Table of Contents

1. FEATURES

(1) High transmission efficiency

TOSOK ball screws have an extremely high transmission efficiency of over 90%, as compared with the conventional Acme screws, and the required torque reduced to only one-third or less. This allows the effective conversion of linear motion to rotary motion.
(See Chart on the next right.)

(2) Axial clearance adjustable

Conventional Acme screws do not roll smoothly when the axial clearance is small. TOSOK ball screws, however, can roll smoothly even when the axial clearance is reduced.
In addition, TOSOK ball screws can eliminate the axial clearance by preloading with two nuts and also resulting in increased rigidity.

(3) Long life and low wear

Due to rolling contact, very little wear occurs over the life of the ball screws, assuring high precision performance for long period of time.

(4) Precision fine feed possible

Reduced starting torque due to the rolling contact permits precision fine feed.

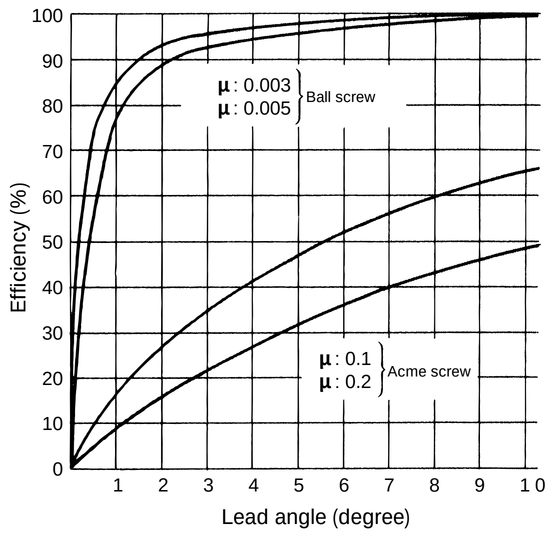
(5) High precision

All TOSOK ball screws are ground, assembled and inspected under a strict temperature control.

(6) Drastic quality control system

TOSOK has promptly obtained a qualification for ISO9001 and established a drastic quality control system to manufacture quality products that can satisfy customers' needs to the full.

Fig.1 Efficiencies of Ball Screw and Acme Screw



2. ACCURACY

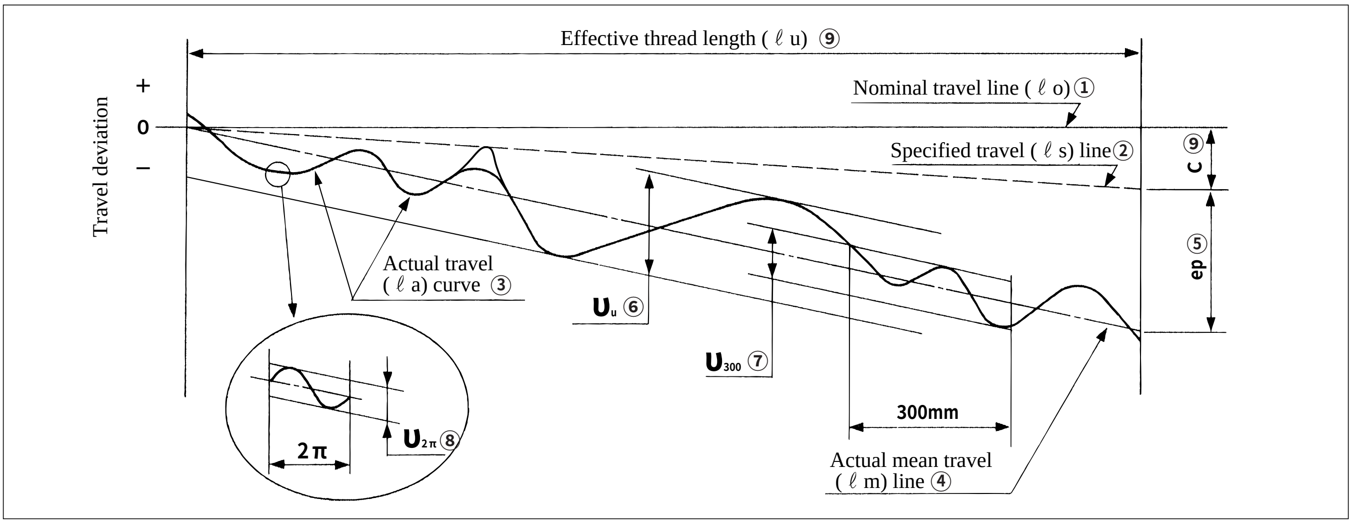
2.1 Accuracy Grade

The grade of accuracy of TOSOK Precision Ball Screws conformes to JIS B 1192 (Ball Screws) and is prescribed by JIS Series (C0, C1, C3, C5) and (G1, G3, G5) conforming to ISO.

