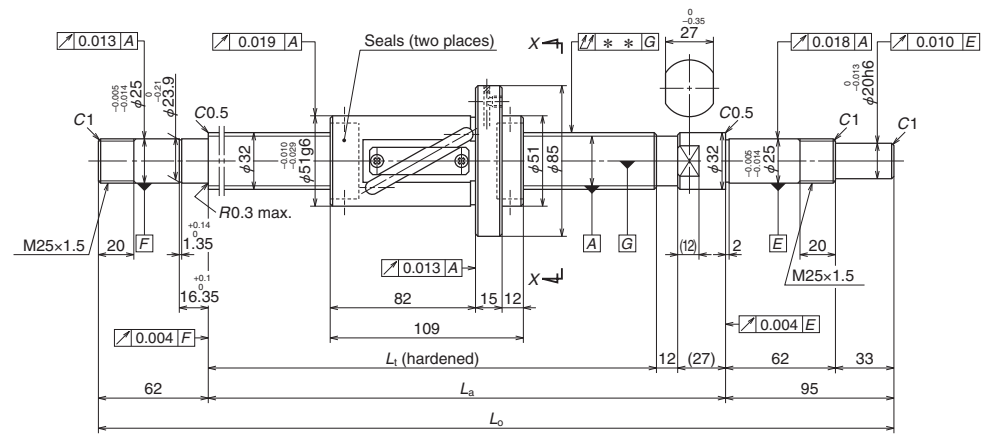
For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK25-01W (square)	WBK25-01W (square)	WBK25S-01W (square)
WBK25-11 (round)	WBK25-11 (round)	

Unit: mm

Screw shaft length			Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L_t	L_a	L_o	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
1 180	1 219	1 376	0	0.046	0.030	0.090	9.3	2 180	2 180
1 680	1 719	1 876	0	0.065	0.040	0.120	12.3	1 600	2 180
2 180	2 219	2 376	0	0.077	0.046	0.160	15.4	930	1 300
2 780	2 819	2 976	0	0.093	0.054	0.200	19.1	570	800

B213

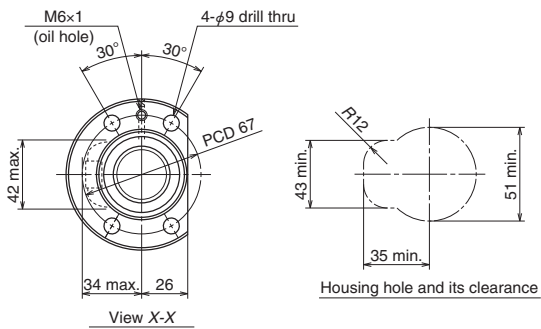
Finished shaft end FA Type
 (High helix lead)



Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W3211FA-3P-C5Z32	W3211FA-4-C5T32	1 000	1 054
W3216FA-3P-C5Z32	W3216FA-4-C5T32	1 500	1 554
W3221FA-3P-C5Z32	W3221FA-4-C5T32	2 000	2 054
W3227FA-3P-C5Z32	W3227FA-4-C5T32	2 600	2 654

Notes: 1. We recommend NSK support unit. See page B389 for details.
 2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
 3. Contact NSK if the permissible rotational speed is to be exceeded.

Nut models: LPFT, LSFT

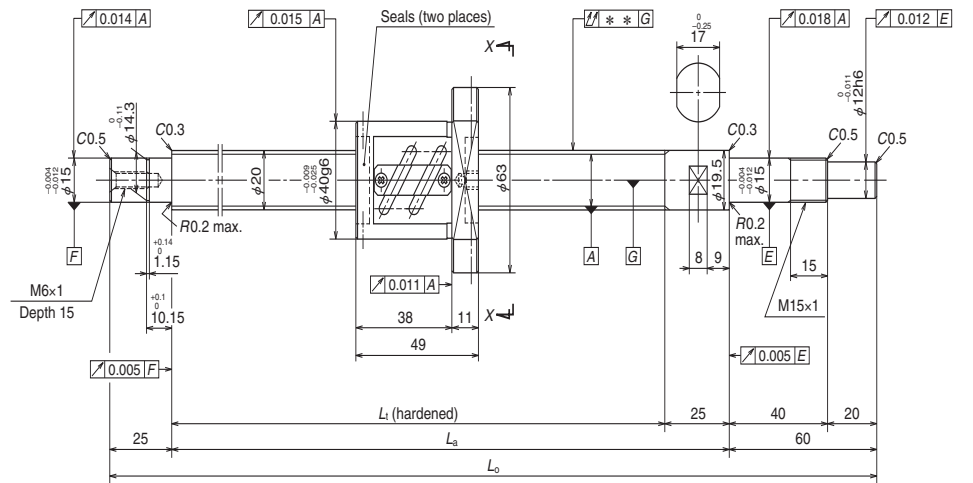


Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. x Lead / Direction of turn		32 x 32 / Right	
Preload / Ball recirculation		P-preload / Return tube	
Ball dia. / Ball circle dia.		4.762 / 33.25	
Screw shaft root diameter		28.3	
Effective turns of balls		1.5 x 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C ₀	10 100	13 300
	Static C _{0a}	16 800	25 200
Axial play		0	0.005 or less
Preload (N)		392	—
Dynamic friction torque, (N·cm)		6.9 – 31.5	7.8 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease LR3	
Internal spatial volume of nut (cm ³)		14	
Standard volume of grease replenishing (cm ³)		7	

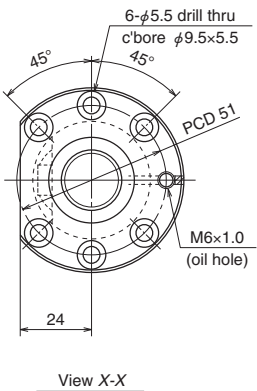
Recommended support unit		
For drive side (Fixed)	For opposite to drive side (Fixed)	(Simple)
WBK25-01W (square)	WBK25-01W (square)	WBK25S-01W (square)
WBK25-11 (round)	WBK25-11 (round)	

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
								Supporting condition	
L _t	L _a	L _o	T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
1 180	1 219	1 376	0	0.046	0.030	0.090	9.3	2 180	2 180
1 680	1 719	1 876	0	0.065	0.040	0.120	12.3	1 590	2 180
2 180	2 219	2 376	0	0.077	0.046	0.160	15.4	930	1 290
2 780	2 819	2 976	0	0.093	0.054	0.200	19.1	570	790

Finished shaft end SA Type
 (Fine lead)



Nut model: PFT



NSK

Screw shaft ø20

Lead 4

Unit: mm

Ball screw specifications		
Shaft dia. x Lead / Direction of turn	20 x 4 / Right	
Preload / Ball recirculation	P-preload / Return tube	
Ball dia. / Ball circle dia.	2.381 / 20.3	
Effective turns of balls	2.5 x 2	
Screw shaft root diameter	17.8	
Accuracy grade / Preload	C5 / Z	
Basic load rating (N)	Dynamic C _s	6 550
	Static C _{0a}	10 900
Preload (N)	294	
Dynamic friction torque, median, (N·cm)	3.9	
Spacer ball	Yes	
Factory-packed grease	Refer to Notes 2.	
Internal spatial volume of nut (cm ³)	2.7	
Standard volume of grease replenishing (cm ³)	1.4	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK15-01A (square)	WBK15S-01 (square)
WBK15-11 (round)	

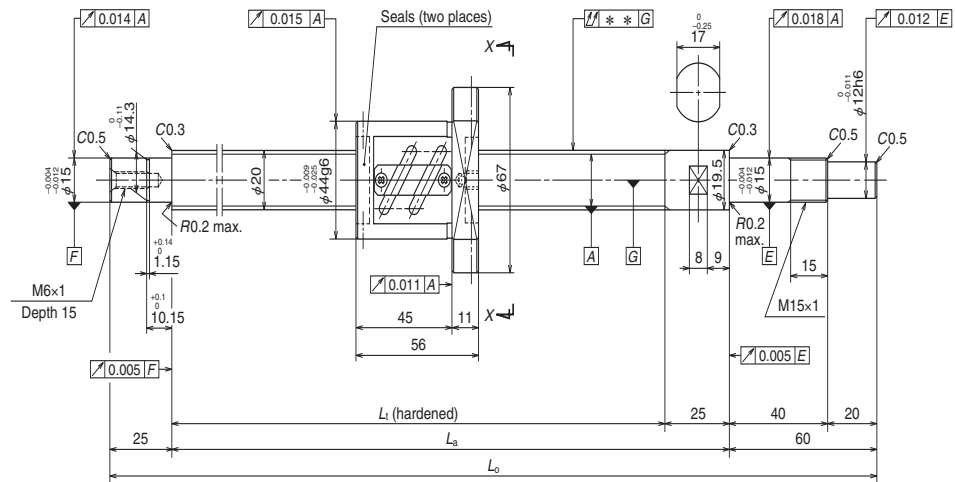
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L _t	L _a	L _o
W2002SA-1P-C5Z4	150	170	225	250	335
W2002SA-2P-C5Z4	200	220	275	300	385
W2003SA-1P-C5Z4	300	320	375	400	485
W2004SA-1P-C5Z4	400	420	475	500	585
W2005SA-1P-C5Z4	500	520	575	600	685
W2006SA-1P-C5Z4	600	620	675	700	785

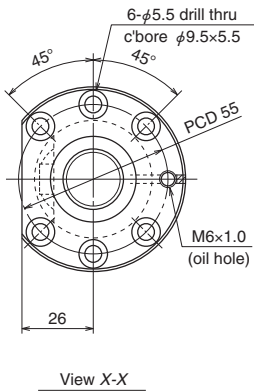
Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
T	e _p	v _u			Supporting condition	
					Fixed - Simple support	Fixed - Fixed
-0.005	0.023	0.018	0.045	1.1	3 000	3 000
-0.007	0.023	0.018	0.045	1.2	3 000	3 000
-0.009	0.025	0.020	0.055	1.5	3 000	3 000
-0.011	0.027	0.020	0.070	1.7	3 000	3 000
-0.014	0.030	0.023	0.085	1.9	3 000	3 000
-0.016	0.035	0.025	0.085	2.1	3 000	3 000

- Notes:
1. We recommend NSK support unit. See page B389 for details.
 2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
 3. Contact NSK if the permissible rotational speed is to be exceeded.
 4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.
 5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

Finished shaft end SA Type
 (Fine lead)



Nut model: PFT



NSK

Screw shaft ø20

Lead 5

Unit: mm

Ball screw specifications		
Shaft dia. x Lead / Direction of turn	20 × 5 / Right	
Preload / Ball recirculation	P-preload / Return tube	
Ball dia. / Ball circle dia.	3.175 / 20.5	
Screw shaft root diameter	17.2	
Effective turns of balls	2.5 × 2	
Accuracy grade / Preload	C5 / Z	
Basic load rating (N)	Dynamic C _s	11 100
	Static C _{0a}	17 100
Preload (N)	490	
Dynamic friction torque, median, (N·cm)	7.8	
Spacer ball	Yes	
Factory-packed grease	Refer to Notes 2.	
Internal spatial volume of nut (cm ³)	4.3	
Standard volume of grease replenishing (cm ³)	2.2	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK15-01A (square)	WBK15S-01 (square)
WBK15-11 (round)	

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	Supporting condition		
			L _t	L _a	L _o
W2002SA-3P-C5Z5	150	163	225	250	335
W2002SA-4P-C5Z5	200	213	275	300	385
W2003SA-2P-C5Z5	300	313	375	400	485
W2004SA-2P-C5Z5	400	413	475	500	585
W2005SA-2P-C5Z5	500	513	575	600	685
W2007SA-1P-C5Z5	700	713	775	800	885

Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
T	e _p	v _u			Supporting condition	
					Fixed - Simple support	Fixed - Fixed
-0.005	0.023	0.018	0.045	1.3	3 000	3 000
-0.007	0.023	0.018	0.045	1.4	3 000	3 000
-0.009	0.025	0.020	0.055	1.6	3 000	3 000
-0.011	0.027	0.020	0.070	1.8	3 000	3 000
-0.014	0.030	0.023	0.085	2.0	3 000	3 000
-0.019	0.035	0.025	0.110	2.5	3 000	3 000

Notes: 1. We recommend NSK support unit. See page B389 for details.

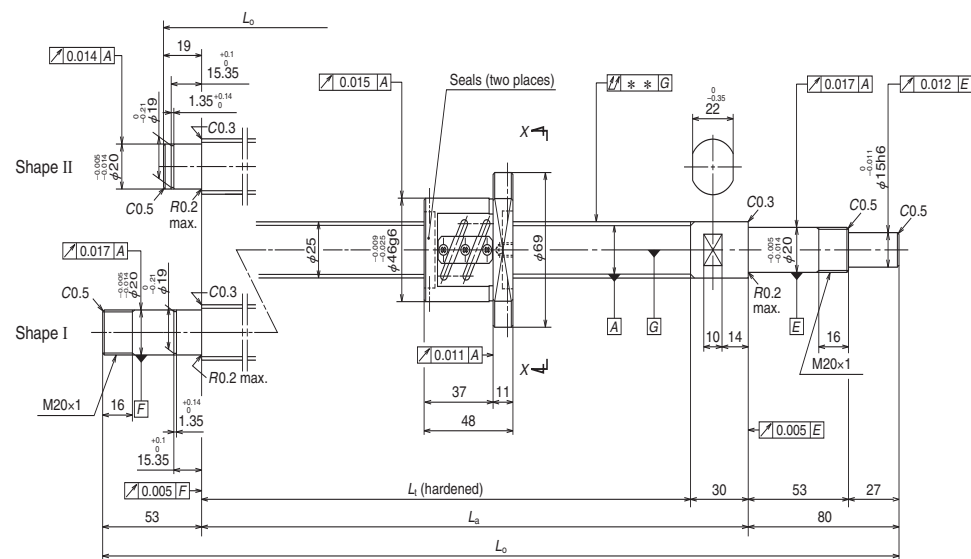
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

4. If Fixed is used for opposite driven side, configuration of support bearing area is designed by the customer.

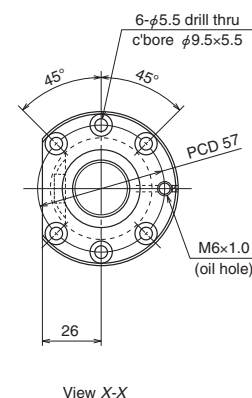
5. See B51 and B52 for ball screw supporting method (Fixed-Supported, Fixed-Fixed, etc.).

(Fine lead)

**NSK**

Lead 4

Unit: mm



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		25 x 4 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		2.381 / 25.3
Screw shaft root diameter		22.8
Effective turns of balls		2.5 x 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	7 110
	Static C_{0a}	13 600
Preload (N)		290
Dynamic friction torque, median, (N-cm)		4.9
Spacer ball		Yes
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		3.2
Standard volume of grease replenishing (cm ³)		1.6

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Unit: mm

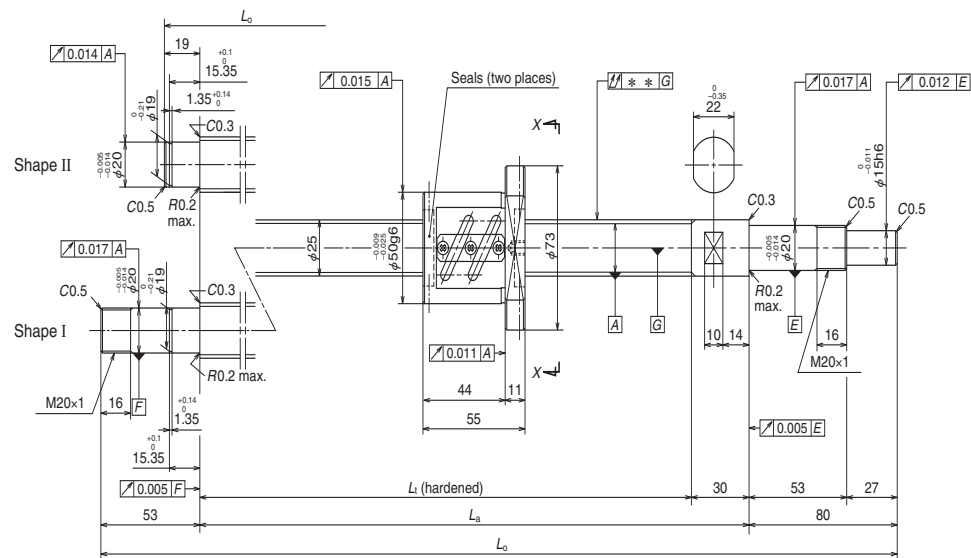
Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2502SA-1P-C5Z4	150	166	220	250	349
W2502SA-2P-C5Z4	200	216	270	300	399
W2503SA-1P-C5Z4	300	316	370	400	499
W2504SA-1P-C5Z4	400	416	470	500	599
W2505SA-1P-C5Z4	500	516	570	600	733
W2507SA-1P-C5Z4	700	716	770	800	933

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.

4. The maximum stroke is -8 mm when Fixed-Fixed is used for left shaft end shape I.

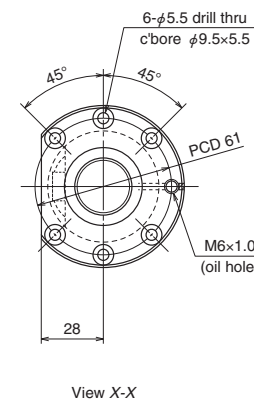
Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
	T	e _p	v _u			Supporting condition	
						Fixed - Simple support	Fixed - Fixed
II	-0.005	0.023	0.018	0.035	1.6	2 800	—
II	-0.006	0.023	0.018	0.035	1.8	2 800	—
II	-0.009	0.025	0.020	0.040	2.2	2 800	—
II	-0.011	0.027	0.020	0.050	2.5	2 800	—
I	-0.014	0.030	0.023	0.060	3.0	2 800	2 800
I	-0.018	0.035	0.025	0.075	3.7	2 800	2 800

(Fine lead)

**NSK**

Lead 5

Unit: mm



View X-X

Ball screw specifications		
Shaft dia. x Lead / Direction of turn		25 x 5 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		3.175 / 25.5
Screw shaft root diameter		22.2
Effective turns of balls		2.5 x 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_h	12 300
	Static C_{0h}	21 800
Preload (N)		540
Dynamic friction torque, median, (N·cm)		8.8
Spacer ball		Yes
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		5.0
Standard volume of grease replenishing (cm ³)		2.5

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

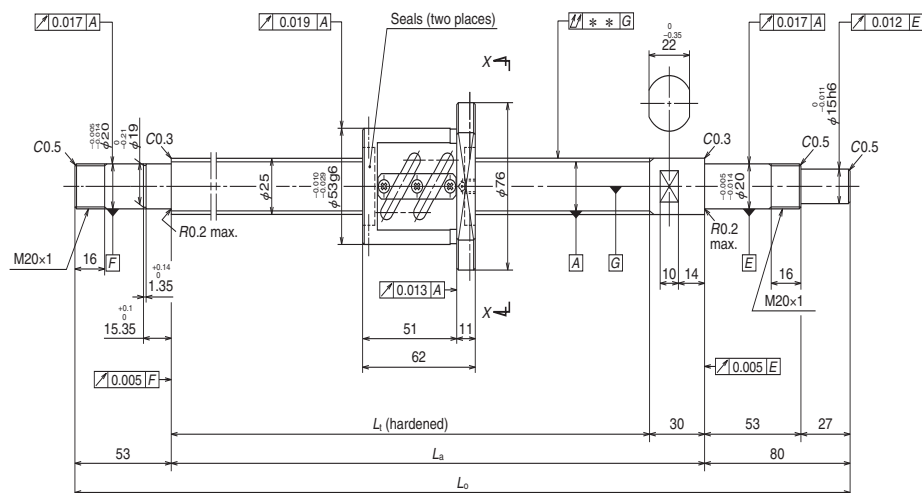
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2502SA-3P-C5Z5	150	159	220	250	349
W2502SA-4P-C5Z5	200	209	270	300	399
W2503SA-2P-C5Z5	300	309	370	400	499
W2504SA-2P-C5Z5	400	409	470	500	599
W2505SA-2P-C5Z5	500	509	570	600	733
W2506SA-1P-C5Z5	600	609	670	700	833
W2507SA-2P-C5Z5	700	709	770	800	933
W2509SA-1P-C5Z5	900	909	970	1 000	1 133
W2511SA-1P-C5Z5	1 100	1 109	1 170	1 200	1 333

4. The maximum stroke is -8 mm when Fixed-Fixed is used for left shaft end shape I.

Left side shaft end	Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
	T	e _p	v _u			Supporting condition	
						Fixed - Simple support	Fixed - Fixed
II	-0.005	0.023	0.018	0.035	1.8	2 800	—
II	-0.006	0.023	0.018	0.035	2.0	2 800	—
II	-0.009	0.025	0.020	0.040	2.3	2 800	—
II	-0.011	0.027	0.020	0.050	2.7	2 800	—
I	-0.014	0.030	0.023	0.060	3.1	2 800	2 800
I	-0.016	0.035	0.025	0.075	3.4	2 800	2 800
I	-0.018	0.035	0.025	0.075	3.8	2 800	2 800
I	-0.023	0.040	0.027	0.090	4.5	2 800	2 800
I	-0.028	0.046	0.030	0.120	5.2	2 520	2 800

(Fine lead)

**NSK**

Lead 6

6- ϕ 5.5 drill thru
c'bore ϕ 9.5x5.5

45° 45°

PCD 64

M6x1.0
(oil hole)

29

View X-X

Ball screw specifications		
Shaft dia. x Lead / Direction of turn		25 × 6 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		3.969 / 25.5
Screw shaft root diameter		21.4
Effective turns of balls		2.5 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_d	16 600
	Static C_{0a}	26 700
Preload (N)		685
Dynamic friction torque, median, (N·cm)		13.8
Spacer ball		Yes
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		7.0
Standard volume of grease replenishing (cm ³)		3.5

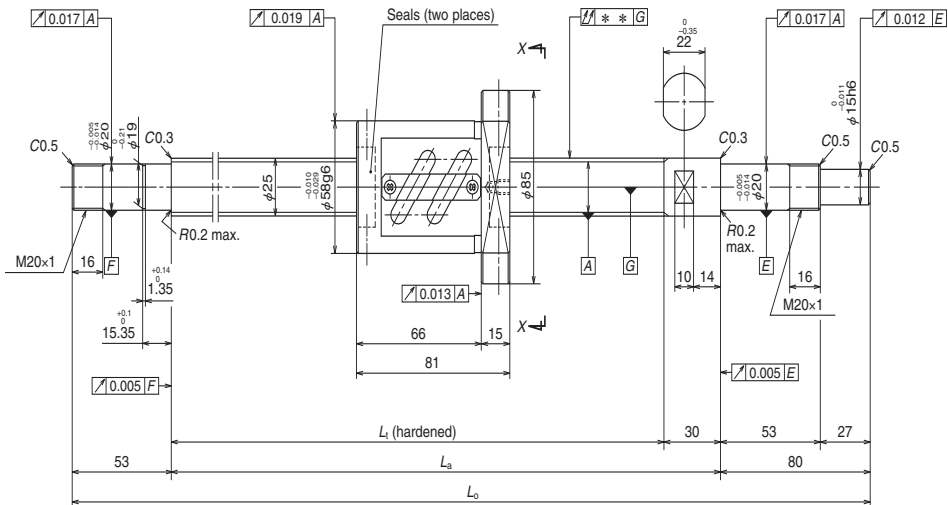
For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2503SA-3P-C5Z6	250	302	370	400	533
W2505SA-3P-C5Z6	450	502	570	600	733
W2507SA-3P-C5Z6	650	702	770	800	933
W2511SA-2P-C5Z6	1 050	1 102	1 170	1 200	1 333

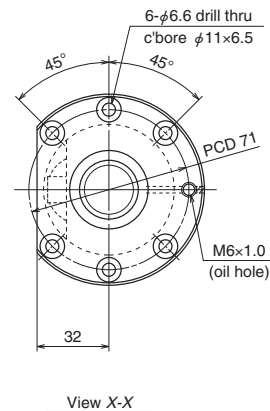
Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
					Supporting condition	
T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
-0.009	0.025	0.020	0.050	2.5	2 800	2 800
-0.014	0.030	0.023	0.060	3.2	2 800	2 800
-0.018	0.035	0.025	0.075	3.9	2 800	2 800
-0.028	0.046	0.030	0.120	5.2	2 450	2 800

Finished shaft end SA Type

(Fine lead)



Nut model: PFT



NSK

Screw shaft ø25

Lead 10

Unit: mm

Ball screw specifications

Shaft dia. x Lead / Direction of turn	25 x 10 / Right
Preload / Ball recirculation	P-preload / Return tube
Ball dia. / Ball circle dia.	4.762 / 25.5
Screw shaft root diameter	20.5
Effective turns of balls	1.5 x 2
Accuracy grade / Preload	C5 / Z
Basic load rating (N)	Dynamic C_a 13 600 Static C_{0a} 18 900
Preload (N)	585
Dynamic friction torque, median, (N·cm)	13.8
Spacer ball	Yes
Factory-packed grease	Refer to Notes 2.
Internal spatial volume of nut (cm ³)	9.5
Standard volume of grease replenishing (cm ³)	4.8

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2503SA-4P-C5Z10	250	283	370	400	533
W2505SA-4P-C5Z10	450	483	570	600	733
W2507SA-4P-C5Z10	650	683	770	800	933
W2509SA-2P-C5Z10	850	883	970	1 000	1 133
W2511SA-3P-C5Z10	1 050	1 083	1 170	1 200	1 333
W2514SA-1P-C5Z10	1 350	1 383	1 470	1 500	1 633

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
T	e_p	v_u			Supporting condition	
					Fixed - Simple support	Fixed - Fixed
-0.009	0.025	0.020	0.050	3.2	2 800	2 800
-0.014	0.030	0.023	0.060	3.8	2 800	2 800
-0.018	0.035	0.025	0.075	4.5	2 800	2 800
-0.023	0.040	0.027	0.090	5.2	2 800	2 800
-0.028	0.046	0.030	0.120	5.9	2 390	2 800
-0.035	0.054	0.035	0.150	6.9	1 490	2 060

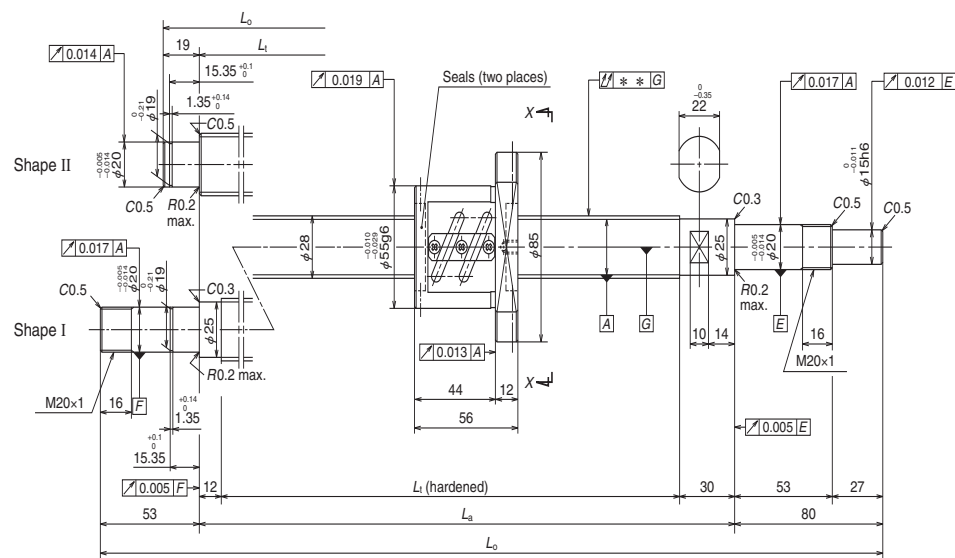
Notes: 1. We recommend NSK support unit. See page B389 for details.

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

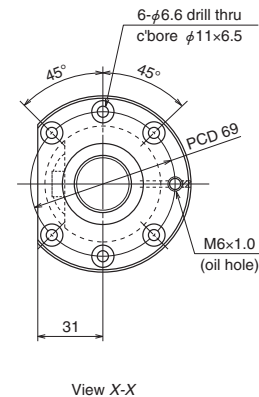
4. The maximum stroke is -8 mm when Fixed-Fixed is used.

(Fine lead)

**NSK**

Lead 5

Unit: mm



Shaft dia. $\times$ Lead / Direction of turn	28 $\times$ 5 / Right	
Preload / Ball recirculation	P-preload / Return tube	
Ball dia. / Ball circle dia.	3.175 / 28.5	
Screw shaft root diameter	25.2	
Effective turns of balls	2.5 $\times$ 2	
Accuracy grade / Preload	C5 / Z	
Basic load rating (N)	Dynamic C_a	13 000
	Static C_{0a}	24 400
Preload (N)		540
Dynamic friction torque, median, (N $\cdot$ cm)		9.8
Spacer ball		Yes
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		6.0
Standard volume of grease replenishing (cm ³)		3.0

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

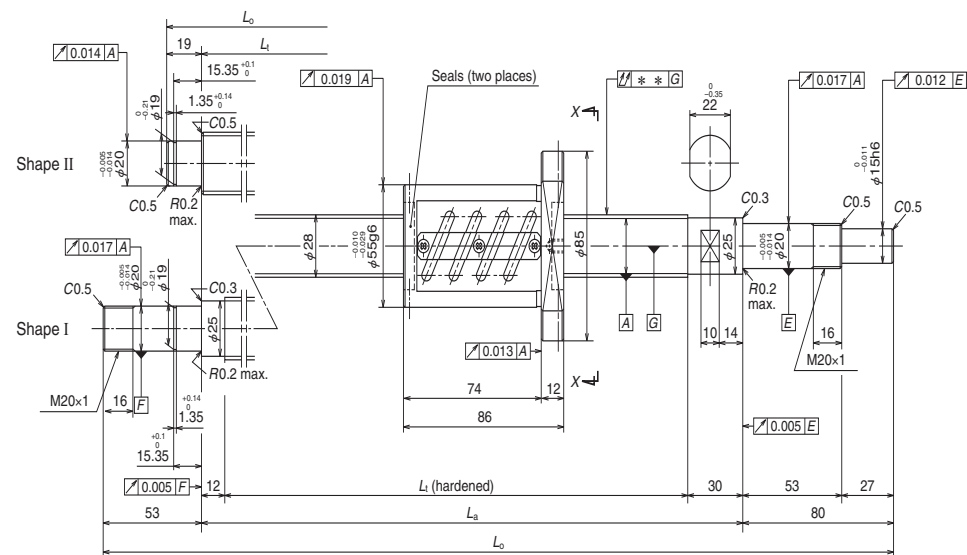
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2802SA-1P-C5Z5	200	208	270	300	399
W2803SA-1P-C5Z5	300	308	370	400	499
W2804SA-1P-C5Z5	400	408	470	500	599
W2805SA-1P-C5Z5	450	502	558	600	733
W2807SA-1P-C5Z5	650	702	758	800	933
W2809SA-1P-C5Z5	850	902	958	1 000	1 133
W2811SA-1P-C5Z5	1 050	1 102	1 158	1 200	1 333

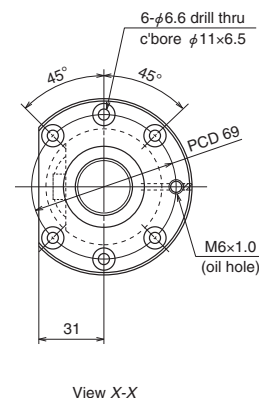
4. The maximum stroke is -2 mm when Fixed-Fixed is used for left shaft end shape I.

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
						Supporting condition	
	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
II	-0.006	0.023	0.018	0.035	2.5	2 500	—
II	-0.009	0.025	0.020	0.040	2.9	2 500	—
II	-0.011	0.027	0.020	0.050	3.3	2 500	—
I	-0.014	0.030	0.023	0.060	3.8	2 500	2 500
I	-0.018	0.035	0.025	0.075	4.7	2 500	2 500
I	-0.024	0.040	0.027	0.090	5.6	2 500	2 500
I	-0.028	0.046	0.030	0.120	6.5	2 500	2 500

(Fine lead)



Nut model: ZFT



View X-X

NSK

Screw shaft ø28

Lead 5

Unit: mm

Ball screw specifications

Basic load rating		
Shaft dia. x Lead / Direction of turn		28 × 5 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		3.175 / 28.5
Screw shaft root diameter		25.2
Effective turns of balls		2.5 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	20 600
	Static C_{0a}	48 700
Preload (N)		1 220
Dynamic friction torque, median, (N·cm)		21.5
Spacer ball		None
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		9.0
Standard volume of grease replenishing (cm ³)		4.5

Recommended support unit

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2802SA-2Z-C5Z5	150	178	270	300	399
W2803SA-2Z-C5Z5	250	278	370	400	499
W2804SA-2Z-C5Z5	350	378	470	500	599
W2805SA-2Z-C5Z5	450	472	558	600	733
W2807SA-2Z-C5Z5	650	672	758	800	933
W2809SA-2Z-C5Z5	850	872	958	1 000	1 133
W2811SA-2Z-C5Z5	1 050	1 072	1 158	1 200	1 333

Notes: 1. We recommend NSK support unit. See page B389 for details.

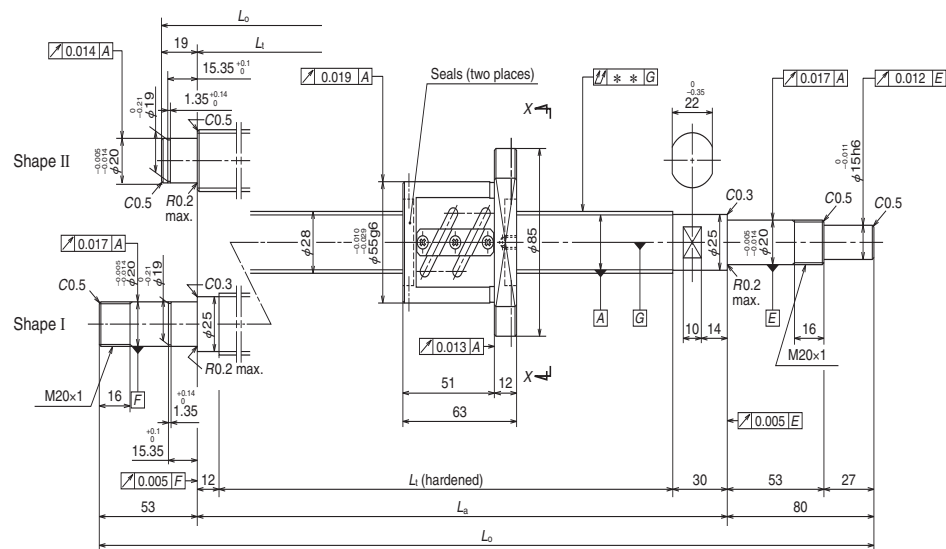
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

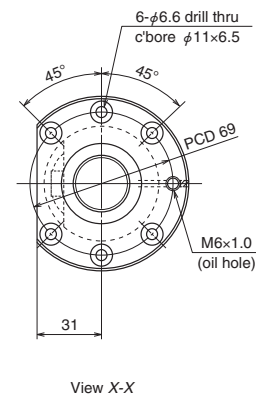
4. The maximum stroke is -2 mm when Fixed-Fixed is used for left shaft end shape I.

Left side shaft end	Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
	T	e _p	v _u			Supporting condition	
						Fixed - Simple support	Fixed - Fixed
II	-0.006	0.023	0.018	0.035	2.8	2 500	—
II	-0.009	0.025	0.020	0.040	3.2	2 500	—
II	-0.011	0.027	0.020	0.050	3.7	2 500	—
I	-0.013	0.030	0.023	0.060	4.2	2 500	2 500
I	-0.018	0.035	0.025	0.075	5.1	2 500	2 500
I	-0.023	0.040	0.027	0.090	5.9	2 500	2 500
I	-0.028	0.046	0.030	0.120	6.8	2 500	2 500

(Fine lead)



Nut model: PFT



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		28 × 6 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		3.175 / 28.5
Screw shaft root diameter		25.2
Effective turns of balls		2.5 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_d	12 900
	Static C_{0a}	24 300
Preload (N)		540
Dynamic friction torque, median, (N·cm)		11.8
Spacer ball		Yes
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		6.0
Standard volume of grease replenishing (cm ³)		3.0

Recommended support unit

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2803SA-3P-C5Z6	250	301	370	400	499
W2805SA-3P-C5Z6	450	501	570	600	699
W2807SA-3P-C5Z6	650	695	758	800	933
W2809SA-3P-C5Z6	850	895	958	1 000	1 133
W2811SA-3P-C5Z6	1 050	1 095	1 158	1 200	1 333

Notes: 1. We recommend NSK support unit. See page B389 for details.

2. **Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.** See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

4. The maximum stroke is -2 mm when Fixed-Fixed is used for left shaft end shape I.

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
	T	e _p	v _u			Supporting condition	
						Fixed - Simple support	Fixed - Fixed
II	-0.009	0.025	0.020	0.040	3.0	2 500	—
II	-0.014	0.030	0.023	0.060	3.9	2 500	—
I	-0.018	0.035	0.025	0.075	4.9	2 500	2 500
I	-0.023	0.040	0.027	0.090	5.8	2 500	2 500
I	-0.028	0.046	0.030	0.120	6.6	2 500	2 500

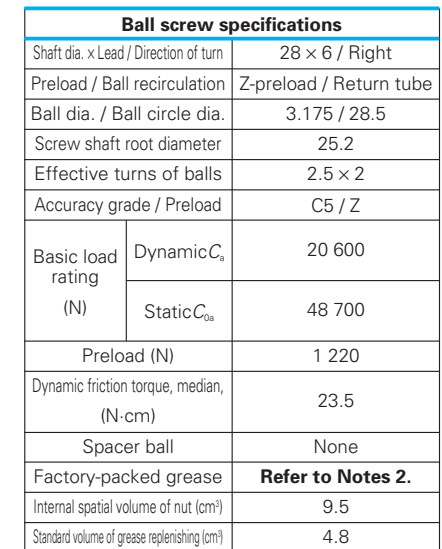
(Fine lead)



Screw shaft ø28

Lead 6

Unit: mm



Recommended support unit

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Unit: mm

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
						Supporting condition	
	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
II	-0.009	0.025	0.020	0.040	3.4	2 500	—
II	-0.014	0.030	0.023	0.060	4.3	2 500	—
I	-0.018	0.035	0.025	0.075	5.3	2 500	2 500
I	-0.023	0.040	0.027	0.090	6.2	2 500	2 500
I	-0.028	0.046	0.030	0.120	7.1	2 500	2 500

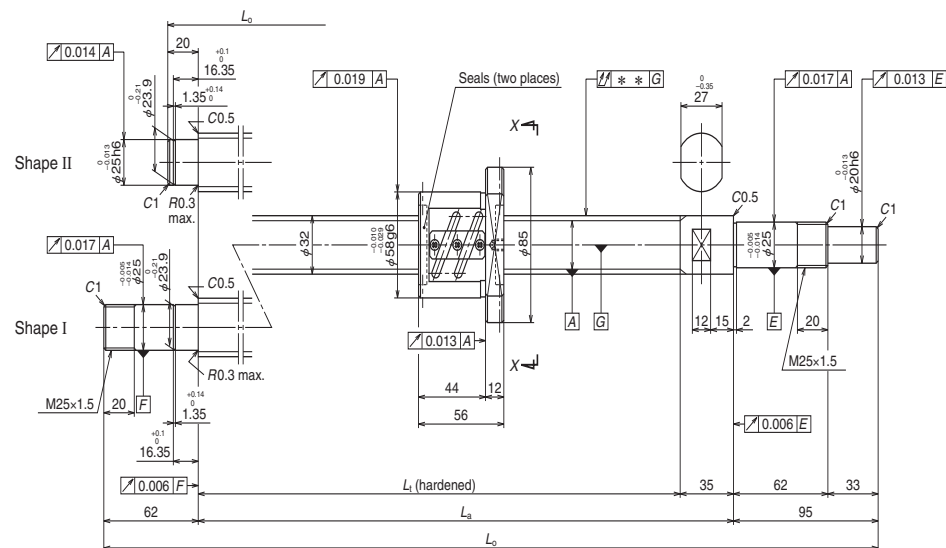
Notes: 1. We recommend NSK support unit. See page B389 for details.

2. **Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.** See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

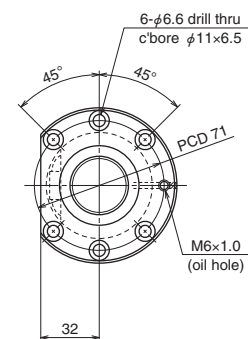
4. The maximum stroke is -2 mm when Fixed-Fixed is used for left shaft end shape I.

(Fine lead)

**NSK**

Lead 5

Unit: mm



View X-X

Ball screw specifications		
Shaft dia. x Lead / Direction of turn		32 x 5 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		3.175 / 32.5
Screw shaft root diameter		29.2
Effective turns of balls		2.5 x 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	13 700
	Static C_{0a}	28 000
Preload (N)		590
Dynamic friction torque, median, (N-cm)		11.8
Spacer ball		Yes
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		7.0
Standard volume of grease replenishing (cm ³)		3.5

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK25-01W (square)	WBK25-01W (square)	WBK25S-01W (square)
WBK25-11 (round)	WBK25-11 (round)	

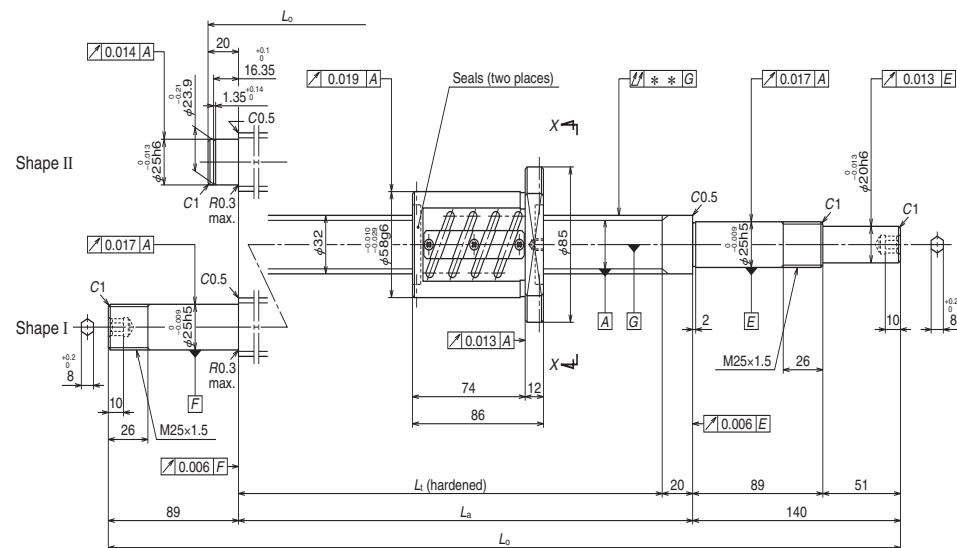
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W3202SA-1P-C5Z5	150	201	265	300	415
W3203SA-1P-C5Z5	250	301	365	400	515
W3204SA-1P-C5Z5	350	401	465	500	615
W3205SA-1P-C5Z5	450	501	565	600	715
W3206SA-1P-C5Z5	550	601	665	700	857
W3207SA-1P-C5Z5	650	701	765	800	957
W3209SA-1P-C5Z5	850	901	965	1 000	1 157
W3211SA-1P-C5Z5	1 050	1 101	1 165	1 200	1 357
W3214SA-1P-C5Z5	1 350	1 401	1 465	1 500	1 657

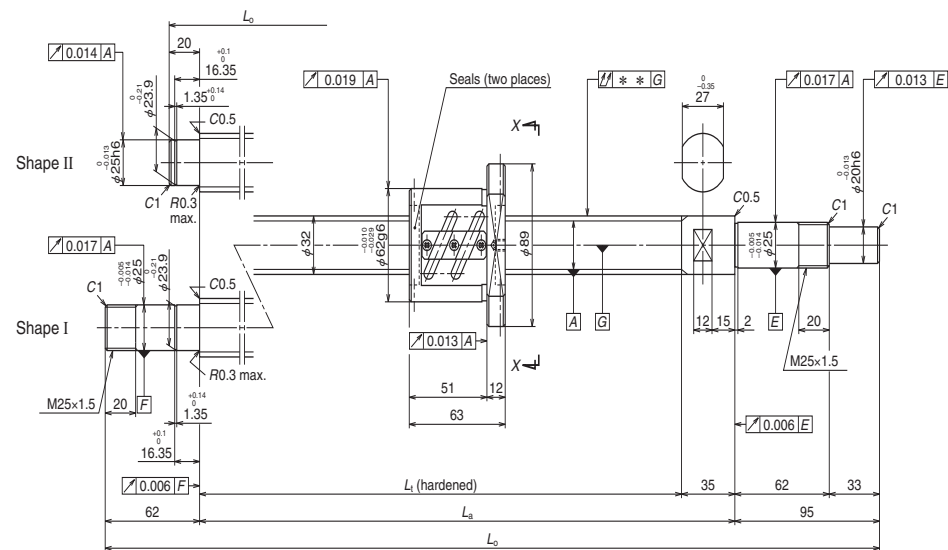
4. The maximum stroke is -9 mm when Fixed-Fixed is used for left shaft end shape I.

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
						Supporting condition	
	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
II	-0.006	0.023	0.018	0.040	3.1	2 180	—
II	-0.009	0.025	0.020	0.050	3.7	2 180	—
II	-0.011	0.027	0.020	0.050	4.2	2 180	—
II	-0.014	0.030	0.023	0.060	4.8	2 180	—
I	-0.016	0.035	0.025	0.075	5.6	2 180	2 180
I	-0.018	0.035	0.025	0.075	6.1	2 180	2 180
I	-0.023	0.040	0.027	0.090	7.3	2 180	2 180
I	-0.028	0.046	0.030	0.120	8.5	2 180	2 180
I	-0.035	0.054	0.035	0.150	10.2	2 100	2 180

(Fine lead)



(Fine lead)



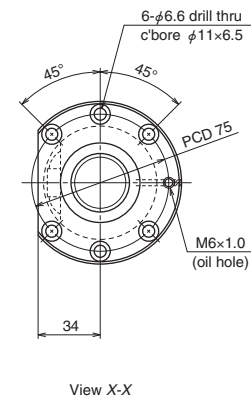
Nut model: PFT

NSK

Screw shaft ø32

Lead 6

Unit: mm



View X-X

Ball screw specifications		
Shaft dia. x Lead / Direction of turn		32 × 6 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		3.969 / 32.5
Screw shaft root diameter		28.4
Effective turns of balls		2.5 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	18 300
	Static C_{0a}	34 700
Preload (N)		780
Dynamic friction torque, median, (N·cm)		15.7
Spacer ball		Yes
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		9.5
Standard volume of grease replenishing (cm ³)		4.8

Recommended support unit

For drive side (Fixed)	For opposite to drive side	
	(Fixed)	(Simple)
WBK25-01W (square)	WBK25-01W (square)	WBK25S-01W (square)
WBK25-11 (round)	WBK25-11 (round)	

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W3203SA-3P-C5Z6	250	294	365	400	515
W3205SA-3P-C5Z6	450	494	565	600	715
W3207SA-3P-C5Z6	650	694	765	800	957
W3209SA-3P-C5Z6	850	894	965	1 000	1 157
W3211SA-3P-C5Z6	1 050	1 094	1 165	1 200	1 357
W3214SA-3P-C5Z6	1 350	1 394	1 465	1 500	1 657

Notes: 1. We recommend NSK support unit. See page B389 for details.

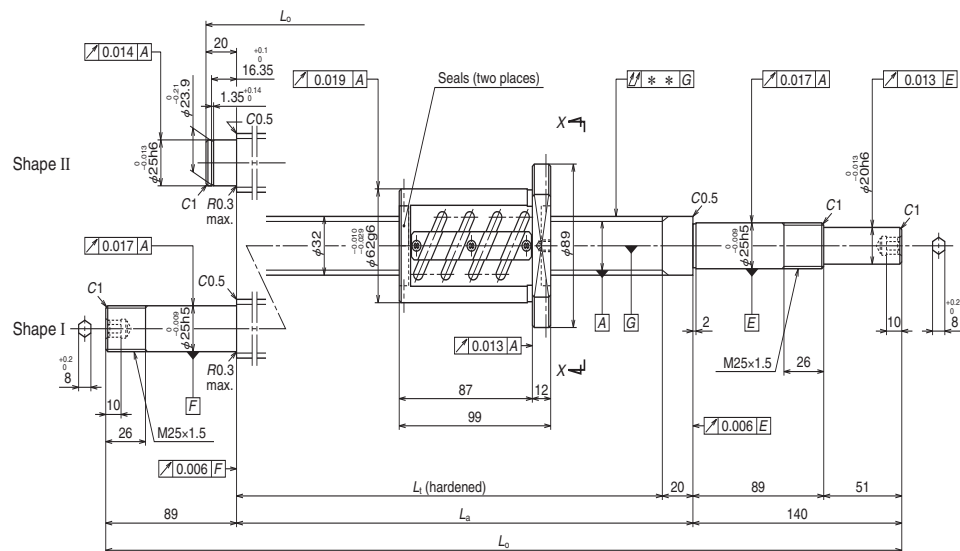
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

4. The maximum stroke is -9 mm when Fixed-Fixed is used for left shaft end shape I.

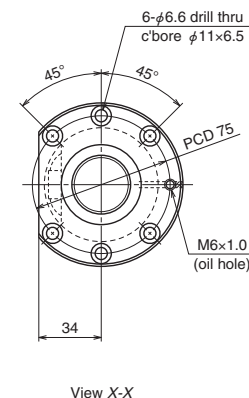
Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
						Supporting condition	
	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
II	-0.009	0.025	0.020	0.050	3.8	2 180	—
II	-0.014	0.030	0.023	0.060	5.0	2 180	—
I	-0.018	0.035	0.025	0.075	6.3	2 180	2 180
I	-0.023	0.040	0.027	0.090	7.4	2 180	2 180
I	-0.028	0.046	0.030	0.120	8.5	2 180	2 180
I	-0.035	0.054	0.035	0.150	10.2	2 050	2 180

(Fine lead)

**NSK**

Lead 6

Unit: mm



View X-X

Shaft dia. x Lead / Direction of turn		32 x 6 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		3.969 / 32.5
Screw shaft root diameter		28.4
Effective turns of balls		2.5 x 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C _a	29 100
	Static C _{0a}	69 300
Preload (N)		1 710
Dynamic friction torque, median, (N·cm)		35.0
Spacer ball		None
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		14
Standard volume of grease replenishing (cm ³)		7

For drive side, for opposite to drive side
(Fixed)

WBK25DF-31H (round)

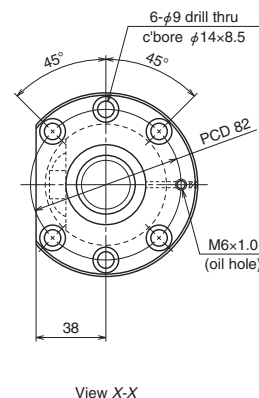
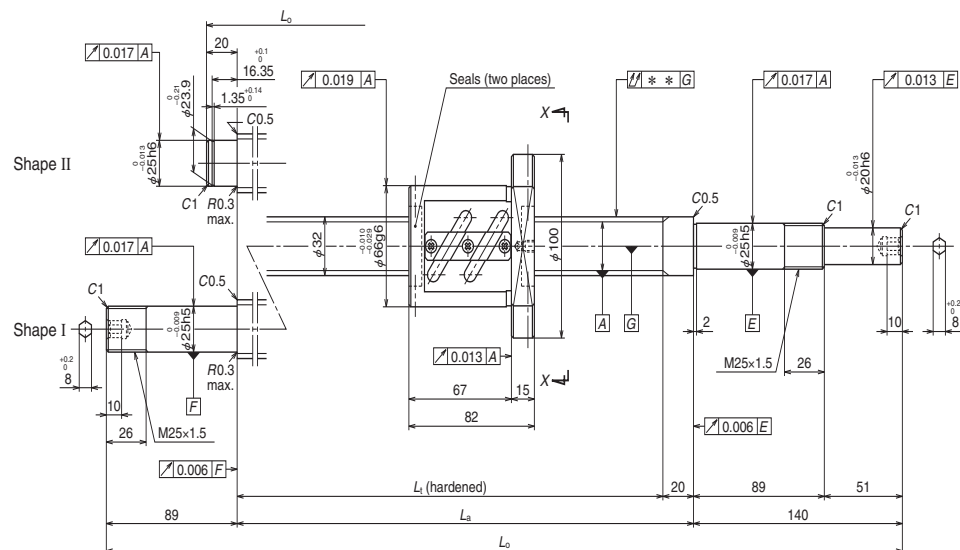
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W3203SA-4Z-C5Z6	250	273	380	400	560
W3205SA-4Z-C5Z6	450	473	580	600	760
W3207SA-4Z-C5Z6	650	673	780	800	1 029
W3209SA-4Z-C5Z6	850	873	980	1 000	1 229
W3211SA-4Z-C5Z6	1 050	1 073	1 180	1 200	1 429
W3214SA-4Z-C5Z6	1 350	1 373	1 480	1 500	1 729

2. **Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.** See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
						Supporting condition	
	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
II	-0.009	0.025	0.020	0.050	4.5	2 180	—
II	-0.014	0.030	0.023	0.060	5.6	2 180	—
I	-0.019	0.035	0.025	0.090	7.0	2 180	2 180
I	-0.024	0.040	0.027	0.090	8.1	2 180	2 180
I	-0.028	0.046	0.030	0.120	9.3	2 180	2 180
I	-0.036	0.054	0.035	0.150	11.0	2 060	2 180



Ball screw specifications

Shaft dia. x Lead / Direction of turn	32 × 8 / Right
Preload / Ball recirculation	Z-preload / Return tube
Ball dia. / Ball circle dia.	4.762 / 32.5
Screw shaft root diameter	27.5
Effective turns of balls	2.5 × 1
Accuracy grade / Preload	C5 / Z
Basic load rating (N)	Dynamic C_d 20 600 Static C_0 40 900
Preload (N)	1 320
Dynamic friction torque, median, (N·cm)	31.0
Spacer ball	None
Factory-packed grease	Refer to Notes 2.
Internal spatial volume of nut (cm ³)	13
Standard volume of grease replenishing (cm ³)	6.5

Recommended support unit

For drive side, for opposite to drive side (Fixed)

WBK25DF-31H (round)

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_0
W3203SA-5Z-C5Z8	250	290	380	400	560
W3205SA-5Z-C5Z8	450	490	580	600	760
W3207SA-5Z-C5Z8	650	690	780	800	1 029
W3209SA-5Z-C5Z8	850	890	980	1 000	1 229
W3214SA-5Z-C5Z8	1 350	1 390	1 480	1 500	1 729

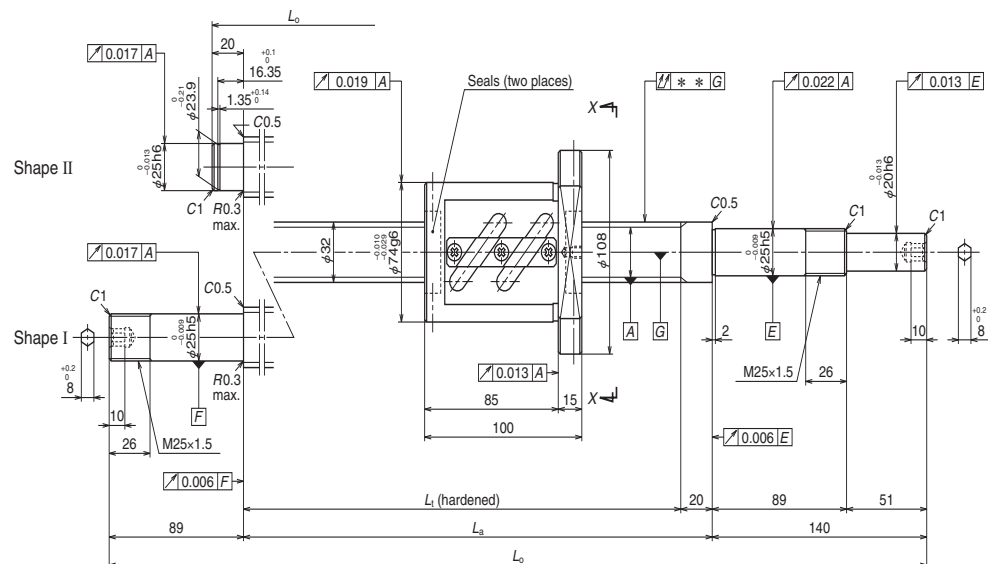
Notes: 1. We recommend NSK support unit. See page B389 for details.

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
	T	e _p	v _u			Supporting condition	
						Fixed - Simple support	Fixed - Fixed
II	-0.009	0.025	0.020	0.050	4.7	2 180	—
II	-0.014	0.030	0.023	0.060	5.8	2 180	—
I	-0.019	0.035	0.025	0.090	7.2	2 180	2 180
I	-0.024	0.040	0.027	0.090	8.3	2 180	2 180
I	-0.036	0.054	0.035	0.150	11.1	1 960	2 180

(Fine lead)



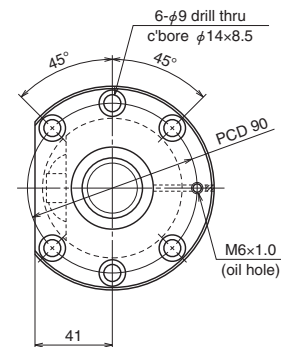
Nut model: ZFT

NSK

Screw shaft ø32

Lead 10

Unit: mm



View X-X

Ball screw specifications

Shaft dia. x Lead / Direction of turn		32 × 10 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		6.35 / 33
Screw shaft root diameter		26.4
Effective turns of balls		2.5 × 1
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	30 000
	Static C_{0a}	55 100
Preload (N)		1 960
Dynamic friction torque, median, (N·cm)		54.0
Spacer ball		None
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		22
Standard volume of grease replenishing (cm ³)		11

Recommended support unit

For drive side, for opposite to drive side (Fixed)
WBK25DF-31H (round)

Unit: mm

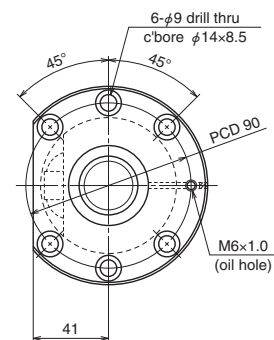
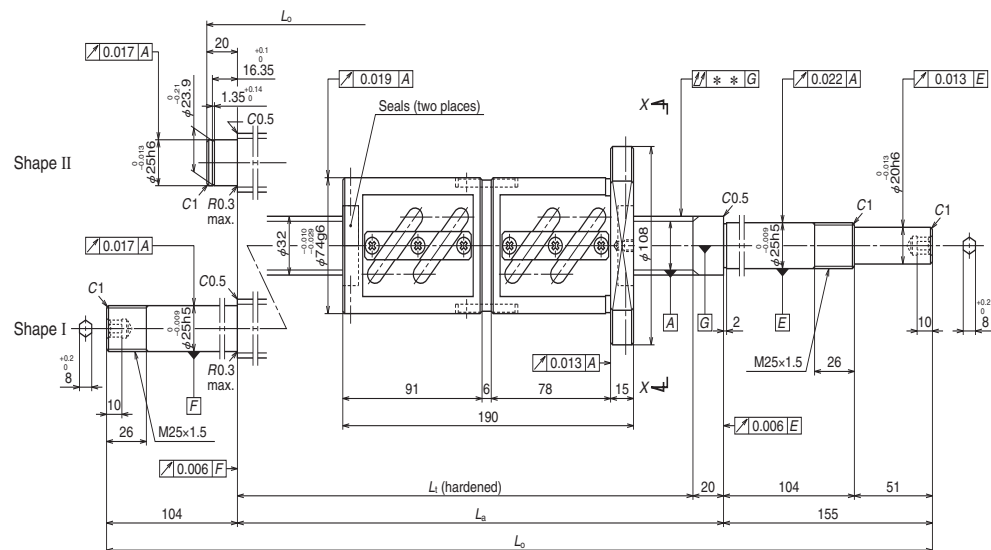
Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum			
			L_t	L_a	L_o
W3203SA-6Z-C5Z10	250	272	380	400	560
W3204SA-3Z-C5Z10	350	372	480	500	660
W3205SA-6Z-C5Z10	450	472	580	600	760
W3206SA-3Z-C5Z10	550	572	680	700	929
W3207SA-6Z-C5Z10	650	672	780	800	1 029
W3209SA-6Z-C5Z10	850	872	980	1 000	1 229
W3211SA-5Z-C5Z10	1 050	1 072	1 180	1 200	1 429
W3214SA-6Z-C5Z10	1 350	1 372	1 480	1 500	1 729
W3217SA-1Z-C5Z10	1 650	1 672	1 780	1 800	2 029

Notes: 1. We recommend NSK support unit. See page B389 for details.

2. **Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.** See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
						Supporting condition	
	T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
II	-0.009	0.025	0.020	0.050	5.5	2 180	—
II	-0.012	0.027	0.020	0.060	6.0	2 180	—
II	-0.014	0.030	0.023	0.060	6.6	2 180	—
I	-0.016	0.035	0.025	0.075	7.4	2 180	2 180
I	-0.019	0.035	0.025	0.090	7.9	2 180	2 180
I	-0.024	0.040	0.027	0.090	9.0	2 180	2 180
I	-0.028	0.046	0.030	0.120	10.1	2 180	2 180
I	-0.036	0.054	0.035	0.150	11.7	1 920	2 180
I	-0.043	0.065	0.040	0.200	13.3	1 310	1 810



View X-X

Ball screw specifications

Shaft dia. x Lead / Direction of turn		32 × 10 / Right
Preload / Ball recirculation		D-preload / Return tube
Ball dia. / Ball circle dia.		6.35 / 33
Screw shaft root diameter		26.4
Effective turns of balls		2.5 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	DynamicC _a	54 500
	StaticC _{0a}	110 000
Preload (N)		3 230
Dynamic friction torque, median, (N·cm)		83.0
Spacer ball		None
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		44
Standard volume of grease replenishing (cm ³)		22

Recommended support unit

For drive side, for opposite to drive side (Fixed)
WBK25DFD-31H (round)

Unit: mm

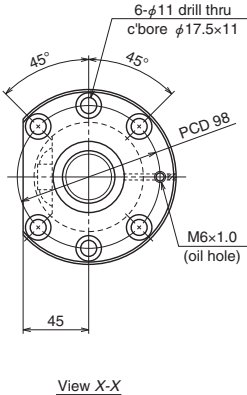
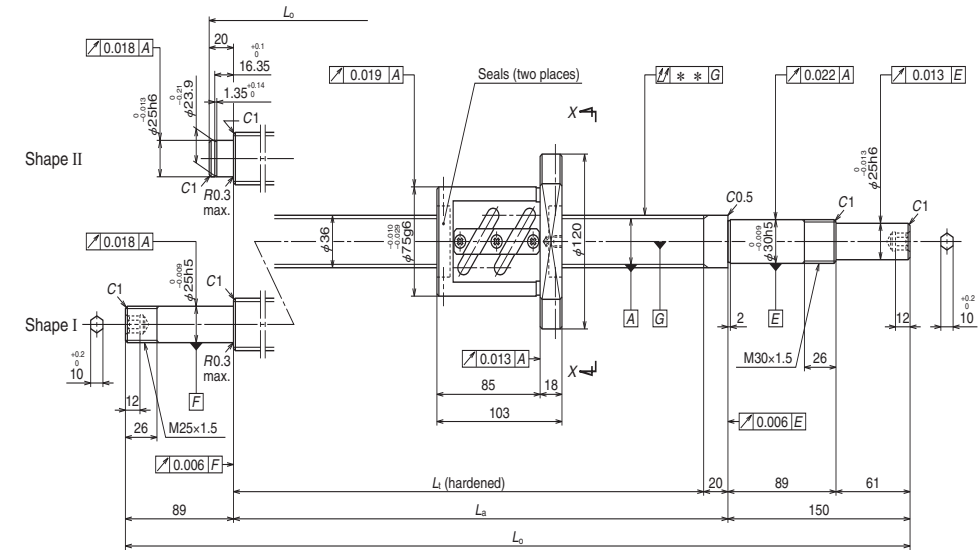
Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum			
			L_t	L_s	L_o
W3203SA-7D-C5Z10	150	182	380	400	575
W3204SA-4D-C5Z10	250	282	480	500	675
W3205SA-7D-C5Z10	350	382	580	600	775
W3206SA-4D-C5Z10	450	482	680	700	959
W3207SA-7D-C5Z10	550	582	780	800	1 059
W3209SA-7D-C5Z10	750	782	980	1 000	1 259
W3211SA-6D-C5Z10	950	982	1 180	1 200	1 459
W3214SA-7D-C5Z10	1 250	1 282	1 480	1 500	1 759
W3217SA-2D-C5Z10	1 550	1 582	1 780	1 800	2 059

Notes: 1. We recommend NSK support unit. See page B389 for details.

2. **Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.** See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
						Supporting condition	
	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
II	-0.009	0.025	0.020	0.050	7.5	2 180	—
II	-0.012	0.027	0.020	0.060	8.1	2 180	—
II	-0.014	0.030	0.023	0.060	8.6	2 180	—
I	-0.016	0.035	0.025	0.075	9.5	2 180	2 180
I	-0.019	0.035	0.025	0.090	10.0	2 180	2 180
I	-0.024	0.040	0.027	0.120	11.1	2 180	2 180
I	-0.028	0.046	0.030	0.120	12.2	2 180	2 180
I	-0.036	0.054	0.035	0.150	13.8	2 050	2 180
I	-0.043	0.065	0.040	0.200	15.4	1 380	1 910



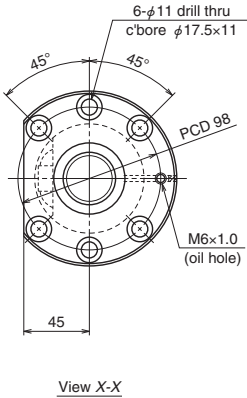
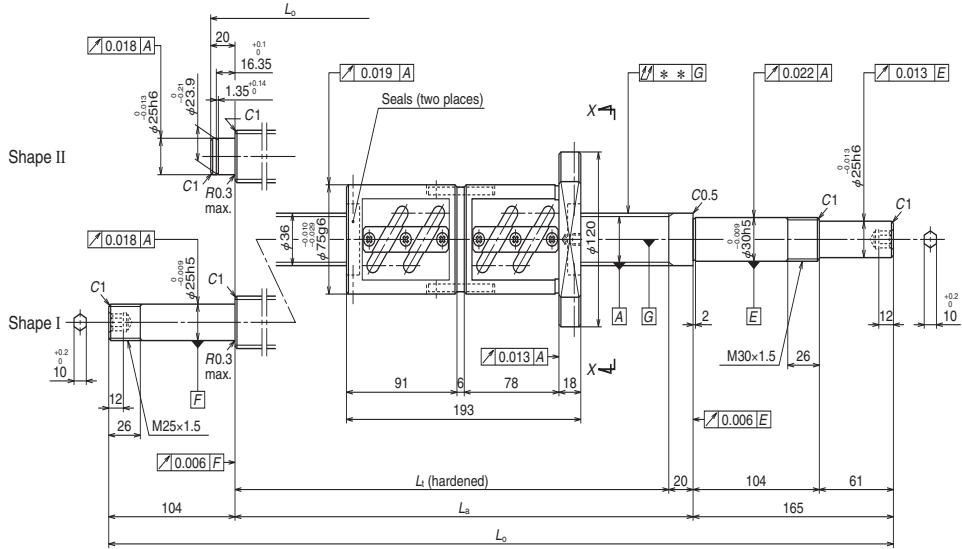
Ball screw specifications		
Shaft dia. x Lead / Direction of turn		36 × 10 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		6.35 / 37
Screw shaft root diameter		30.4
Effective turns of balls		2.5 × 1
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C _s	32 000
	Static C _{0s}	61 100
Preload (N)		2 060
Dynamic friction torque, median, (N·cm)		59.0
Spacer ball		None
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		32
Standard volume of grease replenishing (cm ³)		16

Recommended support unit		
For drive side (Fixed)		For opposite to drive side (Simple)
WBK30DF-31H (round)		WBK25DF-31H (round)

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L _t	L _a	L _o
W3604SA-1Z-C5Z10	350	370	480	500	670
W3606SA-1Z-C5Z10	550	570	680	700	870
W3609SA-1Z-C5Z10	850	870	980	1 000	1 239
W3613SA-1Z-C5Z10	1 250	1 270	1 380	1 400	1 639
W3617SA-1Z-C5Z10	1 650	1 670	1 780	1 800	2 039

Left side shaft end	Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
						Supporting condition	
	T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
II	-0.012	0.027	0.020	0.040	7.4	1 940	—
II	-0.016	0.035	0.025	0.050	8.8	1 940	—
I	-0.024	0.040	0.027	0.065	11.1	1 940	1 940
I	-0.033	0.054	0.035	0.100	13.9	1 940	1 940
I	-0.043	0.065	0.040	0.130	16.6	1 510	1 940

Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.



Ball screw specifications		
Shaft dia. x Lead / Direction of turn	36 × 10 / Right	
Preload / Ball recirculation	D-preload / Return tube	
Ball dia. / Ball circle dia.	6.35 / 37	
Screw shaft root diameter	30.4	
Effective turns of balls	2.5 × 2	
Accuracy grade / Preload	C5 / Z	
Basic load rating (N)	Dynamic C _s	58 000
	Static C _{0s}	122 000
Preload (N)	3 430	
Dynamic friction torque, median, (N·cm)	93.0	
Spacer ball	None	
Factory-packed grease	Refer to Notes 2.	
Internal spatial volume of nut (cm ³)	64	
Standard volume of grease replenishing (cm ³)	27	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)
WBK30DFD-31H (round)	WBK25DFD-31H (round)

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L _t	L _a	L _o
W3604SA-2D-C5Z10	250	280	480	500	685
W3606SA-2D-C5Z10	450	480	680	700	885
W3609SA-2D-C5Z10	750	780	980	1 000	1 269
W3613SA-2D-C5Z10	1 150	1 180	1 380	1 400	1 669
W3617SA-2D-C5Z10	1 550	1 580	1 780	1 800	2 069

- Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

Left side shaft end	Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
						Supporting condition	
	T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
II	-0.012	0.027	0.020	0.040	9.3	1 940	—
II	-0.016	0.035	0.025	0.050	10.7	1 940	—
I	-0.024	0.040	0.027	0.080	13.1	1 940	1 940
I	-0.033	0.054	0.035	0.100	15.9	1 940	1 940
I	-0.043	0.065	0.040	0.130	18.6	1 600	1 940

(Fine lead)



Screw shaft ø40

Lead 5

Unit: mm



Recommended support unit

Unit: mm

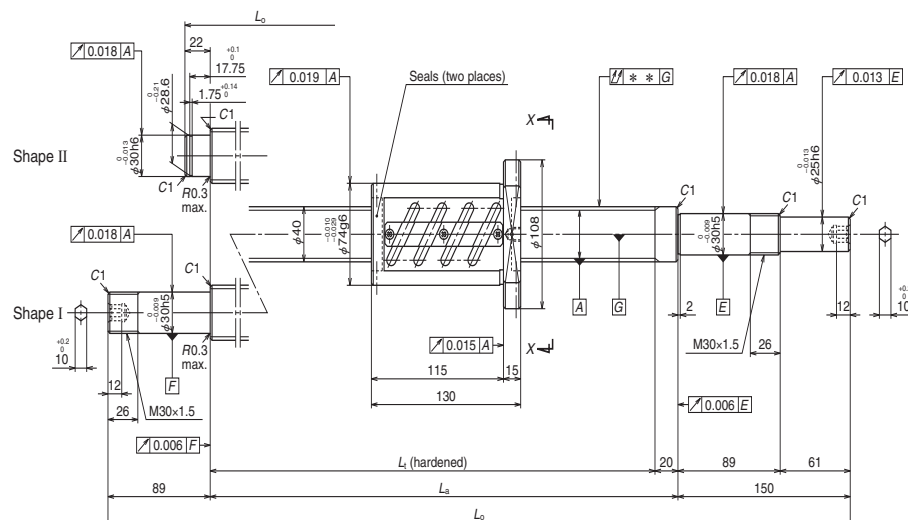
Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
	T	e _p	v _u			Supporting condition	
						Fixed - Simple support	Fixed - Fixed
II	-0.009	0.025	0.020	0.035	6.3	1 750	—
II	-0.014	0.030	0.023	0.040	8.1	1 750	—
I	-0.019	0.035	0.025	0.065	10.3	1 750	1 750
I	-0.024	0.040	0.027	0.065	12.2	1 750	1 750
I	-0.028	0.046	0.030	0.080	14.0	1 750	1 750
I	-0.038	0.054	0.035	0.100	17.7	1 750	1 750

Notes: 1. We recommend NSK support unit. See page B389 for details.

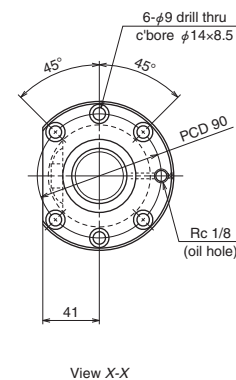
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.

3. Contact NSK if the permissible rotational speed is to be exceeded.

(Fine lead)



Nut model: ZFT

**NSK**

Screw shaft ø40

Lead 8

Unit: mm

Ball screw specifications		
Shaft dia. x Lead / Direction of turn		40 x 8 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		4.762 / 40.5
Screw shaft root diameter		35.5
Effective turns of balls		2.5 x 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_d	41 100
	Static C_{0a}	103 000
Preload (N)		2 450
Dynamic friction torque, median, (N-cm)		64.0
Spacer ball		None
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		27
Standard volume of grease replenishing (cm ³)		14

Recommended support unit

For drive side, for opposite to drive side (Fixed)
WBK30DF-31H (round)

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W4003SA-2Z-C5Z8	200	243	380	400	572
W4005SA-2Z-C5Z8	400	443	580	600	772
W4007SA-2Z-C5Z8	600	643	780	800	1 039
W4009SA-2Z-C5Z8	800	843	980	1 000	1 239
W4011SA-2Z-C5Z8	1 000	1 043	1 180	1 200	1 439
W4015SA-2Z-C5Z8	1 400	1 443	1 580	1 600	1 839

Notes: 1. We recommend NSK support unit. See page B389 for details.

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.

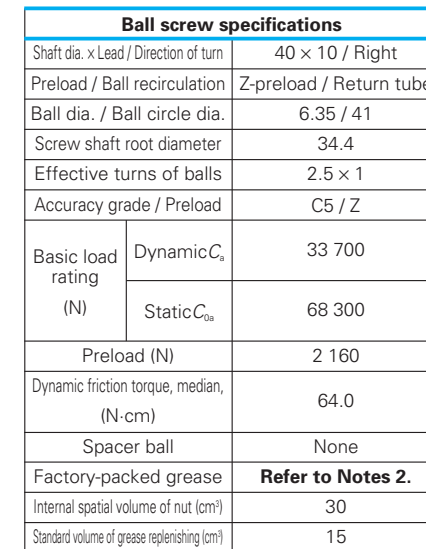
3. Contact NSK if the permissible rotational speed is to be exceeded.

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
	T	e _p	v _u			Supporting condition	
						Fixed - Simple support	Fixed - Fixed
II	-0.009	0.025	0.020	0.035	7.4	1 750	—
II	-0.014	0.030	0.023	0.040	9.2	1 750	—
I	-0.019	0.035	0.025	0.065	11.3	1 750	1 750
I	-0.024	0.040	0.027	0.065	13.1	1 750	1 750
I	-0.028	0.046	0.030	0.080	14.9	1 750	1 750
I	-0.038	0.054	0.035	0.100	18.5	1 750	1 750

(Fine lead)



Unit: mm

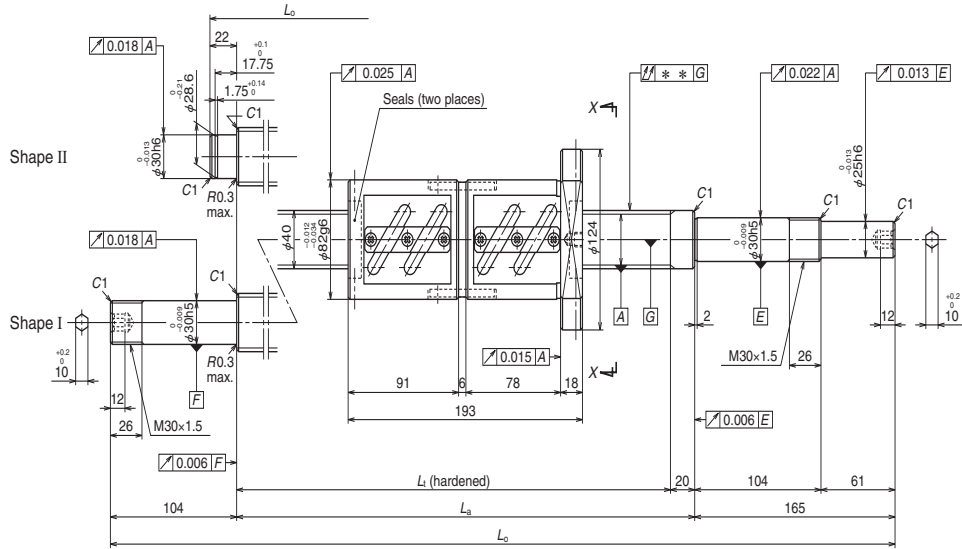


Unit: mm

Left side shaft end	Lead accuracy			Shaft run- out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
	T	e _p	v _u			Supporting condition	
						Fixed - Simple support	Fixed - Fixed
II	-0.012	0.027	0.020	0.040	8.7	1 750	—
II	-0.014	0.030	0.023	0.040	9.6	1 750	—
II	-0.016	0.035	0.025	0.050	10.4	1 750	—
I	-0.019	0.035	0.025	0.065	11.7	1 750	1 750
I	-0.024	0.040	0.027	0.065	13.4	1 750	1 750
I	-0.028	0.046	0.030	0.080	15.1	1 750	1 750
I	-0.033	0.054	0.035	0.100	16.9	1 750	1 750
I	-0.038	0.054	0.035	0.100	18.6	1 750	1 750
I	-0.043	0.065	0.040	0.130	20.3	1 710	1 750
I	-0.057	0.077	0.046	0.170	25.5	940	1 320

B259

Finished shaft end SA Type
 (Fine lead)



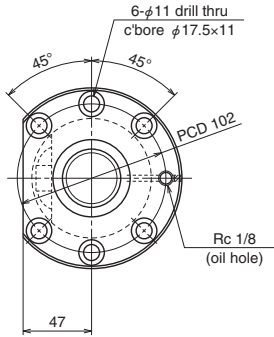
Nut model: DFT

NSK

Screw shaft ø40

Lead 10

Unit: mm



View X-X

Ball screw specifications

Shaft dia. x Lead / Direction of turn	40 × 10 / Right
Preload / Ball recirculation	D-preload / Return tube
Ball dia. / Ball circle dia.	6.35 / 41
Screw shaft root diameter	34.4
Effective turns of balls	2.5 × 2
Accuracy grade / Preload	C5 / Z
Basic load rating (N)	Dynamic C _s 61 200 Static C _{0s} 137 000
Preload (N)	3 630
Dynamic friction torque, median, (N·cm)	108
Spacer ball	None
Factory-packed grease	Refer to Notes 2.
Internal spatial volume of nut (cm ³)	59
Standard volume of grease replenishing (cm ³)	30

Recommended support unit

For drive side, for opposite to drive side (Fixed)

WBK30DFD-31H (round)

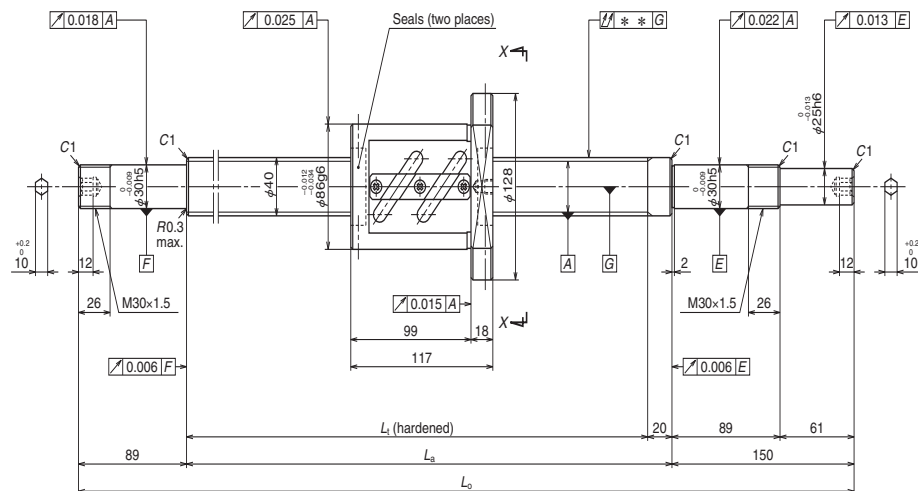
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	Supporting condition		
			Fixed - Simple support	Fixed - Fixed	
W4004SA-2D-C5Z10	250	280	480	500	687
W4005SA-4D-C5Z10	350	380	580	600	787
W4006SA-2D-C5Z10	450	480	680	700	887
W4007SA-4D-C5Z10	550	580	780	800	1 069
W4009SA-4D-C5Z10	750	780	980	1 000	1 269
W4011SA-4D-C5Z10	950	980	1 180	1 200	1 469
W4013SA-2D-C5Z10	1 150	1 180	1 380	1 400	1 669
W4015SA-4D-C5Z10	1 350	1 380	1 580	1 600	1 869
W4017SA-2D-C5Z10	1 550	1 580	1 780	1 800	2 069
W4023SA-2D-C5Z10	2 150	2 180	2 380	2 400	2 669

- Notes:
- We recommend NSK support unit. See page B389 for details.
 - Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
 - Contact NSK if the permissible rotational speed is to be exceeded.

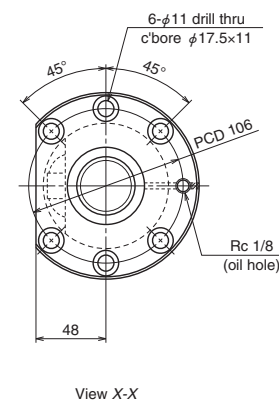
Left side shaft end	Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
	Supporting condition						
	T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
II	-0.012	0.027	0.020	0.040	11.0	1 750	—
II	-0.014	0.030	0.023	0.040	11.9	1 750	—
II	-0.016	0.035	0.025	0.050	12.7	1 750	—
I	-0.019	0.035	0.025	0.065	14.1	1 750	1 750
I	-0.024	0.040	0.027	0.080	15.8	1 750	1 750
I	-0.028	0.046	0.030	0.080	17.5	1 750	1 750
I	-0.033	0.054	0.035	0.100	19.3	1 750	1 750
I	-0.038	0.054	0.035	0.100	21.0	1 750	1 750
I	-0.043	0.065	0.040	0.130	22.7	1 750	1 750
I	-0.057	0.077	0.046	0.170	27.9	980	1 370

(Fine lead)

**NSK**

Lead 12

Unit: mm



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		40 × 12 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		7.144 / 41.5
Screw shaft root diameter		34.1
Effective turns of balls		2.5 × 1
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	39 500
	Static C_{0a}	77 200
Preload (N)		2 550
Dynamic friction torque, median, (N·cm)		83.0
Spacer ball		None
Factory-packed grease		Refer to Notes 2.
Internal spatial volume of nut (cm ³)		33
Standard volume of grease replenishing (cm ³)		17

For drive side, for opposite to drive side
(Fixed)

WBK30DF-31H (round)

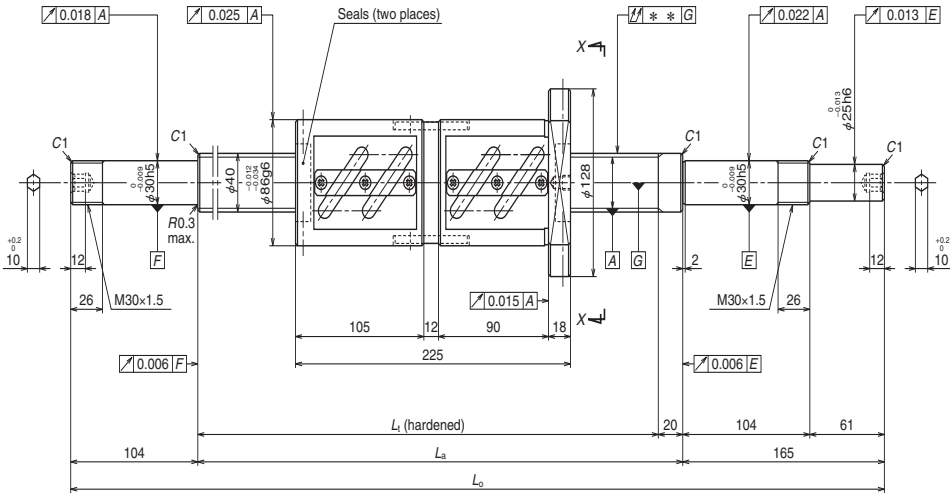
Unit: mm

Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
					Supporting condition	
T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
-0.016	0.035	0.025	0.050	11.6	1 750	1 750
-0.024	0.040	0.027	0.065	14.2	1 750	1 750
-0.033	0.054	0.035	0.100	17.7	1 750	1 750
-0.043	0.065	0.040	0.130	21.2	1 710	1 750
-0.060	0.077	0.046	0.170	27.2	870	1 210

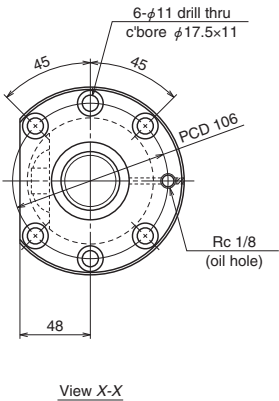
Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W4006SA-3Z-C5Z12	500	556	680	700	939
W4009SA-5Z-C5Z12	800	856	980	1 000	1 239
W4013SA-3Z-C5Z12	1 200	1 256	1 380	1 400	1 639
W4017SA-3Z-C5Z12	1 600	1 656	1 780	1 800	2 039
W4024SA-1Z-C5Z12	2 300	2 356	2 480	2 500	2 739

2. **Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.** See page D13 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

Finished shaft end SA Type
 (Fine lead)



Nut model: DFT



NSK

Screw shaft ø40

Lead 12

Unit: mm

Ball screw specifications		
Shaft dia. x Lead / Direction of turn	40 × 12 / Right	
Preload / Ball recirculation	D-preload / Return tube	
Ball dia. / Ball circle dia.	7.144 / 41.5	
Screw shaft root diameter	34.1	
Effective turns of balls	2.5 × 2	
Accuracy grade / Preload	C5 / Z	
Basic load rating (N)	Dynamic C_d	71 700
	Static C_{0a}	154 000
Preload (N)	4 310	
Dynamic friction torque, median, (N·cm)	137	
Spacer ball	None	
Factory-packed grease	Refer to Notes 2.	
Internal spatial volume of nut (cm ³)	76	
Standard volume of grease replenishing (cm ³)	38	

Recommended support unit

For drive side, for opposite to drive side (Fixed)
WBK30DFD-31H (round)

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W4006SA-4D-C5Z12	400	448	680	700	969
W4009SA-6D-C5Z12	700	748	980	1 000	1 269
W4013SA-4D-C5Z12	1 100	1 148	1 380	1 400	1 669
W4017SA-4D-C5Z12	1 500	1 548	1 780	1 800	2 069
W4024SA-2D-C5Z12	2 200	2 248	2 480	2 500	2 769

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
T	e_p	v_u			Supporting condition	
					Fixed - Simple support	Fixed - Fixed
-0.016	0.035	0.025	0.050	14.8	1 750	1 750
-0.024	0.040	0.027	0.080	17.4	1 750	1 750
-0.033	0.054	0.035	0.100	20.9	1 750	1 750
-0.043	0.065	0.040	0.130	24.3	1 750	1 750
-0.060	0.077	0.046	0.170	30.4	910	1 270

- Notes:
- We recommend NSK support unit. See page B389 for details.
 - Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
 - Contact NSK if the permissible rotational speed is to be exceeded.

(Fine lead)



Unit: mm

WBK35DF-31H (round)

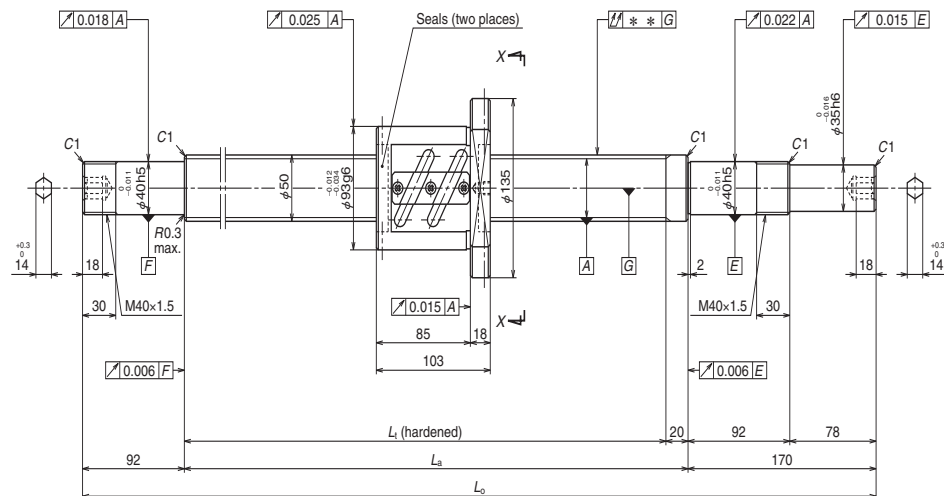
Unit: mm

Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
					Supporting condition	
T	e _p	v _u			Fixed - Simple support	Fixed - Fixed
-0.016	0.035	0.025	0.050	13.4	1 550	1 550
-0.024	0.040	0.027	0.065	16.7	1 550	1 550
-0.033	0.054	0.035	0.100	21.2	1 550	1 550
-0.043	0.065	0.040	0.130	25.6	1 550	1 550
-0.060	0.077	0.046	0.170	33.4	990	1 390

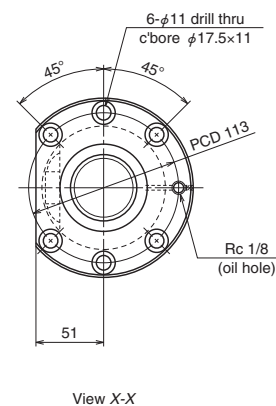
3. Contact NSK if the permissible rotational speed is to be exceeded.

Finished shaft end SA Type

(Fine lead)



Nut model: ZFT



NSK

Screw shaft ø50

Lead 10

Unit: mm

Ball screw specifications

Shaft dia. x Lead / Direction of turn			50 × 10 / Right
Preload / Ball recirculation			Z-preload / Return tube
Ball dia. / Ball circle dia.			6.35 / 51
Screw shaft root diameter			44.4
Effective turns of balls			2.5 × 1
Accuracy grade / Preload			C5 / Z
Basic load rating (N)	Dynamic C_a	37 500	
	Static C_{0a}	87 200	
Preload (N)			2 450
Dynamic friction torque, median, (N·cm)			79.0
Spacer ball			None
Factory-packed grease			Refer to Notes 2.
Internal spatial volume of nut (cm ³)			37
Standard volume of grease replenishing (cm ³)			19

Recommended support unit

For drive side, for opposite to drive side (Fixed)

WBK40DF-31H (round)

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W5005SA-1Z-C5Z10	450	468	580	600	862
W5007SA-1Z-C5Z10	650	668	780	800	1 062
W5009SA-1Z-C5Z10	850	868	980	1 000	1 262
W5011SA-1Z-C5Z10	1 050	1 068	1 180	1 200	1 462
W5014SA-1Z-C5Z10	1 350	1 368	1 480	1 500	1 762
W5019SA-1Z-C5Z10	1 850	1 868	1 980	2 000	2 262
W5025SA-1Z-C5Z10	2 450	2 468	2 580	2 600	2 862

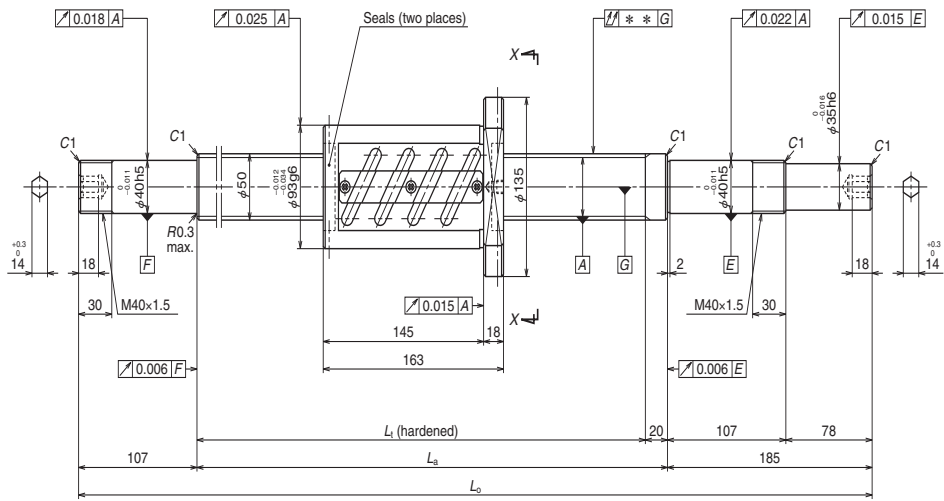
Notes: 1. We recommend NSK support unit. See page B389 for details.

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.

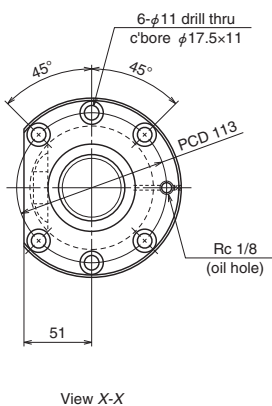
3. Contact NSK if the permissible rotational speed is to be exceeded.

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
T	e_p	v_u			Supporting condition	
					Fixed - Simple support	Fixed - Fixed
-0.014	0.030	0.023	0.050	14.8	1 400	1 400
-0.019	0.035	0.025	0.065	17.6	1 400	1 400
-0.024	0.040	0.027	0.080	20.3	1 400	1 400
-0.028	0.046	0.030	0.080	23.1	1 400	1 400
-0.036	0.054	0.035	0.100	27.3	1 400	1 400
-0.048	0.065	0.040	0.130	34.2	1 400	1 400
-0.062	0.093	0.054	0.170	42.5	1 030	1 400

Finished shaft end SA Type
 (Fine lead)



Nut model: ZFT



NSK

Screw shaft ø50

Lead 10

Unit: mm

Ball screw specifications		
Shaft dia. x Lead / Direction of turn	50 × 10 / Right	
Preload / Ball recirculation	Z-preload / Return tube	
Ball dia. / Ball circle dia.	6.35 / 51	
Screw shaft root diameter	44.4	
Effective turns of balls	2.5 × 2	
Accuracy grade / Preload	C5 / Z	
Basic load rating (N)	Dynamic C _s	68 100
	Static C _{0s}	174 000
Preload (N)	4 020	
Dynamic friction torque, median, (N·cm)	137	
Spacer ball	None	
Factory-packed grease	Refer to Notes 2.	
Internal spatial volume of nut (cm ³)	59	
Standard volume of grease replenishing (cm ³)	30	

Recommended support unit

For drive side, for opposite to drive side (Fixed)
WBK40DFD-31H (round)

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L _t	L _a	L _o
W5005SA-2Z-C5Z10	350	408	580	600	892
W5007SA-2Z-C5Z10	550	608	780	800	1 092
W5009SA-2Z-C5Z10	750	808	980	1 000	1 292
W5011SA-2Z-C5Z10	950	1 008	1 180	1 200	1 492
W5014SA-2Z-C5Z10	1 250	1 308	1 480	1 500	1 792
W5019SA-2Z-C5Z10	1 750	1 808	1 980	2 000	2 292
W5025SA-2Z-C5Z10	2 350	2 408	2 580	2 600	2 892

- Notes:
1. We recommend NSK support unit. See page B389 for details.
 2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
 3. Contact NSK if the permissible rotational speed is to be exceeded.

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
T	e _p	v _u			Supporting condition	
					Fixed - Simple support	Fixed - Fixed
-0.014	0.030	0.023	0.050	16.8	1 400	1 400
-0.019	0.035	0.025	0.065	19.6	1 400	1 400
-0.024	0.040	0.027	0.080	22.3	1 400	1 400
-0.028	0.046	0.030	0.080	25.1	1 400	1 400
-0.036	0.054	0.035	0.100	29.3	1 400	1 400
-0.048	0.065	0.040	0.130	36.2	1 400	1 400
-0.062	0.093	0.054	0.170	44.6	1 060	1 400

B-3-1.4 Finished Shaft End Ball Screws Made of Stainless Steel KA Type

1. Order of the dimension tables

The tables begin with the smallest shaft diameter ball screw, and proceeds to larger sizes. If ball screws have the same shaft diameter, those with smaller leads appear first. Page numbers of shaft diameter and lead combinations are shown in **Table 1**.

2. Dimension tables

The dimension tables show shapes/sizes as well as specification factors of each shaft diameter/lead combination. Tables also contain data as follows:

●Stroke

Nominal stroke : A reference for your use.
Maximum stroke: The stroke limit that the nut can move.

●Lead accuracy

Lead accuracy is C3 and C5 grades.

T : Travel compensation

e_p : Tolerance on specified travel

v_v : Travel variation

See "Technical Description: Lead Accuracy" (page B37) for details of the codes.

●Permissible rotational speed

$d \cdot n$: Limited by the relative peripheral speed between screw shaft and nut.

Critical speed: Limited by the natural frequency of a ball screw shaft. Critical speed depends on the supporting condition of screw shaft.

The lower of the two criteria, the $d \cdot n$ and critical speed, will determine the overall permissible rotational speed of the ball screw. For details, see "Technical Description: Permissible Rotational Speed" (page B47).

3. Material

A martensitic stainless steel is used. A special heat treatment technology provides the ball groove section with sufficient hardness which produces high load carrying capacity and durability.

4. Other

Seal of the ball screw, ball recirculating deflector, and end cap are made of synthetic resin. Consult NSK when using the ball screws under extreme environments or special environments, or using special lubricant or oil.

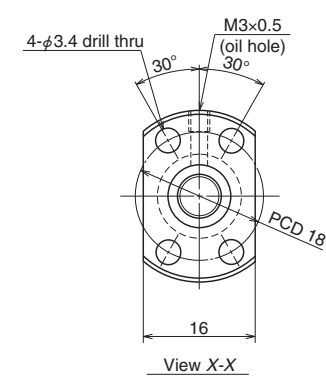
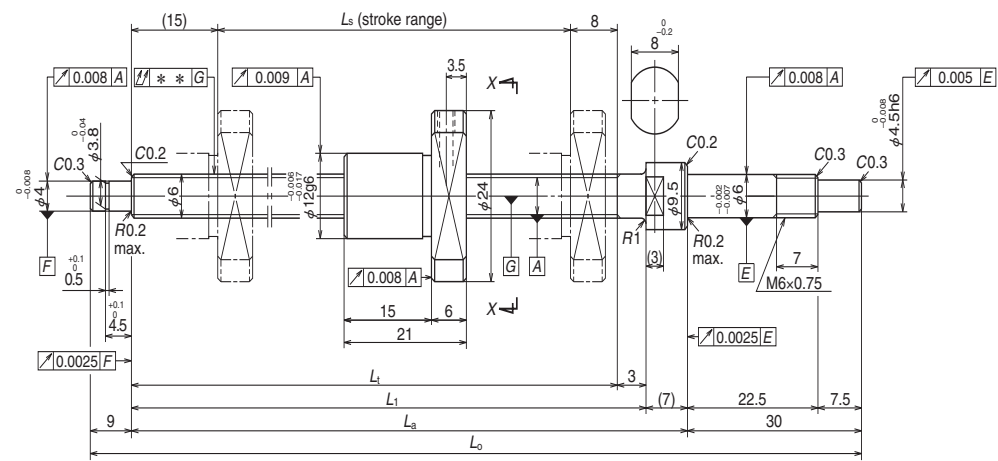
For special environments, see pages B70 and D2. See pages B67 and D13 for lubricants.

Note: For details of standard stock products, contact NSK.

