B BLOCK

Ball Screw

B-1 Selection Guide to NSK Ball Screw

B-2 Technical Description of Ball Screws

B-3 Ball Screw Dimension Table

B1 -B36
B37 -B104
B105 -B582

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.

(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.

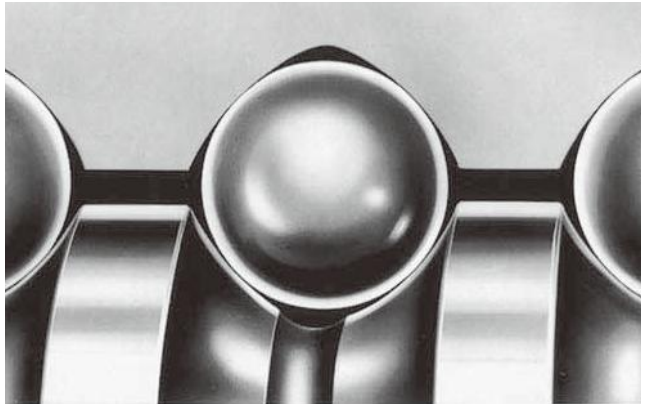


Fig. 1.1 Ball groove profile of NSK ball screw

(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.

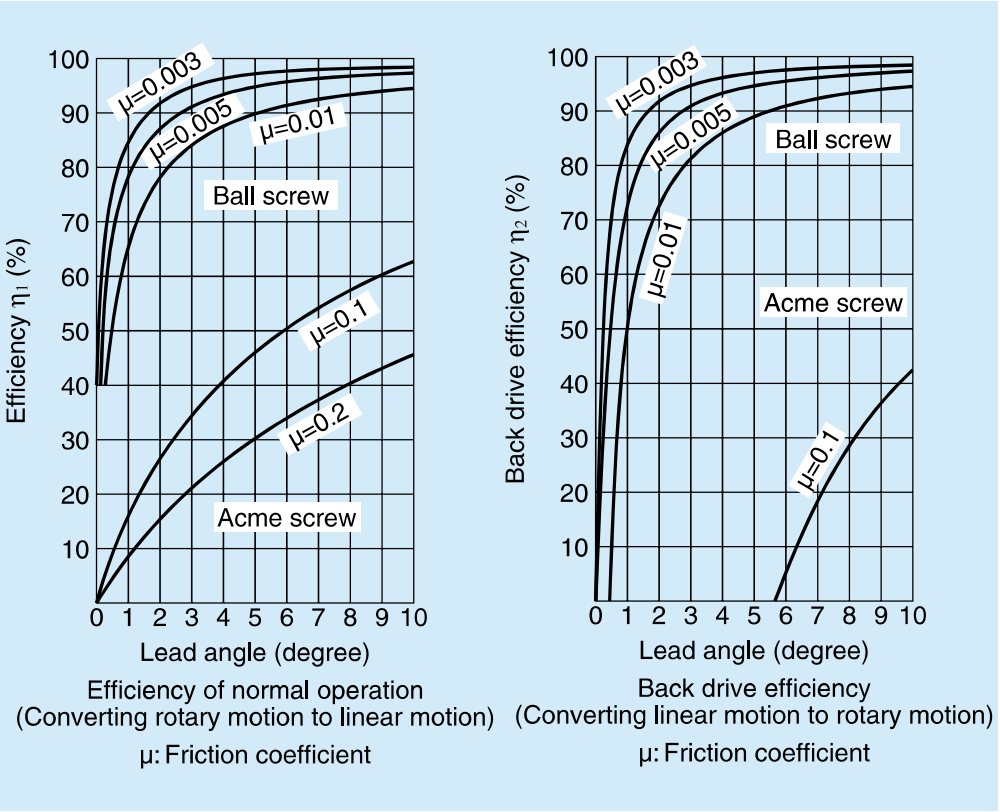


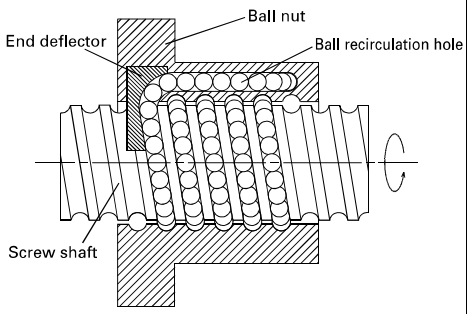
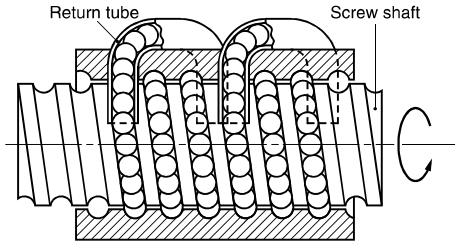
Fig. 1.2 Mechanical efficiency of ball screws

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.

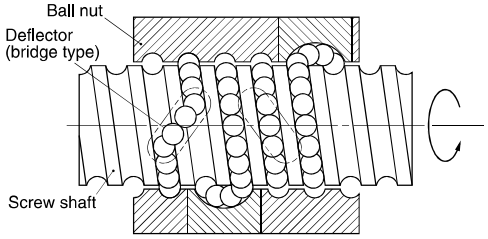
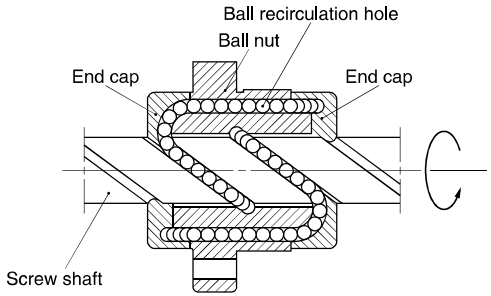
(1) Converting motion: Changing rotary motion to linear motion (normal operation); Changing linear motion to rotary motion efficiently (back-drive operation).
(2) Increasing power: A small torque is converted to a large thrust force.
(3) Positioning: Sets accurate position in linear motion.

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

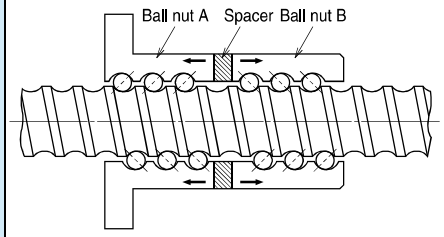
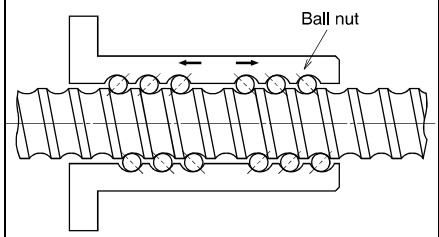
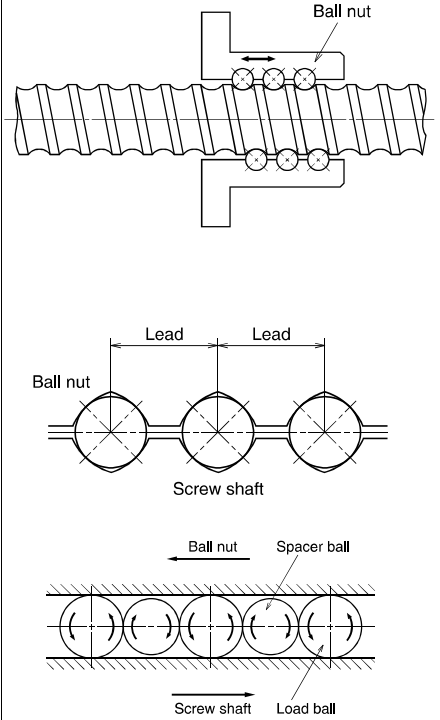
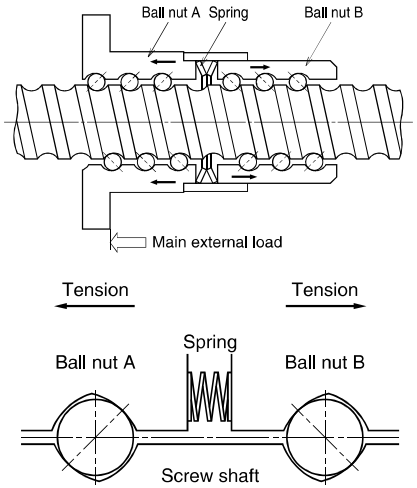
A ball recirculation system is categorically most important, as well as the preload system, to classify the structure of ball screw.
As shown in **Table 2.1**, four types of ball recirculation system are used for the NSK ball screws.

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

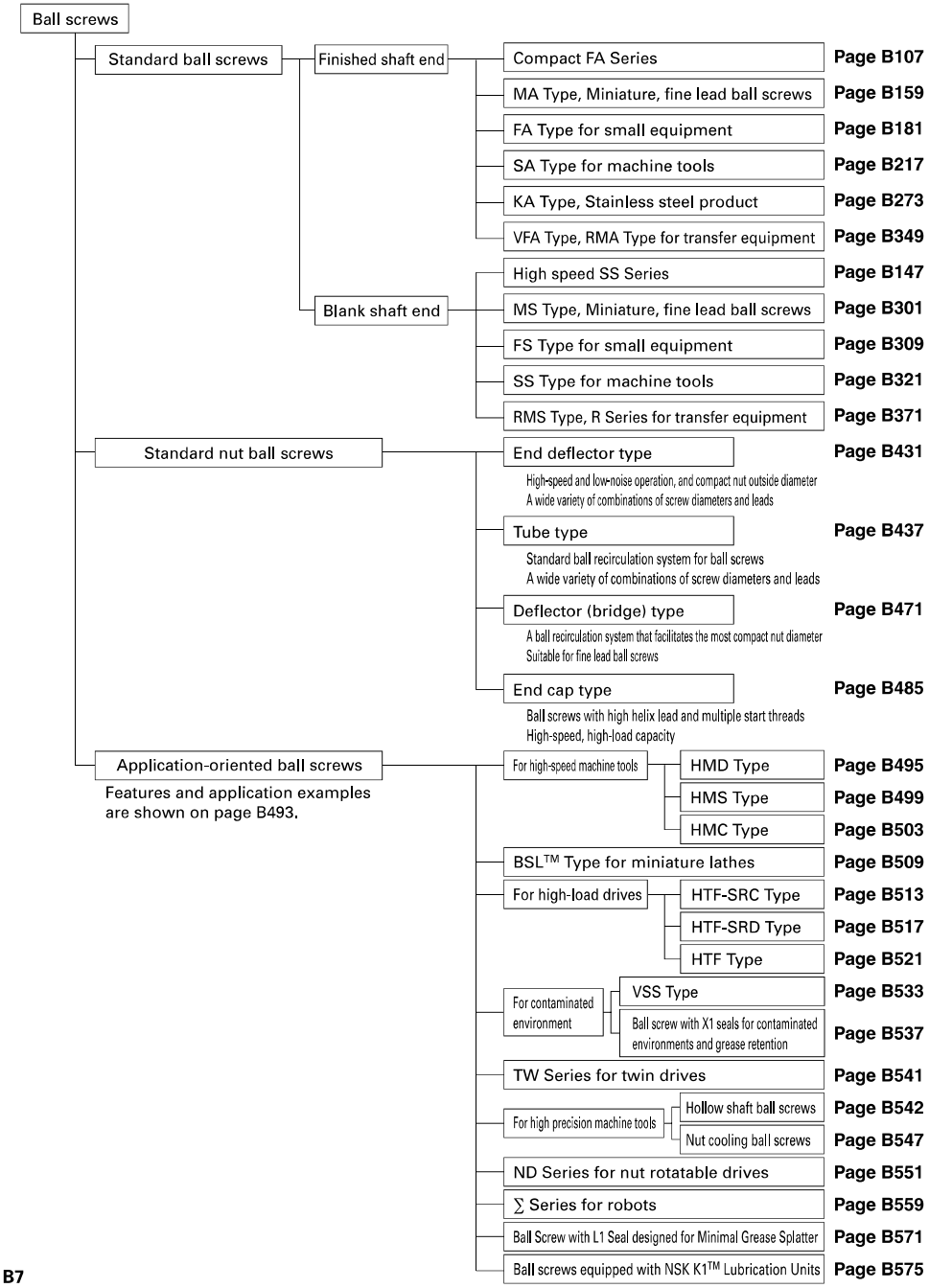
There are four systems to apply preload to NSK ball screws depending on the application.

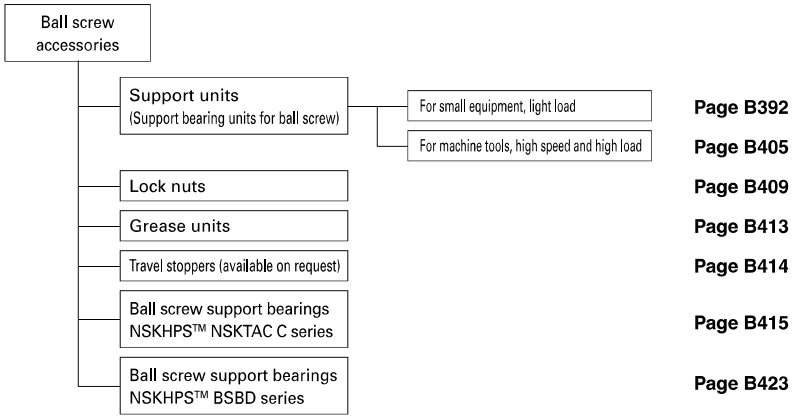
Table 2.2 Preload system for ball screws

Preload system	Double nut preload (D-Preload)	Offset preload (Z-Preload)	Oversize ball preload (P-Preload)	Spring preloaded double nut (J-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.	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	Long	Medium	Short	Long
Torque characteristics	○	○	○	◎
Rigidity	◎	◎	○	△

B-1-3 Ball Screw Series

B-1-3.1 Ball Screw Classification





Lead classification

Classification	Lead ratio K = lead *l* / shaft diameterd
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

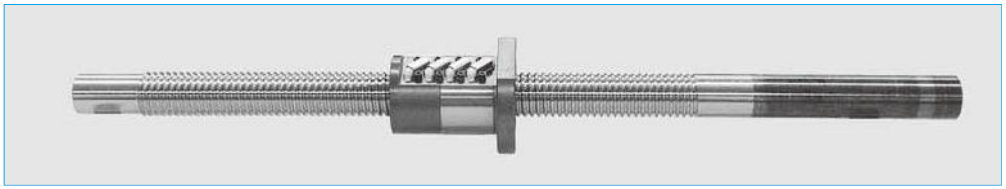


Fig. 3.2 Blank shaft end high-speed SS Series Page B147

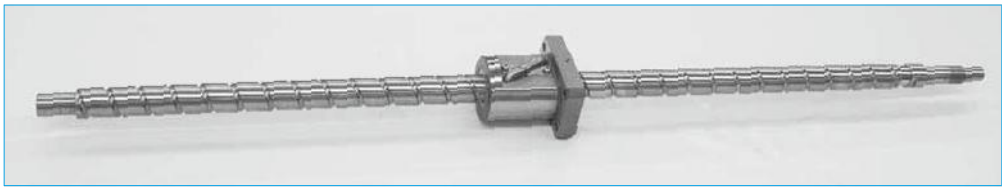


Fig. 3.3 Finished shaft end MA type, FA type and SA type Page B157

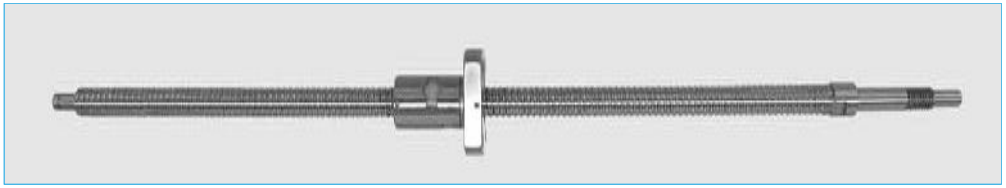


Fig. 3.4 Finished shaft end KA type Page B273

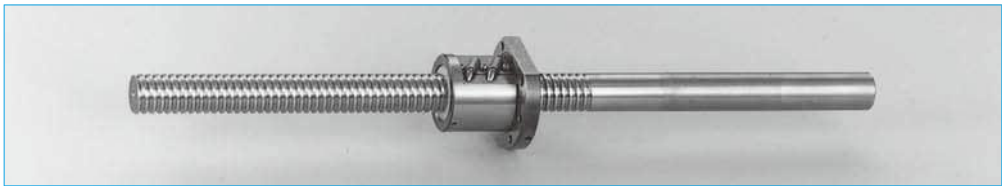


Fig. 3.5 Blank shaft end MS type, FS type and SS type Page B299

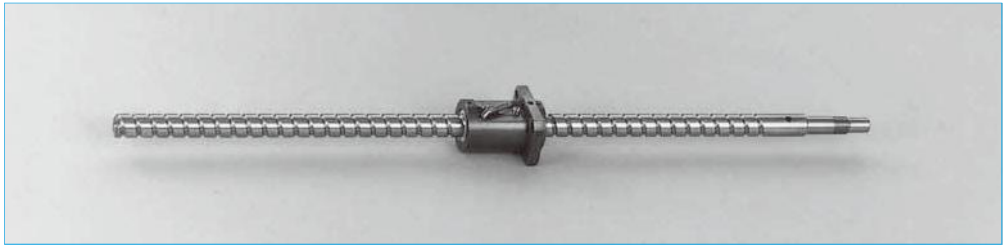


Fig. 3.6 Finished shaft end VFA type for transfer equipment Page B349

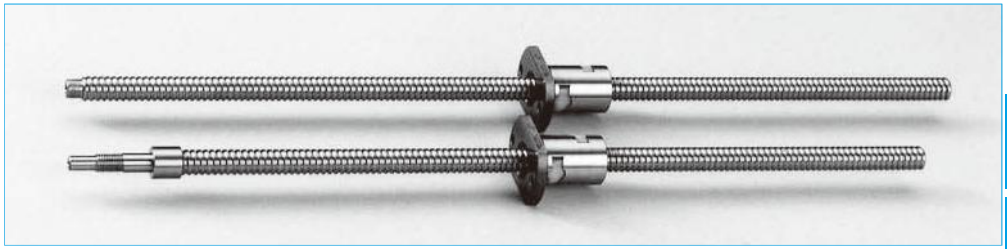


Fig. 3.7 Finished shaft end RMA type and blank shaft end RMS type for transfer equipment Page B349

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

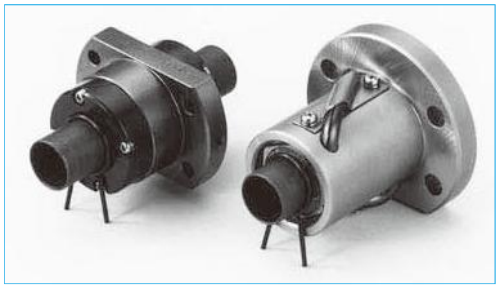


Fig. 3.9 R series nut assembly for transfer equipment Page B349

●Standard nut ball screws

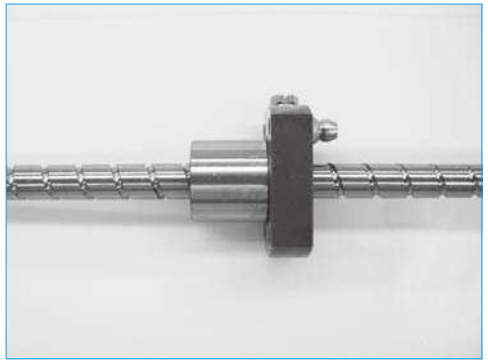


Fig. 3.10 End deflector type Page B431

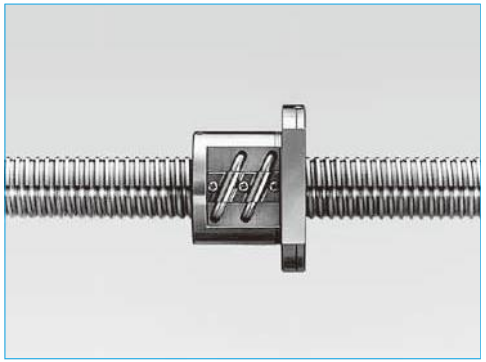


Fig. 3.11 Tube type Page B437

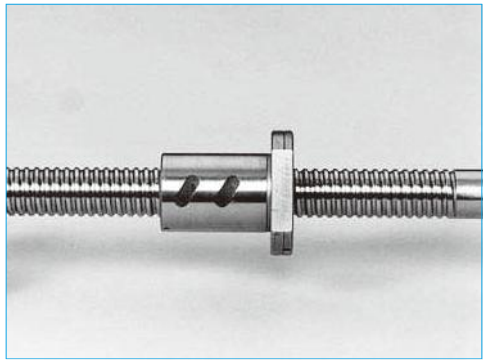


Fig. 3.12 Deflector (bridge) type Page B471

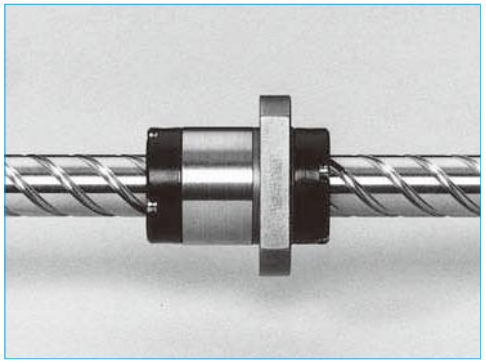


Fig. 3.13 End cap type Page B485

●Application-oriented ball screws

Fig. 3.14 HMD type for high-speed machine tools Page B495

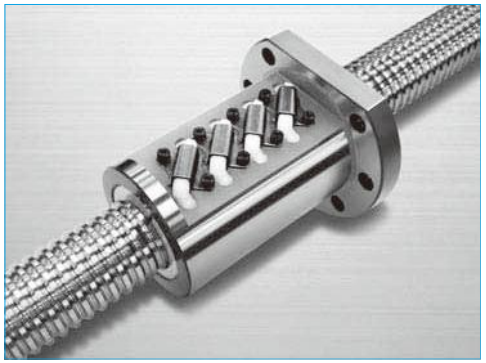


Fig. 3.15 HMS type for high-speed machine tools Page B499

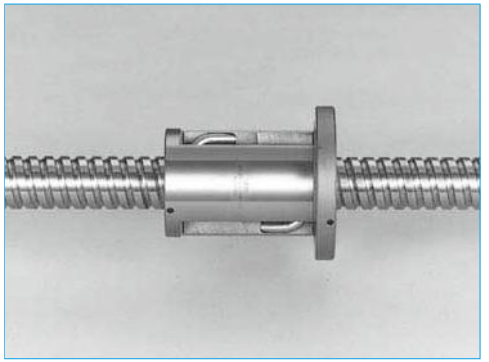


Fig. 3.16 HMC type for high-speed machine tools Page B503

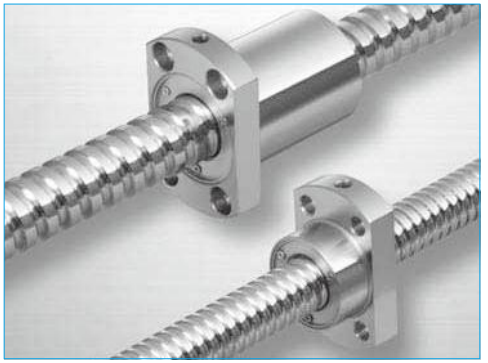


Fig. 3.17 BSL™ type for miniature lathes Page B509

Fig. 3.18 HTF-SRC type for high-load drives Page B513

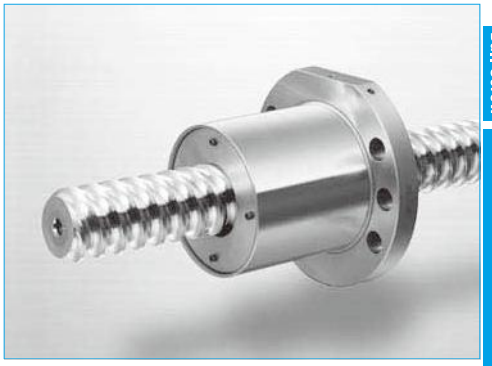


Fig. 3.19 HTF-SRD type for high-load drives Page B517

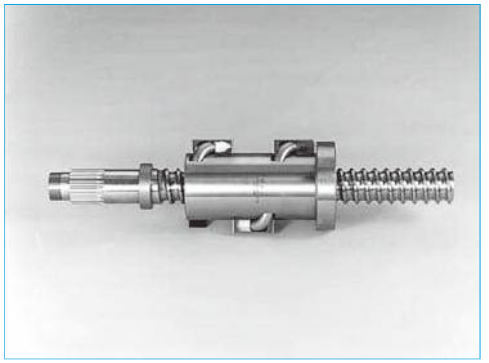


Fig. 3.20 HTF type for high-load drives Page B521

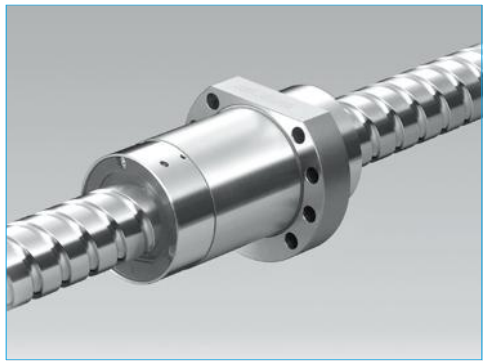


Fig. 3.21 VSS type for contaminated environments Page B533

Fig. 3.22 Ball screw with X1 seals for contaminated environments and grease retention Page B537

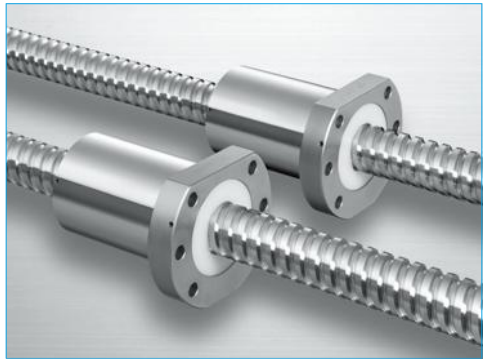


Fig. 3.23 TW series for twin-drive systems Page B541

Fig. 3.24 Nut cooling ball screws for high precision machine tools Page B547

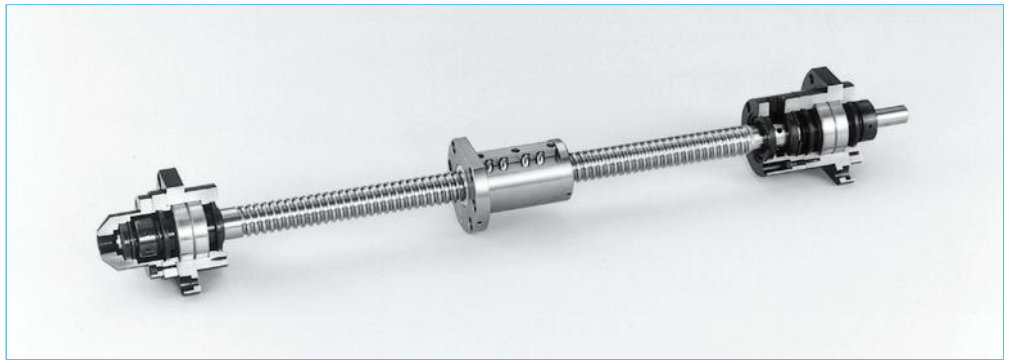


Fig. 3.25 Hollow shaft ball screws for high-precision machine tools Page B542

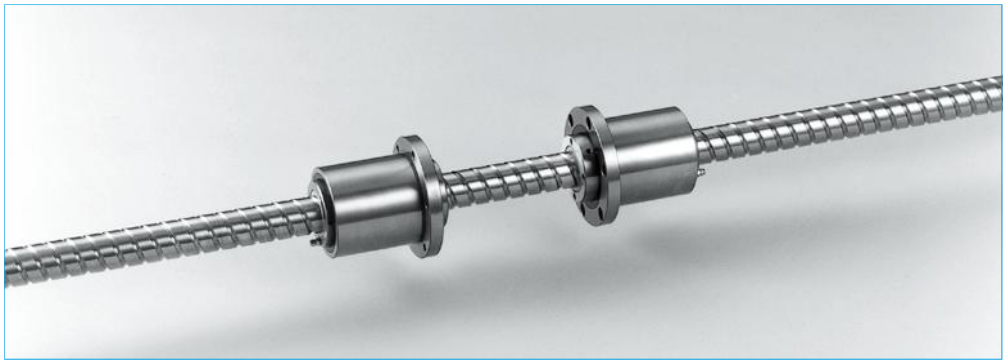


Fig. 3.26 ND series for nut-rotatable drives Page B551

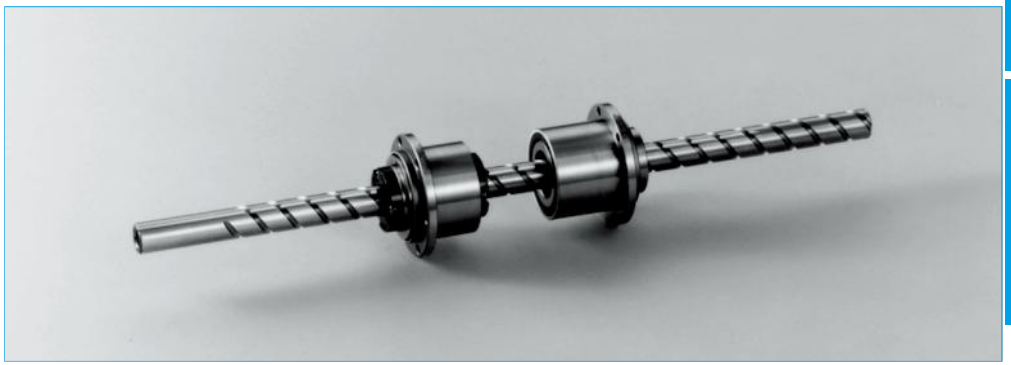


Fig. 3.27 Σ series for robots Page B559

Fig. 3.28 Ball Screw with L1 Seal designed for Minimal Grease Splatter Page B571

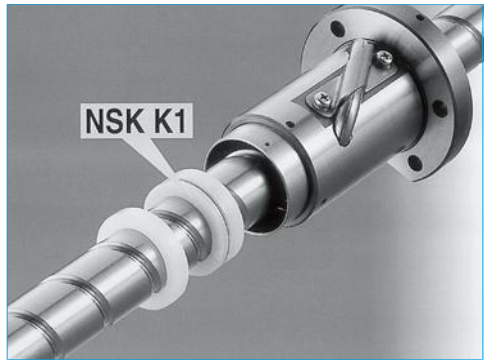


Fig. 3.29 Ball screws equipped with NSK K1™ lubrication units Page B575

(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. 3.31 Support kits for RMA and RMS types **Page B401**

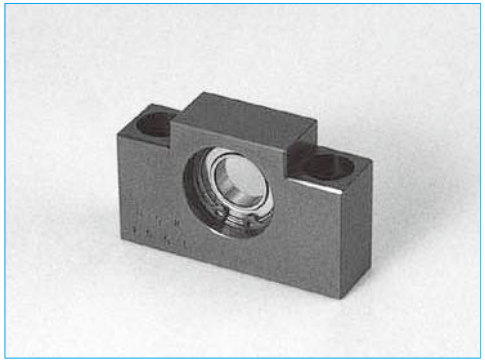


Fig. 3.32 Support unit for VFA type **Page B402**
(simple support side)

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

Fig. 3.34 Lock nuts for light load **Page B409**

Fig. 3.35 Lock nuts for high load **Page B410**

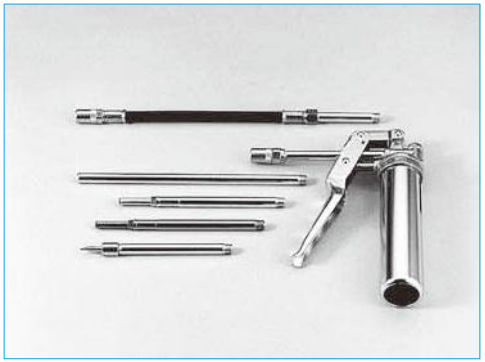


Fig. 3.36 NSK hand grease pump unit **Page D19**

Fig. 3.37 NSK grease **Page B413, D19**

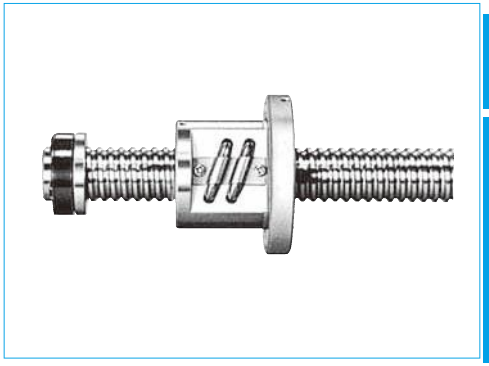


Fig. 3.38 Travel stoppers **Page B414**
(by order)

Fig. 3.39 Ball screw support bearings NSKHPS™ NSKTAC C series **Page B415**

Fig. 3.40 Ball screw support bearings NSKHPS™ BSBD series **Page B423**

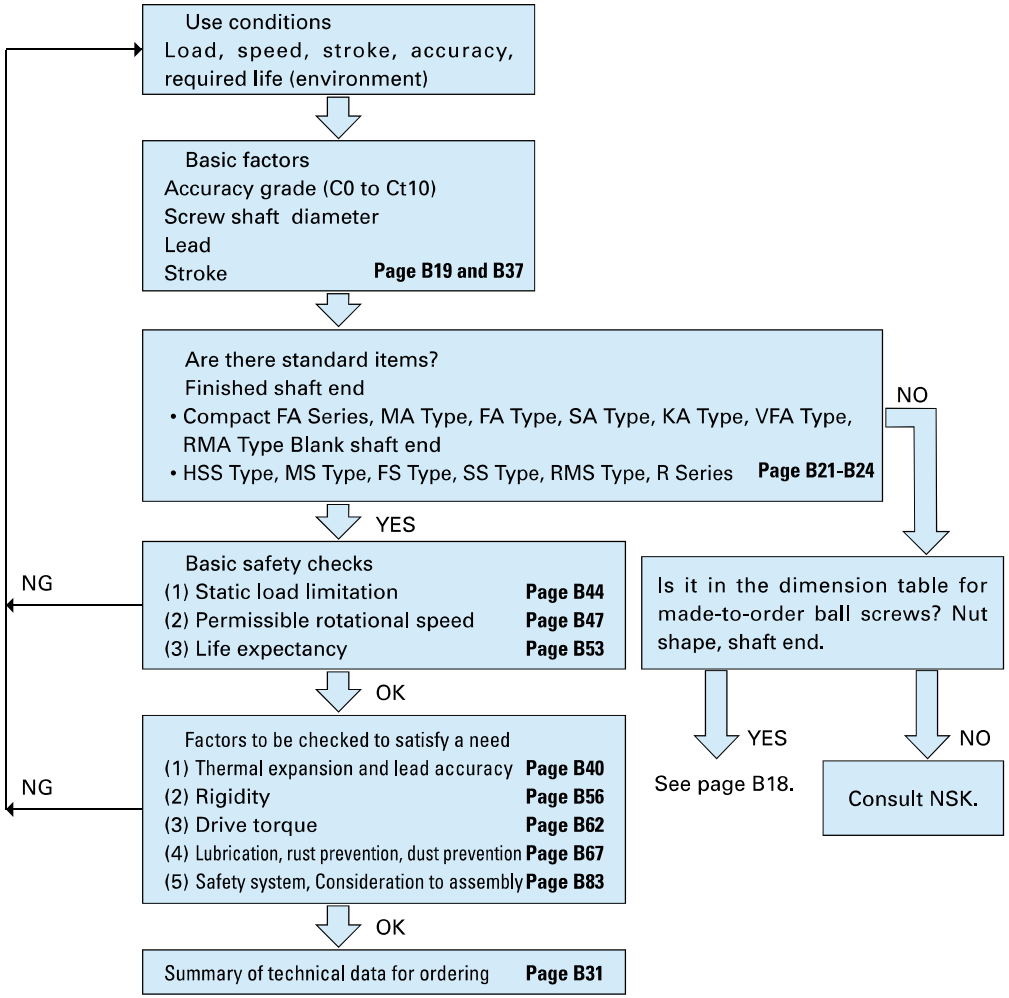
B-1-4 Procedures to Select Ball Screw

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.

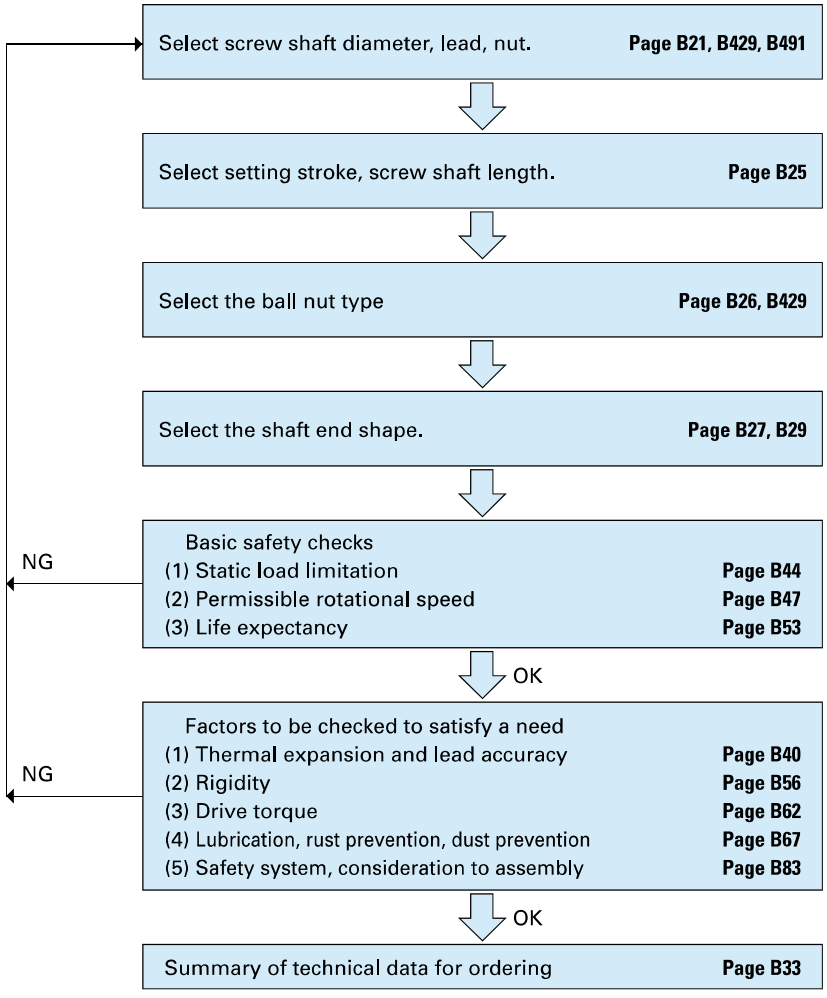
(1) Standard ball screw

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 presss	Laser cutting machines		Woodworking 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	General industrial machines, Machines for specific use	Semiconductor/associated industry						Industrial robots						Steel mills equipment	Plastic injection molding machines	Three-dimensional coordinate measuring machines	Office machines	Image processing equipment	Nuclear power		Aircrafts
		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	Mechanical snubbers	
								Assembly	other purposes	Assembly	other purposes										
Accuracy grade C0		○			○											○		○			
C1		◎		◎	◎		○									◎		◎			
C2				○	◎	○	○	○								○					
C3	○		○			○	◎	○		○		○							○		○
C5	◎		○			◎	○	◎	○	◎	○	○			○		○		◎		◎
C7	◎		◎					○	◎	○	◎	◎	○	◎			◎		○	◎	
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* 0 mm (Preload)	*T* 0.005 mm or less	*S* 0.020 mm or less	*N* 0.050 mm or less	*L* 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	80	100	80	100	—
8 – 10	250	200	250	300	—
12 – 16	500	400	500	600	700
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.

B-1-4.4 Screw Shaft Diameter, Lead, and Stroke

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.

(1) Standard ball screw

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				●		●		●		●		●	
	30			●		●		●		●		●		
14	5			○	○		○	△	○		○		△	○
	8			○	○	○	○	○	○	○	○△	○	○	○
15	5			●	●		●		●				●	
	10			●○	○	●○	○	●○△✓	○	●○	○	●○△✓	○	●○
	20			●○	○	●○	○	●○✓	○△	●○	○	●○✓	○△	●○
	30				●		●		●		●		●	
16	2		○	○	○	○△		○	△					
	2.5		○	○	○	○△		○	△					
	5			○	○	○		○		○	△			○
	16			○	○	○	○	○	○	○	○	○△	○	○
	32							○				○		
20	4				○	○	△	○		○	△	○		○
	5				●○	●○△		●○		●○△		●○		●△
	10					●○		●○		●○		●○		●○
	20					○		○	●	○	●	○	●	○
	30					●		●		●		●		●
	40										●○		●	
	60										●		●	
25	4					○	△	○		○		○	△	
	5				●○△	●○△		●○△		●○△		●○△		○
	6							○△				○		
	10						○	△	●		●○	△	●	△
	20											●		●
	25												●	
	30												●	
	50												●	
28	5				○	○	○	○△	○	○	○	○△		
	6						○	○△			○	○△		
32	5				○	○	○	○▲△	○	○	○	○▲△	○	○
	6						○	○			○	○△		
	8						○				○	△		
	10				○		○	▲△	○△		○	▲△	○△	
	25													
	32													
36	10						○		○		○	△	○△	
40	5						○				○	△		
	8					○				●			△	○
	10						○		○	▲	○	△	○△	
	12										○		○	
	16													
	20													
45	10												○	
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

Shaft dia.	Lead	Stroke												
		– 700	– 750	– 800	– 850	– 900	– 950	– 1 100	– 1 200	– 1 300	– 1 400	– 1 500	– 1 700	– 2 100	– 3 000
15	10	●	○	△											
	20	●	●○		●○△✓	△		●○△							
	30	●	●○	●	●○✓	●		●○△							
16	2							●							
	2.5														
	5				○	△									
	16		○		○			○△							
	32				○	△				○△					
20	4		△												
	5		●○		●○		△	●○	○	●○△					
	10		●○		●○△		○	●○	○	●○△					
	20	●	○	●	○	●	○△	●○	○	●		○△	●		
	30		●		●			●		●					
	40	●		●		●○		●○△		●○			●○△	●	
	60	●		●		●		●		●			●	●	
25	4		○					△							
	5		●○△		●△		○	●	○△						
	6		○△						○△						
	10	●○	△	●		●○	△	●○△			○	△	●		
	20	○	●		●	○		●○		●○△		○	●○	●○△	
	25	●○		●○		●○		●○		●○△		○	●○	●○△	
	30	●		●		●		●		●			●	●	
	50	●		●○		●		●○		●		△	●○	●○△	
28	5	○	○△			○	○	○	○△						
	6	○	△			○		○	△						
32	5	○	○△		▲△	○	○	○▲	○△		○▲	○△	△		
	6	○	○			○	○△	○	○		○	○△			
	8	○				○	△				○	△			
	10	○		○	△	○▲△		○		○▲△	○		○▲△		
	25							○					○△	○	○△
	32							○					○△	○	○△
36	10			○	▲△	○		△	○	○			○△	△	
40	5	○				○	△	○				○	△		
	8				○			○△				○	△		
	10	○		○	△	○▲△		○		○△	○	○▲	○△		○▲△
	12			○△	▲△	○△			○	○	▲△	△	○		○▲△
	16					▲					▲	▲			▲
	20				▲						▲				▲
45	10					○▲△				○		▲△	○		○▲△
50	10	○			○△	○▲△		○		▲	○△		▲	○△	○▲△
	12				▲										▲

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 B491.

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

Screw shaft diameter \ 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							

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

Screw shaft diameter \ Accuracy grade	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≥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**)

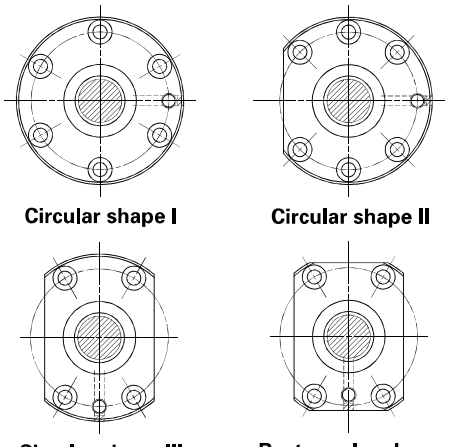


Fig. 4.1 Flange shape

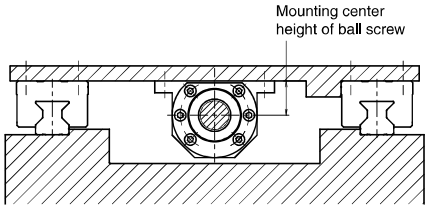


Fig. 4.2 Installation example

(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.

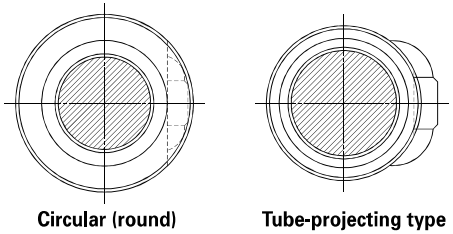


Fig. 4.3 Shape of the cross section of nut

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.

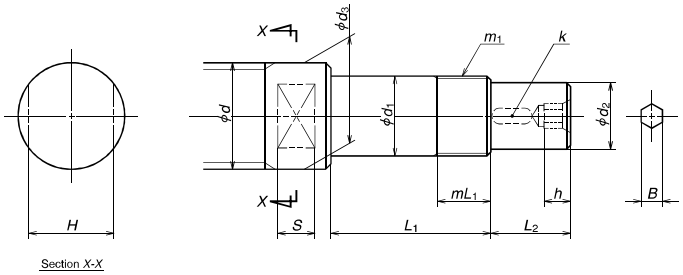


Fig. 4.4 Configuration of standard shaft end (drive side)

Table 4.9 Dimensions of shaft ends (drive side)

Unit: mm

Screw shaft diameter d	Bearing journal		Thread		Drive section			Seal section	Hexagon hole		Wrench flats		Support unit Reference No.	
	Outside diameter d_1	Length L_1	Nominal spec. m_1	Length mL_1	Outside diameter d_2	Length L_2	Key width k	Outside diameter d_3	Width across flats B	Depth h	Width across flats H	Length S		
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.

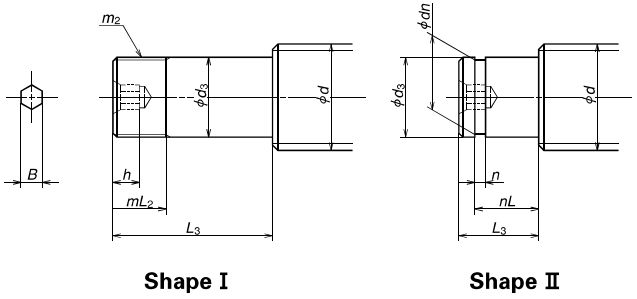


Fig. 4.5 Standard shaft end configuration (opposite to the drive side)

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 Reference No. Numbers in parentheses are bearing reference number.	
		Outside diameter d_3	Length L_3	Nominal spec. m_2	Length mL_2	Width n	Groove diameter dn	Groove position nL	Width across flats B	Depth h		
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	
25	Ⅱ	20	19	—	—	1.35	19	15.35	6	8	WBK20S-01	
	Ⅰ	20	53	M20×1	16	—	—	—	6	8	WBK20-01	WBK20-11
	Ⅰ	20	81	M20×1	23	—	—	—	6	8	WBK20DF-31H	
28	Ⅱ	20	19	—	—	1.35	19	15.35	6	8	WBK20S-01	
	Ⅰ	20	53	M20×1	16	—	—	—	6	8	WBK20-01	WBK20-11
	Ⅰ	20	81	M20×1	23	—	—	—	6	8	WBK20DF-31H	
32	Ⅱ	25	20	—	—	1.35	23.9	16.35	8	10	WBK25S-01W	
	Ⅰ	25	62	M25×1.5	20	—	—	—	8	10	WBK25-01W	WBK25-11
	Ⅰ	25	89	M25×1.5	26	—	—	—	8	10	WBK25DF-31H	
36	Ⅱ	25	20	—	—	1.35	23.9	16.35	10	12	(6205)	
	Ⅰ	25	89	M25×1.5	26	—	—	—	10	12	WBK25DF-31H	
40	Ⅱ	30	22	—	—	1.75	28.6	17.75	10	12	(6206)	
	Ⅰ	30	89	M30×1.5	26	—	—	—	10	12	WBK30DF-31H	
45	Ⅱ	35	25	—	—	1.75	33	18.75	12	14	(6207)	
	Ⅰ	35	92	M35×1.5	30	—	—	—	12	14	WBK35DF-31H	
50	Ⅱ	40	25	—	—	1.95	38	19.95	14	18	(6208)	
	Ⅰ	40	92	M40×1.5	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.

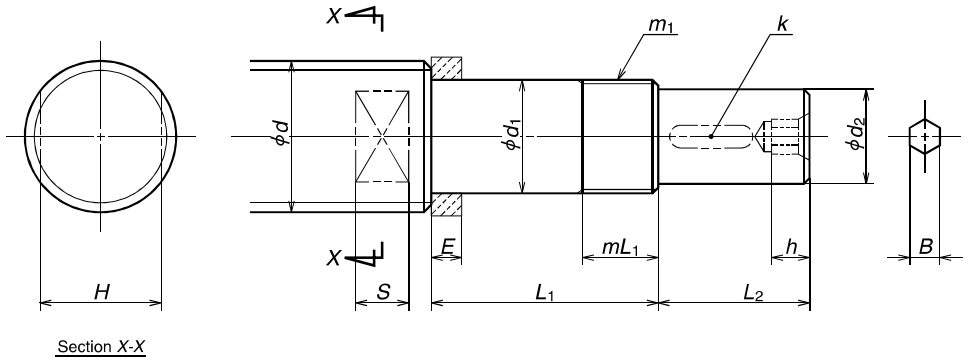


Fig. 4.6 R Series shaft end (drive side)

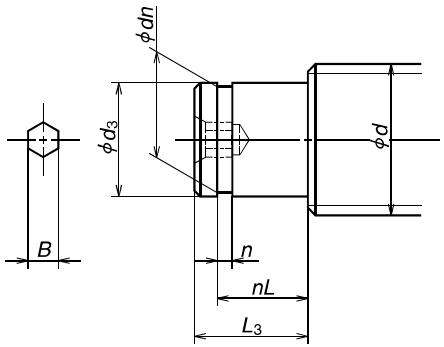


Fig. 4.7 Shaft end configuration of R Series (opposite to the drive side)

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

Unit: mm

Screw shaft diameter	Bearing journal		Thread for lock nut		Spacer	Drive section			Hexagonal hole		Wrench flat		Support unit	
	Outside diameter	Length	Nominal spec	Length	Width	Outside diameter	Length	Key width	Width across flats	Depth	Width across flats	Length	Reference No.	
d	d_1	L_1	m_1	mL_1	*E*	d_2	L_2	*k*	*B*	*h*	*H*	*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)".

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

Unit: mm

Screw shaft diameter	Bearing journal		Retaining ring groove			Hexagonal hole		Support unit
	Outside diameter	Length	Width	Groove diameter	Groove position	Width across flats	Depth	Numbers in parentheses are bearing reference numbers.
d	d_3	L_3	*n*	*dn*	*nL*	*B*	*h*	
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	6	WBK12S-01(6000)
15	10	12	1.15	9.6	9.15	4	6	WBK12S-01(6000)
16	10	12	1.15	9.6	9.15	4	6	WBK12S-01(6000)
18	10	12	1.15	9.6	9.15	4	6	WBK12S-01(6000)
20	15	13	1.15	14.3	10.15	5	7	WBK15S-01(6002)
25	17	16	1.15	16.2	13.15	6	8	WBK17S-01(6203)
	20	19	1.35	19	15.35	6	8	WBK20S-01(6204)
28	20	19	1.35	19	15.35	6	8	WBK20S-01(6204)
32	25	20	1.35	23.9	16.35	8	10	WBK25S-01W(6205)
36	25	20	1.35	23.9	16.35	8	10	WBK25S-01W(6205)
40	30	22	1.75	28.6	17.75	10	12	(6206)
45	35	23	1.75	33	18.75	12	14	(6207)
50	35	23	1.75	33	18.75	12	14	(6207)

B-1-5 When Placing Orders

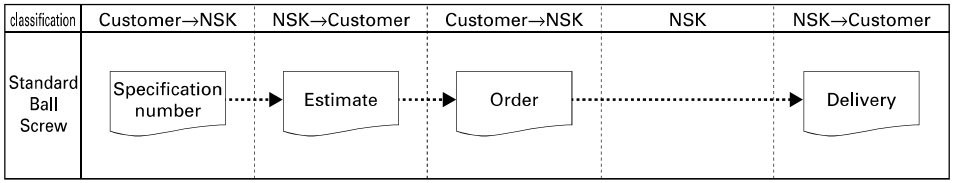
To avoid confusion, please use "reference number" or "specification number" when inquiring about desired ball screw specifications.

◇ **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.)

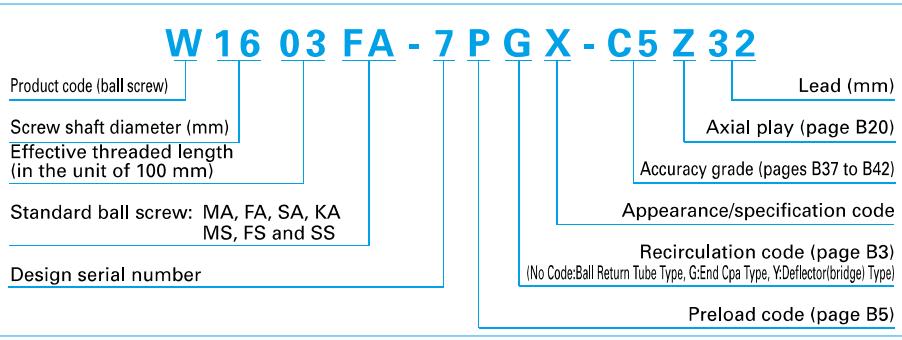
B-1-5.1 When Ordering Standard Ball Screws

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.

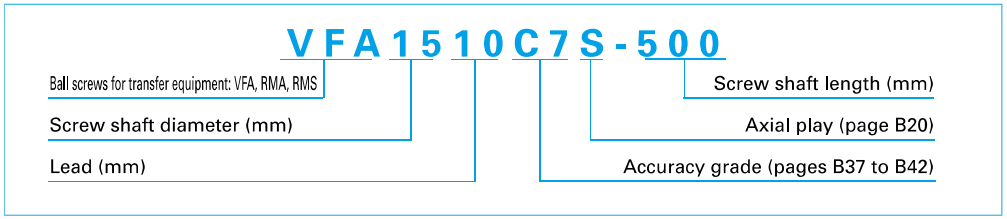


(1) Example of reference number for Standard ball screws Compact FA Series and high-speed SS Series

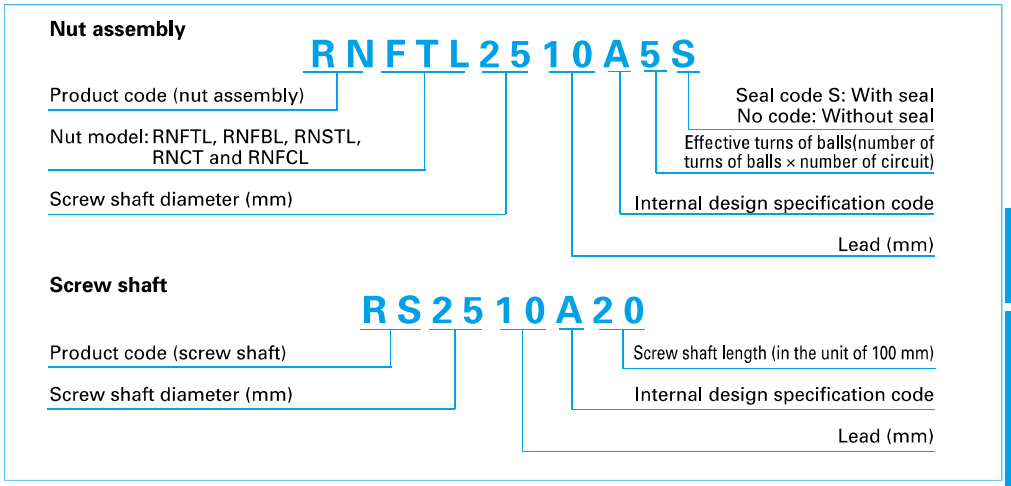
(2) Example of reference number of Standard ball screws



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

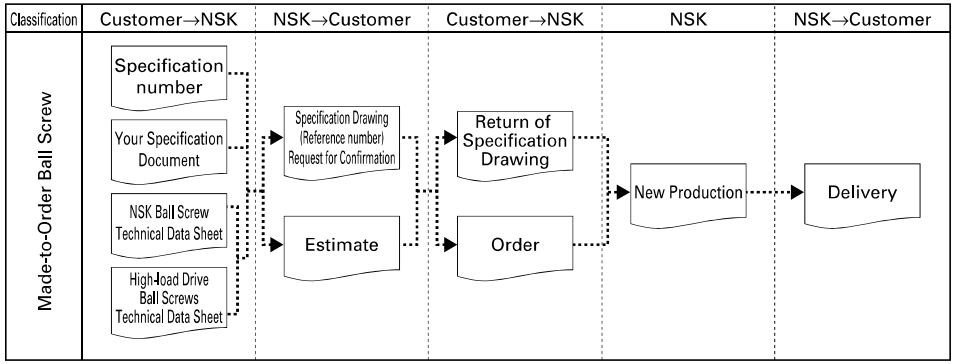


(4) Example of reference number of R series ball screws for transfer equipment

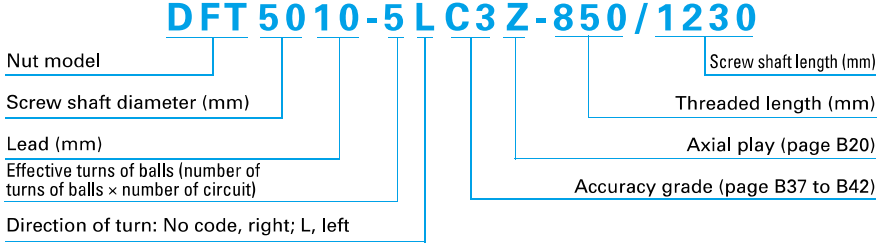


B-1-5.2 When Ordering Made-to-Order Ball Screws

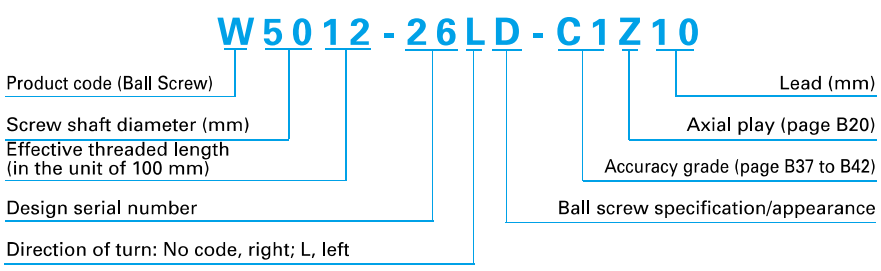
If you would like to discuss technical points regarding specifications, use the NSK ball screw technical data sheet as an aid (page B36). For high-load drive ball screws, use the technical sheet on page B531 for NSK high-load drive ball screw.
The following is the flow chart for ordering made-to-order ball screws.



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



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



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 _____ Date: Day Month Year

Address _____ Telephone _____

Person in charge _____ Section _____

Machine which uses the ball screw *Machining center Model MC-* Application *Table left/right movement (X axis)*

Drawing/rough sketch attached? Yes (No)

Use conditions

	Axial load	Rotational speed	Operating hours		
Maximum load	*9 000* N	*20* min^{-1}	*15* %	Operating conditions	(Shaft rotation - Moving nut) (Normal operation) / Shaft rotation - Moving shaft / Back drive operation / Nut rotation - Moving nut / Nut rotation - Moving shaft / Oscillation
Load in normal use	*4 000* N	*360* min^{-1}	*60* %		
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: *1 μm*)
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 Ball Screw Technical Data Sheet (example)

(2) Made-to-order ball screw

Company name _____ Date: Day Month Year

Address _____ Telephone _____

Person in charge _____ Section _____

Machine which uses the ball screw _____ Application _____

Drawing/rough sketch attached? Yes No

Use conditions

	Axial load	Rotational speed	Operating hours		
Maximum load	N	min^{-1}	%	Operating conditions	Shaft rotation - Moving nut / Normal operation / Shaft rotation - Moving shaft / Back drive operation / Nut rotation - Moving nut / Nut rotation - Moving shaft / Oscillation
Load in normal use	N	min^{-1}	%		
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*, υ_u, υ_{300}, and $\upsilon_{2\pi}$.
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.

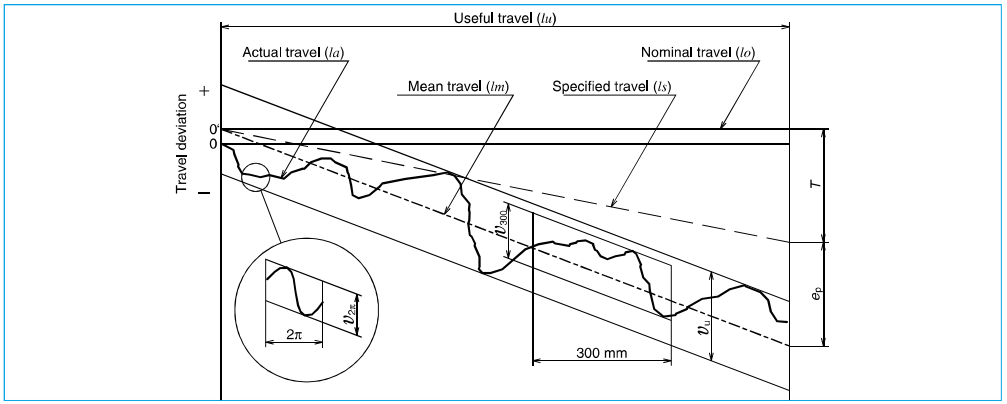


Fig. 1.1 Definition of lead accuracy

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	υ_u υ_{300} $\upsilon_{2\pi}$	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 (±*ep*) and travel variation (υ_u) of the positioning (*C* type) ball screws

Unit: μm

Accuracy grade			C0		C1		C2		C3		C5	
	over	or less	±*ep*	υ_u	±*ep*	υ_u	±*ep*	υ_u	±*ep*	υ_u	±*ep*	υ_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 (υ_{300}) and one revolution ($\upsilon_{2\pi}$) of the positioning (*C* type) ball screws

Unit: μm

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

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

Table 1.4 Travel variation (υ_{300}) relative to 300 mm of the transportation (*C*t type) ball screws

Unit: μm

Accuracy grade	Ct7	Ct10
υ_{300}	52	210

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

$$ep = \frac{2 \cdot lu}{300} \cdot \upsilon_{300}$$

*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

Stroke + nut length + margin =1 000 + 193 + 100

=1 293 (mm)···→1 300 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 ··· ±0.054/1 250 – 1 600

C3 ··· ±0.029/1 250 – 1 600

(3) Determine lead accuracy

Positioning accuracy is: ±ep ＜±0.035/1 000 mm

Accuracy grade: C3 grade $\pm ep$ = 0.029/length of thread (1 300 mm)

υ_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.

$\Delta L_\theta = \rho \cdot \theta \cdot L$ (mm) ····· 1)

In this formula:

ΔL_θ : Thermal expansion (mm)

ρ : Thermal expansion coefficient (12.0×10^{-6} °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 B542 to B550).
- 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.

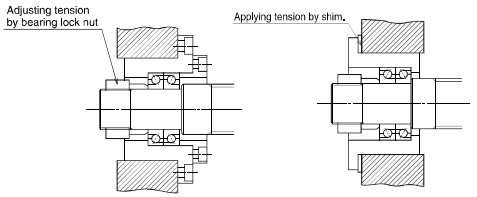


Fig. 1.2 Bearing structure to provide pre-tension

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).

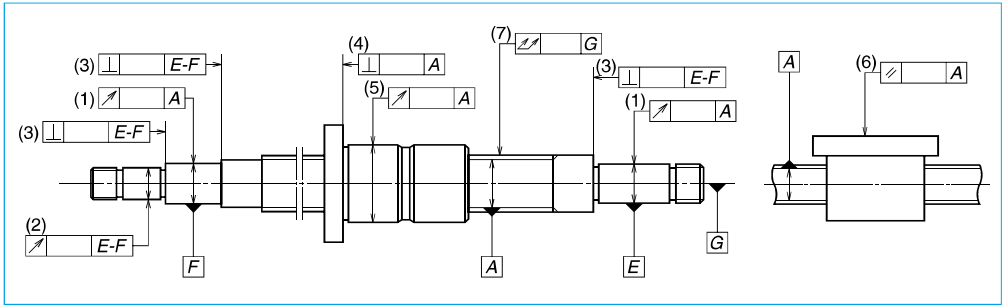


Fig. 1.3 Mounting accuracy of ball screw

(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) Perpendicularity of the shoulder of support bearing seat relative to the axis of support bearing seat.
(4) Perpendicularity of the nut flange surface, or of the nut end datum surface, relative to the axis of screw shaft.
(5) Eccentricity 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		–	8	12	20	32	50	80
	over	or less	8	12	20	32	50	80		8	12	20	32	50	80	125
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		–	8	12	20	32	50	80
	over	or less	8	12	20	32	50	80	125		8	12	20	32	50	80	125
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.)

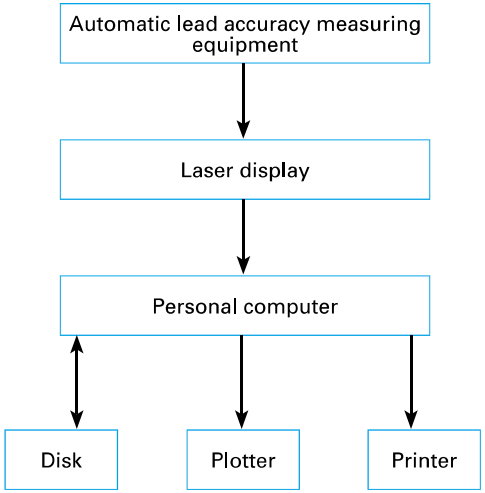


Fig. 1.4 Lead accuracy measuring system

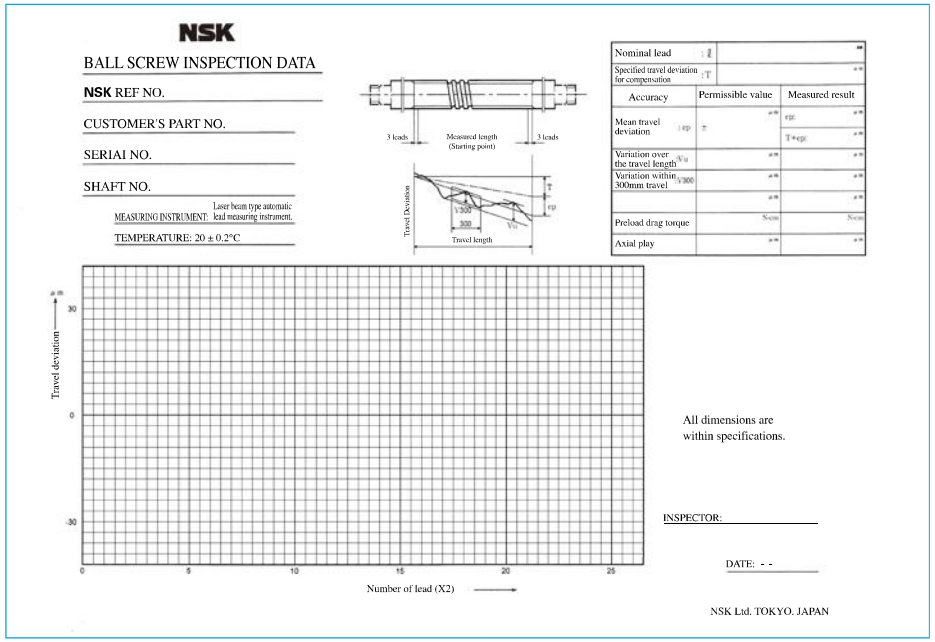


Fig. 1.5 Ball screw Inspection data

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.

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

In this formula:

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

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

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 bucking 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

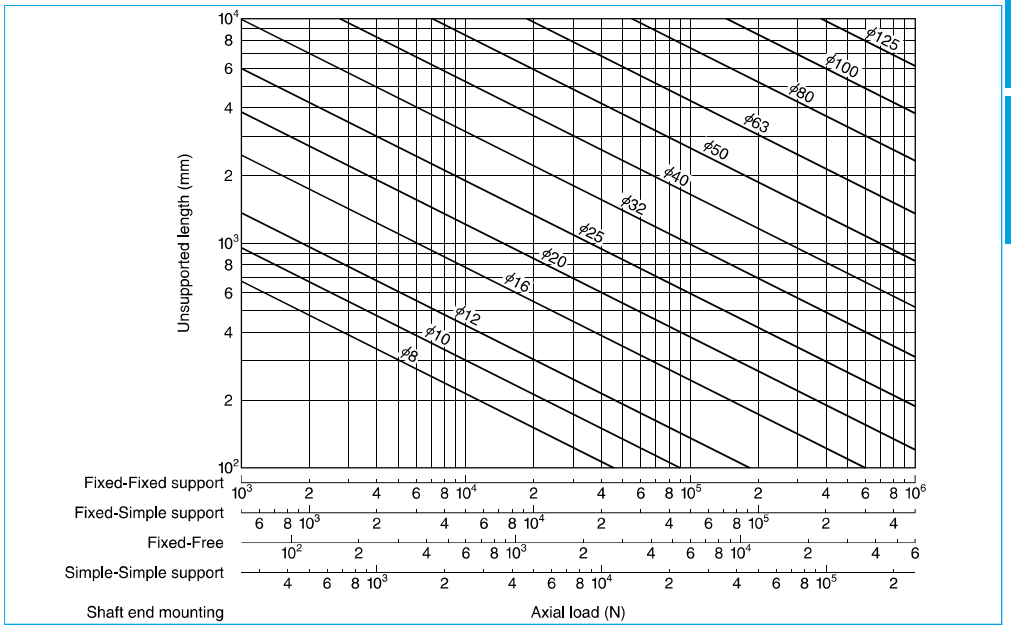


Fig. 2.1 Buckling load

<<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

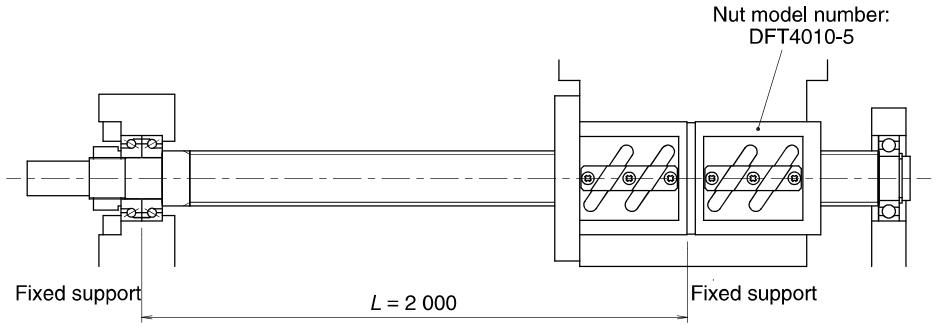


Fig. 2.2 Calculation example of buckling load

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

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

In this formula:

σ : Allowable stress (= 147 MPa)

A : Cross section area of a screw shaft using root diameter (mm^2)

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

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)

$P = 1.15 d_r^2 \times 10^2 = 1.15 \times 34.4^2 \times 10^2$

$= 136\,086$ (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}.

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

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 B551.)

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.

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

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

In this formula:
α : Safety factor (α = 0.8)
E : Elastic modulus (E = 2.06 × 10^5 MPa)
I : Moment of inertia of area of screw shaft

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

d_r : Screw shaft root diameter (mm) (See the dimension table.)
g : Acceleration of gravity (= 9.8 × 10^3 mm/s^2)
γ : Specific weight (γ = 7.65 × 10^{-5} N/mm^3)
A : Cross section area of the screw shaft root diameter (mm^2)

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

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

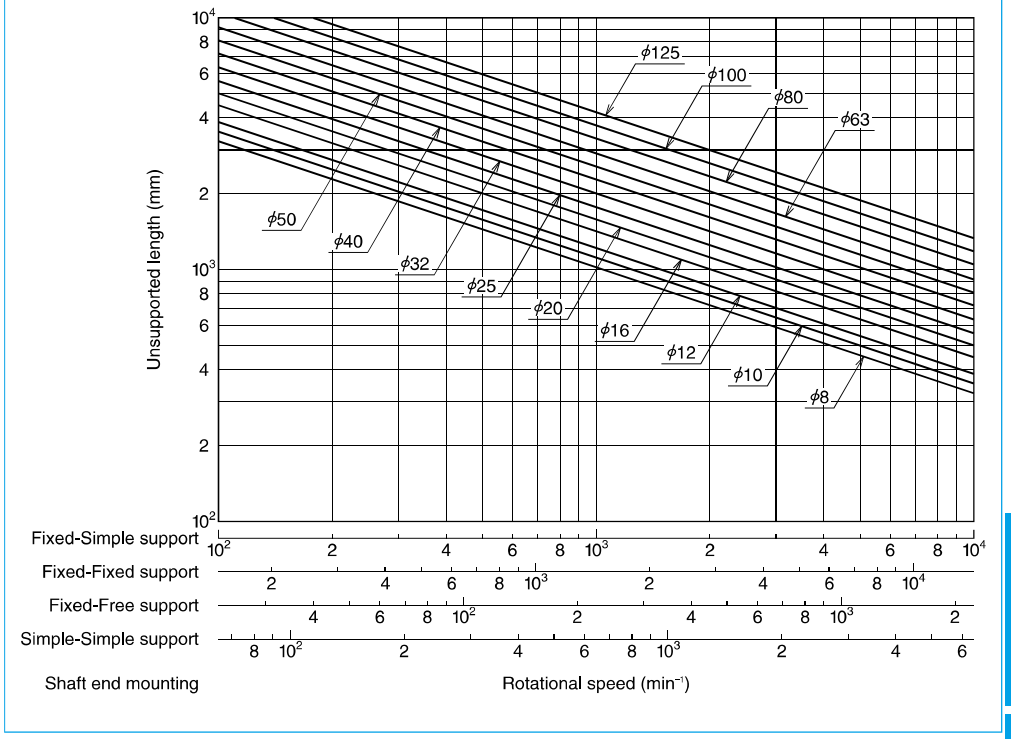


Fig. 3.1 Permissible rotational speeds vs. critical speeds

<<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 mm

Screw shaft root diameter d_r = 34.4 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

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

n_c = 1 290 min^{-1} or under

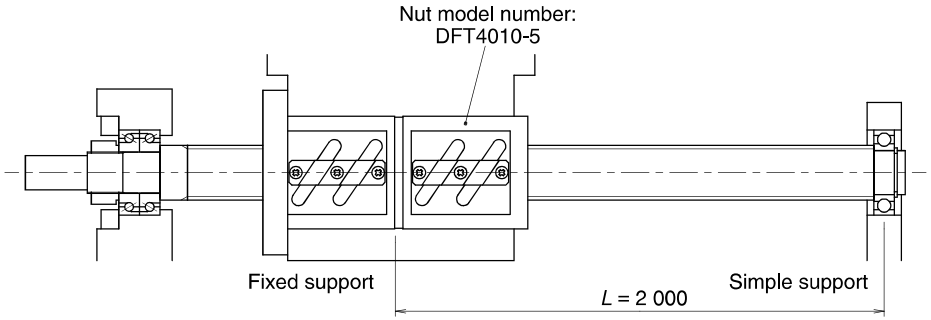


Fig. 3.2 Calculation example of permissible rotational speed to the critical speed

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

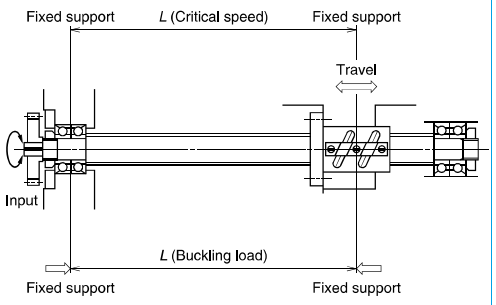
*1) Please refer to the explanation of each ball screw for which two allowable d·n values are listed
- HMC type for high-speed machine tools: page B503
- HTF-SRC type for high-load drives: page B513
- HTF type for high-load drives: page B521

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

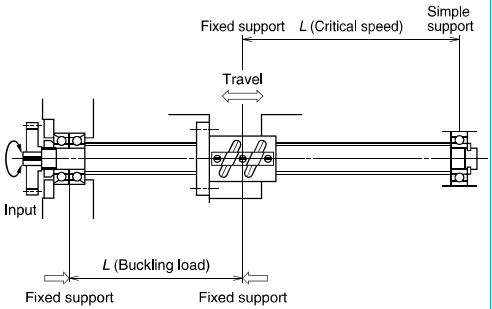
Figs. 4.1 and **4.2** are typical conditions in supporting ball screws. Use them as reference to calculate the buckling load and the critical speed.
Please consult NSK if it is necessary to scrutinize calculation due to use conditions, or if boundary conditions are not clear due to special installation.

[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.

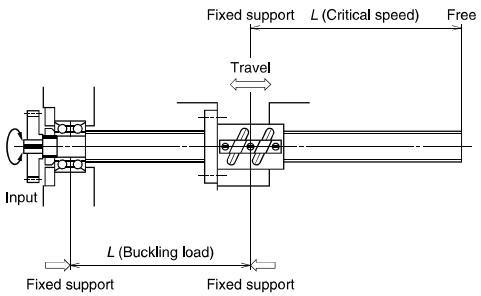
i
Buckling load: Fixed - Fixed support
Critical speed: Fixed - Fixed support



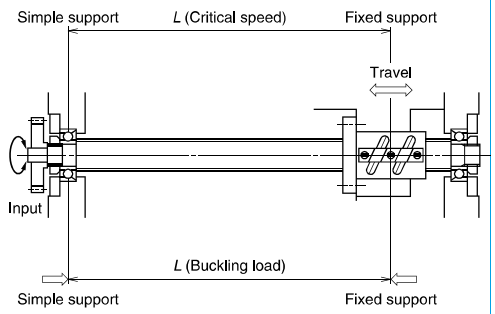
ii
Buckling load: Fixed - Fixed support
Critical speed: Fixed - Simple support



iii
Buckling load: Fixed - Fixed support
Critical speed: Fixed - Free support



iv
Buckling load: Fixed - Simple support
Critical speed: Fixed - Simple support



v
Buckling load: Fixed - Fixed support
Critical speed: Fixed - Fixed

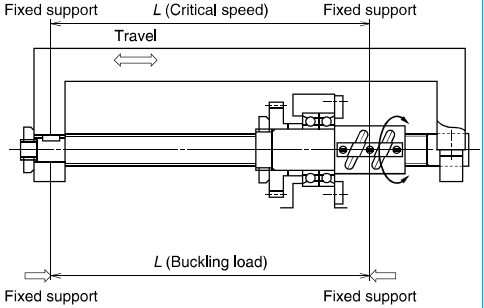
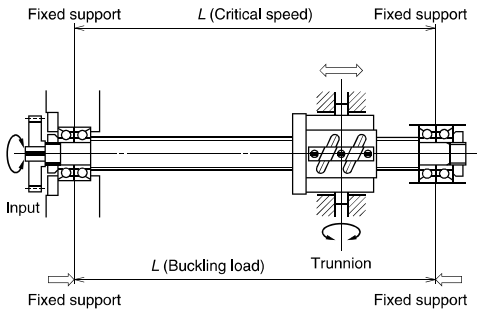
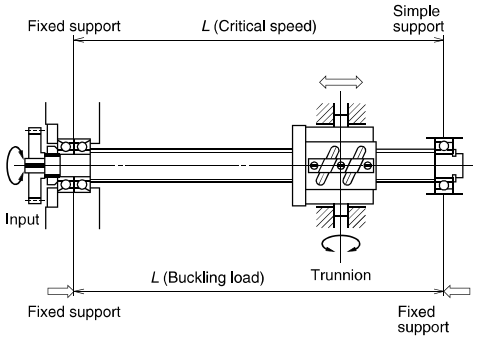


Fig. 4.1 Supporting conditions for screw shaft and ball nut

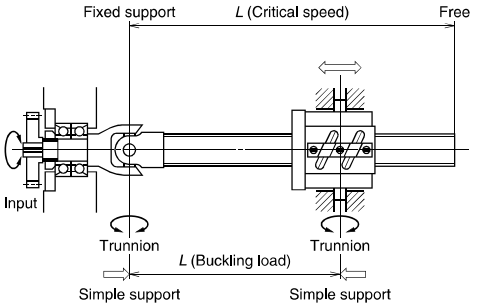
vi
Buckling load: Fixed - Fixed support
Critical speed: Fixed - Fixed support
} Minimum value (estimate) is obtained in the state as shown in the figure.



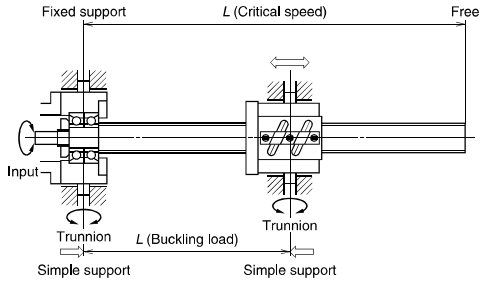
vii
Buckling load: Fixed - Fixed support
Critical speed: Fixed - Simple support
} Minimum value (estimate) is obtained in the state as shown in the figure.



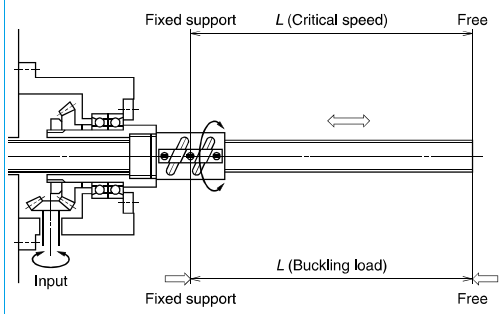
viii
Buckling load: Simple support - Simple support
Critical speed: Fixed - Free support→ Minimum value (estimate) is obtained in the state as shown in the figure.



ix
Buckling load: Simple support - Simple support
Critical speed: Fixed - Free support→ Minimum value (estimate) is obtained in the state as shown in the figure.



x
Buckling load: Fixed - Free support
Critical speed: Fixed - Free support



xi
Buckling load: Fixed - Fixed support
Critical speed: Fixed - Free support

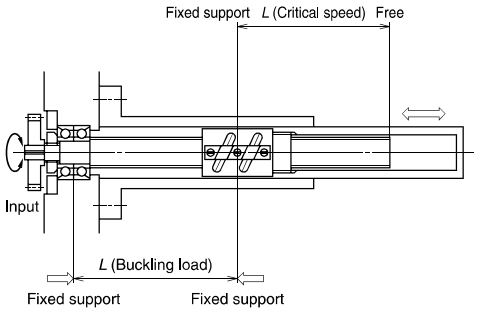


Fig. 4.2 Supporting conditions of screw shaft and ball nut

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.

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

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

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

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.**

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

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

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

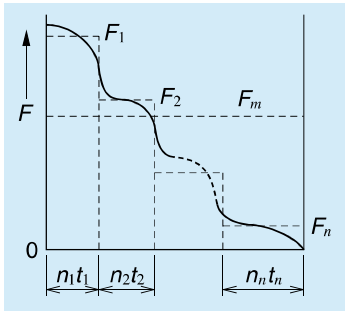


Fig. 5.1 Stepwise load variation

(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.

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

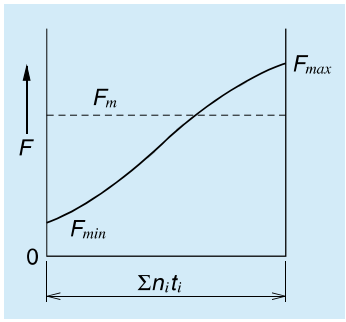


Fig. 5.2 Linear load change

(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.

When the sine curve is Fig. (a)

$$F_m \fallingdotseq 0.65\, F_{max} \quad \cdots 14)$$

When the sine curve is Fig. (b)

$$F_m \fallingdotseq 0.75\, F_{max} \quad \cdots 15)$$

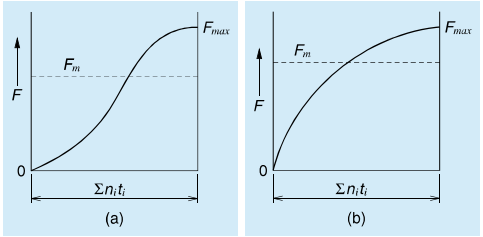


Fig. 5.3 Load changes in sinusoidal pattern

(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 ··1/2 000 or less
Eccentricity·····20 μm or less

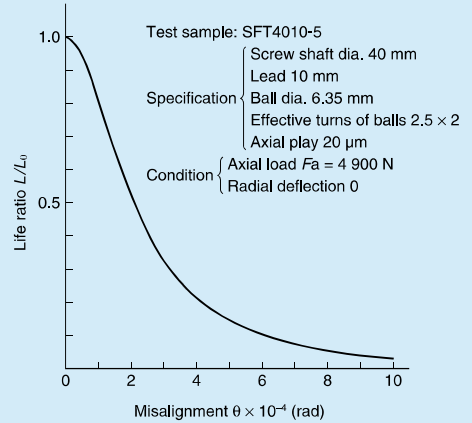


Fig. 5.4 Affects of misalignment

(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} *1 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.

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

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.

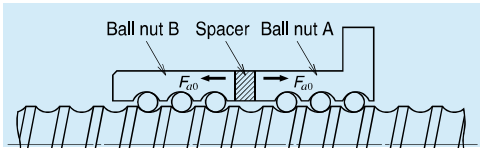
NSK has the data of wear accumulated through abundant experience. Please contact NSK for inquiry pertaining to the wear.

B-2-6 Preload and Rigidity

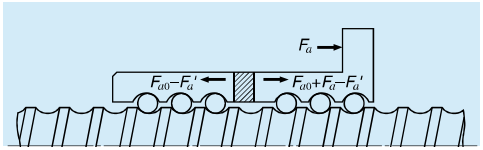
B-2-6.1 Elastic Deformation of Preloaded Ball Screw

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

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



(a) External load : 0



(b) External load : F_a

Fig. 6.1 Position preload (double-nut)

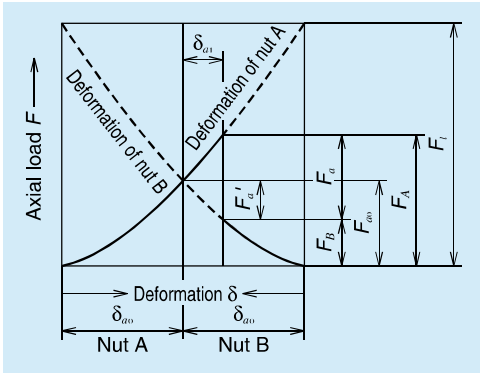


Fig. 6.2 Deformation of A and B nut (position preload)

Elastic deformation of Nut A and B is already given at time of assembly by the amount of δao by preload F_{ao}. 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**,

$$\delta_a = \delta_{ao} + \delta_{a1} \qquad \delta_b = \delta_{ao} - \delta_{a1}$$

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

$$F_A = F_{ao} + F_a - F_a'$$
$$F_B = F_{ao} - F_a'$$

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_{ao}, 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**).

$$\delta_{ao} = K \cdot F_{ao}^{2/3} \qquad 2\delta_{ao} = K \cdot F_l^{2/3}$$

(K: Invariable number)

$$\left[\frac{F_l}{F_{ao}}\right]^{2/3} = \frac{2\delta_{ao}}{\delta_{ao}} = 2$$

$$F_l = 2^{3/2} \times F_{ao} \fallingdotseq 3F_{ao}$$

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 10% of C_a, which is the criterion of the maximum preload, the ball screw may adversely increases 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.

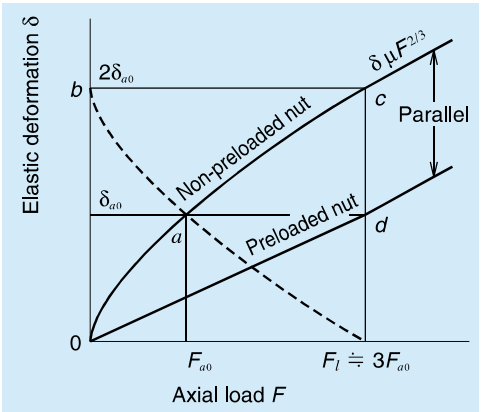


Fig. 6.3 Deformation of preloaded ball nut (position preload)

(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.**

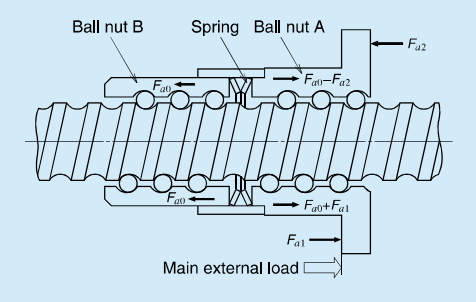


Fig. 6.4 Constant pressure preload (double nut)

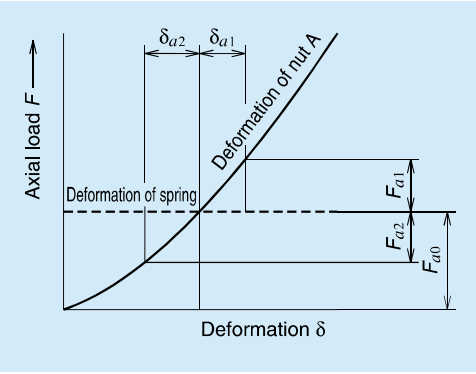


Fig. 6.5 Deformation curve of constant pressure preloaded nut

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.

$$\delta = \frac{F_a}{K_T} \quad \cdots\cdots 17)$$

$$\frac{1}{K_T} = \frac{1}{K_S} + \frac{1}{K_N} + \frac{1}{K_B} + \frac{1}{K_H} \quad \cdots\cdots 18)$$

In this formula:

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

$$K_S = \frac{A \cdot E}{x} \times 10^{-3} \quad \cdots\cdots 19)$$

In this formula:

K_S : Axial rigidity of the screw shaft (N/μm)
A : Cross section area of the screw shaft (mm^2)

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

dr : Screw shaft root diameter (mm)
E : Elastic modulus ($E = 2.06 \times 10^5$ MPa)
x : Distance between points of load application (mm)

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

$$K_S = \frac{A \cdot E \cdot L}{x\,(L - x)} \times 10^{-3} \quad \cdots\cdots 20)$$

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.

$$K_S = \frac{4A \cdot E}{L} \times 10^{-3} \quad \cdots\cdots 21)$$

<<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 mm
Screw shaft root diameter (from the dimension table)
d_r = 34.4 mm

<Calculation>

By formula 19), axial rigidity K_S is :

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

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

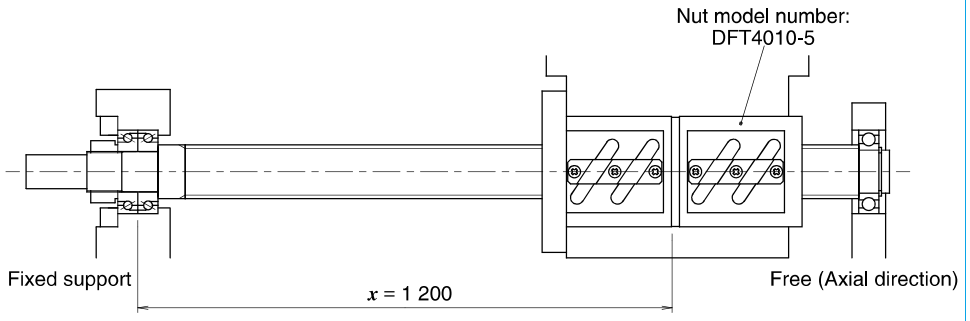


Fig. 6.6 Calculation example of axial rigidity of the screw shaft (1)

<<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 mm

Distance between points of load application:

Screw shaft root diameter (from the dimension table)

dr = 34.4 mm

<Calculation>

By formula 21), axial rigidity K_S is :

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

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

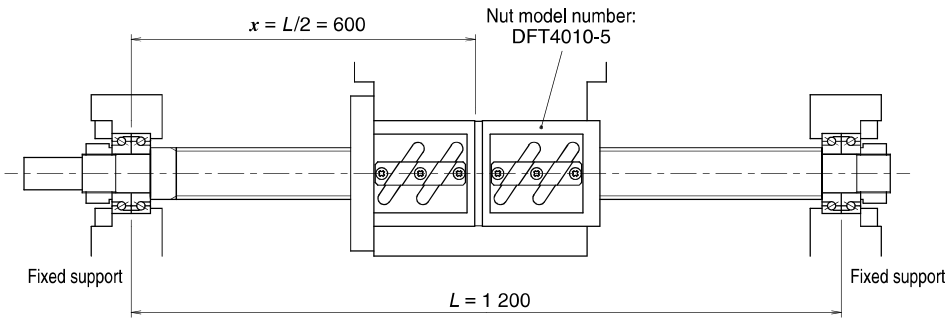


Fig. 6.7 Calculation example of axial rigidity of the screw shaft (2)

(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."

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

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 N

F_a = Rigidity at 0.3 C_a K = 706 N/μm (from the dimension table)

<Calculation>

By formula 22), axial rigidity K_N is :

$$K_N = 0.8 \times K \left(\frac{F_a}{0.3 \cdot C_a} \right)^{1/3}$$

$$= 0.8 \times 706 \times \left(\frac{6\,000}{0.3 \times 52\,000} \right)^{1/3}$$

$$= 410 \ (N/\mu m)$$

(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".

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

In this formula:

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

F_{a0} : Preload (N)

ε : Basic factor to calculate rigidity (ε = 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 N

Rigidity K when $F_{a0} = \varepsilon\ C_a$: K = 1 376 N/μm (from the dimension table on page B457)

Basic factor to calculate rigidity when D Preload: ε = 0.1

<Calculation>

By formula 23)

$$K_N = 0.8 \times K \left(\frac{F_{a0}}{\varepsilon \cdot C_a} \right)^{1/3}$$

$$= 0.8 \times 1\,376 \times \left(\frac{4\,000}{0.1 \times 52\,000} \right)^{1/3}$$

$$= 1\,008 \ (N/\mu m)$$

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 0.1 C_a (0.05 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 – 0.04 C_a
Medium- high-speed machine tools for cutting	0.03 C_a – 0.07 C_a
Low to medium-speed systems that require especially high rigidity	0.07 C_a – 0.1 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 B423 for BSBD series.

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

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 (Break away torque)

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

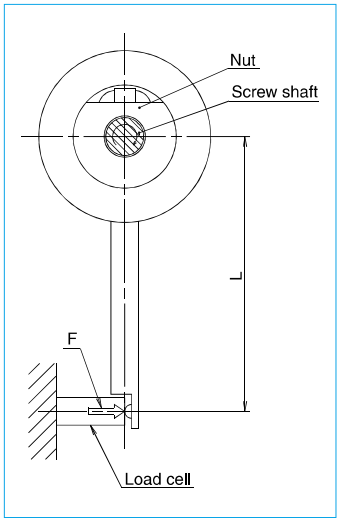


Fig. 7.1 Preload dynamic torque measuring method

(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*.

$$T_p = F \cdot L \qquad \cdots 24)$$

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

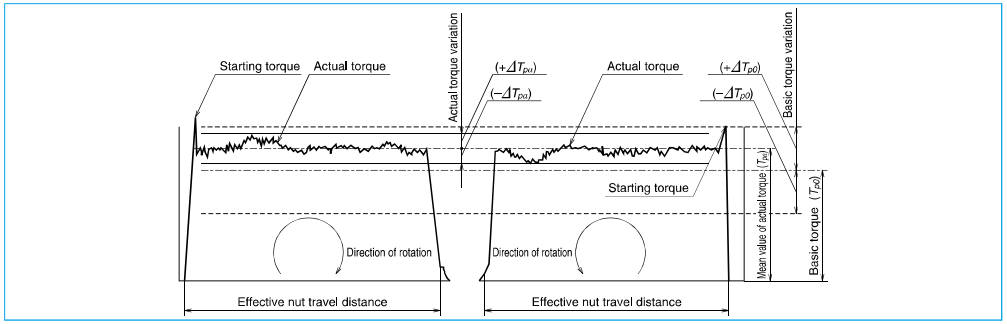


Fig. 7.2 Definitions of dynamic preloaded drag torque

(3) Calculation of basic torque

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

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

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.

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

In this formula:

T_a : Normal operation torque (N · cm)

F_a : Axial load (N)

l : Lead (cm)

η_1 : Normal efficiency (η_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.

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

In this formula:

T_b : Reverse operation torque (N · cm)

η_2 : Reverse efficiency (η_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).

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.

(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.

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

In this formula:

T_a : Drive torque at constant speed

$$T_a = \frac{F_a \cdot l}{2\pi \cdot \eta_1} \qquad \cdots 26)$$

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.

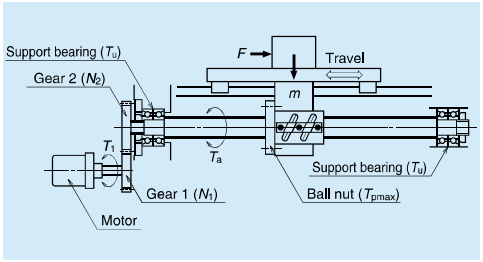


Fig. 7.3 Driving mechanism of ball screw

(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.

$$T_2 = T_1 + J \cdot \dot{\omega} \qquad \cdots 29)$$

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

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 (kg · m^2)

J_M : Moment of inertia of the motor (kg · m^2)

J_{G1} : Moment of inertia of Gear 1 (kg · m^2)

J_{G2} : Moment of inertia of Gear 2 (kg · m^2)

J_S : Moment of inertia of the screw shaft (kg · 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

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

In this formula:

γ : Material density (kg/cm^3)

D : Diameter of the cylindrical object (cm)

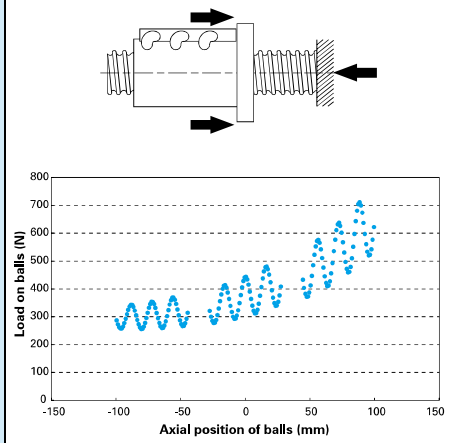
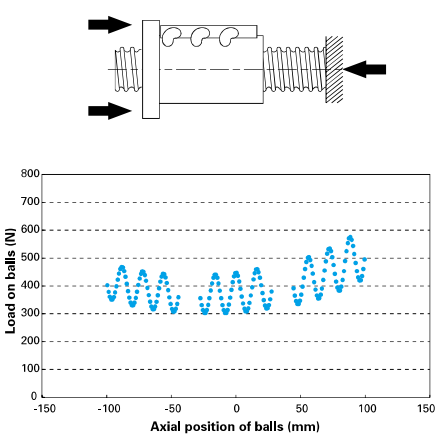
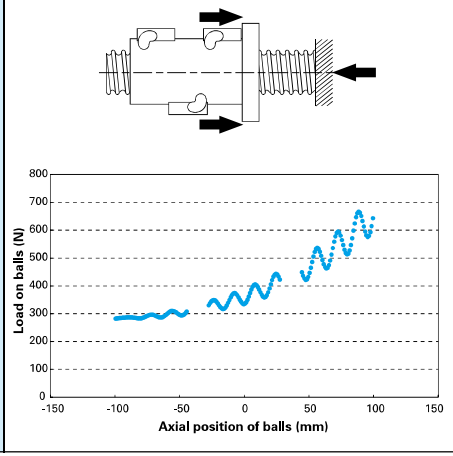
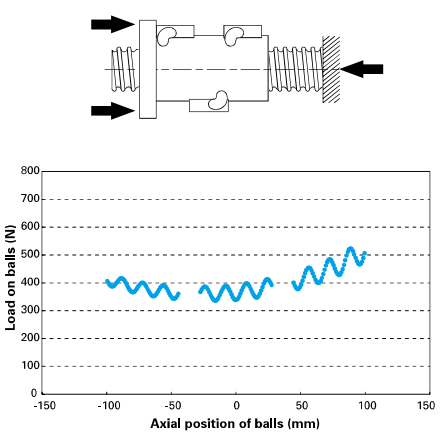
L : Length of the cylindrical object (cm)

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

	NSK recommended mounting direction	Conventional mounting direction
Conventional design		
HTF design		

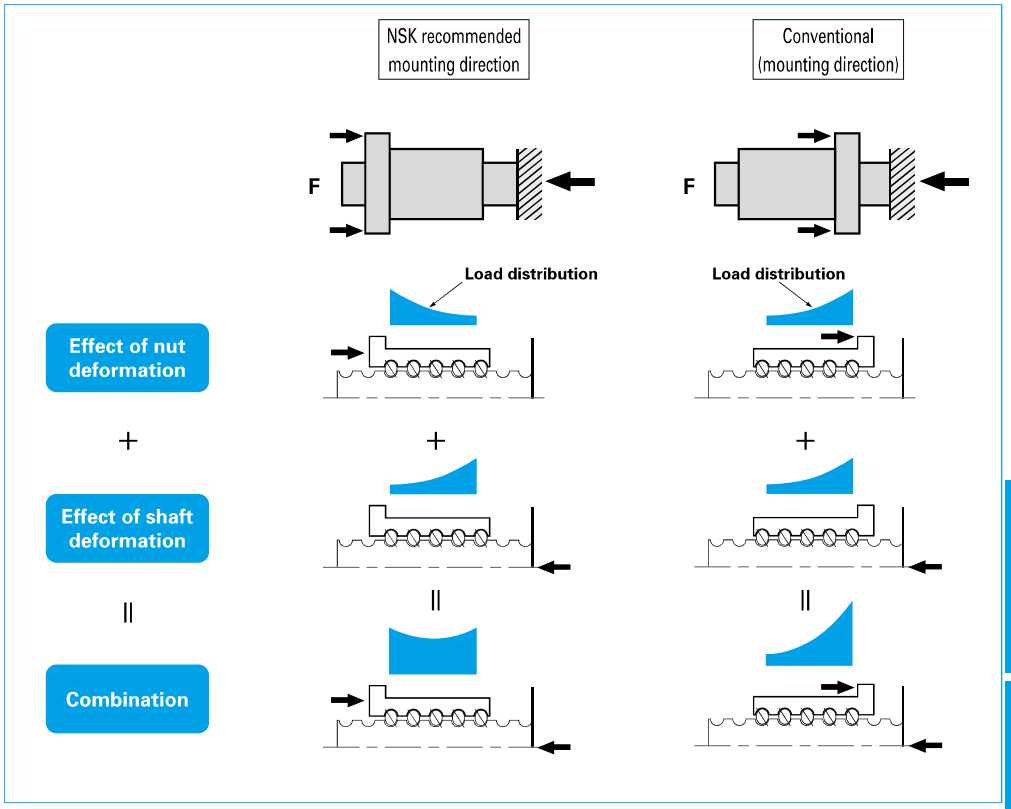


Fig. 8.1 The relationship between acting point of load and load distribution

B-2-9 Lubrication of Ball Screw

Lithium soap-based grease with base oil viscosity of 30 to 140 mm^2/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 base	Mineral oil	130	–10 – 110	General heavy load
NSK Grease PS2	Lithium base	Synthetic oil combined with Synthetic hydrocarbon oil	15.9	–50 – 110	Light load
NSK Grease LR3	Lithium base	Synthetic oil	30	–30 – 130	High-speed medium load
NSK Grease LG2	Lithium base	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	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.)

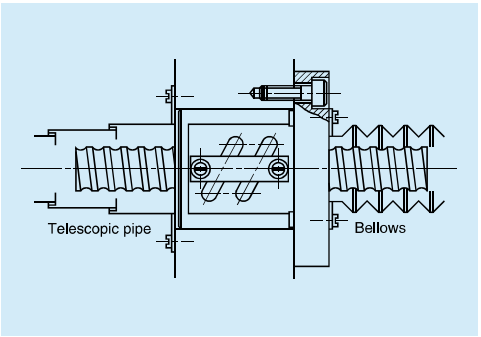


Fig. 10.1 Dust prevention by telescopic pipe and bellows

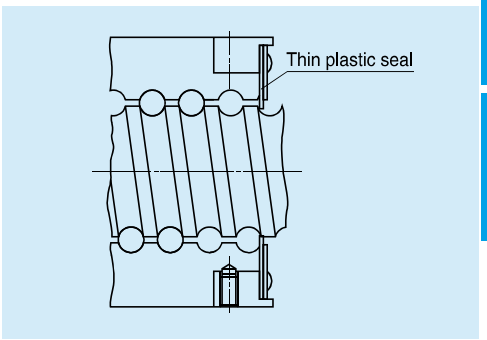


Fig. 10.2 Thin plastic seal

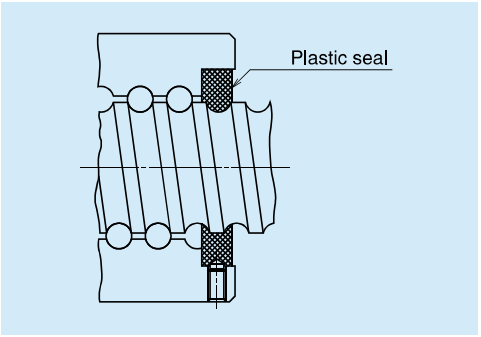


Fig. 10.3 Plastic seal

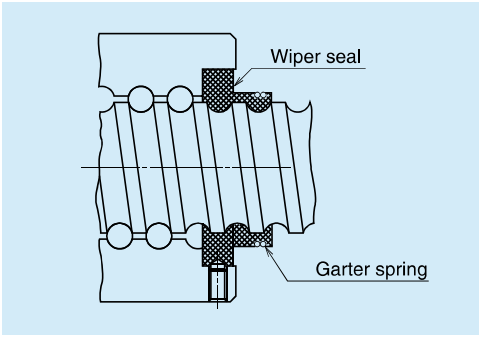


Fig. 10.4 Wiper seal

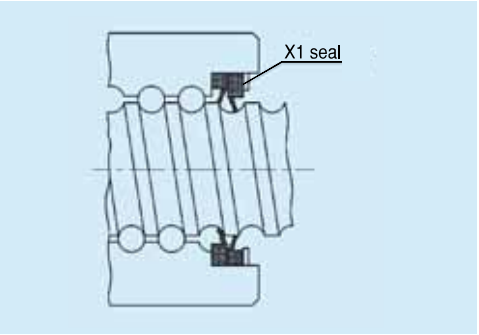


Fig. 10.5 X1 seal

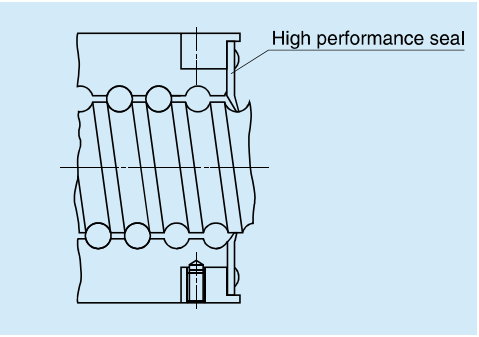


Fig. 10.6 High performance seal

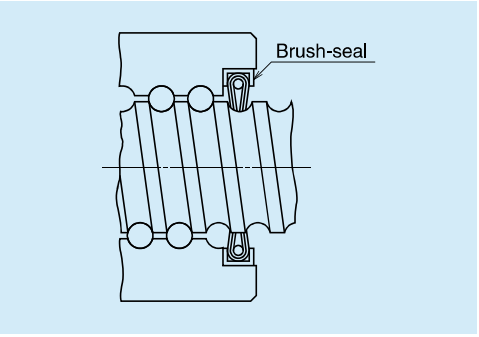


Fig. 10.7 Brush-seal for R Series

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.

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 MoS_2 / WS_2 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 MoS_2, WS_2 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. MoS_2 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.

(a) Use as a large lead as possible to reduce rotational speed.

(b) 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

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

(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).

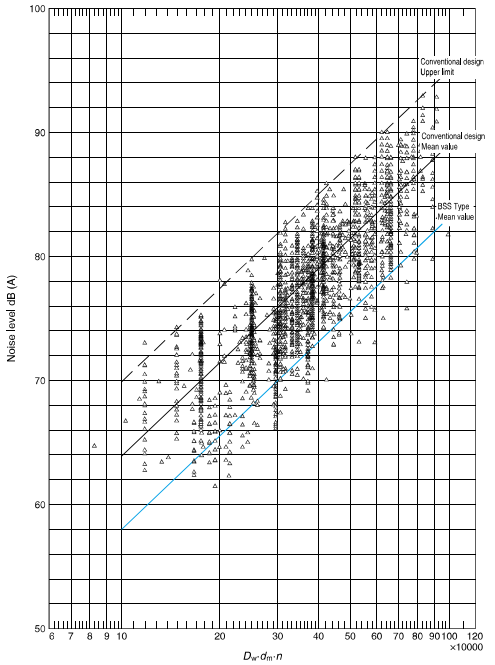


Fig. 13.1 Noise levels of ball screws

<<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 min^{-1}

<Calculation>

By formula 34):

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

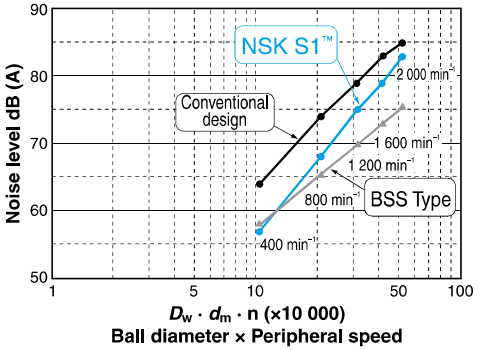
The average value of noise level by ball screws alone at maximum rotational speed (measuring distance 400 mm) is 82 dB (A).

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).

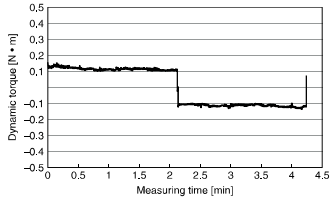
When installed, the noise of ball screw becomes higher by the noise of the machine and characteristics of machine vibration.