2.2 Lead Accuracy

Lead Accuracy for TOSOK Precision Ball Screws conforms to JIS B 1192 (Ball Screws) which prescribes the tolerance on specified travel and travel variation in respect to the effective length of travel of nut or to the effective length of threaded portion of screw shaft, as well as on travel variation in respect to a length of 300mm taken arbitrarily within the effective length of the screw shaft and on travel variation in respect to arbitrary one revolution (2π rad) within the effective length of threaded portion.

Fig. 2 Terms of lead accuracy



2.2.1 Terms and Definitions of Lead Accuracy

(1) Specified lead
Lead that is calculated by correcting the nominal lead to some degree to compensate the amount of deformation which may occur due to temperature rise or load.

(2) Specified travel ℓ s
Axial travel attained when screw shaft has been rotated by arbitrary number of times in accordance with specified travel. [② in Fig. 2]

(3) Actual travel ℓ a
Axial travel obtained by continuous measurement of the actual axial travel of nut to arbitrary angle of screw shaft rotation. [③ in Fig.2]

(4) Actual mean travel ℓ m
Straight line representing the tendency of actual travel.
This straight line can be obtained by the least square method or a simple and appropriate approximation method similar to that, from a curve indicating the actual travel in respect to the effective travel of the nut or the effective length of threaded portion of the screw shaft. [④ in Fig.2]

(5) Tolerance on specified travel ep
Difference between actual mean travel corresponding to the effective travel of the nut or the effective length of threaded portion of the screw shaft and specified travel. [⑤ in Fig.2]

(6) Travel variation v
The maximum width of actual travel curve put between 2 straight lines drawn in parallel to actual mean travel line, and it is specified on the following 3 items.

vu :That corresponds to the effective travel distance of nut or effective length of threaded portion of the screw shaft. [⑥ in Fig.2]
v300 :That corresponds to a length of 300mm which is arbitrarily taken within the effective threaded portion of the screw shaft. [⑦ in Fig.2]
v2 π :That corresponds to one arbitrary revolution (2 π rad) within the effective threaded portion of screw shaft. [⑧ in Fig.2]

(7) Target value C of specified travel
Target value used to preset specified travel to ”minus ” or ”plus ” side against nominal travel. [⑨ in Fig.2]

Table 1. Tolerance on specified travel and Travel variation (Permissible Values) Unit: μm

Grade		C0		C1		C3		C5		G1		G3		G5	
Items / Effective length of threaded portion (mm)		Tolerance on specified travel	(1) Travel variation	Tolerance on specified travel	(1) Travel variation	Tolerance on specified travel	(1) Travel variation	Tolerance on specified travel	(1) Travel variation	Tolerance on specified travel	(1) Travel variation	Tolerance on specified travel	(1) Travel variation	Tolerance on specified travel	(1) Travel variation
Over	Not more than	$\pm e_p$	v_u	$\pm e_p$	v_u	$\pm e_p$	v_u	$\pm e_p$	v_u	$\pm e_p$	v_u	$\pm e_p$	v_u	$\pm e_p$	v_u
—	100	3	3	3.5	5	8	8	18	18						
100	200	3.5	3	4.5	5	10	8	20	18						
200	315	4	3.5	6	5	12	8	23	18	6	6	12	12	23	23
315	400	5	3.5	7	5	13	10	25	20	7	6	13	12	25	25
400	500	6	4	8	5	15	10	27	20	8	7	15	13	27	29
500	630	6	4	9	6	16	12	30	23	9	7	16	14	32	29
630	800	7	5	10	7	18	13	35	25	10	8	18	16	36	31
800	1000	8	6	11	8	21	15	40	27	11	9	21	17	40	34
1000	1250	9	6	13	9	24	16	46	30	13	10	24	19	47	39
1250	1600	11	7	15	10	29	18	54	35	15	11	29	22	55	44

Note (1): Travel variation in respect to the effective travelling distance of nut or to the effective length of threaded portion of screw shaft.

Table 2. Travel variation (Permissible Values)

Grade	C0		C1		C3		C5		G1		G3		G5	
Items	v_{300}(2)	$v_{2\pi}$(3)	v_{300}(2)	$v_{2\pi}$(3)	v_{300}(2)	$v_{2\pi}$(3)	v_{300}(2)	$v_{2\pi}$(3)	v_{300}(2)	$v_{2\pi}$(3)	v_{300}(2)	$v_{2\pi}$(3)	v_{300}(2)	$v_{2\pi}$(3)
Permissible value	3.5	3	5	4	8	6	18	8	6	4	12	6	23	8

Note (2) : Travel variation in respect to 300mm taken arbitrarily within the effective length of threaded portion of screw shaft.
(3) : Travel variation in respect to arbitrary revolution (2π rad) within the effective length of threaded portion of screw shaft.