Table 1 Combinations of screw shaft diameter and lead

Lead (mm) \ Screw shaft diameter (mm)	1	2
6	B275	
8	B277	B279
10		B281
12		B285
15		
16		B295
20		

4	5	10	20
B283			
	B287	B289	
		B291	B293
			B297



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		6 × 1 / Right
Preload / Ball recirculation		P-preload / Deflector (bridge)
Ball dia. / Ball circle dia.		0.800 / 6.2
Screw shaft root diameter		5.2
Effective turns of balls		1 × 3
Accuracy grade / Preload		C3 / Z
Basic load rating (N)	Dynamic C _s	555
	Static C _{0s}	680
Axial play		0
Preload (N)		24.5
Dynamic friction torque, (N·cm)		1.3 or less
Spacer ball		None
Factory-packed grease		Refer to Notes 1.

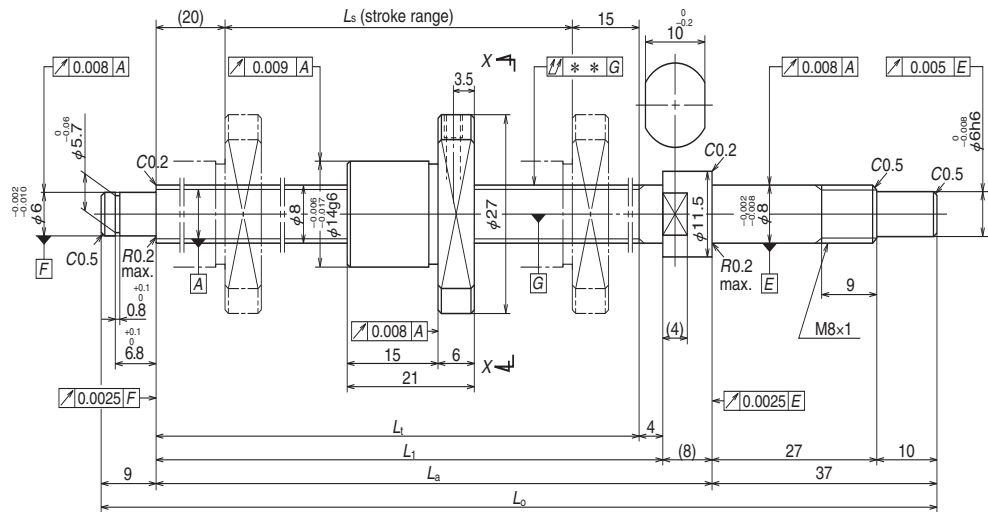
Ball screw No.	Stroke L _s		Thread length			
	Nominal	Maximum				
			L ₁	L ₁	L _a	L _o
W0601KA-3PY-C3Z1	100	102	125	128	135	174

Notes: 1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Ball nut does not have seal.
3. Contact NSK if the permissible rotational speed is to be exceeded.

Unit: mm

Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
					Supporting condition
T	e _p	v _u			Fixed - Simple support
0	0.010	0.008	0.025	0.06	3 000

Finished shaft end stainless steel product KA Type
 (Fine lead)



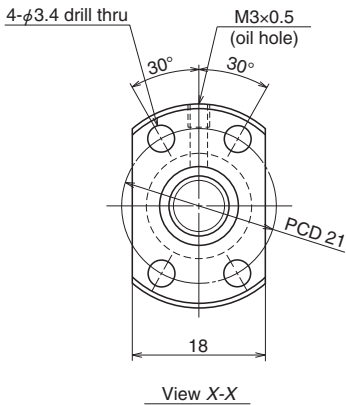
Nut model: MPFD

NSK

Screw shaft ø8

Lead 1

Unit: mm



Ball screw specifications		
Shaft dia. x Lead / Direction of turn	8 × 1 / Right	
Preload / Ball recirculation	P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.	0.800 / 8.2	
Screw shaft root diameter	7.2	
Effective turns of balls	1 × 3	
Accuracy grade / Preload	C3 / Z	
Basic load rating (N)	Dynamic C _s	645
	Static C _{0s}	955
Axial play		0
Preload (N)		29.4
Dynamic friction torque, (N·cm)		1.8 or less
Spacer ball		None
Factory-packed grease		Refer to Notes 1.

Recommended support unit

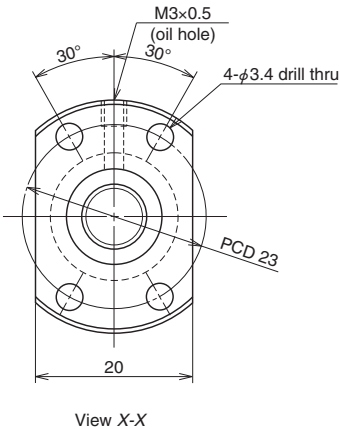
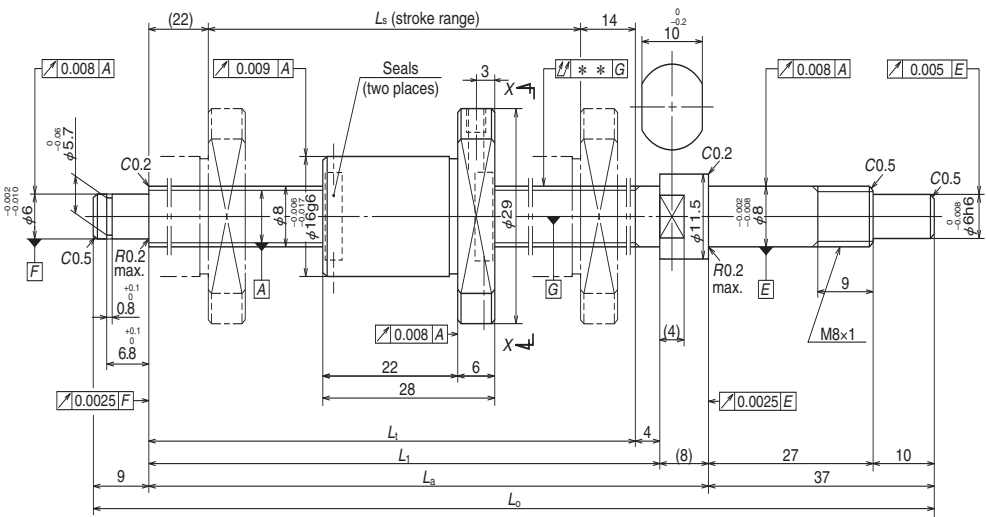
For drive side (Fixed)	For opposite to drive side (Free)
WBK08-01C (square, clean)	WBK08S-01C (square, clean)
WBK08-11C (round, clean)	

Unit: mm

Ball screw No.	Stroke L _s		Thread length			
	Nominal	Maximum	L _t	L ₁	L _a	L _o
W0802KA-1PY-C3Z1	150	155	190	194	202	248

- Notes:
1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
 2. Ball nut does not have seal.
 3. Contact NSK if the permissible rotational speed is to be exceeded.

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
T	e _p	v _u			Supporting condition
0	0.010	0.008	0.035	0.12	Fixed - Simple support
					3 000



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		8 × 2 / Right
Preload / Ball recirculation		P-preload / Deflector (bridge)
Ball dia. / Ball circle dia.		1.200 / 8.3
Screw shaft root diameter		6.9
Effective turns of balls		1 × 3
Accuracy grade / Preload		C3 / Z
Basic load rating (N)	Dynamic C _s	1 270
	Static C _{0s}	1 630
Axial play		0
Preload (N)		49.0
Dynamic friction torque, (N·cm)		2.0 or less
Spacer ball		None
Factory-packed grease		Refer to Notes 1.
Internal spatial volume of nut (cm ³)		0.34
Standard volume of grease replenishing (cm ³)		0.17

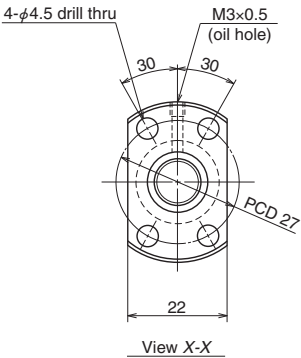
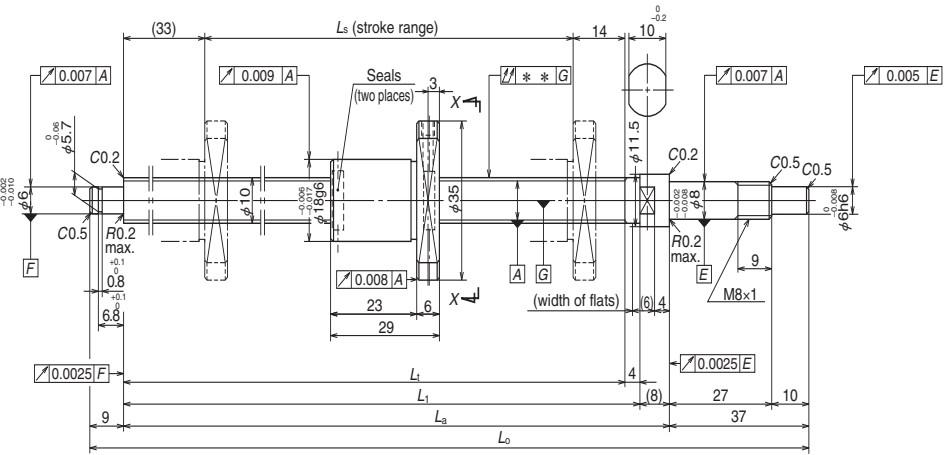
Recommended support unit

For drive side (Fixed)	For opposite to drive side (Free)
WBK08-01C (square, clean)	WBK08S-01C (square, clean)
WBK08-11C (round, clean)	

Ball screw No.	Stroke L _s		Thread length			
	Nominal	Maximum	L _t	L ₁	L _a	L _o
W0802KA-5PY-C3Z2	150	154	190	194	202	248

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
T	e _p	v _u			Supporting condition
0	0.010	0.008	0.035	0.13	Fixed - Simple support
					3 000

Notes: 1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		10 × 2 / Right
Preload / Ball recirculation		P-preload / Deflector (bridge)
Ball dia. / Ball circle dia.		1.200 / 10.3
Screw shaft root diameter		8.9
Effective turns of balls		1 × 3
Accuracy grade / Preload		C3 / Z
Basic load rating (N)	Dynamic C _s	1 470
	Static C _{0s}	2 190
Axial play		0
Preload (N)		58.8
Dynamic friction torque, (N·cm)		0.10 – 2.5
Spacer ball		None
Factory-packed grease		Refer to Notes 1.
Internal spatial volume of nut (cm ³)		0.44
Standard volume of grease replenishing (cm ³)		0.22

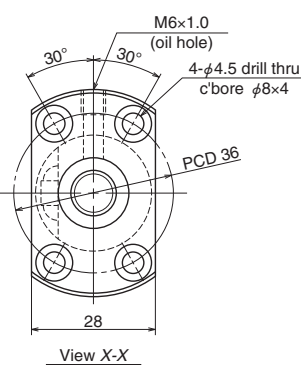
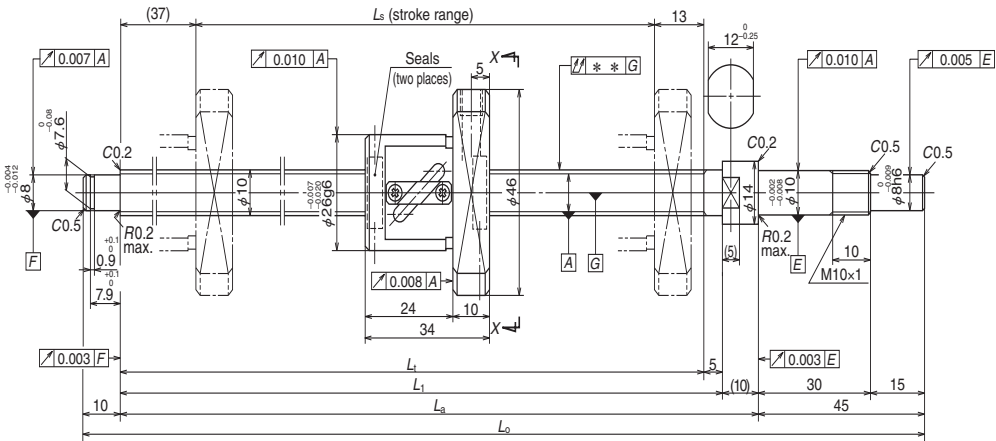
Recommended support unit

For drive side (Fixed)	For opposite to drive side (Free)
WBK08-01C (square, clean)	WBK08S-01C (square, clean)
WBK08-11C (round, clean)	

Ball screw No.	Stroke L _s		Thread length			
	Nominal	Maximum	L _t	L ₁	L _a	L _o
W1002KA-3PY-C3Z2	200	203	250	254	262	308

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
T	e _p	v _u			Supporting condition
0	0.012	0.008	0.030	0.22	Fixed - Simple support
3 000					

Notes: 1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		10 x 4 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		2.000 / 10.3
Screw shaft root diameter		8.2
Effective turns of balls		2.5 x 1
Accuracy grade / Preload		C3 / Z
Basic load rating (N)	Dynamic C _s	2 630
	Static C _{0s}	3 270
Axial play		0
Preload (N)		98.1
Dynamic friction torque, (N·cm)		0.5 – 3.9
Spacer ball		None
Factory-packed grease		Refer to Notes 1.
Internal spatial volume of nut (cm ³)		0.8
Standard volume of grease replenishing (cm ³)		0.4

Recommended support unit

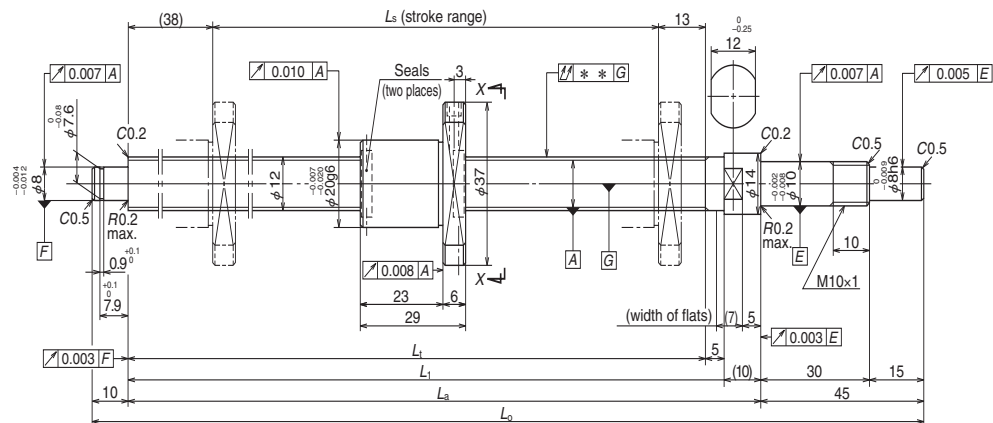
For drive side (Fixed)	For opposite to drive side (Free)
WBK10-01C (square, clean)	WBK10S-01C (square, clean)
WBK10-11C (round, clean)	

Ball screw No.	Stroke L _s		Thread length			
	Nominal	Maximum	L ₁	L ₂	L ₃	L ₄
W1001KA-3P-C3Z4	100	110	160	165	175	230
W1003KA-3P-C3Z4	300	310	360	365	375	430

Notes: 1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
T	e _p	v _u			Supporting condition
0	0.010	0.008	0.030	0.29	3 000
0	0.013	0.008	0.050	0.39	3 000

(Fine lead)



Ball screw No.	Stroke L_s		Thread length			
	Nominal	Maximum	L_t	L_1	L_a	L_o
W1201KA-3PY-C3Z2	100	109	160	165	175	230
W1203KA-1PY-C3Z2	250	259	310	315	325	380

Notes: **1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.**
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.

2. Contact NSK if the permissible rotational speed is to be exceeded.

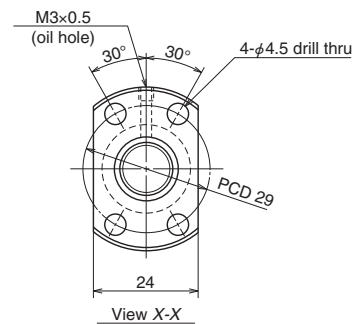
Nut model: MPFD

NSK

Screw shaft ø12

Lead 2

Unit: mm



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		12 x 2 / Right
Preload / Ball recirculation		P-preload / Deflector (bridge)
Ball dia. / Ball circle dia.		1.200 / 12.3
Screw shaft root diameter		10.9
Effective turns of balls		1 x 3
Accuracy grade / Preload		C3 / Z
Basic load rating (N)	Dynamic C _a	1 600
	Static C _{0a}	2 670
Axial play		0
Preload (N)		98.1
Dynamic friction torque, (N·cm)		0.4 – 3.4
Spacer ball		None
Factory-packed grease		Refer to Notes 1.
Internal spatial volume of nut (cm ³)		0.53
Standard volume of grease replenishing (cm ³)		0.27

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Free)
WBK10-01C (square, clean)	WBK10S-01C (square, clean)
WBK10-11C (round, clean)	

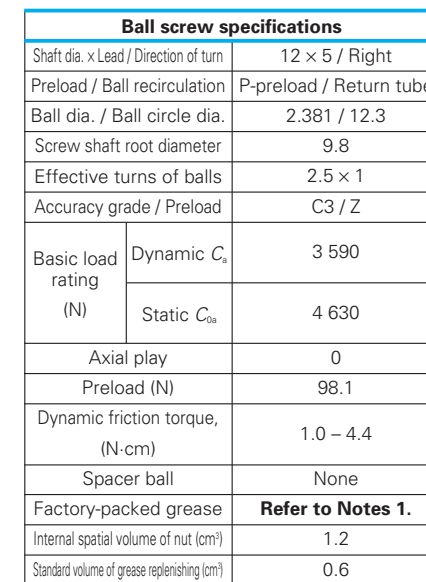
Unit: mm

Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
					Supporting condition
T	e_p	v_u			Fixed - Simple support
0	0.010	0.008	0.030	0.24	3 000
0	0.012	0.008	0.040	0.36	3 000

(Fine lead)



Unit: mm



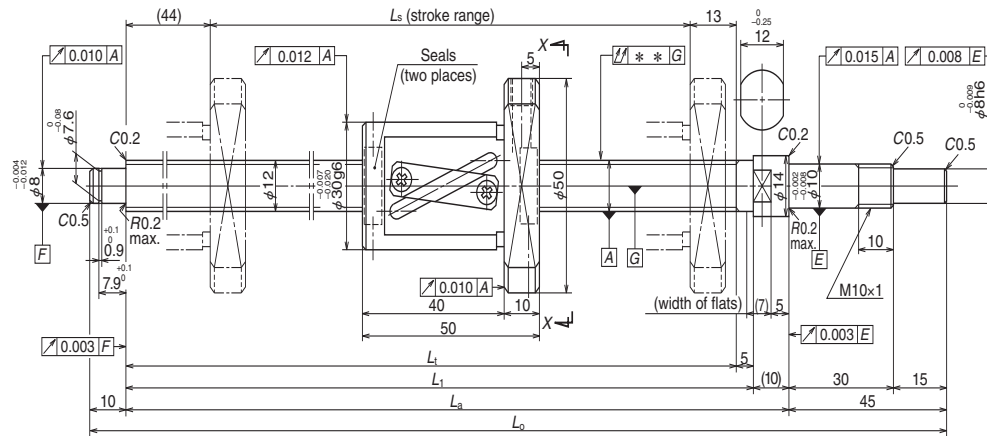
For drive side (Fixed)	For opposite to drive side (Free)
WBK10-01C (square, clean)	WBK10S-01C (square, clean)
WBK10-11C (round, clean)	

Unit: mm

Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
T	e _p	v _u			Supporting condition
					Fixed - Simple support
0	0.012	0.008	0.040	0.47	3 000
0	0.016	0.012	0.065	0.66	3 000

B287

(Medium lead)



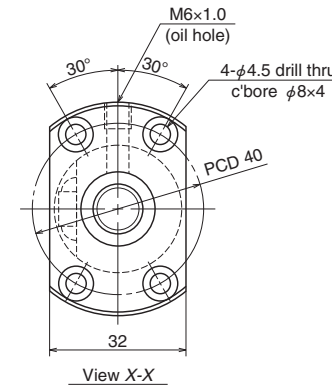
Nut model: LPFT

NSK

Screw shaft ø12

Lead 10

Unit: mm



Ball screw specifications	
Shaft dia. x Lead / Direction of turn	12 × 10 / Right
Preload / Ball recirculation	P-preload / Return tube
Ball dia. / Ball circle dia.	2.381 / 12.5
Screw shaft root diameter	10.0
Effective turns of balls	2.5 × 1
Accuracy grade / Preload	C5 / Z
Basic load rating (N)	Dynamic C_a
	Static C_{0a}
Axial play	0
Preload (N)	98.1
Dynamic friction torque, (N·cm)	1.0 – 4.9
Spacer ball	None
Factory-packed grease	Refer to Notes 1.
Internal spatial volume of nut (cm ³)	1.4
Standard volume of grease replenishing (cm ³)	0.7

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Free)
WBK10-01C (square, clean)	WBK10S-01C (square, clean)
WBK10-11C (round, clean)	

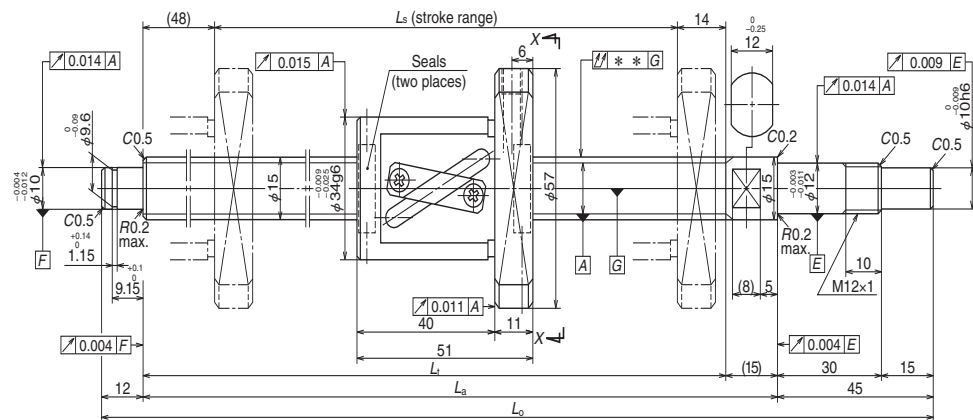
Unit: mm

Ball screw No.	Stroke L_s		Thread length			
	Nominal	Maximum				
			L_t	L_1	L_a	L_o
W1203KA-3P-C5Z10	250	253	310	315	325	380
W1205KA-3P-C5Z10	450	453	510	515	525	580

- Notes: **1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.**
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
- 2. Contact NSK if the permissible rotational speed is to be exceeded.**

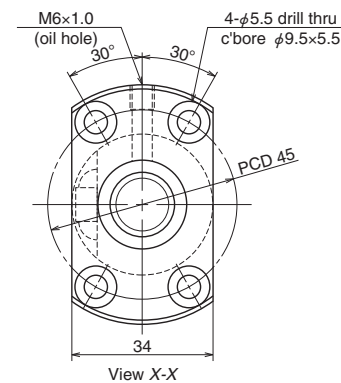
Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
					Supporting condition
					Fixed - Simple support
<i>T</i>	<i>e_p</i>	<i>v_u</i>			
0	0.023	0.018	0.050	0.56	3 000
0	0.030	0.023	0.075	0.72	3 000

(Medium lead)

**NSK**

Lead 10

Unit: mm



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		15 × 10 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		3.175 / 15.5
Screw shaft root diameter		12.2
Effective turns of balls		2.5 × 1
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C _r	6 660
	Static C _{0a}	9 480
Axial play		0
Preload (N)		147
Dynamic friction torque, (N·cm)		1.5 – 7.9
Spacer ball		None
Factory-packed grease		Refer to Notes 1.
Internal spatial volume of nut (cm³)		2.3
Standard volume of grease replenishing (cm³)		1.4

HA

For drive side (Fixed)	For opposite to drive side (Free)
WBK12-01C (square, clean)	WBK12S-01C (square, clean)
WBK12-11C (round, clean)	

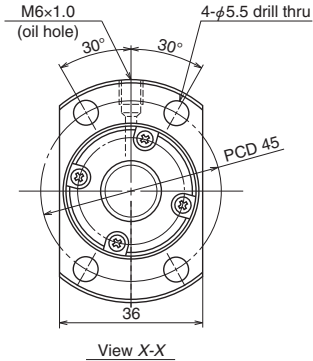
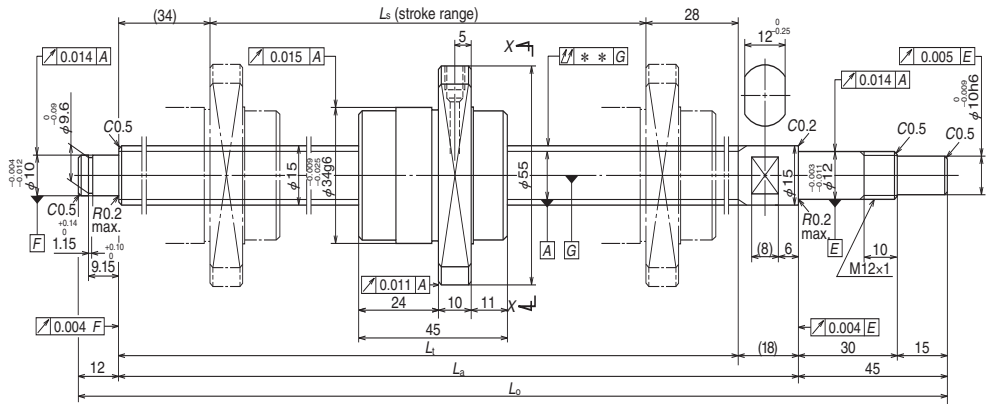
Unit: mm

Ball screw No.	Stroke L_s		Thread length		
	Nominal	Maximum	L_t	L_a	L_o
W1504KA-3P-C5Z10	400	427	489	504	561
W1506KA-3P-C5Z10	600	627	689	704	761
W1510KA-1P-C5Z10	1 000	1 027	1 089	1 104	1 161

Notes: **1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.**
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.

2. Contact NSK if the permissible rotational speed is to be exceeded.

Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
					Supporting condition
T	e _p	v _u			Fixed - Simple support
0	0.027	0.020	0.050	0.99	3 000
0	0.035	0.025	0.065	1.2	3 000
0	0.046	0.030	0.110	1.7	1 610



Ball screw specifications

Shaft dia. x Lead / Direction of turn		15 × 20 / Right
Preload / Ball recirculation		P-preload / End cap
Ball dia. / Ball circle dia.		3.175 / 15.5
Screw shaft root diameter		12.2
Effective turns of balls		1.7 × 1
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C _s	4 630
	Static C _{0a}	6 430
Axial play		0
Preload (N)		147
Dynamic friction torque, (N·cm)		1.5 – 7.9
Spacer ball		None
Factory-packed grease		Refer to Notes 1.
Internal spatial volume of nut (cm³)		1.9
Standard volume of grease replenishing (cm³)		1.0

Recommended support unit

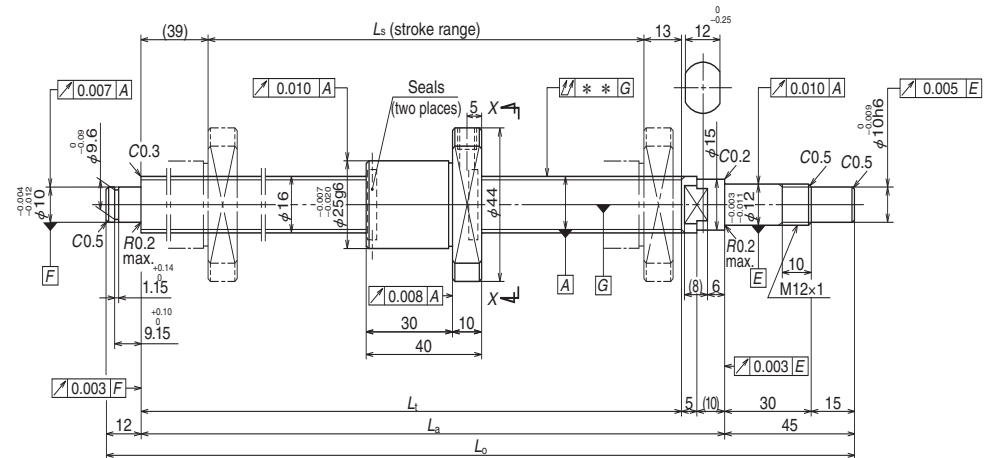
For drive side (Fixed)	For opposite to drive side (Free)
WBK12-01C (square, clean)	WBK12S-01C (square, clean)
WBK12-11C (round, clean)	

Unit: mm

Ball screw No.	Stroke L _s		Thread length		
	Nominal	Maximum			
			L ₁	L _a	L ₀
W1504KA-7PG-C5Z20	400	424	486	504	561
W1506KA-7PG-C5Z20	600	624	686	704	761
W1510KA-3PG-C5Z20	1 000	1 024	1 086	1 104	1 161

Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
					Supporting condition
<i>T</i>	<i>e</i> _p	<i>v</i> _u			Fixed - Simple support
0	0.027	0.020	0.050	1.0	3 000
0	0.035	0.025	0.065	1.3	3 000
0	0.046	0.030	0.110	1.8	1 610

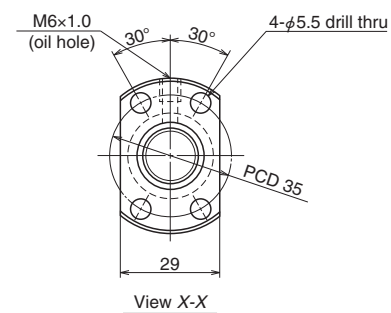
Notes: 1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.



Ball screw No.	Stroke L_s		Thread length		
	Nominal	Maximum			
			L_t	L_a	L_o
W1601KA-3PY-C3Z2	100	137	189	204	261
W1603KA-1PY-C3Z2	300	337	389	404	461

Notes: **1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.**
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.

2. Contact NSK if the permissible rotational speed is to be exceeded.



Shaft dia. x Lead / Direction of turn		16 × 2 / Right
Preload / Ball recirculation		P-preload / Deflector (bridge)
Ball dia. / Ball circle dia.		1.588 / 16.4
Screw shaft root diameter		14.6
Effective turns of balls		1 × 4
Accuracy grade / Preload		C3 / Z
Basic load rating (N)	Dynamic C _a	3 400
	Static C _{0a}	6 240
Axial play		0
Preload (N)		147
Dynamic friction torque, (N·cm)		0.5 – 4.9
Spacer ball		None
Factory-packed grease		Refer to Notes 1.
Internal spatial volume of nut (cm³)		1.6
Standard volume of grease replenishing (cm³)		0.8

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Free)
WBK12-01C (square, clean)	WBK12S-01C (square, clean)
WBK12-11C (round, clean)	

Unit: mm

Lead accuracy			Shaft run-out ** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
					Supporting condition
<i>T</i>	<i>e_p</i>	<i>v_u</i>			Fixed - Simple support
0	0.010	0.008	0.020	0.46	3 000
0	0.013	0.010	0.035	0.75	3 000

Finished shaft end stainless steel product KA Type
 (High helix lead)

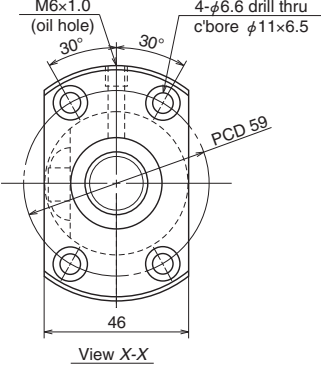
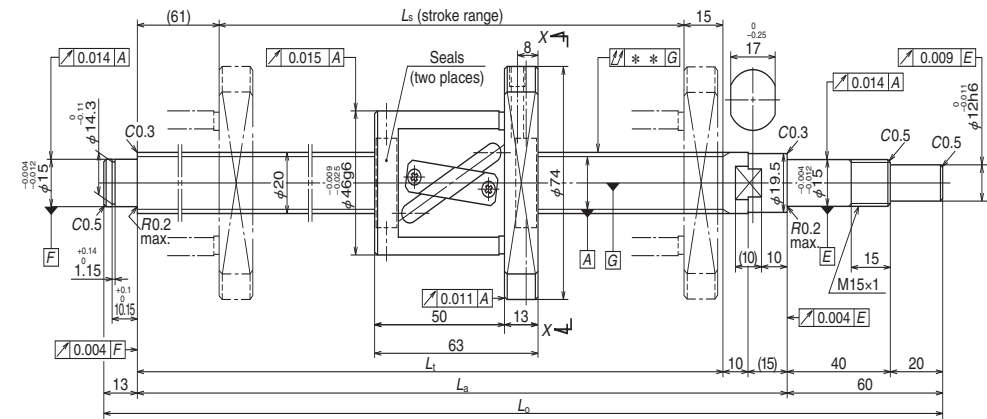
Nut model: LPFT

NSK

Screw shaft ø20

Lead 20

Unit: mm



Ball screw specifications		
Shaft dia. x Lead / Direction of turn	20 x 20 / Right	
Preload / Ball recirculation	P-preload / Return tube	
Ball dia. / Ball circle dia.	3.969 / 21	
Screw shaft root diameter	16.9	
Effective turns of balls	1.5 x 1	
Accuracy grade / Preload	C5 / Z	
Basic load rating (N)	Dynamic C _s	6 700
	Static C _{0s}	9 710
Axial play		0
Preload (N)		196
Dynamic friction torque, (N·cm)		2.0 – 11.8
Spacer ball		None
Factory-packed grease		Refer to Notes 1.
Internal spatial volume of nut (cm ³)		4.2
Standard volume of grease replenishing (cm ³)		2.1

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Free)
WBK15-01C (square, clean)	WBK15S-01C (square, clean)
WBK15-11C (round, clean)	

Unit: mm

Ball screw No.	Stroke L _s		Thread length		
	Nominal	Maximum	L _t	L _a	L _o
W2005KA-3P-C5Z20	400	434	510	535	608
W2007KA-3P-C5Z20	600	634	710	735	808
W2011KA-3P-C5Z20	1 000	1 034	1 110	1 135	1 208

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min ⁻¹)
T	e _p	v _u			Supporting condition
0	0.030	0.023	0.050	2.0	Fixed - Simple support
0	0.035	0.025	0.085	2.5	3 000
0	0.046	0.030	0.110	3.4	2 160

Notes:

1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details. Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.

B-3-1.5 Blank Shaft End MS Type, FS Type, SS Type

1. Order of the dimension tables

The dimension table begins with the smallest shaft diameter of each MS, FS and SS type ball screws, and proceed to larger sizes. If ball screws have the same shaft diameter, those with smaller leads appear first. Page numbers of shaft diameter and lead combinations are shown in the Table 1.

2. Dimension tables

The dimension tables show shapes/sizes as well as specification factors of each shaft diameter/lead combination. Tables also contain data as follows:

● Lead accuracy

Lead accuracy is either C3 or C5 grades.

T : Travel compensation

e_p : Tolerance of specified travel

v_u : Travel variation

See "Technical Description: Lead Accuracy" (page B37) for details of the codes.

● Permissible rotational speed

$d \cdot n$: Limited by the relative peripheral speed between the screw shaft and the nut.

Critical speed : Limited by the natural frequency of a ball screw shaft. Critical speed depends on the supporting condition of screw shaft.

Criterion of maximum rotational speed

: 3 000 min⁻¹

The lower of the two criteria, $d \cdot n$ and critical speed, will determine the overall permissible rotational speed of the ball screw. For details, see "Technical Description: Permissible Rotational Speed" (page B47).

3. Shaft end processing

MS, FS, and SS types require shaft end processing to your specification. The exclusive support units (page B389) are available to design the bearing seats. See "Configuration of shaft end" (page B27 and following pages) when

using a support unit. See "Technical Description: Shaft End Processing" (page B86) for procedures of shaft end processing and precautions.

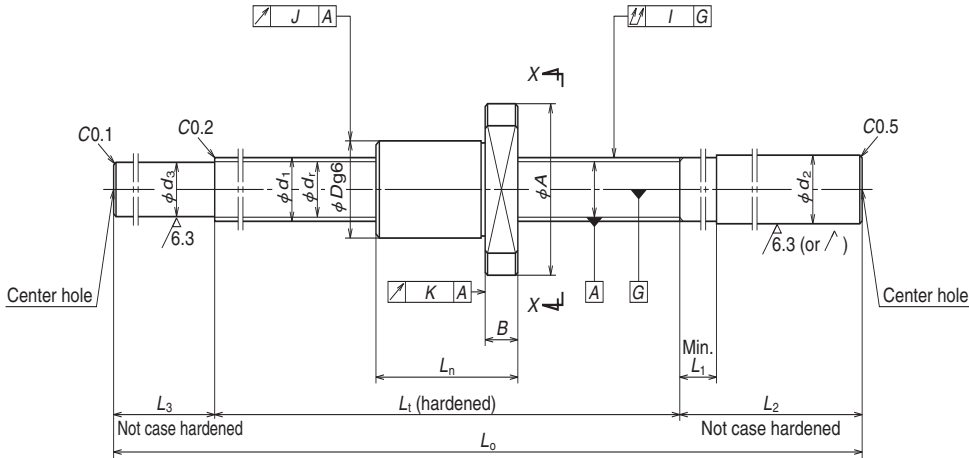
4. Other

The seals of the ball screw, ball recirculating deflectors and end caps are made of synthetic resin. Consult NSK when using the ball screws under extreme environments or special environments, or using special lubricant or oil. For special environments, see pages B70 and D2. See pages B67 and D13 for lubricants. Note: For details of standard stock products, contact NSK.

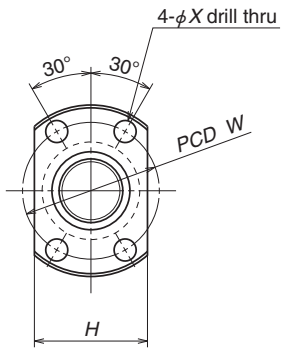
Table 1 Combinations of screw shaft diameter and lead

Lead(mm) Screw shaft diameter(mm)	1	1.5	2	2.5	4	5	6
4	B301						
6	B301						
8	B301	B303	B303				
10			B303	B305	B309		
12			B305	B305		B309	
14						B311	
15							
16			B307	B307		B315	
20					B321	B321	
25					B323	B323 B325	B323
28						B327 B329	B327 B329
32						B331 B333 B335	B331 B333
36							
40						B337	
45							
50							

8	10	12	16	20	25	32	40	50
	B309							
B311								
	B311			B313				
			B315			B313		
	B315			B315			B313	
	B325 B327			B317	B317			B317
B333	B335 B337 B339				B319	B319		
	B337 B339							
B341	B341 B343 B345	B341 B343						
	B347							
	B345 B347							



Nut type code: MSFD

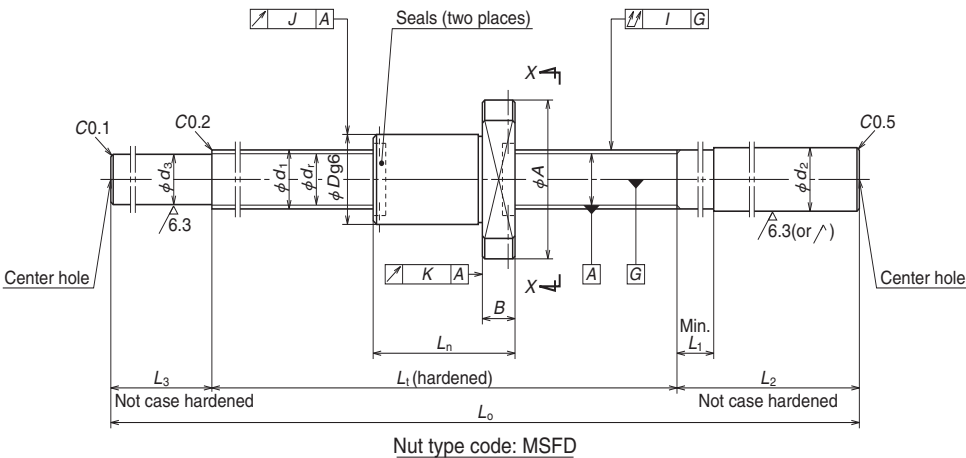


View X-X

Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N)		Axial play Max.	Nut			
								Dynamic C_a	Static C_{0a}		Outside dia.		Flange	
											D	A	H	B
W0400MS-1Y-C3T1	68	4	1	0.8	4.2	3.2	2	370	370	0.005	10	20	14	3
W0601MS-1Y-C3T1	110	6	1	0.8	6.2	5.2	3	680	920	0.005	12	24	16	3.5
W0801MS-1Y-C3T1	94	8	1	0.8	8.2	7.2	3	790	1 290	0.005	14	27	18	4
W0802MS-1Y-C3T1	174													

Blank shaft end MS type

(Fine lead: Deflector (bridge) type)



Nut model: MSFD

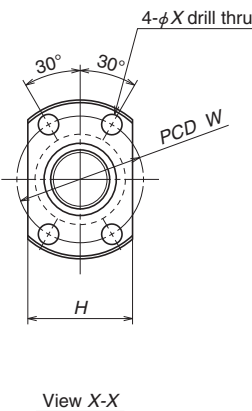
NSK

Screw shaft ø8

Lead 1.5, 2

Screw shaft ø10

Lead 2

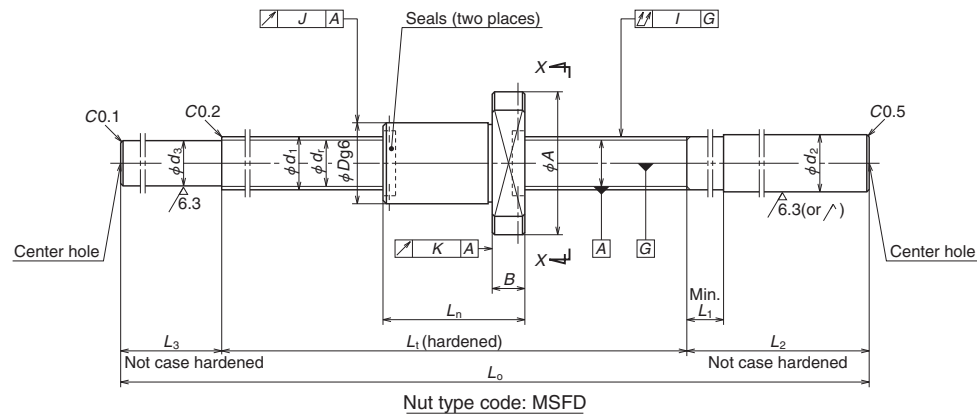


Ball screw No.	Stroke Max. L_t - L_n	Screw shaft dia. d_1	Lead l	Ball dia. d_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N)		Axial play Max.	Nut			
								Dynamic C_a	Static C_{0a}		Outside dia.		Flange	
											D	A	H	B
W0801MS-2Y-C3T1.5	88	8	1.5	1.0	8.3	7.0	3	1 270	1 970	0.005	15	28	19	4
W0802MS-2Y-C3T1.5	168													
W0801MS-3Y-C3T2	84	8	2	1.2	8.3	6.9	3	1 560	2 200	0.005	16	29	20	4
W0802MS-3Y-C3T2	164													
W1001MS-1Y-C3T2	122	10	2	1.2	10.3	8.9	3	1 800	2 970	0.005	18	35	22	5
W1002MS-1Y-C3T2	222													

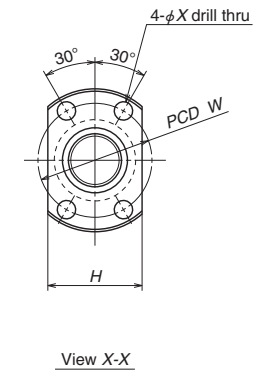
dimensions			Screw shaft dimensions						Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	
Overall length	Bolt hole		Threaded length <i>L</i> _t	Shaft end, right			Shaft end, left		Overall length <i>L</i> _o	<i>T</i>	Deviation <i>e</i> _p	Variation <i>v</i> _u	Shaft straightness <i>I</i>	Radial run-out			
<i>L</i> _n	<i>W</i>	<i>X</i>		<i>d</i> ₂	<i>L</i> ₁	<i>L</i> ₂	<i>d</i> ₃	<i>L</i> ₃						<i>J</i>			<i>K</i>
22	22	3.4	110190	10.2	4	60	7.2	25	195275	0	0.010	0.008	0.0300.050	0.009	0.008	0.120.15	3 000
26	23	3.4	110190	10.2	4	60	7.0	25	195275	0	0.010	0.008	0.0300.050	0.009	0.008	0.120.15	3 000
28	27	4.5	150250	12.2	4	70	9.0	30	250350	0	0.0100.012	0.008	0.0350.050	0.009	0.008	0.220.17	3 000

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

(Fine lead: Deflector (bridge) type)

**NSK**

Lead 2, 2.5



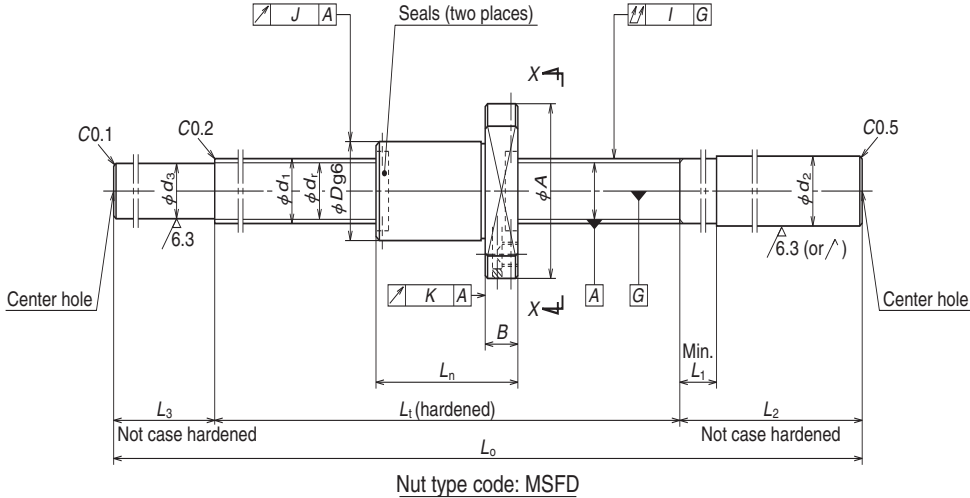
Ball screw No.	Stroke Max. L_{t-L_n}	Screw shaft dia. d_t	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N)		Axial play Max.	Nut			
								Dynamic C_a	Static C_{0a}		Flange			
											Outside dia. D	A	H	B
W1001MS-2Y-C3T2.5	118	10	2.5	1.588	10.4	8.6	3	2 500	3 630	0.005	19	36	23	5
W1002MS-2Y-C3T2.5	218													
W1202MS-1Y-C3T2	182	12	2	1.200	12.3	10.9	3	1 960	3 620	0.005	20	37	24	5
W1203MS-1Y-C3T2	282													
W1202MS-2Y-C3T2.5	178	12	2.5	1.588	12.4	10.6	3	2 790	4 530	0.005	21	38	25	5
W1203MS-2Y-C3T2.5	278													

3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

dimensions			Screw shaft dimensions						Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	
Overall length	Bolt hole		Threaded length <i>L</i> ₁	Shaft end, right			Shaft end, left		Overall length <i>L</i> ₀	<i>T</i>	Deviation <i>e</i> _p	Variation <i>v</i> _u	Shaft straightness <i>I</i>	Radial run-out			
<i>L</i> ₁	<i>W</i>	<i>X</i>		<i>d</i> ₂	<i>L</i> ₁	<i>L</i> ₂	<i>d</i> ₃	<i>L</i> ₃						<i>J</i>			<i>K</i>
32	28	4.5	150 250	12.2	4	70	8.7	30	250 350	0	0.010 0.012	0.008	0.035 0.050	0.010	0.008	0.23 0.28	3 000
28	29	4.5	210 310	14.2	5	80	11.0	35	325 425	0	0.012	0.008	0.050 0.060	0.010	0.008	0.36 0.44	3 000
32	30	4.5	210 310	14.2	5	80	10.7	35	325 425	0	0.012	0.008	0.050 0.060	0.010	0.008	0.37 0.45	3 000

Blank shaft end MS type

(Fine lead: Deflector (bridge) type)

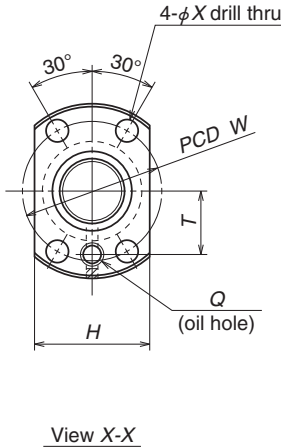


Nut model: MSFD

NSK

Screw shaft ø16

Lead 2, 2.5

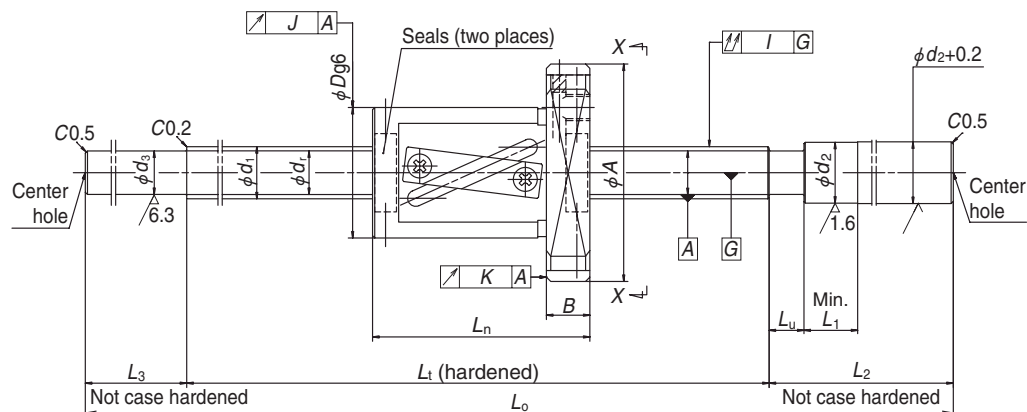


Ball screw No.	Stroke Max. L_t - L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N)		Axial play Max.	Nut							
								Dynamic C_a	Static C_{0a}		Outside dia				Overall length		Bolt hole	
											D	A	H	B	L_n	W	X	
W1602MS-1Y-C3T2	210	16	2	1.588	16.4	14.6	4	4 150	8 450	0.005	25	44	29	10	40	35	5.5	
W1604MS-1Y-C3T2	360																	
W1602MS-2Y-C3T2.5	206	16	2.5	1.588	16.4	14.6	4	4 150	8 440	0.005	25	44	29	10	44	35	5.5	
W1604MS-2Y-C3T2.5	356																	

dimensions		Screw shaft dimensions						Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)	
Oil hole		Threaded length <i>L_t</i>	Shaft end, right			Shaft end, left		Overall length <i>L_o</i>	<i>T</i>	Deviation <i>e_p</i>	Variation <i>v_u</i>	Shaft straightness <i>I</i>	Radial run-out					
<i>Q</i>	<i>T</i>		<i>d₂</i>	<i>L₁</i>	<i>L₂</i>	<i>d₃</i>	<i>L₃</i>						<i>J</i>					<i>K</i>
M6×1	16	250	16.2	30	100	14.7	40	390	0	0.012	0.008	0.035	0.010	0.008	0.71 0.93	3 000	1.5	0.8
		400																
M6×1	16	250	16.2	30	100	14.7	40	390	0	0.012	0.008	0.035	0.010	0.008	0.73 0.95	3 000	1.5	0.8
		400																

- Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

(Fine, Medium lead: Tube type)



Nut type code: SFT, LSFT

Nut models: SFT, LSFT

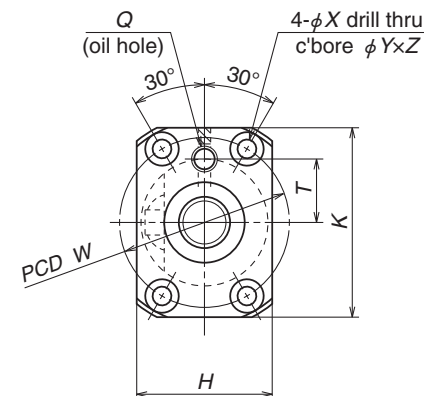
NSK

Screw shaft ø10

Lead 4

Screw shaft ø12

Lead 5, 10



View X-X

Ball screw No.	Stroke Max. L_1-L_n	Screw shaft dia. d_1	Lead l	Ball dia. d_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns x Circuits	Basic load rating (N)		Axial play Max.	Nut											
								Dynamic C_a	Static C_{0a}		Outside dia.	Flange				Overall length L_n	Bolt hole					
							D					A	H	K	B		W	X	Y	Z		
W1001FS-1-C3T4	126	10	4	2.000	10.3	8.2	2.5×1	3 210	4 420	0.005	26	46	28	42	10	34	36	4.5	8	4.5		
W1002FS-1-C3T4	226																					
W1003FS-1-C3T4	326																					
W1201FS-1-C3T5	110	12	5	2.381	12.3	9.8	2.5×1	4 390	6 260	0.005	30	50	32	45	10	40	40	4.5	8	4.5		
W1202FS-1-C3T5	210																					
W1204FS-1-C3T5	410																					
W1202FS-2-C5T10	200	12	10	2.381	12.5	10.0	2.5×1	4 430	6 430	0.005	30	50	32	45	10	50	40	4.5	8	4.5		
W1204FS-2-C5T10	400																					

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.

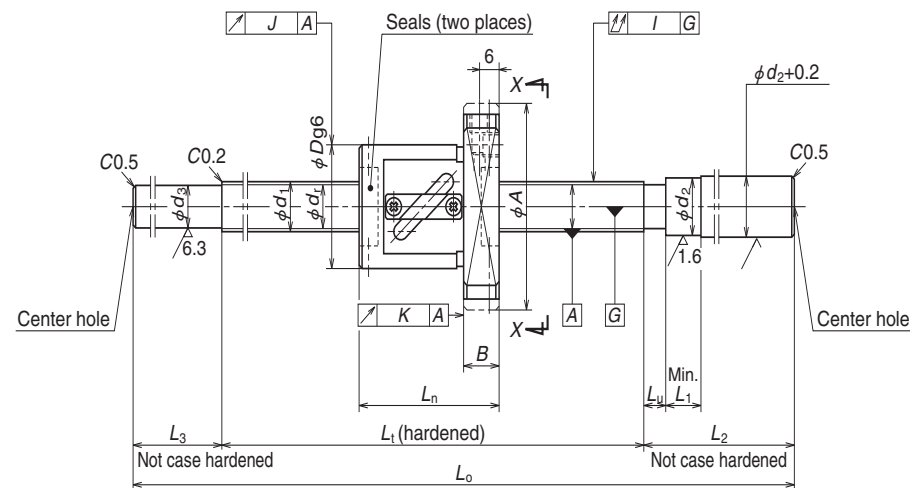
See page D13 for details.

3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Unit: mm																				
dimensions		Screw shaft dimensions								Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)	
Oil hole		Thread length	Shaft end, right				Shaft end, left		Overall length	T	Deviation e _p	Variation u _v	Shaft straightness I	Radial run-out						
Q	T		L ₁	d ₂	L _u	L ₁	L ₂	d ₃						L ₃	L _o					J
M6×1	14	160	14	5	40	70	8.2	35	265	0	0.010	0.008	0.030		0.010	0.008	0.34	3 000	0.86	0.43
		260							365		0.012	0.008	0.040				0.39			
		360							465		0.013	0.010	0.050				0.45			
M6×1	15	150	14	5	40	70	9.8	35	255	0	0.010	0.008	0.030	0.010	0.008	0.44	3 000	1.2	0.6	
		250							355		0.012	0.008	0.040			0.52				
		450							555		0.015	0.010	0.065			0.67				
M6×1	15	250	14	8	40	70	10.0	35	355	0	0.023	0.018	0.050	0.012	0.010	0.57	3 000	1.4	0.7	
		450							555		0.027	0.020	0.075			0.74				

Blank shaft end FS type

(Fine, Medium lead: Tube type)



Nut type code: SFT, LSFT

Ball screw No.	Stroke Max. L_t - L_n	Screw shaft dia. d_f	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns x Circuits	Basic load rating (N)		Axial play Max.	Nut											
								Dynamic C_a	Static C_{0a}		Outside dia. D	Flange				Overall length L_n	Bolt hole					
												A	H	K	B		W	X	Y	Z		
W1403FS-1-C3T5	310	14	5	3.175	14.5	11.2	2.5x1	7 970	11 900	0.005	34	57	34	50	11	40	45	5.5	9.5	5.5		
W1406FS-1-C3T5	560																					
W1405FS-1-C5T8	454	14	8	3.175	14.5	11.2	2.5x1	7 880	11 800	0.005	34	57	34	50	11	46	45	5.5	9.5	5.5		
W1408FS-1-C5T8	754																					
W1504FS-1-C5T10	349	15	10	3.175	15.5	12.2	2.5x1	8 140	12 800	0.005	34	57	34	50	11	51	45	5.5	9.5	5.5		
W1506FS-1-C5T10	549																					
W1509FS-1-C5T10	849																					
W1511FS-1-C5T10	1 049																					

- Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Nut models: SFT, LSFT

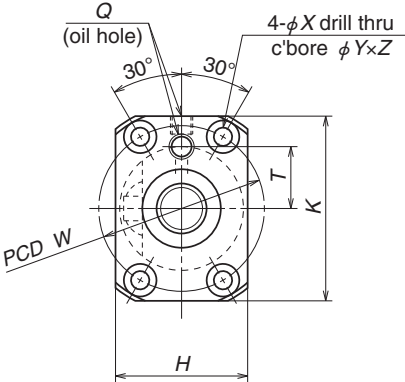
NSK

Screw shaft ø14

Lead 5, 8

Screw shaft ø15

Lead 10

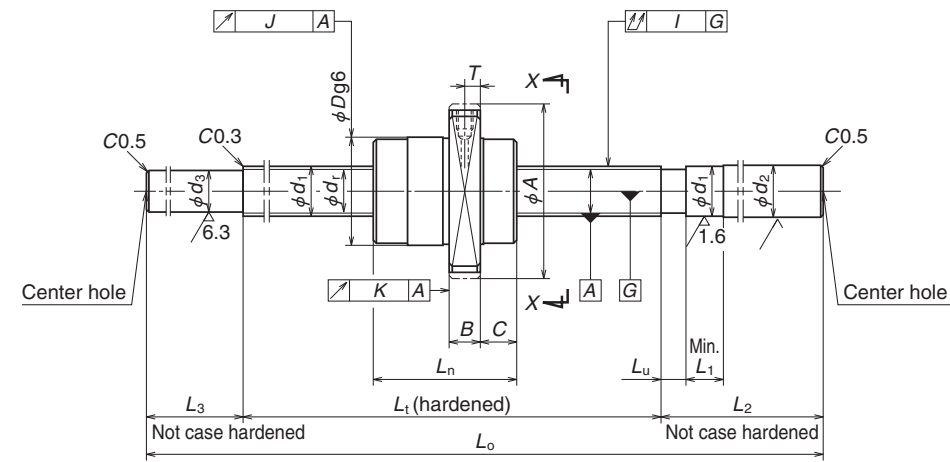


View X-X

Unit: mm																			
dimensions		Screw shaft dimensions								Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Oil hole		Threaded length	Shaft end, right				Shaft end, left		Overall length	T	Deviation e _p	Variation v _u	Shaft straightness I	Radial run-out					
Q	T		L _t	d ₂	L _u	L ₁	L ₂	d ₃						L ₃	L ₀				
M6×1	17	350 600	15	5	40	100	11.2	40	490 740	0	0.013 0.016	0.010 0.012	0.035 0.055	0.012	0.008	0.78 1.0	3 000	2.0	1.0
M6×1	17	500 800	15	8	40	100	11.2	40	640 940	0	0.027 0.035	0.020 0.025	0.065 0.085	0.015	0.011	1.0 1.3	3 000	2.0	1.0
M6×1	17	400 600 900 1 100	15	8	40	120	12.2	50	570 770 1 070 1 270	0	0.025 0.030 0.040 0.046	0.020 0.023 0.027 0.030	0.050 0.065 0.110 0.150	0.015	0.011	1.0 1.3 1.7 1.9	3 000	2.3	1.2

Blank shaft end FS type

(High helix, Ultra high helix: End cap type)



Nut type code: USFC

Nut model: USFC

NSK

Screw shaft $\phi 15$

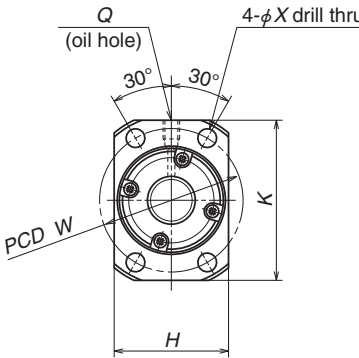
Lead 20

Screw shaft $\phi 16$

Lead 32

Screw shaft $\phi 20$

Lead 40

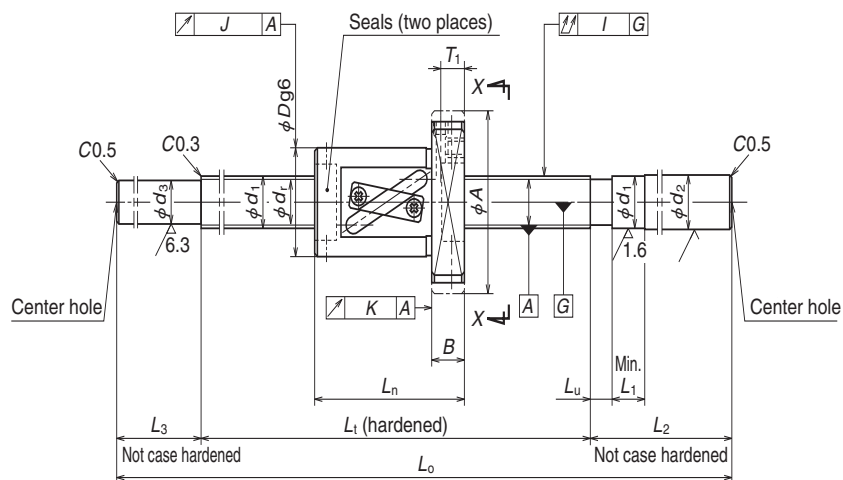


Ball screw No.	Stroke Max. L_t - L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N)		Axial play Max.	Nut									
								Dynamic C_a	Static C_{0a}		Flange						Overall length L_n	Bolt hole		
											Outside dia. D	A	H	K	B	C		W	X	
W1504FS-2G-C5T20	355	15	20	3.175	15.5	12.2	1.7×1	5 660	8 700	0.005	34	55	36	50	10	11	45	45	5.5	
W1506FS-2G-C5T20	555																			
W1509FS-2G-C5T20	855																			
W1511FS-2G-C5T20	1 055	16	32	3.175	16.75	13.4	0.7×2	4 320	6 760	0.005	34	55	36	50	10	10.5	34	45	5.5	
W1609FS-2GX-C5T32	866																			
W1613FS-1GX-C5T32	1 266																			
W2011FS-1GX-C5T40	1 059	20	40	3.175	20.75	17.4	0.7×2	4 870	8 420	0.005	38	58	40	52	10	11	41	48	5.5	
W2017FS-1GX-C5T40	1 659																			

dimensions		Screw shaft dimensions								Lead accuracy			Run-out		Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)	
Oil hole		Threaded length	Shaft end, right			Shaft end, left			Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out					
<i>Q</i>	<i>T</i>	<i>L</i> ₁	<i>d</i> ₂	<i>L</i> _u	<i>L</i> ₁	<i>L</i> ₂	<i>d</i> ₃	<i>L</i> ₃	<i>L</i> ₀	<i>T</i>	<i>e</i> _p	<i>v</i> _u	<i>I</i>	<i>J</i>	<i>K</i>				
M6×1	5	400	15.2	13	40	120	12.2	50	570	0	0.025	0.020	0.050	0.015	0.011	1.0	3 000	1.9	1.0
		600							770		0.030	0.023	0.065			1.3			
		900							1 070		0.040	0.027	0.110			1.7			
		1 100							1 270		0.046	0.030	0.150			2.0			
M6×1	5	900	16.2	19	40	150	13.4	60	1 110	0	0.040	0.027	0.110	0.015	0.011	1.9	3 000	2.0	1.0
		1 300							1 510		0.054	0.035	0.150			2.5			
M6×1	5	1 100	20.2	22	60	150	17.4	80	1 330	0	0.046	0.030	0.150	0.015	0.011	3.5	3 000	2.7	1.4
		1 700							1 930		0.065	0.040	0.200			4.9			

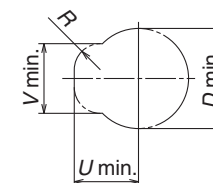
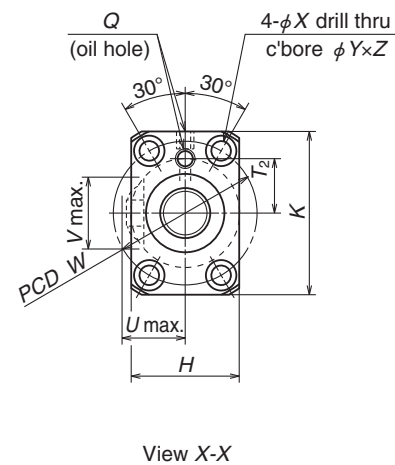
Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

(Fine, Medium, High helix lead: Tube type)



Nut models: SFT, LSFT

Lead 10, 20



Housing hole and its clearance
(only applicable to shaft dia. $\phi 16$, lead 16)

Ball screw No.	Stroke Max. L_t - L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns x Circuits	Basic load rating (N)		Axial play Max.	Nut									
								Dynamic C_a	Static C_{0a}		Outside dia. D	Flange				Overall length L_n	Bolt		hole	
																		A	H	K
W1605FS-1-C3T5	458	16	5	3.175	16.5	13.2	2.5x1	8 620	13 800	0.005	40	63	40	55	11	42	51	5.5	9.5	5.5
W1609FS-1-C3T5	858																			
W1606FS-1-C5T16	544																			
W1611FS-1-C5T16	1 044	16	16	3.175	16.75	13.4	1.5x1	5 480	8 080	0.005	34	57	34	50	12	56	45	5.5	9.5	5.5
W2009FS-1-C5T10	846																			
W2013FS-1-C5T10	1 246																			
W2010FS-1-C5T20	937	20	20	3.969	21	16.9	2.5x1	13 300	21 900	0.005	46	74	46	66	13	54	59	6.6	11	6.5
W2015FS-1-C5T20	1 437																			

3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

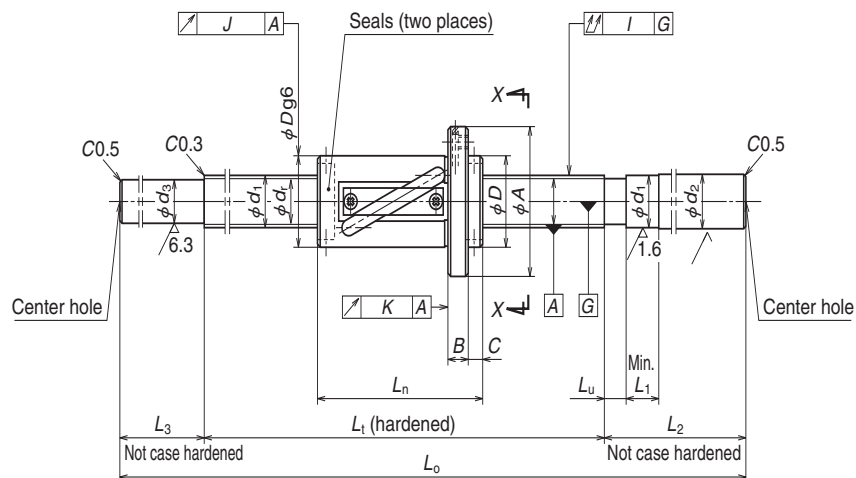
Unit: mm																							
dimensions						Screw shaft dimensions								Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Projecting tube			Oil hole			Threaded length	Shaft end, right			Shaft end, left			Overall length	Deviation	Variation	Shaft straightness	Radial run-out						
U	V	R	Q	T ₁	T ₂	L ₁	d ₂	L ₄	L ₁	L ₂	d ₃	L ₃	L ₀	T	e _p	v _u	I	J	K				
—	—	—	M6×1	6	17	$\frac{500}{900}$	16.2	5	40	150	13.2	60	$\frac{710}{1110}$	0	0.015	0.010	0.055	0.012	0.008	$\frac{1.4}{1.9}$	3 000	2.6	1.3
19	20	8	M6×1	8	17	$\frac{600}{1100}$	16.2	10	40	150	13.4	60	$\frac{810}{1310}$	0	0.030	0.023	0.085	0.015	0.011	$\frac{1.5}{2.3}$	3 000	2.1	1.1
						0.046							0.030		0.150	2 480							
—	—	—	M6×1	6	24	$\frac{900}{1300}$	20.2	10	60	150	16.9	80	$\frac{1130}{1530}$	0	0.040	0.027	0.110	0.015	0.011	$\frac{3.2}{4.1}$	3 000	4.7	2.4
						0.054							0.035		0.150	2 190							
—	—	—	M6×1	8	24	$\frac{1000}{1500}$	20.2	13	60	150	16.9	80	$\frac{1230}{1730}$	0	0.040	0.027	0.110	0.015	0.011	$\frac{3.6}{4.8}$	3 000	4.2	2.1
						0.054							0.035		0.200	1 610							

(Medium, High helix, Ultra high helix lead: End cap type)



Nut type code: USFC

(Medium, High helix lead: Tube type)



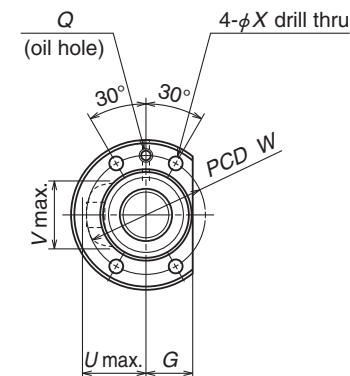
Nut type code: LSFT

Nut model: LSFT

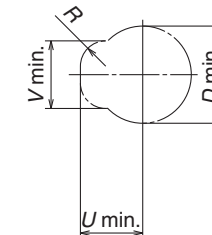
NSK

Screw shaft ø32

Lead 25, 32



View X-X



Housing hole and its clearance

Ball screw No.	Stroke Max. L_t - L_n	Screw shaft dia. d_t	Lead l	Ball dia. d_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N)		Axial play Max.	Nut								
							Turns x Circuits	Dynamic C_a	Static C_{0a}		Outside dia. D	Flange					Overall length L_n	Bolt hole	
												A	G	B	C	W		X	
W3217FS-1-C5T25	1 583	32	25	4.762	33.25	28.3	2.5x1	20 400	42 200	0.005	51	85	26	15	10	117	67	9	
W3227FS-1-C5T25	2 583																		
W3217FS-2-C5T32	1 591	32	32	4.762	33.25	28.3	1.5x1	13 300	25 200	0.005	51	85	26	15	12	109	67	9	
W3227FS-2-C5T32	2 591																		

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.

3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Unit: mm

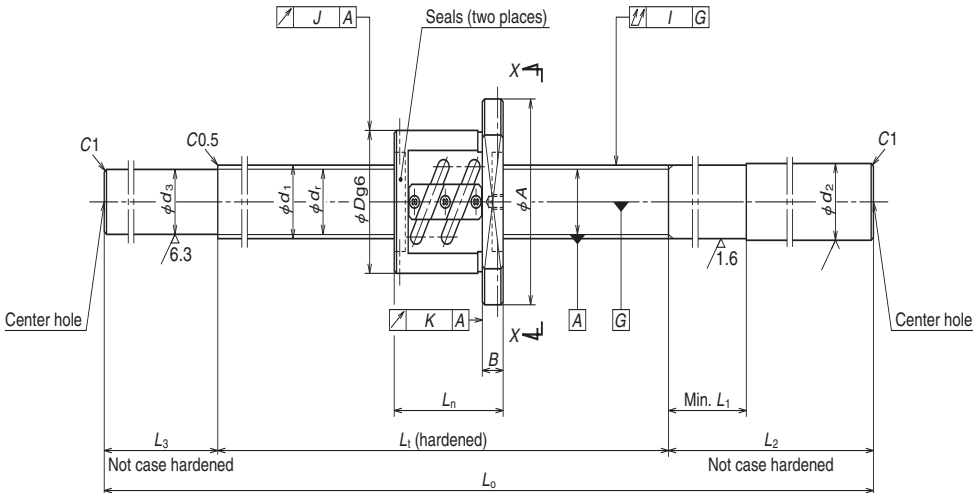
dimensions				Screw shaft dimensions								Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spiral volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Projecting tube		Oil hole	Threaded length	Shaft end, right				Shaft end, left		Overall length	Lead con- pensation	Deviation	Variation	Shaft straightness	Radial run-out						
<i>U</i>	<i>V</i>	<i>R</i>	<i>Q</i>	<i>L_t</i>	<i>d₂</i>	<i>L_u</i>	<i>L₁</i>	<i>L₂</i>	<i>d₃</i>	<i>L₃</i>	<i>L_o</i>	<i>T</i>	<i>e_p</i>	<i>v_u</i>	<i>I</i>	<i>J</i>	<i>K</i>				
34	42	12	M6x1	1 700 2 700	32.3	15	70	250	28.3	120	2 070 3 070	0	0.065 0.093	0.040 0.054	0.160 0.210	0.019	0.013	13.8 2 180 20.0 800	17	8.5	
34	42	12	M6x1	1 700 2 700	32.3	19	70	250	28.3	120	2 070 3 070	0	0.065 0.093	0.040 0.054	0.160 0.210	0.019	0.013	13.9 2 180 20.0 790	15	7.5	

Unit: mm

FS

Blank shaft end SS type

(Fine lead: Tube type)



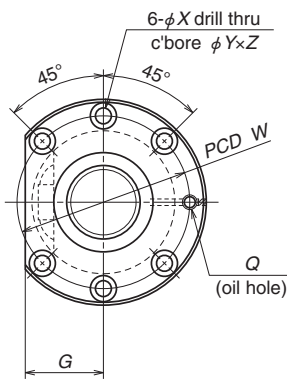
Nut type code: PFT

Nut model: PFT

NSK

Screw shaft ø20

Lead 4, 5



View X-X

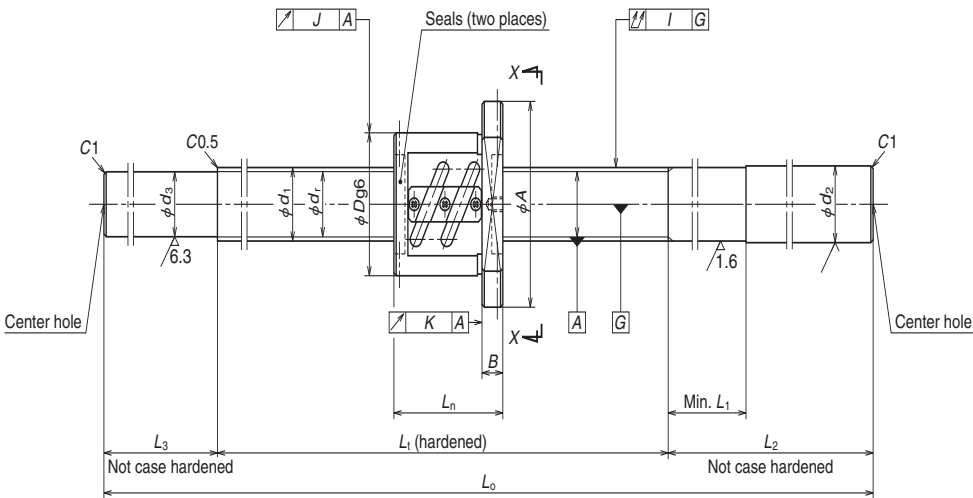
Ball screw No.	Stroke Max. L_f - L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut							
							Turns × Circuits	Dynamic C_a	Static C_{0a}			Outside dia. D	Flange				Overall length L_n	Bolt hole	
													A	G	B	W		X	
W2003SS-1P-C5Z4	251	20	4	2.381	20.3	17.8	2.5×2	6 550	10 900	290	3.9	40	63	24	11	49	51	5.5	
W2005SS-1P-C5Z4	451																		
W2008SS-1P-C5Z4	751																		
W2003SS-2P-C5Z5	244	20	5	3.175	20.5	17.2	2.5×2	11 100	17 100	490	7.8	44	67	26	11	56	55	5.5	
W2005SS-2P-C5Z5	444																		
W2007SS-1P-C5Z5	644																		
W2010SS-1P-C5Z5	944																		

Unit: mm																			
dimensions			Screw shaft dimensions							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Bolt hole	Oil hole		Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out						
Y	Z	Q	L _t	d ₂	L ₁	L ₂	d ₃	L ₃	L ₀	T	e _p	v _u	I	J	K				
9.5	5.5	M6×1	300	20.2	40	150	17.8	50	700	-0.007	0.023	0.018	0.055	0.015	0.011	1.5	3 000	2.7	
			500													2.0			
			800													2.9			
9.5	5.5	M6×1	300	20.2	40	150	17.2	50	700	-0.007	0.023	0.018	0.055	0.015	0.011	1.6	3 000	4.3	
			500													2.2			
			700					200	100	1 000	-0.017	0.035	0.025			0.110			2.8
			1 000					200	100	1 300	-0.024	0.040	0.027			0.180			3.5

- Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Blank shaft end SS type

(Fine lead: Tube type)



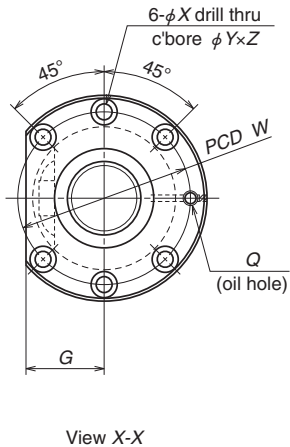
Nut type code: PFT

Nut model: PFT

NSK

Screw shaft ø25

Lead 4, 5, 6



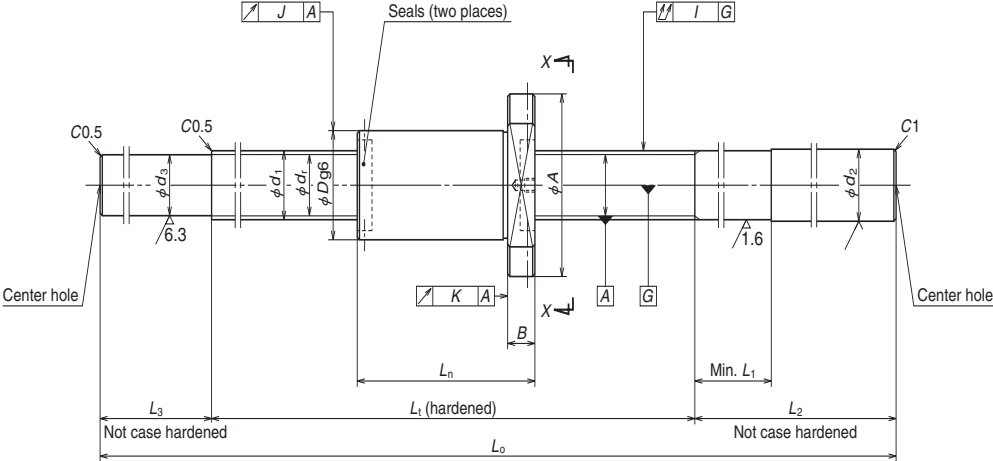
Ball screw No.	Stroke Max. L_t - L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut						
							Turns × Circuits	Dynamic C_a	Static C_{0a}			Outside dia. D	Flange			Overall length L_n	Bolt hole	
													A	G	B		W	X
W2503SS-1P-C5Z4	252																	
W2506SS-1P-C5Z4	552	25	4	2.381	25.3	22.8	2.5x2	7 110	13 600	290	4.9	46	69	26	11	48	57	5.5
W2510SS-1P-C5Z4	952																	
W2503SS-2P-C5Z5	245																	
W2505SS-1P-C5Z5	445	25	5	3.175	25.5	22.2	2.5x2	12 300	21 800	540	8.8	50	73	28	11	55	61	5.5
W2508SS-1P-C5Z5	745																	
W2512SS-1P-C5Z5	1 145																	
W2504SS-1P-C5Z6	338																	
W2508SS-2P-C5Z6	738	25	6	3.969	25.5	21.4	2.5x2	16 600	26 700	690	13.8	53	76	29	11	62	64	5.5
W2512SS-2P-C5Z6	1 138																	

dimensions			Screw shaft dimensions							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Bolt hole	Oil hole		Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out						
Y	Z	Q	L _t	d ₂	L ₁	L ₂	d ₃	L ₃	L _n	T	e _p	v _u	I	J	K				
9.5	5.5	M6x1	300			150		—	450	-0.007	0.023	0.018	0.040			2.2	2 800	3.2	1.6
			600	25.2	40	200	22.8	100	900	-0.014	0.030	0.023	0.075	0.015	0.011	3.8			
			1 000			200		100	1 300	-0.024	0.040	0.027	0.120		5.2				
9.5	5.5	M6x1	300			200		—	500	-0.007	0.023	0.018	0.040			2.5	2 800	5.2	2.6
			500	25.2	40	200	22.2	50	750	-0.012	0.027	0.020	0.060	0.015	0.011	3.4			
			800			250		100	1 150	-0.019	0.035	0.025	0.090		4.8				
			1 200			300		100	1 600	-0.029	0.046	0.030	0.120		6.3				
9.5	5.5	M6x1	400			200		—	600	-0.010	0.025	0.020	0.050			3.0	2 800	7.0	3.5
			800	25.2	40	250	21.4	100	1 150	-0.019	0.035	0.025	0.090	0.019	0.013	4.8			
			1 200			300		100	1 600	-0.029	0.046	0.030	0.120		6.3				

- Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Blank shaft end SS type

(Fine lead: Deflector (bridge) type)



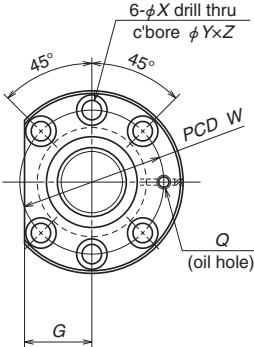
Nut type code: ZFD

Nut model: ZFD

NSK

Screw shaft ø25

Lead 5, 10



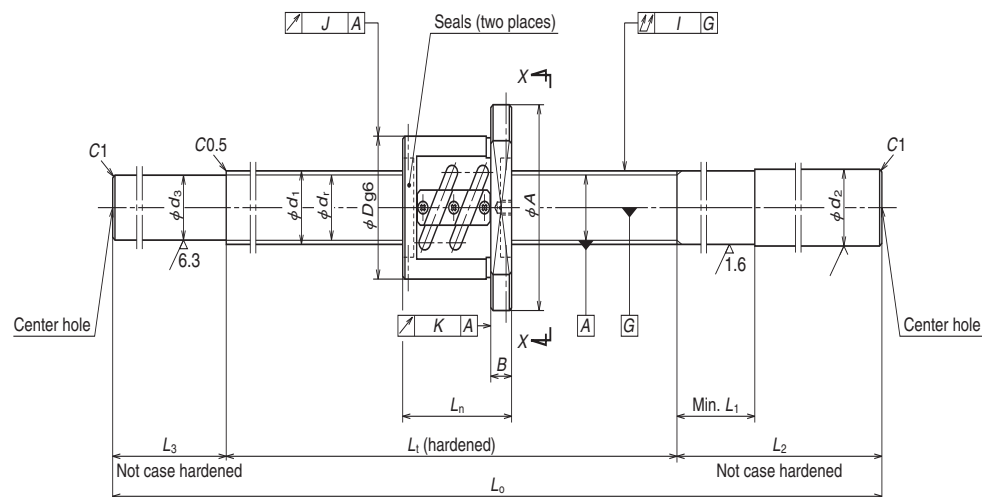
View X-X

Ball screw No.	Stroke Max. $L-L_n$	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut							
								Dynamic C_a	Static C_{0a}			Outside dia. D	Flange				Overall length L_n	Bolt hole	
													A	G	B	L		W	X
W2502SS-1ZY-C5Z5	184	25	5	3.175	25.75	22.4	1×3	11 600	22 900	740	13.8	40	63	24	11	66	51	5.5	
W2504SS-3ZY-C5Z5	334																		
W2506SS-2ZY-C5Z5	534																		
W2509SS-1ZY-C5Z5	834																		
W2512SS-3ZY-C5Z5	1 134																		
W2504SS-4ZY-C5Z10	312	25	10	4.762	26.25	21.3	1×2	13 300	21 200	880	21.5	42	69	26	15	88	55	6.6	
W2506SS-3ZY-C5Z10	512																		
W2508SS-3ZY-C5Z10	712																		
W2511SS-1ZY-C5Z10	1 012																		
W2515SS-2ZY-C5Z10	1 412																		

Unit: mm																			
dimensions		Screw shaft dimensions							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)	
Bolt hole	Oil hole	Threaded length	Shaft end, right	Shaft end, left	Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out									
Y	Z	Q	L_t	d_2	L_1	L_2	d_3	L_3	L_0	T	e_p	v_u	I	J	K				
9.5	5.5	M6x1	250	25.2	40	250	22.4	—	450	-0.005	0.023	0.018	0.040	0.015	0.011	2 800	5.4	2.7	
			400					50	650	-0.009	0.025	0.020	0.060						
			600					100	950	-0.013	0.030	0.023	0.075						
			900					100	1 250	-0.021	0.040	0.027	0.090						
			1 200					100	1 600	-0.028	0.046	0.030	0.120						
11	6.5	M6x1	400	25.2	60	250	21.3	50	650	-0.008	0.025	0.020	0.060	0.015	0.011	2 800	9.0	4.5	
			600					100	950	-0.012	0.030	0.023	0.075						
			800					100	1 150	-0.017	0.035	0.025	0.090						
			1 100					100	1 500	-0.024	0.046	0.030	0.120						
			1 500					100	1 900	-0.034	0.054	0.035	0.150						

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

(Fine lead: Tube type)



Nut type code: PFT

Nut model: PFT

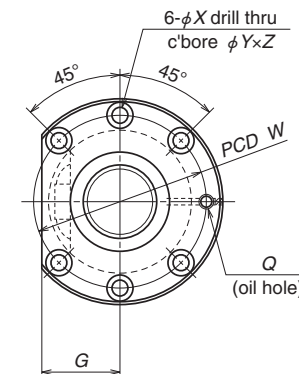
NSK

Screw shaft ø25

Lead 10

Screw shaft ø28

Lead 5, 6



View X-X

Ball screw No.	Stroke Max.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective ball turns Turns × Circuits	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut							
	L_t-L_n	d_1	l	D_w	d_m	d_r	Dynamic C_a	Static C_{0a}	Outside dia. D			Flange				Overall length		Bolt hole	
												A	G	B	L_n	W	X		
W2504SS-2P-C5Z10	319	25	10	4.762	25.5	20.5	1.5x2	13 600	18 900	590	13.8	58	85	32	15	81	71	6.6	
W2507SS-1P-C5Z10	619																		
W2510SS-2P-C5Z10	919																		
W2515SS-1P-C5Z10	1 419																		
W2804SS-1P-C5Z5	344	28	5	3.175	28.5	25.2	2.5x2	13 000	24 400	540	9.8	55	85	31	12	56	69	6.6	
W2806SS-1P-C5Z5	544																		
W2808SS-1P-C5Z5	744																		
W2812SS-1P-C5Z5	1 144																		
W2804SS-3P-C5Z6	337	28	6	3.175	28.5	25.2	2.5x2	12 900	24 300	540	10.8	55	85	31	12	63	69	6.6	
W2806SS-3P-C5Z6	537																		
W2808SS-3P-C5Z6	737																		
W2812SS-3P-C5Z6	1 137																		

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.

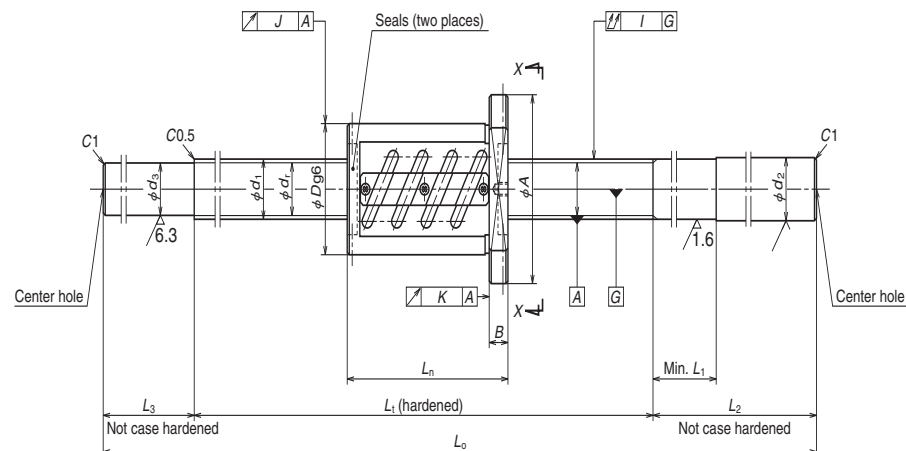
See page D13 for details.