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.

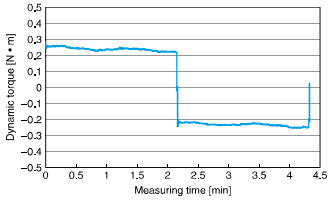


B-2-13.2 Consideration to Operational Characteristics

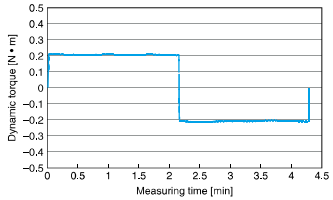
Smooth motion is achieved by using spacer balls on conventional ball return tube type ball screws. By using NSK S1 the smoothness is further improved. The BSS type will achieve the smoothness equivalent to ball screws with NSK S1.



Spacer balls



NSK S1 Inserting type



BSS Type, PSS Type

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.

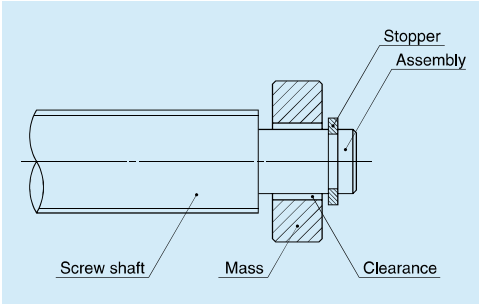
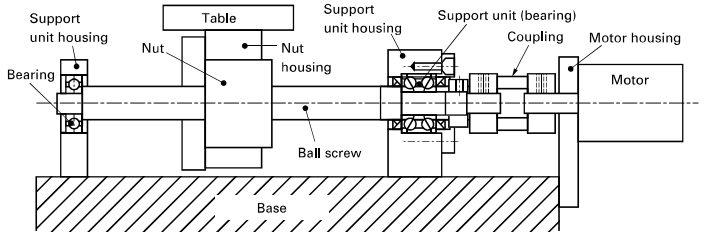


Fig. 13.2 Impact damper (Applied for patent)

B-2-14 Installation of Ball Screw

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



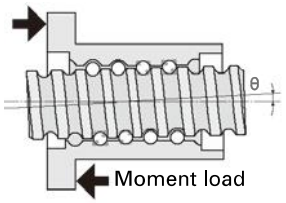
The screw shaft of the ball screw is supported by a nut and bearings, and it is driven by a motor.
It is critically important to complete the centering work to ensure the predetermined operation life, functionality and accuracy of the ball screw. In general, the following accuracy is recommended for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

Inclination of center line: 1/2000 or less (Target: 1/5000 or less)
Eccentricity: 0.020 mm or less

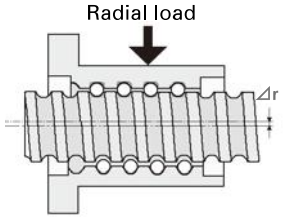
The following problems could occur if an installation error negatively affected the ball screw:

(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.

<Inclination of center line>

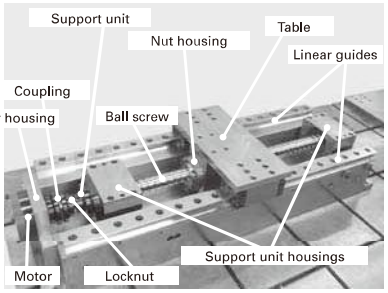


<Eccentricity>



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.



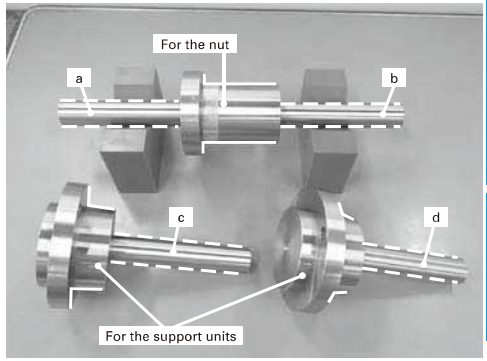
B-2-14.1 Installation Procedure for Machine Tools, Where High Installation Accuracy Is Required

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

1. Centering of nut housing
2. Centering of support unit housing
3. Installation of ball screw
4. Installation of support unit
5. Adjusting axial runout of screw shaft end and fastening lock nut of support unit
6. Replenishing lubrication grease
7. Verification of functionality
8. Centering of motor housing
9. Installation of coupling and motor
10. Trial operation

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.

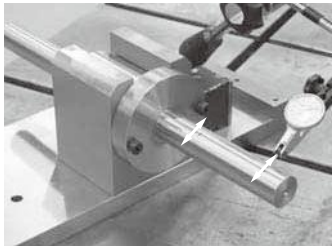


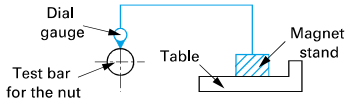
II. Installation of assembled body

1. Centering of nut housing

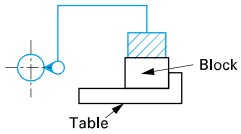
1-1

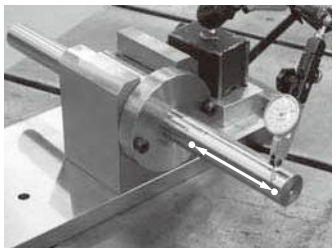
Turn the table over and mount the nut housing and test bar for the nut onto it.
Set up a magnet stand with a dial gauge attached, taking the rear side of the table as reference. Measure two spots at the top of the test bar for the nut by moving the magnetic stand around to check the inclination in the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

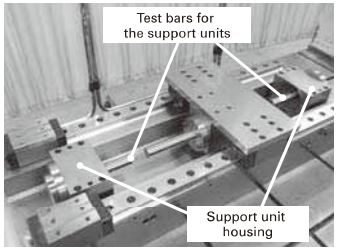




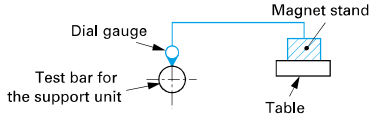
2. Centering of support unit housing

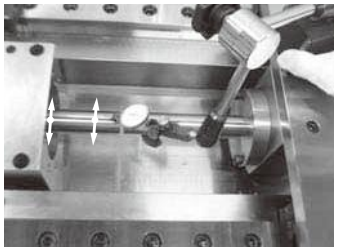
Install the linear guides onto a machine base, and then install the table, which has already been centered. (For installation of linear guides, please refer to A67 of CAT. No. 9008.)

2-1
Install the test bar for the support unit onto the support unit housing.

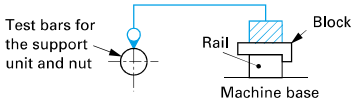


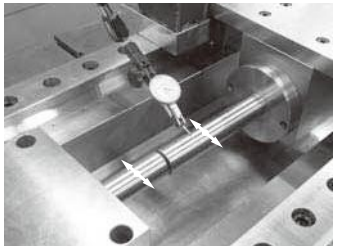
2-2
Install the magnet stand, with the dial gauge attached, using the table as reference. While moving the table, measure the two spots at the top of the test bar for the motor-side support unit to check the inclination in the vertical direction. If inclination of center line is observed, adjust the mounting surfaces of the support unit housing.
Follow the same procedure for the opposite side of the motor.



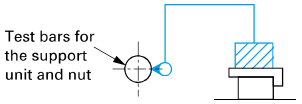


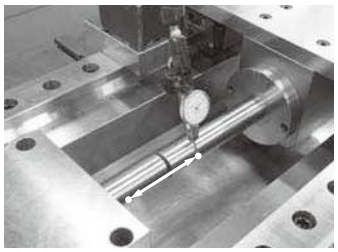
2-3
Fix the magnet stand, with the dial gauge attached, onto a block, and install the block onto the top surface of the linear guide rail. Measure the top points of the test bar for the nut and the support unit to check for eccentricity in the vertical direction.
If eccentricity is observed, adjust the mounting surface of the support unit housing.
Follow the same procedure for the opposite side of the motor.





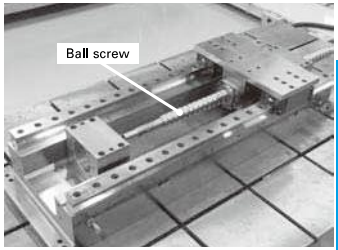
2-4
Fix the magnet stand, with the dial gauge attached, onto a block. While pressing the block toward the top surface of the linear guide rail as reference and moving it, take measurements of the side surfaces of the test bars for the nut and support unit to check for eccentricity in the horizontal direction. If eccentricity is observed, adjust the mounting surface of the support unit housing.
Follow the same procedure for the opposite side of the motor.





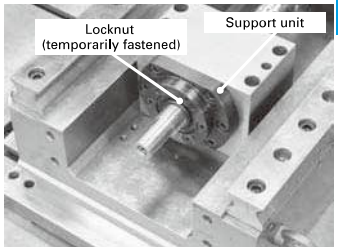
3. Installation of ball screw

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.



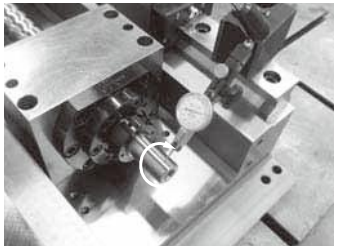
4. Installation of support unit

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.



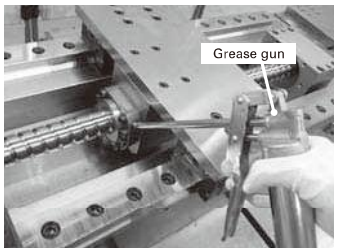
5. Adjusting axial runout of screw shaft end and fastening lock nut of support unit

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.



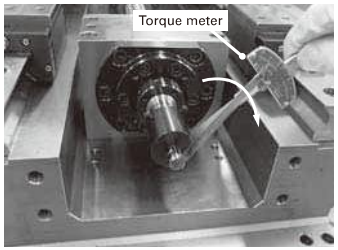
6. Replenishing lubrication grease

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

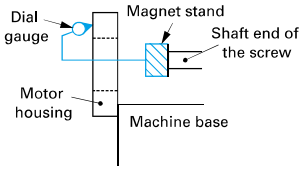
To check whether the ball screw has been installed accurately, verify its functionality. Measure the driving torque with a torque meter over the entire movable range of the screw.
Confirm (including by touch) that there are no abnormalities.



8. Centering of motor housing

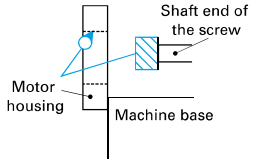
8-1

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.



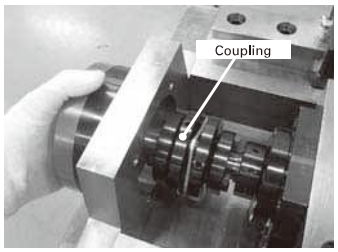
8-2

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.

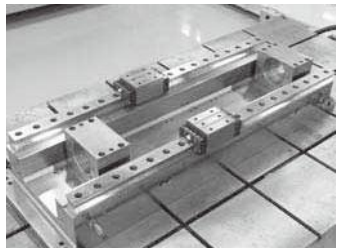
The installation procedure used for the single-axis table is shown below:

1. Installation of support unit housing
2. Installation of ball screw
3. Installation of support unit
4. Adjusting runout of screw shaft end and fastening support unit lock nut
5. Centering of ball screw
6. Installation of nut housing
7. Replenishing lubrication grease
8. Verification of functionality
9. Centering of the motor housing
10. Installation of coupling and motor
11. Trial operation

I. Installation of assembled body

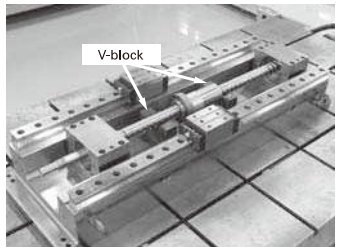
1. Installation of support unit housing

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.



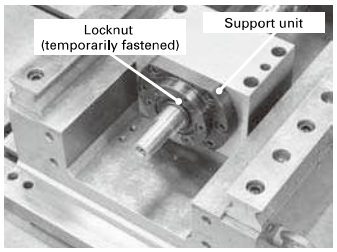
2. Installation of ball screw

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.



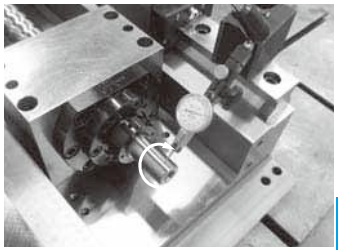
3. Installation of support unit

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

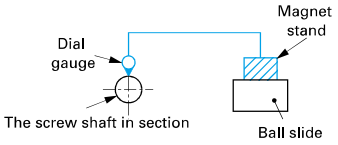
Bring the dial gauge into contact with the top of the shaft end. Then, while rotating the screw shaft, measure the runout of the shaft end. While adjusting the shaft end runout, fasten the locknut to attain the required fastening torque.
Follow the same procedure for the opposite side of the motor.

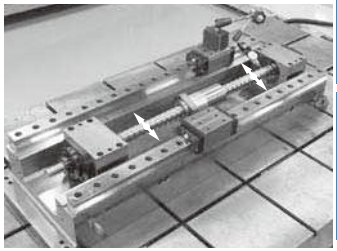


5. Centering of ball screw

5-1

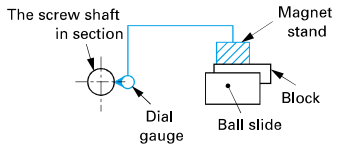
Set up a magnet stand with a dial gauge attached, using the ball slide of the linear guide as reference. Measure the top of the screw shaft in the vicinity of the support unit housing both on the motor and opposite sides to check the inclination in the vertical direction. If inclination of center line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

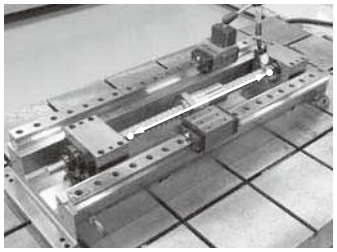




5-2

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.

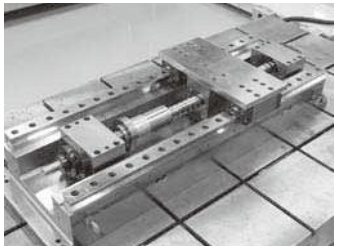




6. Installation of nut housing

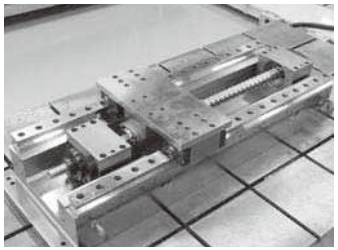
6-1

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.



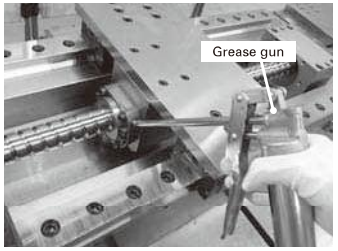
6-2

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.



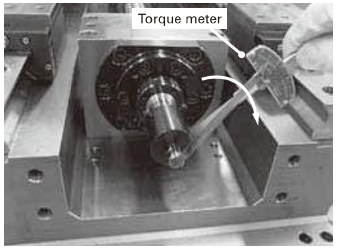
7. Replenishing lubrication grease

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

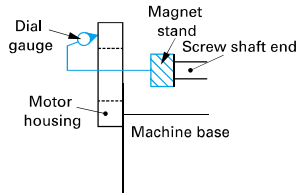
To check whether the ball screw has been installed accurately, verify its functionality. Measure the driving torque with a torque meter over the entire movable range of the screw.
Confirm (including by touch) that there are no abnormalities.



9. Centering of motor housing

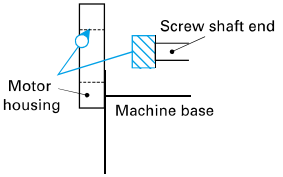
9-1

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.



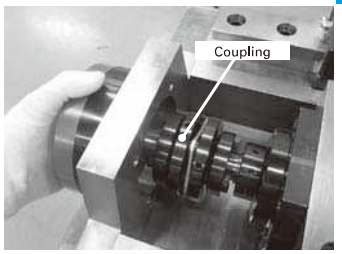
9-2

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 speficication (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**)

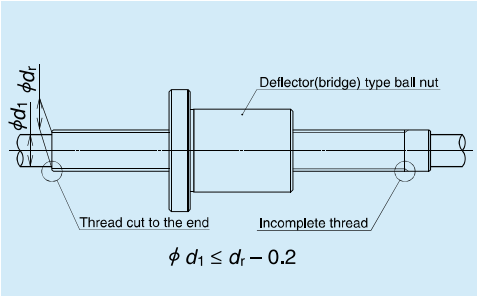


Fig. 15.1 Shaft end of a deflector (bridge) recirculation system ball screw

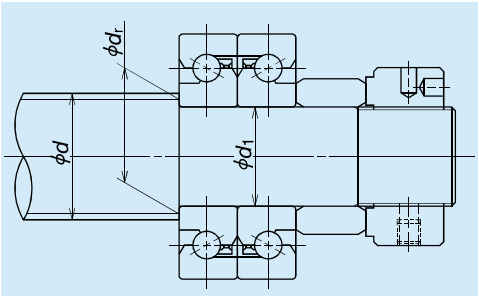


Fig. 15.2 Support bearing and end face (shoulder) for installation

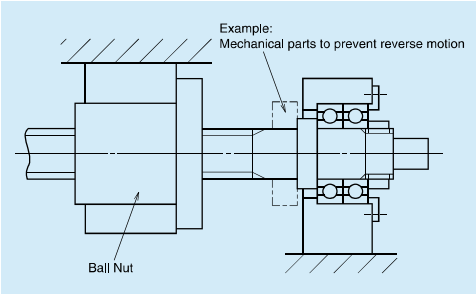


Fig. 15.3 Nut and ball screw are required to be separated when installing in this structure.

(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.

(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."

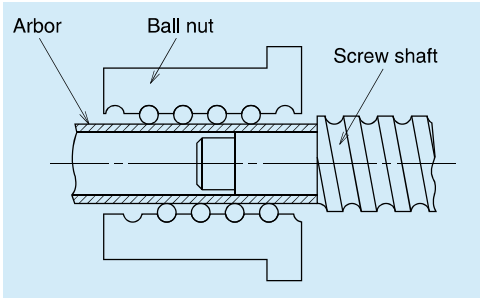


Fig. 15.4 Arbor to install and remove nut

(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.

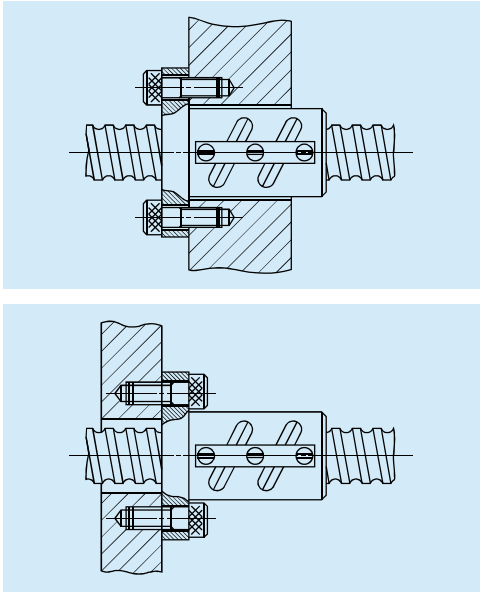


Fig. 15.5 Fixing a ball nut by flange

(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.

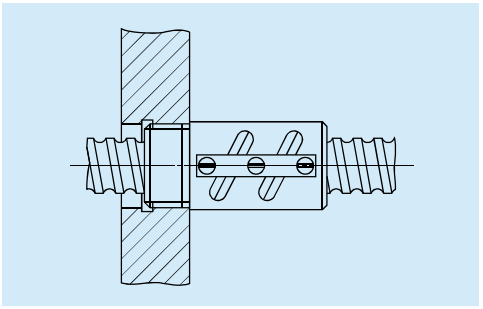


Fig. 15.6 Fixing a ball nut with thread screw

(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.**

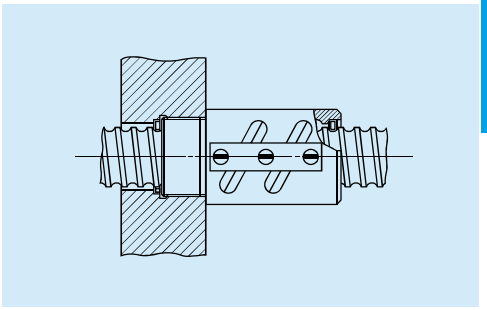


Fig. 15.7 Installation of brush-seal to a ball nut with thread screw

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.

(2) Additional machining of R Series ball screw shaft end

(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) The following process is the same as "(1) Machining of blank shaft ends of precision ball screws" above.

B-2-17 Ball Screw Selection Exercise

Drill 1: High-speed transporting system

1. Design conditions

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

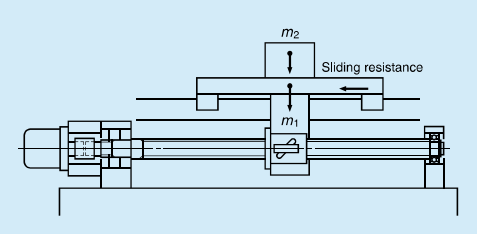


Fig. 16.1 System appearance

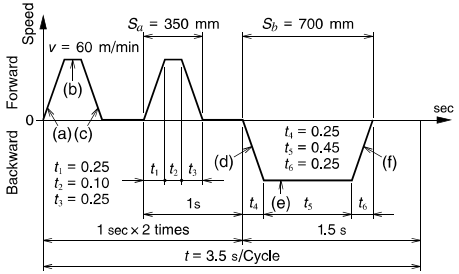


Fig. 16.2 Operating condition

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 : ±0.005 (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))

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

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

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

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

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

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 fomula 2) on page B44:

$$d_r \geq \left(\frac{P \cdot L_a^2}{m} \times 10^{-4} \right)^{1/4} = \left(\frac{246 \times 804^2}{19.9} \times 10^{-4} \right)^{1/4}$$
$$= 5.3 \text{ (mm)}$$

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 min^{-1}. Since the motor maximum rotational speed is 3 000 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:

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

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

[2] Calculation of life expectancy

At the basic dynamic load rating C_a of W1507FA-3PG-C5Z20 (Clearance Z) is 3 870 N (as per the dimension table on page B193), from the formulas 8) and 9) on page B53:

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

$$= \left(\frac{3\,870}{195 \times 1.2}\right)^3 \times \frac{1}{60 \times 1\,200} \times 10^6$$

$$\fallingdotseq 62\,800$$

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

$e_p = \pm 0.035/800$ (mm)

$\upsilon_u = 0.025$ (mm)

This grade satisfies the required positioning accuracy of ±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)

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

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

(Moving part)

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

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

(Coupling)

$J_c = 0.25$ (kg · cm^2)···Temporary

(As a whole)

Moment of inertia of the ball screw J_L is:

$$J_L = J_B + J_W + J_C$$

$$= 0.31 + 6.1 + 0.25$$

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

[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 · cm^2) (3.1 × 10^{-4} kg · m^2).

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

Motor rating torque: $T_M \geq T_{rms}$ (N · 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: $W_M = 300$ (W)
Maximum rotational speed:
$N_M = 3\,000$ (min^{-1})
Rating torque: $T_M = 1$ (N · m) = 1×10^2 (N · cm)
Moment of inertia: $J_M = 3.1 \times 10^{-4}$ (kg · m^2)
= 3.1 (kg · 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 $T_M' = 2 \times T_M$:

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

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

$$= 0.23$$

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

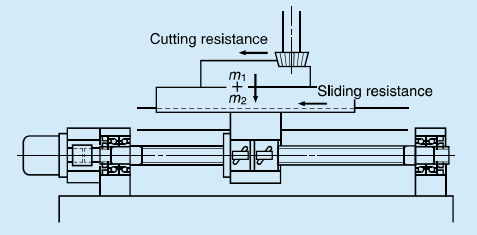


Fig. 16.3 System appearance

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: $F_r = \mu (m_1 + m_2) g = 0.15 \times (1\,000 + 600) \times 9.80665 = 2\,354$ (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 = Maximum stroke + nut length + 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 = ±0.029/1 600 (mm)
v_u = 0.018 (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.

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

$$N_m = \frac{N_1 \cdot t_a + N_2 \cdot t_b + N_3 \cdot t_c}{t}$$

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 (mm) ····· $C_a \geq$ 33 500 (N)

l = 10 (mm) ····· $C_a \geq$ 31 100 (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 *Ca*: (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	31 700	–	46 300	–
36	–	–	49 300	–
40	34 900	–	52 000	–
45	–	–	54 200	76 800
50	38 700	54 900	57 700	81 800

(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 (mm) ····· N = 1 875 (min^{-1})

l = 10 (mm) ····· N = 1 500 (min^{-1})

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

$$d_r \geqq \frac{N \cdot L_a^2}{f} \times 10^{-7} \ (mm)$$

In this formula, unsupported length L_a is:

L_a = Maximum stroke + nut length/2 + shaft end extra length

= 1 000 + 100 + 200 = 1 300 (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 (mm) ····· $d_r \geq$ 14.5 (mm)

l = 10 (mm) ···· $d_r \geq$ 11.6 (mm)

[2] $d \cdot n$ value

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

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

l = 8 (mm) ····· $d \leq$ 37.3 (mm)

l = 10 (mm) ····· $d \leq$ 46.7 (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 • 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 (μm) × 0.8 = 16 (μm)

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.

$\Delta L \leq 8$ (μm)

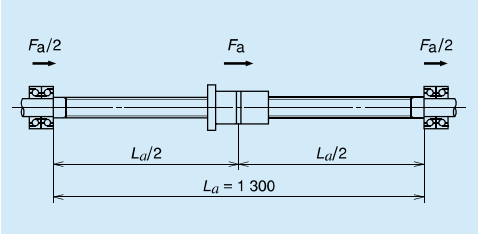


Fig. 16.3 Unsupported length

[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:

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

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

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

The sliding resistance F_a is:

$$F_a = \mu \ (m_1 + m_2) = 0.15 \times (1\,000 + 600)$$

= 2 354 (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}.

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

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

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

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 NSKTAC 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 B419 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
	K_S	ΔL_S	K_N	ΔL_N	K_B	ΔL_B	ΔL
DFT3210-5	347	6.8	839	2.8	1 000	1.2	10.8
DFT3610-5	460	5.1	907	2.6			8.9
DFT4010-5	589	4.0	973	2.4	1 030	1.1	7.5
DFT4510-5	772	3.0	1 050	2.2	1 180	1.0	6.2
DFT4510-7.5			1 375	1.7			5.7

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: 52 000 (N)

6. Decision of screw shaft length

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

L_a = Maximum stroke + nut length + margin

= 1 000 + 193 + 100 = 1 293 → 1 300 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).

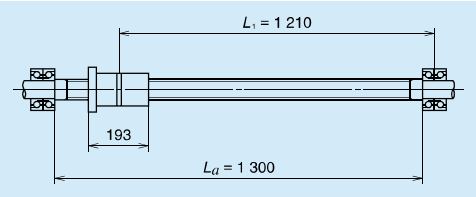


Fig. 16.4 Examination of bucking load

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

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

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

From the specification of DFT4010-5 ball nut (page B457), the root diameter of screw shaft d_r 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:

$$n = f \cdot \frac{d_r}{L_1^2} \times 10^7 = 21.9 \times \frac{34.4}{1\,210^2} \times 10^7$$

$$\fallingdotseq 5\,140$$

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·n of tube type ball nut is 70 000 or less, and meets the requirement.

Result: Acceptable

(3) Life L_t

The dynamic load rating C_a is 52 000 N (see dimension table on page B457), and from the formulas 8) and 9) on page B53 the life expectancy is:

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

$$\fallingdotseq 95\,000$$

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 ±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 = ±0.029/1 600 (mm)

v_u = 0.018 (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_θ

From the formula 1) on page B40:

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

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

(b) Pre-tension force : F_θ

$$F_\theta = \Delta L_\theta \cdot Ks = \frac{\Delta L_\theta \cdot E \cdot \pi \cdot d_r^2}{4 L_a}$$

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

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

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_θ) is ε, select a bearing which generally satisfies the following:

$$\varepsilon = F_\theta / C_a < 0.20$$

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_o is 1 550 mm.

(Screw shaft)

$$J_B = \frac{\pi \cdot \gamma}{32} D^4 \cdot L_o = \frac{\pi \times 7.8 \times 10^{-3}}{32} \times 4^4 \times 155$$

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

(Moving part)

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

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

(Coupling)

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

(Total)

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

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

[2] Driving torque

The required torque to drive a ball screw resisting to external loads T_1 can be obtained by the formula 28) on page B64:

$$T_1 = T_A + T_P + T_U$$

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:

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

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

$$\eta_1 = 0.9$$

Refer to the starting torque value in **Table 3** on page B419:

T_U is:

$$T_U = 21 + 21 = 42 \text{ (N} \cdot \text{cm)}$$

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

(At the time of rapid traverse)

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

$$= \frac{2\,354 \times 1}{2\pi \times 0.9} + 0.014 \times 3\,500 \sqrt{4.1 \times 1} + 42$$

$$= 557 \text{ (N} \cdot \text{cm)} \rightarrow 557 \times 10^{-2} \text{ (N} \cdot \text{m)}$$

(At the time of heavy cutting)

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

$$= \frac{10\,354 \times 1}{2\pi \times 0.9} + 0.014 \times 3\,500 \sqrt{4.1 \times 1} + 42$$

$$= 1\,972 \text{ (N} \cdot \text{cm)} \rightarrow 1\,972 \times 10^{-2} \text{ (N} \cdot \text{m)}$$

[3] Selection of the motor

〈Selection conditions〉

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

Motor rating torque: $T_M > T_1$ (N · m)

Moment of inertia of the motor: $J_M > J_L / 3$ (kg · 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:

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

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 · m^2)

$= 190$ (kg · cm^2)

[4] Checking the time to reach maximum speed:
Required time to reach rapid traverse speed can be calculated as follows (whereas $T_M' = 2 \times T_M$):

$$t_a = \frac{(J_L + J_M) \times 2\pi \times N}{(T_M' - T_1) \times 60} \times 1.4$$

$$= \frac{(80 \times 10^{-4} + 190 \times 10^{-4}) \times 2\pi \times 1\,500}{(2 \times 22.5 - 580 \times 10^{-2}) \times 60} \times 1.4$$

$= 0.15$ (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) : μ = 0.01 (friction coefficient)
Drive motor : AC servo motor ($N_{max} = 1\,000$ min^{-1})
Environment : Slightly dusty

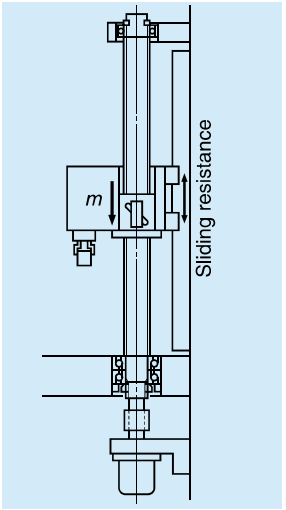


Fig. 16.5 System appearance

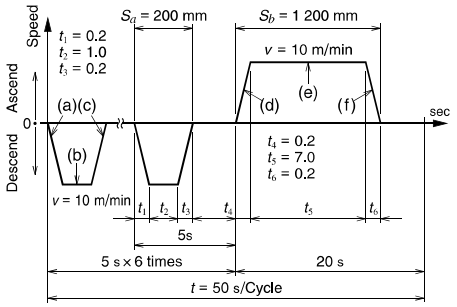


Fig. 16.6 Operating condition

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, 45, 50 (mm)
Lead : 10 (mm)
Stroke : 1 500 (mm)

4. Decision of screw length

Screw length L_o is:

L_o = Stroke + nut length + margin + shaft end length

= 1 500 + 100 + 100 + 200 = 1 900 (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:

$$d \geq \frac{L_s}{70} = \frac{1\,900}{70} = 27.1 \text{ (mm)}$$

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:

$$\alpha = \frac{V}{60\,t} = \frac{10 \times 10^3}{60 \times 0.2} = 833 \text{ (mm/s}^2\text{)}$$

$$= 0.833 \text{ (m/s}^2\text{)}$$

$t = t_1 = t_3 = t_4 = t_6$

(a), (f) ····· $F_1 = mg - m\alpha$

$= 300 \times 9.80665 - 300 \times 0.833$

$= 2\,690$ (N)

(b), (e) ····· $F_2 = mg = 2\,940$ (N)

(c), (d) ····· $F_3 = mg + m\alpha = 3\,190$ (N)

[2] Buckling load

For condition in **Fig. 16.7**, use values below.

$P = 3\,190$ N, $L_1 = 1\,600$ mm

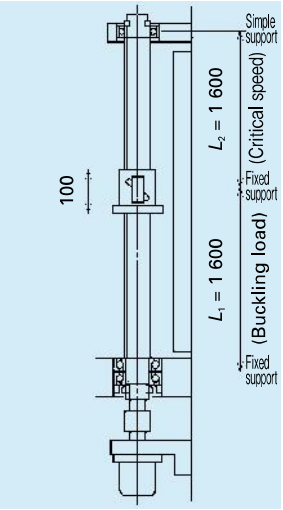


Fig. 16.7 Inspecting for buckling load and critical speed

From the formula 2) on page B44:

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

$$= \left(\frac{3\,190 \times 1\,600^2}{19.9} \times 10^{-4} \right)^{1/4} = 14.2 \text{ (mm)}$$

(2) Checking permissible rotational speed

[1] Critical speed

Use values below.

$n = 1\,000$ (min^{-1}), $L_2 = 1\,600$ (mm)

From the formula 7) on page B47:

$$d_r \geq \frac{n \cdot L_2^2}{f} \times 10^{-7} = \frac{1\,000 \times 1\,600^2}{15.1} \times 10^{-7}$$

$= 17$ (mm)

[2] $d \cdot n$ value

From **Table 3.2** on page B50:

$$d \leq \frac{50\,000}{n} = \frac{50\,000}{1\,000}$$

$= 50$ (mm)

∗ Please consult NSK when the d • 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)$_{\times 6}$(f)	$F_1 = 2\,690$	$N_1 = 500$	$t_a = 1.4$
(b)$_{\times 6}$(e)	$F_2 = 2\,940$	$N_2 = 1\,000$	$t_b = 13.0$
(c)$_{\times 6}$(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:

$$F_m = \left(\frac{F_1^3 \cdot N_1 \cdot t_a + F_2^3 \cdot N_2 \cdot t_b + F_3^3 \cdot N_3 \cdot t_c}{N_1 \cdot t_a + N_2 \cdot t_b + N_3 \cdot t_c} \right)^{1/3}$$

$= 2\,940$ (N)

$$N_m = \frac{N_1 \cdot t_a + N_2 \cdot t_b + N_3 \cdot t_c}{t}$$

$= 288$ (min^{-1})

From the formulas 8) and 9) on page B53:

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

$$= (60 \times 288 \times 24\,000)^{1/3} \times 2\,940 \times 1.2 \times 10^{-2}$$

$= 26\,300$ (N)

(4) Checking static load rating

$$C_{0a} = F_{max} \times f_s = 3\,190 \times 2$$

$= 6\,380$ (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-)

No.	Issued Date	Title
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

B-2-19 Guide to Technical Services

(1) CAD data

■Web page

http://www.jp.nsk.com/app01/en/ctrg/

■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.

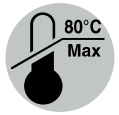
(4) If the recirculation component, the shaft outside, or the ball groove is scratched or damaged by impact, recirculation operation becomes deficient, and may cause a loss of function.

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

B-3-1 Dimension Table and Reference Number of Standard Ball Screws

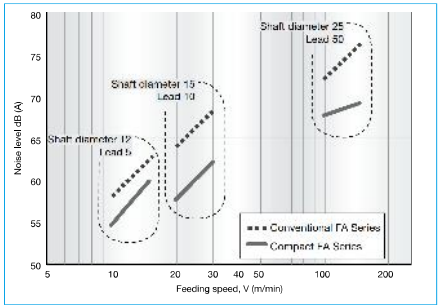
B-3-1.1 Compact FA Series PSS Type, USS Type, and FSS Type

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, 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.

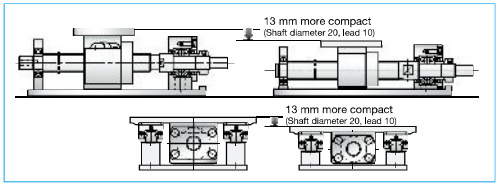


Fig. 2 Comparison of FA Type and Compact FA Series PSS Type

●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.

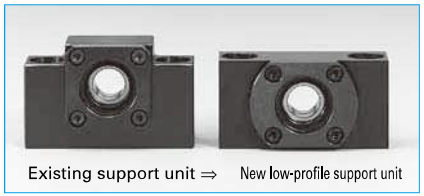


Fig. 3 Comparison of support units

●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.

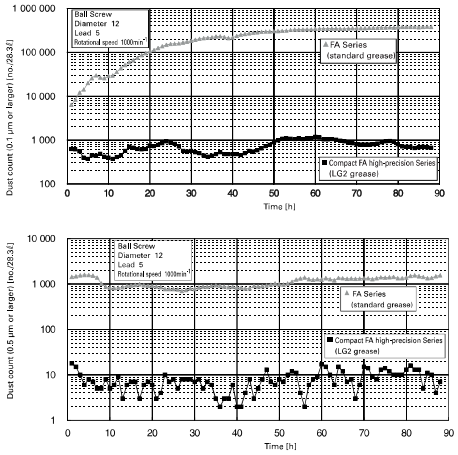


Fig.4 Comparison of dust count

●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 (L_1).

●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.

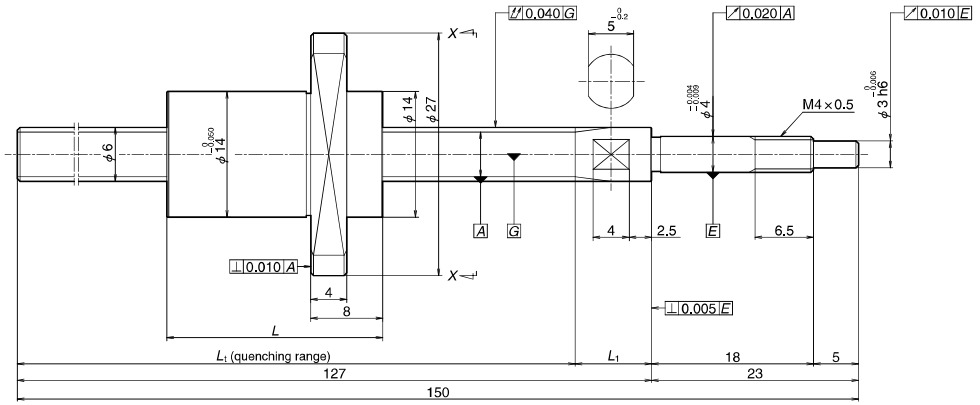
Table 1 Combinations of screw shaft diameter and lead

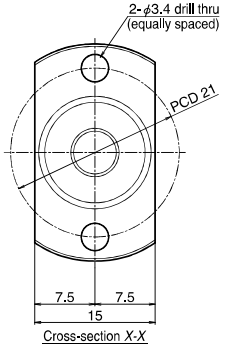
Screw shaft diameter \ Lead	5	8	10	12	15	20	25	30	40	50	60
6		B109		B109							
8			B111		B111						
10	B113 B133		B113								
12	B115 B135		B115 B139			B115		B115			
15	B117 B137		B117 B141			B119 B141		B119			
20	B121		B121 B143			B123 B143		B123	B125		B125
25	B127		B127 B145			B129 B145	B129 B145	B131		B131	

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

Ball screw No.	Screw shaft diameter d	Lead l	Effective turns of balls	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Maximum stroke	Nut length L	Screw shaft dimensions L_t	Screw shaft dimensions L_1
PSS0608NAD0150	6	8	2	550	715	97.5	16	118.5	8.5
PSS0608NBD0150			4	1 180	1 760	89.5	24	118.5	8.5
PSS0612NAD0150		12	2	550	715	92	20	117	10
PSS0612NBD0150			4	1 180	1 760	80	32	117	10

Lead accuracy Target value T	Lead accuracy Error e_p	Lead accuracy Variation v_u	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)
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

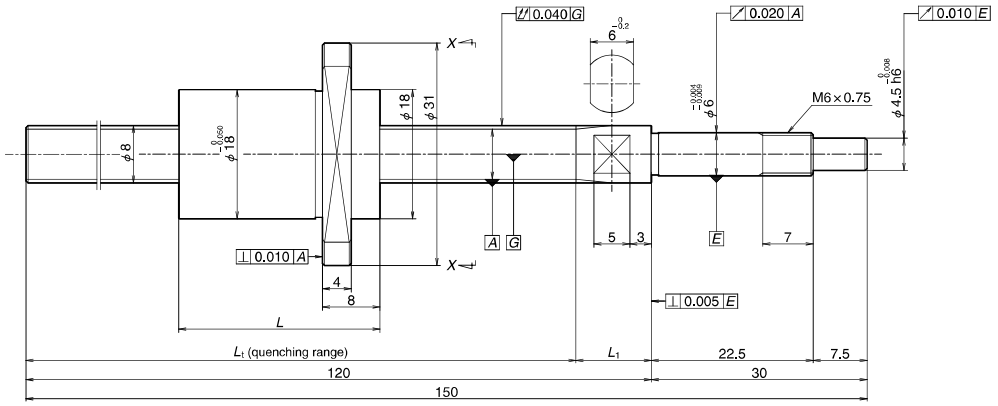
Notes: 1. Contact NSK if permissible rotational speed is to be exceeded.

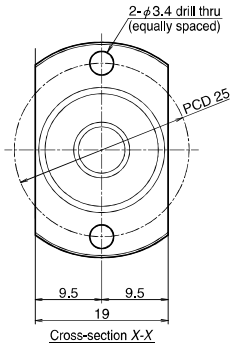
2. Service temperature range is 0 to 80˚C.
3. Use of NSK support unit is recommended. Refer to page B389 for details.

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

Ball screw No.	Screw shaft diameter d	Lead l	Effective turns of balls	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Maximum stroke	Nut length L	Screw shaft dimensions L_t	Screw shaft dimensions L_1
PSS0810NAD0150	8	10	2	910	1 260	86.5	18	109.5	10.5
PSS0810NBD0150			4	1 950	3 080	76.5	28	109.5	10.5
PSS0815NAD0150		15	2	910	1 260	80	22	107	13
PSS0815NBD0150			4	1 950	3 080	65	37	107	13

Lead accuracy Target value T	Lead accuracy Error e_p	Lead accuracy Variation v_u	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)
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

Notes: 1. Contact NSK if permissible rotational speed is to be exceeded.

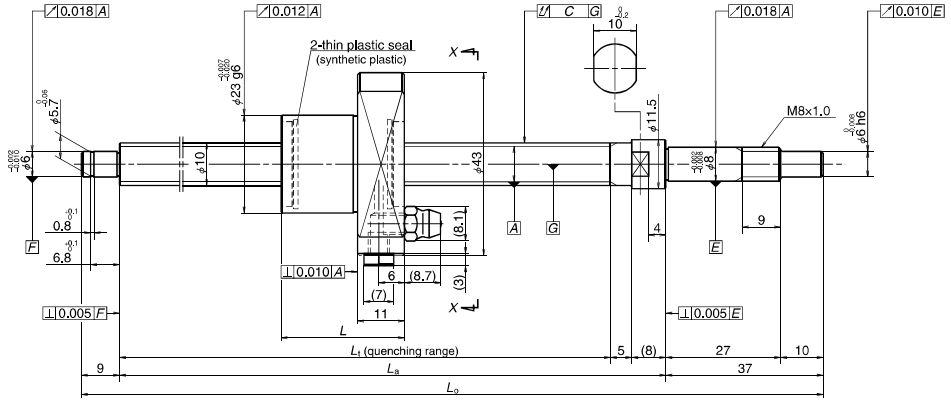
2. Service temperature range is 0 to 80˚C.
3. Use of NSK support unit is recommended. Refer to page B389 for details.

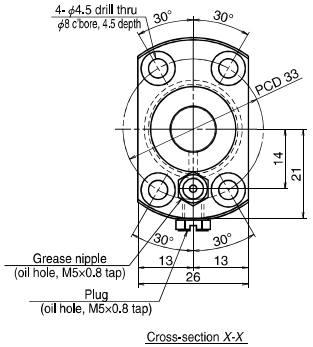
NSK

Screw shaft ø10

Lead 5, 10

Unit: mm





Cross-section X-X

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)
WBK08-11B (round, high load)	

Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions L_t	L_a	L_o
PSS1005N1D0171	10	5	2 930	4 790	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	1 970	3 010	100	125	32	162	175	221
PSS1010N1D0321					200	225		262	275	321
PSS1010N1D0421					300	325		362	375	421
PSS1010N1D0521					400	425		462	475	521

Lead accuracy Target value T	Error e_p	Variation v_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min^{-1}) *2 Fixed-Simple	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
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			
	0.020	0.018	0.045	0.7 – 3.3	0.3	5 000	0.7	0.4
	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			

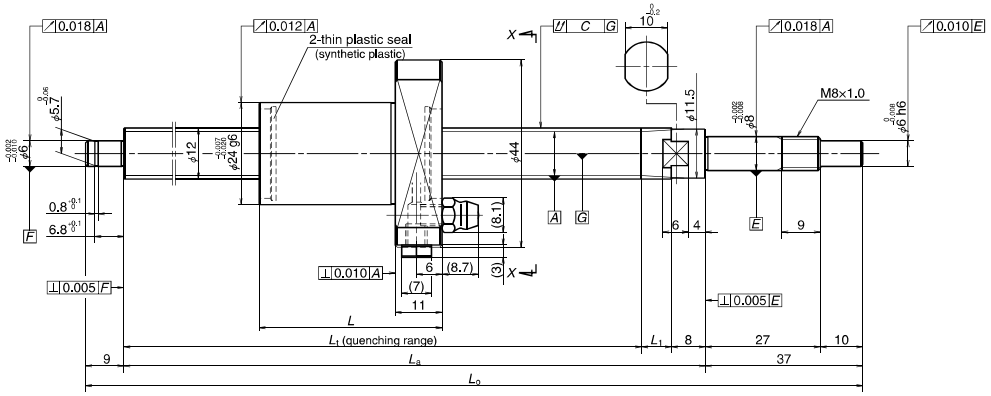
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

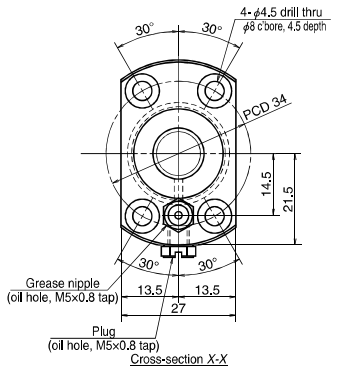
PSS

NSK

Screw shaft ø12

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

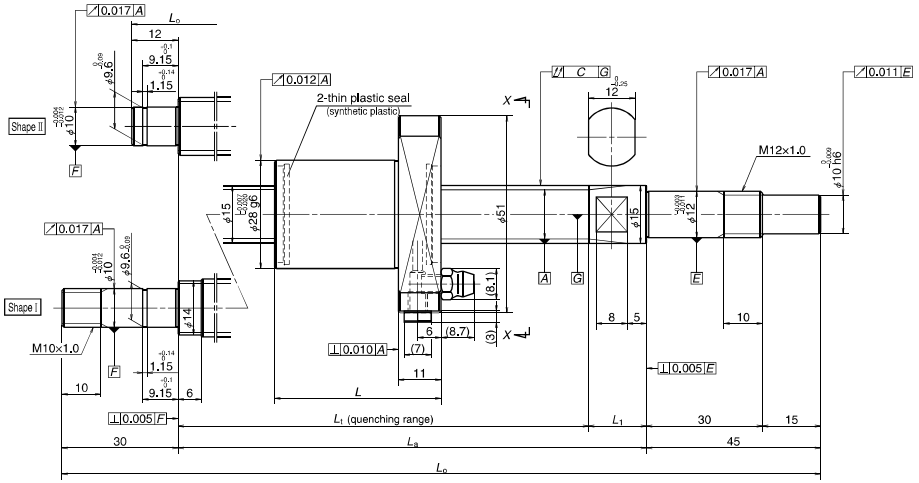
For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01B (low-profile, square)	WBK08S-01B (low-profile, square)
WBK08-11B (round, high load)	

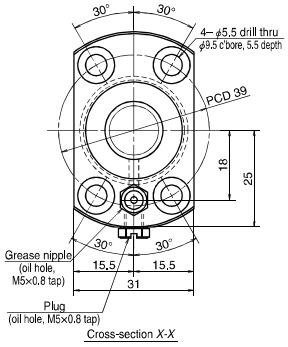
Unit: mm

Ball screw No.	Screw shaft diameter	Lead	Basic load ratings (N)		Stroke		Nut length	Screw shaft dimensions				Lead accuracy			Shaft run-out	Dynamic preload torque	Mass	Permissible rotational speed (min⁻¹) *2	Internal spatial volume of nut	Standard volume of grease replenishing
			Dynamic	Static								Target value	Error	Variation				Fixed-Simple		
	d	l	C_a	C_{0a}	Nominal	Max.	L	L_t	L_a	L_o	L_1	T	e_p	v_u	C	(N·cm) *1	(kg)		(cm³)	(cm³)
PSS1205N1D0171	12	5	3 200	5 860	50	75	30	110	125	171	7	0	0.020	0.018	0.030	0.7 – 3.3	0.3	5 000	1.0	0.5
PSS1205N1D0221					100	125		160	175	221			0.020	0.018	0.045	0.7 – 3.3	0.3			
PSS1205N1D0321					200	225		260	275	321			0.023	0.018	0.060	0.6 – 4.3	0.4			
PSS1205N1D0421					300	325		360	375	421			0.025	0.020	0.070	0.6 – 4.3	0.5			
PSS1205N1D0521					400	425		460	475	521			0.027	0.020	0.085	0.6 – 4.3	0.6			
PSS1205N1D0621					500	525		560	575	621			0.030	0.023	0.085	0.4 – 4.9	0.7			
PSS1210N1D0221		10	3 200	5 860	100	112	43	160	175	221	7		0.020	0.018	0.045	0.7 – 3.3	0.4	5 000	1.0	0.5
PSS1210N1D0321					200	212		260	275	321			0.023	0.018	0.060	0.6 – 4.3	0.5			
PSS1210N1D0421					300	312		360	375	421			0.025	0.020	0.070	0.6 – 4.3	0.5			
PSS1210N1D0521					400	412		460	475	521			0.027	0.020	0.085	0.6 – 4.3	0.6			
PSS1210N1D0621					500	512		560	575	621			0.030	0.023	0.085	0.4 – 4.9	0.7			
PSS1220N1D0271		20	2 150	3 610	100	153	50	208	225	271	9		0.023	0.018	0.045	1.4 – 4.5	0.4	5 000	1.2	0.6
PSS1220N1D0371					200	253		308	325	371			0.023	0.018	0.060	0.9 – 4.9	0.5	5 000		
PSS1220N1D0471					300	353		408	425	471			0.027	0.020	0.070	0.9 – 4.9	0.6	5 000		
PSS1220N1D0571					400	453		508	525	571			0.030	0.023	0.085	0.6 – 5.9	0.7	5 000		
PSS1220N1D0671					500	553		608	625	671			0.030	0.023	0.110	0.6 – 5.9	0.8	4 480		
PSS1230N1D0271		30	2 150	3 610	100	128	70	203	225	271	14		0.023	0.018	0.045	1.4 – 4.5	0.5	5 000	1.5	0.8
PSS1230N1D0371					200	228		303	325	371			0.023	0.018	0.060	0.9 – 4.9	0.6	5 000		
PSS1230N1D0471					300	328		403	425	471			0.027	0.020	0.070	0.9 – 4.9	0.7	5 000		
PSS1230N1D0571					400	428		503	525	571			0.030	0.023	0.085	0.6 – 5.9	0.7	5 000		
PSS1230N1D0671					500	528		603	625	671			0.030	0.023	0.110	0.6 – 5.9	0.8	4 720		

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.
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.

PSS





NSK

Screw shaft ø15

Lead 5, 10

Unit: mm

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)	For opposite to drive side (Simple)
WBK12-01B (low-profile, square)	WBK10-01B (low-profile, square)	WBK12S-01B (low-profile, square)
WBK12-11 (round)	WBK10-11 (round)	

Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions L_t	L_a	L_o	L_1
PSS1505N1D0211	15	5	5 460	10 200	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	5 460	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	

Left shaft end (opposite driven side)	Lead accuracy Target value T	Lead accuracy Error e_p	Lead accuracy Variation v_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Permissible rotational speed (min⁻¹) *2 Fixed-Fixed	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
II	0	0.020	0.018	0.035	0.2 – 6.9	0.5	5 000			
II		0.020	0.018	0.035	0.2 – 6.9	0.5	5 000			
II		0.023	0.018	0.045	0.2 – 6.9	0.6	5 000			
II		0.025	0.020	0.050	0.4 – 9.8	0.8	5 000	—	2.0	1.0
II		0.027	0.020	0.060	0.4 – 9.8	0.9	5 000			
II		0.030	0.023	0.075	0.4 – 9.8	1.0	5 000			
II		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	—		
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	—	2.0	1.0
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		

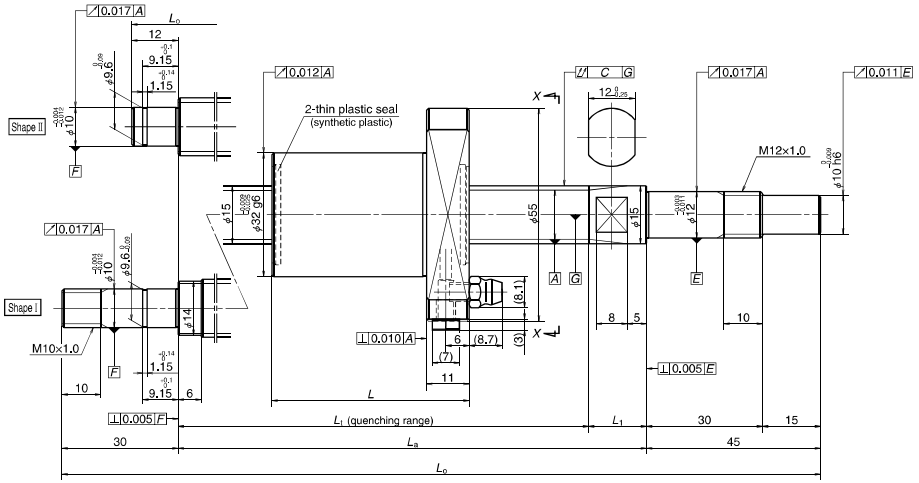
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

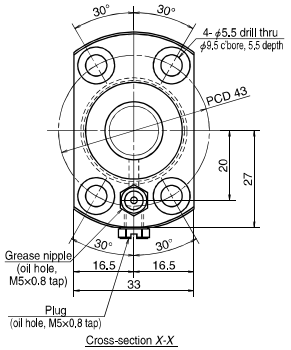
NSK

Screw shaft ø15

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)	For opposite to drive side (Simple)
WBK12-01B (low-profile, square)	WBK10-01B (low-profile, square)	WBK12S-01B (low-profile, square)
WBK12-11 (round)	WBK10-11 (round)	

Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions L_t	L_a	L_o	L_1
PSS1520N1D0261	15	20	5 070	8 730	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	5 070	8 730	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	

Left shaft end (opposite driven side)	Lead accuracy Target value T	Lead accuracy Error e_p	Lead accuracy Variation v_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Permissible rotational speed (min⁻¹) *2 Fixed-Fixed	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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		

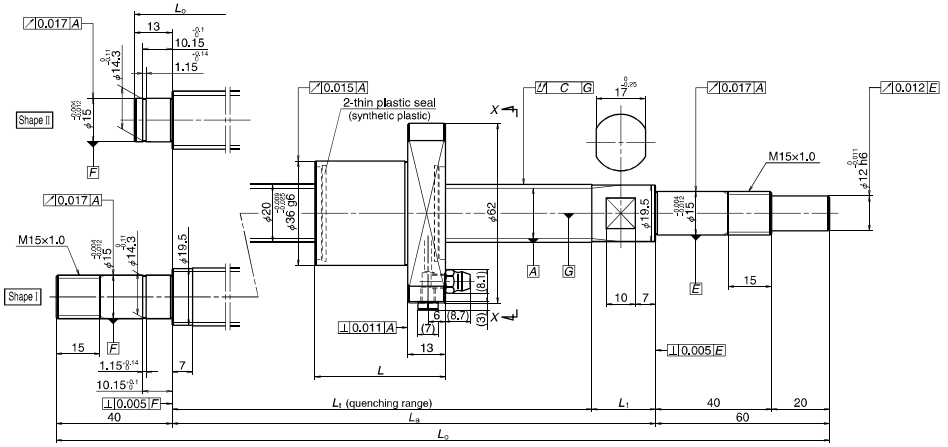
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

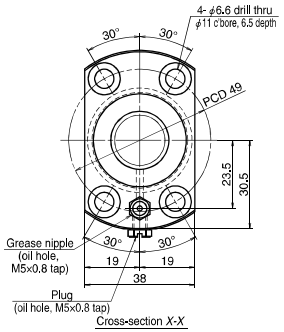
NSK

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)	For opposite to drive side (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 d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions L_t	L_a	L_o	L_1
PSS2005N1D0323	20	5	8 790	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		10	8 790	18 500	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	

Left shaft end (opposite driven side)	Lead accuracy Target value T	Lead accuracy Error e_p	Lead accuracy Variation v_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Permissible rotational speed (min⁻¹) *2 Fixed-Fixed	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
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		

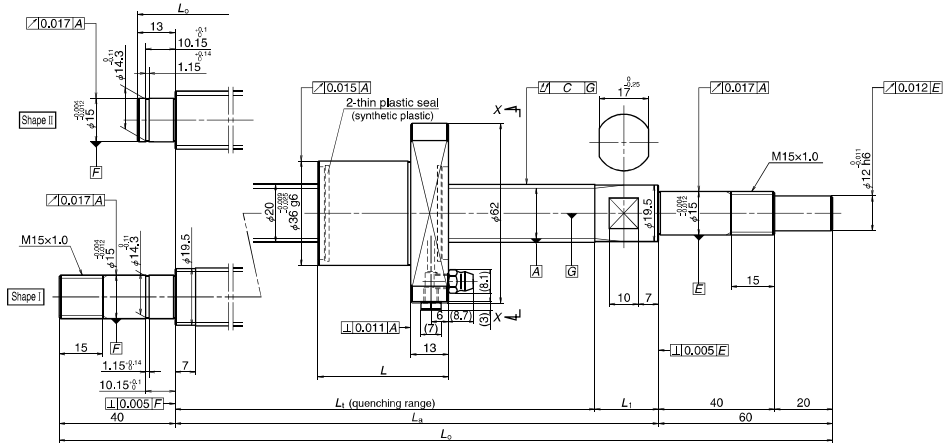
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

NSK

Screw shaft ø20

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)	For opposite to drive side (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 d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions L_t	L_a	L_o	L_1
PSS2020N1D0508	20	20	5 900	11 700	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	5 900	11 700	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	

Left shaft end (opposite driven side)	Lead accuracy Target value T	Lead accuracy Error e_p	Lead accuracy Variation v_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Permissible rotational speed (min⁻¹) *2 Fixed-Fixed	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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		

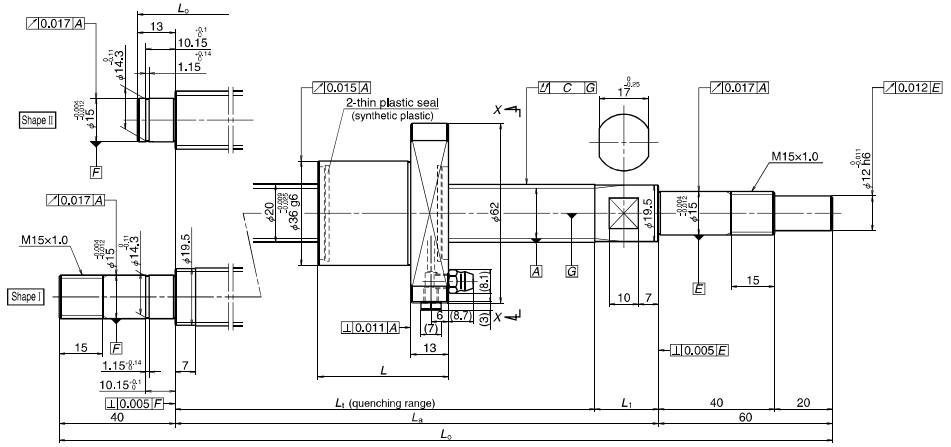
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

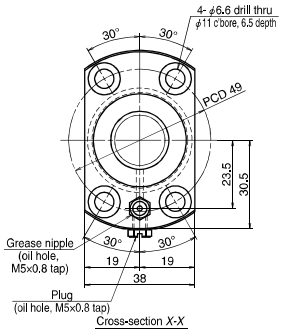
NSK

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)	For opposite to drive side (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 d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions L_t	L_a	L_o	L_1
PSS2040N1D0658	20	40	5 900	11 700	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	5 900	11 700	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	

Left shaft end (opposite driven side)	Lead accuracy Target value T	Lead accuracy Error e_p	Lead accuracy Variation v_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Permissible rotational speed (min⁻¹) *2 Fixed-Fixed	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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		

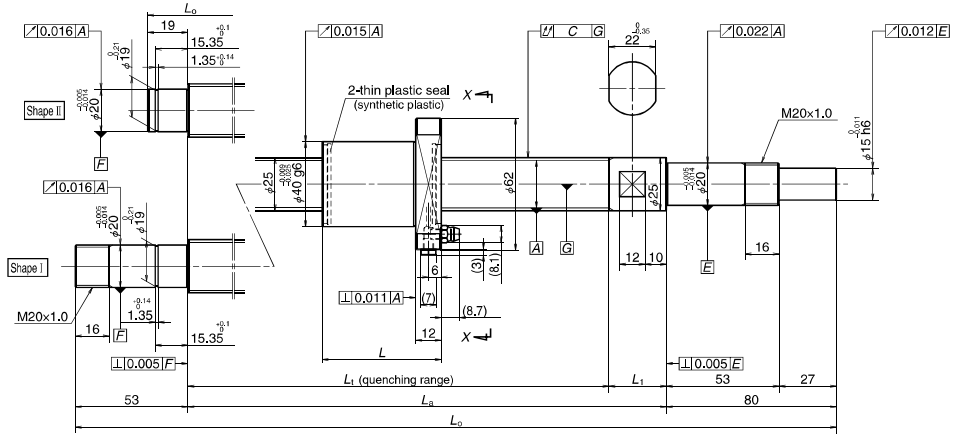
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

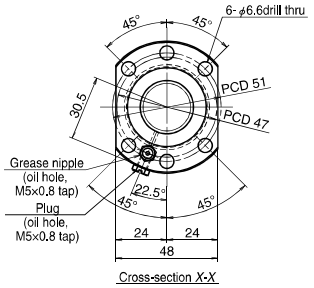
NSK

Screw shaft ø25

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)	For opposite to drive side (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) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions L_t	L_a	L_o	L_1
PSS2505N1D0349	25	5	9 760	23 600	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	12 800	32 300	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	

Left shaft end (opposite driven side)	Lead accuracy Target value T	Error e_p	Variation v_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Fixed-Fixed	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
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		

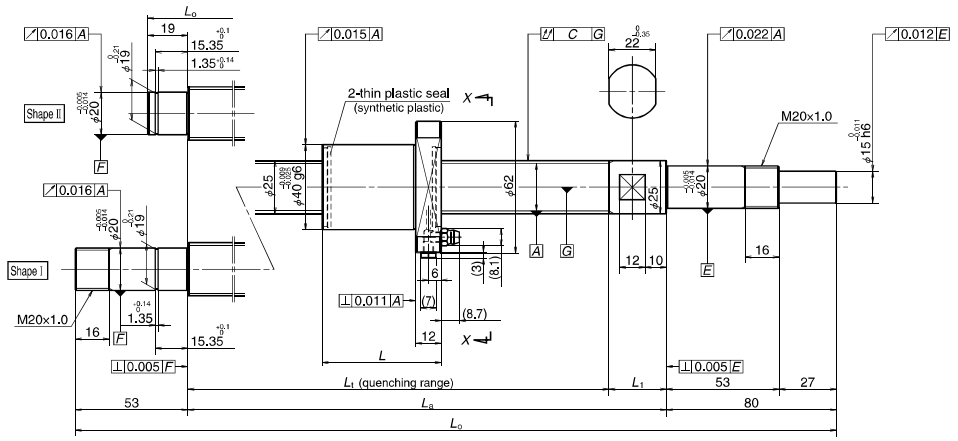
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

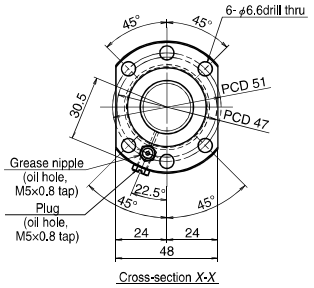
NSK

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)	For opposite to drive side (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) Dynamic Ca	Basic load ratings (N) Static C0a	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions Lt	La	Lo	L1
PSS2520N1D0729	25	20	6 560	14 600	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	6 560	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	

Left shaft end (opposite driven side)	Lead accuracy Target value T	Lead accuracy Error ep	Lead accuracy Variation vu	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Permissible rotational speed (min⁻¹) *2 Fixed-Fixed	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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		

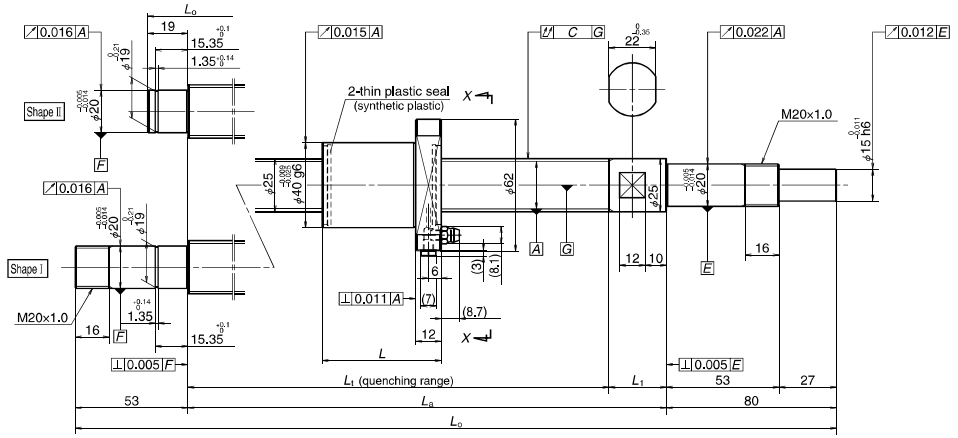
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

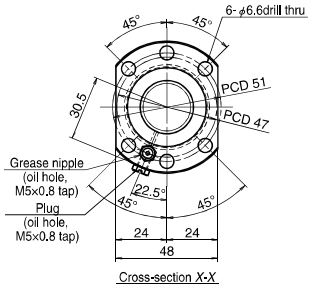
NSK

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)	For opposite to drive side (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) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length *L*	Screw shaft dimensions L_t	L_a	L_o	L_1
PSS2530N1D0779	25	30	6 560	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	6 560	14 600	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	

Left shaft end (opposite driven side)	Lead accuracy Target value *T*	Lead accuracy Error e_p	Lead accuracy Variation v_u	Shaft run-out *C*	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Permissible rotational speed (min⁻¹) *2 Fixed-Fixed	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
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		

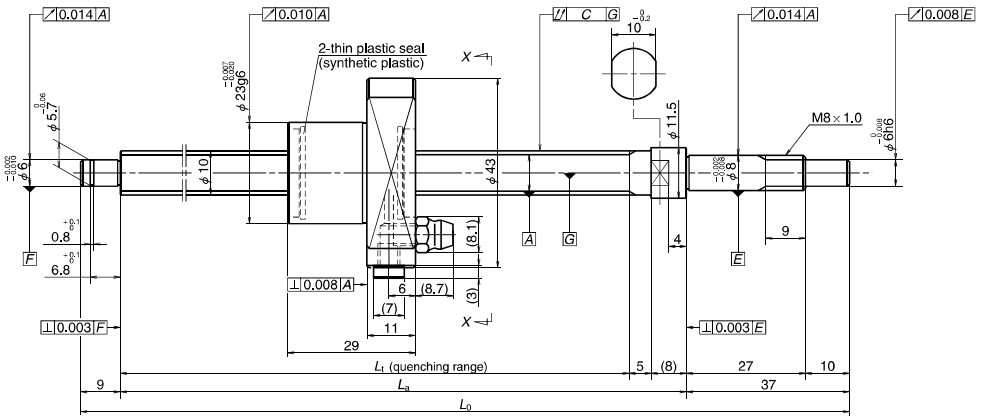
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. Refer to page B389 for details.
5. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.

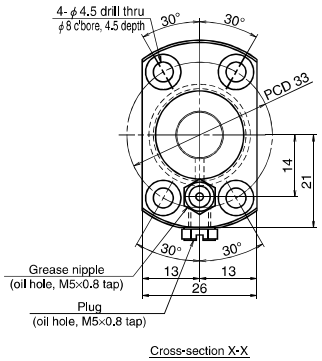
NSK

Screw shaft ø10

Lead 5

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	C3 / 0
Factory-packed grease	NSK grease LR2

Recommended support unit

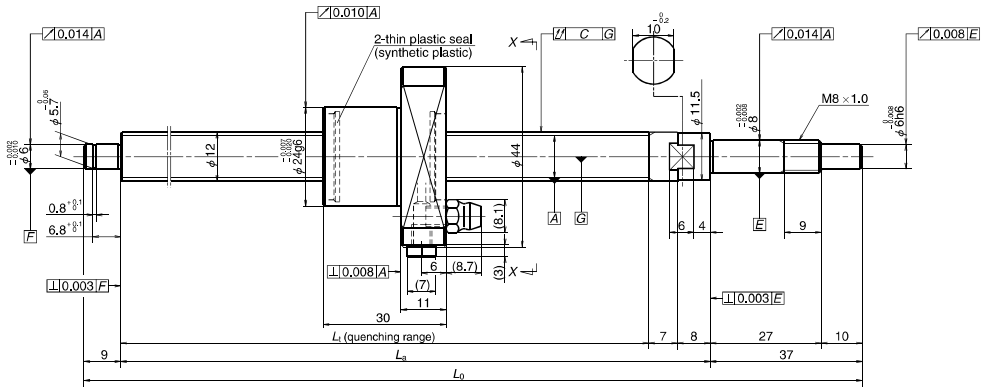
For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01C (square, clean)	WBK08S-01C (square, clean)
WBK08-11C (round, clean)	WBK08S-01B (low-profile, square)
WBK08-01B (low-profile, square)	
WBK08-11 (round)	

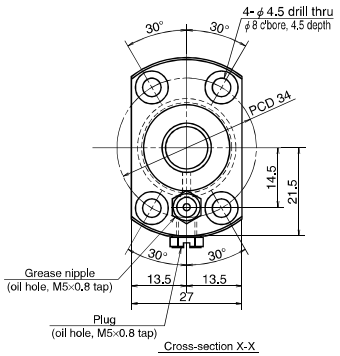
Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Screw shaft dimensions L_t	Screw shaft dimensions L_a	Screw shaft dimensions L_0
USS1005N1D0221	10	5	2 930	4 790	100	133	162	175	221
USS1005N1D0321					200	233	262	275	321
USS1005N1D0521					400	433	462	475	521

Lead accuracy Target value T	Lead accuracy Error e_p	Lead accuracy Variation V_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
0	0.010	0.008	0.035	0.2–1.8	0.3	5 000	0.8	0.4
	0.012	0.008	0.045	0.2–2.0	0.3			
	0.015	0.010	0.070	0.2–3.0	0.5			

Notes: 1. Indicates ball screw preload control value. Approximately 0.5 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.
4. Use of NSK support unit is recommended. See page B389 for details.





NSK

Screw shaft ø12

Lead 5

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	C3 / 0
Factory-packed grease	NSK grease LR2

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)	

Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Screw shaft dimensions L_t	L_a	L_o
USS1205N1D0221	12	5	3 200	5 860	100	130	160	175	221
USS1205N1D0321					200	230	260	275	321
USS1205N1D0621					500	530	560	575	621

Lead accuracy Target value T	Error e_p	Variation V_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
0	0.010	0.008	0.035	0.2–1.8	0.3	5 000	1.0	0.5
	0.012	0.008	0.045	0.2–2.0	0.3			
	0.016	0.012	0.070	0.2–3.0	0.7			

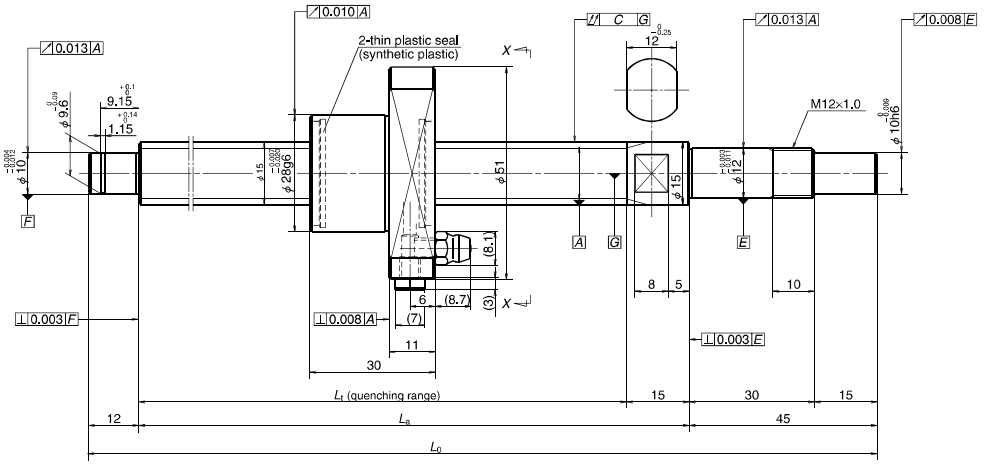
Notes: 1. Indicates ball screw preload control value. Approximately 0.5 N·cm of torque is added due to thin plastic seals.
2. Contact NSK if permissible rotational speed is to be exceeded.
3. Service temperature range is 0 to 80°C.
4. Use of NSK support unit is recommended. See page B389 for details.

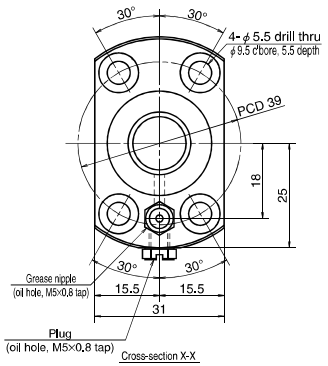
NSK

Screw shaft ø15

Lead 5

Unit: mm





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	C3 / 0
Factory-packed grease	NSK grease LR2

Recommended support unit

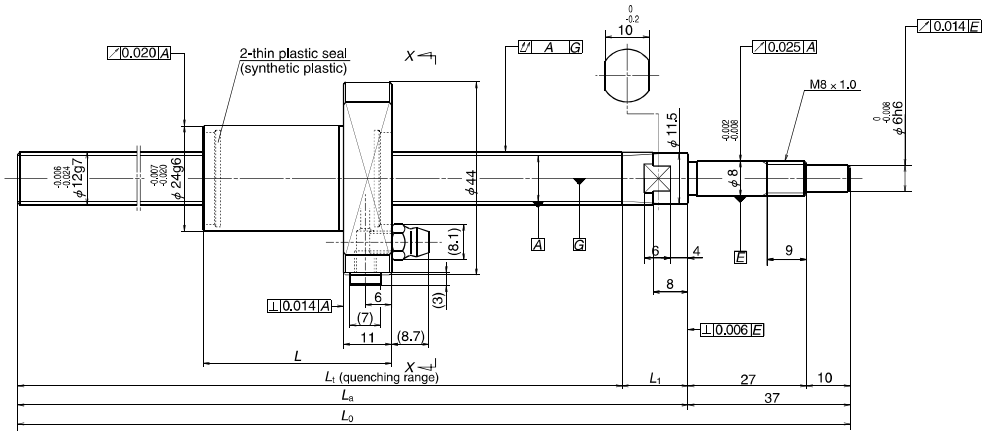
For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01C (square, clean)	WBK12S-01C (square, clean)
WBK12-11C (round, clean)	WBK12-01B (low-profile, square)
WBK12S-01B (low-profile, square)	
WBK12-11 (round)	

Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Screw shaft dimensions L_t	L_a	L_o
USS1505N1D0261	15	5	5 460	10 200	100	159	189	204	261
USS1505N1D0361					200	259	289	304	361
USS1505N1D0561					400	459	489	504	561
USS1505N1D0761					600	653	689	704	761

Lead accuracy Target value T	Error e_p	Variation V_u	Shaft run-out C	Dynamic preload torque (N·cm) *1	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
0	0.010	0.008	0.025	0.2–5.0	0.5	5 000	2.0	1.0
	0.012	0.008	0.035	0.2–5.0	0.6	5 000		
	0.015	0.010	0.045	0.2–6.0	0.9	5 000		
	0.018	0.013	0.060	0.2–8.0	1.1	4 130		

Notes: 1. Indicates ball screw preload control value. Approximately 0.5 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.
4. Use of NSK support unit is recommended. See page B389 for details.



Ball screw No.	Screw shaft diameter	Lead	Basic load ratings (N)		Stroke		Nut length	Screw shaft dimensions			
			Dynamic	Static	Nominal	Max.					
	d	l	C_a	C_{0a}			L	L_t	L_a	L_o	L_1
FSS1210N1D0400	12	10	3 200	5 860	250	287	43	348	363	400	15
FSS1210N1D0600					450	487		548	563	600	
FSS1210N1D0900					750	787		848	863	900	

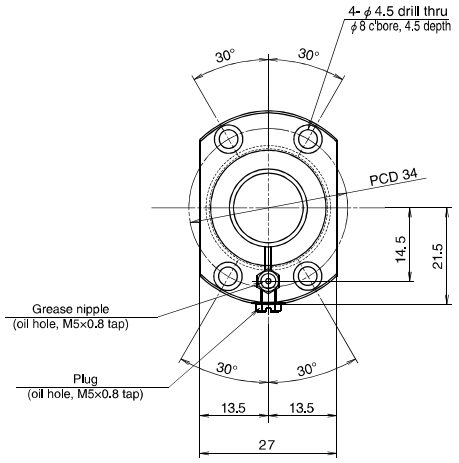
Notes: 1. Indicates ball screw preload control value. Approximately 2.0 N·cm of torque is added due to thin plastic seals.
2. Service temperature range is 0 to 80°C.
3. Use of NSK support unit is recommended. See page B389 for details.

NSK

Screw shaft ø12

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	Dynamic preload torque	Mass	Permissible rotational speed (min⁻¹) *2	Internal spatial volume of nut	Standard volume of grease replenishing
Target value	Error	Variation				Fixed-Simple		
T	e_p	V_{300}	C	(N·cm)	(kg)		(cm³)	(cm³)
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

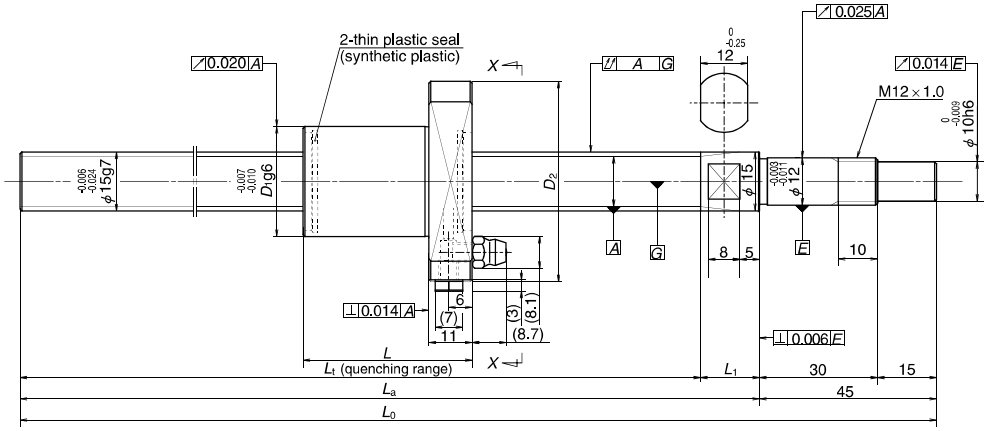
FSS

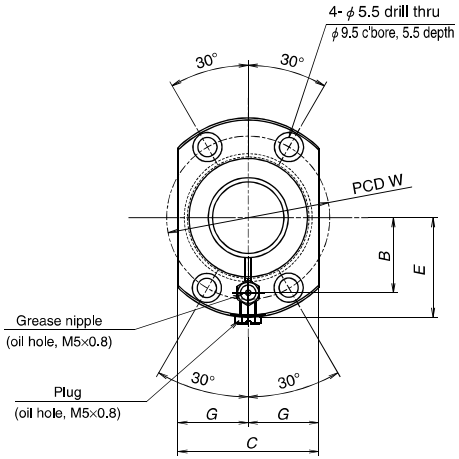
NSK

Screw shaft ø15

Lead 10, 20

Unit: mm





Ball screw specification		
Lead	10	20
Ball diameter/screw shaft root diameter	2.778 / 12.6	3.175 / 12.2
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)
WBK12-01B (low-profile, square)	WBK15SF-01B (low-profile, square)

Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Screw shaft dimensions L_1	L_a	L_0	L_1	Lead accuracy Target value T	Error e_p	Variation V_{300}
FSS1510N1D0500	15	10	5 460	10 200	350	379	440	455	500	15	0	0.155	0.052
FSS1510N1D1000					850	879	940	955	1 000			0.310	
FSS1510N1D1450					1 300	1 329	1 390	1 405	1 450			0.490	
FSS1520N1D0500		20	5 070	8 730	350	368	437	455	500	18		0.155	
FSS1520N1D1000					850	868	937	955	1 000			0.310	
FSS1520N1D1450					1 300	1 318	1 387	1 405	1 450			0.490	

Nut dimensions L	D_1	D_2	W	B	C	E	G	Shaft run-out C	Dynamic preload torque (N·cm)	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
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		

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}

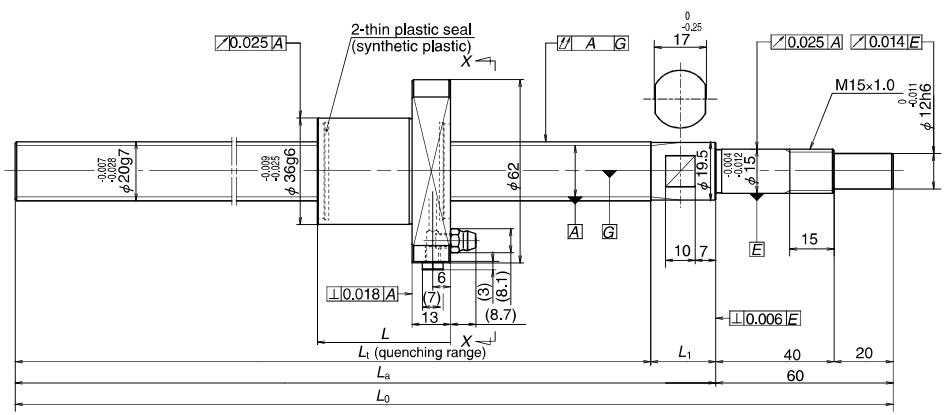
FSS

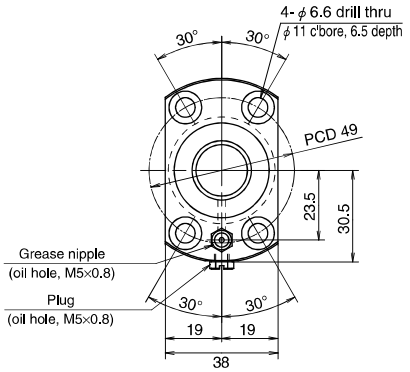
NSK

Screw shaft ø20

Lead 10, 20

Unit: mm





Ball screw specification	
Ball diameter/screw shaft root diameter	3.175 / 17.2
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)
WBK15-01B (low-profile, square)	WBK20SF-01B (low-profile, square)

Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions L_t	L_a	L_0	L_1
FSS2010N1D0600	20	10	8 790	18 500	400	451	45	518	540	600	22
FSS2010N1D1000					800	851		918	940	1 000	
FSS2010N1D1450					1 250	1 301		1 368	1 390	1 450	
FSS2020N1D0600		20	5 900	11 700	400	442	54	518	540	600	
FSS2020N1D1000					800	842		918	940	1 000	
FSS2020N1D1450					1 250	1 292		1 368	1 390	1 450	

Lead accuracy Target value T	Error e_p	Variation V_{300}	Shaft run-out C	Dynamic preload torque (N·cm)	Mass (kg)	Permissible rotational speed (min^{-1}) *2 Fixed-Simple	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
0	0.195	0.052	0.085	–	1.7	5 000	3.2	1.6
	0.310		0.125		2.6	3 310		
	0.490		0.200		3.6	1 450		
	0.195		0.085		1.8	5 000		
	0.310		0.125		2.7	3 350		
	0.490		0.200		3.8	1 460		

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}

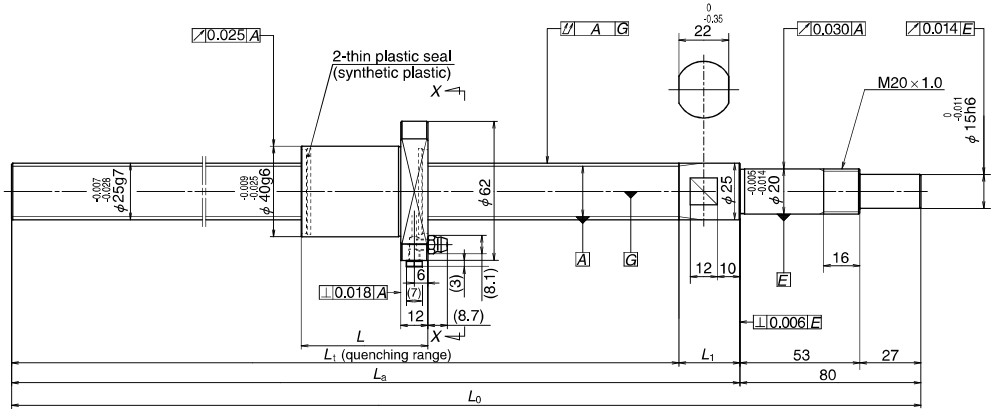
FSS

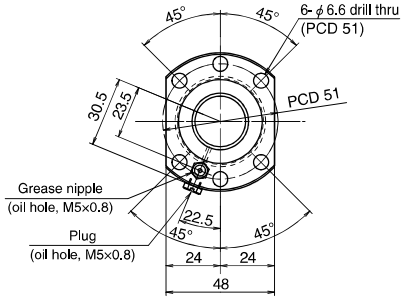
NSK

Screw shaft ø25

Lead 10, 20, 25

Unit: mm





Ball screw specification	
Ball diameter/screw shaft root diameter	3.175 / 22.2
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)
WBK20-01 (square)	WBK25SF-01 (square)

Unit: mm

Ball screw No.	Screw shaft diameter d	Lead l	Basic load ratings (N) Dynamic C_a	Basic load ratings (N) Static C_{0a}	Stroke Nominal	Stroke Max.	Nut length L	Screw shaft dimensions L_t	L_a	L_o	L_1
FSS2510N1D0600	25	10	12 800	32 300	400	415	56	493	520	600	27
FSS2510N1D1000					800	815		893	920	1 000	
FSS2510N1D1450					1 250	1 265		1 343	1 370	1 450	
FSS2520N1D0600		20	6 560	14 600	400	418	54	494	520	600	26
FSS2520N1D1000					800	818		894	920	1 000	
FSS2520N1D1450					1 250	1 268		1 344	1 370	1 450	
FSS2525N1D0600		25			400	405	63	490	520	600	30
FSS2525N1D1000					800	805		890	920	1 000	
FSS2525N1D1450					1 250	1 255		1 340	1 370	1 450	

Lead accuracy Target value T	Error e_p	Variation V_{300}	Shaft run-out C	Dynamic preload torque (N·cm)	Mass (kg)	Permissible rotational speed (min⁻¹) *2 Fixed-Simple	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
0	0.155	0.052	0.065	–	2.6	5 000	4.7	2.4
	0.310		0.090		4.0	4 590		
	0.490		0.130		5.8	1 970		
	0.155		0.065		2.6	5 000	3.9	2.0
	0.310		0.090		4.0	4 570		
	0.490		0.130		5.8	1 960		
	0.155		0.065		2.6	5 000	4.3	2.2
	0.310		0.090		4.1	4 660		
	0.490		0.130		5.8	1 990		

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 • 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.

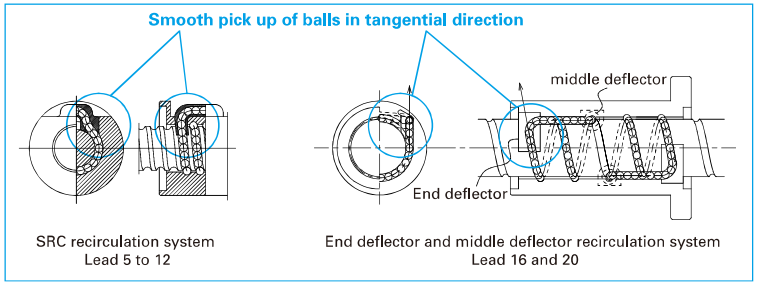


Fig 1 Ball recirculation system

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, 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.

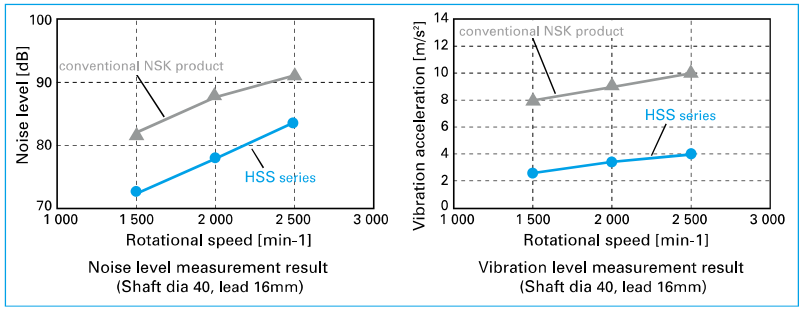


Table 2

● 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".

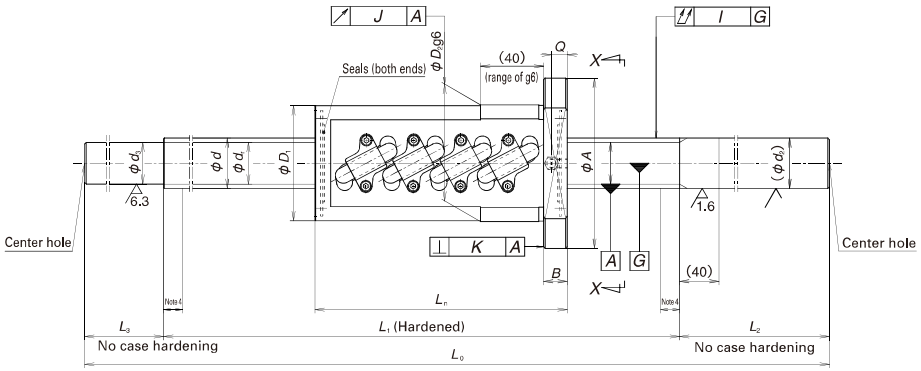
◇ Other

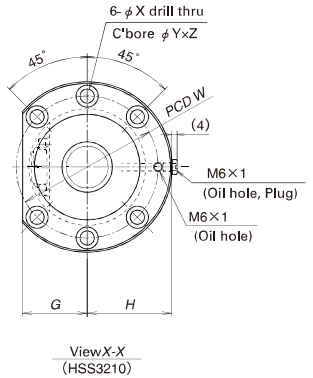
The seal of the ball screw and recirculation parts are made of synthetic resin. Consult NSK when using the ball screws under extreme environments or special environments, or using special lubrican or oil.
For special environments, see pages B70 and D2. See pages B67 and D13 for lubricants.

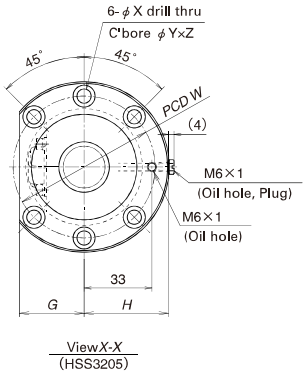
Table 3 Combinations of screw shaft diameter and lead

Screw shaft diameter [mm] \ Lead [mm]	5	10	12	16	20
32	B149	B149			
40		B151	B151	B153	B153
45		B155			
50		B155	B155		

Screw shaft ϕ 32
Lead 5,10







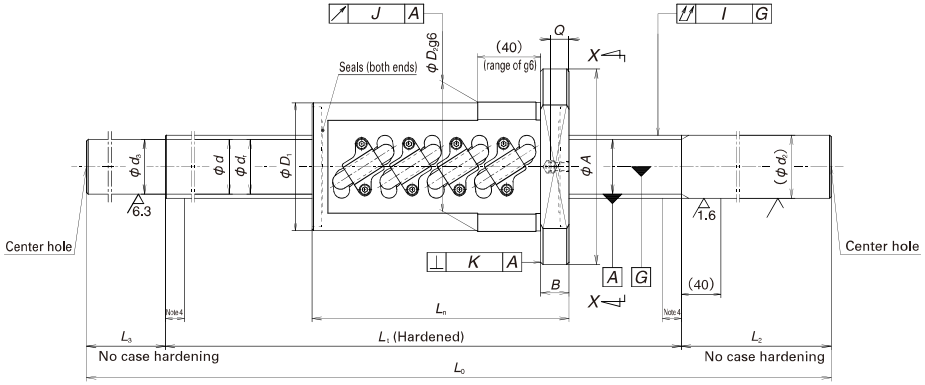
Unit : mm

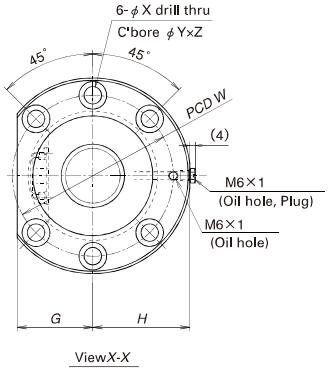
Reference No.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective balls turns Tune × Circuits	Basic load rating(N) Dynamic	Basic load rating(N) Static	Preload	Dynamic friction torque, median	Ball nut dimensions: Diameter		Flange				Overall length	
	d	l	D_w	d_m	d_r		C_a	C_{oa}	(N)	(N·cm)	D_1	D_2	A	G	H	B	L_n	W
HSS3205N1D0650	32	5	3.175	32.5	29.2	2.5X2	18500	56100	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	46300	108000	2310	59.5	73	74	108	41	53.5	15	160	90
HSS3210N1D1050																		
HSS3210N1D1450																		
HSS3210N1D1850																		
HSS3210N1D2250																		

Bolt hole X	Bolt hole Y	Bolt hole Z	Oil hole Q	Screw shaft dimension: Threaded length L_1	Shaft end, right d_2	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_0	Lead accuracy: Travel compensation T	Deviation e_p	Variation V_u	Run-out: Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed (min^{-1}): Installation Fixed-Free support	Permissible rotational speed (min^{-1}): Installation Fixed-Fixed support	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
6.6	11	6.5	8	400	32	200	29.2	50	650	-0.010	0.025	0.020	0.055	0.019	0.013	5.2	5000	5000	10	5
				600		250		100	950	-0.014	0.030	0.023	0.065			7.0	5000	5000		
				900		250		100	1250	-0.022	0.040	0.027	0.080			8.7	5000	5000		
				1150		300		100	1550	-0.028	0.046	0.030	0.100			10.5	3500	4700		
				1450		300		100	1850	-0.035	0.054	0.035	0.130			12.2	2200	2900		
9	14	8.5	10	500	32	250	26.4	100	850	-0.012	0.027	0.020	0.065	0.019	0.013	8.9	5000	5000	43	22
				700		250		100	1050	-0.017	0.035	0.025	0.080			10.0	5000	5000		
				1050		300		100	1450	-0.025	0.046	0.030	0.100			12.2	4100	5000		
				1450		300		100	1850	-0.035	0.054	0.035	0.130			14.3	2100	2800		
				1850		300		100	2250	-0.045	0.065	0.040	0.170			16.5	1200	1700		

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 ϕ 40
Lead 10, 12





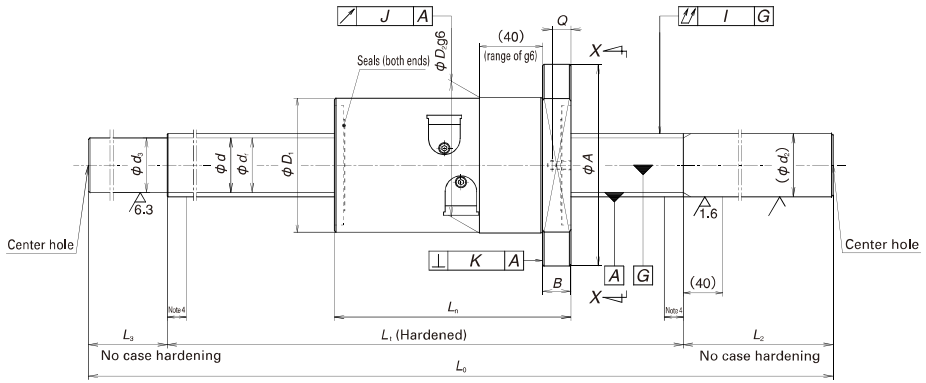
Unit : mm

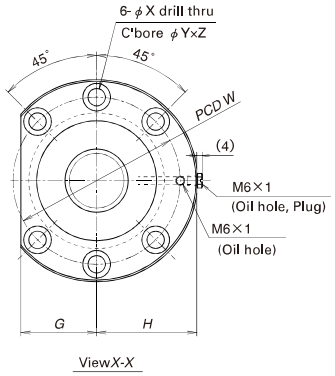
Reference No.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective balls turns	Basic load rating(N)		Preload	Dynamic friction torque, median	Ball nut dimensions							
						Tune × Circuits	Dynamic	Static			Diameter		Flange				Overall length	
	d	l	D_w	d_m	d_r		C_a	C_{0a}	(N)	(N·cm)	D_1	D_2	A	G	H	B	L_n	W
HSS4010N1D0950	40	10	6.350	41.0	34.4	2.5X2	52000	137000	2600	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	61000	155000	3050	96.0	85	86	128	48	63.5	18	187	106
HSS4012N1D2100																		
HSS4012N1D2900																		

Bolt hole			Oil hole	Screw shaft dimension						Lead accuracy			Run-out			Mass	Permissible rotational speed (min^{-1})		Internal spatial volume of nut	Standard volume of grease replenishing
				Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Nut O.D. eccentricity	Flange perpendicularity		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	(cm^3)	(cm^3)
11	17.5	11	12	600	40	250	34.4	100	950	-0.014	0.030	0.023	0.050	0.025	0.015	13.5	4000	4000	52	26
				1050		300		100	1450	-0.025	0.046	0.030	0.070			17.9	4000	4000		
				1600		350		150	2100	-0.039	0.054	0.035	0.110			23.5	2200	3000		
				2400		350		150	2900	-0.058	0.077	0.046	0.140			30.5	900	1300		
11	17.5	11	12	1050	40	300	34.1	100	1450	-0.025	0.046	0.030	0.070	0.025	0.015	19.1	4000	4000	67	34
				1600		350		150	2100	-0.039	0.054	0.035	0.110			24.8	2200	3000		
				2400		350		150	2900	-0.058	0.077	0.046	0.140			31.8	900	1300		

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 ϕ40
Lead 16, 20





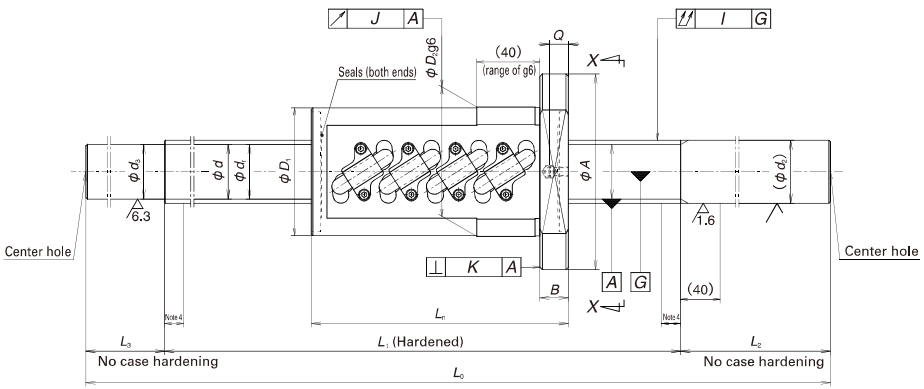
Unit : mm

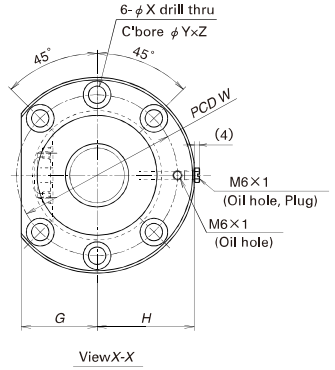
Reference No.	Screw shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Effective balls turns	Basic load rating(N)		Preload	Dynamic friction torque, median	Ball nut dimensions							
						Tune × Circuits	Dynamic	Static			Diamete		Flange				Overall length	
	d	l	D_w	d_m	d_r		C_a	C_{0a}	(N)	(N·cm)	D_1	D_2	A	G	H	B	L_n	W
HSS4016N1D1450	40	16	7.144	41.5	34.1	3.7X1	57100	130000	2850	104.0	85	86	128	48	63.5	18	160	106
HSS4016N1D2100																		
HSS4016N1D2900																		
HSS4020N1D1450	40	20	7.144	41.5	34.1	3.7X1	57100	130000	2850	116.5	85	86	128	48	63.5	18	192	106
HSS4020N1D2100																		
HSS4020N1D2900																		

Bolt hole			Oil hole	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)
				Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Nut O.D. eccentricity	Flange perpendicularity		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	11	1050	40	300	34.1	100	1450	-0.025	0.046	0.030	0.070	0.025	0.015	19.2	4000	4000	40	20
				1600		350		150	2100	-0.039	0.054	0.035	0.110			25.0	2200	3000		
				2400		350		150	2900	-0.058	0.077	0.046	0.140			32.2	900	1300		
11	17.5	11	11	1050	40	300	34.4	100	1450	-0.025	0.046	0.030	0.070	0.025	0.015	20.3	4000	4000	47	24
				1600		350		150	2100	-0.039	0.054	0.035	0.110			26.2	2200	3000		
				2400		350		150	2900	-0.058	0.077	0.046	0.140			33.5	900	1300		

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 ϕ 45, 50
Lead 10, 12





Unit : mm

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	Ball nut dimensions							
						Tune × Circuits	Dynamic	Static			Diamete		Flange				Overall length	
	d	l	D_w	d_m	d_r		C_a	C_{0a}	(N)	(N·cm)	D_1	D_2	A	G	H	B	L_n	W
HSS4510N1D1450	45	10	6.350	46.0	39.4	2.5X2	54200	155000	2710	82.0	87	88	132	50	65.5	18	163	110
HSS4510N1D2100																		
HSS4510N1D2900																		
HSS5010N1D1450	50	10	6.350	51.0	44.4	2.5X2	57700	175000	2880	92.0	92	93	135	51	67	18	163	113
HSS5010N1D1850																		
HSS5010N1D2350																		
HSS5010N1D2900																		
HSS5012N1D1450	50	12	7.938	51.5	43.2	2.5X2	77600	214000	3880	136.5	99	100	146	55	72.5	22	193	122
HSS5012N1D2100																		
HSS5012N1D2900																		

Bolt hole			Oil hole	Screw shaft dimension						Lead accuracy			Run-out			Mass	Permissible rotational speed (min⁻¹)		Internal spatial volume of nut	Standard volume of grease replenishing
				Threaded length	Shaft end, right		Shaft end, left		Overall length	Travel compensation	Deviation	Variation	Shaft straightness	Nut O.D. eccentricity	Flange perpendicularity		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	(cm³)	(cm³)
11	17.5	11	12	1050	45	300	39.4	100	1450	-0.025	0.046	0.030	0.070	0.025	0.015	22.0	3500	3500	58	29
				1600		350		150	2100	-0.039	0.054	0.035	0.110			29.2	2500	3400		
				2400		350		150	2900	-0.058	0.077	0.046	0.140			38.2	1100	1500		
11	17.5	11	12	1050	50	300	44.4	100	1450	-0.025	0.046	0.030	0.070	0.025	0.015	26.3	3200	3200	64	32
				1450		300		100	1850	-0.035	0.054	0.035	0.090			31.9	3200	3200		
				1850		350		150	2350	-0.045	0.065	0.040	0.110			38.8	2100	2900		
				2400		350		150	2900	-0.058	0.077	0.046	0.140			46.5	1200	1700		
14	20	13	12	1050	50	300	43.2	100	1450	-0.025	0.046	0.030	0.070	0.025	0.015	28.5	3200	3200	99	50
				1600		350		150	2100	-0.039	0.054	0.035	0.110			37.3	2800	3200		
				2400		350		150	2900	-0.058	0.077	0.046	0.140			48.2	1200	1600		

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.

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

υ_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).

3. Other

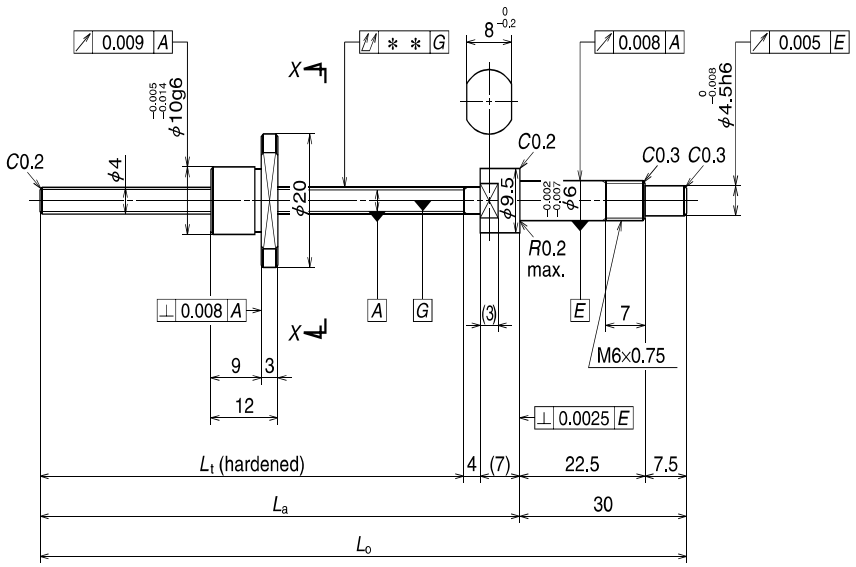
The seal of the ball screw, ball recirculating deflector, and end cap are made of synthetic resin. Consult NSK when using our ball screws under extreme environments or in special environments, or if using special lubricant or oil. For special environments, see pages B70 and D2. For lubricants, see pages B67 and D13.

Note: For details of standard stock products, contact NSK.

Table 1 Combinations of screw shaft diameter and lead

Screw shaft diameter (mm) \ Lead (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							

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							

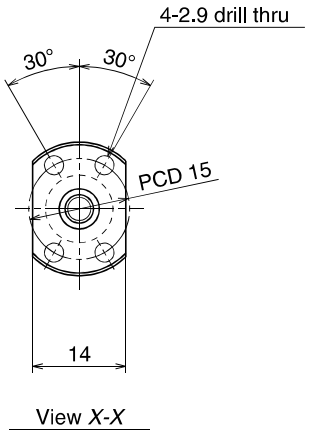


NSK

Screw shaft ø4

Lead 1

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		4 × 1 / Right	
Preload / Ball recirculation		P-preload / Deflector (bridge type)	
Ball dia. / Ball circle dia.		0.800 / 4.2	
Screw shaft root diameter		3.2	
Effective turns of balls		1 × 2	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	315	
	Static C_{0a}	370	
Axial play		0	0.005 or less
Preload (N)		19.6	—
Dynamic friction torque, (N·cm)		1.0 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)

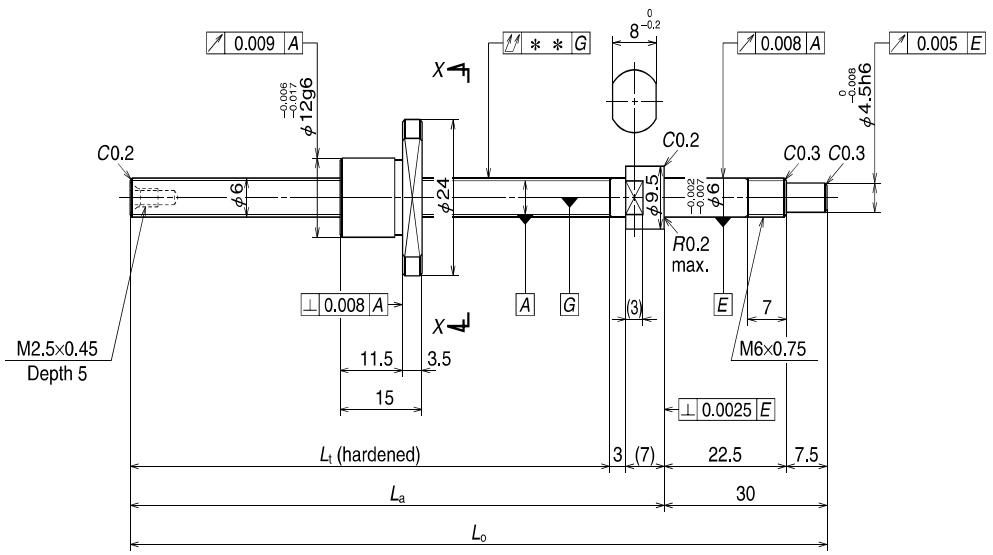
MA

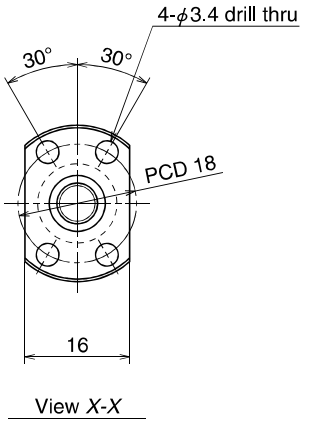
Unit: mm

Ball screw No.		Stroke	
Preloaded (MPFD)	Precise clearance (MSFD)	Nominal	Maximum
W0400MA-1PY-C3Z1	**W0400MA-2Y-C3T1**	20	32
W0400MA-3PY-C3Z1	**W0400MA-4Y-C3T1**	40	52
W0401MA-1PY-C3Z1	**W0401MA-2Y-C3T1**	70	82

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed \ (min⁻¹) Supporting condition
L_t	L_a	L_o	T	e_p	υ_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

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.