2.3 Axial Clearance

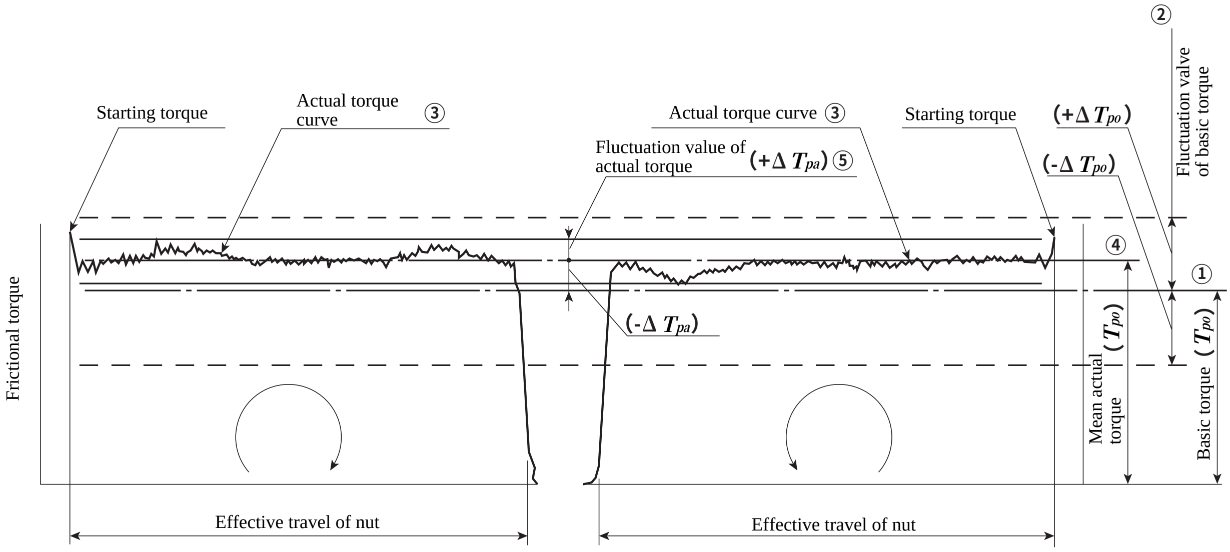
Combination of TOSOK Precision Ball Screw of each grade with axial clearance is shown in Table 3.

Table 3. Combination of Grade with Axial Clearance

Axial clearance / Grade		Z: 0 (Preload)		T: Not more than 0.005		S: Not more than 0.020		N: Not more than 0.050	
C0	—	C0Z	—	C0T	—	—	—	—	—
C1	G1	C1Z	G1Z	C1T	G1T	—	—	—	—
C3	G3	C3Z	G3Z	C3T	G3T	C3S	G3S	—	—
C5	G5	C5Z	G5Z	C5T	G5T	C5S	G5S	C5N	G5N

2.4 Preload Torque

Fig. 3. Terms of Preload Torque



2.4.1. Terms and Definitions of Preload Torque

(1) Preload F_{pr}
A force which is allowed to exert action in a ball screw, assembling a group of nuts, which have been displaced in an axial direction to each other, to attempt to decrease the backlash and to increase the ridgidity of the ball screw.

(2) Dynamic drag torque T_p
A dynamic torque required to rotate the nut against the screw shaft or the screw shaft against the nut, under the conditions of the ball screw which has been subjected to the prescribed preload in the absence of any external load and with the end seal removed.

(3) Total dynamic drag torque T_t
A dynamic torque required to rotate the nut against the screw shaft or the screw shaft against the nut, under the conditions of the ball screw which has been subjected to the prescribed preload in the absence of any external load and with the end seal removed.

(4) Basic torque T_{po}
Dynamic drag torque which has been established as a target. [① in Fig. 3]

(5) Fluctuation value of basic torque ΔT_{po}
Fluctuation value of dynamic drag torque which has been established as a target. It is taken as the positive and negative in respect to basic torque. [② in Fig. 3]

(6) Fluctuation rate of torque
Rate of basic torque fluctuation value ΔT_{po} to basic torque T_{po}.

(7) Actual torque curve
Dynamic torque curve which has been measured on actual preload ball screw. [③ in Fig. 3]

(8) Mean actual torque T_{pa}
Arithmetic mean value of maximum value and mininum value of actual torque (except starting torque) when measured allowing the nut to have reciprocating motion in respect to the effective length of the threaded portion. [④ in Fig. 3]

(9) Fluctuating value of actual torque ΔT_{pa}
Maximum fluctuation value of actual torque curve (except starting torque) when measured allowing the nut to have reciprocating motion in respect to the effective length of threaded portion. It is taken as the positive and negative in respect to mean actual torque.
[⑤ in Fig. 3]

(10) Fluctuation rate of actual torque
Rate of mean actual torque ΔT_{pa} to fluctuation value of actual torque T_{pa}.