3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Unit: mm

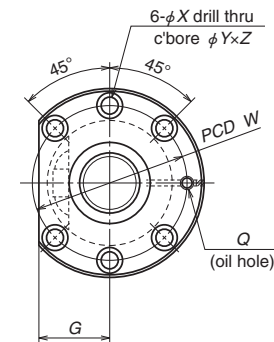
dimensions			Screw shaft dimensions						Lead accuracy			Run-out		Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)			
Bolt hole	Oil hole	Threaded length	Shaft end, right			Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out							
Y	Z	Q	L ₁	d ₂	L ₁	L ₂	d ₃	L ₃	L ₀	T	e _p	v _u	I	J	K					
11	6.5	M6x1	400	25.2	60	20.5	200		50	650	-0.010	0.025	0.020	0.060	0.019	0.013	3.8	2 800	9.7	4.9
			700				250	100	1 050	-0.017	0.035	0.025	0.090	5.1						
			1 000				250	100	1 350	-0.024	0.040	0.027	0.120	6.1						
			1 500				300	100	1 900	-0.036	0.054	0.035	0.150	8.0						
11	6.5	M6x1	400	28.2	40	25.2	200		—	600	-0.010	0.025	0.020	0.050	0.019	0.013	3.7	2 500	6.1	3.1
			600				250	100	950	-0.014	0.030	0.023	0.075	5.2						
			800				250	100	1 150	-0.019	0.035	0.025	0.090	6.1						
			1 200				300	100	1 600	-0.029	0.046	0.030	0.120	8.1						
11	6.5	M6x1	400	28.2	40	25.2	200		—	600	-0.010	0.025	0.020	0.050	0.019	0.013	3.8	2 500	6.1	3.1
			600				250	100	950	-0.014	0.030	0.023	0.075	5.3						
			800				250	100	1 150	-0.019	0.035	0.025	0.090	6.2						
			1 200				300	100	1 600	-0.029	0.046	0.030	0.120	8.2						

(Fine lead: Tube type)



Nut model: ZFT

Lead 5, 6



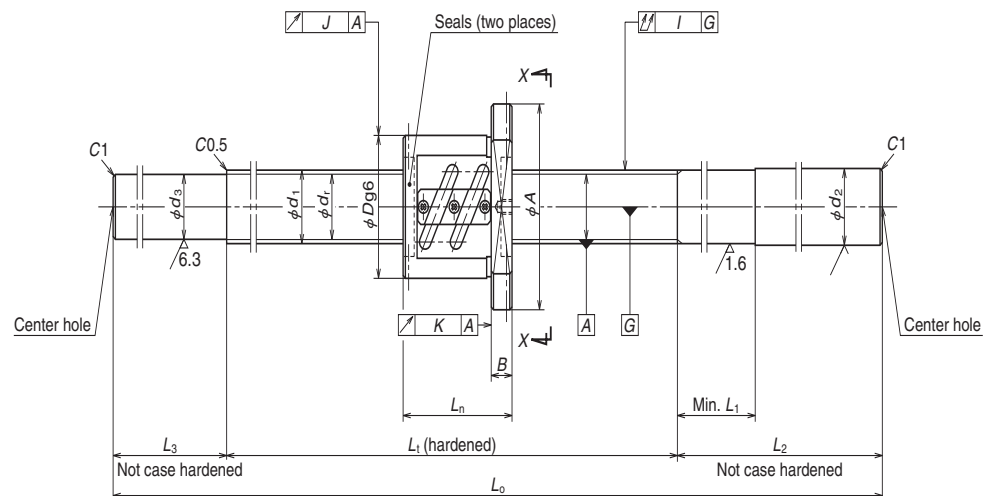
View X-X

Ball screw No.	Stroke Max.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective ball turns	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut							
	$L-L_n$	d_1	l	d_w	d_m	d_r	Turns × Circuits	Dynamic C_a	Static C_{0a}			Outside dia. D	Flange				Overall length		Bolt hole
														A	G	B	L_n	W	X
W2804SS-2Z-C5Z5	314	28	5	3.175	28.5	25.2	2.5×2	20 600	48 700	1 225	21.5	55	85	31	12	86	69	6.0	
W2806SS-2Z-C5Z5	514																		
W2808SS-2Z-C5Z5	714																		
W2812SS-2Z-C5Z5	1 114																		
W2804SS-4Z-C5Z6	301	28	6	3.175	28.5	25.2	2.5×2	20 600	48 700	1 225	22.5	55	85	31	12	99	69	6.0	
W2806SS-4Z-C5Z6	501																		
W2808SS-4Z-C5Z6	701																		
W2812SS-4Z-C5Z6	1 101																		

3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Unit: mm																			
dimensions			Screw shaft dimensions						Lead accuracy				Run-out		Mass (kg)	Permissible rotational speed N(r/min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)	
Bolt hole	Oil hole	Threaded length	Shaft end, right	Shaft end, left	Overall length	Travel straightness	Deviation	Variation	Shaft straightness	Radial run-out									
Y	Z	Q	L ₁	d ₂ L ₂	d ₃ L ₃	L _p	T	e _p	v _u	I	J	K							
11	6.5	M6x1	400	28.2	40	200	25.2	—	600	-0.010	0.025	0.020	0.050	0.019	0.013	4.7	2 500	9.2	4.6
			600			250		100	950	-0.014	0.030	0.023	0.075			5.5			
			800			250		100	1 150	-0.019	0.035	0.025	0.090			6.4			
			1 200			300		100	1 600	-0.029	0.046	0.030	0.120			8.4			
11	6.5	M6x1	400	28.2	40	200	25.2	—	600	-0.010	0.025	0.020	0.050	0.019	0.013	4.2	2 500	9.5	4.8
			600			250		100	950	-0.014	0.030	0.023	0.075			5.7			
			800			250		100	1 150	-0.019	0.035	0.025	0.090			6.6			
			1 200			300		100	1 600	-0.029	0.046	0.030	0.120			8.6			

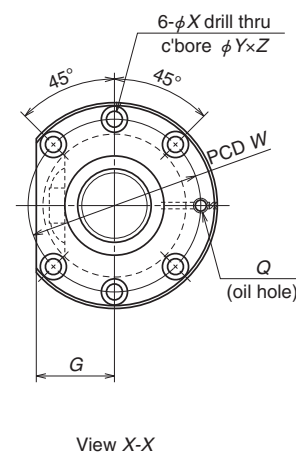
(Fine lead: Tube type)



Nut type code: PFT

NSK

Lead 5, 6

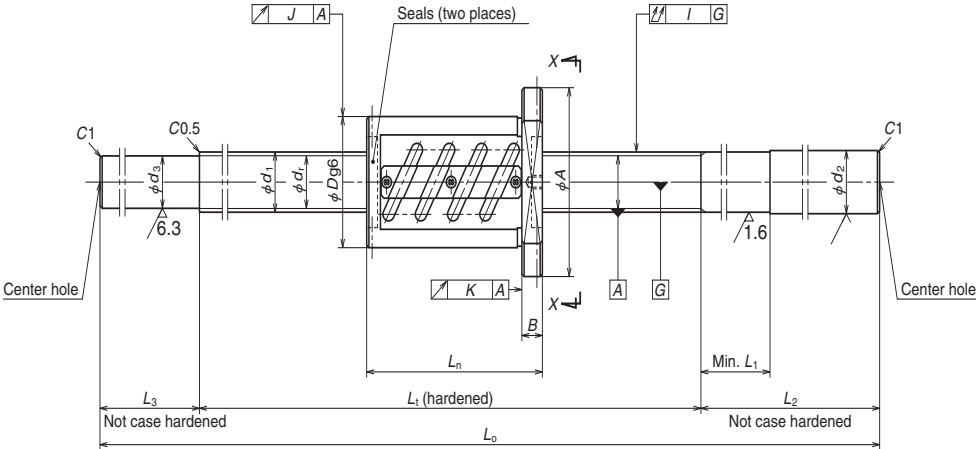


Unit: mm

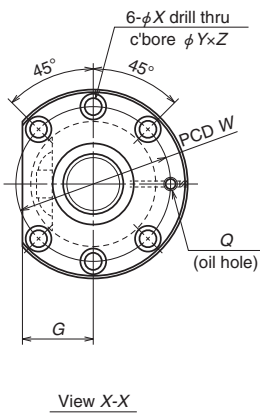
Ball screw No.	Stroke Max.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective ball turns Turns × Circuits	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut				
	L_f-L_n	d_f	l	D_w	d_m	d_f	Dynamic C_a	Static C_{0a}	Outside dia. D			Flange			Overall length L_n	
												A	G	B		
W3204SS-1P-C5Z5	344	32	5	3.175	32.5	29.2	2.5×2	13 700	28 000	590	10.8	58	85	32	12	56
W3206SS-1P-C5Z5	544															
W3208SS-1P-C5Z5	744															
W3212SS-1P-C5Z5	1 144															
W3215SS-1P-C5Z5	1 444															
W3206SS-3P-C5Z6	537	32	6	3.969	32.5	28.4	2.5×2	18 300	34 700	780	15.6	62	89	34	12	63
W3210SS-1P-C5Z6	937															
W3215SS-3P-C5Z6	1 437															

3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

dimensions					Screw shaft dimensions							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Bolt hole				Oil hole	Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out						
W	X	Y	Z	Q	L ₁	d ₂	L ₁	L ₂	d ₃	L ₃	L ₀	T	e _p	v _u	I	J	K				
71	6.6	11	6.5	M6x1	400	32.3	40	200	29.2	50	650	-0.010	0.025	0.020	0.060	0.019	0.013	4.8	2 180	6.9	3.5
					600					100	950	-0.014	0.030	0.023	0.075			6.5			
					800					100	1 150	-0.019	0.035	0.025	0.090			7.7			
					1 200					100	1 600	-0.029	0.046	0.030	0.120			10.3			
					1 500					100	1 900	-0.036	0.054	0.035	0.150			12.1			
75	6.6	11	6.5	M6x1	600	32.3	40	250	28.4	100	950	-0.014	0.030	0.023	0.075	0.019	0.013	6.7	2 180	9.4	4.7
					1 000						1 400	-0.024	0.040	0.027	0.120			9.2			
					1 500						1 900	-0.036	0.054	0.035	0.150			12.1			



Nut type code: ZFT



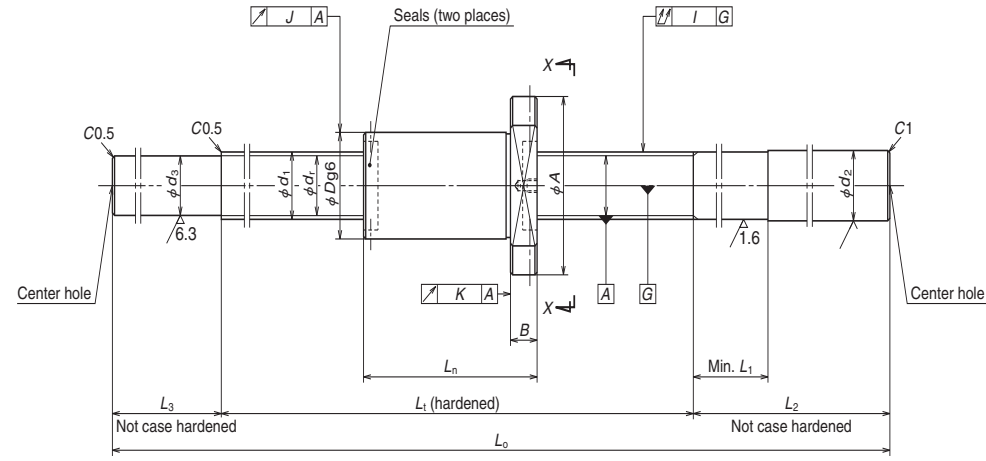
Ball screw No.	Stroke Max. L_r-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns $\times$ Circuits	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut				
								Dynamic C_a	Static C_{0a}			Outside dia. D	Flange			Overall length L_n
													A	G	B	
W3204SS-2Z-C5Z5	314	32	5	3.175	32.5	29.2	2.5×2	21 800	56 000	1 270	22.5	58	85	32	12	86
W3206SS-2Z-C5Z5	514															
W3208SS-2Z-C5Z5	714															
W3212SS-2Z-C5Z5	1 114															
W3215SS-2Z-C5Z5	1 414															
W3206SS-4Z-C5Z6	501	32	6	3.969	32.5	28.4	2.5×2	29 100	69 300	1 720	34.5	62	89	34	12	99
W3210SS-2Z-C5Z6	901															
W3215SS-4Z-C5Z6	1 401															
W3206SS-5Z-C5Z8	518	32	8	4.762	32.5	27.5	2.5×1	20 600	40 900	1 320	30.5	66	100	38	15	82
W3210SS-3Z-C5Z8	918															
W3215SS-5Z-C5Z8	1 418															

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Unit: mm																					
dimensions					Screw shaft dimensions						Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)	
Bolt hole				Oil hole	Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out						
W	X	Y	Z	Q	L _t	d ₂	L ₁	L ₂	d ₃	L ₃	L ₀	T	e _p	v _u	I	J	K				
71	6.6	11	6.5	M6x1	400	32.3	40	200	29.2	50	650	-0.010	0.025	0.020	0.060	0.019	0.013	5.1	2 180	10	5.0
					600			250		100	950	-0.014	0.030	0.023	0.075			6.9			
					800			250		100	1 150	-0.019	0.035	0.025	0.090			8.0			
					1 200			300		100	1 600	-0.029	0.046	0.030	0.120			10.1			
					1 500			300		100	1 900	-0.036	0.054	0.035	0.150			12.4			
75	6.6	11	6.5	M6x1	600	32.3	40	250	28.4	—	950	-0.014	0.030	0.023	0.075	0.019	0.013	7.1	2 180	15	7.5
					1 000			300		100	1 400	-0.024	0.040	0.027	0.120			9.7			
					1 500			300		—	1 900	-0.036	0.054	0.035	0.150			12.6			
82	9	14	8.5	M6x1	600	32.3	50	250	27.5	—	950	-0.014	0.030	0.023	0.075	0.019	0.013	7.3	2 180	7.9	4.0
					1 000			300		100	1 400	-0.024	0.040	0.027	0.120			9.8			
					1 500			300		—	1 900	-0.036	0.054	0.035	0.150			12.6			

Blank shaft end SS type

(Fine lead: Deflector (bridge) type)



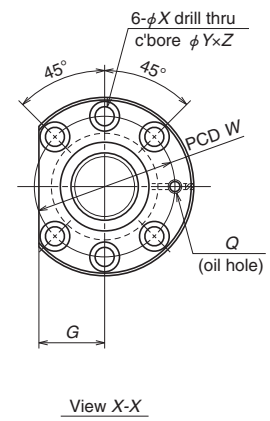
Nut type code: ZFD

Nut model: ZFD

NSK

Screw shaft ø32

Lead 5, 10

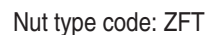


Ball screw No.	Stroke Max.	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut				
	L_t-L_n							Dynamic C_a	Static C_{0a}			Outside dia.				Overall length
												D	Flange			
												A	G	B	L_n	
W3204SS-3ZY-C5Z5	323	32	5	3.175	32.75	29.4	4	16 800	40 600	1 080	19.6	48	75	29	12	77
W3206SS-6ZY-C5Z5	523															
W3209SS-1ZY-C5Z5	823															
W3212SS-3ZY-C5Z5	1 123															
W3216SS-1ZY-C5Z5	1 523															
W3205SS-3ZY-C5Z10	380	32	10	6.35	33.75	27.1	3	30 500	52 500	1 860	49.0	54	88	34	15	120
W3207SS-3ZY-C5Z10	580															
W3210SS-6ZY-C5Z10	880															
W3214SS-3ZY-C5Z10	1 280															
W3218SS-3ZY-C5Z10	1 680															

dimensions					Screw shaft dimensions							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Bolt hole				Oil hole	Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out						
W	X	Y	Z	Q		L ₁	d ₂	L ₁	L ₂						d ₃	L ₃	L ₀				
61	6.6	11	6.5	M6x1	400	32.3	40	200	29.4	50	650	-0.009	0.025	0.020	0.060	0.015	0.011	4.6	2 180	22	11
					600			250		100	950	-0.013	0.030	0.023	0.075			6.4			
					900			250		100	1 250	-0.021	0.040	0.027	0.090			8.1			
					1 200			300		100	1 600	-0.028	0.046	0.030	0.120			10.2			
					1 600			300		100	2 000	-0.037	0.054	0.035	0.150			12.6			
70	9	14	8.5	M6x1	500	32.3	60	250	27.1	100	850	-0.010	0.027	0.020	0.075	0.019	0.013	6.2	2 180	23	12
					700			250		100	1 050	-0.015	0.035	0.025	0.090			7.3			
					1 000			300		100	1 400	-0.022	0.040	0.027	0.120			9.3			
					1 400			350		120	1 870	-0.032	0.054	0.035	0.150			11.9			
					1 800			350		120	2 270	-0.041	0.065	0.040	0.200			14.1			

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. The permissible rotational speed is determined by d·n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

(Fine lead: Tube type)

**NSK**

Lead 5

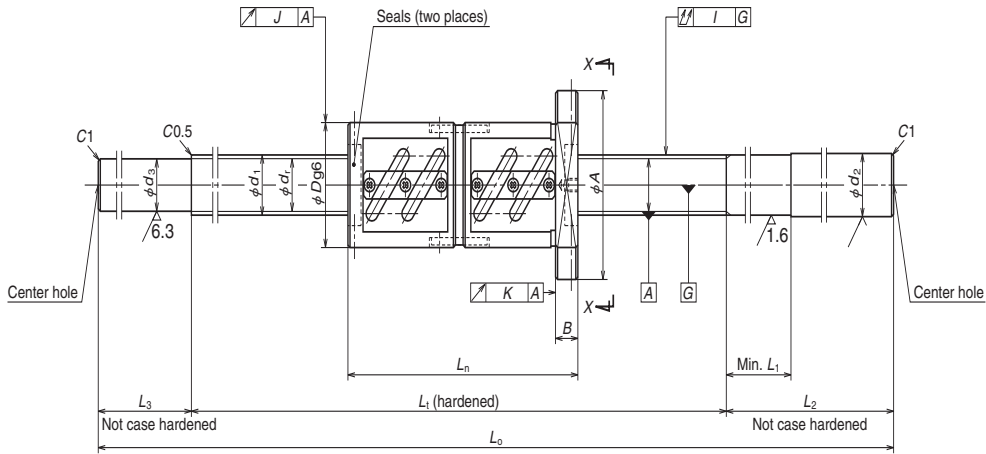


dimensions					Screw shaft dimensions							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of grease replenishing (cm ³)	Standard volume of grease (cm ³)
Bolt hole				Oil hole	Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out						
W	X	Y	Z	Q	L ₁	d ₂	L ₁	L ₂	d ₃	L ₃	L ₀	T	e _p	v _u	I	J	K				
90	9	14	8.5	M6x1	500	32.3	60	250	26.4	100	850	-0.012	0.027	0.020	0.075	0.019	0.013	7.5	2 180	22	11
					700			250		100	1 050	-0.017	0.035	0.025	0.090			8.5			
					1 000			300		100	1 400	-0.024	0.040	0.027	0.120			10.5			
					1 400			350		120	1 870	-0.034	0.054	0.035	0.150			13.1			
					1 800			350		120	2 270	-0.043	0.065	0.040	0.200			15.2	1 820		
98	11	17.5	11	M6x1	700	36.3	60	300	30.4	100	1 100	-0.017	0.035	0.025	0.065	0.019	0.013	10.9	1 940	27	14
					1 200			350		120	1 670	-0.029	0.046	0.030	0.100			14.9			
					2 000			350		120	2 470	-0.048	0.065	0.040	0.130			20.4			
83	9	14	8.5	Rc1/8	600	40.3	50	300	37.2	100	1 000	-0.014	0.030	0.023	0.050	0.019	0.013	11.1	1 750	14	7.0
					1 000			300		1 400	-0.024	0.040	0.027	0.080	14.8						
					1 600			350		2 050	-0.038	0.054	0.035	0.130	20.8						

B337

Blank shaft end SS type

(Fine lead: Tube type)



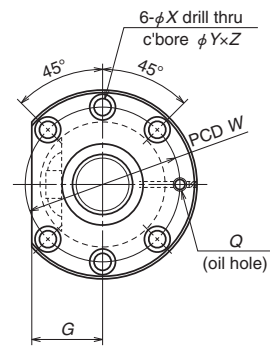
Nut type code: DFT

Nut model: DFT

NSK

Screw shaft ø32, ø36

Lead 10

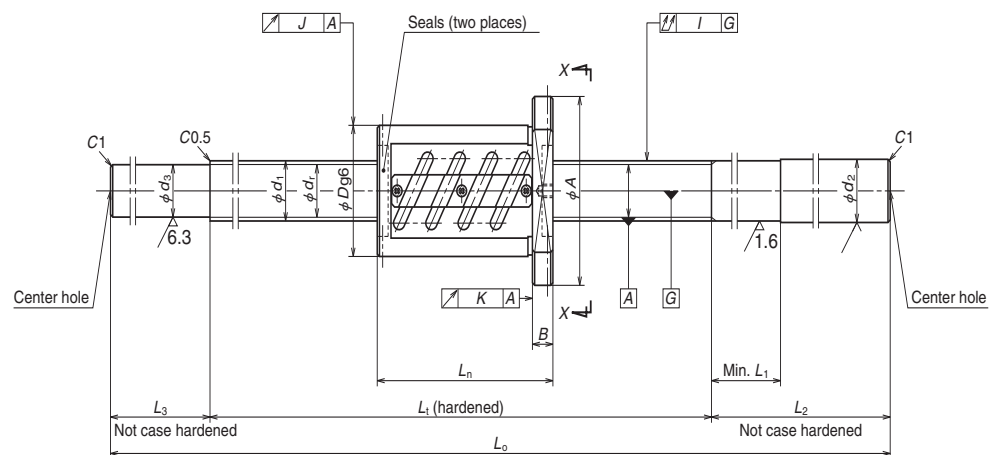


Ball screw No.	Stroke Max.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective ball turns	Basic load rating (N)		Dynamic friction torque, median (N·cm)	Nut				
	L_t-L_n	d_1	l	D_w	d_m	d_r	Turns × Circuits	Dynamic C_a	Static C_{0a}		Preload (N)	Flange			
												Outside dia. D	A	G	Overall length L_n
W3205SS-2D-C5Z10	310	32	10	6.350	33	26.4	2.5×2	54 500	110 000	3 240	83	74	108	41	150
W3207SS-2D-C5Z10	510														
W3210SS-5D-C5Z10	810														
W3214SS-2D-C5Z10	1 210														
W3218SS-2D-C5Z10	1 610														
W3607SS-2D-C5Z10	507	36	10	6.350	37	30.4	2.5×2	58 000	122 000	3 430	93	75	120	45	180
W3612SS-2D-C5Z10	1 007														
W3620SS-2D-C5Z10	1 807														

dimensions					Screw shaft dimensions							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenish (cm ³)
Bolt hole				Oil hole	Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out						
W	X	Y	Z	Q	L _t	d ₂	L ₁	L ₂	d ₃	L ₃	L ₀	T	e _p	v _u	I	J	K				
90	9	14	8.5	M6×1	500	32.3	60	250	26.4	100	850	-0.012	0.027	0.020	0.075	0.019	0.013	9.5	2 180	57	29
					700			250		100	1 050	-0.017	0.035	0.025	0.090			10.6			
					1 000			300		100	1 400	-0.024	0.040	0.027	0.120			12.5			
					1 400			350		120	1 870	-0.034	0.054	0.035	0.150			15.1			
					1 800			350		120	2 270	-0.043	0.065	0.040	0.200			17.2			
98	11	17.5	11	M6×1	700	36.3	60	300	30.4	100	1 100	-0.017	0.035	0.025	0.065	0.019	0.013	12.8	1 940	67	34
					1 200			350		120	1 670	-0.029	0.046	0.030	0.100			16.8			
					2 000			350		120	2 470	-0.048	0.065	0.040	0.130			22.3			

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

(Fine lead: Tube type)



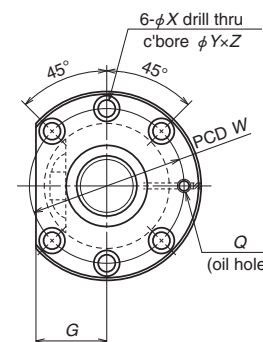
Nut type code: ZFT

Nut model: ZFT

NSK

Screw shaft ø40

Lead 8, 10, 12



View X-X

Ball screw No.	Stroke Max. L_c - L_n	Screw shaft dia. d_i	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut				
								Dynamic C_a	Static C_{0a}			Outside dia. D	Flange			Overall length L_n
													A	G	B	
W4007SS-1Z-C5Z8	570	40	8	4.762	40.5	35.5	2.5x2	41 100	103 000	2 450	64	74	108	41	15	130
W4012SS-1Z-C5Z8	1 070															
W4018SS-1Z-C5Z8	1 670															
W4007SS-2Z-C5Z10	597	40	10	6.350	41	34.4	2.5x1	33 700	68 300	2 160	64	82	124	47	18	103
W4010SS-2Z-C5Z10	897															
W4014SS-1Z-C5Z10	1 297															
W4018SS-2Z-C5Z10	1 697															
W4024SS-1Z-C5Z10	2 297															
W4010SS-4Z-C5Z12	883															
W4016SS-2Z-C5Z12	1 483	40	12	7.144	41.5	34.1	2.5x1	39 500	77 200	2 550	83	86	128	48	18	117
W4025SS-1Z-C5Z12	2 383															

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.

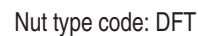
See page D13 for details.

3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Unit: mm																					
dimensions					Screw shaft dimensions							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Bolt hole				Oil hole	Threaded length	Shaft end, right			Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out					
W	X	Y	Z	Q	L ₁	d ₂	L ₁	L ₂	d ₃	L ₃	L ₀	T	e _p	v _u	I	J	K				
90	9	14	8.5	Rc1/8	700	40.3	50	300	35.5	100	1 100	-0.017	0.035	0.025	0.065	0.019	0.013	13.0	1 750	27	14
					1 200			350		100	1 650	-0.029	0.046	0.030	0.100			18.0			
					1 800			350		120	2 270	-0.043	0.065	0.040	0.130			23.5			
102	11	17.5	11	Rc1/8	700	40.3	60	300	34.4	100	1 100	-0.017	0.035	0.025	0.065	0.025	0.015	13.3	1 750	30	15
					1 000			300		100	1 400	-0.024	0.040	0.027	0.080			15.9			
					1 400			350		120	1 870	-0.034	0.054	0.035	0.100			20.0			
					1 800			350		120	2 270	-0.043	0.065	0.040	0.130			23.4			
					2 400			400		150	2 950	-0.058	0.077	0.046	0.170			29.4			
					1 000			300		100	1 400	-0.024	0.040	0.027	0.080			16.7			
106	11	17.5	11	Rc1/8	1 600	40.3	70	350	34.1	150	2 100	-0.038	0.054	0.035	0.130	0.025	0.015	22.9	1 750	35	18
					2 500			400		150	3 050	-0.060	0.077	0.046	0.170			31.1			
					1 200			300		100	1 400	-0.024	0.040	0.027	0.080			16.7			

Unit: mm

(Fine lead: Tube type)

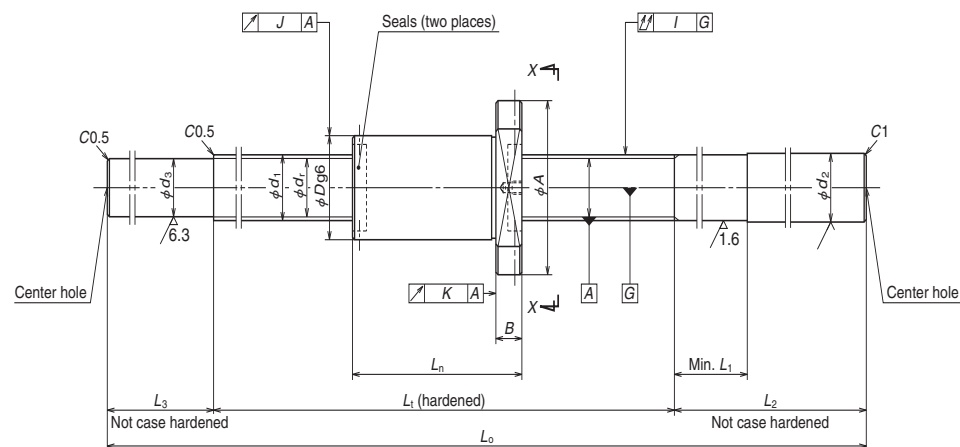


Lead 10, 12



Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
 See page D13 for details.
 3. The permissible rotational speed is determined by d·n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

(Fine lead: Deflector (bridge) type)



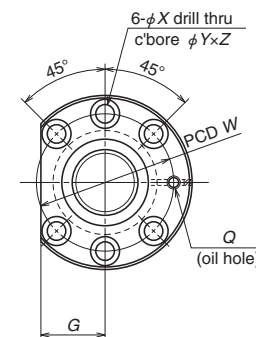
Nut type code: ZFD

Nut model: ZFD

NSK

Screw shaft ø40, ø50

Lead 10



View X-X

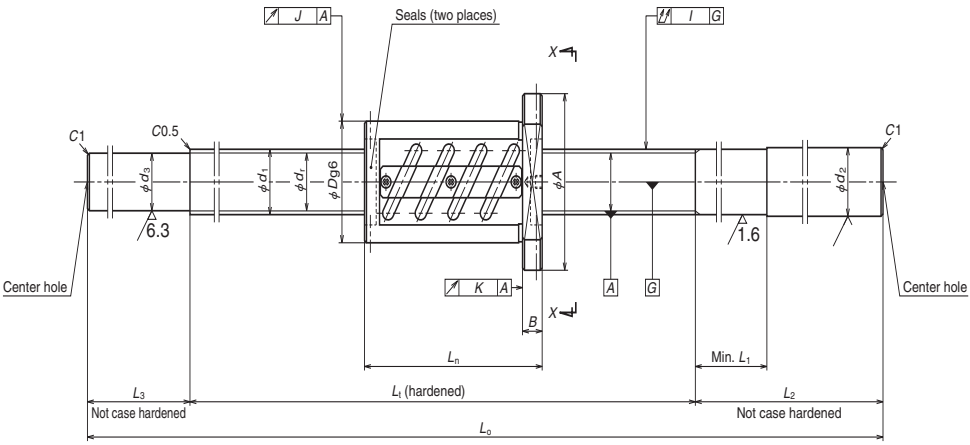
Ball screw No.	Stroke Max.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective ball turns	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut				
	L_t-L_n	d_t	l	D_w	d_m	d_r		Dynamic C_a	Static C_{0a}			Outside dia.	Flange			Overall length
												D	A	G	B	L_n
W4007SS-4ZY-C5Z10	557	40	10	6.350	41.75	35.1	4	45 200	93 100	2 840	83	62	104	40	18	143
W4010SS-6ZY-C5Z10	857															
W4014SS-3ZY-C5Z10	1 257															
W4018SS-4ZY-C5Z10	1 657															
W4024SS-3ZY-C5Z10	2 257															
W5007SS-1ZY-C5Z10	557	50	10	6.350	51.75	45.1	4	51 500	122 000	3 240	108	72	114	44	18	143
W5010SS-3ZY-C5Z10	857															
W5015SS-3ZY-C5Z10	1 357															
W5020SS-3ZY-C5Z10	1 857															
W5026SS-3ZY-C5Z10	2 457															

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.

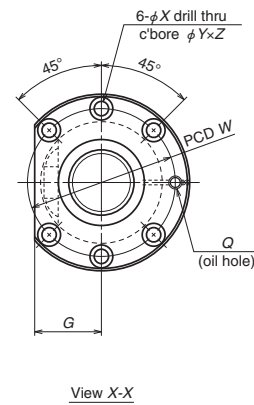
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.

3. The permissible rotational speed is determined by d-n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

Unit: mm																					
dimensions					Screw shaft dimensions							Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Bolt hole				Oil hole	Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out						
W	X	Y	Z	Q	L ₁	d ₂	L ₁	L ₂	d ₃	L ₃	L ₀	T	e _p	u _s	I	J	K				
82	11	17.5	11	Rc1/8	700	40.3	60	300	35.1	100	1 100	-0.015	0.035	0.025	0.065	0.019	0.013	12.1	1 750	32	16
					1 000			300		100	1 400	-0.022	0.040	0.027	0.080			14.7			
					1 400			350		120	1 870	-0.032	0.054	0.035	0.100			18.9			
					1 800			350		120	2 270	-0.041	0.065	0.040	0.130			22.5			
					2 400			400		150	2 950	-0.056	0.077	0.046	0.170			28.5			
92	11	17.5	11	Rc1/8	700	50.3	60	300	45.1	100	1 100	-0.015	0.035	0.025	0.065	0.019	0.013	18.3	1 400	39	20
					1 000			300		100	1 400	-0.022	0.040	0.027	0.080			22.5			
					1 500			400		150	2 050	-0.034	0.054	0.035	0.130			31.8			
					2 000			400		150	2 550	-0.046	0.065	0.040	0.170			38.9			
					2 600			500		200	3 300	-0.060	0.093	0.054	0.220			49.5			



Nut type code: ZFT



Ball screw No.	Stroke Max.	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N)		Preload (N)	Dynamic friction torque, median (N·cm)	Nut				
	L_t-L_n							Dynamic C_a	Static C_{0a}			Outside dia. D	Flange			Overall length L_n
													A	G	B	
W4510SS-1Z-C5Z10	897	45	10	6.350	46	39.4	2.5×1	36 300	78 500	2 260	69	88	132	50	18	103
W4516SS-1Z-C5Z10	1 497															
W4525SS-1Z-C5Z10	2 397															
W5010SS-1Z-C5Z10	897	50	10	6.350	51	44.4	2.5×1	37 500	87 200	2 450	78	93	135	51	18	103
W5015SS-1Z-C5Z10	1 397															
W5020SS-1Z-C5Z10	1 897															
W5026SS-1Z-C5Z10	2 497															
W5010SS-2Z-C5Z10	837															
W5015SS-2Z-C5Z10	1 337	50	10	6.350	51	44.4	2.5×2	68 100	174 000	4 020	138	93	135	51	18	163
W5020SS-2Z-C5Z10	1 837															
W5026SS-2Z-C5Z10	2 437															

dimensions				Screw shaft dimensions					Lead accuracy			Run-out			Mass (kg)	Permissible rotational speed N (min ⁻¹)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Bolt hole				Oil hole	Threaded length	Shaft end, right	Shaft end, left	Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Radial run-out					
W	X	Y	Z	Q	L_t	d_2	L_1	L_2	d_3	L_3	L_o	T	e_p	v_u	I	J	K	
110	11	17.5	11	Rc1/8	1 000	45.3	60	300	100	1 400	-0.024	0.040	0.027	0.080	0.025	0.015	19.7	1 550
					1 600						-0.038	0.054	0.035	0.130				
					2 500						-0.060	0.077	0.046	0.170				
113	11	17.5	11	Rc1/8	1 000	50.3	60	300	100	1 400	-0.024	0.040	0.027	0.080	0.025	0.015	23.8	1 400
					1 500						-0.036	0.054	0.035	0.130				
					2 000						-0.048	0.065	0.040	0.170				
					2 600						-0.062	0.093	0.054	0.220				
					450						-0.062	0.093	0.054	0.220				
113	11	17.5	11	Rc1/8	1 000	50.3	60	300	100	1 400	-0.024	0.040	0.027	0.080	0.025	0.015	25.5	1 400
					1 500						-0.036	0.054	0.035	0.130				
					2 000						-0.048	0.065	0.040	0.170				
					2 600						-0.062	0.093	0.054	0.220				
					450						-0.062	0.093	0.054	0.220				

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. The permissible rotational speed is determined by d·n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.

B-3-1.6 Ball Screws for Transfer Equipment

1. Features

● Transporting mechanism

A series with accuracy grades of Ct7 and Ct10 only demonstrates high ball screw performance for transporting mechanism of Cartesian type robots and single axis actuators.

The following types are categorized ball screw for transfer equipment. VFA and RMA types have finished shaft ends. RMS type, R series of RNFTL, RNFB, RNCT, RNFL, and RNSTL types have blank shaft ends.

Table 1 Classifications of ball screws for transfer equipment

Finished shaft end	VFA type, RMA type
	RMS type
Blank shaft end	R Series
	RNFTL type, RNFB type
	RNCT type, RNFL type, RNSTL type

● Interchangeable screw shaft and ball nut

Screw shaft and nut assembly components are sold separately, and randomly-matched. The maximum axial play after assembly is shown in the dimension tables.

2. Specifications

(1) Ball recirculation system

Figs. 1, 2, and 3 show the structures of ball return tube, deflector (bridge type), and end cap ball recirculation systems.

Deflector (bridge type) recirculation system has the feature of compact nut outside diameter for small lead. End cap recirculation system is for screws with high helix lead and multiple start threads. Since the leads are in the range larger than 1.3 times of the screw shaft diameter, it is suitable for high-speed operation.

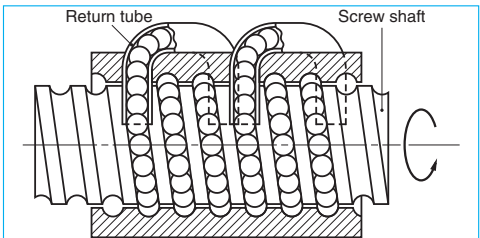


Fig. 1 Structure of return tube recirculation system

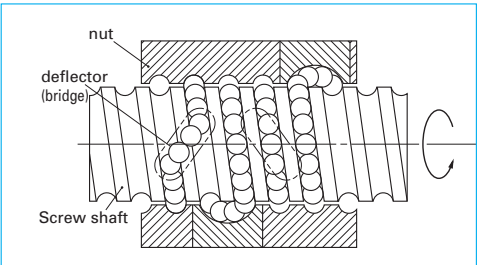


Fig. 2 Structure of deflector (bridge type) recirculation system

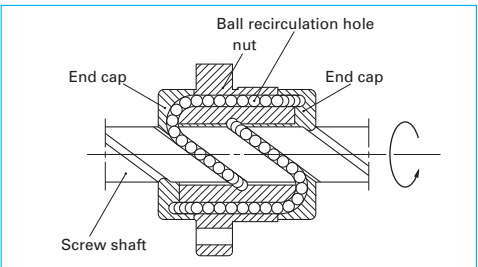


Fig. 3 Structure of end cap recirculation system

(2) Accuracy grade and axial play

Standard lead accuracy and axial play are shown on Table 2. Axial play varies with internal specification. Refer to the dimension tables.

Table 2 Accuracy grade and axial play

Accuracy grade	VFA type, RMA type, RMS type: Ct7 R Series: Ct10
Axial play	See dimension tables

(3) Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Table 3 Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value	50 000 or less
Criterion of maximum rotational speed	3 000 min ⁻¹

d·n value: shaft dia. d [mm] × rotational speed n [min⁻¹]

Note: Please also review the critical speed. See "Technical Description: Permissible Rotational Speed" (page B47) for details.

3. Product categories

Ball screws for transfer equipment have models as follows.

Table 4 Product categories of ball screws for transfer equipment

Nut model	Shape	Flange shape	Recirculation system	Preload system	Page
VFA		Flanged rectangular	Return tube type	Non-preload Slight axial play	353 – B358
RMA RMS		Flanged Circular III	Deflector (bridge) type	Non-preload Slight axial play	B359 – B372
RNFTL		Flanged Circular I Projecting tube type	Return tube type	Non-preload Slight axial play	B373 – B378
RNFB		Flanged Circular II	Return tube type	Non-preload Slight axial play	B379 – B380
RNCT		V-thread (no flange) Projecting tube type	Return tube type	Non-preload Slight axial play	B381 – B382
RNFL		Flanged Circular III	End cap type	Non-preload Slight axial play	B383 – B386
RNSTL		Square type	Return tube type	Non-preload Slight axial play	B387 – B388

4. Structure of reference number

The followings describe the structure of "Reference number for ball screw".

◇Reference number for VFA, RMA, and RMS types

VFA 15 10 - C7 S - 500					
Ball screw for transfer equipment: VFA, RMA, RMS			Screw shaft length (mm)		
Screw shaft diameter (mm)			Axial play		
Lead (mm)			Accuracy grade code		

◇Reference number for R series

Nut assembly (example)

RNFTL 25 10 A5 S

Nut model : RNFTL, RNFB, RNCT,
RNFL, RNSTL

Screw shaft diameter (mm)

Seal code S: With seal
No code: Without seal
Effective turns of balls
(turns of balls × number of circuit)

Internal design code

Lead (mm)

Screw shaft (example)

RS 25 10 A20

Product code

Screw shaft length (in the unit of 100 mm)

Screw shaft diameter (mm)

Internal design code

Lead (mm)

5. Combinations of shaft diameter and lead

Combinations of shaft diameter and lead are shown below.

For details of standard stock products, contact NSK.

Table 5 Combinations of shaft diameter and lead for VFA, RMA, RMS types

Lead	1	1.5	2	10	20
Screw shaft diameter					
6	B359, 371				
8	B361, 371	B363, 371	B365, 371		
10			B367, 371		
12			B369, 371	B353	
15				B355	B357

Table 6 Combinations of shaft diameter and lead for R series

Screw shaft diameter (mm)	3	4	5	6	8	10	12	16	20	25	32	40	50	64	80
10	○B373 △B381			○B373 ●B379											
12					○B373 ●B379		○B377 ○B383								
14		○B373 ●B379 △B381 □B387	○B373 ●B379 △B381 □B387												
15															
16						○B373		○B377 ○B383			○B385				
18					○B373 ●B379 △B381 □B387										
20			○B373 ●B379 △B381 □B387			○B373 ●B379 △B381 □B387		○B377 ○B383			○B385				
25			○B373 ●B379 △B381 □B387			○B369 ●B365 △B367 □B373			○B377 ○B383			○B385			
28				○B375 ●B379 △B381 □B387											
32						○B375 ●B379 △B381 □B387					○B377 ○B383		○B385		
36						○B375 ●B379 △B381 □B387									
40						○B375 △B381 ●B379						○B377 ○B383		○B385	
45							○B375 △B381 □B387								
50						○B375 △B381		○B375 △B381					○B383		

○: RNFTL ●: RNFB △: RNCT ◎: RNFL □: RNSTL

6. Precautions for designing

As shown in the illustration on Page B83 and B103, general precautions for ball screw.

(1) Nut assembly

When delivered, the nut of R series is separated from the screw shaft, and inserted into an arbor shaft. The nut must be inserted to the screw shaft when mounting ball screw.

(a) Consideration to end configuration of screw shaft

The balls may fall out during moving the assembled nut from the arbor to the screw shaft if the sizes and shapes of the arbor and the screw shaft are not appropriate.

If the end of the ball groove can touch the end of the arbor, connect both ends and move the assembled nut from the arbor to the screw shaft (Fig. 4). If the end face of the arbor cannot connect to the end face of the screw because of configuration of both ends of screw shaft, wrap a tape outside of ball screw shaft so that the layers of tape is equal

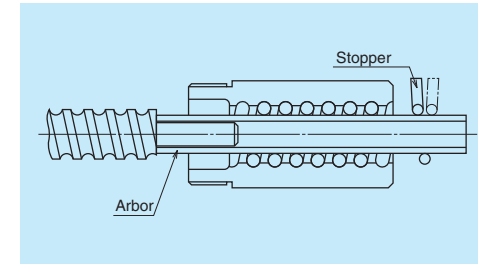


Fig. 4 Inserting nut into screwshaft

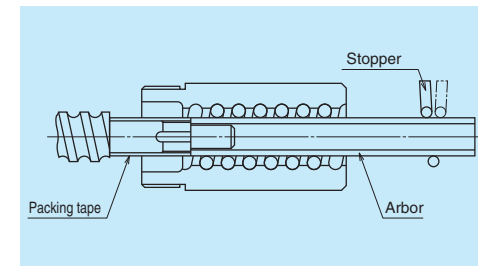


Fig. 5 Arbor and shaft end configuration

with the outside diameter of the arbor (Fig. 5). If there is a key way or a nick along the way, fill such gaps prior to moving the ball nut.

(b) Installation of arbor

Confirm the correct nut orientation for installation.

Remove the stop ring on the side from where the assembled nut is to be removed. Align the centers of the screw shaft and the arbor while pressing firmly the screw shaft end against the arbor.

(c) Moving the nut

Slide the nut until it lightly touches the shoulder of the ball groove section, and stop it. Turn the ball nut to the direction so that it moves to the ball grooves, while pressing the arbor to the screw shaft. Do not separate the arbor from the screw shaft until the ball groove end appears completely in the ball nut.

(2) Shaft end configuration

RMS type and R series must be machining of blank shaft ends. See page B27, use of NSK support unit.

(a) Cutting screw shaft

Carry out the same process as "(1) Machining of blank shaft ends of precision ball screws" above.

(b) Annealing the shaft end (Heat the section of the shaft end to be machined with an acetylene torch. Then gradually cool it in ambient atmosphere.)

* The area not machined loses hardness if exposed to heat. This may shorten the all screw life. Cool with water the areas where should not be heated to avoid heat conduction.

(c) Turning by lathe

Cut to the length, turn shaft end steps, turn thread screw, and provide the center hole. Refer to JIS B1192 which sets standards for the shaft end accuracy.

(d) Processing by grinding

Apply the same precautions as for cutting for centering, securing nut, and work rest. Grind sections where the bearings and a "Spann ring" are installed.

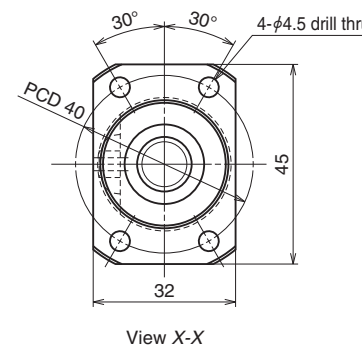
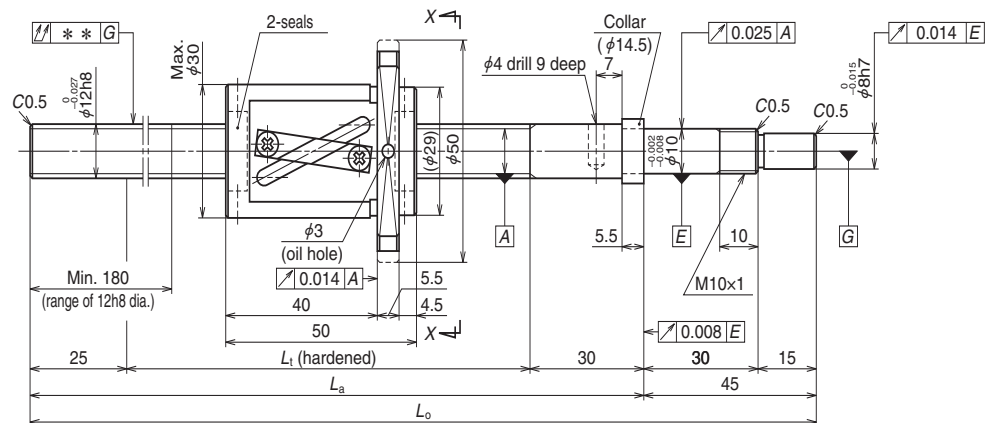
(e) Milling processing

Process keyways and tooth seats for lock washers.

(f) Deburring, washing, and rust prevention

Wash with clean white kerosene after processing. Apply lubricant for immediate use. For later use, apply rust preventive agent.

Note: Contact NSK if nut is accidentally removed.



Ball screw specification		
Shaft dia.xLead / Direction of turn		12 × 10 / Right
Ball recirculation		Return tube
Ball dia. / Ball circle dia.		2.381 / 12.5
Screw shaft root dia.		10.0
Effective turns of balls		2.5 × 1
Accuracy grade / Axial play code		Ct7 / S
Basic load rating (N)	Dynamic C _s	4 430
	Static C _{0a}	6 430
Axial play		0.010 or less
Dynamic friction torque (N·cm)		1.5 or less
Spacer ball		None
Factory-packed grease		NSK grease LR3
Internal spatial volume of nut (cm ³)		1.4
Reference of grease replenishing amount		0.7

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK10-01A (square)	WBK12SF-01 (square)
WBK10-11 (round)	

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum (L_t -nut length)	L_t	L_a	L_o
VFA1210C7S-410	250	260	310	365	410
VFA1210C7S-610	450	460	510	565	610

Notes: 1. We recommend NSK support units (page B389). WBK12SF-01 (on simple support side) supports ball screw directly on shaft outside diameter.

2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

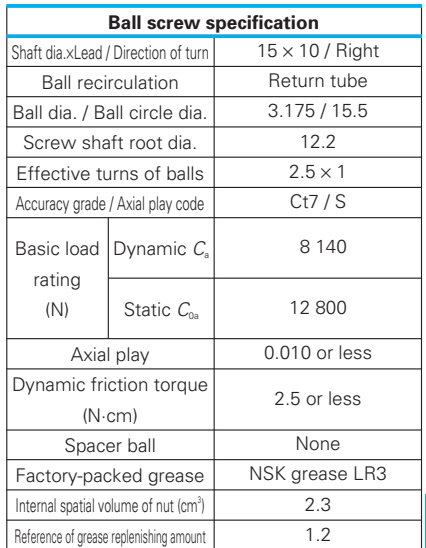
3. Permissible rotational speed is determined by $d \cdot n$ value and critical speed. See pages B47 and B349.

Unit: mm						
Lead accuracy			Shaft run-out** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
					Supporting condition	
					Fixed - Simple support	Fixed - Free
T	e_p	v_{300}				
0	0.085	0.052	0.100	0.56	3 000	3 000
0	0.155	0.052	0.160	0.73	3 000	1 300

(Medium lead)



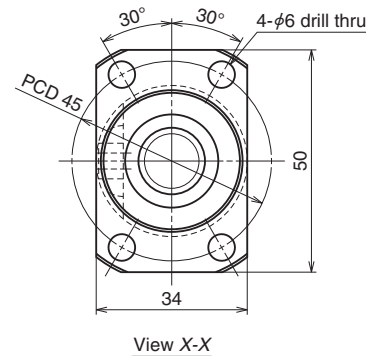
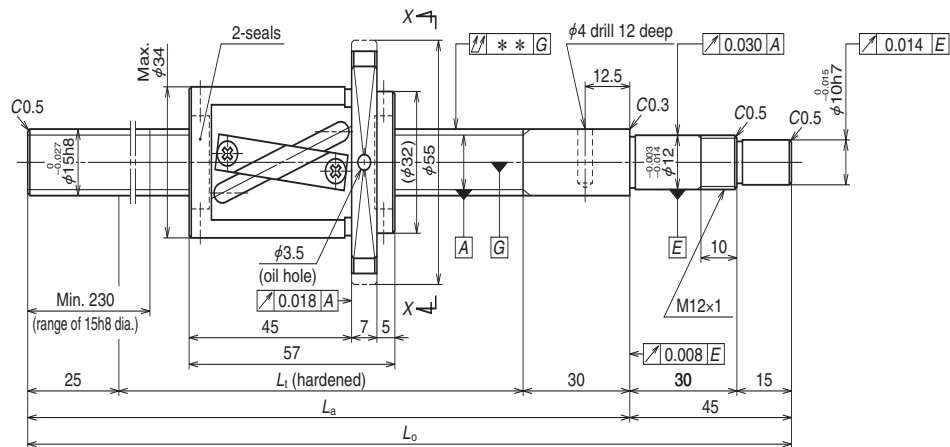
Unit: mm



For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK15SF-01 (square)
WBK12-11 (round)	

Lead accuracy			Shaft run-out** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
					Supporting condition	
<i>T</i>	<i>e</i> _o	<i>v</i> ₃₀₀			Fixed - Simple support	Fixed - Free
0	0.120	0.052	0.075	0.89	3 000	2 600
0	0.195	0.052	0.110	1.1	3 000	1 150
0	0.310	0.052	0.180	1.5	2 340	510

Unit: mm



Screw shaft ø15

Lead 20

Unit: mm

Ball screw specification	
Shaft dia. x Lead / Direction of turn	15 × 20 / Right
Ball recirculation	Return tube
Ball dia. / Ball circle dia.	3.175 / 15.5
Screw shaft root dia.	12.2
Effective turns of balls	1.5 × 1
Accuracy grade / Axial play code	Ct7 / S
Basic load rating (N)	Dynamic C_a
	Static C_{0a}
Axial play	0.010 or less
Dynamic friction torque (N·cm)	2.5 or less
Spacer ball	None
Factory-packed grease	NSK grease LR3
Internal spatial volume of nut (cm ³)	2.3
Reference of grease replenishing amount	1.4

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK15SF-01 (square)
WBK12-11 (round)	

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum (L_t -nut length)			
			L_t	L_a	L_o
VFA1520C7S-500	300	343	400	455	500
VFA1520C7S-700	500	543	600	655	700
VFA1520C7S-1000	800	843	900	955	1 000

- Notes: 1. We recommend NSK support units (page B389). WBK12SF-01 (on simple support side) supports ball screw directly on shaft outside diameter.
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Permissible rotational speed is determined by $d \cdot n$ value and critical speed. See pages B47 and B349.

Lead accuracy			Shaft run-out** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)	
					Supporting condition	
<i>T</i>	<i>e</i> _p	<i>v</i> ₃₀₀			Fixed - Simple support	Fixed - Free
0	0.120	0.052	0.075	0.94	3 000 2 630	
0	0.195	0.052	0.110	1.2	3 000 1 160	
0	0.310	0.052	0.180	1.6	2 350 510	

Unit: mm

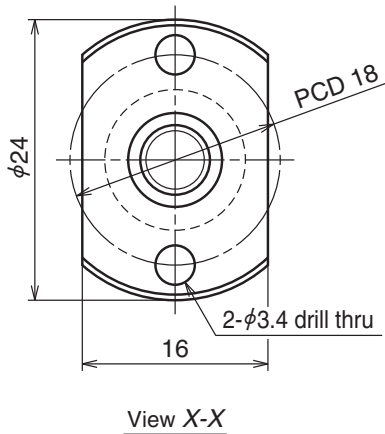
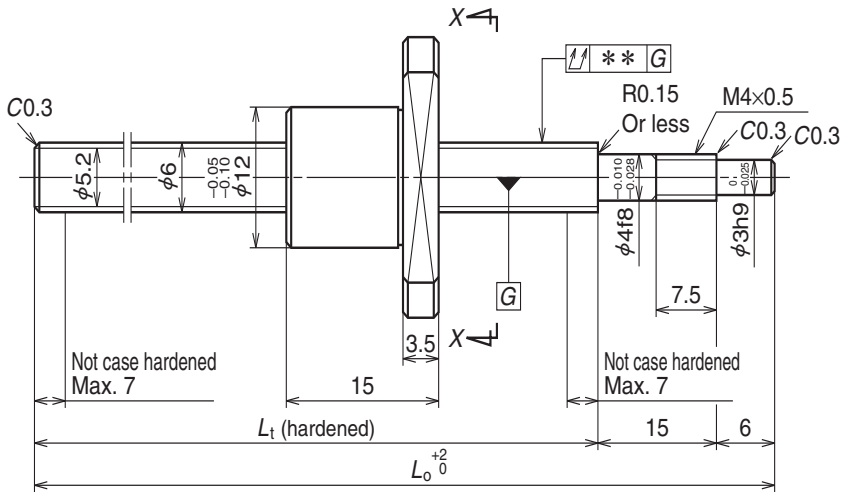
Ball screw specification

Shaft dia.xLead / Direction of turn		6 × 1 / Right
Ball recirculation		Deflector (bridge)
Ball dia. / Ball circle dia.		0.800 / 6.2
Screw shaft root dia.		5.2
Effective turns of balls		1 × 3
Accuracy grade / Axial play code		Ct7 / S
Basic load rating (N)	Dynamic C _a	610
	Static C _{0a}	920
Axial play		0.020 or less
Dynamic friction torque (N·cm)		1.0 or less
Spacer ball		None
Factory-packed grease		See Notes 2.

Recommended support unit

For drive side
(Fixed)

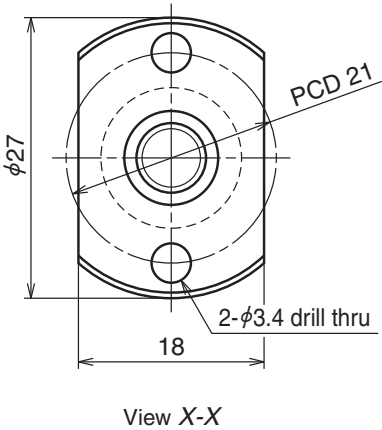
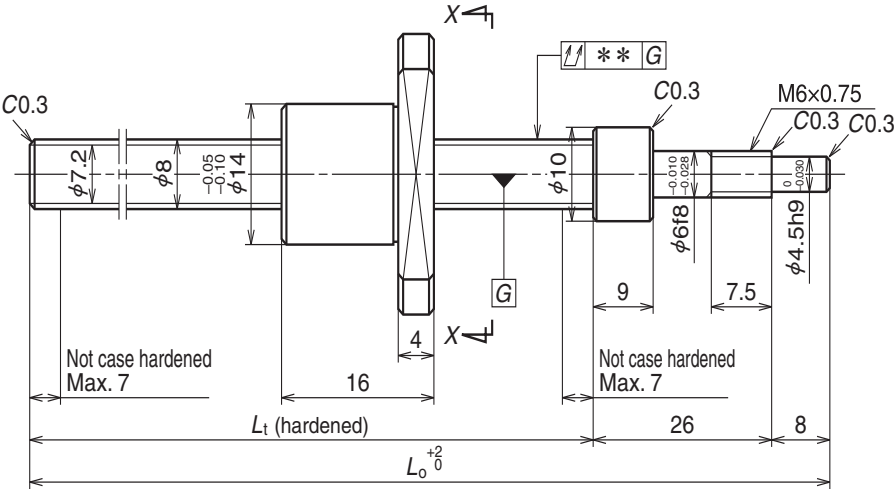
WBK04R-11 (round)



Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L _t -Nut length)	L _t	L ₀
RMA0601C7S-160	100	124	139	160
RMA0601C7S-260	200	224	239	260

Lead accuracy			Shaft run-out**	Mass (kg)	Permissible rotational speed N (min ⁻¹)
Target compensation T	Deviation e _p	Variation v ₃₀₀			
0	0.052	0.052	0.060	0.045	3 000
0	0.085	0.052	0.090	0.065	3 000

Notes: 1. We recommend NSK support bearing kit (page B401).
2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. Permissible rotational speed is determined by d-n value and critical speed. See pages B47 and B349.



Ball screw specification		
Shaft dia.xLead / Direction of turn	8 × 1 / Right	
Ball recirculation	Deflector (bridge)	
Ball dia. / Ball circle dia.	0.800 / 8.2	
Screw shaft root dia.	7.2	
Effective turns of balls	1 × 3	
Accuracy grade / Axial play code	Ct7 / S	
Basic load rating (N)	Dynamic C _a	710
	Static C _{0a}	1 290
Axial play		0.020 or less
Dynamic friction torque (N·cm)		1.0 or less
Spacer ball		None
Factory-packed grease		See Notes 2.

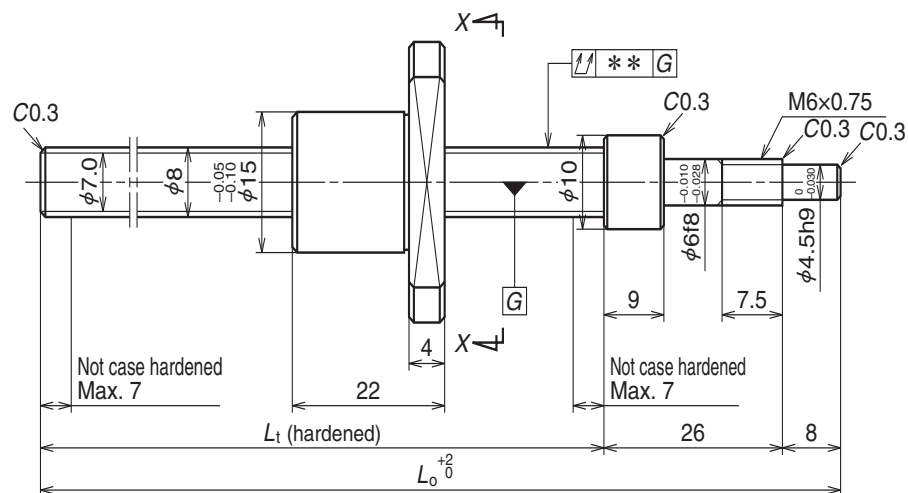
Recommended support unit

For drive side (Fixed)	
WBK06R-11 (round)	

Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L _t -Nut length)	L _t	L _o
RMA0801C7S-180	100	130	146	180
RMA0801C7S-280	200	230	246	280

Notes: 1. We recommend NSK support bearing kit (page B401).
2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. Permissible rotational speed is determined by d·n value and critical speed. See pages B47 and B349.

Lead accuracy			Shaft run-out**	Mass (kg)	Permissible rotational speed N (min ⁻¹)
Target compensation T	Deviation e _p	Variation v ₃₀₀			
0	0.052	0.052	0.060	0.085	3 000
0	0.085	0.052	0.090	0.12	3 000

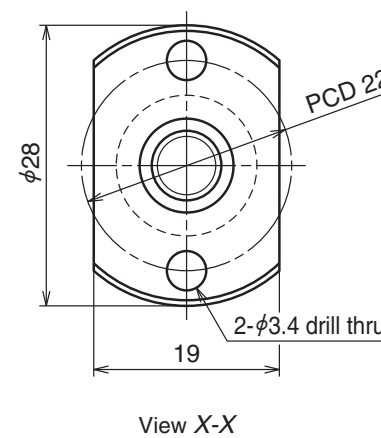


Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L_t -Nut length)		
			L_t	L_o
RMA0801.5C7S-180	100	124	146	180
RMA0801.5C7S-280	200	224	246	280

Notes: 1. We recommend NSK support bearing kit (page B401).

2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.

3. Permissible rotational speed is determined by d·n value and critical speed. See pages B47 and B349.

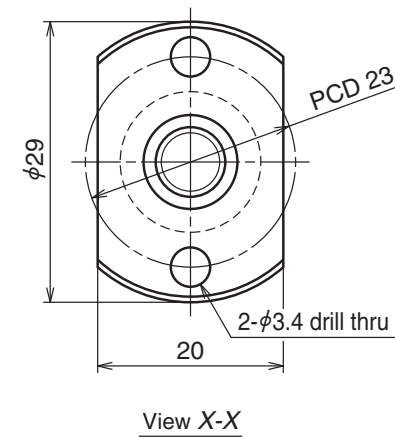
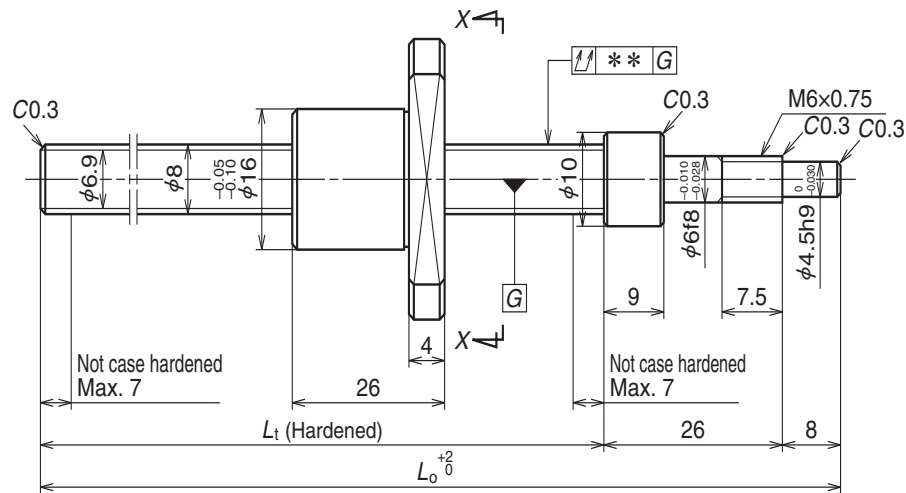


Ball screw specification		
Shaft dia.xLead / Direction of turn		8 × 1.5 / Right
Ball recirculation		Deflector (bridge)
Ball dia. / Ball circle dia.		1.000 / 8.3
Screw shaft root dia.		7.0
Effective turns of balls		1 × 3
Accuracy grade / Axial play code		Ct7 / S
Basic load rating (N)	Dynamic C _a	955
	Static C _{0a}	1 580
Axial play		0.020 or less
Dynamic friction torque (N-cm)		1.0 or less
Spacer ball		None
Factory-packed grease		See Notes 2.

Recommended support unit
For drive side (Fixed)
WBK06R-11 (round)

Unit: mm

Lead accuracy			Shaft run-out** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
Target compensation <i>T</i>	Deviation <i>e_p</i>	Variation <i>v₃₀₀</i>			
0	0.052	0.052	0.060	0.093	3 000
0	0.085	0.052	0.090	0.13	3 000



Ball screw specification		
Shaft dia.xLead / Direction of turn		8 × 2 / Right
Ball recirculation		Deflector (bridge)
Ball dia. / Ball circle dia.		1.200 / 8.3
Screw shaft root dia.		6.9
Effective turns of balls		1 × 3
Accuracy grade / Axial play code		Ct7 / S
Basic load rating (N)	Dynamic C _a	1 260
	Static C _{0a}	1 940
Axial play		0.020 or less
Dynamic friction torque (N·cm)		1.0 or less
Spacer ball		None
Factory-packed grease		See Notes 2.

Recommended support unit

For drive side (Fixed)
WBK06R-11 (round)

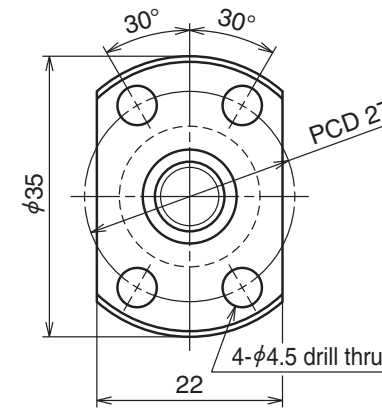
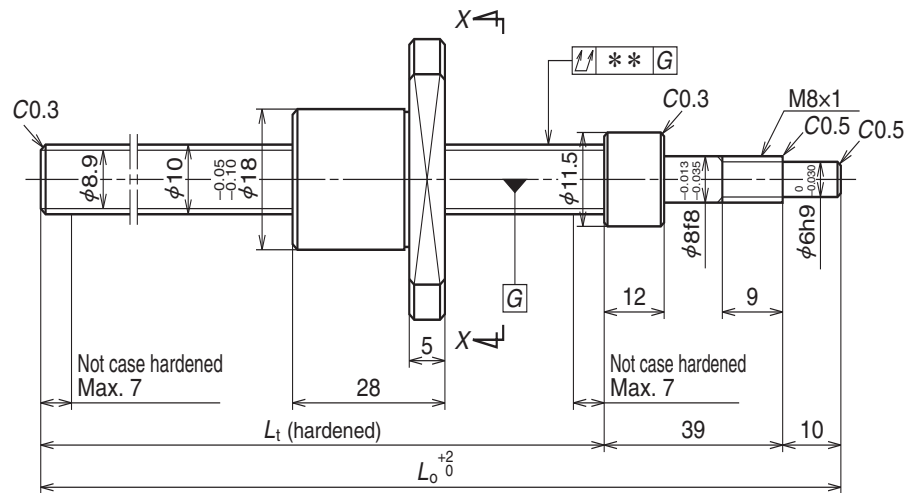
Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L_r -Nut length)		
			L_t	L_o
RMA0802C7S-180	100	120	146	180
RMA0802C7S-280	200	220	246	280

Notes: 1. We recommend NSK support bearing kit (page B401).

2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.

3. Permissible rotational speed is determined by d·n value and critical speed. See pages B47 and B349.

Unit: mm					
Lead accuracy			Shaft run-out** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
Target compensation <i>T</i>	Deviation e_p	Variation v_{300}			
0	0.052	0.052	0.060	0.10	3 000
0	0.085	0.052	0.090	0.14	3 000

View *X-X*

Ball screw specification		
Shaft dia.xLead / Direction of turn		10 × 2 / Right
Ball recirculation		Deflector (bridge)
Ball dia. / Ball circle dia.		1.200 / 10.3
Screw shaft root dia.		8.9
Effective turns of balls		1 × 3
Accuracy grade / Axial play code		Ct7 / S
Basic load rating (N)	Dynamic C _a	1 460
	Static C _{0a}	2 620
Axial play		0.020 or less
Dynamic friction torque (N·cm)		1.0 or less
Spacer ball		None
Factory-packed grease		See Notes 2.

Recommended support unit

For drive side (Fixed)
WBK08-01A (square)
WBK08-11 (round)

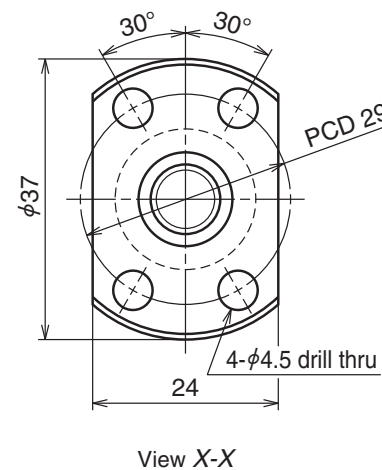
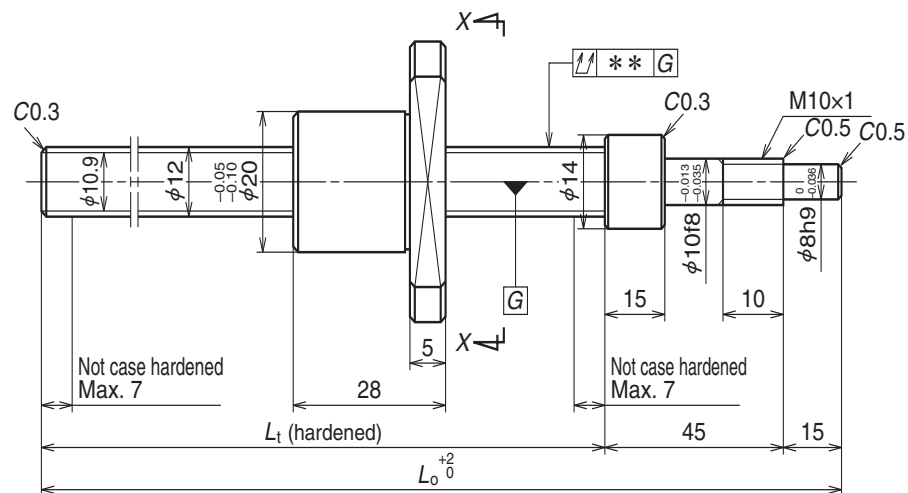
Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L_r -Nut length)		
			L_t	L_o
RMA1002C7S-250	150	173	201	250
RMA1002C7S-350	250	273	301	350

Notes: 1. We recommend NSK support bearing kit (page B389).

2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.

3. Permissible rotational speed is determined by d·n value and critical speed. See pages B47 and B349.

Lead accuracy			Shaft run-out** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
Target compensation <i>T</i>	Deviation <i>e</i> _p	Variation <i>v</i> ₃₀₀			
0	0.085	0.052	0.070	0.19	3 000
0	0.085	0.052	0.100	0.25	3 000



Ball screw specification		
Shaft dia. x Lead / Direction of turn		12 × 2 / Right
Ball recirculation		Deflector (bridge)
Ball dia. / Ball circle dia.		1.200 / 12.3
Screw shaft root dia.		10.9
Effective turns of balls		1 × 3
Accuracy grade / Axial play code		Ct7 / S
Basic load rating (N)	Dynamic C_d	1 590
	Static C_{0a}	3 190
Axial play		0.020 or less
Dynamic friction torque (N-cm)		1.0 or less
Spacer ball		None
Factory-packed grease		See Notes 2.

Recommended support unit
For drive side (Fixed)
WBK10-01A (square)
WBK10-11 (round)

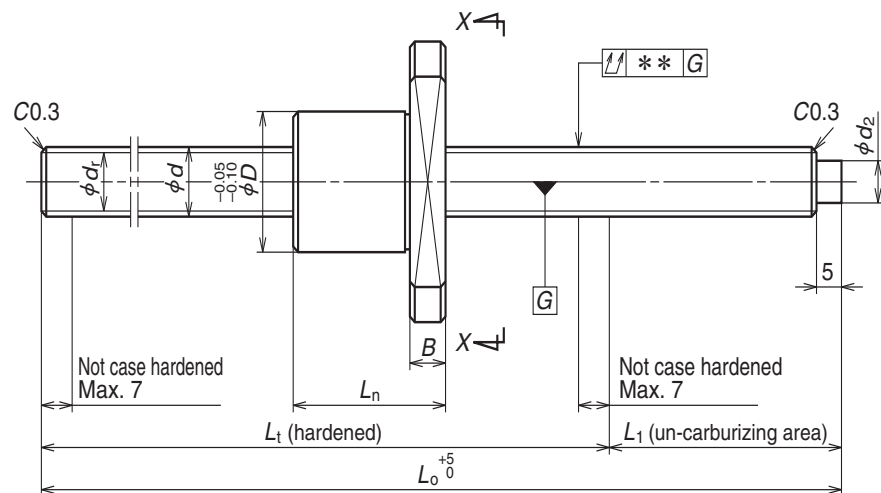
Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L_t -Nut length)		
			L_t	L_o
RMA1202C7S-250	150	162	190	250
RMA1202C7S-350	250	262	290	350

Notes: 1. We recommend NSK support bearing kit (page B389).

2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.

3. Permissible rotational speed is determined by d-n value and critical speed. See pages B47 and B349.

Unit: mm					
Lead accuracy			Shaft run-out** 	Mass (kg)	Permissible rotational speed N (min ⁻¹)
Target compensation T	Deviation e _p	Variation v ₃₀₀			
0	0.060	0.052	0.070	0.26	3 000
0	0.085	0.052	0.100	0.34	3 000



Ball screw No.	Stroke Max. L_t-L_n	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_f	Effective turns of balls	Basic load rating (N)		Axial play Max.
								Dynamic C_a	Static C_{0a}	
RMS0601C7S-300	235	6	1	0.800	6.2	5.3	3	610	920	0.02
RMS0801C7S-300	234	8	1	0.800	8.2	7.3	3	710	1 290	0.02
RMS0801.5C7S-300	228		1.5	1.000	8.3	7.2		955	1 580	
RMS0802C7S-300	224		2	1.200	8.3	7.0		1 260	1 940	
RMS1002C7S-350	262	10	2	1.200	10.3	9.0	3	1 460	2 620	0.02
RMS1202C7S-350	262	12	2	1.200	12.3	11.0	3	1 590	3 190	0.02

Notes: 1. We recommend NSK support unit (page B389) or support kit (page B401).

2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.

See page D13 for details.

3. Seal is not installed.

4. Permissible rotational speed is determined by d-n value and critical speed. See pages B47 and B349.

Screw shaft ø6

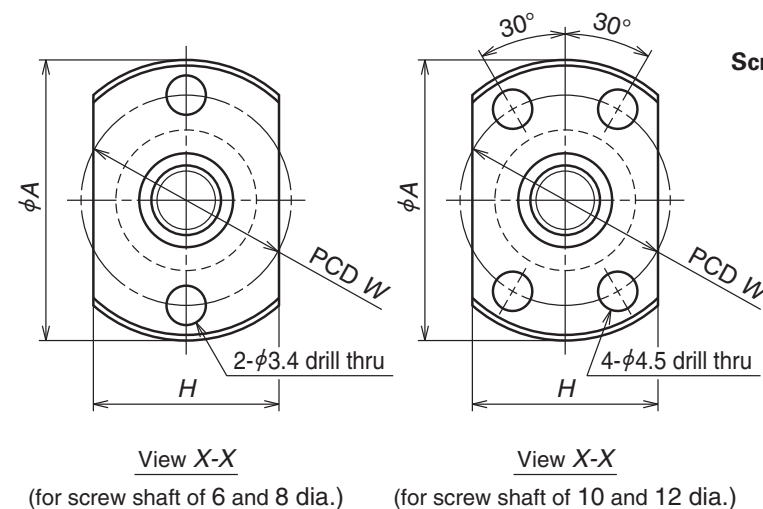
Lead 1

Screw shaft ø8

Lead 1, 1.5, 2

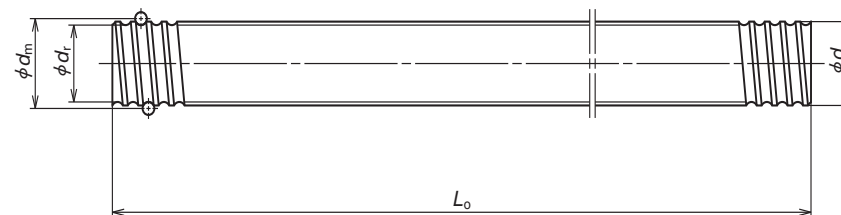
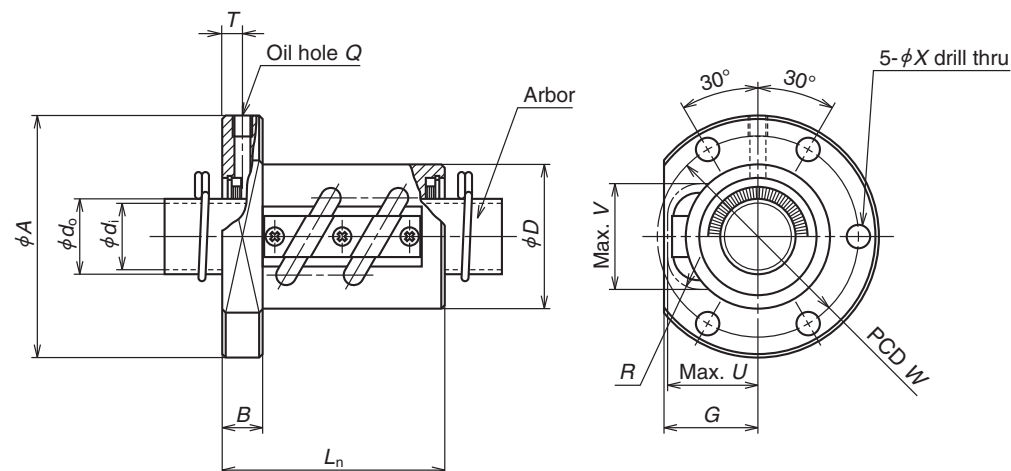
Screw shaft ø10, ø12

Lead 2



Unit: mm

Nut dimensions						Screw shaft dimensions				Lead accuracy			Shaft run-out** 	Mass (Kg)	Permissible rotational speed N (min ⁻¹)
<i>D</i>	<i>A</i>	<i>H</i>	<i>B</i>	<i>L_n</i>	<i>W</i>	Effective thread length <i>L_t</i>	Shaft end		Overall length <i>L_o</i>	Target compensation <i>T</i>	Deviation <i>e_p</i>	Variation <i>v₃₀₀</i>			
							<i>L₁</i>	<i>d₂</i>							
12	24	16	3.5	15	18	250	50	4	300	0	0.085	0.052	0.09	0.075	3 000
14	27	18	4	16	21	250	50	6	300	0	0.085	0.052	0.09	0.13	
15	28	19		22	22									0.14	
16	29	20		26	23									0.15	
18	35	22	5	28	27	290	60	8	350	0	0.085	0.052	0.10	0.25	
20	37	24	5	28	29	290	60	10	350	0	0.085	0.052	0.10	0.35	

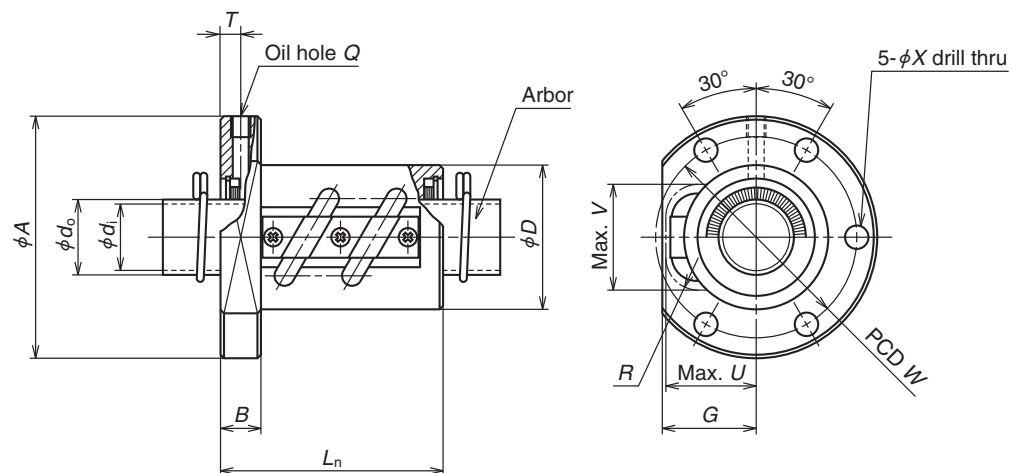


Ball nut No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_b</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial play Max.	Ball nut dimensions Outside dia. <i>D</i>
							Dynamic <i>C_a</i>	Static <i>C_{0a}</i>		
RNFTL 1003A3.5	10	3	2.381	10.65	8.1	3.5×1	4 440	6 700	0.10	20
RNFTL 1006A2.5S	10	6	2.381	10.65	8.1	2.5×1	3 280	4 730	0.10	20
RNFTL 1208A2.5S	12	8	2.778	12.65	9.6	2.5×1	4 290	6 610	0.10	25
RNFTL 1404A3.5S	14	4	2.778	14.5	11.5	3.5×1	6 310	10 800	0.10	25
RNFTL 1405A2.5S	14	5	3.175	14.5	11.0	2.5×1	6 170	9 940	0.10	30
RNFTL 1610A2.5	16	10	3.175	16.75	13.3	2.5×1	6 810	11 600	0.10	30
RNFTL 1808A3.5	18	8	4.762	18.5	13.6	3.5×1	15 500	26 200	0.15	34
RNFTL 1808A3.5S	18	8	4.762	18.5	13.6	3.5×1	15 500	26 200	0.15	34
RNFTL 2005A2.5	20	5	3.175	20.5	17.0	2.5×1	7 500	14 200	0.10	40
RNFTL 2005A2.5S	20	5	3.175	20.5	17.0	2.5×1	7 500	14 200	0.10	40
RNFTL 2010A2.5	20	10	4.762	21.25	16.2	2.5×1	12 700	21 600	0.15	40
RNFTL 2010A2.5S	20	10	4.762	21.25	16.2	2.5×1	12 700	21 600	0.15	40
RNFTL 2505A5	25	5	3.175	25.5	22.0	2.5×2	15 100	36 300	0.10	42
RNFTL 2505A5S	25	5	3.175	25.5	22.0	2.5×2	15 100	36 300	0.10	42
RNFTL 2510A2.5	25	10	6.35	26	19.0	2.5×1	20 500	34 900	0.20	44
RNFTL 2510A2.5S						2.5×1	20 500	34 900		44
RNFTL 2510A5						2.5×2	37 300	69 800		44
RNFTL 2510A5S						2.5×2	37 300	69 800		44

Notes: 1. Protruding portion of tube does not interfere with ball nut housing if its dimensions corresponding to U and V are large enough.
2. Actual screw shaft length may become slightly longer than nominal length L_0 due to manufacturing tolerance.
3. Only ball nut part numbers ending "S" are equipped with seals. External dimensions of those with seals are the same as those without.
In ball nut side view drawing, above the center line there is a seal, and beneath it there is no seal.
Seal for those with shaft diameter of 14 mm or less is made of synthetic resin. Seal for those of 16 mm or more is a "Brush" seal.

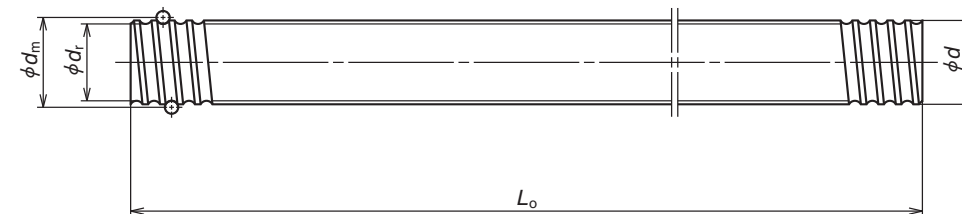
																				Unit: mm																
Ball nut dimensions											Nut Mass. (kg)	Arbor		Screw shaft					Shaft mass/m (kg)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)															
Flange			Length	Bolt hole		Oil hole		Projecting tube				Outside dia.	Bore	Standard length			Screw shaft																			
A	G	B	L _n	W	X	Q	T	U	V	R		d _o	d	L _s			No.																			
40	15	6	34	30	4.5	M3x0.5	3.0	15	15	7	0.092	8.1	6.1	400	800	—	RS1003A··	0.50	—	—																
40	15	6	36	30	4.5	M3x0.5	3.5	15	15	5	0.095	8.1	6.1	400	800	—	RS1006A··	0.56	1.1	0.6																
45	19	8	46	35	4.5	M3x0.5	5.5	19	18	7	0.18	9.6	7.6	400	800	—	RS1208A··	0.74	1.8	0.9																
50	19	10	43	40	4.5	M6x1	5.0	19	20	7	0.20	11.5	9.5	500	1 000	—	RS1404A··	1.02	2.0	1.0																
50	22	10	45	40	4.5	M6x1	5.0	22	21	8	0.26	11.0	9.0	500	1 000	—	RS1405A··	1.00	2.4	1.2																
53	23	10	54	41	5.5	M6x1	5.5	23	22.5	8	0.28	13.3	11.3	500	1 000	1 500	RS1610A··	1.37	2.7	1.4																
63	27	12	58	49	6.6	M6x1	6.0	27	27	8	0.43	13.6	11.6	500	1 000	1 500	RS1808A··	1.60	5.2	2.6																
60	28	10	46	50	4.5	M6x1	5.0	28	27	10	0.42	17.0	14.6	500	1 000	2 000	RS2005A··	2.17	3.5	1.8																
67	30	12	59	53	6.6	M6x1	6.0	30	29	12	0.55	16.2	13.8	500	1 000	2 000	RS2010A··	2.18	7.1	3.6																
71	28	12	66	57	6.6	M6x1	6.0	28	31	10	0.62	22.0	19.6	1 000	2 000	2 500	RS2505A··	3.47	6.5	3.3																
80	34	15	62	62	9	M6x1	7.5	34	37	17	0.75	19.0	16.6	1 000	2 000	2 500	RS2510A··	3.13	13	6.5																
80	34	15	92	62	9	M6x1	7.5	34	37	17									18	9.0																

4. Nut assembly with arbor and screw shaft are separate at time of delivery.
5. Value obtained by dividing standard screw shaft length by 100 mm will be entered at end of the part number where marked with ···.
6. Items in stock do not have surface treatment. For details of standard stock products, contact NSK.
7. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
8. Internal spatial volume of nut and volume of grease to be replenished are values for ball screws with seals. Recommended amount for replenishing is approximately 50% of nut's internal space. For ball screws without seals, apply grease to screw shaft surface or move ball nut by hand while filling them with grease so that grease permeates all areas. See page D16 for details.



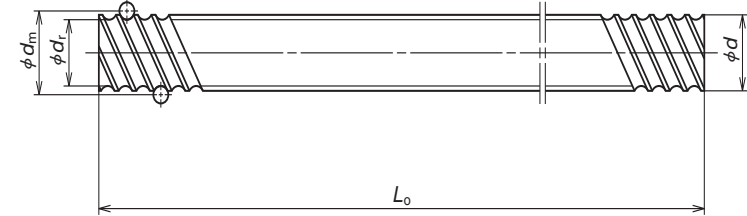
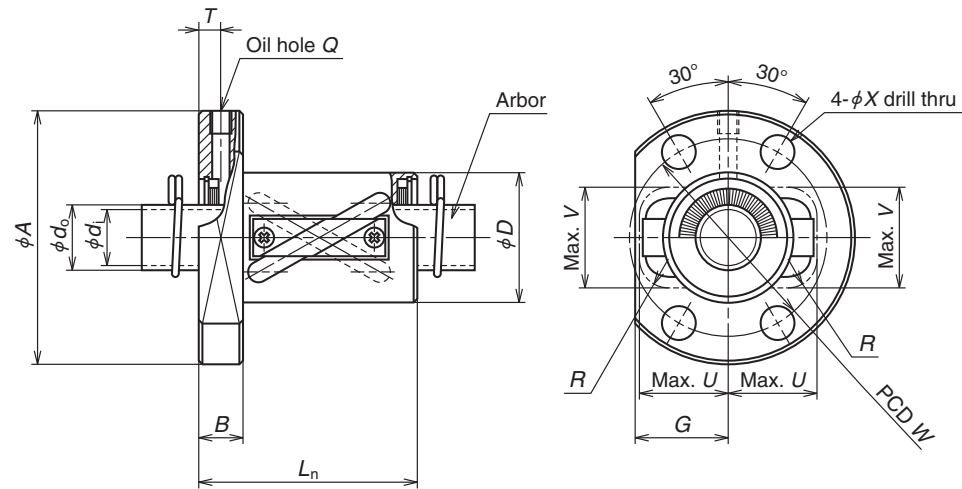
Ball nut No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial play Max.	Ball nut dimensions
							Dynamic <i>C_a</i>	Static <i>C_{0a}</i>		Outside dia. <i>D</i>
RNFTL 2806A2.5 RNFTL 2806A2.5S	28	6	3.175	28.5	25.0	2.5×1	8 760	20 200	0.10	50
RNFTL 2806A5 RNFTL 2806A5S						2.5×2	15 900	40 500		50
RNFTL 3210A5 RNFTL 3210A5S	32	10	6.35	33.75	27.0	2.5×2	42 000	91 800	0.20	55
RNFTL 3610A2.5 RNFTL 3610A2.5S	36	10	6.35	37	30.0	2.5×1	24 700	50 800	0.20	60
RNFTL 3610A5 RNFTL 3610A5S						2.5×2	44 900	102 000		60
RNFTL 4010A7 RNFTL 4010A7S	40	10	6.35	41.75	35.0	3.5×2	63 100	164 000	0.20	65
RNFTL 4512A5 RNFTL 4512A5S	45	12	7.144	46.5	39.0	2.5×2	58 500	147 000	0.23	70
RNFTL 5010A7 RNFTL 5010A7S	50	10	6.35	51.75	45.0	3.5×2	70 100	205 000	0.20	80
RNFTL 5016A5 RNFTL 5016A5S	50	16	9.525	52	42.0	2.5×2	117 000	299 000	0.23	85

Notes: 1. Protruding portion of tube does not interfere with ball nut housing if its dimensions corresponding to U and V are large enough.
2. Actual screw shaft length may become slightly longer than nominal length L_n due to manufacturing tolerance.
3. Only ball nut part numbers ending "S" are equipped with seals. External dimensions of those with seals are the same as those without.
In ball nut side view drawing, above the center line there is a seal, and beneath it there is no seal.
Seal for those with shaft diameter of 14 mm or less is made of synthetic resin. Seal for those of 16 mm or more is a "Brush" seal.



																				Unit: mm		
Ball nut dimensions											Nut Mass. (kg)	Arbor		Screw shaft					Shaft mass/m (kg)	Internal spatial volume of nut, (cm ³)	Standard volume of gears representing (cm ³)	
Flange			Length	Bolt hole		Oil hole		Projecting tube				Outside dia	Bore	Standard length			Screw shaft No.					
A	G	B	L _n	W	X	Q	T	U	V	R		d _o	d	L _p								
79	33	15	55	65	6.6	M6×1	7.5	33	34	10	0.85	25.0	22.6	1 000	2 000	2 500	RS2806A··	4.47	5.9	3.0		
79	33	15	79	65	6.6	M6×1	7.5	33	34	10	1.07			8.4	4.2							
97	39	18	97	75	11	M6×1	9.0	39	42	17	1.55	27.0	24.6	1 000	2 000	3 000	RS3210A··	5.53	29	15		
102	42	18	68	80	11	M6×1	9.0	42	46	17	1.47	30.0	27.6	1 000	2 000	3 000	RS3610A··	6.91	21	11		
102	42	18	98	80	11	M6×1	9.0	42	46	17	1.80			33	17							
114	44	20	120	90	14	M6×1	10.0	44	50	20	2.49	35.0	31.8	2 000	3 000	4 000	RS4010A··	8.87	42	21		
130	47	22	116	100	18	M6×1	11.0	47	55	20	3.07	39.0	35.8	2 000	3 000	4 000	RS4512A··	11.16	49	25		
140	52	22	122	110	18	M6×1	11.0	52	59	20	4.06	45.0	41.8	2 000	3 000	4 000	RS5010A··	14.15	53	27		
163	57	28	146	125	22	M6×1	14.0	57	63	25	6.42	42.0	38.8	2 000	3 000	4 000	RS5016A··	13.48	94	47		

4. Nut assembly with arbor and screw shaft are separate at time of delivery.
5. Value obtained by dividing standard screw shaft length by 100 mm will be entered at end of the part number where marked with ...
6. Items in stock do not have surface treatment. For details of standard stock products, contact NSK.
7. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
8. Internal spatial volume of nut and volume of grease to be replenished are values for ball screws with seals. Recommended amount for replenishing is approximately 50% of nut's internal space. For ball screws without seals, apply grease to screw shaft surface or move ball nut by hand while filling them with grease so that grease permeates all areas. See page D16 for details.



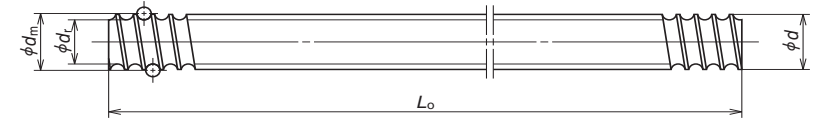
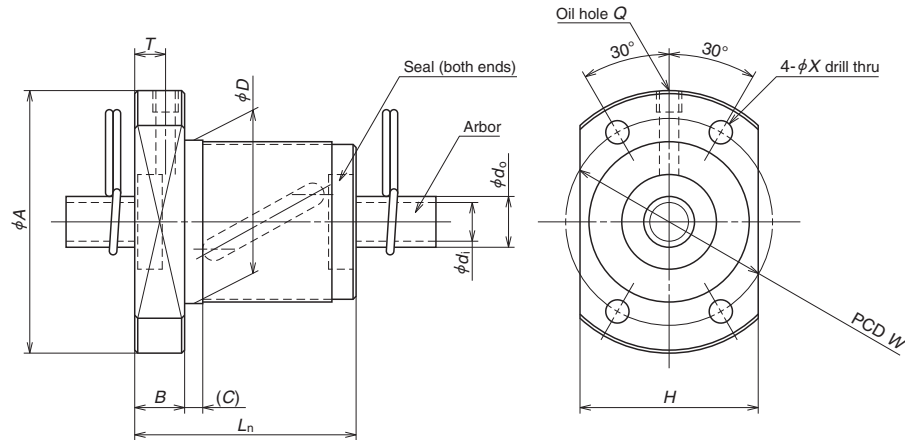
Ball nut No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls × Circuits	Basic load rating (N)		Axial play Max.	Ball nut dimensions Outside dia. <i>D</i>
							Dynamic <i>C_a</i>	Static <i>C_{0a}</i>		
RNFTL 1212A3	12	12	2.381	12.65	10.1	1.5 × 2	3 900	6 250	0.10	24
RNFTL 1616A3 RNFTL 1616A3S	16	16	2.778	16.65	13.6	1.5 × 2	5 440	9 550	0.10	30
RNFTL 2020A3 RNFTL 2020A3S	20	20	3.175	20.75	17.3	1.5 × 2	8 080	15 700	0.10	35
RNFTL 2525A3 RNFTL 2525A3S	25	25	3.969	26	22.0	1.5 × 2	12 100	24 500	0.12	45
RNFTL 3232A3 RNFTL 3232A3S	32	32	4.762	33.25	28.0	1.5 × 2	17 600	37 700	0.15	55
RNFTL 4040A3 RNFTL 4040A3S	40	40	6.35	41.75	35.0	1.5 × 2	28 100	62 900	0.20	70

Notes: 1. Protruding portion of tube does not interfere with ball nut housing if its dimensions corresponding to U and V are large enough.
2. Actual screw shaft length may become slightly longer than nominal length L_o due to manufacturing tolerance.
3. Only ball nut part numbers ending "S" are equipped with seals. External dimensions of those with seals are the same as those without.
In ball nut side view drawing, above the center line there is a seal, and beneath it there is no seal.
Seal for those with shaft diameter of 14 mm or less is made of synthetic resin. Seal for those of 16 mm or more is a "Brush" seal.

Unit: mm

Ball nut dimensions											Nut Mass (kg)	Arbor		Screw shaft				Shaft mass/m (kg)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Flange		Length	Bolt hole		Oil hole		Projecting tube			Outside dia.		Bore	Standard length			Screw shaft No.				
A	G	B	L _n	W	X	Q	T	U	V	R		d _o	d _i	L _o						
44	17	8	44	34	4.5	M3×0.5	4.0	17	16	5	0.16	10.1	8.1	400	800	—	RS1212A··	0.74	1.7	0.9
55	22	10	50	43	6.6	M6×1	5.0	22	22	7	0.29	13.6	11.6	500	1 000	1 500	RS1616A··	1.37	2.8	1.4
68	25	12	59	52	9	M6×1	6.0	25	27	8	0.49	17.3	14.9	500	1 000	2 000	RS2020A··	2.19	4.9	2.5
80	31	12	69	63	9	M6×1	6.0	31	32	10	0.80	22.0	19.6	1 000	2 000	2 500	RS2525A··	3.43	9.1	4.6
100	37	15	84	80	11	M6×1	7.5	37	40	12	1.46	28.0	25.6	1 000	2 000	3 000	RS3232A··	5.71	19	9.5
120	46	18	103	95	14	M6×1	9.0	46	49	15	2.69	35.0	31.8	2 000	3 000	4 000	RS4040A··	8.82	39	20

4. Nut assembly with arbor and screw shaft are separate at time of delivery.
5. Value obtained by dividing standard screw shaft length by 100 mm will be entered at end of the part number where marked with ···.
6. Items in stock do not have surface treatment. For details of standard stock products, contact NSK.
7. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
8. Internal spatial volume of nut and volume of grease to be replenished are values for ball screws with seals. Recommended amount for replenishing is approximately 50% of nut's internal space. For ball screws without seals, apply grease to screw shaft surface or move ball nut by hand while filling them with grease so that grease permeates all areas. See page D16 for details.

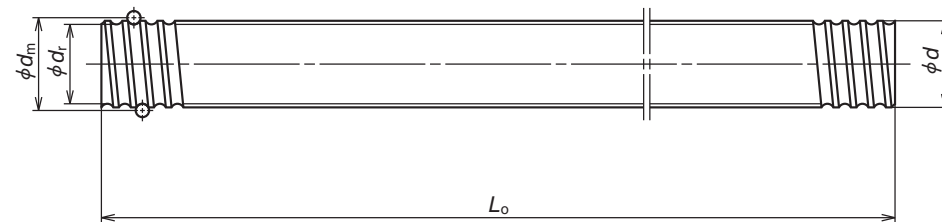
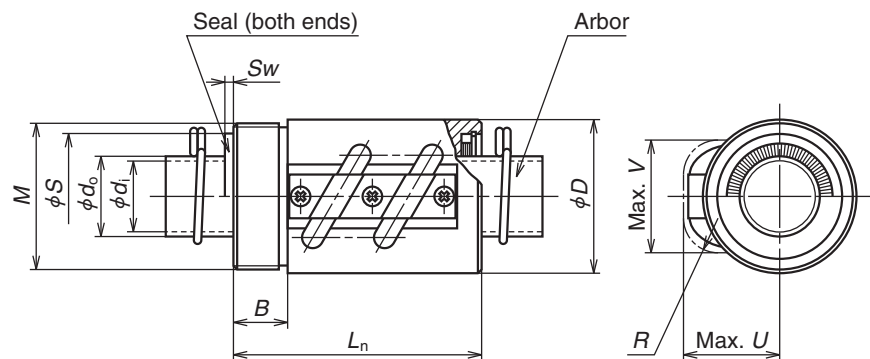


Ball nut No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial play Max.	Ball nut dimensions Outside dia. <i>D</i>
							Dynamic <i>C_a</i>	Static <i>C_{0b}</i>		
RNFBL 1006A2.5S	10	6	2.381	10.65	8.1	2.5×1	3 280	4 730	0.10	26
RNFBL 1208A2.5S	12	8	2.778	12.65	9.6	2.5×1	4 290	6 610	0.10	29
RNFBL 1404A3.5S	14	4	2.778	14.5	11.5	3.5×1	6 310	10 800	0.10	31
RNFBL 1405A2.5S	14	5	3.175	14.5	11.0	2.5×1	6 170	9 940	0.10	32
RNFBL 1808A3.5S	18	8	4.762	18.5	13.6	3.5×1	15 500	26 200	0.15	50
RNFBL 2005A2.5S	20	5	3.175	20.5	17.0	2.5×1	7 500	14 200	0.10	40
RNFBL 2010A2.5S	20	10	4.762	21.25	16.2	2.5×1	12 700	21 600	0.15	52
RNFBL 2505A2.5S	25	5	3.175	25.5	22.0	2.5×1	8 340	18 100	0.10	43
RNFBL 2505A5S						2.5×2	15 100	36 300		
RNFBL 2510A2.5S	25	10	6.35	26	19.0	2.5×1	20 500	34 900	0.20	60
RNFBL 2510A5S						2.5×2	37 300	69 800		
RNFBL 2806A2.5S	28	6	3.175	28.5	25.0	2.5×1	8 760	20 200	0.10	50
RNFBL 2806A5S						2.5×2	15 900	40 500		
RNFBL 3210A2.5S	32	10	6.35	33.75	27.0	2.5×1	23 100	45 900	0.20	67
RNFBL 3210A5S						2.5×2	42 000	91 800		
RNFBL 3610A2.5S	36	10	6.35	37	30.0	2.5×1	24 700	50 800	0.20	70
RNFBL 3610A5S						2.5×2	44 900	102 000		
RNFBL 4010A5S	40	10	6.35	41.75	35.0	2.5×2	47 200	116 000	0.20	76

- Notes: 1. Actual screw shaft length may become slightly longer than nominal length L_0 due to manufacturing tolerance.
2. Nut assembly with arbor and screw shaft are separate at time of delivery.
3. Value obtained by diving standard screw shaft length by 100 mm will be entered at end of the part number where marked with ...

Unit: mm																		
Ball nut dimensions									Nut Mass. (kg)	Arbor		Screw shaft				Shaft mass/m (kg)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Flange			Length		Bolt hole		Oil hole			Outside dia.	Bore	Standard length			Screw shaft No.			
A	H	B	L _n	(C)	W	X	Q	T	d _o	d _i	L _s							
42	29	8	36	3	34	4.5	M3×0.5	5.0	0.16	8.1	6.1	400	800	—	RS1006A··	0.56	1.1	0.6
45	32	8	44	3	37	4.5	M3×0.5	5.5	0.21	9.6	7.6	400	800	—	RS1208A··	0.81	1.6	0.8
50	37	10	40	4	40	4.5	M6×1	5.0	0.25	11.5	9.5	500	1 000	—	RS1404A··	1.02	2.4	1.2
50	38	10	40	4	40	4.5	M6×1	5.0	0.26	11.0	9.0	500	1 000	—	RS1405A··	1.00	1.9	1.0
80	60	12	61	4	65	6.6	M6×1	6.0	1.00	13.6	11.6	500	1 000	1 500	RS1808A··	1.60	5.8	2.9
60	46	10	40	4	50	4.5	M6×1	5.0	0.37	17.0	14.6	500	1 000	2 000	RS2005A··	2.17	2.8	1.4
82	64	12	61	5	67	6.6	M6×1	6.0	1.05	16.2	13.8	500	1 000	2 000	RS2010A··	2.18	7.6	3.8
67	50	10	40	4	55	5.5	M6×1	5.0	0.40	22.0	19.6	1 000	2 000	2 500	RS2505A··	3.47	3.5	1.8
			0.50						4.7								2.4	
96	72	15	66	5	78	9.0	M6×1	7.5	1.52	19.0	16.6	1 000	2 000	2 500	RS2510A··	3.13	14	7.0
			1.99						19								9.5	
80	60	12	47	5	65	6.6	M6×1	6.0	0.70	25.0	22.6	1 000	2 000	2 500	RS2806A··	4.47	4.5	2.3
			0.87						7.6								3.8	
103	78	15	67	5	85	9.0	M6×1	7.5	1.72	27.0	24.6	1 000	2 000	3 000	RS3210A··	5.53	20	10
			2.25						28								14	
110	82	17	69	5	90	11.0	M6×1	8.5	1.97	30.0	27.6	1 000	2 000	3 000	RS3610A··	6.91	21	11
			2.53						29								15	
116	88	17	99	5	96	11.0	M6×1	8.5	2.86	35.0	31.8	2 000	3 000	4 000	RS4010A··	8.87	36	18

4. Items in stock do not have surface treatment. For details of standard stock products, contact NSK.
5. Seal for those with shaft diameter of 14 mm or less is made of synthetic resin. Seal for those of 16 mm or more is a "Brush" seal.
6. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
7. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.



Unit: mm

Ball nut No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_i</i>	Effective turns of balls × Circuits	Basic load rating (N)		Axial play Max.	Ball nut dimensions Outside dia. <i>D</i>
							Dynamic <i>C_a</i>	Static <i>C_{0a}</i>		
RNCT 1003A3.5	10	3	2.381	10.65	8.1	3.5 × 1	4 440	6 700	0.10	20
RNCT 1404A3.5S	14	4	2.778	14.5	11.5	3.5 × 1	6 310	10 800	0.10	25
RNCT 1405A2.5S	14	5	3.175	14.5	11.0	2.5 × 1	6 170	9 940	0.10	30
RNCT 1808A3.5	18	8	4.762	18.5	13.6	3.5 × 1	15 500	26 200	0.15	34
RNCT 1808A3.5S										
RNCT 2005A2.5	20	5	3.175	20.5	17.0	2.5 × 1	7 500	14 200	0.10	40
RNCT 2005A2.5S										
RNCT 2505A5	25	5	3.175	25.5	22.0	2.5 × 2	15 100	36 300	0.10	42
RNCT 2505A5S										
RNCT 2510A5	25	10	6.35	26	19.0	2.5 × 2	37 300	69 800	0.20	44
RNCT 2510A5S										
RNCT 2806A5	28	6	3.175	28.5	25.0	2.5 × 2	15 900	40 500	0.10	50
RNCT 2806A5S										
RNCT 3210A5	32	10	6.35	33.75	27.0	2.5 × 2	42 000	91 800	0.20	55
RNCT 3210A5S										
RNCT 3610A5	36	10	6.35	37	30.0	2.5 × 2	44 900	102 000	0.20	60
RNCT 3610A5S										
RNCT 4010A7	40	10	6.35	41.75	35.0	3.5 × 2	63 100	164 000	0.20	65
RNCT 4010A7S										
RNCT 4512A5	45	12	7.144	46.5	39.0	2.5 × 2	58 500	147 000	0.23	70
RNCT 4512A5S										
RNCT 5010A7	50	10	6.35	51.75	45.0	3.5 × 2	70 100	205 000	0.20	80
RNCT 5010A7S										
RNCT 5016A5	50	16	9.525	52	42.0	2.5 × 2	117 000	299 000	0.23	85
RNCT 5016A5S										

Notes: 1. Protruding portion of tube does not interfere with ball nut housing if its dimensions corresponding to U and V are large enough.

2. Actual screw shaft length may become slightly longer than nominal length L_o due to manufacturing tolerance.

3. Only ball nut part numbers ending "S" are equipped with seals. External dimensions of those with seals are the same as those without.

In ball nut side view drawing, above the center line there is a seal, and beneath it there is no seal.

Seal for those with shaft diameter of 14 mm or less is made of synthetic resin. Seal for those of 16 mm or more is a "Brush" seal.

Ball nut dimensions						Nut Mass. (kg)	Seal dimensions		Arbor		Screw shaft				Shaft mass/m (kg)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
V-thread		Length	Projecting tube				Diameter	Thickness	Outside dia.	Bore	Standard length			Screw shaft No.			
M	B		L _n	U	V						R	S	Sw				
M18 × 1	10	38	15	15	7	0.049	—	—	8.1	6.1	400	800	—	RS1003A··	0.50	—	—
M24 × 1	10	43	19	20	7	0.083	—	—	11.5	9.5	500	1 000	—	RS1404A··	1.02	2.7	1.4
M26 × 1.5	10	45	22	21	8	0.15	—	—	11.0	9.0	500	1 000	—	RS1405A··	1.00	3.1	1.6
M32 × 1.5	12	58	27	27	8	0.21	28.5	2.5	13.6	11.6	500	1 000	1 500	RS1808A··	1.60	6.6	3.3
M36 × 1.5	12	48	28	27	10	0.28	29.5	2.5	17.0	14.6	500	1 000	2 000	RS2005A··	2.17	4.8	2.4
M40 × 1.5	15	69	28	31	10	0.38	34.5	2.5	22.0	19.6	1 000	2 000	2 500	RS2505A··	3.47	8.4	4.2
M42 × 1.5	15	92	34	37	17	0.49	38.5	2.5	19.0	16.6	1 000	2 000	2 500	RS2510A··	3.13	21	1
M45 × 1.5	15	79	33	34	10	0.68	37.5	2.5	25.0	22.6	1 000	2 000	2 500	RS2806A··	4.47	9.7	4.9
M50 × 1.5	18	97	39	42	17	0.79	45.5	2.5	27.0	24.6	1 000	2 000	3 000	RS3210A··	5.53	32	16
M55 × 2	18	98	42	46	17	0.97	50.5	3.0	30.0	27.6	1 000	2 000	3 000	RS3610A··	6.91	32	16
M60 × 2	25	125	44	50	20	1.37	54.5	3.0	35.0	31.8	2 000	3 000	4 000	RS4010A··	8.87	51	26
M65 × 2	30	124	47	55	20	1.42	60.5	3.0	39.0	35.8	2 000	3 000	4 000	RS4512A··	11.16	60	30
M75 × 2	40	140	52	59	20	2.41	64.5	3.0	45.0	41.8	2 000	3 000	4 000	RS5010A··	14.15	76	38
M80 × 2	40	158	57	63	25	3.14	68.5	3.0	42.0	38.8	2 000	3 000	4 000	RS5016A··	13.48	114	57

4. Nut assembly with arbor and screw shaft are separate at time of delivery.

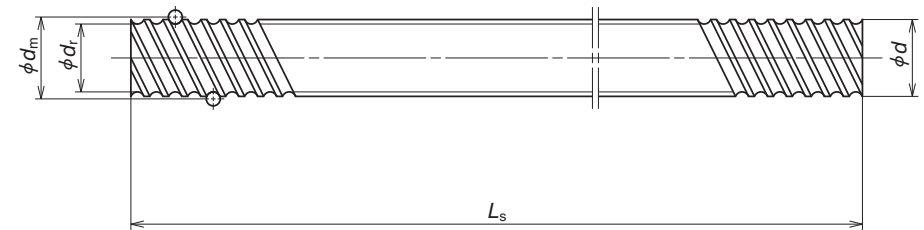
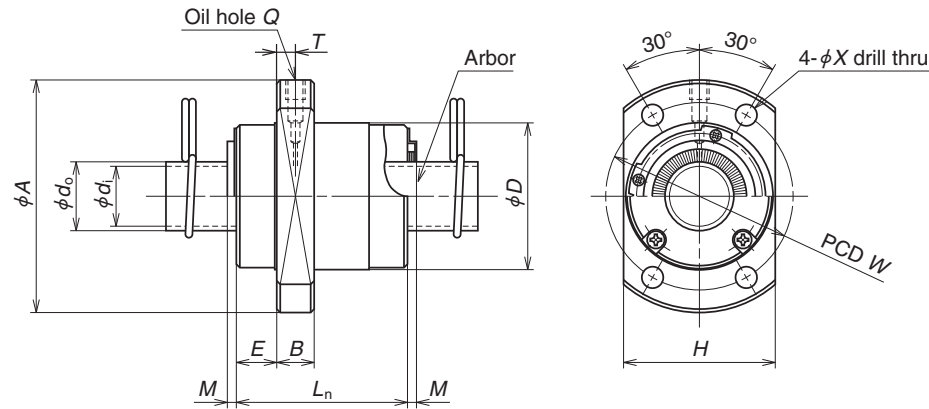
5. Value obtained by dividing standard screw shaft length by 100 mm will be entered at end of the part number where marked with ···.

6. Items in stock do not have surface treatment. For details of standard stock products, contact NSK.

7. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.

8. Internal spatial volume of nut and volume of grease to be replenished are values for ball screws with seals.

Recommended amount for replenishing is approximately 50% of nut's internal space. For ball screws without seals, apply grease to screw shaft surface or move ball nut by hand while filling them with grease so that grease permeates all areas. See page D16 for details.