NSK

Screw shaft ø6

Lead 1

Unit: mm

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × 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	575	
	Static C_{0a}	925	
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)

MA

Unit: mm

Ball screw No.		Stroke		Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)
												Supporting condition
Preloaded (MPFD)	Precise clearance (MSFD)	Nominal	Maximum	L_t	L_a	L_o	T	e_p	υ_u			Fixed - Free
W0600MA-1PY-C3Z1	**W0600MA-2Y-C3T1**	40	50	65	75	105	0	0.008	0.008	0.015	0.039	3 000
W0601MA-1PY-C3Z1	**W0601MA-2Y-C3T1**	70	80	95	105	135	0	0.008	0.008	0.020	0.045	3 000
W0601MA-3PY-C3Z1	**W0601MA-4Y-C3T1**	100	110	125	135	165	0	0.010	0.008	0.025	0.051	3 000

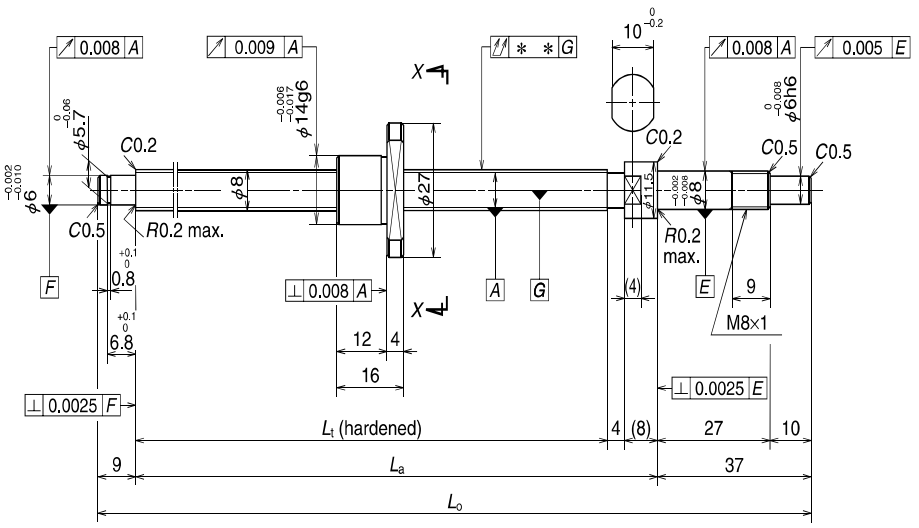
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Ball nut does not have seal.
4. Contact NSK if the permissible rotational speed is to be exceeded.

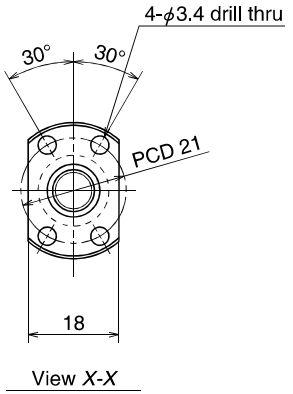
NSK

Screw shaft ø8

Lead 1

Unit: mm





View *X-X*

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × 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 / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	670	
	Static C_{0a}	1 290	
Axial play		0	0.005 or less
Preload (N)		29.4	—
Dynamic friction torque, (N·cm)		1.8 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	
Preloaded (MPFD)	Precise clearance (MSFD)	Nominal	Maximum
W0800MA-1PY-C3Z1	**W0800MA-2Y-C3T1**	40	59
W0801MA-1PY-C3Z1	**W0801MA-2Y-C3T1**	70	89
W0801MA-3PY-C3Z1	**W0801MA-4Y-C3T1**	100	119
W0802MA-1PY-C3Z1	**W0802MA-2Y-C3T1**	150	169

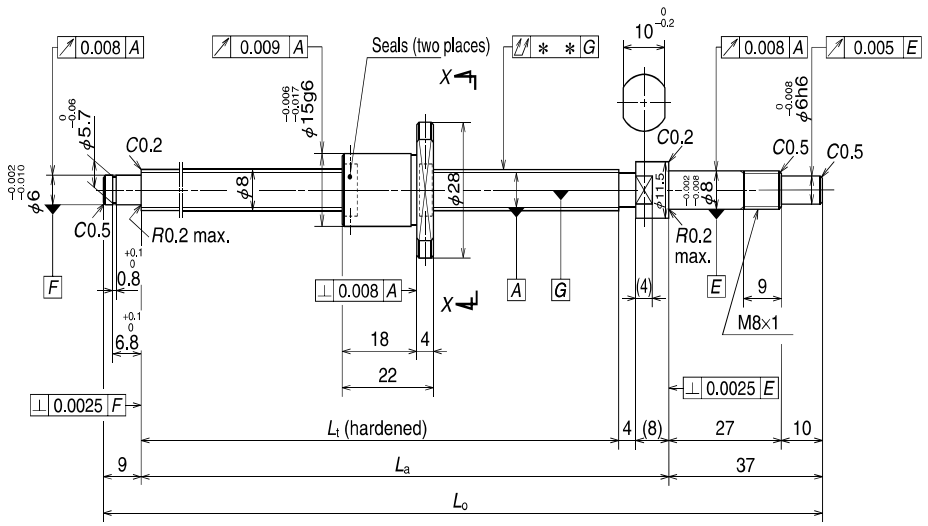
Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)
								Supporting condition
L_t	L_a	L_o	T	e_p	υ_u	↥↧		Fixed - Simple support
80	92	138	0	0.008	0.008	0.025	0.073	3 000
110	122	168	0	0.010	0.008	0.030	0.084	3 000
140	152	198	0	0.010	0.008	0.030	0.095	3 000
190	202	248	0	0.010	0.008	0.035	0.11	3 000

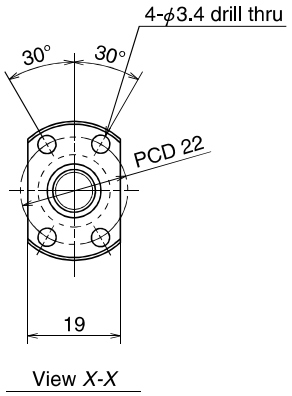
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Ball nut does not have seal.
4. Contact NSK if the permissible rotational speed is to be exceeded.

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	1 080	
	Static C_{0a}	1 980	
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

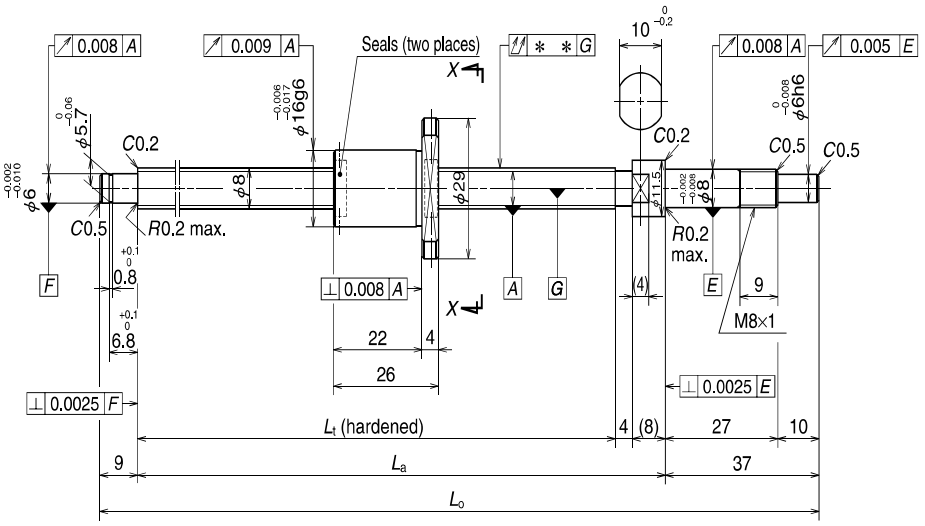
For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01A (square)	WBK08S-01 (square)
WBK08-11 (round)	

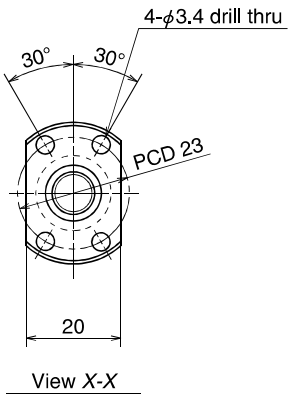
Unit: mm

Ball screw No.		Stroke	
Preloaded (MPFD)	Precise clearance (MSFD)	Nominal	Maximum
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

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed \ (min⁻¹)
								Supporting condition
L_t	L_a	L_o	T	e_p	υ_u	↥↧		Fixed - Simple support
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

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.





NSK

Screw shaft ø8

Lead 2

Unit: mm

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × 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 / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	1 320	
	Static C_{0a}	2 210	
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)	

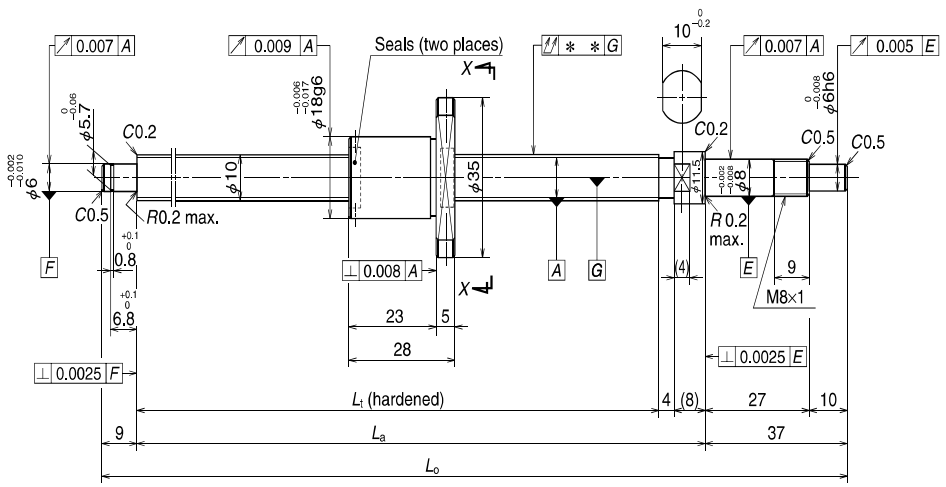
MA

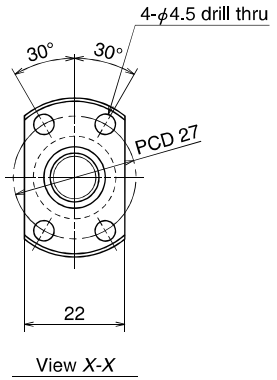
Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (MPFD)	Precise clearance (MSFD)		
W0800MA-5PY-C3Z2	**W0800MA-6Y-C3T2**	40	49
W0801MA-9PY-C3Z2	**W0801MA-10Y-C3T2**	70	79
W0801MA-11PY-C3Z2	**W0801MA-12Y-C3T2**	100	109
W0802MA-5PY-C3Z2	**W0802MA-6Y-C3T2**	150	159

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.

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	υ_u	↗↗		Fixed - Simple support
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





NSK

Screw shaft ø10

Lead 2

Unit: mm

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × 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 / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	1 490	
	Static C_{0a}	2 850	
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	
Preloaded (MPFD)	Precise clearance (MSFD)	Nominal	Maximum
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

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	υ_u	↕		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

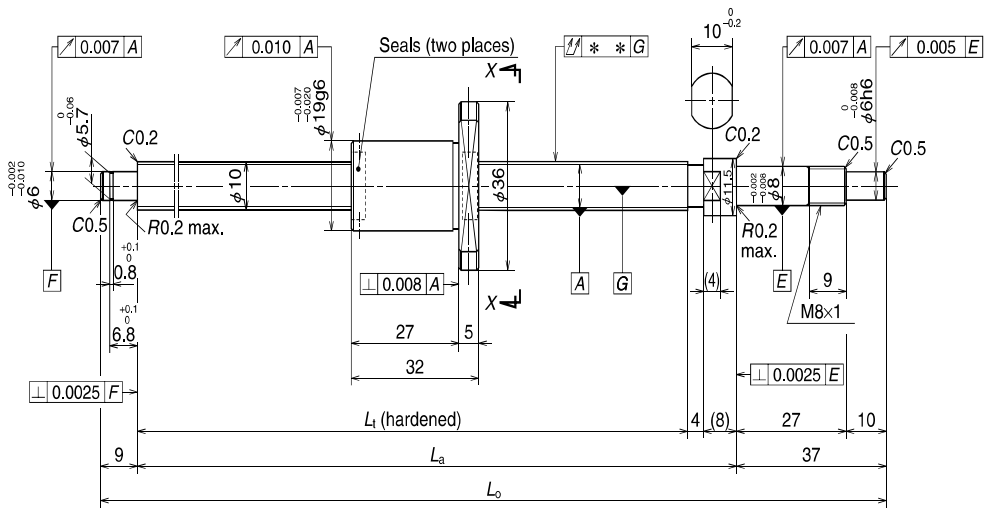
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

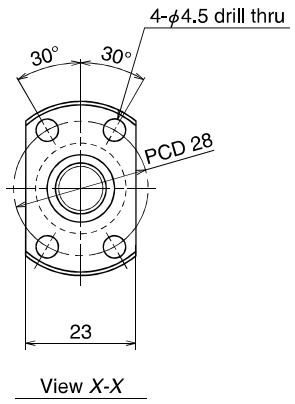
NSK

Screw shaft ø10

Lead 2.5

Unit: mm





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Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		10 × 2.5 / Right	
Preload / Ball recirculation		P-preload / Deflector (bridge)	
Ball dia. / Ball circle dia.		1.588 / 10.4	
Screw shaft root diameter		8.6	
Effective turns of balls		1 × 3	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	2 130	
	Static C_{0a}	3 640	
Axial play		0	0.005 or less
Preload (N)		98.1	—
Dynamic friction torque, (N·cm)		0.2 – 2.9	0.5 or less
Spacer ball		None	
Factory-packed grease		NSK grease PS2	

Recommended support unit

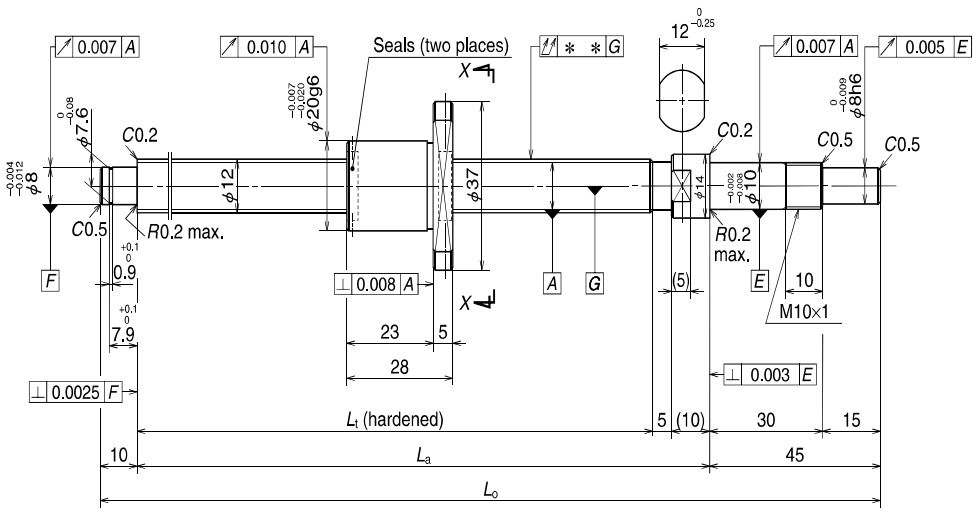
For drive side (Fixed)	For opposite to drive side (Simple)
WBK08-01A (square)	WBK08S-01 (square)
WBK08-11 (round)	

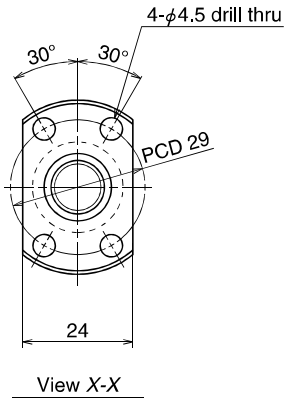
Unit: mm

Ball screw No.		Stroke	
Preloaded (MPFD)	Precise clearance (MSFD)	Nominal	Maximum
W1001MA-5PY-C3Z2.5	**W1001MA-6Y-C3T2.5**	50	63
W1001MA-7PY-C3Z2.5	**W1001MA-8Y-C3T2.5**	100	113
W1002MA-5PY-C3Z2.5	**W1002MA-6Y-C3T2.5**	150	163
W1002MA-7PY-C3Z2.5	**W1002MA-8Y-C3T2.5**	200	213

Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed \ (min⁻¹)
								Supporting condition
L_t	L_a	L_o	T	e_p	υ_u	⟂		Fixed - Simple support
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

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.





NSK

Screw shaft ø12

Lead 2

Unit: mm

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		12 × 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 × 3	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	1 660	
	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	
Preloaded (MPFD)	Precise clearance (MSFD)	Nominal	Maximum
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

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	υ_u	⊥		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

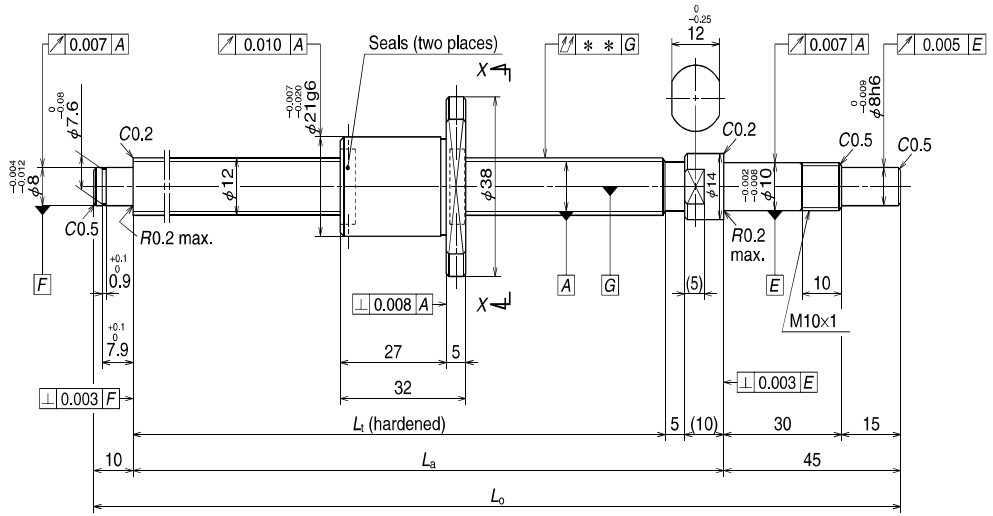
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

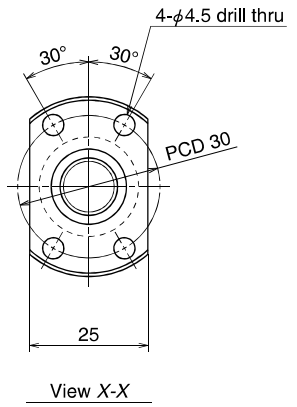
NSK

Screw shaft ø12

Lead 2.5

Unit: mm





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Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		12 × 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 × 3	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	2 360	
	Static C_{0a}	4 540	
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

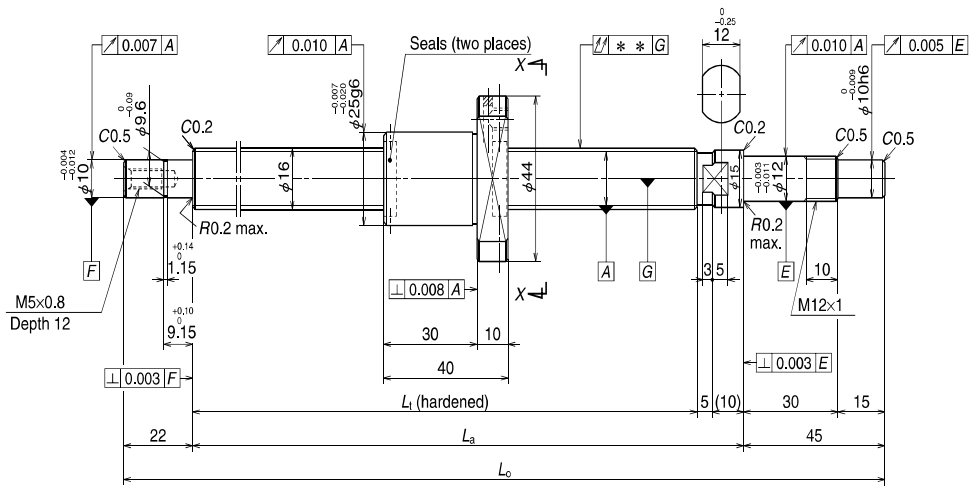
For drive side (Fixed)	For opposite to drive side (Simple)
WBK10-01A (square)	WBK10S-01 (square)
WBK10-11 (round)	

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)
								Supporting condition
L_t	L_a	L_o	T	e_p	υ_u	↗↗		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

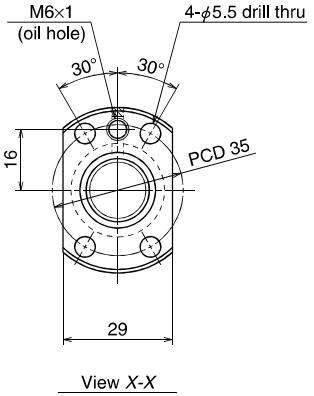
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Apply to screw shaft surface when replenishing. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.



NSK

Screw shaft ø16

Lead 2



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Unit: mm

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × 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 / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	3 510	
	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

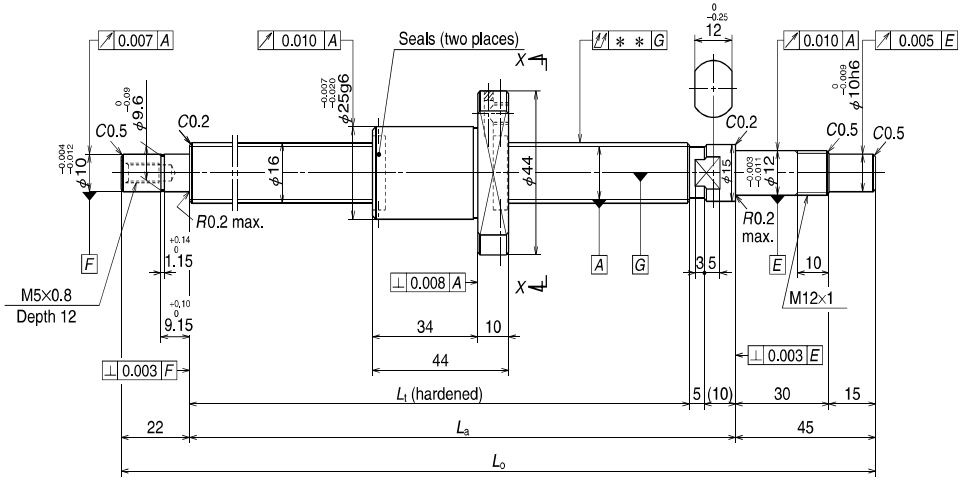
For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

MA

Unit: mm

Ball screw No.		Stroke		Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min^{-1})	
												Supporting condition	
Preloaded (MPFD)	Precise clearance (MSFD)	Nominal	Maximum	L_t	L_a	L_o	T	e_p	υ_u			Fixed - Simple support	Fixed - Fixed
W1601MA-1PY-C3Z2	**W1601MA-2Y-C3T2**	50	93	139	154	221	0	0.010	0.008	0.020	0.41	3 000	3 000
W1601MA-3PY-C3Z2	**W1601MA-4Y-C3T2**	100	143	189	204	271	0	0.010	0.008	0.020	0.48	3 000	3 000
W1602MA-1PY-C3Z2	**W1602MA-2Y-C3T2**	150	193	239	254	321	0	0.012	0.008	0.030	0.55	3 000	3 000
W1602MA-3PY-C3Z2	**W1602MA-4Y-C3T2**	200	243	289	304	371	0	0.012	0.008	0.030	0.62	3 000	3 000
W1603MA-1PY-C3Z2	**W1603MA-2Y-C3T2**	300	343	389	404	471	0	0.013	0.010	0.035	0.77	3 000	3 000

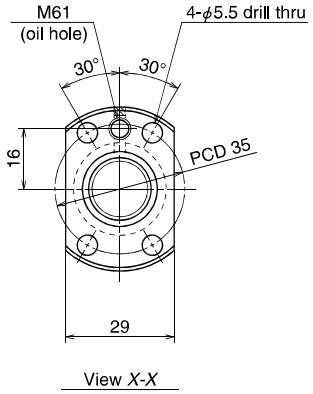
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease PS2 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.
4. If Fixed is used for 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.).



NSK

Screw shaft ø16

Lead 2.5



Unit: mm

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	3 510	
	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

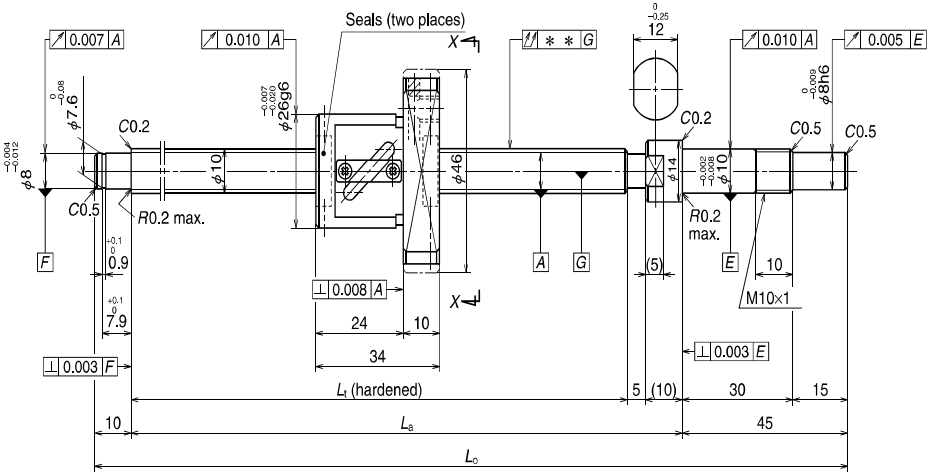
For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

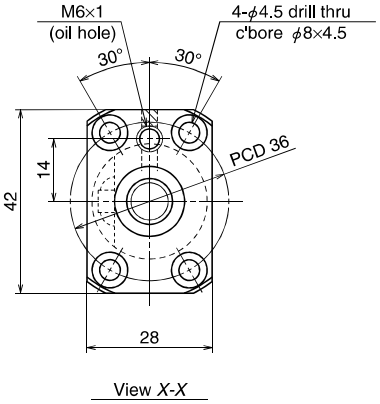
MA

Unit: mm

Ball screw No.		Stroke		Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min^{-1})	
												Supporting condition	
Preloaded (MPFD)	Precise clearance (MSFD)	Nominal	Maximum	L_t	L_a	L_o	T	e_p	υ_u			Fixed - Simple support	Fixed - Fixed
W1601MA-5PY-C3Z2.5	**W1601MA-6Y-C3T2.5**	50	89	139	154	221	0	0.010	0.008	0.020	0.42	3 000	3 000
W1601MA-7PY-C3Z2.5	**W1601MA-8Y-C3T2.5**	100	139	189	204	271	0	0.010	0.008	0.020	0.49	3 000	3 000
W1602MA-5PY-C3Z2.5	**W1602MA-6Y-C3T2.5**	150	189	239	254	321	0	0.012	0.008	0.030	0.57	3 000	3 000
W1602MA-7PY-C3Z2.5	**W1602MA-8Y-C3T2.5**	200	239	289	304	371	0	0.012	0.008	0.030	0.64	3 000	3 000
W1603MA-3PY-C3Z2.5	**W1603MA-4Y-C3T2.5**	300	339	389	404	471	0	0.013	0.010	0.035	0.79	3 000	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.
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.).





View *X-X*

Unit: mm

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	1 730	2 740
	Static C_{0a}	2 230	4 450
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)	

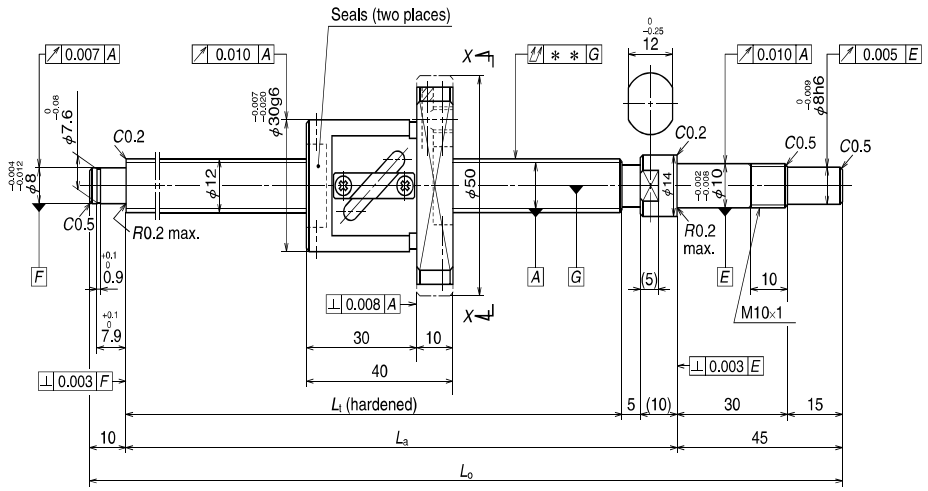
FA

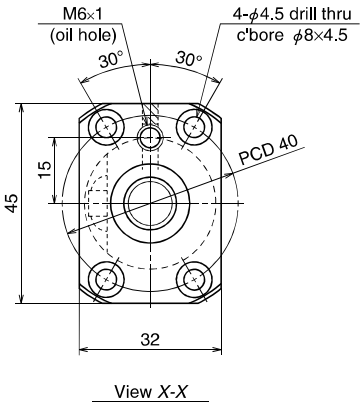
Unit: mm

Ball screw No.		Stroke	
Preloaded (PFT)	Precise clearance (SFT)	Nominal	Maximum
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) Supporting condition
L_t	L_a	L_o	T	e_p	υ_u	↗↗		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 No.		Stroke	
Preloaded (PFT)	Precise clearance (SFT)	Nominal	Maximum
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

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.

NSK

Screw shaft ø12

Lead 5

Unit: mm

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		12 × 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 × 1	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	2 370	3 760
	Static C_{0a}	3 160	6 310
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	

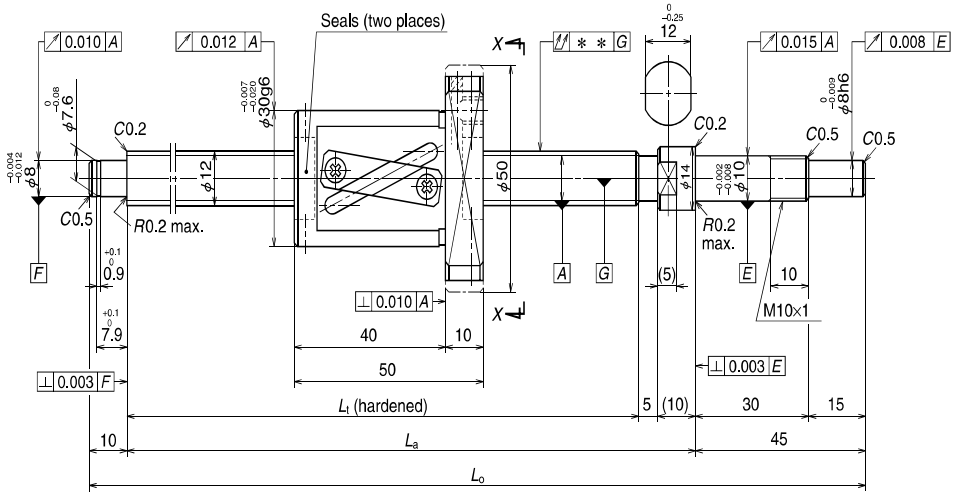
Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK10-01A (square)	WBK10S-01 (square)
WBK10-11 (round)	

Unit: mm

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

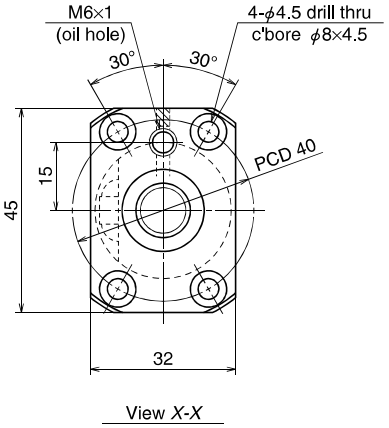
FA



NSK

Screw shaft ø12

Lead 10



View *X-X*

Unit: mm

Ball screw specifications			
Product classification		Preloaded	Precise clearance
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 / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	2 360	3 750
	Static C_{0a}	3 240	6 480
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)	

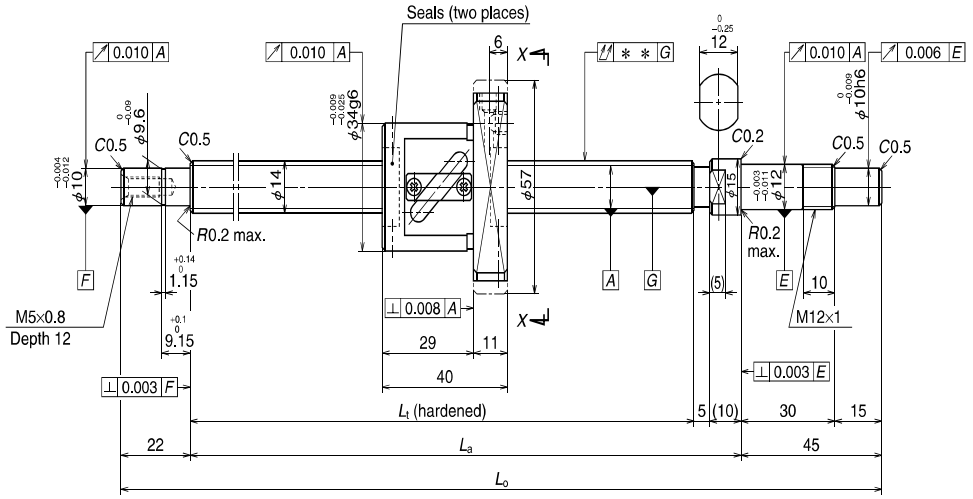
FA

Unit: mm

Ball screw No.		Stroke	
Preloaded (LPFT)	Precise clearance (LSFT)	Nominal	Maximum
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

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
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

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.

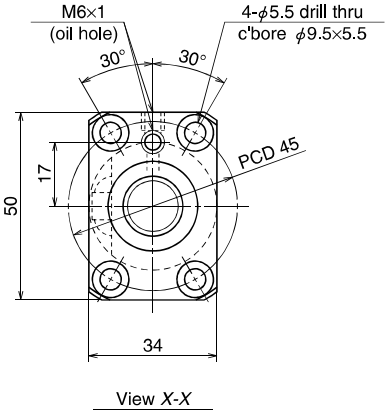


NSK

Screw shaft ø14

Lead 5

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		14 × 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 × 1	
Accuracy grade / Preload / Axial play		C3 / Z	C3 / T
Basic load rating (N)	Dynamic C_a	4 280	6 790
	Static C_{0a}	5 840	11 700
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)	

FA

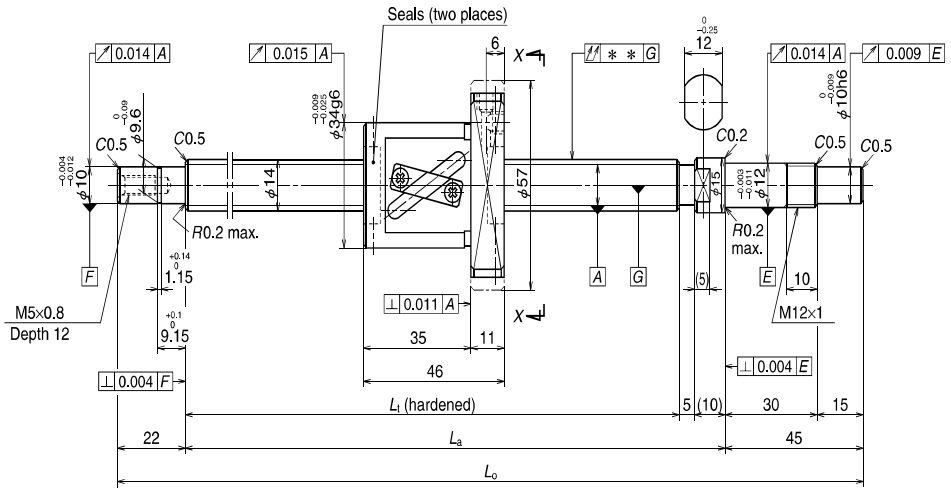
Unit: mm

Ball screw No.		Stroke	
Preloaded (PFT)	Precise clearance (SFT)	Nominal	Maximum
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

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	0.52	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: 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.

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.).

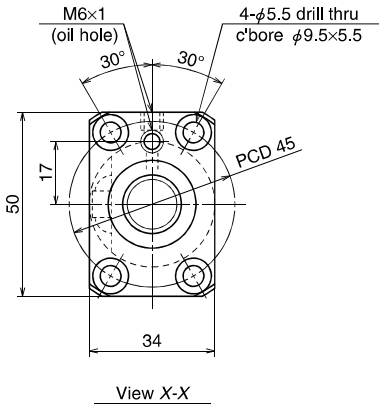


NSK

Screw shaft ø14

Lead 8

Unit: mm



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		14 × 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 × 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	4 280	6 790
	Static C_{0a}	5 840	11 700
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	

Unit: mm

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

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	υ_u			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: 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.

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.).

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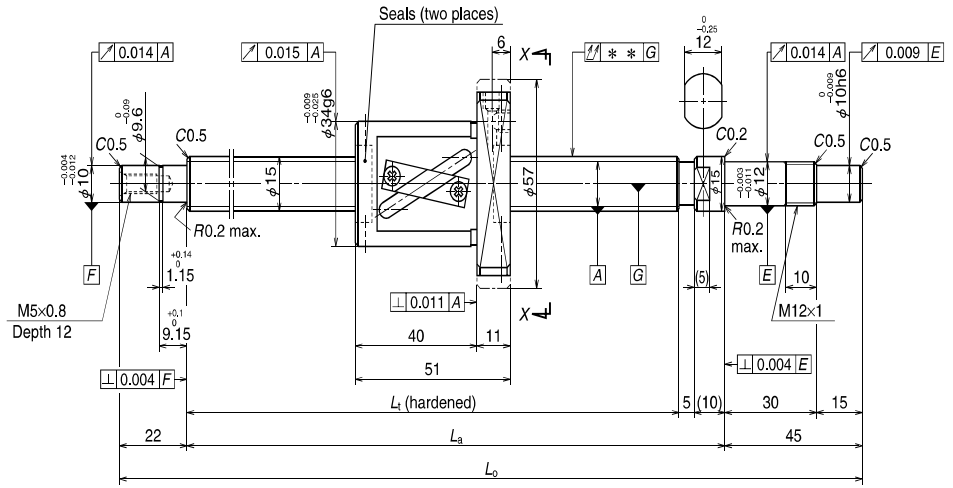
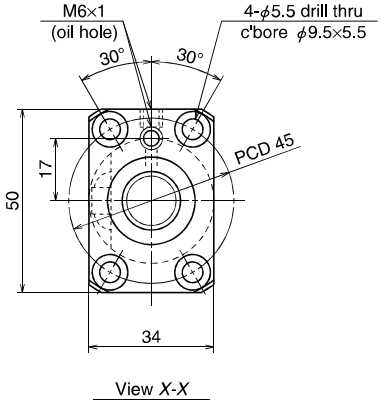




View *X-X*

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK12S-01 (square)
WBK12-11 (round)	

Screw shaft ø15

Lead 10

Unit: mm

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	4 450	7 070
	Static C_{oa}	6 380	12 800
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)		2.3	
Standard volume of grease replenishing (cm^3)		1.2	

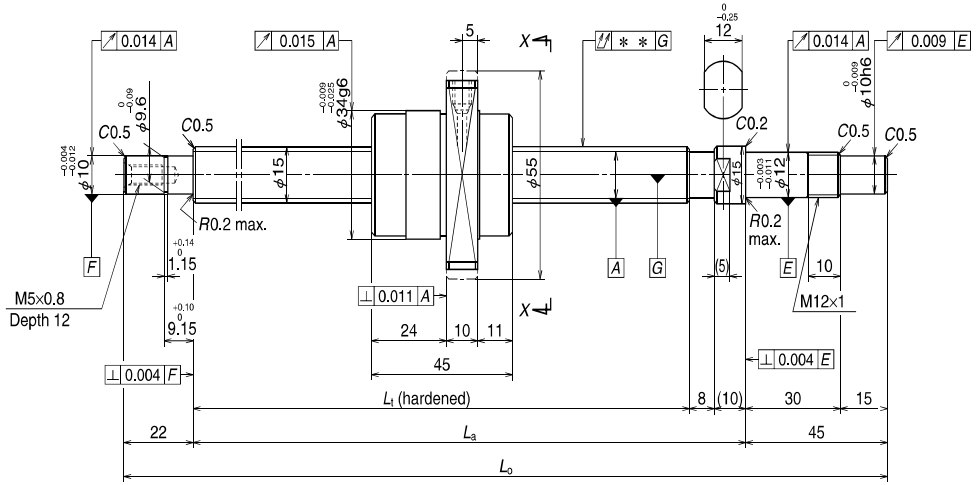
Unit: mm

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

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	υ_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: 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.

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.).

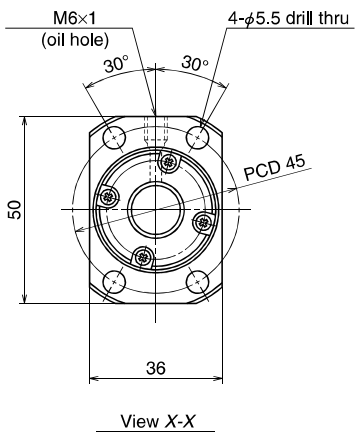


NSK

Screw shaft ø15

Lead 20

Unit: mm



View *X-X*

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	3 870	5 070
	Static C_{0a}	5 820	8 730
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)		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

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	υ_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: 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.

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.).

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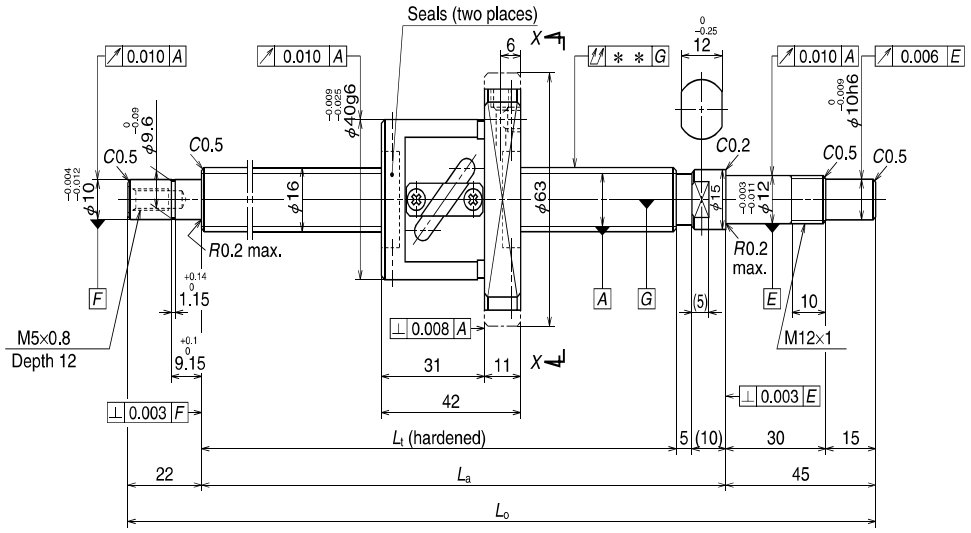
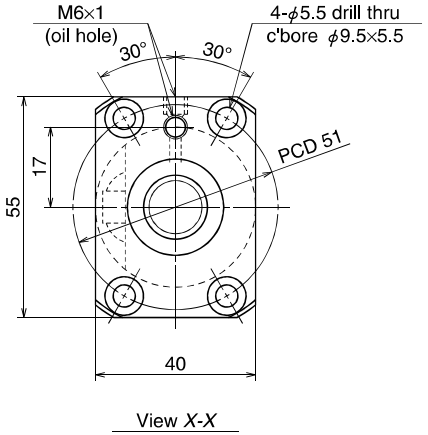


NSK

Screw shaft ø16

Lead 5

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × 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	4 620	7 330
	Static C_{0a}	6 750	13 500
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)	

FA

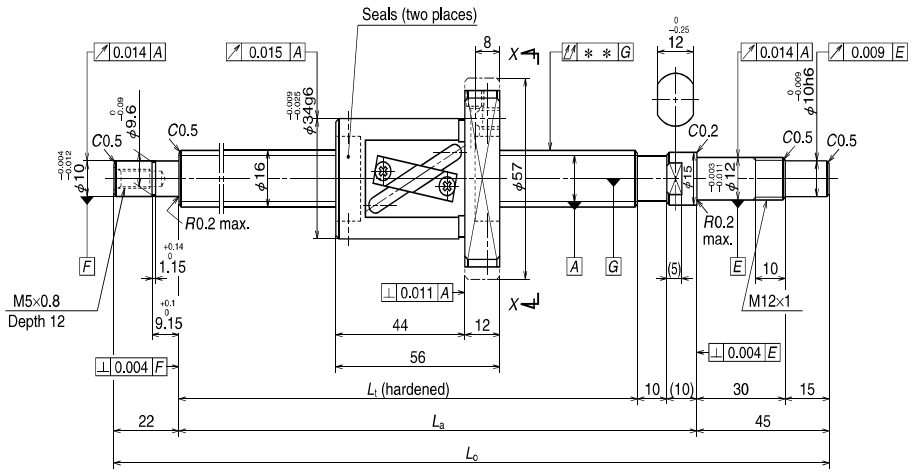
Unit: mm

Ball screw No.		Stroke	
Preloaded (PFT)	Precise clearance (SFT)	Nominal	Maximum
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

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

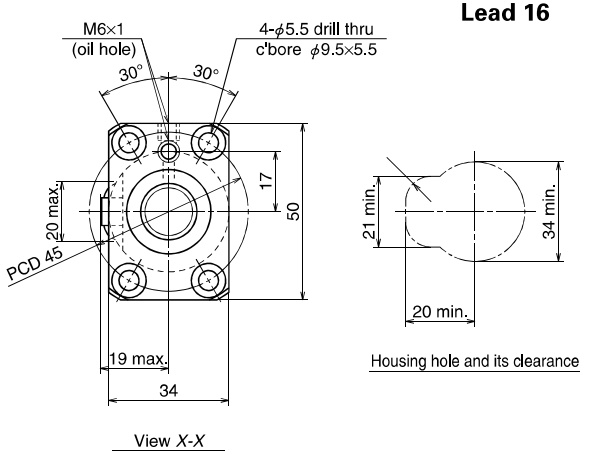
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

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.).



Unit: mm

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. × Lead / Direction of turn		16 × 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 × 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	3 600	4 710
	Static C_{0a}	5 410	8 110
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	

Unit: mm

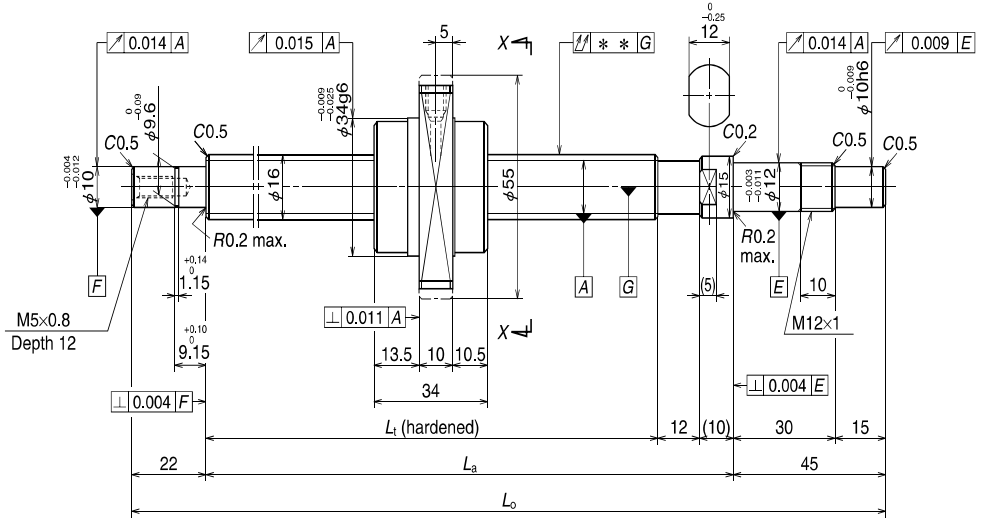
Ball screw No.		Stroke	
Preloaded (LPFT)	Precise clearance (LSFT)	Nominal	Maximum
W1601FA-3P-C5Z16	**W1601FA-4-C5T16**	100	122
W1602FA-3P-C5Z16	**W1602FA-4-C5T16**	150	172
W1602FA-5P-C5Z16	**W1602FA-6-C5T16**	200	222
W1603FA-3P-C5Z16	**W1603FA-4-C5T16**	250	272
W1603FA-5P-C5Z16	**W1603FA-6-C5T16**	300	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.

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
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.).

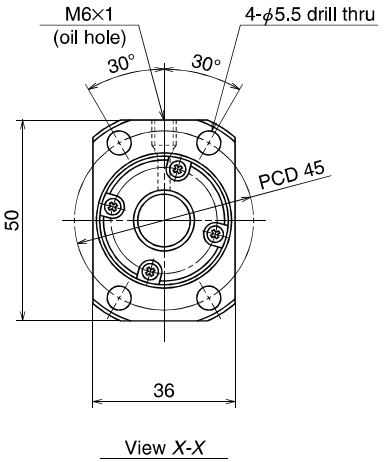


NSK

Screw shaft ø16

Lead 32

Unit: mm



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Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		16 × 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 × 2	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	4 000	
	Static C_{0a}	6 690	
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 (cm³)		2.0	
Standard volume of grease replenishing (cm³)		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

Ball screw No.		Stroke	
Preloaded (UPFC)	Precise clearance (USFC)	Nominal	Maximum
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

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
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: 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.

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.).

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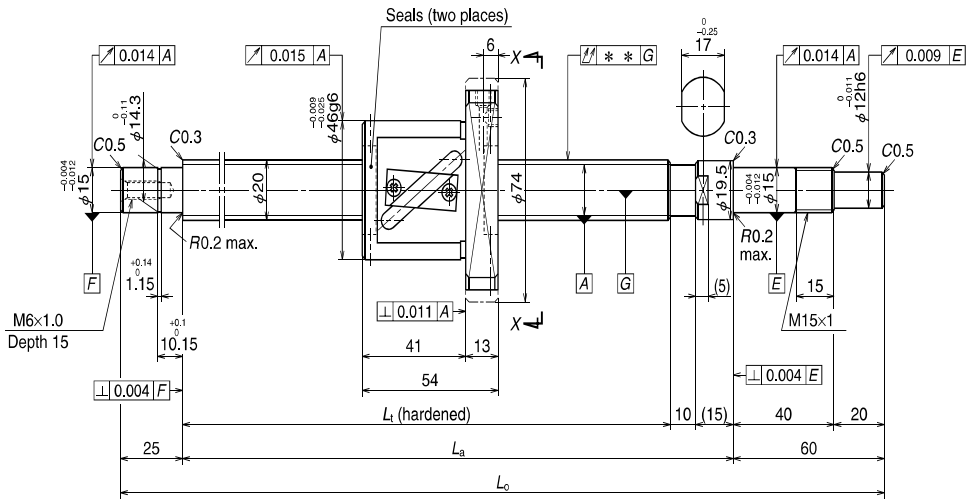
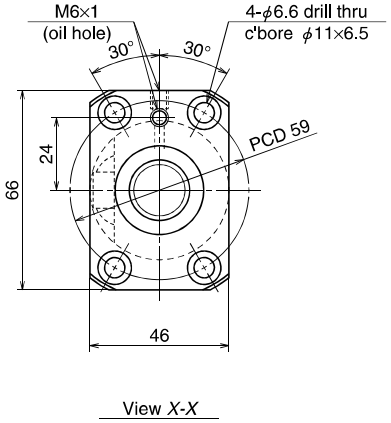


NSK

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. × Lead / Direction of turn		20 × 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 × 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	6 880	10 900
	Static C_{0a}	10 800	21 700
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.

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	υ_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.).

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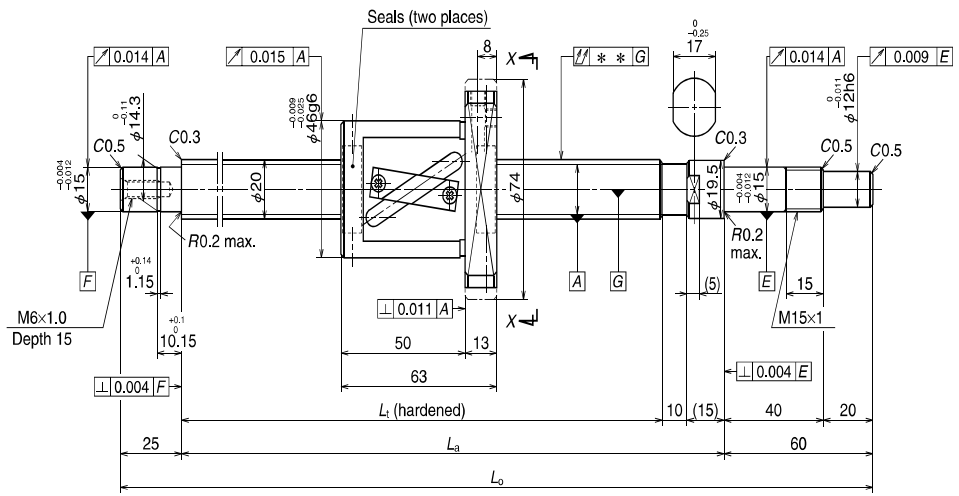
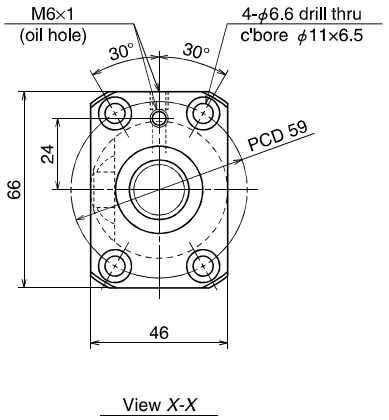


NSK

Screw shaft ø20

Lead 20

Unit: mm



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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. × Lead / Direction of turn		20 × 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 × 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	5 370	7 040
	Static C_{0a}	8 450	12 700
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

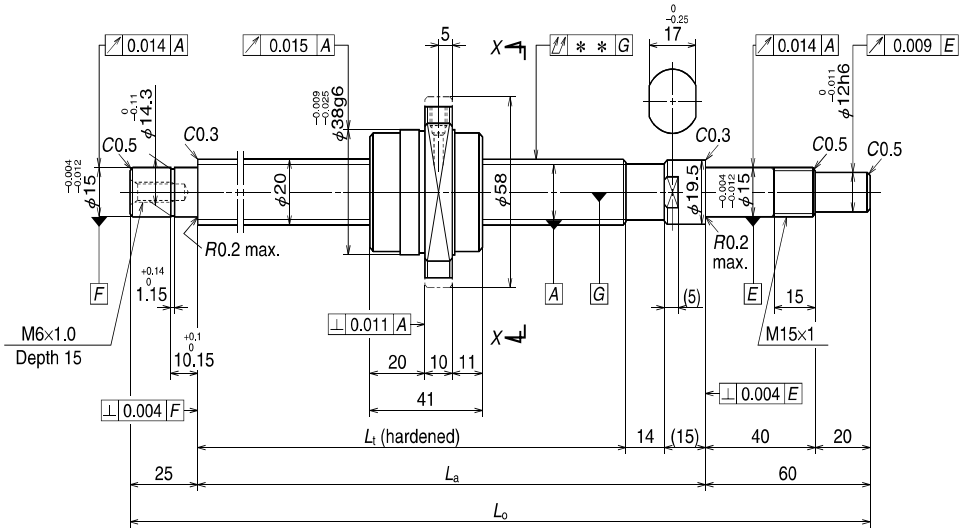
Ball screw No.		Stroke	
		Nominal	Maximum
Preloaded (LPFT)	Precise clearance (LSFT)		
W2003FA-3P-C5Z20	**W2003FA-4-C5T20**	200	241
W2004FA-3P-C5Z20	**W2004FA-4-C5T20**	300	341
W2005FA-3P-C5Z20	**W2005FA-4-C5T20**	400	441
W2006FA-3P-C5Z20	**W2006FA-4-C5T20**	500	541
W2007FA-3P-C5Z20	**W2007FA-4-C5T20**	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	1 040
W2012FA-3P-C5Z20	**W2012FA-4-C5T20**	1 100	1 141
W2015FA-1P-C5Z20	**W2015FA-2-C5T20**	1 400	1 441

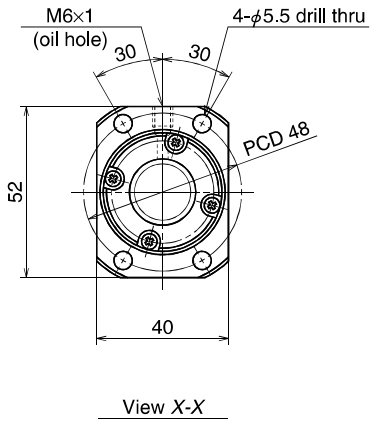
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.

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	υ_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.).





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Unit: mm

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		20 × 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 × 2	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	4 490	
	Static C_{0a}	8 640	
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)	

FA

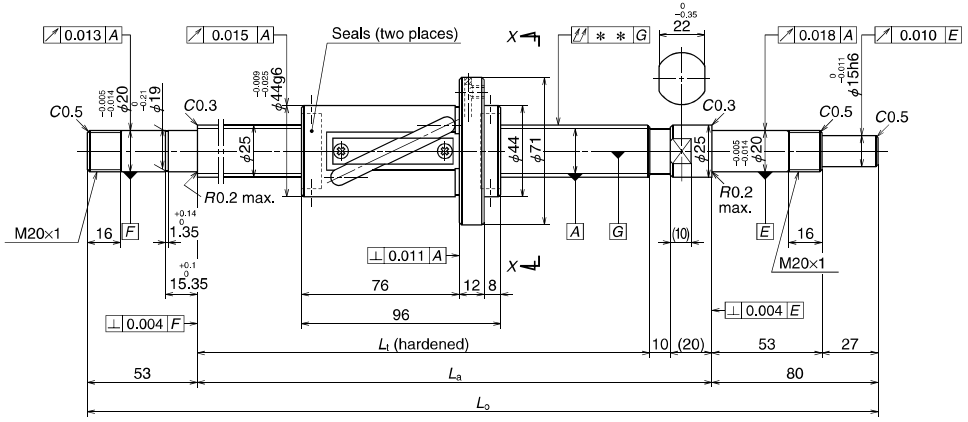
Unit: mm

Ball screw No.		Stroke	
Preloaded (UPFC)	Precise clearance (USFC)	Nominal	Maximum
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

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
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: 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.

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.).

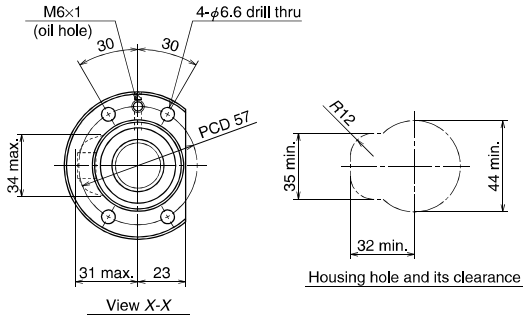


NSK

Screw shaft ø25

Lead 20

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × 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	9 900	15 700
	Static C_{0a}	16 400	32 800
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	

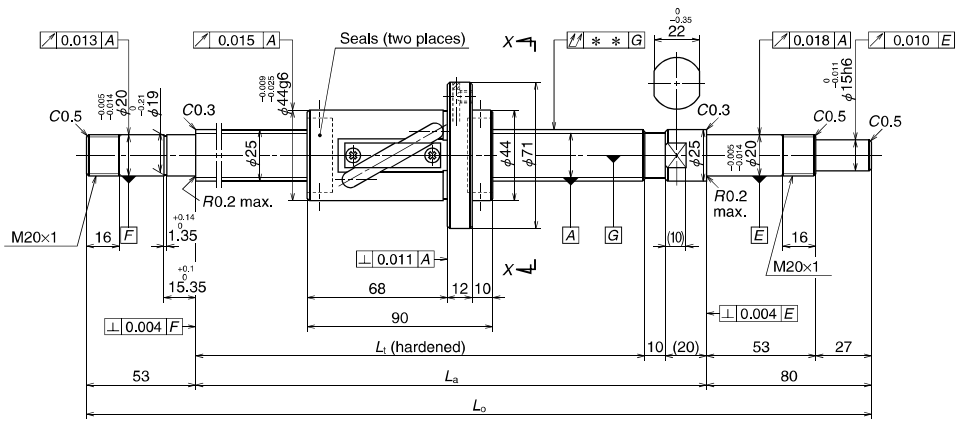
Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (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			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min^{-1})	
												Supporting condition	
Preloaded (LPFT)	Precise clearance (LSFT)	Nominal	Maximum	L_t	L_a	L_o	T	e_p	υ_u			Fixed - Simple support	Fixed - Fixed
W2507FA-1P-C5Z20	**W2507FA-2-C5T20**	600	640	750	780	913	0	0.035	0.025	0.055	4.0	2 800	2 800
W2509FA-1P-C5Z20	**W2509FA-2-C5T20**	800	840	950	980	1 113	0	0.040	0.027	0.070	4.7	2 800	2 800
W2511FA-1P-C5Z20	**W2511FA-2-C5T20**	1 000	1 040	1 150	1 180	1 313	0	0.046	0.030	0.090	5.4	2 590	2 800
W2513FA-1P-C5Z20	**W2513FA-2-C5T20**	1 200	1 240	1 350	1 380	1 513	0	0.054	0.035	0.090	6.2	1 860	2 550
W2515FA-1P-C5Z20	**W2515FA-2-C5T20**	1 400	1 440	1 550	1 580	1 713	0	0.054	0.035	0.120	6.9	1 400	1 940
W2517FA-1P-C5Z20	**W2517FA-2-C5T20**	1 600	1 640	1 750	1 780	1 913	0	0.065	0.040	0.120	7.6	1 090	1 520
W2521FA-1P-C5Z20	**W2521FA-2-C5T20**	2 000	2 040	2 150	2 180	2 313	0	0.077	0.046	0.160	9.1	720	1 000

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.

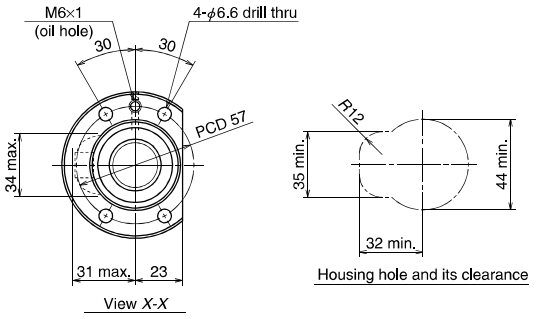


NSK

Screw shaft ø25

Lead 25

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × 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	7 730	10 100
	Static C_{0a}	12 700	19 100
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	

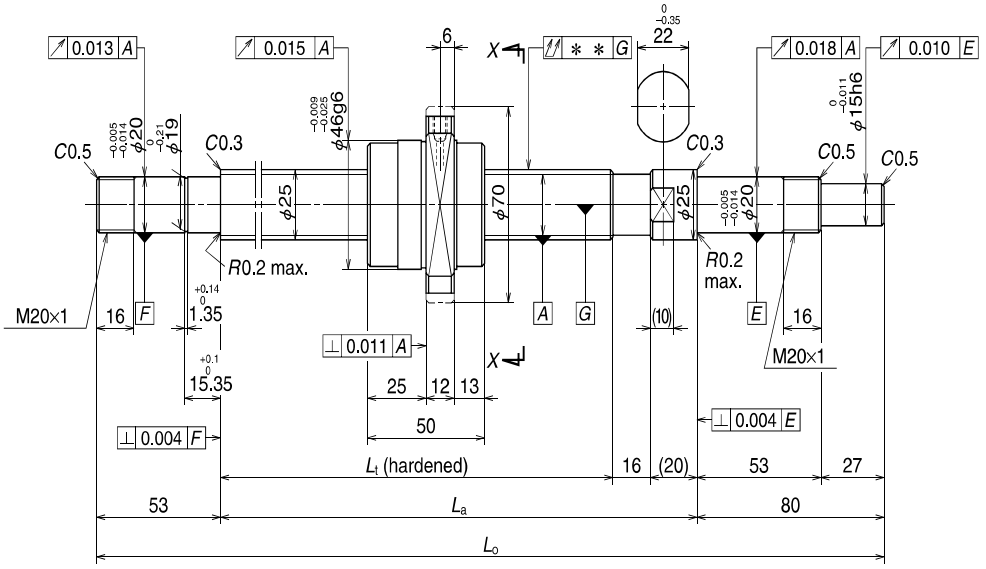
Recommended support unit

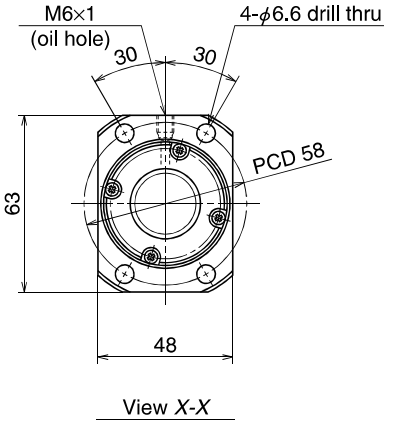
For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

Unit: mm

Ball screw No.		Stroke		Screw shaft length			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min^{-1})	
												Supporting condition	
Preloaded (LPFT)	Precise clearance (LSFT)	Nominal	Maximum	L_t	L_a	L_o	T	e_p	υ_u			Fixed - Simple support	Fixed - Fixed
W2507FA-3P-C5Z25	**W2507FA-4-C5T25**	600	646	750	780	913	0	0.035	0.025	0.055	4.0	2 800	2 800
W2509FA-3P-C5Z25	**W2509FA-4-C5T25**	800	846	950	980	1 113	0	0.040	0.027	0.070	4.7	2 800	2 800
W2511FA-3P-C5Z25	**W2511FA-4-C5T25**	1 000	1 046	1 150	1 180	1 313	0	0.046	0.030	0.090	5.4	2 580	2 800
W2513FA-3P-C5Z25	**W2513FA-4-C5T25**	1 200	1 246	1 350	1 380	1 513	0	0.054	0.035	0.090	6.2	1 850	2 550
W2515FA-3P-C5Z25	**W2515FA-4-C5T25**	1 400	1 446	1 550	1 580	1 713	0	0.054	0.035	0.120	7.0	1 400	1 930
W2517FA-3P-C5Z25	**W2517FA-4-C5T25**	1 600	1 646	1 750	1 780	1 913	0	0.065	0.040	0.120	7.7	1 090	1 510
W2521FA-3P-C5Z25	**W2521FA-4-C5T25**	2 000	2 046	2 150	2 180	2 313	0	0.077	0.046	0.160	9.1	710	1 000

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.





View *X-X*

NSK

Screw shaft ø25

Lead 50

Unit: mm

Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		25 × 50 / Right	
Preload / Ball recirculation		P-preload / End cap	
Ball dia. / Ball circle dia.		3.969 / 26	
Screw shaft root diameter		21.9	
Effective turns of balls		0.7 × 2	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	6 690	
	Static C_{0a}	13 500	
Axial play		0	0.005 or less
Preload (N)		196	—
Dynamic friction torque, (N·cm)		2.9 – 21.5	4.9 or less
Spacer ball		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	

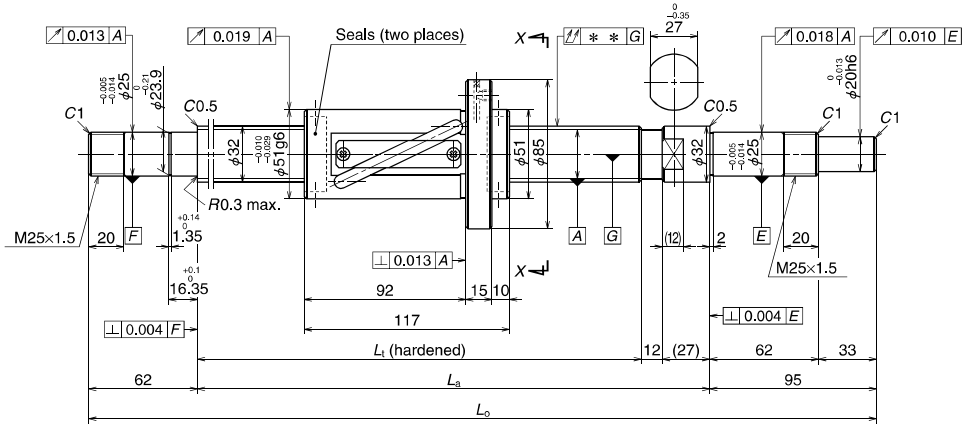
Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (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			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min^{-1})	
												Supporting condition	
Preloaded (UPFC)	Precise clearance (USFC)	Nominal	Maximum	L_t	L_a	L_o	T	e_p	v_u			Fixed - Simple support	Fixed - Fixed
W2508FA-1PGX-C5Z50	**W2508FA-2GX-C5T50**	700	780	844	880	1 013	0	0.040	0.027	0.070	4.1	2 800	2 800
W2511FA-5PGX-C5Z50	**W2511FA-6GX-C5T50**	1 000	1 080	1 144	1 180	1 313	0	0.046	0.030	0.090	5.3	2 600	2 800
W2516FA-1PGX-C5Z50	**W2516FA-2GX-C5T50**	1 500	1 580	1 644	1 680	1 813	0	0.065	0.040	0.120	7.2	1 250	1 720
W2521FA-5PGX-C5Z50	**W2521FA-6GX-C5T50**	2 000	2 080	2 144	2 180	2 313	0	0.077	0.046	0.160	9.1	730	1 010

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.

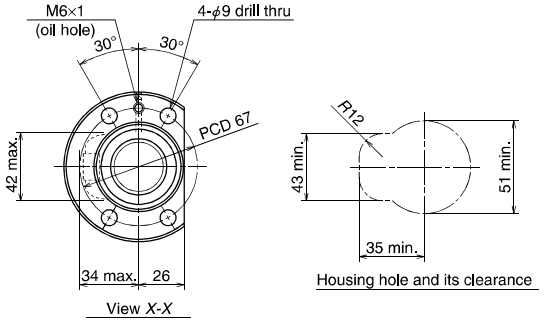


NSK

Screw shaft ø32

Lead 25

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		32 × 25 / 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		2.5 × 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	11 300	17 900
	Static C_{0a}	20 900	41 800
Axial play		0	0.005 or less
Preload (N)		441	—
Dynamic friction torque, (N·cm)		6.8 – 31.5	7.8 or less
Spacer ball		Yes	None
Factory-packed grease		NSK grease LR3	
Internal spatial volume of nut (cm³)		17.5	
Standard volume of grease replenishing (cm³)		8.8	

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)	

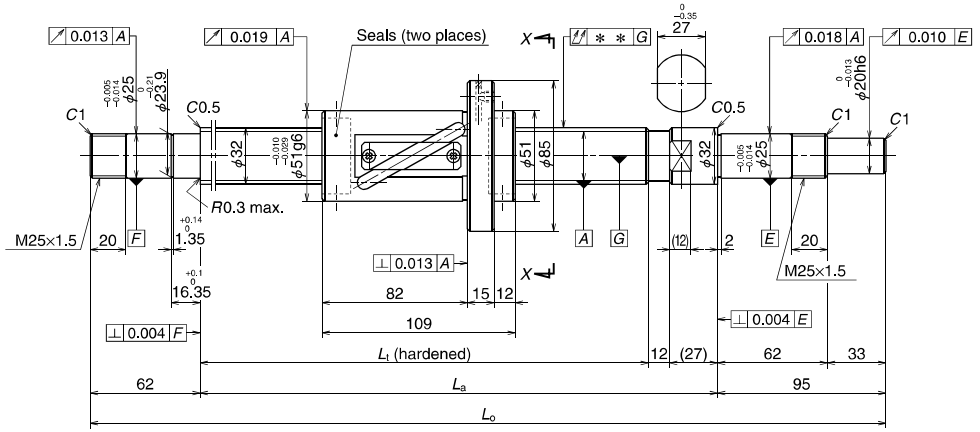
FA

Unit: mm

Ball screw No.		Stroke	
Preloaded (LPFT)	Precise clearance (LSFT)	Nominal	Maximum
W3211FA-1P-C5Z25	**W3211FA-2-C5T25**	1 000	1 046
W3216FA-1P-C5Z25	**W3216FA-2-C5T25**	1 500	1 546
W3221FA-1P-C5Z25	**W3221FA-2-C5T25**	2 000	2 046
W3227FA-1P-C5Z25	**W3227FA-2-C5T25**	2 600	2 646

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	υ_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

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.

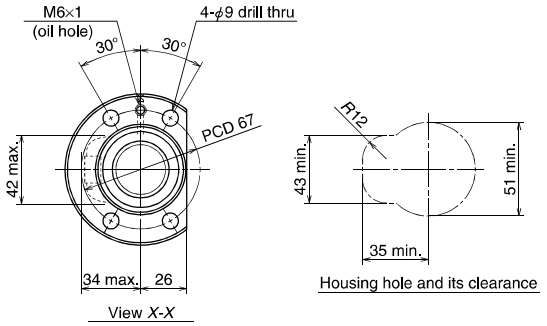


NSK

Screw shaft ø32

Lead 32

Unit: mm



Ball screw specifications			
Product classification		Preloaded	Precise clearance
Shaft dia. × Lead / Direction of turn		32 × 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 × 1	
Accuracy grade / Preload / Axial play		C5 / Z	C5 / T
Basic load rating (N)	Dynamic C_a	8 800	11 500
	Static C_{0a}	16 600	24 800
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 (cm³)		14	
Standard volume of grease replenishing (cm³)		7	

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK25-01W (square)	WBK25-01W (square)	WBK25S-01W (square)
WBK25-11 (round)	WBK25-11 (round)	

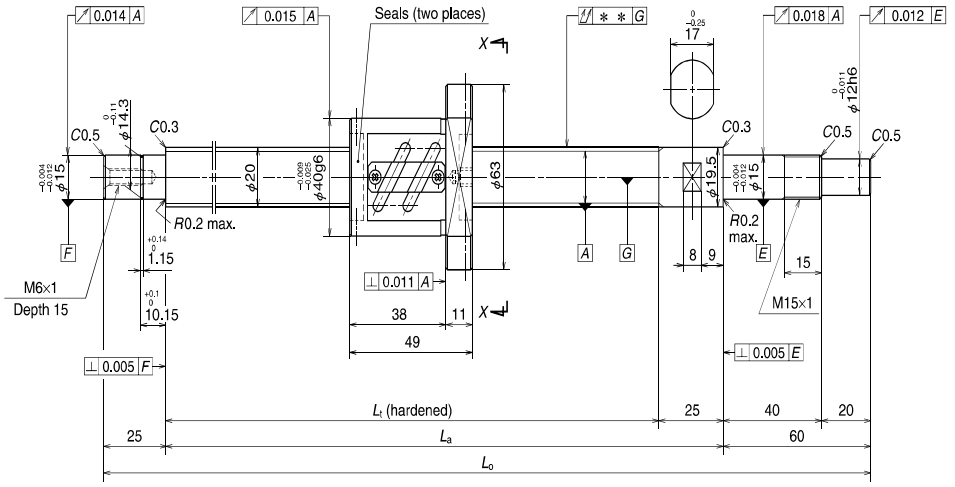
FA

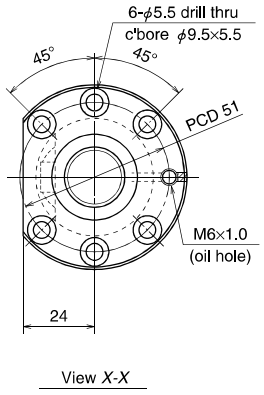
Unit: mm

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

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	υ_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

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.





NSK

Screw shaft ø20

Lead 4

Unit: mm

Ball screw specifications		
Shaft dia. x Lead / Direction of turn		20 × 4 / Right
Preload / Ball recirculation		P-preload / Return tube
Ball dia. / Ball circle dia.		2.381 / 20.3
Effective turns of balls		2.5 × 2
Screw shaft root diameter		17.8
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	5 420
	Static C_{0a}	10 700
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 (cm³)		2.7
Standard volume of grease replenishing (cm³)		1.4

Recommended support unit

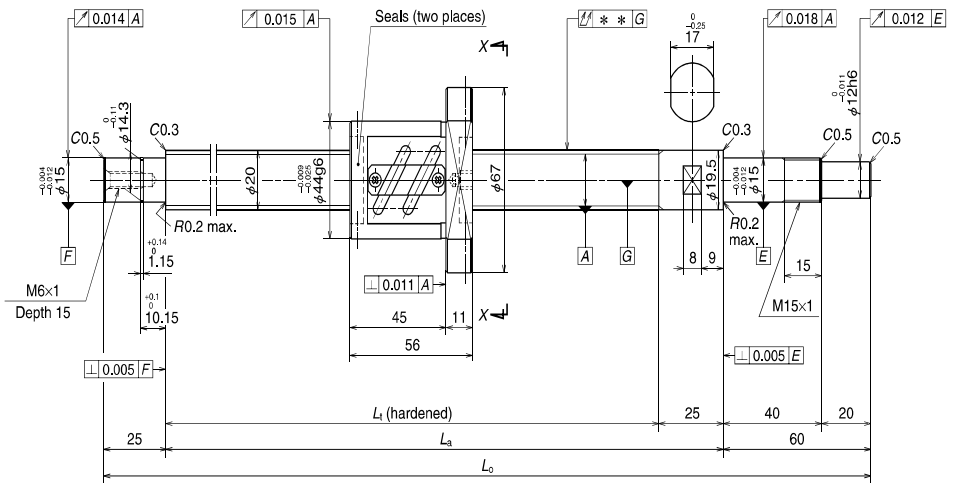
For drive side (Fixed)	For opposite to drive side (Simple)
WBK15-01A (square)	WBK15S-01 (square)
WBK15-11 (round)	

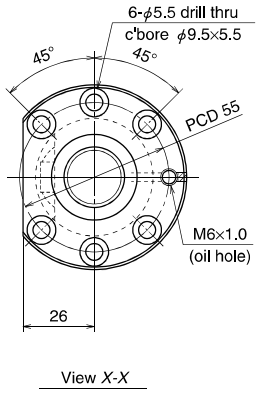
Unit: mm

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)	
					Supporting condition	
T	e_p	υ_u			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.).





View X-X

NSK

Screw shaft ø20

Lead 5

Unit: mm

Ball screw specifications		
Shaft dia. × 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_a	9 410
	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

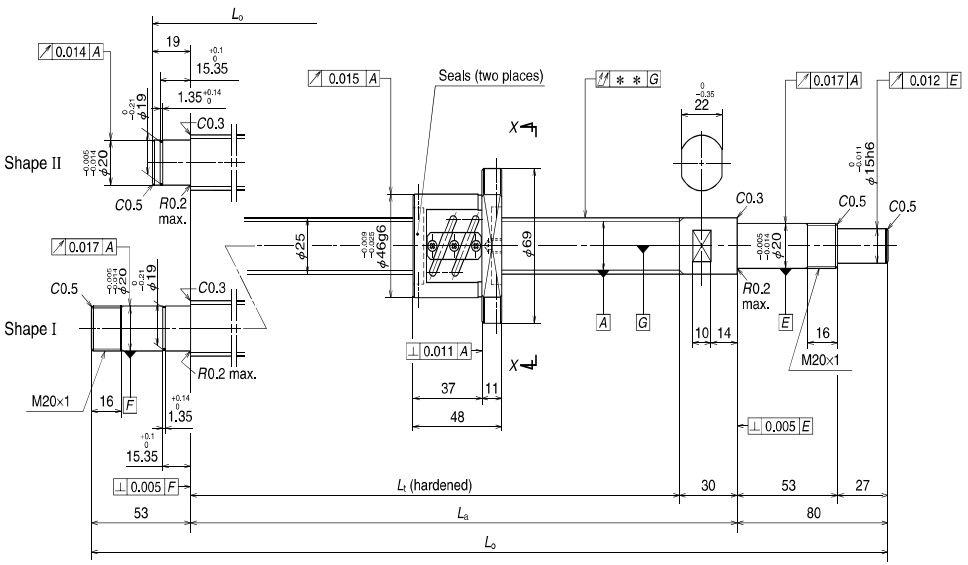
For drive side (Fixed)	For opposite to drive side (Simple)
WBK15-01A (square)	WBK15S-01 (square)
WBK15-11 (round)	

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	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})	
					Supporting condition	
T	e_p	υ_u			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.).



Unit: mm

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		25 × 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 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	6 020
	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 (cm³)		3.2
Standard volume of grease replenishing (cm³)		1.6

Recommended support unit

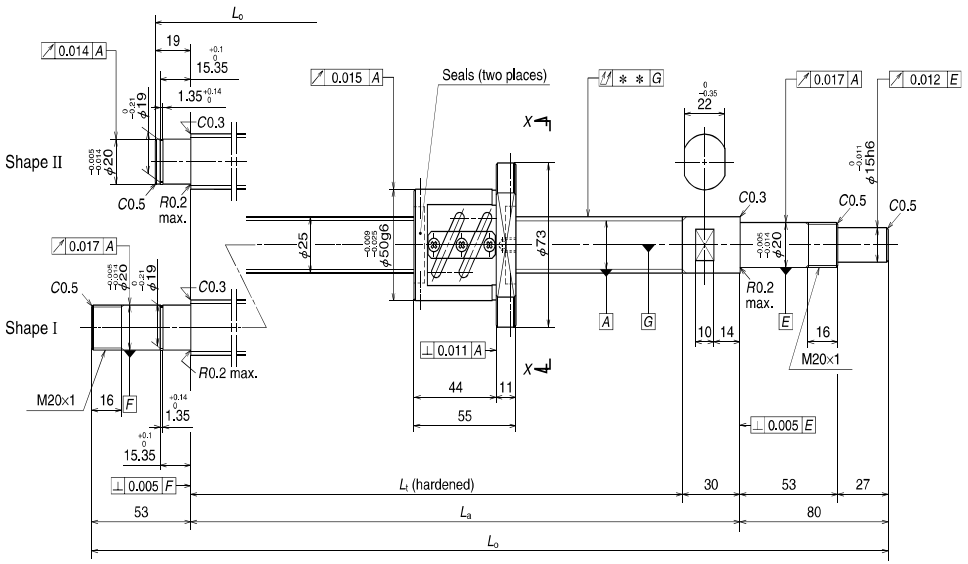
For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

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

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	–0.005	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

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 for left shaft end shape Ⅰ.



Unit: mm

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		25 × 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 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	10 400
	Static C_{0a}	21 900
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 (cm³)		5.0
Standard volume of grease replenishing (cm³)		2.5

Recommended support unit

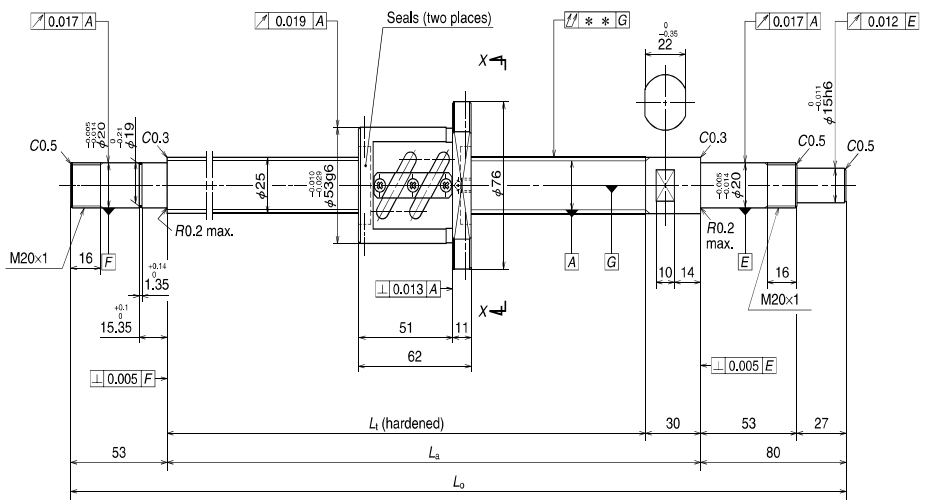
For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

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

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
						Supporting condition	
	T	e_p	υ_u			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

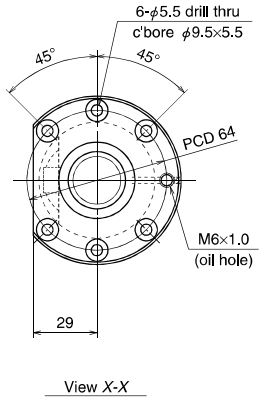
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. Contact NSK if the the permissible rotational speed is to be exceeded.
4. The maximum stroke is -8 mm when Fixed-Fixed is used for left shaft end shape Ⅰ.



NSK

Screw shaft ø25

Lead 6



View *X-X*

Unit: mm

Ball screw specifications		
Shaft dia. × 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_a	14 100
	Static C_{0a}	26 800
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

Recommended support unit

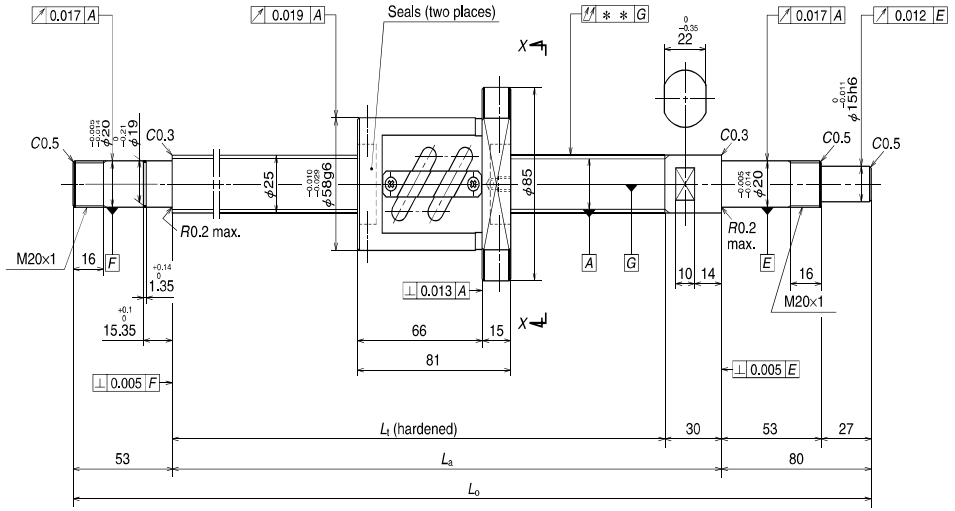
For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

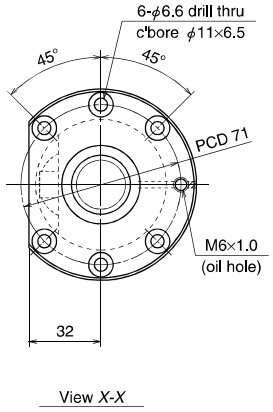
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2503SA-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	υ_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

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 for left shaft end shape **I**.





View *X-X*

NSK

Screw shaft ø25

Lead 10

Unit: mm

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		25 × 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 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	11 600
	Static C_{0a}	19 000
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 (cm³)		9.5
Standard volume of grease replenishing (cm³)		4.8

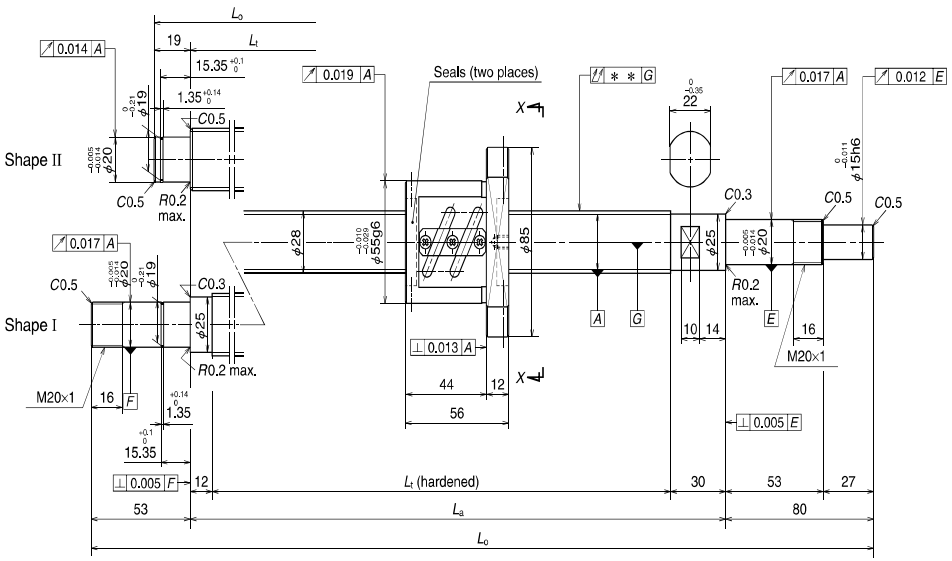
Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (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			Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹) Supporting condition	
	Nominal	Maximum	L_t	L_a	L_o	T	e_p	υ_u			Fixed - Simple support	Fixed - Fixed
W2503SA-4P-C5Z10	250	283	370	400	533	–0.009	0.025	0.020	0.050	3.2	2 800	2 800
W2505SA-4P-C5Z10	450	483	570	600	733	–0.014	0.030	0.023	0.060	3.8	2 800	2 800
W2507SA-4P-C5Z10	650	683	770	800	933	–0.018	0.035	0.025	0.075	4.5	2 800	2 800
W2509SA-2P-C5Z10	850	883	970	1 000	1 133	–0.023	0.040	0.027	0.090	5.2	2 800	2 800
W2511SA-3P-C5Z10	1 050	1 083	1 170	1 200	1 333	–0.028	0.046	0.030	0.120	5.9	2 390	2 800
W2514SA-1P-C5Z10	1 350	1 383	1 470	1 500	1 633	–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 for left shaft end shape I.



Unit: mm

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		28 × 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 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	11 000
	Static C_{0a}	24 400
Preload (N)		540
Dynamic friction torque, median, (N·cm)		9.8
Spacer ball		Yes
Factory-packed grease		**Refer to Notes 2.**
Internal spatial volume of nut (cm³)		6.0
Standard volume of grease replenishing (cm³)		3.0

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (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

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
						Supporting condition	
	T	e_p	υ_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

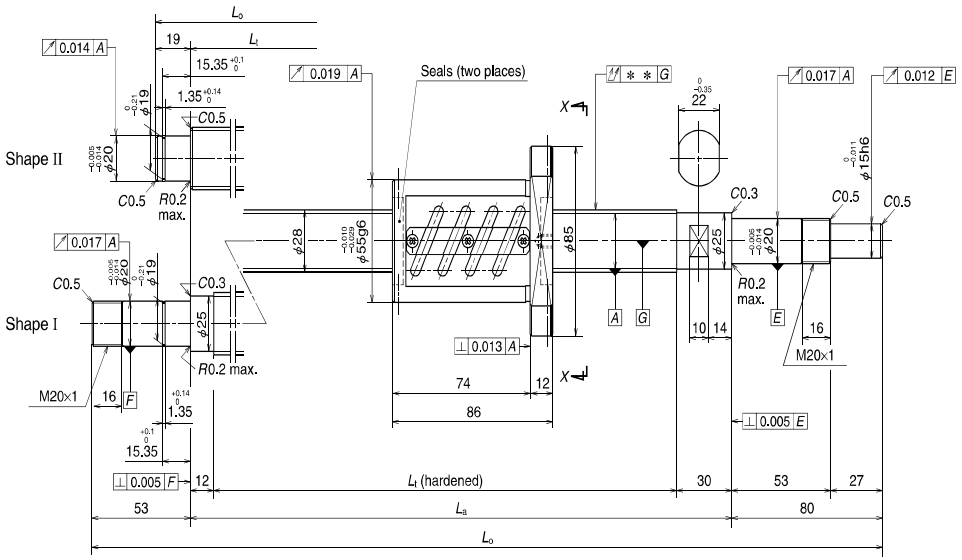
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.
4. The maximum stroke is -2 mm when Fixed-Fixed is used for left shaft end shape Ⅰ.

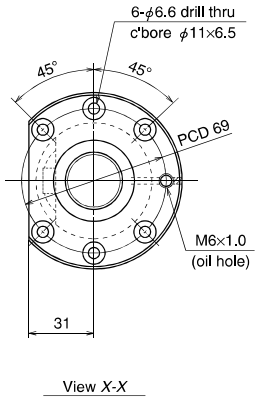
NSK

Screw shaft ø28

Lead 5

Unit: mm





View X-X

Ball screw specifications		
Shaft dia. × 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	17 400
	Static C_{0a}	48 800
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 (cm³)		9.0
Standard volume of grease replenishing (cm³)		4.5

Recommended support unit

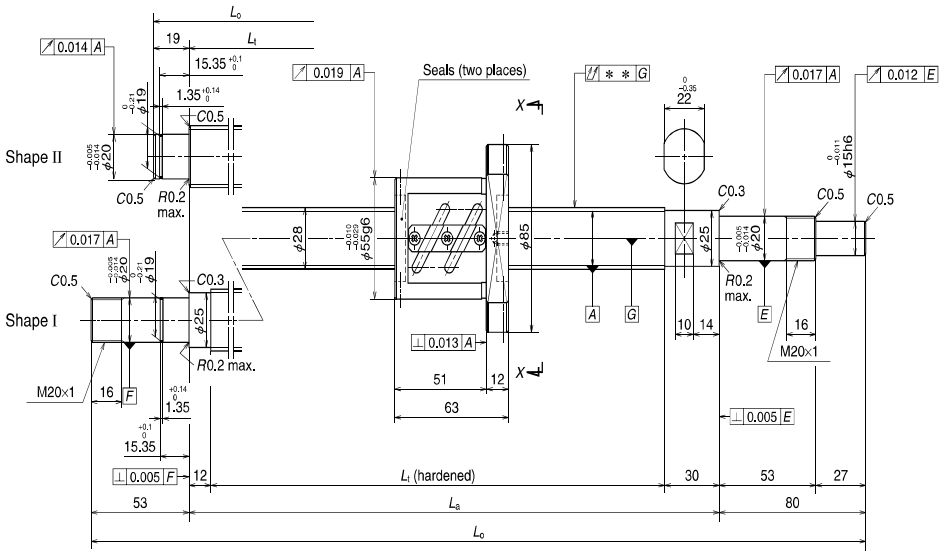
For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

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

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
						Supporting condition	
	T	e_p	υ_u			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

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.

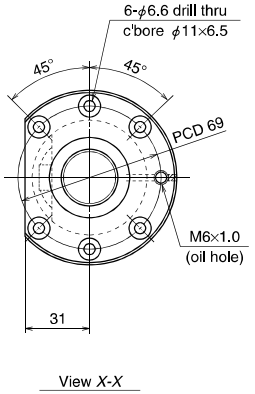


NSK

Screw shaft ø28

Lead 6

Unit: mm



Ball screw specifications		
Shaft dia. × 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_a	11 000
	Static C_{0a}	24 400
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 (cm³)		6.0
Standard volume of grease replenishing (cm³)		3.0

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

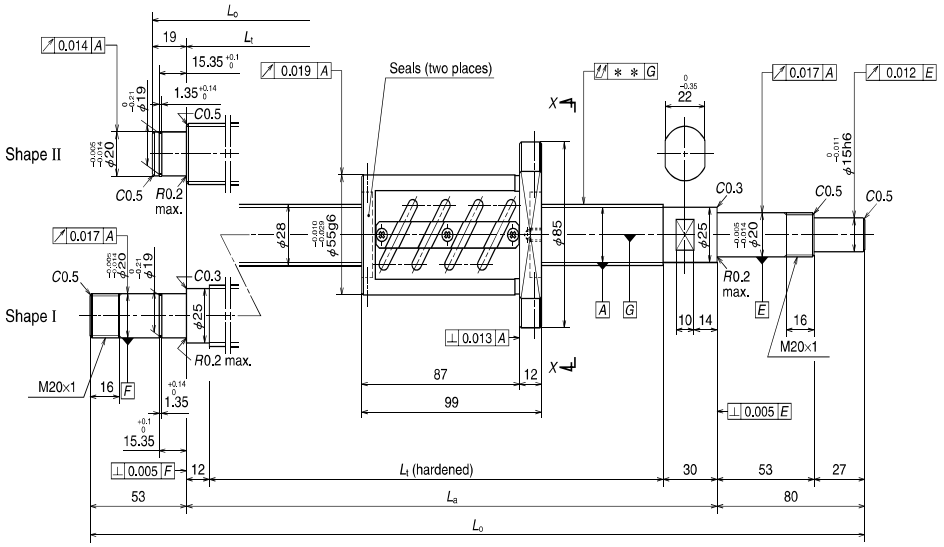
Unit: mm

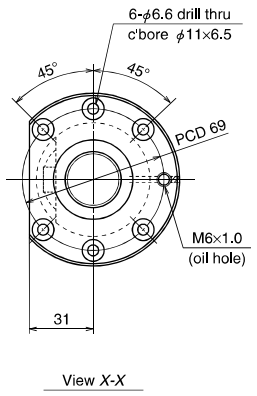
Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2803SA-3P-C5Z6	250	301	370	400	499
W2805SA-3P-C5Z6	450	501	570	600	699
W2807SA-3P-C5Z6	650	695	758	800	933
W2809SA-3P-C5Z6	850	895	958	1 000	1 133
W2811SA-3P-C5Z6	1 050	1 095	1 158	1 200	1 333

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
						Supporting condition	
	T	e_p	υ_u	⊿		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

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.

SA





View *X-X*

NSK

Screw shaft ø28

Lead 6

Unit: mm

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		28 × 6 / 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	17 400
	Static C_{0a}	48 800
Preload (N)		1 220
Dynamic friction torque, median, (N·cm)		23.5
Spacer ball		None
Factory-packed grease		**Refer to Notes 2.**
Internal spatial volume of nut (cm³)		9.5
Standard volume of grease replenishing (cm³)		4.8

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK20-01 (square)	WBK20-01 (square)	WBK20S-01 (square)
WBK20-11 (round)	WBK20-11 (round)	

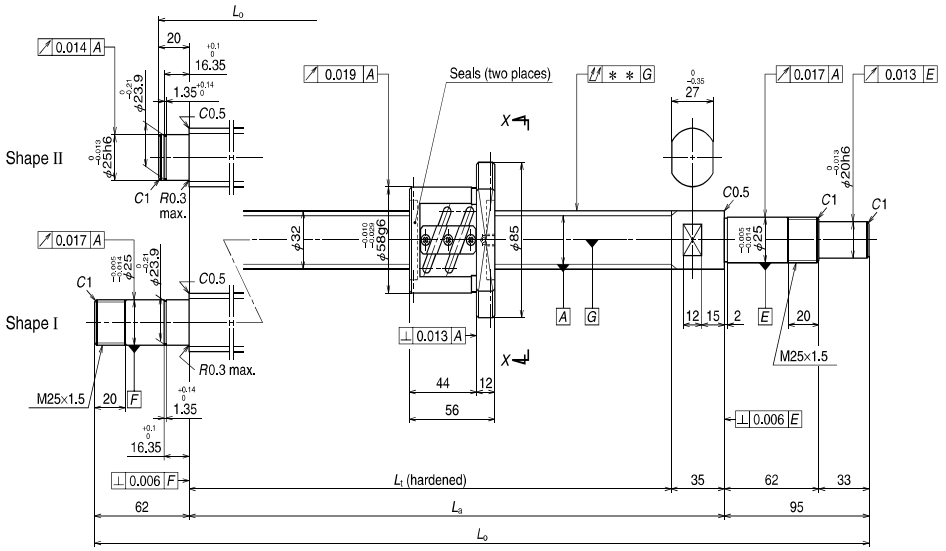
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W2803SA-4Z-C5Z6	250	265	370	400	499
W2805SA-4Z-C5Z6	450	465	570	600	699
W2807SA-4Z-C5Z6	650	659	758	800	933
W2809SA-4Z-C5Z6	850	859	958	1 000	1 133
W2811SA-4Z-C5Z6	1 050	1 059	1 158	1 200	1 333

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.

SA

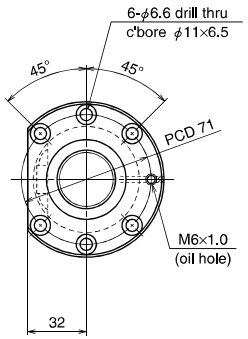


NSK

Screw shaft ø32

Lead 5

Unit: mm



View *X-X*

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		32 × 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 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	11 600
	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 (cm³)		7.0
Standard volume of grease replenishing (cm³)		3.5

Recommended support unit

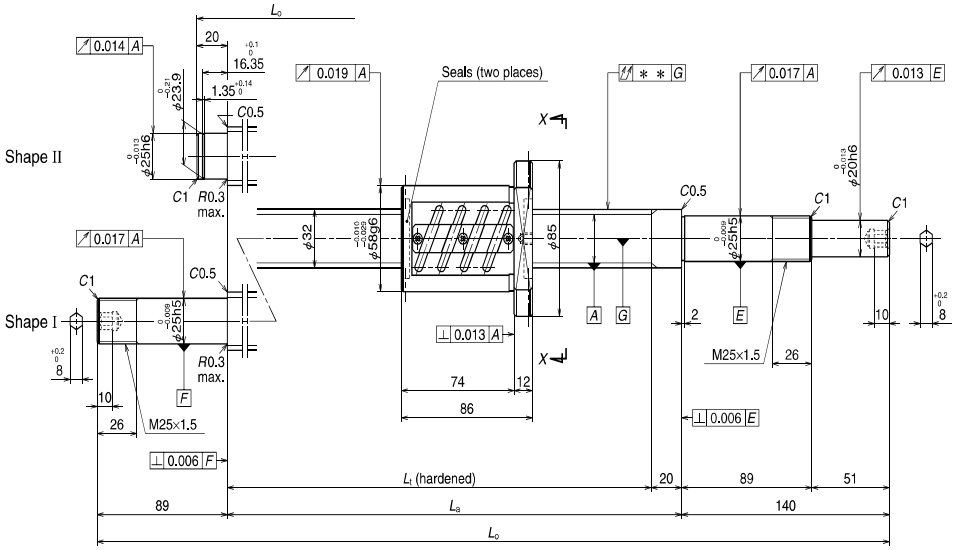
For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK25-01W (square)	WBK25-01W (square)	WBK25S-01W (square)
WBK25-11 (round)	WBK25-11 (round)	

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

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
						Supporting condition	
	T	e_p	υ_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

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.

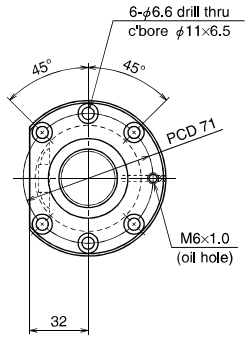


NSK

Screw shaft ø32

Lead 5

Unit: mm



View *X-X*

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		32 × 5 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		3.175 / 32.5
Screw shaft root diameter		29.2
Effective turns of balls		2.5 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	18 500
	Static C_{0a}	56 100
Preload (N)		1 270
Dynamic friction torque, median, (N·cm)		23.5
Spacer ball		None
Factory-packed grease		**Refer to Notes 2.**
Internal spatial volume of nut (cm³)		10
Standard volume of grease replenishing (cm³)		5

Recommended support unit

For drive side, for opposite to drive side (Fixed)
WBK25DF-31H (round)

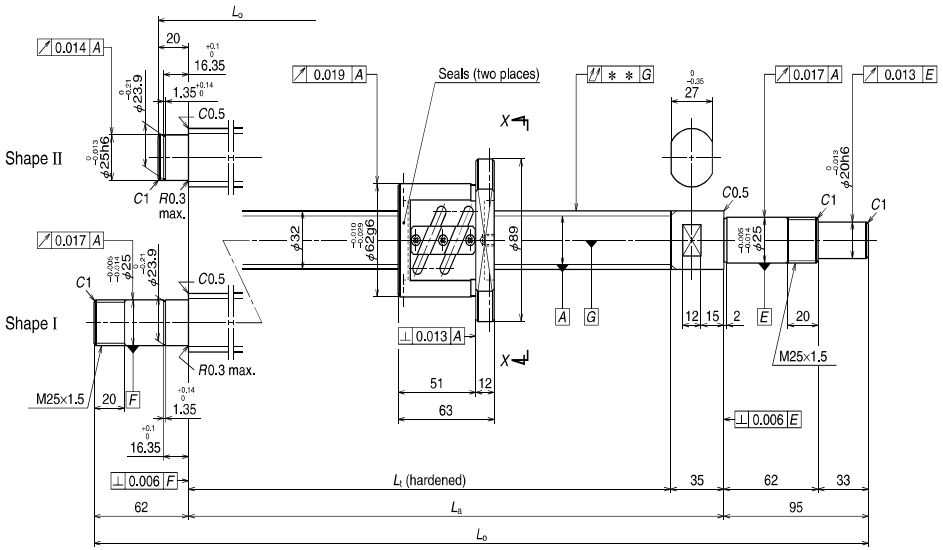
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W3202SA-2Z-C5Z5	150	186	280	300	460
W3203SA-2Z-C5Z5	250	286	380	400	560
W3204SA-2Z-C5Z5	350	386	480	500	660
W3205SA-2Z-C5Z5	450	486	580	600	760
W3206SA-2Z-C5Z5	550	586	680	700	929
W3207SA-2Z-C5Z5	650	686	780	800	1 029
W3209SA-2Z-C5Z5	850	886	980	1 000	1 229
W3211SA-2Z-C5Z5	1 050	1 086	1 180	1 200	1 429
W3214SA-2Z-C5Z5	1 350	1 386	1 480	1 500	1 729

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
						Supporting condition	
	T	e_p	υ_u	⊥		Fixed - Simple support	Fixed - Fixed
Ⅱ	–0.007	0.023	0.018	0.040	3.5	2 180	—
Ⅱ	–0.009	0.025	0.020	0.050	4.1	2 180	—
Ⅱ	–0.012	0.027	0.020	0.060	4.7	2 180	—
Ⅱ	–0.014	0.030	0.023	0.060	5.3	2 180	—
Ⅰ	–0.016	0.035	0.025	0.075	6.1	2 180	2 180
Ⅰ	–0.019	0.035	0.025	0.090	6.7	2 180	2 180
Ⅰ	–0.024	0.040	0.027	0.090	7.9	2 180	2 180
Ⅰ	–0.028	0.046	0.030	0.120	9.0	2 180	2 180
Ⅰ	–0.036	0.054	0.035	0.150	10.8	2 100	2 180

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.

SA

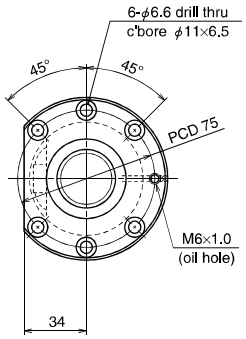


NSK

Screw shaft ø32

Lead 6

Unit: mm



View *X-X*

Ball screw specifications		
Shaft dia. × 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	15 500
	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 (cm³)		9.5
Standard volume of grease replenishing (cm³)		4.8

Recommended support unit

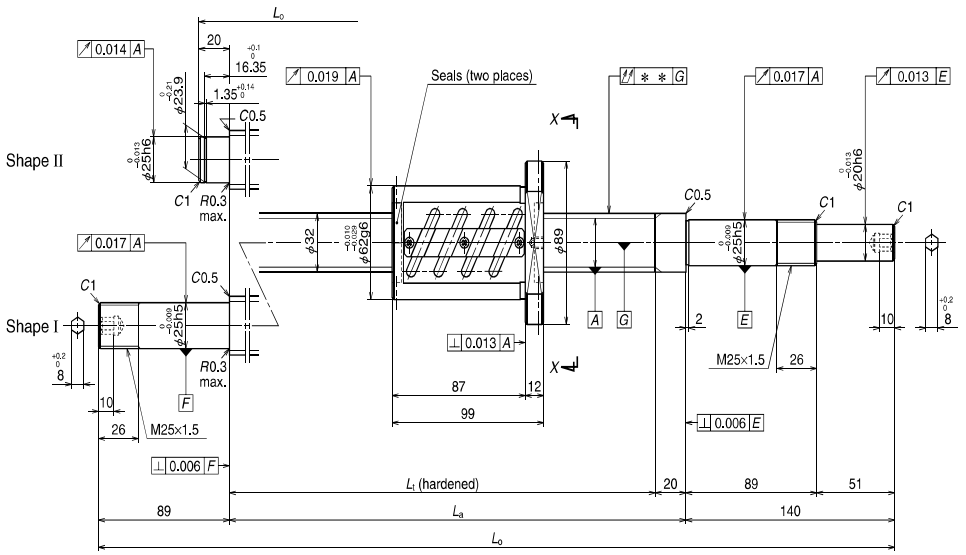
For drive side (Fixed)	For opposite to drive side (Fixed)	For opposite to drive side (Simple)
WBK25-01W (square)	WBK25-01W (square)	WBK25S-01W (square)
WBK25-11 (round)	WBK25-11 (round)	

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

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

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.