Table 4. Tolerance Zone of Fluctuation Rate of Torque

Basic torque N・m		Slenderness(4): 40 maximum				Slenderness(4): 60 maximum			
		Grade				Grade			
Over	Not more than	C0	C1,G1	C3,G3	C5,G5	C0	C1,G1	C3,G3	C5,G5
0.2	0.4	±30%	±35%	±40%	±50%	±40%	±40%	±50%	±60%
0.4	0.6	±25	±30	±35	±40	±35	±35	±40	±45
0.6	1.0	±20	±25	±30	±35	±30	±30	±35	±40
1.0	2.5	±15	±20	±25	±30	±25	±25	±30	±35

Note (4) : Slenderness means the numerical value of effective length of threaded portion of the screw shaft divided by the nominal outside diameter of ball screw.
Remarks: Basic torque of not more than 0.2 is separately controlled by TOSOK Standard.

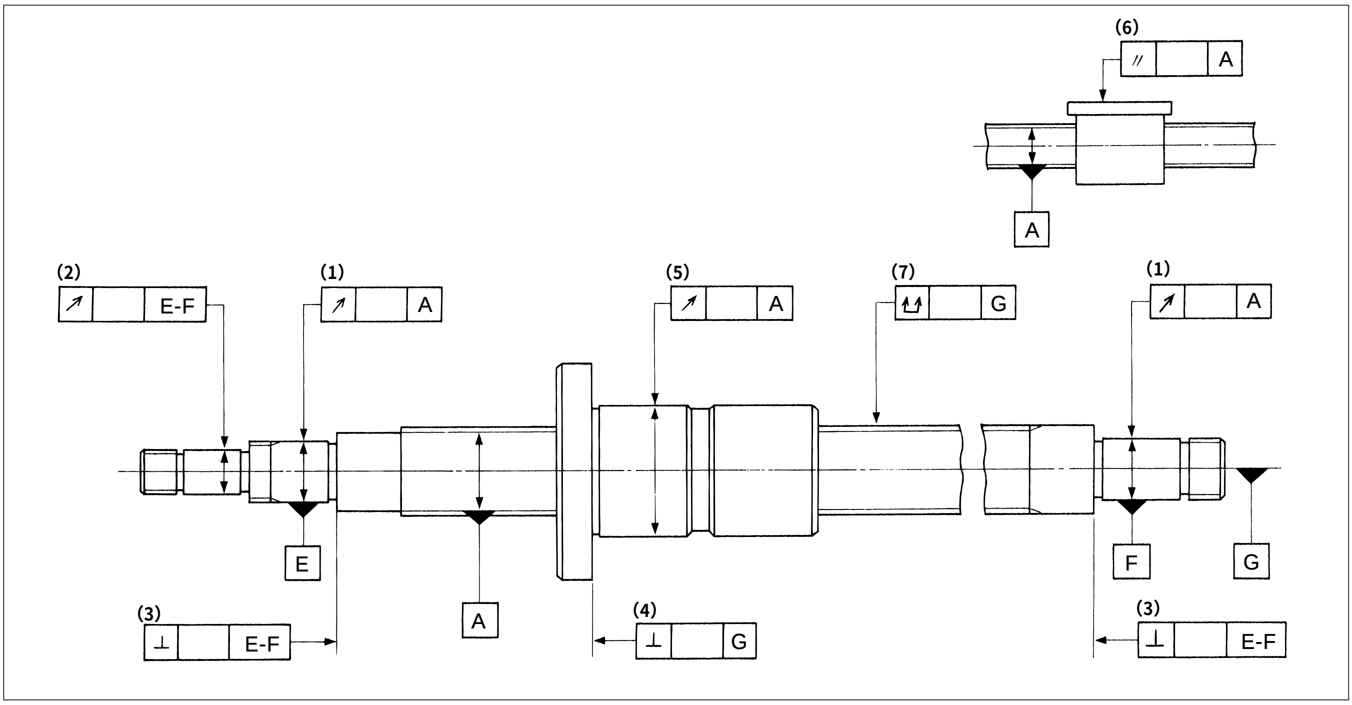
2.5 Accuracies on Supporting Part of Ball Screw

2.5.1 Accuracies on supporting part of C Series Ball Screws

Fig. 4 shows Accuracies on supporting part of ball screw. The respective accuracies and permissible values conform to JIS B 1192 (Ball Screws).