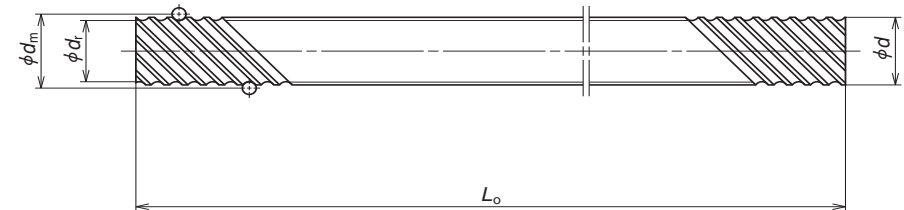
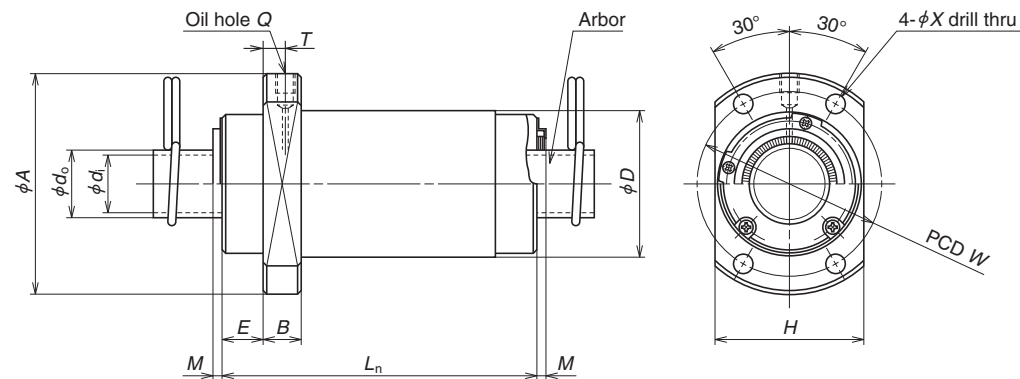


Ball nut No.	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_i	Effective turns of balls Turns $\times$ Circuits	Basic load rating (N)		Axial play Max.	Ball nut dimensions Outside dia. D
							Dynamic C_d	Static C_{sa}		
RNFCL 1212A3 RNFCL 1212A6	12	12	2.381	12.65	10.1	1.7 $\times$ 2 1.7 $\times$ 4	4 350 7 890	6 580 13 200	0.10	26
RNFCL 1520A3 RNFCL 1520A6S	15	20	3.175	15.5	12.2	1.7 $\times$ 2	7 510	12 300	0.10	33
RNFCL 1616A3 RNFCL 1616A3S RNFCL 1616A6 RNFCL 1616A6S	16	16	2.778	16.65	13.5	1.7 $\times$ 2 1.7 $\times$ 4	6 060 11 000	10 300 20 500	0.10	32
RNFCL 2020A3 RNFCL 2020A3S RNFCL 2020A6 RNFCL 2020A6S	20	20	3.175	20.75	17.3	1.7 $\times$ 2 1.7 $\times$ 4	9 000 16 300	16 700 33 400	0.10	39
RNFCL 2525A3 RNFCL 2525A3S RNFCL 2525A6 RNFCL 2525A6S	25	25	3.969	26	22.0	1.7 $\times$ 2 1.7 $\times$ 4	13 400 24 400	26 100 52 200	0.12	47
RNFCL 3232A3 RNFCL 3232A3S RNFCL 3232A6 RNFCL 3232A6S	32	32	4.762	33.25	28.0	1.7 $\times$ 2 1.7 $\times$ 4	19 600 35 600	39 800 79 600	0.15	58
RNFCL 4040A3 RNFCL 4040A3S RNFCL 4040A6 RNFCL 4040A6S	40	40	6.35	41.75	35.0	1.7 $\times$ 2 1.7 $\times$ 4	31 300 56 900	66 800 134 000	0.20	73
RNFCL 5050A3 RNFCL 5050A3S RNFCL 5050A6 RNFCL 5050A6S	50	50	7.938	52.25	44.0	1.7 $\times$ 2 1.7 $\times$ 4	46 800 85 000	104 000 209 000	0.25	90

Ball nut dimensions											Nut Mass. (kg)	Arbor		Screw shaft				Shaft mass/m (kg)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Flange			Length			Bolt hole		Oil hole		Outside dia. <i>d</i> _o		Bore <i>d</i> _i	Standard length			Screw shaft No.				
A	H	B	E	L _n	M	W	X	Q	T				L _s							
44	28	6	9	30	—	35	4.5	M3 × 0.5	3.0	0.12	10.1	8.1	400	800	—	RS1212A··	0.74	—	—	
51	35	10	11	45	— 3	42	4.5	M6 × 1	5.0	0.28	12.2	10.2	500	1 000	1 500	RS1520A··	1.15	3.3	1.7	
53	34	10	10	38	— 3	42	4.5	M6 × 1	5.0	0.23	13.5	11.5	500	1 000	1 500	RS1616A··	1.37	2.6	1.3	
					— 3													2.6	1.3	
					— 3															
62	41	10	11.5	46	— 3	50	5.5	M6 × 1	5.0	0.37	17.3	14.9	500	1 000	2 000	RS2020A··	2.19	4.4	2.2	
					— 3													4.9	2.5	
					— 3															
74	49	12	13	55	— 3	60	6.6	M6 × 1	6.0	0.62	22.0	19.6	1 000	2 000	2 500	RS2525A··	3.43	8.2	4.1	
					— 3													8.9	4.5	
					— 3															
92	60	12	16	70	— 3	74	9	M6 × 1	5.5	1.10	28.0	25.6	1 000	2 000	3 000	RS3232A··	5.71	16	8.0	
					— 3													17	8.5	
					— 3															
114	75	15	19.5	85	— 3.5	93	11	M6 × 1	6.5	2.09	35.0	31.8	2 000	3 000	4 000	RS4040A··	8.82	32	16	
					— 3.5													33	17	
					— 3.5															
135	92	20	21.5	107	— 3.5	112	14	M6 × 1	7.0	3.90	44.0	40.8	2 000	3 000	4 000	RS5050A··	13.81	64	32	
					— 3.5													68	34	
					— 3.5															

Notes: 1. Actual screw shaft length may become slightly longer than nominal length L_s due to manufacturing tolerance.
2. Nut assembly with arbor and screw shaft are separate at time of delivery.
3. Value obtained by dividing the standard screw shaft length by 100 mm will be entered at end of the part number where marked with ··.
4. Items in stock do not have surface treatment. For details of standard stock products, contact NSK.
5. Length of nut becomes longer (2 $\times$ M) for those with "brush" seals.

6. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
7. Internal spatial volume of nut and volume of grease to be replenished are values for ball screws with seals. Recommended amount for replenishing is approximately 50% of nut's internal space. For ball screws without seals, apply grease to screw shaft surface or move ball nut by hand while filling them with grease so that grease permeates all areas. See page D16 for details.

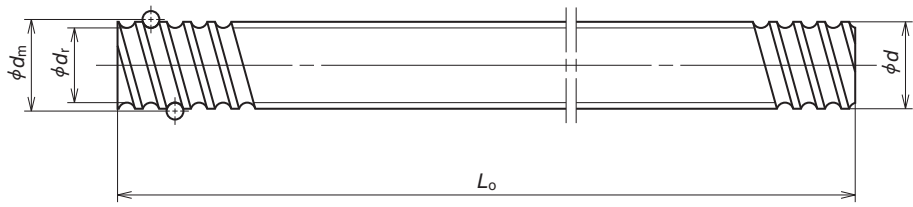
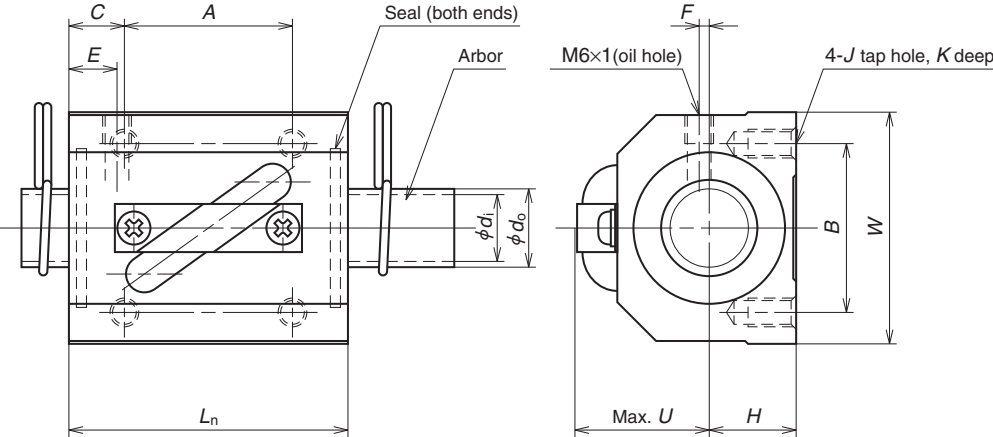


Ball nut No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial play Max.	Ball nut dimensions
							Dynamic <i>C_a</i>	Static <i>C_{oa}</i>		Outside dia. <i>D</i>
	RNFCL 1632A2 RNFCL 1632A2S RNFCL 1632A3 RNFCL 1632A3S RNFCL 1632A6 RNFCL 1632A6S	16	32	2.778	16.65	13.5	0.7 × 4 1.7 × 2 1.7 × 4	4 880 5 760 10 500	8 330 10 300 20 500	0.10
RNFCL 2040A2 RNFCL 2040A2S RNFCL 2040A3 RNFCL 2040A3S RNFCL 2040A6 RNFCL 2040A6S	20	40	3.175	20.75	17.3	0.7 × 4 1.7 × 2 1.7 × 4	7 170 8 480 15 400	13 200 16 500 33 100	0.10	38
RNFCL 2550A2 RNFCL 2550A2S RNFCL 2550A3 RNFCL 2550A3S RNFCL 2550A6 RNFCL 2550A6S	25	50	3.969	26	22.0	0.7 × 4 1.7 × 2 1.7 × 4	10 700 12 700 23 000	20 700 26 500 53 000	0.12	46
RNFCL 3264A3 RNFCL 3264A3S RNFCL 3264A6 RNFCL 3264A6S	32	64	4.762	33.25	28.0	1.7 × 2 1.7 × 4	17 900 32 400	40 200 80 300	0.15	58
RNFCL 4080A3 RNFCL 4080A3S RNFCL 4080A6 RNFCL 4080A6S	40	80	6.350	41.75	35.0	1.7 × 2 1.7 × 4	29 500 53 600	67 900 136 000	0.20	73

Ball nut dimensions										Nut Mass. (kg)	Arbor		Screw shaft					Shaft mass/m (kg)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Flange			Length			Bolt hole		Oil hole	Outside dia. <i>d_o</i>		Bore <i>d_i</i>	Standard length				Screw shaft No.				
<i>A</i>	<i>H</i>	<i>B</i>	<i>E</i>	<i>L_n</i>	<i>M</i>	<i>W</i>	<i>X</i>	<i>Q</i>				<i>T</i>	<i>L_o</i>							
50	34	10	10	34	— 3	41	4.5	M6 × 1	5.5	0.21	13.5	11.5	500	1 000	1 500	—	RS1632A	1.34	2.4	1.2
				66	— 3					0.33									3.9	2.0
				66	— 3					0.33									4.1	2.1
58	40	10	11	41	— 3	48	5.5	M6 × 1	5.5	0.31	17.3	14.9	500	1 000	1 500	2 000	RS2040A	2.15	4.1	2.1
				81	— 3					0.53									6.3	3.2
				81	— 3					0.53									7.0	3.5
70	48	12	13	50	— 3	58	6.6	M6 × 1	7.0	0.53	22.0	19.6	1 000	2 000	2 500	—	RS2550A	3.37	8.4	4.2
				100	— 3					0.91									14	7.0
				100	— 3					0.91									15	7.5
92	60	12	15.5	126	— 3 3	74	9	M6 × 1	7.5	1.76	28.0	25.6	1 000	2 000	3 000	4 000	RS3264A	5.63	24	12
					26														13	
114	75	15	19	158	— 3.5 — 3.5	93	11	M6 × 1	10.0	3.44	35.0	31.8	2 000	3 000	4 000	5 000	RS4080A	8.69	52	26
					55														28	

- Notes: 1. Actual screw shaft length may become slightly longer than nominal length *L_o* due to manufacturing tolerance.
2. Nut assembly with arbor and screw shaft are separate at time of delivery.
3. Value obtained by dividing the standard screw shaft length by 100 mm will be entered at end of the part number where marked with · · ·
4. Items in stock do not have surface treatment. For details of standard stock products, contact NSK.
5. Length of nut becomes longer (2 × *M*) for those with "brush" seals.

6. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
7. Internal spatial volume of nut and volume of grease to be replenished are values for ball screws with seals. Recommended amount for replenishing is approximately 50% of nut's internal space. For ball screws without seals, apply grease to screw shaft surface or move ball nut by hand while filling them with grease so that grease permeates all areas. See page D16 for details.



Ball nut No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls × Circuits	Basic load rating (N)		Axial play Max.	Ball nut dimensions Length <i>L_n</i>
							Dynamic <i>C_s</i>	Static <i>C_{os}</i>		
RNSTL 1404A3.5S	14	4	2.778	14.5	11.5	3.5 × 1	6 310	10 800	0.10	38
RNSTL 1405A2.5S	14	5	3.175	14.5	11.0	2.5 × 1	6 170	9 940	0.10	38
RNSTL 1808A3.5S	18	8	4.762	18.5	13.6	3.5 × 1	15 500	26 200	0.15	56
RNSTL 2005A2.5S	20	5	3.175	20.5	17.0	2.5 × 1	7 500	14 200	0.10	38
RNSTL 2010A2.5S	20	10	4.762	21.25	16.2	2.5 × 1	12 700	21 600	0.15	58
RNSTL 2505A2.5S	25	5	3.175	25.5	22.0	2.5 × 1	8 340	18 100	0.10	35
RNSTL 2510A5S	25	10	6.35	26	19.0	2.5 × 2	37 300	69 800	0.20	94
RNSTL 2806A2.5S	28	6	3.175	28.5	25.0	2.5 × 1	8 760	20 200	0.10	42
RNSTL 2806A5S						2.5 × 2	15 900	40 500		67
RNSTL 3210A2.5S	32	10	6.35	33.75	27.0	2.5 × 1	23 100	45 900	0.20	64
RNSTL 3210A5S						2.5 × 2	42 000	91 800		94
RNSTL 3610A2.5S	36	10	6.35	37	30.0	2.5 × 1	24 700	50 800	0.20	64
RNSTL 3610A5S						2.5 × 2	44 900	102 000		96
RNSTL 4512A5S	45	12	7.144	46.5	39.0	2.5 × 2	58 500	147 000	0.23	115

Ball nut dimensions										Nut Mass. (kg)	Arbor		Screw shaft				Shaft mass/m (kg)	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
Width	Center height	Bolt hole					Oil hole					Outside dia.	Bore	Standard length		Screw shaft No.			
		A	B	C	J	K	E	F	U					L _o					
W	H	A	B	C	J	K	E	F	U		d _o	d _i	L _o						
34	13	22	26	8	M4	7	7	3	20	0.20	11.5	9.5	500	1 000	–	RS1404A··	1.02	1.6	0.8
34	13	22	26	8	M4	7	7	3	21	0.20	11.0	9.0	500	1 000	–	RS1405A··	1.00	1.8	0.9
48	17	35	35	10.5	M6	10	8	3	26	0.31	13.6	11.6	500	1 000	1 500	RS1808A··	1.60	3.4	1.7
48	17	22	35	8	M6	9	6	2	27	0.24	17.0	14.6	500	1 000	2 000	RS2005A··	2.17	2.5	1.3
48	18	35	35	11.5	M6	10	10	2	28	0.35	16.2	13.8	500	1 000	2 000	RS2010A··	2.18	6.3	3.2
60	20	22	40	6.5	M8	10	6	0	27	0.31	22.0	19.6	1 000	2 000	2 500	RS2505A··	3.47	2.6	1.3
60	23	60	40	17	M8	12	10	0	32	1.32	19.0	16.6	1 000	2 000	2 500	RS2510A··	3.13	18	9.0
60	22	18	40	12	M8	12	8	0	32	0.65	25.0	22.6	1 000	2 000	2 500	RS2806A··	4.47	3.5	1.8
60	22	40	40	13.5						1.04								7.0	3.5
70	26	45	50	9.5	M8	12	10	0	38	1.12	27.0	24.6	1 000	2 000	3 000	RS3210A··	5.53	18	9.0
70	26	60	50	17						1.75								27	14
86	29	45	60	9.5	M10	16	11	0	41	1.76	30.0	27.6	1 000	2 000	3 000	RS3610A··	6.91	18	9.0
86	29	60	60	18						2.64								27	14
100	36	75	75	20	M12	20	13	0	46	1.22	39.0	35.8	2 000	3 000	4 000	RS4512A··	11.16	47	24

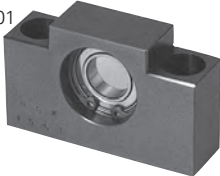
Notes: 1. Actual screw shaft length may become slightly longer than nominal length *L_s* due to manufacturing tolerance.
2. Nut assembly with arbor and screw shaft are separate at time of delivery.
3. Value obtained by dividing the standard screw shaft length by 100 mm will be entered at end of the part number where marked with ··

4. Items in stock do not have surface treatment. For details of standard stock products, contact NSK.
5. Seal for those with shaft diameter of 14 mm or less is made of synthetic resin. Seal for those of 16 mm or more is a "Brush" seal.
6. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
7. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

B-3-1.7 Accessories

Accessories to use with NSK ball screws are available.

Table 1 Support unit categories

Application		Shape	Support side	Bearing in use	Bearing bore, Bearing seat diameter	Page
Small equipment, light load	Square	WBK**-01* 	Fixed support side	Angular contact ball bearing	φ 4 – φ 25	B395 –
		WBK**-S-01* 	Simple support side	Deep groove ball bearing	φ 6 – φ 25	B399 –
		WBK**-SF-01 		Deep groove ball bearing	φ 12, φ 15 (exclusive for VFA type)	B399

1. Classification

Ball screw support units are classified into categories by their shape (Table 1). Select the type that best suits your particular needs.

2. Features

●Bearings and seals

On the fixed support side, the angular contact ball bearing is used. It has great rigidity and low friction torque, which match the rigidity of the ball screw. The thrust angular contact ball bearing with high precision and great rigidity is another choice for the fixed support side. An oil seal is installed to the fixed support side used with an angular contact ball bearing. Fine clearance may occur with this seal. A deep-groove ball bearing with a shield on both sides is used on the simple support side.

●Lock nut is provided.

A lock nut with fine grade finish is provided to fix the bearing with high precision. The lock nuts are designed to be difficult to loosen, but they can still loosen if subjected to strong mechanical vibration. If necessary, this should be prevented by applying threadlocking adhesive or taking similar precautions.

Application		Shape	Support side	Bearing in use	Bearing bore, Bearing seat diameter	Page
Small equipment, light load	Round	WBK**-R-11 (Support kit) 	Fixed support side	Deep groove ball bearing (arranged to have angular contact)	φ 4, φ 6 (exclusive for RMA and RMS types)	B401
		WBK**-11* 		Angular contact ball bearing	φ 4 – φ 25	B397 –
Machine tools, high speed, heavy load	Round	WBK**-DF*-31H 	Fixed support side	Thrust angular contact ball bearing	φ 17 – φ 40	B407 –

3. Reference number coding

(For light load)

Example: **WBK 08 S - 01 A**

Product code for support unit

Nominal size code*

Mounting code

No code: Fixed support unit
S: Simple support unit
SF: Simple support unit (for FSS and VFA)
R: Fixed support unit (support kit for miniature ball screws)

No code or A: For general use
B: Low-profile type (only for square type)
C: For clean environment use
M: Miniature general-purpose use
W: Lost-wax product

01: Square type
11: Round type

*) In case of simple support unit, please note that the nominal size code of 12 or less does not strictly represent internal bore of bearing in millimeters. Please refer to the dimensional table for internal bore of bearing.

(For high speed and heavy load)

Example: **WBK 25 DF - 31H**

Product code for support unit

Nominal size code (internal bore of bearing)

H: High speed type

Bearing combination code

DF: Face to face duplex combination
DFD: Face to face triplex combination
DFF: Face to face quadruplex combination

(1) Support Units for Light Load and Small Equipment

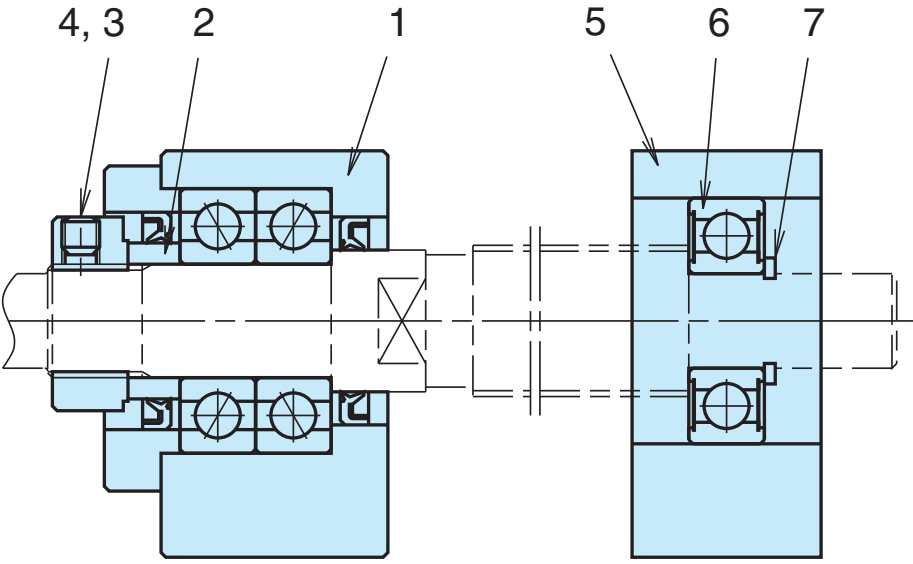
Support units for light load and small equipment provide both fixed and support side bearing assemblies to support screw shafts. They provide all required parts such as bearing locknuts so that you can mount them directly to NSK standard ball screws, of which shaft ends are machined.

Please refer to the dimensions listed on the dimension table for the configuration of standard screw shaft ends for NSK standard ball screws with blank shaft ends. For ball screws for transfer equipment, you require optional spacers when mounting fixed support side support units.

- (a) Features
- Prompt delivery
Support units are standard products.
 - Best selection of bearings for your application
General use support units for fixed support side are equipped with highly rigid angular contact ball bearings that have been assembled with proper preload, and packed with the appropriate volume of grease. On the other hand, clean support units for fixed support side uses low dust emission grease, and low torque special bearings. Sealed deep groove ball bearings are used for simple support side units for both general and clean environment use.

●Accessories
Support units provide everything necessary for mounting ball screws to machines. (Please refer to the table below.)

* Do not disassemble fixed support side units as they are equipped with bearings and oil seals.



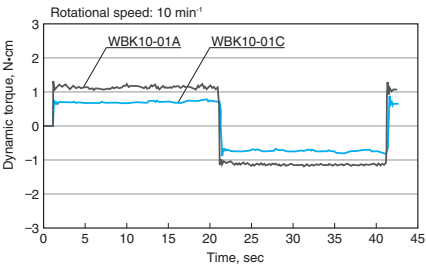
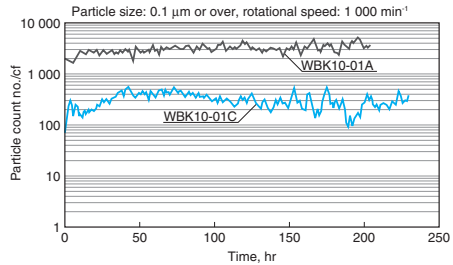
●Antirust treatment
The table on the right shows the surface treatment for the bearing housing, and material of small parts.

Fixed support side		Simple support side	
Part No.	Name of parts	Part No.	Name of parts
1	Bearing housing	5	Bearing housing
2	Spacer	6	Bearing
3	Locknut	7	Snap ring
4	Set screw with brass pad		

General support unit	
Bearings and grease	Angular contact ball bearings, PS2
Surface treatment	Black oxide
Screws and snap rings	Standard material

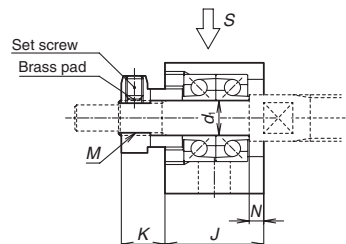
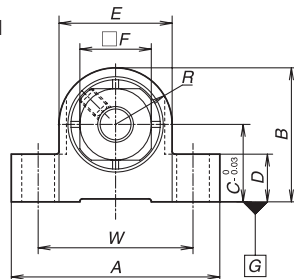
- (b) Features of Clean Support Unit
- Outstanding low dust emission
Clean support unit uses "NSK clean grease LG2" which has a proven feature of low dust emission. It reduces dust emission to 1/10 of general support units.
 - Low torque
It features low torque characteristics because of special bearings. (50% lower than general support unit.)
 - High antirust specification
Low temperature chrome plating is applied to bearing housings, retaining plates, locknuts and spacers to improve antirust properties. Moreover, bolts and snap rings are made of stainless steel.
The table below shows the surface treatment of the bearing housing and material of small parts.

	Clean support unit
Bearing • grease	Special bearings, LG2
Surface treatment	Low temperature chrome plating
Set screw and snap ring material	Stainless steel

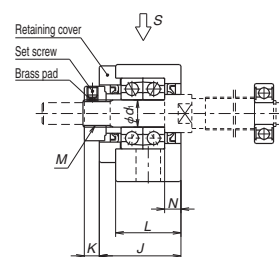
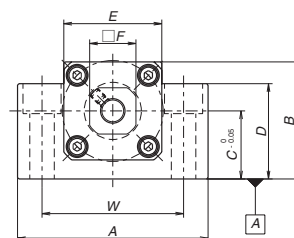


Support Units for Light Load and Small Equipment

WBK**-01M



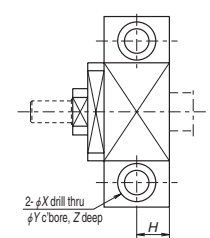
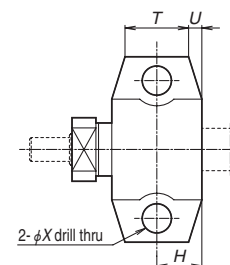
WBK**-01*



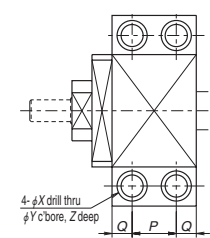
Fixed support side support unit (square type)

Reference No.	Use	d_i	A	B	C	D	E	F	L	J	K	R
WBK04-01M	General	4	27	17	10	6	14	10	—	14	5.5	7
WBK06-01M	General	6	35	22.5	13	8	19	12	—	17	7.5	9.5
WBK06-01A ^{*1}	General	6	42	25	13	20	18	12	20	20	5.5	—
WBK08-01A ^{*1}	General	8	52	32	17	26	25	14	23	23	7	—
WBK08-01B	Low type		62	31	15.5	31	—		21.5	25.5	4.5	
WBK08-01C ^{*1}	Clean environment		52	32	17	26	25		23	23	7	
WBK10-01A	General	10	70	43	25	35	36	17	24	30	5.5	—
WBK10-01B	Low type			38	20	38	—					
WBK10-01C	Clean environment			43	25	35	36					
WBK12-01A	General	12	70	43	25	35	36	19	24	30	5.5	—
WBK12-01B	Low type			38	20	38	—					
WBK12-01C	Clean environment			43	25	35	36					
WBK15-01A	General	15	80	50	30	40	41	22	25	31	12	—
WBK15-01B	Low type			42	22	42	—					
WBK15-01C	Clean environment			50	30	40	41					
WBK17-01A	General	17	86	64	39	55	50	24	35	44	7	—
WBK20-01	General	20	95	58	30	45	56	30	42	52	10	—
WBK25-01W	General	25	105	68	35	25	66	36	48	61	13	—

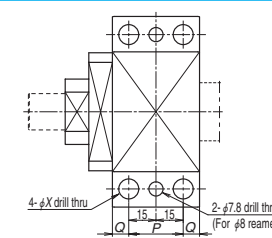
Notes: 1. Use datum surface A for mounting to machine base.
 2. Tighten set screw after locknut has been adjusted and tightened.
 3. Insert brass pad provided with unit into locknut set screw hole, then insert and tighten the set screw.
 4. Deep groove ball bearing and snap ring are also provided for simple support side.
 (except WBK04-01M, WBK06-01M and WBK06-01A)



View S (WBK06 – 15)



View S (WBK17 – 20)



View S (WBK25)

Reference No.	Tightening torque (reference) [N·cm]	
	Locknut	Set screw
WBK04-**	100	69 (M3)
WBK06-**	190	69 (M3)
WBK08-**	230	69 (M3)
WBK10-**	280	147 (M4)
WBK12-**	630	147 (M4)
WBK15-**	790	147 (M4)
WBK17-**	910	147 (M4)
WBK20-**	1670	147 (M4)
WBK25-**	2060	490 (M6)

Units: mm

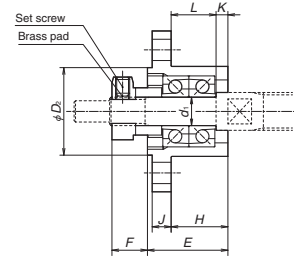
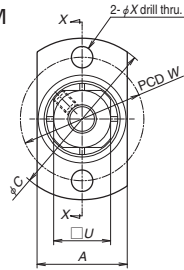
T	U	N	Counterbore dimensions							Mass (kg)	Locknut screw M	Attached bearing for support side
			H	P	Q	W	X	Y	Z			
9	2.5	2	7	—	—	21	3.5	—	—	0.03	M4×0.5	—
12	2.5	2.5	8.5	—	—	26	5.5	—	—	0.05	M6×0.75	—
—	—	3.5	10	—	—	30	5.5	9.5	11	0.15	M6×0.75	—
—	—	4	11.5	—	—	38	6.6	11	12	0.25	M8×1	606ZZ
		3.5	11			46	9	14	18	0.3		606ZZ
		4	11.5			38	6.6	11	12	0.25		606VV
—	—	6	12	—	—	52	9	14	11	0.5	M10×1	608ZZ
									19	0.45		608ZZ
									11	0.5		608VV
—	—	6	12	—	—	52	9	14	11	0.5	M12×1	6000ZZ
									19	0.4		6000ZZ
									11	0.5		6000VV
—	—	5	12.5	—	—	60	11	17	15	0.7	M15×1	6002ZZ
									23	0.6		6002ZZ
									15	0.7		6002VV
—	—	7	—	19	8	68	9	14	11	1.3	M17×1	6203ZZ
—	—	10	—	22	10	75	11	17	15	1.4	M20×1	6204ZZ
—	—	14	—	30	9	85	11	—	—	1.9	M25×1.5	6205ZZ

5. Bearings for WBK04-01M and WBK06-01M are equipped with non-contact metal shield.

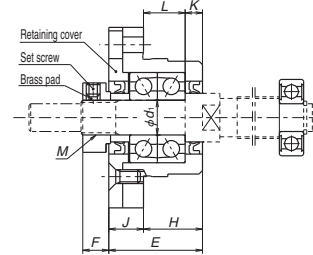
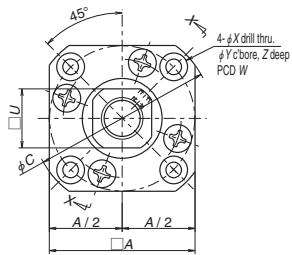
*1) For retaining cover side of WBK06-01A, WBK08-01A and WBK08-01C, there are no seals.

6. Contact NSK if the rotational speed is 50 min⁻¹ and below.

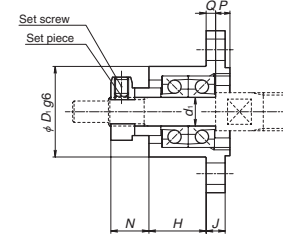
WBK**-11M



WBK**-11*



View X-X (example 1)



(example 2)

Reference No.	Tightening torque (reference) [N·cm]	
	Locknut	Set screw
WBK04-**-11M	100	69 (M3)
WBK06-**-11M	190	69 (M3)
WBK08-**-11M	230	69 (M3)
WBK10-**-11M	280	147 (M4)
WBK12-**-11M	630	147 (M4)
WBK15-**-11M	790	147 (M4)
WBK17-**-11M	910	147 (M4)
WBK20-**-11M	1670	147 (M4)
WBK25-**-11M	2060	490 (M6)

Fixed support side support unit (round type)

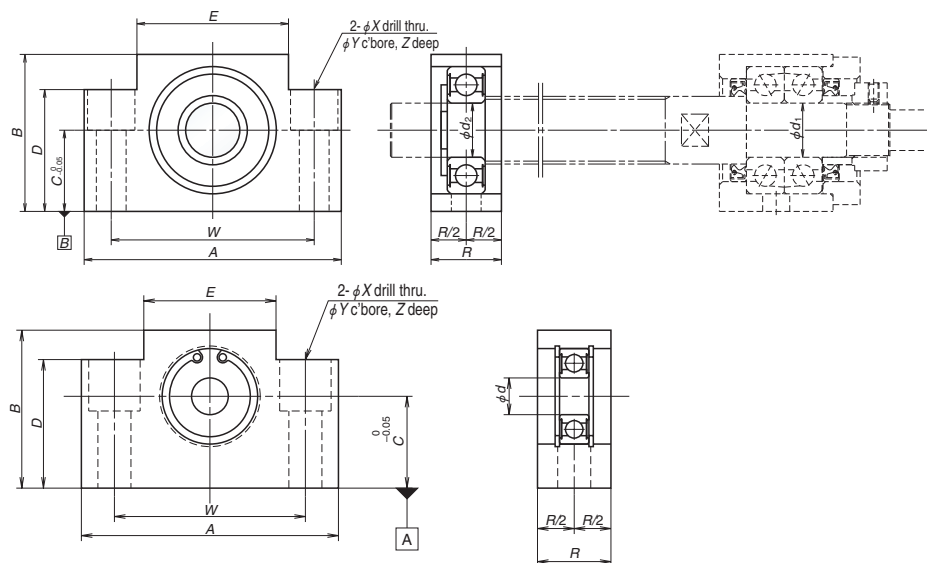
Reference No.	Use	d_1	A	C	D_1	D_2	E	H	L	K	F	N
WBK04-11M	General	4	14	26	14	14	13.5	8.5	7	1.5	5.5	6.6
WBK06-11M	General	6	19	34	19	18.5	17	12	9.5	2.5	7.5	8
WBK06-11*	General	6	28	35	22	—	20	13	9.5	3.5	5.5	6.5
WBK08-11B	High-load type	8	42	52	34	—	25.5	15.5	12	3.5	4.5	7
WBK08-11*	General		35	43	28	—	23	14	10	4	7	8
WBK08-11C*	Clean environment		—	—	—	—	—	—	—	—	—	—
WBK10-11	General	10	42	52	34	—	27	17	12	5	7.5	8.5
WBK10-11C	Clean environment		—	—	—	—	—	—	—	—	—	—
WBK12-11	General	12	44	54	36	—	27	17	12	5	7.5	8.5
WBK12-11C	Clean environment		—	—	—	—	—	—	—	—	—	—
WBK15-11	General	15	52	63	40	—	32	17	11	6	12	14
WBK15-11C	Clean environment		—	—	—	—	—	—	—	—	—	—
WBK20-11	General	20	68	85	57	—	52	30	20	10	10	14
WBK25-11	General	25	79	98	63	—	57	30	20	10	13	20

- Notes:**
1. Tighten set screw after locknut has been adjusted and tightened.
 2. Insert brass pad provided with unit into locknut set screw hole, then insert and tighten the set screw.
 3. Deep groove ball bearing and snap ring are also provided for simple support side.
(except WBK04-11M, WBK06-11M and WBK06-11)

U	P	Q	Counterbore dimensions					Mass (kg)	Locknut screw M	Attached bearing for support side
			J	W	X	Y	Z			
10	2.6	2.4	3	20	3.5	—	—	0.02	M4x0.5	—
12	3	2	4	26	4.5	—	—	0.04	M6x0.75	—
12	4.5	2.5	7	28	2.9	5.5	3.5	0.1	M6x0.75	—
14	6	4	10	42	4.5	8	4	0.2	M8x1	606ZZ
	5		9	35	3.4	6.5		0.15		606ZZ
										606VV
17	6	4	10	42	4.5	8	4	0.2	M10x1	608ZZ
										608VV
19	6	4	10	44	4.5	8	4	0.25	M12x1	6000ZZ
										6000VV
22	8	7	15	50	5.5	9.5	6	0.4	M15x1	6002ZZ
										6002VV
30	14	8	22	70	6.6	11	10	1.1	M20x1	6204ZZ
36	17	10	27	80	9	15	13	1.5	M25x1.5	6205ZZ

4. Bearings for WBK04-11M and WBK06-11M are equipped with non-contact metal shield.
- *For retaining cover side of WBK06-11, WBK08-11 and WBK08-11C, there are no seals.
5. Contact NSK if the rotational speed is 50 min⁻¹ and below.

Accessories



Simple support side support unit (square type)

Units: mm

Reference No.	Use	d_2	A	B	C	D	E	R	Counterbore dimensions				Mass (kg)
									W	X	Y	Z	
WBK08S-01	General	6	52	32	17	26	25	15	38	6.6	11	12	0.15
WBK08S-01B	Low type		62	31	15.5	31	—	16	46	9	14	18	0.2
WBK08S-01C	Clean environment		52	32	17	26	25	15	38	6.6	11	12	0.15
WBK10S-01	General	8	70	43	25	35	36	20	52	9	14	11	0.4
WBK10S-01C	Clean environment		70	43	25	35	36	20	52	9	14	11	0.4
WBK12S-01	General	10	70	43	25	35	36	20	52	9	14	11	0.35
WBK12S-01B	Low type			38	20	38	—					19	0.4
WBK12S-01C	Clean environment			43	25	35	36					11	0.35
WBK12SF-01^{*2}	General	12	62	31	15.5	31	—	18	46	9	14	18	0.2
WBK12SF-01B^{*1}	Low type											18	0.2
WBK15S-01	General	15	80	50	30	40	41	20	60	9	14	11	0.45
WBK15S-01B	Low type			42	22	42	—					23	0.4
WBK15S-01C	Clean environment			50	30	40	41					11	0.45
WBK15SF-01^{*2}	General		70	43	25	35	36	52	18	9	14	19	0.3
WBK15SF-01B^{*1}	Low type			38	20	38	—					19	0.3
WBK17S-01	General	17	86	64	39	55	50	23	68	9	14	11	0.8
WBK20S-01	General	20	95	58	30	45	56	26	75	11	17	15	0.8
WBK20SF-01B	Low type		80	42	22	42	—	22	60			23	0.4
WBK25S-01W	General	25	105	68	35	25	66	30	85	11	—	—	0.9
WBK25SF-01^{*1}			95	58	30	45	56	22	75	11	17	15	0.55

- Notes:**
1. Use datum surface B for mounting to machine base.
 2. For reference No. 12 or lower numbers, note that the reference numbers and inner dimensions of the bearing are different.
 3. WBK ** SF is a type supporting screw shaft OD.
 4. See page B400 for bearing reference number and the basic dynamic load rating in the radial direction.
 5. *1 is exclusive for FSS type.
 6. *2 is exclusive for VFA type.

B399

Support Unit (Support Units for Light Load and Small Equipment)

NSK

Specifications of support unit

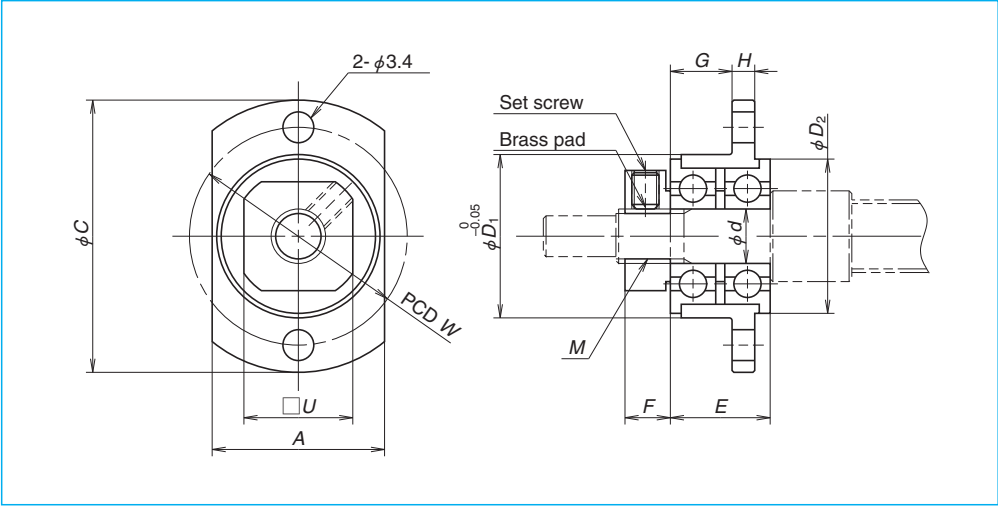
Fixed support side support unit						Simple support side support unit		
Reference No.	Use	Axial direction			Maximum starting torque [N·cm]	Reference No.	Bearing reference No.	Radial direction Basic dynamic load rating C [N]
		Basic dynamic load rating Ca [N]	Load limit [N]	Rigidity [N/μm]				
WBK04-01M	General	1 470	464	39	0.2	—	—	—
WBK04-11M	General	1 470	464	39	0.2	—	—	—
WBK06-01A	General	2 670	1 040	28	0.49	—	—	—
WBK06-01M	General	2 760	854	60	0.35	—	—	—
WBK06-11	General	2 670	1 040	28	0.49	—	—	—
WBK06-11M	General	2 760	854	60	0.35	—	—	—
WBK08-01A	General	4 400	1 450	49	0.88	WBK08S-01	606ZZ	2 260
WBK08-01B	Low type	6 600	2 730	94	1.9	WBK08S-01B	606ZZ	2 260
						WBK12SF-01B^{*1}	6801ZZ	1 920
WBK08-01C	Clean environment	3 100	1 100	36	0.52	WBK08S-01C	606VV	2 260
WBK08-11	General	4 400	1 450	49	0.88	WBK08S-01	606ZZ	2 260
WBK08-11B	High load	6 600	2 730	94	1.9	—	606ZZ	2 260
WBK08-11C	Clean environment	3 100	1 100	36	0.52	WBK08S-01C	606VV	2 260
WBK10-01A	General	6 600	2 730	94	1.9	WBK10S-01	608ZZ	3 300
WBK10-01B	Low type	6 600	2 730	94	1.9	WBK12SF-01^{*2}	6001ZZ	5 100
						—	608ZZ	3 300
WBK10-01C	Clean environment	4 250	1 364	50	1.1	WBK10S-01C	608VV	3 300
WBK10-11	General	6 600	2 730	94	1.9	WBK10S-01	608ZZ	3 300
WBK10-11C	Clean environment	4 250	1 364	50	1.1	WBK10S-01C	608VV	3 300
WBK12-01A	General	7 100	3 040	104	2.1	WBK12S-01	6000ZZ	4 550
WBK12-01B	Low type	7 100	3 040	104	2.1	WBK15SF-01^{*2}	6902ZZ	4 350
						WBK12S-01B	6000ZZ	4 550
WBK12-01C	Clean environment	4 700	2 443	57	1.2	WBK15SF-01B^{*1}	6902ZZ	4 350
						WBK12S-01C	6000VV	4 550
WBK12-11	General	7 100	3 040	104	2.1	WBK12S-01	6000ZZ	4 550
WBK12-11C	Clean environment	4 700	2 443	57	1.2	WBK12S-01C	6000VV	4 550
WBK15-01A	General	7 600	3 380	113	2.4	WBK15S-01	6002ZZ	5 600
WBK15-01B	Low type	7 600	3 380	113	2.4	WBK15S-01B	6002ZZ	5 600
						WBK20SF-01B^{*1}	6804ZZ	4 000
WBK15-01C	Clean environment	5 100	2 757	63	1.3	WBK15S-01C	6002VV	5 600
WBK15-11	General	7 600	3 380	113	2.4	WBK15S-01	6002ZZ	5 600
WBK15-11C	Clean environment	5 100	2 757	63	1.3	WBK15S-01C	6002VV	5 600
WBK17-01A	General	13 400	5 800	120	3.5	WBK17S-01	6203ZZ	9 550
WBK20-01	General	17 900	8 240	155	6.2	WBK20S-01	6204ZZ	12 800
						WBK25SF-01^{*1}	6005ZZ	10 100
WBK20-11	General	17 900	8 240	155	6.2	WBK20S-01	6204ZZ	12 800
WBK25-01W	General	20 200	10 000	192	7.2	WBK25S-01W	6205ZZ	14 000
WBK25-11	General	20 200	10 000	192	7.2	WBK25S-01W	6205ZZ	14 000
WBK04R-11	General	615	490	6.5	0.59	—	—	—
WBK06R-11	General	1 280	930	9	0.59	—	—	—

- Notes:**
1. *1 is exclusive for FSS type.
 2. *2 is exclusive for VFA type.
 3. Permissible axial load is 0.7 times of limiting axial load.

B400

Support kits for ball screws for transfer equipment

Support kits are for RMA type ball screw.
In case of RMA1002 or larger rolled ball screws, please use support units for general use.



Units: mm

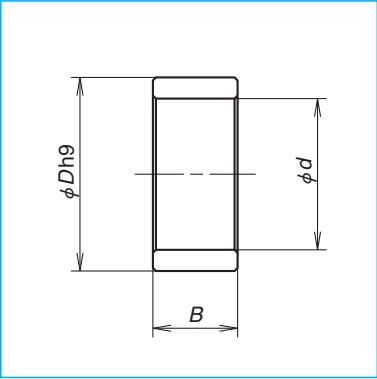
Reference No.	A	C	d	D ₁	D ₂	E	F	G	H	W	U	M	Mass (kg)
WBK04R-11	14	25	4	13	12.5	9	5	5	2.5	19	10	M4×0.5	0.13
WBK06R-11	19	30	6	18	17	11	5	6.8	2.5	24	12	M6×0.75	0.23

Reference No.	Applicable ball screw	Locknut tightening torque (reference) [N·cm]	Set screw tightening torque (reference) [N·cm]
WBK04R-11	RMA0601	100	38 (M2.5)
WBK06R-11	RMA0801 RMA0801.5 RMA0802	190	69 (M3)

- Notes:**
- Oscillate bearings slowly so that they fall into place in which run-out of mounting surface is minimal, and then tighten locknut.
 - Support kit is on provisional shaft (bolt) during shipping.
 - When securing support unit on shaft, insert brass pad that is provided with support unit into lock nut hole, and then tighten set screw.

Spacer

When using a fixed support unit, it may require an optional spacer to have an effective shoulder surface at where the ball thread is threaded to the end of the shoulder. This is common for the R series for transporting ball screws.

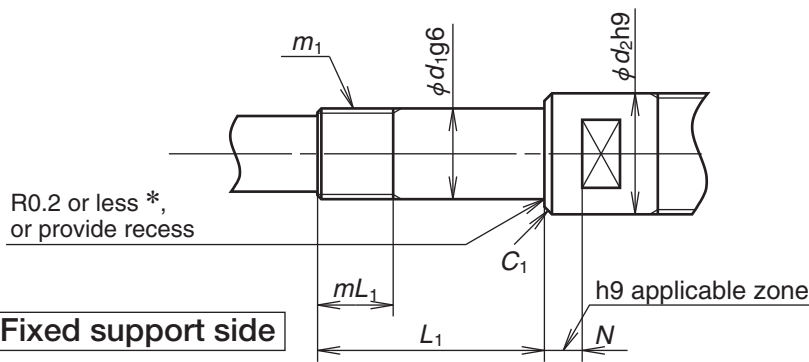


Units: mm

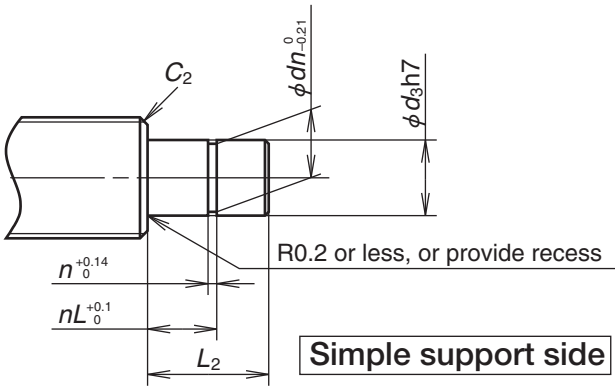
Reference No.	Internal diameter, d	Outside diameter, D	Width B	Mass (g)	Applicable support unit
WBK06K	6	9.5	5.0	2	WBK06- **
WBK08K	8	11.5	5.5	2	WBK08- **
WBK10K	10	14.5	5.5	4	WBK10- **
WBK12K	12	15.0	5.6	3	WBK12- **
WBK15K	15	19.5	10.0	10	WBK15- **
WBK17K	17	24.4	7.0	13	WBK17- **
WBK20K	20	25.5	11.0	17	WBK20- **
WBK25K	25	32.0	14.0	34	WBK25- **

Screw shaft end configuration

Dimensions of the shaft end configurations for light load and small equipment support units are shown in the table below. When using a spacer with a ball screw for transporting equipment, add the width of the spacer (B from the table of spacer dimensions on page B402) to L_1 dimension below.



Radius marked with * above is 0.15 or less for WBK04R-11 and WBK06R-11.



Units: mm

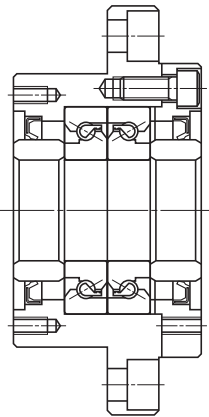
Reference No.	Fixed support side						
	Bearing journal		Locknut thread		Sealing part		Chamfer
	d_1	L_1	m_1	mL_1	d_2	N	C_1
WBK06- **	6	22.5	M6x0.75	7	9.5	3.5	0.2
WBK08- **	8	27	M8x1	9	11.5	4	0.2
WBK10- **	10	30	M10x1	10	14	6	0.2
WBK12- **	12	30	M12x1	10	15	6	0.2
WBK15- **	15	40	M15x1	15	19.5	5	0.3
WBK17- **	17	46	M17x1	17	24	7	0.3
WBK20- **	20	53	M20x1	16	25	10	0.3
WBK25- **	25	62	M25x1.5	20	32	14	0.5
WBK04R-11	4	15	M4x0.5	7.5	—	—	0.3
WBK06R-11	6	17	M6x0.75	7.5	—	—	0.3

Units: mm

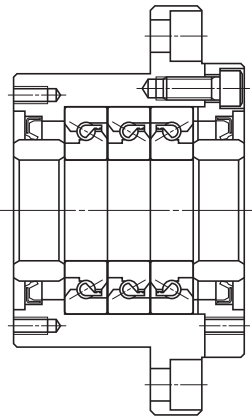
Reference No.	Simple support side					
	Bearing journal		Snap ring groove			Chamfer
	d_3	L_2	n	dn	nL	C_2
WBK08S- **	6	9	0.8	5.7	6.8	0.2
WBK10S- **	8	10	0.9	7.6	7.9	0.2
WBK12S- **	10	22	1.15	9.6	9.15	0.5
WBK15S- **	15	25	1.15	14.3	10.15	0.5
WBK17S- **	17	16	1.15	16.2	13.15	0.5
WBK20S- **	20	19	1.35	19	15.35	0.5
WBK25S- **	25	20	1.35	23.9	16.35	0.5

(2) Support unit for ball screws for high-speed and heavy-load machine tools

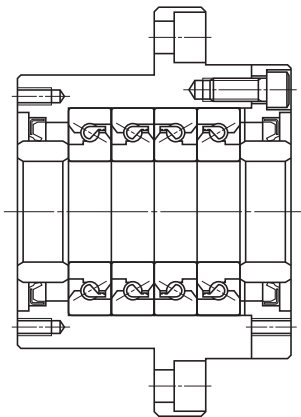
Support units for high-speed and heavy-load machine tools use the ball screw support bearings NSKHPS™ BSBD series. This series has very suitable functions and structure as a ball screw support bearing. There are three bearing combinations as shown below.



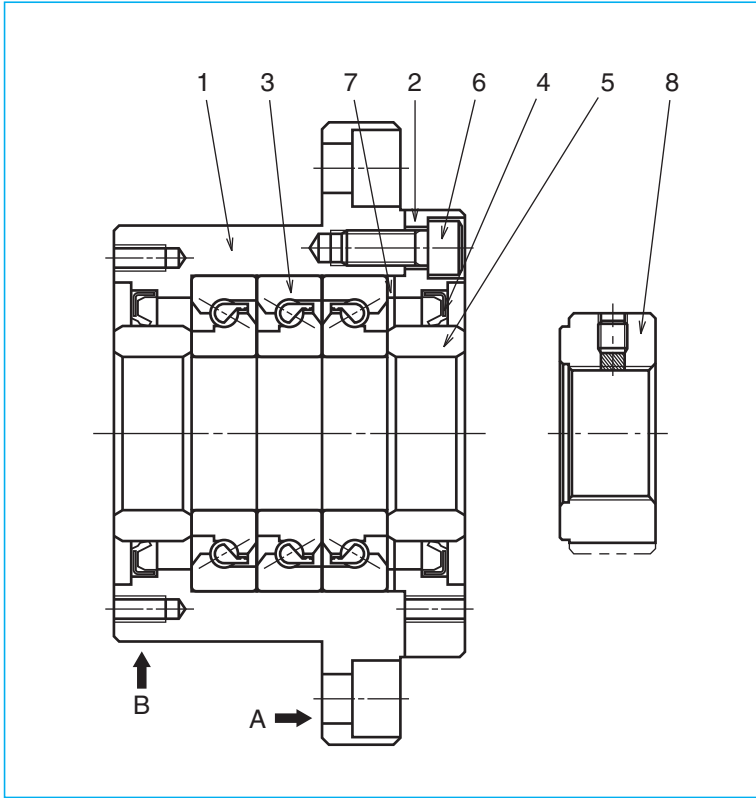
DF combination



DFD combination



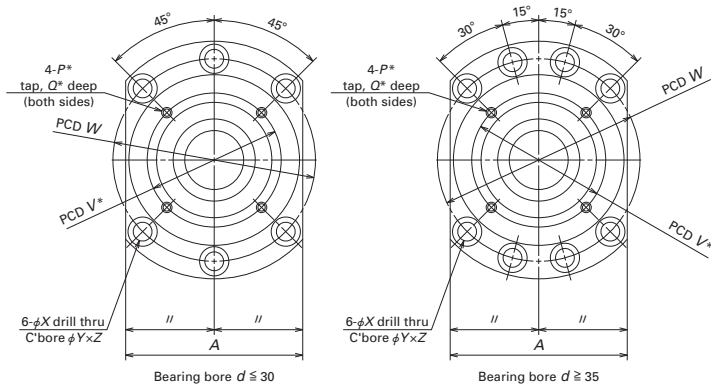
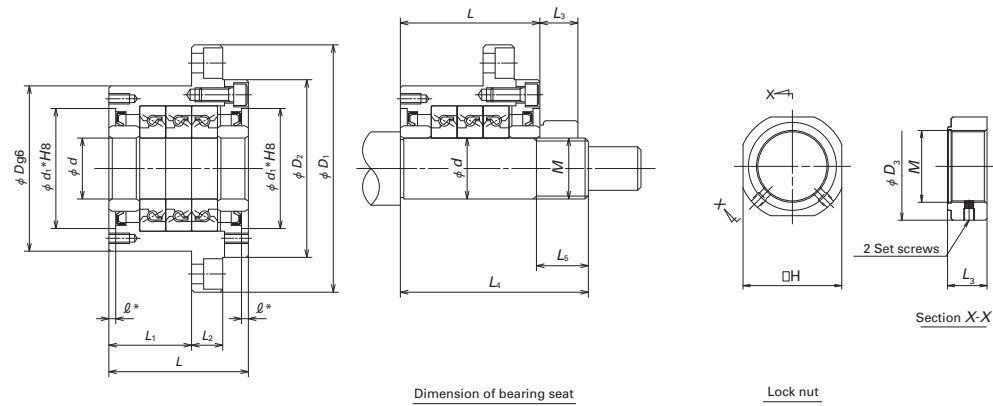
DFF combination



Parts list

Part No.	Part name	Quantity
1	Housing	1
2	Retaining cover	1
3	High accuracy thrust angular contact ball bearing	One set
4	Dust seal	2
5	Collar	2
6	Preload bolt	6 or 8
7	Shim	One set
8	Lock nut	1

- Notes:**
- 1. Surface A and B are the datum surfaces to mount a support unit to machine housing.
 - 2. NSK support units are precisely preloaded and adjusted. Do not disassemble the components 1, 2, 3, 4, 5, 6 and 7.
 - 3. Grease is packed into the bearings.
 - 4. Lock nut 8 is exclusively prepared for ball screws. End surface of nut is in strict control being precisely perpendicular to the V thread. Secure lock nut using set screw. Lock nut is also available as accessory. (See page B409.)
 - 5. See page B415 as well for NSK TAC C Series angular contact thrust ball bearings for ball screw support.



Support unit No.	Support unit																	Basic dynamic load rating	Limiting axial load
	d	D	D ₁	D ₂	L	L ₁	L ₂	A	W	X	Y	Z	d ₁ *	ℓ*	V*	P*	Q*	C ₉ [N]	[N]
WBK17DF-31H	17	70	106	72	60	32	15	80	88	9	14	8.5	45	3	58	M5	10	23 000	26 600
WBK20DF-31H	20	70	106	72	60	32	15	80	88	9	14	8.5	45	3	58	M5	10	23 000	26 600
WBK25DF-31H	25	85	130	90	66	33	18	100	110	11	17.5	11	57	4	70	M6	12	29 900	40 500
WBK25DFD-31H					81	48												48 500 (29 900)	81 500 (40 500)
WBK30DF-31H	30	85	130	90	66	33	18	100	110	11	17.5	11	57	4	70	M6	12	30 500	43 000
WBK30DFD-31H					81	48												50 000 (30 500)	86 000 (43 000)
WBK35DF-31H	35	95	142	102	66	33	18	106	121	11	17.5	11	69	4	80	M6	12	32 500	50 000
WBK35DFD-31H					81	48												53 000 (32 500)	100 000 (50 000)
WBK35DFF-31H					96	48												53 000	100 000
WBK40DF-31H	40	95	142	102	66	33	18	106	121	11	17.5	11	69	4	80	M6	12	33 500	52 000
WBK40DFD-31H					81	48												54 000 (33 500)	104 000 (52 000)
WBK40DFF-31H					96	48												54 000	104 000

Notes: 1. Rigidity
Values in the table are theoretical values obtained from the elastic deformation between ball groove and balls.
2. Starting torque
Starting torque indicates torque due to the preload of the bearing. It does not include seal torque.
3. The tolerance of the shaft bearing seat
We recommend h5 class of the fits tolerance.
4. Values in parentheses of basic dynamic load rating and permissible axial load are the values when axial load is applied in a line.

Preload	Axial rigidity	Starting torque	Lock nut					Bearing seat for unit	Permissible rotational speed	Mass		
			Dimension				Screwing torque (reference)					
C ₉ [N]	[N/μm]	[N · cm]	M	H	D ₃	L ₃	[N · cm]	d	L ₄	L ₅	[min ⁻¹]	[kg]
1 450	630	14	M17×1.0	32	37	18	4 100	17	81	23	6 900	1.9
1 450	630	14	M20×1.0	36	40	18	4 500	20	81	23	6 900	1.9
2 280	850	21	M25×1.5	41	45	20	8 500	25	89	26	5 200	3.1
3 100	1 250	28							104			3.4
2 400	890	23	M30×1.5	46	50	20	10 100	30	89	26	4 900	3.0
3 260	1 310	30							104			3.3
2 750	1 030	27	M35×1.5	50	55	22	13 800	35	92	30	4 100	3.4
3 740	1 500	34							107			4.3
5 490	2 060	43							122			5.0
2 860	1 080	28	M40×1.5	55	60	22	15 500	40	92	30	4 100	3.6
3 900	1 590	36							107			4.2
5 730	2 150	46							122			4.7

5. Dimensions with * (asterisk) mark
*Pilot diameter and tapped screws marked with asterisk are used for seal unit installation for NSK standard hollow shaft ball screws. They also can be used for dust cover and damper installation.
6. Grease is packed into bearing. It is not necessary to apply grease before use.
7. Permissible axial load is 0.7 times of limiting axial load.
8. Contact NSK if the rotational speed is 50 min⁻¹ and below.

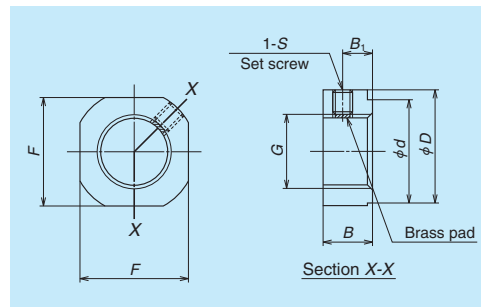
Accessories

In addition to the support units, NSK has other components for ball screws as shown below.

(3) Lock nuts

Ball screw support bearings must be installed

with minimum inclination against ball screw center. NSK lock nuts exclusive for ball screw support bearings help to reduce this inclination.



Light load Shapes and dimensions



Light load lock nuts

Light load lock nuts

Lock nut reference No.	G	D	F	B	d
WBK04L-01	M4×0.5	11.5	10	5	6
WBK06L-01	M6×0.75	14.5	12	5	10
WBK08L-01	M8×1	17	14	6.5	13
WBK10L-01	M10×1	20	17	8	16
WBK12L-01	M12×1	22	19	8	17
WBK15L-01	M15×1	25	22	10	21
WBK17L-01	M17×1	29	24	13	24
WBK20L-01	M20×1	35	30	13	26
WBK25L-01	M25×1.5	42	36	16	34

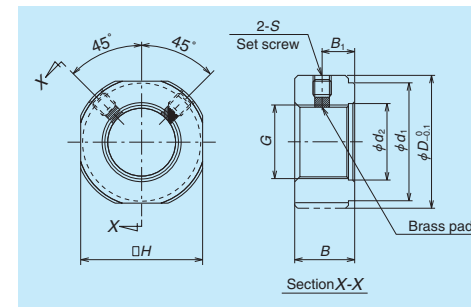
Note: Insert brass pad and then tighten securing set screw.

High speed and heavy load lock nuts

Lock nut reference No.	G	$D_{\phi 1}$	B	d_1	d_2
WBK17L-31H	M17×1	37	18	30	18
WBK20L-31H	M20×1	40	18	30	21
WBK25L-31H	M25×1.5	45	20	40	26
WBK30L-31H	M30×1.5	50	20	40	31
WBK35L-31H	M35×1.5	55	22	49	36
WBK40L-31H	M40×1.5	60	22	49	41

Lock nut

NSK



High speed and heavy load Shapes and dimensions



High speed and heavy load lock nuts

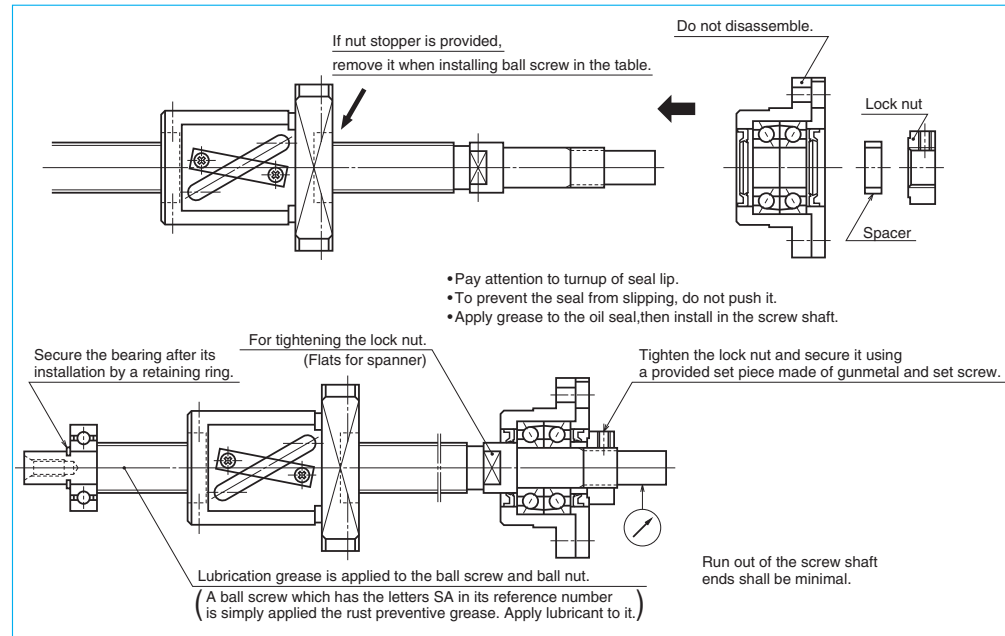
Unit: mm				
B_1	S	Tightening torque (reference) [N · cm]	Set screw tightening torque (reference) [N · cm]	Mass (g)
2.75	M3, with a brass pad	100	69 (M2.5)	3.0
2.75	M3, with a brass pad	190	69 (M3)	3.8
4	M3, with a brass pad	230	69 (M3)	6.4
5	M4, with a brass pad	280	147 (M4)	11.2
5	M4, with a brass pad	630	147 (M4)	12.8
6	M4, with a brass pad	790	147 (M4)	20.0
8	M4, with a brass pad	910	147 (M4)	33.1
8	M4, with a brass pad	1 670	147 (M4)	50.0
10	M6, with a brass pad	2 060	490 (M6)	87.0

Unit: mm					
B_1	H	S	Tightening torque (reference) [N · cm]	Set screw tightening torque (reference) [N · cm]	Mass (g)
10	32	M6	4 100	490 (M6)	100.9
10	36	M6	4 500	490 (M6)	117.3
11	41	M6	8 500	490 (M6)	163.8
11	46	M6	10 100	490 (M6)	186.7
12	50	M6	13 800	490 (M6)	233.4
12	55	M6	15 500	490 (M6)	258.8

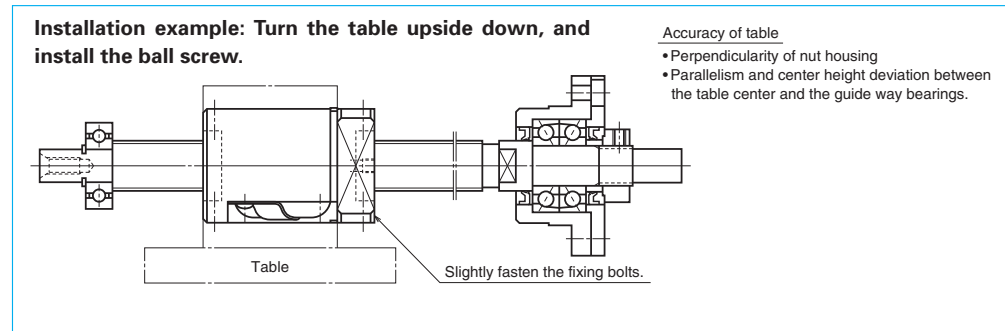
Installation of Ball Screw and Support Unit

The illustrations below show typical installation procedures for a standard ball screw and a support unit.

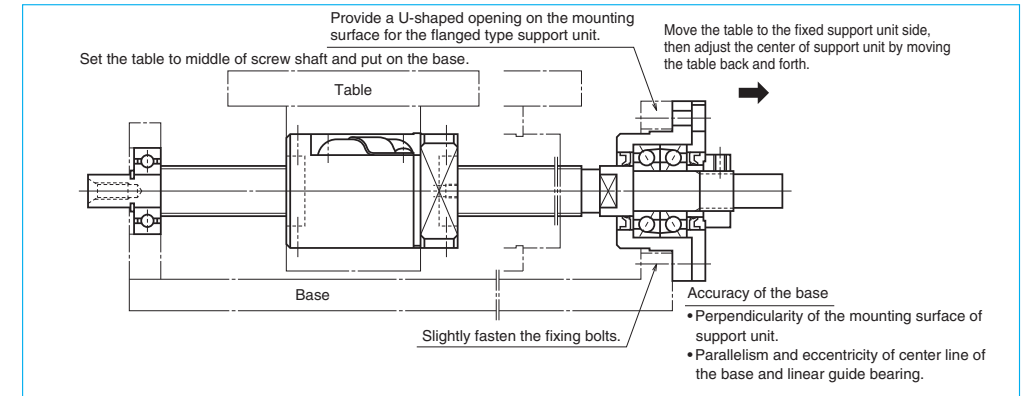
1) Assembly of support unit



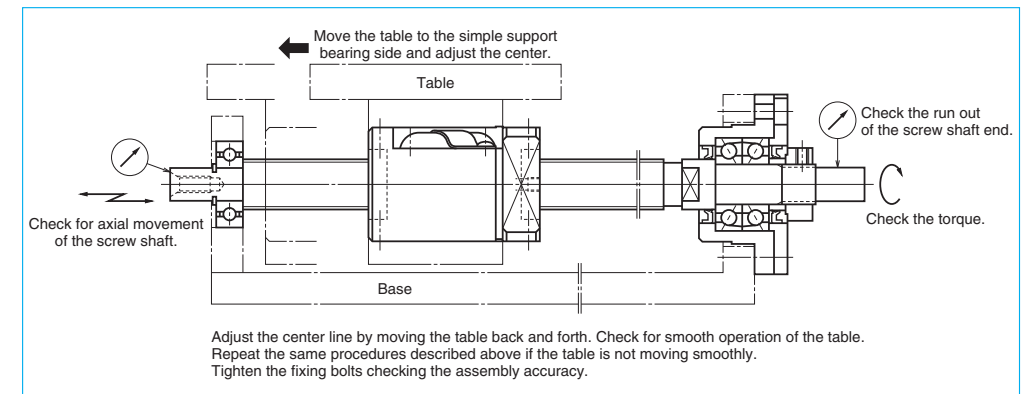
2) Installation of ball nut to the table



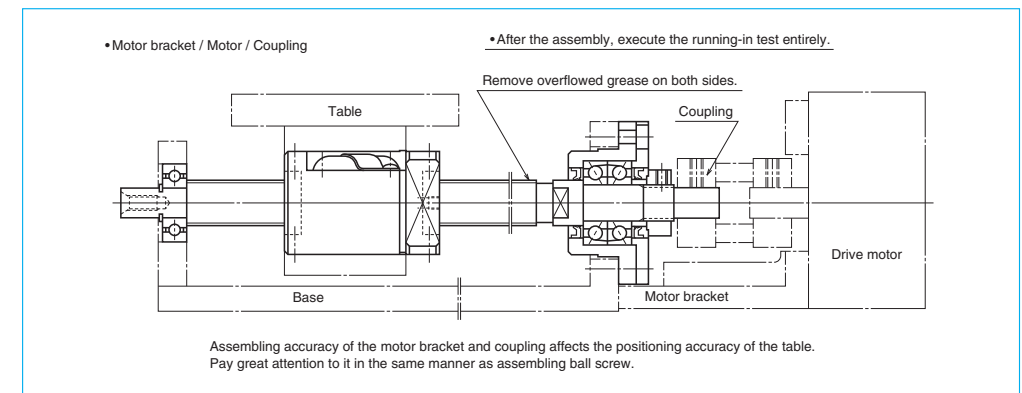
3) Base and the support unit installation on the fixed support side



4) Base and bearing installation on simple support side, and confirming assembling accuracy.



5) Assembly completed.



(4) Grease unit

NSK has numerous grease types that are exclusive for ball screw lubrication. They come in bellows-shaped tubes, which can be attached to a hand grease pump quickly. For details of grease types, see page D13 and for a hand grease pump and nozzles, see page D19.



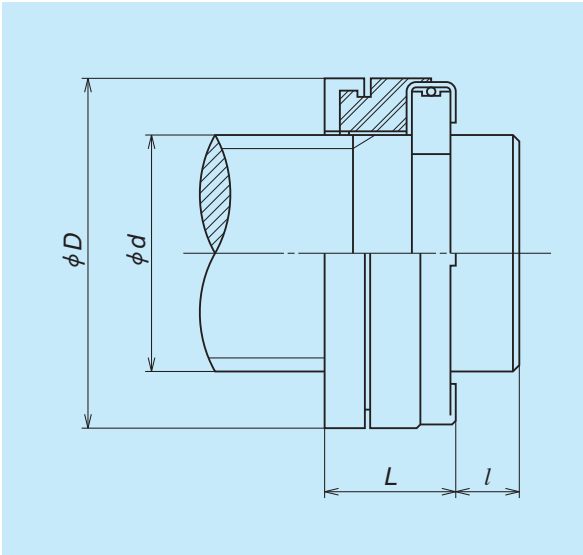
NSK greases

Lubricant greases		
Name	Use	Base oil viscosity mm ² /s (40°C)
NSK Grease AS2	For heavy load	130
NSK Grease PS2	High-speed, light load	15
NSK Grease LR3	High-speed, medium load	30
NSK Grease LG2	Clean environment	30
NSK Grease LGU	Clean environment	100

(5) Travel stopper (made-to-order)

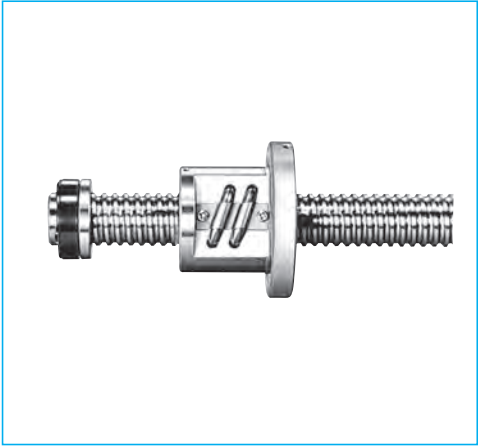
A travel stopper is installed in some cases to prevent the ball nut from overrunning to the end of ball thread due to a malfunction of the safety system of the equipment or by a human error. NSK has several series of shock-absorbing travel stoppers. The travel stopper is not sold as a single item since it is not for general use.

Also, a travel stopper cannot be used for ball screw with the end cap type ball recirculation system, because the stopper would come directly into contact with the component for ball recirculation. Please request NSK for the installation of the travel stoppers when ordering a ball screw.



Stopper No.	Applicable shaft dia.	Outer dia.	Length	Unit: mm Shaft end width (Min.)
	<i>d</i>	<i>D</i>	<i>L</i>	<i>l</i>
BSR 20	20	32	16	5
BSR 25	25	38	16	5
BSR 32	32	46	20	6
BSR 40	40	60	22	6
BSR 50	50	72	24	7
BSR 63	63	85	25	7

Note: This stopper is patented by NSK Ltd.



Shock-absorbing travel stopper

(6) NSKHPS angular contact thrust ball bearings for ball screw support

1. Features

This is highly rigid and accurate ball screw support bearing often used for the machine tools driving mechanism.

NSKHPS:Reliability has been improved by focusing on material cleanliness, which has the biggest impact on bearing life, by employing NSK's proprietary material evaluation technology. The dynamic load rating has been improved by 5% compared with that of conventional bearings.

The NSKTAC C Series features high axial rigidity and is suitable for machine tool feeding mechanisms, while the NSKTAC 03 Series with its high axial load capacity is well suited for the support of large ball screws in high-load drive applications such as electric injection molding machines. With these series users can achieve much lower torque and higher accuracy than with roller bearings.

(a) High axial rigidity

The axial rigidity is high because of a higher contact angle of 60°

(b) Low starting torque

Compared with tapered roller bearings or cylindrical roller bearings, this type has lower starting torque; so smoother rotation is possible with driving force.

(c) Easy Installation

The clearance in each individual bearing in a combination is adjusted to obtain the optimum preload. With universal combination bearings (combination symbol SU), a specific preload is obtained when used with others having the same bearing number in any combination (DB, DF, and others).

Table 2 Comparison with other types of bearings

Bearing type	Bearing rigidity (See Fig. 1)	Starting torque	Preload adjustment	Installation structure
Ball screw support bearings	High	Low	Not required	Simple
Combined angular contact ball bearing	Low	Low	Not required	Simple
Tapered roller bearing	Low	High	Complicated	Simple
Thrust ball bearing and radial bearing	High	Low	Complicated	Complicated
Thrust cylindrical roller bearing and radial bearing	Extremely high	Extremely high	Complicated	Complicated

Note: Consult NSK when you use these bearings other than the purpose of ball screw support.

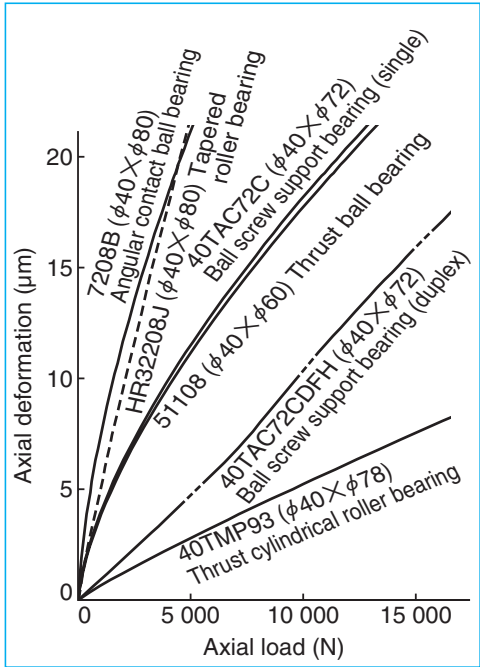


Fig. 1 Axial rigidity of various bearings

(d) Structural simplicity

Since this type can sustain both axial and radial loads, the surrounding structure is simpler and more compact than when using a combination of radial and thrust bearings.

(e) Easy handling

Since the Inner and outer rings are inseparable, handling is easy.

Ball screw support bearings

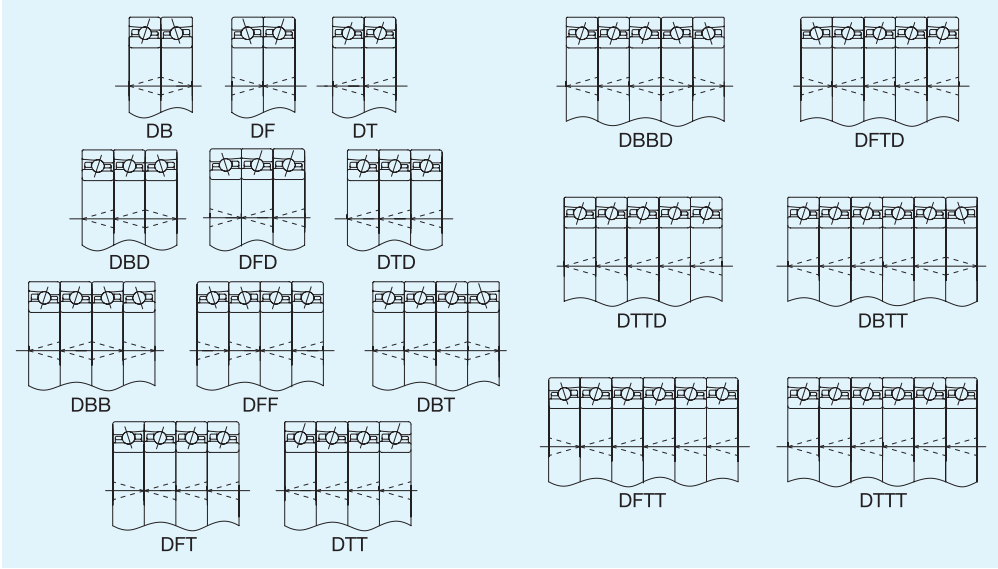
2. Bearing combinations

Angular contact thrust ball bearings for ball screw support are generally used in two or more rows with preload applied.

Universal Combination Bearings

NSK manufactures universal combination bearings which have been controlled to have the same amount of stand-out (offset) on their front and back faces. That way, for bearings with the same bearing number, users will achieve the specified amount for each standard preload, regardless of which combination they chose. Each universal combination bearing comes with a V-shaped mark on the surface of the outer ring to simplify identification of the correct direction when mounting and to ensure that the correct combination is achieved. The V-shaped mark points to the direction of the axial load that the inner ring supports (contact angle).

Combination Mark and Matching Method for Universal Combination Bearings



3. Permissible Axial Load for Angular Contact Ball Bearings

NSK has defined the limiting static axial load as the smaller of the two values listed below:

- (1) Limiting axial load that produces shoulder override
The limiting load at which the contact ellipse generated between the ball and the raceway overrides the shoulder of the raceway groove (Fig. 2)

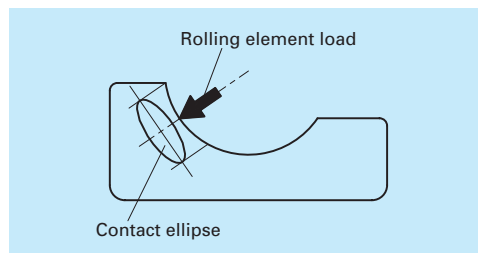


Fig. 2 Ride-over limit axial load

- (2) Limiting axial load in terms of surface pressure
The limiting load at which the contact stress at the center of the contact area between the ball and the raceway groove reaches a level that leaves an indentation as defined in the basic static load rating (Fig. 3)

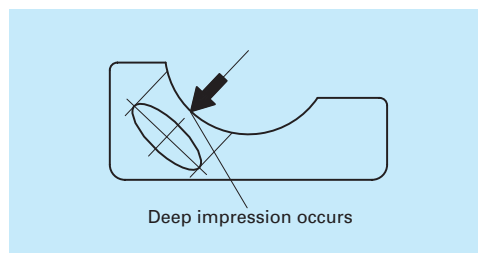


Fig. 3 Contact pressure limit axial load

To maintain optimal bearing performance, NSK has defined permissible static axial load values by applying a safety factor to the limiting axial load based on many years of experience.

The formula for calculating the basic static axial load rating C_{0a} does not take the shoulder height of the raceway groove into account. Therefore, in some cases the C_{0a} value may exceed the limiting axial load that produces shoulder override.

In such cases, the maximum load that the bearing can sustain is lower than the C_{0a} value, making the C_{0a} value unsuitable (Fig. 4). Therefore, instead of C_{0a} values, we have listed limiting axial load values in the bearing tables where necessary, particularly for angular contact thrust ball bearings as they are usually used to support heavy axial loads.

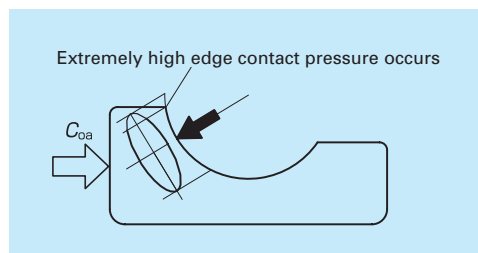


Fig. 4 C_{0a} and limit axial load

4. Rolling contact fatigue life

The relationship between basic load rating, bearing load, and basic rating life for the rolling bearing is presented in the following formula.

$$L_h = \frac{10^6}{60n} \left(\frac{C_r}{P} \right)^3$$

Where, L_h : Basic rating life (h)

C_r : Basic dynamic load rating (N)

P : Dynamic equivalent load (N)

n : Rotational speed (min^{-1})

See the right table for dynamic equivalent load in each combination.

Dynamic equivalent load $P_a = XF_r + YF_a$									
Bearing configuration Combination code Number of the row that receives axial load	Duplex		Triplex			Quadruplet			
	DF	DT	DFD	DTD	DFT	DFF	DFT		
	One row	Two rows	One row	Two rows	Three rows	One row	Two rows	Three rows	
$e = 2.17$	X	1.9	–	1.43	2.33	–	1.17	1.9	2.53
$F_a/F_r \leq e$	Y	0.55	–	0.77	0.35	–	0.89	0.55	0.26
$F_a/F_r > e$	X	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
	Y	1	1	1	1	1	1	1	1

5. Fits

Recommended interference values for standard operating conditions of ball screws are listed in Tables 3. When using angular contact thrust ball bearings for high-load drive ball screw support, in cases where a single end is supported and moment loads are high, it is advisable to increase shaft interference, for example by choosing k5 etc. as required.

Table 3 Tolerances for Shaft and Housing Bore Diameters Unit: μm

Shaft Outer Diameter, Housing Bore Diameter (mm)		Tolerance of shaft outer diameter						Tolerance of housing bore diameter		
		Angular contact thrust ball bearings for high-rigidity applications			Angular contact thrust ball bearings for high-load drive applications					
Over	Incl.	h5	Min.	Max.	js5	Min.	Max.	H6	Min.	Max.
10	18		−8	0		−4	4		−	−
18	30		−9	0		−4.5	4.5		−	−
30	50		−10	0		−5.5	5.5		0	16
50	80		−13	0		−6.5	6.5		0	19
80	120		−	−		−7.5	7.5		0	22
120	180		−	−		−9.0	9.0		0	25
180	250		−	−		−	−		0	29
250	315		−	−		−	−		0	32
315	400	−	−	−	−	0	36			

6. Bearing Accuracy

Table 4 to 6 shows accuracy for angular contact thrust ball bearings for ball screw support.

Table 4 Tolerances for angular contact thrust ball bearings NSK TAC C for high-rigidity ball screw support (Class PN7C ⁽¹⁾) Unit: μm

Nominal Bore (or outer diameter) (mm)		Single Plane Mean Bore Diameter Deviation Δd_{mp}		Deviation of Single Bore Diameter Δd_s		Single Plane Mean Outside Diameter Deviation ΔD_{mp}		Deviation of Single Outside Diameter ΔD_s		Deviation of Single Inner Ring Width ΔB_s		Inner ring (Outer Ring) Face Runout with Raceway S_{ia} (Seal)	
Over	Incl.	High	Low	High	Low	High	Low	High	Low	High	Low	Max.	Max.
10	18	0	–4	0	–4	–	–	–	–	0	–120	2.5	2.5
18	30	0	–5	0	–5	–	–	–	–	0	–120	2.5	2.5
30	50	0	–6	0	–6	0	–6	0	–6	0	–120	2.5	2.5
50	80	0	–7	0	–7	0	–7	0	–7	0	–150	2.5	2.5
80	120	–	–	–	–	0	–8	0	–8	–	–	–	2.5

Note: 1. NSK specification

Table 5 Tolerances for angular contact thrust ball bearings NSK TAC 03 for high-load drive applications ball screw support (Class PN5D ⁽²⁾) Unit: μm

Nominal Bore (or outer diameter) (mm)		Single Plane Mean Bore Diameter Deviation Δd_{mp}		Single Plane Mean Outside Diameter Deviation ΔD_{mp}		Deviation of Single Inner Ring Width ΔB_s		Inner ring (Outer Ring) Face Runout with Raceway S_{ia} (Seal)	
Over	Incl.	High	Low	High	Low	High	Low	Max.	Max.
10	18	0	–5	–	–	0	–80	5	5
18	30	0	–6	–	–	0	–120	5	5
30	50	0	–8	0	–7	0	–120	5	5
50	80	0	–9	0	–9	0	–150	8	8
80	120	0	–10	0	–10	0	–200	8	8
120	150	0	–13	0	–11	0	–250	10	10
150	180	0	–13	0	–13	0	–250	10	10
180	250	–	–	0	–15	–	–	10	10
250	315	–	–	0	–18	–	–	11	11
315	400	–	–	0	–20	–	–	13	13

Note: 2. NSK specification

Table 6 Tolerances for BSBD Series double-row bearings (Class P2B ⁽³⁾ of BSF and BSN series) Unit: μm

Nominal Bore Diameter (mm)		Single Plane Mean Bore Diameter Deviation Δd_{mp}		Single Plane Mean Outside Diameter Deviation ΔD_{mp}		Inner Ring Face Runout with Raceway S_{ia}	Radial Runout of Inner Ring K_{ia}	Width Tolerance	
Over	Incl.	High	Low	High	Low	Max.	Max.	High	Low
10	18	0	–5	0	–10	1.5	1.5	0	–250
18	30	0	–5	0	–10	2.5	2.5	0	–250
30	50	0	–5	0	–10	2.5	2.5	0	–250
50	80	0	–8	0	–15	2.5	2.5	0	–250

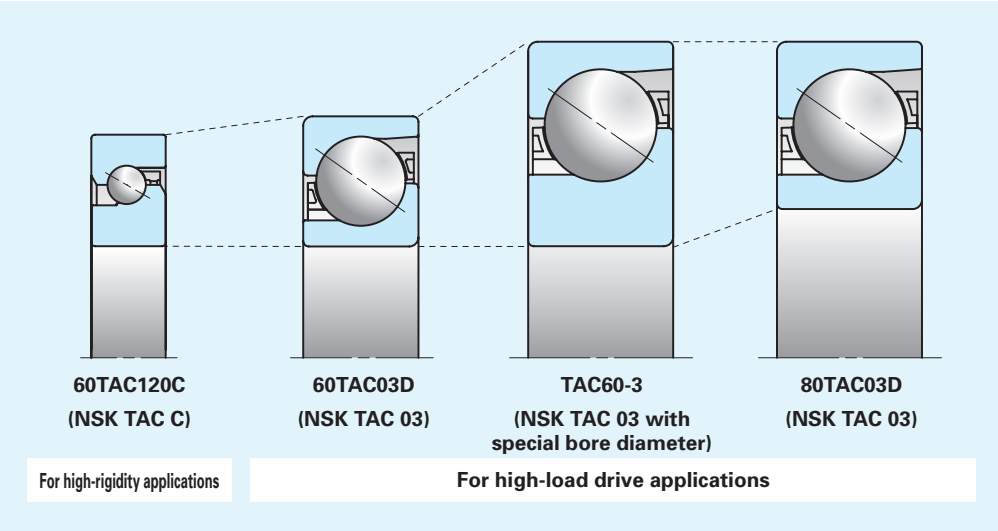
Note: 3. NSK specification

NSKTAC C Angular Contact Thrust Ball Bearings for Ball Screw Support in High-Rigidity Applications

A larger number of balls and a 60° contact angle provide high axial rigidity and make these bearings ideally suited for machine tool feeding mechanisms. The “DDG” seals used for the sealed bearings of this series are light-contact seals for high-speed capability; a strong sealing effect is achieved by a labyrinth between the seal lip and the seal groove of the inner ring. This ensures that no foreign particles can get into the bearing and no grease can leak out, thus helping to keep the surrounding area clean. Some bearings from this series are also available as non-contact sealed bearings for even lower torque and lower heat generation. For ease of handling and increased efficiency, NSKTAC C bearings come prepacked with “WPH” grease that resists high temperatures and is less likely to soften and leak.

NSKTAC 03 Angular Contact Thrust Ball Bearings for Ball Screw Support in High-Load Drive Applications

Optimized internal design has led to a higher limiting axial load. The number of rows may be reduced, contributing to smaller sized devices. We also offer bearings with special bore diameters. That way, bearings with higher load capacity may be employed without any need to modify the shaft diameter, allowing for more compact screw shaft ends. For the validity of this series for industries except Injection molding machines and machine tools, please ask NSK.



Numbering System of NSKTAC C Angular Contact Thrust Ball Bearings for Ball Screw Support in High-Rigidity Applications

Bearing number example: 30 TAC 62 C SU H PN7C

Nominal bore diameter	Accuracy
Bearing type	Preload
Nominal outer diameter	Arrangement
Internal design	Seal

30	Nominal bore diameter	Bore diameter (mm)
TAC	Bearing type	Angular contact thrust ball bearing
62	Nominal outer diameter	Outer diameter (mm)
C	Internal design	Contact angle 60°
	Seal	No symbol: Open type DDG: Contact rubber seal V1V: Non-contact rubber seal
SU	Arrangement	SU: Universal arrangement (single-row)
H	Preload	H: Heavy preload (standard in the HPS Series)
PN7C	Accuracy	PN7C: NES Class 7C (axial runout equivalent to P2)

Numbering System of NSKTAC 03 Angular Contact Thrust Ball Bearings for Ball Screw Support in High-Load Drive Applications

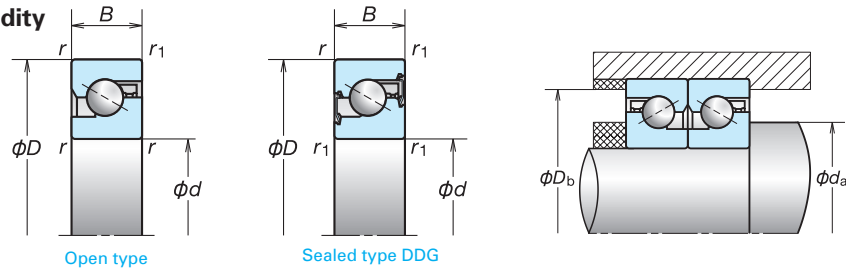
Bearing number example: 60 TAC 03 D T85 SU M PN5D

Nominal bore diameter	Accuracy
Bearing type	Preload
Dimension series	Arrangement
Internal design	Cage

60	Nominal bore diameter	Bore diameter (mm)
TAC	Bearing type	Angular contact thrust ball bearing
03	Dimension series	02: 02 Series 03: 03 Series
D	Internal design	Contact angle 55°
T85	Cage	T85: Polyamide cage M:Brass Cage
SU	Arrangement	SU: Universal arrangement (single-row)
M	Preload	M: Medium preload EL: Extra light preload
PN5D	Accuracy	PN5D: Standard accuracy (equivalent to ISO Class 5)

NSKHPS is not applicable for TAC160-3 and 180TAC03D.

for High-Rigidity



(Open type)

Bearing Numbers	Boundary Dimensions (mm)					Abutment and Fillet Dimensions (mm)				Recommended Grease Quantities (cc)	Contact angle (degree)	Limiting Speeds ⁽²⁾ (min ⁻¹)		Mass (kg) (approx.)
	<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> (Min.)	<i>r</i> ₁ (Min.)	<i>D</i> _b (Max.)	<i>d</i> _a (Min.)	<i>D</i> _a (Max.)	<i>d</i> _b (Min.)			Grease	Oil	
15TAC47C	15	47	15	1	0.6	42	19.5	41	19.5	2.2	60	6 900	9 200	0.146
17TAC47C	17	47	15	1	0.6	42	23	41	23	2.2	60	6 900	9 200	0.140
20TAC47C	20	47	15	1	0.6	42	25	41	25	2.2	60	6 900	9 200	0.135
25TAC62C	25	62	15	1	0.6	57	31	56	31	3.0	60	5 200	6 900	0.252
30TAC62C	30	62	15	1	0.6	57	36	56	36	3.2	60	4 900	6 400	0.224
35TAC72C	35	72	15	1	0.6	67	42	66	42	3.8	60	4 100	5 800	0.310
40TAC72C	40	72	15	1	0.6	67	47	66	47	3.9	60	4 100	5 500	0.275
40TAC90C	40	90	20	1	0.6	85	48	84	48	8.8	60	3 500	4 600	0.674
45TAC75C	45	75	15	1	0.6	68	54	67	54	4.2	60	3 700	4 900	0.270
45TAC100C	45	100	20	1	0.6	93	55	92	55	9.7	60	3 000	4 100	0.842
50TAC100C	50	100	20	1	0.6	92	60	91	60	10.2	60	3 000	3 900	0.778
55TAC100C	55	100	20	1	0.6	92	63	91	63	10.2	60	3 000	3 900	0.714
55TAC120C	55	120	20	1	0.6	112	63	111	63	12	60	2 500	3 500	1.23
60TAC120C	60	120	20	1	0.6	112	70	111	70	12	60	2 500	3 500	1.16

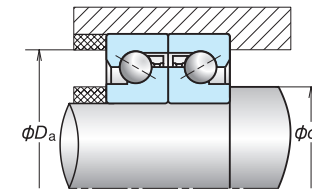
(Sealed Type)

Bearing Numbers ⁽¹⁾	Boundary Dimensions (mm)					Abutment and Fillet Dimensions (mm)				Contact angle (degree)	Limiting Speeds ⁽²⁾ (min ⁻¹)	Mass (kg) (approx.)
	<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> (Min.)	<i>r</i> ₁ (Min.)	<i>D</i> _b (Max.)	<i>d</i> _a (Min.)	<i>D</i> _a (Max.)	<i>d</i> _b (Min.)		Grease	
* 15TAC47CDDG	15	47	15	1	0.6	42	19.5	41	19.5	60	6 900	0.146
* 17TAC47CDDG	17	47	15	1	0.6	42	22	41	22	60	6 900	0.140
* 20TAC47CDDG	20	47	15	1	0.6	42	25	41	25	60	6 900	0.135
* 25TAC62CDDG	25	62	15	1	0.6	57	30	56	30	60	5 200	0.252
30TAC62CDDG	30	62	15	1	0.6	57	36	56	36	60	4 900	0.224
35TAC72CDDG	35	72	15	1	0.6	67	41	66	41	60	4 100	0.310
40TAC72CDDG	40	72	15	1	0.6	67	46	66	46	60	4 100	0.275
40TAC90CDDG	40	90	20	1	0.6	85	47	84	47	60	3 500	0.674
45TAC100CDDG	45	100	20	1	0.6	93	54	92	54	60	3 000	0.842
50TAC100CDDG	50	100	20	1	0.6	92	59	91	59	60	3 000	0.778
55TAC100CDDG	55	100	20	1	0.6	92	63	91	63	60	3 000	0.714

Note: 1. An asterisk (*) indicates bearings that are also available as non-contact sealed bearings.

2. Limiting speeds are based on high preload (H). The values shown are valid for all types of bearing arrangement.

3. To calculate permissible axial load, multiply limiting axial load by 0.7.



Calculation of preload, axial rigidity and starting torque for bearing arrangements
Multiply by factors in table B.

Table B	DFD	DF	DFT
	DBD	DBB	DBT
Preload factor	1.36	2.00	1.57
Axial rigidity	1.49	2.00	1.89
Starting torque	1.35	2.00	1.55

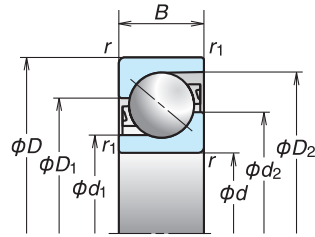
Preload (DB and DF Arrangement) (N)	Axial Rigidity (DB and DF Arrangement) (N/μm)	Starting Torque (DB and DF Arrangement) ⁽¹⁾ (N·m) (reference)	Basic dynamic load rating Ca by number of rows sustaining Fa			Limiting axial load by number of rows sustaining Fa ⁽³⁾		
			1 row (kN)	2 rows (kN)	3 rows (kN)	1 row (kN)	2 rows (kN)	3 rows (kN)
H	H	H	1 row (kN)	2 rows (kN)	3 rows (kN)	1 row (kN)	2 rows (kN)	3 rows (kN)
1 450	630	0.09	23.0	37.5	49.5	26.6	53.0	79.5
1 450	630	0.09	23.0	37.5	49.5	26.6	53.0	79.5
1 450	630	0.09	23.0	37.5	49.5	26.6	53.0	79.5
2 280	850	0.15	29.9	48.5	64.5	40.5	81.5	122
2 400	890	0.16	30.5	50.0	66.0	43.0	86.0	129
2 750	1 030	0.18	32.5	53.0	70.5	50.0	100	150
2 860	1 080	0.19	33.5	54.0	72.0	52.0	104	157
3 450	1 150	0.29	62.0	101	134	89.5	179	269
3 100	1 170	0.20	34.5	56.0	74.5	57.0	114	170
4 440	1 340	0.40	64.5	105	140	99.0	198	298
4 650	1 410	0.42	66.0	107	142	104	208	310
4 650	1 410	0.42	66.0	107	142	104	208	310
5 450	1 660	0.49	70.5	115	153	123	246	370
5 450	1 660	0.49	70.5	115	153	123	246	370

Preload (DB and DF Arrangement) (N)	Axial Rigidity (DB and DF Arrangement) (N/μm)	Starting Torque (DB and DF Arrangement) ⁽¹⁾ (N·m) (reference)	Basic dynamic load rating Ca by number of rows sustaining Fa			Limiting axial load by number of rows sustaining Fa ⁽³⁾		
			1 row (kN)	2 rows (kN)	3 rows (kN)	1 row (kN)	2 rows (kN)	3 rows (kN)
H	H	H	1 row (kN)	2 rows (kN)	3 rows (kN)	1 row (kN)	2 rows (kN)	3 rows (kN)
1 450	630	0.09	23.0	37.5	49.5	26.6	53.0	79.5
1 450	630	0.09	23.0	37.5	49.5	26.6	53.0	79.5
1 450	630	0.09	23.0	37.5	49.5	26.6	53.0	79.5
2 280	850	0.15	29.9	48.5	64.5	40.5	81.5	122
2 400	890	0.16	30.5	50.0	66.0	43.0	86.0	129
2 750	1 030	0.18	32.5	53.0	70.5	50.0	100	150
2 860	1 080	0.19	33.5	54.0	72.0	52.0	104	157
3 450	1 150	0.29	62.0	101	134	89.5	179	269
4 440	1 340	0.40	64.5	105	140	99.0	198	298
4 650	1 410	0.42	66.0	107	142	104	208	310
4 650	1 410	0.42	66.0	107	142	104	208	310

4. The starting torque values in the table apply to grease lubricated bearings. Contact seal torque is not included. For oil lubricated bearings, multiply by 1.4.