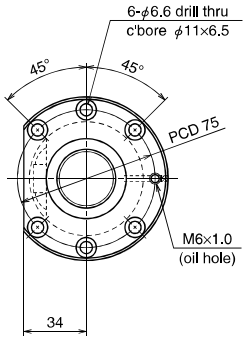


NSK

Screw shaft ø32

Lead 6

Unit: mm



View *X-X*

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		32 × 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 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	24 700
	Static C_{0a}	69 400
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

Recommended support unit

For drive side, for opposite to drive side (Fixed)
WBK25DF-31H (round)

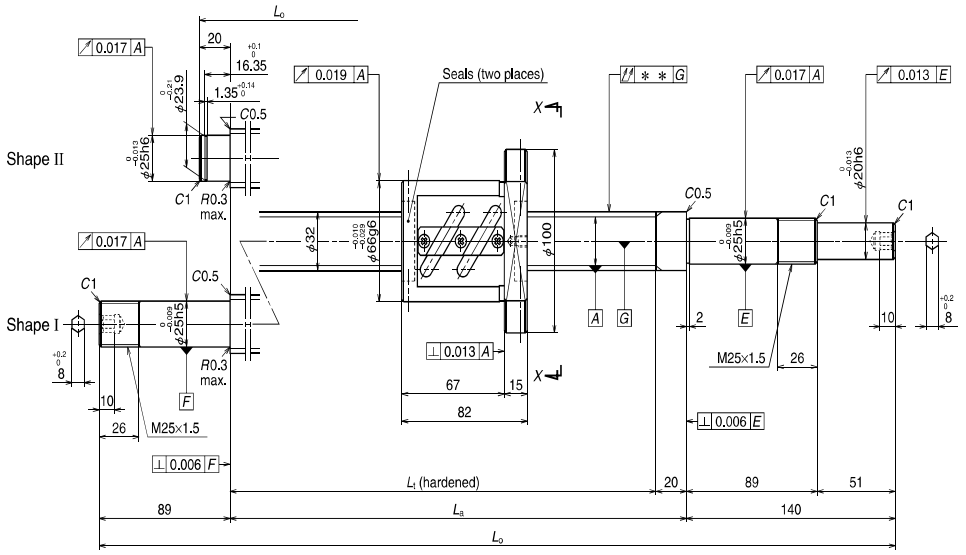
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W3203SA-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

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min^{-1})	
						Supporting condition	
	T	e_p	υ_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

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.

SA

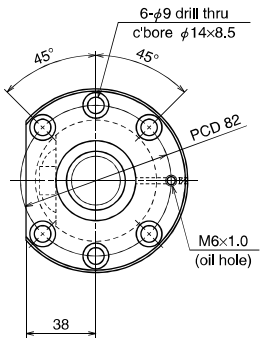


NSK

Screw shaft ø32

Lead 8

Unit: mm



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Ball screw specifications		
Shaft dia. × 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_a	17 500
	Static C_{0a}	41 000
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)

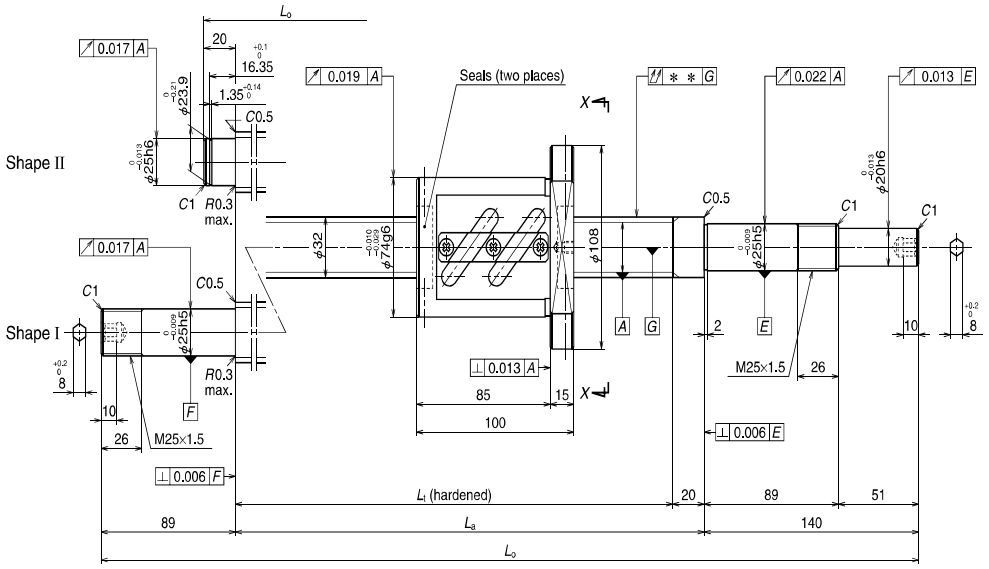
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
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

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	4.7	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

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.

SA



View *X-X*

Unit: mm

Ball screw specifications		
Shaft dia. × 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	25 500
	Static C_{0a}	54 000
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 (cm³)		22
Standard volume of grease replenishing (cm³)		11

Recommended support unit

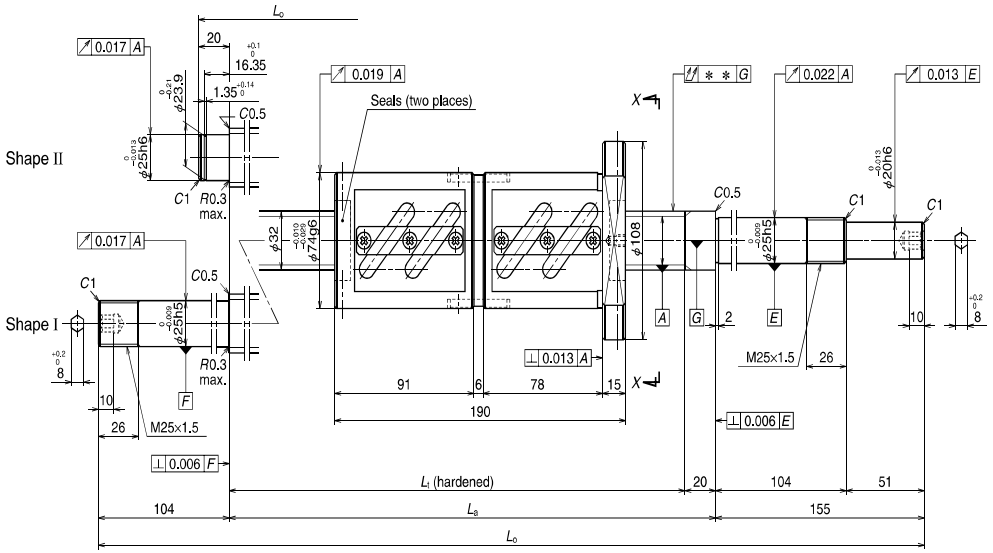
For drive side, for opposite to drive side (Fixed)
WBK25DF-31H (round)

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

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
						Supporting condition	
	T	e_p	υ_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

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.



NSK

Screw shaft ø32

Lead 10

Unit: mm

Ball screw specifications		
Shaft dia. × 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)	Dynamic C_a	46 300
	Static C_{0a}	108 000
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 (cm³)		44
Standard volume of grease replenishing (cm³)		22

Recommended support unit

For drive side, for opposite to drive side (Fixed)
WBK25DFD-31H (round)

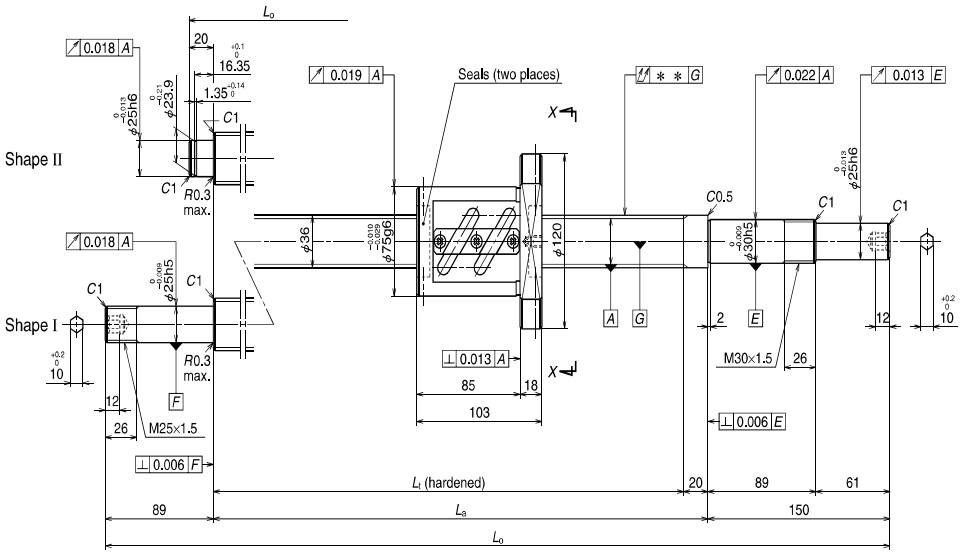
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	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

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
						Supporting condition	
	T	e_p	υ_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

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.

SA

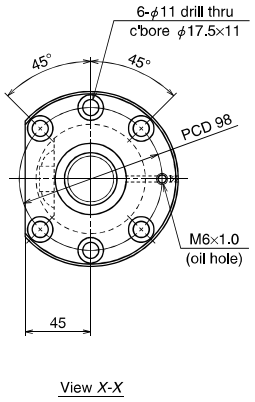


NSK

Screw shaft ø36

Lead 10

Unit: mm



View *X-X*

Ball screw specifications		
Shaft dia. × 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_a	27 200
	Static C_{0a}	61 300
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

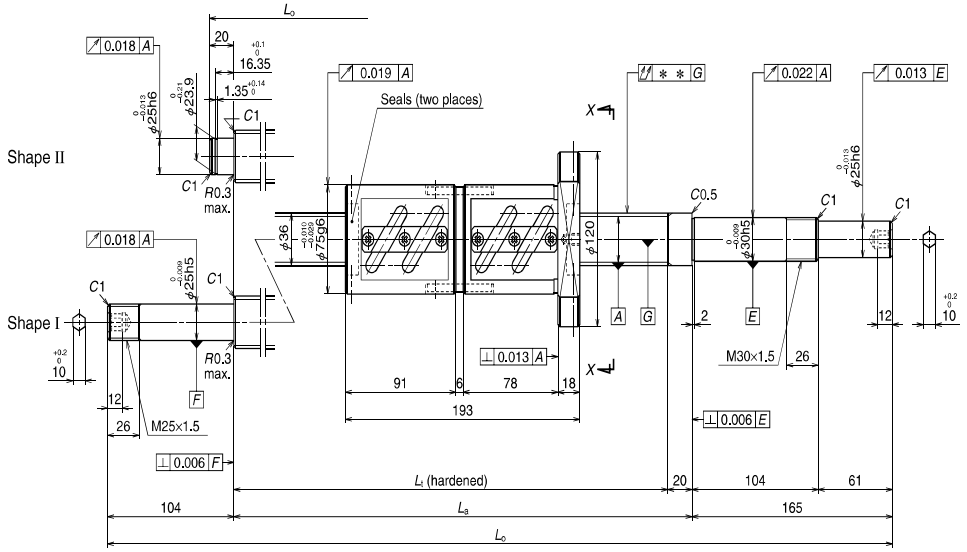
For drive side (Fixed)	For opposite to drive side (Simple)
WBK30DF-31H (round)	WBK25DF-31H (round)

Unit: mm

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	υ_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.

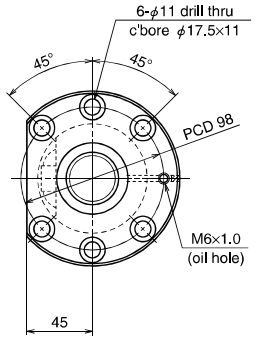


NSK

Screw shaft ø36

Lead 10

Unit: mm



View *X-X*

Ball screw specifications		
Shaft dia. × 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_a	49 300
	Static C_{0a}	123 000
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)

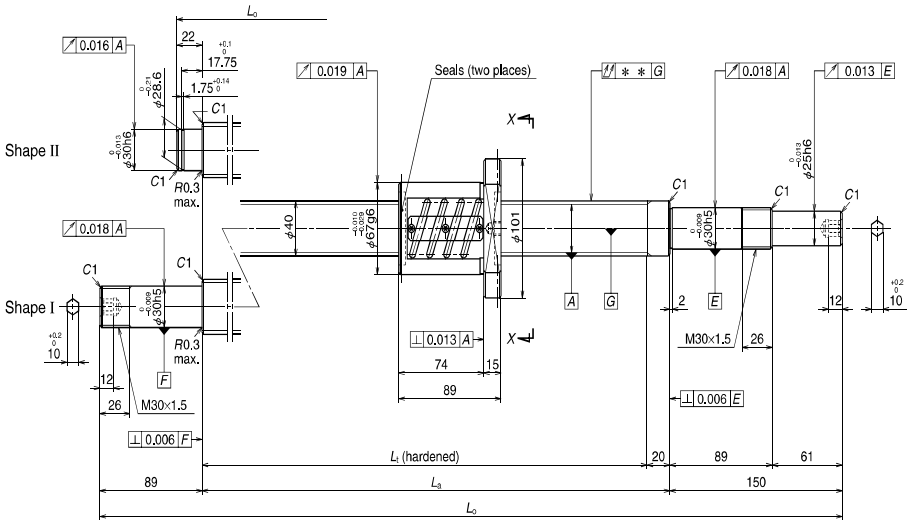
Unit: mm

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

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

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.

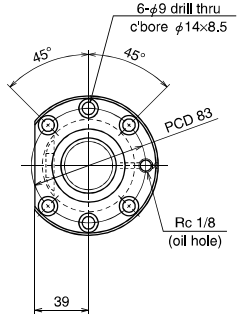
SA



NSK

Screw shaft ø40

Lead 5



View *X-X*

Unit: mm

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		40 × 5 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		3.175 / 40.5
Screw shaft root diameter		37.2
Effective turns of balls		2.5 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	20 200
	Static C_{0a}	70 600
Preload (N)		1 420
Dynamic friction torque, median, (N·cm)		29.5
Spacer ball		None
Factory-packed grease		**Refer to Notes 2.**
Internal spatial volume of nut (cm³)		14
Standard volume of grease replenishing (cm³)		7

Recommended support unit

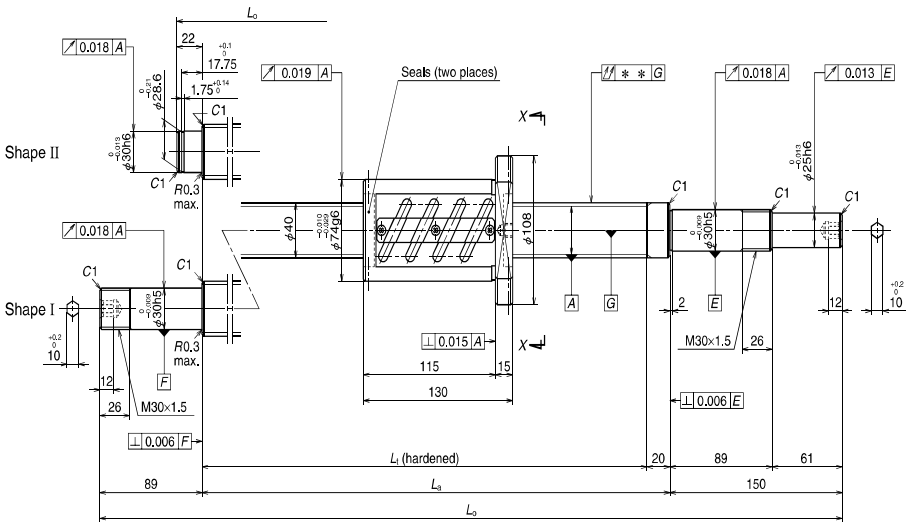
For drive side, for opposite to drive side (Fixed)
WBK30DF-31H (round)

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W4003SA-1Z-C5Z5	250	284	380	400	572
W4005SA-1Z-C5Z5	450	484	580	600	772
W4007SA-1Z-C5Z5	650	684	780	800	1 039
W4009SA-1Z-C5Z5	850	884	980	1 000	1 239
W4011SA-1Z-C5Z5	1 050	1 084	1 180	1 200	1 439
W4015SA-1Z-C5Z5	1 450	1 484	1 580	1 600	1 839

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
						Supporting condition	
	T	e_p	υ_u	⊥		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.

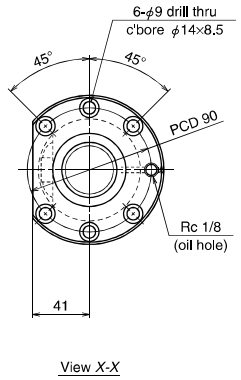


NSK

Screw shaft ø40

Lead 8

Unit: mm



View *X-X*

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		40 × 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 × 2
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	34 900
	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

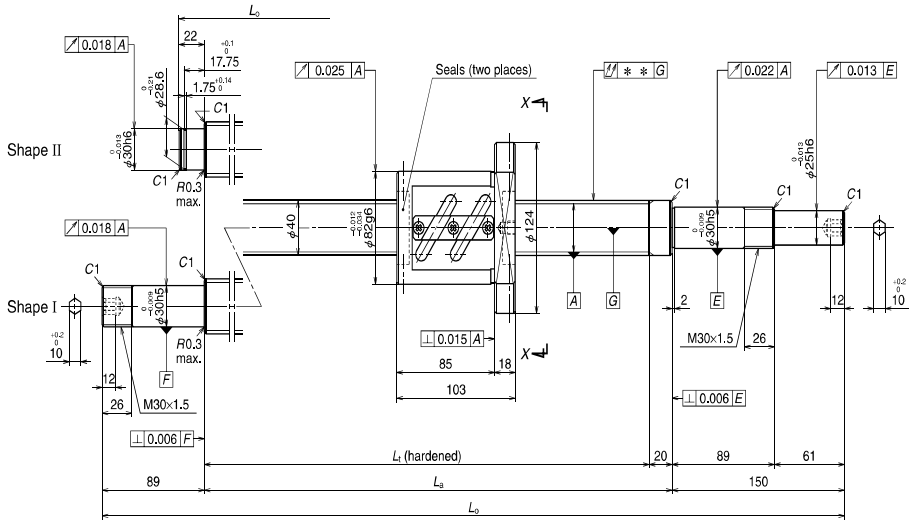
For drive side, for opposite to drive side (Fixed)
WBK30DF-31H (round)

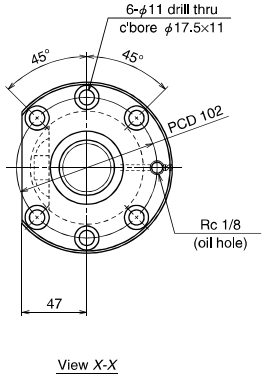
Unit: mm

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

Left side shaft end	Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min^{-1})	
						Supporting condition	
	T	e_p	υ_u			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

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.





View *X-X*

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W4004SA-1Z-C5Z10	350	370	480	500	672
W4005SA-3Z-C5Z10	450	470	580	600	772
W4006SA-1Z-C5Z10	550	570	680	700	872
W4007SA-3Z-C5Z10	650	670	780	800	1 039
W4009SA-3Z-C5Z10	850	870	980	1 000	1 239
W4011SA-3Z-C5Z10	1 050	1 070	1 180	1 200	1 439
W4013SA-1Z-C5Z10	1 250	1 270	1 380	1 400	1 639
W4015SA-3Z-C5Z10	1 450	1 470	1 580	1 600	1 839
W4017SA-1Z-C5Z10	1 650	1 670	1 780	1 800	2 039
W4023SA-1Z-C5Z10	2 250	2 270	2 380	2 400	2 639

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.

NSK

Screw shaft ø40

Lead 10

Unit: mm

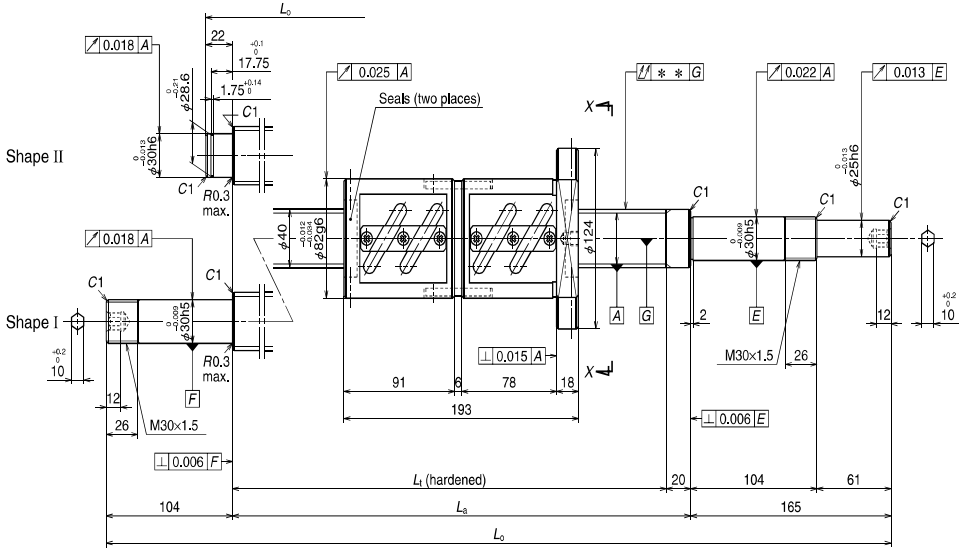
Ball screw specifications		
Shaft dia. × Lead / Direction of turn		40 × 10 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		6.35 / 41
Screw shaft root diameter		34.4
Effective turns of balls		2.5 × 1
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	28 600
	Static C_{0a}	68 600
Preload (N)		2 160
Dynamic friction torque, median, (N·cm)		64.0
Spacer ball		None
Factory-packed grease		**Refer to Notes 2.**
Internal spatial volume of nut (cm³)		30
Standard volume of grease replenishing (cm³)		15

Recommended support unit

For drive side, for opposite to drive side (Fixed)
WBK30DF-31H (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	υ_u	⊥		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

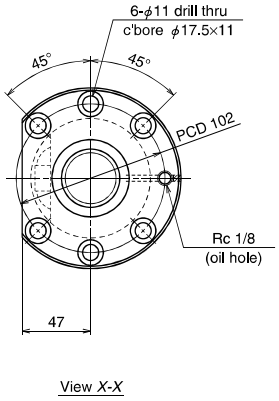


NSK

Screw shaft ø40

Lead 10

Unit: mm



View *X-X*

Ball screw specifications		
Shaft dia. × 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_a	52 000
	Static C_{0a}	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

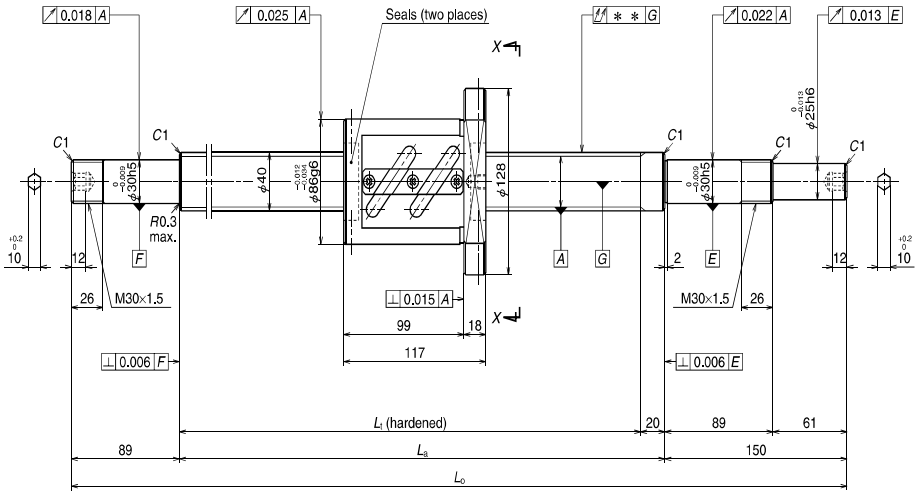
For drive side, for opposite to drive side (Fixed)
WBK30DFD-31H (round)

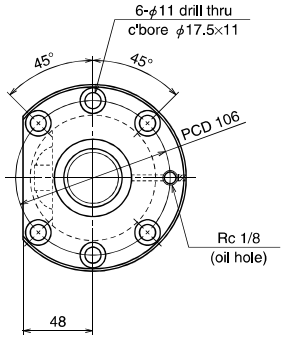
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
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

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

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.





View *X-X*

Unit: mm

Ball screw specifications		
Shaft dia. × 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	33 600
	Static C_{0a}	77 500
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

Recommended support unit

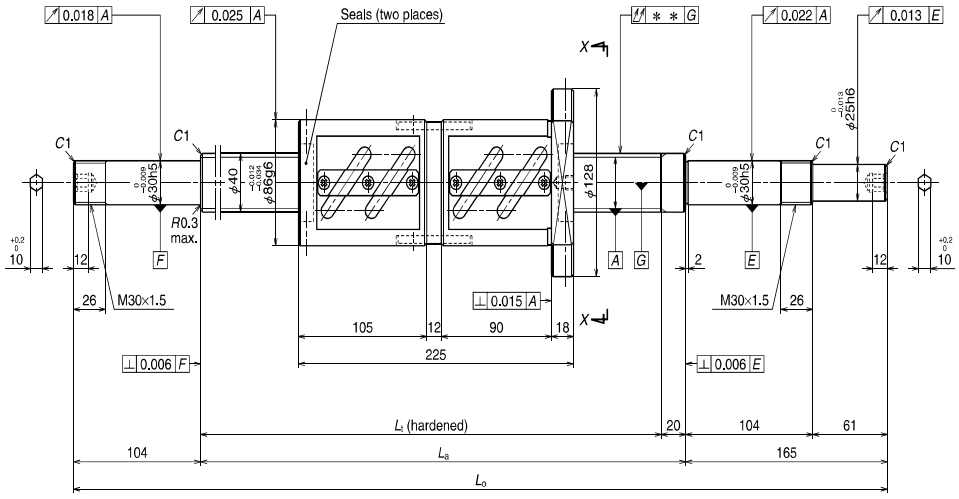
For drive side, for opposite to drive side (Fixed)
WBK30DF-31H (round)

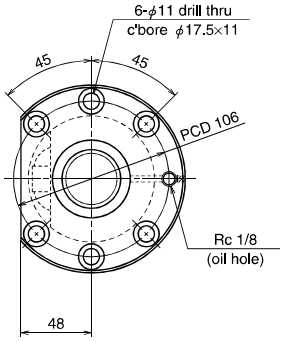
Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
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

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min^{-1})	
					Supporting condition	
T	e_p	υ_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

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.





View *X-X*

NSK

Screw shaft ø40

Lead 12

Unit: mm

Ball screw specifications		
Shaft dia. × 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_a	61 000
	Static C_{0a}	155 000
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

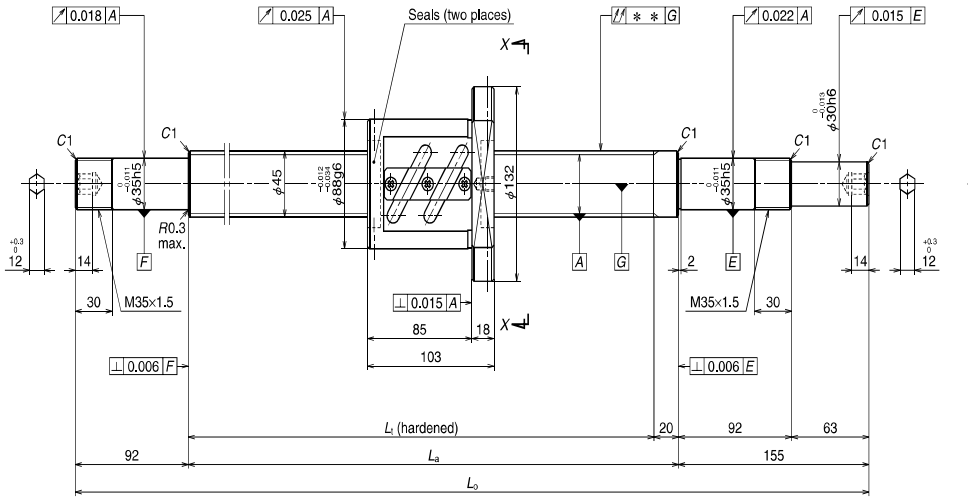
For drive side, for opposite to drive side (Fixed)
WBK30DFD-31H (round)

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})	
					Supporting condition	
T	e_p	υ_u			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

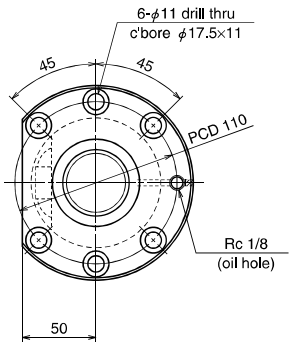
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.



NSK

Screw shaft ø45

Lead 10



View X-X

Unit: mm

Ball screw specifications		
Shaft dia. × Lead / Direction of turn		45 × 10 / Right
Preload / Ball recirculation		Z-preload / Return tube
Ball dia. / Ball circle dia.		6.35 / 46
Screw shaft root diameter		39.4
Effective turns of balls		2.5 × 1
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	29 900
	Static C_{0a}	77 300
Preload (N)		2 260
Dynamic friction torque, median, (N·cm)		69.0
Spacer ball		None
Factory-packed grease		**Refer to Notes 2.**
Internal spatial volume of nut (cm³)		33
Standard volume of grease replenishing (cm³)		17

Recommended support unit

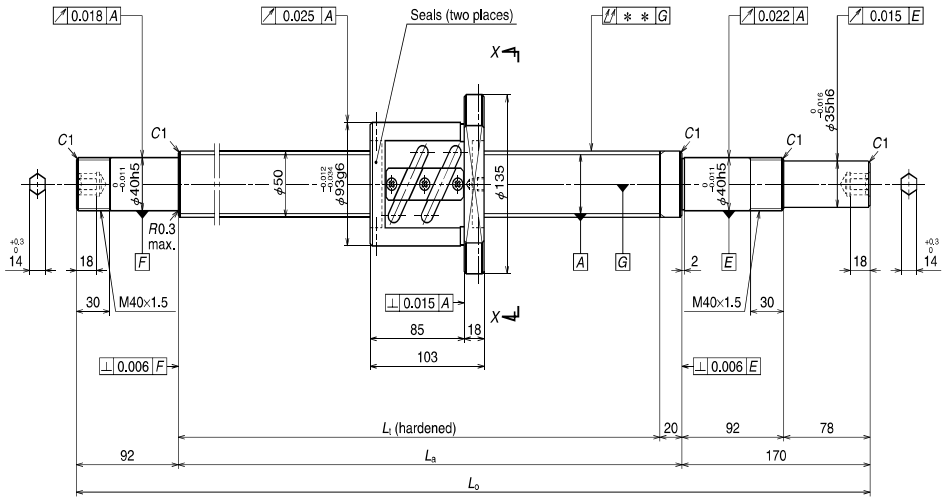
For drive side, for opposite to drive side (Fixed)
WBK35DF-31H (round)

Unit: mm

Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum	L_t	L_a	L_o
W4506SA-1Z-C5Z10	550	568	680	700	947
W4509SA-1Z-C5Z10	850	868	980	1 000	1 247
W4513SA-1Z-C5Z10	1 250	1 268	1 380	1 400	1 647
W4517SA-1Z-C5Z10	1 650	1 668	1 780	1 800	2 047
W4524SA-1Z-C5Z10	2 350	2 368	2 480	2 500	2 747

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
					Supporting condition	
T	e_p	υ_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

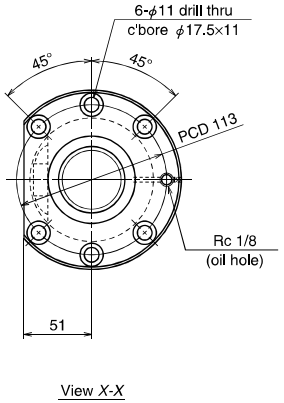
Notes: 1. We recommend NSK support unit. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use. See page D13 for details.
3. Contact NSK if the permissible rotational speed is to be exceeded.



NSK

Screw shaft ø50

Lead 10



View *X-X*

Unit: mm

Ball screw specifications		
Shaft dia. × 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	31 800
	Static C_{0a}	87 400
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 (cm³)		37
Standard volume of grease replenishing (cm³)		19

Recommended support unit

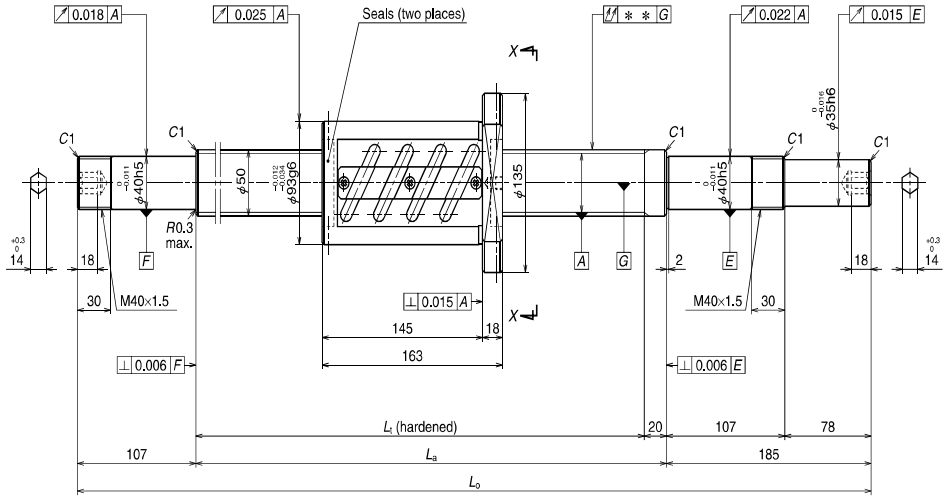
For drive side, for opposite to drive side (Fixed)
WBK40DF-31H (round)

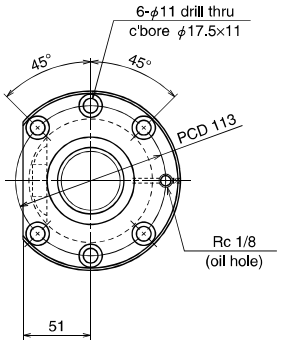
Unit: mm

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	667	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

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
					Supporting condition	
T	e_p	υ_u			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

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.





View X-X

NSK

Screw shaft ø50

Lead 10

Unit: mm

Ball screw specifications		
Shaft dia. × 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_a	57 700
	Static C_{0a}	175 000
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 (cm³)		59
Standard volume of grease replenishing (cm³)		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

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)	
					Supporting condition	
T	e_p	υ_u	↑↑		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

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.

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

υ_u : Travel variation

See "Technical Description: Lead Accuracy" (page B37) for details of the codes.

●Permissible rotational speed

d • 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·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

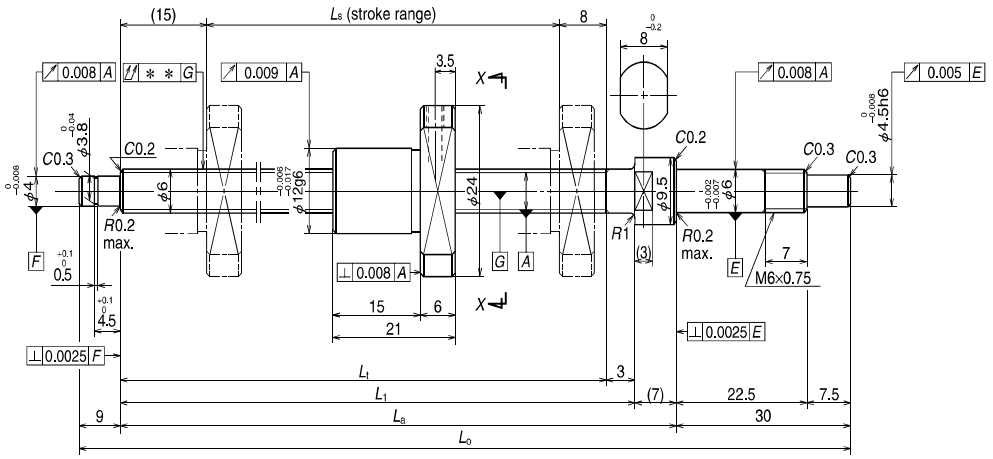
Screw shaft diameter (mm) \ Lead (mm)	1	2	4	5	10	20
6	B275					
8	B277	B279				
10		B281	B283			
12		B285		B287	B289	
15					B291	B293
16		B295				
20						B297

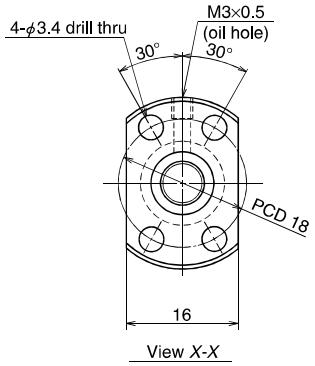
NSK

Screw shaft ø6

Lead 1

Unit: mm





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_a	470
	Static C_{0a}	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.**

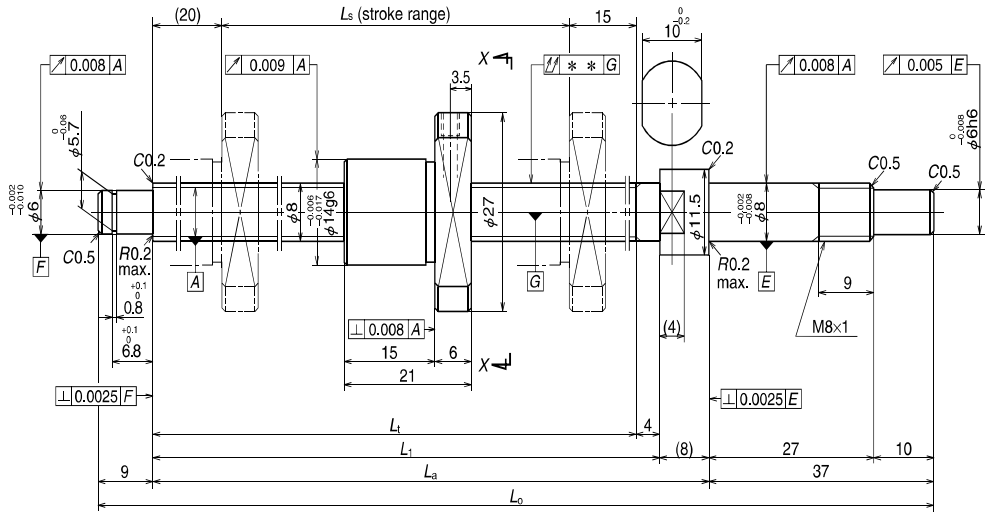
Unit: mm

Ball screw No.	Stroke L_s		Thread length			
	Nominal	Maximum	L_t	L_1	L_a	L_o
W0601KA-3PY-C3Z1	100	102	125	128	135	174

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

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.

KA

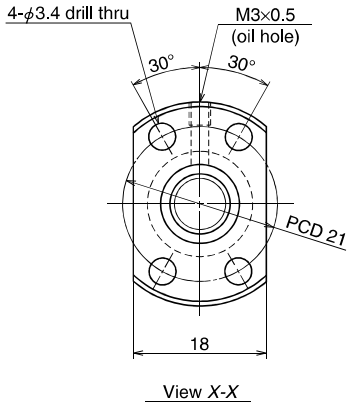


NSK

Screw shaft ø8

Lead 1

Unit: mm



View *X-X*

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_a	545
	Static C_{0a}	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)	

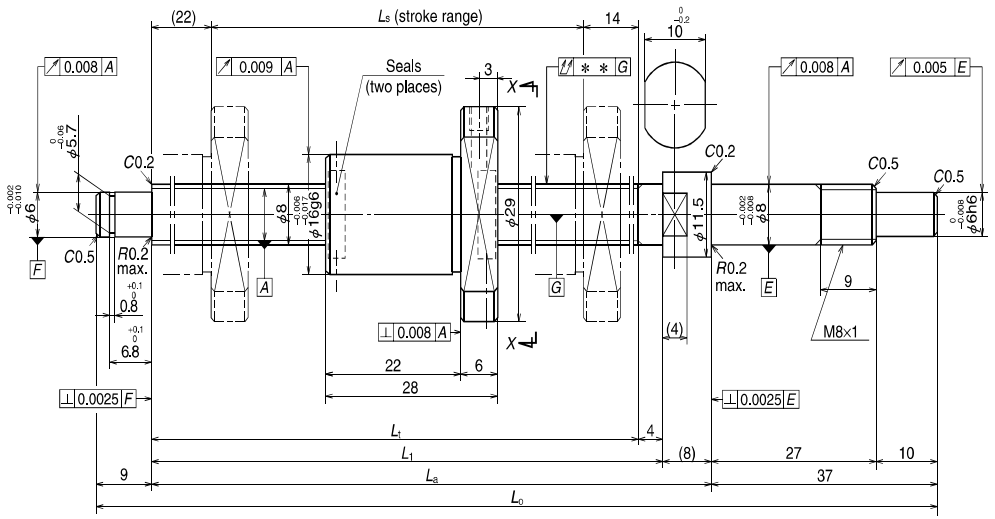
Unit: mm

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

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)
					Supporting condition
T	e_p	υ_u			Fixed - Simple support
0	0.010	0.008	0.035	0.12	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. Ball nut does not have seal.
3. Contact NSK if the permissible rotational speed is to be exceeded.

KA

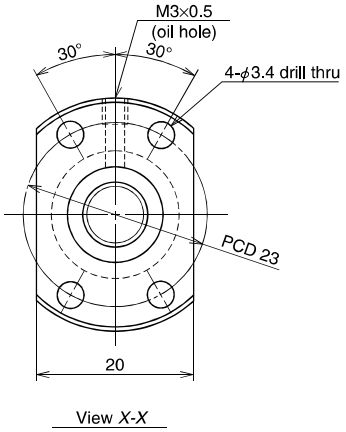


NSK

Screw shaft ø8

Lead 2

Unit: mm



View *X-X*

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_a	1 080
	Static C_{0a}	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)	

Unit: mm

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})
					Supporting condition
T	e_p	v_u			Fixed - Simple support
0	0.010	0.008	0.035	0.13	3 000

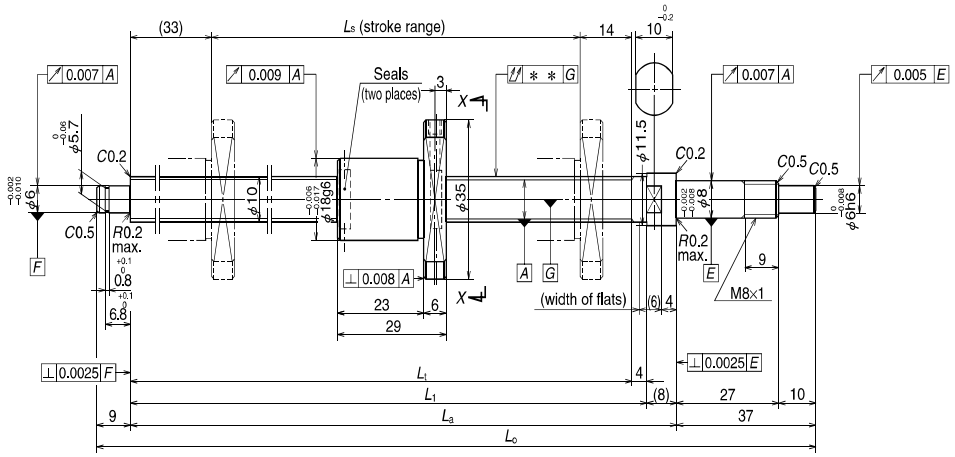
Notes: **1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.**
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.

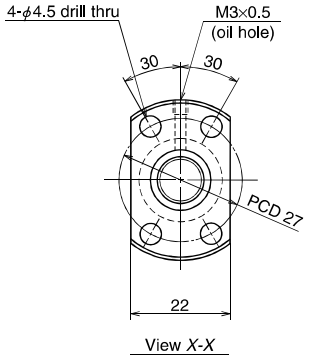
NSK

Screw shaft ø10

Lead 2

Unit: mm





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_a	1 210
	Static C_{0a}	2 110
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 (cm³)		0.44
Standard volume of grease replenishing (cm³)		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)	

Unit: mm

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)
					Supporting condition
T	e_p	v_u			Fixed - Simple support
0	0.012	0.008	0.030	0.22	3 000

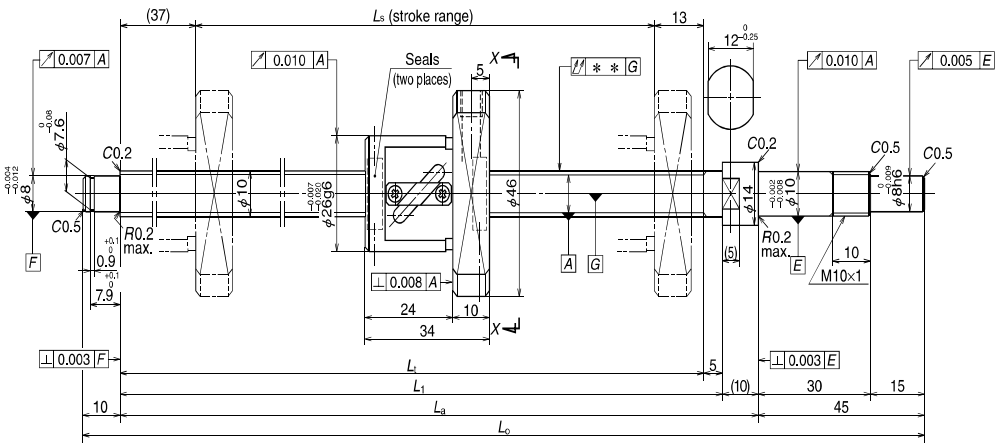
Notes: **1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.**
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.

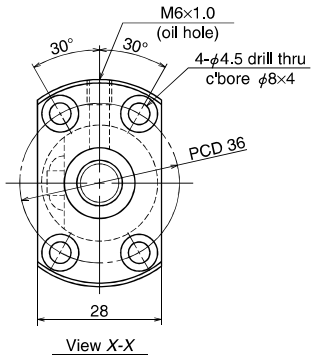
NSK

Screw shaft ø10

Lead 4

Unit: mm





View *X-X*

Ball screw specifications		
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		C3 / Z
Basic load rating (N)	Dynamic C_a	2 250
	Static C_{0a}	3 290
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 (cm³)		0.8
Standard volume of grease replenishing (cm³)		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)	

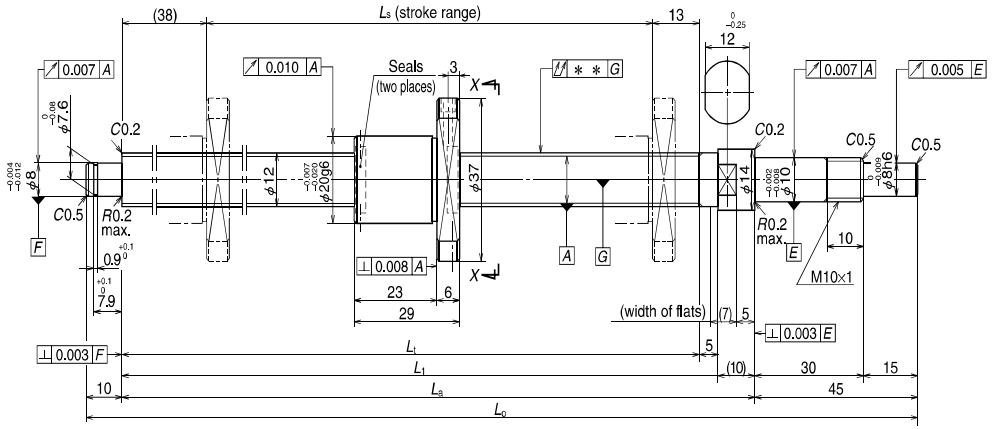
Unit: mm

Ball screw No.	Stroke L_s		Thread length			
	Nominal	Maximum	L_t	L_1	L_a	L_o
W1001KA-3P-C3Z4	100	110	160	165	175	230
W1003KA-3P-C3Z4	300	310	360	365	375	430

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	0.29	3 000
0	0.013	0.008	0.050	0.39	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.

KA

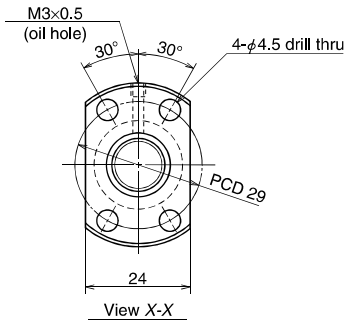


NSK

Screw shaft ø12

Lead 2

Unit: mm



Ball screw specifications		
Shaft dia. x Lead / Direction of turn		12 × 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 × 3
Accuracy grade / Preload		C3 / Z
Basic load rating (N)	Dynamic C_a	1 360
	Static C_{0a}	2 680
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 (cm³)		0.53
Standard volume of grease replenishing (cm³)		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

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

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

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.

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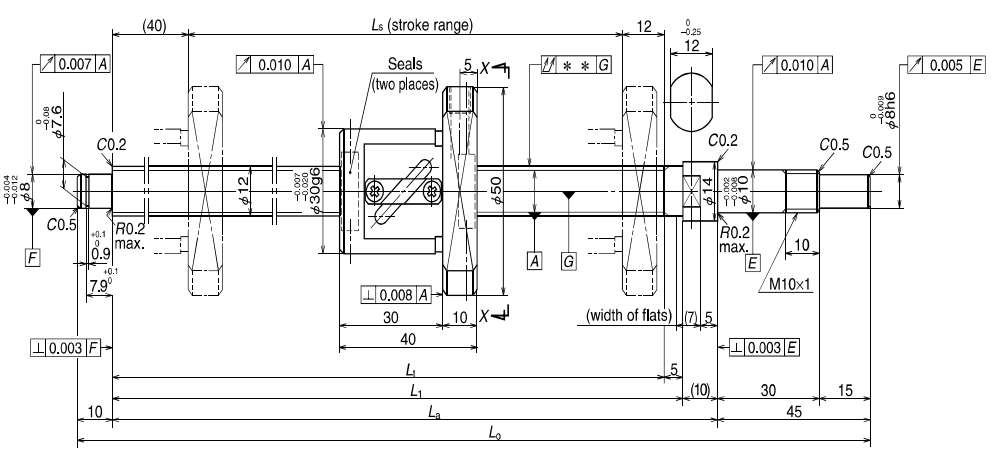
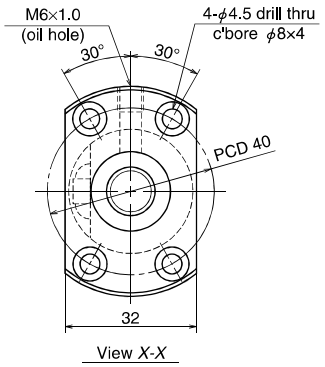
NSK

Screw shaft ø12

Lead 5

Unit: mm





Ball screw specifications		
Shaft dia. x Lead / Direction of turn		12 × 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 × 1
Accuracy grade / Preload		C3 / Z
Basic load rating (N)	Dynamic C_a	3 070
	Static C_{0a}	4 670
Axial play		0
Preload (N)		98.1
Dynamic friction torque, (N·cm)		1.0 – 4.4
Spacer ball		None
Factory-packed grease		**Refer to Notes 1.**
Internal spatial volume of nut (cm³)		1.2
Standard volume of grease replenishing (cm³)		0.6

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
W1202KA-3P-C3Z5	200	208	260	265	275	330
W1205KA-1P-C3Z5	450	458	510	515	525	580

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)
					Supporting condition
T	e_p	υ_u			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

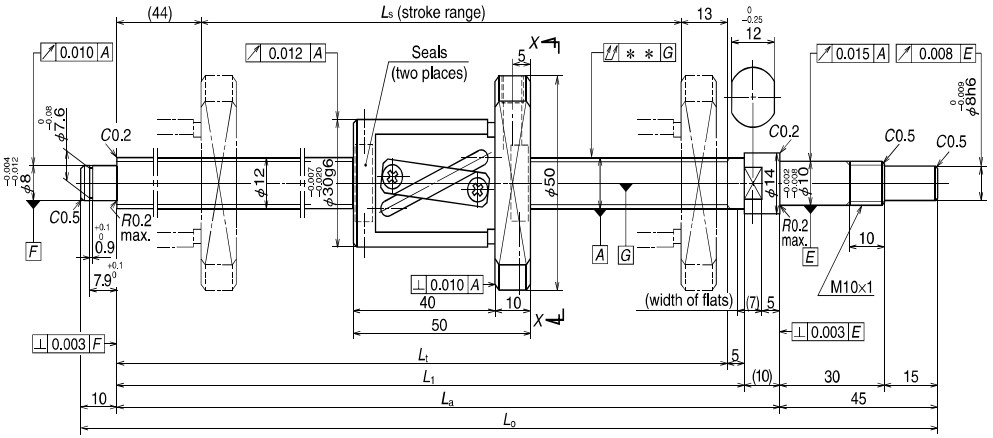
Notes: **1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.**
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.

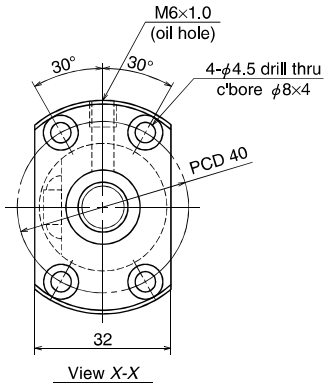
NSK

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	3 070
	Static C_{0a}	4 790
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 (cm³)		1.4
Standard volume of grease replenishing (cm³)		0.7

Recommended support unit

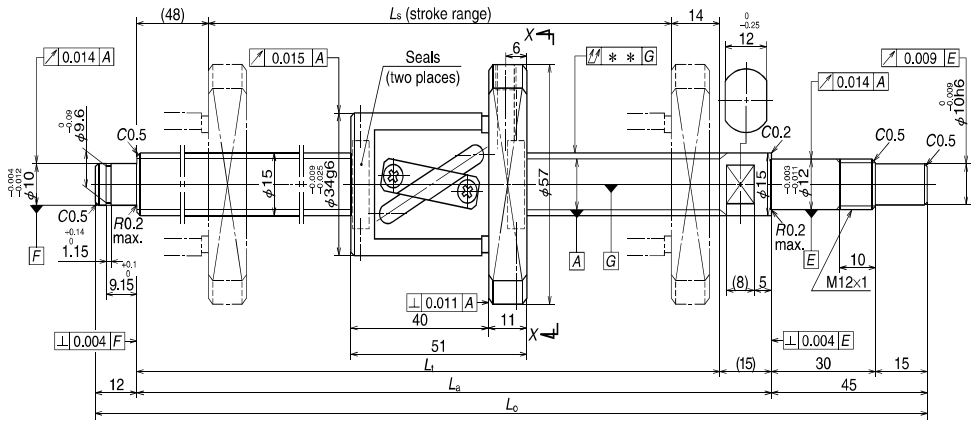
For drive side (Fixed)	For opposite to drive side (Free)
WBK10-01C (square, clean)	WBK10S-01C (square, clean)
WBK10-11C (round, clean)	

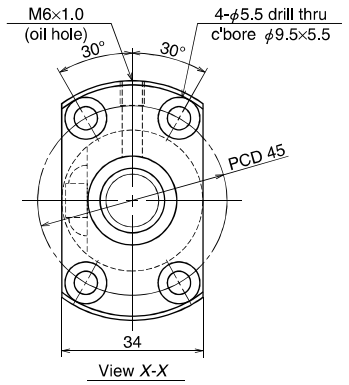
Unit: mm

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

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)
					Supporting condition
T	e_p	υ_u			Fixed - Simple support
0	0.023	0.018	0.050	0.56	3 000
0	0.030	0.023	0.075	0.72	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.





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_a	5 780
	Static C_{0a}	9 430
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 (cm^3)		2.3
Standard volume of grease replenishing (cm^3)		1.4

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)	

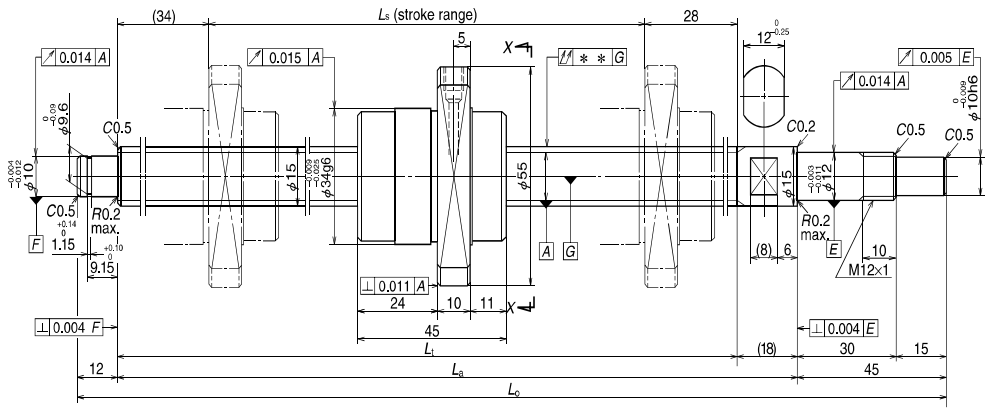
Unit: mm

Ball screw No.	Stroke L_s		Thread length		
	Nominal	Maximum	L_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

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min^{-1})
					Supporting condition
T	e_p	υ_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

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.

KA

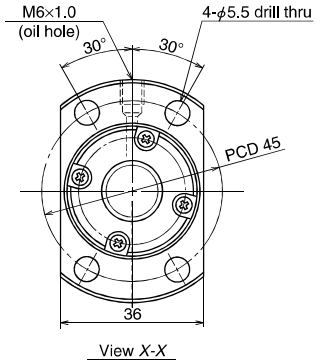


NSK

Screw shaft ø15

Lead 20

Unit: mm



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_a	4 150
	Static C_{0a}	6 450
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_t	L_a	L_o
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
T	e_p	υ_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

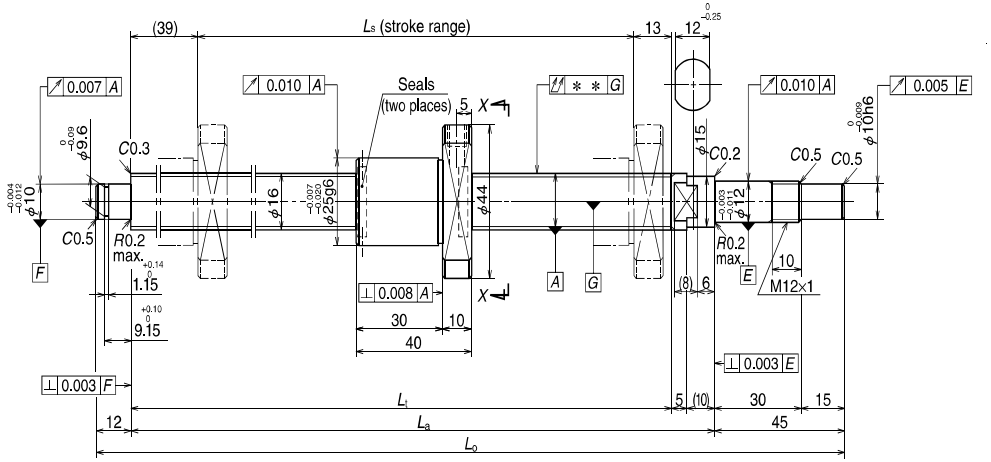
Notes: **1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.**
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.

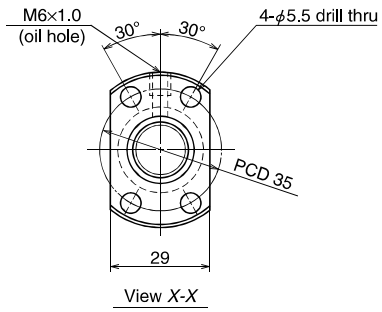
NSK

Screw shaft ø16

Lead 2

Unit: mm





Ball screw specifications		
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	2 870
	Static C_{0a}	6 250
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

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

Lead accuracy			Shaft run-out **	Mass (kg)	Permissible rotational speed N (min⁻¹)
					Supporting condition
T	e_p	υ_u			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

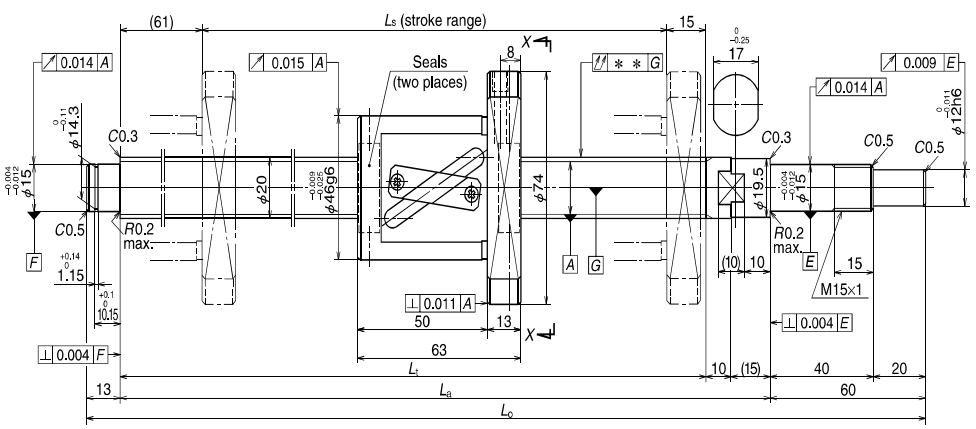
Notes: **1. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.**
See page D13 for details.
Use of NSK Clean Grease LG2 is recommended.
2. Contact NSK if the permissible rotational speed is to be exceeded.

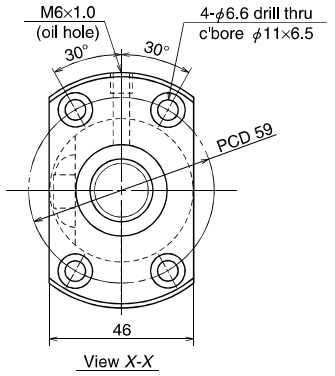
NSK

Screw shaft ø20

Lead 20

Unit: mm





Ball screw specifications		
Shaft dia. x Lead / Direction of turn		20 × 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 × 1
Accuracy grade / Preload		C5 / Z
Basic load rating (N)	Dynamic C_a	5 760
	Static C_{0a}	9 370
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 (cm³)		4.2
Standard volume of grease replenishing (cm³)		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)
					Supporting condition
T	e_p	υ_u			Fixed - Simple support
0	0.030	0.023	0.050	2.0	3 000
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

υ_u : Travel variation

See "Technical Description: Lead Accuracy" (page B37) for 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.

Criterion of maximum rotational speed : 3 000 min^{-1}

The lower of the two criteria, 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).

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.

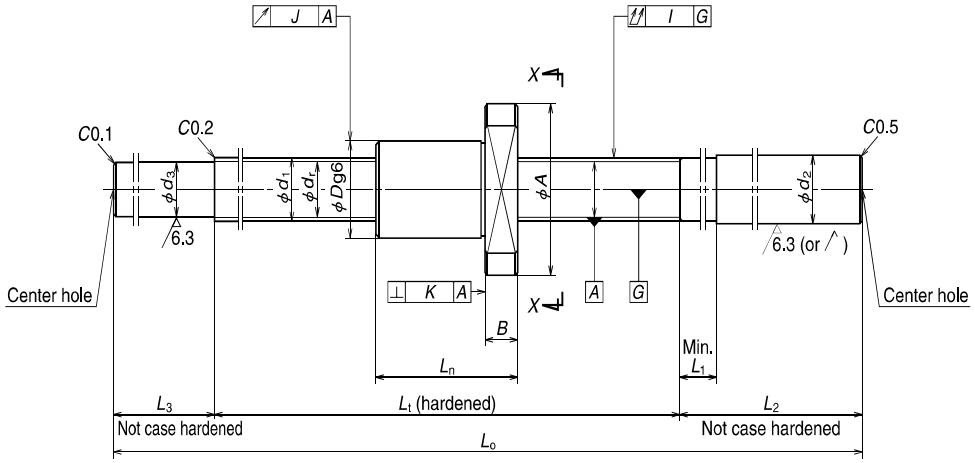
4. Other

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.

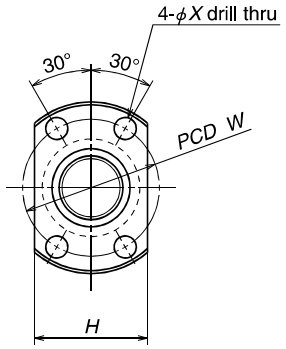
Note: For details of standard stock products, contact NSK.

Table 1 Combinations of screw shaft diameter and lead

Screw shaft diameter(mm) \ Lead(mm)	1	1.5	2	2.5	4	5	6	8	10	12	16	20	25	32	40	50
4	B301															
6	B301															
8	B301	B303	B303													
10			B303	B305	B309											
12			B305	B305		B309			B309							
14						B311		B311								
15									B311			B313				
16			B307	B307		B315					B315			B313		
20					B321	B321			B315			B315			B313	
25					B323	B323 B325	B323		B325 B327			B317	B317			B317
28						B327 B329	B327 B329									
32						B331 B333 B335	B331 B333	B333	B335 B337 B339				B319	B319		
36									B337 B339							
40						B337		B341	B341 B343 B345	B341 B343						
45									B347							
50									B345 B347							



Nut type code: MSFD



View X-X

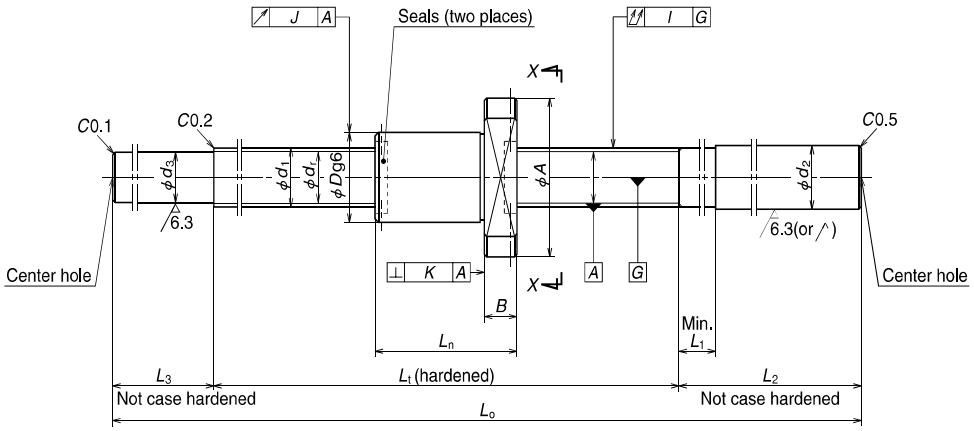
Unit: mm

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) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial play Max.	Nut Outside dia. D	Nut Flange A	Nut Flange H	Nut Flange B
W0400MS-1Y-C3T1	68	4	1	0.8	4.2	3.2	2	315	370	0.005	10	20	14	3
W0601MS-1Y-C3T1	110	6	1	0.8	6.2	5.2	3	575	925	0.005	12	24	16	3.5
W0801MS-1Y-C3T1	94	8	1	0.8	8.2	7.2	3	670	1 290	0.005	14	27	18	4
W0802MS-1Y-C3T1	174													

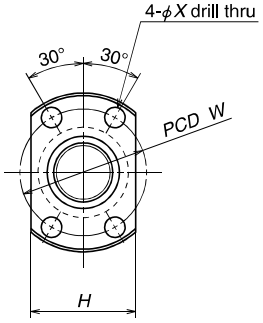
dimensions Overall length L_n	Bolt hole W	Bolt hole X	Screw shaft dimensions Threaded length L_t	Shaft end, right d_2	Shaft end, right L_1	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy T	Lead accuracy Deviation e_p	Lead accuracy Variation v_u	Run-out Shaft straightness I	Run-out Nut O.D. eccentricity J	Run-out Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min^{-1})
12	15	2.9	80	6.0	4	40	3.3	10	130	0	0.008	0.008	0.030	0.009	0.008	0.026	3 000
15	18	3.4	125	8.0	4	50	5.3	15	190	0	0.010	0.008	0.030	0.009	0.008	0.063	3 000
16	21	3.4	110	10.2	4	60	7.3	25	195	0	0.010	0.008	0.030	0.009	0.008	0.11	3 000
			190						275				0.050			0.14	

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. Ball nut does not have seal.
4. 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.

Screw shaft ø8
Lead 1.5, 2
Screw shaft ø10
Lead 2



Nut type code: MSFD



View X-X

Unit: mm

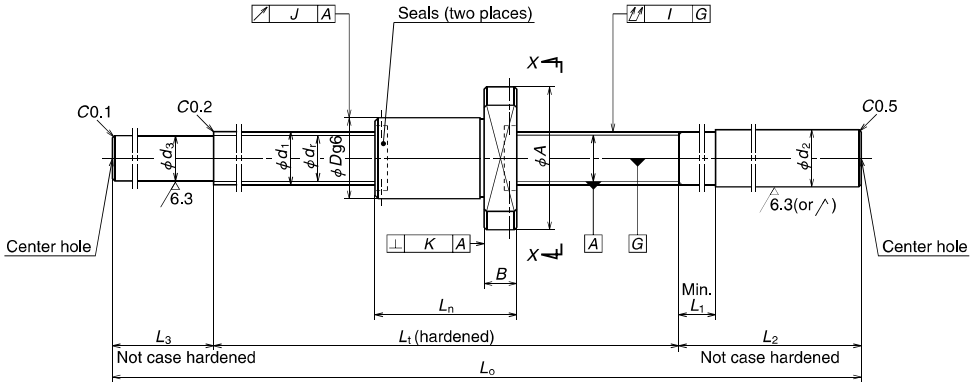
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial play Max.	Nut Outside dia. D	Nut Flange A	Nut Flange H	Nut Flange B
W0801MS-2Y-C3T1.5	88	8	1.5	1.0	8.3	7.0	3	1 080	1 980	0.005	15	28	19	4
W0802MS-2Y-C3T1.5	168													
W0801MS-3Y-C3T2	84	8	2	1.2	8.3	6.9	3	1 320	2 210	0.005	16	29	20	4
W0802MS-3Y-C3T2	164													
W1001MS-1Y-C3T2	122	10	2	1.2	10.3	8.9	3	1 490	2 850	0.005	18	35	22	5
W1002MS-1Y-C3T2	222													

dimensions Overall length L_n	Bolt hole W	Bolt hole X	Screw shaft dimensions Threaded length L_t	Shaft end, right d_2	Shaft end, right L_1	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy T	Deviation e_p	Variation v_u	Run-out Shaft straightness I	Run-out Nut O.D. eccentricity J	Run-out Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min^{-1})
22	22	3.4	110	10.2	4	60	7.2	25	195	0	0.010	0.008	0.030	0.009	0.008	0.12	3 000
			190						275				0.050			0.15	
26	23	3.4	110	10.2	4	60	7.0	25	195	0	0.010	0.008	0.030	0.009	0.008	0.12	3 000
			190						275				0.050			0.15	
28	27	4.5	150	12.2	4	70	9.0	30	250	0	0.010	0.008	0.035	0.009	0.008	0.22	3 000
			250						350		0.012		0.050			0.17	

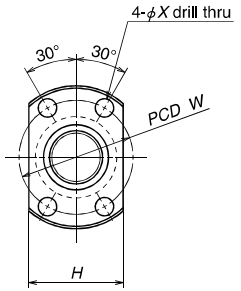
Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. The permissible rotational speed is determined by d·n value, critical speed, and maximum 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.

NSK

Screw shaft ø10
Lead 2.5
Screw shaft ø12
Lead 2, 2.5



Nut type code: MSFD



View X-X

Unit: mm

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) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial play Max.	Nut Outside dia. D	Nut Flange A	Nut Flange H	Nut Flange B
W1001MS-2Y-C3T2.5	118	10	2.5	1.588	10.4	8.6	3	2 130	3 640	0.005	19	36	23	5
W1002MS-2Y-C3T2.5	218													
W1202MS-1Y-C3T2	182	12	2	1.200	12.3	10.9	3	1 660	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	2 360	4 540	0.005	21	38	25	5
W1203MS-2Y-C3T2.5	278													

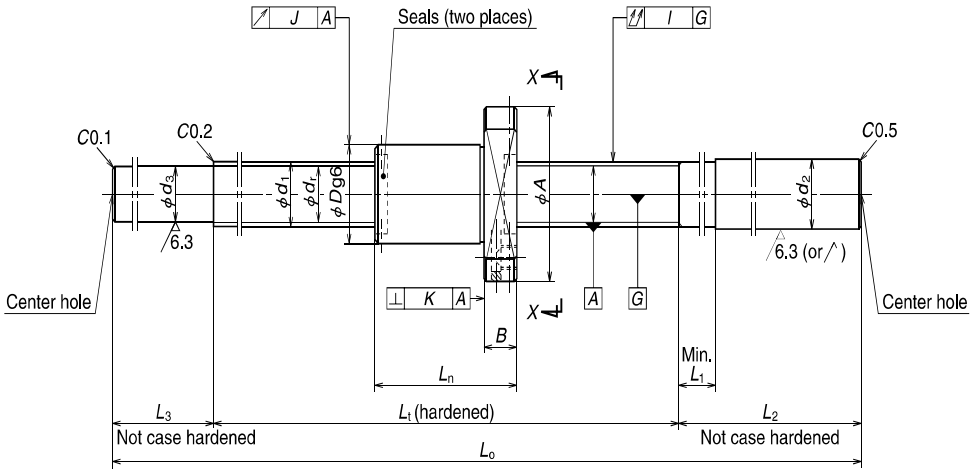
dimensions Overall length L_n	Bolt hole W	Bolt hole X	Screw shaft dimensions Threaded length L_t	Shaft end, right d_2	Shaft end, right L_1	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy T	Deviation e_p	Variation v_u	Run-out Shaft straightness I	Run-out Nut O.D. eccentricity J	Run-out Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min^{-1})
32	28	4.5	150	12.2	4	70	8.7	30	250	0	0.010	0.008	0.035	0.010	0.008	0.23	3 000
			250						350		0.012		0.050			0.28	
28	29	4.5	210	14.2	5	80	11.0	35	325	0	0.012	0.008	0.050	0.010	0.008	0.36	3 000
			310						425				0.060			0.44	
32	30	4.5	210	14.2	5	80	10.7	35	325	0	0.012	0.008	0.050	0.010	0.008	0.37	3 000
			310						425				0.060			0.45	

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.

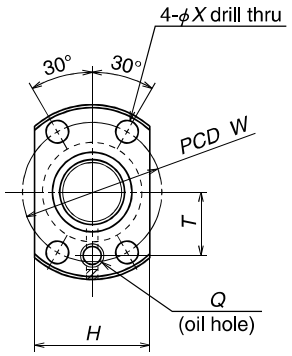
NSK

Screw shaft ø16

Lead 2, 2.5



Nut type code: MSFD



View X-X

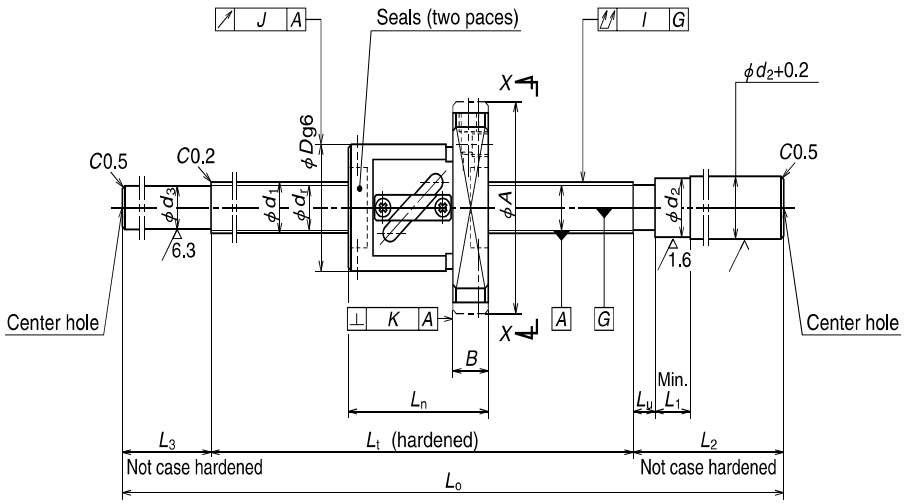
Unit: mm

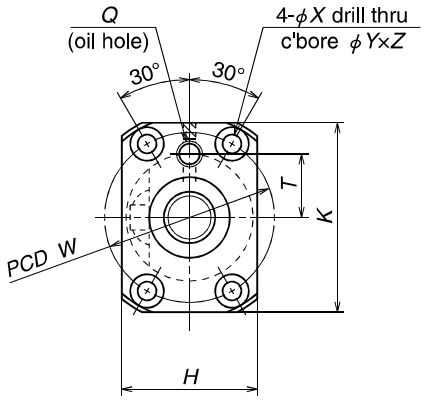
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial play Max.	Nut Outside dia. D	Nut Flange A	Nut Flange H	Nut Flange B	Nut Overall length L_n	Nut Bolt hole W	Nut Bolt hole X
W1602MS-1Y-C3T2	210	16	2	1.588	16.4	14.6	4	3 510	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	3 510	8 450	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 Q	Oil hole T	Threaded length L_t	Shaft end, right d_2	Shaft end, right L_1	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	T	Deviation e_p	Variation v_u	Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K				
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	3 000	1.5	0.8
		400						540		0.013	0.010	0.050			0.93			
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	3 000	1.5	0.8
		400						540		0.013	0.010	0.050			0.95			

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.

Screw shaft ø10
Lead 4
Screw shaft ø12
Lead 5, 10





View *X-X*

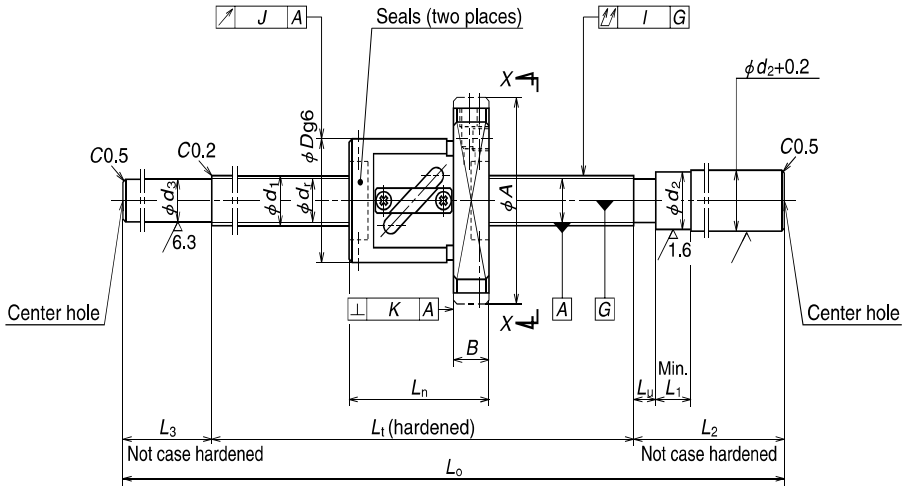
Nut type code: SFT, LSFT

Unit: mm

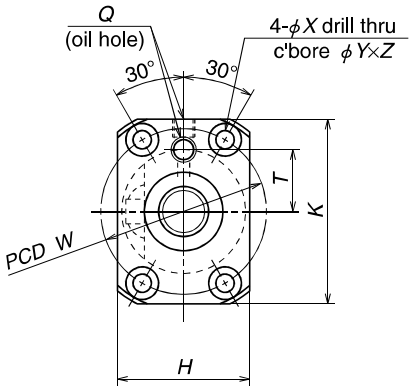
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial play Max.	Nut: Outside dia. D	Nut: Flange A	Nut: Flange H	Nut: Flange K	Nut: Flange B	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X	Nut: Bolt hole Y	Nut: Bolt hole Z
W1001FS-1-C3T4	126	10	4	2.000	10.3	8.2	2.5×1	2 740	4 450	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	3 760	6 310	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	3 750	6 480	0.005	30	50	32	45	10	50	40	4.5	8	4.5
W1204FS-2-C5T10	400																			

dimensions: Oil hole Q	T	Screw shaft dimensions: Threaded length L_t	Shaft end, right d_2	L_u	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy T	Deviation e_p	Variation v_u	Run-out: Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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			

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 type code: SFT, LSFT



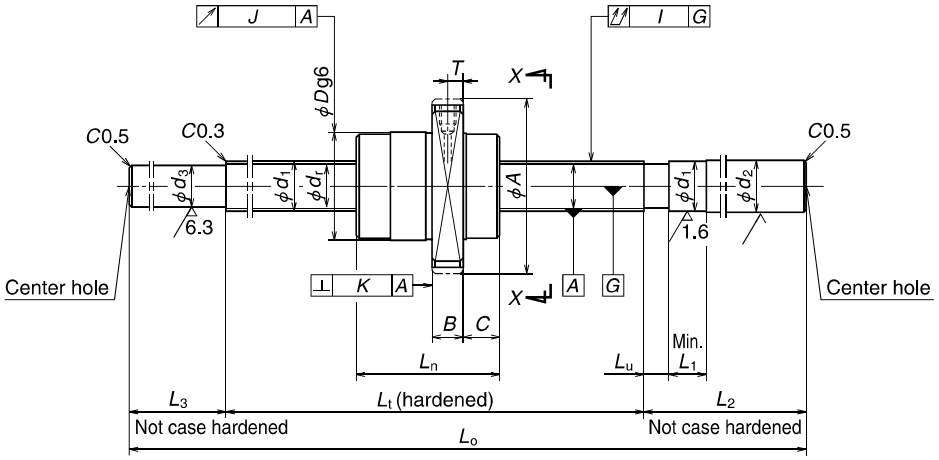
View X-X

Unit: mm

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	Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial play Max.	Nut: Outside dia. D	Nut: Flange A	Nut: Flange H	Nut: Flange K	Nut: Flange B	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X	Nut: Bolt hole Y	Nut: Bolt hole Z
W1403FS-1-C3T5	310	14	5	3.175	14.5	11.2	2.5×1	6 790	11 700	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	2.5×1	6 790	11 700	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	2.5×1	7 070	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																			

dimensions: Oil hole Q	Oil hole T	Screw shaft dimensions: Threaded length L_t	Shaft end, right d_2	Shaft end, right L_u	Shaft end, right L_1	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy T	Lead accuracy Deviation e_p	Lead accuracy Variation v_u	Run-out Shaft straightness I	Run-out Nut O.D. eccentricity J	Run-out Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
M6×1	17	350	15	5	40	100	11.2	40	490	0	0.013	0.010	0.035	0.012	0.008	0.78	3 000	2.0	1.0
		600							740		0.016	0.012	0.055			1.0			
M6×1	17	500	15	8	40	100	11.2	40	640	0	0.027	0.020	0.065	0.015	0.011	1.0	3 000	2.0	1.0
		800							940		0.035	0.025	0.085			1.3			
M6×1	17	400	15	8	40	120	12.2	50	570	0	0.025	0.020	0.050	0.015	0.011	1.0	3 000	2.3	1.2
		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			1.9			

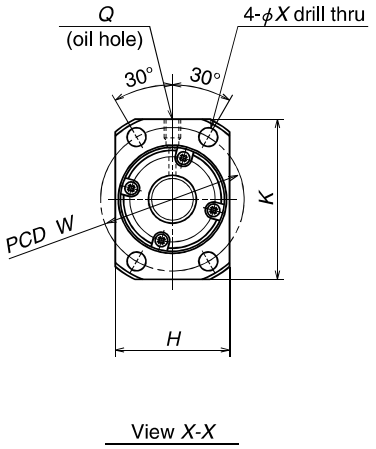
Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. The permissible rotational speed is determined by d·n value, critical speed, and maximum 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.



Nut type code: USFC

NSK

Screw shaft ø15
Lead 20
Screw shaft ø16
Lead 32
Screw shaft ø20
Lead 40



View X-X

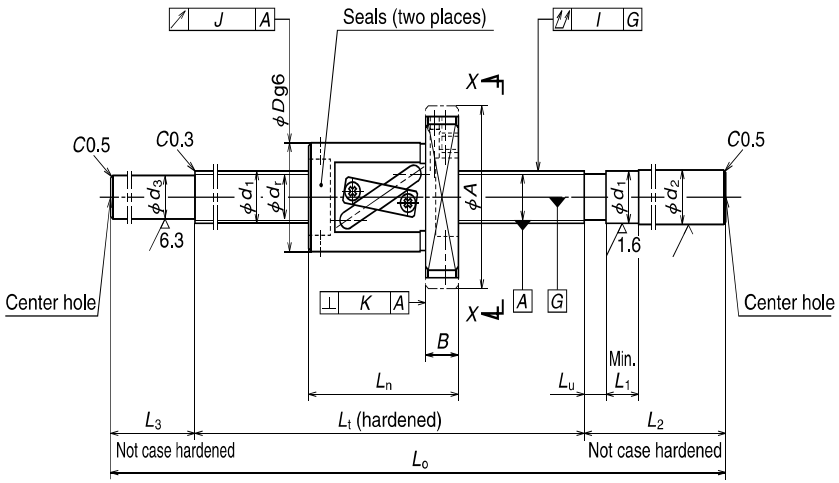
Unit: mm

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): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial play Max.	Nut: Outside dia. D	Nut: Flange A	Nut: Flange H	Nut: Flange K	Nut: Flange B	Nut: Flange C	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X
W1504FS-2G-C5T20	355	15	20	3.175	15.5	12.2	1.7×1	5 070	8 730	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																		
W1609FS-2GX-C5T32	866	16	32	3.175	16.75	13.4	0.7×2	4 000	6 690	0.005	34	55	36	50	10	10.5	34	45	5.5
W1613FS-1GX-C5T32	1 266																		
W2011FS-1GX-C5T40	1 059	20	40	3.175	20.75	17.4	0.7×2	4 490	8 640	0.005	38	58	40	52	10	11	41	48	5.5
W2017FS-1GX-C5T40	1 659																		

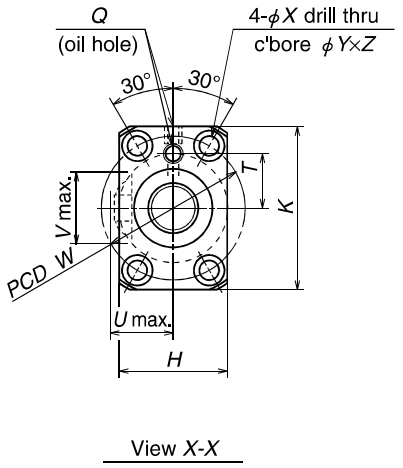
dimensions: Oil hole Q	Oil hole T	Screw shaft dimensions: Threaded length L_t	Shaft end, right d_2	Shaft end, right L_u	Shaft end, left L_1	Shaft end, left L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy: Tolerance grade T	Lead accuracy: Deviation e_p	Lead accuracy: Variation v_u	Run-out: Shaft straightness I	Run-out: Nut O.D. eccentricity J	Run-out: Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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.

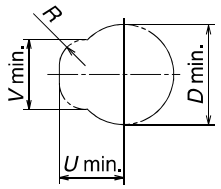
FS



Nut type code: SFT, LSFT



View X-X



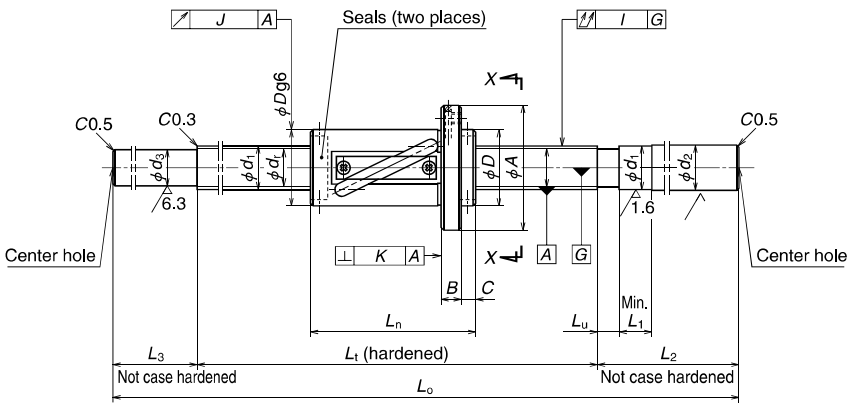
Housing hole and its clearance
(only applicable to shaft dia. φ16, lead 16)

Unit: mm

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	Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial play Max.	Nut: Outside dia. D	Nut: Flange A	Nut: Flange H	Nut: Flange K	Nut: Flange B	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X	Nut: Bolt hole Y	Nut: Bolt hole Z
W1605FS-1-C3T5	458	16	5	3.175	16.5	13.2	2.5×1	7 330	13 500	0.005	40	63	40	55	11	42	51	5.5	9.5	5.5
W1609FS-1-C3T5	858																			
W1606FS-1-C5T16	544	16	16	3.175	16.75	13.4	1.5×1	4 710	8 110	0.005	34	57	34	50	12	56	45	5.5	9.5	5.5
W1611FS-1-C5T16	1 044																			
W2009FS-1-C5T10	846	20	10	3.969	21	16.9	2.5×1	10 900	21 700	0.005	46	74	46	66	13	54	59	6.6	11	6.5
W2013FS-1-C5T10	1 246																			
W2010FS-1-C5T20	937	20	20	3.969	21	16.9	1.5×1	7 040	12 700	0.005	46	74	46	66	13	63	59	6.6	11	6.5
W2015FS-1-C5T20	1 437																			

dimensions: Projecting tube U	V	R	Oil hole Q	T	Screw shaft dimensions: Threaded length L_t	Shaft end, right d_2	L_u	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy T	Deviation e_p	Variation v_u	Run-out: Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
—	—	—	M6×1	17	500	16.2	5	40	150	13.2	60	710	0	0.015	0.010	0.055	0.012	0.008	1.4	3 000	2.6	1.3
					900							1 110		0.021	0.015	0.095			1.9			
19	20	8	M6×1	17	600	16.2	10	40	150	13.4	60	810	0	0.030	0.023	0.085	0.015	0.011	1.5	3 000	2.1	1.1
					1 100							1 310		0.046	0.030	0.150			2.3	2 480		
—	—	—	M6×1	24	900	20.2	10	60	150	16.9	80	1 130	0	0.040	0.027	0.110	0.015	0.011	3.2	3 000	4.7	2.4
					1 300							1 530		0.054	0.035	0.150			4.1	2 190		
—	—	—	M6×1	24	1 000	20.2	13	60	150	16.9	80	1 230	0	0.040	0.027	0.110	0.015	0.011	3.6	3 000	4.2	2.1
					1 500							1 730		0.054	0.035	0.200			4.8	1 610		

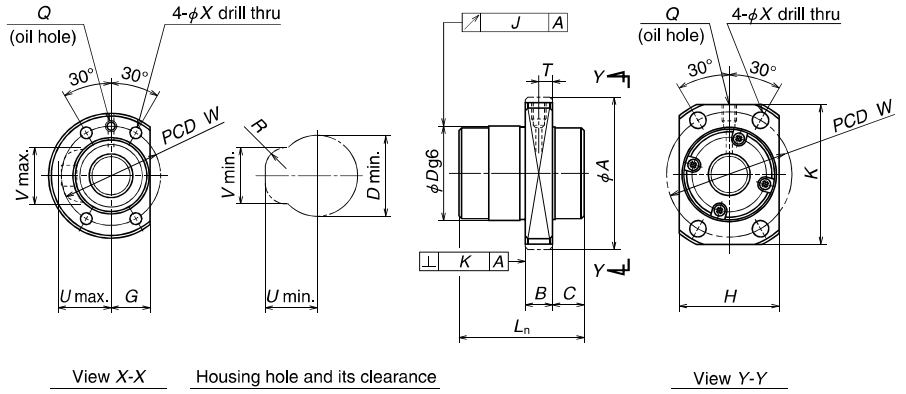
Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. The permissible rotational speed is determined by d·n value, critical speed, and maximum 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 type code: LSFT

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): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial play Max.	Nut: Nut type code	Nut: Outside dia. D	Nut: Flange A	Nut: Flange G	Nut: Flange H	Nut: Flange K	Nut: Flange B	Nut: Flange C	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X
W2513FS-1-C5T20	1 254	25	20	4.762	26.25	21.3	2.5×1	15 700	32 800	0.005	LSFT	44	71	23	—	—	12	8	96	57	6.6
W2521FS-1-C5T20	2 054																				
W2513FS-2-C5T25	1 260	25	25	4.762	26.25	21.3	1.5×1	10 100	19 100	0.005	LSFT	44	71	23	—	—	12	10	90	57	6.6
W2521FS-2-C5T25	2 060																				
W2515FS-1GX-C5T50	1 450	25	50	3.969	26	21.9	0.7×2	6 700	13 500	0.005	USFC	46	70	—	48	63	12	13	50	58	6.6
W2521FS-3GX-C5T50	2 100																				

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.

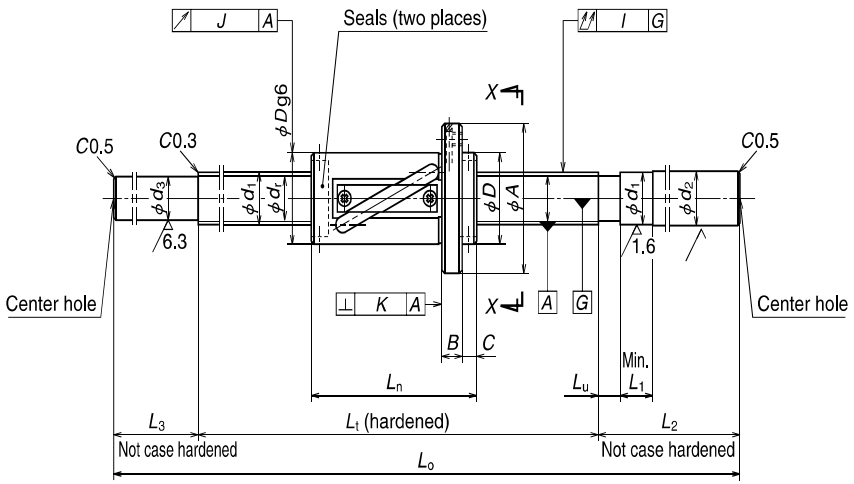


Nut type code: USFC

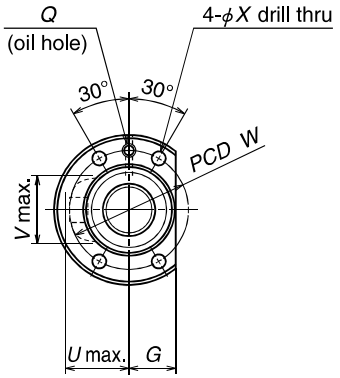
Unit: mm

dimensions: Projecting tube U	dimensions: Projecting tube V	dimensions: Projecting tube R	dimensions: Oil hole Q	dimensions: Oil hole T	Screw shaft dimensions: Threaded length L_1	Screw shaft dimensions: Shaft end, right d_2	Screw shaft dimensions: Shaft end, right L_u	Screw shaft dimensions: Shaft end, right L_1	Screw shaft dimensions: Shaft end, right L_2	Screw shaft dimensions: Shaft end, left d_3	Screw shaft dimensions: Shaft end, left L_3	Screw shaft dimensions: Overall length L_o	Lead accuracy T	Lead accuracy: Deviation e_p	Lead accuracy: Variation v_u	Run-out: Shaft straightness I	Run-out: Nut O.D. eccentricity J	Run-out: Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
31	35	12	M6×1	—	1 350	25.2	13	70	200	21.3	100	1 650	0	0.054	0.035	0.120	0.015	0.011	6.8	2 550	12	6.0
					2 150							2 450		0.077	0.046	0.160			9.8	1 000		
32	34	12	M6×1	—	1 350	25.2	15	70	200	21.3	100	1 650	0	0.054	0.035	0.120	0.015	0.011	6.8	2 540	10	5.0
					2 150							2 450		0.077	0.046	0.160			9.8	1 000		
—	—	—	M6×1	6	1 500	25.2	26	70	200	21.9	100	1 800	0	0.054	0.035	0.120	0.015	0.011	7.3	1 250	5.3	2.7
					2 150							2 450		0.077	0.046	0.160			9.8	1 000		

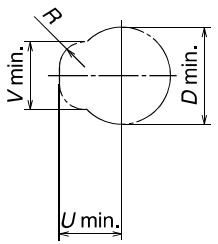
FS



Nut type code: LSFT



View X-X



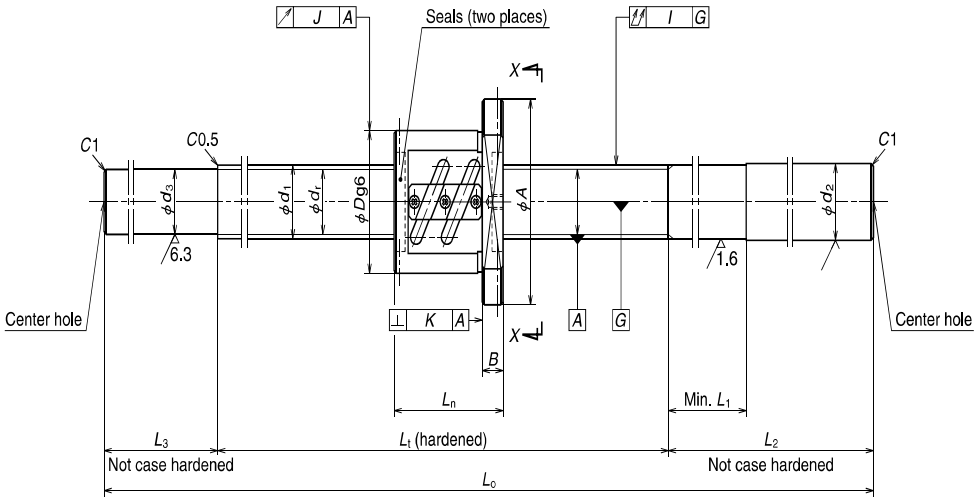
Housing hole and its clearance

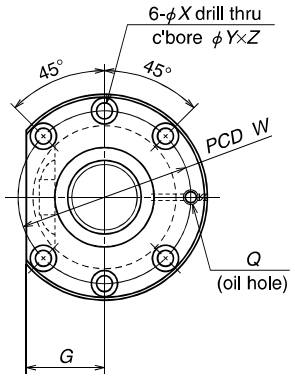
Unit: mm

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): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial play Max.	Nut: Outside dia. D	Nut: Flange A	Nut: Flange G	Nut: Flange B	Nut: Flange C	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X
W3217FS-1-C5T25	1 583	32	25	4.762	33.25	28.3	2.5×1	17 900	41 800	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	1.5×1	11 500	24 800	0.005	51	85	26	15	12	109	67	9
W3227FS-2-C5T32	2 591																	

dimensions: Projecting tube U	V	R	Oil hole Q	Screw shaft dimensions: Threaded length L_t	Shaft end, right d_2	L_u	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy: Travel compensation T	Deviation e_p	Variation v_u	Run-out: Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
34	42	12	M6×1	1 700	32.3	15	70	250	28.3	120	2 070	0	0.065	0.040	0.160	0.019	0.013	13.8	2 180	17	8.5
				2 700							3 070		0.093	0.054	0.210			20.0	800		
34	42	12	M6×1	1 700	32.3	19	70	250	28.3	120	2 070	0	0.065	0.040	0.160	0.019	0.013	13.9	2 180	15	7.5
				2 700							3 070		0.093	0.054	0.210			20.0	790		

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.





View X-X

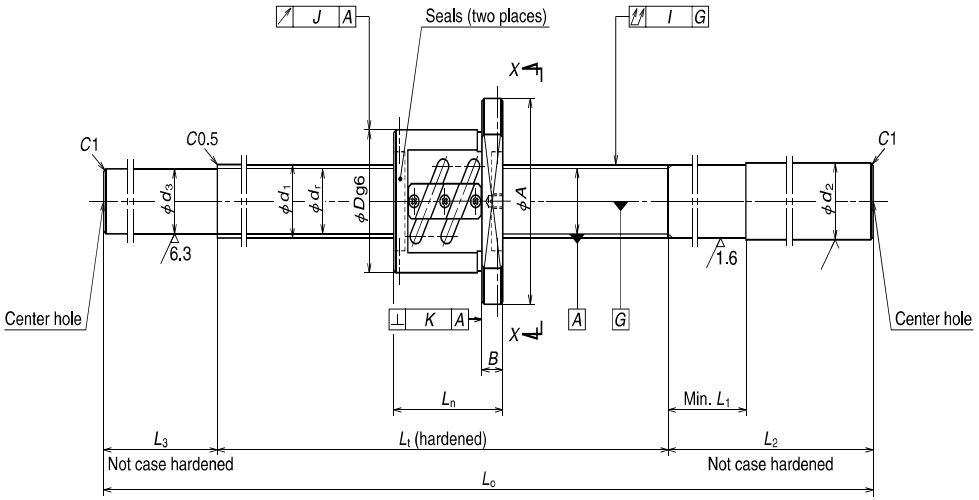
Nut type code: PFT

Unit: mm

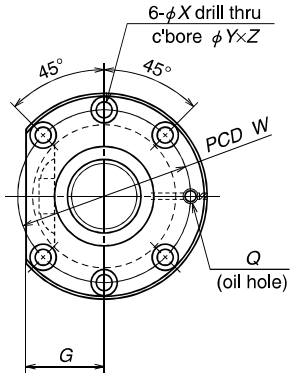
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut: Outside dia. D	Nut: Flange A	Nut: Flange G	Nut: Flange B	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X
W2003SS-1P-C5Z4	251	20	4	2.381	20.3	17.8	2.5×2	5 420	10 700	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	9 410	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																	

dimensions: Bolt hole Y	Bolt hole Z	Oil hole Q	Screw shaft dimensions: Threaded length L_t	Shaft end, right d_2	Shaft end, right L_1	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy: Travel compensation T	Lead accuracy: Deviation e_p	Lead accuracy: Variation v_u	Run-out: Shaft straightness I	Run-out: Nut O.D. eccentricity J	Run-out: Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min^{-1})	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
9.5	5.5	M6×1	300	20.2	40	150	17.8	—	450	-0.007	0.023	0.018	0.055	0.015	0.011	1.5	3 000	2.7	1.4
			500			150		50	700	-0.012	0.027	0.020	0.085			2.0			
			800			200		100	1 100	-0.019	0.035	0.025	0.140			2.9			
9.5	5.5	M6×1	300	20.2	40	150	17.2	—	450	-0.007	0.023	0.018	0.055	0.015	0.011	1.6	3 000	4.3	2.2
			500			150		50	700	-0.012	0.027	0.020	0.085			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.



Nut type code: PFT



View X-X

Unit: mm

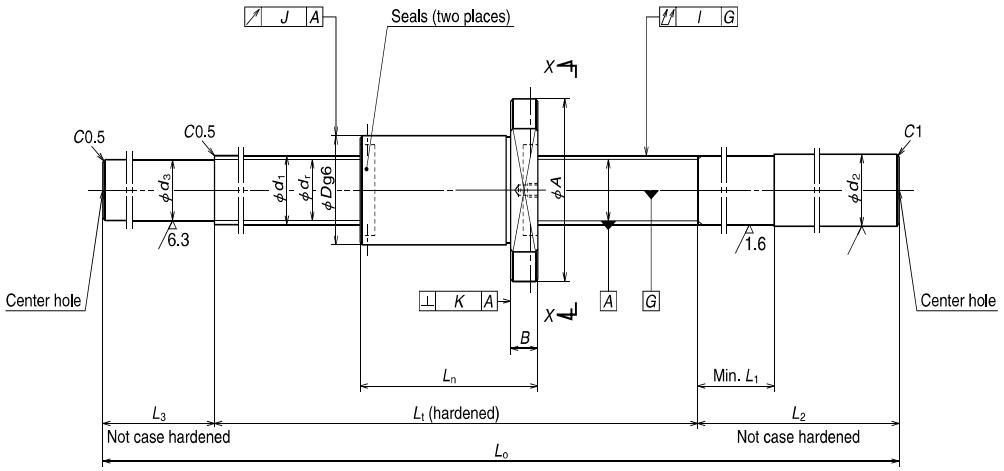
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut: Outside dia. D	Nut: Flange A	Nut: Flange G	Nut: Flange B	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X
W2503SS-1P-C5Z4	252	25	4	2.381	25.3	22.8	2.5x2	6 020	13 600	290	4.9	46	69	26	11	48	57	5.5
W2506SS-1P-C5Z4	552																	
W2510SS-1P-C5Z4	952																	
W2503SS-2P-C5Z5	245	25	5	3.175	25.5	22.2	2.5x2	10 400	21 900	540	8.8	50	73	28	11	55	61	5.5
W2505SS-1P-C5Z5	445																	
W2508SS-1P-C5Z5	745																	
W2512SS-1P-C5Z5	1 145																	
W2504SS-1P-C5Z6	338	25	6	3.969	25.5	21.4	2.5x2	14 100	26 800	690	13.8	53	76	29	11	62	64	5.5
W2512SS-2P-C5Z6	1 138																	

dimensions: Bolt hole Y	Bolt hole Z	Oil hole Q	Screw shaft dimensions: Threaded length L_1	Shaft end, right d_2	Shaft end, right L_1	Shaft end, left L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy: Travel compensation T	Lead accuracy: Deviation e_p	Lead accuracy: Variation v_u	Run-out: Shaft straightness I	Run-out: Nut O.D. eccentricity J	Run-out: Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min^{-1})	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
9.5	5.5	M6×1	300	25.2	40	150	22.8	—	450	-0.007	0.023	0.018	0.040	0.015	0.011	2.2	2 800	3.2	1.6
			600			200		100	900	-0.014	0.030	0.023	0.075			3.8			
			1 000			200		100	1 300	-0.024	0.040	0.027	0.120			5.2			
9.5	5.5	M6×1	300	25.2	40	200	22.2	—	500	-0.007	0.023	0.018	0.040	0.015	0.011	2.5	2 800	5.2	2.6
			500			200		50	750	-0.012	0.027	0.020	0.060			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	M6×1	400	25.2	40	200	21.4	—	600	-0.010	0.025	0.020	0.050	0.019	0.013	3.0	2 800	7.0	3.5
			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			

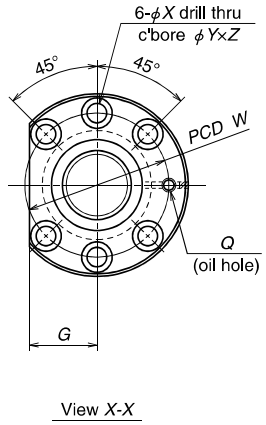
Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
2. Only rust preventive agent is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. The permissible rotational speed is determined by d·n value, critical speed, and maximum 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.