(1) Circumferential runouts in radial direction of outside diameter of the supporting part of screw shaft in respect to axial line of screw groove surface.
(2) Circumferential runouts in radial direction of outside diameter of the mounting part in respect to axial line of supporting part of screw shaft.
(3) Squareness of end face of supporting part in respect to axial line of supporting part of screw shaft.
(4) Squareness of basic end face of nut or flange mounting surface in respect to axial line of screw shaft.
(5) Circumferential runout in radial direction on outer peripheral face of nut (in case of cylindrical shape) in respect to axial line of screw shaft.
(6) Parallelism of outer peripheral face of nut (in case of plane mounting surface) in respect to axial line of screw shaft.
(7) Total radial runout on axial line of screw shaft.

Fig. 4 Accuracies on Supporting Part of Ball Screw



3. NOTATION OF TOSOK PRECISION BALL SCREWS

Notation of TOSOK Precision Ball Screws

(Example)

BS 16 04 B1 S F - C3 Z - 400 R 500

- **500** — Overall length of screw shaft (mm)
- **R** — Thread direction
  - R : Right-hand thread
  - L : Left-hand thread
- **400** — Thread length of screw shaft (mm)
- **Z** — Symbol of axial clearance
  - Z : 0 (mm)
  - T : 0.005 or less
  - S : 0.020 or less
  - N : 0.050 or less
  - (T, S, N) See page 5.
- **C3** — Symbol of classification
  - C0, C1, C3, C5 : JIS
  - G1, G3, G5 : ISO
- **F** — Preload symbol
  - F : Offset lead preloading type
  - No symbol : Other preloading type and clearance type than above-mentioned
- **S** — Nut symbol
  - S : Single nut
  - W : Double nut
- **B1** — Number of circuits
  - Tube
    - A1 : 1.5 turns, 1 circuit
    - A2 : 1.5 turns, 2 circuits
    - B1 : 2.5 turns, 1 circuit
    - B2 : 2.5 turns, 2 circuits
    - B3 : 2.5 turns, 3 circuits
    - E1 : 3.5 turns, 1 circuit
  - Return guide
    - D : 3.7 turns, 1 circuit
- **04** — Lead (mm)
- **16** — Outer diameter of screw shaft (mm)
- **BS** — Symbol of ball screw

4. DESIGN OF SCREW SHAFTS

4.1 Combination of Nominal Outside Diameter and Lead of Screw Shaft

Table 5. Combination of Nominal Outside Diameter and Lead of Screw Shaft

Nominal O.D. of screw shaft (mm)	Lead (mm)													
	1	1.5	2	2.5	3	4	5	6	8	10	12	16	20	25
3	**○**													
4	**○**													
5	**○**		○											
6	**○**	**○**	**○**											
8	**○**	**○**	**○**	**○**	**○**		○							
10	**○**	**○**	**○**	**○**	**○**	**○**	○			○				
12	**○**		**○**	**○**	**○**	**○**	**○**	**○**	**○**	**○**		**○**	**○**	
14	**○**		**○**	**○**	**○**	**○**	**○**			**○**			○	
15					○	○				**○**			○	
16	○		**○**	**○**	○	**○**	**○**	**○**				○		
18										**○**				
20			○		○	**○**	**○**	**○**		**○**	**○**		**○**	○
25					○	**○**	**○**	**○**	○	○	○		**○**	**○**
28					○		**○**	**○**	○	○				
32			○		○	**○**	**○**	**○**	**○**	**○**				
36					○	○	**○**	**○**	**○**	○				
40							**○**	**○**	**○**	**○**				