5. Abutment and fillet dimensions are recommendable values for the use of standard Machine tool applications. For heavy load applications, please ask NSK

for High-Load Drive Applications



Bearing Numbers ⁽¹⁾	Boundary Dimensions (mm)					Reference Dimensions (mm)				Recommended Grease Quantities (cc/row)	Contact angle (degree)	Limiting Speeds ⁽²⁾ (min ⁻¹)		Mass (kg) (approx.)
	d	D	B	r (Min.)	r1 (Min.)	d1	d2	D1	D2			Grease	Oil	
15TAC02D	15	35	11	0.6	0.3	19.1	24.5	26	31.9	1	55	12 000	14 800	0.047
20TAC03D	20	52	15	1.1	0.6	27.2	35.3	37.5	46.1	2.7	55	8 300	10 300	0.155
25TAC02D	25	52	15	1	0.6	30.8	38.1	39.6	47.3	3	55	7 700	9 700	0.137
TAC35-3	35	90	23	1.5	1	50.4	64.2	67.1	81.7	14	55	4 600	6 000	0.712
40TAC03D	40	90	23	1.5	1	50.4	64.2	67.1	81.7	14	55	4 600	5 700	0.659
TAC40-3	40	110	27	2	1	62	79.1	82.4	100.6	25	55	3 700	5 000	1.28
45TAC03D	45	100	25	1.5	1	56.5	71.7	74.7	90.8	18	55	4 100	5 200	0.877
TAC45-3	45	110	27	2	1	62	79.1	82.4	100.6	25	55	3 700	4 800	1.21
50TAC03D	50	110	27	2	1	62	79.1	82.4	100.6	25	55	3 700	4 700	1.14
TAC50-3	50	130	31	2.1	1.1	73.9	93.8	98	119	40	55	3 100	4 200	2.00
55TAC03D	55	120	29	2	1	68	86.4	90.2	109.7	32	55	3 400	4 300	1.44
60TAC03D	60	130	31	2.1	1.1	73.9	93.8	98	119	40	55	3 100	3 900	1.80
TAC60-3	60	170	39	2.1	1.1	98.5	123.6	128.7	157.5	85	55	2 400	3 300	4.47
70TAC03D	70	150	35	2.1	1.1	86.3	108.6	113.4	137.8	59	55	2 700	3 400	2.67
75TAC03D	75	160	37	2.1	1.1	92.4	116.2	121	146.2	67	55	2 500	3 200	3.20
80TAC03D	80	170	39	2.1	1.1	98.5	123.6	128.7	157.5	85	55	2 400	3 000	3.80
TAC80-3	80	215	47	3	1.1	124	154.9	160.4	194.5	156	55	1 900	2 600	8.66
100TAC03D	100	215	47	3	1.1	124	154.9	160.4	194.5	156	55	1 900	2 400	7.54
TAC100-3	100	260	55	3	1.1	150.5	186.9	193.4	231.7	254	55	1 500	2 100	14.8
120TAC03D	120	260	55	3	1.1	150.5	186.9	193.4	231.7	254	55	1 500	2 000	13.3
* TAC120-3M	120	300	62	4	1.5	170.8	215.3	224.1	265.7	336	55	1 300	1 800	24.5
* 140TAC03DM	140	300	62	4	1.5	170.8	215.3	224.1	265.7	336	55	1 300	1 700	22.5
* TAC140-3M	140	340	68	4	1.5	197.5	246.2	254.3	298.8	442	55	1 200	1 600	34.5
* 160TAC03DM	160	340	68	4	1.5	197.5	246.2	254.3	298.8	442	55	1 200	1 500	32.0
* TAC160-3M	160	380	75	4	1.5	221.1	275.6	284.9	334.9	624	55	1 000	1 400	46.8
* 180TAC03DM	180	380	75	4	1.5	221.1	275.6	284.9	334.9	624	55	1 000	1 400	43.7

Note: 1. An asterisk (*) indicates bearings that are also available equipped with screw holes for mounting bolts.
2. Limiting speeds are based on the standard preload of each bearing. The values shown are valid for all types of bearing arrangement.
3. Preload values for bearings with a bore diameter of 100mm or more as well as for TAC80-3 are based on EL preload.

Multi-row combination calculations

Calculation of preload, axial rigidity and starting torque for bearing arrangements
Multiply by factors in table B.

Table
B

Number of load-sustaining rows	2 rows		3 rows			4 rows		5 rows	
	DFD ○○○○	DF ○○○○	DFT ○○○○	DFD ○○○○	DF ○○○○	DFTD ○○○○	DF ○○○○	DFTT ○○○○	DF ○○○○
	DBD ○○○○	DBB ○○○○	DBT ○○○○	DBD ○○○○	DBB ○○○○	DBTD ○○○○	DBB ○○○○	DBTT ○○○○	DBT ○○○○
Preload factor	1.36	2.00	1.57	2.42	3.00	1.72	2.72	1.83	
Axial rigidity	1.49	2.00	1.89	2.51	3.00	2.24	2.97	2.57	
Starting torque	1.35	2.00	1.55	2.41	3.00	1.68	2.71	1.77	

Preload ⁽³⁾ (DB and DF Arrangement) (N)	Axial Rigidity ⁽³⁾ (DB and DF Arrangement) (N/μm)	Starting Torque ⁽⁴⁾ (DB and DF Arrangement) (N·m)	Basic dynamic load rating Ca by number of rows sustaining Fa					Limiting axial load by number of rows sustaining Fa ⁽⁵⁾				
			1 row (kN)	2 rows (kN)	3 rows (kN)	4 rows (kN)	5 rows (kN)	1 row (kN)	2 rows (kN)	3 rows (kN)	4 rows (kN)	5 rows (kN)
400	290	0.017	21.0	34.0	45.0	55.5	64.5	18.6	37.5	56.0	74.5	93.0
830	430	0.026	42.5	69.5	92.0	113	132	38.5	77.0	116	154	193
690	430	0.036	37.0	60.0	79.5	97.5	114	36.0	72.5	109	145	181
2 500	780	0.26	113	184	244	299	350	118	235	355	470	590
2 500	780	0.26	113	184	244	299	350	118	235	355	470	590
3 900	970	0.50	166	270	360	440	515	181	360	540	720	905
2 800	830	0.31	133	216	287	350	410	142	283	425	565	710
3 900	970	0.50	166	270	360	440	515	181	360	540	720	905
3 900	970	0.50	166	270	360	440	515	181	360	540	720	905
5 200	1 120	0.78	218	355	470	575	670	242	485	725	965	1 210
4 280	1 060	0.68	190	310	410	500	585	210	420	630	840	1 050
5 200	1 120	0.78	218	355	470	575	670	242	485	725	965	1 210
8 050	1 400	1.5	305	495	660	805	940	390	775	1 170	1 550	1 940
6 400	1 250	1.1	262	425	565	690	810	305	615	920	1 230	1 530
7 230	1 330	1.3	283	460	610	750	875	345	690	1 040	1 380	1 730
8 050	1 400	1.5	305	495	660	805	940	390	775	1 170	1 550	1 940
1 240	880	0.15	420	685	910	1 110	1 300	510	1 020	1 530	2 040	2 550
1 240	880	0.15	420	685	910	1 110	1 300	510	1 020	1 530	2 040	2 550
1 620	1 050	0.21	520	850	1 130	1 380	1 610	680	1 360	2 040	2 720	3 400
1 620	1 050	0.21	520	850	1 130	1 380	1 610	680	1 360	2 040	2 720	3 400
1 710	1 130	0.24	640	1 040	1 380	1 680	1 970	794	1 590	2 380	3 200	3 950
1 710	1 130	0.24	640	1 040	1 380	1 680	1 970	794	1 590	2 380	3 200	3 950
1 850	1 240	0.27	725	1 180	1 570	1 920	2 240	1 040	2 080	3 100	4 150	5 200
1 850	1 240	0.27	725	1 180	1 570	1 920	2 240	1 040	2 080	3 100	4 150	5 200
1 940	1 310	0.30	815	1 330	1 760	2 150	2 520	1 360	2 720	4 100	5 450	6 800
1 940	1 310	0.30	815	1 330	1 760	2 150	2 520	1 360	2 720	4 100	5 450	6 800

4. The starting torque values in the table apply to grease lubrication.
5. To calculate permissible axial load, multiply limiting axial load by 0.7.

NSKHPS™ BSBD Series

The BSBD Series are double-row bearing units for the support of ball screws that can accurately and quickly position a work piece or a spindle unit.



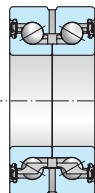
Features

The bearings of this series are double-row angular contact thrust ball bearings with a 60° contact angle and a single outer ring. The specifications are the same as those of the NSKTAC bearings, both series being optimized for the support of ball screws in machine tools. All BSBD Series bearings are equipped with a rubber contact seal and prepacked with high performance grease.

● BSN Type

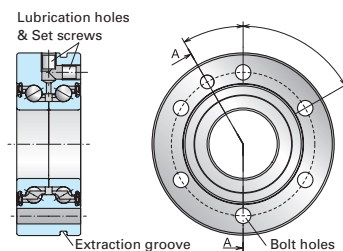
The BSN type of ball screw support bearings are double row angular contact thrust ball bearings in a back-to-back arrangement, with a single outer ring.

The bearings are prepacked with high performance grease. Lubrication holes allow for relubrication during operation if necessary. The contact seal offers minimized friction and temperature rise while providing excellent sealing performance.



● BSF Type

The BSF type of bearings is equivalent to the BSN range of bearings, with bolt holes on the outer ring for easy direct mounting. Two lubrication holes – one in the outer surface and one in the face of the outer ring – allow for relubrication during operation if required. If not used, these holes are closed off with set screws. An extraction groove on the outer surface of the outer ring aids removal of the bearing.



Note: BSF type bearings are supplied with seal and set screws included. Mounting bolts are not included.

BSN Type Single product

Bearing Numbers	Boundary Dimensions (mm)						Abutment and Fillet Dimensions (mm)		Contact Angle (°)	Basic Load Rating (kN)		Limiting ⁽¹⁾ Axial Load (kN)	Preload (N)	Axial Rigidity (N/μm)	Mass (kg)	Limiting speed (min ⁻¹) Greased	Starting torque ⁽²⁾ (N·m) H	Recommended Clamping force (N)
	<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> (min)	<i>r</i> ₁ (min)	<i>φd</i> _a (min)	<i>φD</i> _b (max)	<i>C</i> _a (Dynamic)		<i>C</i> _{0a} (Static)								
BSN1242	12	42	25	0.6	0.3	15	33	60	18.5	24.0	17.6	720	375	0.20	8 000	0.038	4 030	
BSN1545	15	45	25	0.6	0.3	19	35	60	19.4	26.9	19.4	675	400	0.22	7 100	0.034	4 050	
BSN1747	17	47	25	0.6	0.6	21	37	60	20.3	29.7	21.2	880	450	0.23	6 700	0.05	4 400	
BSN2052	20	52	28	0.6	0.6	24	43	60	26.4	41.0	29.3	1 885	650	0.31	5 800	0.13	7 600	
BSN2557	25	57	28	0.6	0.6	29	48	60	28.3	48.0	34.0	2 245	750	0.36	5 100	0.16	8 100	
BSN3062	30	62	28	0.6	0.6	34	53	60	30.0	55.5	38.5	2 625	850	0.40	4 500	0.19	8 600	
BSN3072	30	72	38	0.6	0.6	35	64	60	60.5	94.0	66.5	4 855	950	0.74	3 900	0.59	11 100	
BSN3572	35	72	34	0.6	0.6	40	62	60	42.0	77.5	52.0	2 630	900	0.66	3 800	0.21	13 500	
BSN4075	40	75	34	0.6	0.6	46	67	60	44.5	88.0	58.5	3 065	1 000	0.65	3 500	0.24	14 100	
BSN4090	40	90	46	0.6	0.6	46	80	60	78.5	135	91.0	7 220	1 200	1.38	3 100	1.02	18 700	
BSN5090	50	90	34	0.6	0.6	56	82	60	48.0	110	71.5	4 020	1 250	0.93	2 800	0.33	15 400	
BSN50110	50	110	54	0.6	0.6	57	98	60	116	219	149	7 435	1 400	2.46	2 500	1.06	19 100	
BSN60110	60	110	45	0.6	0.6	68	100	60	86.5	187	126	4 780	1 300	1.82	2 400	0.50	20 900	

Notes: 1. Permissible axial load equals 0.7 times of limiting axial load.

2. The values indicate starting torque of preloaded bearings, not including seal torque.

NSKHPS BSBD Series

Bearing number

Example: **BS F 30 80 DDU H P2B DT**

Bearing type

F: Flange type
N: No Flange type

Bore diameter

Outer diameter

Arrangement

Accuracy

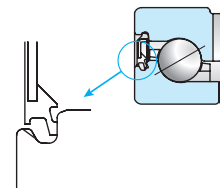
Preload

Seal type

Note:
P2B is an accuracy class specific to the BSBD Series, indicating the following:
Running accuracy:
ISO Class 2
Others: NSK-specific

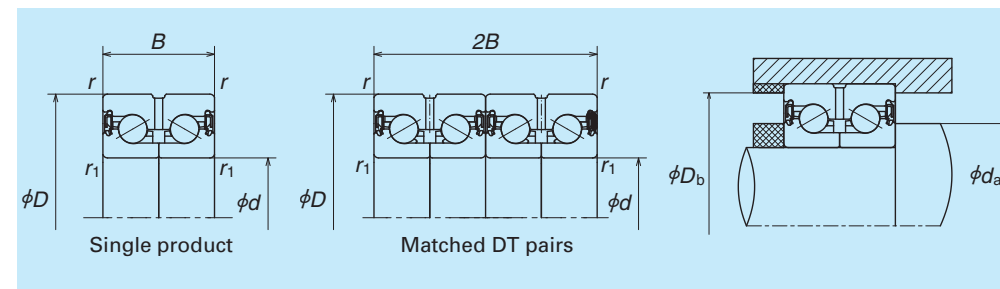
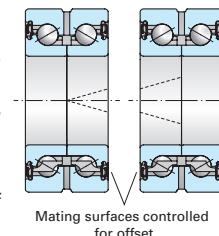
● Seal

Rubber contact seal on both sides. Triple lip structure provides high grease sealing performance and dust resistance.



● Matched DT pairs

BSBD bearings are available in matched DT pairs for applications with large external loads or where high rigidity and long life are required. The mating surfaces of the 2-row bearing set are controlled for offset, so as to have no impact on the preload of each individual bearing.



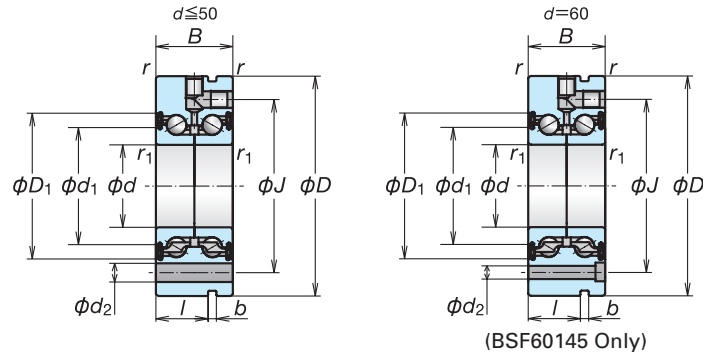
BSN Type Matched DT pairs

Bearing Numbers	Boundary Dimensions (mm)					Abutment and Fillet Dimensions (mm)		Contact Angle (°)	Basic Load Rating (kN)		Limiting ⁽¹⁾ Axial Load (kN)	Axial Rigidity (N/μm)	Mass (kg)	Limiting speed (min ⁻¹)	Starting torque ⁽²⁾ (N·m)	Recommended Clamping force (N)
	d	D	2B	r (min)	r ₁ (min)	φd _a (min)	φD _b (max)		C _s (Dynamic)	C _{0a} (Static)				Greased	H	
BSN1747-DT	17	47	50	0.6	0.6	21	37	60	33.0	59.5	42.5	790	0.46	6 700	0.10	4 400
BSN2052-DT	20	52	56	0.6	0.6	24	43	60	43.0	82.0	58.5	1 180	0.62	5 800	0.26	7 600
BSN2557-DT	25	57	56	0.6	0.6	29	48	60	46.0	96.0	68.0	1 370	0.71	5 100	0.32	8 100
BSN3062-DT	30	62	56	0.6	0.6	34	53	60	49.0	111	77.0	1 580	0.80	4 500	0.37	8 600
BSN3072-DT	30	72	76	0.6	0.6	35	64	60	98.0	188	133	1 800	1.47	3 900	1.17	11 100
BSN3572-DT	35	72	68	0.6	0.6	40	62	60	68.0	155	104	1 630	1.32	3 800	0.41	13 500
BSN4075-DT	40	75	68	0.6	0.6	46	67	60	72.0	176	117	1 850	1.30	3 500	0.49	14 100
BSN4090-DT	40	90	92	0.6	0.6	46	80	60	128	269	182	2 300	2.76	3 100	2.03	18 700
BSN5090-DT	50	90	68	0.6	0.6	56	82	60	78.0	220	143	2 330	1.86	2 800	0.66	15 400
BSN50110-DT	50	110	108	0.6	0.6	57	98	60	188	440	299	2 690	4.92	2 500	2.11	19 100

3. Inner rings can be separable easily. Please push or pull bearings by clamping innerring at mounting and dismounting.

4. Abutment and fillet dimensions are recommendable values for the use of standard Machine tool applications. For heavy load applications, please ask NSK.

NSKHPS™ BSBD Series



BSF Type Single product

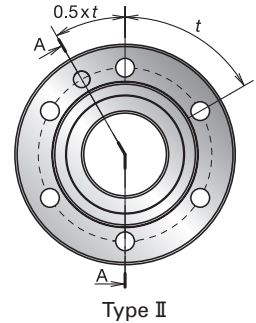
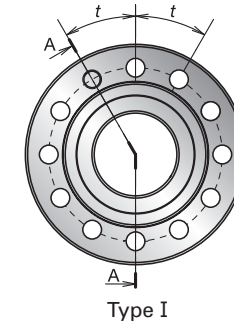
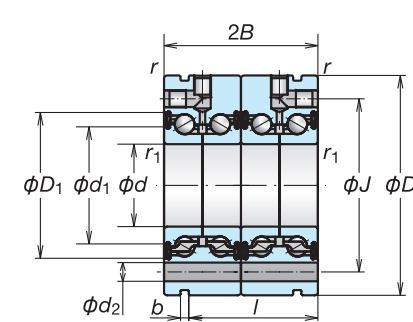
Bearing Numbers	Boundary Dimensions (mm)					Basic Load Rating (kN)		Limiting ⁽¹⁾ Axial Load (kN)	Axial Rigidity (N/μm)	Mass (kg)	Limiting speed (min ⁻¹) Grease
	d	D	B	r ₁ (min)	r ₁ (min)	C _a (Dynamic)	C _{0a} (Static)				
BSF1255	12	55	25	0.6	0.3	18.5	24.0	17.6	375	0.37	8 000
BSF1560	15	60	25	0.6	0.3	19.4	26.9	19.4	400	0.44	7 100
BSF1762	17	62	25	0.6	0.6	20.3	29.7	21.2	450	0.46	6 700
BSF2068	20	68	28	0.6	0.6	26.4	41.0	29.3	650	0.61	5 800
BSF2575	25	75	28	0.6	0.6	28.3	48.0	34.0	750	0.73	5 100
BSF3080	30	80	28	0.6	0.6	30.0	55.5	38.5	850	0.79	4 500
BSF30100	30	100	38	0.6	0.6	60.5	94	66.5	950	1.71	3 900
BSF3590	35	90	34	0.6	0.6	42.0	77.5	52.0	900	1.20	3 800
BSF40100	40	100	34	0.6	0.6	44.5	88.0	58.5	1 000	1.49	3 500
BSF40115	40	115	46	0.6	0.6	78.5	135	91.0	1 200	2.56	3 100
BSF50115	50	115	34	0.6	0.6	48.0	110	71.5	1 250	1.89	2 800
BSF50140	50	140	54	0.6	0.6	116	219	149	1 400	4.46	2 500
BSF60145	60	145	45	0.6	0.6	86.5	187	126	1 300	4.06	2 400

BSF Type Matched pairs

Bearing Numbers	Boundary Dimensions (mm)					Basic Load Rating (kN)		Limiting ⁽¹⁾ Axial Load (kN)	Axial Rigidity (N/μm)	Mass (kg)	Limiting speed (min ⁻¹) Grease
	d	D	2B	r ₁ (min)	r ₁ (min)	C _a (Dynamic)	C _{0a} (Static)				
BSF1762-DT	17	62	50	0.6	0.6	33.0	59.5	42.5	790	0.890	6 700
BSF2068-DT	20	68	56	0.6	0.6	43.0	82.0	58.5	1 180	1.17	5 800
BSF2575-DT	25	75	56	0.6	0.6	46.0	96.0	68.0	1 370	1.46	5 100
BSF3080-DT	30	80	56	0.6	0.6	49.0	111	77.0	1 580	1.58	4 500
BSF30100-DT	30	100	76	0.6	0.6	98.0	188	133	1 800	3.41	3 900
BSF3590-DT	35	90	68	0.6	0.6	68.0	155	104	1 630	2.30	3 800
BSF40100-DT	40	100	68	0.6	0.6	72.0	176	117	1 850	2.88	3 500
BSF40115-DT	40	115	92	0.6	0.6	128	269	182	2 300	5.12	3 100
BSF50115-DT	50	115	68	0.6	0.6	78.0	220	143	2 330	3.78	2 800
BSF50140-DT	50	140	108	0.6	0.6	188	440	299	2 690	8.92	2 500

Notes: 1. Permissible axial load equals 0.7 times of limiting axial load.

The values refer to the limiting load of the bearing only, without taking the mounting bolts into account.



Reference Dimensions (mm)							Type	Mounting Bolts		Preload (N)	Starting torque ⁽²⁾ (N·m) H	Recommended Clamping Force (N)
d ₁	D ₁	J	d ₂	l	b	t		Bolt Dia.	Number of Bolts			
23.7	32.7	42	6.8	17	3	3 × 120°	II	M6	3	720	0.038	4 030
26.7	35.7	46	6.8	17	3	3 × 120°	II	M6	3	675	0.034	4 050
28.1	37.7	48	6.8	17	3	3 × 120°	II	M6	3	890	0.05	4 400
32.6	43	53	6.8	19	3	4 × 90°	II	M6	4	1 885	0.13	7 600
37.6	48	58	6.8	19	3	4 × 90°	II	M6	4	2 245	0.16	8 100
42.6	53	63	6.8	19	3	6 × 60°	II	M6	6	2 625	0.19	8 600
49.1	64.4	80	8.8	30	3	8 × 45°	II	M8	8	4 855	0.59	11 100
53.1	62.2	75	8.8	25	3	4 × 90°	II	M8	4	2 630	0.21	13 500
55.1	67.2	80	8.8	25	3	4 × 90°	II	M8	4	3 065	0.24	14 100
63.1	80.1	94	8.8	36	3	12 × 30°	II	M8	12	7 220	1.02	18 700
70.1	82.2	94	8.8	25	3	6 × 60°	II	M8	6	4 020	0.33	15 400
78.1	97.5	113	11	45	3	12 × 30°	II	M10	12	7 435	1.06	19 100
83.1	99.3	120	8.8	35	3	8 × 45°	II	M8	8	4 780	0.50	20 900

Reference Dimensions (mm)							Type	Mounting Bolts		Starting torque ⁽²⁾ (N·m) H	Recommended Clamping Force (N)
d ₁	D ₁	J	d ₂	l	b	t		Bolt Dia.	Number of Bolts		
28.1	37.7	48	6.8	42	3	6 × 60°	I	M6	5	0.10	4 400
32.6	43	53	6.8	47	3	8 × 45°	I	M6	7	0.26	7 600
37.6	48	58	6.8	47	3	8 × 45°	I	M6	7	0.32	8 100
42.6	53	63	6.8	47	3	12 × 30°	I	M6	11	0.37	8 600
49.1	64.4	80	8.8	68	3	8 × 45°	II	M8	8	1.17	11 100
53.1	62.2	75	8.8	59	3	8 × 45°	I	M8	7	0.41	13 500
55.1	67.2	80	8.8	59	3	8 × 45°	I	M8	7	0.49	14 100
63.1	80.1	94	8.8	82	3	12 × 30°	II	M8	12	2.03	18 700
70.1	82.2	94	8.8	59	3	12 × 30°	I	M8	11	0.66	15 400
78.1	97.5	113	11	99	3	12 × 30°	II	M10	12	2.11	19 100

2. The values indicate starting torque of preloaded bearings, not including seal torque.

3. Inner rings can be separable easily. Please push or pull bearings by clamping inner ring at mounting and dismounting.

- 1. End Deflector Type B431
- 2. Tube Type B437
- 3. Deflector(bridge) Type B469
- 4. End Cap Type B483

B-3-2 Dimension Table and Reference Number of
Standard Nut Ball Screws

B-3-2.1 End Deflector Type Ball Screws

This product is being applied for a patent.

1. Features

●Low and less offensive noise

The average noise level is reduced by more than 6 dB(A) compared with our existing products. At low-speed rotation, the ball screws are nearly silent, while their noise is unprecedentedly low at high-speed rotation.

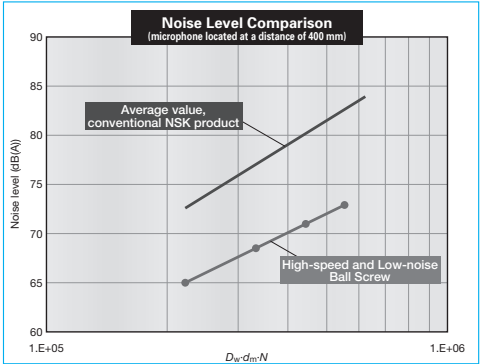


Fig. 1 Comparison of noise level

●High-speed operation

Realizes the d-n of 180 000, outstanding for ball screws and far surpassing the 100 000 d-n performance of existing return tube type products. For high-lead ball screws, high-speed operation at over 200 m/min is also possible.

●Compact

The external diameter of the ball nut is 30% smaller than our existing models. Compact configurations are possible for low-profile XY tables as well as for other devices and equipment.

●Grease fitting provided as standard equipment

The ball screws with shaft diameters equal to or less than $\phi 25$ are equipped with a grease fitting (M5 $\times$ 0.8) as a standard. Lubrication ports are provided in 2 places for ease of maintenance. The ball screws can be easily connected to an integrated lubrication system.

2. Specifications

(1) Ball recirculation system

Fig. 2 shows the structure of the end-deflector recirculation system.

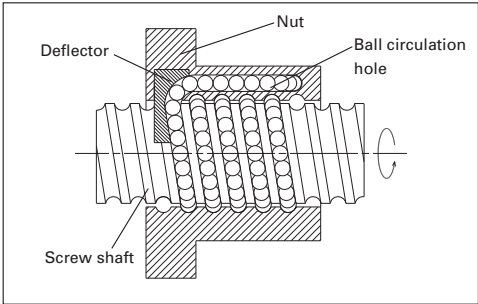


Fig. 2 Structure of end-deflector recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

Accuracy grade	C0, C1, C2, C3, C5, Ct7
Axial play	Z, 0 mm (preloaded); T, 0.005 mm or less; S, 0.020 mm or less; N, 0.050 mm or less

(3) Allowable d-n value and the criterion of maximum rotational speed

Allowable d-n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Allowable d-n value : 180 000 or less

Standard of rotational speed: 5 000 min⁻¹

Note: Please also review the critical speed. See "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Seal

A compact and thin plastic seal is used. Nut outside diameter is compact compare with the return tube recirculation system.

(5) Option

Optional NSK K1 lubrication unit, molded from resin and impregnated with lubrication oil, supplies fresh oil onto ball rolling surfaces, ensuring long-term, maintenance-free operation. Please contact NSK when using NSK K1.

3. Design precautions

When designing the shaft end of a ball screw which diameter is 25 mm or less, or 32 mm or over, and the lead is the same as its shaft diameter, one end of the screw must meet either one of the following conditions. If not, we

cannot install the ball nut on the screw shaft.

- Cut the ball groove through to the shaft end.
- The diameters of bearing journals and the gear or pulley seat must be less than the root diameter of ball groove "dr" specified on the dimension table.

For general precautions regarding ball screws, refer to "Design Precautions"(page B83) and "Handling Precautions"(page B103).

4. Product categories

End deflector type ball screws have the model as follows.

Table 2 End-deflector type ball screw product categories

Nut model	Shape	Flang shape	Nut shape	Preload system
BSS		Circular II, III	Circular	Non-preload, Slight axial play P-preload (light preload)

5. Structure of model number and reference number

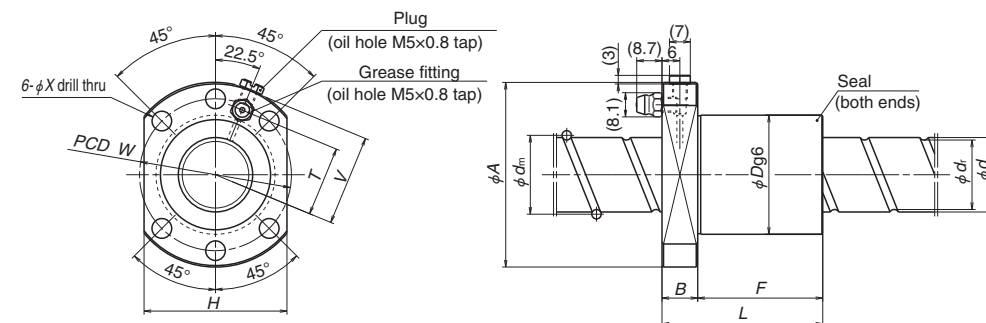
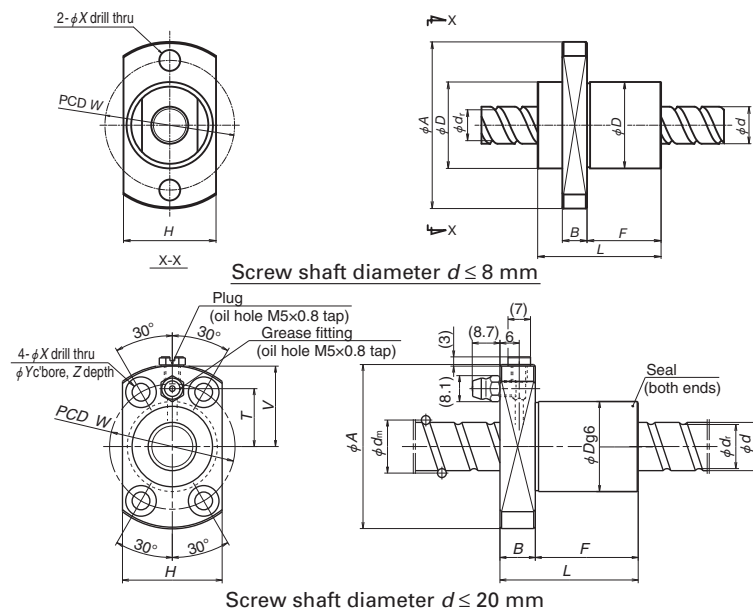
The following describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

BSS	10	10	- 2E
Nut model: BSS	Screw shaft diameter (mm)	Effective turns of balls	Lead (mm)

◇Reference number for ball screw

W	10	01	- **	P	SS	- C5	Z	10
Product code	Screw shaft diameter (mm)	Effective threaded length (in the unit of 100 mm)	NSK design serial number	Preload code: No code, non-preload; P, P-preload (page B5)	End-deflector recirculation system	Accuracy grade: C0, C1, C2, C3, C5, C7 (Ct7) (page B37 to B42)	Axial play code: Z, T, S, N (page B20)	Lead (mm)

Screw shaft diameter $d = 25$ mm

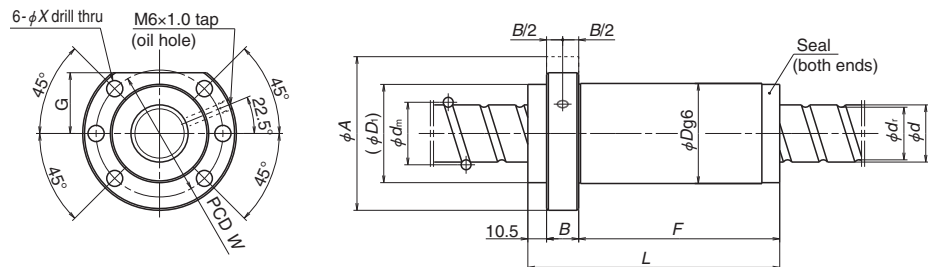
Model No.	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls	Basic load rating (N)		Axial rigidity K (N/μm)
							Dynamic C_d	Static C_s	
BSS0608-2E	6	8	1.2	6.2	4.9	2	620	725	32
BSS0608-4E		8				4	1 330	1 750	75
BSS0612-2E		12				2	600	720	29
BSS0612-4E		12				4	1 280	1 770	69
BSS0810-2E	8	10	1.588	8.3	6.6	2	1 040	1 280	43
BSS0810-4E		10				4	2 220	3 090	99
BSS0815-2E		15				2	1 010	1 290	40
BSS0815-4E		15				4	2 170	3 170	93
BSS1005-3E	10	5	2.000	10.3	8.2	3	3 420	4 840	133
BSS1010-2E		10				2	2 290	2 980	81
BSS1205-3E		5				3	3 750	5 810	154
BSS1210-3E		10				3	3 760	5 780	150
BSS1220-2E	12	20	2.000	12.3	10.2	2	2 330	3 600	86
BSS1230-2E		30				2	2 190	3 650	75
BSS1505-3E	15	5	2.778	15.5	12.6	3	6 410	10 100	193
BSS1510-3E		10				3	6 530	10 200	192
BSS1520-2E		20				2	5 660	8 700	132
BSS1530-2E		30				2	5 500	8 580	119
BSS2005-3E	20	5	3.175	20.5	17.2	3	10 400	18 500	284
BSS2010-3E		10				3	10 200	18 600	281
BSS2020-2E		20				2	6 790	11 800	175
BSS2030-2E		30				2	6 550	11 800	164
BSS2040-2E	20	40				2	6 380	11 600	151
BSS2060-2E		60				2	5 680	11 800	126
BSS2505-3E	25	5	3.175	25.5	22.2	3	11 500	23 500	343
BSS2510-4E		10				4	15 000	32 400	460
BSS2520-2E		20				2	7 650	14 800	214
BSS2525-2E		25				2	7 490	14 600	206
BSS2530-2E	25	30				2	7 490	14 600	203
BSS2550-2E		50				2	6 910	14 700	180

Note: 1) The axial rigidity K in the table above is a theoretical value derived from elastic displacement between screw grooves and balls when axial load is applied to a ball nut for which preload is set at 3% of the basic dynamic load rating (C_d).
For ball screws with shaft diameters less than $\phi 25$, the standard Compact FA PSS type can be available.

Nut entire length L	Nut diameter D	Flange diameter A	Flange width B	Nut length F	Flange dimension		Bolt hole PCD W	Bolt hole dimension			Oil hole distance T
					H	V		X	Y	Z	
16	14	27	4	8	15 (10)	—	21	3.4	—	—	—
24				16							
20				12							
32				24							
18	18	31	4	10	19 (13)	—	25	3.4	—	—	—
28				20							
22				14							
37				29							
29	23	43	11	18	26	21	33	4.5	8	4.5	14
32				21							
30				19							
43				32							
50	24	44	11	39	27	21.5	34	4.5	8	4.5	14.5
70				59							
30	28	51	11	19	31	25	39	5.5	9.5	5.5	18
43				32							
51				40							
71				60							
31	36	62	13	18	38	30.5	49	6.6	11	6.5	23.5
45				32							
54				41							
74				61							
92	40	62	12	79	48	30.5	51	6.6	—	—	23.5
129				116							
32				20							
56				44							
54	40	62	12	42	48	30.5	51	6.6	—	—	23.5
63				51							
74				62							
114				102							

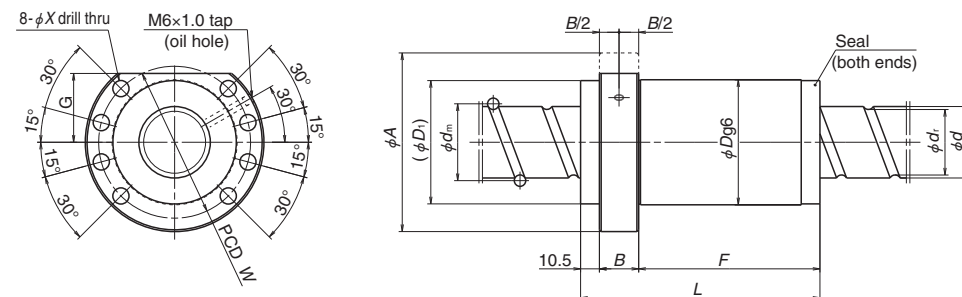
2) The axial play of $\phi 6$ mm and $\phi 8$ mm shaft diameter is only for $T=0.005$ mm max.

3) Dimensions in parentheses are for flat nut configurations.

Screw shaft diameter $d = 32$ mm

Model No.	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls	Basic load rating (N)		Axial rigidity K (N/μm)
							Dynamic C_d	Static C_{0s}	
BSS3205-4E	32	5	3.175	32.5	29.2	4	16 800	41 700	566
BSS3210-6E		10	5.556	33	27.2	6	50 900	110 000	907
BSS3212-5E		12	5.556	33	27.2	5	43 000	91 300	755
BSS3216-5E		16	5.556	33	27.2	5	44 300	90 800	756
BSS3220-5E		20	5.556	33	27.2	5	43 900	91 200	752
BSS3232-2E		32	5.556	33	27.2	2	17 700	32 900	274
BSS3264-2E	36	64	5.556	33	27.2	2	16 800	32 900	240
BSS3605-3E		5	3.175	36.5	33.2	3	13 500	34 100	459
BSS3610-6E		10	6.35	37	30.4	6	65 000	141 000	1 018
BSS3612-6E		12	6.35	37	30.4	6	64 800	141 000	1 014
BSS3616-6E	40	16	6.35	37	30.4	6	64 500	142 000	1 012
BSS3620-6E		20	6.35	37	30.4	6	64 000	141 000	1 001
BSS4010-5E		10	6.35	41	34.4	5	58 100	130 000	924
BSS4012-5E		12				5	58 000	130 000	922
BSS4016-5E		16				5	57 700	131 000	921
BSS4020-5E		20				5	57 400	130 000	913
BSS4025-4E		25				4	46 300	102 000	720
BSS4030-3E		30				3	36 100	74 800	533
BSS4040-2E	45	40	6.35	46	39.4	2	23 700	47 100	334
BSS4080-2E		80				2	22 200	46 600	289
BSS4510-5E		10				5	62 400	147 000	1 026
BSS4512-5E		12				5	62 300	147 000	1 023
BSS4516-5E	50	16				5	62 100	147 000	1 018
BSS4520-5E		20				5	61 800	146 000	1 011
BSS4525-5E		25				5	61 400	147 000	1 006
BSS4530-4E		30				4	49 600	115 000	790
BSS5010-4E	50	10	6.35	51	44.4	4	52 600	129 000	883
BSS5012-4E		12				4	52 500	129 000	881
BSS5016-4E		16				4	52 400	128 000	878
BSS5020-4E		20				4	52 200	129 000	879
BSS5025-4E		25				4	51 900	129 000	871
BSS5030-4E		30				4	51 500	128 000	861
BSS5050-2E		50				2	26 100	58 300	394
BSS50100-2E		100				2	24 100	58 900	343

Note: The axial rigidity K in the table above is a theoretical value derived from elastic displacement between screw grooves and balls when axial load is applied to a ball nut for which preload is set at 3% of the basic dynamic load rating (C_d).

Screw shaft diameter $d \geq 36$ mm

Unit: mm								
Nut entire length	Nut diameter	Seal section diameter	Flange diameter	Flange width	Nut length	Notched flange	Bolt hole PCD	Bolt hole dimension
L	D	D_1	A	B	F	G	W	X
55	56	(55)	86	12	32.5	34	71	9
104				18	75.5			
103				18	74.5			
122				18	93.5			
141				18	112.5			
94				18	65.5			
153				18	124.5			
50	65	(64)	95	12	27.5	36	80	9
109				22	76.5			
120				22	87.5			
143				22	110.5			
166				22	133.5			
99	70	(69)	100	22	66.5	38.5	85	9
108					75.5			
127					94.5			
146					113.5			
145					112.5			
134					101.5			
110					77.5			
184					151.5			
99	75	(74)	110	22	66.5	43	93	11
108					75.5			
127					94.5			
146					113.5			
170					137.5			
164					131.5			
89	82	(81)	118	22	56.5	46	100	11
96					63.5			
111					78.5			
126					93.5			
145					112.5			
164					131.5			
130					97.5			
224					191.5			

B-3-2.2 Return Tube Type Ball Screws

1. Features

Return tube type is a standard way of ball recirculation system for ball screws. It has various combinations of shaft diameter and lead.

2. Specifications

(1) Ball recirculation system

The structure of return tube recirculation system is shown below.

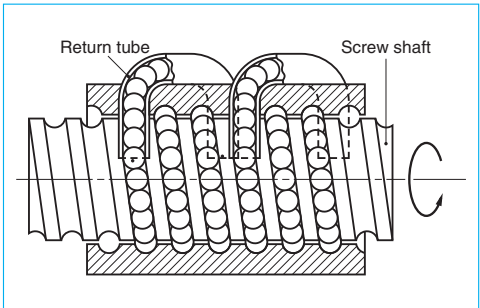


Fig.1 Structure of return tube recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are shown in **Table 1**. Please consult NSK for other grades.

(3) Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below. Basic measures must be taken for the high-speed ball screws respectively.

Allowable d·n value :

Standard specification : 70 000 or less

High-speed specification: 100 000 or less

Standard of rotational speed : 3 000 min⁻¹

Note: Please also review the critical speed. Refer to "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Option

A type equipped with NSK K1 lubrication unit is also available.

(5) Other specifications

Please consult NSK for other specifications not listed in the dimension tables.

3. Product categories

There are four different preloaded systems with several models. Since the leads are in the range from 1/2 to the same length of the shaft

Table 1 Accuracy grade and axial play

Accuracy grade	SFT, PFT, ZFT, DFT: C0, C1, C2, C3, C5, Ct7
	LSFT, LPFT, LDFT: C1, C2, C3, C5, Ct7 (Ct7 is not included in DFT, LDFT)
Axial play	Z, 0 mm (preloaded); T, 0.005 mm or less; S, 0.020 mm or less; N, 0.050 mm or less

Table 2 Return tube type ball screws product categories

Nut model	Shape	Flange shape	Nut shape	Preload system
SFT		Flanged d=16mm or under	Circle dia.	Non-preload, Slight axial play
PFT		Rectangle d=20mm or over Circular I, II		P-preload (light preload) Spacer ball 1:1
ZFT		Flanged Circular I, II	Circle dia.	Z-preload (medium preload)

Nut model	Shape	Flange shape	Nut shape	Preload system
DFT		Flanged Circular I, II	Circular	D-preload (medium preload) (heavy preload)
LSFT		Flanged d=20mm or under	d=20mm or under Circular	Non-preload, Slight axial play
LPFT		Rectangle d=25mm or over Circular II	d=25mm or over Tube- projecting type	P-preload (light preload) Spacer ball 1:1
LDFT		Flanged Circular II	Circular	D-preload (medium preload) (heavy preload)

diameter (medium-high helix lead), LSFT, LPFT, LDFT Type ball screws are suitable for high-speed operation.

4. Structure of model number and reference number

The followings describe the structure of "Model number" and "Reference number for ball screw".

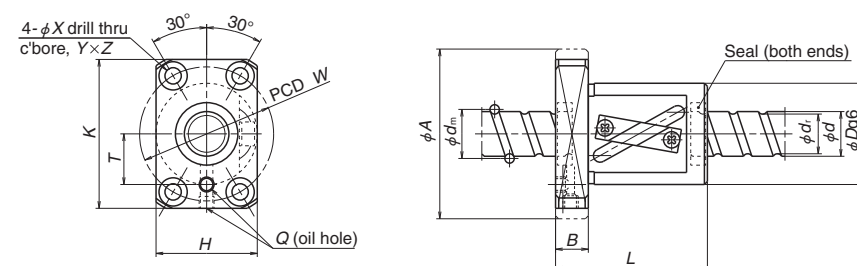
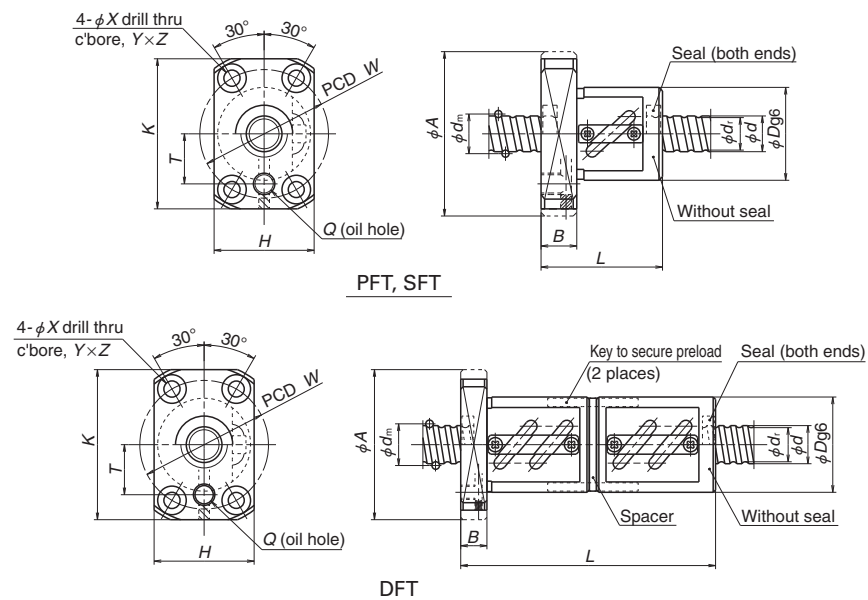
◇ Model number

SFT 14 05 - 2.5			
Nut model: SFT, PFT, ZFT, DFT LSFT, LPFT, LDFT		Effective turns of balls (Note)	Lead (mm)
Screw shaft diameter (mm)			

Note: In case of Z-preload, the number here is twice as large as the effective turns of balls.

◇ Reference number for ball screw

W 14 01 - ** P - C3 Z 5			
Product code			Lead (mm)
Screw shaft diameter (mm)			Axial play code: Z, T, S, N (page B20)
Effective threaded length (in the unit of 100 mm)			Accuracy grade code: C0, C1, C2, C3, C5, C7 (Ct7) (page B37 to B42)
NSK design serial number			
Preload code: No code, non-preload; P, P-preload Z, Z-preload; D, D-preload (page B5)			



Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)					
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>						
* PFT 1004-2.5 SFT 1004-2.5	P Clearance	10	4	2.000	10.3	8.2	2.5×1	2 020 3 210	2 210 4 420	79 94					
PFT 1204-2.5 PFT 1204-3	P P	12	4	2.381	12.3	9.8	2.5×1	2 780 3 250	3 140 3 770	93 111					
SFT 1204-2.5 SFT 1204-3	Clearance Clearance						2.5×1 1.5×2	4 410 5 160	6 280 7 540	111 132					
* PFT 1205-2.5 PFT 1205-3	P P						5	2.381	12.3	9.8	2.5×1 1.5×2	2 770 3 240	3 130 3 760	92 110	
SFT 1205-2.5 SFT 1205-3	Clearance Clearance										2.5×1 1.5×2	4 390 5 140	6 260 7 510	110 131	
* LPFT 1210-2.5 LSFT 1210-2.5	P Clearance		10	2.381	12.5	10.0					2.5×1	2 790 4 430	3 220 6 430	92 110	
* PFT 1405-2.5 SFT 1405-2.5 PFT 1405-5 SFT 1405-5	P Clearance P Clearance		14	5	3.175	14.5					11.2	2.5×1 2.5×1 2.5×2	5 020 7 970 9 110	5 970 11 900 11 900	126 150 244
* LPFT 1408-2.5 LSFT 1408-2.5	P Clearance	8					3.175	14.5	11.2	2.5×1		4 960 7 880	5 920 11 800	124 147	
* LPFT 1510-2.5 LSFT 1510-2.5	P Clearance	15					10	3.175	15.5	12.2		2.5×1	5 130 8 140	6 420 12 800	129 156
PFT 1604-3 SFT 1604-2.5 DFT 1604-2.5 PFT 1604-5 SFT 1604-3 DFT 1604-3	P Clearance D P Clearance D	16					4	2.381	16.3	13.8		1.5×2 2.5×1 2.5×1 2.5×2 1.5×2 1.5×2	3 740 5 070 5 070 5 800 5 930 5 930	5 130 8 500 8 500 8 500 10 300 10 300	141 140 275 226 168 329

Notes: 1. Nut flange for shaft diameter 16 mm or smaller comes in rectangular shape.

2. Seals are equipped as a standard for LSFT and LPFT of shaft diameter 20 mm or smaller. The outside dimensions are the same as those of without seals.

3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

Unit: mm

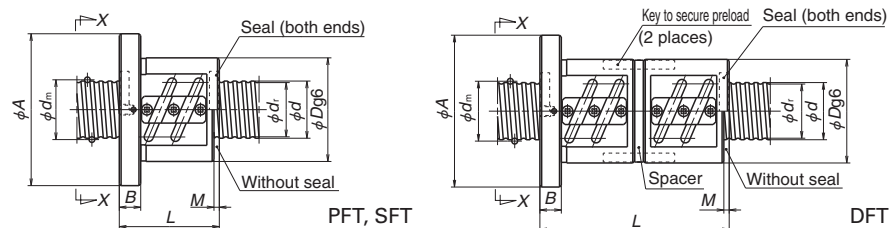
Ball nut dimensions											
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Rectangle flanged diameter		Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole length <i>T</i>	Oil hole <i>Q</i>
				<i>H</i>	<i>K</i>	<i>X</i>	<i>Y</i>	<i>Z</i>			
34	26	46	10	28	42	4.5	8	4.5	36	14	M6×1
38	30	50	10	32	45	4.5	8	4.5	40	15	M6×1
44											
38											
44											
40	30	50	10	32	45	4.5	8	4.5	40	15	M6×1
48											
40											
48											
50	30	50	10	32	45	4.5	8	4.5	40	15	M6×1
40	34	57	11	34	50	5.5	9.5	5.5	45	17	M6×1
40											
55											
55											
46	34	57	11	34	50	5.5	9.5	5.5	45	17	M6×1
51	34	57	11	34	50	5.5	9.5	5.5	45	17	M6×1
45	34	57	11	34	50	5.5	9.5	5.5	45	17	M6×1
38	34										
70	36										
50	34										
45	34										
85	36										

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_a*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

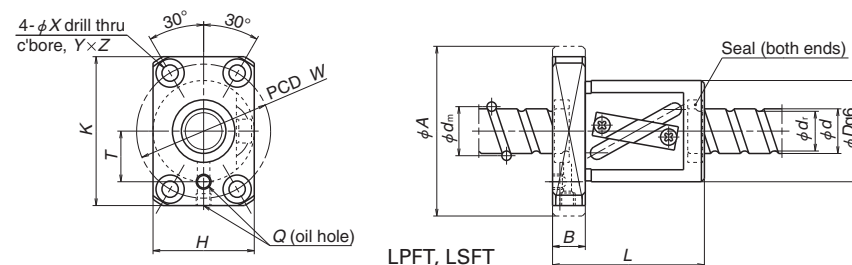
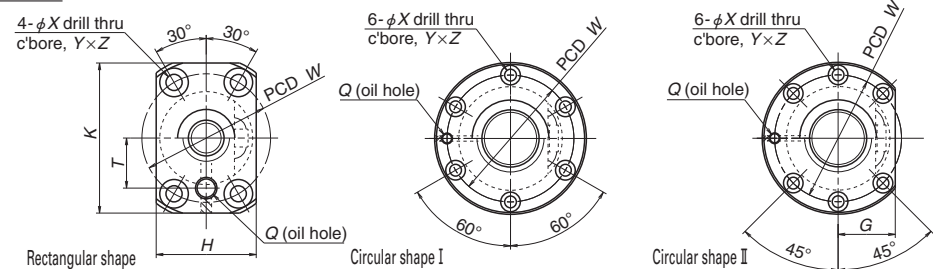
5. For PFT and LPFT, the basic load ratings differ from the other models as the spacer balls are installed.

6. The models marked with * (asterisk) are available in the FA type standard ball screws with finished shaft end.

7. Preload system: P, Oversize ball preload; D, Double nut preload (See page B5.)



View X-X



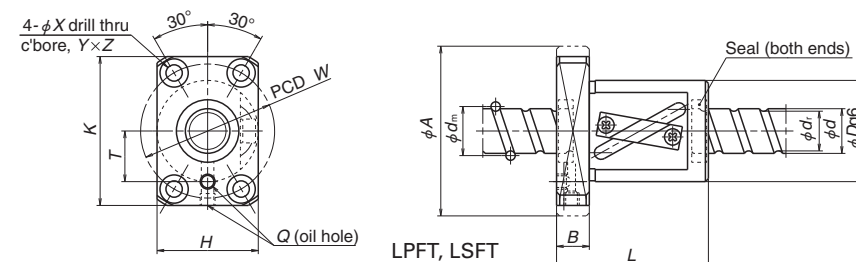
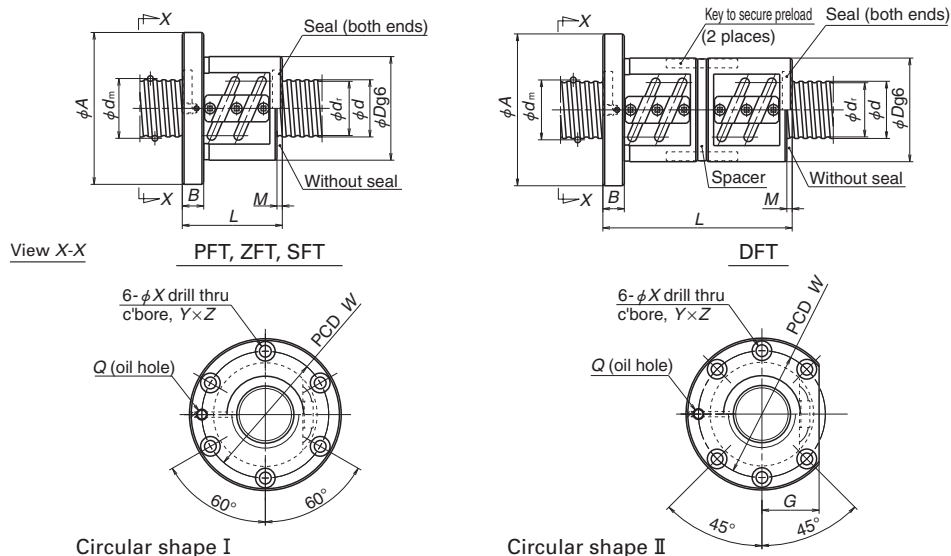
Unit: mm

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_e</i>	Static <i>C_{0a}</i>	
PFT 1605-3	P	16	5	3.175	16.5	13.2	1.5×2	6 350	8 070	166
SFT 1605-2.5	Clearance						2.5×1	8 620	13 800	168
DFT 1605-2.5	D						2.5×1	8 620	13 800	330
PFT 1605-5	P						2.5×2	9 850	13 800	270
SFT 1605-3	Clearance						1.5×2	10 100	16 100	197
DFT 1605-3	D						1.5×2	10 100	16 100	387
SFT 1605-5	Clearance						2.5×2	15 600	27 600	326
DFT 1605-5	D						2.5×2	15 600	27 600	639
PFT 1606-2.5	P		6	3.175	16.5	13.2	2.5×1	5 410	6 880	139
SFT 1606-2.5	Clearance						2.5×1	8 590	13 800	168
DFT 1606-2.5	D						2.5×1	8 590	13 800	329
SFT 1606-3	Clearance						1.5×2	10 100	16 100	197
DFT 1606-3	D						1.5×2	10 100	16 100	386
* LPFT 1616-1.5	P	16	3.175	16.75	13.4	1.5×1	4	4 180	5 390	107
LSFT 1616-1.5	Clearance						5	4 480	8 080	98
SFT 2004-2.5	Clearance	20	4	2.381	20.3	17.8	2.5×1	5 730	10 900	171
DFT 2004-2.5	D						2.5×1	5 730	10 900	336
* PFT 2004-5	P						2.5×2	6 550	10 900	276
SFT 2004-5	Clearance						2.5×2	10 400	21 800	332
DFT 2004-5	D						2.5×2	10 400	21 800	651
PFT 2005-3	P		5	3.175	20.5	17.2	1.5×2	7 140	10 300	201
SFT 2005-2.5	Clearance						2.5×1	9 690	17 100	201
DFT 2005-2.5	D						2.5×1	9 690	17 100	393
* PFT 2005-5	P						2.5×2	11 100	17 100	327
SFT 2005-3	Clearance						1.5×2	11 300	20 500	238
DFT 2005-3	D						1.5×2	11 300	20 500	467
SFT 2005-5	Clearance						2.5×2	17 600	34 200	388
DFT 2005-5	D						2.5×2	17 600	34 200	762

- Notes: 1. Nut flange for shaft diameter 16 mm or smaller comes in rectangular shape. It comes in circular shape I and circular shape II for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for PFT, SFT, and DFT, the nut length "L" is shortened by dimension "M".
3. Seals are equipped as a standard for LSFT and LPFT of shaft diameter 20 mm or smaller. The outside dimensions are the same as those of without seals.
4. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

Ball nut dimensions													
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Rectangle flanged diameter		Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole length <i>T</i>	Oil hole <i>Q</i>
					<i>H</i>	<i>K</i>		<i>X</i>	<i>Y</i>	<i>Z</i>			
52	40	63	11	—	40	55	—	5.5	9.5	5.5	51	20	M6×1
42													
77													
57													
52													
97	40	63	11	—	40	55	—	5.5	9.5	5.5	51	20	M6×1
57													
57													
107													
44													
56	40	63	12	—	40	55	—	5.5	9.5	5.5	51	17	M6×1
110													
37													
69													
49													
49	40	63	11	24	—	—	3	5.5	9.5	5.5	51	—	M6×1
93													
52													
41													
76													
56	44	67	11	26	—	—	3	5.5	9.5	5.5	55	—	M6×1
52													
97													
56													
106													

5. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_e*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
6. For PFT and LPFT, the basic load ratings differ from the other models as the spacer balls are installed.
7. The models marked with * (asterisk) are available in the FA or SA type standard ball screws with finished shaft end.
8. Preload system: P, Oversize ball preload; D, Double nut preload (See page B5.)



Unit: mm

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
PFT 2006-2.5	P	20	6	3.969	20.5	16.4	2.5×1	8 120	10 500	172
PFT 2006-3	P						1.5×2	9 500	12 600	204
SFT 2006-2.5	Clearance						2.5×1	12 900	21 000	204
DFT 2006-2.5	D						2.5×1	12 900	21 000	401
SFT 2006-3	Clearance						1.5×2	15 100	25 200	243
DFT 2006-3	D						1.5×2	15 100	25 200	477
PFT 2008-2.5	P		8	3.969	20.5	16.4	2.5×1	8 080	10 500	170
SFT 2008-2.5	Clearance						2.5×1	12 800	20 900	203
DFT 2008-2.5	D						2.5×1	12 800	20 900	397
SFT 2008-3	Clearance						1.5×2	15 000	25 100	241
DFT 2008-3	D						1.5×2	15 000	25 100	473
* LPFT 2010-2.5	P						10	3.969	21.0	16.9
LSFT 2010-2.5	Clearance		1.5×2	13 300	21 900	211				
LPFT 2016-2.5	P		16	3.969	21.0	16.9	2.5×1	8 170	10 800	171
LSFT 2016-2.5	Clearance						1.5×2	13 000	21 600	203
* LPFT 2020-1.5	P	25	20	3.969	21.0	16.9	1.5×1	6 250	8 760	132
LSFT 2020-1.5	Clearance						2.5×1	8 190	13 100	123
SFT 2504-2.5	Clearance						2.5×1	6 220	13 600	203
ZFT 2504-5	Z						2.5×1	6 220	13 600	399
* PFT 2504-5	P		4	2.381	25.3	22.8	2.5×2	7 110	13 600	328
SFT 2504-5	Clearance						2.5×2	11 300	27 200	394
ZFT 2504-10	Z						2.5×2	11 300	27 200	773
PFT 2505-3	P						1.5×2	7 940	12 800	235
SFT 2505-2.5	Clearance						2.5×1	10 800	21 800	243
ZFT 2505-5	Z						2.5×1	10 800	21 800	477
* PFT 2505-5	P						2.5×2	12 300	21 800	391
SFT 2505-3	Clearance						1.5×2	12 600	25 600	285
DFT 2505-3	D						1.5×2	12 600	25 600	558
PFT 2505-7.5	P						2.5×3	17 500	32 700	576
SFT 2505-5	Clearance						2.5×2	19 600	43 600	470
ZFT 2505-10	Z						2.5×2	19 600	43 600	923
SFT 2505-7.5	Clearance						2.5×3	27 700	65 400	692

- Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for PFT, SFT, and DFT, the nut length "L" is shortened by dimension "M".
3. Seals are equipped as a standard for LSFT and LPFT of shaft diameter 20 mm or smaller. The outside dimensions are the same as those of without seals.
4. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

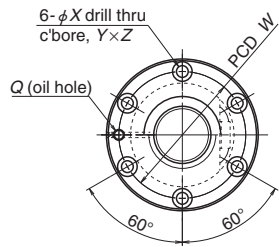
Ball nut dimensions													
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Rectangle flanged diameter <i>H</i> <i>K</i>		Seal dimension <i>M</i>	Bolt hole dimension <i>X</i> <i>Y</i> <i>Z</i>			Bolt hole PCD <i>W</i>	Bolt hole length <i>T</i>	Oil hole <i>Q</i>
44	48	71	11	27	—	—	3	5.5	9.5	5.5	59	—	M6×1
56													
44													
86													
56													
110													
54	48	75	13	28	—	—	5	6.6	11	6.5	61	—	M6×1
54													
102													
64													
120													
54	46	74	13	—	46	66	—	6.6	11	6.5	59	24	M6×1
72													
63													
36													
48													
48													
48	46	69	11	26	—	—	3	5.5	9.5	5.5	57	—	M6×1
72													
52													
40													
55													
55													
52	50	73	11	28	—	—	3	5.5	9.5	5.5	61	—	M6×1
102													
70													
55													
85													
70													

5. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
6. For PFT and LPFT, the basic load ratings differ from the other models as the spacer balls are installed.
7. The models marked with * (asterisk) are available in the FA or SA type standard ball screws with finished shaft end.
8. Preload system: P, Oversize ball preload; Z, Offset preload; D, Double nut preload (See page B5.)

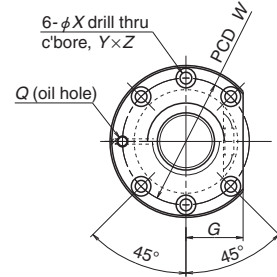
Return tube type

NSK

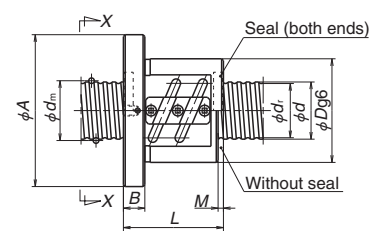
View X-X



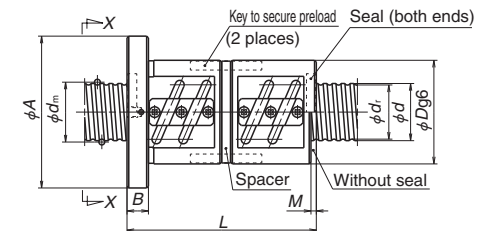
Circular shape I



Circular shape II



PFT, ZFT, SFT



DFT

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
PFT 2506-3	P	25	6	3.969	25.5	21.4	1.5×2	10 700	16 000	247
SFT 2506-2.5	Clearance						2.5×1	14 500	26 700	247
ZFT 2506-5	Z						2.5×1	14 500	26 700	485
* PFT 2506-5	P						2.5×2	16 600	26 700	402
SFT 2506-3	Clearance						1.5×2	17 000	32 000	294
DFT 2506-3	D						1.5×2	17 000	32 000	577
SFT 2506-5	Clearance						2.5×2	26 300	53 400	478
ZFT 2506-10	Z						2.5×2	26 300	53 400	938
PFT 2508-2.5	P		8	4.762	25.5	20.5	2.5×1	11 700	15 900	213
PFT 2508-3	P						1.5×2	13 700	18 900	245
SFT 2508-2.5	Clearance						2.5×1	18 500	31 800	253
ZFT 2508-5	Z						2.5×1	18 500	31 800	495
SFT 2508-3	Clearance						1.5×2	21 700	37 900	299
DFT 2508-3	D						1.5×2	21 700	37 900	587
PFT 2510-2.5	P		10	4.762	25.5	20.5	2.5×1	11 600	15 900	211
ZFT 2510-3	Z						1.5×1	11 900	18 900	301
PFT 2510-3	P						1.5×2	13 600	18 900	243
SFT 2510-2.5	Clearance						2.5×1	18 500	31 700	251
DFT 2510-2.5	D						2.5×1	18 500	31 700	493
SFT 2510-3	Clearance						1.5×2	21 600	37 800	297
DFT 2510-3	D						1.5×2	21 600	37 800	583
SFT 2510-3.5	Clearance						3.5×1	24 700	44 600	347
DFT 2510-3.5	D						3.5×1	24 700	44 600	681

Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.

2. If there is no seal for PFT, ZFT, SFT, and DFT, the nut length "L" is shortened by dimension "M".

3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

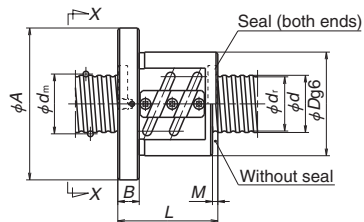
Ball nut dimensions											Unit: mm
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole <i>Q</i>	
						<i>X</i>	<i>Y</i>	<i>Z</i>			
56	53	76	11	29	3	5.5	9.5	5.5	64	M6×1	
44											
62											
62											
56											
110											
62	58	85	13	32	5	6.6	11	6.5	71	M6×1	
98											
56											
69											
56											
80											
67	58	85	15	32	8	6.6	11	6.5	71	M6×1	
81											
81											
67											
127											
81											
151											
77											
147											

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_a*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

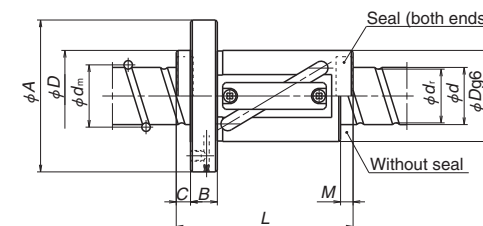
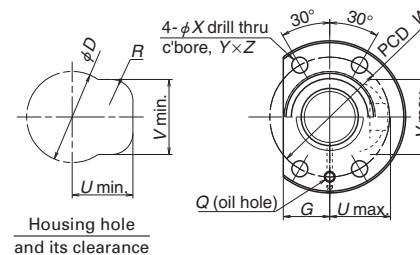
5. For PFT, the basic load ratings differ from the other models as the spacer balls are installed.

6. The models marked with * (asterisk) are available in the SA type standard ball screws with finished shaft end.

7. Preload system: P, Oversize ball preload; Z, Offset preload; D, Double nut preload (See page B5.)

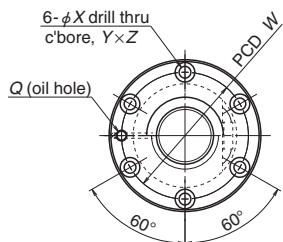


PFT, ZFT, SFT

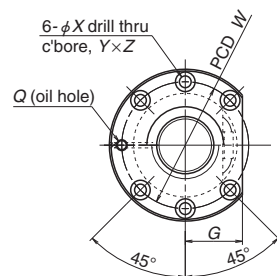


LPFT, LSFT

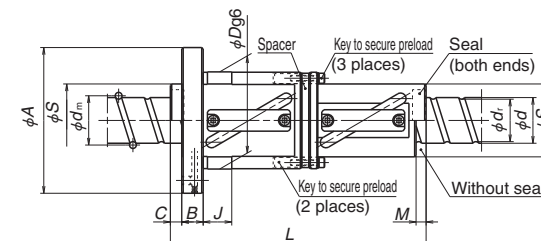
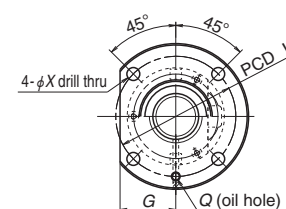
View X-X



Circular shape I



Circular shape II



LDFT

Unit: mm

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)	Nut entire length <i>L</i>
								Dynamic <i>C_s</i>	Static <i>C_{0s}</i>		
LPFT 2516-2.5	P	25	16	4.762	26.25	21.3	2.5×1	11 400	16 500	213	84
LPFT 2516-3	P						1.5×2	13 400	19 500	251	100
LSFT 2516-2.5	Clearance						2.5×1	18 100	33 000	253	84
LDFT 2516-2.5	D						2.5×1	18 100	33 000	496	152
LSFT 2516-3	Clearance						1.5×2	21 200	39 000	298	100
LDFT 2516-3	D						1.5×2	21 200	39 000	584	181
* LPFT 2520-2.5	P		20	4.762	26.25	21.3	2.5×1	11 700	16 300	211	96
LPFT 2520-3	P						1.5×2	13 700	19 300	248	116
LSFT 2520-2.5	Clearance						2.5×1	18 600	32 600	251	96
LDFT 2520-2.5	D						2.5×1	18 600	32 600	492	177
LSFT 2520-3	Clearance						1.5×2	21 800	38 600	296	116
LDFT 2520-3	D						1.5×2	21 800	38 600	580	217
* LPFT 2525-1.5	P	25	4.762	26.25	21.3	1.5×1	7 400	9 860	124	90	
LDFT 2525-1.5	D						11 700	19 700	297	166	
LSFT 2525-1.5	Clearance						11 700	19 700	151	90	
SFT 2805-2.5	Clearance						11 300	24 400	265	41	
ZFT 2805-5	Z	28	5	3.175	28.5	25.2	2.5×1	11 300	24 400	519	56
PFT 2805-5	P						2.5×2	13 000	24 400	432	56
SFT 2805-5	Clearance						2.5×2	20 600	48 700	514	56
* ZFT 2805-10	Z						2.5×2	20 600	48 700	1 007	86

- Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for PFT, ZFT, and SFT, the nut length "L" is shortened by dimension "M".
3. If there is no seal for LSFT and LDFT of shaft diameter 25 mm or larger, the nut length "L" is shortened by dimension "M" and "C".
4. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

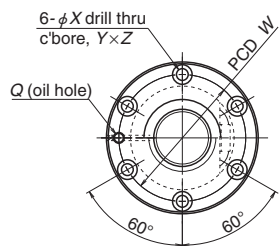
Ball nut dimensions															
Nut diameter		Flanged diameter	Flanged width	Notched flange	Tube projecting type			Seal dimension		Diameter g6	Bolt hole dimension			Bolt hole PCD	Oil hole
<i>D</i>	<i>S</i>	<i>A</i>	<i>B</i>	<i>G</i>	<i>U</i>	<i>V</i>	<i>R</i>	<i>M</i>	<i>C</i>	<i>J</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>	<i>Q</i>
44	—	71	12	23	31	35	12	6	8	—	6.6	—	—	57	M6×1
44	—	71		23	31	35	12			—				57	
44	—	71		23	31	35	12			—				57	
62	44	89		34	—	—	—			18				75	
44	—	71		23	31	35	12			—				57	
62	44	89		34	—	—	—			18				75	
44	—	71	12	23	31	35	12	7	8	—	6.6	—	—	57	M6×1
44	—	71		23	31	35	12			—				57	
44	—	71		23	31	35	12			—				57	
62	44	89		34	—	—	—			18				75	
44	—	71		23	31	35	12			—				57	
62	44	89		34	—	—	—			18				75	
44	—	71	12	23	32	34	12	10	10	—	6.6	—	—	57	M6×1
62	44	89		34	—	—	—			18				75	
44	—	71		23	32	34	12			—				57	
55	—	85	12	31	—	—	—	3	—	—	6.6	11	6.5	69	M6×1

5. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_d*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
6. For PFT and LPFT, the basic load ratings differ from the other models as the spacer balls are installed.
7. The models marked with * (asterisk) are available in the FA or SA type standard ball screws with finished shaft end.
8. Preload system: P, Oversize ball preload; Z, Offset preload; D, Double nut preload (See page B5.)

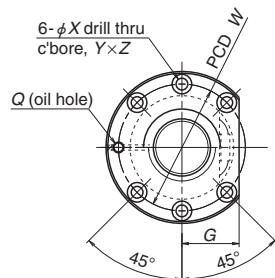
Return tube type

NSK

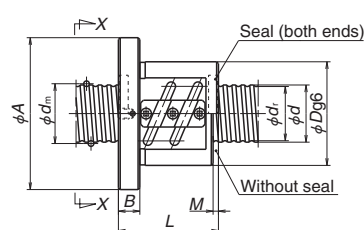
View X-X



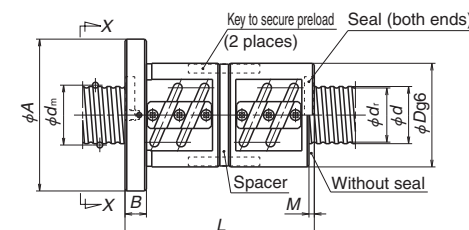
Circular shape I



Circular shape II



PFT, ZFT, SFT



DFT

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
PFT 2806-3	P	28	6	3.175	28.5	25.2	1.5x2	8 350	14 600	265
SFT 2806-2.5	Clearance						2.5x1	11 300	24 300	265
ZFT 2806-5	Z						2.5x1	11 300	24 300	519
* PFT 2806-5	P						2.5x2	12 900	24 300	430
SFT 2806-3	Clearance						1.5x2	13 200	29 200	315
DFT 2806-3	D						1.5x2	13 200	29 200	617
SFT 2806-5	Clearance						2.5x2	20 600	48 700	513
* ZFT 2806-10	Z						2.5x2	20 600	48 700	1 006
PFT 2810-2.5	P		10	4.762	28.5	23.5	2.5x1	12 300	17 900	229
ZFT 2810-3	Z						1.5x1	12 600	21 400	332
PFT 2810-3	P						1.5x2	14 400	21 400	275
SFT 2810-2.5	Clearance						2.5x1	19 600	35 800	277
DFT 2810-2.5	D						2.5x1	19 600	35 800	543
SFT 2810-3	Clearance						1.5x2	22 900	42 700	328
DFT 2810-3	D						1.5x2	22 900	42 700	643
SFT 3204-2.5	Clearance	32	4	2.381	32.3	29.8	2.5x1	6 850	17 500	247
ZFT 3204-5	Z						2.5x1	6 850	17 500	485
PFT 3204-5	P						2.5x2	7 840	17 500	403
SFT 3204-5	Clearance						2.5x2	12 400	35 000	479
ZFT 3204-10	Z						2.5x2	12 400	35 000	939
PFT 3205-3	P		5	3.175	32.5	29.2	1.5x2	8 850	16 800	296
SFT 3205-2.5	Clearance						2.5x1	12 000	28 000	296
ZFT 3205-5	Z						2.5x1	12 000	28 000	580
* PFT 3205-5	P						2.5x2	13 700	28 000	481
SFT 3205-3	Clearance						1.5x2	14 000	33 600	351
DFT 3205-3	D						1.5x2	14 000	33 600	689
PFT 3205-7.5	P						2.5x3	19 500	42 000	709
SFT 3205-5	Clearance						2.5x2	21 800	56 000	572
* ZFT 3205-10	Z						2.5x2	21 800	56 000	1 123
SFT 3205-7.5	Clearance						2.5x3	30 900	84 000	843
DFT 3205-7.5	D						2.5x3	30 900	84 000	1 652

Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.

2. If there is no seal for PFT, ZFT, SFT, and DFT, the nut length "L" is shortened by dimension "M".

3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

Ball nut dimensions										
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole <i>Q</i>
						<i>X</i>	<i>Y</i>	<i>Z</i>		
57	55	85	12	31	3	6.6	11	6.5	69	M6×1
45										
63										
63										
57										
111	60	94	15	36	7	9	14	8.5	76	M6×1
63										
99										
68										
82										
82	54	81	12	31	3	6.6	11	6.5	67	M6×1
68										
128										
82										
152										
37	58	85	12	32	3	6.6	11	6.5	71	M6×1
49										
49										
49										
73										
53										
41										
56										
56										
53										
103										
71										
56										
86										
71										
136										

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_a*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

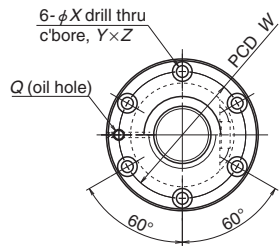
5. For PFT, the basic load ratings differ from the other models as the spacer balls are installed.

6. The models marked with * (asterisk) are available in the SA type standard ball screws with finished shaft end.

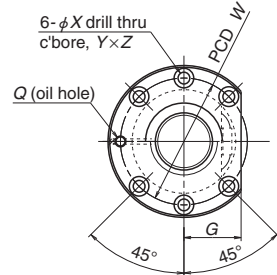
7. Preload system: P, Oversize ball preload; Z, Offset preload; D, Double nut preload (See page B5.)

Return tube type

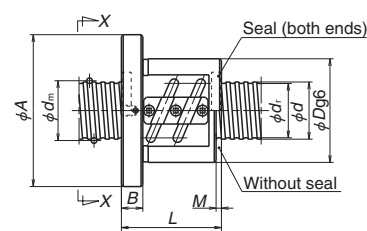
View X-X



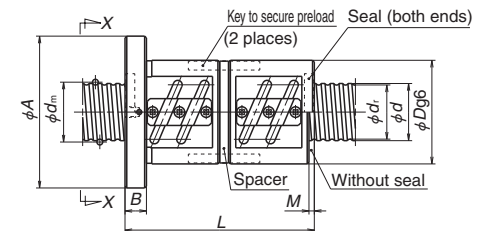
Circular shape I



Circular shape II



PFT, ZFT, SFT



DFT

Unit: mm

Model No.	Preload system	Shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity K (N/μm)
		<i>d</i>	<i>l</i>	<i>D_w</i>	<i>d_m</i>	<i>d_r</i>		Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
PFT 3206-3	P	32	6	3.969	32.5	28.4	1.5x2	11 800	20 600	300
SFT 3206-2.5	Clearance						2.5x1	16 000	34 700	302
ZFT 3206-5	Z						2.5x1	16 000	34 700	592
PFT 3206-5	P						2.5x2	18 300	34 700	491
SFT 3206-3	Clearance						1.5x2	18 800	41 200	357
DFT 3206-3	D						1.5x2	18 800	41 200	700
SFT 3206-5	Clearance						2.5x2	29 100	69 300	585
ZFT 3206-10	Z						2.5x2	29 100	69 300	1 146
PFT 3208-3	P		8	4.762	32.5	27.5	1.5x2	15 100	24 700	308
SFT 3208-2.5	Clearance						2.5x1	20 600	40 900	307
ZFT 3208-5	Z						2.5x1	20 600	40 900	602
PFT 3208-5	P						2.5x2	23 500	40 900	493
SFT 3208-3	Clearance						1.5x2	24 000	49 400	366
ZFT 3208-6	Z						1.5x2	24 000	49 400	718
SFT 3208-5	Clearance						2.5x2	37 300	81 800	594
DFT 3208-5	D						2.5x2	37 300	81 800	1 164
ZFT 3208-10	Z		2.5x2	37 300	81 800	1 164				
PFT 3210-2.5	P		10	6.35	33.0	26.4	2.5x1	18 900	27 600	266
ZFT 3210-3	Z						1.5x1	19 300	32 300	381
PFT 3210-3	P						1.5x2	22 100	32 300	316
SFT 3210-2.5	Clearance						2.5x1	30 000	55 100	322
ZFT 3210-5	Z						2.5x1	30 000	55 100	631
PFT 3210-5	P						2.5x2	34 300	55 100	515
SFT 3210-3	Clearance						1.5x2	35 100	64 500	376
DFT 3210-3	D						1.5x2	35 100	64 500	738
SFT 3210-3.5	Clearance						3.5x1	40 100	76 600	441
DFT 3210-3.5	D						3.5x1	40 100	76 600	865
SFT 3210-5	Clearance						2.5x2	54 500	110 000	623
DFT 3210-5	D						2.5x2	54 500	110 000	1 222
ZFT 3210-10	Z		2.5x2	54 500	110 000	1 222				
PFT 3212-2.5	P	12	6.35	33.0	26.4	2.5x1	18 800	27 500	265	
ZFT 3212-3	Z					1.5x1	19 300	32 200	380	
PFT 3212-3	P					1.5x2	22 000	32 200	315	
SFT 3212-2.5	Clearance					2.5x1	29 900	55 000	320	
DFT 3212-2.5	D					2.5x1	29 900	55 000	628	
SFT 3212-3	Clearance					1.5x2	35 000	64 400	375	
DFT 3212-3	D					1.5x2	35 000	64 400	735	

Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.

2. If there is no seal for PFT, ZFT, SFT, and DFT, the nut length "L" is shortened by dimension "M".

3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

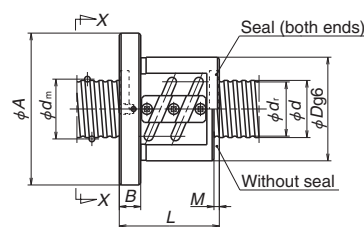
Ball nut dimensions										
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole <i>Q</i>
						<i>X</i>	<i>Y</i>	<i>Z</i>		
57	62	89	12	34	3	6.6	11	6.5	75	M6×1
45										
63										
63										
57										
111										
63										
99										
71										
58										
82	66	100	15	38	5	9	14	8.5	82	M6×1
82										
71										
111										
82										
154										
130										
70										
87										
87										
70	74	108	15	41	7	9	14	8.5	90	M6×1
100										
100										
87										
167										
80										
150										
100										
190										
160										
81	74	108	18	41	9	9	14	8.5	90	M6×1
97										
97										
81										
153										
97										
181										

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_d*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

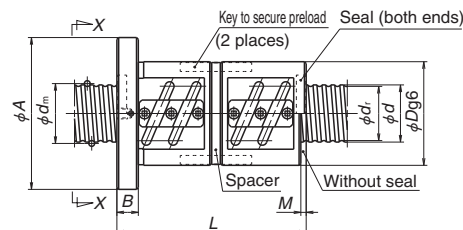
5. For PFT, the basic load ratings differ from the other models as the spacer balls are installed.

6. The models marked with * (asterisk) are available in the SA type standard ball screws with finished shaft end.

7. Preload system: P, Oversize ball preload; Z, Offset preload; D, Double nut preload (See page B5.)

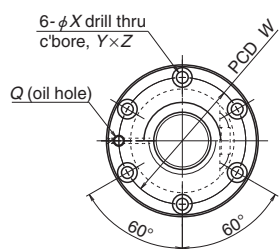


PFT, ZFT, SFT

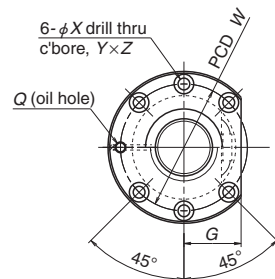


DFT

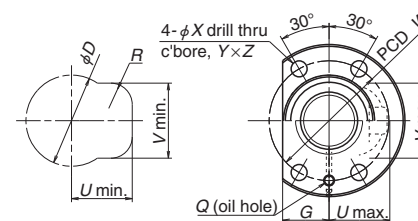
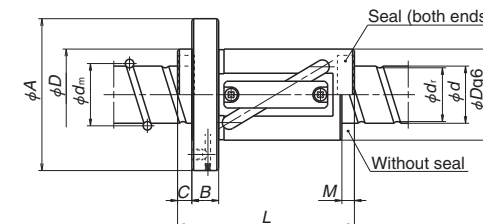
View X-X



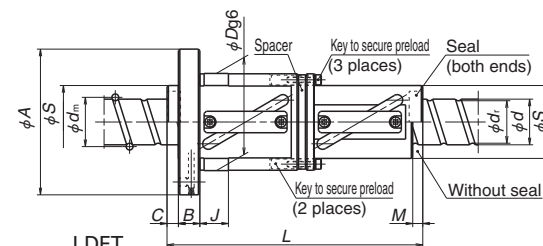
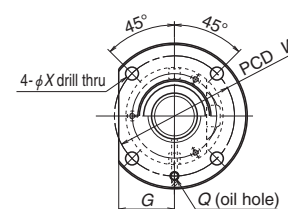
Circular shape I



Circular shape II

Housing hole
and its clearance

LPFT, LSFT



LDFT

Unit: mm

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls × Circuits	Basic load rating (N) Dynamic <i>C_d</i>	Static <i>C₀</i>	Axial rigidity <i>K</i> (N/μm)	Nut entire length <i>L</i>
LPFT 3220-2.5	P	32	20	4.762	33.25	28.3	2.5×1	13 000	20 900	255	99
LPFT 3220-3	P						1.5×2	15 300	25 100	301	119
LSFT 3220-2.5	Clearance						2.5×1	20 700	41 900	307	99
LDFT 3220-2.5	D						2.5×1	20 700	41 900	603	179
LSFT 3220-3	Clearance						1.5×2	24 200	50 200	366	119
LDFT 3220-3	D						1.5×2	24 200	50 200	717	219
LPFT 3225-2.5	P		25	4.762	33.25	28.3	2.5×1	12 900	21 100	256	117
LPFT 3225-3	P						1.5×2	15 100	24 900	295	142
LSFT 3225-2.5	Clearance						2.5×1	20 400	42 200	304	117
LDFT 3225-2.5	D						2.5×1	20 400	42 200	597	218
LSFT 3225-3	Clearance						1.5×2	23 900	49 700	358	142
LDFT 3225-3	D						1.5×2	23 900	49 700	702	268
LPFT 3232-1.5	P	36	32	4.762	33.25	28.3	1.5×1	8 360	12 600	155	109
LSFT 3232-1.5	Clearance						1.5×1	13 300	25 200	184	109
LDFT 3232-1.5	D						1.5×1	13 300	25 200	361	205
ZFT 3605-5	Z						2.5×1	12 600	31 600	637	59
PFT 3605-5	P						2.5×2	14 400	31 600	529	59
PFT 3605-7.5	P						2.5×3	20 400	47 500	779	74
SFT 3605-5	Clearance		5	3.175	36.5	33.2	2.5×2	22 900	63 300	630	59
ZFT 3605-10	Z						2.5×2	22 900	63 300	1 235	89
SFT 3605-7.5	Clearance						2.5×3	32 400	94 900	926	74
DFT 3605-7.5	D						2.5×3	32 400	94 900	1 817	139

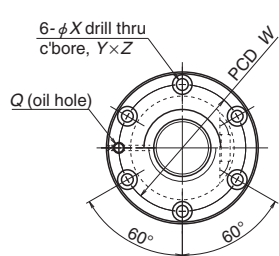
- Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for PFT, ZFT, SFT, and DFT the nut length "L" is shortened by dimension "M".
3. If there is no seal for LSFT and LDFT of shaft diameter 25 mm or larger, the nut length "L" is shortened by dimension "M" and "C".
4. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

Ball nut dimensions														
Nut diameter		Flanged diameter	Flanged width	Notched flange	Tube projecting type			Seal dimension		Diameter g6	Bolt hole dimension			Bolt hole PCD
<i>D</i>	<i>S</i>	<i>A</i>	<i>B</i>	<i>G</i>	<i>U</i>	<i>V</i>	<i>R</i>	<i>M</i>	<i>C</i>	<i>J</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>
51	—	85	15	26	34	42	12	7	8	—	9	—	—	67
51	—	85		26	34	42	12			—				67
51	—	85		26	34	42	12			—				67
68	51	102		39	—	—	—			20				84
51	—	85		26	34	42	12			—				67
68	51	102		39	—	—	—			20				84
51	—	85	15	26	34	42	12	10	10	—	9	—	—	67
51	—	85		26	34	42	12			—				67
51	—	85		26	34	42	12			—				67
68	51	102		39	—	—	—			20				84
51	—	85		26	34	42	12			—				67
51	—	85		26	34	42	12			—				67
68	51	102		39	—	—	—			20				84
51	—	85	15	26	34	42	12	13	12	—	9	—	—	67
51	—	85		26	34	42	12			—				67
68	51	102		39	—	—	—			20				84
65	—	100	15	38	—	—	—	3	—	—	9	14	8.5	82

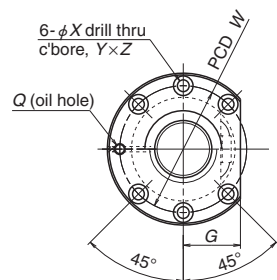
5. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_d*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
6. For PFT and LPFT, the basic load ratings differ from the other models as the spacer balls are installed.
7. The models marked with * (asterisk) are available in the FA type standard ball screws with finished shaft end.
8. Preload system: P, Oversize ball preload; Z, Offset preload; D, Double nut preload (See page B5.)

Return tube type

View X-X



Circular shape I



Circular shape II

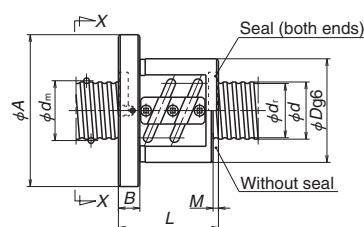
Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N) Dynamic <i>C_d</i>	Static <i>C_{0a}</i>	Axial rigidity <i>K</i> (N/μm)
ZFT 3606-5	Z	36	6	3.969	36.5	32.4	2.5×1	17 200	39 200	656
PFT 3606-5	P						2.5×2	19 700	39 200	545
PFT 3606-7.5	P						2.5×3	27 900	58 800	802
SFT 3606-5	Clearance						2.5×2	31 300	78 400	648
ZFT 3606-10	Z						2.5×2	31 300	78 400	1 271
SFT 3606-7.5	Clearance						2.5×3	44 400	118 000	954
DFT 3606-7.5	D						2.5×3	44 400	118 000	1 872
PFT 3610-2.5	P		10	6.35	37.0	30.4	2.5×1	20 100	30 500	290
ZFT 3610-3	Z						1.5×1	20 600	36 600	422
PFT 3610-3	P						1.5×2	23 600	36 600	342
SFT 3610-2.5	Clearance						2.5×1	32 000	61 100	350
* ZFT 3610-5	Z						2.5×1	32 000	61 100	687
PFT 3610-5	P						2.5×2	36 600	61 100	562
SFT 3610-3	Clearance						1.5×2	37 400	73 300	417
DFT 3610-3	D						1.5×2	37 400	73 300	817
PFT 3610-7.5	P						2.5×3	51 800	91 600	826
SFT 3610-5	Clearance						2.5×2	58 000	122 000	678
DFT 3610-5	D						2.5×2	58 000	122 000	1 329
ZFT 3610-10	Z						2.5×2	58 000	122 000	1 329
SFT 3610-7.5	Clearance	40	5	3.175	40.5	37.2	2.5×3	82 200	183 000	998
PFT 4005-3	P						1.5×2	9 700	21 200	354
SFT 4005-2.5	Clearance						2.5×1	13 200	35 300	354
ZFT 4005-5	Z						2.5×1	13 200	35 300	695
PFT 4005-5	P						2.5×2	15 100	35 300	577
SFT 4005-3	Clearance						1.5×2	15 400	42 300	421
DFT 4005-3	D						1.5×2	15 400	42 300	826
PFT 4005-7.5	P						2.5×3	21 300	52 900	848
SFT 4005-5	Clearance						2.5×2	23 900	70 500	685
* ZFT 4005-10	Z						2.5×2	23 900	70 500	1 344
SFT 4005-7.5	Clearance						2.5×3	33 900	106 000	1 009
DFT 4005-7.5	D						2.5×3	33 900	106 000	1 979
ZFT 4006-5	Z	40	6	3.969	40.5	36.4	2.5×1	18 000	43 800	715
PFT 4006-5	P						2.5×2	20 500	43 800	592
SFT 4006-3	Clearance						1.5×2	21 000	52 500	433
DFT 4006-3	D						1.5×2	21 000	52 500	850
PFT 4006-7.5	P						2.5×3	29 100	65 600	872
SFT 4006-5	Clearance						2.5×2	32 600	87 500	705
ZFT 4006-10	Z						2.5×2	32 600	87 500	1 383
SFT 4006-7.5	Clearance						2.5×3	46 200	131 000	1 038
DFT 4006-7.5	D						2.5×3	46 200	131 000	2 036

Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.

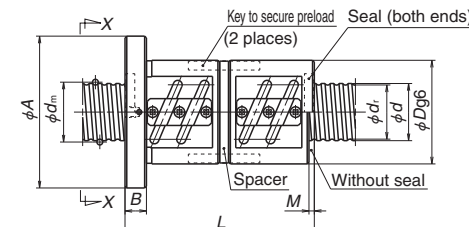
2. If there is no seal for PFT, ZFT, SFT, and DFT, the nut length "L" is shortened by dimension "M".

3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

NSK



PFT, ZFT, SFT



DFT

Unit: mm

Ball nut dimensions										
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole <i>Q</i>
						<i>X</i>	<i>Y</i>	<i>Z</i>		
66	65	100	15	38	3	9	14	8.5	82	M6×1
66										
84										
66										
102										
84										
162	75	120	18	45	7	11	17.5	11	98	M6×1
73										
90										
90										
73										
103										
103										
90										
170										
133										
103										
193	67	101	15	39	3	9	14	8.5	83	Rc1/8
163										
133										
56										
44										
59										
59										
56										
106										
74										
59										
89	70	104	15	40	3	9	14	8.5	86	Rc1/8
74										
139										
66										
66										
60										
114										
84										
66										
102										
84										
162										

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_d*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

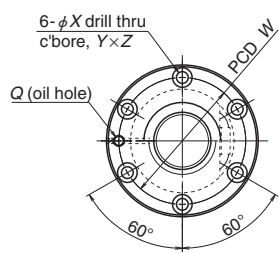
5. For PFT, the basic load ratings differ from the other models as the spacer balls are installed.

6. The models marked with * (asterisk) are available in the SA type standard ball screws with finished shaft end.

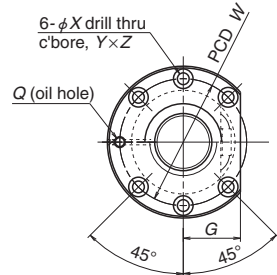
7. Preload system: P, Oversize ball preload; Z, Offset preload; D, Double nut preload (See page B5.)

Return tube type

View X-X



Circular shape I



Circular shape II

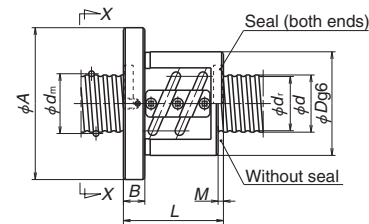
Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
PFT 4008-3	P	40	8	4.762	40.5	35.5	1.5×2	16 700	31 200	370
SFT 4008-2.5	Clearance						2.5×1	22 700	51 500	368
ZFT 4008-5	Z						2.5×1	22 700	51 500	721
PFT 4008-5	P						2.5×2	25 900	51 500	598
SFT 4008-3	Clearance						1.5×2	26 500	62 500	440
DFT 4008-3	D						1.5×2	26 500	62 500	863
SFT 4008-5	Clearance						2.5×2	41 100	103 000	711
ZFT 4008-10	Z						2.5×2	41 100	103 000	1 394
PFT 4010-2.5	P		10	6.35	41	34.4	2.5×1	21 300	34 200	322
PFT 4010-3	P						1.5×2	24 900	41 000	383
SFT 4010-2.5	Clearance						2.5×1	33 700	68 300	383
ZFT 4010-5	Z						2.5×1	33 700	68 300	751
PFT 4010-5	P						2.5×2	38 600	68 300	623
SFT 4010-3	Clearance						1.5×2	39 500	82 000	456
ZFT 4010-6	Z						1.5×2	39 500	82 000	894
ZFT 4010-7	Z						3.5×1	45 100	97 100	1 045
SFT 4010-3.5	Clearance						3.5×1	45 100	97 100	533
PFT 4010-7	P						3.5×2	51 500	97 100	859
SFT 4010-5	Clearance						2.5×2	61 200	137 000	741
DFT 4010-5	D						2.5×2	61 200	137 000	1 454
ZFT 4010-10	Z	2.5×2	61 200	137 000	1 454					
SFT 4010-7	Clearance	3.5×2	81 800	194 000	1 032					
PFT 4012-2.5	P	12	7.144	41.5	34.1	2.5×1	24 900	38 600	323	
SFT 4012-2.5	Clearance					2.5×1	39 500	77 200	390	
ZFT 4012-5	Z					2.5×1	39 500	77 200	766	
PFT 4012-5	P					2.5×2	45 200	77 200	626	
PFT 4012-7.5	P					2.5×3	64 000	116 000	921	
SFT 4012-5	Clearance					2.5×2	71 700	154 000	756	
DFT 4012-5	D					2.5×2	71 700	154 000	1 482	
ZFT 4012-10	Z					2.5×2	71 700	154 000	1 482	
SFT 4012-7.5	Clearance	2.5×3	102 000	232 000	1 114					
ZFT 4016-3	Z	16	7.144	41.5	34.1	1.5×1	25 400	46 200	468	
SFT 4016-2.5	Clearance					2.5×1	39 300	77 000	388	
DFT 4016-2.5	D					2.5×1	39 300	77 000	760	
SFT 4016-3	Clearance					1.5×2	46 000	92 400	461	
DFT 4016-3	D					1.5×2	46 000	92 400	905	

Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.

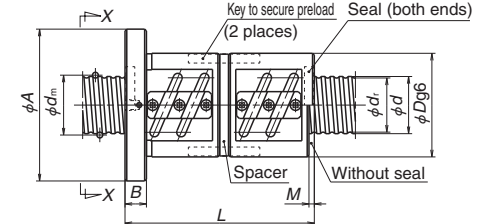
2. If there is no seal for PFT, ZFT, SFT, and DFT, the nut length "L" is shortened by dimension "M".

3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

NSK



PFT, ZFT, SFT



DFT

Unit: mm

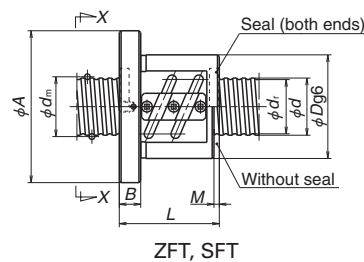
Ball nut dimensions										
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole <i>Q</i>
						<i>X</i>	<i>Y</i>	<i>Z</i>		
71	74	108	15	41	5	9	14	8.5	90	Rc1/8
58										
82										
82										
71										
135										
82										
130										
73										
90										
73										
103										
90	82	124	18	47	7	11	17.5	11	102	Rc1/8
140										
123										
83										
123										
103										
193										
163										
123										
81										
81										
117	86	128	18	48	9	11	17.5	11	106	Rc1/8
117										
153										
117										
225										
189										
153										
118										
102										
182										
118										
214										

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_a*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

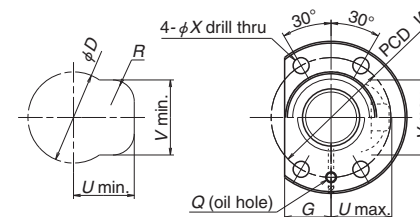
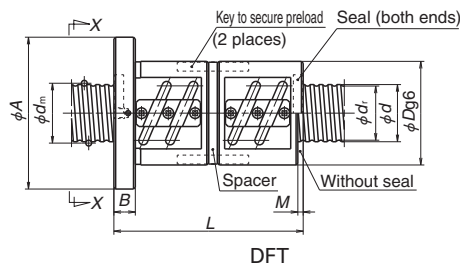
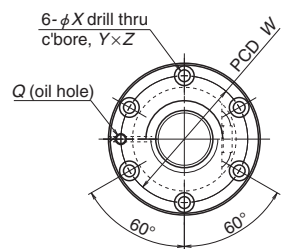
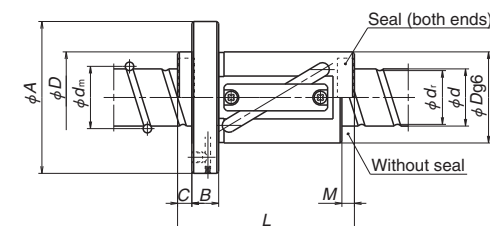
5. For PFT, the basic load ratings differ from the other models as the spacer balls are installed.