Screw shaft ø25

Lead 5, 10



Nut type code: ZFD



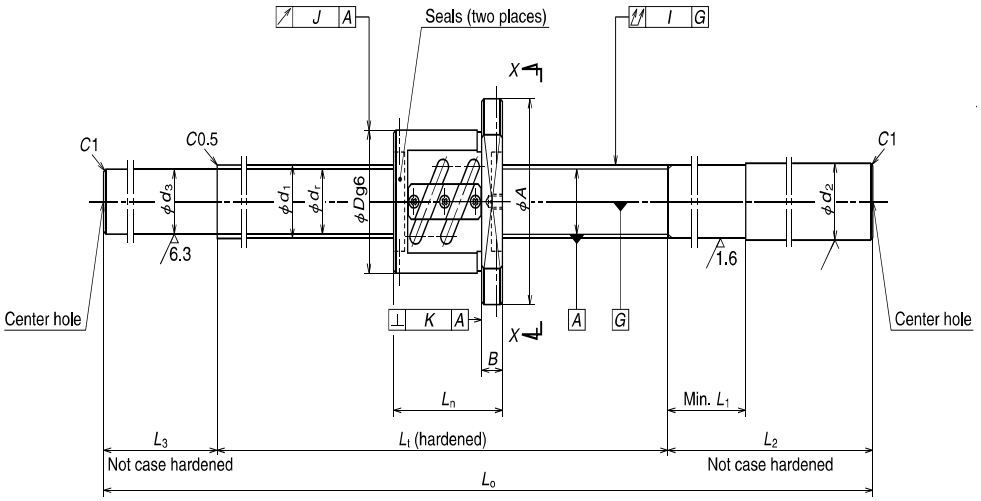
View X-X

Unit: mm

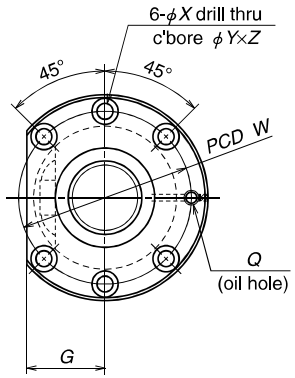
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut: Outside dia. D	Nut: Flange A	Nut: Flange G	Nut: Flange B	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X
W2502SS-1ZY-C5Z5	184	25	5	3.175	25.75	22.4	1×3	9 790	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	11 400	21 400	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																	

dimensions: Bolt hole Y	Bolt hole Z	Oil hole Q	Screw shaft dimensions: Threaded length L_1	Shaft end, right d_2	Shaft end, right L_1	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy: Travel compensation T	Lead accuracy: Deviation e_p	Lead accuracy: Variation v_u	Run-out: Shaft straightness I	Run-out: Nut O.D. eccentricity J	Run-out: Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
9.5	5.5	M6×1	250	25.2	40	200	22.4	—	450	-0.005	0.023	0.018	0.040	0.015	0.011	2.1	2 800	5.4	2.7
			400			200		50	650	-0.009	0.025	0.020	0.060			2.8			
			600			250		100	950	-0.013	0.030	0.023	0.075			3.9			
			900			250		100	1 250	-0.021	0.040	0.027	0.090			4.9			
			1 200			300		100	1 600	-0.028	0.046	0.030	0.120			6.2			
11	6.5	M6×1	400	25.2	60	200	21.3	50	650	-0.008	0.025	0.020	0.060	0.015	0.011	3.0	2 800	9.0	4.5
			600			250		100	950	-0.012	0.030	0.023	0.075			4.1			
			800			250		100	1 150	-0.017	0.035	0.025	0.090			4.8			
			1 100			300		100	1 500	-0.024	0.046	0.030	0.120			6.0			
			1 500			300		100	1 900	-0.034	0.054	0.035	0.150			7.4			

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 type code: PFT



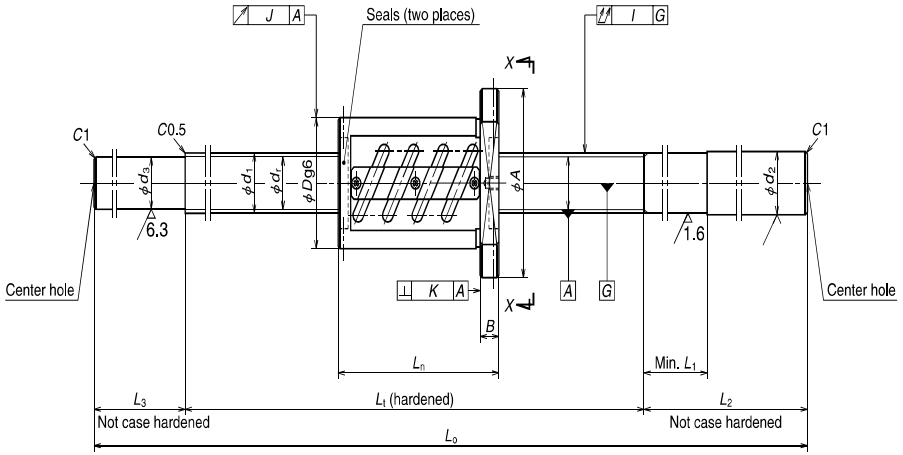
View X-X

Unit: mm

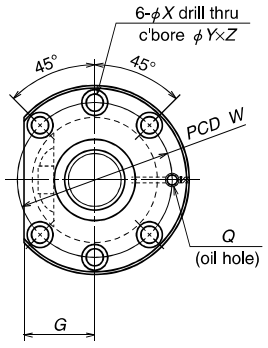
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut Outside dia. D	Nut Flange A	Nut Flange G	Nut Flange B	Nut Overall length L_n	Nut Bolt hole W	Nut Bolt hole X
W2504SS-2P-C5Z10	319	25	10	4.762	25.5	20.5	1.5×2	11 600	19 000	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	2.5×2	11 000	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	2.5×2	11 000	24 400	540	10.8	55	85	31	12	63	69	6.6
W2806SS-3P-C5Z6	537																	
W2808SS-3P-C5Z6	737																	
W2812SS-3P-C5Z6	1 137																	

dimensions Bolt hole Y	dimensions Oil hole Z	dimensions Q	Screw shaft dimensions Threaded length L_1	Shaft end, right d_2	Shaft end, right L_1	Shaft end, left L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy Travel compensation T	Lead accuracy Deviation e_p	Lead accuracy Variation v_u	Run-out Shaft straightness I	Run-out Nut O.D. eccentricity J	Run-out Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
11	6.5	M6×1	400	25.2	60	200	20.5	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	2 050		
11	6.5	M6×1	400	28.2	40	200	25.2	—	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	M6×1	400	28.2	40	200	25.2	—	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			

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 type code: ZFT



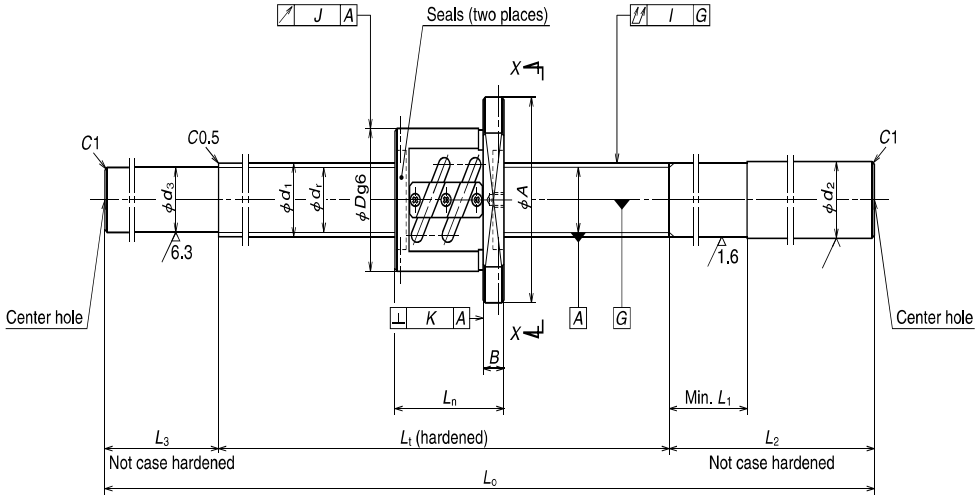
View X-X

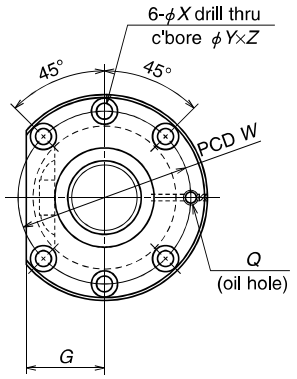
Unit: mm

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): Dynamic C_a	Basic load rating (N): Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut: Outside dia. D	Nut: Flange A	Nut: Flange G	Nut: Flange B	Nut: Overall length L_n	Nut: Bolt hole W	Nut: Bolt hole X
W2804SS-2Z-C5Z5	314	28	5	3.175	28.5	25.2	2.5×2	17 400	48 800	1 225	21.5	55	85	31	12	86	69	6.6
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	17 400	48 800	1 225	22.5	55	85	31	12	99	69	6.6
W2806SS-4Z-C5Z6	501																	
W2808SS-4Z-C5Z6	701																	
W2812SS-4Z-C5Z6	1 101																	

dimensions: Bolt hole Y	dimensions: Oil hole Z	dimensions: Q	Screw shaft dimensions: Threaded length L_t	Shaft end, right: d_2	Shaft end, right: L_1	Shaft end, left: L_2	Shaft end, left: d_3	Shaft end, left: L_3	Overall length L_o	Lead accuracy: Travel compensation T	Lead accuracy: Deviation e_p	Lead accuracy: Variation v_u	Run-out: Shaft straightness I	Run-out: Nut O.D. eccentricity J	Run-out: Flange perpendicularity K	Mass (kg)	Permissible rotational speed N(min^{-1})	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
11	6.5	M6×1	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	M6×1	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			

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.





View *X-X*

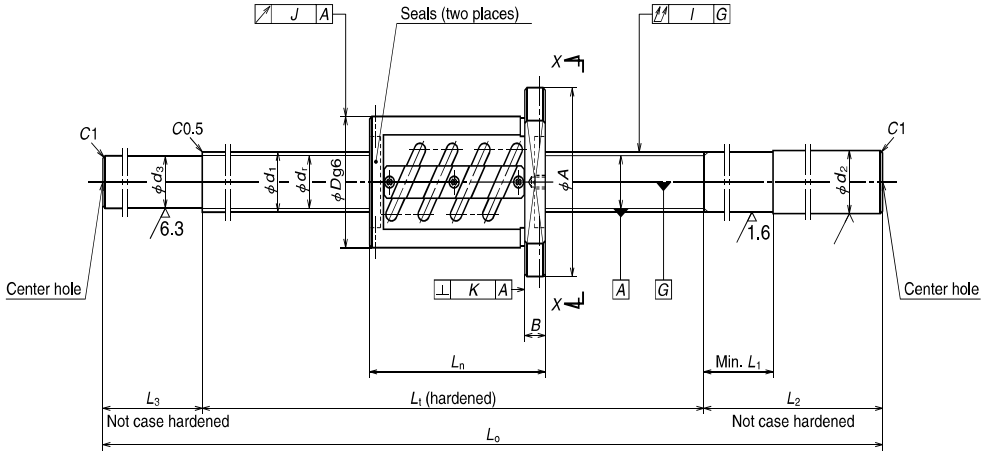
Nut type code: PFT

Unit: mm

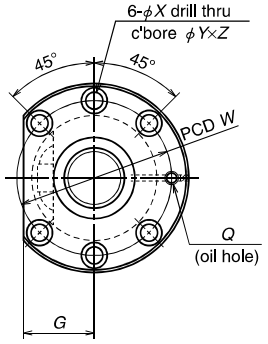
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut Outside dia. D	Nut Flange A	Nut Flange G	Nut Flange B	Nut Overall length L_n
W3204SS-1P-C5Z5	344	32	5	3.175	32.5	29.2	2.5×2	11 600	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	15 500	34 700	780	15.6	62	89	34	12	63
W3210SS-1P-C5Z6	937															
W3215SS-3P-C5Z6	1 437															

dimensions Bolt hole W	X	Y	Z	Oil hole Q	Screw shaft dimensions Threaded length L_1	Shaft end, right d_2	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy Travel compensation T	Deviation e_p	Variation v_u	Run-out Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
71	6.6	11	6.5	M6×1	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			250		100	950	-0.014	0.030	0.023	0.075			6.5			
					800			250		100	1 150	-0.019	0.035	0.025	0.090			7.7			
					1 200			300		100	1 600	-0.029	0.046	0.030	0.120			10.3			
					1 500			300		100	1 900	-0.036	0.054	0.035	0.150			12.1			
75	6.6	11	6.5	M6×1	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			300			1 400	-0.024	0.040	0.027	0.120			9.2			
					1 500			300			1 900	-0.036	0.054	0.035	0.150			12.1			

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.



Nut type code: ZFT



View X-X

Unit: mm

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 × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut Outside dia. D	Nut Flange A	Nut Flange G	Nut Flange B	Nut Overall length L_n
W3204SS-2Z-C5Z5	314	32	5	3.175	32.5	29.2	2.5×2	18 500	56 100	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	24 700	69 400	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	17 500	41 000	1 320	30.5	66	100	38	15	82
W3210SS-3Z-C5Z8	918															
W3215SS-5Z-C5Z8	1 418															

dimensions Bolt hole W	X	Y	Z	Oil hole Q	Screw shaft dimensions Threaded length L_t	Shaft end, right d_2	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy Travel compensation T	Deviation e_p	Variation v_u	Run-out Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min^{-1})	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
71	6.6	11	6.5	M6×1	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	M6×1	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	M6×1	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			

Notes: 1. Use of NSK support unit is recommended. See page B389 for details.
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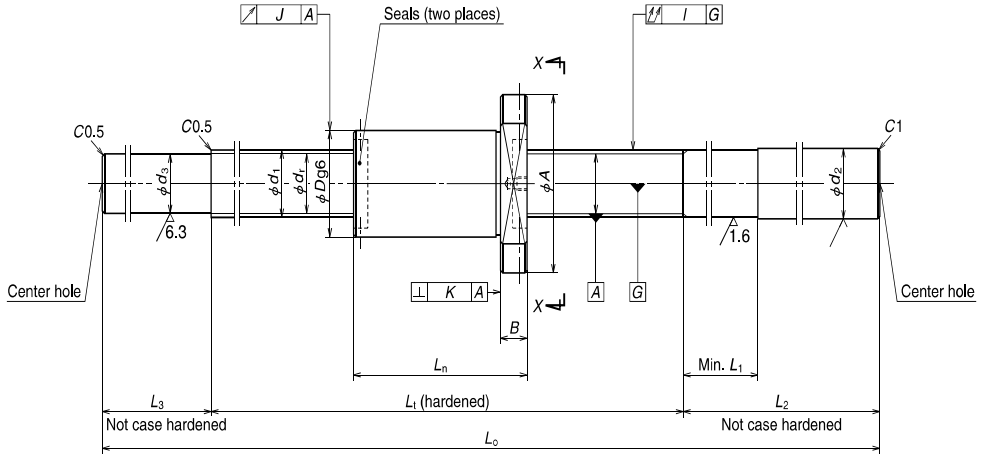
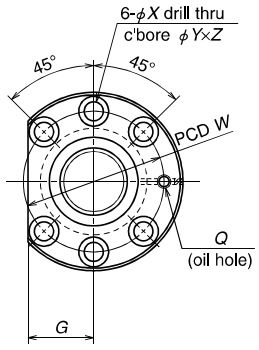
See page D13 for details.
3. The permissible rotational speed is determined by d·n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.



Nut type code: ZFD



View X-X

Unit: mm

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): Dynamic C_a	Basic load rating (N): Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut: Outside dia. D	Nut: Flange A	Nut: Flange G	Nut: Flange B	Nut: Overall length L_n
W3204SS-3ZY-C5Z5	323	32	5	3.175	32.75	29.4	4	14 200	40 700	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	25 900	52 800	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: Bolt hole W	X	Y	Z	Oil hole Q	Screw shaft dimensions: Threaded length L_t	Shaft end, right d_2	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy: Travel compensation T	Deviation e_p	Variation v_u	Run-out: Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
61	6.6	11	6.5	M6×1	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	M6×1	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.
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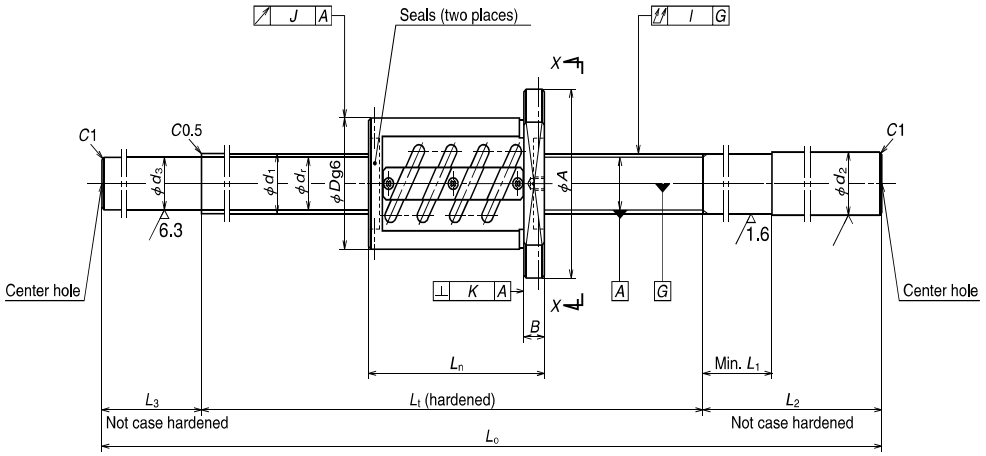
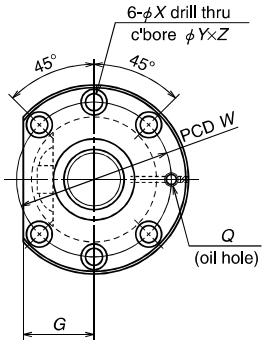
3. The permissible rotational speed is determined by d·n value, critical speed, and maximum rotational speed. See B299 and B47. The permissible rotational speed shown in the table is the value when the ball screw mounting method is Fixed-Fixed.



Nut type code: ZFT



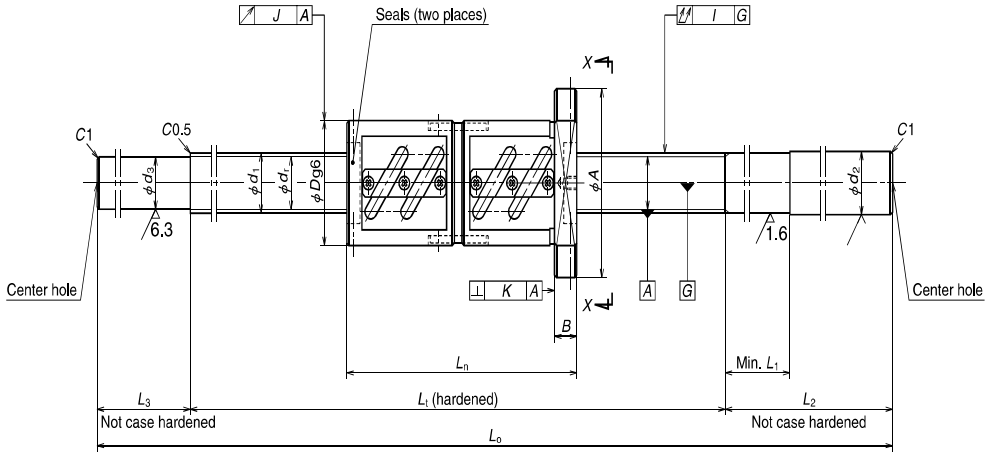
View X-X

Unit: mm

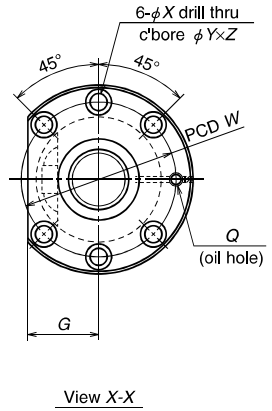
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut Outside dia. D	Nut Flange A	Nut Flange G	Nut Flange B	Nut Overall length L_n
W3205SS-1Z-C5Z10	400	32	10	6.350	33	26.4	2.5×1	25 500	54 000	1 960	50	74	108	41	15	100
W3207SS-1Z-C5Z10	600															
W3210SS-4Z-C5Z10	900															
W3214SS-1Z-C5Z10	1 300															
W3218SS-1Z-C5Z10	1 700															
W3607SS-1Z-C5Z10	597	36	10	6.350	37	30.4	2.5×1	27 200	61 300	2 060	56	75	120	45	18	103
W3612SS-1Z-C5Z10	1 097															
W3620SS-1Z-C5Z10	1 897															
W4006SS-1Z-C5Z5	511	40	5	3.175	40.5	37.2	2.5×2	20 200	70 600	1 420	28.5	67	101	39	15	89
W4010SS-1Z-C5Z5	911															
W4016SS-1Z-C5Z5	1 511															

dimensions Bolt hole W	X	Y	Z	Oil hole Q	Screw shaft dimensions Threaded length L_t	Shaft end, right d_2	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy Travel compensation T	Deviation e_p	Variation v_u	Run-out Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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	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	M6×1	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			

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 type code: DFT



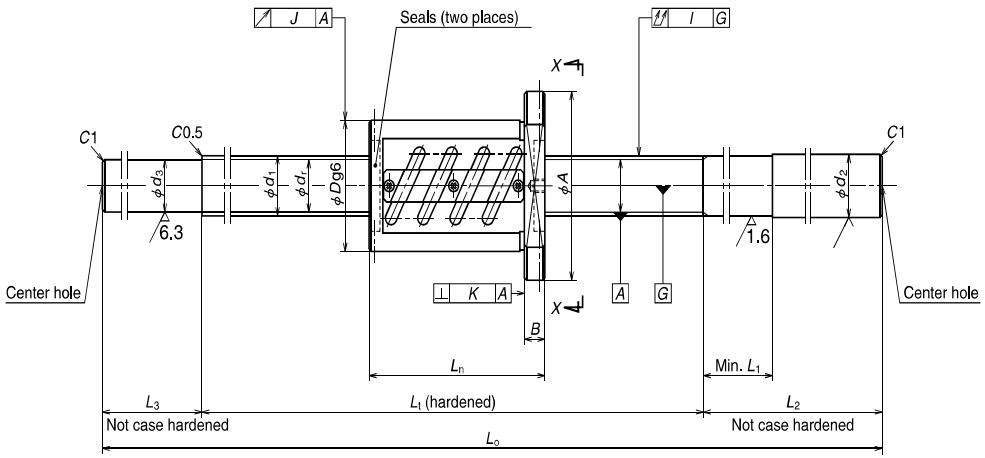
View X-X

Unit: mm

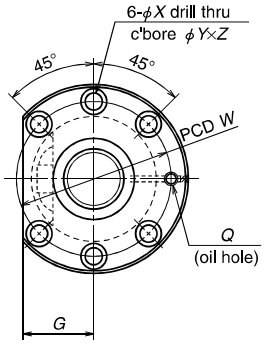
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut: Outside dia. D	Nut: Flange A	Nut: Flange G	Nut: Flange B	Nut: Overall length L_n
W3205SS-2D-C5Z10	310	32	10	6.350	33	26.4	2.5×2	46 300	108 000	3 240	83	74	108	41	15	190
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	49 300	123 000	3 430	93	75	120	45	18	193
W3612SS-2D-C5Z10	1 007															
W3620SS-2D-C5Z10	1 807															

dimensions: Bolt hole W	X	Y	Z	Oil hole Q	Screw shaft dimensions: Threaded length L_t	Shaft end, right d_2	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy: Travel compensation T	Deviation e_p	Variation v_u	Run-out: Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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	1 910		
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.



Nut type code: ZFT



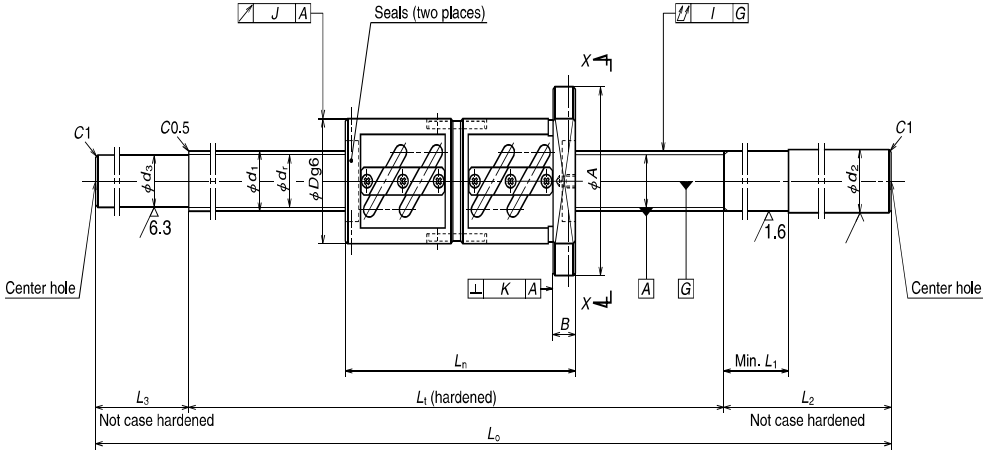
View X-X

Unit: mm

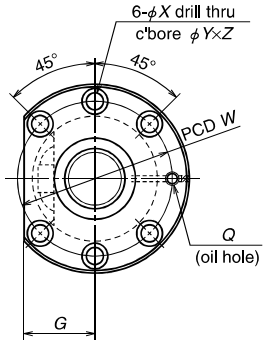
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut Outside dia. D	Nut Flange A	Nut Flange G	Nut Flange B	Nut Overall length L_n
W4007SS-1Z-C5Z8	570	40	8	4.762	40.5	35.5	2.5×2	34 900	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	2.5×1	28 600	68 600	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	40	12	7.144	41.5	34.1	2.5×1	33 600	77 500	2 550	83	86	128	48	18	117
W4016SS-2Z-C5Z12	1 483															
W4025SS-1Z-C5Z12	2 383															

dimensions Bolt hole W	X	Y	Z	Oil hole Q	Screw shaft dimensions Threaded length L_t	Shaft end, right d_2	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy Travel compensation T	Deviation e_p	Variation v_u	Run-out Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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			
106	11	17.5	11	Rc1/8	1 000	40.3	70	300	34.1	100	1 400	–0.024	0.040	0.027	0.080	0.025	0.015	16.7	1 750	35	18
					1 600			350		150	2 100	–0.038	0.054	0.035	0.130			22.9			
					2 500			400		150	3 050	–0.060	0.077	0.046	0.170			31.1	1 220		

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.



Nut type code: DFT



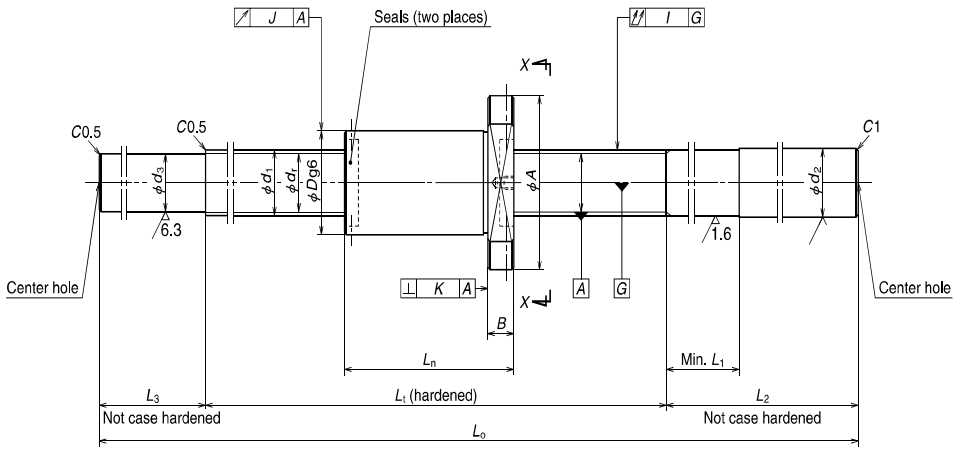
View X-X

Unit: mm

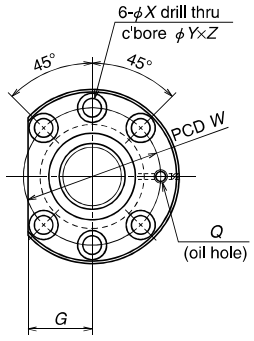
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut Outside dia. D	Nut Flange A	Nut Flange G	Nut Flange B	Nut Overall length L_n
W4007SS-3D-C5Z10	507	40	10	6.350	41	34.4	2.5×2	52 000	137 000	3 630	108	82	124	47	18	193
W4010SS-3D-C5Z10	807															
W4014SS-2D-C5Z10	1 207															
W4018SS-3D-C5Z10	1 607															
W4024SS-2D-C5Z10	2 207															
W4010SS-5D-C5Z12	775	40	12	7.144	41.5	34.1	2.5×2	61 000	155 000	4 310	138	86	128	48	18	225
W4016SS-3D-C5Z12	1 375															
W4025SS-2D-C5Z12	2 275															

dimensions Bolt hole W	X	Y	Z	Oil hole Q	Screw shaft dimensions Threaded length L_t	Shaft end, right d_2	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy Travel compensation T	Deviation e_p	Variation v_u	Run-out Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min^{-1})	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
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	15.5	1 750	74	37
					1 000			300		100	1 400	–0.024	0.040	0.027	0.080			18.1			
					1 400			350		120	1 870	–0.034	0.054	0.035	0.100			22.2			
					1 800			350		120	2 270	–0.043	0.065	0.040	0.130			25.6			
					2 400			400		150	2 950	–0.058	0.077	0.046	0.170			31.6	1 370		
106	11	17.5	11	Rc1/8	1 000	40.3	70	300	34.1	100	1 400	–0.024	0.040	0.027	0.080	0.025	0.015	19.7	1 750	93	47
					1 600			350		150	2 100	–0.038	0.054	0.035	0.130			25.8			
					2 500			400		150	3 050	–0.060	0.077	0.046	0.170			34.0	1 260		

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 type code: ZFD



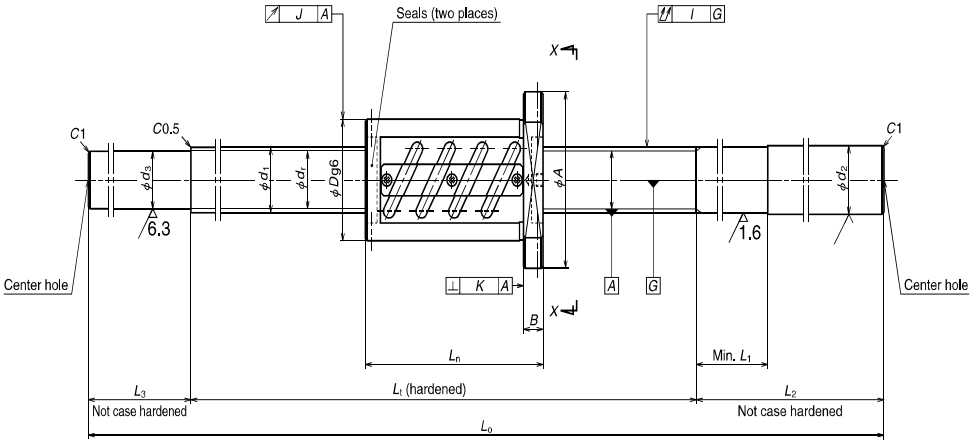
View X-X

Unit: mm

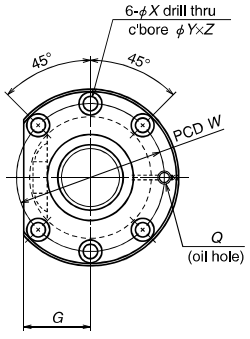
Ball screw No.	Stroke Max. L_t-L_n	Screw shaft dia. d_1	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective ball turns	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut Outside dia. D	Nut Flange A	Nut Flange G	Nut Flange B	Nut Overall length L_n
W4007SS-4ZY-C5Z10	557	40	10	6.350	41.75	35.1	4	38 400	93 300	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	43 600	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															

dimensions Bolt hole W	X	Y	Z	Oil hole Q	Screw shaft dimensions Threaded length L_t	Shaft end, right d_2	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy Travel compensation T	Deviation e_p	Variation v_u	Run-out Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min^{-1})	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
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	1 320		
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			

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 type code: ZFT



View X-X

Unit: mm

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): Dynamic C_a	Basic load rating (N): Static C_{0a}	Preload (N)	Dynamic friction torque, median (N·cm)	Nut: Outside dia. D	Nut: Flange A	Nut: Flange G	Nut: Flange B	Nut: Overall length L_n
W4510SS-1Z-C5Z10	897	45	10	6.350	46	39.4	2.5×1	29 900	77 300	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	31 800	87 400	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	50	10	6.350	51	44.4	2.5×2	57 700	175 000	4 020	138	93	135	51	18	163
W5015SS-2Z-C5Z10	1 337															
W5020SS-2Z-C5Z10	1 837															
W5026SS-2Z-C5Z10	2 437															

dimensions: Bolt hole W	X	Y	Z	Oil hole Q	Screw shaft dimensions: Threaded length L_t	Shaft end, right d_2	L_1	L_2	Shaft end, left d_3	L_3	Overall length L_o	Lead accuracy: Travel compensation T	Deviation e_p	Variation v_u	Run-out: Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass (kg)	Permissible rotational speed N (min⁻¹)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
110	11	17.5	11	Rc1/8	1 000	45.3	60	300	39.4	100	1 400	-0.024	0.040	0.027	0.080	0.025	0.015	19.7	1 550	34	17
					1 600			400		150	2 150	-0.038	0.054	0.035	0.130			28.1			
					2 500			450		150	3 100	-0.060	0.077	0.046	0.170			38.8	1 400		
113	11	17.5	11	Rc1/8	1 000	50.3	60	300	44.4	100	1 400	-0.024	0.040	0.027	0.080	0.025	0.015	23.8	1 400	37	19
					1 500			400		150	2 050	-0.036	0.054	0.035	0.130			32.9			
					2 000			400		150	2 550	-0.048	0.065	0.040	0.170			39.8			
					2 600			450		150	3 200	-0.062	0.093	0.054	0.220			48.9			
113	11	17.5	11	Rc1/8	1 000	50.3	60	300	44.4	100	1 400	-0.024	0.040	0.027	0.080	0.025	0.015	25.5	1 400	59	30
					1 500			400		150	2 050	-0.036	0.054	0.035	0.130			34.6			
					2 000			400		150	2 550	-0.048	0.065	0.040	0.170			41.5			
					2 600			450		150	3 200	-0.062	0.093	0.054	0.220			50.7			

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, RNFBL, RNCT, RNFCL, and RNSTL types have blank shaft ends.

Table 1 Classifications of ball screws for transfer equipment

Finished shaft end	VFA type, RMA type
Blank shaft end	RMS type
	R Series
	RNFTL type, RNFBL type
	RNCT type, RNFCL 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.

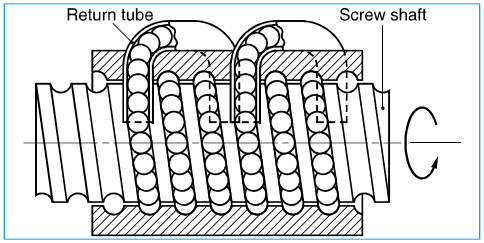


Fig. 1 Structure of return tube recirculation system

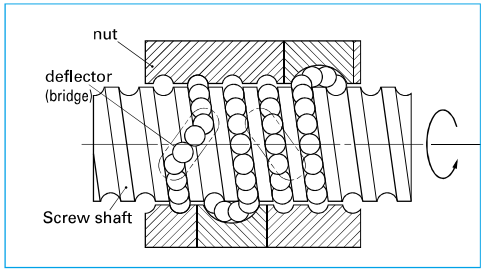


Fig. 2 Structure of deflector (bridge type) recirculation system

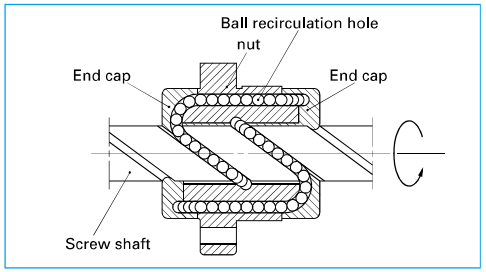


Fig. 3 Structure of end cap recirculation system

(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}

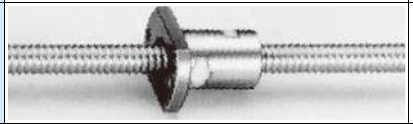
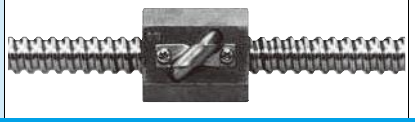
d·n value: shaft dia. d [mm] × rotational speed n [min^{-1}]

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
RNFBL		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
RNFCL		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

- VFA: Ball screw for transfer equipment: VFA, RMA, RMS
- 15: Screw shaft diameter (mm)
- 10: Lead (mm)
- C7: Accuracy grade code
- S: Axial play
- 500: Screw shaft length (mm)

◇Reference number for R series

Nut assembly (example)

RNFTL 25 10 A5 S

- RNFTL: Nut model : RNFTL, RNFBL, RNCT, RNFCL, RNSTL
- 25: Screw shaft diameter (mm)
- 10: Lead (mm)
- A: Internal design code
- 5: Effective turns of balls (turns of balls × number of circuit)
- S: Seal code S: With seal / No code: Without seal

Screw shaft (example)

RS 25 10 A 20

- RS: Product code
- 25: Screw shaft diameter (mm)
- 10: Lead (mm)
- A: Internal design code
- 20: Screw shaft length (in the unit of 100 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

Screw shaft diameter \ Lead	1	1.5	2	10	20
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)	Lead (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 □B367												
15									◎B383						
16						○B373		○B377 ◎B383			◎B385				
18					○B373 ●B379 △B381 □B387										
20			○B373 ●B379 △B381 □B387			○B373 ●B379 □B387			○B377 ◎B383			◎B385			
25			○B373 ●B379 △B381 □B387			○B359 ●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 ●: RNFBL △: RNCT ◎: RNFCL □: 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

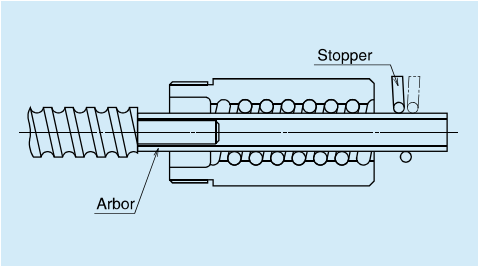


Fig. 4 Inserting nut into screwshaft

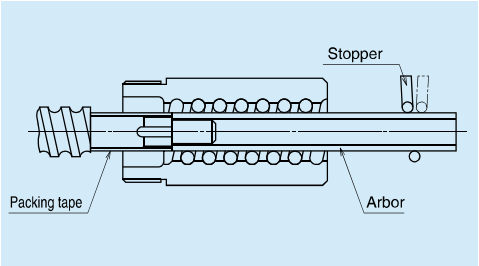


Fig. 5 Arbor and shaft end configuration

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 seriese must be machining of blank shaft ends. See page B27, use of NSK suport 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.

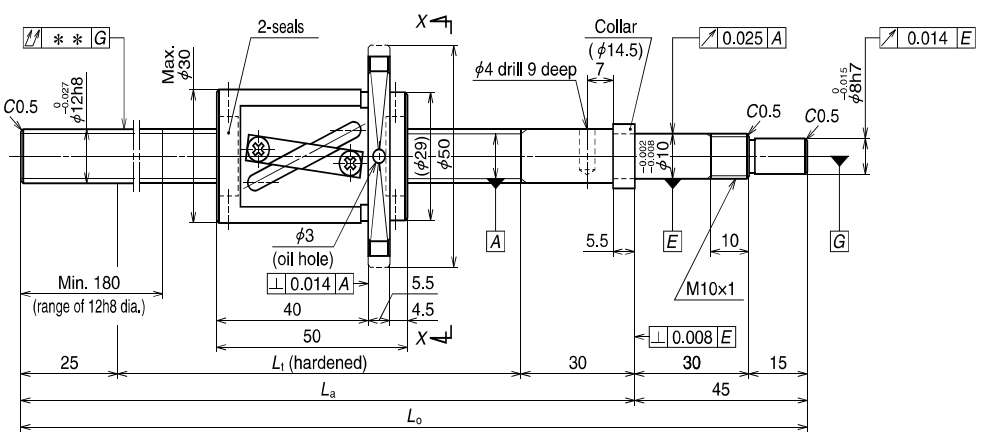
(f) Deburring, washing, and rust prevention
Wash with clean white kerosene after processing. Apply lubricant for immediate use. For later use, apply rust preventive agent.
Note: Contact NSK if nut is accidentally removed.

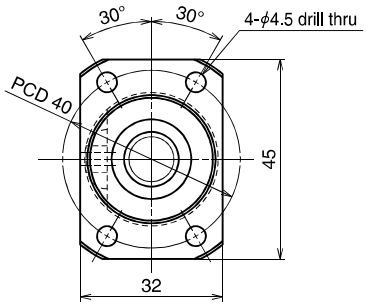
NSK

Screw shaft ø12

Lead 10

Unit: mm





View *X-X*

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_a	3 750
	Static C_{0a}	6 480
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)	

VFA

Unit: mm

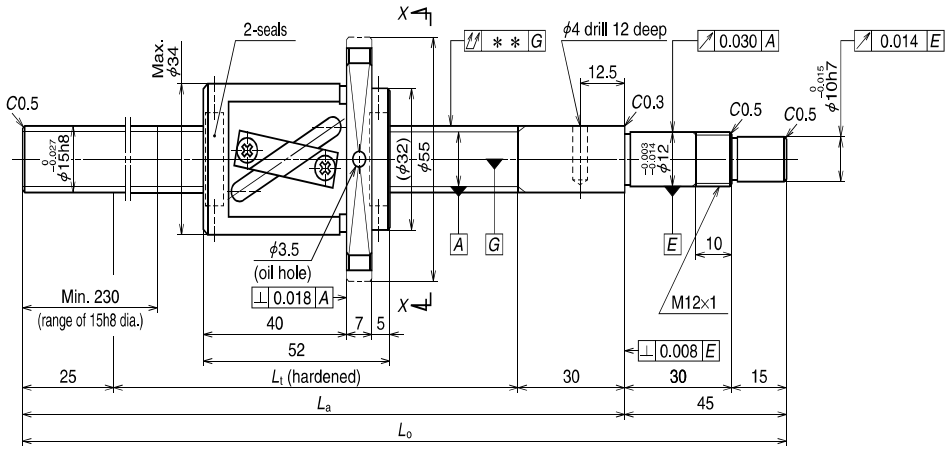
Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum (L_t-nut length)	L_t	L_a	L_o
VFA1210C7S-410	250	260	310	365	410
VFA1210C7S-610	450	460	510	565	610

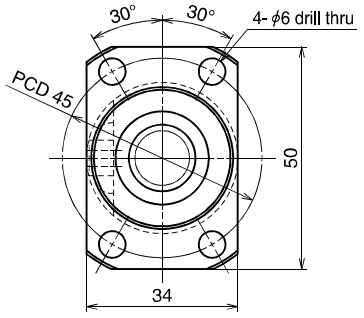
Lead accuracy			Shaft run-out**	Mass (kg)	Permissible rotational speed N (min^{-1})	
					Supporting condition	
T	e_p	υ_{300}			Fixed - Simple support	Fixed - Free
0	0.085	0.052	0.100	0.56	3 000	3 000
0	0.155	0.052	0.160	0.73	3 000	1 300

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 · n value and critical speed. See pages B47 and B349.

Screw shaft ø15
Lead 10

Unit: mm





View *X-X*

Ball screw specification		
Shaft dia.×Lead / Direction of turn		15 × 10 / Right
Ball recirculation		Return tube
Ball dia. / Ball circle dia.		3.175 / 15.5
Screw shaft root dia.		12.2
Effective turns of balls		2.5 × 1
Accuracy grade / Axial play code		Ct7 / S
Basic load rating (N)	Dynamic C_a	7 070
	Static C_{0a}	12 800
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		1.2

Recommended support unit

For drive side (Fixed)	For opposite to drive side (Simple)
WBK12-01A (square)	WBK15SF-01 (square)
WBK12-11 (round)	

VFA

Unit: mm

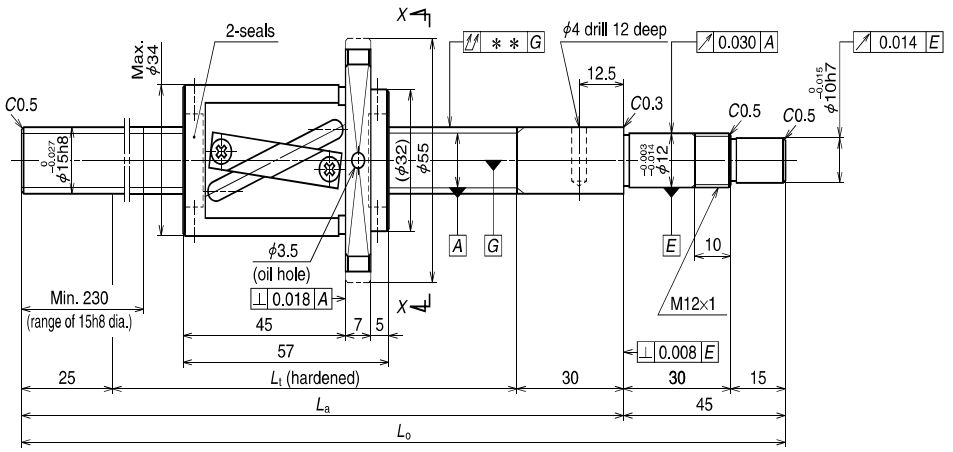
Ball screw No.	Stroke		Screw shaft length		
	Nominal	Maximum (L_t-nut length)	L_t	L_a	L_o
VFA1510C7S-500	300	348	400	455	500
VFA1510C7S-700	500	548	600	655	700
VFA1510C7S-1000	800	848	900	955	1 000

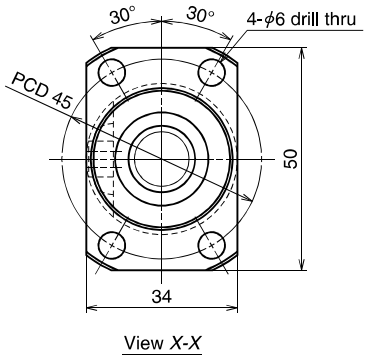
Lead accuracy			Shaft run-out**	Mass (kg)	Permissible rotational speed N (min^{-1})	
					Supporting condition	
T	e_p	υ_{300}			Fixed - Simple support	Fixed - Free
0	0.120	0.052	0.075	0.89	3 000	2 600
0	0.195	0.052	0.110	1.1	3 000	1 150
0	0.310	0.052	0.180	1.5	2 340	510

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 · n value and critical speed. See pages B47 and B349.

Screw shaft ø15
Lead 20

Unit: mm





View X-X

Ball screw specification		
Shaft dia.×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	4 560
	Static C_{0a}	7 730
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)	

VFA

Unit: mm

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

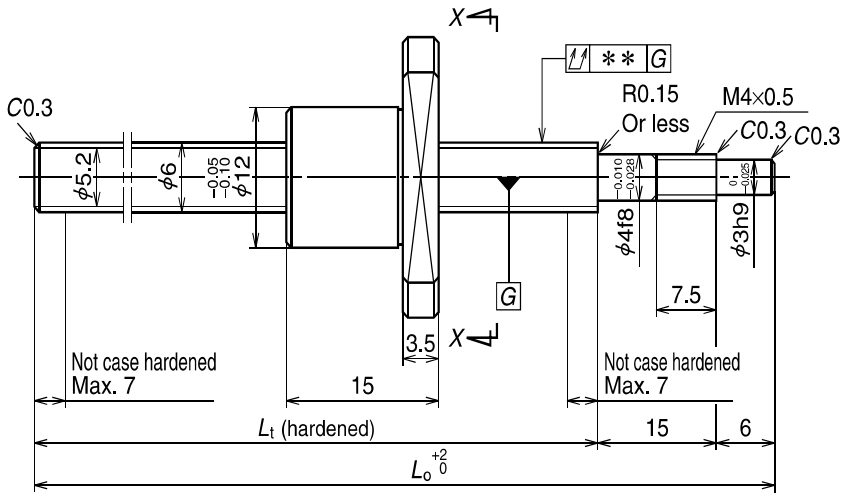
Lead accuracy			Shaft run-out**	Mass (kg)	Permissible rotational speed N (min^{-1})	
					Supporting condition	
T	e_p	υ_{300}			Fixed - Simple support	Fixed - Free
0	0.120	0.052	0.075	0.94	3 000	2 630
0	0.195	0.052	0.110	1.2	3 000	1 160
0	0.310	0.052	0.180	1.6	2 350	510

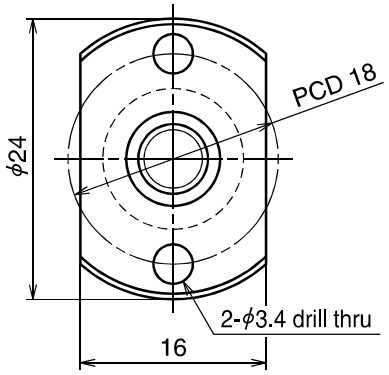
Notes: 1. We recommend NSK support units (page B389). WBK12SF-01 (on simple support side) supports ball screw directly on shaft outside diameter.
2. Use of NSK grease LR3 is recommended. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.
3. Permissible rotational speed is determined by d · n value and critical speed. See pages B47 and B349.

Screw shaft ø6

Lead 1

Unit: mm





View *X-X*

Ball screw specification		
Shaft dia.×Lead / 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	520
	Static C_{0a}	925
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)

RMA

Unit: mm

Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L_t-Nut length)	L_t	L_o
RMA0601C7S-160	100	124	139	160
RMA0601C7S-260	200	224	239	260

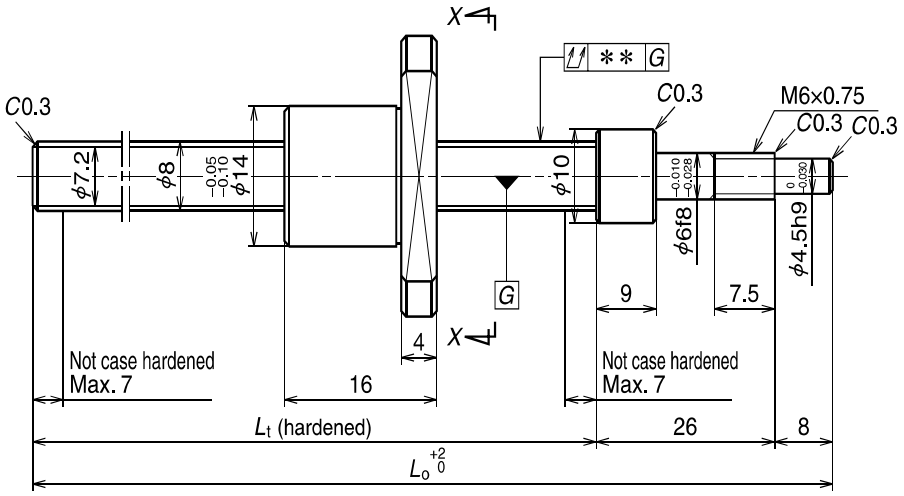
Lead accuracy			Shaft run-out**	Mass (kg)	Permissible rotational speed N (min^{-1})
Target compensation T	Deviation e_p	Variation v_{300}			
0	0.052	0.052	0.060	0.045	3 000
0	0.085	0.052	0.090	0.065	3 000

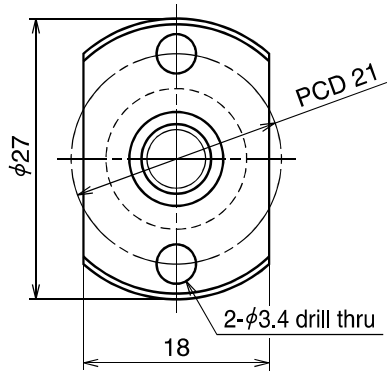
Notes: 1. We recommend NSK support bearing kit (page B401).
2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. Permissible rotational speed is determined by d·n value and critical speed. See pages B47 and B349.

Screw shaft ø8

Lead 1

Unit: mm





View *X-X*

Ball screw specification		
Shaft dia.×Lead / 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	600
	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)

RMA

Unit: mm

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

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

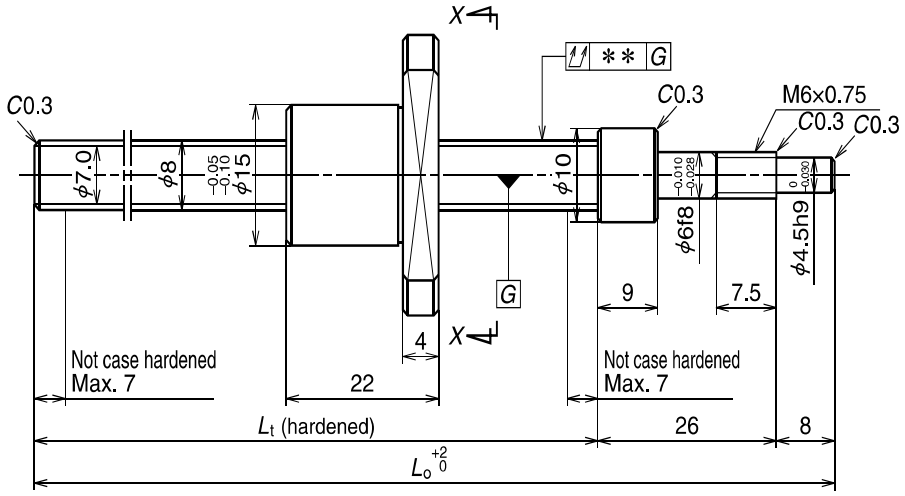
Notes: 1. We recommend NSK support bearing kit (page B401).
2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. Permissible rotational speed is determined by d·n value and critical speed. See pages B47 and B349.

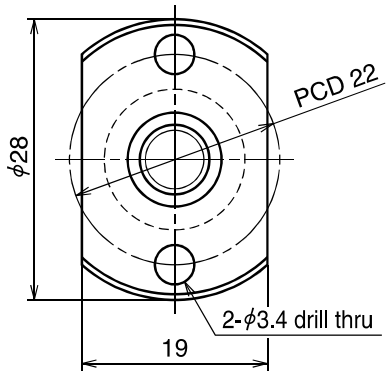
NSK

Screw shaft ø8

Lead 1.5

Unit: mm





View *X-X*

Ball screw specification		
Shaft dia.×Lead / 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	810
	Static C_{0a}	1 590
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)

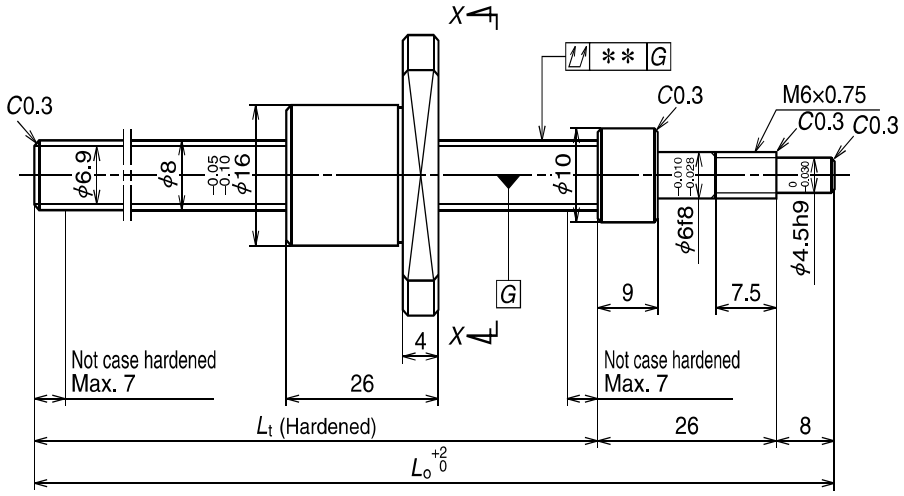
RMA

Unit: mm

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

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	0.093	3 000
0	0.085	0.052	0.090	0.13	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.

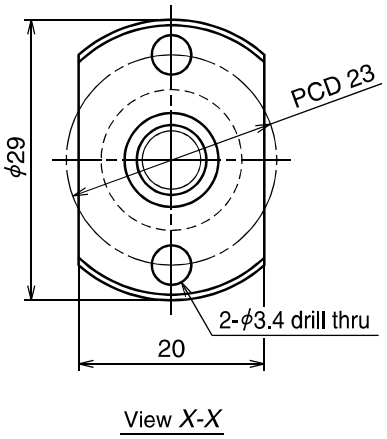


NSK

Screw shaft ø8

Lead 2

Unit: mm



View *X-X*

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	1 070
	Static C_{0a}	1 950
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)

RMA

Unit: mm

Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L_t-Nut length)	L_t	L_o
RMA0802C7S-180	100	120	146	180
RMA0802C7S-280	200	220	246	280

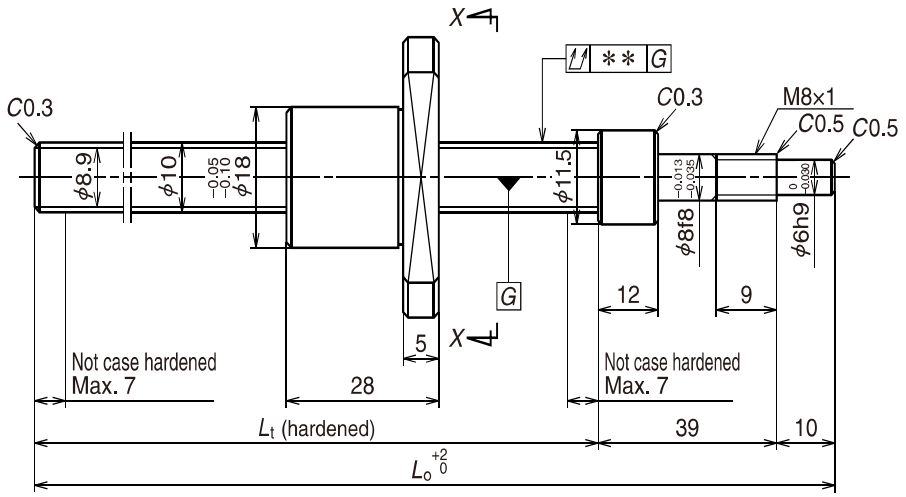
Lead accuracy			Shaft run-out**	Mass (kg)	Permissible rotational speed N (min^{-1})
Target compensation T	Deviation e_p	Variation v_{300}			
0	0.052	0.052	0.060	0.10	3 000
0	0.085	0.052	0.090	0.14	3 000

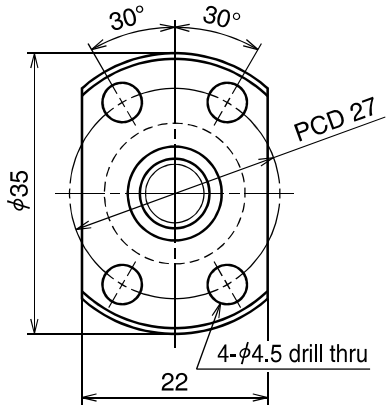
Notes: 1. We recommend NSK support bearing kit (page B401).
2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. Permissible rotational speed is determined by d·n value and critical speed. See pages B47 and B349.

Screw shaft ø10

Lead 2

Unit: mm





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	1 210
	Static C_{0a}	2 510
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)

RMA

Unit: mm

Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L_t-Nut length)	L_t	L_o
RMA1002C7S-250	150	173	201	250
RMA1002C7S-350	250	273	301	350

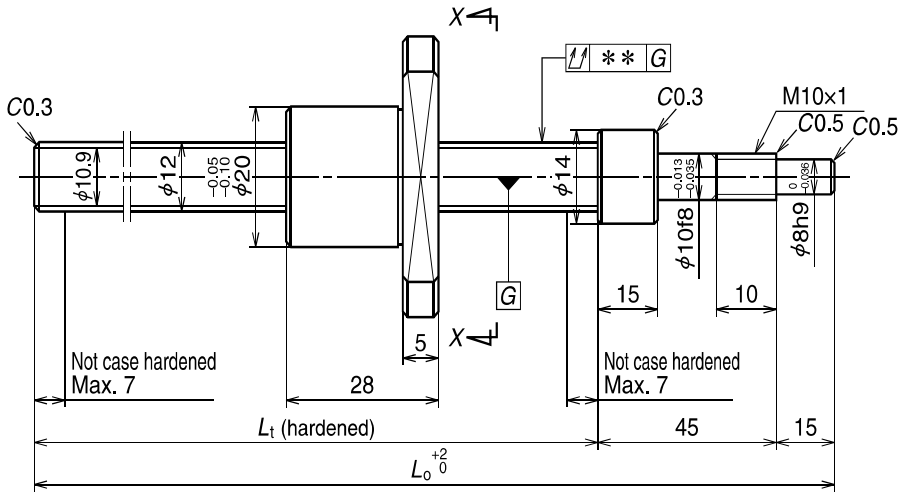
Lead accuracy			Shaft run-out**	Mass (kg)	Permissible rotational speed N (min^{-1})
Target compensation T	Deviation e_p	Variation v_{300}			
0	0.085	0.052	0.070	0.19	3 000
0	0.085	0.052	0.100	0.25	3 000

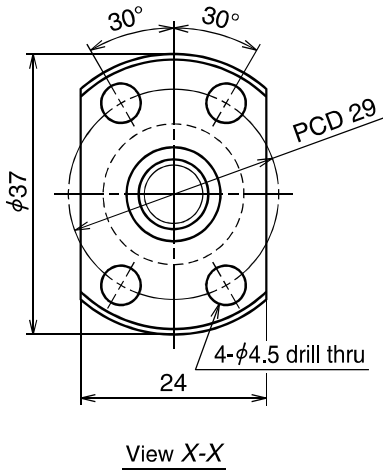
Notes: 1. We recommend NSK support bearing kit (page B389).
2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. Permissible rotational speed is determined by d·n value and critical speed. See pages B47 and B349.

Screw shaft ø12

Lead 2

Unit: mm





View *X-X*

Ball screw specification		
Shaft dia.×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_a	1 350
	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)

RMA

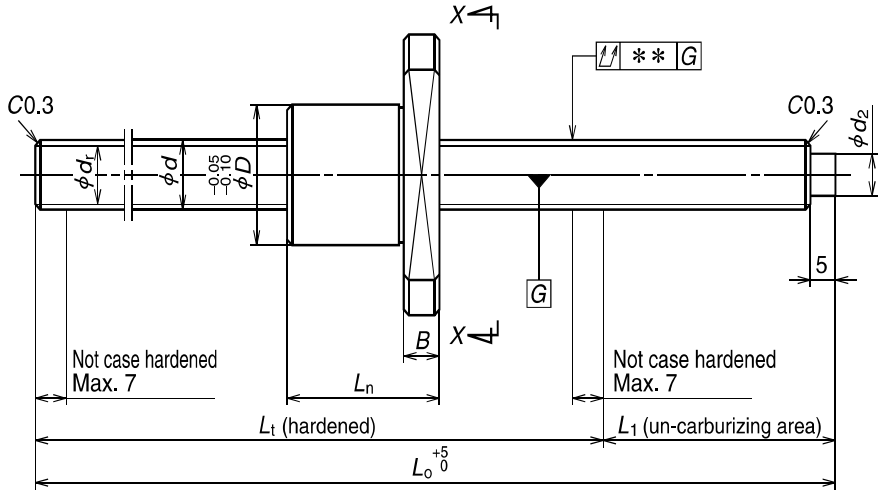
Unit: mm

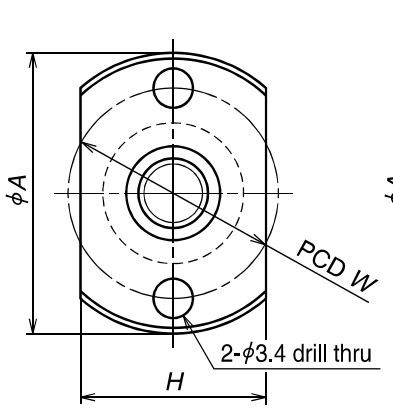
Ball screw No.	Stroke		Screw shaft length	
	Nominal	Maximum (L_t-Nut length)	L_t	L_o
RMA1202C7S-250	150	162	190	250
RMA1202C7S-350	250	262	290	350

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

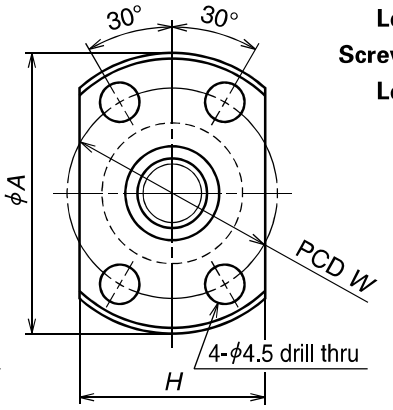
Notes: 1. We recommend NSK support bearing kit (page B389).
2. Only rust preventive oil is applied at time of delivery. Please apply lubricant (oil or grease) before use.
See page D13 for details.
3. Permissible rotational speed is determined by d·n value and critical speed. See pages B47 and B349.

Screw shaft ø6
Lead 1
Screw shaft ø8
Lead 1, 1.5, 2
Screw shaft ø10, ø12
Lead 2





View *X-X*
(for screw shaft of 6 and 8 dia.)



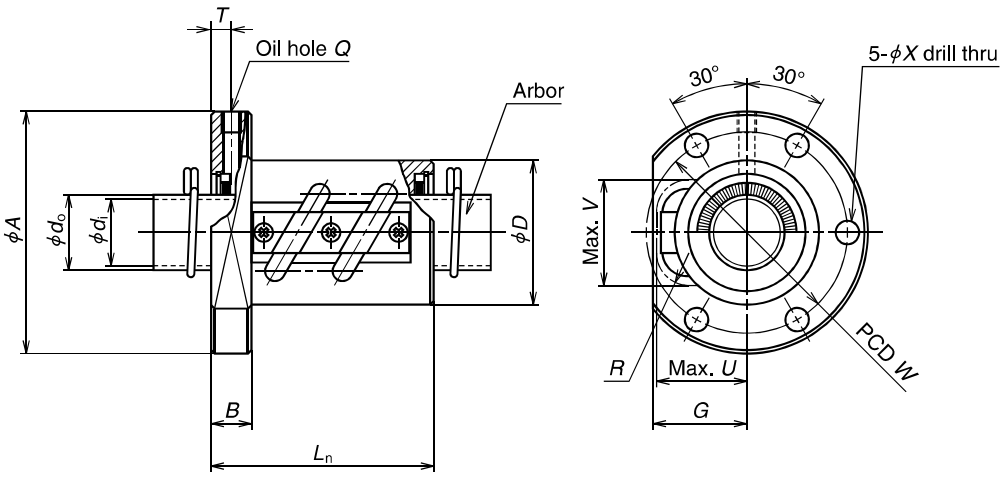
View *X-X*
(for screw shaft of 10 and 12 dia.)

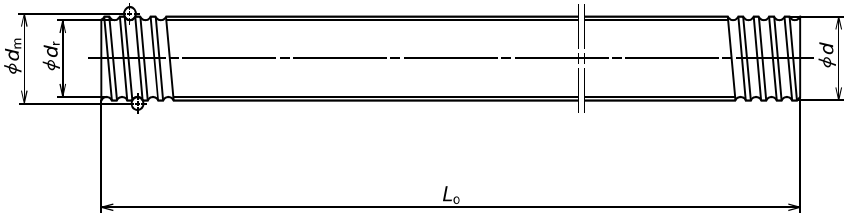
Unit: mm

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_r	Effective turns of balls	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial play Max.
RMS0601C7S-300	235	6	1	0.800	6.2	5.3	3	520	925	0.02
RMS0801C7S-300	234	8	1	0.800	8.2	7.3	3	600	1 290	0.02
RMS0801.5C7S-300	228		1.5	1.000	8.3	7.2		810	1 590	
RMS0802C7S-300	224		2	1.200	8.3	7.0		1 070	1 950	
RMS1002C7S-350	262	10	2	1.200	10.3	9.0	3	1 210	2 510	0.02
RMS1202C7S-350	262	12	2	1.200	12.3	11.0	3	1 350	3 190	0.02

Nut dimensions D	A	H	B	L_n	W	Screw shaft dimensions Effective thread length L_t	Shaft end L_1	Shaft end d_2	Overall length L_o	Lead accuracy Target: compensation T	Deviation e_p	Variation v_{300}	Shaft run-out**	Mass (Kg)	Permissible rotational speed N (min^{-1})
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	

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.



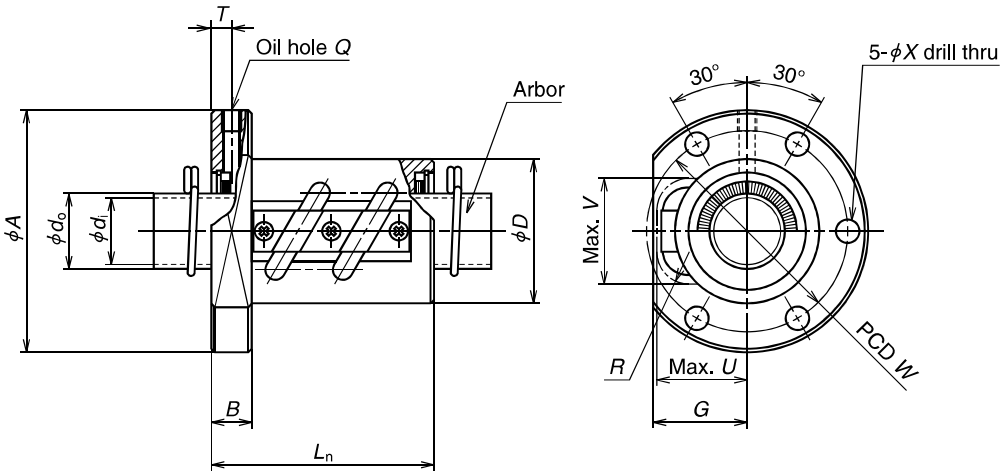


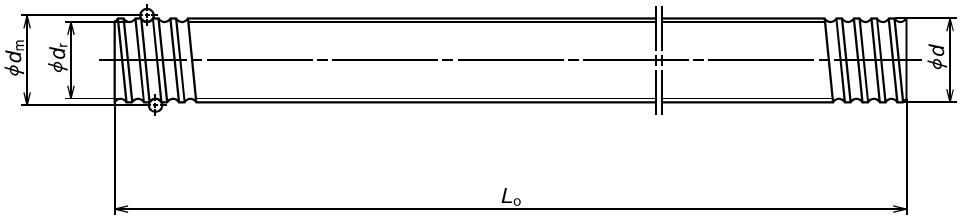
Unit: mm

Ball nut No.	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	Basic load rating (N): Static C_{0a}	Axial play Max.	Ball nut dimensions: Outside dia. D
RNFTL 1003A3.5	10	3	2.381	10.65	8.1	3.5×1	3 780	6 730	0.10	20
RNFTL 1006A2.5S	10	6	2.381	10.65	8.1	2.5×1	2 830	4 810	0.10	20
RNFTL 1208A2.5S	12	8	2.778	12.65	9.6	2.5×1	3 730	6 560	0.10	25
RNFTL 1404A3.5S	14	4	2.778	14.5	11.5	3.5×1	5 370	10 800	0.10	25
RNFTL 1405A2.5S	14	5	3.175	14.5	11.0	2.5×1	5 260	9 720	0.10	30
RNFTL 1610A2.5 **RNFTL 1610A2.5S**	16	10	3.175	16.75	13.3	2.5×1	5 660	11 500	0.10	30
RNFTL 1808A3.5 **RNFTL 1808A3.5S**	18	8	4.762	18.5	13.6	3.5×1	13 200	25 800	0.15	34
RNFTL 2005A2.5 **RNFTL 2005A2.5S**	20	5	3.175	20.5	17.0	2.5×1	6 360	14 200	0.10	40
RNFTL 2010A2.5 **RNFTL 2010A2.5S**	20	10	4.762	21.25	16.2	2.5×1	10 900	21 800	0.15	40
RNFTL 2505A5 **RNFTL 2505A5S**	25	5	3.175	25.5	22.0	2.5×2	12 800	36 300	0.10	42
RNFTL 2510A2.5 **RNFTL 2510A2.5S**	25	10	6.35	26	19.0	2.5×1	17 500	35 200	0.20	44
RNFTL 2510A5 **RNFTL 2510A5S**						2.5×2	31 800	70 300		44

Ball nut dimensions: Flange A	G	B	Length L_n	Bolt hole W	X	Oil hole Q	T	Projecting tube U	V	R	Nut Mass. (kg)	Arbor: Outside dia. d_0	Bore d_i	Screw shaft: Standard length L_o			Screw shaft No.	Shaft mass/m (kg)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
40	15	6	34	30	4.5	M3×0.5	3.0	15	15	7	0.092	8.1	6.1	400	800	–	RS1003A··	0.50	–	–
40	15	6	36	30	4.5	M3×0.5	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	M3×0.5	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	M6×1	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	M6×1	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	M6×1	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	M6×1	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	M6×1	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	M6×1	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	M6×1	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	M6×1	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	M6×1	7.5	34	37	17									18	9.0

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.
4. Nut assembly with arbor and screw shaft are separate at time of delivery.
5. Value obtained by diving 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. 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.



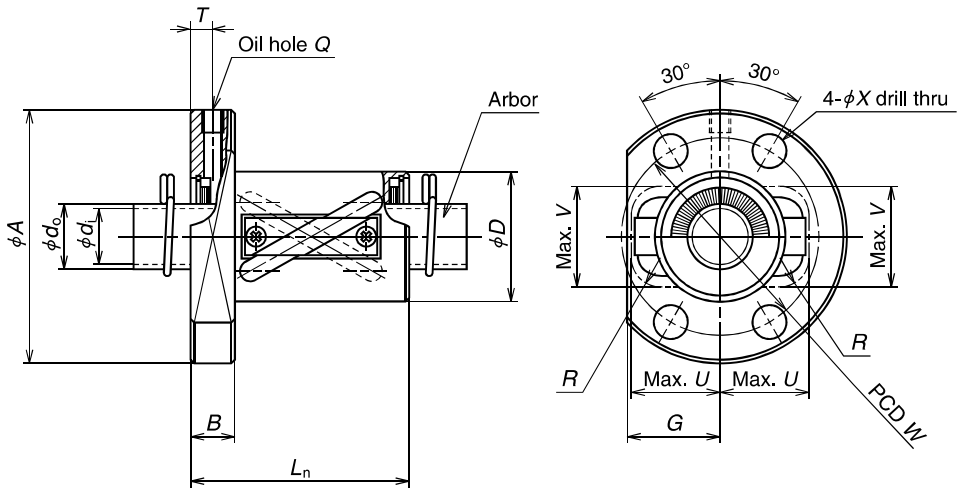


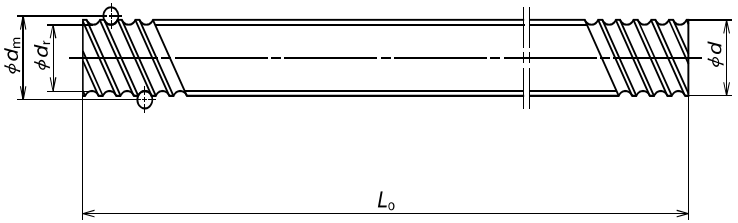
Unit: mm

Ball nut No.	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	Basic load rating (N): Static C_{0a}	Axial play Max.	Ball nut dimensions: Outside dia. D
RNFTL 2806A2.5 **RNFTL 2806A2.5S**	28	6	3.175	28.5	25.0	2.5×1	7 430	20 300	0.10	50
RNFTL 2806A5 **RNFTL 2806A5S**						2.5×2	13 500	40 600		50
RNFTL 3210A5 **RNFTL 3210A5S**	32	10	6.35	33.75	27.0	2.5×2	35 700	92 200	0.20	55
RNFTL 3610A2.5 **RNFTL 3610A2.5S**	36	10	6.35	37	30.0	2.5×1	21 000	51 000	0.20	60
RNFTL 3610A5 **RNFTL 3610A5S**						2.5×2	38 100	102 000		60
RNFTL 4010A7 **RNFTL 4010A7S**	40	10	6.35	41.75	35.0	3.5×2	53 500	164 000	0.20	65
RNFTL 4512A5 **RNFTL 4512A5S**	45	12	7.144	46.5	39.0	2.5×2	49 600	147 000	0.23	70
RNFTL 5010A7 **RNFTL 5010A7S**	50	10	6.35	51.75	45.0	3.5×2	59 500	205 000	0.20	80
RNFTL 5016A5 **RNFTL 5016A5S**	50	16	9.525	52	42.0	2.5×2	99 900	293 000	0.23	85

Ball nut dimensions: Flange A	G	B	Length L_n	Bolt hole W	X	Oil hole Q	T	Projecting tube U	V	R	Nut Mass. (kg)	Arbor: Outside dia. d_0	Arbor: Bore d_r	Screw shaft: Standard length L_o			Screw shaft No.	Shaft mass/m (kg)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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

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.
4. Nut assembly with arbor and screw shaft are separate at time of delivery.
5. Value obtained by diving 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. 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.





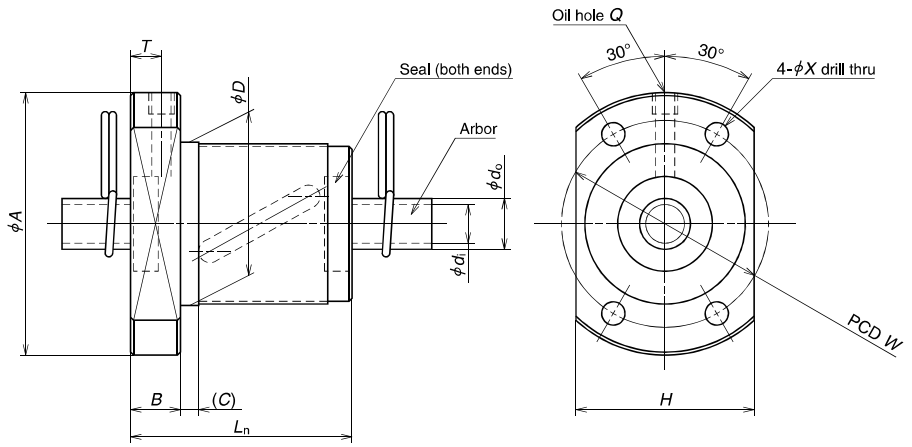
Unit: mm

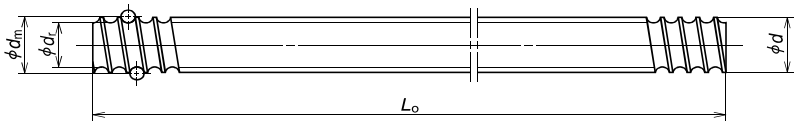
Ball nut No.	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial play Max.	Ball nut dimensions: Outside dia. D
RNFTL 1212A3	12	12	2.381	12.65	10.1	1.5 × 2	3 360	6 270	0.10	24
RNFTL 1616A3 **RNFTL 1616A3S**	16	16	2.778	16.65	13.6	1.5 × 2	4 880	9 650	0.10	30
RNFTL 2020A3 **RNFTL 2020A3S**	20	20	3.175	20.75	17.3	1.5 × 2	7 010	15 400	0.10	35
RNFTL 2525A3 **RNFTL 2525A3S**	25	25	3.969	26	22.0	1.5 × 2	10 500	24 100	0.12	45
RNFTL 3232A3 **RNFTL 3232A3S**	32	32	4.762	33.25	28.0	1.5 × 2	15 300	37 100	0.15	55
RNFTL 4040A3 **RNFTL 4040A3S**	40	40	6.35	41.75	35.0	1.5 × 2	24 400	61 600	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.

Ball nut dimensions: Flange A	Flange G	Flange B	Length L_n	Bolt hole W	Bolt hole X	Oil hole Q	Oil hole T	Projecting tube U	Projecting tube V	Projecting tube R	Nut Mass. (kg)	Arbor: Outside dia. d_o	Arbor: Bore d_i	Screw shaft: Standard length L_o			Screw shaft No.	Shaft mass/m (kg)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
44	17	8	44	34	4.5	M3 x 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 x 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 x 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 x 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 x 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 x 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 diving 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. 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.



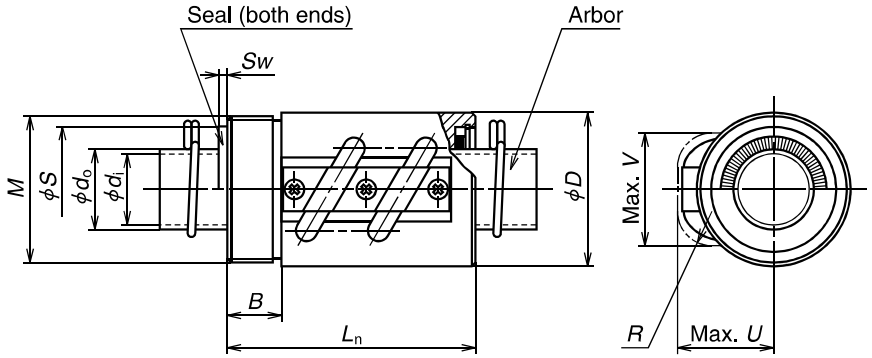


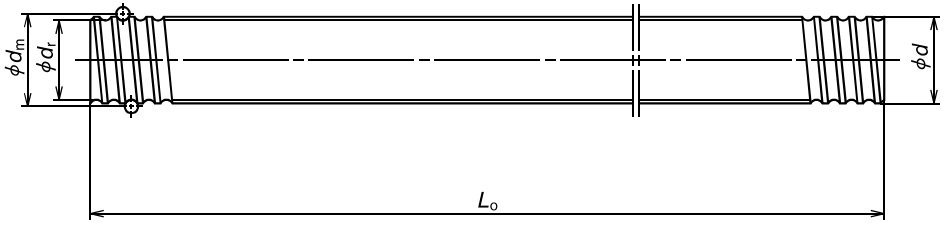
Unit: mm

Ball nut No.	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	Basic load rating (N): Static C_{oa}	Axial play Max.	Ball nut dimensions: Outside dia. D
RNFBL 1006A2.5S	10	6	2.381	10.65	8.1	2.5×1	2 830	4 810	0.10	26
RNFBL 1208A2.5S	12	8	2.778	12.65	9.6	2.5×1	3 730	6 560	0.10	29
RNFBL 1404A3.5S	14	4	2.778	14.5	11.5	3.5×1	5 370	10 800	0.10	31
RNFBL 1405A2.5S	14	5	3.175	14.5	11.0	2.5×1	5 260	9 720	0.10	32
RNFBL 1808A3.5S	18	8	4.762	18.5	13.6	3.5×1	13 200	25 800	0.15	50
RNFBL 2005A2.5S	20	5	3.175	20.5	17.0	2.5×1	6 360	14 200	0.10	40
RNFBL 2010A2.5S	20	10	4.762	21.25	16.2	2.5×1	10 900	21 800	0.15	52
RNFBL 2505A2.5S	25	5	3.175	25.5	22.0	2.5×1	7 070	18 200	0.10	43
RNFBL 2505A5S						2.5×2	12 800	36 300		
RNFBL 2510A2.5S	25	10	6.35	26	19.0	2.5×1	17 500	35 200	0.20	60
RNFBL 2510A5S						2.5×2	31 800	70 300		
RNFBL 2806A2.5S	28	6	3.175	28.5	25.0	2.5×1	7 430	20 300	0.10	50
RNFBL 2806A5S						2.5×2	13 500	40 600		
RNFBL 3210A2.5S	32	10	6.35	33.75	27.0	2.5×1	19 700	46 100	0.20	67
RNFBL 3210A5S						2.5×2	35 700	92 200		
RNFBL 3610A2.5S	36	10	6.35	37	30.0	2.5×1	21 000	51 000	0.20	70
RNFBL 3610A5S						2.5×2	38 100	102 000		
RNFBL 4010A5S	40	10	6.35	41.75	35.0	2.5×2	40 100	116 000	0.20	76

Ball nut dimensions: Flange A	Flange H	Flange B	Length: Overall length L_n	Length (C)	Bolt hole W	Bolt hole X	Oil hole Q	Oil hole T	Nut Mass. (kg)	Arbor: Outside dia. d_0	Arbor: Bore d_1	Screw shaft: Standard length L_o			Screw shaft No.	Shaft mass/m (kg)	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
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
			55						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
			96						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
			65						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
			97						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
			99						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

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 diving 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. Recommended quantity of grease is about 50% of ball nut's internal space. See page D16 for details.





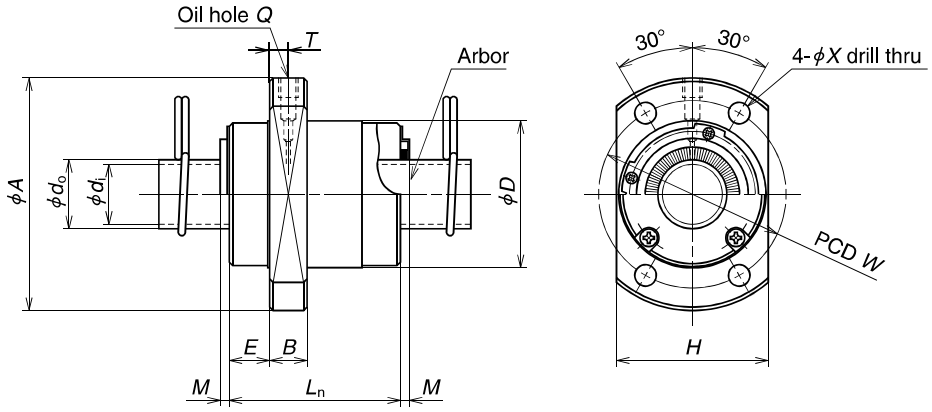
Unit: mm

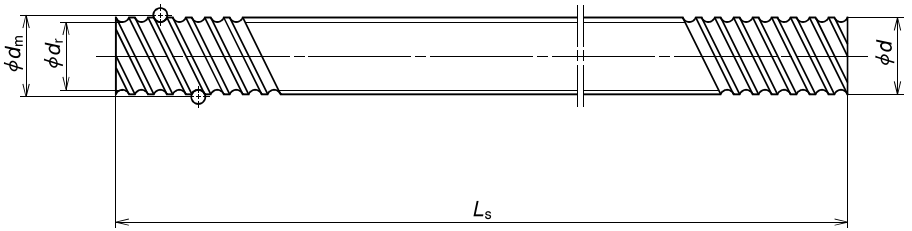
Ball nut No.	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial play Max.	Ball nut dimensions: Outside dia. D
RNCT 1003A3.5	10	3	2.381	10.65	8.1	3.5 × 1	3 780	6 730	0.10	20
RNCT 1404A3.5S	14	4	2.778	14.5	11.5	3.5 × 1	5 370	10 800	0.10	25
RNCT 1405A2.5S	14	5	3.175	14.5	11.0	2.5 × 1	5 260	9 720	0.10	30
RNCT 1808A3.5 **RNCT 1808A3.5S**	18	8	4.762	18.5	13.6	3.5 × 1	13 200	25 800	0.15	34
RNCT 2005A2.5 **RNCT 2005A2.5S**	20	5	3.175	20.5	17.0	2.5 × 1	6 360	14 200	0.10	40
RNCT 2505A5 **RNCT 2505A5S**	25	5	3.175	25.5	22.0	2.5 × 2	12 800	36 300	0.10	42
RNCT 2510A5 **RNCT 2510A5S**	25	10	6.35	26	19.0	2.5 × 2	31 800	70 300	0.20	44
RNCT 2806A5 **RNCT 2806A5S**	28	6	3.175	28.5	25.0	2.5 × 2	13 500	40 600	0.10	50
RNCT 3210A5 **RNCT 3210A5S**	32	10	6.35	33.75	27.0	2.5 × 2	35 700	92 200	0.20	55
RNCT 3610A5 **RNCT 3610A5S**	36	10	6.35	37	30.0	2.5 × 2	38 100	102 000	0.20	60
RNCT 4010A7 **RNCT 4010A7S**	40	10	6.35	41.75	35.0	3.5 × 2	53 500	164 000	0.20	65
RNCT 4512A5 **RNCT 4512A5S**	45	12	7.144	46.5	39.0	2.5 × 2	49 600	147 000	0.23	70
RNCT 5010A7 **RNCT 5010A7S**	50	10	6.35	51.75	45.0	3.5 × 2	59 500	205 000	0.20	80
RNCT 5016A5 **RNCT 5016A5S**	50	16	9.525	52	42.0	2.5 × 2	99 900	293 000	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_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.

Ball nut dimensions: V-thread M	B	Length L_n	Projecting tube U	V	R	Nut Mass. (kg)	Seal dimensions: Diameter S	Thickness Sw	Arbor: Outside dia. d_0	Bore d_i	Screw shaft: Standard length L_0			Screw shaft No.	Shaft mass/m (kg)	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
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 diving 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. 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.



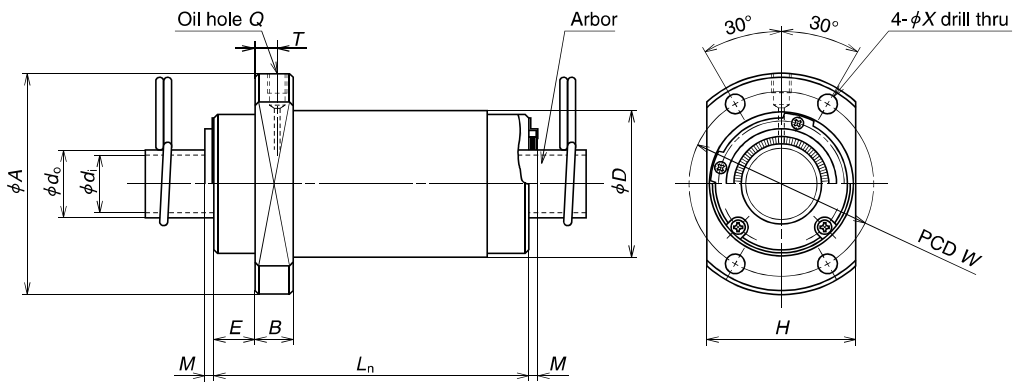


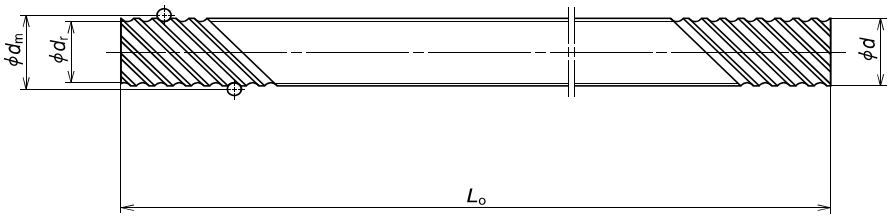
Unit: mm

Ball nut No.	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	Basic load rating (N): Static C_{oa}	Axial play Max.	Ball nut dimensions: Outside dia. D
RNFCL 1212A3	12	12	2.381	12.65	10.1	1.7 × 2	3 740	6 640	0.10	26
RNFCL 1212A6						1.7 × 4	6 780	13 300		
RNFCL 1520A3	15	20	3.175	15.5	12.2	1.7 × 2	6 730	12 300	0.10	33
RNFCL 1520A3S										
RNFCL 1616A3	16	16	2.778	16.65	13.5	1.7 × 2	5 430	10 400	0.10	32
RNFCL 1616A3S										
RNFCL 1616A6						1.7 × 4	9 860	20 800		
RNFCL 1616A6S										
RNFCL 2020A3	20	20	3.175	20.75	17.3	1.7 × 2	7 810	16 500	0.10	39
RNFCL 2020A3S										
RNFCL 2020A6						1.7 × 4	14 200	33 000		
RNFCL 2020A6S										
RNFCL 2525A3	25	25	3.969	26	22.0	1.7 × 2	11 700	25 800	0.12	47
RNFCL 2525A3S										
RNFCL 2525A6						1.7 × 4	21 200	51 500		
RNFCL 2525A6S										
RNFCL 3232A3	32	32	4.762	33.25	28.0	1.7 × 2	17 100	40 500	0.15	58
RNFCL 3232A3S										
RNFCL 3232A6						1.7 × 4	31 000	81 000		
RNFCL 3232A6S										
RNFCL 4040A3	40	40	6.35	41.75	35.0	1.7 × 2	27 200	67 900	0.20	73
RNFCL 4040A3S										
RNFCL 4040A6						1.7 × 4	49 300	136 000		
RNFCL 4040A6S										
RNFCL 5050A3	50	50	7.938	52.25	44.0	1.7 × 2	40 600	106 000	0.25	90
RNFCL 5050A3S										
RNFCL 5050A6						1.7 × 4	73 700	212 000		
RNFCL 5050A6S										

Ball nut dimensions: Flange A	Flange H	Flange B	Length E	Length L_n	Bolt hole M	Bolt hole W	Bolt hole X	Oil hole Q	Oil hole T	Nut Mass. (kg)	Arbor: Outside dia. d_o	Arbor: Bore d_i	Screw shaft: Standard length L_o			Screw shaft No.	Shaft mass/m (kg)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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
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
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
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
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
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

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 diving 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 x M) for those with "brush" seals.
6. 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.



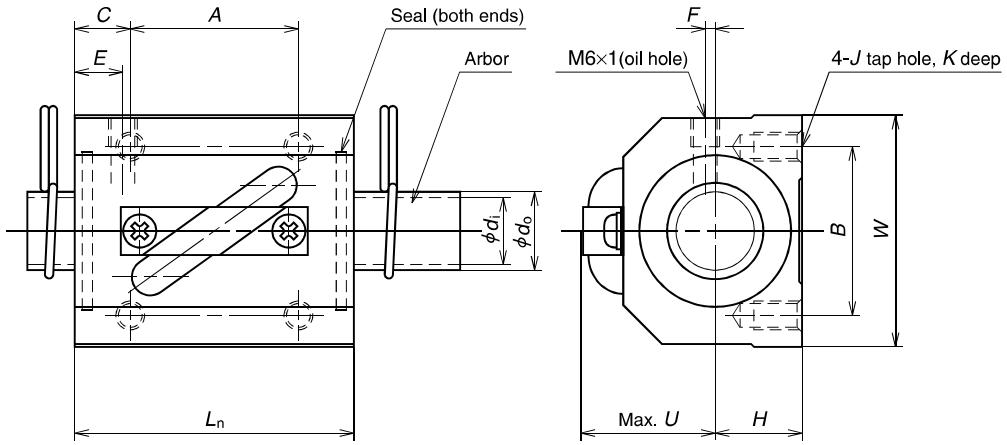


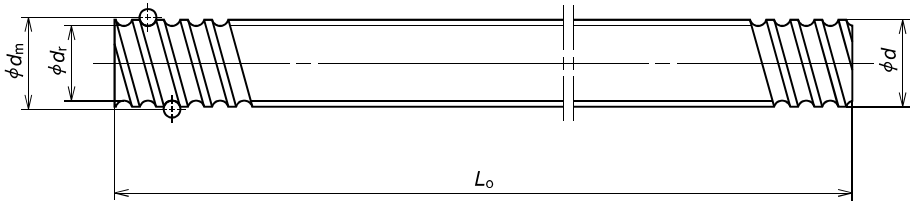
Unit: mm

Ball nut No.	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	Basic load rating (N): Static C_{oa}	Axial play Max.	Ball nut dimensions: Outside dia. D
RNFCL 1632A2	16	32	2.778	16.65	13.5	0.7 × 4	4 600	8 460	0.10	32
RNFCL 1632A2S										
RNFCL 1632A3						1.7 × 2	5 430	10 400		
RNFCL 1632A3S										
RNFCL 1632A6						1.7 × 4	9 860	20 800		
RNFCL 1632A6S										
RNFCL 2040A2	20	40	3.175	20.75	17.3	0.7 × 4	6 610	13 600	0.10	38
RNFCL 2040A2S										
RNFCL 2040A3						1.7 × 2	7 810	16 500		
RNFCL 2040A3S										
RNFCL 2040A6						1.7 × 4	14 200	33 000		
RNFCL 2040A6S										
RNFCL 2550A2	25	50	3.969	26	22.0	0.7 × 4	9 870	21 200	0.12	46
RNFCL 2550A2S										
RNFCL 2550A3						1.7 × 2	11 700	25 800		
RNFCL 2550A3S										
RNFCL 2550A6						1.7 × 4	21 200	51 500		
RNFCL 2550A6S										
RNFCL 3264A3	32	64	4.762	33.25	28.0	1.7 × 2	17 100	40 500	0.15	58
RNFCL 3264A3S										
RNFCL 3264A6						1.7 × 4	31 000	81 000		
RNFCL 3264A6S										
RNFCL 4080A3	40	80	6.350	41.75	35.0	1.7 × 2	27 200	67 900	0.20	73
RNFCL 4080A3S										
RNFCL 4080A6						1.7 × 4	49 300	136 000		
RNFCL 4080A6S										

Ball nut dimensions: Flange A	H	B	Length E	L_n	M	Bolt hole W	X	Oil hole Q	T	Nut Mass. (kg)	Arbor: Outside dia. d_0	Arbor: Bore d_i	Screw shaft: Standard length L_o				Screw shaft No.	Shaft mass/m (kg)	Internal spatial volume of nut (cm^3)	Standard volume of grease replenishing (cm^3)
50	34	10	10	34	–	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
					3															
				66	–					0.33									3.9	2.0
					3															
				66	–					0.33									4.1	2.1
					3															
58	40	10	11	41	–	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
					3															
				81	–					0.53									6.3	3.2
					3															
				81	–					0.53									7.0	3.5
					3															
70	48	12	13	50	–	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
					3															
				100	–					0.91									14	7.0
					3															
				100	–					0.91									15	7.5
					3															
92	60	12	15.5	126	–	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
					3															
					–														26	13
					3															
114	75	15	19	158	–	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
					3.5															
					–														55	28
					3.5															

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 diving 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 x M) for those with "brush" seals.
6. 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.





Unit: mm

Ball nut No.	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	Basic load rating (N) Static C_{oa}	Axial play Max.	Ball nut dimensions Length L_n
RNSTL 1404A3.5S	14	4	2.778	14.5	11.5	3.5 × 1	5 370	10 800	0.10	38
RNSTL 1405A2.5S	14	5	3.175	14.5	11.0	2.5 × 1	5 260	9 720	0.10	38
RNSTL 1808A3.5S	18	8	4.762	18.5	13.6	3.5 × 1	13 200	25 800	0.15	56
RNSTL 2005A2.5S	20	5	3.175	20.5	17.0	2.5 × 1	6 360	14 200	0.10	38
RNSTL 2010A2.5S	20	10	4.762	21.25	16.2	2.5 × 1	10 900	21 800	0.15	58
RNSTL 2505A2.5S	25	5	3.175	25.5	22.0	2.5 × 1	7 070	18 200	0.10	35
RNSTL 2510A5S	25	10	6.35	26	19.0	2.5 × 2	31 800	70 300	0.20	94
RNSTL 2806A2.5S	28	6	3.175	28.5	25.0	2.5 × 1	7 430	20 300	0.10	42
RNSTL 2806A5S						2.5 × 2	13 500	40 600		67
RNSTL 3210A2.5S	32	10	6.35	33.75	27.0	2.5 × 1	19 700	46 100	0.20	64
RNSTL 3210A5S						2.5 × 2	35 700	92 200		94
RNSTL 3610A2.5S	36	10	6.35	37	30.0	2.5 × 1	21 000	51 000	0.20	64
RNSTL 3610A5S						2.5 × 2	38 100	102 000		96
RNSTL 4512A5S	45	12	7.144	46.5	39.0	2.5 × 2	49 600	147 000	0.23	115

Ball nut dimensions: Width W	Center height H	Bolt hole A	Bolt hole B	Bolt hole C	Oil hole J	Oil hole K	Oil hole E	Oil hole F	U	Nut Mass. (kg)	Arbor: Outside dia. d_0	Arbor: Bore d_i	Screw shaft: Standard length L_o			Screw shaft No.	Shaft mass/m (kg)	Internal spatial volume of nut (cm³)	Standard volume of grease replenishing (cm³)
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_o due to manufacturing tolerance.
2. Nut assembly with arbor and screw shaft are separate at time of delivery.
3. Value obtained by diving 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. 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	ϕ4 – ϕ25	B395 –
		WBK**S-01* 	Simple support side	Deep groove ball bearing	ϕ6 – ϕ25	B399 –
		WBK**SF-01 		Deep groove ball bearing	ϕ12, ϕ15 (exclusive for VFA type)	B402
Small equipment, light load	Round	WBK**R-11 (Support kit) 	Fixed support side	Deep groove ball bearing (arranged to have angular contact)	ϕ4, ϕ6 (exclusive for RMA and RMS types)	B401
		WBK**-11* 		Angular contact ball bearing	ϕ4 – ϕ25	B397 –
Machine tools, high speed, heavy load	Round	WBK**DF*-31H 	Fixed support side	Thrust angular contact ball bearing	ϕ17 – ϕ40	B407 –

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.

3. Reference number coding

(For light load)

Example: WBK 08 S - 01 A

- Product code for support unit: WBK
- Nominal size code*: 08
- 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)
- 01: Square type
- 11: Round type
- 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

*) 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: WBK
- Nominal size code (internal bore of bearing): 25
- Bearing combination code
  - DF: Face to face duplex combination
  - DFD: Face to face triplex combination
  - DFF: Face to face quadruplex combination
- H: High speed type

(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

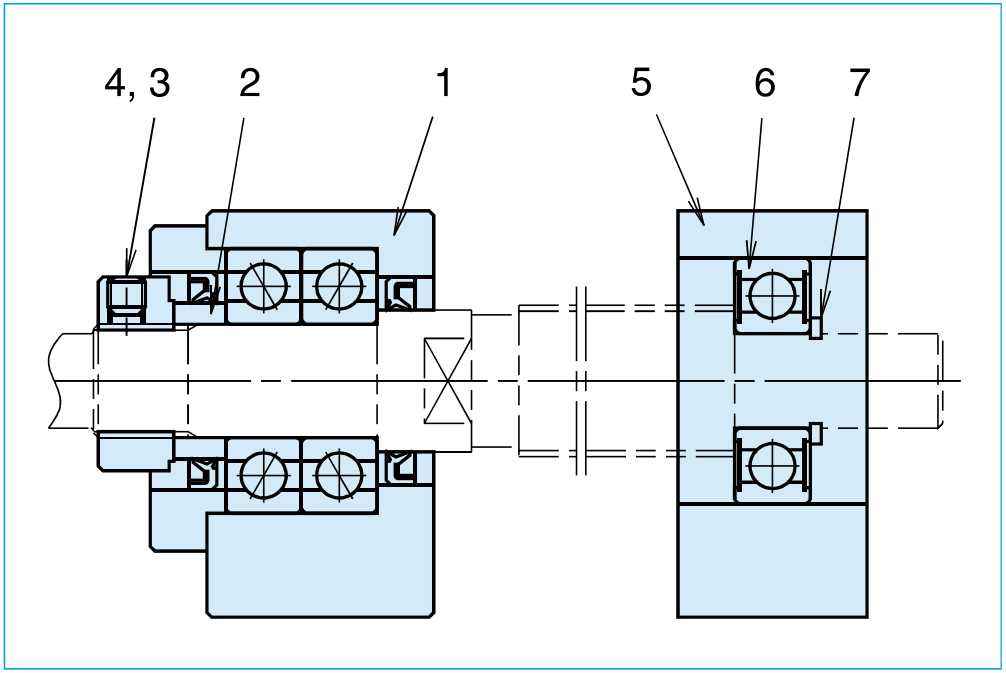
Support units are standard products.

●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

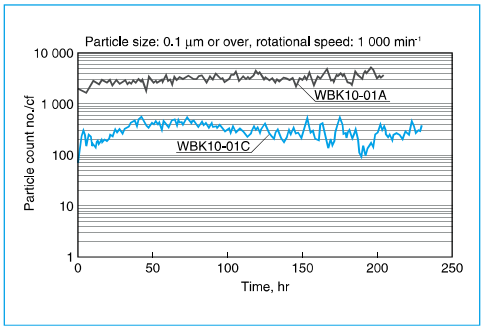
(b) Features of Clean Support Unit

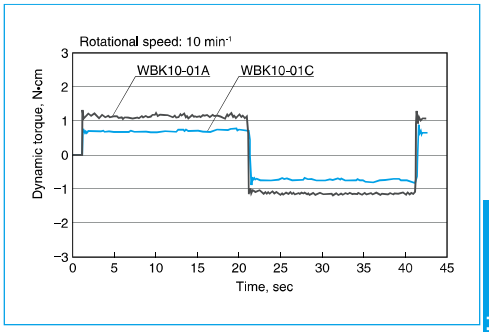
●Outstanding low dust emission
Clean support unit uses "NSK clean grease LG2" which has a proven feature of low dust emission. It reduces dust emission to 1/10 of general support units.

●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.

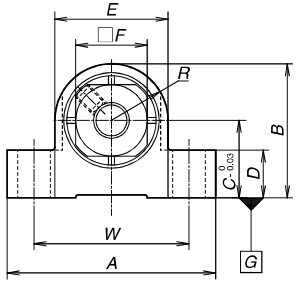
	Clean support unit
Bearing • grease	Special bearings, LG2
Surface treatment	Low temperature chrome plating
Set screw and snap ring material	Stainless steel

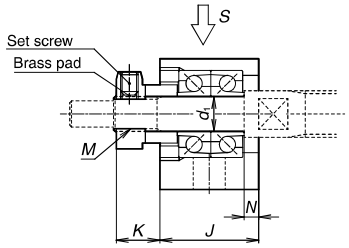




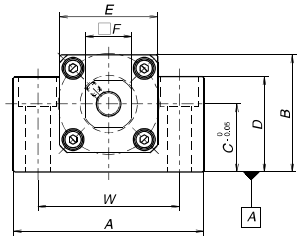
Support Units for Light Load and Small Equipment

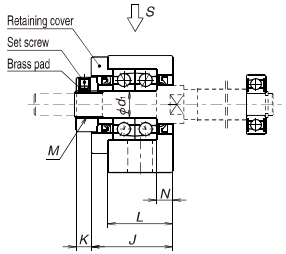
WBK**-01M

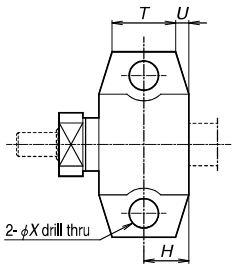


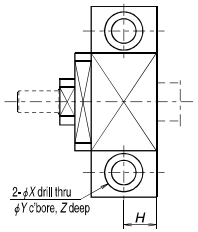


WBK**-01*

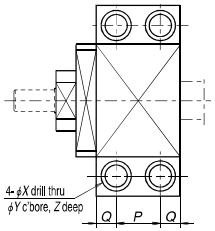








View S (WBK06 – 15)



View S (WBK17 – 25)

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)

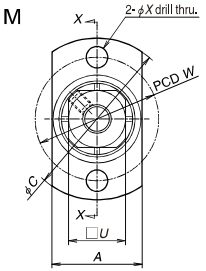
Fixed support side support unit (square type)

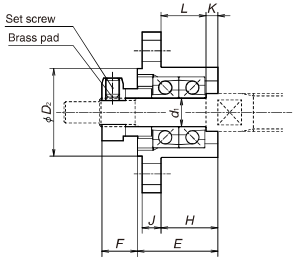
Units: mm

Reference No.	Use	d_1	A	B	C	D	E	F	L	J	K	R	T	U	N	Counterbore dimensions H	P	Q	W	X	Y	Z	Mass (kg)	Locknut screw M	Attached bearing for support side
WBK04-01M	General	4	27	17	10	6	14	10	—	14	5.5	7	9	2.5	2	7	—	—	21	3.5	—	—	0.03	M4×0.5	—
WBK06-01M	General	6	35	22.5	13	8	19	12	—	17	7.5	9.5	12	2.5	2.5	8.5	—	—	26	5.5	—	—	0.05	M6×0.75	—
WBK06-01A[*1]	General	6	42	25	13	20	18	12	20	20	5.5	—	—	—	3.5	10	—	—	30	5.5	9.5	11	0.15	M6×0.75	—
WBK08-01A[*1]	General	8	52	32	17	26	25	14	23	23	7	—	—	—	4	11.5	—	—	38	6.6	11	12	0.25	M8×1	606ZZ
WBK08-01B	Low type		62	31	15.5	31	—		21.5	25.5	4.5				3.5	11			46	9	14	18	0.3		606ZZ
WBK08-01C[*1]	Clean environment		52	32	17	26	25		23	23	7				4	11.5			38	6.6	11	12	0.25		606VV
WBK10-01A	General	10	70	43	25	35	36	17	24	30	5.5	—	—	—	6	12	—	—	52	9	14	11	0.5	M10×1	608ZZ
WBK10-01B	Low type			38	20	38	—															19	0.45		608ZZ
WBK10-01C	Clean environment			43	25	35	36															11	0.5		608VV
WBK12-01A	General	12	70	43	25	35	36	19	24	30	5.5	—	—	—	6	12	—	—	52	9	14	11	0.5	M12×1	6000ZZ
WBK12-01B	Low type			38	20	38	—															19	0.4		6000ZZ
WBK12-01C	Clean environment			43	25	35	36															11	0.5		6000VV
WBK15-01A	General	15	80	50	30	40	41	22	25	31	12	—	—	—	5	12.5	—	—	60	11	17	15	0.7	M15×1	6002ZZ
WBK15-01B	Low type			42	22	42	—															23	0.6		6002ZZ
WBK15-01C	Clean environment			50	30	40	41															15	0.7		6002VV
WBK17-01A	General	17	86	64	39	55	50	24	35	44	7	—	—	—	7	—	19	8	68	9	14	11	1.3	M17×1	6203ZZ
WBK20-01	General	20	95	58	30	45	56	30	42	52	10	—	—	—	10	—	22	10	75	11	17	15	1.4	M20×1	6204ZZ
WBK25-01W	General	25	105	68	35	25	66	36	48	61	13	—	—	—	14	—	30	9	85	11	—	—	1.9	M25×1.5	6205ZZ

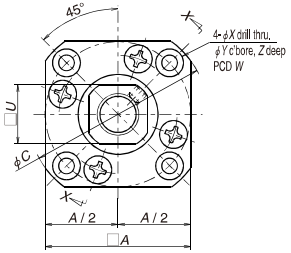
Notes: 1. Use datum surface A for mounting to machine base.
2. Tighten set screw after locknut has been adjusted and tightened.
3. Insert brass pad provided with unit into locknut set screw hole, then insert and tighten the set screw.
4. Deep groove ball bearing and snap ring are also provided for simple support side. (except WBK04-01M and WBK06-01M)
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.

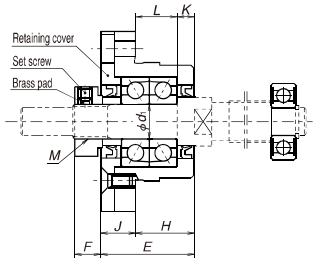
WBK**-11M



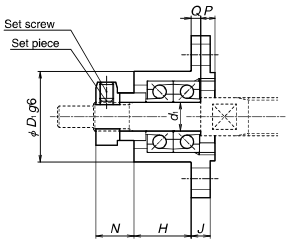


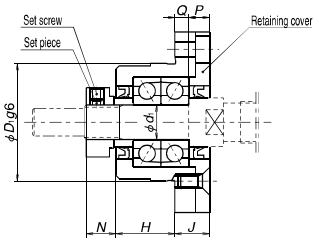
WBK**-11*





View X-X (example 1)





(example 2)

Reference No.	Tightening torque (reference) [N·cm]	
	Locknut	Set screw
WBK04-**	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)

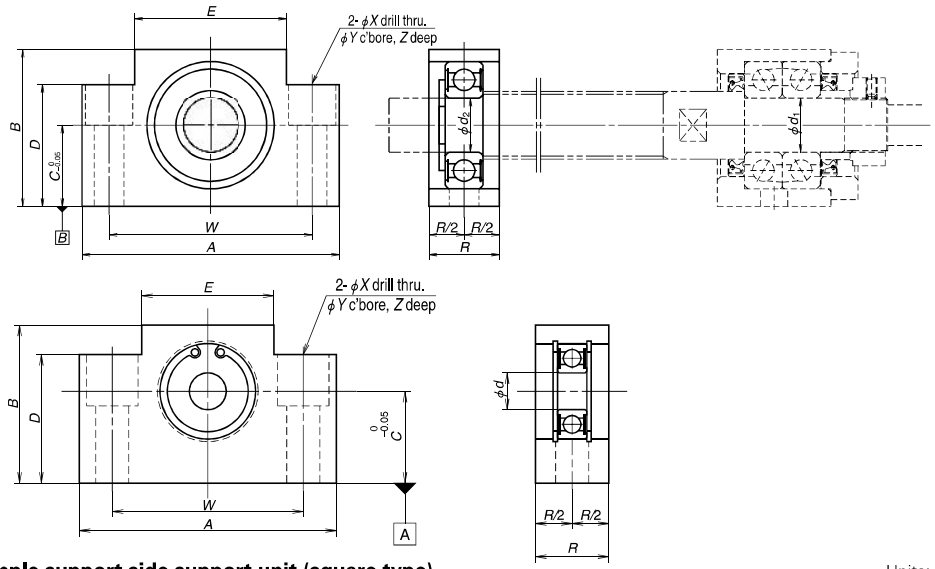
Fixed support side support unit (round type)

Units: mm

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

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	M4×0.5	—
12	3	2	4	26	4.5	—	—	0.04	M6×0.75	—
12	4.5	2.5	7	28	2.9	5.5	3.5	0.1	M6×0.75	—
14	6	4	10	42	4.5	8	4	0.2	M8×1	606ZZ
	5		9	35	3.4	6.5		0.15		606ZZ
										606VV
17	6	4	10	42	4.5	8	4	0.2	M10×1	608ZZ
										608VV
19	6	4	10	44	4.5	8	4	0.25	M12×1	6000ZZ
										6000VV
22	8	7	15	50	5.5	9.5	6	0.4	M15×1	6002ZZ
										6002VV
30	14	8	22	70	6.6	11	10	1.1	M20×1	6204ZZ
36	17	10	27	80	9	15	13	1.5	M25×1.5	6205ZZ

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 and WBK06-11M)
4. Bearings for WBK04-01M and WBK06-01M are equipped with non-contact metal shield.
*For retaining cover side of WBK06-01A, WBK08-01A, and WBK08-01C, there are no seals.
5. Contact NSK if the rotational speed is 50 min^{-1} and below.