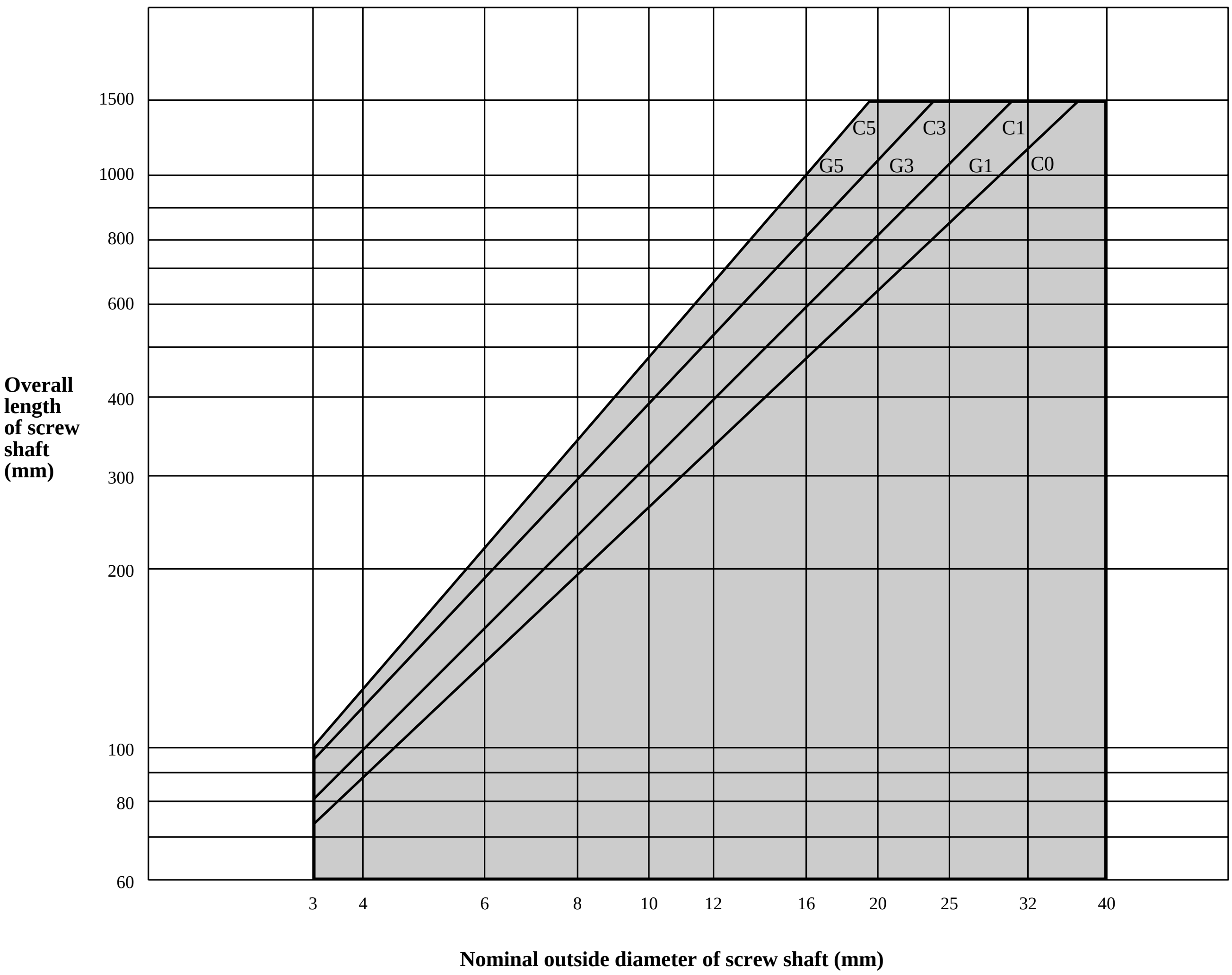
Note: Although combinations other than the halftone circles are not given in Dimension Tables (Page 24 - 57), they are manufactured upon order.
For your specific requirements other than these combinations, contact TOSOK.

4. DESIGN OF SCREW SHAFTS

4.2 Dimensional Ranges of Screw Shafts

Fig. 5 shows the dimensional ranges of screw shafts classified by their grades.
For your specific requirements outside these ranges, contact our company.