6. The models marked with * (asterisk) are available in the SA type standard ball screws with finished shaft end.

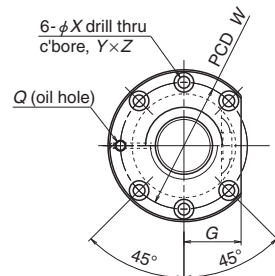
7. Preload system: P, Oversize ball preload; Z, Offset preload; D, Double nut preload (See page B5.)



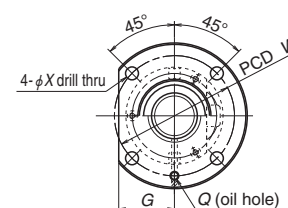
View X-X

Housing hole
and its clearance

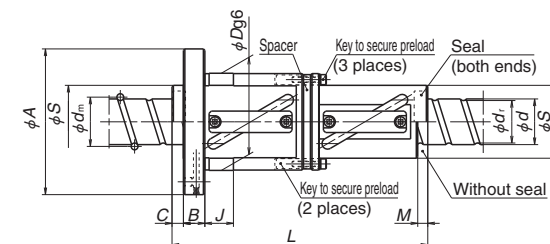
Circular shape I



Circular shape II



LPFT, LSFT



LDFT

Unit: mm

Model No.	Preload system	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity K (N/μm)	Nut entire length L
								Dynamic C_d	Static C_{0d}		
LPFT 4025-2.5	P	40	25	6.35	41.75	35.1	2.5×1	21 500	35 100	324	123
LPFT 4025-3	P						1.5×2	25 100	41 800	375	148
LSFT 4025-2.5	Clearance D						2.5×1	34 100	70 100	385	123
LDFT 4025-2.5	Clearance D						2.5×1	34 100	70 100	755	223
LSFT 4025-3	Clearance D						1.5×2	39 900	83 600	456	148
LDFT 4025-3	Clearance D						1.5×2	39 900	83 600	894	273
LPFT 4032-2.5	P		32	6.35	41.75	35.1	2.5×1	21 200	35 300	316	146
LSFT 4032-2.5	Clearance D						2.5×1	33 600	70 700	381	146
LDFT 4032-2.5	Clearance D						2.5×1	33 600	70 700	747	274
LPFT 4040-1.5	P		40	6.35	41.75	35.1	1.5×1	13 400	21 000	191	133
LSFT 4040-1.5	Clearance D						1.5×1	21 200	42 000	227	133
LDFT 4040-1.5	Clearance D						1.5×1	21 200	42 000	446	253
ZFT 4510-5	Z	45	10	6.35	46.0	39.4	2.5×1	36 300	78 500	841	103
PFT 4510-7	P						3.5×2	55 400	109 000	947	123
PFT 4510-7.5	P						2.5×3	58 800	118 000	1 015	133
SFT 4510-5	Clearance D						2.5×2	65 800	157 000	830	103
DFT 4510-5	Clearance D						2.5×2	65 800	157 000	1 627	193
SFT 4510-7	Clearance D						3.5×2	87 900	218 000	1 136	123
SFT 4510-7.5	Clearance D						2.5×3	93 300	235 000	1 221	133
DFT 4510-7.5	Clearance D						2.5×3	93 300	235 000	2 395	253
SFT 4512-2.5	Clearance D		12	7.144	46.5	39.1	2.5×1	41 600	88 200	432	83
ZFT 4512-5	Z						2.5×1	41 600	88 200	848	119
SFT 4512-5	Clearance D						2.5×2	75 600	176 000	838	119
DFT 4512-5	Clearance D						2.5×2	75 600	176 000	1 643	227

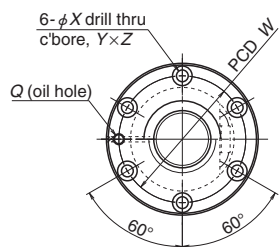
- Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for ZFT, SFT, and DFT the nut length "L" is shortened by dimension "M".
3. If there is no seal for LSFT and LDFT of shaft diameter 25 mm or larger, the nut length "L" is shortened by dimension "M" and "C".
4. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

Ball nut dimensions														
Nut diameter		Flanged diameter A	Flanged width B	Notched flange G	Tube projecting type			Seal dimension		Diameter g6 J	Bolt hole dimension			Oil hole
D	S				U	V	R	M	C		X	Y	Z	
64	—	106	18	33	42	52	15	10	10	—	11	—	—	84
64	—	106		33	42	52	15			—				
64	—	106		33	42	52	15			—				
84	64	126		48	—	—	—			22				
64	—	106		33	42	52	15			—				
84	64	126		48	—	—	—			22				
64	—	106	18	33	42	52	15	13	12	—	11	—	—	84
64	—	106		33	42	52	15			—				
84	64	126		48	—	—	—			22				
64	—	106	18	33	42	52	15	16	14	—	11	—	—	84
64	—	106		33	42	52	15			—				
84	64	126		48	—	—	—			22				
88	—	132	18	50	—	—	—	7	—	—	11	17.5	11	110
90	—	132	18	50	—	—	—	8	—	—	11	17.5	11	110

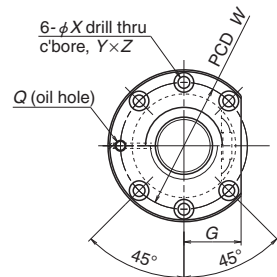
5. The axial rigidity K in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (C_d) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
6. For LPFT, the basic load ratings differ from the other models as the spacer balls are installed.
7. Preload system: P, Oversize ball preload; Z, Offset preload; D, Double nut preload (See page B5.)

Return tube type

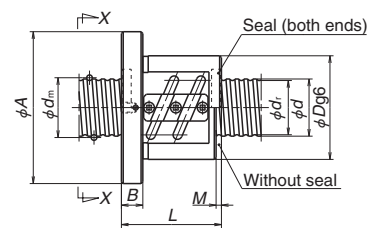
View X-X



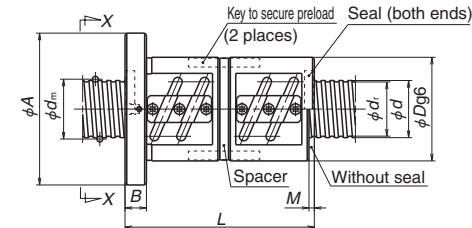
Circular shape I



Circular shape II



ZFT, SFT



DFT

Unit: mm

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
SFT 5005-3	Clearance	50	5	3.175	50.5	47.2	1.5×2	16 800	52 500	499
ZFT 5005-6	Z						1.5×2	16 800	52 500	978
SFT 5005-4.5	Clearance						1.5×3	23 900	78 800	735
ZFT 5005-9	Z						1.5×3	23 900	78 800	1 442
SFT 5006-3	Clearance		6	3.969	50.5	46.4	1.5×2	23 000	66 100	519
DFT 5006-3	D						1.5×2	23 000	66 100	1 017
PFT 5006-7.5	P						2.5×3	31 900	82 700	1 045
SFT 5006-5	Clearance						2.5×2	35 700	110 000	844
ZFT 5006-10	Z						2.5×2	35 700	110 000	1 656
SFT 5006-7.5	Clearance						2.5×3	50 700	165 000	1 243
DFT 5006-7.5	D						2.5×3	50 700	165 000	2 438
SFT 5008-3	Clearance						8	4.762	50.5	45.5
DFT 5008-3	D		1.5×2	29 500	78 900	1 039				
SFT 5008-5	Clearance		2.5×2	45 700	131 000	859				
ZFT 5008-10	Z		2.5×2	45 700	131 000	1 685				
SFT 5008-7.5	Clearance		2.5×3	64 800	196 000	1 265				
DFT 5008-7.5	D		2.5×3	64 800	196 000	2 481				
SFT 5010-2.5	Clearance		10	6.35	51.0	44.4	2.5×1	37 500	87 200	464
ZFT 5010-5	Z						2.5×1	37 500	87 200	909
SFT 5010-3	Clearance						1.5×2	43 900	102 000	544
DFT 5010-3	D						1.5×2	43 900	102 000	1 067
ZFT 5010-7	Z						3.5×1	50 100	122 000	1 251
PFT 5010-7.5	P						2.5×3	60 800	131 000	1 099
SFT 5010-5	Clearance						2.5×2	68 100	174 000	898
ZFT 5010-10	Z						2.5×2	68 100	174 000	1 761
SFT 5010-7.5	Clearance						2.5×3	96 500	262 000	1 321
DFT 5010-7.5	D						2.5×3	96 500	262 000	2 592
SFT 5012-2.5	Clearance		12	7.938	51.5	43.2	2.5×1	50 400	109 000	478
ZFT 5012-5	Z						2.5×1	50 400	109 000	937
SFT 5012-5	Clearance						2.5×2	91 500	218 000	926
DFT 5012-5	D						2.5×2	91 500	218 000	1 815
ZFT 5012-10	Z						2.5×2	91 500	218 000	1 815
SFT 5016-2.5	Clearance		16	7.938	51.5	43.2	2.5×1	50 300	109 000	476
ZFT 5016-5	Z						2.5×1	50 300	109 000	933
PFT 5016-7.5	P						2.5×3	81 400	163 000	1 125
SFT 5016-5	Clearance						2.5×2	91 200	218 000	921
DFT 5016-5	D						2.5×2	91 200	218 000	1 807
SFT 5016-7.5	Clearance						2.5×3	129 000	326 000	1 355
ZFT 5020-3	Z	20	7.938	51.5	43.2	1.5×1	32 300	63 800	563	
SFT 5020-2.5	Clearance					2.5×1	50 100	108 000	473	
DFT 5020-2.5	D					2.5×1	50 100	108 000	928	
SFT 5020-3	Clearance					1.5×2	58 600	128 000	556	
DFT 5020-3	D					1.5×2	58 600	128 000	1 090	

Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.

2. If there is no seal for ZFT, SFT, and DFT, the nut length "L" is shortened by dimension "M".

3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

Ball nut dimensions										
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole <i>Q</i>
						<i>X</i>	<i>Y</i>	<i>Z</i>		
58	80	114	15	43	3	9	14	8.5	96	Rc1/8
83										
68										
103										
62										
116										
86	84	118	15	45	3	9	14	8.5	100	Rc1/8
68										
104										
86										
164										
74										
138	87	129	18	49	5	11	17.5	11	107	Rc1/8
85										
133										
109										
205										
73										
103	93	135	18	51	7	11	17.5	11	113	Rc1/8
90										
170										
123										
133										
103										
163	100	146	22	55	8	14	20	13	122	Rc1/8
133										
253										
87										
123										
123										
231	100	146	22	55	14	14	20	13	122	Rc1/8
195										
104										
152										
200										
152										
280	100	146	28	55	17	14	20	13	122	Rc1/8
200										
147										
127										
227										
147										
267	100	146	28	55	17	14	20	13	122	Rc1/8
147										
267										

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_n*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

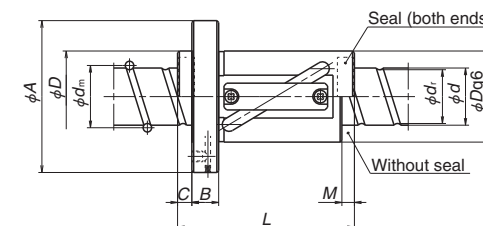
5. The models marked with * (asterisk) are available in the SA type standard ball screws with finished shaft end.

6. Preload system: Z, Offset preload; D, Double nut preload (See page B5.)

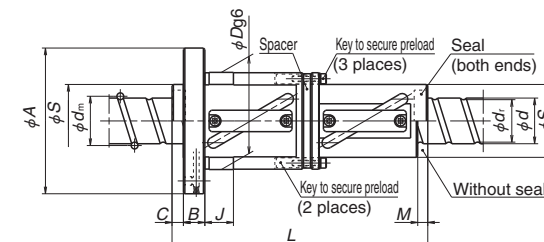
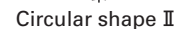
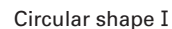
Return tube type



ZFT, SFT



LPFT, LSFT



LDFT

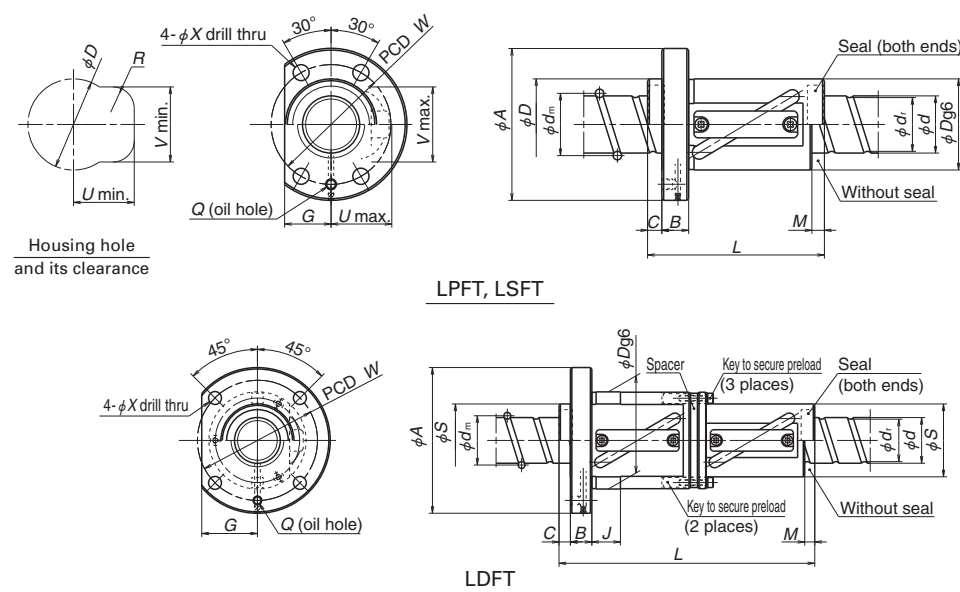
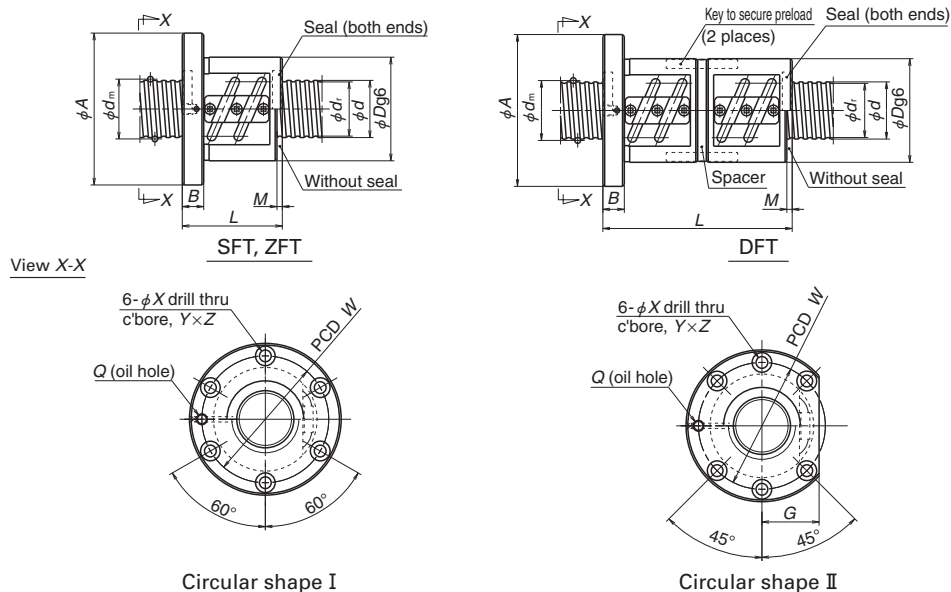
Unit: mm

Ball nut dimensions															
Nut diameter		Flanged diameter	Flanged width	Notched flange	Tube projecting type			Seal dimension		Diameter g6	Bolt hole dimension			Bolt hole PCD	Oil hole
<i>D</i>	<i>S</i>	<i>A</i>	<i>B</i>	<i>G</i>	<i>U</i>	<i>V</i>	<i>R</i>	<i>M</i>	<i>C</i>	<i>J</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>	<i>Q</i>
80	—	126	22	41	52	64	19	11	11	—	14	—	—	102	Rc1/8
80	—	126		41	52	64	19			—				102	
80	—	126		41	52	64	19			—				102	
106	80	152		56	—	—	—			25				128	
80	—	126		41	52	64	19			—				102	
106	80	152		56	—	—	—			25				128	
80	—	126	22	41	52	64	19	14	12	—	14	—	—	102	Rc1/8
80	—	126		41	52	64	19			—				102	
80	—	126		41	52	64	19			—				102	
106	80	152		56	—	—	—			25				128	
80	—	126		41	52	64	19			—				102	
106	80	152		56	—	—	—			25				128	
80	—	126	22	41	52	64	19	17	14	—	14	—	—	102	Rc1/8
80	—	126		41	52	64	19			—				102	
106	80	152		56	—	—	—			25				128	
80	—	126	22	41	52	64	19	21	16	—	14	—	—	102	Rc1/8
80	—	126		41	52	64	19			—				102	
80	—	126		41	52	64	19			—				102	
106	80	152		56	—	—	—			25				128	
102	—	144	18	54	—	—	—	7	—	—	11	17.5	11	122	Rc1/8

5. The axial rigidity K in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (C_0) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
6. For LPFT, the basic load ratings differ from the other models as the spacer balls are installed.
7. Preload system: P. Oversize ball preload: Z. Offset preload: D. Double nut preload (See page B5.)

Return tube type

NSK



Unit: mm

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)	Nut entire length <i>L</i>
								Dynamic <i>C_s</i>	Static <i>C_{0a}</i>		
SFT 6310-2.5	Clearance	63	10	6.35	64.0	57.4	2.5×1	41 100	111 000	557	77
ZFT 6310-5	Z						2.5×1	41 100	111 000	1 091	107
PFT 6310-7.5	P						2.5×3	66 600	166 000	1 322	137
SFT 6310-5	Clearance						2.5×2	74 600	221 000	1 078	107
ZFT 6310-10	Z						2.5×2	74 600	221 000	2 113	167
SFT 6310-7.5	Clearance						2.5×3	106 000	332 000	1 588	137
DFT 6310-7.5	D						2.5×3	106 000	332 000	3 113	257
ZFT 6312-5	Z		12	7.938	64.5	56.2	2.5×1	55 900	136 000	1 119	123
SFT 6312-2.5	Clearance						2.5×1	55 900	136 000	571	87
SFT 6312-5	Clearance						2.5×2	102 000	273 000	1 107	123
DFT 6312-5	D						2.5×2	102 000	273 000	2 171	231
SFT 6316-2.5	Clearance		16	9.525	65.0	55.2	2.5×1	93 600	227 000	746	110
DFT 6316-2.5	D						2.5×1	93 600	227 000	1 464	206
PFT 6316-5	P						2.5×2	107 000	227 000	1 200	158
SFT 6316-5	Clearance						2.5×2	170 000	454 000	1 446	158
DFT 6316-5	D						2.5×2	170 000	454 000	2 835	302
SFT 6320-2.5	Clearance		20	9.525	65.0	55.2	2.5×1	93 400	227 000	744	127
DFT 6320-2.5	D						2.5×1	93 400	227 000	1 459	227
PFT 6320-5	P						2.5×2	107 000	227 000	1 196	187
SFT 6320-5	Clearance						2.5×2	170 000	453 000	1 442	187
DFT 6320-5	D						2.5×2	170 000	453 000	2 827	347
LPFT 6340-2.5	P		40	7.938	65.25	57	2.5×1	35 300	69 200	472	178
LPFT 6340-3	P						1.5×2	41 300	83 100	557	218
LSFT 6340-2.5	Clearance						2.5×1	56 000	138 000	567	178
LDFT 6340-2.5	D						2.5×1	56 000	138 000	1 112	339
LSFT 6340-3	Clearance						1.5×2	65 500	166 000	674	218
LDFT 6340-3	D						1.5×2	65 500	166 000	1 323	419
LPFT 6350-1.5	P		50	7.938	65.25	57	1.5×1	22 400	41 100	282	161
LPFT 6350-2.5	P						2.5×1	34 800	69 600	471	211
LSFT 6350-1.5	Clearance						1.5×1	35 600	82 200	341	161
LDFT 6350-1.5	D						1.5×1	35 600	82 200	669	311
LSFT 6350-2.5	Clearance						2.5×1	55 300	139 000	561	211
LDFT 6350-2.5	D						2.5×1	55 300	139 000	1 099	411

Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.

2. If there is no seal for ZFT, SFT, and DFT the nut length "L" is shortened by dimension "M".

3. If there is no seal for LSFT and LDFT of shaft diameter 25 mm or larger, the nut length "L" is shortened by dimension "M" and "C".

4. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

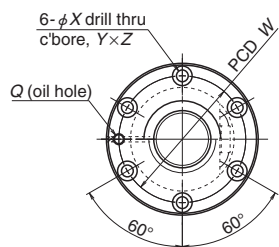
5. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C₀*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

6. For LPFT, the basic load ratings differ from the other models as the spacer balls are installed.

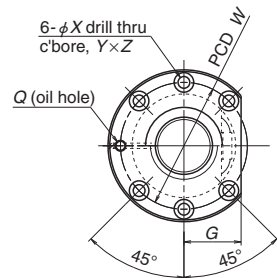
7. Preload system: P Oversize ball preload; Z Offset preload; D, Double nut preload (See page B5.)

Return tube type

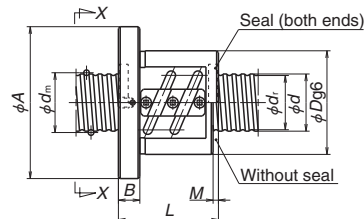
View X-X



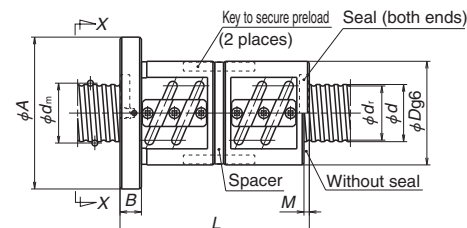
Circular shape I



Circular shape II



SFT



DFT

Unit: mm

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
SFT 8010-5	Clearance	80	10	6.35	81.0	74.4	2.5×2	83 200	282 000	1 309
DFT 8010-5	D						2.5×2	83 200	282 000	2 567
SFT 8010-7.5	Clearance						2.5×3	118 000	423 000	1 927
DFT 8010-7.5	D						2.5×3	118 000	423 000	3 779
SFT 8012-5	Clearance		12	7.938	81.5	73.2	2.5×2	113 000	350 000	1 345
DFT 8012-5	D						2.5×2	113 000	350 000	2 637
SFT 8012-7.5	Clearance						2.5×3	161 000	525 000	1 983
DFT 8012-7.5	D						2.5×3	161 000	525 000	3 889
SFT 8016-5	Clearance		16	9.525	82.0	72.2	2.5×2	192 000	581 000	1 764
DFT 8016-5	D						2.5×2	192 000	581 000	3 459
SFT 8016-7.5	Clearance						2.5×3	271 000	872 000	2 593
DFT 8016-7.5	D						2.5×3	271 000	872 000	5 085
SFT 8020-5	Clearance	100	20	9.525	82.0	72.2	2.5×2	191 000	581 000	1 758
DFT 8020-5	D						2.5×2	191 000	581 000	3 447
SFT 8020-7.5	Clearance						2.5×3	271 000	871 000	2 588
DFT 8020-7.5	D						2.5×3	271 000	871 000	5 075
SFT 10012-5	Clearance		12	7.938	101.5	93.2	2.5×2	124 000	441 000	1 611
DFT 10012-5	D						2.5×2	124 000	441 000	3 159
SFT 10012-7.5	Clearance						2.5×3	176 000	661 000	2 372
DFT 10012-7.5	D						2.5×3	176 000	661 000	4 652
SFT 10016-5	Clearance		16	9.525	102	92.2	2.5×2	208 000	736 000	2 109
DFT 10016-5	D						2.5×2	208 000	736 000	4 136
SFT 10016-7.5	Clearance						2.5×3	295 000	1 100 000	3 105
DFT 10016-7.5	D						2.5×3	295 000	1 100 000	6 089
SFT 10020-5	Clearance		20	9.525	102	92.2	2.5×2	208 000	735 000	2 106
DFT 10020-5	D						2.5×2	208 000	735 000	4 131
SFT 10020-7.5	Clearance						2.5×3	294 000	1 100 000	3 098
DFT 10020-7.5	D						2.5×3	294 000	1 100 000	6 075
SFT 12516-5	Clearance	125	16	9.525	127	117.2	2.5×2	231 000	918 000	2 520
DFT 12516-5	D						2.5×2	231 000	918 000	4 942
SFT 12516-7.5	Clearance						2.5×3	327 000	1 380 000	3 708
DFT 12516-7.5	D						2.5×3	327 000	1 380 000	7 272
SFT 12520-5	Clearance		20	9.525	127	117.2	2.5×2	230 000	917 000	2 515
DFT 12520-5	D						2.5×2	230 000	917 000	4 931
SFT 12520-7.5	Clearance						2.5×3	327 000	1 380 000	3 705
DFT 12520-7.5	D						2.5×3	327 000	1 380 000	7 266

Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape I and circular shape II. Select a flange that is suitable for the space available for nut installation.

2. If there is no seal for SFT, and DFT, the nut length "L" is shortened by dimension "M".

3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

Ball nut dimensions										
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole <i>Q</i>
						<i>X</i>	<i>Y</i>	<i>Z</i>		
107	130	176	22	66	7	14	20	13	152	Rc1/8
197										
137										
257										
123	136	182	22	68	8	14	20	13	158	Rc1/8
231										
159										
303										
158	143	204	28	77	10	18	26	17.5	172	Rc1/8
302										
206										
398										
187	143	204	28	77	17	18	26	17.5	172	Rc1/8
347										
247										
467										
129	160	220	28	82	8	18	26	17.5	188	Rc1/8
237										
165										
309										
162	170	243	32	91	10	22	32	21.5	205	Rc1/8
306										
210										
402										
191	170	243	32	91	17	22	32	21.5	205	Rc1/8
351										
251										
471										
170	200	290	36	109	10	26	39	25.5	243	Rc1/8
314										
218										
410										
199	200	290	36	109	12	26	39	25.5	243	Rc1/8
379										
259										
499										

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_a*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

5. Preload system: D; Double nut preload (See page B5.)

B-3-2.3 Deflector(bridge) Type Ball Screws

1. Features

The deflector(bridge) type has the smallest ball nut compared to the other recirculation systems, and suitable for fine lead operation.

2. Specifications

(1) Ball recirculation system

It has a small ball nut outside diameter, and suits for small lead ball screws. Fig.1 shows the structure of the deflector(bridge) recirculation system.

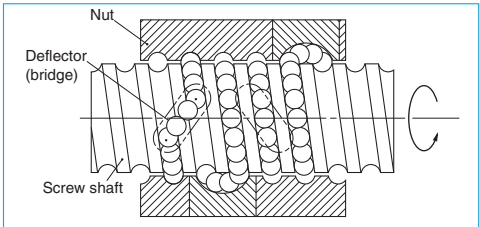


Fig. 1 Structure of deflector(bridge) recirculation system

Table 1 Accuracy grade and axial play

Accuracy grade	C0, C1, C2, C3, C5, Ct7 (Ct7 is not included in DFD)
Axial play	Z, 0 mm (preloaded); T, 0.005 mm or less S, 0.020 mm or less; N, 0.050 mm or less

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are shown in Table 1. Please consult NSK for other grades.

(3) Allowable d·n value and the criterion of maximum rotational speed

The allowable d·n value and criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below. Basic measure must be taken for the high speed ball screws respectively.

Allowable d·n value:

Standard specification ; 84 000 or less

High-speed specification; 100 000 or less

Standard of rotational speed : 3 000 min⁻¹

Note: Please also review the critical speed. Refer to "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Other specifications

Please consult NSK for other specifications not listed in the dimension tables.

Table 2 Deflector(bridge) type ball screw product categories

Nut model	Shape	Flange shape	Preload system
MSFD		Flanged Circular III	Non-preload, Slight axial play
MPFD			P-preload (light preload) no spacer ball
SFD		Screw shaft diameter of 16 mm or smaller: Flanged Screw shaft diameter of 20 mm or smaller: Rectangle Circular I, II	Non-preload, Slight axial play
ZFD		Flanged Circular I, II	Z-preload (medium preload)
DFD		Flanged Circular I, II	D-preload (medium preload) (heavy preload)

3. Product categories

There are four different preload systems (Table 2). Synthetic resin that shows superb characteristics against wear is used in the recirculation deflector (bridge) for MSFD, MPFD, and has enhanced the smooth recirculation of balls. This product is being applied for a patent.

4. Design Precautions

When designing the screw shaft end, one end of the screw must meet either one of the following conditions. If not, we cannot install the ball nut on the screw shaft.

- Cut the ball groove through to the shaft end.

- The diameters of bearing journals and the gear or pulley seat must be less than the root diameter of ball groove "dr" specified on the dimension table.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

5. Structure of model number and reference number

The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

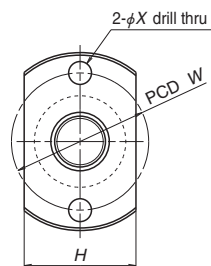
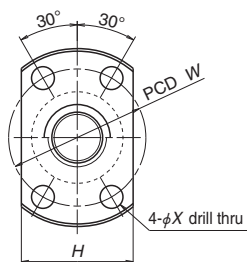
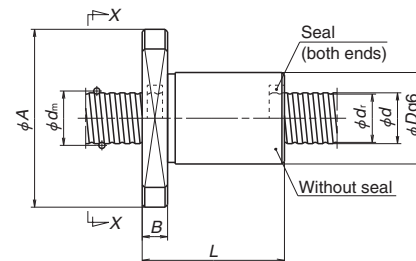
SFD 40 08 - 4			
Nut model: SFD, ZFD, DFD MSFD, MPFD			Effective turns of balls (Note)
Screw shaft diameter (mm)			Lead (mm)

Note: In case of ZFD, the number here is twice as large as the effective turns of balls.

◇Reference number for ball screw

W 40 08 - ** D Y - C3 Z 5			
Product code			Lead (mm)
Screw shaft diameter (mm)			Axial play code: Z, T, S, N (page B20)
Effective threaded length (in the unit of 100 mm)			Accuracy grade code: C0, C1, C2, C3, C5, C7(Ct7) (page B37 to B42)
NSK design serial number			Deflector(bridge) recirculation system
Preload code: No code, non-preload; Z, Z-preload; D, D-preload; P, P-preload (page B5)			

View X-X

Lead $l = 0.5 \text{ mm}$ Lead $l > 1 \text{ mm}$ 

Unit: mm

Model No.	Preload system	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N)	
								Dynamic C_a	Static C_{0a}
MSFD 0400.5-3	Clearance	4	0.5	0.400	4.1	3.6	1×3	205	280
MPFD 0400.5-3	P								
MSFD 0401-2	Clearance		1	0.800	4.2	3.2	1×2	370	370
MPFD 0401-2	P								
MSFD 0600.5-3	Clearance	6	0.5	0.400	6.1	5.6	1×3	240	430
MPFD 0600.5-3	P								
MSFD 0601-3	Clearance		1	0.800	6.2	5.2	1×3	680	920
MPFD 0601-3	P								
MSFD 0602-3	Clearance	8	2	0.800	6.2	5.2	1×3	675	920
MPFD 0602-3	P								
MSFD 0800.5-3	Clearance		0.5	0.400	8.1	7.6	1×3	275	595
MPFD 0800.5-3	P								
MSFD 0801-3	Clearance	8	1	0.800	8.2	7.2	1×3	790	1 290
MPFD 0801-3	P								
MSFD 0801.5-3	Clearance		1.5	1.000	8.3	7.0	1×3	1 270	1 970
MPFD 0801.5-3	P								
MSFD 0802-3	Clearance	10	2	1.200	8.3	6.9	1×3	1 560	2 200
MPFD 0802-3	P								
MSFD 1001-3	Clearance	10	1	0.800	10.2	9.2	1×3	880	1 660
MPFD 1001-3	P								
MSFD 1002-3	Clearance		2	1.200	10.3	8.9	1×3	1 800	2 970
MPFD 1002-3	P								
MSFD 1002.5-3	Clearance	12	2.5	1.588	10.4	8.6	1×3	2 500	3 630
MPFD 1002.5-3	P								
MSFD 1201-3	Clearance	12	1	0.800	12.2	11.2	1×3	940	1 980
MPFD 1201-3	P								
MSFD 1202-3	Clearance		2	1.200	12.3	10.9	1×3	1 960	3 620
MPFD 1202-3	P								
MSFD 1202.5-3	Clearance	14	2.5	1.588	12.4	10.6	1×3	2 790	4 530
MPFD 1202.5-3	P								
MSFD 1203-3	Clearance	14	3	2.000	12.5	10.2	1×3	3 680	5 400
MPFD 1203-3	P								
MSFD 1402-3	Clearance	14	2	1.200	14.3	12.9	1×3	2 100	4 260
MPFD 1402-3	P								
MSFD 1403-3	Clearance	14	3	2.000	14.5	12.2	1×3	4 010	6 480
MPFD 1403-3	P								

Notes: 1. If the shaft OD is less than 6 mm or the lead is less than 1 mm, a seal is not installed in the nut. (See page B68 for dust protection.)

2. Ball nuts with shaft diameters under 14 mm do not have oil holes.

3. Right turn screw is standard. Please consult NSK for left turn screw.

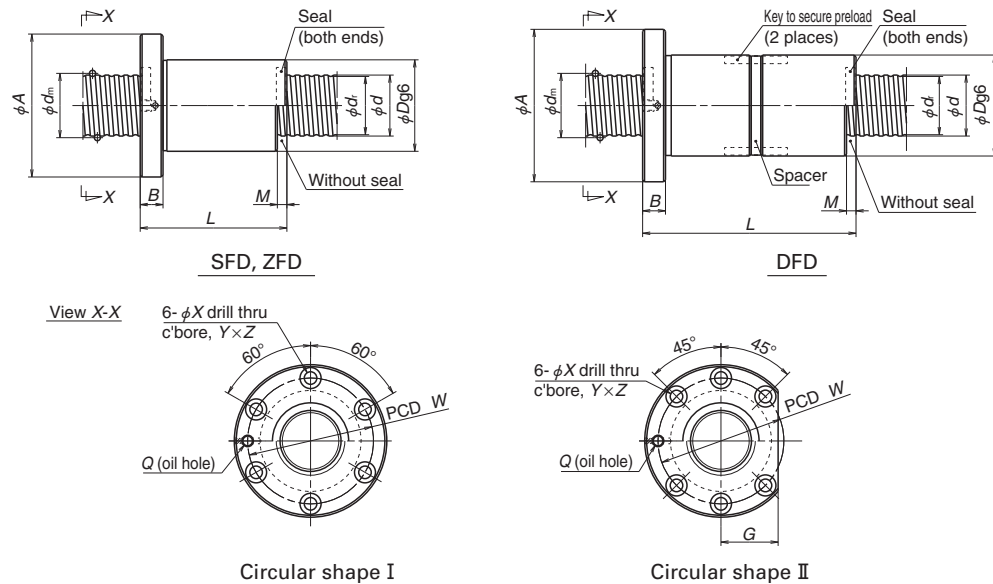
Axial rigidity K (N/μm)	Ball nut dimensions						
	Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Flanged dimension H	Bolt hole dimension X	Bolt hole PCD W
32	13	10	22	3	11	3.4	16
50							
23	12	10	20	3	14	2.9	15
36							
44	13	12	24	3	13	3.4	18
69							
51	15	12	24	3.5	16	3.4	18
80							
51	17	13	25	4	17	3.4	19
79							
57	13	14	27	3	15	3.4	21
89							
67	16	14	27	4	18	3.4	21
104							
79	22	15	28	4	19	3.4	22
123							
76	26	16	29	4	20	3.4	23
119							
81	16	16	29	4	20	3.4	23
127							
97	28	18	35	5	22	4.5	27
151							
94	32	19	36	5	23	4.5	28
147							
93	16	18	31	4	22	3.4	25
145							
114	28	20	37	5	24	4.5	29
177							
113	32	21	38	5	25	4.5	30
176							
111	36	22	39	5	26	4.5	31
174							
129	29	22	41	6	26	5.5	32
201							
129	37	24	43	6	28	5.5	34
201							

4. The axial rigidity K in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (C_a) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

5. The models marked with * (asterisk) are available in the MA type standard ball screw with finished shaft end.

6. Preload system: P; Oversize ball preload (See page B5.)

Deflector(bridge) type

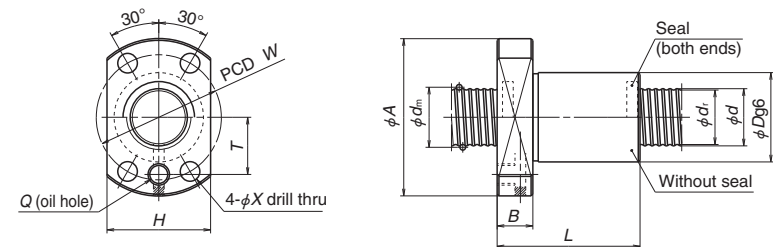


Circular shape I

Circular shape II

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N) Dynamic <i>C_a</i> Static <i>C_{0a}</i>	Axial rigidity <i>K</i> (N/μm)
MSFD 1602-4	Clearance P	16	2	1.588	16.4	14.6	1×4	4 150 8 450	194
MPFD 1602-4	P		2.5	1.588	16.4	14.6	1×4	4 150 8 440	302
MSFD 1602.5-4	Clearance P	20	2	1.588	20.4	18.6	1×4	4 620 10 900	237
MPFD 1602.5-4	P		5	3.175	20.75	17.4	1×3	10 100 17 400	369
SFD 2005-3	Clearance Z		5	3.175	20.75	17.4	1×3	10 100 17 400	206
ZFD 2005-6	Clearance Z		5	3.175	20.75	17.4	1×4	13 000 23 300	404
SFD 2005-4	Clearance D		5	3.175	20.75	17.4	1×4	13 000 23 300	271
DFD 2005-4	D		5	3.175	20.75	17.4	1×4	13 000 23 300	532
SFD 2006-3	Clearance Z		6	3.969	21	16.9	1×3	13 100 20 500	202
ZFD 2006-6	Clearance Z		6	3.969	21	16.9	1×3	13 100 20 500	396
SFD 2006-4	Clearance D		6	3.969	21	16.9	1×4	16 800 27 400	266
DFD 2006-4	D		6	3.969	21	16.9	1×4	16 800 27 400	521
MSFD 2502-4	Clearance P	25	2	1.588	25.4	23.6	1×4	5 100 13 900	287
MPFD 2502-4	P		5	3.175	25.75	22.4	1×3	11 600 22 900	447
SFD 2505-3	Clearance Z		5	3.175	25.75	22.4	1×3	11 600 22 900	257
ZFD 2505-6	Clearance Z		5	3.175	25.75	22.4	1×3	11 600 22 900	503
SFD 2505-4	Clearance D		5	3.175	25.75	22.4	1×4	14 800 30 500	337
DFD 2505-4	D		5	3.175	25.75	22.4	1×4	14 800 30 500	661
SFD 2506-3	Clearance Z		6	3.969	26	21.9	1×3	15 200 27 300	254
ZFD 2506-6	Clearance Z		6	3.969	26	21.9	1×3	15 200 27 300	499
SFD 2506-4	Clearance D		6	3.969	26	21.9	1×4	19 400 36 400	334
DFD 2506-4	D		6	3.969	26	21.9	1×4	19 400 36 400	656
SFD 2510-4	Clearance Z	10	10	4.762	26.25	21.3	1×2	13 300 21 200	337
ZFD 2510-3	Clearance Z		10	4.762	26.25	21.3	1×3	18 900 31 800	253
DFD 2510-3	D		10	4.762	26.25	21.3	1×3	18 900 31 800	497

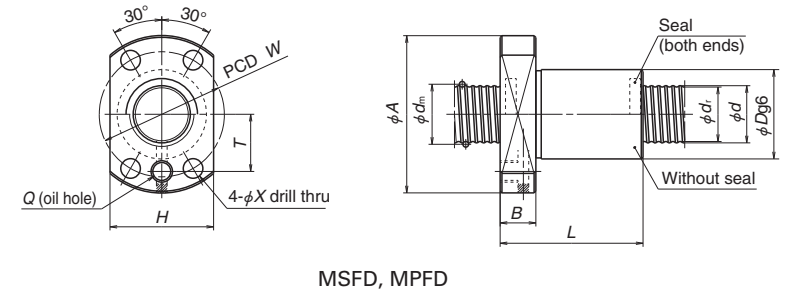
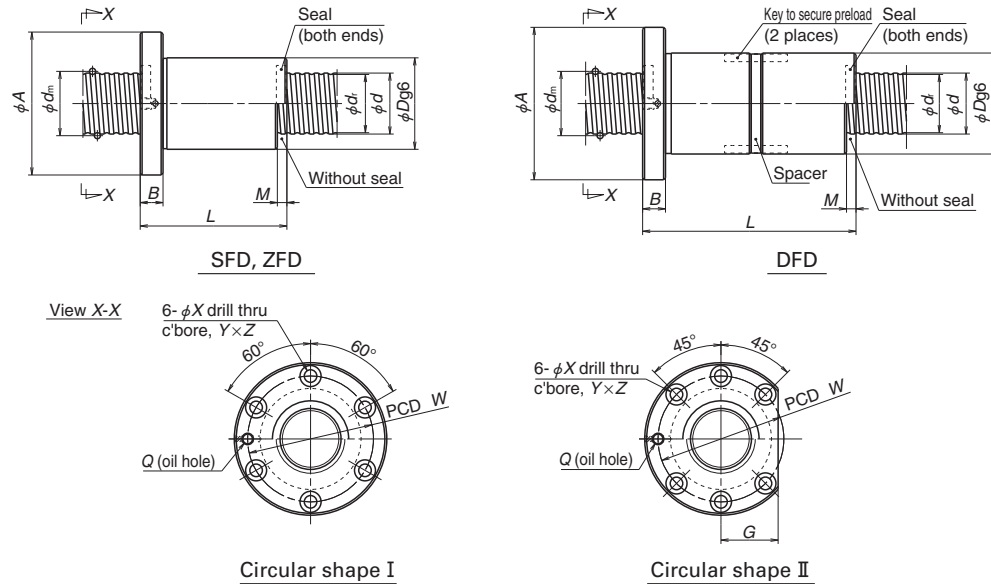
- Notes: 1. Nut comes in circular shape I and circular shape II for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for SFD, ZFD, and DFD, the nut length "L" is shortened by dimension "M". For MSFD and MPFD, the nut length is the same as those with seal.
3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw. Please consult NSK for MSFD and MPFD.



MSFD, MPFD

Ball nut dimensions												Unit: mm	
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange		Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole dimension <i>T</i>	Oil hole <i>Q</i>	
				<i>G</i>	<i>H</i>		<i>X</i>	<i>Y</i>	<i>Z</i>				
40	25	44	10	—	29	—	5.5	—	—	35	16	M6×1	
44	25	44	10	—	29	—	5.5	—	—	35	16	M6×1	
40	30	49	10	—	34	—	5.5	—	—	40	18.5	M6×1	
46	35	58	11	22.5	—	5	5.5	9.5	5.5	46	—	M6×1	
66	35	58		22.5									
51	35	58		22.5									
91	41	64	11	25	—	6	5.5	9.5	5.5	46	—	M6×1	
52	35	58		22.5									
76	35	58		22.5									
60	35	58		22.5									
108	42	65		25									
40	36	55	10	—	40	—	5.5	—	—	46	21.5	M6×1	
46	40	63	11	24	—	5	5.5	9.5	5.5	51	—	M6×1	
66	40	63		24									
51	40	63		24									
91	46	69		26									
52	40	63		24									
76	40	63	11	24	—	6	5.5	9.5	5.5	51	—	M6×1	
60	40	63		24									
108	47	70		27									
88	42	69	15	26	—	10	6.6	11	6.5	55	—	M6×1	
80	42	69		26									
140	47	74		28									

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
5. It is recommended to use with seals when the shaft diameter is 16 mm or over and an oil hole is provided on the ball nut.
6. The models marked with * (asterisk) are available in the MA type standard ball screw with finished shaft end.
7. Preload system: Z, Offset preload; P, Oversize ball preload; D, Double nut preload (See page B5.)

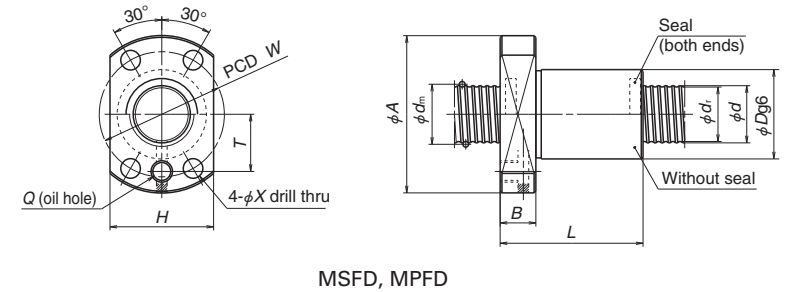
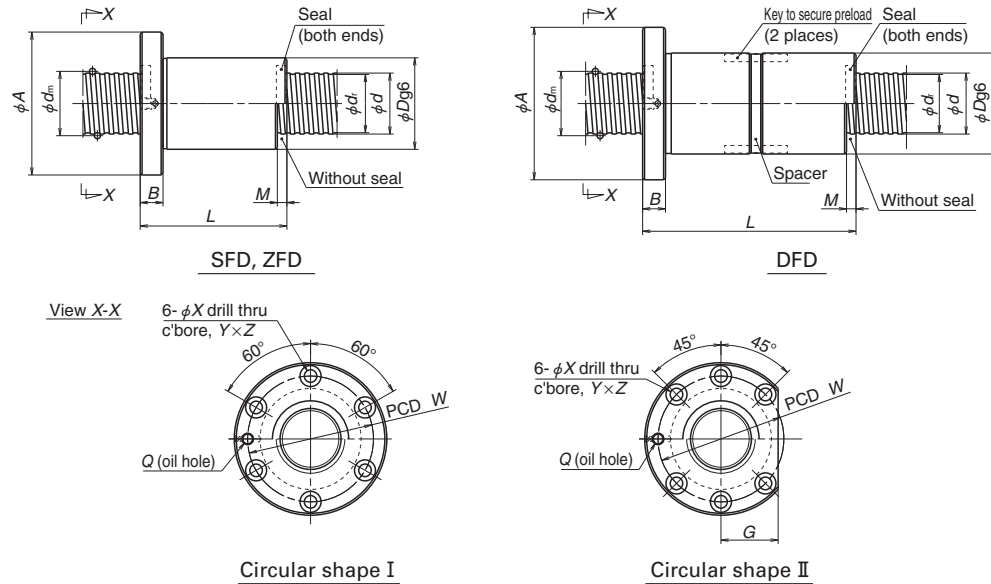


Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
MSFD 3202-6	Clearance	32	2	1.588	32.4	30.6	1×6	8 030	27 100	521
MPFD 3202-6	P									811
SFD 3205-3	Clearance		5	3.175	32.75	29.4	1×3	13 100	30 500	322
ZFD 3205-6	Z						1×3	13 100	30 500	631
SFD 3205-4	Clearance						1×4	16 800	40 600	424
ZFD 3205-8	Z						1×4	16 800	40 600	831
SFD 3205-6	Clearance						1×6	23 800	60 900	623
DFD 3205-6	D						1×6	23 800	60 900	1 222
SFD 3206-3	Clearance		6	3.969	33	28.9	1×3	17 700	37 400	328
ZFD 3206-6	Z						1×3	17 700	37 400	643
SFD 3206-4	Clearance						1×4	22 600	49 900	431
ZFD 3206-8	Z						1×4	22 600	49 900	846
SFD 3206-6	Clearance						1×6	32 100	74 800	635
DFD 3206-6	D						1×6	32 100	74 800	1 245
SFD 3208-3	Clearance		8	4.762	33.25	28.3	1×3	21 600	41 700	316
ZFD 3208-6	Z						1×3	21 600	41 700	619
SFD 3208-4	Clearance						1×4	27 700	55 600	415
ZFD 3208-8	Z						1×4	27 700	55 600	815
SFD 3210-3	Clearance		10	6.35	33.75	27.1	1×3	30 500	52 500	313
ZFD 3210-6	Z						1×3	30 500	52 500	614
SFD 3210-4	Clearance						1×4	39 000	70 000	411
DFD 3210-4	D						1×4	39 000	70 000	807

Notes: 1. Nut comes in circular shape I and circular shape II for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for SFD, ZFD, and DFD, the nut length "L" is shortened by dimension "M". For MSFD and MPFD, the nut length is the same as those with seal.
3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw. Please consult NSK for MSFD and MPFD.

Ball nut dimensions												
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange		Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole dimension <i>T</i>	Oil hole <i>Q</i>
				<i>G</i>	<i>H</i>		<i>X</i>	<i>Y</i>	<i>Z</i>			
50	42	65	10	—	46	—	6.6	—	—	54	26.5	M6×1
47	48	75	12	29	—	5	6.6	11	6.5	61	—	M6×1
67	48	75		29						61		
52	48	75		29						61		
77	48	75		29						61		
62	48	75		29						61		
112	53	80		30						66		
53	48	75	12	29	—	6	6.6	11	6.5	61	—	M6×1
77	48	75		29						61		
61	48	75		29						61		
90	48	75		29						61		
73	48	75		29						61		
133	54	81		31						67		
67	50	84	15	32	—	8	9	14	8.5	66	—	M6×1
99												
76												
116												
80	54	88	15	34	—	10	9	14	8.5	70	—	M6×1
120												
90												
160												

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_a*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
5. It is recommended to use with seals when the shaft diameter is 16 mm or over and an oil hole is provided on the ball nut.
6. The models marked with * (asterisk) are available in the SS type standard ball screw with finished shaft end.
7. Preload system: Z, Offset preload; P, Oversize ball preload; D, Double nut preload (See page B5.)

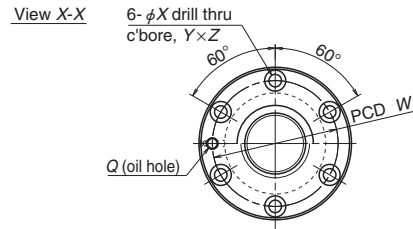


Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
MSFD 4002-6	Clearance P	40	2	1.588	40.4	38.6	1×6	8 720	33 900	620 966
MPFD 4002-6	Clearance P									
SFD 4005-4	Clearance Z		5	3.175	40.75	37.4	1×4	18 700	52 200	517
ZFD 4005-8	Clearance Z						1×4	18 700	52 200	1 013
SFD 4005-6	Clearance Z						1×6	26 500	78 300	761
ZFD 4005-12	Clearance Z						1×6	26 500	78 300	1 492
SFD 4006-4	Clearance Z		6	3.969	41.0	36.9	1×4	25 100	63 500	522
ZFD 4006-8	Clearance Z						1×4	25 100	63 500	1 023
SFD 4006-6	Clearance Z						1×6	35 600	95 200	768
ZFD 4006-12	Clearance Z						1×6	35 600	95 200	1 506
SFD 4008-4	Clearance D		8	4.762	41.25	36.3	1×4	32 000	75 000	529
ZFD 4008-8	Clearance D						1×4	32 000	75 000	1 038
SFD 4008-6	Clearance D						1×6	45 400	113 000	779
DFD 4008-6	Clearance D						1×6	45 400	113 000	1 528
SFD 4010-3	Clearance Z	50	10	6.35	41.75	35.1	1×3	35 300	69 800	394
ZFD 4010-6	Clearance Z						1×3	35 300	69 800	773
SFD 4010-4	Clearance Z						1×4	45 200	93 100	518
ZFD 4010-8	Clearance Z						1×4	45 200	93 100	1 016
SFD 5005-4	Clearance Z		5	3.175	50.75	47.4	1×4	20 700	66 700	627
ZFD 5005-8	Clearance Z						1×4	20 700	66 700	1 230
SFD 5005-6	Clearance Z						1×6	29 300	100 000	923
ZFD 5005-12	Clearance Z						1×6	29 300	100 000	1 810
SFD 5006-4	Clearance Z		6	3.969	51.0	46.9	1×4	27 900	81 600	636
ZFD 5006-8	Clearance Z						1×4	27 900	81 600	1 248
SFD 5006-6	Clearance Z						1×6	39 600	122 000	937
ZFD 5006-12	Clearance Z						1×6	39 600	122 000	1 837

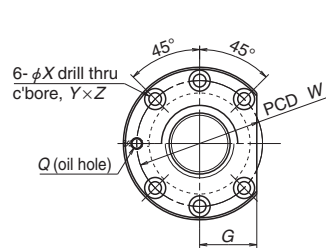
Notes: 1. Nut comes in circular shape I and circular shape II for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for SFD, ZFD, and DFD, the nut length "L" is shortened by dimension "M". For MSFD and MPFD, the nut length is the same as those with seal.
3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw. Please consult NSK for MSFD and MPFD.

Ball nut dimensions													Unit: mm
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange		Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole dimension <i>T</i>	Oil hole <i>Q</i>	
				<i>G</i>	<i>H</i>		<i>X</i>	<i>Y</i>	<i>Z</i>				
50	51	74	10	—	55	—	6.6	—	—	63	31	M6×1	
55	56	90	15	34	—	5	9	14	8.5	72	—	Rc1/8	
80													
65													
101													
64	56	90	15	34	—	6	9	14	8.5	72	—	Rc1/8	
93													
76													
118													
76	60	94	15	36	—	8	9	14	8.5	76	—	Rc1/8	
116													
93													
168													
83	62	96	18	40	—	10	11	17.5	11	82	—	Rc1/8	
123													
93													
143													
55	66	100	15	38	—	5	9	14	8.5	82	—	Rc1/8	
80													
65													
101													
64	66	100	15	38	—	6	9	14	8.5	82	—	Rc1/8	
93													
76													
118													

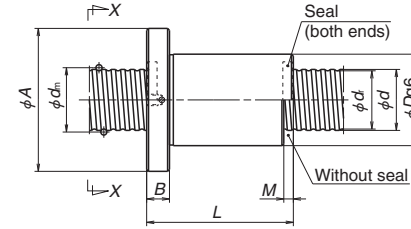
4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_a*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
5. It is recommended to use with seals when the shaft diameter is 16 mm or over and an oil hole is provided on the ball nut.
6. Preload system: Z, Offset preload; P, Oversize ball preload; D, Double nut preload (See page B5.)



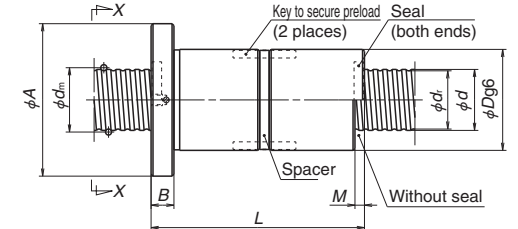
Circular shape I



Circular shape II



SFD, ZFD



DFD

Unit: mm

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_i</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
SFD 5008-4	Clearance	50	8	4.762	51.25	46.3	1×4	35 300	94 700	635
ZFD 5008-8	Z						1×4	35 300	94 700	1 246
SFD 5008-6	Clearance						1×6	50 000	142 000	935
DFD 5008-6	D						1×6	50 000	142 000	1 833
SFD 5010-3	Clearance		10	6.35	51.75	45.1	1×3	40 200	91 500	489
ZFD 5010-6	Z						1×3	40 200	91 500	960
SFD 5010-4	Clearance						1×4	51 500	122 000	644
ZFD 5010-8	Z						1×4	51 500	122 000	1 263
SFD 5010-6	Clearance						1×6	72 900	183 000	947
DFD 5010-6	D						1×6	72 900	183 000	1 858
SFD 5012-3	Clearance		12	7.938	52.25	44	1×3	52 800	109 000	485
ZFD 5012-6	Z						1×3	52 800	109 000	952
SFD 5012-4	Clearance						1×4	67 600	145 000	639
DFD 5012-4	D						1×4	67 600	145 000	1 252
SFD 5020-3	Clearance		20	7.938	52.25	44	1×3	52 400	109 000	480
DFD 5020-3	D						1×3	52 400	109 000	942
SFD 6306-4	Clearance	63	6	3.969	64.0	59.9	1×4	30 800	104 000	772
ZFD 6306-8	Z						1×4	30 800	104 000	1 513
SFD 6306-6	Clearance						1×6	43 600	156 000	1 135
ZFD 6306-12	Z						1×6	43 600	156 000	2 226
SFD 6308-4	Clearance		8	4.762	64.25	59.3	1×4	39 600	124 000	787
ZFD 6308-8	Z						1×4	39 600	124 000	1 543
SFD 6308-6	Clearance						1×6	56 200	186 000	1 159
DFD 6308-6	D						1×6	56 200	186 000	2 272
SFD 6310-4	Clearance		10	6.35	64.75	58.1	1×4	58 700	162 000	810
ZFD 6310-8	Z						1×4	58 700	162 000	1 588
SFD 6310-6	Clearance						1×6	83 200	244 000	1 192
DFD 6310-6	D						1×6	83 200	244 000	2 337
ZFD 6312-6	Z		12	7.938	65.25	57	1×3	59 900	143 000	1 181
SFD 6312-4	Clearance						1×4	76 800	191 000	793
DFD 6312-4	D						1×4	76 800	191 000	1 555
SFD 6312-6	Clearance						1×6	109 000	286 000	1 167
DFD 6312-6	D						1×6	109 000	286 000	2 289
SFD 6320-3	Clearance		20	9.525	65.75	56	1×3	98 400	231 000	766
DFD 6320-3	D						1×3	98 400	231 000	1 503

Notes: 1. Nut comes in circular shape I and circular shape II for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.

2. If there is no seal the nut length "L" is shortened by dimension "M".

3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

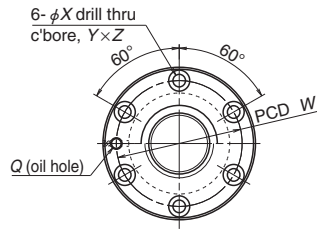
Ball nut dimensions										
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole <i>Q</i>
						<i>X</i>	<i>Y</i>	<i>Z</i>		
79	70	112	18	43	8	11	17.5	11	90	Rc1/8
119	70	112		43					90	
96	70	112		43					90	
171	72	114		44					92	
83	72	114	18	44	10	11	17.5	11	92	Rc1/8
123										
93										
143										
114										
205	75	121	22	47	12	14	20	13	97	Rc1/8
99										
147										
111										
195	75	121	28	47	20	14	20	13	97	Rc1/8
146										
253	80	122	18	47	6	11	17.5	11	100	Rc1/8
67										
96										
79										
121										
79	82	124	18	47	8	11	17.5	11	102	Rc1/8
119	82	124		47					102	
96	82	124		47					102	
175	85	127		48					105	
97	85	131	22	50	10	14	20	13	107	Rc1/8
147										
118										
214										
147	90	136	22	52	12	14	20	13	112	Rc1/8
111										
195										
136										
248										
146	95	153	28	59	20	18	26	17.5	123	Rc1/8
253										

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_a*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

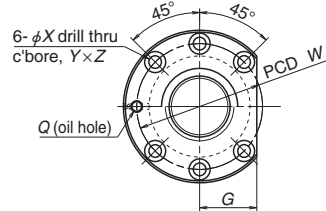
5. It is recommended to use with seals when the shaft diameter is 16 mm or over and an oil hole is provided on the ball nut.

6. Preload system: Z, Offset preload; D, Double nut preload (See page B5.)

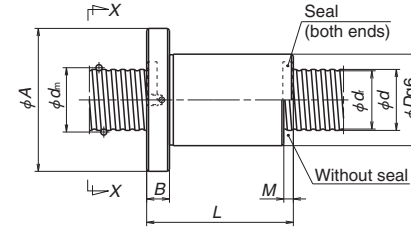
View X-X



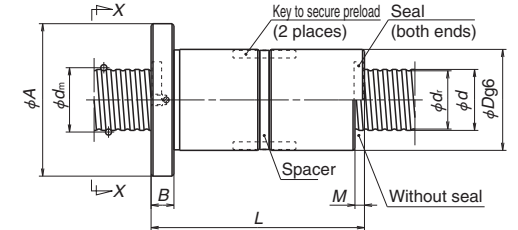
Circular shape I



Circular shape II



SFD



DFD

Model No.	Preload system	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
								Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	
SFD 8010-4	Clearance	80	10	6.35	81.75	75.1	1×4	65 100	209 000	987
DFD 8010-4	D						1×4	65 100	209 000	1 935
SFD 8010-6	Clearance						1×6	92 200	313 000	1 452
DFD 8010-6	D						1×6	92 200	313 000	2 848
SFD 8012-4	Clearance		12	7.938	82.25	74	1×4	87 400	254 000	996
DFD 8012-4	D						1×4	87 400	254 000	1 954
SFD 8012-6	Clearance						1×6	124 000	381 000	1 467
DFD 8012-6	D						1×6	124 000	381 000	2 877
SFD 8020-3	Clearance	100	20	9.525	82.75	73	1×3	114 000	312 000	978
DFD 8020-3	D						1×3	114 000	312 000	1 918
SFD 8020-4	Clearance						1×4	146 000	416 000	1 287
DFD 8020-4	D						1×4	146 000	416 000	2 524
SFD 10010-6	Clearance		10	6.35	101.75	95.1	1×6	102 000	400 000	1 762
DFD 10010-6	D									3 456
SFD 10012-6	Clearance		12	7.938	102.25	94	1×6	138 000	490 000	1 789
DFD 10012-6	D									3 509
SFD 10020-4	Clearance		20	9.525	102.75	93	1×4	161 000	525 000	1 546
DFD 10020-4	D									3 031

- Notes
1. Nut comes in circular shape I and circular shape II for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.
 2. If there is no seal the nut length "L" is shortened by dimension "M".
 3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.

Ball nut dimensions										
Nut entire length <i>L</i>	Nut diameter <i>D</i>	Flanged diameter <i>A</i>	Flanged width <i>B</i>	Notched flange <i>G</i>	Seal dimension <i>M</i>	Bolt hole dimension			Bolt hole PCD <i>W</i>	Oil hole <i>Q</i>
						<i>X</i>	<i>Y</i>	<i>Z</i>		
97	105	151	22	57	10	14	20	13	127	Rc1/8
172										
118										
214										
111	110	156	22	59	12	14	20	13	132	Rc1/8
195										
136										
248										
146	115	173	28	66	20	18	26	17.5	143	Rc1/8
253										
168										
297										
118	125	171	22	64	10	14	20	13	147	Rc1/8
214										
142										
254										
172	135	205	32	79	20	22	32	21.5	169	Rc1/8
301										

4. The axial rigidity *K* in the table above is a theoretical value obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (*C_a*) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B56) if the axial load and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.
5. It is recommended to use with seals when the shaft diameter is 16 mm or over and an oil hole is provided on the ball nut.
6. Preload system: D; Double nut preload (See page B5.)

B-3-2.4 End Cap Type Ball Screws

1. Features

The end cap recirculation system is suitable for high-helix lead and multiple start threads. Since the leads are 1 to 3 times larger than their screw shaft diameter, it makes them more suitable for high-speed operation.

2. Specifications

(1) Ball recirculation system

The structure of end cap recirculation system is shown in Fig. 1.

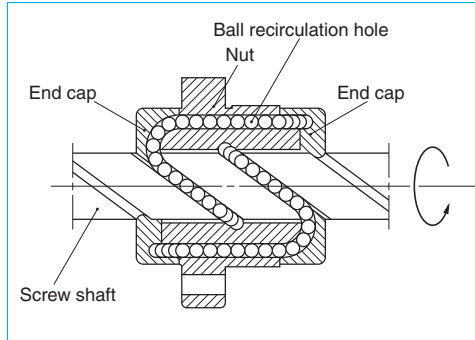


Fig. 1 Structure of end cap recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are shown in Table 1. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

Accuracy grade	LSFC, LPFC: C1, C2, C3, C5, Ct7 USFC, UPFC: C3, C5, Ct7 (Three times lead or over are C5, Ct7)
Axial play	Z, 0 mm (preloaded); T, 0.005 mm or less; S, 0.020 mm or less; N, 0.050 mm or less

(3) Allowable d·n value and the criterion of maximum rotational speed.

The allowable d·n value and criterion of maximum rotational speed are shown below. Please consult NSK for high-speed specification. Basic measure must be taken for the high speed ball screws respectively.

Allowable d·n value:

Standard specification : 80 000 or less

High-speed specification; 100 000 or less

Standard of rotational speed : 3 000 min⁻¹

※Please also review the critical speed. Refer to "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Other specifications

Please consult NSK for other specifications not listed in the dimension tables.

3. Product categories

There are two different preload systems with several models (Table 2).

Table 2 End cap type ball screws product categories

Nut model	Shape	Flange shape	Nut shape	Preload system
LSFC		Flanged Circular III	Circular	Non-preload, Slight axial play
LPFC			Circular	P-preload (light preload) no spacer ball
USFC		Flanged Rectangular	Circular	Non-preload, Slight axial play
UPFC			Circular	P-preload (light preload) no spacer ball

4. Design Precautions

When designing the screw shaft end, one end of the screw must meet either one of the following conditions. If not, we cannot install the ball nut on the screw shaft.

- Cut the ball groove through to the shaft end.
- The diameters of bearing journals and the gear or pulley seat must be less than the root diameter of ball groove "dr" specified on the dimension table.

Special bearings which have higher-load carrying capacity are available.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

5. Example of model number in dimension tables

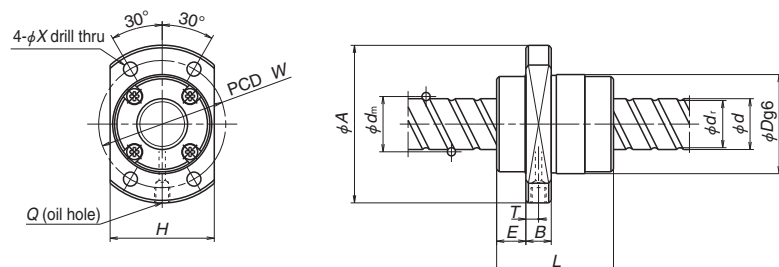
The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

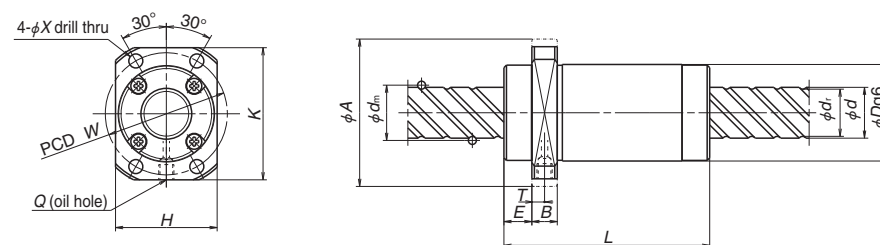
UPFC 25 25 - 3			
Nut model: LSFC, LPFC, USFC, UPFC		Effective turns of balls	
Screw shaft diameter (mm)		Lead (mm)	

◇Reference number for ball screw

W 25 09 - ** P G X - C3 Z 25									
Product code		Screw shaft diameter (mm)				Lead (mm)			
Effective threaded length (in the unit of 100 mm)			NSK design serial number				Axial play code: Z, T, S, N (page B20)		
Preload code: No code, non-preload; P, P-preload (page B5)		Appearance/specification code				Accuracy grade code: C1, C2, C3, C5, C7 (Ct7) (page B37 to B42)			
						End cap recirculation system			



LSFC, LPFC



USFC, UPFC

Unit: mm

Model No.	Preload system	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_n	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity K (N/μm)
								Dynamic C_o	Static C_{oa}	
USFC 1220-1.5	Clearance	12	20	2.381	12.5	9.9	1.7×1	2 960	4 370	68
UPFC 1220-1.5	P									106
USFC 1520-1.5	Clearance	15	20	3.175	15.5	12.2	1.7×1	5 660	8 700	101
UPFC 1520-1.5	P									156
USFC 1540-1	Clearance		40	3.175	15.75	12.2	0.7×2	4 430	7 320	65
UPFC 1540-1	P						0.7×2	4 430	7 320	102
USFC 1540-2	Clearance	16	40	3.175	15.75	12.2	0.7×4	8 040	14 600	134
UPFC 1540-2	P						0.7×4	8 040	14 600	209
LSFC 1616-3	Clearance		16	2.778	16.65	13.7	1.7×2	7 910	13 700	185
LPFC 1616-3	P						1.7×2	7 910	13 700	288
LSFC 1616-6	Clearance	16	16	2.778	16.65	13.7	1.7×4	14 400	27 400	359
LPFC 1616-6	P						1.7×4	14 400	27 400	559
USFC 1632-1	Clearance		32	3.175	16.75	13.4	0.7×2	4 800	7 510	79
UPFC 1632-1	P						0.7×2	4 800	7 510	124
USFC 1632-3	Clearance	16	32	3.175	16.75	13.4	1.7×2	10 300	18 500	187
UPFC 1632-3	P						1.7×2	10 300	18 500	230
USFC 1632-6	Clearance		50	3.175	16.75	13.4	1.7×4	18 700	37 000	361
UPFC 1632-6	P						1.7×4	18 700	37 000	562
USFC 1650-1	Clearance	20	50	3.175	16.75	13.4	0.7×2	4 410	7 840	65
UPFC 1650-1	P						0.7×2	4 410	7 840	105
USFC 1650-2	Clearance		50	3.175	16.75	13.4	0.7×4	8 000	15 700	130
UPFC 1650-2	P						0.7×4	8 000	15 700	203
LSFC 2020-3	Clearance	20	20	3.175	20.75	17.4	1.7×2	12 300	23 600	258
LPFC 2020-3	P						1.7×2	12 300	23 600	402
LSFC 2020-6	Clearance		20	3.175	20.75	17.4	1.7×4	22 400	47 200	500
LPFC 2020-6	P						1.7×4	22 400	47 200	779
USFC 2040-1	Clearance	20	40	3.175	20.75	17.4	0.7×2	5 410	9 360	94
UPFC 2040-1	P						0.7×2	5 410	9 360	147
USFC 2040-3	Clearance		40	3.175	20.75	17.4	1.7×2	11 600	23 400	224
UPFC 2040-3	P						1.7×2	11 600	23 400	349
USFC 2040-6	Clearance	20	60	3.175	20.75	17.4	1.7×4	21 100	46 800	435
UPFC 2040-6	P						1.7×4	21 100	46 800	677
USFC 2060-1	Clearance		60	3.175	20.75	17.4	0.7×2	4 950	9 590	81
UPFC 2060-1	P						0.7×2	4 950	9 590	125
USFC 2060-2	Clearance	20	60	3.175	20.75	17.4	0.7×4	8 990	19 200	156
UPFC 2060-2	P						0.7×4	8 990	19 200	243

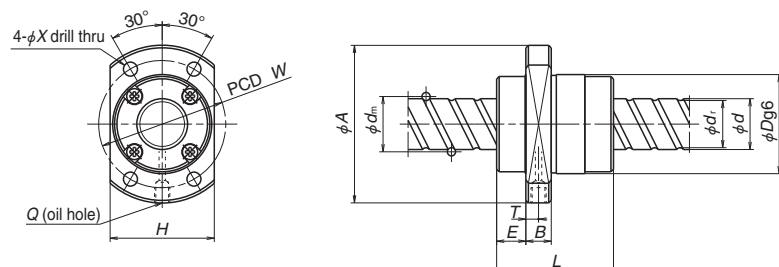
Notes: 1. For the LSFC and USFC type ball screws, the axial rigidity K in the table above is the theoretical values obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (C_o). For the LPFC and UPFC type, the rigidity is the theoretical value when the preload is 10% of the basic dynamic load rating (C_o) and an axial load is applied to it. Refer to the "Technical Description" (page B56) if the rigidity and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

Ball nut dimensions										
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Flanged dimension		End cap dimension E	Bolt hole dimension X	Bolt hole PCD W	Oil hole Q	Oil hole position T
				H	K					
44	26	44	10	28	40	9	4.5	35	M6×1	5
45	34	55	10	36	50	11	5.5	45	M6×1	5
40	32	53	10	33	48	12	5.5	43	M6×1	5
38	32	53	10	34	—	10	4.5	42	M6×1	5
34	34	55	10	36	50	10.5	5.5	45	M6×1	5
34										
66										
66										
50	34	55	10	36	50	12	5.5	45	M6×1	5
46	39	62	10	41	—	11.5	5.5	50	M6×1	5
41	38	58	10	40	52	11	5.5	48	M6×1	5.5
41										
81										
81										
58	38	58	10	40	52	12.3	5.5	48	M6×1	5

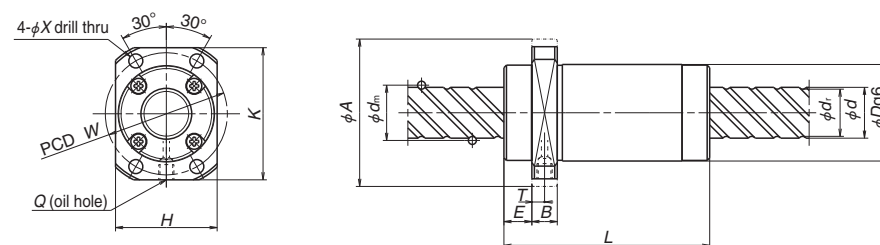
2. The right turn screw is the standard. Please consult NSK for the left turn screw.

3. The models marked with * (asterisk) are available in the FA type standard ball screws with finished shaft end.

4. Preload system: P; Oversize ball preload (See page B5.)



LSFC, LPFC



USFC, UPFC

Unit: mm

Model No.	Preload system	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N)		Axial rigidity K (N/μm)
								Dynamic C_0	Static C_{0a}	
LSFC 2525-3	Clearance	25	25	3.969	26.0	21.9	1.7×2	18 400	36 900	318
LPFC 2525-3	P						1.7×2	18 400	36 900	495
LSFC 2525-6	Clearance						1.7×4	33 400	73 800	616
LPFC 2525-6	P						1.7×4	33 400	73 800	959
*USFC 2550-1	Clearance		50	3.969	26.0	21.9	0.7×2	8 090	14 600	112
UPFC 2550-1	P						0.7×2	8 090	14 600	181
USFC 2550-3	Clearance						1.7×2	17 300	37 500	281
UPFC 2550-3	P						1.7×2	17 300	37 500	437
USFC 2550-6	Clearance						1.7×4	31 500	75 000	545
UPFC 2550-6	P						1.7×4	31 500	75 000	848
USFC 2580-1	Clearance		80	3.969	26.0	21.9	0.7×2	7 290	15 300	97
UPFC 2580-1	P						0.7×2	7 290	15 300	151
USFC 2580-2	Clearance						0.7×4	13 200	30 600	188
UPFC 2580-2	P						0.7×4	13 200	30 600	293
LSFC 3232-3	Clearance	32	32	4.762	33.25	28.3	1.7×2	26 800	56 300	383
LPFC 3232-3	P						1.7×2	26 800	56 300	618
LSFC 3232-6	Clearance						1.7×4	48 700	113 000	770
LPFC 3232-6	P						1.7×4	48 700	113 000	1 198
USFC 3264-1	Clearance		64	4.762	33.25	28.3	0.7×2	11 400	23 800	150
UPFC 3264-1	P						0.7×2	11 400	23 800	234
USFC 3264-3	Clearance						1.7×2	24 400	56 800	346
UPFC 3264-3	P						1.7×2	24 400	56 800	571
USFC 3264-6	Clearance						1.7×4	44 400	114 000	670
UPFC 3264-6	P						1.7×4	44 400	114 000	1 043
LSFC 4040-3	Clearance	40	40	6.350	41.75	35.2	1.7×2	42 900	94 500	494
LPFC 4040-3	P						1.7×2	42 900	94 500	769
LSFC 4040-6	Clearance						1.7×4	77 800	189 000	956
LPFC 4040-6	P						1.7×4	77 800	189 000	1 488
LSFC 5050-3	Clearance	50	50	7.938	52.25	44.1	1.7×2	64 100	148 000	608
LPFC 5050-3	P						1.7×2	64 100	148 000	1 004
LSFC 5050-6	Clearance						1.7×4	116 000	295 000	1 176
LPFC 5050-6	P						1.7×4	116 000	295 000	1 831

Notes: 1. For the LSFC and USFC type ball screws, the axial rigidity K in the table above is the theoretical values obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (C_0). For the LPFC and UPFC type, the rigidity is the theoretical value when the preload is 10% of the basic dynamic load rating (C_0) and an axial load is applied to it. Refer to the "Technical Description" (page B56) if the rigidity and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

Ball nut dimensions										
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Flanged dimension		End cap dimension E	Bolt hole dimension X	Bolt hole PCD W	Oil hole Q	Oil hole position T
				H	K					
55	47	74	12	49	—	13	6.6	60	M6×1	6
50	46	70	12	48	63	13	6.6	58	M6×1	7
50										
100										
100										
100	46	70	12	48	63	14.5	6.6	58	M6×1	6
75										
75										
75										
70	58	92	12	60	—	16	9	74	M6×1	5.5
62	58	92	12	60	82	15.5	9	74	M6×1	7.5
62										
126										
126										
126	73	114	15	75	—	19.5	11	93	M6×1	6.5
85										
85										
85										
107	90	135	20	92	—	21.5	14	112	M6×1	7

2. The right turn screw is the standard. Please consult NSK for the left turn screw.

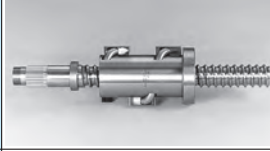
3. The models marked with * (asterisk) are available in the FA type standard ball screws with finished shaft end.

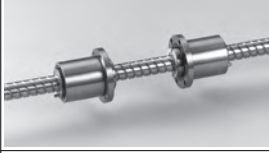
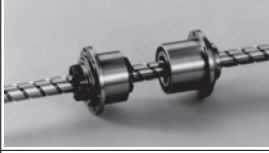
4. Preload system: P; Oversize ball preload (See page B5.)

1. HMD Type for High-Speed Machine Tools	B493
2. HMS Type for High-Speed Machine Tools	B497
3. HMC Type for High-Speed Machine Tools	B501
4. BSL™ Type for Miniature Lathes	B507
5. For High-Load Drives	
5.1 HTF-SRC Type	B511
5.2 HTF-SRD Type	B515
5.3 HTF Type	B519
6. For Contaminated Environments	
6.1 VSS Type	B535
6.2 Ball Screw with X1 Seals for Contaminated Environments and Grease Retention	B539
7. TW Series for Twin-Drive Systems	B545
8. For High Precision Machine Tools	
8.1 Hollow Shaft Ball Screws	B546
8.2 Nut Cooling Ball Screws	B551
9. ND Series for Nut-Rotatable Drives	B555
10. Σ Series for Robots	B563
11. Ball Screw with L1 Seal designed for Minimal Grease Splatter	B575
12. Equipped with "NSK K1™" Lubrication Unit	B579
13. Special Ball Screws	B585

B-3-3 Dimension Table and Reference Number of Application-Oriented Ball Screws

◆Features and application examples of application-oriented ball screws

Applications		Shape	Features	Applications	Page
High-Speed Machine Tools	HMD Type		High-speed operation: 64 to 120 m/min Rigidity: 5% greater than the HMC series. High-load carrying capacity: 7% greater than the HMC type New recirculation system reduces the noise level by 5 dB(A) or more compared with the HMC type	High-speed machining centers High-speed combined machine tools Die mold processing machine	B493
	HMS Type		Fine lead: 5 to 12 mm High-speed operation: 25 to 50 m/min Easy replacement: Dimensional interchangeability with tube type ball screws New recirculation system reduces the noise level by 5 dB(A) or more compared with the Tube type.	Machining centers Die mold processing machine NC lathes Combined machine tools	B497
	HMC Type		High-speed: 40 to 120 m/min Rigidity: 30% greater than existing tube type ball screws High-Load carrying capacity: 14% greater than existing tube type ball screws Noise reduced by small-diameter balls	High-speed machining centers High-speed combined machine tools Die mold processing machines	B501
Small Lathes	BSL Type		Compact nut: 50% less ball nut volume than NSK existing products. High-dust protection by thin plastic seal Special high-load capacity ball screw support bearings are available.	Small lathes Multi-axis lathes Small machining centers	B507
High-Load Drives	HTF-SRC Type		High-load capacity High-speed operation by high-speed rotation: 930 mm/sec Even load distribution to balls in the ball nut for high-load drive Improved durability by NSK S1	Injection axis of injection molding machines Servo press machines Press brake Bending machines	B511
	HTF-SRD Type		High-load capacity High-speed operation by large screw lead: 1 600 mm/sec Improved durability by NSK S1	Clamping axis of injection molding machines Die cast machines Punch presses Lifting and lowering devices	B515
	HTF Type		High-load capacity Even load distribution to the balls in a ball nut for high-load drive Improved durability by NSK S1 Provide a wide range of screw diameter and lead combinations.	Injection molding machines Press machines Press fitting machines Lifting and lowering machines	B519
Contaminated Environments	VSS Type		High dust-resistant performance: Reduces particle penetration rate to less than 1/15 (compared with standard seal). More than four times longer service life than standard seal under contaminated environments.	Woodworking machines Laser cutting machines Graphite milling machines Tire molding machines Transfer equipment	B535

Applications		Shape	Features	Applications	Page
Contaminated Environments and Grease Retention	Ball Screw with X1 Seals		Highly dustproof: Particle penetration ratio reduced to less than 1/30 of existing standard seals. Superior grease retention: Can reduce lubricant consumption, also effective at suppressing grease splattering.	Machining centers Combined machine tools NC lathes Woodworking machines Laser cutting machines Graphite milling machines Tire molding machines	B539
Twin-Drive Systems	TW Series		Controlled screw lead accuracy and variation of preload torque for twin drive. Improved axial rigidity, expected life and controllability by the paired up two ball-screw driving systems	Machining centers Combined machine tools Large-size machine tools	B545
High-Precision Machine Tools	Hollow Shaft Ball Screws		Suppress thermal deformation by cooling the shaft center Prevent the machine base from deforming due to thermal expansion. NSK special support units and seal units are available.	High-precision die processing machines High-precision combined machine tools High-precision machining centers High-precision lathes	B546
	Nut Cooling Ball Screws		Due to the simple nut cooling setup, cooling is achieved simply by attaching piping to the thermal displacement control nut. Cooling just as effective as core cooling Insulation to prevent heat from affecting the table.	High-precision die processing machines High-precision combined machine tools High-precision machining centers High-precision lathes Large machine tools	B551
Nut-Rotatable Ball Screws	NDT and NDD Type		Angular contact support bearings are integrated into the ball nut. Two or more ball nuts can be installed in a single ball screw shaft. The NDD type ball screws can surpass the critical speed. A special vibration damper enables long-stroke-high-speed operation.	Woodworking machines Laser cutting machines Electronic component mounting devices Liquid crystal display transfer equipment Transfer equipment	B555
Robots	Σ Series		A ball screw and a ball spline are made in one shaft, combining a drive and guide system. A ball screw nut, a ball spline nut and support bearings are combined to the unit. Hollow shaft has an effect for weight saving. The hollow can be used for wiring and piping.	SCALA type robots Electronic-component mounting systems	B563
Ball Screw with L1 Seal designed for Minimal Grease Splatter			Amount of splattered grease : 1/10 or less (compared with standard seal) Reduced grease-splattering helps maintaining machines and working environment clean. It can be fitted to Compact FA Series and High Speed SS Series later.	Electronic component mounting devices Semiconductor/Liquid crystal display manufacturing equipment Food processing/Medical equipment Transfer equipment	B575
Equipped with "NSK K1" Lubrication Unit			Long-term, maintenance-free operation Maintains lubrication efficiency for a prolonged time in contaminated environments Does not pollute the environment Made of compatible material with the FDA regulations is also available.	Automotive manufacturing machines Woodworking machines Laser cutting machines Semiconductor/Liquid crystal display manufacturing equipment Food processing/Medical equipment	B579

B-3-3.1 HMD Type for High-Speed Machine Tools

This product is being applied for a patent. The newly developed ball recirculation components, the end-deflector and middle-deflector, have greatly contributed for the substantial improvements in the maximum rotational speed and noise level compared to the HMC type.

1. Features

● High speed

The permissible rotational speed (d·n value) has greatly increased to 160 000 compared with 135 000 of the HMC type.

● Low noise

Noise reduced by 5 dB(A) or more compared with the HMC type ball screws for high-speed machine tools.

● Nut mounting dimensions

The ball nut diameters are the same as those of the HMC type.

2. Specifications

(1) Recirculation system

Fig.1 shows the structure of the middle-deflector recirculation system of the HMD type.

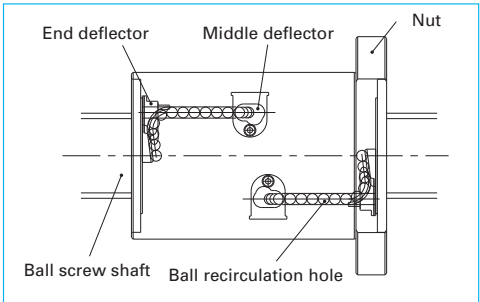


Fig. 1 Structure of middle-deflector recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

Accuracy grade	C3, C5
Axial play	0 mm (preloaded)

(3) Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Allowable d·n value: 160 000 or less

Criterion of maximum rotational speed : 4 000 min⁻¹

Note: Please also review the critical speed.

See "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Options

● For twin-drive systems (See page B545.)

Upon request, the variations in lead accuracy and preload torque between two ball screws of a pair of the TW series are controlled for the further improvement of the reliability.

● Hollow shaft ball screw (See page B546.)

● Nut cooling ball screw (See page B551.)

The temperature rise and measures against thermal expansion of ball screw driving mechanism are the most challenging for high-speed machine tools. We recommend using core forced cooling or nut cooling for the HMD type.

(5) Seal

Compact, thin plastic seal is available. Nut outside diameter is compact compare with the return tube recirculation system.

3. Design precautions

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

4. Product categories

The HMD type has a model as follows.

Table 2 HMD type product categories

Nut model	Shape	Flange shape	Nut shape	Preload system
EM		Flanged Circular II	Circular	Z-Preload (medium preload)

5. Structure of model number and reference number

The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

EM 40 20 - 6E	
Nut model: EM	Effective turns of balls
Screw shaft diameter (mm)	Lead (mm)

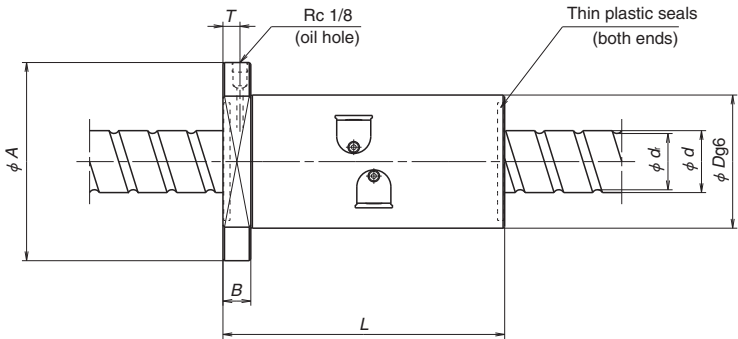
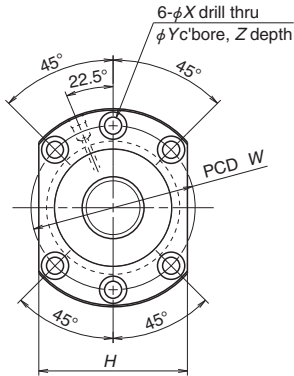
◇Reference number for ball screw

W 40 07 - ** Z M X T - C5 Z 20	
Product code	Lead (mm)
Screw shaft diameter (mm)	Axial play code: Z
Effective threaded length (in the unit of 100 mm)	Accuracy grade: C3 or C5
NSK design serial number	Hollow shaft specification
Preload code: Z; Z-preload	Ball screw specification/appearance
	Middle-deflector recirculation system

6. Handling Precautions

Maximum operating temperature: 80°C

If using NSK K1, operating temperature should not exceed 50°C. Refer to "Designing Precautions" (page B83).



Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Root dia. <i>d_r</i>	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
				Dynamic <i>C_d</i>	Static <i>C_{0s}</i>	
EM4016-4E	40	16	34.1	66 900	131 000	1 023
EM4020-6E		20	34.4	77 900	166 000	1 415
EM4025-6E		25	34.1	91 300	191 000	1 442
EM4030-6E		30	34.1	90 400	190 000	1 419
EM4516-4E	45	16	39.1	69 900	146 000	1 121
EM4520-6E		20	39.4	83 200	187 000	1 573
EM4525-6E		25	39.1	95 700	214 000	1 589
EM5016-4E	50	16	44.1	72 700	161 000	1 216
EM5020-6E		20	44.4	85 700	205 000	1 695
EM5025-6E		25	44.1	103 000	232 000	1 731
EM5030-6E		30	44.1	102 000	235 000	1 730
EM6316-4E	63	16	55.2	131 000	338 000	1 696

Notes: 1. The right turn screw is the standard. Please consult NSK for left turn screws.
2. Rigidity listed under the column K is the value when a 5% of basic dynamic load rating is applied as the preload.

Unit: mm										
Ball nut dimensions								Bolt hole PCD	Oil hole position	Max. feeding speed
Nut length	Nut dia.	Flange dia.	Flange width	Flange size	Bolt hole size					
<i>L</i>	<i>D</i>	<i>A</i>	<i>B</i>	<i>H</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>	<i>T</i>	(m/min)
160	86	128	18	96	11	17.5	11	106	11	64
150										80
182										100
213										120
160	92	134	18	102	11	17.5	11	112	11	56
150										70
182										88
160	98	140	18	107	11	17.5	11	118	11	51
150										64
182										80
213										96
170	122	180	28	138	18	26	17.5	150	14	40

B-3-3.2 HMS Type for High-Speed Machine Tools

1. Features

- High speed
The permissible rotational speed (d-n value) has greatly increased to 160 000 compared with 100 000 for tube type screws.
- Low noise
By adopting SRC recirculation system, noise reduced by 5 dB(A) or more compared with tube type screws.
- Nut mounting dimensions
The ball nut diameters are the same as those of tube type screws.

2. Specifications

(1) Recirculation system

Fig.1 shows the structure of the SRC recirculation system of the HMS type.

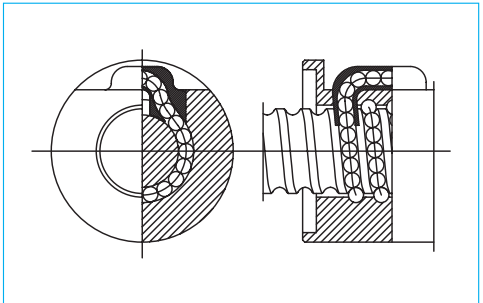


Fig. 1 Structure of SRC recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

Accuracy grade	C3, C5
Axial play	0 mm (preloaded)

(3) Allowable d-n value and the criterion of maximum rotational speed

Allowable d-n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Allowable d-n value: 160 000 or less
Criterion of maximum rotational speed : 5 000 min⁻¹

Note: Please also review the critical speed.
See "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Options

- For twin-drive systems (See page B545.)
Upon request, the variations in lead accuracy and preload torque between two ball screws of a pair of the TW series are controlled for the further improvement of the reliability.
- Hollow shaft ball screw (See page B546.)
- Nut cooling ball screw (See page B551.)
The temperature rise and measures against thermal expansion of ball screw driving mechanism are the most challenging for high-speed machine tools. We recommend using core forced cooling or nut cooling for the HMS type.

3. Design precautions

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

4. Product categories

The HMS type has a model as follows.

Table 2 HMS type product categories

Nut model	Shape	Flange shape	Nut shape	Preload system
ZFRC		Flanged Circular II	Circular	Z-Preload (medium preload)

5. Structure of model number and reference number

The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

ZFRC 40 10 - 10			
Nut model: ZFRC		Effective turns of balls*	
Screw shaft diameter (mm)		Lead (mm)	

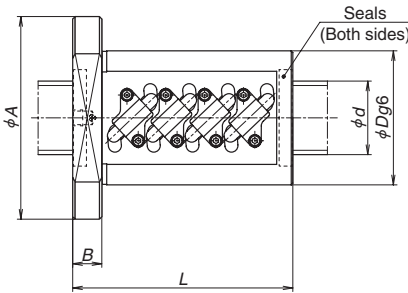
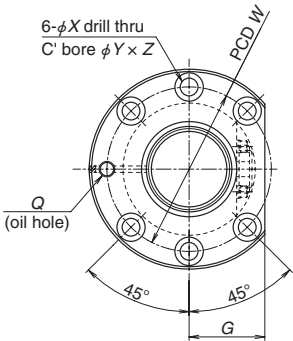
* In the case of Z-preload, the amount shown is twice the effective turn of balls.

◇Reference number for ball screw

W 40 07 - ** Z R C T - C5 Z 10									
Product code		Screw shaft diameter (mm)		Effective threaded length (in the unit of 100 mm)		NSK design serial number		Preload code: Z; Z-preload	

6. Handling Precautions

Maximum operating temperature: 60°C
If using NSK K1, operating temperature should not exceed 50°C. Refer to "Designing Precautions" (page B83).



Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Root dia. <i>d_r</i>	Effective turns Turns × rows	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
					Dynamic	Static	
					<i>C_e</i>	<i>C_{0a}</i>	
ZFRC3205-10	32	5	29.2	2.5×2	21 800	56 000	891
ZFRC3210-10	32	10	26.4	2.5×2	54 500	110 000	970
ZFRC4005-10	40	5	37.2	2.5×2	23 900	70 500	1 067
ZFRC4010-10	40	10	34.4	2.5×2	61 200	137 000	1 154
ZFRC4012-10	40	12	34.1	2.5×2	71 700	154 000	1 177
ZFRC4508-10	45	8	40.5	2.5×2	44 000	118 000	1 234
ZFRC4510-10	45	10	39.4	2.5×2	65 800	157 000	1 291
ZFRC4512-10	45	12	39.1	2.5×2	75 600	176 000	1 304
ZFRC5010-10	50	10	44.4	2.5×2	68 100	174 000	1 397
ZFRC5012-10	50	12	43.2	2.5×2	91 500	218 000	1 441
ZFRC6312-14	63	12	56.2	3.5×2	136 000	385 000	2 388

Notes: 1. The right turn screw is the standard. Please consult NSK for left turn screws.
2. Rigidity listed under the column K is the value when a 5% of basic dynamic load rating is applied as the preload.

Ball nut dimensions								Bolt hole PCD	Oil hole position	Max. feeding speed
Nut length	Nut dia.	Flange dia.	Flange width	Groove size	Bolt hole size					
<i>L</i>	<i>D</i>	<i>A</i>	<i>B</i>	<i>G</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>	<i>Q</i>	(m/min)
89	58	85	12	32	6.6	11	6.5	71	M6×1	25
160	74	108	15	41	9	14	8.5	90	M6×1	50
92	67	101	15	39	9	14	8.5	83	M6×1	25
166	82	124	18	47	11	17.5	11	102	Rc1/8	40
192	86	128	18	48	11	17.5	11	106	Rc1/8	48
136	82	124	18	47	11	17.5	11	102	Rc1/8	28
166	88	132	18	50	11	17.5	11	110	Rc1/8	35
192	90	132	18	50	11	17.5	11	110	Rc1/8	42
166	93	135	18	51	11	17.5	11	113	Rc1/8	32
198	100	146	22	55	14	20	13	122	Rc1/8	38
244	115	161	22	61	14	20	13	137	Rc1/8	30

Unit: mm

B-3-3.3 HMC Type for High-Speed Machine Tools

This product is being applied for a patent.

1. Features

● High-speed traveling

High helix leads of 16 mm to 36 mm are used. Furthermore, the ball recirculation return tube is reinforced to make a high-speed traveling of 40 to 120 m/min. possible.

● High rigidity, high load carrying capacity

Double start thread increases the number of effective turns of balls, and a smaller ball size increases the number of the balls. Together they contribute to have high rigidity and high load carrying capacity, despite the high helix lead.

● Compact nut

The size of nut diameter and length were reduced.

2. Specifications

(1) Ball recirculation system

The ball recirculation circuits and grooves are suited for high-speed operation. Structure of recirculation system is shown in Fig. 1.

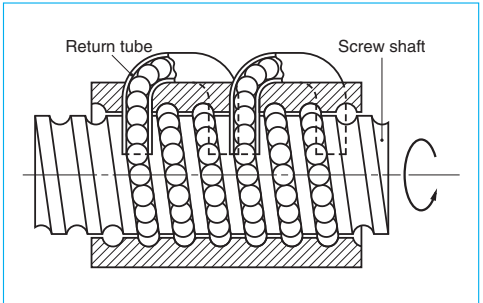


Fig. 1 Structure of return tube recirculation system

(2) Accuracy grades and axial play

Standard accuracy grades and axial play are shown in Table 1. Please consult NSK for other grade.

Table 1 Accuracy grades and axial play

Accuracy grade	C3, C5
Axial play	0 mm (preloaded)

(3) Options

● Equipped with NSK K1 lubrication unit

Optional NSK K1 lubrication unit, molded from

resin and impregnated with lubrication oil, is available. Please consult NSK when using NSK K1.

● For twin-drive systems (See page B545.)

Upon request, the variations in lead accuracy and preload torque between two ball screws of a pair of the TW series are controlled for the further improvement of the reliability.

● Hollow shaft ball screw specifications (See page B546.)

The temperature rise and measures against thermal expansion of ball screw driving mechanism are the most challenging for high-speed machine tools. For the HMD type ball screws, we recommend to utilize the hollow for forced cooling system.

● For a vertical axis ball screw

For a vertical axis ball screw, which constantly supports the load of vertical axis system, a high load capacity ball screw is required. A high load capacity type with compact design is available for the nut models II and III in the dimension tables. For details, please consult NSK.

(4) Allowable d·n value and the criterion of maximum rotational speed

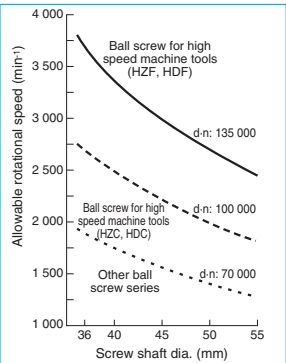
Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Allowable d·n value: HZC, HDC; 100 000 or less
HZF, HDF; 135 000 or less

Criterion of maximum rotational speed: 3 750 min⁻¹

Note: Please also review the critical speed. See "Technical Description: Permissible Rotational Speed" (page B47) for details.

Fig. 2 Comparison of permissible rotational speed



(5) Other specifications

For other specifications not listed in the dimension tables such as high-speed, high-load capacity, and NSK K1 installed type, please consult NSK.

3. Design precautions

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

4. Product categories

HMC type has two different preload systems with several models (Table 2).