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												
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											0.3
WBK12SF-01B*1	Low type		62	31	15.5	31	—	18	46			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				0.3
WBK15SF-01B*1	Low type			38	20	38	—	18				19	
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.

Specifications of support unit

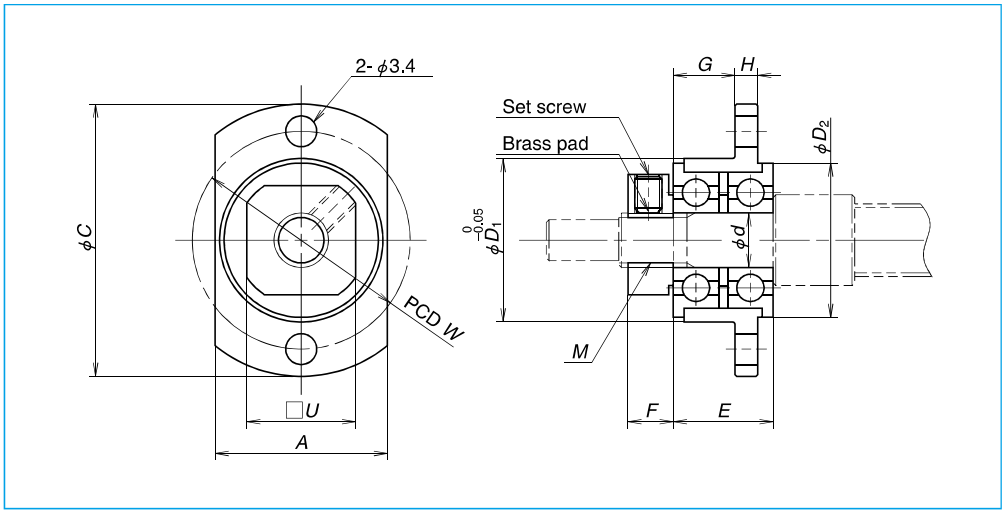
Fixed support side support unit						Simple support side support unit		
Reference No.	Use	Axial direction: Basic dynamic load rating *Ca* [N]	Axial direction: Load limit [N]	Axial direction: Rigidity [N/μm]	Maximum starting torque [N·cm]	Reference No.	Bearing reference No.	Radial direction Basic dynamic load rating *C* [N]
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
						WBK12SF-01*2	6001ZZ	5 100
WBK10-01B	Low type	6 600	2 730	94	1.9	—	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
						WBK15SF-01*2	6902ZZ	4 350
WBK12-01B	Low type	7 100	3 040	104	2.1	**WBK12S-01B**	6000ZZ	4 550
						WBK15SF-01B*1	6902ZZ	4 350
WBK12-01C	Clean environment	4 700	2 443	57	1.2	**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.

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

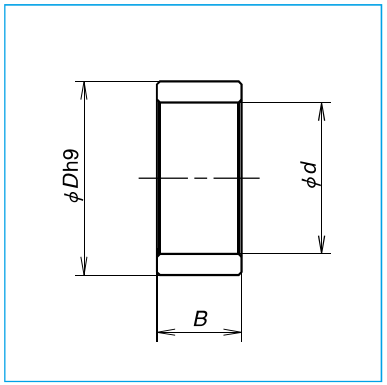
Reference No.	Applicable ball screw	Locknut tightening torque (reference) [N·cm]	Set screw tightening torque (reference) [N·cm]
WBK04R-11	RMA0601	100	38 (M2.5)
WBK06R-11	RMA0801 RMA0801.5 RMA0802	190	69 (M3)

Notes:

1. Oscillate bearings slowly so that they fall into place in which run-out of mounting surface is minimal, and then tighten locknut.
2. Support kit is on provisional shaft (bolt) during shipping.
3. 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.

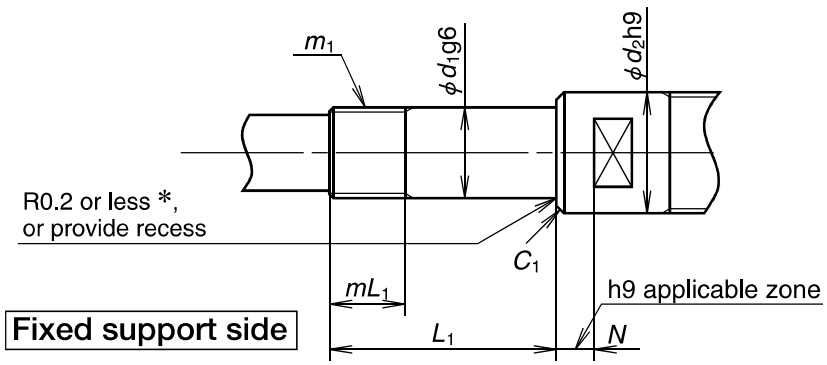


Units: mm

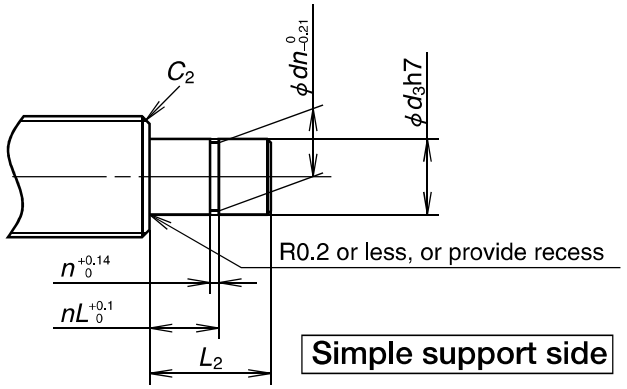
Reference No.	Internal diameter, *d*	Outside diameter, *D*	Width *B*	Mass (g)	Applicable support unit
WBK06K	6	9.5	5.0	2	WBK06-＊＊
WBK08K	8	11.5	5.5	2	WBK08-＊＊
WBK10K	10	14.5	5.5	4	WBK10-＊＊
WBK12K	12	15.0	5.6	3	WBK12-＊＊
WBK15K	15	19.5	10.0	10	WBK15-＊＊
WBK17K	17	24.4	7.0	13	WBK17-＊＊
WBK20K	20	25.5	11.0	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

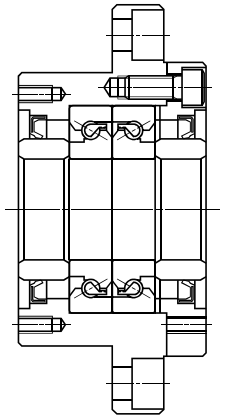
Reference No.	Fixed support side						
	Bearing journal		Locknut thread		Sealing part		Chamfer
	d_1	L_1	m_1	mL_1	d_2	N	C_1
WBK06-＊＊	6	22.5	M6×0.75	7	9.5	3.5	0.2
WBK08-＊＊	8	27	M8×1	9	11.5	4	0.2
WBK10-＊＊	10	30	M10×1	10	14	6	0.2
WBK12-＊＊	12	30	M12×1	10	15	6	0.2
WBK15-＊＊	15	40	M15×1	15	19.5	5	0.3
WBK17-＊＊	17	46	M17×1	17	24	7	0.3
WBK20-＊＊	20	53	M20×1	16	25	10	0.3
WBK25-＊＊	25	62	M25×1.5	20	32	14	0.5
WBK04R-11	4	15	M4×0.5	7.5	—	—	0.3
WBK06R-11	6	17	M6×0.75	7.5	—	—	0.3

Units: mm

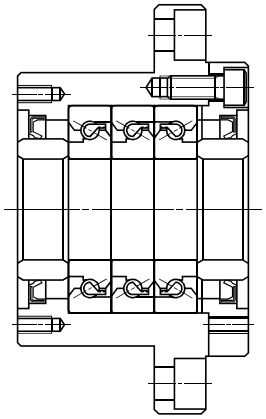
Reference No.	Simple support side					
	Bearing journal		Snap ring groove			Chamfer
	d_3	L_2	n	dn	nL	C_2
————	—	—	—	—	—	—
WBK08S-＊＊	6	9	0.8	5.7	6.8	0.2
WBK10S-＊＊	8	10	0.9	7.6	7.9	0.2
WBK12S-＊＊	10	22	1.15	9.6	9.15	0.5
WBK15S-＊＊	15	25	1.15	14.3	10.15	0.5
WBK17S-＊＊	17	16	1.15	16.2	13.15	0.5
WBK20S-＊＊	20	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

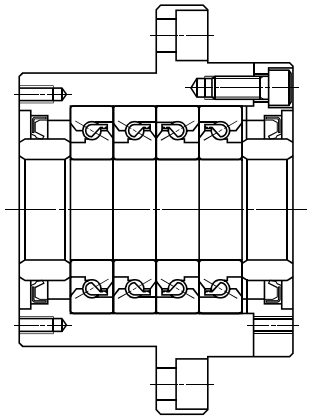
Support units for high-speed and heavy-load machine tools use the ball screw support bearings NSKHPS™ BSBD series. This series has very suitable functions and structure as a ball screw support bearing. There are three bearing combinations as shown below.



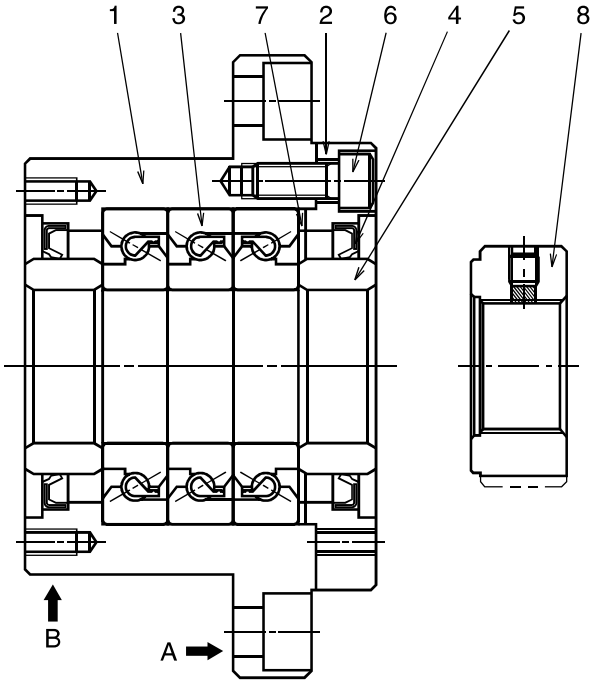
DF combination



DFD combination



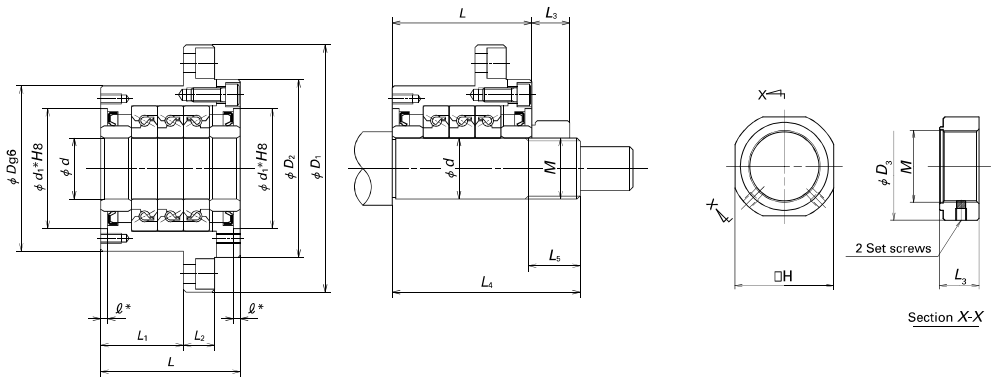
DFF combination



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.) See page B415 as well for ball screw support bearings NSKTAC C series.

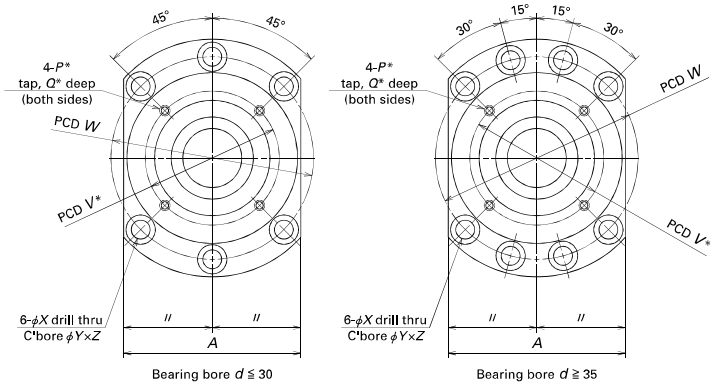


Dimension of bearing seat

Lock nut

Section X-X

Support Unit (For high speed, heavy load machine tools)



Bearing bore $d \leqq 30$

Bearing bore $d \geqq 35$

Unit: mm

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_a [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

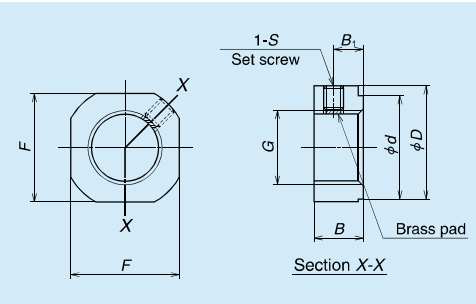
Preload	Axial rigidity	Maximum Starting torque	Lock nut					Bearing seat for unit			Permissible rotational speed	Mass
			Dimension				Screwing torque (reference)					
C_a [N]	[N/μm]	[N · cm]	M	H	D_3	L_3	[N · cm]	d	L_4	L_5	[min^{-1}]	[kg]
1 450	630	14	M17×1.0	32	37	18	4 100	17	81	23	6 900	1.9
1 450	630	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

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.
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.

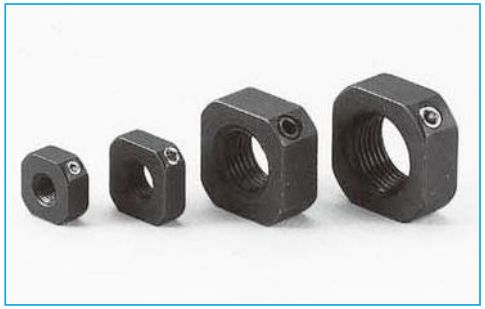
In addition to the support units, NSK has other components for ball screws as shown below.

(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

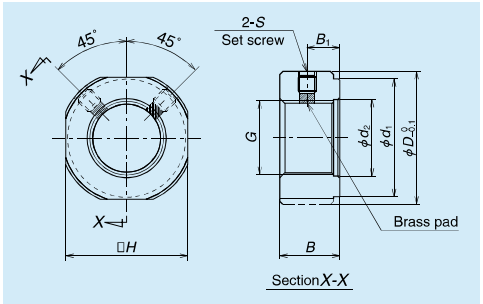
Light load lock nuts

Lock nut reference No.	G	D	F	B	d
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	$D^{0}_{-0.1}$	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



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	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

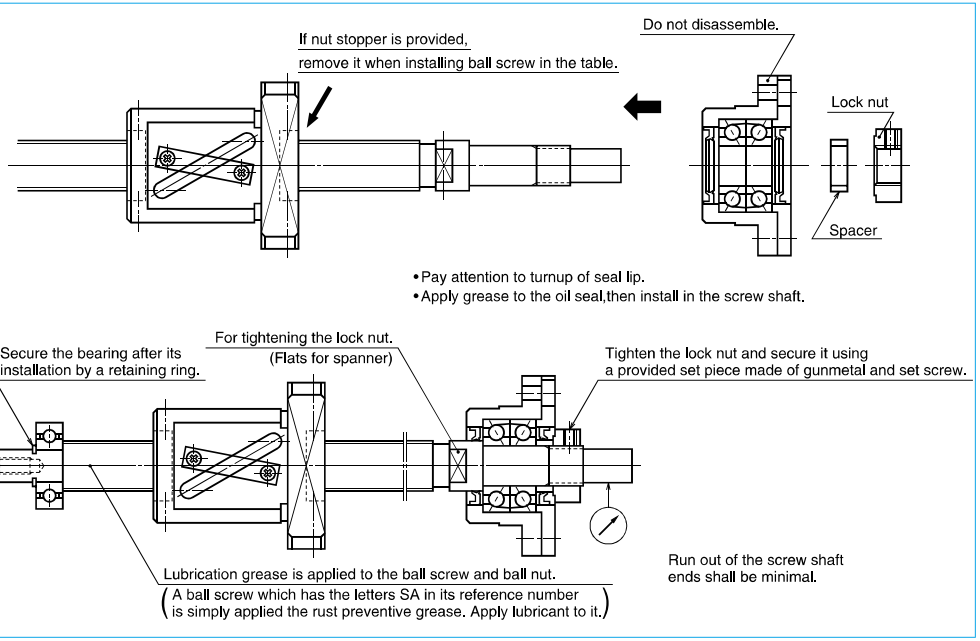
Unit: mm

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

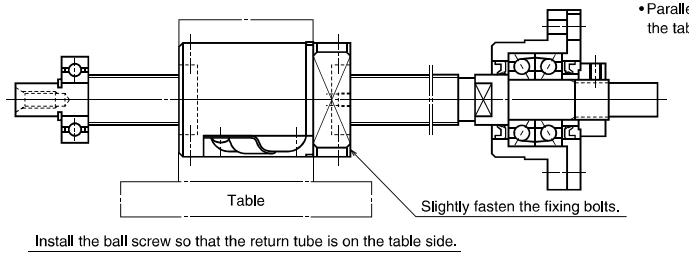
The illustrations below show typical installation procedures for a standard ball screw and a support unit.

1) Assembly of support unit



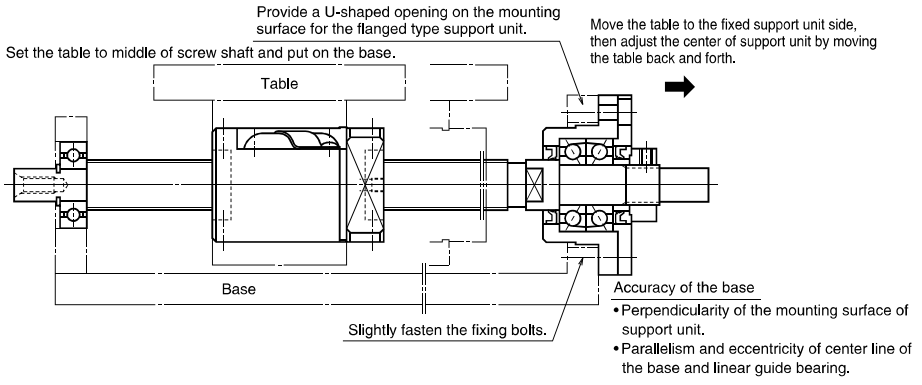
2) Installation of ball nut to the table

Installation example: Turn the table upside down, and install the ball screw.

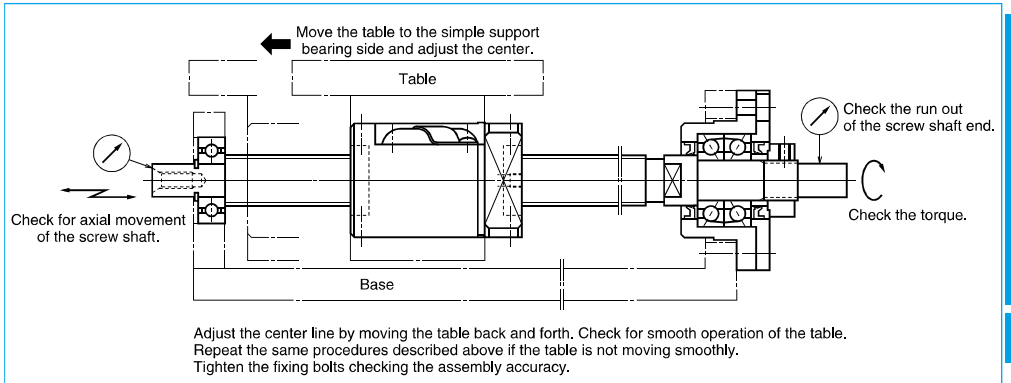


Accuracy of table
- Perpendicularity of nut housing
- Parallelism and center height deviation between the table center and the guide way bearings.

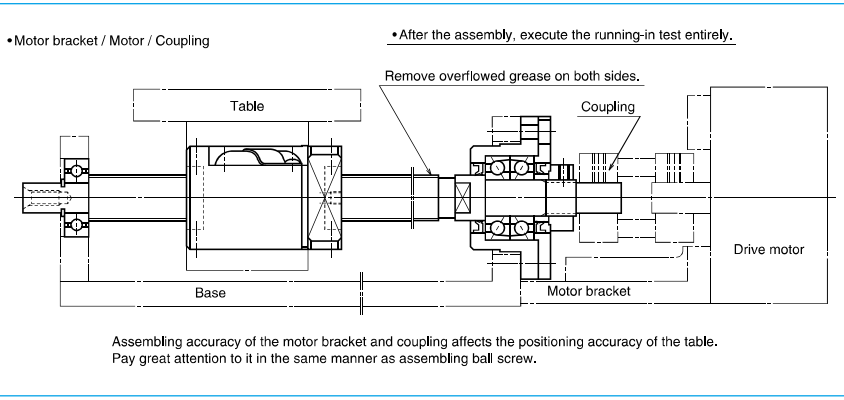
3) Base and the support unit installation on the fixed support side



4) Base and bearing installation on simple support side, and confirming assembling accuracy.

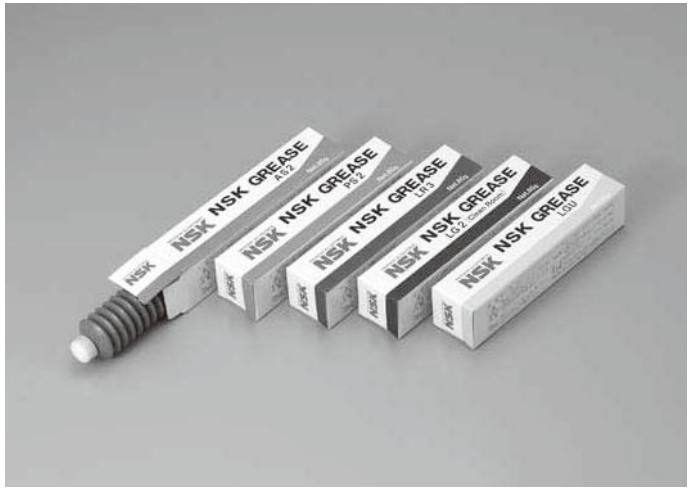


5) Assembly completed.



(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.



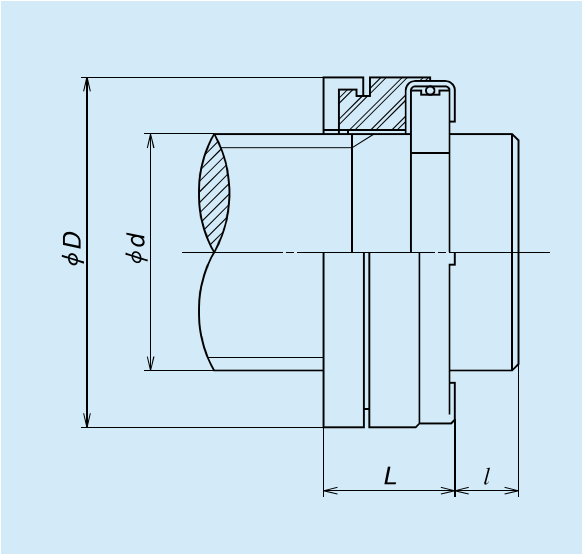
NSK greases

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)

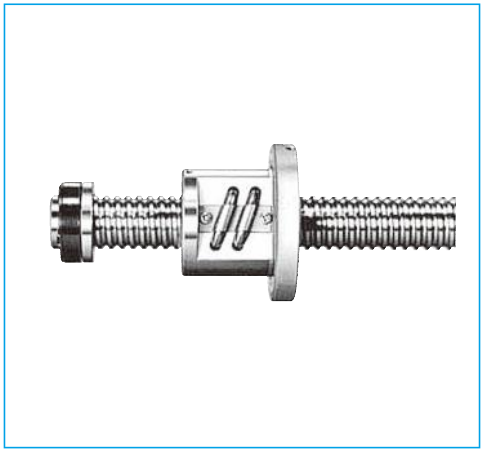
A travel stopper is installed in some cases to prevent the ball nut from overrunning to the end of ball thread due to a malfunction of the safety system of the equipment or by a human error. NSK has several series of shock-absorbing travel stoppers. The travel stopper is not sold as a single item since 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.



Unit: mm

Stopper No.	Applicable shaft dia. *d*	Outer dia. *D*	Length *L*	Shaft end width (Min.) *l*
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) Ball screw support bearings NSKHPS™ NSKTAC C series

1) Features

This is highly rigid and accurate ball screw support bearing often used for the machine tools driving mechanism.

(a) High axial rigidity

High-rigidity achieved by higher contact angle at 60 degrees and an increased number of smaller-diameter balls.

(b) Small friction torque

Friction torque is far less than that of tapered or cylindrical roller bearing. This contributes to accurate rotation by a smaller driving power.

(c) Pre-adjusted axial play

Combination bearings are already adjusted to a suitable preload. Universal combination bearing (SU) furnishes certain preload for all combinations (DB, DF, and other).

(d) Simple mounting structure

A duplex combination of bearings can receive axial and radial loads. Therefore, the installation structure is simpler than when both a thrust bearing and a radial bearing are used.

(e) Easy handling

Inner and outer rings are inseparable, and are easy to handle.

(f) Superb polyamide resin retainer

Uses polyamide resin retainer which is superb to friction and furnishes high precision rotations.

High load capacity ball screw support thrust angular contact ball bearing suitable for ball screw support for high-load drive and large machine tools is also available. See CAT. No. 3238 “NSK Ball Screws for High-Load Drive”.

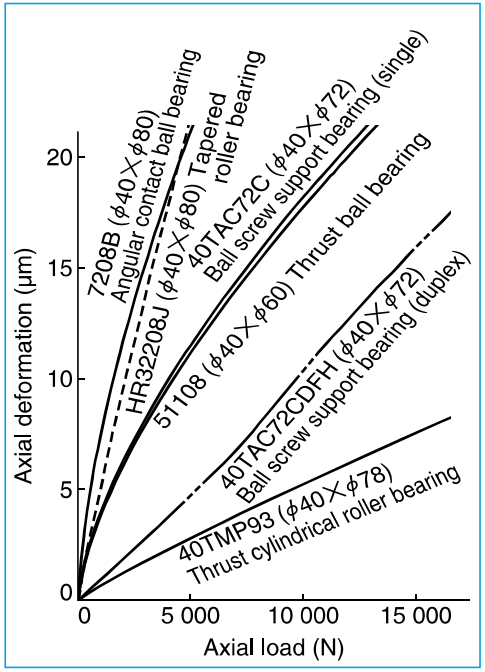


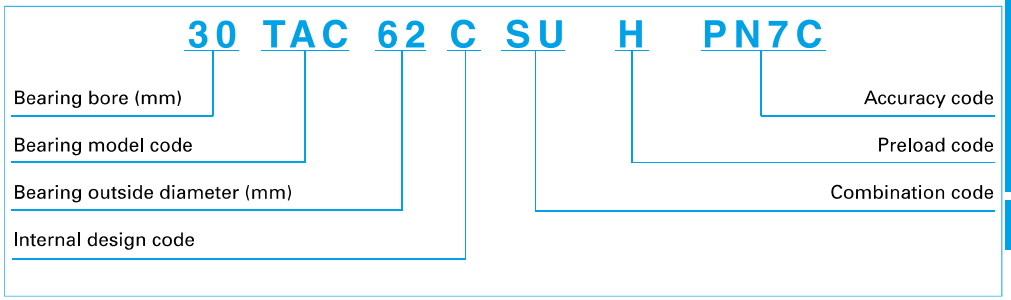
Fig. 1 Axial rigidity of various bearings

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.

2) Composition of reference number



Note: As "30 TAC 62 C," any part of the first half of the reference number is referred to as "nominal size" in this catalog.

3) Combinations of bearings

Generally, a set uses more than two pieces (referred to as 'two rows') of bearings and, thus the preload is applied.
There are two types of combination:

● **Combined bearings**

Bearings are adjusted as a single combined set. Since the bearing alignment is pre-set, there is no interchangeability between the bearing set.

● **Universal combination bearing (SU)**

Single bearings are manufactured under strict control of component accuracy so that they can be universally assembled as a combination of ball screw support bearing set.

(a) Combined bearings

- **Fig. 2** shows examples of combinations. There is "V" mark on the outside surface of the bearing to avoid misarrangement. A complete letter "V" should be formed when all bearings align correctly to form a set.
- DF combination which easily absorbs misalignment with the ball screw nut is used in general.

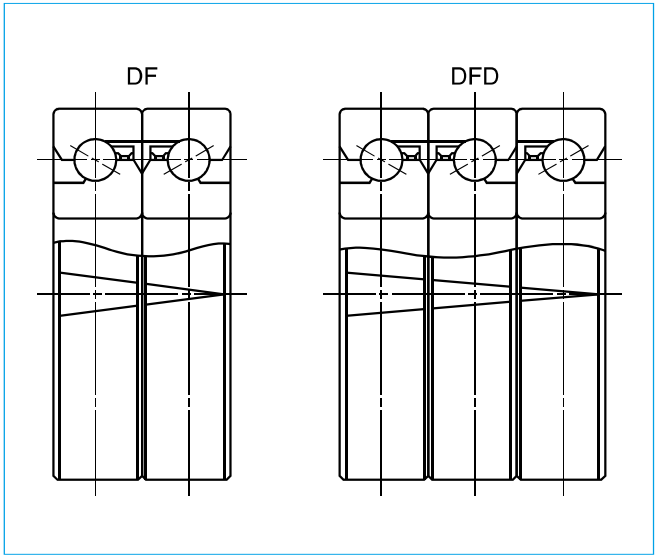


Fig. 2 Examples of combination and "V" mark

(b) Universal combination bearing (SU)

- Unlike the above case, the marks on the outside surface of bearings do not form a letter "V." The tip of the "V" on each bearing simply indicates the direction to which axial load can be applied.

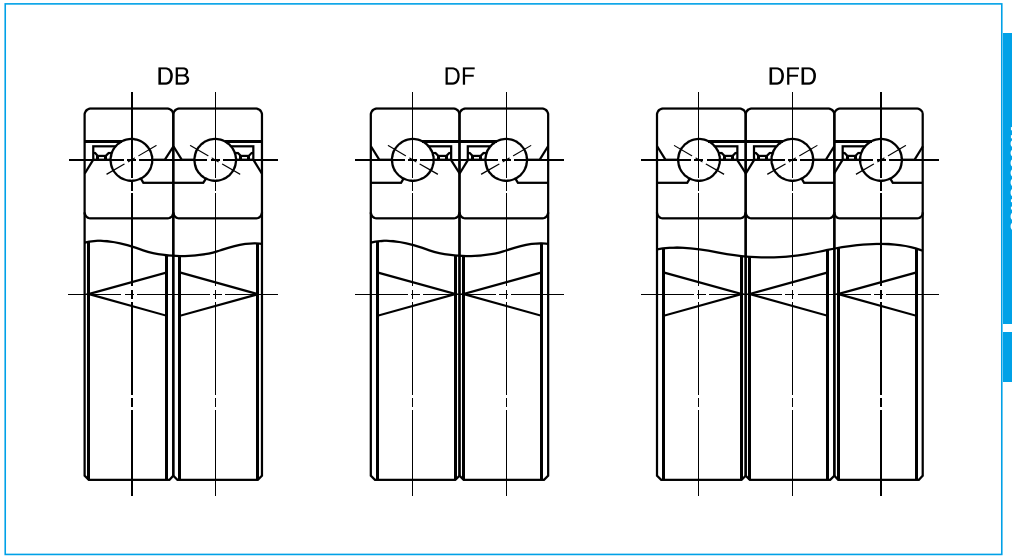


Fig. 3 Example of universal combination (SU) and "V" mark

4) Preload, rigidity, starting torque

Table 3 shows preload, rigidity (spring constant), and starting torque with grease lubrication. (Oil lubrication: Value of starting torque in the table x 1.4)
Please contact NSK for combinations other than those in the table.

5) Accuracy

(a) Accuracy grades
NSK standard PN7C, equivalent to JIS class 4 for radial ball bearings.

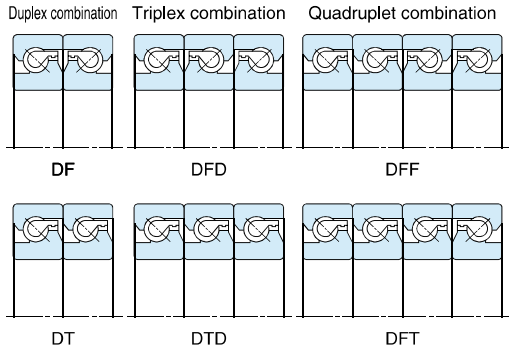
(b) Fitting
Recommended values for dimensional tolerances for shaft and housing bore are shown in **Table 5.**

6) 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.

$$L_h = \frac{10^6}{60n}\left(\frac{C_a}{P}\right)^3$$

Where, L_h: Basic rating life (h)
C_a: Basic dynamic load rating (N)
P : Dynamic equivalent load (N)
n : Rotational speed (min^{-1})



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
e = 2.17		One row	Two rows	One row	Two rows	Three rows	One row	Two rows	Three rows
$F_a/F_r \leqq e$	X	1.9	–	1.43	2.33	–	1.17	1.9	2.53
	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

Table 3 Preload, rigidity, and starting torque

Reference No.	Preload code	Duplex combination DF			Triplex combination DFD			Quadruplet combination DFF		
		Preload (N)	Axial rigidity (N/μm)	Starting torque (N · m)	Preload (N)	Axial rigidity (N/μm)	Starting torque (N · m)	Preload (N)	Axial rigidity (N/μm)	Starting torque (N · m)
15TAC47C	H	1 450	630	0.09	1 970	930	0.12	2 900	1 250	0.17
17TAC47C	H	1 450	630	0.09	1 970	930	0.12	2 900	1 250	0.17
20TAC47C	H	1 450	630	0.09	1 970	930	0.12	2 900	1 250	0.17
25TAC62C	H	2 280	850	0.15	3 100	1 250	0.20	4 560	1 690	0.30
30TAC62C	H	2 400	890	0.16	3 260	1 320	0.21	4 790	1 780	0.31
35TAC72C	H	2 750	1 030	0.18	3 740	1 510	0.24	5 490	2 050	0.36
40TAC72C	H	2 860	1 080	0.19	3 900	1 590	0.25	5 730	2 140	0.37
40TAC90C	H	3 450	1 150	0.29	4 700	1 700	0.40	6 900	2 300	0.59
45TAC75C	H	3 100	1 170	0.20	4 210	1 730	0.27	6 190	2 330	0.40
45TAC100C	H	4 440	1 340	0.40	6 050	1 990	0.54	8 890	2 670	0.80
50TAC100C	H	4 650	1 410	0.42	6 320	2 080	0.56	9 290	2 800	0.83
55TAC100C	H	4 650	1 410	0.42	6 320	2 080	0.56	9 290	2 800	0.83
55TAC120C	H	5 450	1 660	0.49	7 420	2 450	0.66	10 900	3 300	0.97
60TAC120C	H	5 450	1 660	0.49	7 420	2 450	0.66	10 900	3 300	0.97

Table 4 Tolerance: Ball screw support bearings NSKTAC C series

Unit: μm

Nominal bore or outside diameter (mm)		Single plane mean bore dia. deviation Δdmp		Tolerance of bore Δds		Single plane mean outside dia. deviation ΔDmp		Tolerance of outside diameter ΔDs		Tolerance of inner ring width ΔBs		Axial run out of inner or outer ring Sia or Sea
over	or less	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	Maximum
10	18	0	–4	0	–4	–	–	–	–	0	–120	2.5
18	30	0	–5	0	–5	–	–	–	–	0	–120	2.5
30	50	0	–6	0	–6	0	–6	0	–6	0	–120	2.5
50	80	0	–7	0	–7	0	–7	0	–7	0	–150	2.5
80	120	0	–8	0	–8	0	–8	0	–8	0	–200	2.5

Note: The tolerance of the outer ring width is the same as that of the inner ring width of the same bearing.

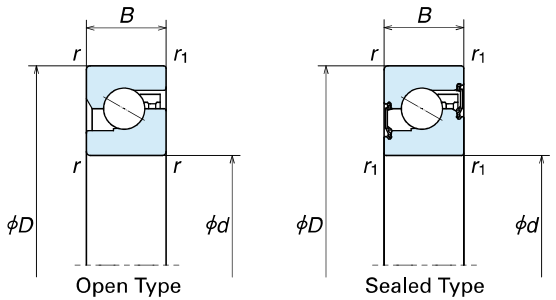
Table 5 Tolerance of shaft bearing seat and housing bore

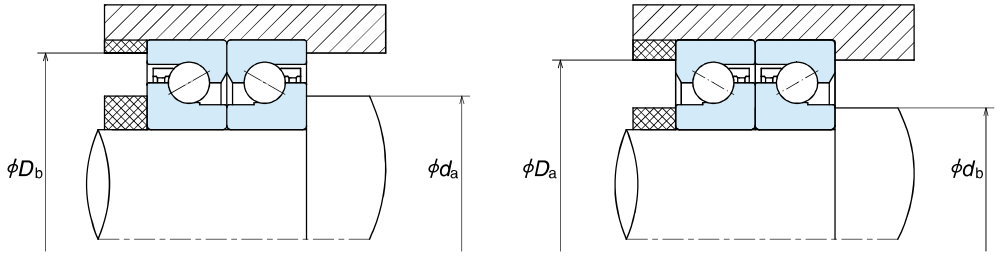
Unit: μm

Size of shaft or housing bore (mm)		Tolerance of shaft bearing seat h5		Tolerance of housing hole H6	
over	or less	upper	lower	upper	lower
10	18	0	–8	–	–
18	30	0	–9	–	–
30	50	0	–11	16	0
50	80	0	–13	19	0
80	120	0	–15	22	0

TACC

Bore 15 to 60 mm





Contact seal	Non-contact seal	Boundary dimensions (mm) d	D	B	r Min.	r1 Min.	Dimensions (mm) Db Max.	da Min.	Da Max.	db Min.	Permissible rotational speed (min-1) Grease lubrication	Oil lubrication	Bearing No.
*	*	15	47	15	1	0.6	42	19.5	41	19.5	6 900	9 200	**15TAC47C**
*	*	17	47	15	1	0.6	42	23	41	23	6 900	9 200	**17TAC47C**
*	*	20	47	15	1	0.6	42	25	41	25	6 900	9 200	**20TAC47C**
*	*	25	62	15	1	0.6	57	31	56	31	5 200	6 900	**25TAC62C**
*		30	62	15	1	0.6	57	36	56	36	4 900	6 400	**30TAC62C**
*		35	72	15	1	0.6	67	42	66	42	4 100	5 800	**35TAC72C**
*		40	72	15	1	0.6	67	47	66	47	4 100	5 500	**40TAC72C**
*		40	90	20	1	0.6	85	48	84	48	3 500	4 600	**40TAC90C**
		45	75	15	1	0.6	68	54	67	54	3 700	4 900	**45TAC75C**
*		45	100	20	1	0.6	93	55	92	55	3 000	4 100	**45TAC100C**
*		50	100	20	1	0.6	92	60	91	60	3 000	3 900	**50TAC100C**
*		55	100	20	1	0.6	92	63	91	63	3 000	3 900	**55TAC100C**
		55	120	20	1	0.6	112	63	111	63	2 500	3 500	**55TAC120C**
		60	120	20	1	0.6	112	70	111	70	2 500	3 500	**60TAC120C**

Basic dynamic load rating Ca One row sustaining load DF (N)	Two rows sustaining load DT, DFD, DFF (N)	Three row sustaining load DTD, DFT (N)	Limiting axial load One row sustaining load DF (N)	Two rows sustaining load DT, DFD, DFF (N)	Three row sustaining load DTD, DFT (N)	Mass (kg) (Reference)
23 000	37 500	49 500	26 600	53 000	79 500	0.146
23 000	37 500	49 500	26 600	53 000	79 500	0.140
23 000	37 500	49 500	26 600	53 000	79 500	0.135
29 900	48 500	64 500	40 500	81 500	122 000	0.252
30 500	50 000	66 000	43 000	86 000	129 000	0.224
32 500	53 000	70 500	50 000	100 000	150 000	0.310
33 500	54 000	72 000	52 000	10 400	157 000	0.275
62 000	101 000	134 000	89 500	179 000	269 000	0.674
34 500	56 000	74 500	57 000	114 000	170 000	0.270
64 500	105 000	140 000	99 000	198 000	298 000	0.842
66 000	107 000	142 000	104 000	208 000	310 000	0.778
66 000	107 000	142 000	104 000	208 000	310 000	0.714
70 500	115 000	153 000	123 000	246 000	370 000	1.23
70 500	115 000	153 000	123 000	246 000	370 000	1.16

Note: 1. * Asterisk indicates bearing with contact seal or non-contact seal.
2. Permissible rotation speed is the value with H preload applied. The value is not influenced by bearing layout.
3. Numerical value indicates starting torque with grease lubrication. In the case of oil lubrication, the value in the above table should be multiplied by 1.4.
4. Permissible axial load is 0.7 times of limiting axial load.
5. The installation dimensions above are the recommended values for general machine tools. Contact NSK if the unit is used under heavy load conditions.

(7) Ball Screw Support Bearings

NSKHPS™ BSBD series

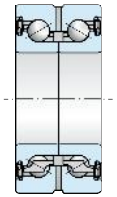
The BSBD series are ball screw support bearings unit that can accurately and quickly position a work piece or a main spindle unit.

Features

The bearings are double row, angular contact ball bearings, with a 60° contact angle and a single outer ring. These have the same specs as TAC bearings, the best specs for ball screw support bearing for machine tools. High-performance grease and contact rubber seal are included as standard.

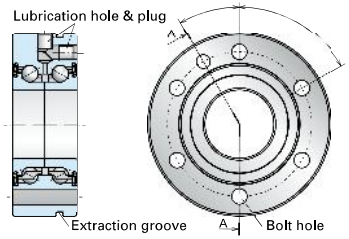
● **BSN series**

A double row, angular contact thrust ball bearing in a back-to-back (DB) arrangement with a single outer ring. Already filled with high-performance grease, operation is easy. Lubrication holes allow for relubrication as required. The contact type seal has excellent seal performance, while minimizing effects on friction loss and heat generation.



● **BSF series**

The BSF series bearings have outer ring bolt holes in addition to the BSN series bearings. Direct mounting on housing side is easy. A lubrication hole on each OD surface and on the side of the bearings, allows relubrication as required. When the holes are not used, plugs prevent foreign matter from entering. In addition, an extraction groove on OD surface of outer ring enhances bearing removal.



Note: Bearing with seal and plug are included. Mounting bolts are not included.

BSN series Single product

Bearing Numbers	Boundary Dimensions (mm) d	D	B	r (min)	r1 (min)	Dimensions (mm) φda (min)	φDb (max)	Contact Angle (°)	Basic Load Rating (kN) Ca (Dynamic)	Coa (Static)	Limiting[1] Axial Load (kN)	Preload (N)	Axial Rigidity (N/μm)	Mass (kg)	Allowable rotating speed (min⁻¹) Greased	Starting torque (N·m) H[2]	Recommended nut tightening force (N)
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	4 026
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	4 056
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	4 432
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	7 611
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	8 115
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	8 650
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	11 070
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	13 514
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	14 105
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	18 704
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	15 392
BSN50110	50	110	54	0.6	0.6	57	98	60	116	219	149	7 435	1 400	2.46	2 500	1.06	19 121
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	20 848

Notes: 1. Permissible axial load is 0.7 times of limiting axial load.
2. Starting torque indicates torque due to the preload of the bearing. It does not include seal torque.

BSBD Series: Nomenclature

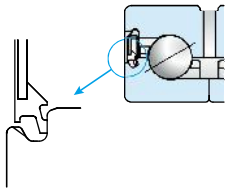
Example: BS F 30 80 DDU H P2B DT

- BS: Series (Ball Screw Support)
- F: Flange type / N: No Flange type
- 30: Bore
- 80: Outer diameter
- DDU: Seal type
- H: Preload
- P2B: Accuracy
- DT: Paired bearing

Note: Accuracy P2B: Special class for this series. It indicates the following. Rotation accuracy: ISO class 2 Other: Special

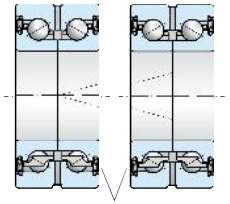
● **Seal**

Contact rubber seals are on both sides. Triple lip structure achieves high grease sealing and dust-proof performance.

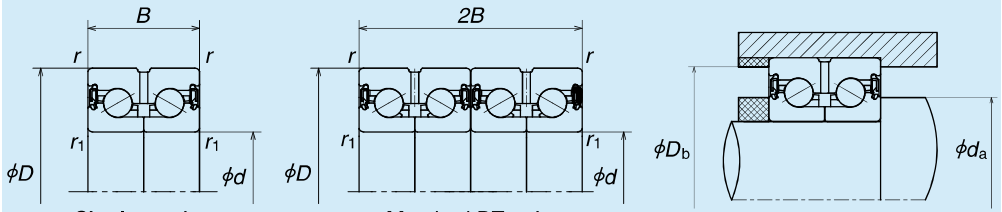


● **Matched DT pairs**

A paired product for large external load or when high rigidity and long life are required. Can be used in four rows with no effects on preload individual bearings as distance between mating surfaces has been adjusted.



Distance between mating surfaces has been adjusted.

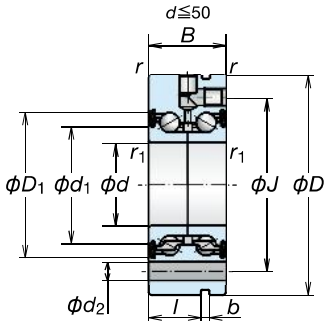


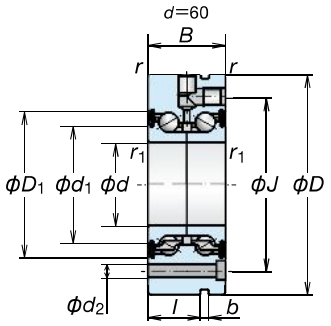
BSN series matched DT pairs

Bearing Numbers	Boundary Dimensions (mm) d	D	2B	r (min)	r1 (min)	Dimensions (mm) φda (min)	φDb (max)	Contact Angle (°)	Basic Load Rating (kN) Ca (Dynamic)	Coa (Static)	Limiting[1] Axial Load (kN)	Axial Rigidity (N/μm)	Mass (kg)	Allowable rotating speed (min⁻¹) Greased	Starting torque (N·m) H[2]	Recommended nut tightening force (N)
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	4 432
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	7 611
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	8 115
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	8 650
BSN3072-DT	30	72	76	0.6	0.6	35	64	60	98.0	188	133	1 800	1.47	3 900	1.17	11 070
BSN3572-DT	35	72	68	0.6	0.6	40	62	60	68.0	155	104	1 630	1.32	3 800	0.41	13 514
BSN4075-DT	40	75	68	0.6	0.6	46	67	60	72.0	176	117	1 850	1.30	3 500	0.49	14 105
BSN4090-DT	40	90	92	0.6	0.6	46	80	60	128	269	182	2 300	2.76	3 100	2.03	18 704
BSN5090-DT	50	90	68	0.6	0.6	56	82	60	78.0	220	143	2 330	1.86	2 800	0.66	15 392
BSN50110-DT	50	110	108	0.6	0.6	57	98	60	188	440	299	2 690	4.92	2 500	2.11	19 121

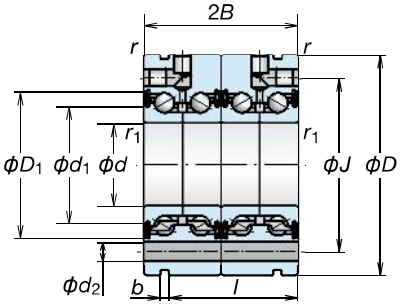
3. Inner rings are likely to separate because of their structure. To remove bearing from shaft, grasp an inner ring to pull it out.
4. The installation dimensions above are the recommended values for general machine tools. Contact NSK if the unit is used under heavy load conditions.

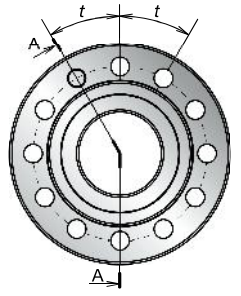
BSBD Series



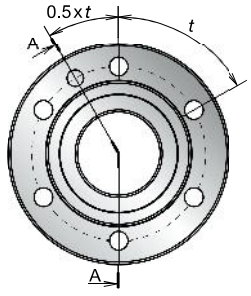


(In the case of BSF60145)





Design Ⅰ



Design Ⅱ

BSF series Single product

Bearing Numbers	Boundary Dimensions (mm)					Basic Load Rating (kN)		Limiting[1] Axial Load (kN)	Axial Rigidity (N/μm)	Mass (kg)	Allowable rotating speed (min⁻¹)
	d	D	B	r (min)	r1 (min)	Ca (Dynamic)	Coa (Static)				Grease Lubrication
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

Reference Dimensions (mm)							Design	Fixing Screws		Preload (N)	Starting torque[2] (N·m)	Recommended nut tightening force (N)
d	D1	J	d2	l	b	t		Size	Quantity		H	
23.7	32.7	42	6.8	17	3	3 x 120°	Ⅱ	M6	3	720	0.038	4 026
26.7	35.7	46	6.8	17	3	3 x 120°	Ⅱ	M6	3	675	0.034	4 056
28.1	37.7	48	6.8	17	3	3 x 120°	Ⅱ	M6	3	890	0.05	4 432
32.6	43	53	6.8	19	3	4 x 90°	Ⅱ	M6	4	1 885	0.13	7 611
37.6	48	58	6.8	19	3	4 x 90°	Ⅱ	M6	4	2 245	0.16	8 115
42.6	53	63	6.8	19	3	6 x 60°	Ⅱ	M6	6	2 625	0.19	8 650
49.1	64.4	80	8.8	30	3	8 x 45°	Ⅱ	M8	8	4 855	0.59	11 070
53.1	62.2	75	8.8	25	3	4 x 90°	Ⅱ	M8	4	2 630	0.21	13 514
55.1	67.2	80	8.8	25	3	4 x 90°	Ⅱ	M8	4	3 065	0.24	14 105
63.1	80.1	94	8.8	36	3	12 x 30°	Ⅱ	M8	12	7 220	1.02	18 704
70.1	82.2	94	8.8	25	3	6 x 60°	Ⅱ	M8	6	4 020	0.33	15 392
78.1	97.5	113	11	45	3	12 x 30°	Ⅱ	M10	12	7 435	1.06	19 121
83.1	99.3	120	8.8	35	3	8 x 45°	Ⅱ	M8	8	4 780	0.50	20 848

BSF series matched pairs

Bearing Numbers	Boundary Dimensions (mm)					Basic Load Rating (kN)		Limiting[1] Axial Load (kN)	Axial Rigidity (N/μm)	Mass (kg)	Allowable rotating speed (min⁻¹)
	d	D	2B	r (min)	r1 (min)	Ca (Dynamic)	Coa (Static)				Grease Lubrication
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

Reference Dimensions (mm)							Design	Fixing Screws		Starting torque[2] (N·m)	Recommended nut tightening force (N)
d	D1	J	d2	l	b	t		Size	Quantity	H	
28.1	37.7	48	6.8	42	3	6 x 60°	Ⅰ	M6	5	0.10	4 432
32.6	43	53	6.8	47	3	8 x 45°	Ⅰ	M6	7	0.26	7 611
37.6	48	58	6.8	47	3	8 x 45°	Ⅰ	M6	7	0.32	8 115
42.6	53	63	6.8	47	3	12 x 30°	Ⅰ	M6	11	0.37	8 650
49.1	64.4	80	8.8	68	3	8 x 45°	Ⅱ	M8	8	1.17	11 070
53.1	62.2	75	8.8	59	3	8 x 45°	Ⅰ	M8	7	0.41	13 514
55.1	67.2	80	8.8	59	3	8 x 45°	Ⅰ	M8	7	0.49	14 105
63.1	80.1	94	8.8	82	3	12 x 30°	Ⅱ	M8	12	2.03	18 704
70.1	82.2	94	8.8	59	3	12 x 30°	Ⅰ	M8	11	0.66	15 392
78.1	97.5	113	11	99	3	12 x 30°	Ⅱ	M10	12	2.11	19 121

Notes: 1. Permissible axial load is 0.7 times of limiting axial load.
This is the limiting load of the bearing. It dose not include strength of the mounting bolt.
2. Starting torque indicates torque due to the preload of the bearing. It does not include seal torque.
3. Inner rings are likely to separate because of their structure. To remove bearing from shaft, grasp an inner ring to pull it out.

(8) Permissible axial loads

NSK has defined the static limit axial load as the lower of the values based on the following two situations:

1. Ride-over limit axial load (Fig. 4)
Limit load which would cause contact ellipse between ball and raceway groove to go over shoulder of raceway groove.

2. Contact pressure limit axial load (Fig. 5)
Load which contact stress at the center of contact area between ball and raceway groove is high and would cause impression specified at basic static load rating.

NSK determines static permissible axial load taking safety factor of limit axial load into consideration based on its many years of experience so that good bearing performance can be kept.

In the calculation of basic static axial load rating C_{oa}, shoulder height of raceway groove is not taken into account. So, the value may exceed the ride-over load.
Since applicable load is actually under the value of C_{oa}, C_{oa} makes no sense in this case (Fig. 6). Therefore, especially for thrust angular contact ball bearing where axial load is assumed to be used under severe conditions, limit axial loads not C_{oa} are listed in each dimension table as needed.

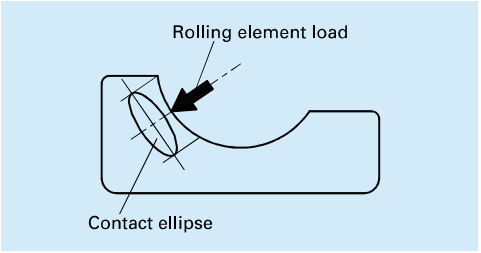


Fig. 4 Ride-over limit axial load

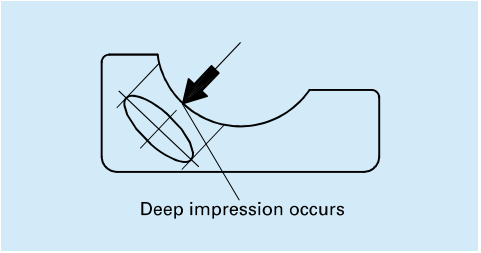


Fig. 5 Contact pressure limit axial load

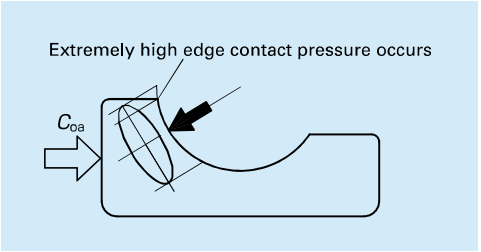


Fig. 6 C_{oa} and limit axial load

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 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.

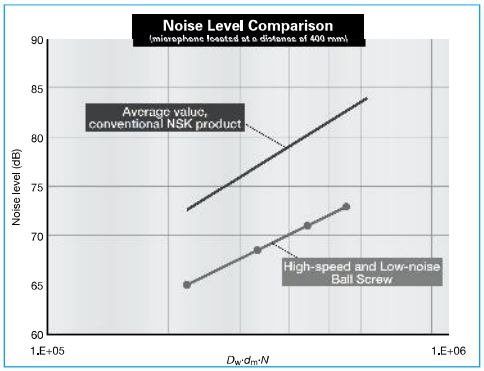


Fig. 1 Comparison of noise level

●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 ø25 are equipped with a grease fitting (M5 × 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.

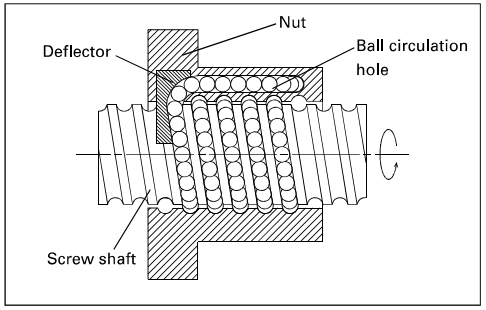


Fig. 2 Structure of end-deflector recirculation system

(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

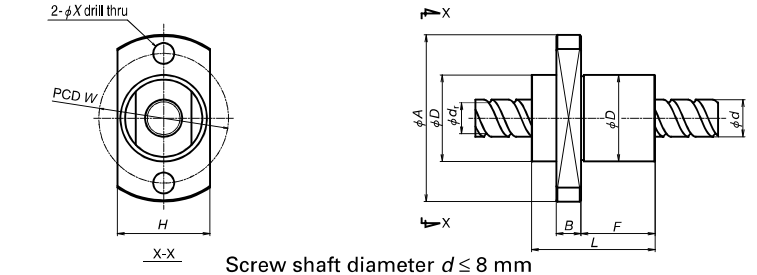
BSS 10 10 - 2E

- BSS: Nut model: BSS
- 10: Screw shaft diameter (mm)
- 10: Lead (mm)
- 2E: Effective turns of balls

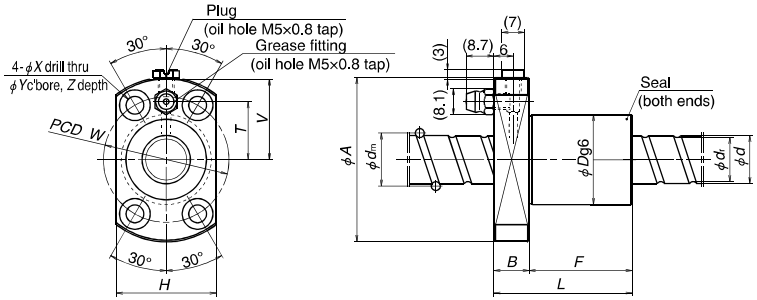
◇Reference number for ball screw

W 10 01 - ** P SS - C5 Z 10

- W: Product code
- 10: Screw shaft diameter (mm)
- 01: Effective threaded length (in the unit of 100 mm)
- **: NSK design serial number
- P: Preload code: No code, non-preload; P, P-preload (page B5)
- SS: End-deflector recirculation system
- C5: Accuracy grade: C0, C1, C2, C3, C5, C7 (Ct7) (page B37 to B42)
- Z: Axial play code: Z, T, S, N (page B20)
- 10: Lead (mm)



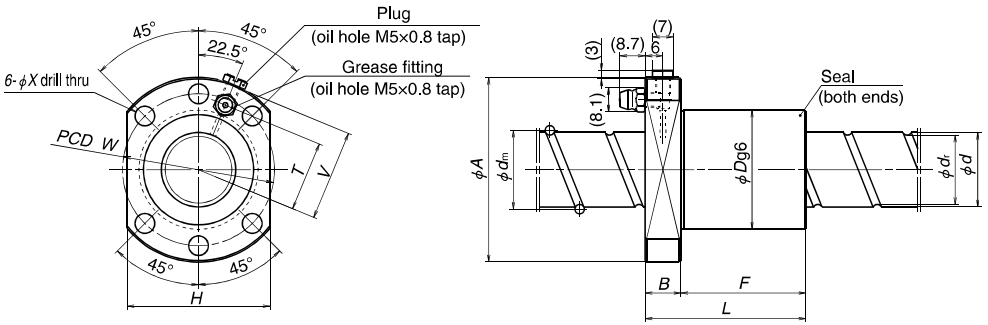
Screw shaft diameter $d \leq 8$ mm



Screw shaft diameter $d \leq 20$ 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) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity K (N/μm)
BSS0608-2E	6	8	1.2	6.2	4.9	2	550	715	24
BSS0608-4E		8				4	1 180	1 760	55
BSS0612-2E		12				2	550	715	22
BSS0612-4E		12				4	1 180	1 760	51
BSS0810-2E	8	10	1.588	8.3	6.6	2	910	1 260	31
BSS0810-4E		10				4	1 950	3 080	72
BSS0815-2E		15				2	910	1 260	29
BSS0815-4E		15				4	1 950	3 080	68
BSS1005-3E	10	5	2.000	10.3	8.2	3	2 930	4 790	126
BSS1010-2E		10				2	1 970	3 010	77
BSS1205-3E	12	5	2.000	12.3	10.2	3	3 200	5 860	146
BSS1210-3E		10				3	3 200	5 860	142
BSS1220-2E		20				2	2 150	3 610	83
BSS1230-2E		30				2	2 150	3 610	75
BSS1505-3E	15	5	2.778	15.5	12.6	3	5 460	10 200	183
BSS1510-3E		10	2.778		12.6	3	5 460	10 200	181
BSS1520-2E		20	3.175		12.2	2	5 070	8 730	127
BSS1530-2E		30	3.175		12.2	2	5 070	8 730	116
BSS2005-3E	20	5	3.175	20.5	17.2	3	8 790	18 500	268
BSS2010-3E		10				3	8 790	18 500	268
BSS2020-2E		20				2	5 900	11 700	167
BSS2030-2E		30				2	5 900	11 700	159
BSS2040-2E		40				2	5 900	11 700	147
BSS2060-2E		60				2	5 900	11 700	128
BSS2505-3E	25	5	3.175	25.5	22.2	3	9 760	23 600	325
BSS2510-4E		10				4	12 800	32 300	437
BSS2520-2E		20				2	6 560	14 600	203
BSS2525-2E		25				2	6 560	14 600	197
BSS2530-2E		30				2	6 560	14 600	194
BSS2550-2E		50				2	6 560	14 600	177

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_a).
For ball screws with shaft diameters less than ø25, the standard Compact FA PSS type can be available.

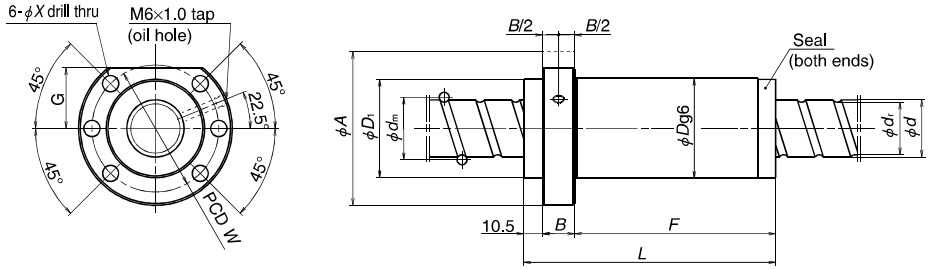


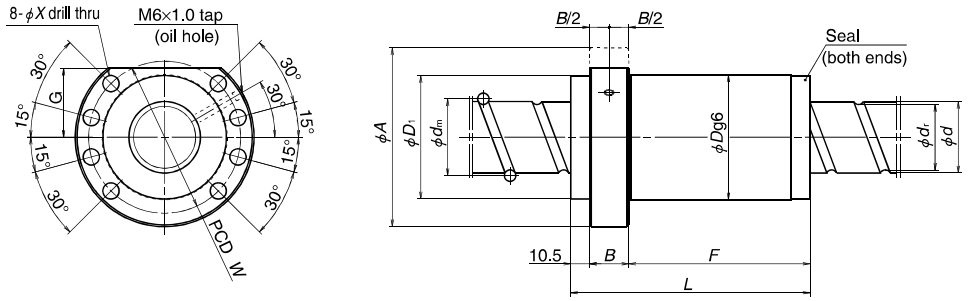
Screw shaft diameter $d = 25$ mm

Unit: mm

Nut entire length L	Nut diameter D	Flange diameter A	Flange width B	Nut length F	Flange dimension H	Flange dimension V	Bolt hole PCD W	Bolt hole dimension X	Bolt hole dimension Y	Bolt hole dimension Z	Oil hole distance T
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	24	44	11	19	27	21.5	34	4.5	8	4.5	14.5
43				32							
50				39							
70				59							
30	28	51	11	19	31	25	39	5.5	9.5	5.5	18
43	28	51		32	31	25	39				18
51	32	55		40	33	27	43				20
71	32	55		60	33	27	43				20
31	36	62	13	18	38	30.5	49	6.6	11	6.5	23.5
45				32							
54				41							
74				61							
92				79							
129				116							
32	40	62	12	20	48	30.5	51	6.6	—	—	23.5
56				44							
54				42							
63				51							
74				62							
114				102							

2) 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) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity K (N/μm)
BSS3205-4E	32	5	3.175	32.5	29.2	4	14 200	41 400	534
BSS3210-6E		10	5.556	33	27.2	6	43 300	111 000	865
BSS3212-5E		12	5.556	33	27.2	5	36 700	90 800	716
BSS3216-5E		16	5.556	33	27.2	5	36 700	90 800	716
BSS3220-5E		20	5.556	33	27.2	5	36 700	90 800	708
BSS3232-2E		32	5.556	33	27.2	2	15 300	32 400	261
BSS3264-2E		64	5.556	33	27.2	2	15 300	32 400	232
BSS3605-3E	36	5	3.175	36.5	33.2	3	11 400	34 100	433
BSS3610-6E		10	6.35	37	30.4	6	55 200	142 000	970
BSS3612-6E		12	6.35	37	30.4	6	55 200	142 000	967
BSS3616-6E		16	6.35	37	30.4	6	55 200	142 000	961
BSS3620-6E		20	6.35	37	30.4	6	55 200	142 000	959
BSS4010-5E	40	10	6.35	41	34.4	5	49 300	130 000	875
BSS4012-5E		12				5	49 300	130 000	873
BSS4016-5E		16				5	49 300	130 000	875
BSS4020-5E		20				5	49 300	130 000	868
BSS4025-4E		25				4	40 100	103 000	686
BSS4030-3E		30				3	30 600	74 000	505
BSS4040-2E		40				2	20 600	46 600	319
BSS4080-2E		80				2	20 600	46 600	286
BSS4510-5E	45	10	6.35	46	39.4	5	51 400	146 000	961
BSS4512-5E		12				5	51 400	146 000	959
BSS4516-5E		16				5	51 400	146 000	955
BSS4520-5E		20				5	51 400	146 000	950
BSS4525-5E		25				5	51 400	146 000	954
BSS4530-4E		30				4	41 800	116 000	752
BSS5010-4E	50	10	6.35	51	44.4	4	44 600	129 000	836
BSS5012-4E		12				4	44 600	129 000	944
BSS5016-4E		16				4	44 600	129 000	832
BSS5020-4E		20				4	44 600	129 000	837
BSS5025-4E		25				4	44 600	129 000	828
BSS5030-4E		30				4	44 600	129 000	821
BSS5050-2E		50				2	22 800	58 300	383
BSS50100-2E		100				2	22 800	58 300	342

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_a).

Screw shaft diameter $d \geq 36$ mm

Unit: mm

Nut entire length L	Nut diameter D	Seal section diameter D_1	Flange diameter A	Flange width B	Nut length F	Notched flange G	Bolt hole PCD W	Bolt hole dimension 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.

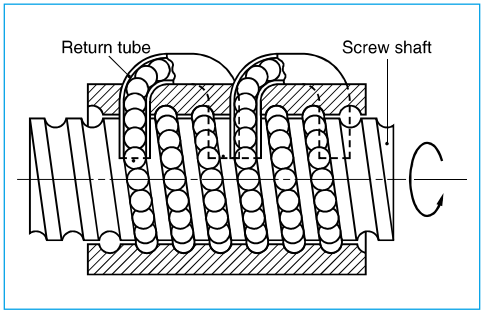


Fig.1 Structure of return tube recirculation system

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

(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.

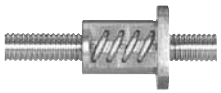
(5) Other specifications

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 diameter (medium-high helix lead), LSFT, LPFT, LDFT Type ball screws are suitable for high-speed operation.

Table 2 Return tube type ball screws product categories

Nut model	Shape	Flange shape	Nut shape	Preload system
SFT PFT		Flanged d=16mm or under Rectangle d=20mm or over Circular I, II	Circle dia.	Non-preload, Slight axial play P-preload (light preload) Spacer ball 1:1
ZFT		Flanged Circular I, II	Circle dia.	Z-preload (medium preload)
DFT		Flanged Circular I, II	Circular	D-preload (medium preload) (heavy preload)
LSFT LPFT		Flanged d=20mm or under Rectangle d=25mm or over Circular II	d=20mm or under Circular d=25mm or over Tube- projecting type	Non-preload, Slight axial play P-preload (light preload) Spacer ball 1:1
LDFT		Flanged Circular II	Circular	D-preload (medium preload) (heavy preload)

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

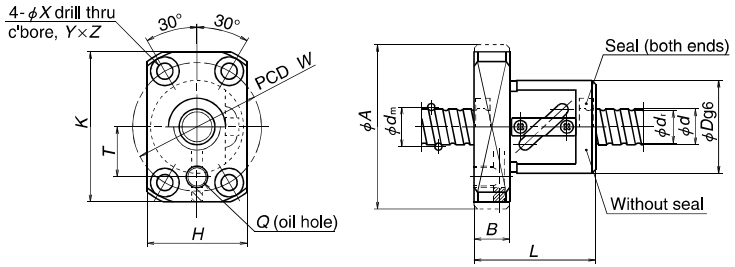
- SFT: Nut model: SFT, PFT, ZFT, DFT / LSFT, LPFT, LDFT
- 14: Screw shaft diameter (mm)
- 05: Lead (mm)
- 2.5: Effective turns of balls (Note)

Note: In case of Z-preload, the number here is twice as large as the effective turns of balls.

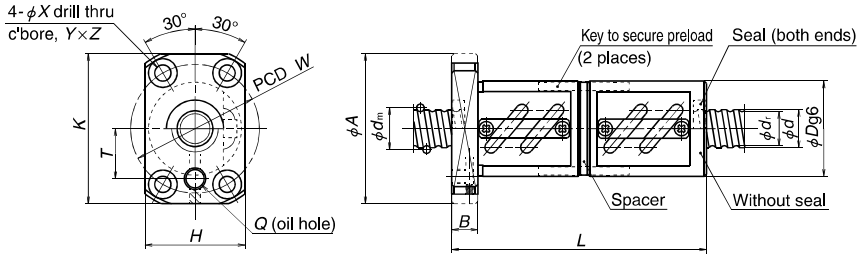
◇ Reference number for ball screw

W 14 01 - ** P - C3 Z 5

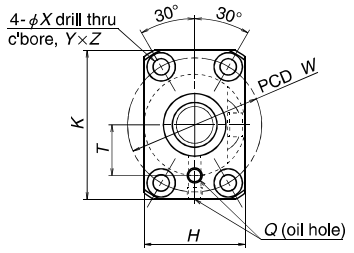
- W: Product code
- 14: Screw shaft diameter (mm)
- 01: Effective threaded length (in the unit of 100 mm)
- **: NSK design serial number
- P: Preload code: No code, non-preload; P, P-preload; Z, Z-preload; D, D-preload (page B5)
- C3: Accuracy grade code: C0, C1, C2, C3, C5, C7 (Ct7) (page B37 to B42)
- Z: Axial play code: Z, T, S, N (page B20)
- 5: Lead (mm)

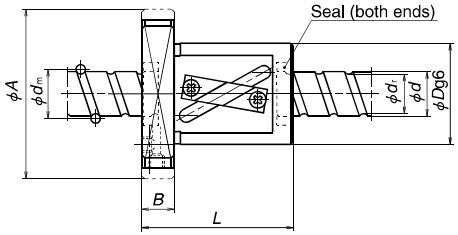


PFT, SFT



DFT





LPFT, LSFT

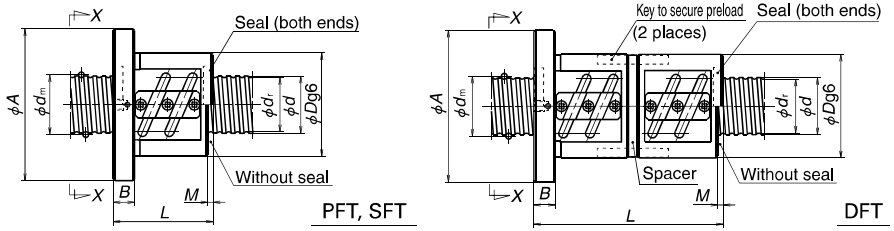
Unit: mm

	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	Basic load rating (N) Static C_{0a}	Axial rigidity K (N/μm)
*	**PFT 1004-2.5**	P	10	4	2.000	10.3	8.2	2.5×1	1 730	2 230	76
	SFT 1004-2.5	Clearance							2 740	4 450	90
	PFT 1204-2.5	P	12	4	2.381	12.3	9.8	2.5×1	2 370	3 160	89
	PFT 1204-3	P						1.5×2	2 770	3 790	106
	SFT 1204-2.5	Clearance						2.5×1	3 760	6 310	106
	SFT 1204-3	Clearance						1.5×2	4 390	7 580	126
*	**PFT 1205-2.5**	P		5	2.381	12.3	9.8	2.5×1	2 370	3 160	89
	PFT 1205-3	P						1.5×2	2 770	3 790	106
	SFT 1205-2.5	Clearance						2.5×1	3 760	6 310	106
	SFT 1205-3	Clearance						1.5×2	4 390	7 580	126
*	**LPFT 1210-2.5**	P		10	2.381	12.5	10.0	2.5×1	2 360	3 240	90
	LSFT 1210-2.5	Clearance							3 750	6 480	110
*	**PFT 1405-2.5**	P	14	5	3.175	14.5	11.2	2.5×1	4 280	5 840	116
	SFT 1405-2.5	Clearance						2.5×1	6 790	11 700	140
	PFT 1405-5	P						2.5×2	7 770	11 700	225
	SFT 1405-5	Clearance						2.5×2	12 300	23 400	274
*	**LPFT 1408-2.5**	P		8	3.175	14.5	11.2	2.5×1	4 280	5 840	120
	LSFT 1408-2.5	Clearance							6 790	11 700	140
*	**LPFT 1510-2.5**	P	15	10	3.175	15.5	12.2	2.5×1	4 450	6 380	127
	LSFT 1510-2.5	Clearance							7 070	12 800	150
	PFT 1604-3	P	16	4	2.381	16.3	13.8	1.5×2	3 170	5 150	135
	SFT 1604-2.5	Clearance						2.5×1	4 300	8 530	134
	DFT 1604-2.5	D						2.5×1	4 300	8 530	263
	PFT 1604-5	P						2.5×2	4 920	8 530	215
	SFT 1604-3	Clearance						1.5×2	5 040	10 300	160
	DFT 1604-3	D						1.5×2	5 040	10 300	315

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.

Ball nut dimensions											
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Rectangle flanged diameter H	Rectangle flanged diameter K	Bolt hole dimension X	Bolt hole dimension Y	Bolt hole dimension Z	Bolt hole PCD W	Oil hole length T	Oil hole Q
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			34							
70	36			36							
50	34			34							
45	34			34							
85	36			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 B37) 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.)



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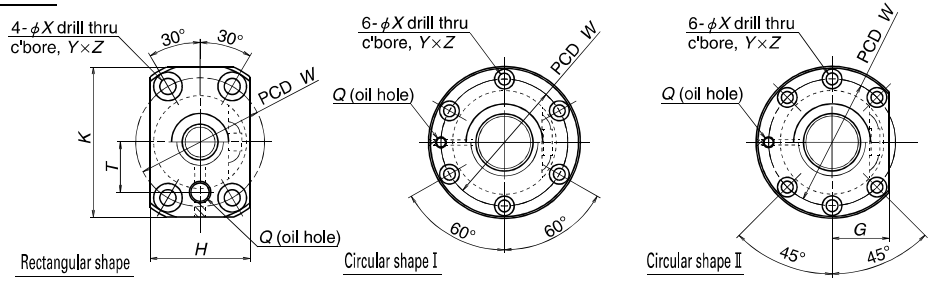
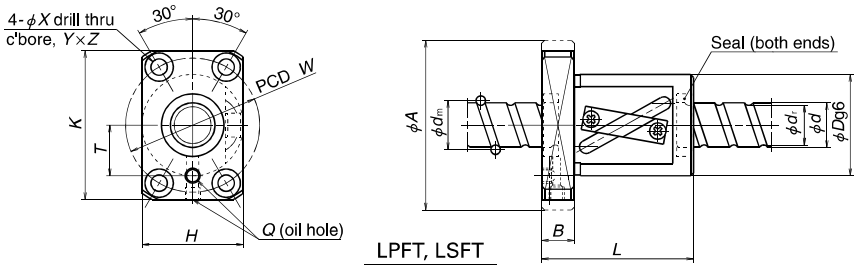


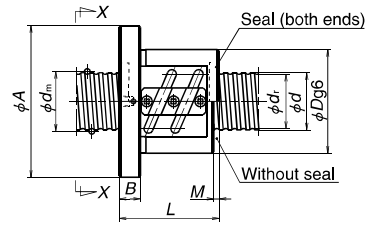


Unit: mm

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	Basic load rating (N) Static C_{0a}	Axial rigidity K (N/μm)
PFT 1605-3	P	16	5	3.175	16.5	13.2	1.5×2	5 400	8 100	158
SFT 1605-2.5	Clearance						2.5×1	7 330	13 500	158
DFT 1605-2.5	D						2.5×1	7 330	13 500	311
PFT 1605-5	P						2.5×2	8 380	13 500	258
SFT 1605-3	Clearance						1.5×2	8 570	16 200	188
DFT 1605-3	D						1.5×2	8 570	16 200	370
SFT 1605-5	Clearance						2.5×2	13 300	27 000	307
DFT 1605-5	D						2.5×2	13 300	27 000	603
PFT 1606-2.5	P		6	3.175	16.5	13.2	2.5×1	4 620	6 750	133
SFT 1606-2.5	Clearance						2.5×1	7 330	13 500	158
DFT 1606-2.5	D						2.5×1	7 330	13 500	311
SFT 1606-3	Clearance						1.5×2	8 570	16 200	188
DFT 1606-3	D						1.5×2	8 570	16 200	370
* **LPFT 1616-1.5**	P		16	3.175	16.75	13.4	1.5×1	3 600	5 410	110
LSFT 1616-1.5	Clearance							4 710	8 110	100
SFT 2004-2.5	Clearance	20	4	2.381	20.3	17.8	2.5×1	4 740	10 700	160
DFT 2004-2.5	D						2.5×1	4 740	10 700	315
* **PFT 2004-5**	P						2.5×2	5 420	10 700	260
SFT 2004-5	Clearance						2.5×2	8 600	21 500	309
DFT 2004-5	D						2.5×2	8 600	21 500	608
PFT 2005-3	P		5	3.175	20.5	17.2	1.5×2	6 060	10 300	191
SFT 2005-2.5	Clearance						2.5×1	8 230	17 100	190
DFT 2005-2.5	D						2.5×1	8 230	17 100	376
* **PFT 2005-5**	P						2.5×2	9 410	17 100	311
SFT 2005-3	Clearance						1.5×2	9 620	20 600	227
DFT 2005-3	D						1.5×2	9 620	20 600	446
SFT 2005-5	Clearance						2.5×2	14 900	34 300	370
DFT 2005-5	D						2.5×2	14 900	34 300	726

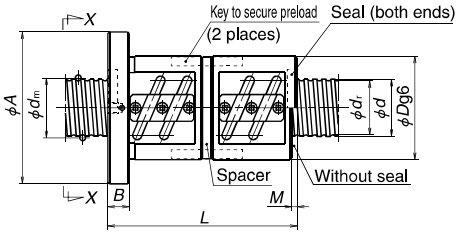
Ball nut dimensions												
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Notched flange G	Rectangle flanged diameter H	Rectangle flanged diameter K	Seal dimension M	Bolt hole dimension X	Bolt hole dimension Y	Bolt hole dimension Z	Bolt hole PCD W	Oil hole length T	Oil hole Q
52	40	63	11	—	40	55	—	5.5	9.5	5.5	51	20	M6×1
42													
77													
57													
52													
97													
57													
107													
44	40	63	11	—	40	55	—	5.5	9.5	5.5	51	20	M6×1
44													
86													
56													
110													
56	40	63	12	—	40	55	—	5.5	9.5	5.5	51	17	M6×1
37	40	63	11	24	—	—	3	5.5	9.5	5.5	51	—	M6×1
69													
49													
49													
93													
52	44	67	11	26	—	—	3	5.5	9.5	5.5	55	—	M6×1
41													
76													
56													
52													
97													
56													
106													

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.
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_a) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B37) 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.)

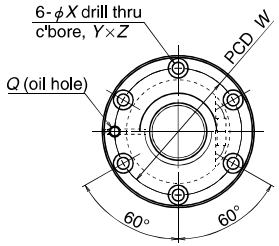


View X-X

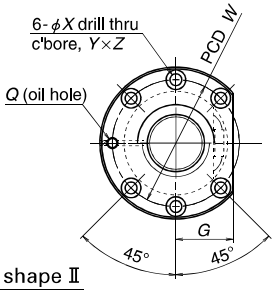
PFT, ZFT, SFT



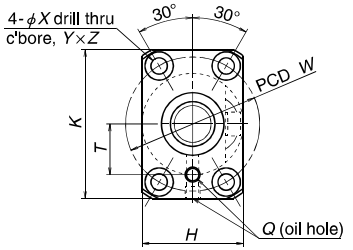
DFT

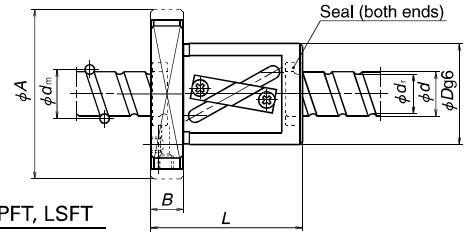


Circular shape I



Circular shape II





LPFT, LSFT

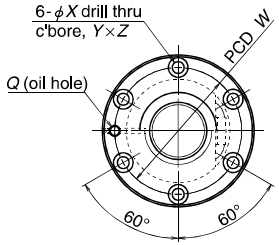
Unit: mm

	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	Basic load rating (N): Static C_{0a}	Axial rigidity K (N/μm)
	PFT 2006-2.5	P	20	6	3.969	20.5	16.4	2.5×1	6 900	10 500	164
	PFT 2006-3	P						1.5×2	8 080	12 700	195
	SFT 2006-2.5	Clearance						2.5×1	11 000	21 100	195
	DFT 2006-2.5	D						2.5×1	11 000	21 100	384
	SFT 2006-3	Clearance						1.5×2	12 800	25 300	232
	DFT 2006-3	D						1.5×2	12 800	25 300	456
	PFT 2008-2.5	P		8	3.969	20.5	16.4	2.5×1	6 900	10 500	164
	SFT 2008-2.5	Clearance						2.5×1	11 000	21 100	195
	DFT 2008-2.5	D						2.5×1	11 000	21 100	384
	SFT 2008-3	Clearance						1.5×2	12 800	25 300	232
	DFT 2008-3	D						1.5×2	12 800	25 300	456
*	**LPFT 2010-2.5**	P		10	3.969	21.0	16.9	2.5×1	6 800	10 800	169
	LSFT 2010-2.5	Clearance							10 900	21 700	202
	LPFT 2016-2.5	P		16	3.969	21.0	16.9	2.5×1	6 880	10 800	169
	LSFT 2016-2.5	Clearance							10 900	21 700	202
*	**LPFT 2020-1.5**	P		20	3.969	21.0	16.9	1.5×1	5 370	8 450	137
	LSFT 2020-1.5	Clearance							7 040	12 700	127
	SFT 2504-2.5	Clearance	25	4	2.381	25.3	22.8	2.5×1	5 270	13 600	193
	ZFT 2504-5	Z						2.5×1	5 270	13 600	379
*	**PFT 2504-5**	P						2.5×2	6 020	13 600	312
	SFT 2504-5	Clearance						2.5×2	9 560	27 200	374
	ZFT 2504-10	Z						2.5×2	9 560	27 200	735
	PFT 2505-3	P		5	3.175	25.5	22.2	1.5×2	6 730	12 800	223
	SFT 2505-2.5	Clearance						2.5×1	9 130	21 900	231
	ZFT 2505-5	Z						2.5×1	9 130	21 900	454
*	**PFT 2505-5**	P						2.5×2	10 400	21 900	372
	SFT 2505-3	Clearance						1.5×2	10 700	25 700	271
	DFT 2505-3	D						1.5×2	10 700	25 700	532
	PFT 2505-7.5	P						2.5×3	14 800	32 800	544
	SFT 2505-5	Clearance						2.5×2	16 600	43 700	447
	ZFT 2505-10	Z						2.5×2	16 600	43 700	876
	SFT 2505-7.5	Clearance						2.5×3	23 500	65 600	654

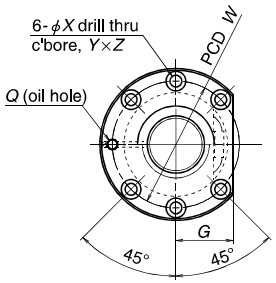
Ball nut dimensions												
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Notched flange G	Rectangle flanged diameter H	Rectangle flanged diameter K	Seal dimension M	Bolt hole dimension X	Bolt hole dimension Y	Bolt hole dimension Z	Bolt hole PCD W	Oil hole length T	Oil hole Q
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	46	74	13	—	46	66	—	6.6	11	6.5	59	24	M6×1
63	46	74	13	—	46	66	—	6.6	11	6.5	59	24	M6×1
36	46	69	11	26	—	—	3	5.5	9.5	5.5	57	—	M6×1
48													
48													
48													
72													
52	50	73	11	28	—	—	3	5.5	9.5	5.5	61	—	M6×1
40													
55													
55													
52													
102													
70													
55													
85													
70													

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.
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_a) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B37) 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.)

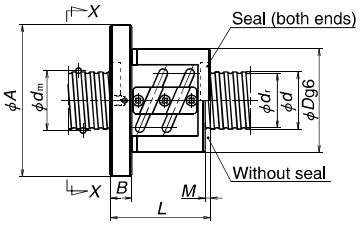
View *X-X*



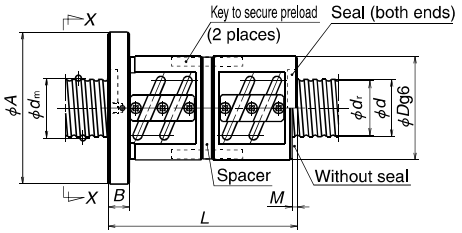
Circular shape Ⅰ



Circular shape Ⅱ



PFT, ZFT, SFT



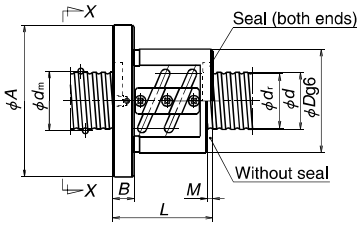
DFT

Unit: mm

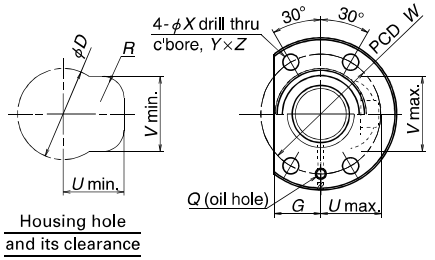
Model No.	Preload system	Shaft dia. *d*	Lead *l*	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity *K* (N/μm)
PFT 2506-3	P	25	6	3.969	25.5	21.4	1.5×2	9 070	16 100	235
SFT 2506-2.5	Clearance						2.5×1	12 300	26 800	235
ZFT 2506-5	Z						2.5×1	12 300	26 800	462
* **PFT 2506-5**	P						2.5×2	14 100	26 800	383
SFT 2506-3	Clearance						1.5×2	14 400	32 100	280
DFT 2506-3	D						1.5×2	14 400	32 100	551
SFT 2506-5	Clearance						2.5×2	22 300	53 500	456
ZFT 2506-10	Z						2.5×2	22 300	53 500	896
PFT 2508-2.5	P		8	4.762	25.5	20.5	2.5×1	9 940	16 000	203
PFT 2508-3	P						1.5×2	11 600	19 000	234
SFT 2508-2.5	Clearance						2.5×1	15 800	32 000	242
ZFT 2508-5	Z						2.5×1	15 800	32 000	476
SFT 2508-3	Clearance						1.5×2	18 500	38 100	286
DFT 2508-3	D						1.5×2	18 500	38 100	562
PFT 2510-2.5	P		10	4.762	25.5	20.5	2.5×1	9 940	16 000	203
ZFT 2510-3	Z						1.5×1	10 200	19 000	291
PFT 2510-3	P						1.5×2	11 600	19 000	234
SFT 2510-2.5	Clearance						2.5×1	15 800	32 000	242
DFT 2510-2.5	D						2.5×1	15 800	32 000	475
SFT 2510-3	Clearance						1.5×2	18 500	38 100	286
DFT 2510-3	D						1.5×2	18 500	38 100	562
SFT 2510-3.5	Clearance						3.5×1	21 100	44 200	330
DFT 2510-3.5	D						3.5×1	21 100	44 200	649

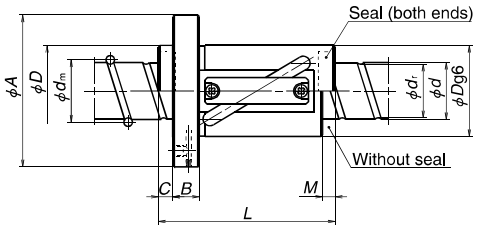
Ball nut dimensions										
Nut entire length *L*	Nut diameter *D*	Flanged diameter *A*	Flanged width *B*	Notched flange *G*	Seal dimension *M*	Bolt hole dimension *X*	Bolt hole dimension *Y*	Bolt hole dimension *Z*	Bolt hole PCD *W*	Oil hole *Q*
56	53	76	11	29	3	5.5	9.5	5.5	64	M6×1
44										
62										
62										
56										
110										
62										
98										
56	58	85	13	32	5	6.6	11	6.5	71	M6×1
69										
56										
80										
69										
133										
67	58	85	15	32	8	6.6	11	6.5	71	M6×1
81										
81										
67										
127										
81										
151										
77										
147										

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.
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 B37) 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.)



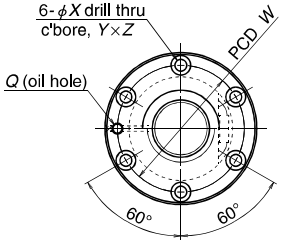
PFT, ZFT, SFT



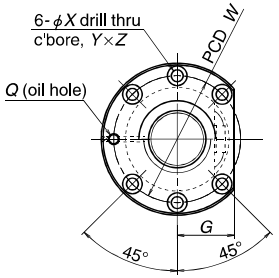


LPFT, LSFT

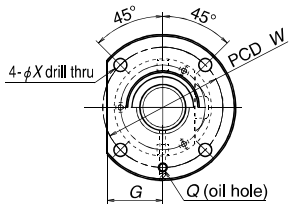
View *X-X*

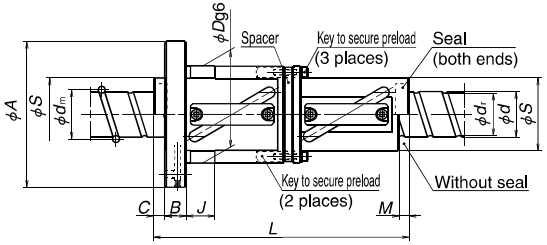


Circular shape Ⅰ



Circular shape Ⅱ





LDFT

Unit: mm

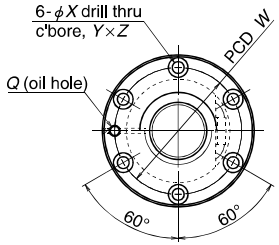
Model No.	Preload system	Shaft dia. *d*	Lead *l*	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial rigidity *K* (N/μm)	Nut entire length *L*
LPFT 2516-2.5	P	25	16	4.762	26.25	21.3	2.5×1	9 900	16 400	210	84
LPFT 2516-3	P						1.5×2	11 600	19 100	247	100
LSFT 2516-2.5	Clearance						2.5×1	15 700	32 800	250	84
LDFT 2516-2.5	D						2.5×1	15 700	32 800	490	152
LSFT 2516-3	Clearance						1.5×2	18 400	38 200	295	100
LDFT 2516-3	D						1.5×2	18 400	38 200	577	181
* **LPFT 2520-2.5**	P		20	4.762	26.25	21.3	2.5×1	9 900	16 400	210	96
LPFT 2520-3	P						1.5×2	11 600	19 100	247	116
LSFT 2520-2.5	Clearance						2.5×1	15 700	32 800	250	96
LDFT 2520-2.5	D						2.5×1	15 700	32 800	490	177
LSFT 2520-3	Clearance						1.5×2	18 400	38 200	295	116
LDFT 2520-3	D						1.5×2	18 400	38 200	577	217
* **LPFT 2525-1.5**	P		25	4.762	26.25	21.3	1.5×1	6 380	9 540	127	90
LDFT 2525-1.5	D							10 100	19 100	308	166
LSFT 2525-1.5	Clearance							10 100	19 100	157	90
SFT 2805-2.5	Clearance	28	5	3.175	28.5	25.2	2.5×1	9 600	24 400	252	41
ZFT 2805-5	Z						2.5×1	9 600	24 400	495	56
PFT 2805-5	P						2.5×2	11 000	24 400	410	56
SFT 2805-5	Clearance						2.5×2	17 400	48 800	487	56
* **ZFT 2805-10**	Z						2.5×2	17 400	48 800	959	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.

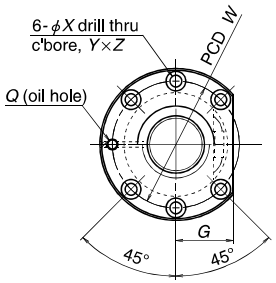
Ball nut dimensions															
Nut diameter		Flanged diameter	Flanged width	Notched flange	Tube projecting type			Seal dimension		Diameter g6	Bolt hole dimension			Bolt hole PCD	Oil hole
D	*S*	*A*	*B*	*G*	*U*	*V*	*R*	*M*	*C*	*J*	*X*	*Y*	*Z*	*W*	*Q*
44	—	71	12	23	31	35	12	6	8	—	6.6	—	—	57	M6×1
44	—	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_a) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B37) 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.)

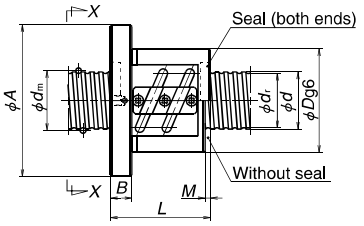
View *X-X*



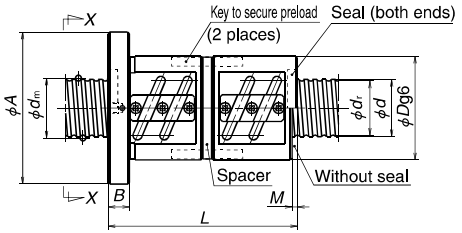
Circular shape I



Circular shape II



PFT, ZFT, SFT



DFT

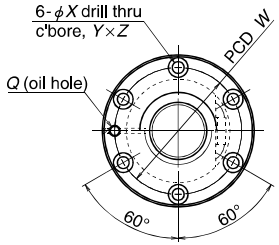
Unit: mm

	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	Basic load rating (N): Static C_{0a}	Axial rigidity *K* (N/μm)
	PFT 2806-3	P	28	6	3.175	28.5	25.2	1.5×2	7 080	14 600	252
	SFT 2806-2.5	Clearance						2.5×1	9 600	24 400	252
	ZFT 2806-5	Z						2.5×1	9 600	24 400	495
*	**PFT 2806-5**	P						2.5×2	11 000	24 400	410
	SFT 2806-3	Clearance						1.5×2	11 200	29 300	300
	DFT 2806-3	D						1.5×2	11 200	29 300	590
	SFT 2806-5	Clearance						2.5×2	17 400	48 800	487
*	**ZFT 2806-10**	Z						2.5×2	17 400	48 800	959
	PFT 2810-2.5	P		10	4.762	28.5	23.5	2.5×1	10 500	18 000	220
	ZFT 2810-3	Z						1.5×1	10 800	21 500	320
	PFT 2810-3	P						1.5×2	12 300	21 500	265
	SFT 2810-2.5	Clearance						2.5×1	16 700	36 100	265
	DFT 2810-2.5	D						2.5×1	16 700	36 100	522
	SFT 2810-3	Clearance						1.5×2	19 500	43 000	314
	DFT 2810-3	D						1.5×2	19 500	43 000	618
	SFT 3204-2.5	Clearance	32	4	2.381	32.3	29.8	2.5×1	5 800	17 500	234
	ZFT 3204-5	Z						2.5×1	5 800	17 500	461
	PFT 3204-5	P						2.5×2	6 630	17 500	382
	SFT 3204-5	Clearance						2.5×2	10 500	35 100	454
	ZFT 3204-10	Z						2.5×2	10 500	35 100	892
	PFT 3205-3	P		5	3.175	32.5	29.2	1.5×2	7 490	16 800	281
	SFT 3205-2.5	Clearance						2.5×1	10 200	28 000	281
	ZFT 3205-5	Z						2.5×1	10 200	28 000	552
*	**PFT 3205-5**	P						2.5×2	11 600	28 000	455
	SFT 3205-3	Clearance						1.5×2	11 900	33 600	333
	DFT 3205-3	D						1.5×2	11 900	33 600	655
	PFT 3205-7.5	P						2.5×3	16 500	42 100	672
	SFT 3205-5	Clearance						2.5×2	18 500	56 100	543
*	**ZFT 3205-10**	Z						2.5×2	18 500	56 100	1 070
	SFT 3205-7.5	Clearance						2.5×3	26 200	84 100	799
	DFT 3205-7.5	D						2.5×3	26 200	84 100	1 572

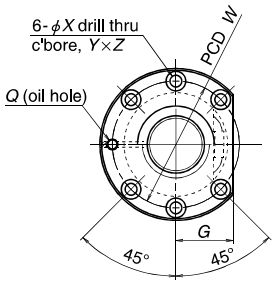
Ball nut dimensions										
Nut entire length *L*	Nut diameter *D*	Flanged diameter *A*	Flanged width *B*	Notched flange *G*	Seal dimension *M*	Bolt hole dimension *X*	Bolt hole dimension *Y*	Bolt hole dimension *Z*	Bolt hole PCD *W*	Oil hole *Q*
57	55	85	12	31	3	6.6	11	6.5	69	M6×1
45										
63										
63										
57										
111										
63										
99										
68	60	94	15	36	7	9	14	8.5	76	M6×1
82										
82										
68										
128										
82										
152										
37	54	81	12	31	3	6.6	11	6.5	67	M6×1
49										
49										
49										
73										
53	58	85	12	32	3	6.6	11	6.5	71	M6×1
41										
56										
56										
53										
103										
71										
56										
86										
71										
136										

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.
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 B37) 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.)

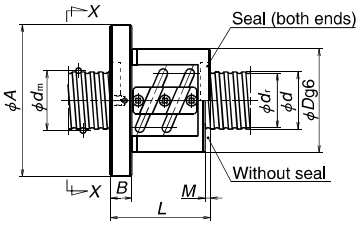
View *X-X*



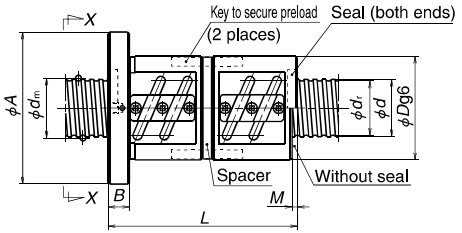
Circular shape Ⅰ



Circular shape Ⅱ



PFT, ZFT, SFT



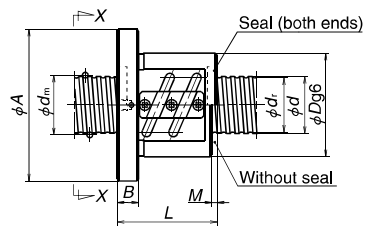
DFT

Unit: mm

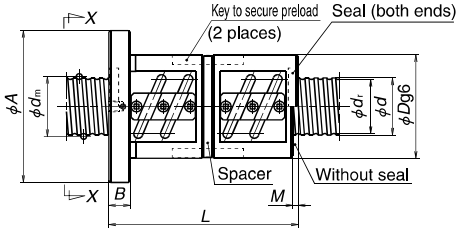
Model No.	Preload system	Shaft dia. *d*	Lead *l*	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity *K* (N/μm)
PFT 3206-3	P	32	6	3.969	32.5	28.4	1.5×2	10 000	20 600	285
SFT 3206-2.5	Clearance						2.5×1	13 600	34 700	287
ZFT 3206-5	Z						2.5×1	13 600	34 700	563
PFT 3206-5	P						2.5×2	15 500	34 700	468
SFT 3206-3	Clearance						1.5×2	15 900	41 200	339
DFT 3206-3	D						1.5×2	15 900	41 200	666
SFT 3206-5	Clearance						2.5×2	24 700	69 400	555
* **ZFT 3206-10**	Z						2.5×2	24 700	69 400	1 090
PFT 3208-3	P		8	4.762	32.5	27.5	1.5×2	12 900	24 800	294
SFT 3208-2.5	Clearance						2.5×1	17 500	41 000	292
ZFT 3208-5	Z						2.5×1	17 500	41 000	573
PFT 3208-5	P						2.5×2	20 000	41 000	470
SFT 3208-3	Clearance						1.5×2	20 400	49 500	349
ZFT 3208-6	Z						1.5×2	20 400	49 500	686
SFT 3208-5	Clearance						2.5×2	31 700	82 000	565
DFT 3208-5	D						2.5×2	31 700	82 000	1 102
ZFT 3208-10	Z						2.5×2	31 700	82 000	1 102
PFT 3210-2.5	P		10	6.35	33.0	26.4	2.5×1	16 100	27 000	255
ZFT 3210-3	Z						1.5×1	16 400	32 400	365
PFT 3210-3	P						1.5×2	18 800	32 400	303
SFT 3210-2.5	Clearance						2.5×1	25 500	54 000	302
* **ZFT 3210-5**	Z						2.5×1	25 500	54 000	594
PFT 3210-5	P						2.5×2	29 200	54 000	494
SFT 3210-3	Clearance						1.5×2	29 900	64 800	360
DFT 3210-3	D						1.5×2	29 900	64 800	707
SFT 3210-3.5	Clearance						3.5×1	34 100	77 000	422
DFT 3210-3.5	D						3.5×1	34 100	77 000	829
SFT 3210-5	Clearance						2.5×2	46 300	108 000	585
* **DFT 3210-5**	D						2.5×2	46 300	108 000	1 156
ZFT 3210-10	Z						2.5×2	46 300	108 000	1 156
PFT 3212-2.5	P		12	6.35	33.0	26.4	2.5×1	16 100	27 000	255
ZFT 3212-3	Z						1.5×1	16 400	32 400	365
PFT 3212-3	P						1.5×2	18 800	32 400	303
SFT 3212-2.5	Clearance						2.5×1	25 500	54 000	302
DFT 3212-2.5	D						2.5×1	25 500	54 000	603
SFT 3212-3	Clearance						1.5×2	29 900	64 800	360
DFT 3212-3	D						1.5×2	29 900	64 800	707

Ball nut dimensions										
Nut entire length *L*	Nut diameter *D*	Flanged diameter *A*	Flanged width *B*	Notched flange *G*	Seal dimension *M*	Bolt hole dimension *X*	Bolt hole dimension *Y*	Bolt hole dimension *Z*	Bolt hole PCD *W*	Oil hole *Q*
57	62	89	12	34	3	6.6	11	6.5	75	M6×1
45										
63										
63										
57										
111										
63										
99										
71	66	100	15	38	5	9	14	8.5	82	M6×1
58										
82										
82										
71										
111										
82										
154										
130										
70	74	108	15	41	7	9	14	8.5	90	M6×1
87										
87										
70										
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										

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.
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 B37) 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.)

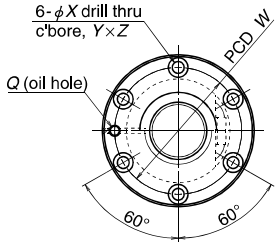


PFT, ZFT, SFT

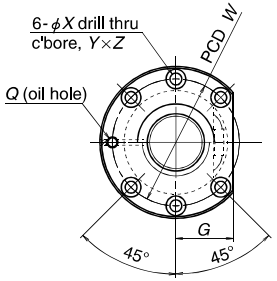


DFT

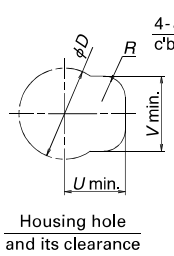
View *X*-*X*



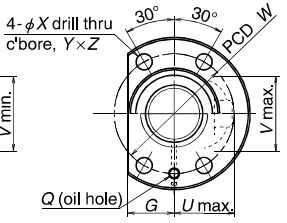
Circular shape Ⅰ

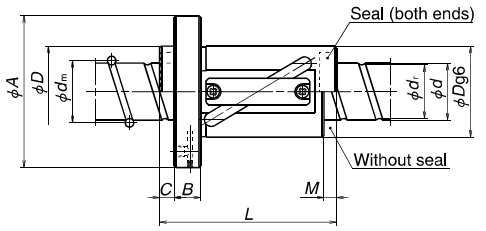


Circular shape Ⅱ

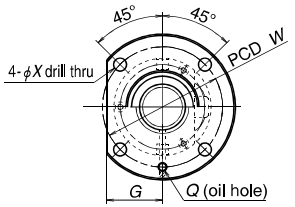


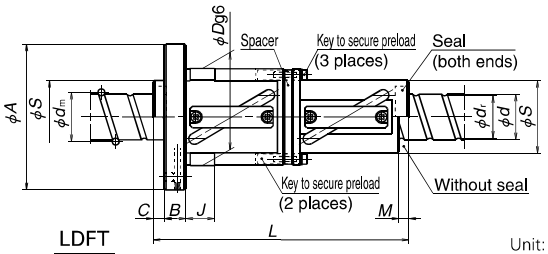
Housing hole
and its clearance





LPFT, LSFT





LDFT

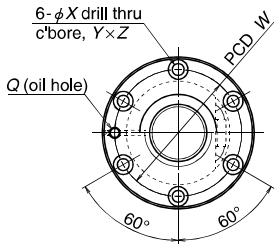
Unit: mm

Model No.	Preload system	Shaft dia. *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	Basic load rating (N): Static C_{0a}	Axial rigidity *K* (N/μm)	Nut entire length *L*
LPFT 3220-2.5	P	32	20	4.762	33.25	28.3	2.5×1	11 300	20 900	251	99
LPFT 3220-3	P						1.5×2	13 200	24 800	297	119
LSFT 3220-2.5	Clearance						2.5×1	17 900	41 800	300	99
LDFT 3220-2.5	D						2.5×1	17 900	41 800	604	179
LSFT 3220-3	Clearance						1.5×2	21 000	49 600	360	119
LDFT 3220-3	D						1.5×2	21 000	49 600	708	219
* **LPFT 3225-2.5**	P		25	4.762	33.25	28.3	2.5×1	11 300	20 900	251	117
LPFT 3225-3	P						1.5×2	13 200	24 800	297	142
LSFT 3225-2.5	Clearance						2.5×1	17 900	41 800	300	117
LDFT 3225-2.5	D						2.5×1	17 900	41 800	604	218
LSFT 3225-3	Clearance						1.5×2	21 000	49 600	360	142
LDFT 3225-3	D						1.5×2	21 000	49 600	708	268
* **LPFT 3232-1.5**	P		32	4.762	33.25	28.3	1.5×1	7 280	12 400	161	109
LSFT 3232-1.5	Clearance							11 500	24 800	190	109
LDFT 3232-1.5	D							11 500	24 800	376	205
ZFT 3605-5	Z	36	5	3.175	36.5	33.2	2.5×1	10 700	31 700	607	59
PFT 3605-5	P						2.5×2	12 200	31 700	504	59
PFT 3605-7.5	P						2.5×3	17 300	47 500	740	74
SFT 3605-5	Clearance						2.5×2	19 400	63 300	597	59
ZFT 3605-10	Z						2.5×2	19 400	63 300	1 170	89
SFT 3605-7.5	Clearance						2.5×3	27 500	95 000	878	74
DFT 3605-7.5	D						2.5×3	27 500	95 000	1 730	139

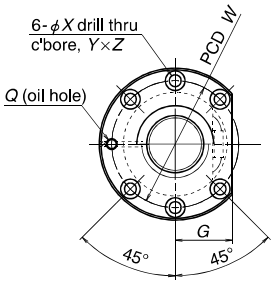
Ball nut dimensions															
Nut diameter		Flanged diameter	Flanged width	Notched flange	Tube projecting type			Seal dimension		Diameter g6	Bolt hole dimension			Bolt hole PCD	Oil hole
D	*S*	*A*	*B*	*G*	*U*	*V*	*R*	*M*	*C*	*J*	*X*	*Y*	*Z*	*W*	*Q*
51	—	85	15	26	34	42	12	7	8	—	9	—	—	67	M6×1
51	—	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	M6×1
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	13	12	—	9	—	—	67	M6×1
68	51	102		39	—	—	—			20				84	
65	—	100	15	38	—	—	—	3	—	—	9	14	8.5	82	M6×1

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.
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_a) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B37) 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.)