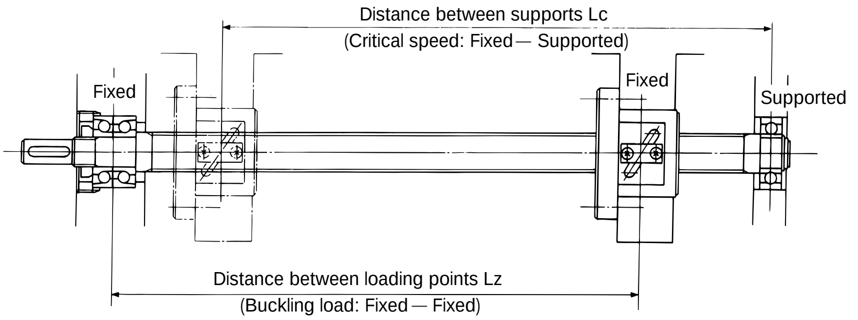
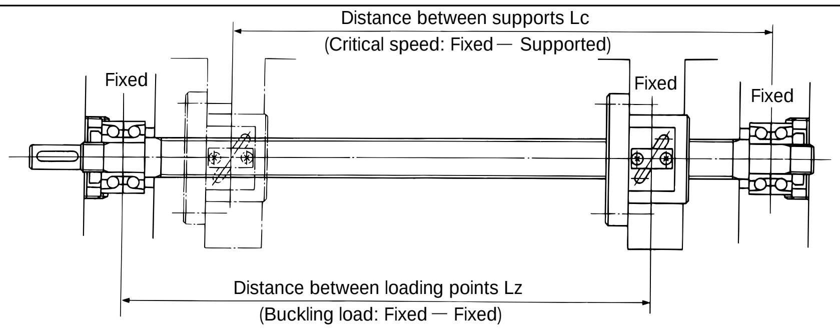
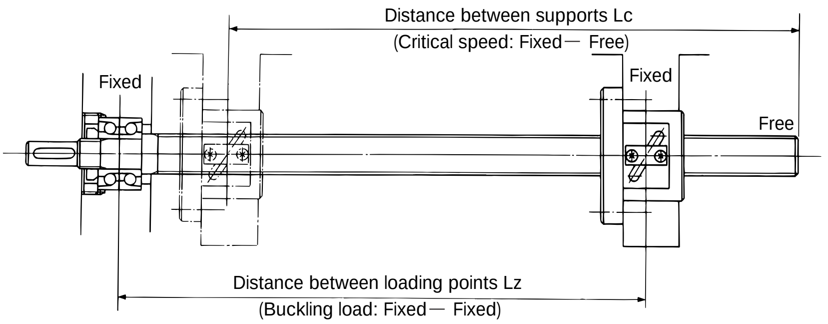
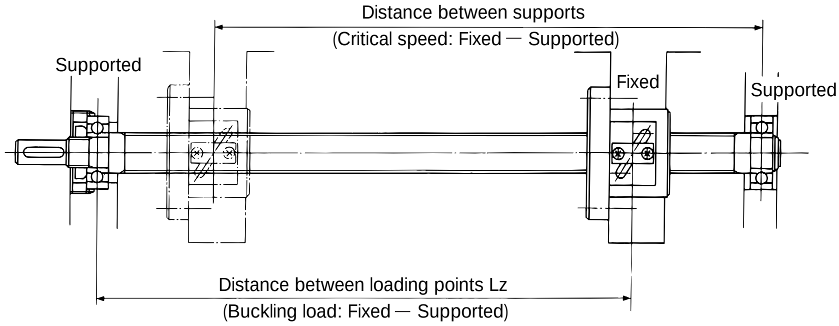
Fig. 5 Dimensional ranges of screw shafts classified by their grades



4.3 Supporting Method

Fig. 6 shows the typical method of supporting ball screws. When strict operating conditions of high degree of accuracy are required, careful consideration must be taken because the supporting method has a direct relation to permissible axial load and critical speed.

Fig. 6 Typical mounting examples of screw shafts and nuts

<table>
<tr><th>Supporting method</th><th>Main applications</th></tr>
<tr><td>
</td><td>・ Ordinary supporting method
・ Medium and highspeed revolution
・ High accuracy</td></tr>
<tr><td>
</td><td>・ Highspeed revolution
・ High accuracy</td></tr>
<tr><td>
</td><td>・ Low speed revolution
・ Medium accuracy
・ For long shaft length</td></tr>
<tr><td>
</td><td>・ Medium speed revolution
・ Medium accuracy</td></tr>
</table>

4. DESIGN OF SCREW SHAFTS

4.4 Permissible Axial Load

(1) Buckling load (Oblique lines in Fig. 7)
When the screw shaft is subject to compression load, it is necessary to take measures to prevent buckling in accordance with the following equation.

$$P = \frac{n \cdot \pi^2 \cdot E \cdot I}{Lz^2} \times \alpha$$

Where P : Permissible axial load to buckling (N)
a : Safety factor (0.5)
Lz: Distance between loading points (mm) (See Fig. 6.)
E : Modulus of longitudinal elasticity ($2.06 \times 10^5 N/mm^2$)
I : Minimum secondary moment of screw shaft cross section (mm^4)

$$I = \frac{\pi}{64} dr^4$$

dr: Screw shaft root diameter (mm) (See Dimension Table.)
n : Factor determined by supporting method of ball screws

Both ends supported	n=1
One end fixed other end supported	n=2
Both ends fixed	n=4
One end fixed other end free	n=0.25

(2) Permissible tensile compressive load (Perpendicular lines to permissible axial load scale marks)
When the distance between loading points is short, it is necessary to examine permissible tensile compressive load in accordance with the following equation independently of the supporting method.
Select a proper load on the "Both ends fixed" scale.