Table 2 HMC type product categories

Nut model	Shape	Flange shape	Preload system
HZC HZF		Flanged Circular I	Z-preload (medium preload)
HDC HDF		Flanged Circular I	D-preload (medium preload)

5. Structure of model number and reference number

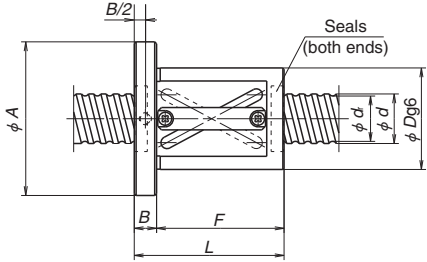
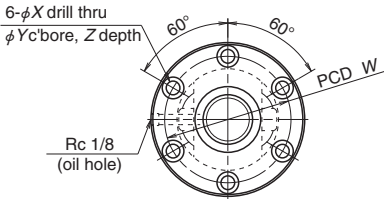
The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

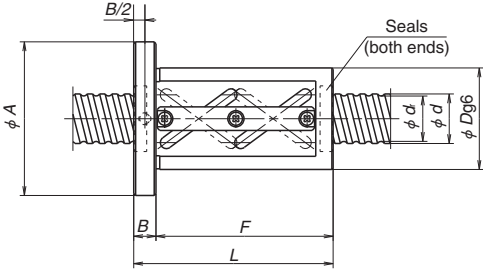
HZF	36	16	5
Nut model: HZC, HZF, HDC, HDF	Screw shaft diameter (mm)	Effective turns of balls	Lead (mm)

◇Reference number for ball screw

W	36	05	- **	Z	X	T	-	C5	Z	16
Product code	Screw shaft diameter (mm)	Effective threaded length (in the unit of 100 mm)	Design serial number	Preload code : Z, Z-preload; D, D-preload (page B5)	Axial play code: Z (page B20)	Accuracy grade: C3, C5 (page B37 to B42)	Hollow shaft ball screw	Appearance/specification code	Lead (mm)	



Nut model I (offset preload)



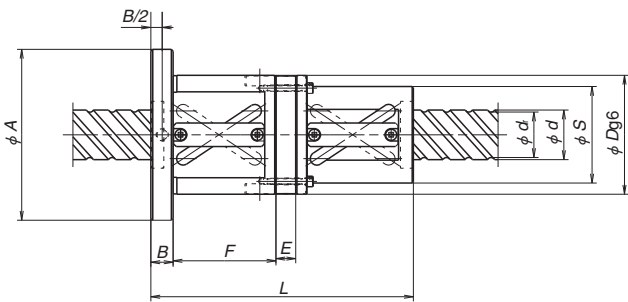
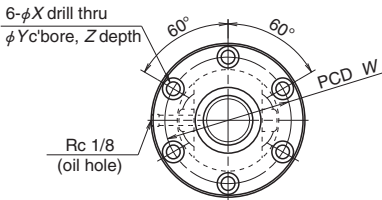
Nut model II (offset preload)

Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Root dia. <i>d_r</i>	Effective turns of balls	Nut model	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)	
						Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	5% <i>C_a</i>	10% <i>C_a</i>
HZF3616-5 HZA3616-5	36	16	31.5	5	II	47 000	102 000	1 156	1 456
HZF3620-3.5 HZA3620-3.5		20	30.4	3.5	I	51 100	98 600	862	1 086
HZF4016-5 HZA4016-5	40	16	35.5	5	II	49 500	113 000	1 269	1 599
HZF4020-3.5 HZA4020-3.5		20	34.4	3.5	I	53 600	107 000	933	1 176
HZF4020-5 HZA4020-5				5	II	72 900	154 000	1 316	1 659
HZF4516-5 HZA4516-7.5		16	40.5	5 7.5	II	51 400 72 800	126 000 189 000	1 390 2 045	1 751 2 576
HZF4520-3.5 HZA4520-3.5	45	20	39.4	3.5	I	57 300	121 000	1 037	1 307
HZF4520-5 HZA4520-5				5	II	77 900	172 000	1 455	1 834
HZF4525-3.5 HZA4525-3.5		25	39.1	3.5	I	65 900	137 000	1 045	1 317
HZF5020-3.5 HZA5020-3.5	50	20	44.4	3.5	I	59 000	132 000	1 119	1 410
HZF5020-5 HZA5020-5				5	II	80 200	189 000	1 575	1 985
HZF5025-3.5 HZA5025-3.5		25	44.1	3.5	I	70 700	152 000	1 153	1 452
HZF5025-5 HZA5025-5				5	II	96 100	217 000	1 617	2 037
HZF5030-3.5 HZA5030-3.5		30	44.1	3.5	I	70 200	152 000	1 140	1 437
HZF5520-3.5 HZA5520-5	55	20	49.4	3.5 5	I II	62 100 84 300	146 000 207 000	1 218 1 706	1 534 2 149
HZF5525-3.5 HZA5525-5		25	49.1	3.5 5	I II	73 100 99 300	165 000 236 000	1 237 1 735	1 558 2 186
HZF5530-3.5		30	49.1	3.5	I	72 700	167 000	1 235	1 556

Ball nut dimensions									Max. feeding speed (m/min)
Nut entire length <i>L</i>	Nut dia. <i>D</i>	Flange dia. <i>A</i>	Flange width <i>B</i>	Nut length <i>F</i>	Bolt hole dimensions			Bolt hole PCD <i>W</i>	
					<i>X</i>	<i>Y</i>	<i>Z</i>		
134	78 71	120 113	18	116	11	17.5	11	98 91	60 44
121	94 78	136 120	18	103	11	17.5	11	114 98	75 56
134	79 76	121 118	18	116	11	17.5	11	99 96	54 40
121	96 82	138 124	18	103	11	17.5	11	116 102	67 50
161	96 82	138 124		143				116 102	67 50
134 187	82	124 128	18 22	116 165	11 14	17.5 20	11 13	102 104	48
122	98 88	140 130	18	104	11	17.5	11	118 108	60 44
162	98 88	140 130		144				118 108	60 44
141	101 92	143 134	18	123	11	17.5	11	121 112	75 56
122	101 95	143 137	18	104	11	17.5	11	121 115	54 40
162	101 95	143 137		144				121 115	54 40
141	103 98	145 140	18	123	11	17.5	11	123 118	67 50
191	103 98	145 140		173				123 118	67 50
159	103 98	145 140	18	141	11	17.5	11	123 118	81 60
122 162	103	145	18	104 144	11	17.5	11	123	49
141 191	105	147	18	123 173	11	17.5	11	125	61
159	105	147	18	141	11	17.5	11	125	73

Notes: 1. Ball screws of 32 or 36 mm lead have triple start threads. Others have double start threads.
2. Rigidity listed under the column 5%Ca is the value when a 5% of basic dynamic load rating is applied as the preload.
Similarly, those listed under the column 10%Ca means a 10% of basic dynamic load rating is applied.



Nut model III (double nut spacer, preload)
(the figure indicates use of double start threads)

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Root dia. <i>d_r</i>	Effective turns of balls	Nut model	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)	
						Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	5% <i>C_a</i>	10% <i>C_a</i>
HDF3620-5 HDC3620-5	36	20	30.4	5	III	69 400	139 000	1 204	1 516
HDF4025-5 HDC4025-5	40	25	34.1	5	III	85 500	176 000	1 334	1 681
HDF4030-5 HDC4030-5		30	34.1	5	III	84 600	175 000	1 313	1 654
HDF4032-7.5 HDC4032-7.5		32	34.4	7.5	III	104 000	232 000	1 909	2 405
HDF4036-4.5		36	34.4	4.5	III	66 500	137 000	1 214	1 530
HDF4525-5 HDC4525-5	45	25	39.1	5	III	89 600	195 000	1 460	1 840
HDF4530-5 HDC4530-5		30	39.1	5	III	91 800	197 000	1 476	1 860
HDF4532-7.5 HDC4532-7.5		32	39.4	7.5	III	108 000	259 000	2 100	2 646
HDF4536-4.5		36	39.4	4.5	III	69 200	15 500	1 280	1 612
HDF5030-5 HDC5030-5	50	30	44.1	5	III	95 500	216 000	1 600	2 016
HDF5032-7.5 HDC5032-7.5		32	44.4	7.5	III	112 000	285 000	2 286	2 881
HDF5530-5	55	30	49.1	5	III	98 700	235 000	1 719	2 166
HDF5532-7.5		32	49.4	7.5	III	118 000	312 000	2 483	3 128

Notes: 1. Ball screws of 32 or 36 mm lead have triple start threads. Others have double start threads.
2. Rigidity listed under the column 5%Ca is the value when a 5% of basic dynamic load rating is applied as the preload.
Similarly, those listed under the column 10%Ca means a 10% of basic dynamic load rating is applied.

Ball nut dimensions											Max. feeding speed (m/min)
Nut entire length <i>L</i>	Nut dia. <i>D</i> <i>S</i>		Flange dia. <i>A</i>	Flange width <i>B</i>	Nut length <i>F</i>	Spacer dimensions <i>E</i>	Bolt hole size <i>X</i> <i>Y</i> <i>Z</i>			Bolt hole PCD <i>W</i>	
191	94	76	136	18	77	5	11	17.5	11	114	75
	78	60	120							98	56
228.5	98	80	140	18	91	13.5	11	17.5	11	118	84
	86	68	128							106	63
248	98	80	140	18	104	8	11	17.5	11	118	101
	86	68	128							106	75
265	96	78	142	22	109	11	14	20	13	118	108
	82	64	128							106	80
200	96	78	138	18	83	4	11	17.5	11	116	120
228.5	101	83	143	18	91	13.5	11	17.5	11	121	75
	92	74	134							112	56
248	101	83	143	18	104	8	11	17.5	11	121	90
	92	74	134							112	67
266	98	80	144	22	109	11	14	20	13	120	96
	88	70	134							110	71
200	98	80	140	18	83	4	11	17.5	11	118	108
249	103	85	145	18	104	8	11	17.5	11	123	81
	98	80	140							118	60
266	101	83	147	22	109	11	14	20	13	123	86
	95	77	141							117	64
249	105	87	147	18	104	8	11	17.5	11	125	73
266	103	85	149	22	109	11	14	20	13	125	78

B-3-3.4 BSL™ Type for Miniature Lathes

1. Features

● Prompt delivery

Screw shaft configuration and ball nut shape are standardized for prompt delivery.

● High speed and low noise

Adoption of end-deflector recirculation system realized high-speed operation with low noise.

● Excellent dust resistance

Thin plastic seal and specially designed ball grooves prevent the entry of foreign matters.

2. Specifications

(1) Ball recirculation system

End-deflector recirculation system has features of high-speed, low-noise operation and compact ball nut. The structure of recirculation system is shown in Fig.1.

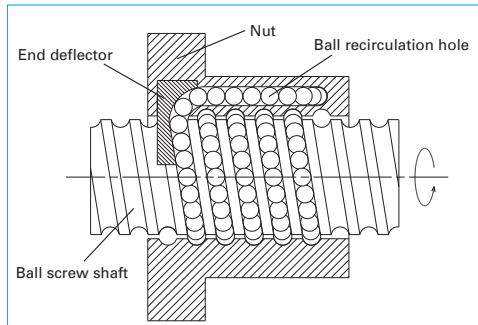


Fig. 1 Structure of end-deflector recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

Accuracy grade	C5
Axial play	0 mm (preloaded)

(3) Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Allowable d·n value: 180 000 or less

Criterion of maximum rotational speed : 4 000 min⁻¹

Note: Please also review the critical speed.

See "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Options

Optional NSK K1 lubrication unit, molded from resin and impregnated with lubrication oil, supplies fresh oil onto ball rolling surface, ensuring long-term, maintenance-free operation. Please consult NSK when using NSK K1.

3. Design Precautions

When designing the screw shaft end, one end of the shaft must meet either one of the following conditions. If not, we cannot install the ball nut on the screw shaft.

- Cut the ball groove through to the shaft end.
- The diameters of bearing journals and the gear or pulley seat must be less than the root diameter of ball groove "dr" specified on the dimension table.

Special bearings which have higher-load carrying capacity are available.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

4. Product categories

The BSL type has a model as follows.

Table 2 BSL type product categories

Nut model	Shape	Flange shape	Preload system
BSL		Circular III	P-Preload (Slight preload)

5. Structure of model number and reference number

The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

BSL	20	05	
Nut model: BSL	Screw shaft diameter (mm)	Lead (mm)	

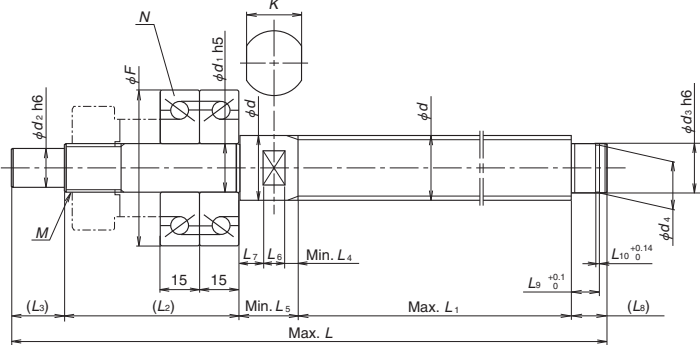
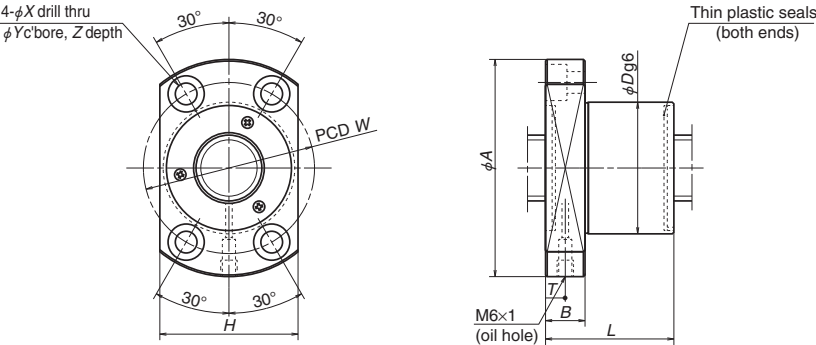
◇Reference number for ball screw

W	20	05	- **	P	SS	- C5	Z 5	
Product code	Screw shaft diameter (mm)	Effective threaded length (in the unit of 100 mm)	NSK design serial number	Preload code: P; P-preload (page B5)		Accuracy grade: C5 (page B37 to B42)	Axial play code: Z (page B20)	Lead (mm)
						End-deflector recirculation system		

6. Handling Precautions

Maximum operating temperature: 80°C

If using NSK K1, operating temperature should not exceed 50°C. Refer to "Designing Precautions" (page B83).



Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Root dia. <i>d_r</i>	Basic load rating (N)		Ball nut dimensions										<i>d_i</i>
				Dynamic <i>C_s</i>	Static <i>C_{0s}</i>	External dimensions					Bolt hole dimensions				Oil hole <i>T</i>	
						<i>D</i>	<i>A</i>	<i>H</i>	<i>B</i>	<i>L</i>	<i>W</i>	<i>X</i>	<i>Y</i>	<i>Z</i>		
BSL2005	20	5	17.2	10 500	16 200	36	63	38	12	37	49	6.6	11	6.5	6.5	15
BSL2006		6	16.4	14 000	20 000	40	65	42		45	51				6.7	
BSL2505	25	5	22.2	11 700	20 400	40	65	42	12	38	51	6.6	11	6.5	7.1	20
BSL2506		6	21.4	15 700	25 400	43	69	45		44	55				6.3	
BSL2508		8	20.5	20 100	29 900	46	72	48		55	58				6.5	
BSL2510		10	20.5	20 000	29 800	46	72	48		65	58				6	
BSL3210	32	10	26.4	32 500	51 800	61	93	63	18	68	76	9	14	8.5	10	25
BSL3212		12		32 400	51 600						77					

Notes: 1. The right turn screw is the standard. Please consult NSK for left turn screw.
2. Shaft dimensions are for reference.

Unit: mm

Shaft configuration and dimensions (reference)																			
Shaft dimension																Exclusive bearing N		Basic dynamic load rating C_r	Permissible axial load (N)
d_2	d_3	d_4	L (max.)	L_1 (max.)	L_2	L_3	L_4 (min.)	L_5 (min.)	L_6	L_7	L_8	L_9	L_{10}	K	M	Bearing reference number	F		
12	15	$14.3^{0}_{-0.11}$	500	500	66	20	3	20	8	9	14	10.15	1.15	17	M15×1.0	15TAC47C	47	21 900	26 600
							4	21											
15	20	$19^{0}_{-0.21}$	700	700	71	27	3	27	10	14	19	15.35	1.35	22	M20×1.0	20TAC62C	62	28 500	40 500
							4	28											
							5	29											
							5	29											
20	25	$23.9^{0}_{-0.21}$	1 000	800	71	33	6	33	12	15	20	16.35	1.35	27	M25×1.5	25TAC62C	62	28 500	40 500
							7	34											

3. Shaft length *L₁* and shaft entire length *L* are the maximum length.
When *L* becomes the same length as the *L₁*, the thread is all screw specification.

B-3-3.5.1 HTF-SRC Type for High-Load Drives

1. Features

● High-speed operation and low noise
The SRC recirculation system contributes to more than twice the feed speed (d-n value: 140 000 and 160 000) and the noise level of less than 8 to 10dB(A) (half to 1/3 of noise) compared with the HTF type.

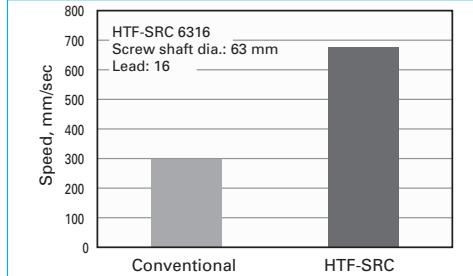


Fig. 1 Feed speed comparison

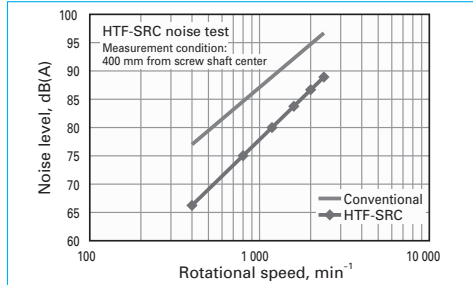


Fig. 2 Noise level comparison

2. Specifications

(1) Ball recirculation system

The SRC recirculation system picks up balls in the direction they are moving, and thus contributed to high-speed, low-noise operation. Structure of the recirculation system is as follows.

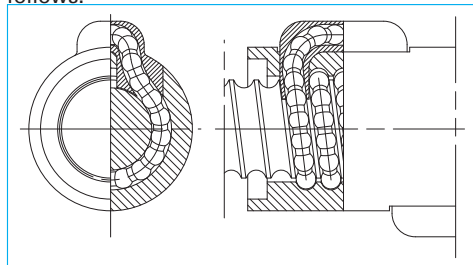


Fig. 3 Structure of SRC recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

Accuracy grade	Ct7
Axial play	S,0.020 mm or less; N,0.050 mm or less

(3) Allowable d-n value and the criterion of maximum rotational speed

Allowable d-n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Table 2 Allowable d-n value and the criterion of maximum rotational speed

Lead	14, 16 mm	20, 25 mm*
Allowable d-n value	160 000 or less	140 000 or less
Criterion of maximum rotational speed	3 225 min ⁻¹	

d-n value: shaft dia. d [mm] × rotational speed n [min⁻¹]

☆ Allowable d · n value for HTF-SRC5020: 160 000

Note: Please also review the critical speed. See "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Ball retaining piece NSK S1™

The NSK S1, resin retainers between the balls, significantly extend ball screw durability to the moment load.

(5) Other

Please consult NSK for special requests, such as the addition of a recirculation circuit to increase the load capacity, or the arrangement of all recirculation circuits on the same phase of ball nut circumference.

3. Design Precautions

The HTF-SRC type is designed to distribute the load uniformly to the load balls for high-load drive mechanism. We recommend installing the ball screws in the way shown below for the full use of this characteristic.

In addition, we will make full analysis when you use the HTF-SRC type under extreme conditions such as application of extremely high load or operating in short stroke. Contact NSK about operating conditions (See page B533).

When designing the screw shaft end, one end

of the screw shaft must meet either one of the following conditions. If not, we cannot install the ball nut on the screw shaft.

- Cut the ball groove through to the shaft end.
- The diameters of bearing journals and the gear or pulley seat must be less than the root diameter of ball groove "dr" specified on the dimension table.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

4. Product categories

The HTF-SRC type has a model as follows.

Table 3 HTF-SRC type product categories

Nut model	Shape	Flange shape	Preload system
HTF-SRC		Flanged Circular I	Non-preload Slight axial play

5. Structure of model number and reference number

The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

HTF-SRC 63 20 - 7.5			
Nut model: HTF-SRC	Screw shaft diameter (mm)	Effective turns of balls	Lead (mm)

◇Reference number for ball screw

W 63 04 - ** RC SP - C7 S 20					
Product code	Screw shaft diameter (mm)	Effective threaded length (in the unit of 100 mm)	NSK design serial number	SRC recirculation system	Lead (mm)
					Axial play code: S, N (page B20)
					Accuracy grade: C7 (Ct7) (page B37 to B42)
					Ball retaining pieces NSK S1 specification

6. Handling Precautions

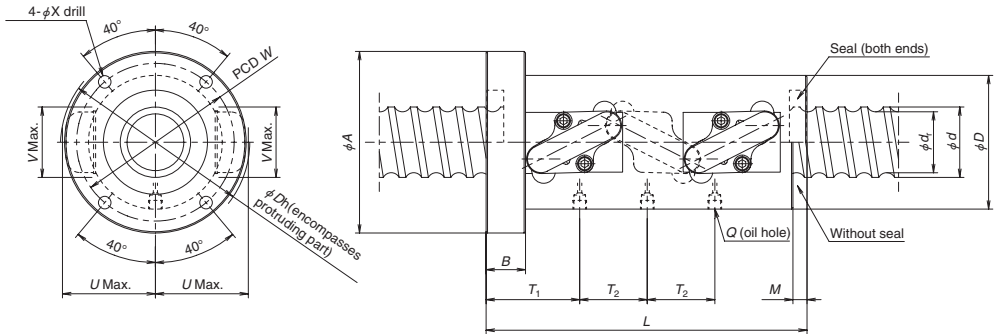
Maximum operating temperature: 70°C

(at outside diameter of ball nut)

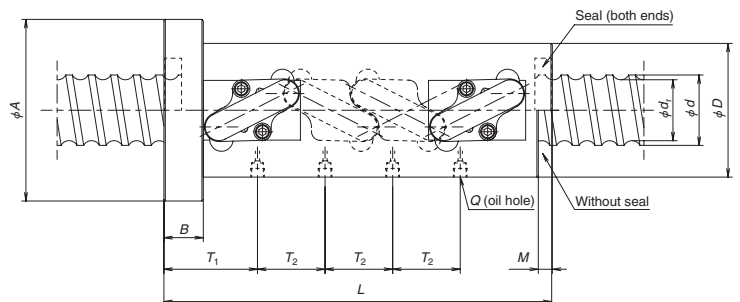
The lubricant deteriorates, operating temperature

is recommended 60°C and under.

Please consult NSK in the case of a short stroke operation less than or equal to four times the length of the ball screw lead.



Nut model I

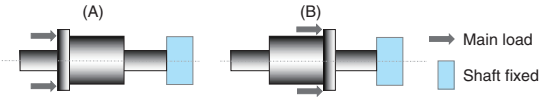


Nut model II

Model No.	Lead <i>l</i>	Shaft dia. <i>d</i>	Root dia. <i>d'</i>	Effective ball turns Turns × Circuits	Nut model	Basic load rating (kN)				
						Dynamic <i>C_H</i>	Static <i>C_{0H}</i>	<i>D</i>	<i>A</i>	<i>B</i>
HTF-SRC5014-7.5	14	50	41.6	2.5×3	I	264	623	80	114	28
HTF-SRC5016-7.5	16	50	39	2.5×3	I	383	818	95	129	28
HTF-SRC6316-7.5	16	63	52	2.5×3	I	429	1 050	105	139	28
HTF-SRC6316-10	16	63	52	2.5×4	II	549	1 410	105	139	28
HTF-SRC6316-10.5	16	63	52	3.5×3	I	562	1 450	105	139	28
HTF-SRC6316-14	16	63	52	3.5×4	II	720	1 930	105	139	28
HTF-SRC8016-10.5	16	80	69	3.5×3	I	627	1 870	120	154	32
HTF-SRC8016-14	16	80	69	3.5×4	II	802	2 490	120	154	32
HTF-SRC5020-7.5	20	50	39	2.5×3	I	383	818	95	129	28
HTF-SRC6320-7.5	20	63	49	2.5×3	I	572	1 280	117	157	32
HTF-SRC6320-10	20	63	49	2.5×4	II	732	1 710	117	157	32
HTF-SRC8020-10.5	20	80	66	3.5×3	I	838	2 300	130	170	32
HTF-SRC10020-10.5	20	100	86	3.5×3	I	936	2 910	145	185	32
HTF-SRC10020-14	20	100	86	3.5×4	II	1 200	3 890	145	185	32
HTF-SRC12020-7.5	20	120	106	2.5×3	I	776	2 550	173	213	40
HTF-SRC12020-10	20	120	106	2.5×4	II	994	3 400	173	213	40
HTF-SRC6325-10.5	25	63	49	3.5×3	I	750	1 770	117	157	32
HTF-SRC8025-7.5	25	80	63	2.5×3	I	790	1 960	145	185	40
HTF-SRC10025-10.5	25	100	83	3.5×3	I	1 200	3 430	159	199	40
HTF-SRC10025-14	25	100	83	3.5×4	II	1 540	4 580	159	199	40
HTF-SRC12025-10.5	25	120	103	3.5×3	I	1 300	4 200	173	213	40
HTF-SRC12025-14	25	120	103	3.5×4	II	1 660	5 600	173	213	40

Remarks: 1. The ball nut length with no seals is shorter by M than that of a ball nut with seals.
2. Please consult NSK if load exceeds the allowable axial load (Fa max.).
3. The right hand screw is the standard. For specifications on left hand screws, contact NSK.
4. The allowable axial load is a value in the case of S clearance. If the clearance amount and mounting conditions differ, please note that the allowable axial load is also different.

Ball nut dimensions										Allowable axial load (kN)	
										Mounting *See below	
<i>L</i>	<i>M</i>	<i>W</i>	<i>X</i>	<i>U</i>	<i>V</i>	<i>Dh</i>	<i>Q</i>	<i>T₁</i>	<i>T₂</i>	[A] Recommended	[B]
202	10	97	9	54.5	46	111	M6×1	69	42	98.5	75.7
228	10	112	9	66	50	134	Rc1/8	74.5	48	124.8	106.2
228	10	122	9	72.5	50	148	Rc1/8	74.5	48	174.2	139.9
276	10	122	9	72.5	50	148	Rc1/8	74.5	48	202.3	152.4
276	10	122	9	72.5	50	148	Rc1/8	74.5	64	210.6	157.9
340	10	122	9	72.5	50	148	Rc1/8	74.5	64	233.8	165.5
278	10	137	9	80	60	165	Rc1/8	78.5	64	305.7	209.4
342	10	137	9	80	60	165	Rc1/8	78.5	64	351.2	220.9
268	10	112	9	66	50	135	Rc1/8	83.5	60	117.7	98.5
279	12	137	11	80	62	163	Rc1/8	90	60	202.2	170
339	12	137	11	80	62	163	Rc1/8	90	60	227.7	183.2
339	12	150	11	88	64	180	Rc1/8	90	80	350	255.5
339	12	165	11	97	78	199	Rc1/8	90	80	497.1	325.6
419	12	165	11	97	78	199	Rc1/8	90	80	572.1	341.8
287	12	193	11	109.5	88	229	Rc1/8	98	60	481.6	365
347	12	193	11	109.5	88	229	Rc1/8	98	60	589.3	404.8
405	12	137	11	81.5	61	167	Rc1/8	101.75	100	220.4	174.1
347	17	165	11	99.5	73	202	Rc1/8	111.75	75	319.3	268.3
422	17	179	11	108	79	220	Rc1/8	111.75	100	539.8	384.5
522	17	179	11	108	79	220	Rc1/8	111.75	100	603.3	402.2
421	17	193	11	116	92	238	Rc1/8	111.25	100	713.4	466.6
521	17	193	11	116	92	238	Rc1/8	111.25	100	815.4	488.3



B-3-3.5.2 HTF-SRD Type for High-Load Drives

This product is being applied for a patent.

1. Features

- High-speed operation and low noise
Used with end deflectors, HTF-SRD type ball screws achieve the maximum feed speed of 1 600 mm/s. The ball nut body surface is completely round, thus enabling well balanced ball nut rotation.
- Low noise and compact design
Double start thread structure which has more recirculation circuits, and large diameter balls contribute to have high load carrying capacity.
- End deflector system using a ball scooping mechanism in the direction of screw spiral offers smoother ball recirculation system, thus contributing to less than half the noise level compared with existing ball screws equipped with a return tube.
- Compact, high-performance seal is available. Nut outside diameter is compact compare with the return tube recirculation system.
- Also, compact, thin plastic seal is available. Nut outside diameter is compact compare with the return tube recirculation system.

2. Specifications

(1) Ball recirculation system

End-deflector recirculation system has features of high-speed, low-noise operation, and compact ball nut. The structure of recirculation parts are as follows.

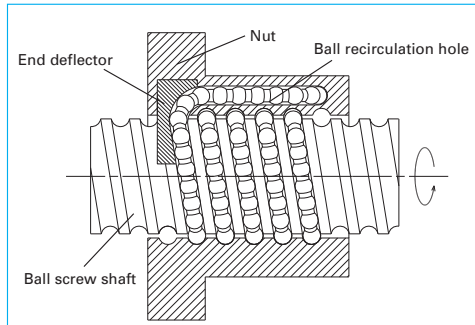


Fig. 1 Structure of End-deflector recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

Accuracy grade	Ct7
Axial play	S, 0.020 mm or less; N, 0.050 mm or less

(3) Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Table 2 Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value	120 000 or less
Criterion of maximum rotational speed	2 400 min ⁻¹

d·n value: shaft dia. d [mm] × rotational speed n [min⁻¹]

Note: Please also review the critical speed. See "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Ball retaining piece NSK S1™

The NSK S1, resin retainers between the balls, significantly extend ball screw durability to the moment load.

3. Design Precautions

The HTF-SRD type is designed to distribute the load uniformly to the load balls for high-load drive mechanism. We recommend installing the ball screws in the way shown below for the full use of this characteristic.

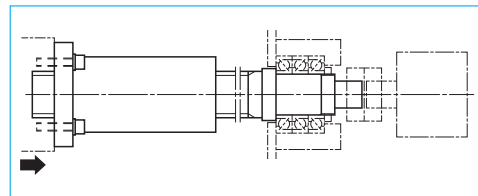


Fig. 2 Recommended installing direction of high-load drives ball screw

In addition, we will make full analysis when you use the HTF-SRD type under extreme conditions such as application of extremely high load or operating in short stroke. Contact NSK about operating conditions (see page B533). When designing the screw shaft end, one end

of the screw shaft must meet either one of the following conditions. If not, we cannot install the ball nut on the screw shaft.

- Cut the ball groove through to the shaft end.
- The diameters of bearing journals and the gear or pulley seat must be less than the root diameter of ball groove "dr" specified on the dimension table.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and

"Handling Precautions" (page B103).

4. Product categories

The HTF-SRD type has a model as follows.

Table 3 HTF-SRD type product categories

Nut model	Shape	Flange shape	Preload system
HTF-SRD		Circular III	Non-preload Slight axial play

5. Structure of model number and reference number

The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

HTF-SRD 50 40 - 6E	
Nut model: HTF-SRD	Effective turns of balls
Screw shaft diameter (mm)	Lead (mm)

◇Reference number for ball screw

W 50 18 - ** SS SP X - C7 N 40	
Product code	Lead (mm)
Screw shaft diameter (mm)	Axial play code: S, N (page B20)
Effective threaded length (in the unit of 100 mm)	Accuracy grade: C7 (Ct7) (page B37 to B42)
NSK design serial number	Ball screw specification/appearance
End-deflector recirculation system	Ball retaining pieces NSK S1 specification

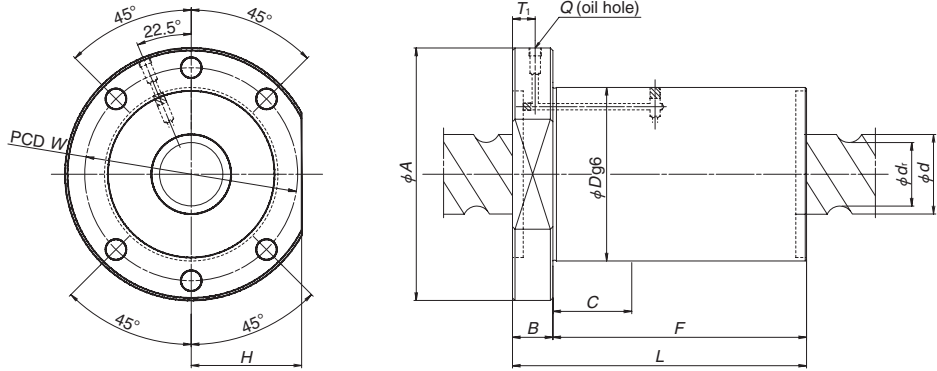
6. Handling Precautions

Maximum operating temperature: 70°C (at outside diameter of ball nut)

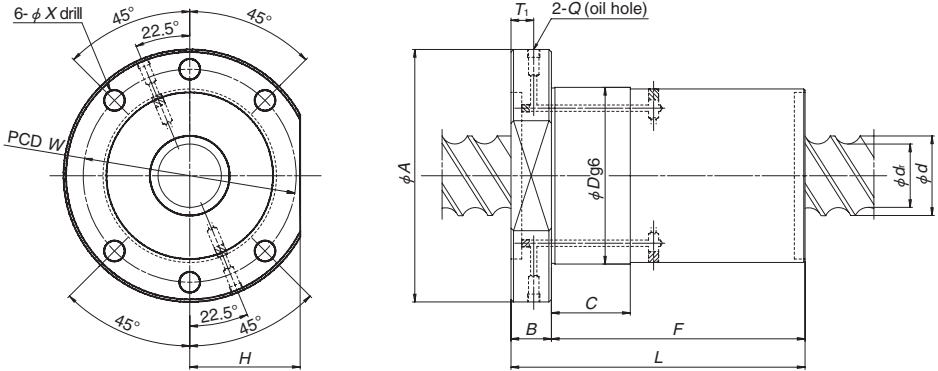
The lubricant deteriorates, operating temperature

is recommended 60°C and under.

Please consult NSK in the case of a short stroke operation less than or equal to four times the length of the ball screw lead.



Nut model I



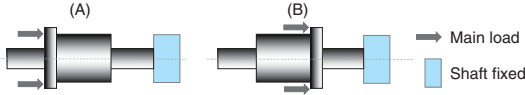
Nut model II

Unit: mm

Model No.	Lead <i>l</i>	Shaft dia. <i>d</i>	Root dia. <i>d_r</i>	Nut model	Basic load rating (kN)				
					Dynamic	Static			
					<i>C_d</i>	<i>C_s</i>	<i>D</i>	<i>A</i>	<i>B</i>
HTF-SRD6332-4E	32	63	49	I	292	590	140	190	32
HTF-SRD5040-6E	40	50	39	II	243	491	115	165	28
HTF-SRD5040-8E	40	50	39	II	319	679	115	165	28
HTF-SRD6340-6E	40	63	49	II	363	768	140	200	32
HTF-SRD6340-8E	40	63	49	II	476	1 060	140	200	32
HTF-SRD5050-6E	50	50	39	II	243	491	115	165	28
HTF-SRD5050-8E	50	50	39	II	319	679	115	165	28
HTF-SRD8050-6E	50	80	63	II	502	1 180	175	250	40
HTF-SRD8050-8E	50	80	63	II	658	1 630	175	250	40
HTF-SRD6360-6E	60	63	49	II	363	768	140	200	32
HTF-SRD6360-8E	60	63	49	II	476	1 060	140	200	32
HTF-SRD10060-6E	60	100	83	II	583	1 490	195	270	40
HTF-SRD10060-8E	60	100	83	II	765	2 060	195	270	40
HTF-SRD12070-6E	70	120	103	II	630	1 810	210	285	50
HTF-SRD12070-8E	70	120	103	II	826	2 520	210	285	50
HTF-SRD8080-6E	80	80	63	II	502	1 180	175	250	40
HTF-SRD8080-8E	80	80	63	II	658	1 630	175	250	40
HTF-SRD100100-6E	100	100	83	II	583	1 490	195	270	40
HTF-SRD100100-8E	100	100	83	II	765	2 060	195	270	40
HTF-SRD80120-4E	120	80	63	II	337	751	175	250	40
HTF-SRD120120-6E	120	120	103	II	630	1 810	210	285	50
HTF-SRD120120-8E	120	120	103	II	826	2 520	210	285	50

Ball nut dimensions								Allowable axial load (kN)	
								Mounting *See below	
<i>F</i>	<i>C</i>	<i>L</i>	<i>H</i>	<i>W</i>	<i>X</i>	<i>Q</i>	<i>T₁</i>	[A] Recommended	[B]
144	—	176	85	165	14	Rc1/8	22	109.7	105.9
131	131	159	72.5	140	14	Rc1/8	18	101	94.9
171	171	199	72.5	140	14	Rc1/8	18	119.7	109.6
131	131	163	90	170	18	Rc1/8	22	170	160.3
171	171	203	90	170	18	Rc1/8	22	205.2	188.2
159	159	187	72.5	140	14	Rc1/8	18	98.1	91.5
209	209	237	72.5	140	14	Rc1/8	18	113.6	103.1
154	154	194	110	210	22	Rc1/8	30	265.3	249.7
204	204	244	110	210	22	Rc1/8	30	322.3	294.5
188	188	220	90	170	18	Rc1/8	22	159.9	148.3
248	248	280	90	170	18	Rc1/8	22	186	167.5
185	185	225	122	235	22	Rc1/8	30	339.7	313.2
245	245	285	122	235	22	Rc1/8	30	415.8	368.3
210	210	260	130	250	22	Rc1/8	40	416.5	373
280	280	330	130	250	22	Rc1/8	40	519.4	440
244	244	284	110	210	22	Rc1/8	30	245.6	226.6
324	100	364	110	210	22	Rc1/8	30	286.5	256.1
301	100	341	122	235	22	Rc1/8	30	318.2	284.5
401	100	441	122	235	22	Rc1/8	30	371.8	318.4
243	243	290	110	210	22	Rc1/8	30	171.7	162.5
356	100	406	130	250	22	Rc1/8	40	389	333.4
476	100	526	130	250	22	Rc1/8	40	463.4	373.9

Remarks: 1. Please consult NSK if load exceeds the allowable axial load (Fa max.).
2. The right hand screw is the standard. For specifications on left hand screws, contact NSK.
3. The allowable axial load is a value in the case of S clearance. If the clearance amount and mounting conditions differ, please note that the allowable axial load is also different.
4. When F and C dimensions are the same, the diameter of whole area of F dimension is $\phi Dg6$



B-3-3.5.3 HTF Type for High-Load Drives

This product is being applied for a patent.

1. Features

- High load carrying capacity
Has an ideal design to bear heavy load. It significantly enhances load rating as well as maximum permissible load.

- Respond to various shaft end configuration
Additional ball screw shaft machining is not required. HTF type responds to various shaft ends that convey high torque.

HTF type can be used with: involute spline (JIS B 1603), straight sided spline (JIS B 1601), key seat, etc.

2. Specifications

(1) Ball recirculation system

Structure of recirculation system is shown in Fig. 1.

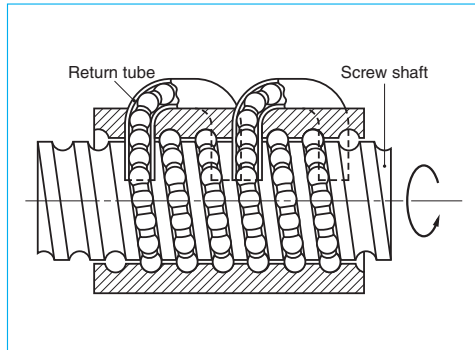


Fig. 1 Structure of return tube recirculation system

(2) Accuracy grade and axial play

The allowable standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

Accuracy grade	Ct7
Axial play	S, 0.020 mm or under; N, 0.050 mm or under

(3) Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below. For higher-speed operation, HTF-SRC type is recommend (See page B511).

Table 2 Allowable d·n value and the criterion of maximum rotational speed

Lead		20 mm	25 mm	30 – 32 mm
Allowable d·n value	Standard specification	70 000 or less	70 000 or less	50 000 or less
	High-speed specification	10 000 or less	—	—
Criterion of maximum rotational speed		3 125 min ⁻¹		

d·n value: shaft dia. d [mm] × rotational speed n [min⁻¹]

Note: Please also review the critical speed. See "Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) Ball retaining piece NSK S1™

The NSK S1, resin retainers between the balls, significantly extend ball screw durability to the moment load.

(5) Other

Please consult NSK for special requests, such as the addition of a recirculation circuit to increase the load capacity, or the arrangement of all recirculation circuits on the same phase of ball nut circumference.

3. Design precautions

For designing shaft end configuration, you should take into account that the HTF type ball screws are dedicated to high-load drives.

The HTF type is designed to distribute the load uniformly to the load balls for high load drive mechanism.

We recommend installing the ball screws in the way shown in Fig. 2 for the full use of this characteristic. In addition, we will make full analysis when you use the HTF type under extreme conditions such as application of extremely high load or operating in short stroke. Contact NSK about operating conditions (See page B533).

When designing the screw shaft end, the one end shall be cut-through and shaft end dimension must be less than the root diameter

of ball groove. If not, the nut cannot be assembled.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

4. Product categories

The HTF type has a model as follows.

Table 3 HTF type product categories

Nut model	Shape	Flange shape	Preload system
HTF		Flanged Circular I	Non-preloaded Slight axial play

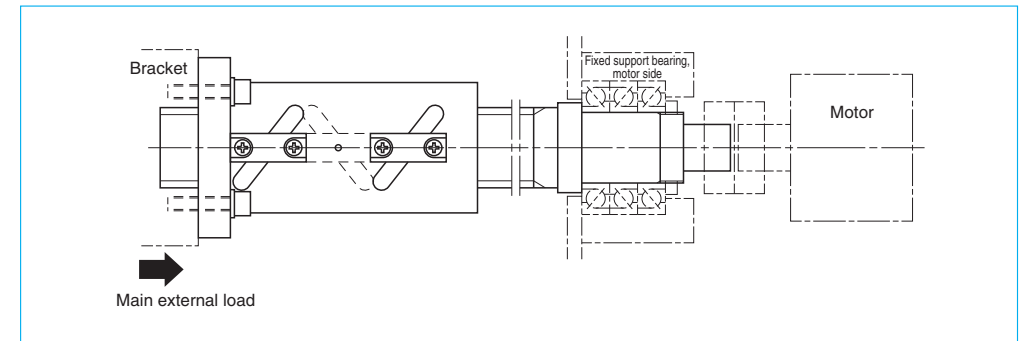
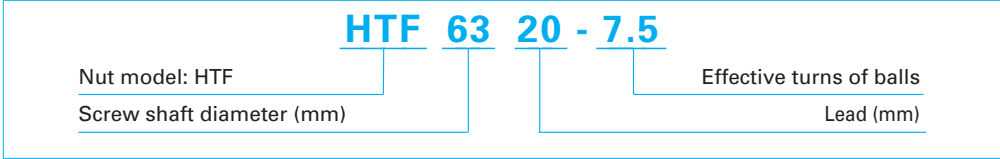


Fig. 2 Recommended installing direction of ball screws for high-load drives

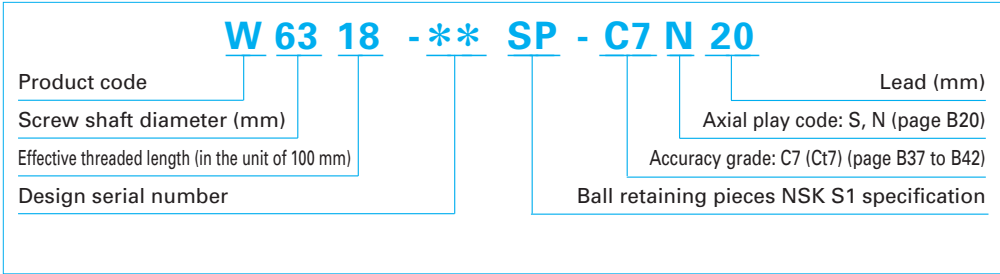
5. Structure of model number and reference number

A structure of "Model number" and "Reference number for ball screw" are as follows.

◇Model number



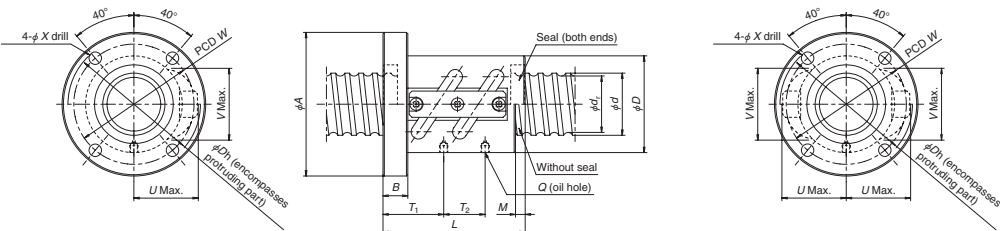
◇Reference number for ball screw



6. Handling precautions

Maximum operating temperature : 70°C
(at outside diameter of all nut)
The lubricant deteriorates, operating temperature is recommended 60°C and under.
Please consult NSK in the case of a short stroke

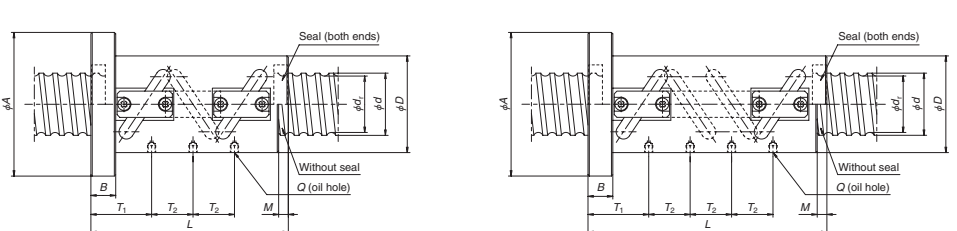
operation less than or equal to four times the length of the ball screw lead.



Nut model I

Model No.	Lead <i>l</i>	Shaft dia. <i>d</i>	Root dia. <i>d'</i>	Effective ball turns Turns × Circuits	Nut model	Basic load rating (kN)				
						Dynamic <i>C_n</i>	Static <i>C_{0n}</i>	<i>D</i>	<i>A</i>	<i>B</i>
HTF3210-5	10	32	25.6	2.5×2	I	88.7	169	58	92	18
HTF3610-5	10	36	29.6	2.5×2	I	96.1	191	62	96	18
HTF4010-7.5	10	40	33.6	2.5×3	II	149	344	66	100	18
HTF4510-7.5	10	45	38.6	2.5×3	II	158	386	70	104	18
HTF4510-10	10	45	38.6	2.5×4	III	203	514	70	104	18
HTF5010-7.5	10	50	43.6	2.5×3	II	166	435	75	109	18
HTF5010-10	10	50	43.6	2.5×4	III	213	580	75	109	18
HTF5510-7.5	10	55	48.6	2.5×3	II	173	477	80	114	18
HTF5510-10	10	55	48.6	2.5×4	III	222	636	80	114	18
HTF3612-5	12	36	29	2.5×2	I	112	228	66	100	22
HTF4012-7.5	12	40	33	2.5×3	II	184	422	70	104	22
HTF4512-7.5	12	45	38	2.5×3	II	195	473	72	106	22
HTF5012-7.5	12	50	43	2.5×3	II	205	525	77	111	22
HTF5012-10	12	50	43	2.5×4	III	263	700	77	111	22
HTF5512-7.5	12	55	48	2.5×3	II	214	586	82	116	22
HTF5512-10	12	55	48	2.5×4	III	274	781	82	116	22
HTF6312-7.5	12	63	56	2.5×3	II	227	668	92	126	22
HTF6312-10	12	63	56	2.5×4	III	290	891	92	126	22

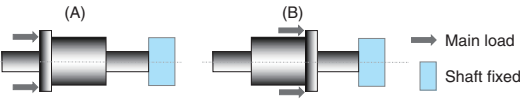
Remarks: 1. The ball nut length with no seals is shorter by M than that of a ball nut with seals.
2. Please consult NSK if load exceeds the allowable axial load (Fa max.).
3. The right hand screw is the standard. For specifications on left hand screws, contact NSK.
4. The allowable axial load is a value in the case of S clearance. If the clearance amount and mounting conditions differ, please note that the allowable axial load is also different.

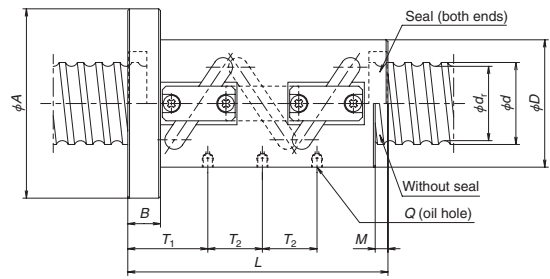
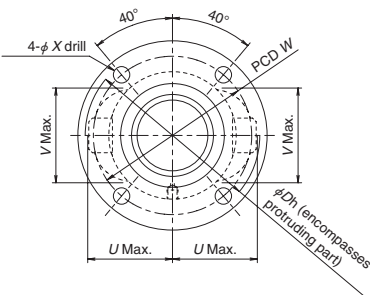


Nut model II

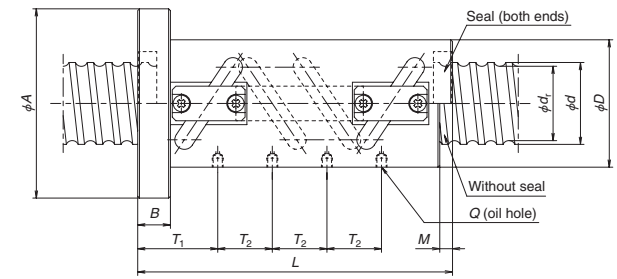
Nut model III

Ball nut dimensions										Allowable axial load (kN)	
										Mounting *See below	
<i>L</i>	<i>M</i>	<i>W</i>	<i>X</i>	<i>U</i>	<i>V</i>	<i>Dh</i>	<i>Q</i>	<i>T₁</i>	<i>T₂</i>	[A] Recommended	[B]
103	7	75	9	40.5	42	82	M6×1	36.5	30	30.9	28.3
103	7	79	9	43	45	87	M6×1	36.5	30	34.9	31.8
143	7	83	9	45	48	91	M6×1	46.5	30	56.2	45.3
143	7	87	9	47	52	95	M6×1	46.5	30	65.7	51.3
173	7	87	9	47	52	95	M6×1	46.5	30	78.2	56.4
143	7	92	9	49	57	99	M6×1	46.5	30	76.2	58.4
173	7	92	9	49	57	99	M6×1	46.5	30	91.9	64.4
143	7	97	9	51.5	62	104	M6×1	46.5	30	85.7	64.7
173	7	97	9	51.5	62	104	M6×1	46.5	30	104.7	71.6
123	8	83	9	46.5	46	94	M6×1	44	36	40.1	36.7
171	8	87	9	47.5	50	96	M6×1	56	36	58.9	49.1
171	8	89	9	49.5	54	100	M6×1	56	36	71.7	55.7
171	8	94	9	52	59	105	M6×1	56	36	82.9	63.2
207	8	94	9	52	59	105	M6×1	56	36	98.3	68.9
171	8	99	9	54.5	63	110	M6×1	56	36	94.4	70.6
207	8	99	9	54.5	63	110	M6×1	56	36	113.3	77.3
171	8	109	9	58.5	70	118	M6×1	56	36	111.5	83.9
207	8	109	9	58.5	70	118	M6×1	56	36	135.8	92.6





Nut model II



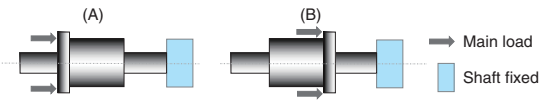
Nut model III

Unit: mm

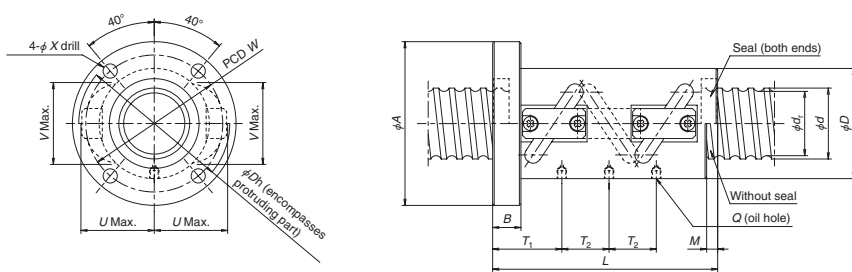
Model No.	Lead	Shaft dia.	Root dia.	Effective ball turns Turns × Circuits	Nut model	Basic load rating (kN)				
						Dynamic	Static			
	<i>l</i>	<i>d</i>	<i>d_r</i>	<i>C_H</i>	<i>C_{0H}</i>	<i>D</i>	<i>A</i>	<i>B</i>		
HTF5014-7.5	14	50	41.7	2.5×3	Ⅱ	264	623	80	114	28
HTF5514-7.5	14	55	46.7	2.5×3	Ⅱ	270	696	85	119	28
HTF6314-7.5	14	63	54.7	2.5×3	Ⅱ	291	800	94	128	28
HTF6314-10	14	63	54.7	2.5×4	Ⅲ	373	1 070	94	128	28
HTF8014-7.5	14	80	71.7	2.5×3	Ⅱ	327	1 020	116	150	28
HTF8014-10	14	80	71.7	2.5×4	Ⅲ	418	1 360	116	150	28
HTF5016-7.5	16	50	39	2.5×3	Ⅱ	383	818	95	129	28
HTF5516-7.5	16	55	44	2.5×3	Ⅱ	399	922	99	133	28
HTF6316-7.5	16	63	52	2.5×3	Ⅱ	429	1 050	105	139	28
HTF6316-10	16	63	52	2.5×4	Ⅲ	549	1 410	105	139	28
HTF6316-10.5	16	63	52	3.5×3	Ⅱ	562	1 450	105	139	28
HTF6316-14	16	63	52	3.5×4	Ⅲ	720	1 930	105	139	28
HTF8016-7.5	16	80	69	2.5×3	Ⅱ	478	1 340	120	154	32
HTF8016-10	16	80	69	2.5×4	Ⅲ	612	1 790	120	154	32
HTF8016-10.5	16	80	69	3.5×3	Ⅱ	627	1 870	120	154	32
HTF8016-14	16	80	69	3.5×4	Ⅲ	802	2 490	120	154	32
HTF10016-7.5	16	100	89	2.5×3	Ⅱ	529	1 710	145	185	32
HTF10016-10	16	100	89	2.5×4	Ⅲ	677	2 280	145	185	32
HTF12016-7.5	16	120	109	2.5×3	Ⅱ	572	2 050	173	213	32
HTF12016-10	16	120	109	2.5×4	Ⅲ	732	2 730	173	213	32

Ball nut dimensions										Allowable axial load (kN)	
										Mounting *See below	
<i>L</i>	<i>M</i>	<i>W</i>	<i>X</i>	<i>U</i>	<i>V</i>	<i>Dh</i>	<i>Q</i>	<i>T₁</i>	<i>T₂</i>	[A] Recommended	[B]
200	10	97	9	55.5	61	112	M6×1	66.5	42	98.6	75.8
200	10	102	9	57.5	65	116	M6×1	66.5	42	112.4	84.7
200	10	111	9	61.5	72	124	M6×1	66.5	42	135.3	100.5
242	10	111	9	61.5	72	124	M6×1	66.5	42	162	109.7
200	10	133	9	72	87	146	M6×1	66.5	42	180	136.2
242	10	133	9	72	87	146	M6×1	66.5	42	220.6	151.1
223	10	112	9	68	66	137	Rc1/8	73	48	124.8	106.2
223	10	116	9	70	70	141	Rc1/8	73	48	143.1	119.2
223	10	122	9	72.5	76	146	Rc1/8	73	48	174.2	139.9
271	10	122	9	72.5	76	146	Rc1/8	73	48	202.3	152.4
271	10	122	9	72.5	76	146	Rc1/8	73	64	210.6	157.9
335	10	122	9	72.5	76	146	Rc1/8	73	64	233.8	165.5
227	10	137	9	80	92	161	Rc1/8	77	48	240.6	182.3
275	10	137	9	80	92	161	Rc1/8	77	48	289.6	200.3
275	10	137	9	80	92	161	Rc1/8	77	64	305.7	209.4
339	10	137	9	80	92	161	Rc1/8	77	64	351.2	220.9
227	10	165	11	91	109	184	Rc1/8	77	48	318.1	242.8
275	10	165	11	91	109	184	Rc1/8	77	48	391.3	270.5
227	10	193	11	104	126	210	Rc1/8	77	48	387.4	305.8
275	10	193	11	104	126	210	Rc1/8	77	48	482.6	346.1

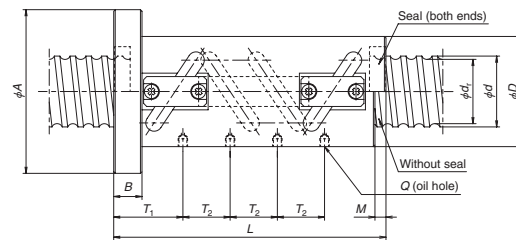
Remarks: 1. The ball nut length with no seals is shorter by M than that of a ball nut with seals.
2. Please consult NSK if load exceeds the allowable axial load (Fa max.).
3. The right hand screw is the standard. For specifications on left hand screws, contact NSK.
4. The allowable axial load is a value in the case of S clearance. If the clearance amount and mounting conditions differ, please note that the allowable axial load is also different.



HTF Type for high-load drives



Nut model II



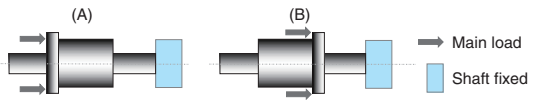
Nut model III

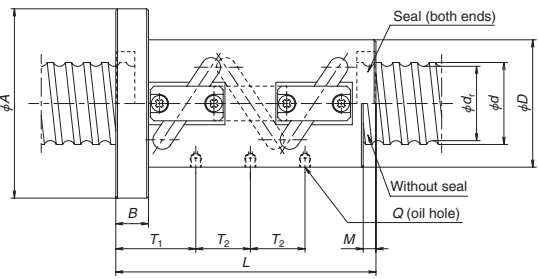
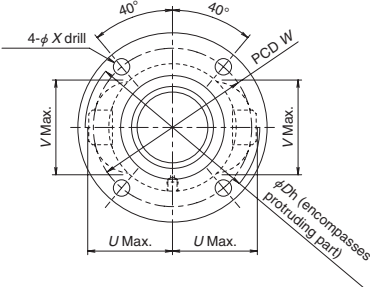
Unit: mm

Model No.	Lead <i>l</i>	Shaft dia. <i>d</i>	Root dia. <i>d'</i>	Effective ball turns Turns × Circuits	Nut model	Basic load rating (kN)				
						Dynamic		Static		
						<i>C_d</i>	<i>C_{0d}</i>	<i>D</i>	<i>A</i>	<i>B</i>
HTF6320-7.5	20	63	49	2.5×3	II	572	1 320	117	157	32
HTF6320-10	20	63	49	2.5×4	III	732	1 760	117	157	32
HTF6320-10.5	20	63	49	3.5×3	II	749	1 810	117	157	32
HTF8020-7.5	20	80	66	2.5×3	II	639	1 690	130	170	32
HTF8020-10	20	80	66	2.5×4	III	818	2 250	130	170	32
HTF8020-10.5	20	80	66	3.5×3	II	838	2 300	130	170	32
HTF10020-7.5	20	100	86	2.5×3	II	713	2 140	145	185	32
HTF10020-10	20	100	86	2.5×4	III	914	2 850	145	185	32
HTF10020-10.5	20	100	86	3.5×3	II	935	2 920	145	185	32
HTF10020-14	20	100	86	3.5×4	III	1 200	3 890	145	185	32
HTF12020-7.5	20	120	106	2.5×3	II	775	2 550	173	213	40
HTF12020-10	20	120	106	2.5×4	III	993	3 400	173	213	40
HTF12020-10.5	20	120	106	3.5×3	II	1 020	3 530	173	213	40
HTF12020-14	20	120	106	3.5×4	III	1 300	4 710	173	213	40
HTF14020-7.5	20	140	126	2.5×3	II	829	3 000	204	250	40
HTF14020-10	20	140	126	2.5×4	III	1 060	4 000	204	250	40
HTF6325-10.5	25	63	49	3.5×3	II	749	1 810	117	157	32
HTF8025-7.5	25	80	64	2.5×3	II	829	2 020	145	185	40
HTF10025-7.5	25	100	84	2.5×3	II	917	2 550	159	199	40
HTF10025-10	25	100	84	2.5×4	III	1 170	3 400	159	199	40
HTF10025-10.5	25	100	84	3.5×3	II	1 200	3 490	159	199	40
HTF10025-14	25	100	84	3.5×4	III	1 540	4 650	159	199	40
HTF12025-7.5	25	120	104	2.5×3	II	990	3 080	173	213	40
HTF12025-10	25	120	104	2.5×4	III	1 270	4 110	173	213	40
HTF12025-10.5	25	120	104	3.5×3	II	1 300	4 200	173	213	40
HTF12025-14	25	120	104	3.5×4	III	1 660	5 600	173	213	40
HTF14025-7.5	25	140	124	2.5×3	II	1 050	3 610	204	250	40
HTF14025-10	25	140	124	2.5×4	III	1 350	4 810	204	250	40
HTF14025-10.5	25	140	124	3.5×3	II	1 380	4 910	204	250	40
HTF14025-14	25	140	124	3.5×4	III	1 770	6 540	204	250	40
HTF16025-7.5	25	160	144	2.5×3	II	1 140	4 140	234	280	40
HTF16025-10	25	160	144	2.5×4	III	1 450	5 520	234	280	40

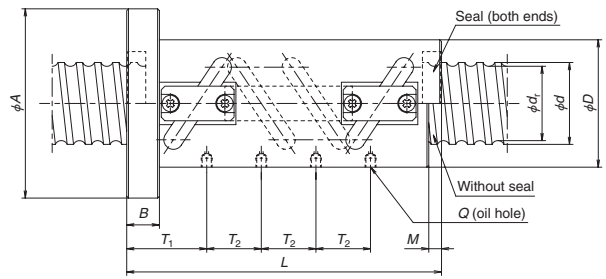
Ball nut dimensions										Allowable axial load (kN)	
										Mounting *See below	
<i>L</i>	<i>M</i>	<i>W</i>	<i>X</i>	<i>U</i>	<i>V</i>	<i>Dh</i>	<i>Q</i>	<i>T₁</i>	<i>T₂</i>	[A] Recommended	[B]
273	12	137	11	83.5	81	168	Rc1/8	88	60	203.6	170.6
333	12	137	11	83.5	81	168	Rc1/8	88	60	229.6	184
333	12	137	11	83.5	81	168	Rc1/8	88	80	239.4	191.1
273	12	150	11	89.5	96	181	Rc1/8	88	60	291.6	228.2
333	12	150	11	89.5	96	181	Rc1/8	88	60	340.2	248.1
333	12	150	11	89.5	96	181	Rc1/8	88	80	352.5	255.9
273	12	165	11	97.5	114	196	Rc1/8	88	60	394.9	289
333	12	165	11	97.5	114	196	Rc1/8	88	60	474.9	315.3
333	12	165	11	97.5	114	196	Rc1/8	90	80	493.5	325.4
413	12	165	11	97.5	114	196	Rc1/8	90	80	566.8	341.6
281	12	193	11	111	130	223	Rc1/8	96	60	479.9	364.9
341	12	193	11	111	130	223	Rc1/8	96	60	586.3	404.7
341	12	193	11	111	131	223	Rc1/8	96	80	618.5	422.6
421	12	193	11	111	131	223	Rc1/8	96	80	722.4	448.8
281	12	226	14	122.5	148	248	Rc1/8	96	60	575	451
341	12	226	14	122.5	148	248	Rc1/8	96	60	712.4	508
398	12	137	11	83.5	83	169	Rc1/8	98.75	100	225.7	177.1
338	17	165	11	102	100	206	Rc1/8	109.25	75	322.7	266.4
338	17	179	11	108.5	118	219	Rc1/8	109.25	75	454.4	347.2
413	17	179	11	108.5	118	219	Rc1/8	109.25	75	532.4	376.6
413	17	179	11	108.5	118	219	Rc1/8	109.25	100	553.2	389.3
513	17	179	11	108.5	118	219	Rc1/8	109.25	100	619.4	406.9
338	17	193	11	116	135	223	Rc1/8	109.25	75	568.3	415.7
413	17	193	11	116	135	223	Rc1/8	109.25	75	678.1	451.5
413	17	193	11	116	134	233	Rc1/8	109.25	100	704.2	465.9
513	17	193	11	116	134	233	Rc1/8	109.25	100	802.1	487.6
338	17	226	14	127.5	153	258	Rc1/8	109.25	75	690.7	516.4
413	17	226	14	127.5	153	258	Rc1/8	109.25	75	842.6	570
413	17	226	14	127.5	153	258	Rc1/8	109.25	100	883.6	592.4
513	17	226	14	127.5	153	258	Rc1/8	109.25	100	1 030.5	627.2
338	17	256	14	138	173	279	Rc1/8	109.25	75	798.7	616.6
413	17	256	14	138	173	279	Rc1/8	109.25	75	984	689.4

Remarks: 1. The ball nut length with no seals is shorter by M than that of a ball nut with seals.
2. Please consult NSK if load exceeds the allowable axial load (Fa max.).
3. The right hand screw is the standard. For specifications on left hand screws, contact NSK.
4. The allowable axial load is a value in the case of S clearance. If the clearance amount and mounting conditions differ, please note that the allowable axial load is also different.





Nut model II



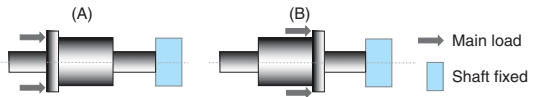
Nut model III

Model No.	Lead	Shaft dia.	Root dia.	Effective ball turns Turns × Circuits	Nut model	Basic load rating (kN)				
						Dynamic	Static			
	<i>l</i>	<i>d</i>	<i>d_r</i>	<i>C_H</i>	<i>C_{0H}</i>	<i>D</i>	<i>A</i>	<i>B</i>		
HTF14030-7.5	30	140	121	2.5×3	Ⅱ	1 310	4 110	222	282	50
HTF14030-10	30	140	121	2.5×4	Ⅲ	1 670	5 490	222	282	50
HTF14030-10.5	30	140	121	3.5×3	Ⅱ	1 710	5 710	222	282	50
HTF16030-7.5	30	160	141	2.5×3	Ⅱ	1 400	4 760	234	294	50
HTF16030-10	30	160	141	2.5×4	Ⅲ	1 790	6 340	234	294	50
HTF16030-10.5	30	160	141	3.5×3	Ⅱ	1 830	6 520	234	294	50
HTF20030-7.5	30	200	181	2.5×3	Ⅱ	1 550	5 960	290	350	50
HTF20030-10	30	200	181	2.5×4	Ⅲ	1 980	7 950	290	350	50
HTF14032-7.5	32	140	118	2.5×3	Ⅱ	1 590	4 740	222	296	70
HTF14032-10	32	140	118	2.5×4	Ⅲ	2 040	6 320	222	296	70
HTF14032-10.5	32	140	118	3.5×3	Ⅱ	2 080	6 420	222	296	70
HTF16032-7.5	32	160	138	2.5×3	Ⅱ	1 660	5 370	234	308	70
HTF16032-10	32	160	138	2.5×4	Ⅲ	2 130	7 160	234	308	70
HTF16032-10.5	32	160	138	3.5×3	Ⅱ	2 180	7 460	234	308	70
HTF20032-7.5	32	200	178	2.5×3	Ⅱ	1 840	6 840	290	364	70
HTF20032-10	32	200	178	2.5×4	Ⅲ	2 360	9 120	290	364	70

Remarks: 1. The ball nut length with no seals is shorter by M than that of a ball nut with seals.
2. Please consult NSK if load exceeds the allowable axial load (Fa max.).
3. The right hand screw is the standard. For specifications on left hand screws, contact NSK.
4. The allowable axial load is a value in the case of S clearance. If the clearance amount and mounting conditions differ, please note that the allowable axial load is also different.

Unit: mm

Ball nut dimensions										Allowable axial load (kN)	
										Mounting *See below	
<i>L</i>	<i>M</i>	<i>W</i>	<i>X</i>	<i>U</i>	<i>V</i>	<i>Dh</i>	<i>Q</i>	<i>T</i> ₁	<i>T</i> ₂	[A] Recommended	[B]
411	22	252	18	139	160	281	Rc1/8	134.5	90	753.5	596.1
501	22	252	18	139	160	281	Rc1/8	134.5	90	894.7	656.4
501	22	252	18	139	160	281	Rc1/8	134.5	120	942.8	686.3
411	22	264	18	148	177	299	Rc1/8	134.5	90	928.4	689.5
501	22	264	18	148	177	299	Rc1/8	134.5	90	1 128.2	758.4
501	22	264	18	148	177	299	Rc1/8	134.5	120	1 175.8	784.5
411	22	320	18	178	212	359	Rc1/8	134.5	90	1 190.1	920.7
501	22	320	18	178	212	359	Rc1/8	134.5	90	1 470.4	1 031.7
465	22	259	22	148	163	299	Rc1/8	166.5	96	856.9	669.1
561	22	259	22	148	163	299	Rc1/8	166.5	96	1 009.6	731.3
561	22	259	22	148	163	299	Rc1/8	166.5	128	1 057.3	760.7
465	22	271	22	152	181	307	Rc1/8	166.5	96	1 043.7	762.9
561	22	271	22	152	181	307	Rc1/8	166.5	96	1 261.7	834.1
561	22	271	22	152	181	307	Rc1/8	166.5	128	1 332.3	871.7
465	22	327	22	182	215	367	Rc1/8	166.5	96	1 359.2	1 034.9
561	22	327	22	182	215	367	Rc1/8	166.5	96	1 670.5	1 151.7



NSK Technical Data Sheet for NSK High-Load Drive Ball Screws

Custom-made ball screw

Company name:	Date:	NSK sales office
Section:	Person in charge:	
Address:		

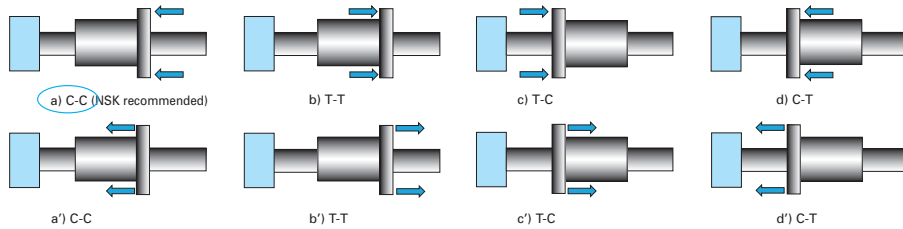
Name of machine*1: Electric injection molding machine; 200-ton capacity Application*2: Injection axisDrawing/rough sketch attached?: ☒ Yes ☐ No

*1 Please specify capacity of the machine in case of injection molding machine or press.

*2 If the application is injection molding machine, please indicate the axis. (Examples: injection axis and clamping axis)

1. Use conditions

Operating conditions	☒ Shaft rotation — Moving nut ☐ Shaft rotation — Moving shaft ☐ Nut rotation — Moving nut ☐ Nut rotation — Moving shaft	☒ Normal operation ☐ Back drive operation ☐ Oscillation	Degree of vibration/impact ☐ Smooth operation without impact ☒ Normal operation ☐ Operation associated with impact or vibration
Direction of load*3	☒ C-C ☐ T-T ☐ T-C ☐ C-T ☐ Other (Refer to figures below.) See attachment	Mounting orientation ☒ Horizontal ☐ Vertical (Indicate the direction of gravity.)	
Lubricant	☒ Grease (Brand name: <u>High-load grease with an extreme pressure additive</u>) ☐ Oil (Maker: _____)	How to replenish lubricant ☐ Grease gun ☒ Automatic (_____ cm ³ /_____ cycles)	
Request for oil hole	☒ NSK recommended ☐ Your request		
Necessity of seals	☒ Yes ☐ No	NSK S1 necessary? ☒ NSK recommended ☐ Not necessary	
Environment	Temperature (<u>40</u> deg)	Particles / ☐ Yes (Size of particle : a) -0.1, b) over 0.1-0.3, c) over 0.3- , d) Ingredient: _____) ☒ No particle.	
Surface treatment	☒ Not required ☐ Low-temperature chrome plating ☐ Fluoride low-temperature chrome plating ☐ Other		
Quantity in mass-production	/Month _____ /Year _____ /Lot _____	Quantity used per machine _____	<u>1</u> pcs./machine

*3 Please specify loading direction code on the figures below. (Shaft fixed: , Main load: )

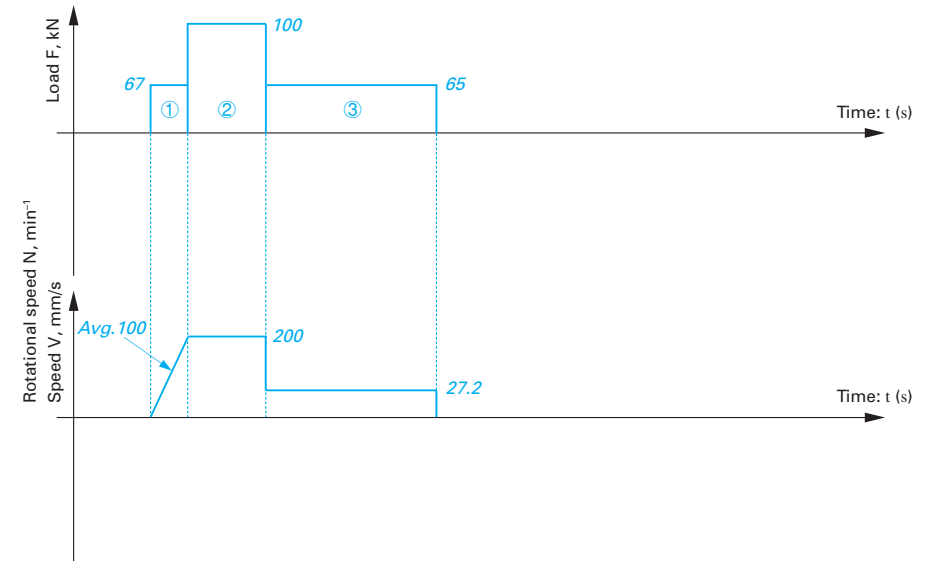
2. Specifications

Shaft diameter	ϕ <u>63</u> mm	Lead	<u>16</u> mm	Accuracy grade	<u>C17</u>	Axial play	<u>0.050 or less</u> mm max.
Nut model No.	<u>HTF-SRC 6316-7.5-S1</u>	Effective turns of balls	<u>2.5 x 3</u>	Direction of turn	<u>right</u>	Thread length/Overall shaft length	<u>800 / 1200</u>

Special note / Requests

NSK Technical Data Sheet for NSK High-Load Drive Ball Screws

3. Load chart (If using multiple ball screws in an axis, fill out the axial load per ball screw.)



	Axial load* F (kN)	Rotational speed or Average speed N (min ⁻¹)	V (mm/s)	Time t (s)	Stroke St (mm)	Remarks
①	<u>67</u>		<u>100</u>	<u>0.1</u>	<u>10</u>	
②	<u>100</u>		<u>200</u>	<u>0.5</u>	<u>100</u>	
③	<u>65</u>		<u>27.2</u>	<u>7</u>	<u>190</u>	
④	<u>0</u>		<u>0</u>	<u>10.4</u>	<u>0</u>	
⑤				<u>Total: 18</u>	<u>Total: 300</u>	
⑥						
⑦						
⑧						
⑨						
⑩						

Dynamic axial load (Max.)*: 100 (kN) Static axial load (Max.)*(at 0 mm/s): _____ (kN)
Stroke in normal use: 300 (mm) Maximum stroke: 500 (mm)
Cycle time: 18 (s) Required life: 40000 (☒ h or ☐ cycles)

*If using multiple ball screws in an axis, fill out the axial load per ball screw.

4. Plan to conduct the endurance test of the ball screw?

Actual data on the machine ☐ Yes
☒ N/A ☐ Planning to check endurance (Date: From the middle of March 20XX)
☐ No (Reason: _____)

Endurance of the ball screw

- (1) Mounting accuracy, load conditions, and lubricating conditions are the main factors affecting the ball screw fatigue life. Therefore, we recommend evaluating the influence of those factors on actual use of your machines.
- (2) A temperature rise caused by operational and environmental conditions may reduce the effectiveness of lubricant.

NSK Technical Data Sheet for NSK High-Load Drive Ball Screws

Custom-made ball screw

Company name:	Date:	NSK sales office
Section:	Person in charge:	
Address:		

Name of machine*1 : _____ Application*2 : _____

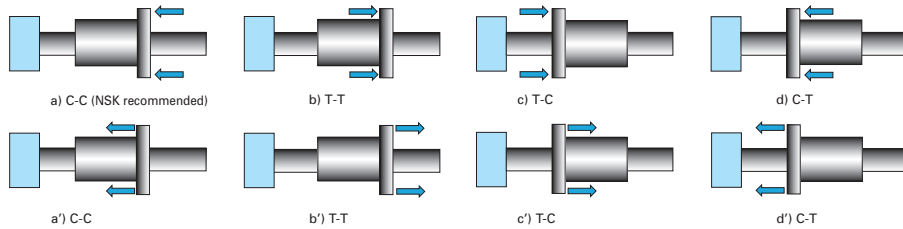
Drawing/rough sketch attached?: ☐ Yes ☐ No

*1 Please specify capacity of the machine in case of injection molding machine or press.

*2 If the application is injection molding machine, please indicate the axis. (Examples: injection axis and clamping axis)

1. Use conditions

Operating conditions	☐ Shaft rotation — Moving nut ☐ Shaft rotation — Moving shaft ☐ Nut rotation — Moving nut ☐ Nut rotation — Moving shaft	☐ Normal operation ☐ Back drive operation ☐ Oscillation	Degree of vibration/impact	☐ Smooth operation without impact ☐ Normal operation ☐ Operation associated with impact or vibration
	Direction of load*3 ☐ C-C ☐ T-T ☐ T-C ☐ C-T ☐ Other (Refer to figures below.)		Mounting orientation	☐ Horizontal ☐ Vertical (Indicate the direction of gravity.)
Lubricant	☐ Grease ☐ Oil (Brand name: _____ Maker: _____)		How to replenish lubricant	☐ Grease gun ☐ Automatic (_____ cm ³ /_____ cycles)
Request for oil hole	☐ NSK recommended ☐ Your request			
Necessity of seals	☐ Yes ☐ No		NSK S1 necessary?	☐ NSK recommended ☐ Not necessary
Environment	Temperature (_____ deg)	Particles / ☐ Yes (Size of particle : a) -0.1, b) over 0.1-0.3, c) over 0.3- , d) Ingredient: _____) ☐ No particle.		
Surface treatment	☐ Not required ☐ Low-temperature chrome plating ☐ Fluoride low-temperature chrome plating ☐ Other			
Quantity in mass-production	/Month	/Year	/Lot	Quantity used per machine _____ pcs./machine

*3 Please specify loading direction code on the figures below. (Shaft fixed: , Main load: )

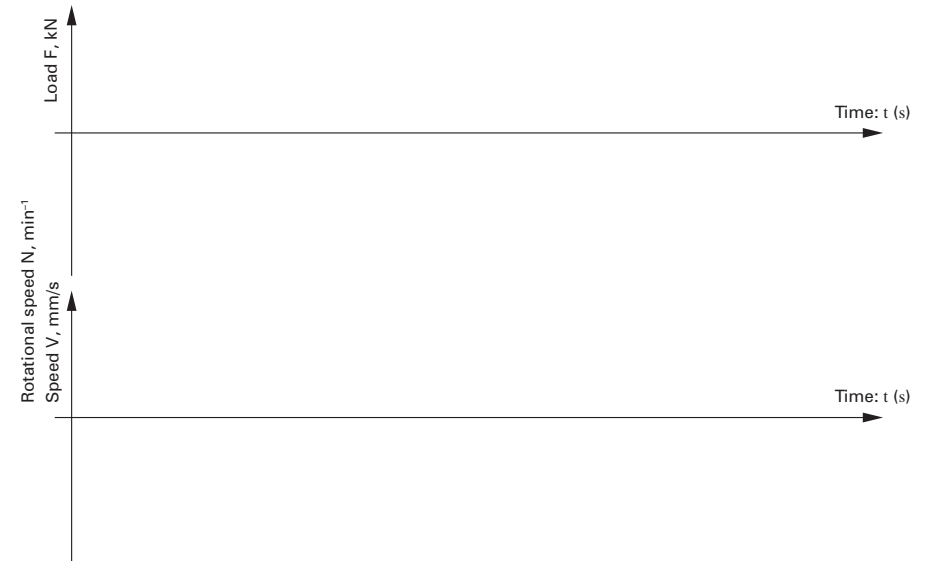
2. Specifications

Shaft diameter	φ	mm	Lead	mm	Accuracy grade		Axial play	mm max.
Nut model No.			Effective turns of balls		Direction of turn		Thread length/Overall shaft length	/

Special note / Requests

NSK Technical Data Sheet for NSK High-Load Drive Ball Screws

3. Load chart (If using multiple ball screws in an axis, fill out the axial load per ball screw.)



	Axial load* F (kN)	Rotational speed or Average speed N (min ⁻¹)	V (mm/s)	Time t (s)	Stroke St (mm)	Remarks
①						
②						
③						
④						
⑤						
⑥						
⑦						
⑧						
⑨						
⑩						

Dynamic axial load (Max.)*: _____ (kN) Static axial load (Max.)* (at 0 mm/s): _____ (kN)
Stroke in normal use: _____ (mm) Maximum stroke: _____ (mm)
Cycle time: _____ (s) Required life: _____ (□ h or □ cycles)

*If using multiple ball screws in an axis, fill out the axial load per ball screw.

4. Plan to conduct the endurance test of the ball screw?

Actual data on the machine ☐ Yes
☐ N/A ☐ Planning to check endurance (Date: _____)
☐ No (Reason: _____)

Endurance of the ball screw

- (1) Mounting accuracy, load conditions, and lubricating conditions are the main factors affecting the ball screw fatigue life. Therefore, we recommend evaluating the influence of those factors on actual use of your machines.
(2) A temperature rise caused by operational and environmental conditions may reduce the effectiveness of lubricant.

B-3-3.6.1 VSS Type for Contaminated Environments

1. Features

● High dust-resistance

Specially profiled screw shaft grooves and high performance seals prevent the entry of fine contaminants. Reduces particle penetration rate to less than 1/15 of existing standard products.

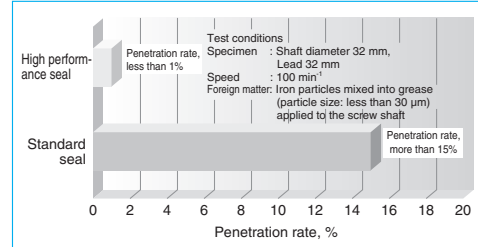


Fig. 1 Particle penetration rate

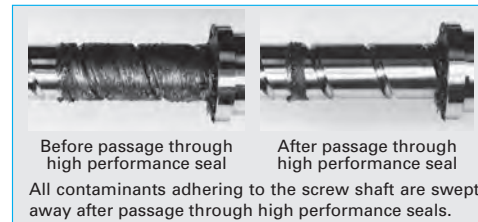


Fig. 2 Contamination before and after particle penetration test

● Long life

High performance seals extend ball screw durability under severely contaminated environments with iron powder.

Extreme durability tests under contaminated environments show the durability of the VSS type extends more than four times longer than our existing type with a standard seal.

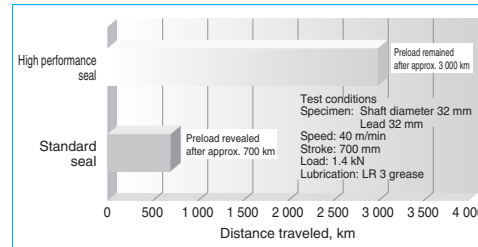


Fig. 3 Extreme durability test results using iron particles

● High speed

For ultimate smoothness of ball recirculation, the internal ball recirculation system enables high-speed operation at a maximum of d-n

150 000. Large lead specifications allow high-speeds of 150 m/min.

● Low-noise

Reduces noise level by more than 6 dB(A) compared with our conventional tube-type ball screws, thereby providing low-noise and good noise tone features.

● Compact size

Ball nut external diameter is up to 25% smaller than our conventional models.

2. Specifications

(1) Ball recirculation system

End-deflector recirculation system has features of high-speed operation with low-noise, and compact ball nut. The structure of recirculation system is shown in Fig. 4.

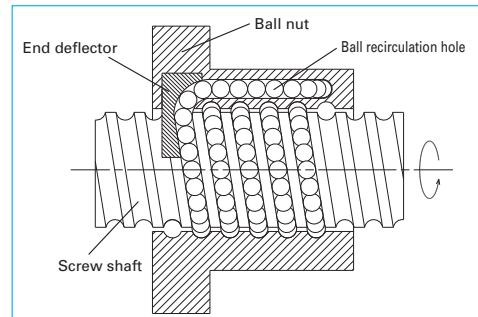


Fig. 4 Structure of end deflector recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

Accuracy grade	C5
Axial play	Z, 0 mm (preloaded) T, 0.005 mm or less; S, 0.020 mm or less

(3) Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Allowable d·n value: 150 000 or less

Criterion of maximum rotational speed: 3 000 min⁻¹

Note: Please also review critical speed. See

"Technical Description: Permissible Rotational Speed" (page B47) for details.

(4) High performance seal

High performance seal (Japanese patents: 3646452, 3692203) with special lip that contacts screw shaft cross-section and prevents entry of fine contaminants.

(5) Lubrication unit

Incorporates NSK K1 lubrication unit to sufficiently lubricate the high performance seal lip, reduce friction, and improve durability.

(6) optional

Non-contact metal protector that traces the ball screw grooves and safeguards the seal against high-temperature foreign matter.

the screw must meet either one of the following conditions. If not, we cannot install the ball nut on the screw shaft.

- Cut the ball groove through to the shaft end.
- The diameters of bearing journals and the gear or pulley seat must be less than the root diameter of ball groove "dr" specified on the dimension table.

High performance seals may increase torque, which may in turn increase temperature. Please inform NSK about your service conditions using the technical data sheet on page B544.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

3. Design precaution

When designing the screw shaft end, one end of

4. Structure of model number and reference number

The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number

VSS 32 10 - 6E	
Nut model: VSS	Effective turns of balls
Screw shaft diameter (mm)	Lead (mm)

◇Reference number for ball screw

W 36 12 - ** P SS V1 - C5 Z 10	
Product code	Lead (mm)
Screw shaft diameter (mm)	Axial play: Z, T, S (page B20)
Effective threaded length (in the unit of 100 mm)	Accuracy grade: C5 (page B37 to B42)
Design serial number	High performance seal V1
Preload code: P; P-Preload (page B5)	End-deflector recirculation system

5. Handling Precautions

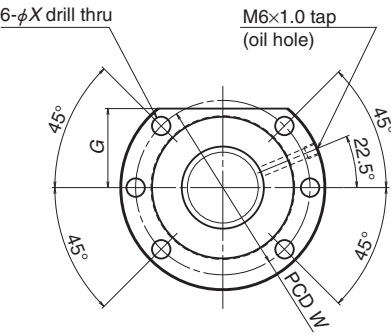
Maximum operating temperature: 50°C

Maximum momentary operating temperature: 80°C

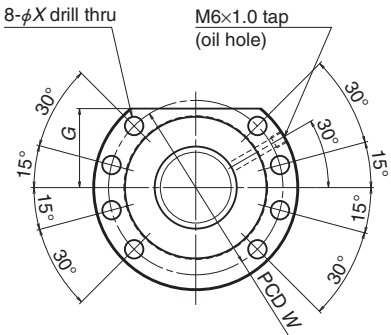
Chemical precautions: Never expose the ball screw to grease-removing organic solvents such as hexane or thinner. Never immerse the ball screw in kerosene or rust preventive oils which contain kerosene.

The data shown in the catalog are the results of our tests, and no warranty is given to sealing performance on actual usage on machinery. Sealing performance is affected by usage environment and lubrication conditions. Dust covers and other measures to keep machinery free of dust are recommended.

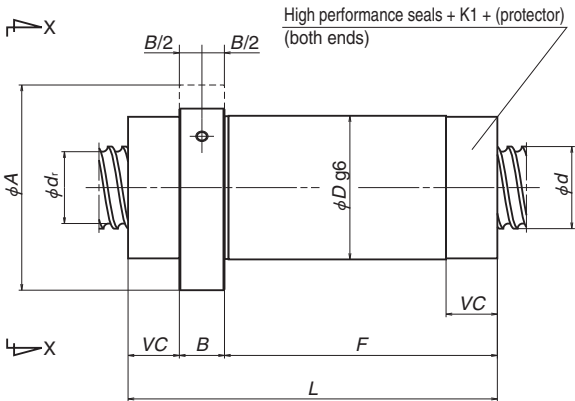
View X-X



Screw shaft diameter $d = 32$ mm



Screw shaft diameter $d \geq 40$ mm



Model No.	Shaft dia. d	Lead l	Root dia. d_r	Effective turns of balls	Basic load rating (N)		Axial rigidity K (N/ μ m)
					Dynamic C_a	Static C_{0a}	
VSS3210-6E	32	10	27.2	6	50 900	110 000	720
VSS3216-5E		16		5	44 300	90 800	600
VSS3220-5E		20		5	43 900	91 200	596
VSS3232-4E		32		4	32 100	65 800	421
VSS4040-4E	40	40	34.4	4	42 900	94 300	513
VSS5050-4E	50	50	44.4	4	47 400	117 000	606

- Notes: 1. The right hand screw is the standard. For specifications on left hand screws, contact NSK.
2. Rigidity in the table is theoretical value obtained from the elastic deformation between screw groove and ball when the preload is 1.5% of the basic dynamic load rating, and axial load is applied to it. Refer to "Technical Description" (page B37) if axial load and preload differs from the conditions above, or when considering change in the deformation of the ball nut itself.
3. Products with axial play may have a partially negative play (preloaded condition) depending on screw length. Refer to "Manufacturing range of effective screw length in combination of accuracy grade and axial play" (page B20).

Ball nut dimensions									Maximum shaft length
Nut entire length L	Nut outside diameter D	Flange outside diameter A	Flange width B	Nut length F	Notch size G	Seal installation dimensions VC	Bolt hole PCD W	Bolt hole dimensions X	
132	56	86	18	89.5	34	24.5	71	9	2 800
150				107.5					
169				126.5					
122				79.5					
144	70	100	22	94	38.5	27.5	85	9	3 800
164	82	118	22	114.5	46	27.5	100	11	5 000

B-3-3.6.2 Ball Screw with X1 Seals for Contaminated Environments and Grease Retention

1. Features

● Highly dustproof

Particle penetration ratio reduced to less than 1/30 of existing standard seals, thus contributing to longer service life for machine tools.

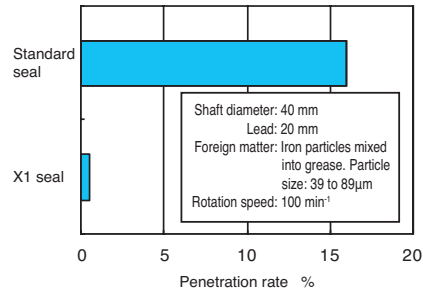


Fig. 1 Results of particle penetration rate test

● Superior grease retention

Automatically adding grease makes it possible to reduce the amount used and keep it from spattering.

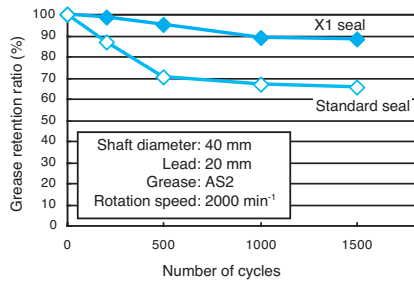


Fig. 2 Results of grease leakage test

● Contact seal with low torque

Optimizing the seal shape reduces torque and enhances seal performance.

2. Specifications

(1) Structure

The ball screw with X1 seals has a double seal structure combining a dustproof seal and a grease-retaining seal.

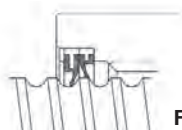


Fig. 3 Seal structure

(2) Scope of application in NSK Ball Screw series

This series is standard for the following four types.

Ball screws for high-speed machine tools	HMS type	Nut model: ZCRC
	HMD type	Nut model: EM
	BSS type	Nut model: BSS
	Deflector (bridge) type	Nut model: ZFD

For specifications other than the above, please consult NSK. Table 1 shows the minimum nut outer diameter on which X1 seals can be mounted.

Table 1 The minimum nut outer diameter on which X1 seals can be mounted

Shaft diameter: 32 mm	56 mm
Shaft diameter: 40 mm	70 mm (68 mm)
Shaft diameter: 45 mm	75 mm (73 mm)
Shaft diameter: 50 mm	82 mm (78 mm)

Values in parentheses are applicable to the deflector (bridge) type

(3) Accuracy grade / axial play

Table 2 shows standard tolerance classes and axial clearances. Please consult NSK for tolerance classes other than those in the table.

Table 2 Accuracy grade and axial play

Accuracy grade	C3, C5
Axial play	0 mm (preloaded)

(4) Design-related precautions

When designing the screw shaft end, assume that the end of the screw shaft is cut.

The temperature will increase somewhat when torque is applied if an X1 seal is attached. Please inform NSK about your service conditions using the technical data sheet on page B544.

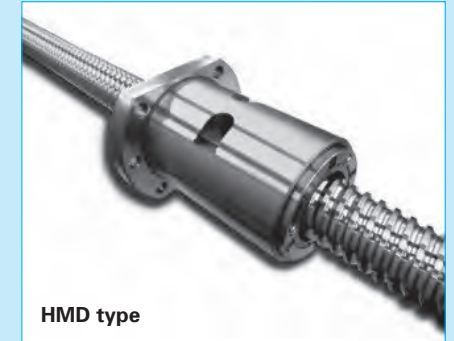
Maximum overall shaft length is 2900 mm.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

The right hand screw is the standard. For specifications on left hand screws, contact NSK.



HMS type



HMD type



BSS type



Deflector (bridge) type

Fig. 4 External appearance

3. Example of reference number

A structure of "Reference number for ball screw" is as follows.

Note: "X1" is added at the end of "nut model code" and "Specifications number".

◇Reference number for ball screw

W4010--ZMX1-C5Z16**

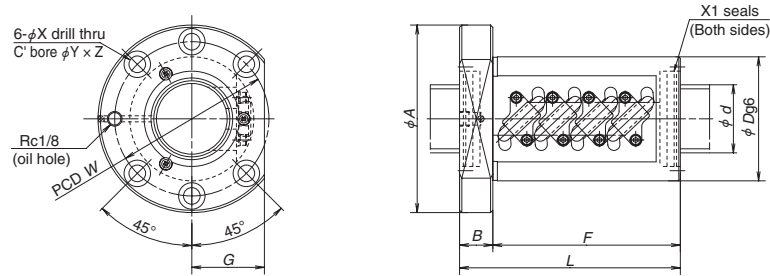
X1 seal equipped type ball screw code

4. Precautions for use

Temperature range for use: Maximum temperature: 60°C (at outside diameter of ball nut)

Chemicals that should not come to contact: Do not leave ball screw in organic solvent, white kerosene such as hexane, thinner which removes oil, and rust preventive oil which contains white kerosene.

The data shown in the catalog are the results of our tests, and no warranty is given to sealing performance on actual usage on machinery. Sealing performance is affected by usage environment and lubrication conditions. Dust covers and other measures to keep machinery free of dust are recommended.

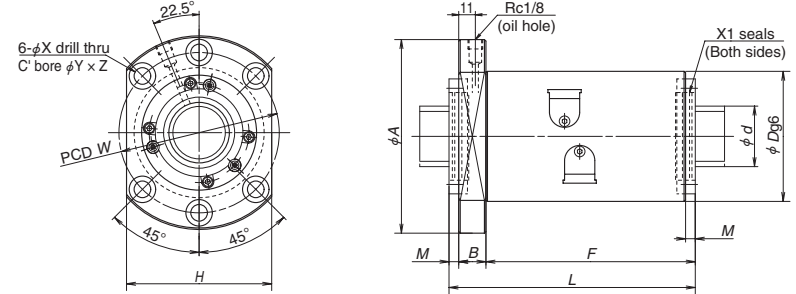


HMS type (Nut model : ZFRC)

Applicable dimensions for HMS type

Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Basic load rating (N)		Nut dimensions								Bolt holes			
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	<i>L</i>	<i>F</i>	<i>B</i>	<i>D</i>	<i>A</i>	<i>G</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>		
ZFRC3205-10	32	5	21 800	56 000	107	87	20	58	85	32	6.6	11	6.5	71		
ZFRC4010-10	40	10	61 200	137 000	173	151	22	82	124	47	11	17.5	11	102		
ZFRC4012-10		12	71 700	154 000	197	175		86	128	48						
ZFRC4508-10	45	8	44 000	118 000	146	124	22	82	124	47	11	17.5	11	102		
ZFRC5010-10	50	10	68 100	174 000	174	151	23	93	135	51	11	17.5	11	113		
ZFRC5012-10		12	91 500	218 000	200	177		100	146	55						

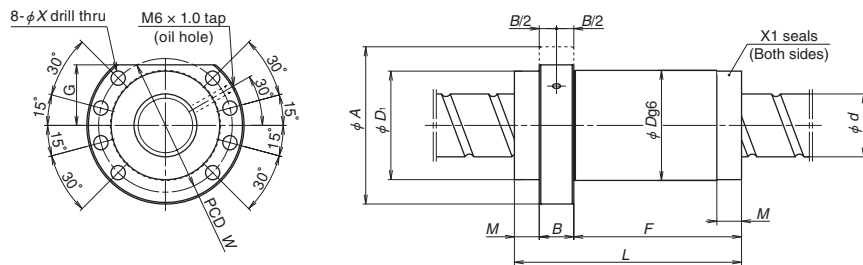


HMD type (Nut model: EM)

Applicable dimensions for HMD type

Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Basic load rating (N)		Nut dimensions										
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	<i>L</i>	<i>F</i>	<i>M</i>	<i>B</i>	<i>D</i>	<i>A</i>	<i>H</i>	Bolt holes			
					<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>							
EM4016-4E	40	16	66 900	131 000	172	148	6	18	86	128	96	11	17.5	11	106
EM4020-6E		20	77 900	166 000	164	139	7								
EM4516-4E	45	16	69 900	146 000	173	148.5	6.5	18	92	134	102	11	17.5	11	112
EM4520-6E		20	83 200	187 000	164	139	7								
EM5016-4E	50	16	72 700	161 000	173	148.5	6.5	18	98	140	107	11	17.5	11	118
EM5020-6E		20	85 700	205 000	164	139	7								
EM5030-6E		30	102 000	235 000	227	202	7								

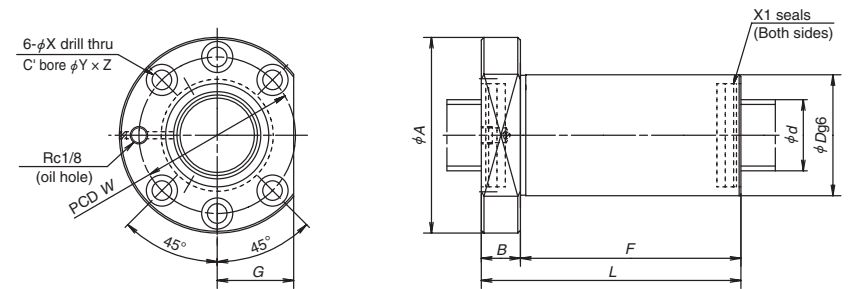


End deflector type (Nut model : BSS)

Applicable dimensions for End deflector type

Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Basic load rating (N)		Nut dimensions								Bolt holes			
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	<i>L</i>	<i>F</i>	<i>M</i>	<i>B</i>	<i>D</i>	<i>D₁</i>	<i>A</i>	<i>G</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>
BSS3205-4E	32	5	16 800	41 700	77	46	19	12	56	55	86	34	9	71		
BSS3210-6E		10	50 900	110 000	114	80.5	15.5	18								
BSS4010-5E	40	10	58 100	130 000	112	73	17	22	70	69	100	38.5	9	85		
BSS4020-5E		20	57 400	130 000	159	120	17									
BSS5010-4E	50	10	52 600	129 000	159	120	17	22	82	81	118	46	11	100		



Deflector (bridge) type (Nut model: ZFD)

Applicable dimensions for Deflector (bridge) type

Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Basic load rating (N)		Nut dimensions								Bolt holes			
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	<i>L</i>	<i>F</i>	<i>B</i>	<i>D</i>	<i>A</i>	<i>G</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>		
ZFD4005-12	40	5	26 500	78 300	119	97	22	68	102	40	9	14	8.5	84		
ZFD4006-12		6	35 600	95 200	135	113										
ZFD4008-8		8	32 000	75 000	131	109										
ZFD4010-8		10	45 200	93 100	153	131										
ZFD5010-8	50	10	51 500	122 000	154	131	23	78	120	47	11	17.5	11	98		
ZFD5020-6		20	52 400	109 000	199	176										

NSK Data Sheet for Ball Screws in Contaminated Environments

[Example]

(Please copy) 1/1

Model: Washing machine Location: Workpiece transfer axis

1. Operating Conditions

Operating Conditions	a) Shaft rotation – nut moving b) Shaft rotation – shaft moving c) Nut rotation – nut moving d) Nut rotation – shaft moving	Stroke in Normal Use	400 [mm] (Please indicate operating pattern)
		Mounting Orientation	a) Vertical b) Horizontal
Lubricant	a) Grease (Brand: AS2) b) Oil (Brand:)	Lubricating Method	a) Automatic b) Grease gun (cm ³ / min)
Operating Duration	years 6 months	Axial play: 0.1 mm	Seal: standard /

2. Ball Screw Environment (Accessories & Contamination)

Contaminant	Iron particles and washing solution	Contaminant Size	Particle size 30 μm max. -
Cause of Contamination	Does not fall directly on it, but there is a possibility that it could happen. (Please reference with photographs)		
Countermeasures (For already assembled parts, complete after inspection)	a) Telescopic cover b) Bellow c) Dust collector d) Dust-resistant lubricant e) Other () (Please supply drawings to demonstrate dust countermeasures)		

3. Ball Screw Dimensions

Screw Shaft Diameter	Φ 32	Lead	5 mm	Accuracy Grade	C5	Axial Play	Z
Nut Model	ZFRC	Effective Turns of Balls	2.5×2	Direction of Turn	Right	Screw/Overall Length	510 / 750

Remarks

Request X1 seal

4. Durability Test

Durability test → Scheduled Scheduled to perform functional evaluation for about 2 months.
→ Not scheduled (Reason:)

Ball Screw Use in Contaminated Environments

※Please read the below and tick the relevant boxes

- ☐ An evaluation test result of the special dust-resistant seal which NSK carried out is one case by a particular examination condition (alien substance environment and operating conditions). I accept that the special dust-resistant seal is unable to completely prevent contamination in such an environment and that life may be affected.
- ☐ In order to improve wear life in contaminated environments, NSK require **dust-proof accessories (covers, lubricating oil, dust collectors, etc)** in addition to the recommended seal exchange.
- ☐ Ball screw wear life is greatly impacted by contamination entering the nut, offset load from misalignment, as well as lubricating condition. **The final durability comes to need the evaluation confirmation with the actual machine.**

Company Name: _____ Date: _____
Department: _____ Name: _____
Address: _____ Tel: _____ Fax: _____

NSK Ltd.
Sales Representative

Sign

NSK Ltd.
Sales Manager

Sign

NSK Ltd.