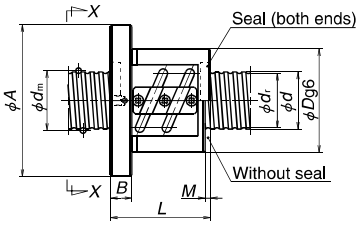
View *X-X*



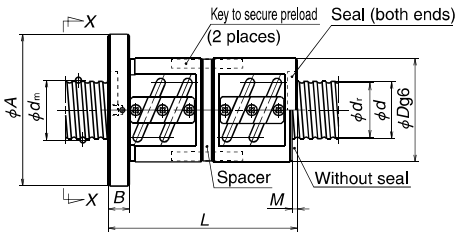
Circular shape Ⅰ



Circular shape Ⅱ



PFT, ZFT, SFT



DFT

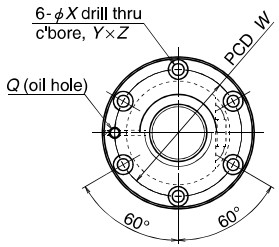
Unit: mm

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	Basic load rating (N): Static C_{0a}	Axial rigidity *K* (N/μm)
ZFT 3606-5	Z	36	6	3.969	36.5	32.4	2.5×1	14 600	39 300	625
PFT 3606-5	P						2.5×2	16 700	39 300	518
PFT 3606-7.5	P						2.5×3	23 700	58 900	763
SFT 3606-5	Clearance						2.5×2	26 500	78 500	615
ZFT 3606-10	Z						2.5×2	26 500	78 500	1 210
SFT 3606-7.5	Clearance						2.5×3	37 600	118 000	905
DFT 3606-7.5	D						2.5×3	37 600	118 000	1 780
PFT 3610-2.5	P		10	6.35	37.0	30.4	2.5×1	17 100	30 600	278
ZFT 3610-3	Z						1.5×1	17 500	36 800	404
PFT 3610-3	P						1.5×2	20 000	36 800	327
SFT 3610-2.5	Clearance						2.5×1	27 200	61 300	334
ZFT 3610-5	Z						2.5×1	27 200	61 300	657
PFT 3610-5	P						2.5×2	31 100	61 300	537
SFT 3610-3	Clearance						1.5×2	31 800	73 500	397
DFT 3610-3	D						1.5×2	31 800	73 500	781
PFT 3610-7.5	P						2.5×3	43 700	96 000	782
SFT 3610-5	Clearance						2.5×2	49 300	123 000	647
DFT 3610-5	D						2.5×2	49 300	123 000	1 259
ZFT 3610-10	Z						2.5×2	49 300	123 000	1 259
SFT 3610-7.5	Clearance						2.5×3	69 900	184 000	945
PFT 4005-3	P	40	5	3.175	40.5	37.2	1.5×2	8 210	21 200	337
SFT 4005-2.5	Clearance						2.5×1	11 100	35 300	336
ZFT 4005-5	Z						2.5×1	11 100	35 300	661
PFT 4005-5	P						2.5×2	12 700	35 300	548
SFT 4005-3	Clearance						1.5×2	13 000	42 400	399
DFT 4005-3	D						1.5×2	13 000	42 400	785
PFT 4005-7.5	P						2.5×3	18 100	53 000	806
SFT 4005-5	Clearance						2.5×2	20 200	70 600	649
* **ZFT 4005-10**	Z						2.5×2	20 200	70 600	1 280
SFT 4005-7.5	Clearance						2.5×3	28 700	106 000	956
DFT 4005-7.5	D						2.5×3	28 700	106 000	1 870
ZFT 4006-5	Z		6	3.969	40.5	36.4	2.5×1	15 200	43 800	679
PFT 4006-5	P						2.5×2	17 400	43 800	564
SFT 4006-3	Clearance						1.5×2	17 800	52 600	411
DFT 4006-3	D						1.5×2	17 800	52 600	807
PFT 4006-7.5	P						2.5×3	24 600	65 700	827
SFT 4006-5	Clearance						2.5×2	27 600	87 600	668
ZFT 4006-10	Z						2.5×2	27 600	87 600	1 320
SFT 4006-7.5	Clearance						2.5×3	39 100	131 000	984
DFT 4006-7.5	D						2.5×3	39 100	131 000	1 940

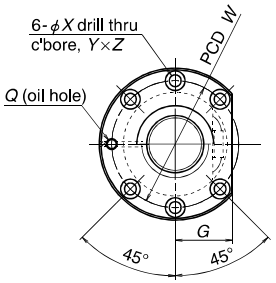
Ball nut dimensions: Nut entire length *L*	Nut diameter *D*	Flanged diameter *A*	Flanged width *B*	Notched flange *G*	Seal dimension *M*	Bolt hole dimension *X*	Bolt hole dimension *Y*	Bolt hole dimension *Z*	Bolt hole PCD *W*	Oil hole *Q*
66	65	100	15	38	3	9	14	8.5	82	M6×1
66										
84										
66										
102										
84										
162										
73	75	120	18	45	7	11	17.5	11	98	M6×1
90										
90										
73										
103										
103										
90										
170										
133										
103										
193										
163										
133										
56	67	101	15	39	3	9	14	8.5	83	Rc1/8
44										
59										
59										
56										
106										
74										
59										
89										
74										
139										
66	70	104	15	40	3	9	14	8.5	86	Rc1/8
66										
60										
114										
84										
66										
102										
84										
162										

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.
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 B37) 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.)

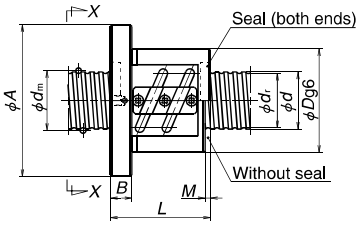
View *X-X*



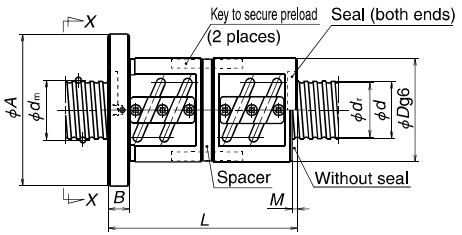
Circular shape Ⅰ



Circular shape Ⅱ



PFT, ZFT, SFT



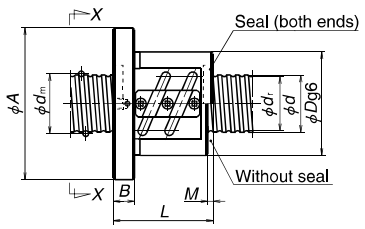
DFT

Unit: mm

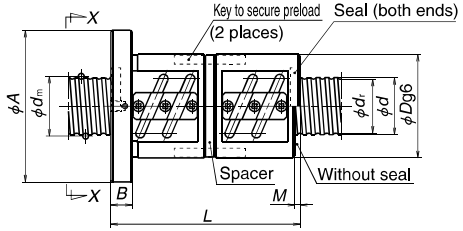
Model No.	Preload system	Shaft dia. *d*	Lead *l*	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial rigidity *K* (N/μm)
PFT 4008-3	P	40	8	4.762	40.5	35.5	1.5×2	14 200	31 300	352
SFT 4008-2.5	Clearance						2.5×1	19 200	51 600	349
ZFT 4008-5	Z						2.5×1	19 200	51 600	687
PFT 4008-5	P						2.5×2	22 000	51 600	570
SFT 4008-3	Clearance						1.5×2	22 500	62 600	418
DFT 4008-3	D						1.5×2	22 500	62 600	822
SFT 4008-5	Clearance						2.5×2	34 900	103 000	675
ZFT 4008-10	Z						2.5×2	34 900	103 000	1 330
PFT 4010-2.5	P		10	6.35	41	34.4	2.5×1	18 000	34 300	307
PFT 4010-3	P						1.5×2	21 100	41 100	366
SFT 4010-2.5	Clearance						2.5×1	28 600	68 600	365
ZFT 4010-5	Z						2.5×1	28 600	68 600	717
PFT 4010-5	P						2.5×2	32 800	68 600	595
SFT 4010-3	Clearance						1.5×2	33 500	82 300	434
ZFT 4010-6	Z						1.5×2	33 500	82 300	854
ZFT 4010-7	Z						3.5×1	38 300	96 000	988
SFT 4010-3.5	Clearance						3.5×1	38 300	96 000	503
PFT 4010-7	P						3.5×2	43 700	96 000	813
SFT 4010-5	Clearance						2.5×2	52 000	137 000	706
* **DFT 4010-5**	D						2.5×2	52 000	137 000	1 376
ZFT 4010-10	Z						2.5×2	52 000	137 000	1 376
SFT 4010-7	Clearance						3.5×2	69 400	192 000	976
PFT 4012-2.5	P		12	7.144	41.5	34.1	2.5×1	21 200	38 800	310
SFT 4012-2.5	Clearance						2.5×1	33 600	77 500	373
ZFT 4012-5	Z						2.5×1	33 600	77 500	733
PFT 4012-5	P						2.5×2	38 400	77 500	600
PFT 4012-7.5	P						2.5×3	54 400	116 000	872
SFT 4012-5	Clearance						2.5×2	61 000	155 000	722
* **DFT 4012-5**	D						2.5×2	61 000	155 000	1 404
ZFT 4012-10	Z						2.5×2	61 000	155 000	1 404
SFT 4012-7.5	Clearance						2.5×3	86 400	233 000	1 054
ZFT 4016-3	Z		16	7.144	41.5	34.1	1.5×1	21 700	46 500	451
SFT 4016-2.5	Clearance						2.5×1	33 600	77 500	373
DFT 4016-2.5	D						2.5×1	33 600	77 500	733
SFT 4016-3	Clearance						1.5×2	39 300	93 100	440
DFT 4016-3	D						1.5×2	39 300	93 100	872

Ball nut dimensions										
Nut entire length *L*	Nut diameter *D*	Flanged diameter *A*	Flanged width *B*	Notched flange *G*	Seal dimension *M*	Bolt hole dimension *X*	Bolt hole dimension *Y*	Bolt hole dimension *Z*	Bolt hole PCD *W*	Oil hole *Q*
71	74	108	15	41	5	9	14	8.5	90	Rc1/8
58										
82										
82										
71										
135										
82										
130										
73	82	124	18	47	7	11	17.5	11	102	Rc1/8
90										
73										
103										
103										
90										
140										
123										
83										
123										
103										
193										
163										
123										
81	86	128	18	48	9	11	17.5	11	106	Rc1/8
81										
117										
117										
153										
117										
225										
189										
153										
118	86	128	22	48	14	11	17.5	11	106	Rc1/8
102										
182										
118										
214										

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.
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 B37) 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.)

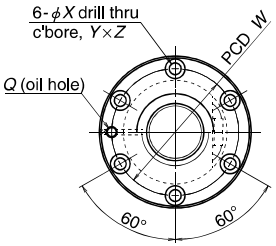


ZFT, SFT

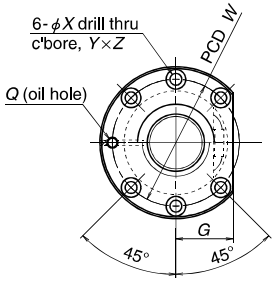


DFT

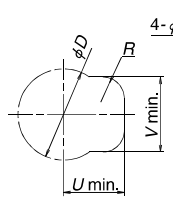
View *X*-*X*



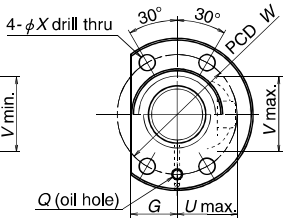
Circular shape Ⅰ

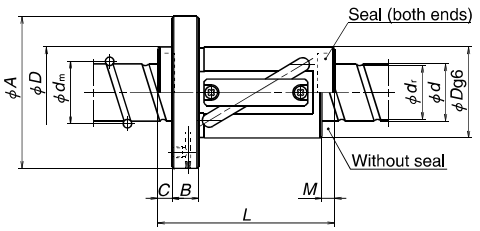


Circular shape Ⅱ

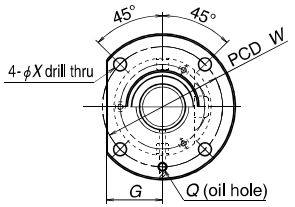


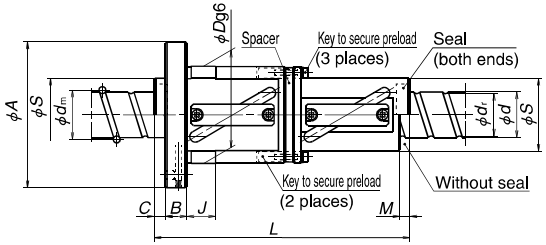
Housing hole
and its clearance





LPFT, LSFT





LDFT

Unit: mm

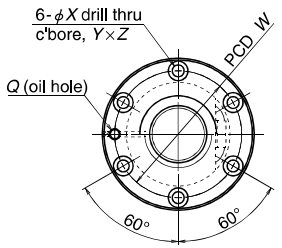
Model No.	Preload system	Shaft dia. *d*	Lead *l*	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity *K* (N/μm)	Nut entire length *L*
LPFT 4025-2.5	P	40	25	6.35	41.75	35.1	2.5×1	18 000	35 000	315	123
LPFT 4025-3	P						1.5×2	21 000	41 200	347	148
LSFT 4025-2.5	Clearance						2.5×1	28 500	70 000	375	123
LDFT 4025-2.5	D						2.5×1	28 500	70 000	737	223
LSFT 4025-3	Clearance						1.5×2	33 400	82 400	444	148
LDFT 4025-3	D						1.5×2	33 400	82 400	873	273
LPFT 4032-2.5	P		32	6.35	41.75	35.1	2.5×1	18 000	35 000	315	146
LSFT 4032-2.5	Clearance							28 500	70 000	375	146
LDFT 4032-2.5	D							28 500	70 000	737	274
LPFT 4040-1.5	P		40	6.35	41.75	35.1	1.5×1	11 600	20 600	199	133
LSFT 4040-1.5	Clearance							18 400	41 200	237	133
LDFT 4040-1.5	D							18 400	41 200	465	253
ZFT 4510-5	Z	45	10	6.35	46.0	39.4	2.5×1	29 900	77 300	784	103
PFT 4510-7	P						3.5×2	45 600	109 000	887	123
PFT 4510-7.5	P						2.5×3	48 400	116 000	950	133
SFT 4510-5	Clearance						2.5×2	54 200	155 000	772	103
DFT 4510-5	D						2.5×2	54 200	155 000	1 520	193
SFT 4510-7	Clearance						3.5×2	72 400	218 000	1 064	123
SFT 4510-7.5	Clearance						2.5×3	76 800	232 000	1 140	133
DFT 4510-7.5	D						2.5×3	76 800	232 000	2 230	253
SFT 4512-2.5	Clearance		12	7.144	46.5	39.1	2.5×1	35 400	88 500	412	83
ZFT 4512-5	Z						2.5×1	35 400	88 500	811	119
SFT 4512-5	Clearance						2.5×2	64 200	177 000	798	119
DFT 4512-5	D						2.5×2	64 200	177 000	1 570	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.

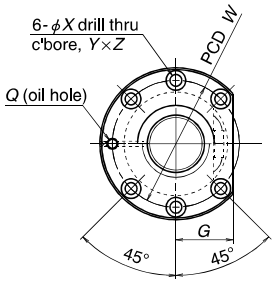
Ball nut dimensions															
Nut diameter		Flanged diameter	Flanged width	Notched flange	Tube projecting type			Seal dimension		Diameter g6	Bolt hole dimension			Bolt hole PCD	Oil hole
D	*S*	*A*	*B*	*G*	*U*	*V*	*R*	*M*	*C*	*J*	*X*	*Y*	*Z*	*W*	*Q*
64	—	106	18	33	42	52	15	10	10	—	11	—	—	84	Rc1/8
64	—	106		33	42	52	15			—				84	
64	—	106		33	42	52	15			—				84	
84	64	126		48	—	—	—			22				104	
64	—	106		33	42	52	15			—				84	
84	64	126		48	—	—	—			22				104	
64	—	106	18	33	42	52	15	13	12	—	11	—	—	84	Rc1/8
64	—	106		33	42	52	15			—				84	
84	64	126		48	—	—	—			22				104	
64	—	106	18	33	42	52	15	16	14	—	11	—	—	84	Rc1/8
64	—	106		33	42	52	15			—				84	
84	64	126		48	—	—	—			22				104	
88	—	132	18	50	—	—	—	7	—	—	11	17.5	11	110	Rc1/8
90	—	132	18	50	—	—	—	8	—	—	11	17.5	11	110	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_a) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B37) 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.)

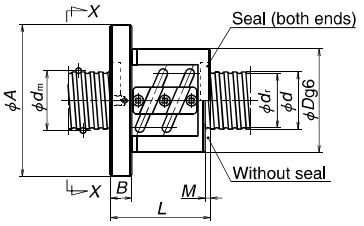
View *X-X*



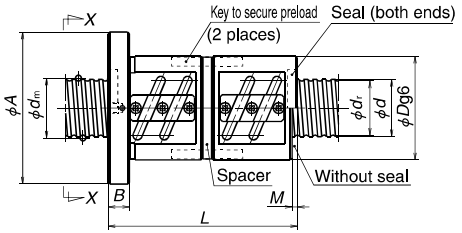
Circular shape Ⅰ



Circular shape Ⅱ



ZFT, SFT



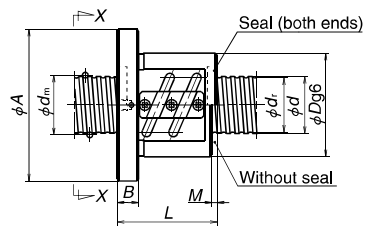
DFT

Unit: mm

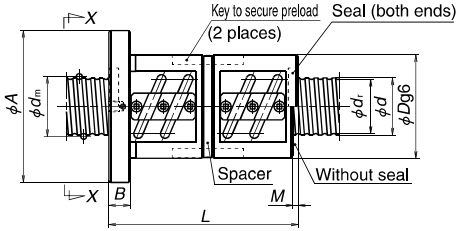
Model No.	Preload system	Shaft dia. *d*	Lead *l*	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity *K* (N/μm)
SFT 5005-3	Clearance	50	5	3.175	50.5	47.2	1.5×2	14 200	52 500	472
ZFT 5005-6	Z						1.5×2	14 200	52 500	930
SFT 5005-4.5	Clearance						1.5×3	20 200	78 800	696
ZFT 5005-9	Z						1.5×3	20 200	78 800	1 360
SFT 5006-3	Clearance		6	3.969	50.5	46.4	1.5×2	19 500	65 100	486
DFT 5006-3	D						1.5×2	19 500	65 100	956
PFT 5006-7.5	P						2.5×3	27 000	81 900	988
SFT 5006-5	Clearance						2.5×2	30 300	109 000	794
ZFT 5006-10	Z						2.5×2	30 300	109 000	1 562
SFT 5006-7.5	Clearance						2.5×3	42 900	164 000	1 170
DFT 5006-7.5	D						2.5×3	42 900	164 000	2 300
SFT 5008-3	Clearance		8	4.762	50.5	45.5	1.5×2	25 000	77 400	496
DFT 5008-3	D						1.5×2	25 000	77 400	975
SFT 5008-5	Clearance						2.5×2	38 700	131 000	815
ZFT 5008-10	Z						2.5×2	38 700	131 000	1 600
SFT 5008-7.5	Clearance						2.5×3	54 900	197 000	1 200
DFT 5008-7.5	D						2.5×3	54 900	197 000	2 350
SFT 5010-2.5	Clearance		10	6.35	51.0	44.4	2.5×1	31 800	87 400	440
ZFT 5010-5	Z						2.5×1	31 800	87 400	866
SFT 5010-3	Clearance						1.5×2	37 200	103 000	517
DFT 5010-3	D						1.5×2	37 200	103 000	1 010
ZFT 5010-7	Z						3.5×1	42 500	122 000	1 190
PFT 5010-7.5	P						2.5×3	51 500	131 000	1 039
SFT 5010-5	Clearance						2.5×2	57 700	175 000	853
* **ZFT 5010-10**	Z						2.5×2	57 700	175 000	1 677
SFT 5010-7.5	Clearance						2.5×3	81 800	262 000	1 250
DFT 5010-7.5	D						2.5×3	81 800	262 000	2 460
SFT 5012-2.5	Clearance		12	7.938	51.5	43.2	2.5×1	42 800	107 000	449
ZFT 5012-5	Z						2.5×1	42 800	107 000	883
SFT 5012-5	Clearance						2.5×2	77 600	214 000	869
DFT 5012-5	D						2.5×2	77 600	214 000	1 718
ZFT 5012-10	Z						2.5×2	77 600	214 000	1 718
SFT 5016-2.5	Clearance		16	7.938	51.5	43.2	2.5×1	42 800	107 000	449
ZFT 5016-5	Z						2.5×1	42 800	107 000	883
PFT 5016-7.5	P						2.5×3	69 300	161 000	1 066
SFT 5016-5	Clearance						2.5×2	77 600	214 000	869
DFT 5016-5	D						2.5×2	77 600	214 000	1 710
SFT 5016-7.5	Clearance						2.5×3	110 000	321 000	1 286
ZFT 5020-3	Z		20	7.938	51.5	43.2	1.5×1	27 600	64 300	542
SFT 5020-2.5	Clearance						2.5×1	42 800	107 000	449
DFT 5020-2.5	D						2.5×1	42 800	107 000	883
SFT 5020-3	Clearance						1.5×2	50 000	129 000	534
DFT 5020-3	D						1.5×2	50 000	129 000	1 050

Ball nut dimensions									
Nut entire length *L*	Nut diameter *D*	Flanged diameter *A*	Flanged width *B*	Notched flange *G*	Seal dimension *M*	Bolt hole dimension *X*	Bolt hole dimension *Y*	Bolt hole dimension *Z*	Bolt hole PCD *W*	Oil hole *Q*
58	80	114	15	43	3	9	14	8.5	96	Rc1/8
83										
68										
103										
62	84	118	15	45	3	9	14	8.5	100	Rc1/8
116										
86										
68										
104										
86										
164										
74	87	129	18	49	5	11	17.5	11	107	Rc1/8
138										
85										
133										
109										
205										
73	93	135	18	51	7	11	17.5	11	113	Rc1/8
103										
90										
170										
123										
133										
103										
163										
133										
253										
87	100	146	22	55	8	14	20	13	122	Rc1/8
123										
123										
231										
195										
104	100	146	22	55	14	14	20	13	122	Rc1/8
152										
200										
152										
280										
200										
147	100	146	28	55	17	14	20	13	122	Rc1/8
127										
227										
147										
267										

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.
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 B37) 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.)

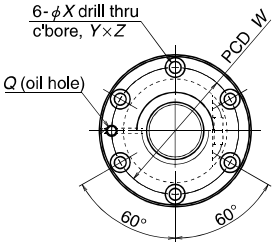


ZFT, SFT

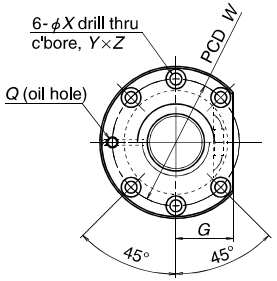


DFT

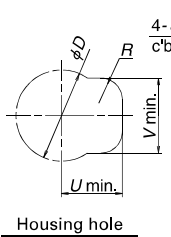
View *X*-*X*



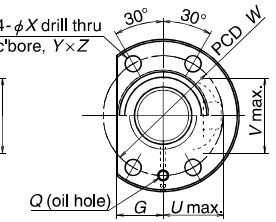
Circular shape Ⅰ

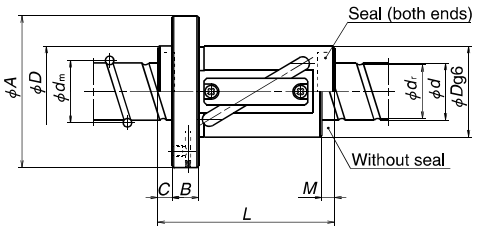


Circular shape Ⅱ

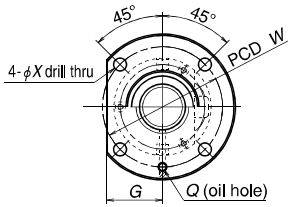


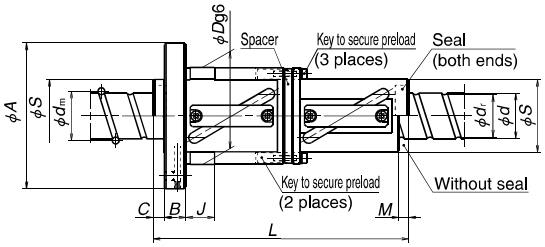
Housing hole
and its clearance





LPFT, LSFT





LDFT

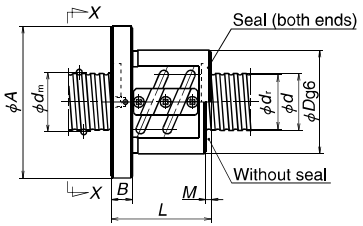
Unit: mm

Model No.	Preload system	Shaft dia. *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	Basic load rating (N) Static C_{0a}	Axial rigidity *K* (N/μm)	Nut entire length *L*
LPFT 5025-2.5	P	50	25	7.938	52.25	44	2.5×1	26 900	54 700	388	129
LPFT 5025-3	P						1.5×2	31 400	66 500	450	154
LSFT 5025-2.5	Clearance						2.5×1	42 700	109 000	462	129
LDFT 5025-2.5	D						2.5×1	42 700	109 000	905	229
LSFT 5025-3	Clearance						1.5×2	49 900	133 000	547	154
LDFT 5025-3	D						1.5×2	49 900	133 000	1 070	279
LPFT 5032-2.5	P		32				2.5×1	26 900	54 700	388	151
LPFT 5032-3	P						1.5×2	31 400	66 500	450	183
LSFT 5032-2.5	Clearance						2.5×1	42 700	109 000	462	151
LDFT 5032-2.5	D						2.5×1	42 700	109 000	905	279
LSFT 5032-3	Clearance						1.5×2	49 900	133 000	547	183
LDFT 5032-3	D						1.5×2	49 900	133 000	1 070	343
LPFT 5040-2.5	P		40				2.5×1	26 900	54 700	388	178
LSFT 5040-2.5	Clearance							42 700	109 000	462	178
LDFT 5040-2.5	D							42 700	109 000	922	338
LPFT 5050-1.5	P		50				1.5×1	17 300	33 200	245	161
LSFT 5050-1.5	Clearance							27 500	66 500	290	161
LDFT 5050-1.5	D							27 500	66 500	572	312
ZFT 5510-5	Z	55	10	6.35	56.0	49.4	2.5×1	32 800	96 100	929	103
SFT 5510-5	Clearance						2.5×2	59 500	192 000	916	103
ZFT 5510-10	Z						2.5×2	59 500	192 000	1 800	163
DFT 5510-5	D						2.5×2	59 500	192 000	1 800	193
SFT 5510-7.5	Clearance						2.5×3	84 300	288 000	1 350	133
DFT 5510-7.5	D						2.5×3	84 300	288 000	2 650	253

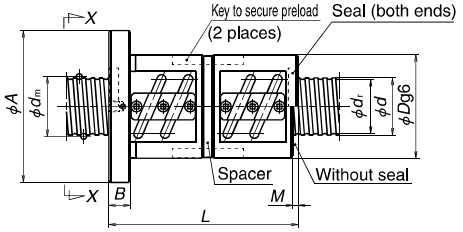
Notes: 1. Nut flange for shaft diameter 20 mm or larger comes in circular shape Ⅰ and circular shape Ⅱ. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for ZFT, SFT, and DFT, the nut length "L" is shortened by dimension "M".
3. If there is no seal 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	Flanged width	Notched flange	Tube projecting type			Seal dimension		Diameter g6	Bolt hole dimension			Bolt hole PCD	Oil hole
D	*S*	*A*	*B*	*G*	*U*	*V*	*R*	*M*	*C*	*J*	*X*	*Y*	*Z*	*W*	*Q*
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	
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_a) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B37) 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.)

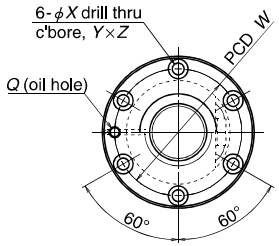


SFT, ZFT

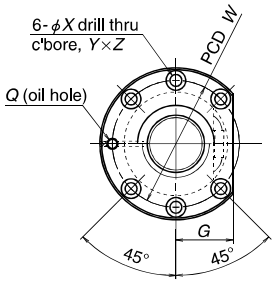


DFT

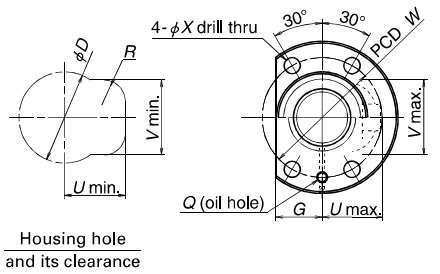
View X-X



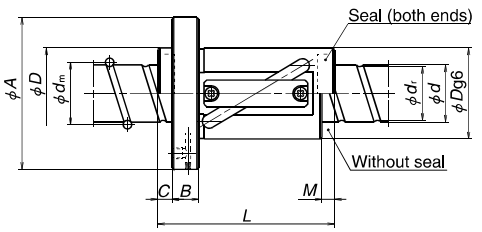
Circular shape I



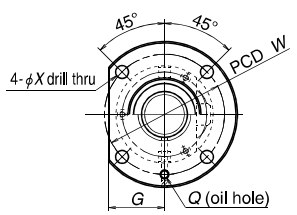
Circular shape II

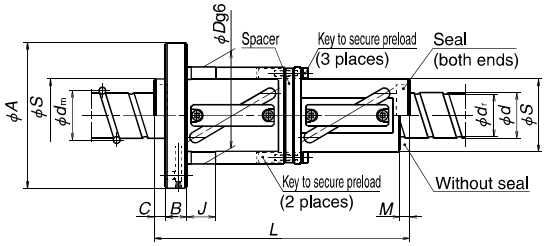


Housing hole
and its clearance



LPFT, LSFT





LDFT

Unit: mm

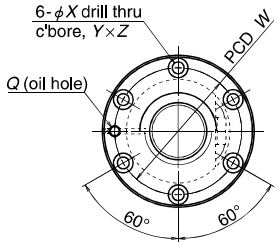
Model No.	Preload system	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial rigidity K (N/μm)	Nut entire length L
SFT 6310-2.5	Clearance	63	10	6.35	64.0	57.4	2.5×1	34 800	111 000	528	77
ZFT 6310-5	Z						2.5×1	34 800	111 000	1 038	107
PFT 6310-7.5	P						2.5×3	56 400	166 000	1 250	137
SFT 6310-5	Clearance						2.5×2	63 200	221 000	1 020	107
ZFT 6310-10	Z						2.5×2	63 200	221 000	2 000	167
SFT 6310-7.5	Clearance						2.5×3	89 500	332 000	1 500	137
DFT 6310-7.5	D						2.5×3	89 500	332 000	2 950	257
ZFT 6312-5	Z		12	7.938	64.5	56.2	2.5×1	47 400	137 000	1 060	123
SFT 6312-2.5	Clearance						2.5×1	47 400	137 000	542	87
SFT 6312-5	Clearance						2.5×2	86 000	273 000	1 050	123
DFT 6312-5	D						2.5×2	86 000	273 000	2 060	231
SFT 6316-2.5	Clearance		16	9.525	65.0	55.2	2.5×1	79 500	228 000	713	110
DFT 6316-2.5	D						2.5×1	79 500	228 000	1 400	206
PFT 6316-5	P						2.5×2	90 900	228 000	1 136	158
SFT 6316-5	Clearance						2.5×2	144 000	455 000	1 380	158
DFT 6316-5	D						2.5×2	144 000	455 000	2 710	302
SFT 6320-2.5	Clearance		20	9.525	65.0	55.2	2.5×1	79 500	228 000	713	127
DFT 6320-2.5	D						2.5×1	79 500	228 000	1 400	227
PFT 6320-5	P						2.5×2	90 900	228 000	1 132	187
SFT 6320-5	Clearance						2.5×2	144 000	455 000	1 380	187
DFT 6320-5	D						2.5×2	144 000	455 000	2 710	347
LPFT 6340-2.5	P		40	7.938	65.25	57	2.5×1	30 600	69 500	466	178
LPFT 6340-3	P						1.5×2	35 800	82 500	551	218
LSFT 6340-2.5	Clearance						2.5×1	48 500	139 000	560	178
LDFT 6340-2.5	D						2.5×1	48 500	139 000	1 100	339
LSFT 6340-3	Clearance						1.5×2	56 800	165 000	667	218
LDFT 6340-3	D						1.5×2	56 800	165 000	1 310	419
LPFT 6350-1.5	P		50	7.938	65.25	57	1.5×1	19 700	41 200	285	161
LPFT 6350-2.5	P						2.5×1	30 600	69 500	478	211
LSFT 6350-1.5	Clearance						1.5×1	31 300	82 500	346	161
LDFT 6350-1.5	D						1.5×1	31 300	82 500	678	311
LSFT 6350-2.5	Clearance						2.5×1	48 500	139 000	560	211
LDFT 6350-2.5	D						2.5×1	48 500	139 000	1 120	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.

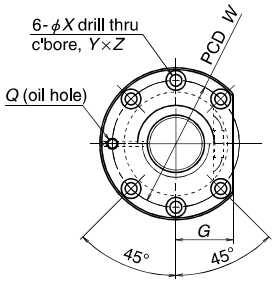
Ball nut dimensions																
Nut diameter		Flanged diameter	Flanged width	Notched flange	Tube projecting type			Seal dimension		Diameter g6	Bolt hole dimension			Bolt hole PCD	Oil hole
D	S	A	B	G	U	V	R	M	C	J	X	Y	Z	W	Q
108	—	154	22	58	—	—	—	7	—	—	14	20	13	130	Rc1/8
115	—	161	22	61	—	—	—	8	—	—	14	20	13	137	Rc1/8
122	—	180	28	69	—	—	—	—	—	—	18	26	17.5	150	Rc1/8
122	—	180	28	69	—	—	—	17	—	—	18	26	17.5	150	Rc1/8
97	—	144	22	49	58	77	19	15	14	—	14	—	—	120	Rc1/8
97	—	144		49	58	77	19			—				120	
97	—	144		49	58	77	19			—				120	
122	97	168		62	—	—	—			29				144	
97	—	144		49	58	77	19			—				120	
122	97	168		62	—	—	—			29				144	
97	—	144	22	49	58	77	19	19	16	—	14	—	—	120	Rc1/8
97	—	144		49	58	77	19			—				120	
97	—	144		49	58	77	19			—				120	
122	97	168		62	—	—	—			29				144	
97	—	144		49	58	77	19			—				120	
122	97	168		62	—	—	—			29				144	

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_a) with non-preload, 10% with D-preload, and 5% with P-preload. Refer to "Technical Description" (page B37) 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.)

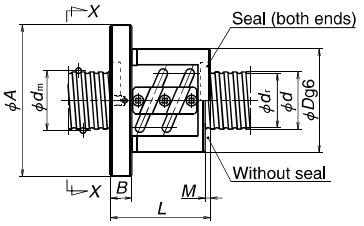
View *X-X*



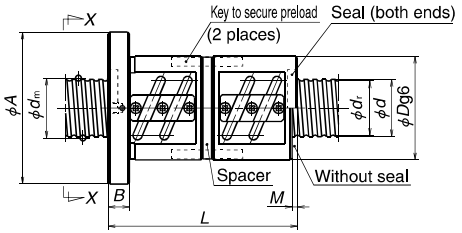
Circular shape Ⅰ



Circular shape Ⅱ



SFT



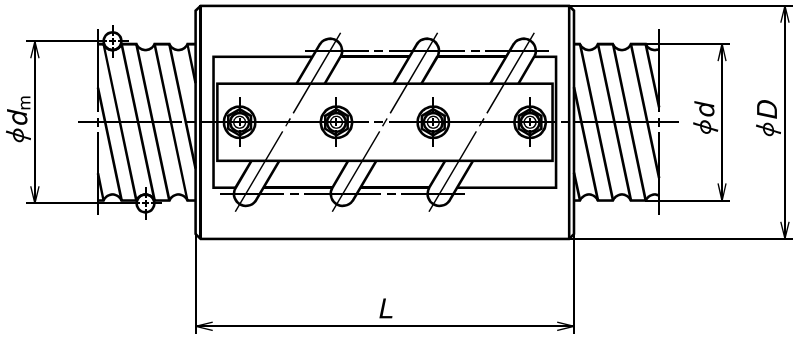
DFT

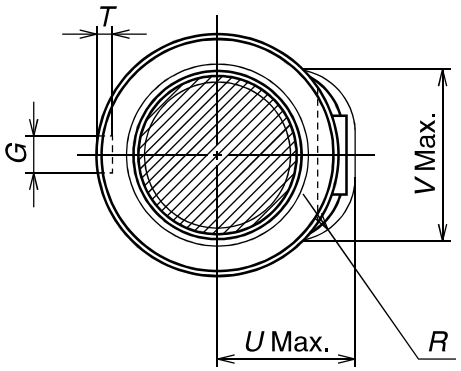
Unit: mm

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	Basic load rating (N) Static C_{0a}	Axial rigidity *K* (N/μm)
SFT 8010-5	Clearance	80	10	6.35	81.0	74.4	2.5×2	70 500	282 000	1 240
DFT 8010-5	D						2.5×2	70 500	282 000	2 430
SFT 8010-7.5	Clearance						2.5×3	99 800	424 000	1 830
DFT 8010-7.5	D						2.5×3	99 800	424 000	3 590
SFT 8012-5	Clearance		12	7.938	81.5	73.2	2.5×2	96 000	350 000	1 280
DFT 8012-5	D						2.5×2	96 000	350 000	2 500
SFT 8012-7.5	Clearance						2.5×3	136 000	526 000	1 880
DFT 8012-7.5	D						2.5×3	136 000	526 000	3 690
SFT 8016-5	Clearance		16	9.525	82.0	72.2	2.5×2	162 000	582 000	1 680
DFT 8016-5	D						2.5×2	162 000	582 000	3 300
SFT 8016-7.5	Clearance						2.5×3	230 000	874 000	2 470
DFT 8016-7.5	D						2.5×3	230 000	874 000	4 850
SFT 8020-5	Clearance		20	9.525	82.0	72.2	2.5×2	162 000	582 000	1 680
DFT 8020-5	D						2.5×2	162 000	582 000	3 300
SFT 8020-7.5	Clearance						2.5×3	230 000	874 000	2 470
DFT 8020-7.5	D						2.5×3	230 000	874 000	4 850
SFT 10012-5	Clearance	100	12	7.938	101.5	93.2	2.5×2	105 000	441 000	1 530
DFT 10012-5	D						2.5×2	105 000	441 000	2 990
SFT 10012-7.5	Clearance						2.5×3	149 000	662 000	2 250
DFT 10012-7.5	D						2.5×3	149 000	662 000	4 400
SFT 10016-5	Clearance		16	9.525	102	92.2	2.5×2	176 000	737 000	2 010
DFT 10016-5	D						2.5×2	176 000	737 000	3 930
SFT 10016-7.5	Clearance						2.5×3	250 000	1 100 000	2 950
DFT 10016-7.5	D						2.5×3	250 000	1 100 000	5 790
SFT 10020-5	Clearance		20	9.525	102	92.2	2.5×2	176 000	737 000	2 010
DFT 10020-5	D						2.5×2	176 000	737 000	3 930
SFT 10020-7.5	Clearance						2.5×3	250 000	1 100 000	2 950
DFT 10020-7.5	D						2.5×3	250 000	1 100 000	5 780
SFT 12516-5	Clearance	125	16	9.525	127	117.2	2.5×2	195 000	918 000	2 390
DFT 12516-5	D						2.5×2	195 000	918 000	4 690
SFT 12516-7.5	Clearance						2.5×3	277 000	1 380 000	3 520
DFT 12516-7.5	D						2.5×3	277 000	1 380 000	6 890
SFT 12520-5	Clearance		20	9.525	127	117.2	2.5×2	195 000	918 000	2 390
DFT 12520-5	D						2.5×2	195 000	918 000	4 690
SFT 12520-7.5	Clearance						2.5×3	277 000	1 380 000	3 520
DFT 12520-7.5	D						2.5×3	277 000	1 380 000	6 890

Ball nut dimensions										
Nut entire length *L*	Nut diameter *D*	Flanged diameter *A*	Flanged width *B*	Notched flange *G*	Seal dimension *M*	Bolt hole dimension *X*	Bolt hole dimension *Y*	Bolt hole dimension *Z*	Bolt hole PCD *W*	Oil hole *Q*
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										

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.
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 B37) 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.)





Model No.	Axial play (Max.)	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	Basic load rating (N) Static C_{0a}
GSCT14025-5	0.25	140	25	15.875	143	126.0	2.5×2	272 000	1 400 000
GSCT14025-7.5							2.5×3	362 000	2 090 000
GSCT14032-5	0.35		32	22.225	144	121.0	2.5×2	428 000	1 920 000
GSCT14032-7.5							2.5×3	568 000	2 880 000
GSCT14040-5	0.35		40	22.225	144	121.0	2.5×2	428 000	1 920 000
GSCT14040-7.5							2.5×3	568 000	2 880 000
GSCT14050-5	0.40		50	25.4	145	119.0	2.5×2	518 000	2 190 000
GSCT14050-7.5							2.5×3	688 000	3 290 000
GSCT16032-5	0.35	160	32	22.225	164	141.0	2.5×2	458 000	2 210 000
GSCT16032-7.5							2.5×3	608 000	3 310 000
GSCT16040-5	0.35		40	22.225	164	141.0	2.5×2	458 000	2 210 000
GSCT16040-7.5							2.5×3	608 000	3 310 000
GSCT16050-5	0.40		50	25.4	165	139.0	2.5×2	544 000	2 560 000
GSCT16050-7.5							2.5×3	722 000	3 840 000
GSCT20032-5	0.35	200	32	22.225	204	181.0	2.5×2	509 000	2 820 000
GSCT20032-7.5							2.5×3	676 000	4 230 000
GSCT20040-5	0.35		40	22.225	204	181.0	2.5×2	509 000	2 820 000
GSCT20040-7.5							2.5×3	676 000	4 230 000
GSCT20050-5	0.40		50	25.4	205	179.0	2.5×2	604 000	3 200 000
GSCT20050-7.5							2.5×3	802 000	4 800 000
GSCT25040-5	0.40	250	40	25.4	255	229.0	2.5×2	662 000	4 000 000
GSCT25040-7.5							2.5×3	879 000	6 000 000
GSCT25050-5	0.51		50	31.75	256	223.0	2.5×2	825 000	5 000 000
GSCT25050-7.5							2.5×3	1 100 000	7 500 000

Notes: 1. Precision grade is equivalent to Ct10 grade of JIS B1192 (see page B37).
2. The entire nut length (L) is the size without seal. The size with a seal is longer by the size of "MS."

Unit: mm

Nut dimensions							
Nut entire length L	Nut diameter D	Key dimension G	Key dimension T	Tube projecting dimension U	Tube projecting dimension V	Tube projecting dimension R	Seal dimension (MS)
200	210	32	11	115	154	50	40
275							
252	220			135	163	60	48
348							
306	220			135	163	60	58
426							
377	225			141	167	70	70
527							
252	245	36	12	141	180	60	48
348							
306	245			141	180	60	58
426							
377	250			147	185	70	70
527							
252	295	45	15	162	216	70	48
348							
306	295			162	216		58
426							
377	300			168	221		70
527							
312	355	50	17	194	266	70	58
432							
385	370			206	274	90	70
535							

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.

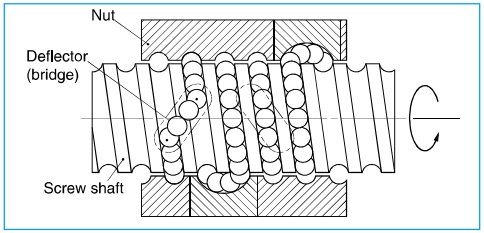


Fig. 1 Structure of deflector(bridge) recirculation system

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

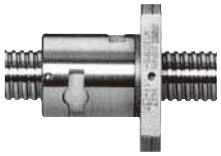
Standard of rotational speed : 3 000 min^{-1}

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 CircularⅠ, 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

- SFD: Nut model: SFD, ZFD, DFD / MSFD, MPFD
- 40: Screw shaft diameter (mm)
- 08: Lead (mm)
- 4: Effective turns of balls (Note)

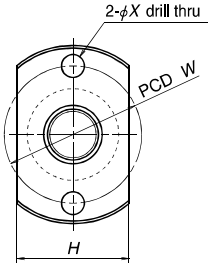
Note: In case of ZFD, the number here is twice as large as the effective turns of balls.

◇Reference number for ball screw

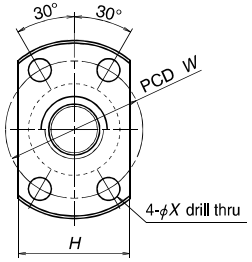
W 40 08 - ** D Y - C3 Z 5

- W: Product code
- 40: Screw shaft diameter (mm)
- 08: Effective threaded length (in the unit of 100 mm)
- **: NSK design serial number
- D: Preload code: No code, non-preload; Z, Z-preload; D, D-preload; P, P-preload (page B5)
- Y: Deflector(bridge) recirculation system
- C3: Accuracy grade code: C0, C1, C2, C3, C5, C7(Ct7) (page B37 to B42)
- Z: Axial play code: Z, T, S, N (page B20)
- 5: Lead (mm)

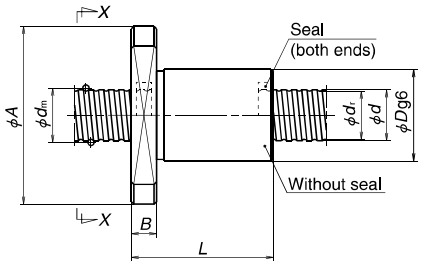
View *X-X*



Lead *l* = 0.5 mm



Lead *l* > 1 mm

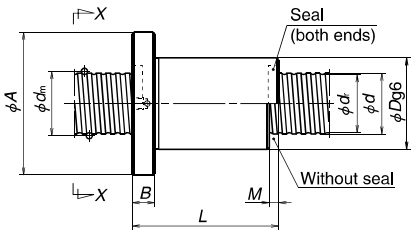


Unit: mm

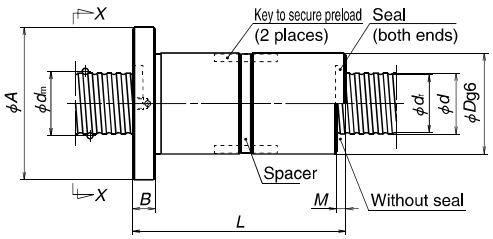
	Model No.	Preload system	Shaft dia. *d*	Lead *l*	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}
	MSFD 0400.5-3	Clearance	4	0.5	0.400	4.1	3.6	1×3	170	280
	MPFD 0400.5-3	P								
	MSFD 0401-2	Clearance		1	0.800	4.2	3.2	1×2	315	370
*	**MPFD 0401-2**	P								
	MSFD 0600.5-3	Clearance	6	0.5	0.400	6.1	5.6	1×3	205	430
	MPFD 0600.5-3	P								
	MSFD 0601-3	Clearance		1	0.800	6.2	5.2	1×3	575	925
*	**MPFD 0601-3**	P								
	MSFD 0602-3	Clearance		2	0.800	6.2	5.2	1×3	575	925
	MPFD 0602-3	P								
	MSFD 0800.5-3	Clearance	8	0.5	0.400	8.1	7.6	1×3	230	595
	MPFD 0800.5-3	P								
	MSFD 0801-3	Clearance		1	0.800	8.2	7.2	1×3	670	1 290
*	**MPFD 0801-3**	P								
	MSFD 0801.5-3	Clearance		1.5	1.000	8.3	7.0	1×3	1 080	1 980
*	**MPFD 0801.5-3**	P								
	MSFD 0802-3	Clearance		2	1.200	8.3	6.9	1×3	1 320	2 210
*	**MPFD 0802-3**	P								
	MSFD 1001-3	Clearance	10	1	0.800	10.2	9.2	1×3	745	1 660
	MPFD 1001-3	P								
	MSFD 1002-3	Clearance		2	1.200	10.3	8.9	1×3	1 490	2 850
*	**MPFD 1002-3**	P								
	MSFD 1002.5-3	Clearance		2.5	1.588	10.4	8.6	1×3	2 130	3 640
*	**MPFD 1002.5-3**	P								
	MSFD 1201-3	Clearance	12	1	0.800	12.2	11.2	1×3	795	1 980
	MPFD 1201-3	P								
	MSFD 1202-3	Clearance		2	1.200	12.3	10.9	1×3	1 660	3 620
*	**MPFD 1202-3**	P								
	MSFD 1202.5-3	Clearance		2.5	1.588	12.4	10.6	1×3	2 360	4 540
*	**MPFD 1202.5-3**	P								
	MSFD 1203-3	Clearance		3	2.000	12.5	10.2	1×3	3 120	5 420
	MPFD 1203-3	P								
	MSFD 1402-3	Clearance	14	2	1.200	14.3	12.9	1×3	1 780	4 270
	MPFD 1402-3	P								
	MSFD 1403-3	Clearance		3	2.000	14.5	12.2	1×3	3 400	6 490
	MPFD 1403-3	P								

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*
30	13	10	22	3	11	3.4	16
47							
22	12	10	20	3	14	2.9	15
34							
42	13	12	24	3	13	3.4	18
66							
49	15	12	24	3.5	16	3.4	18
76							
49	17	13	25	4	17	3.4	19
76							
54	13	14	27	3	15	3.4	21
85							
64	16	14	27	4	18	3.4	21
99							
76	22	15	28	4	19	3.4	22
117							
73	26	16	29	4	20	3.4	23
113							
77	16	16	29	4	20	3.4	23
120							
91	28	18	35	5	22	4.5	27
138							
90	32	19	36	5	23	4.5	28
140							
88	16	18	31	4	22	3.4	25
137							
108	28	20	37	5	24	4.5	29
168							
107	32	21	38	5	25	4.5	30
167							
107	36	22	39	5	26	4.5	31
166							
122	29	22	41	6	26	5.5	32
191							
127	37	24	43	6	28	5.5	34
196							

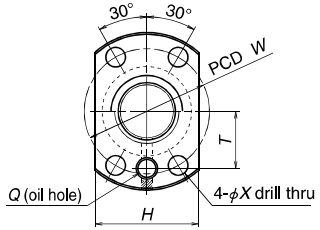
Notes: 1. If the shaft OD is less than 6 mm or the lead is less than 1 mm, a seal is not installed in the nut. (See page B68 for dust protection.)
2. Ball nuts with shaft diameters under 14 mm do not have oil holes.
3. Right turn screw is standard. Please consult NSK for left turn screw.
4. The axial 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 B37) 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.)

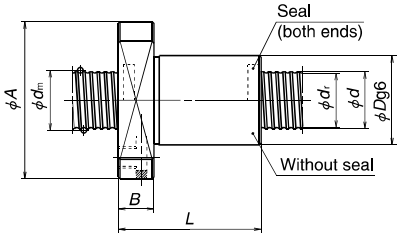


SFD, ZFD



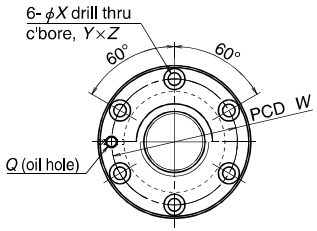
DFD



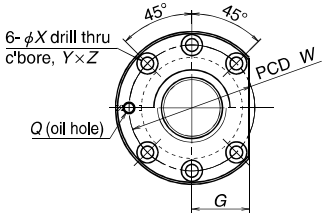


MSFD, MPFD

View X-X



Circular shape I



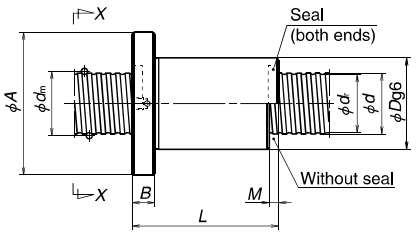
Circular shape II

Unit: mm

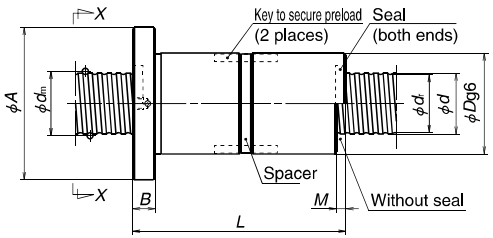
	Model No.	Preload system	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial rigidity K (N/μm)
	MSFD 1602-4	Clearance	16	2	1.588	16.4	14.6	1×4	3 510	8 450	185
*	**MPFD 1602-4**	P									288
	MSFD 1602.5-4	Clearance		2.5	1.588	16.4	14.6	1×4	3 510	8 450	185
*	**MPFD 1602.5-4**	P									288
	MSFD 2002-4	Clearance	20	2	1.588	20.4	18.6	1×4	3 910	10 900	225
	MPFD 2002-4	P									351
	SFD 2005-3	Clearance		5	3.175	20.75	17.4	1×3	8 620	17 500	196
	ZFD 2005-6	Z						1×3	8 620	17 500	382
	SFD 2005-4	Clearance						1×4	11 000	23 300	255
	DFD 2005-4	D						1×4	11 000	23 300	509
	SFD 2006-3	Clearance		6	3.969	21	16.9	1×3	11 100	20 600	196
	ZFD 2006-6	Z						1×3	11 100	20 600	382
	SFD 2006-4	Clearance						1×4	14 300	27 500	255
	DFD 2006-4	D						1×4	14 300	27 500	498
	MSFD 2502-4	Clearance	25	2	1.588	25.4	23.6	1×4	4 310	13 900	273
	MPFD 2502-4	P									425
	SFD 2505-3	Clearance		5	3.175	25.75	22.4	1×3	9 790	22 900	245
*	**ZFD 2505-6**	Z						1×3	9 790	22 900	480
	SFD 2505-4	Clearance						1×4	12 500	30 500	323
	DFD 2505-4	D						1×4	12 500	30 500	630
	SFD 2506-3	Clearance		6	3.969	26	21.9	1×3	12 900	27 300	245
	ZFD 2506-6	Z						1×3	12 900	27 300	470
	SFD 2506-4	Clearance						1×4	16 500	36 500	323
	DFD 2506-4	D						1×4	16 500	36 500	626
	ZFD 2510-4	Z		10	4.762	26.25	21.3	1×2	11 400	21 400	323
	SFD 2510-3	Clearance						1×3	16 100	32 000	245
	DFD 2510-3	D						1×3	16 100	32 000	479

Ball nut dimensions												
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Notched flange G	Notched flange H	Seal dimension M	Bolt hole dimension X	Bolt hole dimension Y	Bolt hole dimension Z	Bolt hole PCD W	Oil hole dimension T	Oil hole Q
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						46		
51	35	58		22.5						46		
91	41	64		25						52		
52	35	58	11	22.5	—	6	5.5	9.5	5.5	46	—	M6×1
76	35	58		22.5						46		
60	35	58		22.5						46		
108	42	65		25						53		
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		
51	40	63		24						51		
91	46	69		26						57		
52	40	63	11	24	—	6	5.5	9.5	5.5	51	—	M6×1
76	40	63		24						51		
60	40	63		24						51		
108	47	70		27						58		
88	42	69	15	26	—	10	6.6	11	6.5	55	—	M6×1
80	42	69		26						55		
140	47	74		28						60		

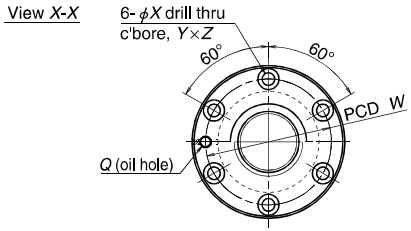
Notes: 1. Nut comes in circular shape I and circular shape II for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for SFD, ZFD, and DFD, the nut length "L" is shortened by dimension "M". For MSFD and MPFD, the nut length 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.
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 B37) 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.)



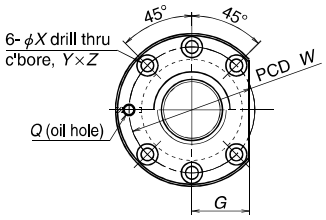
SFD, ZFD



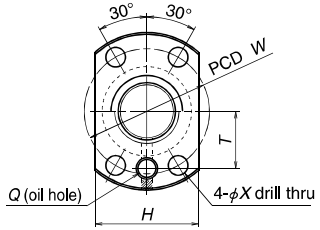
DFD

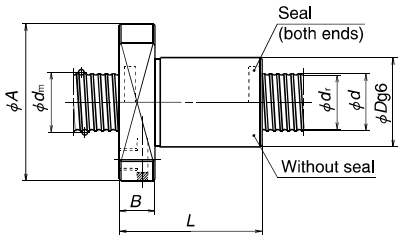


Circular shape Ⅰ



Circular shape Ⅱ





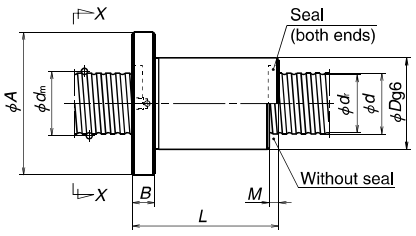
MSFD, MPFD

Unit: mm

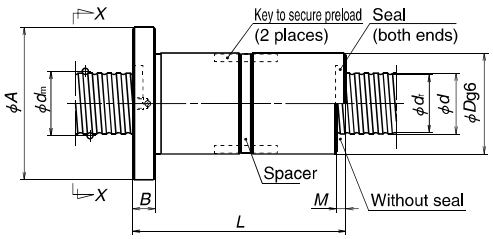
	Model No.	Preload system	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity K (N/μm)
	MSFD 3202-6	Clearance	32	2	1.588	32.4	30.6	1×6	6 790	27 200	494
	MPFD 3202-6	P									769
	SFD 3205-3	Clearance		5	3.175	32.75	29.4	1×3	11 100	30 500	304
	ZFD 3205-6	Z						1×3	11 100	30 500	598
	SFD 3205-4	Clearance						1×4	14 200	40 700	409
*	**ZFD 3205-8**	Z						1×4	14 200	40 700	784
	SFD 3205-6	Clearance						1×6	20 200	61 000	588
	DFD 3205-6	D						1×6	20 200	61 000	1 160
	SFD 3206-3	Clearance		6	3.969	33	28.9	1×3	15 000	37 500	314
	ZFD 3206-6	Z						1×3	15 000	37 500	608
	SFD 3206-4	Clearance						1×4	19 200	49 900	412
	ZFD 3206-8	Z						1×4	19 200	49 900	804
	SFD 3206-6	Clearance						1×6	27 200	74 900	598
	DFD 3206-6	D						1×6	27 200	74 900	1 190
	SFD 3208-3	Clearance		8	4.762	33.25	28.3	1×3	18 300	41 800	304
	ZFD 3208-6	Z						1×3	18 300	41 800	588
	SFD 3208-4	Clearance						1×4	23 500	55 800	392
	ZFD 3208-8	Z						1×4	23 500	55 800	774
	SFD 3210-3	Clearance		10	6.35	33.75	27.1	1×3	25 900	52 800	300
*	**ZFD 3210-6**	Z						1×3	25 900	52 800	588
	SFD 3210-4	Clearance						1×4	33 200	70 300	392
	DFD 3210-4	D						1×4	33 200	70 300	773

Ball nut dimensions												
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Notched flange G	Notched flange H	Seal dimension M	Bolt hole dimension X	Bolt hole dimension Y	Bolt hole dimension Z	Bolt hole PCD W	Oil hole dimension T	Oil hole Q
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												

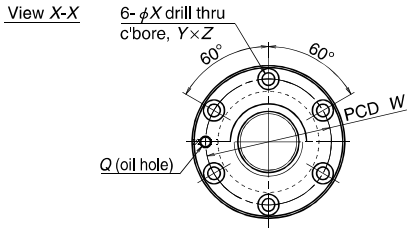
Notes: 1. Nut comes in circular shape Ⅰ and circular shape Ⅱ for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for SFD, ZFD, and DFD, the nut length "L" is shortened by dimension "M". For MSFD and MPFD, the nut length 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.
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 B37) 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.)



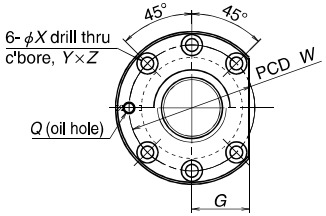
SFD, ZFD



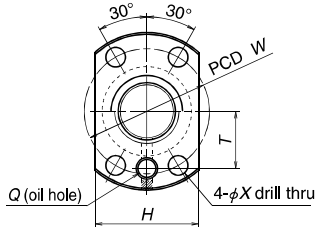
DFD

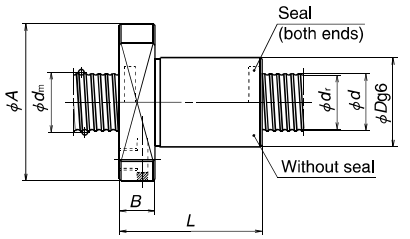


Circular shape Ⅰ



Circular shape Ⅱ





MSFD, MPFD

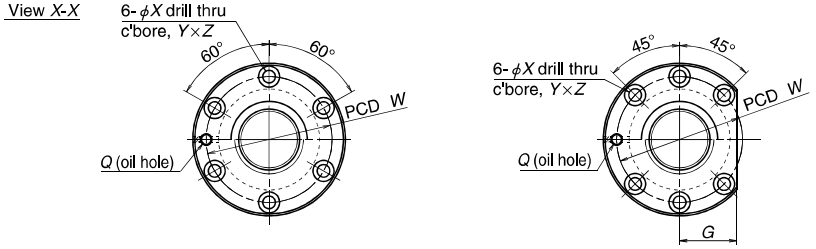
Unit: mm

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	Basic load rating (N): Static C_{0a}	Axial rigidity *K* (N/μm)
MSFD 4002-6	Clearance	40	2	1.588	40.4	38.6	1×6	7 380	33 900	588
MPFD 4002-6	P									916
SFD 4005-4	Clearance		5	3.175	40.75	37.4	1×4	15 800	52 300	490
ZFD 4005-8	Z						1×4	15 800	52 300	960
SFD 4005-6	Clearance						1×6	22 400	78 400	725
ZFD 4005-12	Z						1×6	22 400	78 400	1 410
SFD 4006-4	Clearance		6	3.969	41.0	36.9	1×4	21 300	63 500	490
ZFD 4006-8	Z						1×4	21 300	63 500	970
SFD 4006-6	Clearance						1×6	30 100	95 300	725
ZFD 4006-12	Z						1×6	30 100	95 300	1 431
SFD 4008-4	Clearance		8	4.762	41.25	36.3	1×4	27 200	75 200	500
ZFD 4008-8	Z						1×4	27 200	75 200	990
SFD 4008-6	Clearance						1×6	38 500	113 000	735
DFD 4008-6	D						1×6	38 500	113 000	1 460
SFD 4010-3	Clearance		10	6.35	41.75	35.1	1×3	30 000	70 000	372
ZFD 4010-6	Z						1×3	30 000	70 000	735
SFD 4010-4	Clearance						1×4	38 400	93 300	490
ZFD 4010-8	Z						1×4	38 400	93 300	970
SFD 5005-4	Clearance	50	5	3.175	50.75	47.4	1×4	17 500	66 800	593
ZFD 5005-8	Z						1×4	17 500	66 800	1 170
SFD 5005-6	Clearance						1×6	24 800	100 000	872
ZFD 5005-12	Z						1×6	24 800	100 000	1 720
SFD 5006-4	Clearance		6	3.969	51.0	46.9	1×4	23 600	81 700	598
ZFD 5006-8	Z						1×4	23 600	81 700	1 190
SFD 5006-6	Clearance						1×6	33 500	122 000	892
ZFD 5006-12	Z						1×6	33 500	122 000	1 750

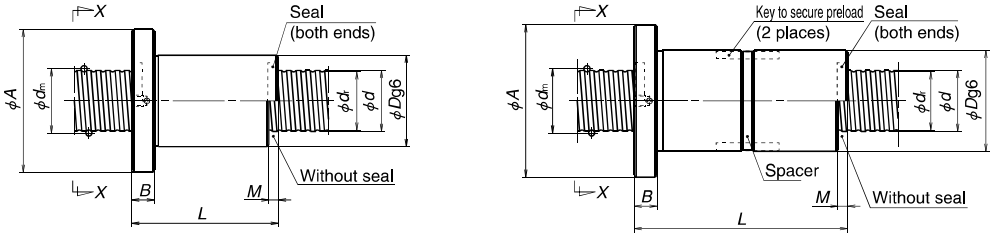
Notes: 1. Nut comes in circular shape Ⅰ and circular shape Ⅱ for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal for SFD, ZFD, and DFD, the nut length "L" is shortened by dimension "M". For MSFD and MPFD, the nut length 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 *L*	Nut diameter *D*	Flanged diameter *A*	Flanged width *B*	Notched flange *G*	Notched flange *H*	Seal dimension *M*	Bolt hole dimension *X*	Bolt hole dimension *Y*	Bolt hole dimension *Z*	Bolt hole PCD *W*	Oil hole dimension *T*	Oil hole *Q*
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	60	94		36						76		
93	60	94		36						76		
168	62	96		37						78		
83	62	104	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 B37) 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



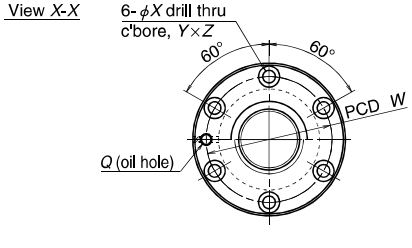
SFD, ZFD　　DFD

Unit: mm

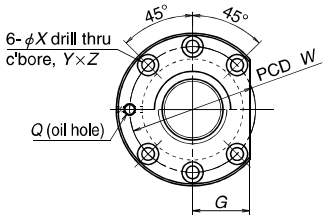
Model No.	Preload system	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Effective turns of balls: Turns × Circuits	Basic load rating (N): Dynamic C_a	Basic load rating (N): Static C_{0a}	Axial rigidity K (N/μm)
SFD 5008-4	Clearance	50	8	4.762	51.25	46.3	1×4	29 900	94 800	598
ZFD 5008-8	Z						1×4	29 900	94 800	1 180
SFD 5008-6	Clearance						1×6	42 400	142 000	887
DFD 5008-6	D						1×6	42 400	142 000	1 740
SFD 5010-3	Clearance		10	6.35	51.75	45.1	1×3	34 100	91 600	461
ZFD 5010-6	Z						1×3	34 100	91 600	914
SFD 5010-4	Clearance						1×4	43 600	122 000	608
ZFD 5010-8	Z						1×4	43 600	122 000	1 200
SFD 5010-6	Clearance						1×6	61 800	183 000	902
DFD 5010-6	D						1×6	61 800	183 000	1 770
SFD 5012-3	Clearance		12	7.938	52.25	44	1×3	44 800	109 000	461
ZFD 5012-6	Z						1×3	44 800	109 000	906
SFD 5012-4	Clearance						1×4	57 300	146 000	608
DFD 5012-4	D						1×4	57 300	146 000	1 200
SFD 5020-3	Clearance		20	7.938	52.25	44	1×3	44 800	109 000	461
DFD 5020-3	D							44 800	109 000	908
SFD 6306-4	Clearance	63	6	3.969	64.0	59.9	1×4	26 100	104 000	735
ZFD 6306-8	Z						1×4	26 100	104 000	1 430
SFD 6306-6	Clearance						1×6	36 900	157 000	1 180
ZFD 6306-12	Z						1×6	36 900	157 000	2 110
SFD 6308-4	Clearance		8	4.762	64.25	59.3	1×4	33 600	124 000	745
ZFD 6308-8	Z						1×4	33 600	124 000	1 460
SFD 6308-6	Clearance						1×6	47 600	186 000	1 100
DFD 6308-6	D						1×6	47 600	186 000	2 150
SFD 6310-4	Clearance		10	6.35	64.75	58.1	1×4	49 700	163 000	764
ZFD 6310-8	Z						1×4	49 700	163 000	1 510
SFD 6310-6	Clearance						1×6	70 500	244 000	1 130
DFD 6310-6	D						1×6	70 500	244 000	2 210
ZFD 6312-6	Z		12	7.938	65.25	57	1×3	50 800	143 000	1 120
SFD 6312-4	Clearance						1×4	65 100	191 000	755
DFD 6312-4	D						1×4	65 100	191 000	1 480
SFD 6312-6	Clearance						1×6	92 200	286 000	1 110
DFD 6312-6	D						1×6	92 200	286 000	2 180
SFD 6320-3	Clearance		20	9.525	65.75	56	1×3	83 700	232 000	735
DFD 6320-3	D									1 440

Ball nut dimensions										
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Notched flange G	Seal dimension M	Bolt hole dimension X	Bolt hole dimension Y	Bolt hole dimension Z	Bolt hole PCD W	Oil hole Q
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										
99	75	121	22	47	12	14	20	13	97	Rc1/8
147										
111										
195										
146	75	121	28	47	20	14	20	13	97	Rc1/8
253										
67	80	122	18	47	6	11	17.5	11	100	Rc1/8
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										

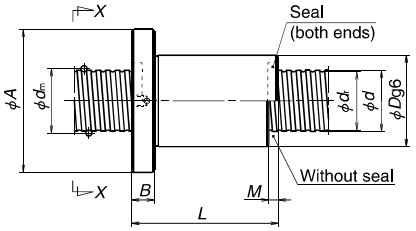
Notes: 1. Nut comes in circular shape I and circular shape II for shaft diameter 20 mm or larger. Select a flange that is suitable for the space available for nut installation.
2. If there is no seal the nut length "L" is shortened by dimension "M".
3. The right turn screw is standard. "L" is added to the end of the model code for the left turn screw.
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 B37) 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.)



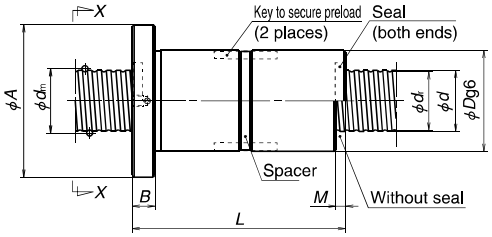
Circular shape I



Circular shape II



SFD



DFD

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	Basic load rating (N) Static C_{0a}	Axial rigidity K (N/μm)
SFD 8010-4	Clearance	80	10	6.35	81.75	75.1	1×4	55 100	209 000	931
DFD 8010-4	D						1×4	55 100	209 000	1 840
SFD 8010-6	Clearance						1×6	78 000	314 000	1 370
DFD 8010-6	D						1×6	78 000	314 000	2 710
SFD 8012-4	Clearance		12	7.938	82.25	74	1×4	74 000	254 000	941
DFD 8012-4	D						1×4	74 000	254 000	1 860
SFD 8012-6	Clearance						1×6	105 000	381 000	1 392
DFD 8012-6	D						1×6	105 000	381 000	2 730
SFD 8020-3	Clearance		20	9.525	82.75	73	1×3	96 600	313 000	931
DFD 8020-3	D						1×3	96 600	313 000	1 830
SFD 8020-4	Clearance						1×4	124 000	417 000	1 230
DFD 8020-4	D						1×4	124 000	417 000	2 410
SFD 10010-6	Clearance	100	10	6.35	101.75	95.1	1×6	86 200	401 000	1 670
DFD 10010-6	D									3 270
SFD 10012-6	Clearance		12	7.938	102.25	94	1×6	117 000	490 000	1 680
DFD 10012-6	D									3 320
SFD 10020-4	Clearance		20	9.525	102.75	93	1×4	136 000	526 000	1 470
DFD 10020-4	D									2 890

Ball nut dimensions										
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Notched flange G	Seal dimension M	Bolt hole dimension X	Bolt hole dimension Y	Bolt hole dimension Z	Bolt hole PCD W	Oil hole Q
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	130	188	28	71	12	18	26	17.5	158	Rc1/8
254										
172	135	205	32	79	20	22	32	21.5	169	Rc1/8
301										

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.
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 B37) 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.**

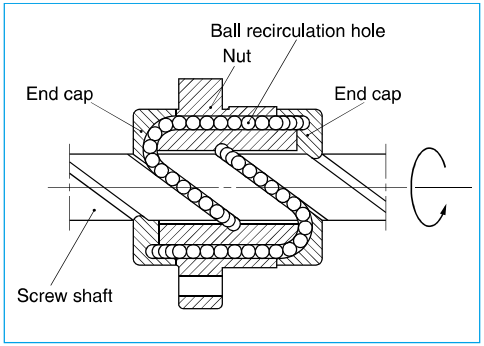


Fig. 1 Structure of end cap recirculation system

(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.

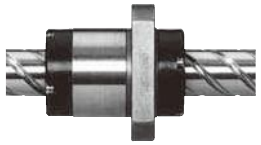
(4) Other specifications

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

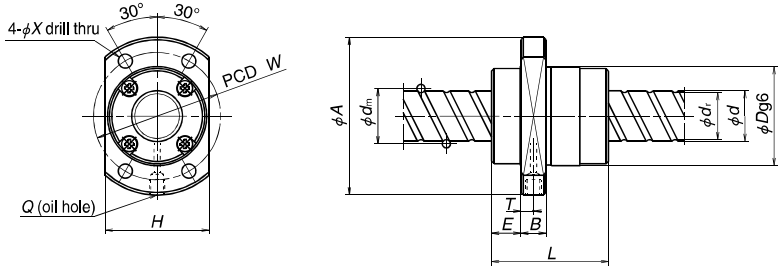
UPFC 25 25 - 3

- UPFC — Nut model: LSFC, LPFC, USFC, UPFC
- 25 — Screw shaft diameter (mm)
- 25 — Lead (mm)
- 3 — Effective turns of balls

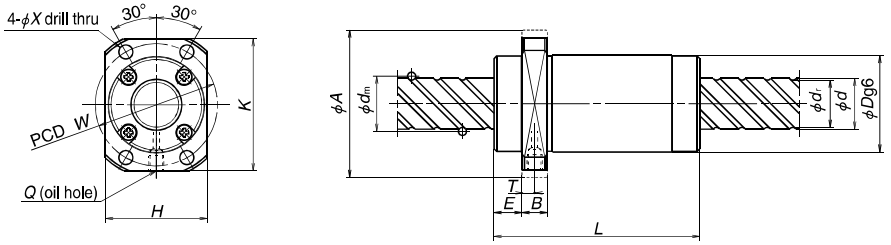
◇Reference number for ball screw

W 25 09 - ** P G X - C3 Z 25

- W — Product code
- 25 — Screw shaft diameter (mm)
- 09 — Effective threaded length (in the unit of 100 mm)
- ** — NSK design serial number
- P — Preload code: No code, non-preload; P, P-preload (page B5)
- G — End cap recirculation system
- X — Appearance/specification code
- C3 — Accuracy grade code: C1, C2, C3, C5, C7 (Ct7) (page B37 to B42)
- Z — Axial play code: Z, T, S, N (page B20)
- 25 — Lead (mm)



LSFC, LPFC



USFC, UPFC

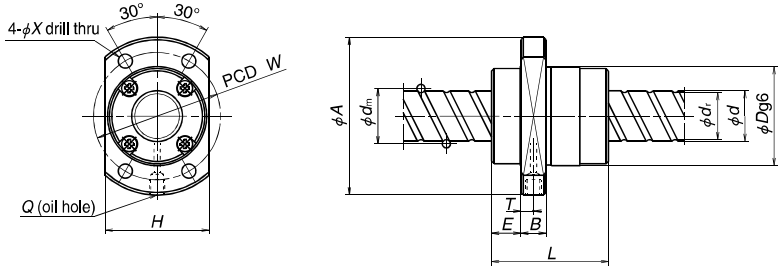
Unit: mm

	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) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity K (N/μm)
	USFC 1220-1.5	Clearance	12	20	2.381	12.5	9.9	1.7×1	2 690	4 420	66
	UPFC 1220-1.5	P									103
	USFC 1520-1.5	Clearance	15	20	3.175	15.5	12.2	1.7×1	5 070	8 730	97
*	**UPFC 1520-1.5**	P									151
	USFC 1540-1	Clearance		40	3.175	15.75	12.2	0.7×2	3 860	6 050	62
	UPFC 1540-1	P						0.7×2	3 860	6 050	97
	USFC 1540-2	Clearance						0.7×4	7 000	12 100	121
	UPFC 1540-2	P						0.7×4	7 000	12 100	188
	LSFC 1616-3	Clearance	16	16	2.778	16.65	13.7	1.7×2	6 380	12 500	172
	LPFC 1616-3	P						1.7×2	6 380	12 500	268
	LSFC 1616-6	Clearance						1.7×4	11 600	25 000	334
	LPFC 1616-6	P						1.7×4	11 600	25 000	520
	USFC 1632-1	Clearance		32	3.175	16.75	13.4	0.7×2	4 000	6 690	74
*	**UPFC 1632-1**	P						0.7×2	4 000	6 690	116
	USFC 1632-3	Clearance						1.7×2	8 580	17 000	176
	UPFC 1632-3	P						1.7×2	8 580	17 000	273
	USFC 1632-6	Clearance						1.7×4	15 600	34 100	340
	UPFC 1632-6	P						1.7×4	15 600	34 100	530
	USFC 1650-1	Clearance		50	3.175	16.75	13.4	0.7×2	4 000	6 690	65
	UPFC 1650-1	P						0.7×2	4 000	6 690	102
	USFC 1650-2	Clearance						0.7×4	7 260	13 400	126
	UPFC 1650-2	P						0.7×4	7 260	13 400	197
	LSFC 2020-3	Clearance	20	20	3.175	20.75	17.4	1.7×2	9 620	21 000	238
	LPFC 2020-3	P						1.7×2	9 620	21 000	370
	LSFC 2020-6	Clearance						1.7×4	17 500	42 000	462
	LPFC 2020-6	P						1.7×4	17 500	42 000	718
	USFC 2040-1	Clearance		40	3.175	20.75	17.4	0.7×2	4 490	8 640	89
*	**UPFC 2040-1**	P						0.7×2	4 490	8 640	138
	USFC 2040-3	Clearance						1.7×2	9 620	21 000	211
	UPFC 2040-3	P						1.7×2	9 620	21 000	328
	USFC 2040-6	Clearance						1.7×4	17 500	42 000	409
	UPFC 2040-6	P						1.7×4	17 500	42 000	636
	USFC 2060-1	Clearance		60	3.175	20.75	17.4	0.7×2	4 490	8 640	78
	UPFC 2060-1	P						0.7×2	4 490	8 640	121
	USFC 2060-2	Clearance						0.7×4	8 140	17 300	151
	UPFC 2060-2	P						0.7×4	8 140	17 300	235

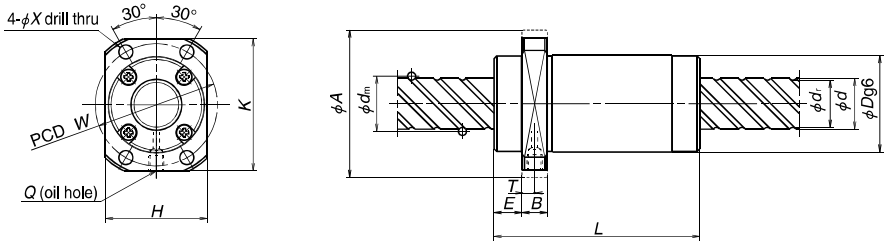
Ball nut dimensions										
Nut entire length L	Nut diameter D	Flanged diameter A	Flanged width B	Flanged dimension H	Flanged dimension K	End cap dimension E	Bolt hole dimension X	Bolt hole PCD W	Oil hole Q	Oil hole position T
44	26	44	10	28	40	9	4.5	35	M6×1	5
45	34	55	10	36	50	11	5.5	45	M6×1	5
40	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										
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										
81										
81										
58	38	58	10	40	52	12.3	5.5	48	M6×1	5

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_a). For the LPFC and UPFC type, the rigidity is the theoretical value when the preload is 10% of the basic dynamic load rating (C_a) and an axial load is applied to it. Refer to the "Technical Description" (page B37) if the rigidity and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

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) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity *K* (N/μm)
LSFC 2525-3	Clearance	25	25	3.969	26.0	21.9	1.7×2	14 400	32 800	293
LPFC 2525-3	P						1.7×2	14 400	32 800	456
LSFC 2525-6	Clearance						1.7×4	26 100	65 600	568
LPFC 2525-6	P						1.7×4	26 100	65 600	883
USFC 2550-1	Clearance		50				0.7×2	6 700	13 500	109
* **UPFC 2550-1**	P						0.7×2	6 700	13 500	170
USFC 2550-3	Clearance						1.7×2	14 400	32 800	264
UPFC 2550-3	P						1.7×2	14 400	32 800	412
USFC 2550-6	Clearance						1.7×4	26 100	65 600	512
UPFC 2550-6	P						1.7×4	26 100	65 600	796
USFC 2580-1	Clearance		80				0.7×2	6 700	13 500	94
UPFC 2580-1	P						0.7×2	6 700	13 500	147
USFC 2580-2	Clearance						0.7×4	12 200	27 000	184
UPFC 2580-2	P						0.7×4	12 200	27 000	285
LSFC 3232-3	Clearance	32	32	4.762	33.25	28.3	1.7×2	21 000	51 600	366
LPFC 3232-3	P						1.7×2	21 000	51 600	570
LSFC 3232-6	Clearance						1.7×4	38 100	103 000	709
LPFC 3232-6	P						1.7×4	38 100	103 000	1 104
USFC 3264-1	Clearance		64				0.7×2	9 800	20 900	143
UPFC 3264-1	P						0.7×2	9 800	20 900	222
USFC 3264-3	Clearance						1.7×2	21 000	51 600	329
UPFC 3264-3	P						1.7×2	21 000	51 600	512
USFC 3264-6	Clearance						1.7×4	38 100	103 000	636
UPFC 3264-6	P						1.7×4	38 100	103 000	991
LSFC 4040-3	Clearance	40	40	6.350	41.75	35.2	1.7×2	33 500	86 500	455
LPFC 4040-3	P						1.7×2	33 500	86 500	708
LSFC 4040-6	Clearance						1.7×4	60 800	173 000	880
LPFC 4040-6	P						1.7×4	60 800	173 000	1 370
LSFC 5050-3	Clearance	50	50	7.938	52.25	44.1	1.7×2	50 000	135 000	560
LPFC 5050-3	P						1.7×2	50 000	135 000	871
LSFC 5050-6	Clearance						1.7×4	90 800	270 000	1 084
LPFC 5050-6	P						1.7×4	90 800	270 000	1 688

Ball nut dimensions									
Nut entire length *L*	Nut diameter *D*	Flanged diameter *A*	Flanged width *B*	Flanged dimension *H*	Flanged dimension *K*	End cap dimension *E*	Bolt hole dimension *X*	Bolt hole PCD *W*	Oil hole *Q*	Oil hole position *T*
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										
100										
75	46	70	12	48	63	14.5	6.6	58	M6×1	6
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										
126										
85	73	114	15	75	—	19.5	11	93	M6×1	6.5
107	90	135	20	92	—	21.5	14	112	M6×1	7

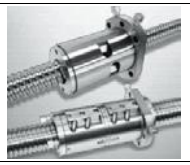
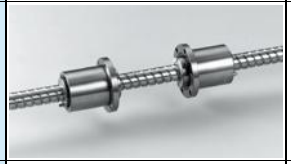
Notes: 1. For the LSFC and USFC type ball screws, the axial rigidity *K* in the table above is the theoretical values obtained from the elastic deformation between screw groove and ball when the axial load is 30% of the basic dynamic load rating (C_a). For the LPFC and UPFC type, the rigidity is the theoretical value when the preload is 10% of the basic dynamic load rating (C_a) and an axial load is applied to it. Refer to the "Technical Description" (page B37) if the rigidity and preload differ from the conditions above, or when the deformation of the ball nut body must be considered.

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.)

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 or more compared with the HMC type	High-speed machining centers High-speed combined machine tools Die mold processing machine	B495
	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 or more compared with the Tube type.	Machining centers Die mold processing machine NC lathes Combined machine tools	B499
	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	B503
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	B509
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	B513
	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	B517
	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	B521
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	B533

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	B537
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	B541
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	B542
	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	B547
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	B551
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	B559
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	B571
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	B575

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 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.

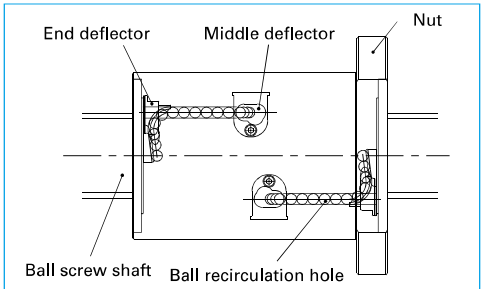


Fig. 1 Structure of middle-deflector recirculation system

(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 B541.)

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 B542.)

● Nut cooling ball screw (See page B547.)

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

- EM — Nut model: EM
- 40 — Screw shaft diameter (mm)
- 20 — Lead (mm)
- 6E — Effective turns of balls

◇Reference number for ball screw

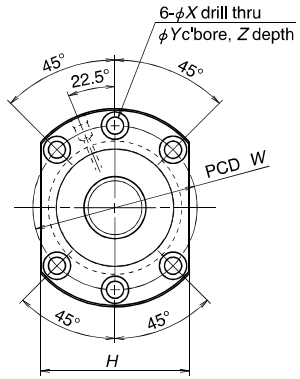
W 40 07 - ** Z M X T - C5 Z 20

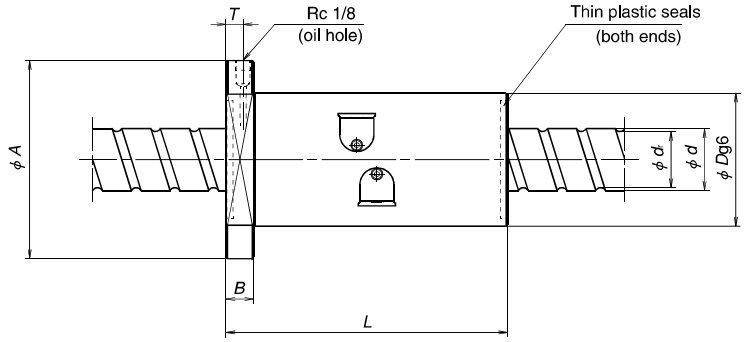
- W — Product code
- 40 — Screw shaft diameter (mm)
- 07 — Effective threaded length (in the unit of 100 mm)
- ** — NSK design serial number
- Z — Preload code: Z; Z-preload
- M — Middle-deflector recirculation system
- X — Ball screw specification/appearance
- T — Hollow shaft specification
- C5 — Accuracy grade: C3 or C5
- Z — Axial play code: Z
- 20 — Lead (mm)

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. d	Lead l	Root dia. d_r	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity K (N/μm)
EM4016-4E	40	16	34.1	57 100	130 000	1 020
EM4020-6E		20	34.4	66 900	165 000	1 340
EM4025-6E		25	34.1	79 100	191 000	1 370
EM4030-6E		30	34.1	79 100	191 000	1 350
EM4516-4E	45	16	39.1	59 600	145 000	1 060
EM4520-6E		20	39.4	69 100	186 000	1 470
EM4525-6E		25	39.1	82 500	213 000	1 510
EM5016-4E	50	16	44.1	61 800	160 000	1 150
EM5020-6E		20	44.4	73 200	206 000	1 600
EM5025-6E		25	44.1	85 600	235 000	1 620
EM5030-6E		30	44.1	85 600	235 000	1 630
EM6316-4E	63	16	55.2	111 000	339 000	1 600

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: Nut length L	Nut dia. D	Flange dia. A	Flange width B	Flange size H	Bolt hole size X	Bolt hole size Y	Bolt hole size Z	Bolt hole PCD W	Oil hole position T	Max. feeding speed (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 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.

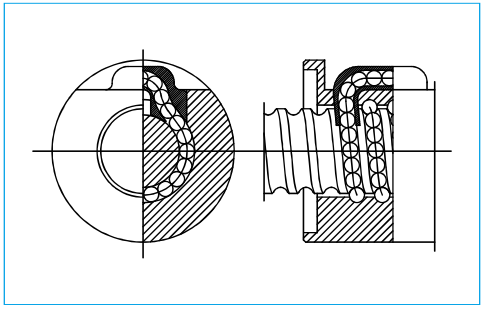


Fig. 1 Structure of SRC recirculation system

(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 B541.)

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 B542.)

● Nut cooling ball screw (See page B547.)

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

- ZFRC: Nut model: ZFRC
- 40: Screw shaft diameter (mm)
- 10: Effective turns of balls*
- 10: Lead (mm)

* In the case of Z-preload, the amount shown is twice the effective turn of balls.

◇Reference number for ball screw

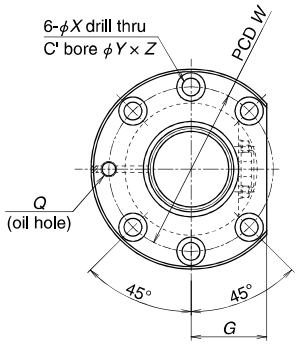
W 40 07 - ** Z RC T - C5 Z 10

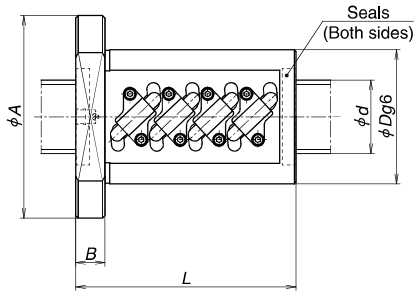
- W: Product code
- 40: Screw shaft diameter (mm)
- 07: Effective threaded length (in the unit of 100 mm)
- **: NSK design serial number
- Z: Preload code: Z; Z-preload
- RC: SRC recirculation system
- T: Hollow shaft specification
- C5: Accuracy grade: C3 or C5
- Z: Axial play code: Z
- 10: Lead (mm)

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).





Unit: mm

Model No.	Shaft dia.	Lead	Root dia.	Effective turns	Basic load rating (N)		Axial rigidity
				Turns × rows	Dynamic	Static	
	d	*l*	d_r		C_a	C_{0a}	*K* (N/μm)
ZFRC3205-10	32	5	29.2	2.5×2	18 500	56 100	840
ZFRC3210-10	32	10	26.4	2.5×2	46 300	108 000	920
ZFRC4010-10	40	10	34.4	2.5×2	52 000	137 000	1 090
ZFRC4012-10	40	12	34.1	2.5×2	61 000	155 000	1 110
ZFRC4508-10	45	8	40.5	2.5×2	37 300	118 000	1 160
ZFRC4510-10	45	10	39.4	2.5×2	54 200	155 000	1 210
ZFRC4512-10	45	12	39.1	2.5×2	64 200	177 000	1 230
ZFRC5010-10	50	10	44.4	2.5×2	57 700	175 000	1 320
ZFRC5012-10	50	12	43.2	2.5×2	77 600	214 000	1 360
ZFRC6312-14	63	12	56.2	3.5×2	115 000	386 000	2 250

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					
L	*D*	*A*	*B*	*G*	*X*	*Y*	*Z*	*W*	*Q*	(m/min)
89	58	85	12	32	6.6	11	6.5	71	M6×1	25
163	74	108	15	41	9	14	8.5	90	M6×1	50
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

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.

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.**

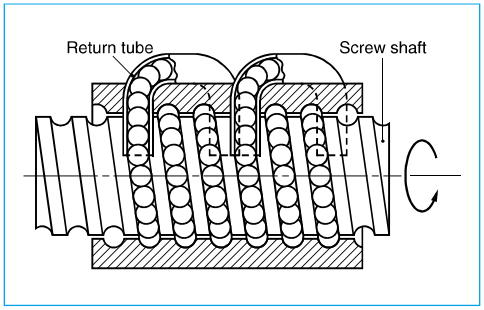


Fig. 1 Structure of return tube recirculation system

(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 B541.)

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 B542.)

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.

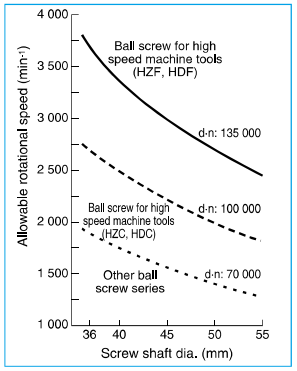


Fig. 2 Comparison of permissible rotational speed

(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.

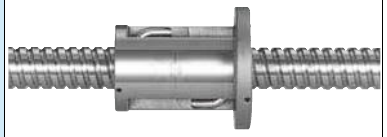
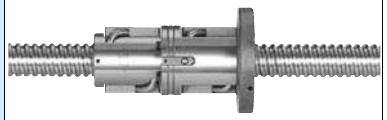
3. Design precautions

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

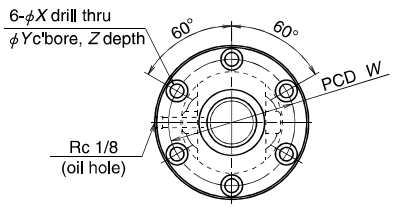
HZF 36 16 - 5

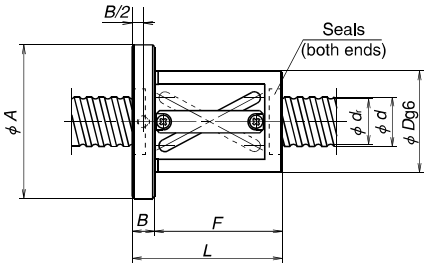
- HZF: Nut model: HZC, HZF, HDC, HDF
- 36: Screw shaft diameter (mm)
- 16: Lead (mm)
- 5: Effective turns of balls

◇Reference number for ball screw

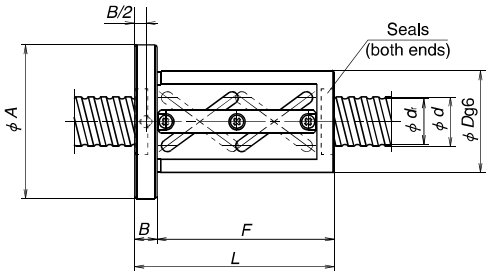
W 36 05 - ** Z X T - C5 Z 16

- W: Product code
- 36: Screw shaft diameter (mm)
- 05: Effective threaded length (in the unit of 100 mm)
- **: Design serial number
- Z: Preload code : Z, Z-prelord; D, D-preload (page B5)
- X: Appearance/specification code
- T: Hollow shaft ball screw
- C5: Accuracy grade: C3, C5 (page B37 to B42)
- Z: Axial play code: Z (page B20)
- 16: Lead (mm)





Nut model Ⅰ (offset preload)



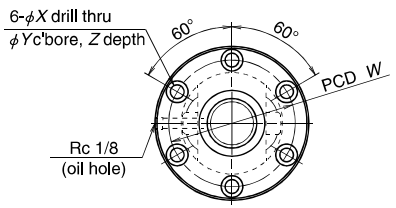
Nut model Ⅱ (offset preload)

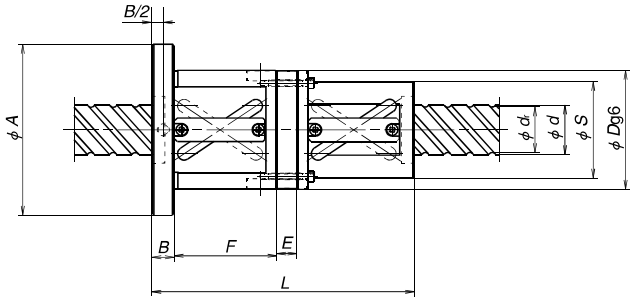
Unit: mm

Model No.	Shaft dia. d	Lead l	Root dia. d_r	Effective turns of balls	Nut model	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity K (N/μm) 5% C_a	Axial rigidity K (N/μm) 10% C_a
HZF3616-5	36	16	31.5	5	Ⅱ	40 200	102 000	1 130	1 420
HZC3616-5									
HZF3620-3.5		20	30.4	3.5	Ⅰ	44 000	98 500	830	1 050
HZC3620-3.5									
HZF4016-5	40	16	35.5	5	Ⅱ	41 200	112 000	1 230	1 550
HZC4016-5									
HZF4020-3.5		20	34.4	3.5	Ⅰ	46 100	107 000	900	1 130
HZC4020-3.5									
HZF4020-5				5	Ⅱ	62 600	153 000	1 260	1 590
HZC4020-5									
HZF4516-5	45	16	40.5	5	Ⅱ	43 800	127 000	1 340	1 690
HZF4516-7.5				7.5		62 100	191 000	1 960	2 470
HZF4520-3.5		20	39.4	3.5	Ⅰ	47 600	120 000	990	1 240
HZC4520-3.5									
HZF4520-5				5	Ⅱ	64 700	170 000	1 380	1 740
HZC4520-5									
HZF4525-3.5		25	39.1	3.5	Ⅰ	56 800	137 000	1 010	1 280
HZC4525-3.5									
HZF5020-3.5	50	20	44.4	3.5	Ⅰ	50 400	133 000	1 080	1 360
HZC5020-3.5									
HZF5020-5				5	Ⅱ	68 500	191 000	1 520	1 910
HZC5020-5									
HZF5025-3.5		25	44.1	3.5	Ⅰ	58 900	152 000	1 100	1 390
HZC5025-3.5									
HZF5025-5				5	Ⅱ	80 100	216 000	1 540	1 940
HZC5025-5									
HZF5030-3.5		30	44.1	3.5	Ⅰ	58 900	152 000	1 100	1 390
HZC5030-3.5									
HZF5520-3.5	55	20	49.4	3.5	Ⅰ	51 600	145 000	1 150	1 450
HZF5520-5				5	Ⅱ	70 200	208 000	1 630	2 050
HZF5525-3.5		25	49.1	3.5	Ⅰ	62 600	165 000	1 190	1 560
HZF5525-5				5	Ⅱ	85 000	238 000	1 680	2 120
HZF5530-3.5		30	49.1	3.5	Ⅰ	62 600	165 000	1 190	1 560

Ball nut dimensions									Max. feeding speed (m/min)
Nut entire length L	Nut dia. D	Flange dia. A	Flange width B	Nut length F	Bolt hole demensions X	Bolt hole demensions Y	Bolt hole demensions Z	Bolt hole PCD W	
134	78	120	18	116	11	17.5	11	98	60
	71	113						91	44
121	94	136	18	103	11	17.5	11	114	75
	78	120						98	56
134	79	121	18	116	11	17.5	11	99	54
	76	118						96	40
121	96	138	18	103	11	17.5	11	116	67
	82	124						102	50
161	96	138		143				116	67
	82	124						102	50
134	82	124	18	116	11	17.5	11	102	48
187		128	22	165	14	20	13	104	
122	98	140	18	104	11	17.5	11	118	60
	88	130						108	44
162	98	140		144				118	60
	88	130						108	44
141	101	143	18	123	11	17.5	11	121	75
	92	134						112	56
122	101	143	18	104	11	17.5	11	121	54
	95	137						115	40
162	101	143		144				121	54
	95	137						115	40
141	103	145	18	123	11	17.5	11	123	67
	98	140						118	50
191	103	145		173				123	67
	98	140						118	50
159	103	145	18	141	11	17.5	11	123	81
	98	140						118	60
122	103	145	18	104	11	17.5	11	123	49
162				144					
141	105	147	18	123	11	17.5	11	125	61
191				173					
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)

Unit: mm

Model No.	Shaft dia. *d*	Lead *l*	Root dia. d_r	Effective turns of balls	Nut model	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Axial rigidity *K* (N/μm) 5% C_a	Axial rigidity *K* (N/μm) 10% C_a
HDF3620-5	36	20	30.4	5	Ⅲ	59 800	138 000	1 160	1 460
HDC3620-5									
HDF4025-5	40	25	34.1	5	Ⅲ	74 000	175 000	1 320	1 660
HDC4025-5									
HDF4030-5		30	34.1	5	Ⅲ	74 000	175 000	1 320	1 660
HDC4030-5									
HDF4032-7.5		32	34.4	7.5	Ⅲ	88 700	230 000	1 920	2 420
HDC4032-7.5									
HDF4036-4.5		36	34.4	4.5	Ⅲ	57 200	138 000	1 170	1 480
HDF4525-5	45	25	39.1	5	Ⅲ	77 200	197 000	1 430	1 800
HDC4525-5									
HDF4530-5		30	39.1	5	Ⅲ	77 200	197 000	1 430	1 800
HDC4530-5									
HDF4532-7.5		32	39.4	7.5	Ⅲ	91 700	256 000	2 090	2 630
HDC4532-7.5									
HDF4536-4.5		36	39.4	4.5	Ⅲ	59 100	155 000	1 280	1 620
HDF5030-5	50	30	44.1	5	Ⅲ	80 100	216 000	1 540	1 940
HDC5030-5									
HDF5032-7.5		32	44.4	7.5	Ⅲ	97 100	286 000	2 270	2 860
HDC5032-7.5									
HDF5530-5	55	30	49.1	5	Ⅲ	85 000	238 000	1 680	2 120
HDC5532-7.5		32	49.4	7.5	Ⅲ	99 500	313 000	2 420	3 050

Ball nut dimensions											Max. feeding speed (m/min)
Nut entire length *L*	Nut dia. *D*	Nut dia. *S*	Flange dia. *A*	Flange width *B*	Nut length *F*	Spacer dimensions *E*	Bolt hole size *X*	Bolt hole size *Y*	Bolt hole size *Z*	Bolt hele PCD *W*	
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

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.

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.**

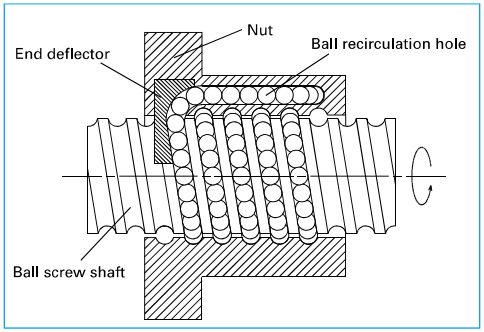


Fig. 1 Structure of end-deflector recirculation system

(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

- BSL — Nut model: BSL
- 20 — Screw shaft diameter (mm)
- 05 — Lead (mm)

◇Reference number for ball screw

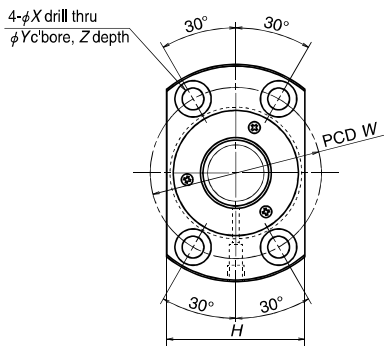
W 20 05 - ** P SS - C5 Z 5

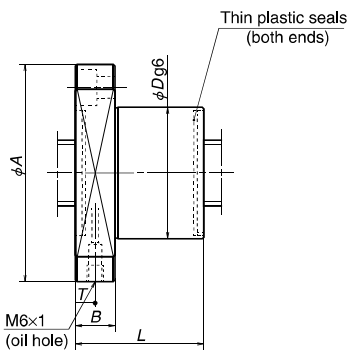
- W — Product code
- 20 — Screw shaft diameter (mm)
- 05 — Effective threaded length (in the unit of 100 mm)
- ** — NSK design serial number
- P — Preload code: P; P-preload (page B5)
- SS — End-deflector recirculation system
- C5 — Accuracy grade: C5 (page B37 to B42)
- Z — Axial play code: Z (page B20)
- 5 — Lead (mm)

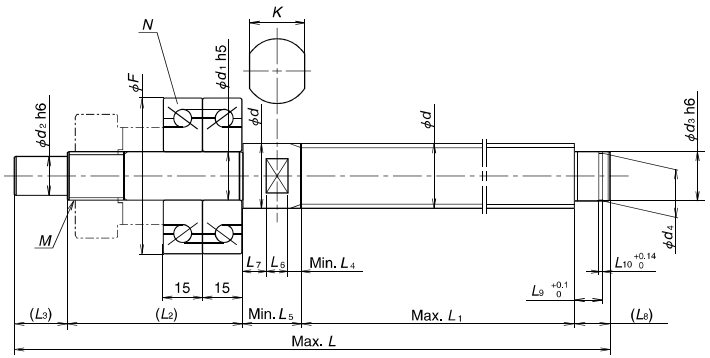
6. Handling Precautions

Maximum operating temperature: 80°C

If using NSK K1, operating temperature should not exceed 50°C. Refer to "Designing Precautions" (page B83).







Unit: mm

Model No.	Shaft dia.	Lead	Root dia.	Basic load rating (N)		Ball nut dimensions										
				Dynamic	Static	External dimensions					Bolt hole dimensions				Oil hole	
	d	l	d_r	C_a	C_{0a}	D	A	H	B	L	W	X	Y	Z	T	d_1
BSL2005	20	5	17.2	8 920	16 300	36	63	38	12	37	49	6.6	11	6.5	6.5	15
BSL2006		6	16.4	11 900	20 000	40	65	42		45	51				6.7	
BSL2505	25	5	22.2	9 900	20 500	40	65	42	12	38	51	6.6	11	6.5	7.1	20
BSL2506		6	21.4	13 300	25 200	43	69	45		44	55				6.3	
BSL2508		8	20.5	17 100	30 100	46	72	48		55	58				6.5	
BSL2510		10	20.5	17 100	30 100	46	72	48		65	58				6	
BSL3210	32	10	26.4	27 700	51 300	61	93	63	18	68	76	9	14	8.5	10	25
BSL3212		12								77						

Model No.	Shaft configuration and dimensions (reference)																						
	Shaft dimension																		Exclusive bearing N		Basic dynamic load rating	Permissible axial load
	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	C_a	(N)
BSL2005	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
BSL2006								4	21											
BSL2505	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
BSL2506								4	28											
BSL2508								5	29											
BSL2510								5	29											
BSL3210	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
BSL3212								7	34											

Notes: 1. The right turn screw is the standard. Please consult NSK for left turn screw.
2. Shaft dimensions are for reference.
3. Shaft length L_1 and shaft entire length L are the maximum length.
When L becomes the same length as the L_1, 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 10 dB (half to 1/3 of noise) compared with the HTF type.

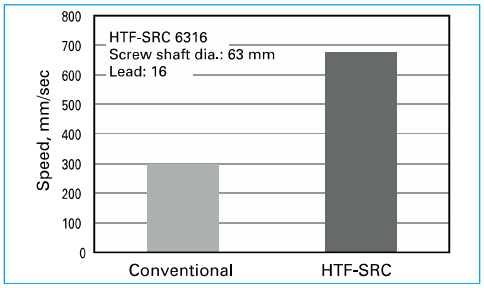


Fig. 1 Feed speed comparison

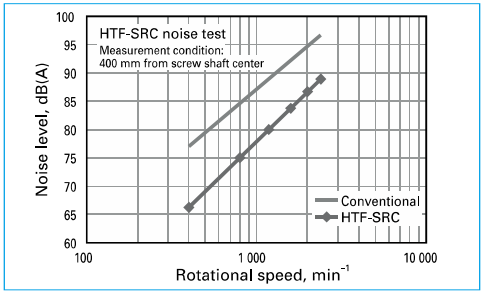


Fig. 2 Noise level comparison

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.

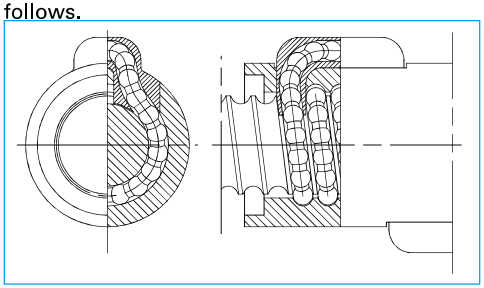


Fig. 3 Structure of SRC recirculation system

(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 B531).

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).

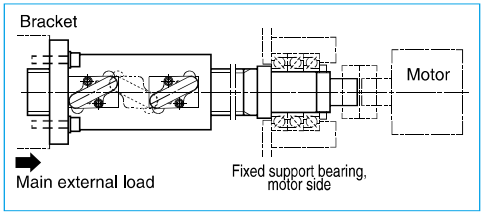


Fig. 4 Recommended installing direction of high-load drive ball screw

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

- HTF-SRC: Nut model: HTF-SRC
- 63: Screw shaft diameter (mm)
- 20: Lead (mm)
- 7.5: Effective turns of balls

◇Reference number for ball screw

W 63 04 - ** RC SP - C7 S 20

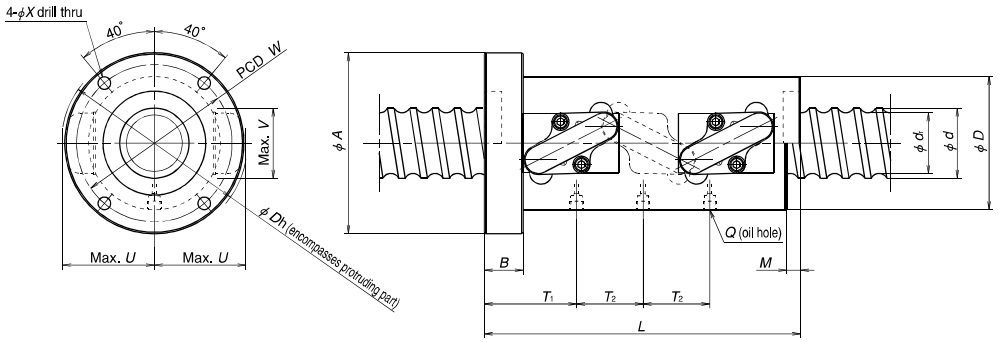
- W: Product code
- 63: Screw shaft diameter (mm)
- 04: Effective threaded length (in the unit of 100 mm)
- **: NSK design serial number
- RC: SRC recirculation system
- SP: Ball retaining pieces NSK S1 specification
- C7: Accuracy grade: C7 (Ct7) (page B37 to B42)
- S: Axial play code: S, N (page B20)
- 20: Lead (mm)

6. Handling Precautions

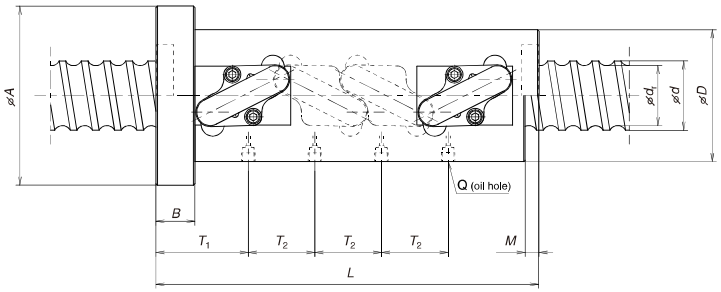
Maximum operating temperature: 70°C
(at outside diameter of ball nut)

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.	Shaft dia.	Lead	Root dia.	Effective turns of balls Turns × Circuits	Nut model	Basic load rating (kN) Dynamic	Basic load rating (kN) Static	Allowable axial load
	d	l	d_r			C_a	C_{0a}	(kN)
HTF-SRC5014-7.5	50	14	41.6	2.5×3	Ⅰ	264	623	73.1
HTF-SRC5016-7.5		16	39	2.5×3		383	818	91.1
HTF-SRC5020-7.5		20	39	2.5×3		383	818	91.0
HTF-SRC6316-7.5	63	16	52	2.5×3	Ⅰ	429	1 050	119
HTF-SRC6316-10				2.5×4	Ⅱ	549	1 410	159
HTF-SRC6316-10.5				3.5×3	Ⅰ	562	1 450	167
HTF-SRC6316-14				3.5×4	Ⅱ	720	1 930	215
HTF-SRC6320-7.5		20	49	2.5×3	Ⅰ	572	1 280	147
HTF-SRC6320-10				2.5×4	Ⅱ	732	1 710	196
HTF-SRC6325-10.5		25	49	3.5×3	Ⅰ	750	1 770	170
HTF-SRC8016-10.5	80	16	69	3.5×3	Ⅰ	627	1 870	221
HTF-SRC8016-14				3.5×4	Ⅱ	802	2 490	295
HTF-SRC8020-10.5		20	66	3.5×3	Ⅰ	838	2 300	267
HTF-SRC8025-7.5		25	63	2.5×3	Ⅰ	790	1 960	221
HTF-SRC10020-10.5	100	20	86	3.5×3	Ⅰ	936	2 910	346
HTF-SRC10020-14				3.5×4	Ⅱ	1 200	3 890	461
HTF-SRC10025-10.5		25	83	3.5×3	Ⅰ	1 200	3 430	408
HTF-SRC10025-14				3.5×4	Ⅱ	1 540	4 580	544
HTF-SRC12020-7.5	120	20	106	2.5×3	Ⅰ	776	2 550	304
HTF-SRC12020-10				2.5×4	Ⅱ	994	3 400	406
HTF-SRC12025-10.5		25	103	3.5×3	Ⅰ	1 300	4 200	498
HTF-SRC12025-14				3.5×4	Ⅱ	1 660	5 600	664

Ball nut dimensions													Max. feeding speed
Nut length	Nut dia.	Flange dia.	Flange width	Seal width	Bolt hole PCD	Bolt hole size	Protruding tube dimensions			Oil hole	Oil hole position		
L	D	A	B	M	W	X	U	V	Dh	Q	T_1	T_2	(mm/sec)
202	80	114	28	10	97	9	54.5	46	111	M6×1	69	42	750
228	95	129			112		66	50	134	Rc1/8	74.5	48	860
268	95	129			112		66	50	134	Rc1/8	83.5	60	1 070
228	105	139	28	10	122	9	72.5	50	148	Rc1/8	74.5	48	680
276												48	
276												64	
340												64	
279	117	157	32	12	137	11	80	62	163		90	60	740
339													
405	117	157	32	12	137	11	81.5	61	167		101.75	100	930
278	120	154	32	10	137	9	80	60	165	Rc1/8	78.5	64	540
342													
339	130	170	32	12	150	11	88	64	180		90	80	590
347	145	185	40	17	165	11	99.5	73	202		111.75	75	730
339	145	185	32	12	165	11	97	78	199	Rc1/8	90	80	470
419													
422	159	199	40	17	179		108	79	220		111.75	100	590
522													
287	173	213	40	12	193	11	109.5	88	229	Rc1/8	98	60	390
347													
421				17	193		116	92	238		111.25	100	490
521													

Notes: 1. The right hand screw is the standard. For specifications on left hand screws, contact NSK.
2. The ball nut length with no seals is shorter by M than that length of a ball nut with seals.
3. Please consult NSK if load exceeds the allowable axial load.
4. The allowable axial load is determined in accordance with the mounting conditions of ball screws recommended by NSK (See page B514). If your mounting conditions differ from those provided, please consult NSK.

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.

Double start thread structure which has more recirculation circuits, and large diameter balls contribute to have high load carrying capacity.

● Low noise and compact design

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.

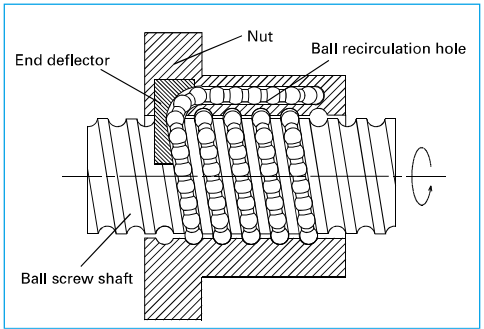


Fig. 1 Structure of End-deflector recirculation system

(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.

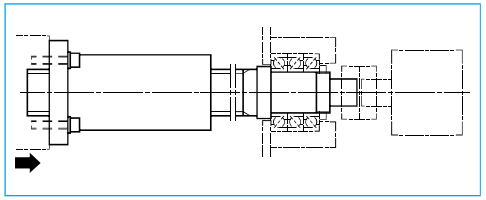


Fig. 2 Recommended installing direction of high-load drives ball screw

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 B531).

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

- HTF-SRD: Nut model: HTF-SRD
- 50: Screw shaft diameter (mm)
- 40: Lead (mm)
- 6E: Effective turns of balls

◇Reference number for ball screw

W 50 18 - ** SS SP X - C7 N 40

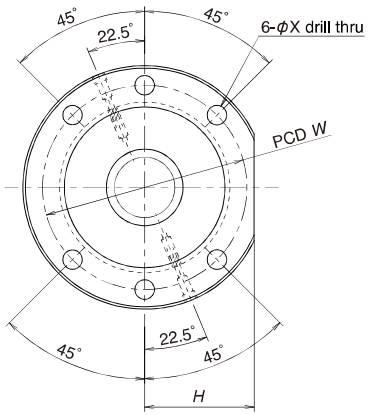
- W: Product code
- 50: Screw shaft diameter (mm)
- 18: Effective threaded length (in the unit of 100 mm)
- **: NSK design serial number
- SS: End-deflector recirculation system
- SP: Ball retaining pieces NSK S1 specification
- X: Ball screw specification/appearance
- C7: Accuracy grade: C7 (Ct7) (page B37 to B42)
- N: Axial play code: S, N (page B20)
- 40: Lead (mm)

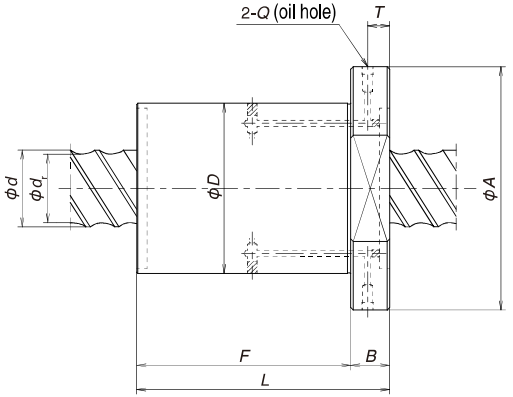
6. Handling Precautions

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.





Unit: mm

Model No.	Shaft dia. d	Lead l	Root dia. d_r	Effective turns of balls	Basic load rating (kN) Dynamic C_a	Basic load rating (kN) Static C_{0a}	Allowable axial load (kN)
HTF-SRD5040-6E	50	40	39	6	243	491	67.6
HTF-SRD5040-8E				8	319	679	92
HTF-SRD6332-4E	63	32	49	4	292	590	72.6
HTF-SRD6340-6E		40		6	363	768	106
HTF-SRD6340-8E				8	476	1 060	144
HTF-SRD8050-6E	80	50	63	6	502	1 180	163
HTF-SRD8050-8E				8	658	1 630	224
HTF-SRD10060-6E	100	60	83	6	583	1 490	211
HTF-SRD10060-8E				8	765	2 060	288
HTF-SRD12070-6E	120	70	103	6	630	1 810	259
HTF-SRD12070-8E				8	826	2 520	352

Notes: 1. The right hand screw is the standard. For specifications on left hand screws, contact NSK.
2. Please consult NSK if load exceeds the allowable axial load.
3. The allowable axial load is determined in accordance with the mounting conditions of ball screws recommended by NSK (See page B517). If your mounting conditions differ from those provided, please consult NSK.

Ball nut dimensions									Max. feeding speed (mm/sec)
Nut entire length L	Nut dia. D	Flange dia. A	Notch size H	Flange width B	Nut length F	Bolt hole PCD W	Bolt hole size X	Oil hole position T	
159	115	165	72.5	28	131	140	14	16	1 600
199					171				
176	140	190	85	32	144	165	14	18	1 000
163		200	90		131	170	18		1 250
203					171				
194	175	250	110	40	154	210	22	18	1 250
244					204				
225	195	270	122	40	185	235	22	20	1 200
285					245				
260	210	285	130	50	210	250	22	25	1 160
330					280				

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.**

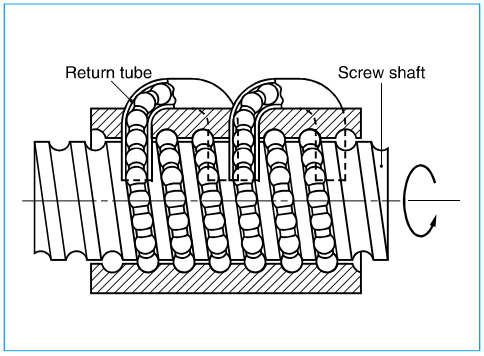


Fig. 1 Structure of return tube recirculation system

(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 B513).

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 0000 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 B531).

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

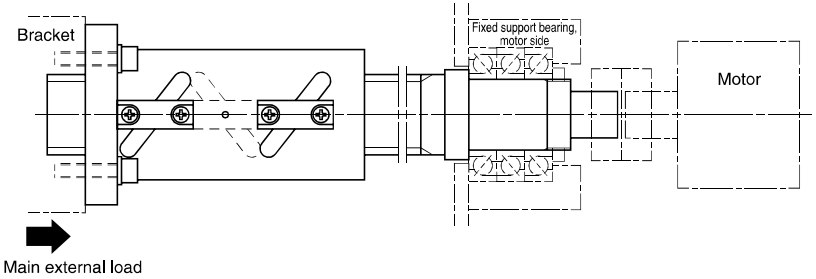
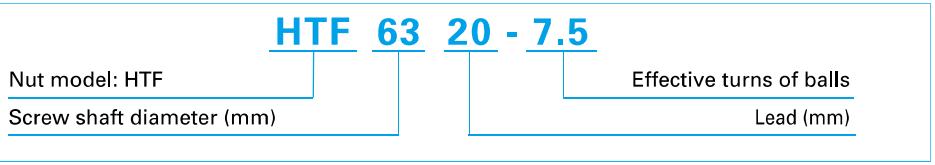


Fig. 2 Recommended installing direction of ball screws for high-load drives

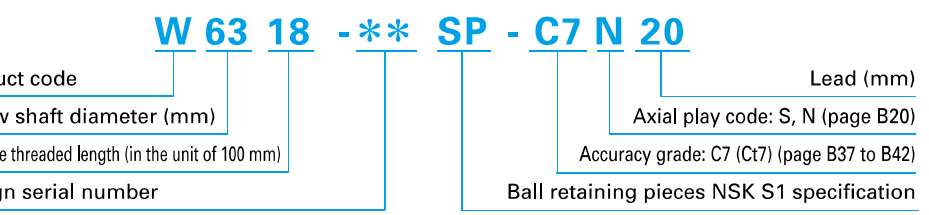
5. Structure of model number and reference number

A structure of "Model number" and "Reference number for ball screw" are as follows.

◇Model number

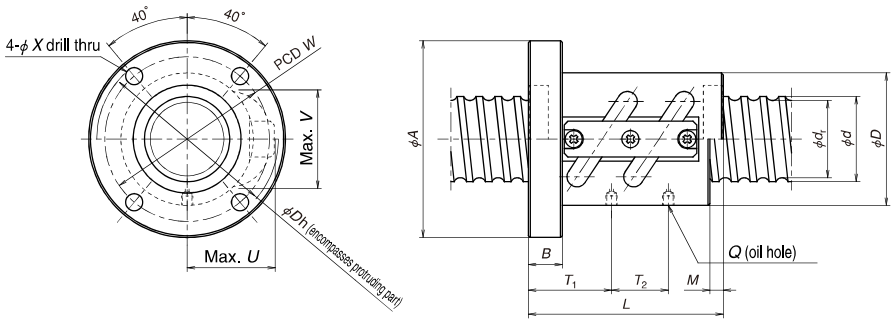


◇Reference number for ball screw

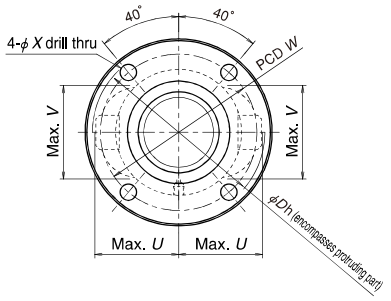


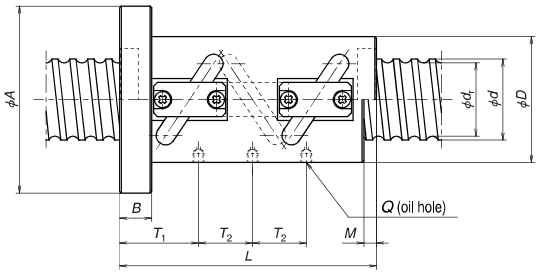
6. Handling precautions

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.

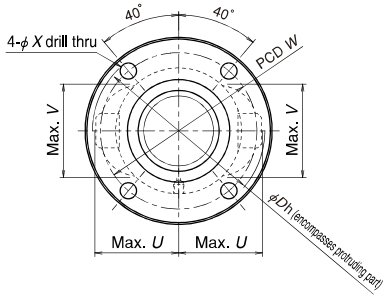


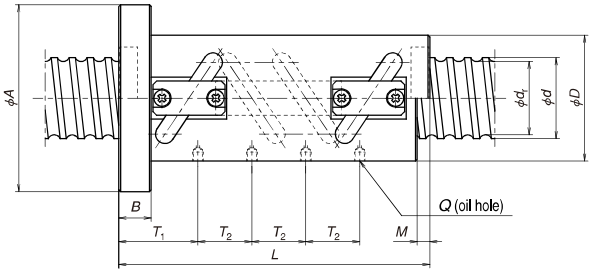
Nut model Ⅰ





Nut model Ⅱ





Nut model Ⅲ

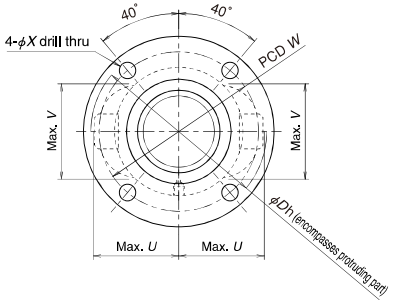
Unit: mm

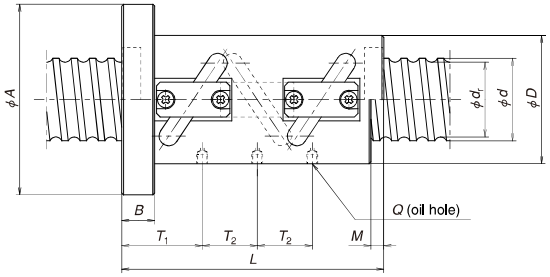
Model No.	Shaft dia. d	Lead l	Root dia. d_r	Effective turns of balls Turns × Circuits	Nut model	Basic load rating (kN) Dynamic C_a	Basic load rating (kN) Static C_{0a}	Allowable axial load (kN)
HTF3210-5	32	10	25.6	2.5×2	Ⅰ	88.7	169	20.3
HTF3610-5	36	10	29.6	2.5×2	Ⅰ	96.1	191	23.4
HTF3612-5		12	29			112	228	28.3
HTF4010-7.5	40	10	33.6	2.5×3	Ⅱ	149	344	39.6
HTF4012-7.5		12	33	2.5×3		184	422	48.0
HTF4510-7.5	45	10	38.6	2.5×3	Ⅱ	158	386	45.3
HTF4510-10				2.5×4	Ⅲ	203	514	60.4
HTF4512-7.5		12	38	2.5×3	Ⅱ	195	473	55.0
HTF14020-7.5	140	20	126	2.5×3	Ⅱ	829	3 000	361
HTF14020-10				2.5×4	Ⅲ	1 060	4 000	481
HTF14025-7.5		25	124	2.5×3	Ⅱ	1 050	3 610	423
HTF14025-10				2.5×4	Ⅲ	1 350	4 810	564
HTF14025-10.5				3.5×3	Ⅱ	1 380	4 910	595
HTF14025-14				3.5×4	Ⅲ	1 770	6 540	793

See HTF-SRC type (page B513) regarding shaft diameter 50 - 120 mm. Consult NSK for shaft diameter and lead except HTF-SRC type.

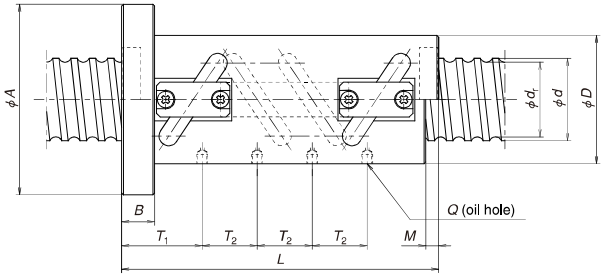
Ball nut dimensions: Nut length L	Nut dia. D	Flange dia. A	Flange width B	Seal width M	Bolt hole PCD W	Bolt hole size X	Protruding tube dimensions U	Protruding tube dimensions V	Protruding tube dimensions Dh	Oil hole Q	Oil hole positions T_1	Oil hole positions T_2	Max. feeding speed (mm/sec)
103	58	92	18	7	75	9	40.5	42	82	M6×1	36.5	30	520
103	62	96	18	7	79	9	43	45	87	M6×1	36.5	30	460
123	66	100	22	8	83		46.5	46	94		44	36	550
143	66	100	18	7	83	9	45	48	91	M6×1	46.5	30	410
171	70	104	22	8	87	9	47.5	50	96	M6×1	56	36	500
143 173	70	104	18	7	87	9	47	52	95	M6×1	46.5	30	370
171	72	106	22	8	89		49.5	54	100		56	36	440
281 341	204	250	40	12	226	14	122.5	148	248	Rc1/8	96	60	230
338 413 413 513	204	250	40	17	226	14	127.5	153	258	Rc1/8	109.25	75 75 100 100	200

Notes: 1. The right hand screw is the standard. "L" is added to the end of the model code for the left turn screw.
2. If there is no seal, the nut length is shorter by the lengths of "M" than those with a seal.
3. Please consult NSK if load exceeds the allowable axial load.
4. The allowable axial load is determined in accordance with the mounting conditions of ball screws recommended by NSK (see page B522). If your mounting conditions differ from those provided, please consult NSK.





Nut model Ⅱ



Nut model Ⅲ

Unit: mm

Model No.	Shaft dia. *d*	Lead *l*	Root dia. *d1*	Effective turns of balls Turns × Circuits	Nut model	Basic load rating (kN) Dynamic *Ca*	Basic load rating (kN) Static *C0a*	Allowable axial load (kN)
HTF14030-7.5	140	30	121	2.5×3	Ⅱ	1 310	4 110	487
HTF14030-10				2.5×4	Ⅲ	1 670	5 490	649
HTF14030-10.5				3.5×3	Ⅱ	1 710	5 710	678
HTF14032-7.5		32	118	2.5×3	Ⅱ	1 590	4 740	549
HTF14032-10				2.5×4	Ⅲ	2 040	6 320	732
HTF14032-10.5				3.5×3	Ⅱ	2 080	6 420	757
HTF16025-7.5	160	25	144	2.5×3	Ⅱ	1 140	4 140	495
HTF16025-10				2.5×4	Ⅲ	1 450	5 520	660
HTF16030-7.5		30	141	2.5×3	Ⅱ	1 400	4 760	564
HTF16030-10				2.5×4	Ⅲ	1 790	6 340	752
HTF16030-10.5				3.5×3	Ⅱ	1 830	6 520	788
HTF16032-7.5		32	138	2.5×3	Ⅱ	1 660	5 370	636
HTF16032-10				2.5×4	Ⅲ	2 130	7 160	848
HTF16032-10.5				3.5×3	Ⅱ	2 180	7 460	885
HTF20030-7.5	200	30	181	2.5×3	Ⅱ	1 550	5 960	718
HTF20030-10				2.5×4	Ⅲ	1 980	7 950	958
HTF20032-7.5		32	178	2.5×3	Ⅱ	1 840	6 840	809
HTF20032-10				2.5×4	Ⅲ	2 360	9 120	1 080

Ball nut dimensions													Max. feeding speed (mm/sec)
Nut length *L*	Nut dia. *D*	Flange dia. *A*	Flange width *B*	Seal width *M*	Bolt hole PCD *W*	Bolt hole size *X*	Protruding tube dimensions *U*	*V*	*Dh*	Oil hole *Q*	Oil hole positions *T1*	*T2*	
411	222	282	50	22	252	18	139	160	281	Rc1/8	134.5	90	170
501												90	
501												120	
465	222	296	70	22	259	22	148	163	299		166.5	96	190
561												96	
561												128	
338	234	280	40	17	256	14	138	173	279	Rc1/8	109.25	75	180
413													
411		294	50	22	264	18	148	177	299		134.5	90	150
501												90	
501												120	
465		308	70	22	271	22	152	181	307		166.5	96	160
561												96	
561												128	
411	290	350	50	22	320	18	178	212	359	Rc1/8	134.5	90	120
501													
465		364	70		327	22	182	215	367		166.5	96	130
561													

Notes: 1. The right hand screw is the standard. "L" is added to the end of the model code for the left turn screw.
2. If there is no seal, the nut length is shorter by the lengths of "M" than those with a seal.
3. Please consult NSK if load exceeds the allowable axial load.
4. The allowable axial load is determined in accordance with the mounting conditions of ball screws recommended by NSK (see page B522). If your mounting conditions differ from those provided, please consult NSK.

NSK Technical Data Sheet for NSK High-Load Drive Ball Screws

Made-to-order ball screw

Company name:	Date:	NSK sales office
Section:	Person in charge:	
Address:		

Name of machine*1 : *Electric injection molding machine; 30-ton capacity* Application*2 : *Clamping axis*

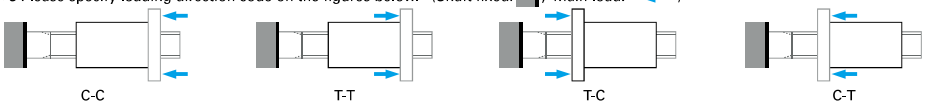
Drawing/rough sketch attached?: ☐ Yes ☑ No

*1 Please specify capacity of the machine in case of injection molding machine or press.
*2 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: *High-load grease with an extreme pressure additive* Maker:)	How to replenish lubricant	☑ Grease gun ☐ Automatic (cm³/ cycles)
Request for oil hole	☑ NSK recommended ☐ Your request		
Necessity of seals	☑ Yes ☐ No	NSK S1 necessary?	☑ NSK recommended ☐ Not necessary
Environment	Temperature (*40* 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	*1* pcs./machine

*3 Please specify loading direction code on the figures below. (Shaft fixed: , Main load:)

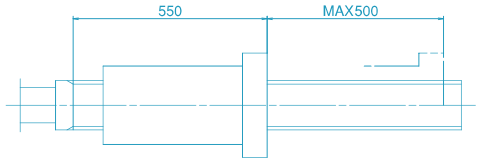


2. Specifications

Shaft diameter	*ϕ140* mm	Lead	*32* mm	Accuracy grade	*Ct7*	Axial play	*0.050 or less* mm max.
Nut model No.	*HTF 14032-7.5-S1*	Effective turns of balls	*2.5 × 3*	Direction of turn	*right*	Thread length /Overall shaft length	*1000* / *1500*

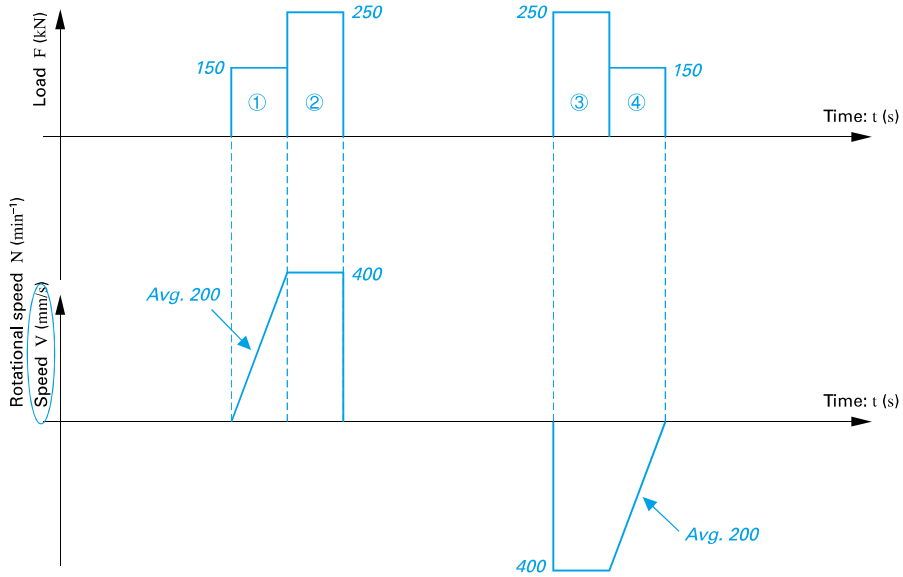
Special note / Requests

See nut stroke on the drawing



NSK Technical Data Sheet for NSK High-Load Drive Ball Screws

3. Load chart



	Axial load* F (kN)	Rotational speed or Average speed N (min⁻¹)	V (mm/s)	Time t (s)	Stroke St (mm)	Remarks
1	*150*		*200*	*0. 5*	*100*	
2	*250*		*400*	*0. 5*	*200*	
3	*250*		*400*	*0. 5*	*200*	
4	*150*		*200*	*0. 5*	*100*	
5				*Total: 2.0*	*Total: 600*	
6						
7						
8						
9						
10						

Dynamic axial load (Max.)*: *250* (kN) Static axial load (Max.)*(at 0 mm/s): (kN)
Stroke in normal use: *300* (mm) Maximum stroke: *500* (mm)
Cycle time: *2. 0* (s) Required life: *2500h*

*If you use 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 December 2013*)
  - 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

Made-to-order ball screw

Company name:	Date:
Section:	Person in charge:
Address:	

NSK sales office

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 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 (cm³/ 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:)

C-C (NSK recommended) T-T T-C C-T

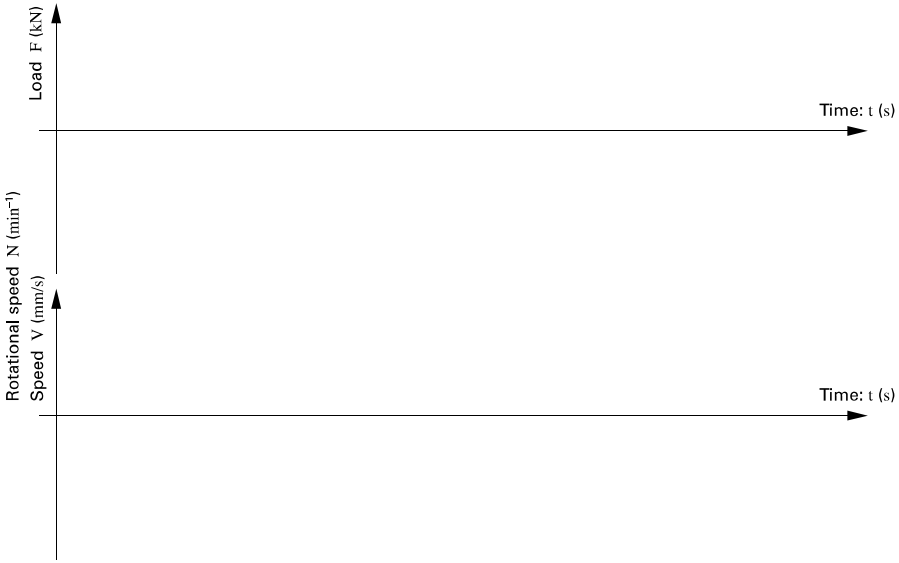
2. Specifications

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



	Axial load* F (kN)	Rotational speed or Average speed N (min⁻¹)	Rotational speed or Average speed 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:

*If you use 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.

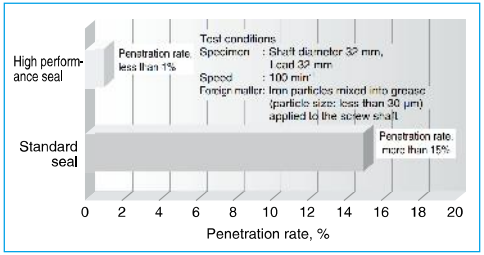


Fig. 1 Particle penetration rate

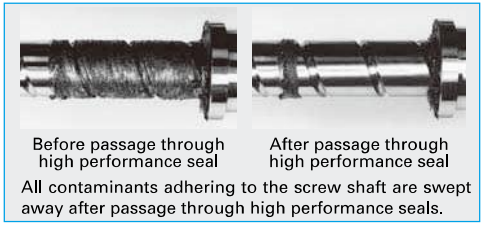


Fig. 2 Contamination before and after particle penetration test

● 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.

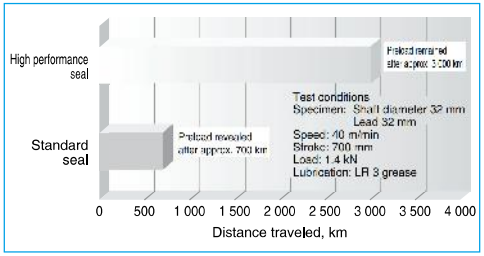


Fig. 3 Extreme durability test results using iron particles

● 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 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.**

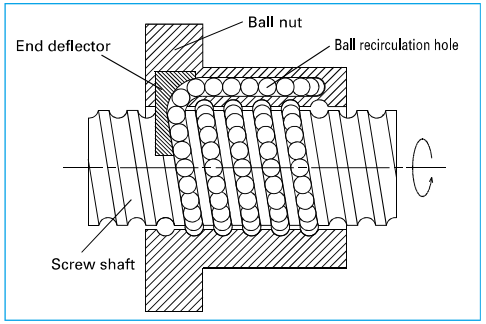


Fig. 4 Structure of end deflector recirculation system

(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.

3. Design precaution

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.

High performance seals may increase torque, which may in turn increase temperature. Please consult with NSK prior to usage under severe service conditions.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

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

- VSS — Nut model: VSS
- 32 — Screw shaft diameter (mm)
- 10 — Lead (mm)
- 6E — Effective turns of balls

◇Reference number for ball screw

W 36 12 - ** P SS V1 - C5 Z 10

- W — Product code
- 36 — Screw shaft diameter (mm)
- 12 — Effective threaded length (in the unit of 100 mm)
- ** — Design serial number
- P — Preload code: P; P-Preload (page B5)
- SS — End-deflector recirculation system
- V1 — High performance seal V1
- C5 — Accuracy grade: C5 (page B37 to B42)
- Z — Axial play: Z, T, S (page B20)
- 10 — Lead (mm)

5. Handling Precautions

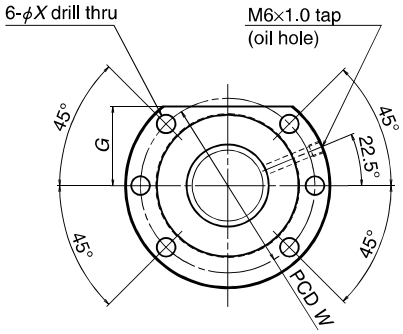
Maximum operating temperature: 50°C

Maximum momentary operating temperature: 80°C

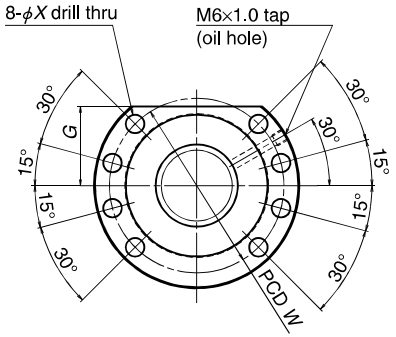
Chemical precautions: Never expose the ball screw to grease-removing organic solvents such as hexane or thinner. Never immerse the ball screw in kerosene or rust preventive oils which contain kerosene.

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.

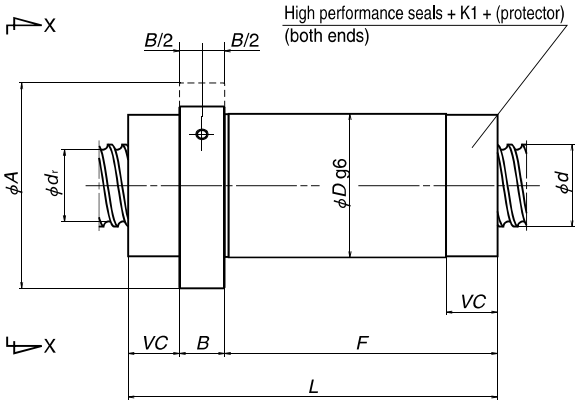
View *X-X*



Screw shaft diameter $d = 32$ mm



Screw shaft diameter $d \geq 40$ mm



Unit: mm

Model No.	Shaft dia. *d*	Lead *l*	Root dia. *dr*	Effective turns of balls	Basic load rating (N) Dynamic *Ca*	Basic load rating (N) Static *C0a*	Axial rigidity *K* (N/μm)
VSS3210-6E	32	10	27.2	6	43 300	111 000	682
VSS3216-5E		16		5	36 700	90 800	563
VSS3220-5E		20		5	36 700	90 800	561
VSS3232-4E		32		4	25 000	58 300	387
VSS4040-4E	40	40	34.4	4	33 600	83 900	472
VSS5050-4E	50	50	44.4	4	37 300	105 000	559

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.

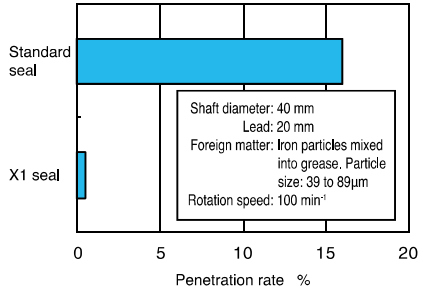


Fig. 1 Results of particle penetration rate test

● Superior grease retention

Automatically adding grease makes it possible to reduce the amount used and keep it from spattering.

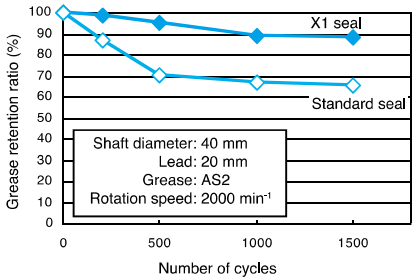


Fig. 2 Results of grease leakage test

● 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.

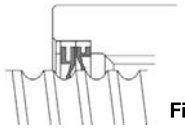


Fig. 3 Seal structure

(2) Scope of application in NSK Ball Screw series

This series is standard for the following two types.

Ball screws for high-speed machine tools	HMS type Nut model: ZFRC
	HMD type Nut model: EM

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: 40 mm	70 mm
Shaft diameter: 45 mm	75 mm
Shaft diameter: 50 mm	82 mm

(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 consult NSK if it is to be used under strict operating conditions.

Maximum overall shaft length is 2900 mm.

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

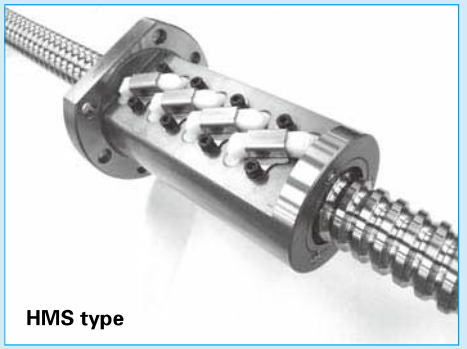


Fig. 4 External appearance

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

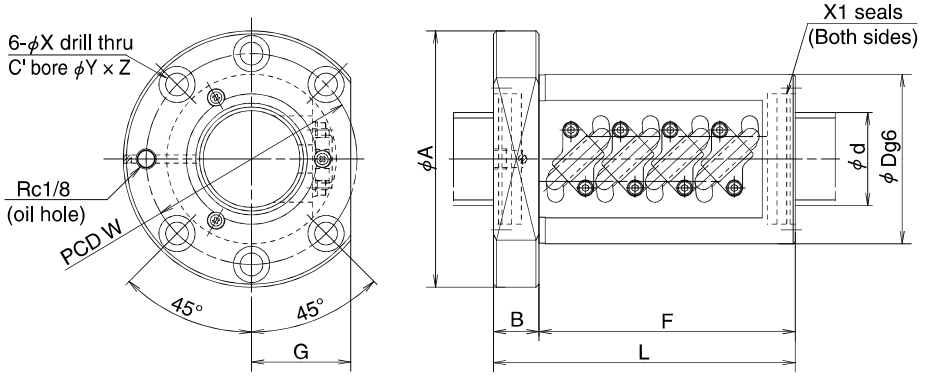
4. Precautions for use

Temperature range for use: Maximum temperature: 60˚C (at outside diameter of ball nut)

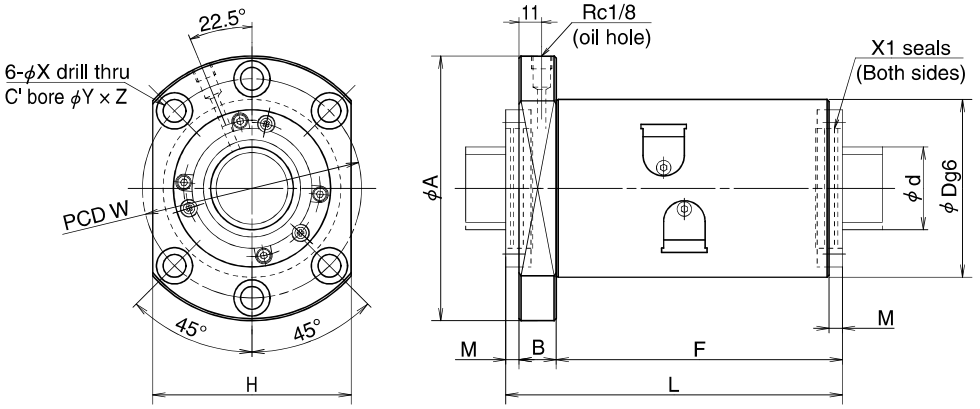
Chemicals that should not come to contact:

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)



HMD type (Nut model: EM)

Applicable dimensions for HMS type

Unit: mm

Model No.	Shaft dia.	Lead	Basic load rating (N)		Nut dimensions									
			Dynamic	Static							Bolt holes			
	d	*l*	C_a	C_{0a}	*L*	*F*	*B*	*D*	*A*	*G*	*X*	*Y*	*Z*	*W*
ZFRC4010-10	40	10	52 000	137 000	173	151	22	82	124	47	11	17.5	11	102
ZFRC4012-10		12	61 000	155 000	197	175		86	128	48				106
ZFRC4508-10	45	8	37 300	118 000	146	124	22	82	124	47	11	17.5	11	102
ZFRC5010-10	50	10	57 700	175 000	174	151	23	93	135	51	11	17.5	11	113
ZFRC5012-10		12	77 600	214 000	200	177		100	146	55	14	20	13	122

Note: 1.The right hand screw is the standard. For specifications on left hand screws, contact NSK.

Applicable dimensions for HMD type

Unit: mm

Model No.	Shaft dia.	Lead	Basic load rating (N)		Nut dimensions											
			Dynamic	Static								Bolt holes				
	d	*l*	C_a	C_{0a}	*L*	*F*	*M*	*B*	*D*	*A*	*H*	*X*	*Y*	*Z*	*W*	
EM4016-4E	40	16	57 100	130 000	172	148	6	18	86	128	96	11	17.5	11	106	
EM4020-6E		20	66 900	165 000	164	139	7									
EM4516-4E	45	16	59 600	145 000	173	148.5	6.5	18	92	134	102	11	17.5	11	112	
EM4520-6E		20	69 100	186 000	164	139	7									
EM5016-4E	50	16	61 800	160 000	173	148.5	6.5	18	98	140	107	11	17.5	11	118	
EM5020-6E		20	73 200	206 000	164	139	7									

Note: 1.The right hand screw is the standard. For specifications on left hand screws, contact NSK.

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 B542 to B550) for more details.

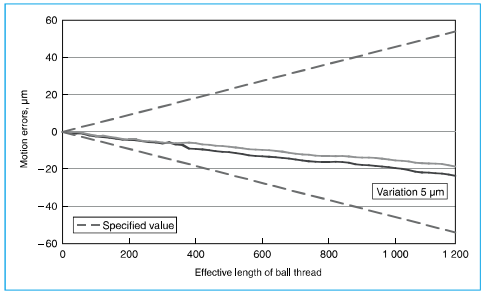


Fig. 1 Example of measured variation in lead accuracy

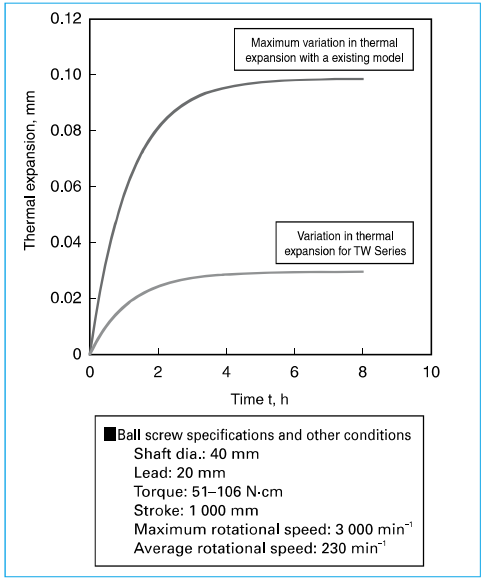


Fig. 2 Calculation example of the variation of thermal expansion

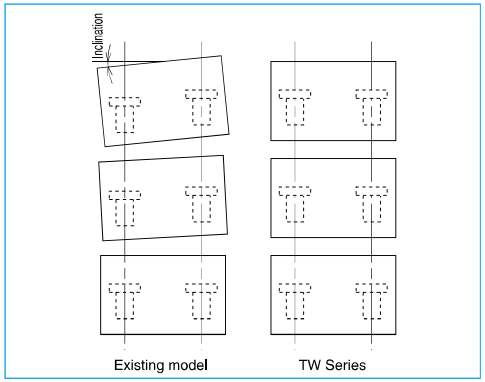


Fig. 3 Schematic diagram of travel accuracy

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 B545) 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 B547) 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).

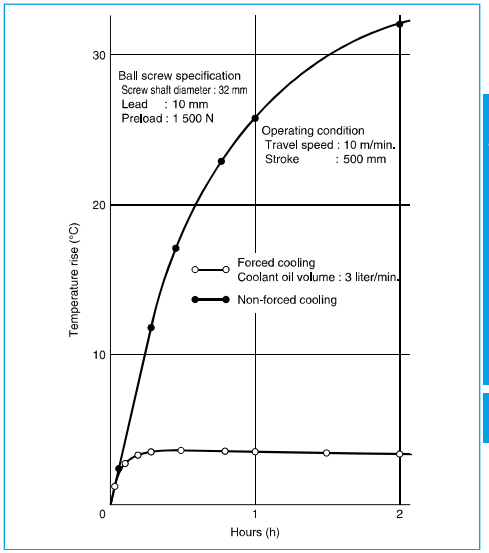


Fig. 1 Effect of forced cooling by hollow shaft ball screw

3. Model example of dimension table

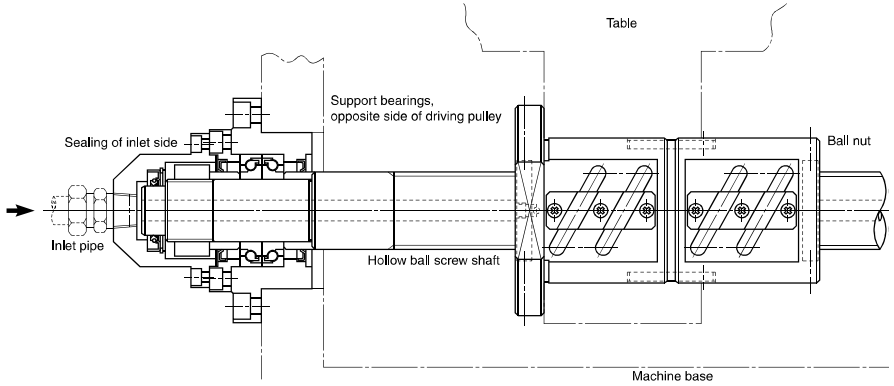
A model number that indicates specification factors is structured as shown below.

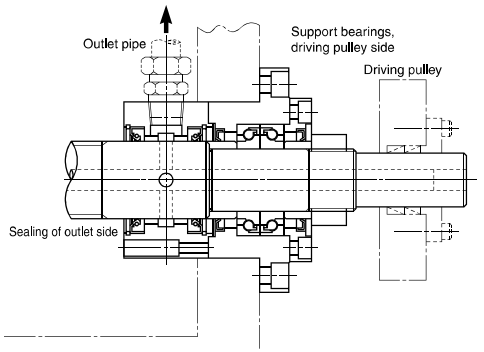
◇Example of model

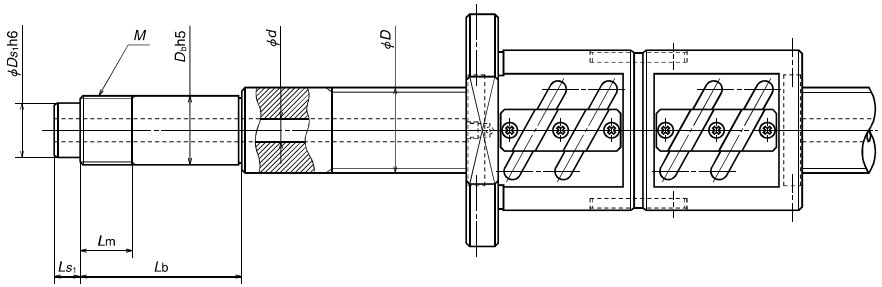
H 32 - 10

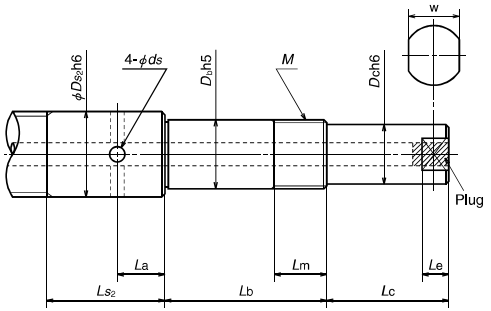
- H: Screw shaft model H
- 32: Screw shaft diameter (mm)
- 10: Hollow bore (mm)

4. Installation example and standard dimensions









Unit: mm

Model No.	Screw shaft		Bearing seat				Sealing					
	Diameter	Hollow	Diameter	Lock nut			Inlet		Outlet			
	D	*d*	*D*b	*M*	*L*m	*L*b	*D*s$_1$	*L*s$_1$	*D*s$_2$	*L*s$_2$	*L*a	*d*s
H32-10	32	10	25	M25×1.5	26	89 104 119	20	15	32	60	25	6
H40-12	40	12	30	M30×1.5	26	89 104 119	25	15	40	60	25	7
H50-15	50	15	40	M40×1.5	30	92 107 122	32	15	50	65	27	8

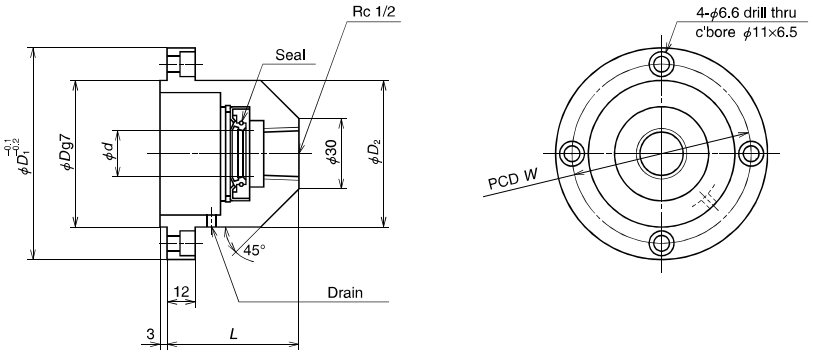
Drive side		Spanner flats		Applicable support unit	Used bearing	Equipped seal unit	
						Shaft end	Shaft outer surface
*D*c	*L*c	*w*	*L*e				
20	40	17	8	WBK25DF-31H WBK25DFD-31H	25TAC62CSUHPN7C DF combination 25TAC62CSUHPN7C DFD combination (25TAC62CSUHPN7C DFF combination)	WSK20A-01	WSK32B-01
25	50	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

Notes: 1. Please consult NSK for other models.
2. See B420 for bearing combination symbols.

5. Seal units for hollow ball screw shaft (available by order)

This is an exclusive joint for coolant of the hollow ball screw shaft.

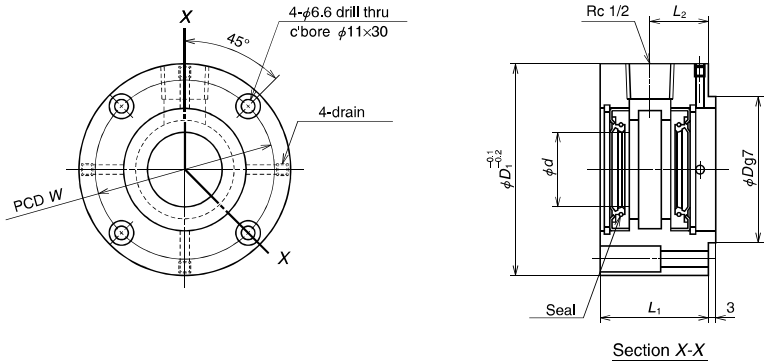
A Type
(for shaft end)



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.

● 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.

◇Reference number for nut cooling ball screw

W4012-＊＊ZMNC-C5Z20

Nut cooling ball screw code

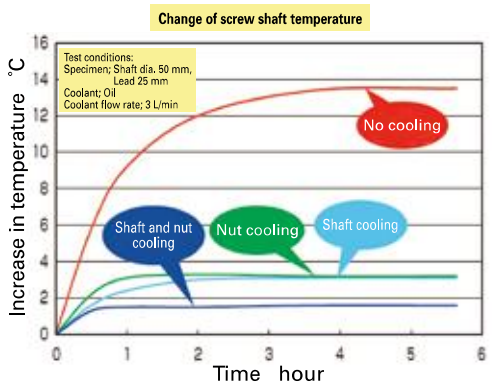
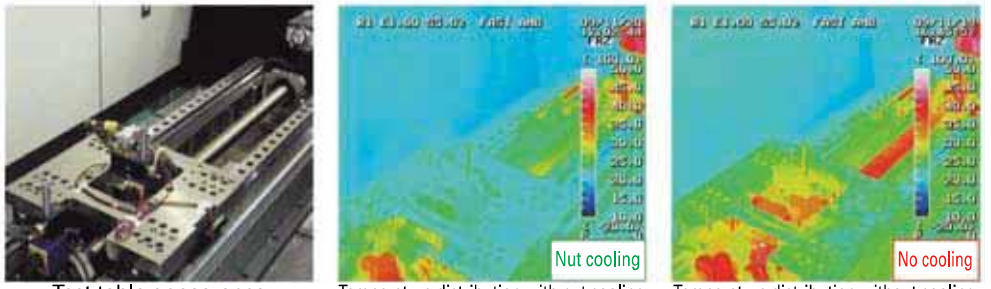


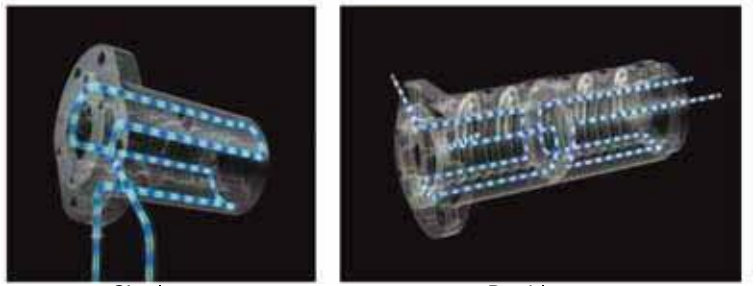
Fig. 1 Effect of forced cooling by nut cooling ball screw



Test table appearance | Temperature distribution with nut cooling | Temperature distribution without cooling

Fig. 2 Effect of forced cooling by nut cooling ball screw

Cooling structure

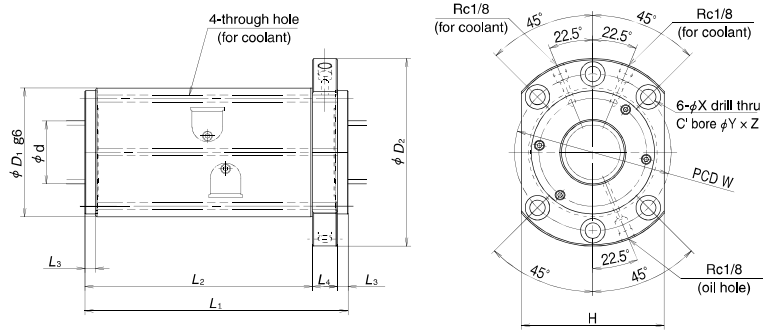


Single nut | Double nut

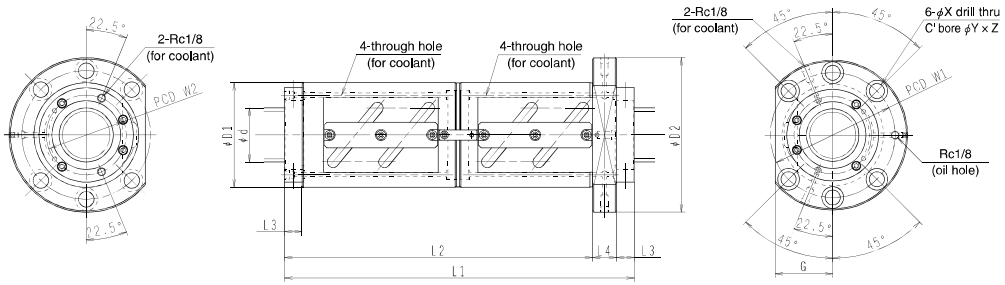
Fig. 3 Cooling structure of a nut cooling ball screw

Nut cooling ball screws: dimension chart

● Single nut cooling ball screws (for HMD type, nut type: EM)



● Double nut cooling ball screws (tube-type, nut type: DFT)



Applicable dimensions for HMD type

Unit: mm

Model No.	Shaft dia. d	Lead l	Nut dimensions D_1	D_2	H	L_1	L_2	L_3	L_4	W	X	Y	Z
EM4016-4E	40	16	86	128	96	166	140.5	7.5	18	106	11	17.5	11
EM4020-6E		20				156	130.5						
EM4025-6E		25				188	162.5						
EM4030-6E		30				219	193.5						
EM4516-4E	45	16	92	134	102	166	140.5	7.5	18	112	11	17.5	11
EM4520-6E		20				156	130.5						
EM4525-6E		25				188	162.5						
EM5016-4E	50	16	98	140	107	166	140.5	7.5	18	118	11	17.5	11
EM5020-6E		20				156	130.5						
EM5025-6E		25				188	162.5						
EM5030-6E		30				219	193.5						
EM6316-4E	63	16	122	180	138	176	139	9	28	150	18	26	17.5

Dimensions for tube type

Unit: mm

Model No.	Shaft dia. d	Lead l	Nut dimensions D_1	D_2	L_1	L_2	L_3	L_4	G	W_1	X	Y	Z	W_2
DFT5010-7.5	50	10	93	135	303	275	10	18	51	113	11	17.5	11	73
DFT5012-5		12	100	146	279	245	12	22	55	122	14	20	13	78
DFT5016-5		16	100	146	344	306	16	22						
DFT5020-3		20	100	146	327	279	20	28						
DFT5510-5	55	10	102	144	243	215	10	18	54	122	11	17.5	11	80
DFT6310-7.5	63	10	108	154	307	275	10	22	58	130	14	20	13	88
DFT6312-5		12	115	161	279	245	12	22	61	137	14	20	13	91
DFT6316-5		16	122	180	350	306	16	28	69	150	18	26	17.5	93
DFT6320-5		20	122	180	407	359	20	28						
DFT8010-5	80	10	130	176	247	215	10	22	66	152	14	20	13	108
DFT8012-5		12	136	182	279	245	12	22	68	158	14	20	13	110
DFT8016-5		16	143	204	350	306	16	28	77	172	18	26	17.5	112
DFT8020-5		20	143	204	407	359	20	28						
DFT10012-5	100	12	160	220	285	245	12	28	82	188	18	26	17.5	134
DFT10016-5		16	170	243	354	306	16	32	91	205	22	32	21.5	136
DFT10020-5		20	170	243	411	359	20	32						

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.

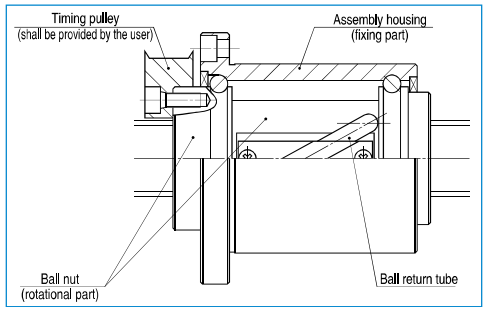


Fig. 1 Ball nut structure

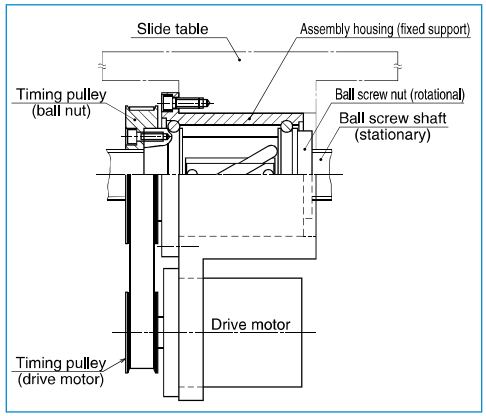


Fig. 2 Example of installation to the table

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.

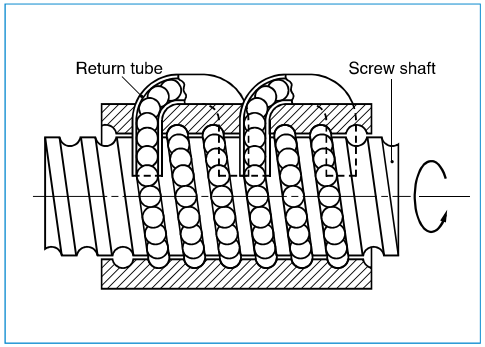


Fig. 3 Structure of ball return tube recirculation system

(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.

$$n_c = f \cdot \frac{d_r}{L_i^2} \times 10^7 \ (min^{-1}) \qquad (Ⅲ\text{-}1)$$

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

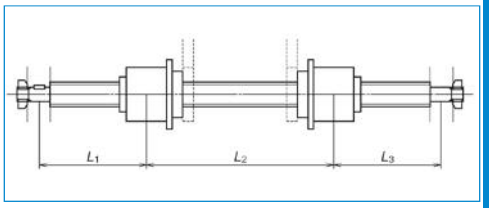


Fig. 4 Installation example

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 interchageability 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.

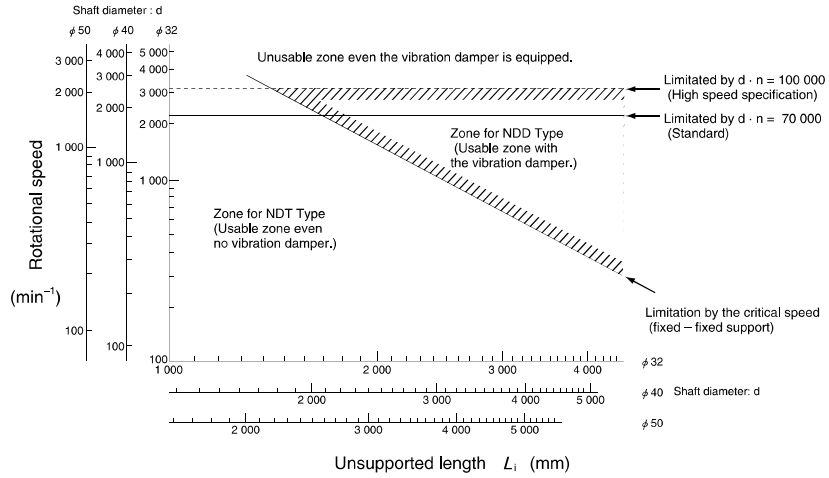


Fig. 5 Compartmentalization between NDT and NDD types to rotational speed and unsupported length

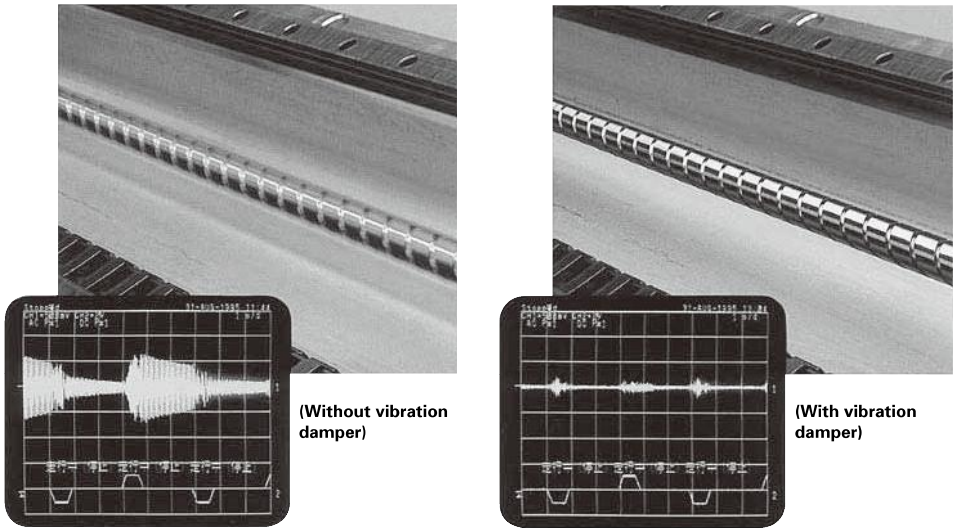


Fig. 6 Vibration of screw shaft when nut is rotating

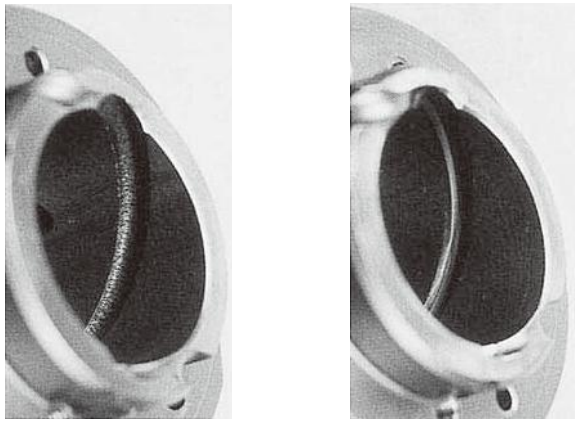


Fig. 7 Effect of vibration damper (results of endurance test)

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:

$$n = \frac{60 \times 10^3}{40} = 1\,500\ (min^{-1})$$

● Calculate d • n value
As the d • n value of standard specification is 7 000, therefore, the permissible rotational speed is;

$$n \leq \frac{70\,000}{40} = 1\,750\ (min^{-1})$$

● Calculate critical speed
The maximum unsupported length comes between Nut A and B.

$L_2 = 3\,300$ (mm)
$f = 21.9$ (Fixed-Fixed)
Root diameter: $d_r = 35.1$ (mm)

Therefore, the permissible rotational speed is;

$$n \leq \frac{21.9 \times 35.1}{3\,300^2} \times 10^7 = 706\ (min^{-1})$$

The calculation indicates that the d • 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}.

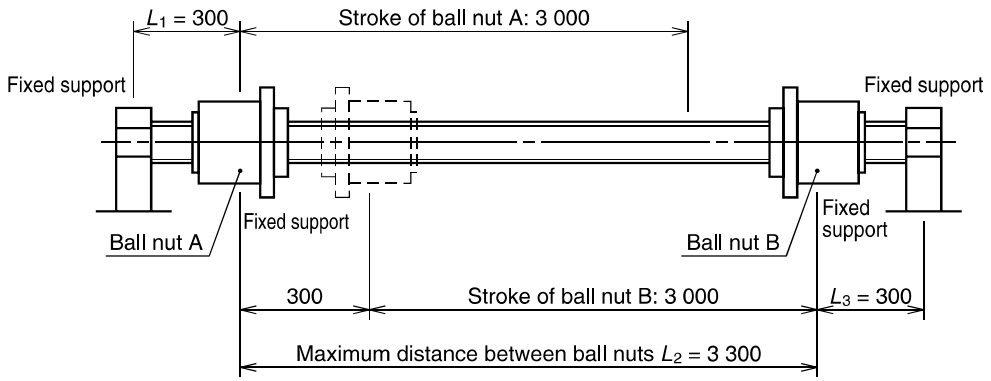


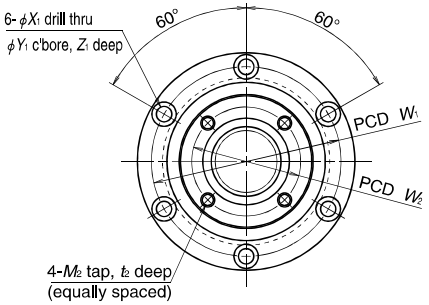
Fig. 8 Calculation example of permissible rotational speed

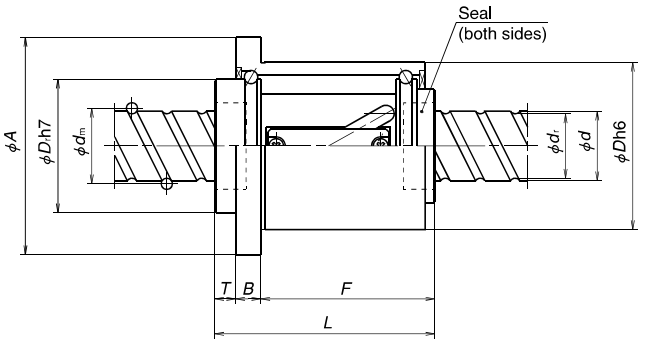
Structure of reference number
The followings describe the structure of "Reference number for ball screw".

◇Reference number for ball screw

W 40 15 - ** P XU - C5 Z 40

- Product code: W
- Screw shaft diameter (mm): 40
- Effective threaded length (in the unit of 100 mm): 15
- Design serial number: **
- Preload code: No code, Non-preload; P, P-preload (page B5): P
- Appearance/specification code ("T" is added for NDD Type.): XU
- Accuracy grade: C3, C5, C7 (Ct7) (page B37 to B42): C5
- Axial play code: Z, T, S (page B20): Z
- Lead (mm): 40





Unit: 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 Turns × Circuits	Basic load rating (N) Dynamic C_a	Basic load rating (N) Static C_{0a}	Moment of inertia, ball nut J (kg·cm²)	Ball nut mass W (kg)
NDT 3220-2.5 NDD 3220-2.5	32	20	4.762	33.25	28.3	2.5×1	17 900	41 800	6.2	2.9
NDT 3225-2.5 NDD 3225-2.5		25	4.762	33.25	28.3	2.5×1	17 900	41 800	6.7	3.2
NDT 3232-1.5 NDD 3232-1.5 NDT 3232-3 NDD 3232-3		32	4.762	33.25	28.3	1.5×1 1.5×2	11 500 18 900	24 800 44 600	6.2	2.9
NDT 4025-2.5 NDD 4025-2.5	40	25	6.35	41.75	35.1	2.5×1	28 500	70 000	19.3	6.0
NDT 4032-1.5 NDD 4032-1.5 NDT 4032-3 NDD 4032-3		32	6.35	41.75	35.1	1.5×1 1.5×2	18 400 30 100	41 200 74 100	18.0	5.5
NDT 4040-1.5 NDD 4040-1.5 NDT 4040-3 NDD 4040-3		40	6.35	41.75	35.1	1.5×1 1.5×2	18 400 30 100	41 200 74 100	19.2	6.0
NDT 5025-2.5 NDD 5025-2.5	50	25	7.938	52.25	44.0	2.5×1	42 700	109 000	45.7	8.5
NDT 5032-2.5 NDD 5032-2.5		32	7.938	52.25	40.0	2.5×1	42 700	109 000	48.9	9.4
NDT 5040-1.5 NDD 5040-1.5 NDT 5040-3 NDD 5040-3		40	7.938	52.25	44.0	1.5×1 1.5×2	27 500 44 900	66 500 120 000	45.5	8.5
NDT 5050-1.5 NDD 5050-1.5 NDT 5050-3 NDD 5050-3		50	7.938	52.25	44.0	1.5×1 1.5×2	27 500 44 900	66 500 120 000	48.7	9.4

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 D_r	Projection tube dimensions T	Bolt hole dimensions X_1	Bolt hole dimensions Y_1	Bolt hole dimensions Z_1	Bolt hole PCD W_1	Tap hole dimensions M_2	Tap hole dimensions t_2	W_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

Notes: 1. The right hand screw is the standard. Consult NSK for the left hand screws.
2. Seals are standard equipment.

B-3-3.10 ∑ Series for Robots

1. Features

∑ 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.

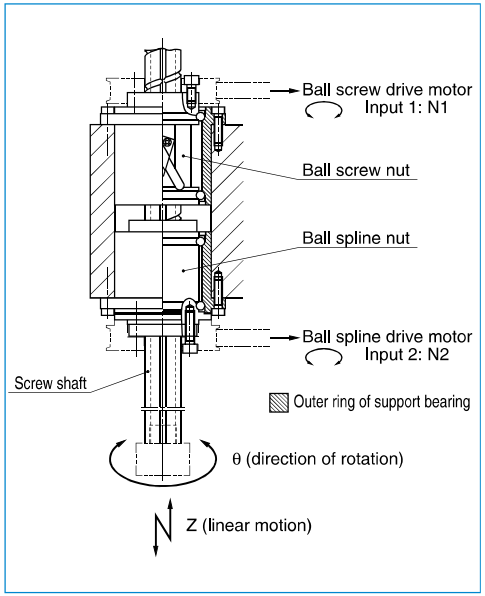


Fig. 1 Example structure of Z axis plus θ axis actuator

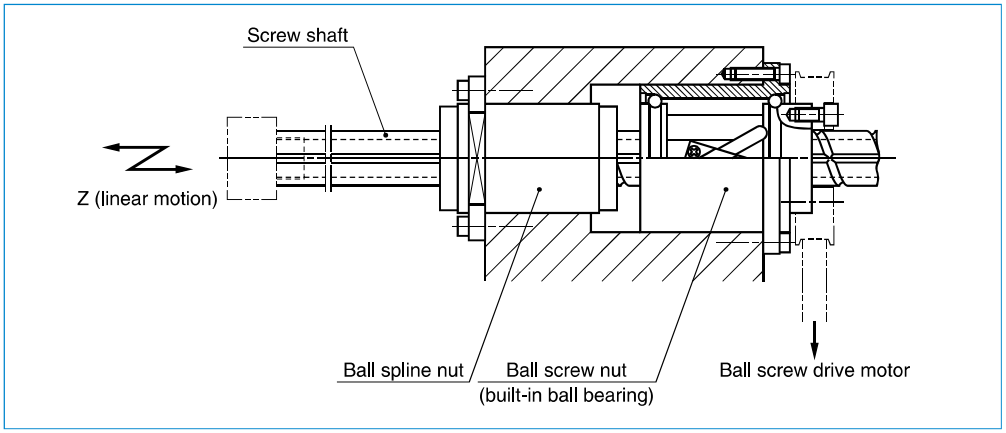


Fig. 2 Example structure of single Z axis unit

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×l	Stop 0	Rotate N1	Stop 0	–
Stop 0	Rotate N2	Rotate N1	Rotate N2	N1 = N2
Up, down N2×l	Rotate N2	Stop 0	Rotate N2	–
Up, down |N1–N2|×l	Rotate N2	Rotate N1	Rotate N2	N1≠N2

3. Specifications

(1) Ball recirculation system

A structure of return tube recirculation system is shown below.

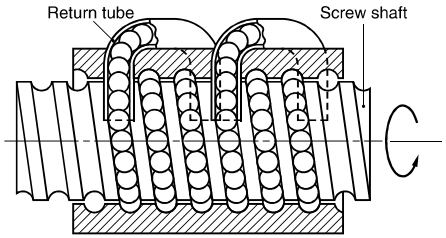


Fig. 3 Structure of return tube recirculation system

(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).

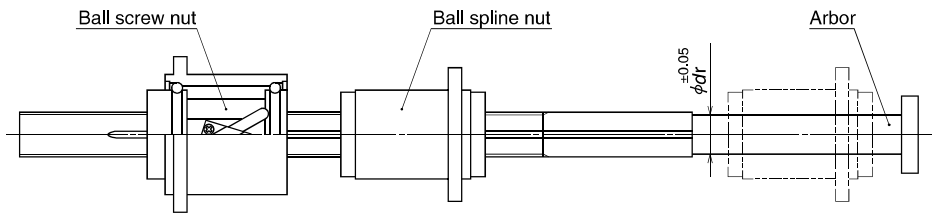
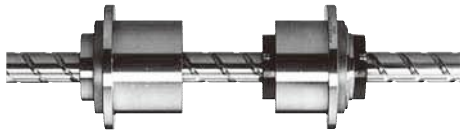


Fig. 4 Removing spline nut

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.

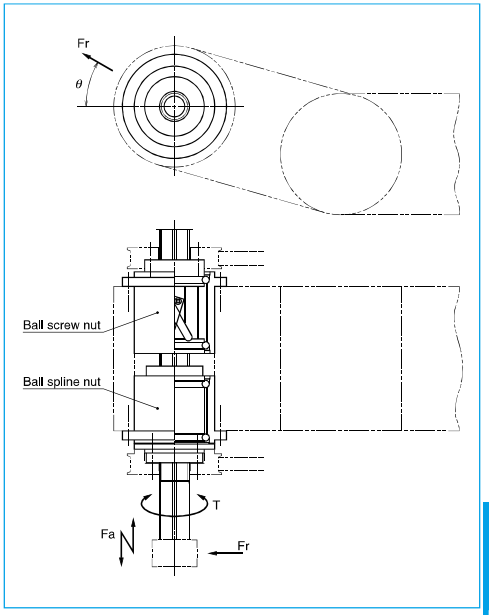


Fig. 5 Example structure of Z axis plus θ axis actuator

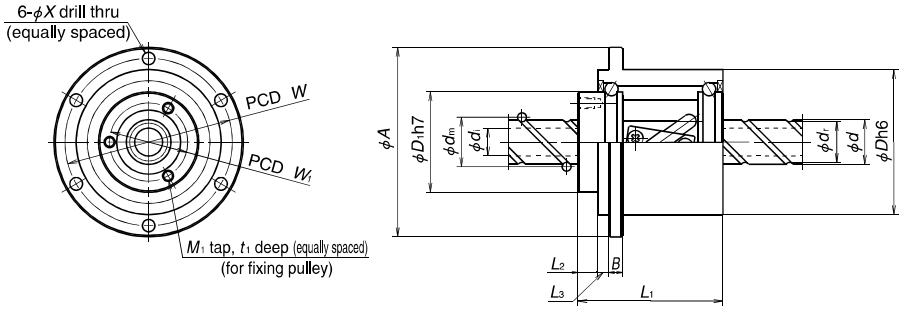
7. Structure of reference number

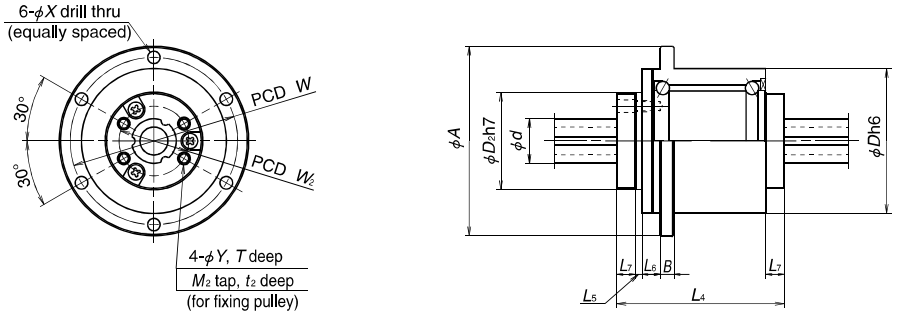
The following describes the structure of "Reference number for ball screw".

◇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)
- Hollow shaft ball screw specification
- Use support unit
- Accuracy grade: C3, C5, C7 (Ct7) (page B37 to B42)
- Axial play code: Z, T, S (page B20)
- Lead (mm)

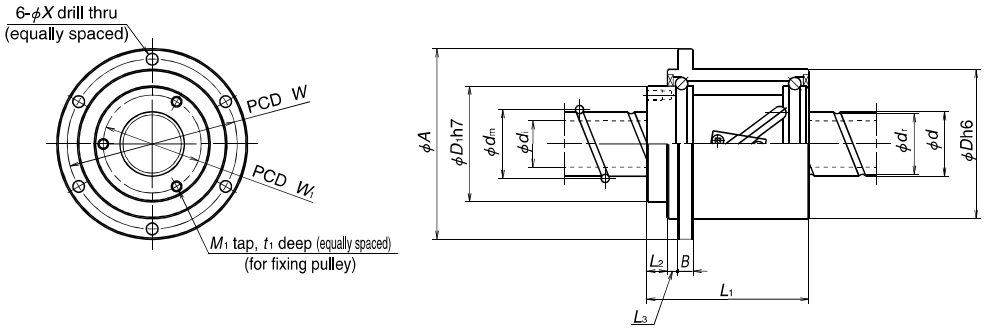


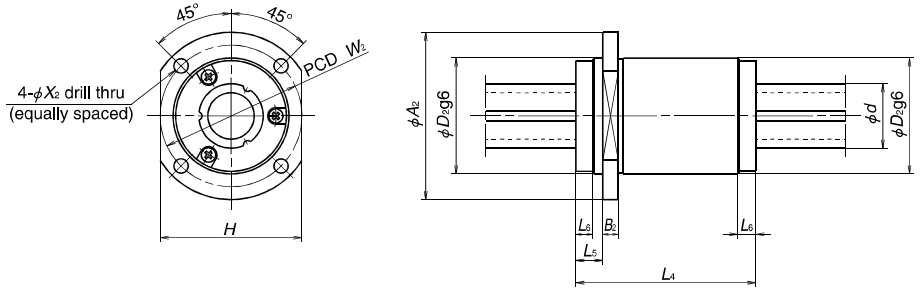


Unit: mm

Model No.	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Screw shaft hollow d_i	Ball screw nut: Basic load rating (N) Dynamic C_a	Static C_{0a}	Dimensions D	A	B	L_1	L_2	L_3	M_1	t_1	W_1	D_1	W	X	Moment of inertia (kg·cm²)
Σ1610	16	10	3.175	16.75	13.4	(8)	4 710	8 110	48	64	5	47	7	4	3-M4	6	28	35	56	4.5	0.41
Σ1632		32					2 990	4 870				52									0.44
Σ2010	20	10	3.175	20.75	17.4	(14)	8 210	17 500	54	70	6	57	8	4	3-M4	6	32	40	62	4.5	0.64
Σ2020		20					5 290	10 300				63									0.65
Σ2040		40					3 360	6 170				57									0.64
Σ2510	25	10	3.175	25.75	22.4	(18)	9 110	21 900	58	74	6	57	8	4	3-M4	6	38	45	66	4.5	1.10
Σ2520		20					5 870	13 200				63									1.18
Σ2525		25					5 870	13 200				72									1.30
Σ2550		50					3 730	7 500				64									1.20
Σ3220	32	20	3.175	32.75	29.4	(25)	6 540	16 800	70	95	8	70	10	6	3-M5	10	44	53	82	6.6	2.60
Σ3232		32					6 540	16 800				91									3.15
Σ4020	40	20	3.969	41.0	36.9	(30)	9 770	26 300	85	110	8	73	10	6	4-M5	10	58	67	96	6.6	5.96
Σ4040		40					9 770	26 300				107									7.85
Σ4520	45	20	3.969	46.0	41.9	(35)	10 300	29 700	90	115	8	73	10	6	4-M5	10	63	72	101	6.6	7.73
Σ4540		40					10 300	29 700				107									10.3

Mass (kg)	Ball spline nut: Basic load rating (N) Dynamic C_r	Static C_{0r}	Basic torque (N·m) Dynamic C_t	Static C_{0t}	Dimensions D	A	B	L_4	L_5	L_6	L_7	Y	T	M_2	t_2	W_2	D_2	W	X	Moment of inertia (kg·cm²)	Mass (kg)
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	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
0.81	6 610	9 450	91.1	145																	
0.74	6 610	9 450	91.1	145																	
0.81	6 630	9 450	115	185	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
0.88	7 290	10 900	125	210																	
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	85	110	8	80	4	7.5	8	5.5	8	M5	8	55	65	96	6.6	9.74	2.38
2.85	11 200	15 900	305	490																	
2.17	11 200	15 900	340	550	90	115	8	85	4	7.5	8	5.5	8	M5	8	60	70	101	6.6	12.5	2.56
3.06	11 700	17 000	360	590																	

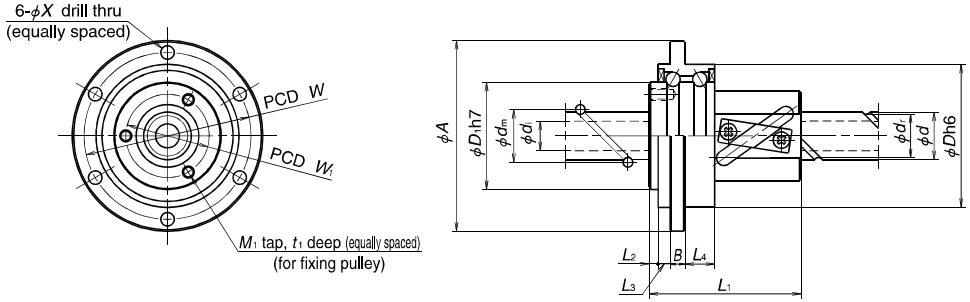


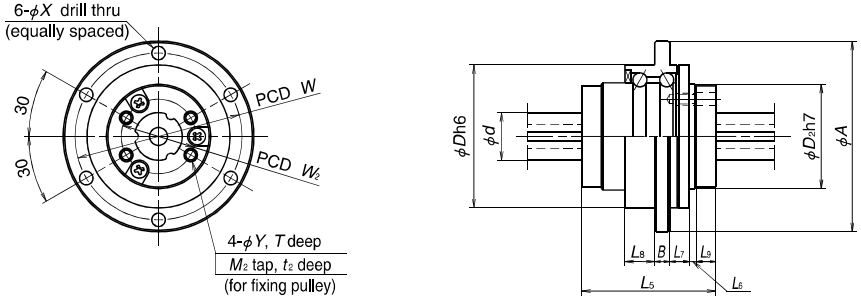


Unit: mm

Model No.	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Screw shaft hollow d_1	Ball screw nut: Basic load rating (N) Dynamic C_a	Static C_{0a}	Dimensions D	A	B	L_1	L_2	L_3	M_1	t_1	W_1	D_1	W	X
∑Z1610	16	10	3.175	16.75	13.4	(8)	4 710	8 110	48	64	5	47	7	4	3-M4	6	28	35	56	4.5
∑Z1632		32					2 990	4 870				52								
∑Z2010	20	10	3.175	20.75	17.4	(14)	8 210	17 500	54	70	6	57	8	4	3-M4	6	32	40	62	4.5
∑Z2020		20					5 290	10 300				63								
∑Z2040		40					3 360	6 170				57								
∑Z2510	25	10	3.175	25.75	22.4	(18)	9 110	21 900	58	74	6	57	8	4	3-M4	6	38	45	66	4.5
∑Z2520		20					5 870	13 200				63								
∑Z2525		25					5 870	13 200				72								
∑Z2550		50					3 730	7 500				64								
∑Z3220	32	20	3.175	32.75	29.4	(25)	6 540	16 800	70	95	8	70	10	6	3-M5	10	44	53	82	6.6
∑Z3232		32					6 540	16 800				91								
∑Z4020	40	20	3.969	41.0	36.9	(30)	9 770	26 300	85	110	8	73	10	6	4-M5	10	58	67	96	6.6
∑Z4040		40					9 770	26 300				107								
∑Z4520	45	20	3.969	46.0	41.9	(35)	10 300	29 700	90	115	8	73	10	6	4-M5	10	63	72	101	6.6
∑Z4540		40					10 300	29 700				107								

Moment of inertia (kg·cm²)	Mass (kg)	Ball spline nut: Basic load rating (N) Dynamic C_t	Static C_{0t}	Basic torque (N·m) Dynamic C_t	Static C_{0t}	Dimensions D_2	A_2	B_2	L_4	L_5	L_6	H	W_2	X	Mass (kg)
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										
1.10	0.81	6 630	9 450	115	185	45	65	6	70	10.5	6.5	55	55	5.5	0.57
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										

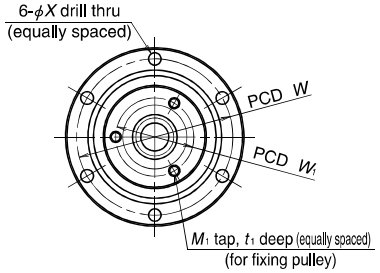


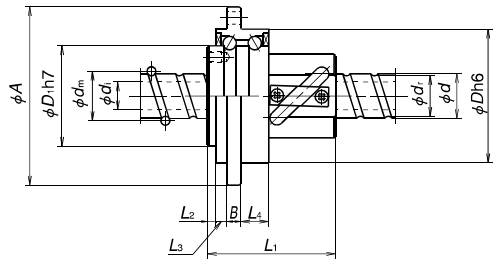


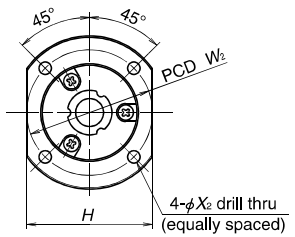
Unit: mm

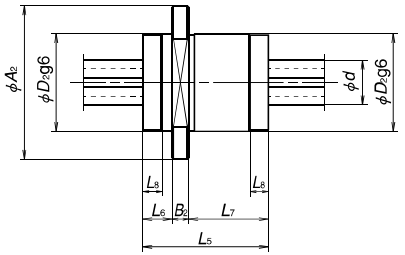
Model No.	Shaft dia.	Lead	Ball dia.	Ball circle dia.	Root dia.	Screw shaft hollow	Ball screw nut															Moment of inertia	Mass
							Basic load rating(N)		Dimensions														
	d	l	D_w	d_m	d_r	d_1	Dynamic C_a	Static C_{0a}	D	A	B	L_1	L_2	L_3	L_4	M_1	t_1	W_1	D_1	W	X	(kg·cm²)	(kg)
∑C1610	16	10	3.175	16.75	13.4	(8)	4 710	8 110	48	64	5	46	3	4	10	3-M4	6	28	35	56	4.5	0.40	
∑C1632		32					2 990	4 870				51										0.43	
∑C2010	20	10	3.175	20.75	17.4	(14)	8 210	17 500	54	70	6	56	4	4	10	3-M4	6	32	40	62	4.5	0.63	
∑C2020		20					5 290	10 300				63										0.65	
∑C2040		40					3 360	6 170				56										0.63	
∑C2510	25	10	3.175	25.75	22.4	(18)	9 110	21 900	58	74	6	56	4	4	10	3-M4	6	38	45	66	4.5	1.04	
∑C2520		20					5 870	13 200				63										1.13	
∑C2525		25					5 870	13 200				71										1.24	
∑C2550		50					3 730	7 500				63										1.13	

Mass	Ball spline nut																							Moment of inertia	Mass
	Basic load rating(N)		Basic torque(N·m)		Dimensions																				
(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_3	W_2	D_2	W	X	(kg·cm²)	(kg)
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																			
0.60	5 130	6 540	87.8	125	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	
0.64	5 870	8 000	100	155																			
0.69	5 870	8 000	100	155																			
0.64	5 870	8 000	100	155																			









Unit: mm

Model No.	Shaft dia. d	Lead l	Ball dia. D_w	Ball circle dia. d_m	Root dia. d_r	Screw shaft hollow d_1	Ball screw nut: Basic load rating(N) Dynamic C_a	Ball screw nut: Basic load rating(N) Static C_{0a}	Dimensions D	A	B	L_1	L_2	L_3	L_4	M_1	t_1	W_1	D_1	W	X
∑CZ1610	16	10	3.175	16.75	13.4	(8)	4 710	8 110	48	64	5	46	3	4	10	3-M4	6	28	35	56	4.5
∑CZ1632		32					2 990	4 870				51									
∑CZ2010	20	10	3.175	20.75	17.4	(14)	8 210	17 500	54	70	6	56	4	4	10	3-M4	6	32	40	62	4.5
∑CZ2020		20					5 290	10 300				63									
∑CZ2040		40					3 360	6 170				56									
∑CZ2510	25	10	3.175	25.75	22.4	(18)	9 110	21 900	58	74	6	56	4	4	10	3-M4	6	38	45	66	4.5
∑CZ2520		20					5 870	13 200				63									
∑CZ2525		25					5 870	13 200				71									
∑CZ2550		50					3 730	7 500				63									

Moment of inertia (kg·cm²)	Mass (kg)	Ball spline nut: Basic load rating(N) Dynamic C_t	Basic load rating(N) Static C_{0r}	Basic torque(N·m) Dynamic C_t	Basic torque(N·m) Static C_{0t}	Dimensions D_2	A_2	B_2	L_5	L_6	L_7	L_8	H	W_2	X_2	Mass (kg)
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											
1.04	0.60	5 130	6 540	87.8	125	45	65	6	55	10.5	38.5	6.5	55	55	5.5	0.44
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 spatter.

● 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)

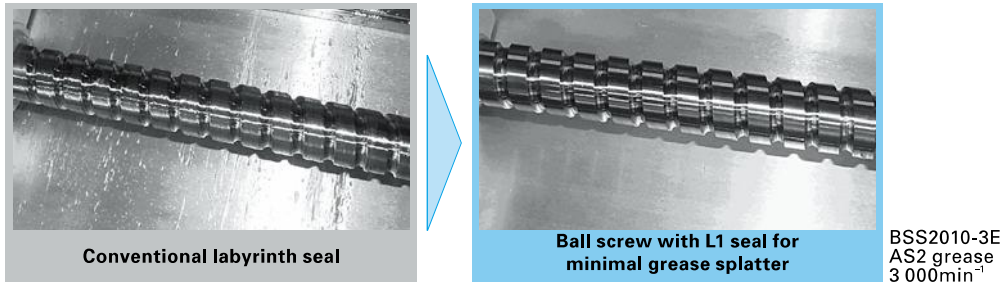


Fig. 1 Comparison of grease splatter from the shaft

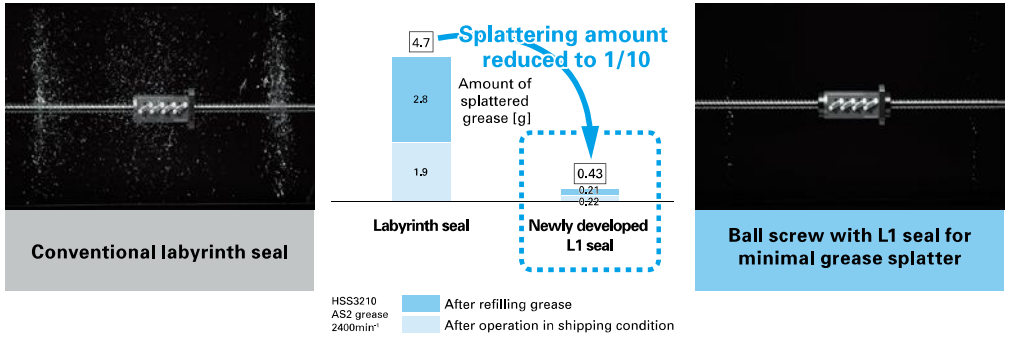


Fig. 2 Results of grease splattering test

(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

Shaft dia. \ Lead	5	10	20	25	Applicable series
15	○	○	○		Compact FA
20	○	○	○		
25	○	○	○	○	
32	○	○			High speed SS

Please contact NSK except for the above types.

Compact FA series (dia.15 to 25 mm)

High Speed SS series (dia.32 mm)

Fig. 3 of grease splatter from the shaft

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

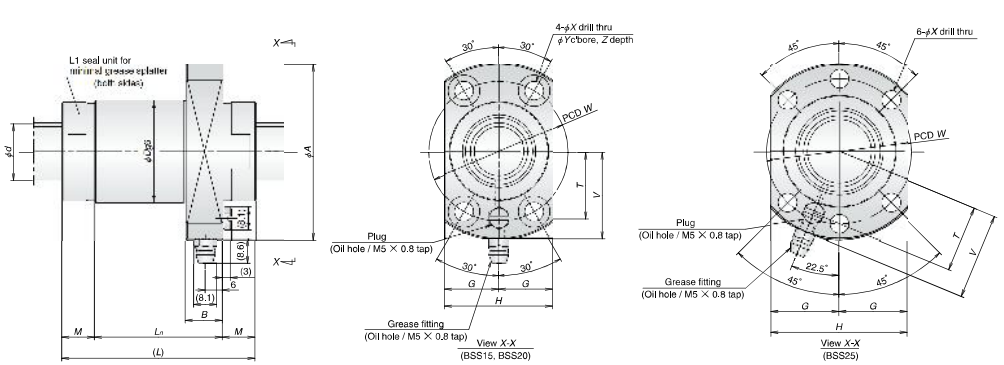
W2005 -**L1 - C5Z10**

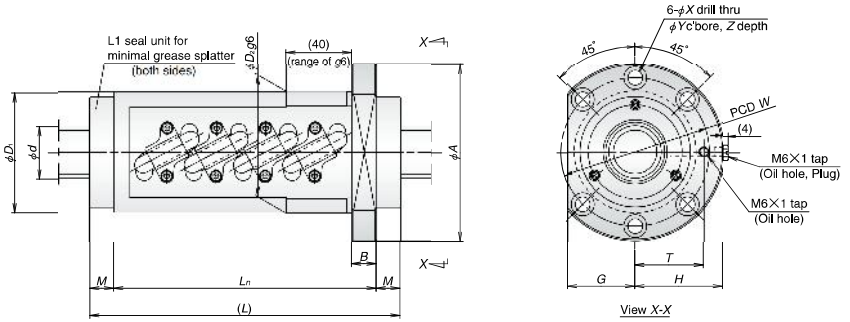
NSK L1 equipped type ball screw code

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.	Lead	Basic load rating (N)		Ball nut dimensions												Seal dimensions	Total length with nut & seal	Internal spatial volume of nut	Standard volume of grease replenishing
			Dynamic	Static	Dia.	Flange				Nut length	Bolt holes				Oil hole position					
	d	l	C_a	C_{0a}	D	A	G	H	B	L_n	W	X	Y	Z	T	V	M	L	(cm^3)	(cm^3)
BSS1505-3E	15	5	5 460	10 200	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								43								63		
BSS1520-2E		20	5 070	8 730	32	55	16.5	33		51	43				20	27	15	81	2.8	1.4
BSS2005-3E	20	5	8 790	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								45								69	3.2	1.6
BSS2020-2E		20	5 900	11 700						54							18	90		
BSS2505-3E	25	5	9 760	23 600	40	62	24	48	12	32	51	6.6	–	–	23.5	30.5	12	56	4.4	2.2
BSS2510-4E		10	12 800	32 300						56								80	4.7	2.4
BSS2520-2E		20	6 560	14 600						54							20	94	3.9	2.0
BSS2525-2E		25								63								103	4.3	2.2

Notes: 1. Maximum operating temperature: 80°C (at outside diameter of ball nut)
2. Grease nipple 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	Standard volume of grease replenishing
			Dynamic	Static	Dia.		Flange				Nut length	Bolt holes				Oil hole position					
	d	l	C_a	C_{0a}	D_1	D_2	A	G	H	B	L_n	W	X	Y	Z	T		M	L	(cm^3)	(cm^3)
HSS3205	32	5	18 500	56 100	57	58	85	32	42	13	89	71	6.6	11	6.5	33		9.5	108	10	5
HSS3210	32	10	46 300	108 000	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

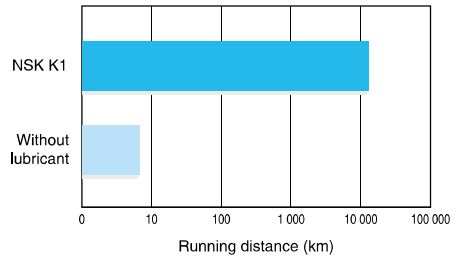


Fig. 1 Duration test results on ball screws without lubricant

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.

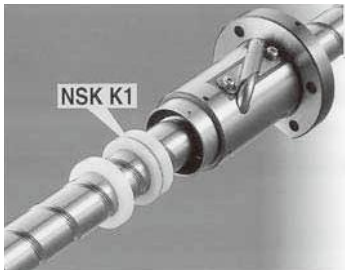


Fig. 2 NSK K1

(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 B577 to B580 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.

Semiconductor/liquid crystal display manufacturing equipment

Industrial robot

Wood working machines

Machine tools

Automobile manufacturing machines

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.

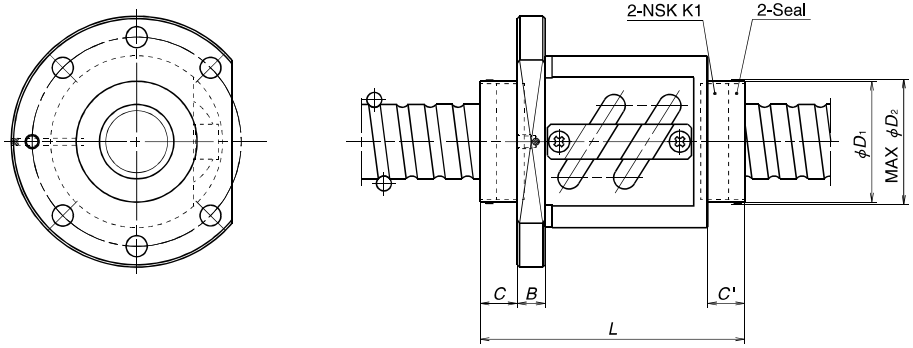
Note: "K1" is added at the end of "nut model code" and "Specifications number".

◇Reference number for ball screw equipped with NSK K1

W1401 - ** P K1 - C3 Z10**

NSK K1 equipped type ball screw code

(1) Tube type



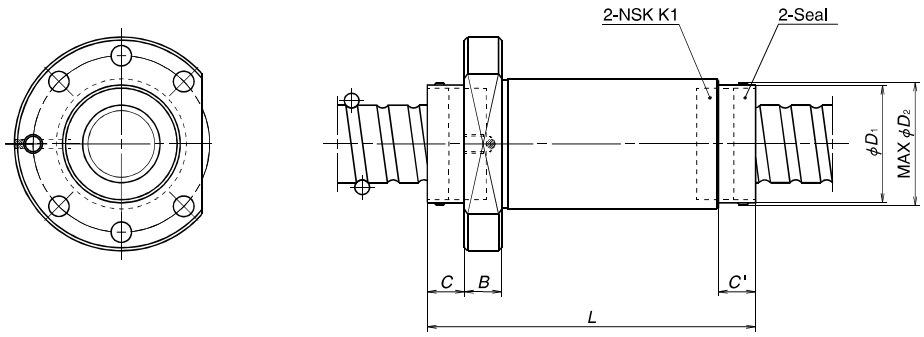
Tube type

Model No.	Screw shaft dia. d	Lead l	K1 installing dimension C	C'	Frange width B	Overall length when equipped K1 L	K1 cap dimension Cap dia. ϕD_1	Protruding dimension ϕD_2
PFT1004-2.5	10	4	14	15	10	61.5	ϕ22	MAX ϕ24
PFT1205-2.5	12	5	14	15	10	66	ϕ26.5	MAX ϕ29
LPFT1210-2.5		10		17		79		
PFT1405-2.5	14	5	14	15	10	65	ϕ30	MAX ϕ32
LPFT1510-2.5	15	10	14	15	10	76	ϕ30	MAX ϕ32
PFT1605-2.5	16	5	14	15	10	67	ϕ32	MAX ϕ34
PFT2005-5	20	5	14	14	10	81	ϕ38	MAX ϕ40
LPFT2010-2.5		10				78		
LPFT2020-1.5		20				84		
ZFT2505-10	25	5	16	17	10	115	ϕ44	MAX ϕ46
PFT2506-5		6	16	17	12	93	ϕ44	MAX ϕ46
PFT2510-2.5		10	16	17	12	89	ϕ44	MAX ϕ46
ZFT2510-3						103		
LPFT2520-2.5		20	12	12	12	109	ϕ38	MAX ϕ40
LPFT2525-1.5		25	12	12	12	98	ϕ38	MAX ϕ40
DFT2805-5	28	5	16	17	12	137	ϕ48	MAX ϕ50
PFT2810-2.5		10				90		
DFT2810-3						174		
PFT3206-5	32	6	16	17	12	93	ϕ52	MAX ϕ54
ZFT3206-10						129		
PFT3210-5		10	16	17		122	ϕ52	MAX ϕ54
ZFT3210-5				17		122		
DFT3210-5				16		212		
PFT3212-3		12	16	17		114	ϕ52	MAX ϕ54
DFT3212-3				16		198		
LPFT3225-2.5		25	12	12		122	ϕ46	MAX ϕ48
LPFT3232-1.5		32	12	12		109	ϕ46	MAX ϕ48

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. d	Lead l	K1 installing dimension C	C'	Frange width B	Overall length when equipped K1 L	K1 cap dimension Cap dia. ϕD_1	Protruding dimension ϕD_2
PFT3610-5	36	10	19	20	15	131	ϕ56	MAX ϕ58
DFT3610-5				19		221		
HZF3616-5		16		19		163		
HZF3620-3.5		20		19		146		
PFT4008-5	40	8	19	20	16	117	ϕ62	MAX ϕ64
ZFT4008-10						165		
ZFT4010-7		10	19	20		152	ϕ62	MAX ϕ64
DFT4010-5				19		222	ϕ61	
PFT4012-5		12	19	20		144	ϕ62	MAX ϕ64
DFT4012-5				19		252	ϕ61	
HZF4016-5		16	19	19		164	ϕ61	MAX ϕ64
HZF4020-5		20	19	19		189	ϕ61	MAX ϕ64
LPFT4032-2.5		32	14	14		151	ϕ54	MAX ϕ56
LPFT4040-1.5		40	14	14		133	ϕ54	MAX ϕ56
DFT4510-5	45	10	19	19	16	222	ϕ72	MAX ϕ75
DFT4512-5		12			16	254		
HZF4520-5		20			18	190		
ZFT5010-10	50	10	19	20	18	194	ϕ73	MAX ϕ76
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	ϕ81	MAX ϕ87
HZF5520-5		20				198		MAX ϕ81
HZF5525-5		25				227		MAX ϕ81
DFT6316-5	63	16	22	22	18	322	ϕ89	MAX ϕ95
DFT6320-5		20				362		

(2) Deflector(bridge) type

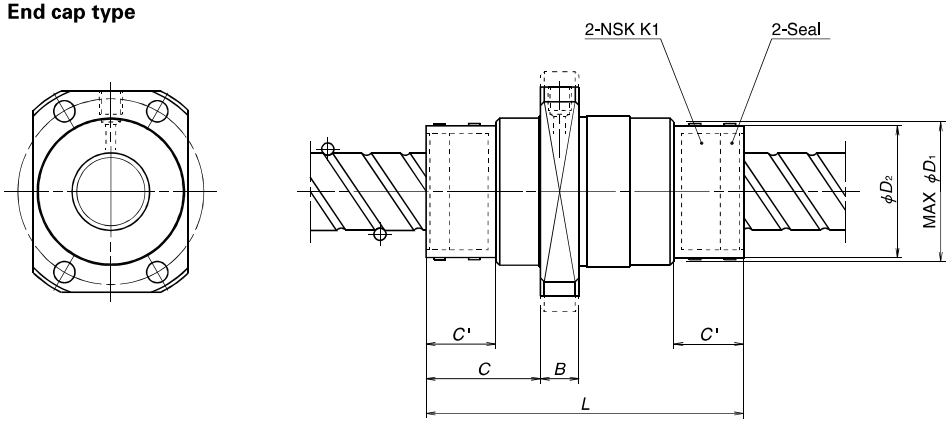


Deflector(bridge) type

Model No.	Screw shaft dia. d	Lead l	K1 installing dimension C	K1 installing dimension C'	Frange width B	Overall length when equipped K1 L	K1 cap dimension Cap dia. φD1	K1 cap dimension Protruding dimension φD2
ZFD2005-6	20	5	9	9	12	87	φ32	MAX φ34
ZFD2506-6	25	6	12	–	12	102	φ38	MAX φ40
ZFD2510-4		10		12		106		
ZFD3208-8	32	8	12	12	12	136	φ46	MAX φ48
ZFD3210-6		10				138		
ZFD3212-6		12				153		
ZFD4010-8	40	10	14	14	16	167	φ54	MAX φ57
ZFD4012-8		12				189		
ZFD5010-8	50	10	14	14	18	169	φ64	MAX φ67
ZFD5012-6		12				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

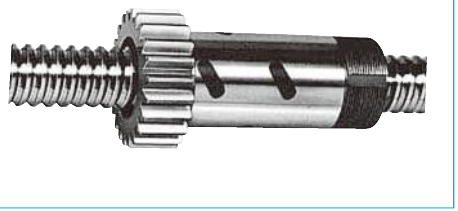
Model No.	Screw shaft dia. d	Lead l	K1 installing dimension C	K1 installing dimension C'	Frange width B	Overall length when equipped K1 L	K1 cap dimension Cap dia. φD1	K1 cap dimension Protruding dimension φD2
UPFC1520-1.5	15	20	29	18	10	81	φ30	MAX φ32
LPFC1616-3	16	16	28	18	10	74	φ28	MAX φ30
LPFC2020-3	20	20	29.5	18	10	82	φ34	MAX φ36
UPFC2040-1		40	29			77	φ32	MAX φ34
LPFC2525-3	25	25	34	21	12	97	φ44	MAX φ46
UPFC2550-1		50				92		
LPFC3232-3	32	32	37	21	12	112	φ52	MAX φ54
UPFC3264-1		64	36.5			104		
LPFC4040-3	40	40	43.5	24	15	133	φ62	MAX φ65
LPFC5050-3	50	50	45.5	24	20	155	φ74	MAX φ77

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.

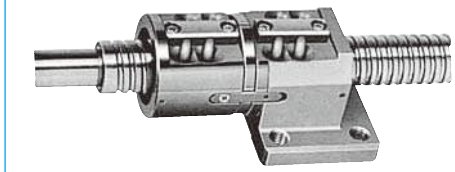
B-3-3.13 Special Ball Screws

In addition to the standard ball screws, NSK manufactures various types of ball screws in special shapes as shown below.

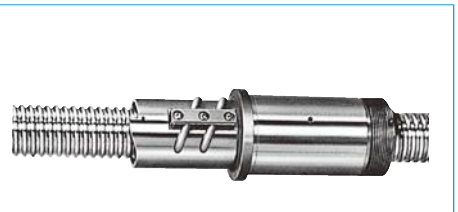
Thoroughly discuss with NSK the specifications before determining specifications and ordering ball screws in special shapes.



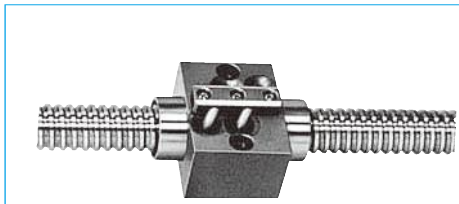
Nut with gear



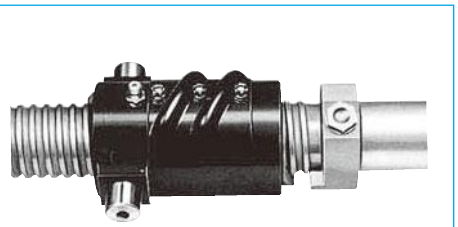
Double nut with flat mounting surface



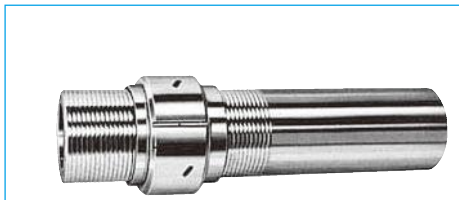
Lightly preloaded single nut with bearing seat



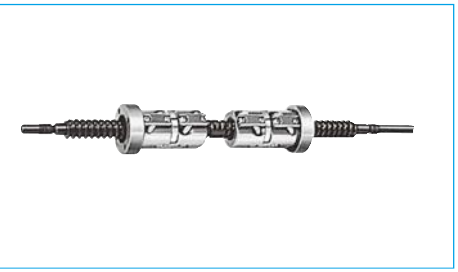
Lightly preloaded single nut with flat mounting surface



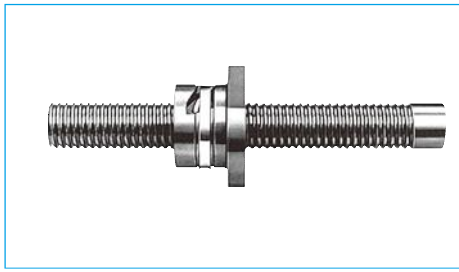
Nut with trunion



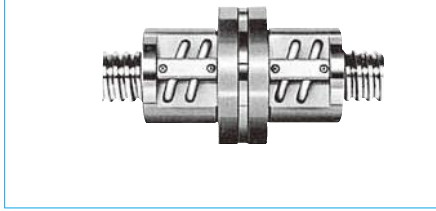
Hollow shaft, lightly preloaded single nut, with large shaft diameter and fine lead



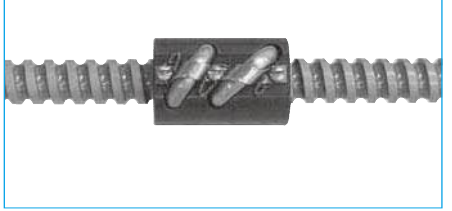
Double nut with right and left turn thread on each side of screw shaft



Ceramic ball screw

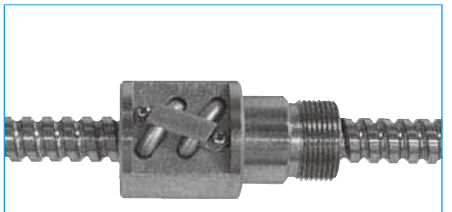


Flanged to flanged ball nut

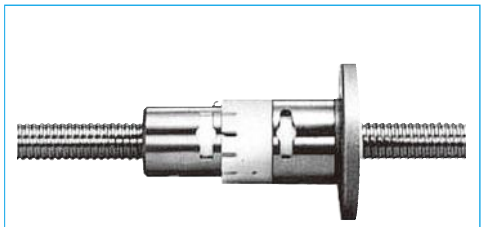


Ball screw for aircraft

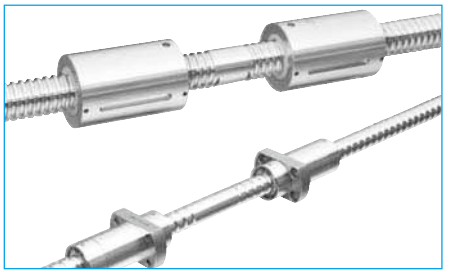
Cylindrical double nut



Ball screw for nuclear power plant



Spring preloaded ball screw



Right and left hand thread on each side of screw