NSK Data Sheet for Ball Screws in Contaminated Environments

(Please copy) 1/1

Model: _____ Location: _____

1. Operating Conditions

Operating Conditions	a) Shaft rotation – nut moving b) Shaft rotation – shaft moving c) Nut rotation – nut moving d) Nut rotation – shaft moving	Stroke in Normal Use	[mm] (Please indicate operating pattern)
		Mounting Orientation	a) Vertical b) Horizontal
Lubricant	a) Grease (Brand:) b) Oil (Brand:)	Lubricating Method	a) Automatic b) Grease gun (cm ³ / min)
Operating Duration	years months	Axial play: mm	Seal: standard /

2. Ball Screw Environment (Accessories & Contamination)

Contaminant		Contaminant Size	Particle size -
Cause of Contamination	(Please reference with photographs)		
Countermeasures (For already assembled parts, complete after inspection)	a) Telescopic cover b) Bellow c) Dust collector d) Dust-resistant lubricant e) Other () (Please supply drawings to demonstrate dust countermeasures)		

3. Ball Screw Dimensions

Screw Shaft Diameter	φ	Lead	mm	Accuracy Grade		Axial Play	
Nut Model		Effective Turns of Balls		Direction of Turn		Screw/Overall Length	/

Remarks

4. Durability Test

Durability test → Scheduled
→ Not scheduled (Reason:)

Ball Screw Use in Contaminated Environments

※Please read the below and tick the relevant boxes

- ☐ An evaluation test result of the special dust-resistant seal which NSK carried out is one case by a particular examination condition (alien substance environment and operating conditions). I accept that the special dust-resistant seal is unable to completely prevent contamination in such an environment and that life may be affected.
- ☐ In order to improve wear life in contaminated environments, NSK require **dust-proof accessories (covers, lubricating oil, dust collectors, etc)** in addition to the recommended seal exchange.
- ☐ Ball screw wear life is greatly impacted by contamination entering the nut, offset load from misalignment, as well as lubricating condition. **The final durability comes to need the evaluation confirmation with the actual machine.**

Company Name: _____ Date: _____
Department: _____ Name: _____
Address: _____ Tel: _____ Fax: _____

NSK Ltd.
Sales Representative

Sign

NSK Ltd.
Sales Manager

Sign

NSK Ltd.

B-3-3.7 TW Series for Twin-Drive Systems

(1) Features

Variations in the lead accuracy and preload torque between two ball screws, which consist of a unit of TW Series, are controlled, resulting improved travel accuracy and ball screw operating lifetime.

Fig. 1 shows measured variation in lead accuracy while **Fig. 2** displays an example of variation in thermal expansion between the two ball screws.

Fig. 3 is a schematic diagram comparing the travel accuracy between the TW Series and conventional model.

● High rigidity and long lifetime

Twin-drive systems are superior to single-drive systems in system rigidity, supporting the design of long-life feeding mechanism even if they make the shaft diameter one size smaller.

● High responsiveness to positioning commands
Twin-drive systems permit the use of screw shaft diameters that are one size smaller, thereby reducing screw shaft inertia by up to 50%, offering high responsiveness to positioning commands.

● Improved high-speed capability and noise level
Twin-drive systems allow the use of smaller screw diameters, resulting in no increase in the level of noise. The end-deflector recirculation system significantly improves high-speed capability and noise level compared with the existing return tube recirculation system, offering high-speed feeding of up to 1 200 mm/min (shaft dia. 40 mm, lead 30 mm, rotational speed 4 000 min⁻¹).

(2) Specifications

Table 1 Specifications of twin-drive systems

Recirculation systems	End-deflector recirculation system, Return tube system, Deflector(bridge type) system
Shaft dia.	32 – 63 mm
Lead	10 – 30 mm
Accuracy grade	C5
Screw shaft length	3 m or less

(3) Optional specifications

- Hollow shaft ball screw and nut cooling ball screw
- Provides high accuracy through the use of forced cooling. Please refer to ball screws for high precision machine tools (page B546 to B554) for more details.

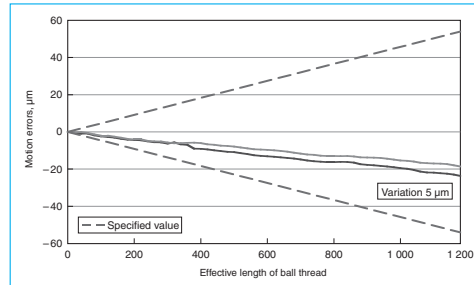


Fig. 1 Example of measured variation in lead accuracy

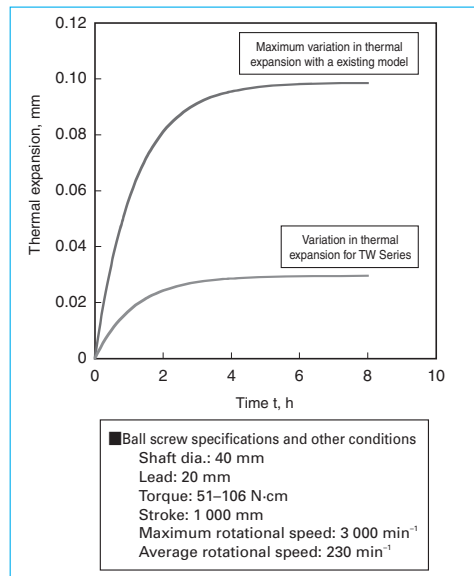


Fig. 2 Calculation example of the variation of thermal expansion

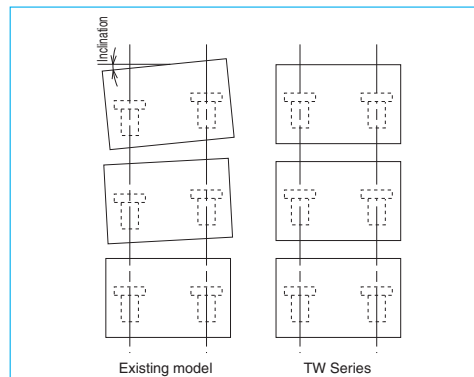


Fig. 3 Schematic diagram of travel accuracy

B-3-3.8.1 Hollow Shaft Ball Screw for High Precision Machine Tools

The increase in speed of the feeding mechanism for highly accurate positioning may require some measures against thermal expansion of the ball screw (forced cooling using hollow ball screw). NSK standardized hollowed screw shafts and shaft ends configuration (sealing section and support bearing seat). NSK recommends this as the most effective measure against thermal expansion.

1. Features

● Stable positioning accuracy

Suppresses expansion of the ball screw shaft by rising temperature, and provides stable, precise positioning.

● Prevents displacement of various sections

Minimizes deformation of the ball screw support bearings as well as of the machine base which is caused by thermal expansion of ball screw. Forced cooling keeps the heat from spreading to other sections, and prevents the processing table from deforming due to heat.

● Reduces warm-up time

Temperature does not rise high, therefore cuts machine warm-up period.

● Maintains lubricant's effect

Removes heat from the ball screw, deterring lubricant deterioration.

● Easy designing for installation

Use support bearing unit exclusive for NSK ball screws (high speed and high load capacity for machine tools, see page B405) and seal unit (page B549) to standardized shaft end. This makes designing of mounting ball screw easy. NSK also provides nut cooling ball screws. The level of temperature rise for nut cooling ball

screw is equal to the hollow shaft ball screw thanks to the optimized nut internal design for cooling. Please refer to nut cooling ball screws (page B551) for more details.

2. Design precautions

Refer to HMC type, end-deflector recirculation system, return tube recirculation system, and deflector(bridge type) recirculation system for ball screw specifications. If the overall ball screw length exceeds 3 000 mm, contact NSK. For general precautions regarding ball screw, refer to "Design Precautions" (page B83) and "Handling precautions" (page B103).

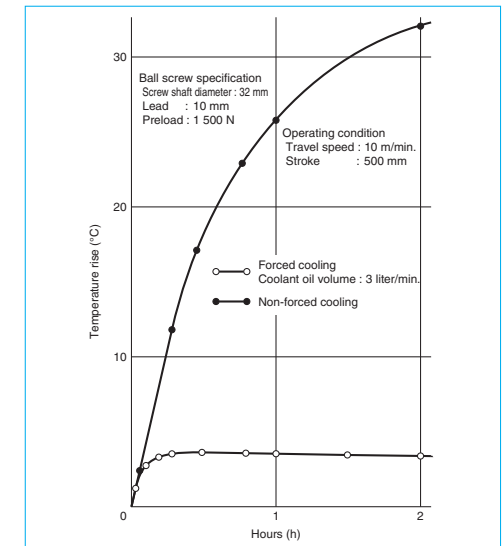


Fig. 1 Effect of forced cooling by hollow shaft ball screw

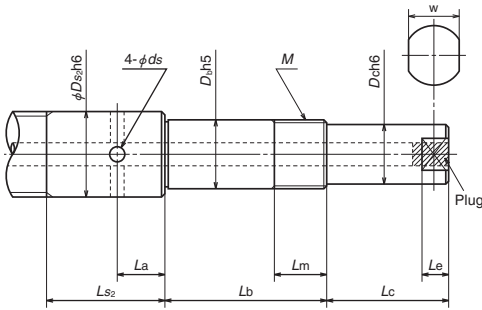
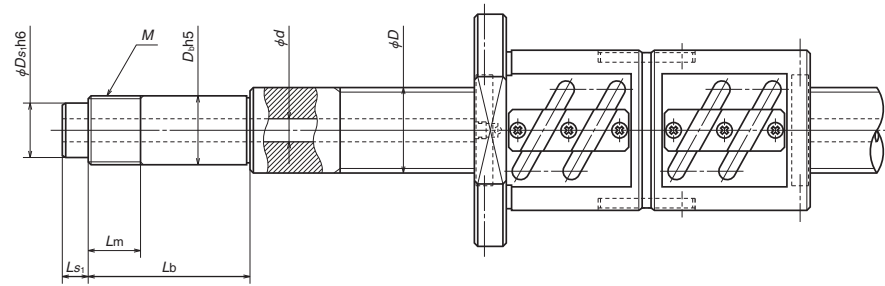
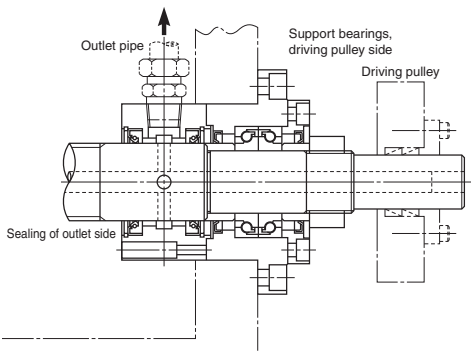
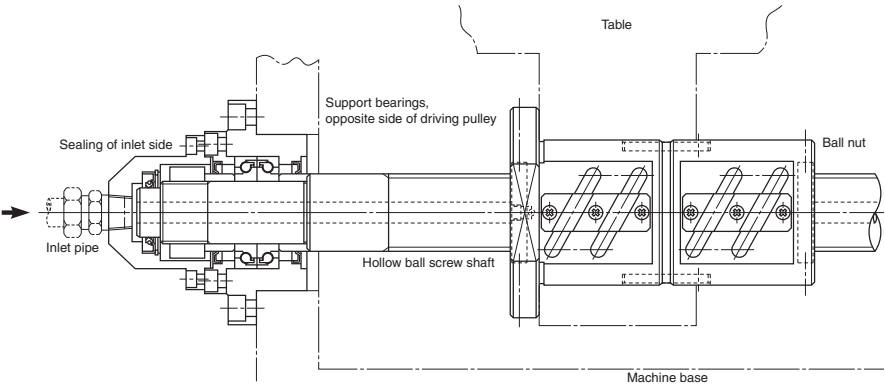
3. Model example of dimension table

A model number that indicates specification factors is structured as shown below.

◇Example of model

H	32	-	10	
Screw shaft model H				Hollow bore (mm)
				Screw shaft diameter (mm)

4. Installation example and standard dimensions



Model No.	Screw shaft		Bearing seat				Sealing					
	Diameter <i>D</i>	Hollow <i>d</i>	Diameter <i>D_b</i>	Lock nut			Inlet		Outlet			
				<i>M</i>	<i>L_m</i>	<i>L_b</i>	<i>D_{S1}</i>	<i>L_{S1}</i>	<i>D_{S2}</i>	<i>L_{S2}</i>	<i>L_a</i>	<i>ds</i>
H32-10	32	10	25	M25×1.5	26	89	20	15	32	60	25	6
						104						
						119						
H40-12	40	12	30	M30×1.5	26	89	25	15	40	60	25	7
						104						
						119						
H50-15	50	15	40	M40×1.5	30	92	32	15	50	65	27	8
						107						
						122						

Notes: 1. Please consult NSK for other models.
2. See B416 for bearing combination symbols.

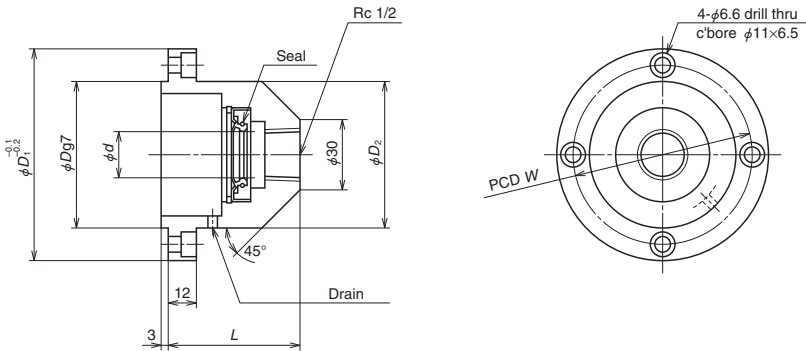
Drive side		Spanner flats		Applicable support unit	Used bearing	Equipped seal unit	
<i>D_c</i>	<i>L_c</i>	<i>w</i>	<i>L_e</i>			Shaft end	Shaft outer surface
20	40	17	8	WBK25DF-31H WBK25DFD-31H	25TAC62CSUHPN7C DF combination 25TAC62CSUHPN7C DFD combination (25TAC62CSUHPN7C DFF combination)	WSK20A-01	WSK32B-01
25	50	22	10	WBK30DF-31H WBK30DFD-31H	30TAC62CSUHPN7C DF combination 30TAC62CSUHPN7C DFD combination (30TAC62CSUHPN7C DFF combination)	WSK25A-01	WSK40B-01
35	70	30	13	WBK40DF-31H WBK40DFD-31H WBK40DFF-31H	40TAC72CSUHPN7C DF combination 40TAC72CSUHPN7C DFD combination 40TAC72CSUHPN7C DFF combination	WSK32A-01	WSK50B-01

Unit: mm

5. Seal units for hollow ball screw shaft (available by order)

This is an exclusive joint for coolant of the hollow ball screw shaft.

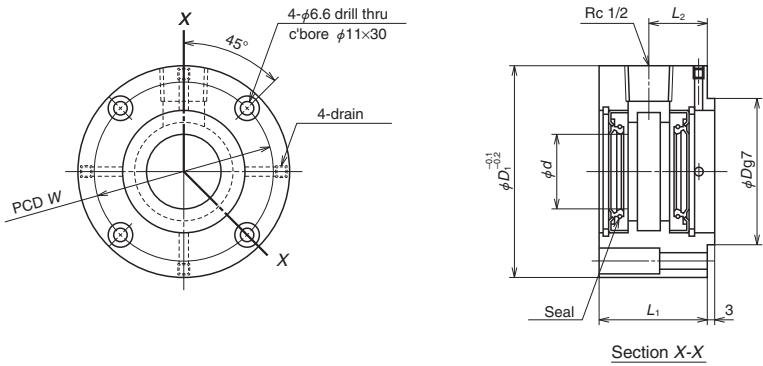
A Type
(for shaft end)



Unit: mm

Reference No.	d	D	D ₁	D ₂	L	W	Fixing bolt
WSK20A-01	20	57	85	57	56	70	M6
WSK25A-01	25	57	85	57	56	70	M6
WSK32A-01	32	69	95	67	61	80	M6

B Type
(for shaft outer surface)



Unit: mm

Reference No.	d	D	D ₁	L ₁	L ₂	W	Fixing bolt
WSK32B-01	32	57	85	46	25	70	M6
WSK40B-01	40	57	85	46	25	70	M6
WSK50B-01	50	69	95	49	27	80	M6

◇ Handling precautions

- Use NSK support unit (high speed and high load capacity for machine tools on page B405) for installation in order to maintain the eccentricity between screw shaft and seal unit.

- Apply grease to the lip section for protection at the time of installation to the ball screw.
- Make certain that the drain holes (one for A Type, four for B Type) of the seal unit directly face downward when the unit is installed.

B-3-3.8.2 Nut Cooling Ball Screws for High Precision Machine Tools

Nut cooling ball screws are easily cooled with a ball nut cooling system and are ideal for use in high-speed and high-precision machine tools that have nut cooling systems.

Using nut cooling ball screws makes it possible to cool long ball screws that are difficult to cool with hollow-core cooling, and they accommodate the broad high-precision needs of machine tools both small and large.

1. Features

● Cooling effects

By optimizing the cooling structure inside the nut, cooling capacity equivalent to hollow shaft cooling has been achieved. The nut in contact with the table is cooled, so that heat conduction from the table to the ball screw is blocked. Moreover, by cooling hollow shaft in parallel, the screw shaft and ball nut can be cooled at the same time for even more precise temperature control.

● Internal design in consideration of preload torque change

The nut cooling ball screw has double contact-point preload in the tensile direction. This prevents an increase in preload torque when the nut is cooled, enabling effective cooling of the ball screw.

◇Reference number for nut cooling ball screw

W4012-ZMNC-C5Z20**

Nut cooling ball screw code

● Cooling structure

The cooling fluid goes in a balanced way through the nut. Double nuts have separate coolant routes for each nut for efficient cooling. Cooling fluid does not go through the inside of spacers, so coolant fluid does not leak even when preload drops and airtightness is maintained.

● Improved handling

Ball screws can be cooled by simply attaching piping to the exterior flange part.* Sliding seals and rotary joints that are required for hollow shaft cooling are not needed. Dimensions for mounting area (without nut cooling) are the same as conventional products, so the nut cooling can be implemented without changing machine designs.

*When cooling double nuts, piping is required on the nut end face on the other side of the flange.

● Long ball screws can be cooled at a low cost

Since these products are suitable for long ball screws for which hollow hole processing is difficult, improved precision of large machine tools can be achieved at a low cost.

2. Cautions regarding design

If heat impact from the bearing is too great, separate cooling for bearing and surrounding areas is recommended. For details, please contact NSK.

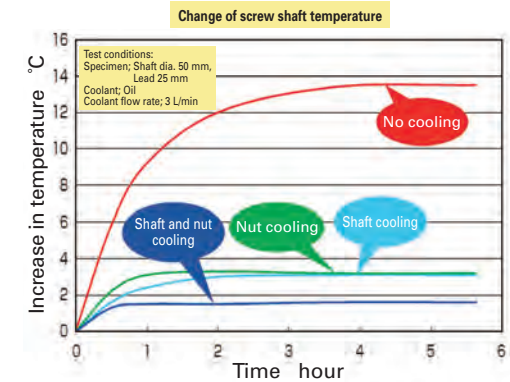


Fig. 1 Effect of forced cooling by nut cooling ball screw

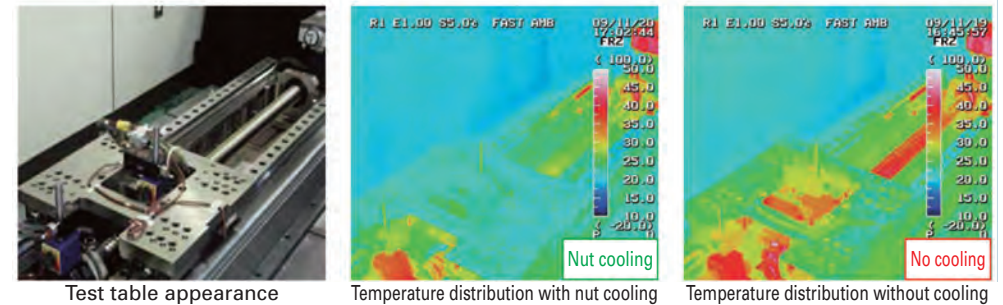


Fig. 2 Effect of forced cooling by nut cooling ball screw

Cooling structure

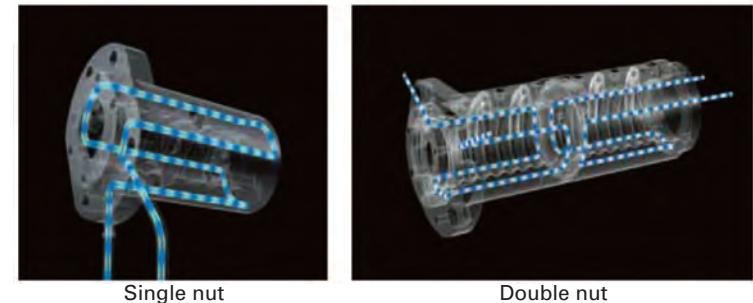


Fig. 3 Cooling structure of a nut cooling ball screw

B-3-3.9 ND Series for Nut-Rotatable Drives

- This product is patented by NSK.

A nut rotatable ball screw is developed as a unit into which angular contact support ball bearings are integrated. It is best suited for an application that requires rotation of the ball nut while the screw shaft is fixed.

NDT model

1. Structure

Balls are installed between the assembly housing and the ball nut. The outer bearing rings are integrated into the assembly housing and thus, compact design are attained.

A timing pulley (prepared by the user) is directly secured to the end face of the nut.

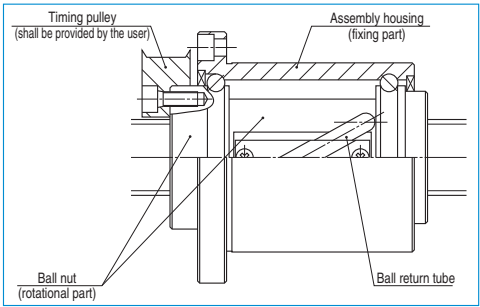


Fig. 1 Ball nut structure

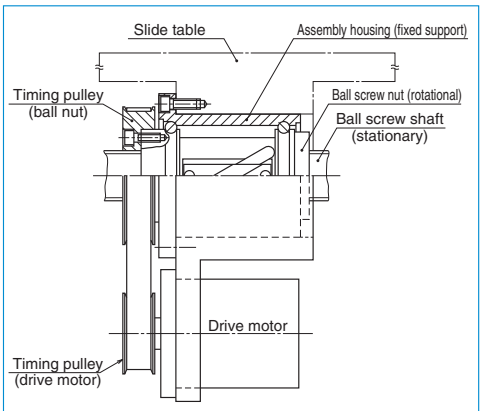


Fig. 2 Example of installation to the table

2. Features

● Multi-nut drive

Two or more nut units can be installed in a single ball screw shaft. They can be operated by respective motors.

● High operation speed

High feeding speed operation, but yet low rotational speed, is feasible by means of medium to high-helix lead ball screws.

● Easy installation

Merely install a mount housing to the table of the machine to take advantage of this multi-nut rotation system.

● Simple shaft end configuration

Shaft end configuration is simple because this unit does not need support bearings.

● Shaft diameter/lead combination

There are 10 types of "shaft diameter/lead" combinations.

Selections are: Shaft diameters -- 32, 40, 50 mm; Leads -- 20, 25, 32, 40, 50 mm.

● Low inertia

Compared to the NSK current product (end cap ball recirculation system), rotational inertia was reduced by 16% at most.

3. Specifications

(1) Ball recirculation system

The structure of return tube recirculation system is shown below.

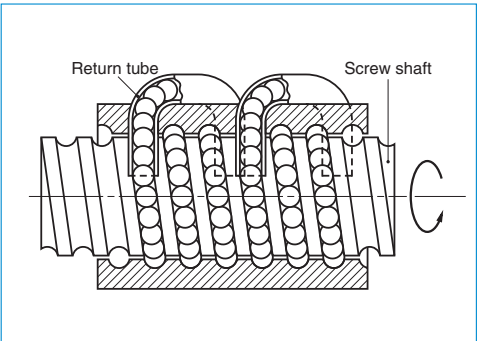


Fig. 3 Structure of ball return tube recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Axial play			
Axial play code	Z	T	S
Axial play	0	0.005 mm or less	0.020 mm or less

Table 2 Combination of accuracy grades and axial play

Accuracy grade	C3	C5	Ct7
Axial play code	Z, T, S	Z, T, S	S

4. Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Note: The basic concept is the same as that of general ball screws. Refer to "Technical Description: Permissible Rotational Speed" (page B47).

Table 3 Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value	Standard specification	70 000 or less
	High-speed specification	100 000 or less
Criterion of maximum rotational speed		3 000 min ⁻¹

d·n value: shaft dia. d [mm] × rotational speed n [min⁻¹]

● Critical speed n_c

As shown Fig. 4, calculate unsupported length (mm) of L_1 , L_2 , and L_3 (assumed that the nut section is a fixed support.) Table 4 shows the coefficients "f" of each shaft end mounting condition.

$$n_c = f \cdot \frac{d_r}{L_i^2} \times 10^7 \text{ (min}^{-1}\text{)} \quad (\text{III-1})$$

d_r : Screw shaft root diameter (See the dimension table.)

L_i : Unsupported length (mm) (See Fig. 4)

f: Factor determined by the ball screw shaft end mounting condition

Table 4

Shaft end mounting condition	f
Fixed – Fixed support	21.9
Fixed – Simple support	15.1
Fixed – Free support	3.4

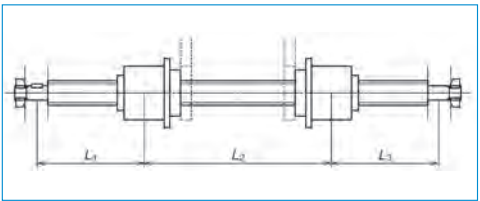


Fig. 4 Installation example

5. Design precautions

One end of the screw thread should be cut-through to the end. Also, if the nut must be removed from the screw shaft, the user should have an arbor to prevent the balls from falling out during this process. (NSK manufactures arbors on request.)

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

NDD Type: (Incorporating vibration damper)

An increase in stroke length may restrict required rotational speed of a ball screw due to the issue of critical speed even if there is no problem on d·n limitation.

In such a case, we recommend using NDD Type nut rotatable ball screws equipped with vibration damper.

It will make it possible to operate a ball screw exceeding the critical speed, which is conventionally considered being impossible.

Notes: 1) However, NDD Type cannot be used exceeding the d·n limitation. Please consult with NSK in such a case.

2) You cannot rotate the screw shaft of NDD Series.

1. Structure

Hollow ball screw shaft has a mechanism to absorb vibration energy (vibration damper). This increases dynamic rigidity of the screw shaft and lowers vibration when exceeding the critical speed.

Construction of the ball nuts are the same as those of NDT Type.

2. Features

- No need for measures against critical speed. Conventionally, an increase in screw shaft diameter or use of intermediate support is the measure against the issue of critical speed. NDD Type ball screw will make these measures needless.

- Dimensional interchangeability with NDT Type ball screws

The vibration damper is set inside a ball screw shaft, and therefore, there is no difference with existing series in regards to external dimensions. The ball nuts of NDD Type are interchangeable with those of NDT Type.

- Others

Benefits in multiple ball nut on a screw shaft, high feeding speed for long stroke, easy in installation, and low inertia of the ball nuts are the same as NDT Type.

3. Specification

Recirculation system, accuracy grade, axial play and preload system are the same as NDT Type.

4. Design precautions

They are the same as NDT Type.

5. Permissible rotational speed

The d·n value is the same as NDT Type.

You don't need to consider the critical speed.

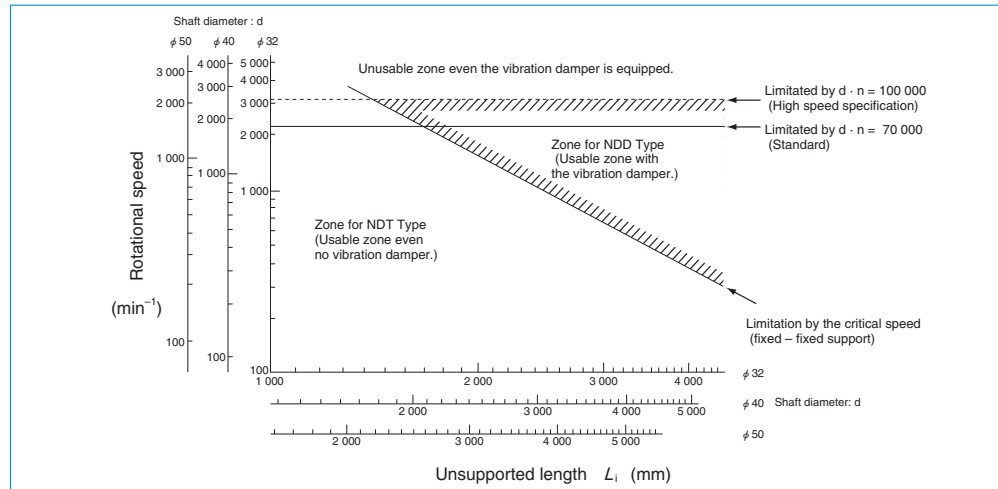


Fig. 5 Compartmentalization between NDT and NDD types to rotational speed and unsupported length

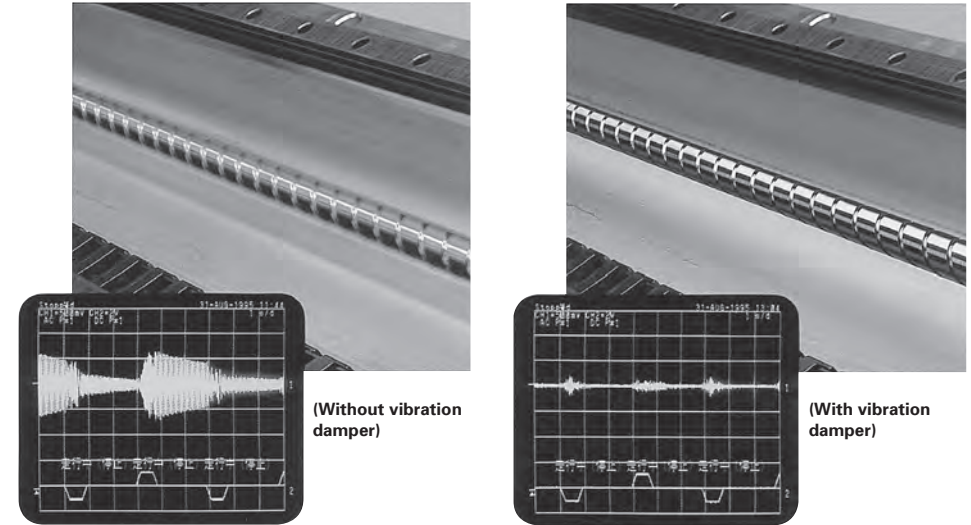


Fig. 6 Vibration of screw shaft when nut is rotating

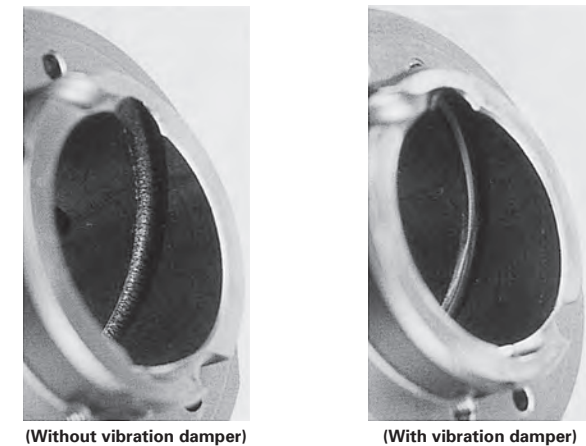


Fig. 7 Effect of vibration damper (results of endurance test)

Calculation example of permissible rotational speed

[Calculation example]

Assume a system which moves two nuts on a shaft as shown below.

Does this system operate appropriately if: both ends of the ball screw (shaft diameter 40 mm/lead 40 mm) are fixed, and the travel speed is at 60 m/min?

[Answer]

The rotational speed n (min^{-1}) when the lead of the ball screw is 40 mm, and the travel speed is at 60 m/min is:

$$n = \frac{60 \times 10^3}{40} = 1\,500 \text{ (min}^{-1}\text{)}$$

● Calculate $d \cdot n$ value

As the $d \cdot n$ value of standard specification is 7 000, therefore, the permissible rotational speed is;

$$n \leq \frac{70\,000}{40} = 1\,750 \text{ (min}^{-1}\text{)}$$

● Calculate critical speed

The maximum unsupported length comes between Nut A and B.

$$L_2 = 3\,300 \text{ (mm)}$$

$$f = 21.9 \text{ (Fixed-Fixed)}$$

$$\text{Root diameter: } d_r = 35.1 \text{ (mm)}$$

Therefore, the permissible rotational speed is;

$$n \leq \frac{21.9 \times 35.1}{3\,300^2} \times 10^7 = 706 \text{ (min}^{-1}\text{)}$$

The calculation indicates that the $d \cdot n$ value is at the safe level. But the critical speed exceeds the limitation. However, with a vibration damper, the system can be operated at 1 500 min^{-1} .

Structure of reference number

The followings describe the structure of "Reference number for ball screw".

◇Reference number for ball screw

W		40	15	-	**	P	XU	-	C5	Z	40	
Product code		Screw shaft diameter (mm)		Effective threaded length (in the unit of 100 mm)		Design serial number		Preload code: No code, Non-preload; P, P-preload (page B5)		Accuracy grade: C3, C5, C7 (Ct7) (page B37 to B42)		Lead (mm)
										Axial play code: Z, T, S (page B20)		
										Appearance/specification code ("T" is added for NDD Type.)		

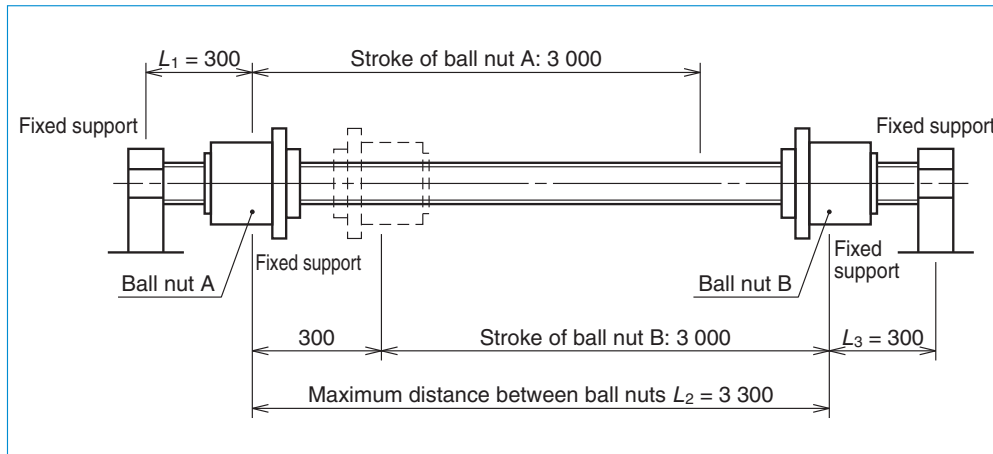
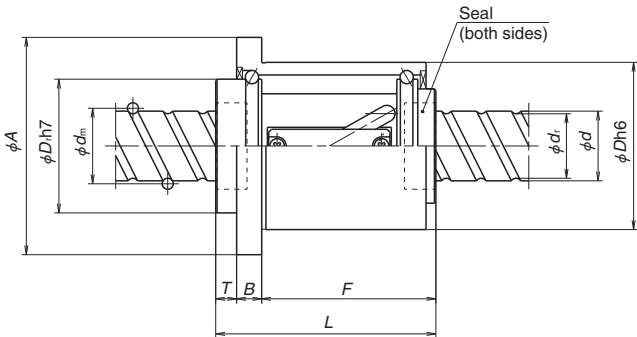
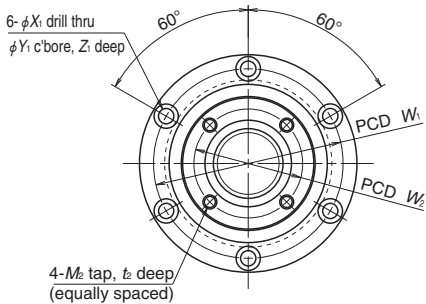


Fig. 8 Calculation example of permissible rotational speed



Unit: mm

Model No.	Shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective turns of balls Turns × Circuits	Basic load rating (N)		Moment of inertia, ball nut J (kg·cm ²)	Ball nut mass W (kg)
	d	l	D _w	d _m	d _r		Dynamic C _a	Static C _{0a}		
NDT NDD 3220-2.5	32	20	4.762	33.25	28.3	2.5×1	20 700	41 900	6.2	2.9
NDT NDD 3225-2.5		25	4.762	33.25	28.3	2.5×1	20 400	42 200	6.7	3.2
NDT NDD 3232-1.5		32	4.762	33.25	28.3	1.5×1	13 300	25 200	6.2	2.9
NDT NDD 3232-3						1.5×2	21 700	45 300		
NDT NDD 4025-2.5	40	25	6.35	41.75	35.1	2.5×1	34 100	70 100	19.3	6.0
NDT NDD 4032-1.5		32	6.35	41.75	35.1	1.5×1	21 600	41 300	18.0	5.5
NDT NDD 4032-3						1.5×2	35 400	74 400		
NDT NDD 4040-1.5		40	6.35	41.75	35.1	1.5×1	21 200	42 000	19.2	6.0
NDT NDD 4040-3						1.5×2	34 700	75 600		
NDT NDD 5025-2.5	50	25	7.938	52.25	44.0	2.5×1	51 300	110 000	45.7	8.5
NDT NDD 5032-2.5		32	7.938	52.25	44.0	2.5×1	50 900	109 000	48.9	9.4
NDT NDD 5040-1.5		40	7.938	52.25	44.0	1.5×1	32 300	64 600	45.5	8.5
NDT NDD 5040-3						1.5×2	52 800	116 000		
NDT NDD 5050-1.5		50	7.938	52.25	44.0	1.5×1	31 700	65 700	48.7	9.4
NDT NDD 5050-3						1.5×2	51 800	118 000		

Notes: 1. The right hand screw is the standard. Consult NSK for the left hand screws.
2. Seals are standard equipment.

Ball nut dimensions													Tap hole PCD
Nut entire length L	Nut outside diameter D	Flange outside diameter A	Flange width B	Nut length F	Projection tube dimensions		Bolt hole dimensions			Bolt hole PCD W ₁	Tap hole dimensions		W ₂
					D _r	T	X ₁	Y ₁	Z ₁		M ₂	t ₂	
107	78	105	12	83	60	12	6.6	11	6.5	91	M6	12	50
120	78	105	12	96	60	12	6.6	11	6.5	91	M6	12	50
107	78	105	12	83	60	12	6.6	11	6.5	91	M6	12	50
136	100	133	15	106	76	15	9	14	8.5	116	M8	16	62
122	100	133	15	92	76	15	9	14	8.5	116	M8	16	62
136	100	133	15	106	76	15	9	14	8.5	116	M8	16	62
140	120	156	18	107	96	15	11	17.5	11	136	M10	18	78
158	120	156	18	125	96	15	11	17.5	11	136	M10	18	78
140	120	156	18	107	96	15	11	17.5	11	136	M10	18	78
158	120	156	18	125	96	15	11	17.5	11	136	M10	18	78

ND Series

B-3-3.10 Σ Series for Robots

1. Features

Σ Series (NSK's Robotte) is a ball screw with a high-performance spline. It is ideal for various actuators such as the vertical axis of SCALA type robot.

A ball screw groove and a ball spline groove are made in one shaft, combining the ball screw and the ball spline.

Mount housing, nuts, and support bearings are combined into a single unit.

Timing pulley (prepared by the user) is directly secured at the end face of the nut.

● High functions

A single shaft has both feeding mechanism and guide functions. This allows the shaft ends to move back and forth (linear motion), as well as to rotate.

● Compact and lightweight

A ball screw nut and a spline nut are placed on one shaft, and a support bearings are also combined to the unit. This allows compact and high-precision design. Hollow shaft is standard to reduce weight. The hollow can be used for wiring and piping. Other components are also designed to be light in weight.

● Low inertia

Because of return tube type ball nut of which outside diameter is decreased, low inertia design is enabled.

It reduces the inertia by 19% of conventional products.

2. Functions

As shown in Fig. 1, the ball screw nut and a spline nut are rotated independently to control rotation value. Thereby the shaft can move in any direction -- linear and rotational. Table 1 shows the relationship between power input and output.

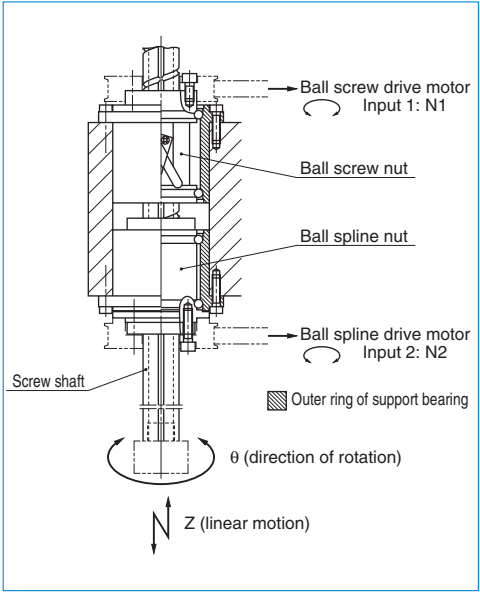


Fig. 1 Example structure of Z axis plus θ axis actuator

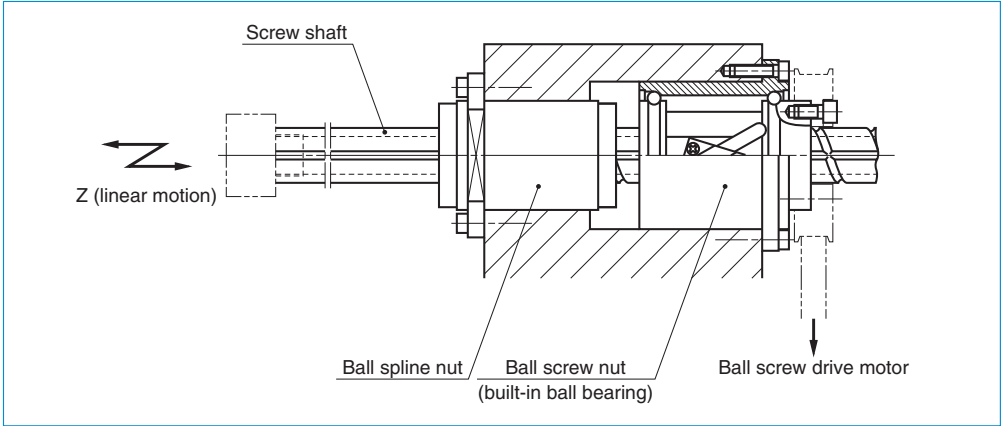


Fig. 2 Example structure of single Z axis unit

Table 1 Power input and output of Σ Series

Shaft movement (output)		Input		
Z (up-down movement) (mm/min)	θ (rotational movement) (min^{-1})	① Ball screw (min^{-1})	② Spline (min^{-1})	Notes
Up, down $N1 \times l$	Stop 0	Rotate N1	Stop 0	—
Stop 0	Rotate N2	Rotate N1	Rotate N2	$N1 = N2$
Up, down $N2 \times l$	Rotate N2	Stop 0	Rotate N2	—
Up, down $ N1 - N2 \times l$	Rotate N2	Rotate N1	Rotate N2	$N1 \neq N2$

3. Specifications

(1) Ball recirculation system

A structure of return tube recirculation system is shown below.

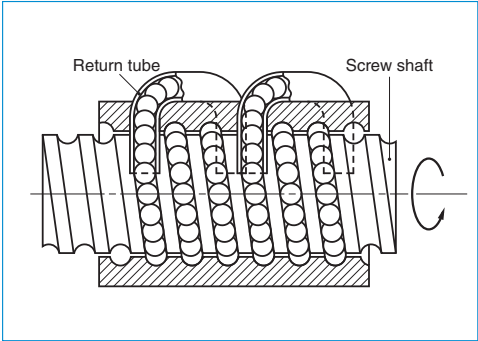


Fig. 3 Structure of return tube recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play for ball screw are as follows. The axial play for spline is 0 mm (preloaded product). Please consult NSK for other grades.

Table 2 Accuracy grade and axial play

Accuracy grade	C3, C5, Ct7
Axial play	Z, 0 mm (preloaded) T, 0.005 mm or less; S, 0.020 mm or less

(3) Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Permissible d·n value: 70 000 or less

Criterion of maximum rotational speed: 3 000 min^{-1}

Note: Please also review the critical speed.

For details, see "Technical Description: Permissible Rotational Speed" (page B47).

(4) Application

SCALA type and Cartesian type industrial robots, semiconductor manufacturing machines, machines for automobile production facilities, material handling systems, other Z (vertical) axis and Z axis plus θ (rotation) axis actuators.

4. Design precautions

The overall length L can be extended to 25 times of the shaft diameter.

To remove the spline nut from the shaft for assembling, use an arbor as shown in Fig. 4. (page B545). Avoid removing ball screw nut as much as possible. Refer to root diameter in the dimension table for arbor diameter. (NSK manufactures the arbors on request.)

For general precautions regarding ball screws, refer to "Precautions in Designing" (page B83) and "Precautions in Handling" (page B103).

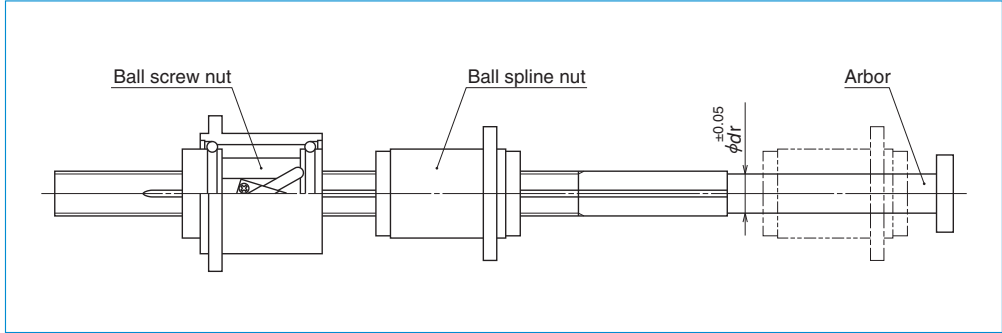


Fig. 4 Removing spline nut

5. Product categories

Σ Series (NSK's Robotte) is four models with different moving functions and performances are available. Select a standard model if rigidity is important. A compact system is recommended for reducing the weight of machine.

Table 3 Σ Series product categories

Model	Appearance	Size	Structure (Movement)
Σ		Standard	Z+θ Unit
ΣZ		Standard	Z Unit
ΣC		Compact	Z+θ Unit
ΣCZ		Compact	Z Unit

6. Load rating and life

The relationship between load rating of the ball spline section and life is the same as in other NSK liner motion products. However, various loads that apply to Robotte must be taken into account. For example, the following factors must be considered in calculating life when the product is used as shown in Fig. 5.

- Fa : Load that is generated when the shaft moves in up-down direction. (Load is applied to the ball screw nut.)
- T : Torque that is generated to the shaft by Fa.
- Fr : Load that is generated by moment of inertia of the shaft and the work attached to Robotte as well as by centrifugal force when the arm rotates.
- θ : Direction of Fr load that changes by shaft rotation.

NSK has life calculation programs which take these factors into account. Please ask NSK for more details.

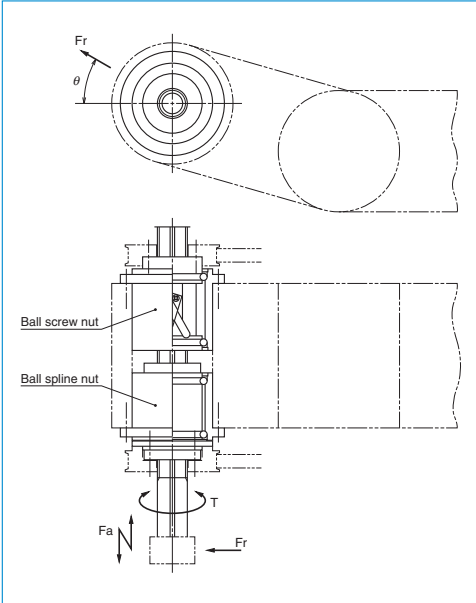


Fig. 5 Example structure of Z axis plus θ axis actuator

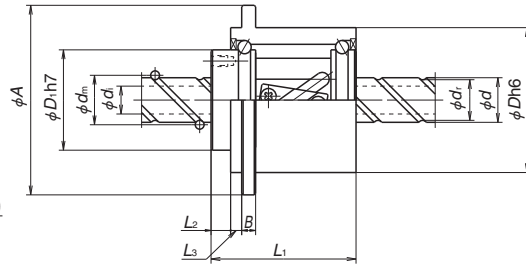
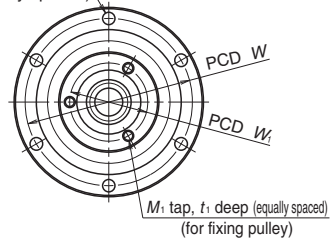
7. Structure of reference number

The following describes the structure of "Reference number for ball screw".

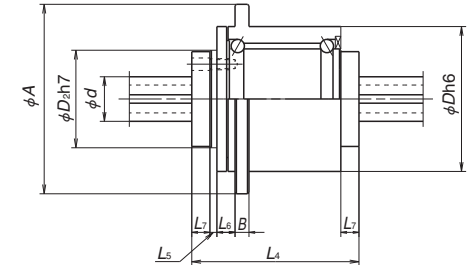
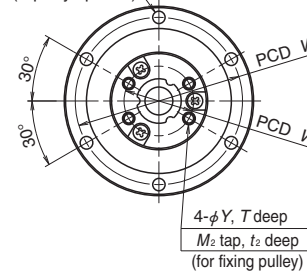
◇Reference number for ball screw

PW	25	02	- **	P	T	U	- C5	Z	20	
Product code	Screw shaft diameter (mm)	Effective threaded length (in the unit of 100 mm)	Design serial number	Preload code: No code, Non-preload; P, P-preload (page B5)						Lead (mm)
										Axial play code: Z, T, S (page B20)
										Accuracy grade: C3, C5, C7 (Ct7) (page B37 to B42)
										Use support unit
										Hollow shaft ball screw specification

6-φX drill thru
(equally spaced)



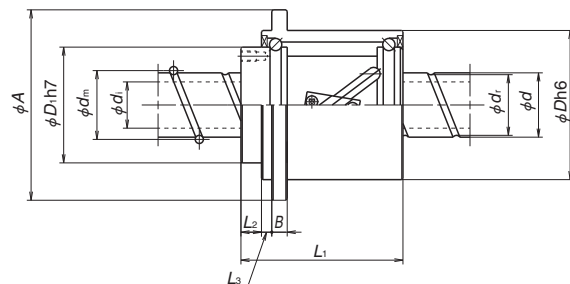
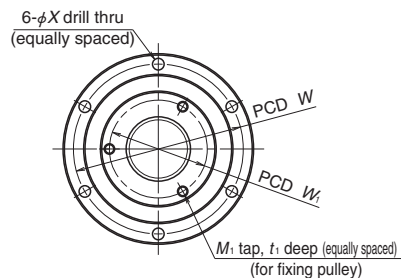
6-φX drill thru
(equally spaced)



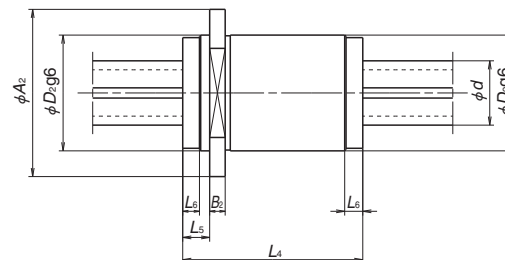
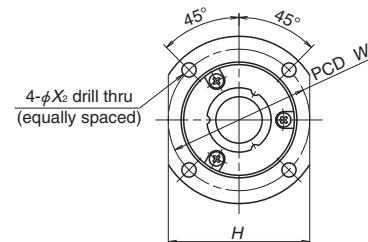
Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Screw shaft hollow <i>d_i</i>	Ball screw nut																Moment of inertia (kg·cm ²)	
							Basic load rating (N)		Dimensions															
							Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	<i>D</i>	<i>A</i>	<i>B</i>	<i>L₁</i>	<i>L₂</i>	<i>L₃</i>	<i>M₁</i>	<i>t₁</i>	<i>W₁</i>	<i>D₁</i>	<i>W</i>	<i>X</i>				
Σ1610	16	10	3.175	16.75	13.4	(8)	5 610	8 300	48	64	5	47	7	4	3-M4	6	28	35	56	4.5	0.41			
Σ1632		32					3 240	4 680				52									0.44			
Σ2010	20	10	3.175	20.75	17.4	(14)	9 560	17 300	54	70	6	57	8	4	3-M4	6	32	40	62	4.5	0.64			
Σ2020		20					6 100	10 500				63									0.65			
Σ2040		40					3 640	6 310				57									0.64			
Σ2510	25	10	3.175	25.75	22.4	(18)	10 700	22 000	58	74	6	57	8	4	3-M4	6	38	45	66	4.5	1.10			
Σ2520		20					6 860	13 100				63									1.18			
Σ2525		25					6 720	13 300				72									1.30			
Σ2550		50					4 040	7 440				64									1.20			
Σ3220	32	20	3.175	32.75	29.4	(25)	7 710	16 900	70	95	8	70	10	6	3-M5	10	44	53	82	6.6	2.60			
Σ3232		32					7 590	16 700				91									3.15			
Σ4020	40	20	3.969	41.0	36.9	(30)	11 600	26 500	85	110	8	73	10	6	4-M5	10	58	67	96	6.6	5.96			
Σ4040		40					11 300	26 200				107									7.85			
Σ4520	45	20	3.969	46.0	41.9	(35)	12 000	30 000	90	115	8	73	10	6	4-M5	10	63	72	101	6.6	7.73			
Σ4540		40					11 800	29 700				107									10.3			

	Ball spline nut																					
Mass (kg)	Basic load rating (N)		Basic torque (N·m)		Dimensions																Moment of inertia (kg·cm ²)	Mass (kg)
	Dynamic C _r	Static C _{0r}	Dynamic C _t	Static C _{0t}	D	A	B	L ₄	L ₅	L ₆	L ₇	Y	T	M ₂	t ₂	W ₂	D ₂	W	X			
0.50	5 530	7 270	61.5	91.3	48	64	5	60	2.5	6.5	6.5	4.5	6.5	M4	7	25	35	56	4.5	0.71	0.63	
0.55	5 890	8 000	65.5	100																		
0.74	6 260	8 720	86.3	135																		
0.81	6 610	9 450	91.1	145	54	70	6	65	2.5	6.5	6.5	5.5	6.5	M5	8	30.5	40	62	4.5	1.15	0.87	
0.74	6 610	9 450	91.1	145																		
0.81	6 630	9 450	115	185																		
0.88	7 290	10 900	125	210	58	74	6	70	2.5	6.5	6.5	5.5	6.5	M5	8	35.5	45	66	4.5	1.88	1.03	
1.00	7 290	10 900	125	210																		
0.91	7 290	10 900	125	210																		
1.46	7 630	11 600	165	285	70	95	8	75	2.5	7.5	6.5	5.5	6.5	M5	8	42	50	82	6.6	3.80	1.62	
1.83	7 950	12 400	175	305																		
2.02	10 600	14 800	290	455																		
2.85	11 200	15 900	305	490	85	110	8	80	4	7.5	8	5.5	8	M5	8	55	65	96	6.6	9.74	2.38	
2.17	11 200	15 900	340	550																		
3.06	11 700	17 000	360	590																		

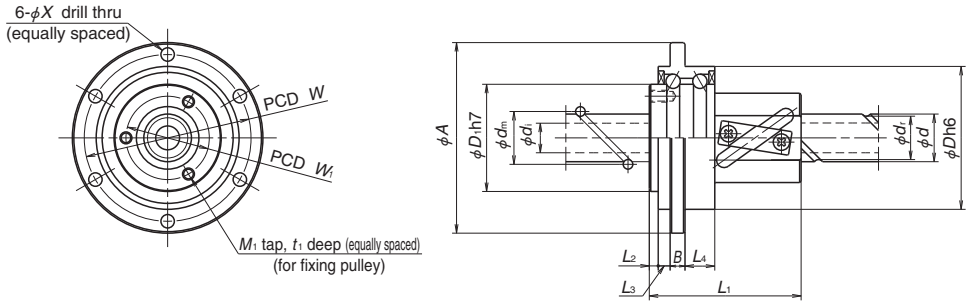


Model No.	Shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Screw shaft hollow	Ball screw nut														
							Basic load rating (N)		Dimensions												
							Dynamic C_a	Static C_{0a}	D	A	B	L_1	L_2	L_3	M_1	t_1	W_1	D_1	W	X	
$\Sigma Z1610$	16	10	3.175	16.75	13.4	(8)	5 610	8 300	48	64	5	47	7	4	3-M4	6	28	35	56	4.5	
$\Sigma Z1632$		32					3 240	4 680				52									
$\Sigma Z2010$	20	10	3.175	20.75	17.4	(14)	9 560	17 300	54	70	6	57	8	4	3-M4	6	32	40	62	4.5	
$\Sigma Z2020$		20					6 100	10 500				63									
$\Sigma Z2040$		40					3 640	6 310				57									
$\Sigma Z2510$	25	10	3.175	25.75	22.4	(18)	10 700	22 000	58	74	6	57	8	4	3-M4	6	38	45	66	4.5	
$\Sigma Z2520$		20					6 860	13 100				63									
$\Sigma Z2525$		25					6 720	13 300				72									
$\Sigma Z2550$		50					4 040	7 440				64									
$\Sigma Z3220$	32	20	3.175	32.75	29.4	(25)	7 710	16 900	70	95	8	70	10	6	3-M5	10	44	53	82	6.6	
$\Sigma Z3232$		32					7 590	16 700				91									
$\Sigma Z4020$	40	20	3.969	41.0	36.9	(30)	11 600	26 500	85	110	8	73	10	6	4-M5	10	58	67	96	6.6	
$\Sigma Z4040$		40					11 300	26 200				107									
$\Sigma Z4520$	45	20	3.969	46.0	41.9	(35)	12 000	30 000	90	115	8	73	10	6	4-M5	10	63	72	101	6.6	
$\Sigma Z4540$		40					11 800	29 700				107									

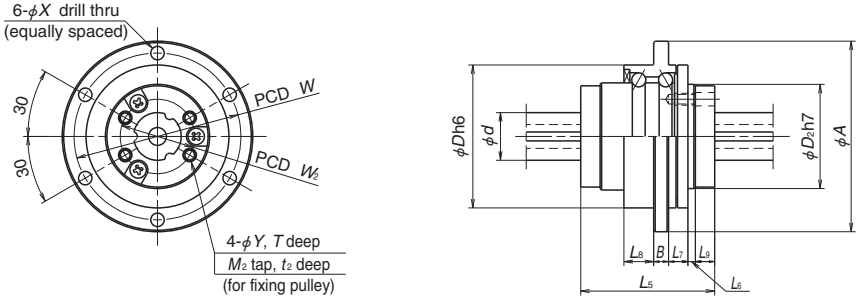


Unit: mm

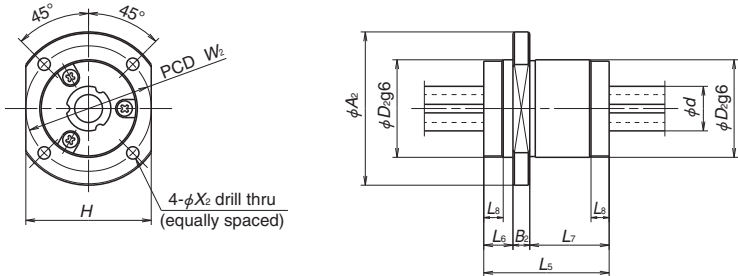
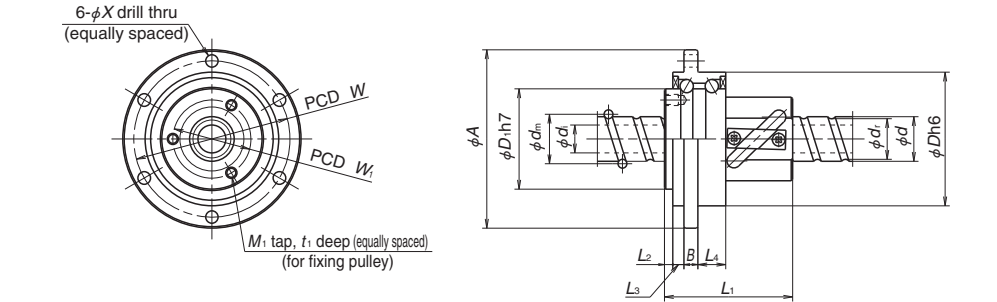
		Ball spline nut													
Moment of inertia (kg·cm ²)	Mass (kg)	Basic load rating (N)		Basic torque (N·m)		Dimensions									Mass (kg)
		Dynamic C _r	Static C _{0r}	Dynamic C _t	Static C _{0t}	D ₂	A ₂	B ₂	L ₄	L ₅	L ₆	H	W ₂	X	
0.41	0.50	5 530	7 270	61.5	91.3	35	55	6	60	10.5	6.5	45	4.5	4.5	0.35
0.44	0.55	5 890	8 000	65.5	100										
0.64	0.74	6 260	8 720	86.5	135	40	60	6	65	10.5	6.5	50	50	5.5	0.46
0.65	0.81	6 610	9 450	91.1	145										
0.64	0.74	6 610	9 450	91.1	145	45	65	6	70	10.5	6.5	55	55	5.5	0.57
1.10	0.81	6 630	9 450	115	185										
1.18	0.88	7 290	10 900	125	210										
1.30	1.00	7 290	10 900	125	210										
1.20	0.91	7 290	10 900	125	210										
2.60	1.46	7 630	11 600	165	285	50	70	6	75	10.5	6.5	60	60	5.5	0.64
3.15	1.83	7 950	12 400	175	305										
5.96	2.02	10 600	14 800	290	455	65	88	8	80	12	8	76	76	6.6	1.20
7.85	2.85	11 200	15 900	305	490										
7.73	2.17	11 200	15 900	340	550	70	93	8	85	12	8	81	81	6.6	1.39
10.3	3.06	11 700	17 000	360	590										



Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Screw shaft hollow <i>d_i</i>	Ball screw nut																
							Basic load rating(N)		Dimensions														Moment of inertia (kg·cm ²)
							Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	<i>D</i>	<i>A</i>	<i>B</i>	<i>L₁</i>	<i>L₂</i>	<i>L₃</i>	<i>L₄</i>	<i>M₁</i>	<i>t₁</i>	<i>W₁</i>	<i>D₁</i>	<i>W</i>	<i>X</i>		
ΣC1610	16	10	3.175	16.75	13.4	(8)	5 670	8 300	48	64	5	46	3	4	10	3-M4	6	28	35	56	4.5	0.40	
ΣC1632		32					3 240	4 680				51										0.43	
ΣC2010	20	10	3.175	20.75	17.4	(14)	9 560	17 300	54	70	6	56	4	4	10	3-M4	6	32	40	62	4.5	0.63	
ΣC2020		20					6 100	10 500				63										0.65	
ΣC2040		40					3 640	6 310				56										0.63	
ΣC2510		10					10 700	22 000				56										1.04	
ΣC2520	25	20	3.175	25.75	22.4	(18)	6 860	13 100	58	74	6	63	4	4	10	3-M4	6	38	45	66	4.5	1.13	
ΣC2525		25					6 720	13 300				71										1.24	
ΣC2550		50					4 040	7 440				63										1.13	



	Ball spline nut																						
Mass (kg)	Basic load rating(N)		Basic torque(N·m)		Dimensions																	Moment of inertia (kg·cm ²)	Mass (kg)
	Dynamic C _r	Static C _{0r}	Dynamic C _t	Static C _{0t}	D	A	B	L ₅	L ₆	L ₇	L ₈	L ₉	Y	T	M ₂	t ₂	W ₂	D ₂	W	X			
0.41	4 300	5 090	47.9	63.9	48	64	5	45	2.5	6.5	10	6.5	4.5	6.5	M4	7	25	35	56	4.5	0.52	0.42	
0.43																							
0.53	4 730	5 820	65.1	90.5	54	70	6	50	2.5	6.5	10	6.5	5.5	6.5	M5	8	30.5	40	62	4.5	0.86	0.56	
0.56	5 110	6 540	70.5	100																			
0.53	5 110	6 540	70.5	100	58	74	6	55	2.5	6.5	10	6.5	5.5	6.5	M5	8	35.5	45	66	4.5	1.44	0.67	
0.60	5 130	6 540	78.8	125																			
0.64	5 870	8 000	100	155																			
0.69	5 870	8 000	100	155																			
0.64	5 870	8 000	100	155																			



Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Ball dia. <i>D_w</i>	Ball circle dia. <i>d_m</i>	Root dia. <i>d_r</i>	Screw shaft hollow <i>d_i</i>	Ball screw nut														
							Basic load rating(N)		Dimensions												
							Dynamic <i>C_s</i>	Static <i>C_{0s}</i>	<i>D</i>	<i>A</i>	<i>B</i>	<i>L₁</i>	<i>L₂</i>	<i>L₃</i>	<i>L₄</i>	<i>M_i</i>	<i>t₁</i>	<i>W₁</i>	<i>D₁</i>	<i>W</i>	<i>X</i>
ΣCZ1610	16	10	3.175	16.75	13.4	(8)	5 670	8 300	48	64	5	46	3	4	10	3-M4	6	28	35	56	4.5
ΣCZ1632		32					3 240	4 680				51									
ΣCZ2010	20	10	3.175	20.75	17.4	(14)	9 560	17 300	54	70	6	56	4	4	10	3-M4	6	32	40	62	4.5
ΣCZ2020		20					6 100	10 500				63									
ΣCZ2040		40					3 640	6 310				56									
ΣCZ2510	25	10	3.175	25.75	22.4	(18)	10 700	22 000	58	74	6	56	4	4	10	3-M4	6	38	45	66	4.5
ΣCZ2520		20					6 860	13 100				63									
ΣCZ2525		25					6 720	13 300				71									
ΣCZ2550		50					4 040	7 440				63									

		Ball spline nut																									
Moment of inertia (kg·cm ²)	Mass (kg)	Basic load rating(N)		Basic torque(N·m)		Dimensions											Mass (kg)										
		Dynamic C _r	Static C _{0r}	Dynamic C _t	Static C _{0t}	D ₂	A ₂	B ₂	L ₅	L ₆	L ₇	L ₈	H	W ₂	X ₂												
0.40	0.41	4 300	5 090	47.9	63.9	35	55	6	45	10.5	28.5	6.5	45	45	4.5	0.26											
0.43	0.43																										
0.63	0.53	4 730	5 820	65.1	90.5												40	60	6	50	10.5	33.5	6.5	50	50	5.5	0.35
0.65	0.56	5 110	6 540	70.5	100																						
0.63	0.53	5 110	6 540	70.5	100	45	65	6	55	10.5	38.5	6.5	55	55	5.5	0.44											
1.04	0.60	5 130	6 540	87.8	125																						
1.13	0.64	5 870	8 000	100	155																						
1.24	0.69	5 870	8 000	100	155																						
1.13	0.64	5 870	8 000	100	155																						

B-3-3.11 Ball Screw with L1 Seal designed for Minimal Grease Splatter [Patent application submitted]

1. Features

● Substantial reduction in grease splatter
The amount of grease splatter for the L1 seal is reduced to 1/10 compared to NSK standard seal to contribute to maintain equipment and working environment clean.

● Adoption of non-contact type seal
Seal torque is avoided by optimizing the seal shape. The current seals with relatively small splatter are all contact type seals, but the L1 seal is the first non-contact type seal to achieve low grease splatter.

● Seal cover is equipped as standard.
To prevent grease from dripping, a seal cover is equipped as standard.

● Later fitting to NSK standard ball screws is available.

NSK ensures quick delivery because later fitting to "Compact FA Series" and "High Speed SS Series" is possible.

2. Specifications

(1) Applicable ball screw

Shaft diameter : 15 to 23 mm
Lead : 5 mm min.
Lubricant : NSK standard grease, NSK clean grease, grease for general food
Environment : Ambient temperature
Short lead time: Can be fitted to NSK standard stock ball screws.
Compact FA series (dia.15 to 25 mm)
High speed SS series (dia.32 mm)

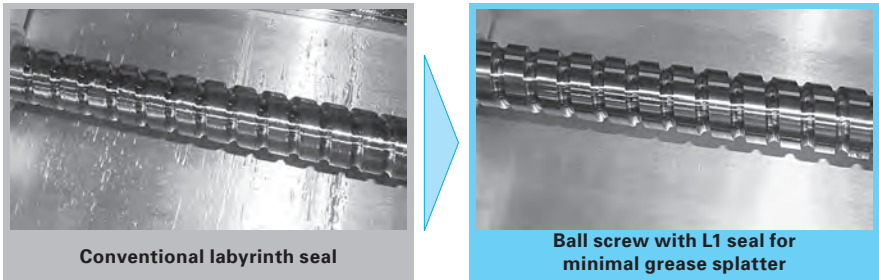


Fig. 1 Comparison of grease splatter from the shaft

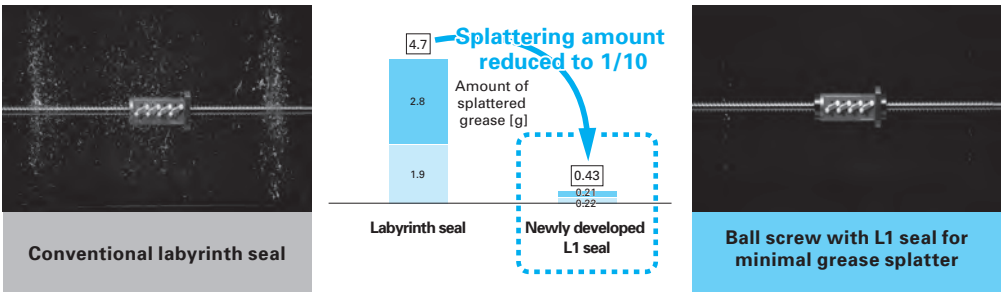


Fig. 2 Results of grease splattering test

(2) Design-related precautions

When designing the screw shaft end, the one end shall be cut-through. For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

Table 1 Combinations of shaft diameter and lead

Lead Shaft dia.	5	10	20	25	Applicable series
15	○	○	○		Compact FA
20	○	○	○		
25	○	○	○	○	
32	○	○			High speed SS

Please contact NSK except for the above types.

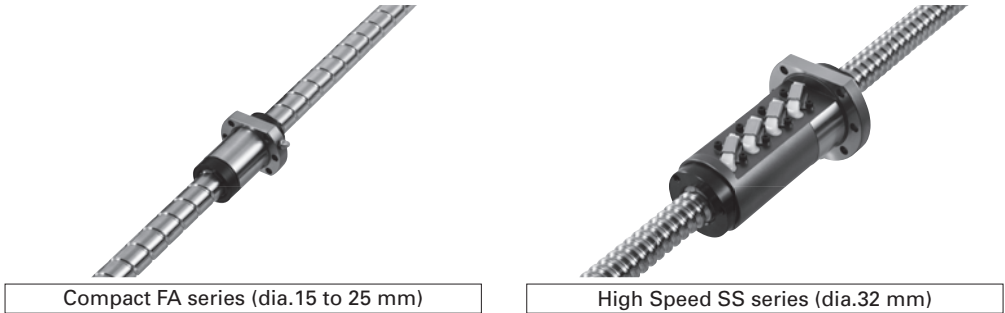


Fig. 3 Appearance

3. Example of reference number

A structure of "Reference number for ball screw" is as follows.

*"L1" is added at the end of "nut model code" and "Specifications number".

◇Reference number for ball screw

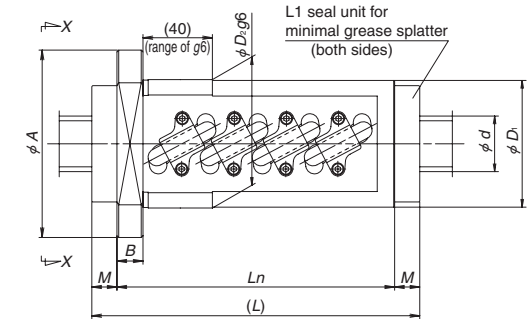
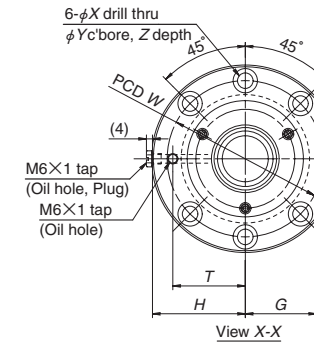
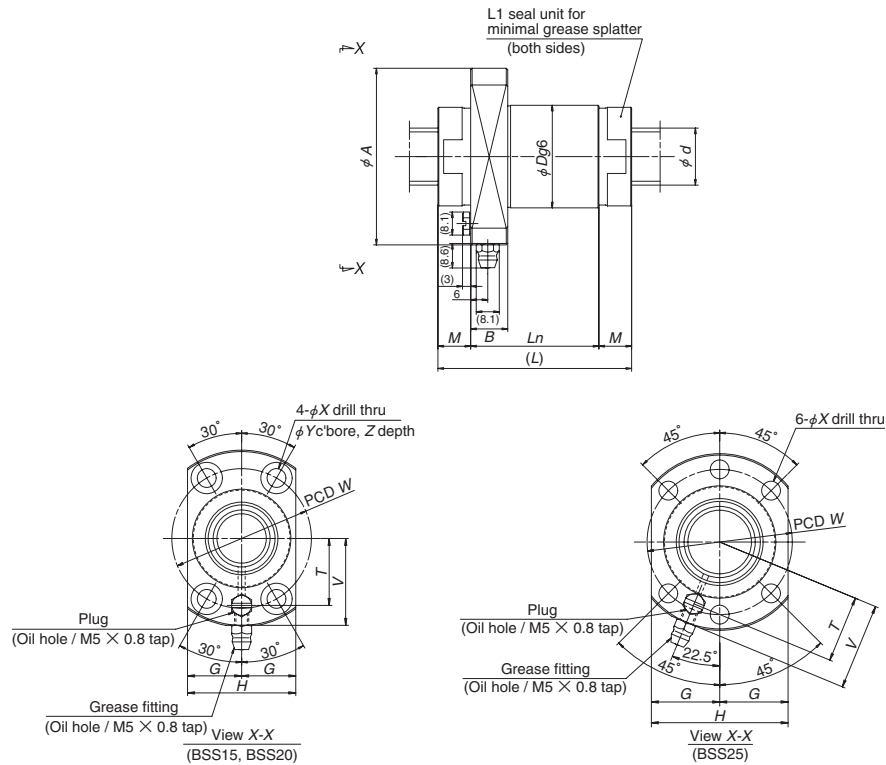
W2005 -*L1 - C5Z10**

NSK L1 equipped type ball screw code

4. Precautions for use

- Maximum temperatures are as follows.
Compact FA series with L1 seal: 80 °C (at outside diameter of ball nut)
High Speed SS series with L1 seal: 60 °C (at outside diameter of ball nut)
- Do not use the product in environments where foreign matter is present.
- Please note that L1 seal reduces grease splatter but cannot reduce it to zero.

The data shown in the catalog are the results of our tests, and no warranty is given to sealing performance on actual usage on machinery.
The amount of grease splatter is affected by usage conditions (rotational speed, temperature, greases, grease filling amount). Dust covers and other measures to keep machinery free of dust are recommended.



Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Basic load rating (N)		Ball nut dimensions											Seal dimensions <i>M</i>	Total length with nut & seal <i>L</i>	Internal spatial volume of nut (cm ³)	Standard volume of grease replenishing (cm ³)
			Dynamic <i>C_a</i>	Static <i>C_{0a}</i>	Dia. <i>D</i>	Flange <i>A</i>	<i>G</i>	<i>H</i>	<i>B</i>	Nut length <i>L_n</i>	<i>W</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	Oil hole position <i>T</i> <i>V</i>				
BSS1505-3E	15	5	6 410	10 100	28	51	15.5	31	11	30	39	5.5	9.5	5.5	18 25	10	50	2.0	1.0
BSS1510-3E		10	6 530	10 200	28	51	15.5	31	11	43	39	5.5	9.5	5.5	18 25	10	63	2.0	1.0
BSS1520-2E		20	5 660	8 700	32	55	16.5	33	13	51	43	5.5	9.5	5.5	20 27	15	81	2.8	1.4
BSS2005-3E	20	5	10 400	18 500	36	62	19	38	13	31	49	6.6	11	6.5	23.5 30.5	12	55	3.4	1.7
BSS2010-3E		10	10 200	18 600	36	62	19	38	13	45	49	6.6	11	6.5	23.5 30.5	12	69	3.2	1.6
BSS2020-2E		20	6 790	11 800	40	62	24	48	12	54	51	6.6	—	—	23.5 30.5	18	90	4.3	2.2
BSS2505-3E	25	5	11 500	23 500	40	62	24	48	12	32	51	6.6	—	—	23.5 30.5	12	56	4.4	2.2
BSS2510-4E		10	15 000	32 400	40	62	24	48	12	56	51	6.6	—	—	23.5 30.5	12	80	4.7	2.4
BSS2520-2E		20	7 650	14 800	40	62	24	48	12	54	51	6.6	—	—	23.5 30.5	20	94	3.9	2.0
BSS2525-2E		25	7 490	14 600	40	62	24	48	12	63	51	6.6	—	—	23.5 30.5	20	103	4.3	2.2

Notes: 1. Maximum operating temperature: 80°C (at outside diameter of ball nut)
2. Grease fitting attachment is done only on the outer side of the flange (see diagram).

Model No.	Shaft dia.	Lead	Basic load rating (N)		Ball nut dimensions											Seal dimensions	Total length with nut & seal	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)	
			Dynamic	Static	Dia.		Flange				Nut length	Bolt holes								Oil hole position
	<i>d</i>	<i>l</i>	<i>C_a</i>	<i>C_{0a}</i>	<i>D</i> ₁	<i>D</i> ₂	<i>A</i>	<i>G</i>	<i>H</i>	<i>B</i>	<i>L</i> _n	<i>W</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>T</i>	<i>M</i>	<i>L</i>		
HSS3205	32	5	21 800	56 000	57	58	85	32	42	13	89	71	6.6	11	6.5	33	9.5	108	10	5
HSS3210	32	10	54 500	110 000	73	74	108	41	53.5	15	160	90	9	14	8.5	45	14.5	189	43	22

Notes: 1. Maximum operating temperature: 60°C (at outside diameter of ball nut)

B-3-3.12 Equipped with "NSK K1™" Lubrication Unit

This product is being applied for a patent.

1. Features

NSK K1 is a new, efficient lubrication unit. Equipped with NSK K1, the ball screws demonstrate a superb performance as shown below.

● Long-term, maintenance-free usage

In mechanical environments where lubrication is difficult to apply, long-term running efficiency is maintained by using the NSK K1 in combination with grease.

[ex.] For automotive component processing lines, etc.

● Does not pollute the environment

A very small volume of grease combined with NSK K1 can provide sufficient lubrication in the environment where grease is undesirable as well as in the environment where high cleanliness is required.

[ex.] Food processing equipment, medical equipment, liquid crystal display/ semiconductor manufacturing equipment, etc.

● Good for environments where lubricant is washed away

When used with grease, life of the machine is prolonged even when the machine is washed entirely by water, or in an environment where the machine is exposed to rain or wind.

[ex.] Food processing equipment, housing/ construction machines, etc.

● Maintains efficiency in dusty environment

In environment where oil- and grease-absorbing dust is produced, long-term efficiency in lubrication and prevention from foreign inclusions are maintained by using the NSK K1 in combination with grease.

[ex.] Woodworking machines, etc.

● Comparative duration test of samples with and without NSK K1

Sample, testing conditions and test result are shown in Table 1 and Fig. 1.

Without lubricant, operation became impossible after running 8.6 km. With NSK K1 alone, it was possible to continue running exceeding 10 000 km.

NSK conducts various tests under different conditions. Please consult NSK.

Table 1 Sample and testing conditions

Ball screw	Shaft dia. 20 mm, lead 20 mm
Lubrication	Comparison with only NSK K1 against no lubrication
Speed	4 000 min ⁻¹ (80 m/min)
Stroke	600 mm

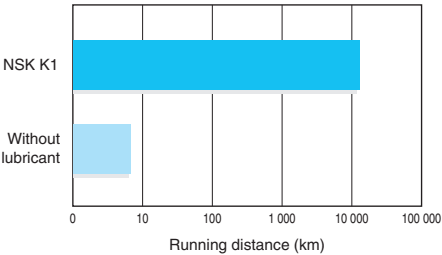


Fig. 1 Duration test results on ball screws without lubricant

2. Specifications

(1) Structure

The structure makes it possible to have a stable contact between the NSK K1 and outside of a ball screw with moderate force by a garter spring which fits onto outside of the NSK K1.

NSK K1 is installed between the ball screw nut and the labyrinth seal. The overall nut length is slightly longer than that of the standard ball screw.

Combination of NSK standard grease (factory-packed in the nut) and NSK K1 are standard specifications.



Fig. 2 NSK K1

(2) Accuracy grade and axial play

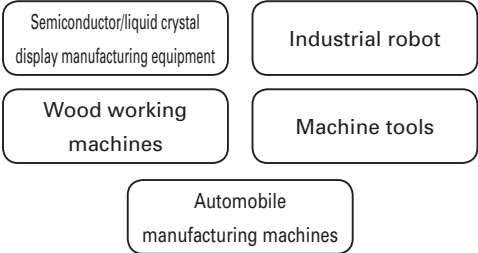
Accuracy grades, clearance and preload specifications remain unchanged from the existing products. There is a slight increase in torque due to the equipped NSK K1.

(3) Overall nut length after equipped with NSK K1™

The nut length becomes longer than that of standard ball screws after equipped with NSK K1. The nut length after equipped with K1 is shown in pages B581 to B584 for each type of ball recirculation. NSK K1 can be installed on other types not listed in the dimension table. Please consult with NSK if you require the K1 for a special ball nut.

(4) Application examples

Ball screws equipped with NSK K1 are maintenance-free for a long period of time. Its application is expanding in various industries.



◇Reference number for ball screw equipped with NSK K1

W1401 - P K1 - C3 Z10**

NSK K1 equipped type ball screw code

3. Precautions for use

Temperature range for use: Maximum temperature: 50°C
Momentary maximum temperature: 80°C

Chemicals that should not come to contact with K1:

Do not leave NSK K1 in organic solvent, white kerosene such as hexane, thinner which removes oil, and rust preventive oil which contains white kerosene.

Note: Water-type cutting oil, oil-type cutting oil, grease such as mineral-type AS2 and ester-type PS2 do not damage K1 Seal.

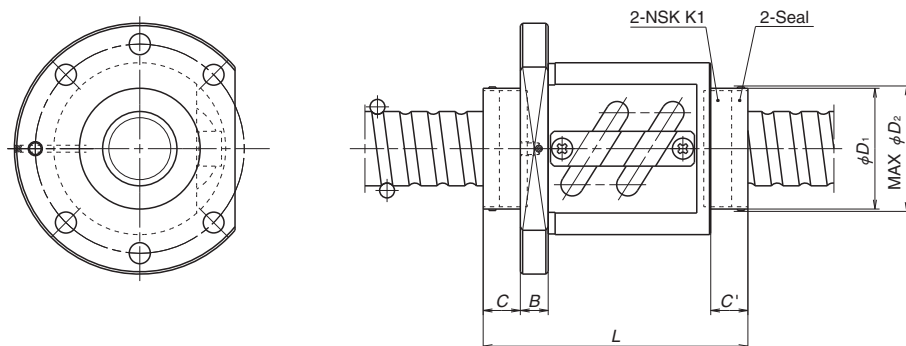
Note: NSK K1 is not applicable to the Compact FA series.

4. Example of reference number

A structure of "Reference number for ball screw" is as follows.

Note: "K1" is added at the end of "nut model code" and "Specifications number".

(1) Tube type



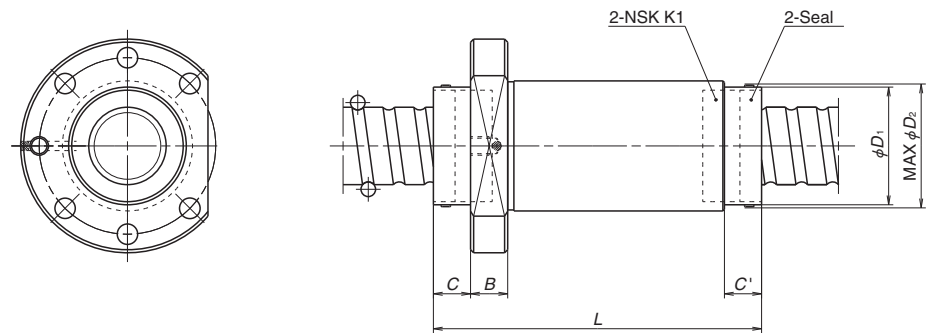
Tube type

Model No.	Screw shaft dia.	Lead	K1 installing dimension		Frange width	Overall length when equipped K1	K1 cap dimension	
	d		l	C			C'	B
PFT1004-2.5	10	4	14	15	10	61.5	$\phi 22$	MAX $\phi 24$
PFT1205-2.5	12	5	14	15	10	66	$\phi 26.5$	MAX $\phi 29$
LPFT1210-2.5		10		17		79		
PFT1405-2.5	14	5	14	15	10	65	$\phi 30$	MAX $\phi 32$
LPFT1510-2.5	15	10	14	15	10	76	$\phi 30$	MAX $\phi 32$
PFT1605-2.5	16	5	14	15	10	67	$\phi 32$	MAX $\phi 34$
PFT2005-5	20	5	14	14	10	81	$\phi 38$	MAX $\phi 40$
LPFT2010-2.5		10				78		
LPFT2020-1.5		20				84		
ZFT2505-10	25	5	16	17	10	115	$\phi 44$	MAX $\phi 46$
PFT2506-5		6	16	17	12	93	$\phi 44$	MAX $\phi 46$
PFT2510-2.5		10	16	17	12	89	$\phi 44$	MAX $\phi 46$
ZFT2510-3						103		
LPFT2520-2.5		20	12	12	12	109	$\phi 38$	MAX $\phi 40$
LPFT2525-1.5		25	12	12	12	98	$\phi 38$	MAX $\phi 40$
DFT2805-5	28	5	16	17	12	137	$\phi 48$	MAX $\phi 50$
PFT2810-2.5		10				90		
DFT2810-3						174		
PFT3206-5	32	6	16	17	12	93	$\phi 52$	MAX $\phi 54$
ZFT3206-10						129		
PFT3210-5						122		
ZFT3210-5		10	16	17	12	122	$\phi 52$	MAX $\phi 54$
DFT3210-5						212		
PFT3212-3		12	16	17	12	114	$\phi 52$	MAX $\phi 54$
DFT3212-3						198		
LPFT3225-2.5		25	12	12	12	122	$\phi 46$	MAX $\phi 48$
LPFT3232-1.5		32	12	12		109	$\phi 46$	MAX $\phi 48$

Notes: 1. NSK K1 can be installed in other types not listed in the table. Please consult NSK.
2. C, C' and L are the dimensions when one NSK K1 is equipped to both ends of the nut.

Model No.	Screw shaft dia.	Lead	K1 installing dimension		Frang width	Overall length when equipped K1	K1 cap dimension	
	<i>d</i>		<i>l</i>	<i>C</i>			<i>C'</i>	<i>B</i>
PFT3610-5	36	10	19	20	15	131	φ 56	MAX φ 58
DFT3610-5		19		221				
HZF3616-5		19		163				
HZF3620-3.5		19		146				
PFT4008-5	40	8	19	20	16	117	φ 62	MAX φ 64
ZFT4008-10		10	19	20		165	φ 62	MAX φ 64
DFT4010-7				19		222	φ 61	
DFT4010-5		12	19	20		144	φ 62	MAX φ 64
PFT4012-5				19		252	φ 61	
DFT4012-5		16	19	19		164	φ 61	MAX φ 64
HZF4016-5		20	19	19		189	φ 61	MAX φ 64
HZF4020-5		32	14	14		151	φ 54	MAX φ 56
LPFT4032-2.5		40	14	14		133	φ 54	MAX φ 56
LPFT4040-1.5								
DFT4510-5	45	10	19	19	16	222	φ 72	MAX φ 75
DFT4512-5		12			16	254		
HZF4520-5		20			18	190		
ZFT5010-10	50	10	19	20	18	194	φ 73	MAX φ 76
DFT5012-5		12		19		256		
ZFT5016-5		16		20		172		
DFT5016-5				19		300		
HZF5020-5		20		19		192		
HZF5025-5		25		19		221		
DFT5516-5	55	16	22	22	18	178	φ 81	MAX φ 87
HZF5520-5		20				198		MAX φ 81
HZF5525-5		25				227		MAX φ 81
DFT6316-5	63	16	22	22	18	322	φ 89	MAX φ 95
DFT6320-5		20				362		

(2) Deflector(bridge) type

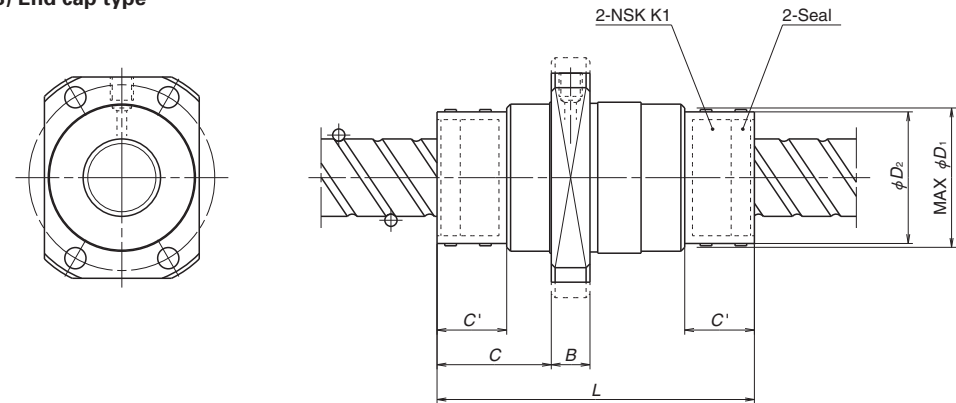


Deflector(bridge) type

Model No.	Screw shaft dia. <i>d</i>	Lead <i>l</i>	K1 installing dimension		Frang width <i>B</i>	Overall length when equipped K1 <i>L</i>	K1 cap dimension	
			<i>C</i>	<i>C'</i>			Cap dia. ϕD_1	Protruding dimension ϕD_2
ZFD2005-6	20	5	9	9	12	87	$\phi 32$	MAX $\phi 34$
ZFD2506-6	25	6	12	—	12	102	$\phi 38$	MAX $\phi 40$
ZFD2510-4		10		12	12	106		
ZFD3208-8	32	8	12	12	12	136	$\phi 46$	MAX $\phi 48$
ZFD3210-6		10			12	138		
ZFD3212-6		12			12	153		
ZFD4010-8	40	10	14	14	16	167	$\phi 54$	MAX $\phi 57$
ZFD4012-8		12			16	189		
ZFD5010-8	50	10	14	14	18	169	$\phi 64$	MAX $\phi 67$
ZFD5012-6		12			18	167		

Notes: 1. NSK K1 can be installed in other types not listed in the table. Please consult NSK.
2. *C*, *C'* and *L* are the dimensions when one NSK K1 is equipped to both ends of the nut.

(3) End cap type



End cap type

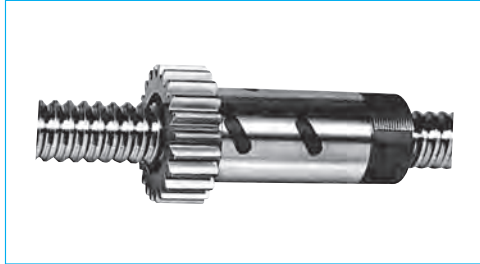
Model No.	Screw shaft dia. <i>d</i>	Lead <i>l</i>	K1 installing dimension		Frang width <i>B</i>	Overall length when equipped K1 <i>L</i>	K1 cap dimension	
			<i>C</i>	<i>C'</i>			Cap dia. ϕD_1	Protruding dimension ϕD_2
UPFC1520-1.5	15	20	29	18	10	81	$\phi 30$	MAX $\phi 32$
LPFC1616-3	16	16	28	18	10	74	$\phi 28$	MAX $\phi 30$
LPFC2020-3	20	20	29.5	18	10	82	$\phi 34$	MAX $\phi 36$
UPFC2040-1		40	29		10	77	$\phi 32$	MAX $\phi 34$
LPFC2525-3	25	25	34	21	12	97	$\phi 44$	MAX $\phi 46$
UPFC2550-1		50			12	92		
LPFC3232-3	32	32	37	21	12	112	$\phi 52$	MAX $\phi 54$
UPFC3264-1		64	36.5		12	104		
LPFC4040-3	40	40	43.5	24	15	133	$\phi 62$	MAX $\phi 65$
LPFC5050-3	50	50	45.5	24	20	155	$\phi 74$	MAX $\phi 77$

Notes: 1. NSK K1 can be installed in other types not listed in the table. Please consult NSK.
2. *C*, *C'* and *L* are the dimensions when one NSK K1 is equipped to both ends of the nut.

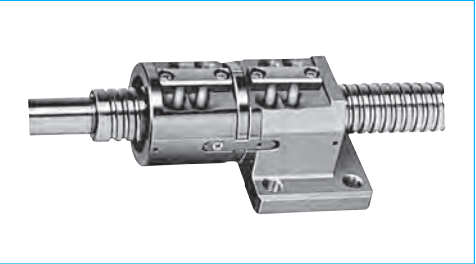
B-3-3.13 Special Ball Screws

In addition to the standard ball screws, NSK manufactures various types of ball screws in special shapes as shown below.

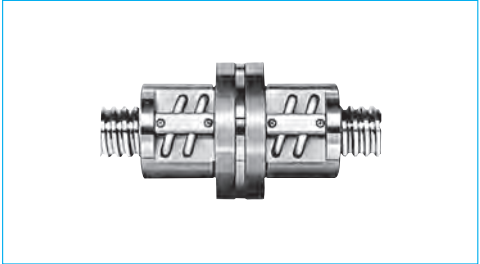
Thoroughly discuss with NSK the specifications before determining specifications and ordering ball screws in special shapes.



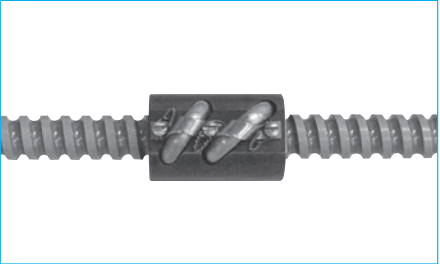
Nut with gear



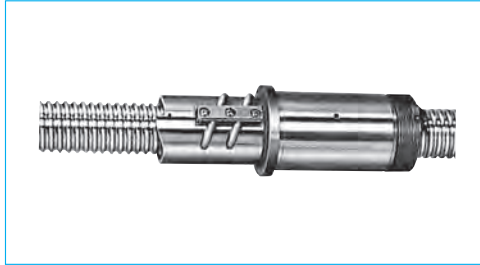
Double nut with flat mounting surface



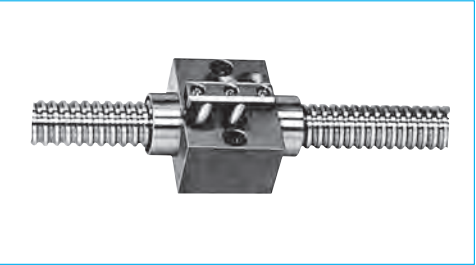
Flanged to flanged ball nut



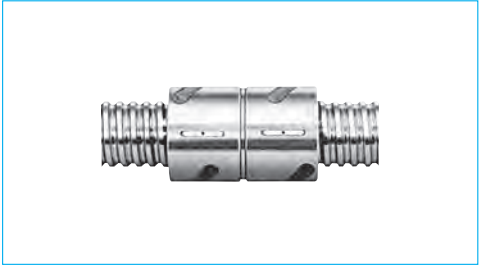
Ball screw for aircraft



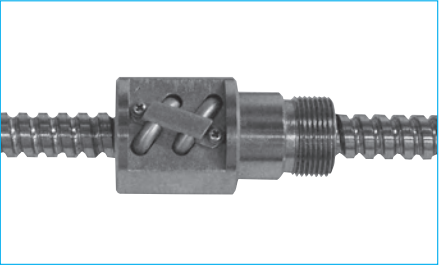
Lightly preloaded single nut with bearing seat



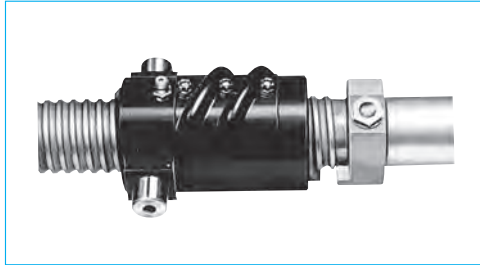
Lightly preloaded single nut with flat mounting surface



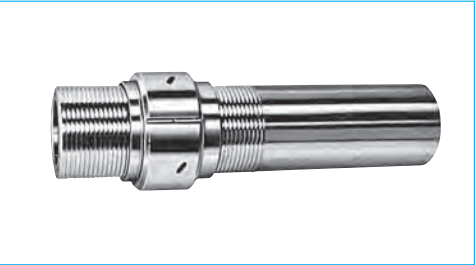
Cylindrical double nut



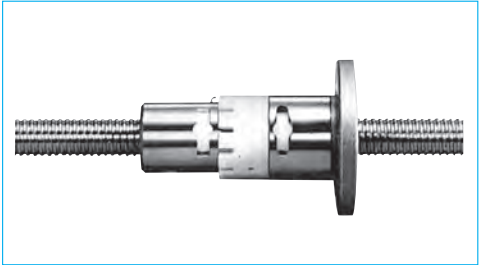
Ball screw for nuclear power plant



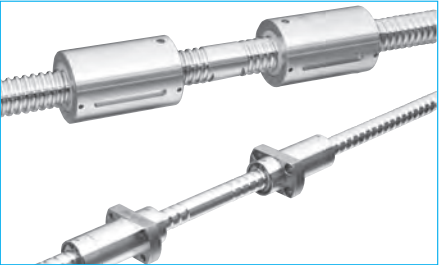
Nut with trunion



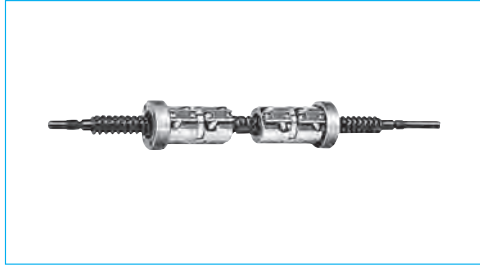
Hollow shaft, lightly preloaded single nut, with large shaft diameter and fine lead



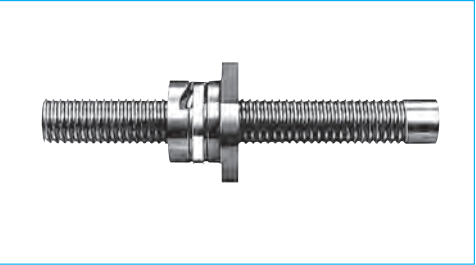
Spring preloaded ball screw



Right and left hand thread on each side of screw



Double nut with right and left turn thread on each side of screw shaft



Ceramic ball screw