$$P = \sigma \cdot A$$

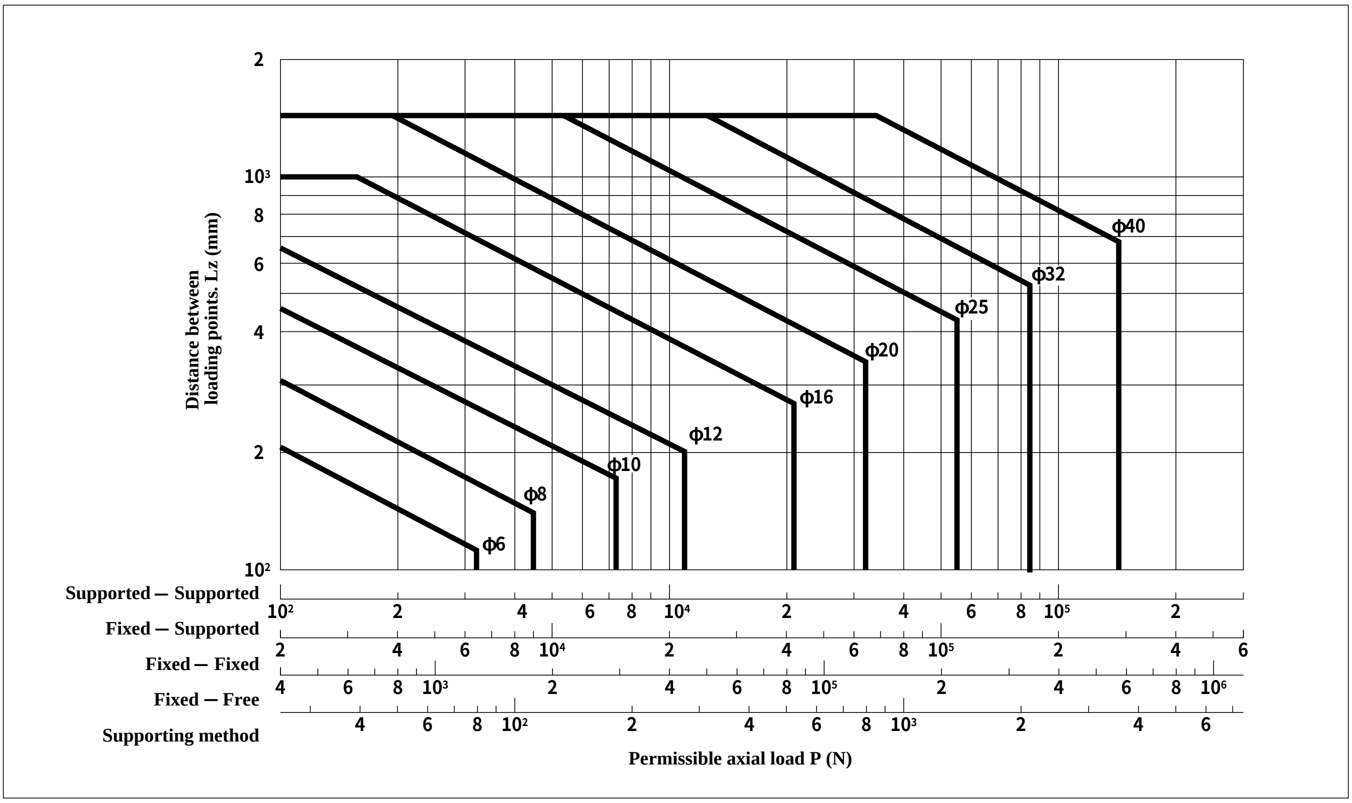
Where P : Permissible tensile compressive load (N)
σ : Permissible stress ($147 N/mm^2$)
A : Sectional area at screw shaft root diameter (mm^2)

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

dr : Screw shaft root diameter (mm) (See Dimension Table.)

(3) Parallel lines to the permissible axial load scale marks represent the maximum length of screw shafts that can be manufactured in the standard operation for the nominal screw shaft outside diameter. As the screw shaft length is limited by the grade, refer to Fig. 5 (Page 10).

Fig. 7 Permissible axial load lines



4.5 Permissible Operating Speed

(1) Critical speed (Oblique lines in Fig. 8)
It is necessary to examine critical speed so that the number of revolutions of the ball screw may not resonate with the natural frequency of the screw shaft.

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

Where N : Permissible operating speed for critical speed (rpm)
α : Safety factor (0.8)
Lc: Distance between supports (mm) (See Fig. 6.)
E : Modulus of longitudinal elasticity ($2.06 \times 10^5 N/mm^2$)
I : Minimum secondary moment of screw shaft cross section (mm^4)

$$I = \frac{\pi}{64} dr^4$$

dr : Screw shaft root diameter (mm) (See Dimension Table.)
g : Acceleration of gravity ($9.8 \times 10^3 mm/sec^2$)
γ : Specific gravity ($7.7 \times 10^{-5} N/mm^3$)
A : Sectional area at screw shaft roof diameter (mm^2)

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

λ : Factor determined by supporting method of ball screws

Both ends supported	$\lambda = \pi$
One end fixed other end supported	$\lambda = 3.927$
Both ends fixed	$\lambda = 4.730$
One end fixed other end free	$\lambda = 1.875$

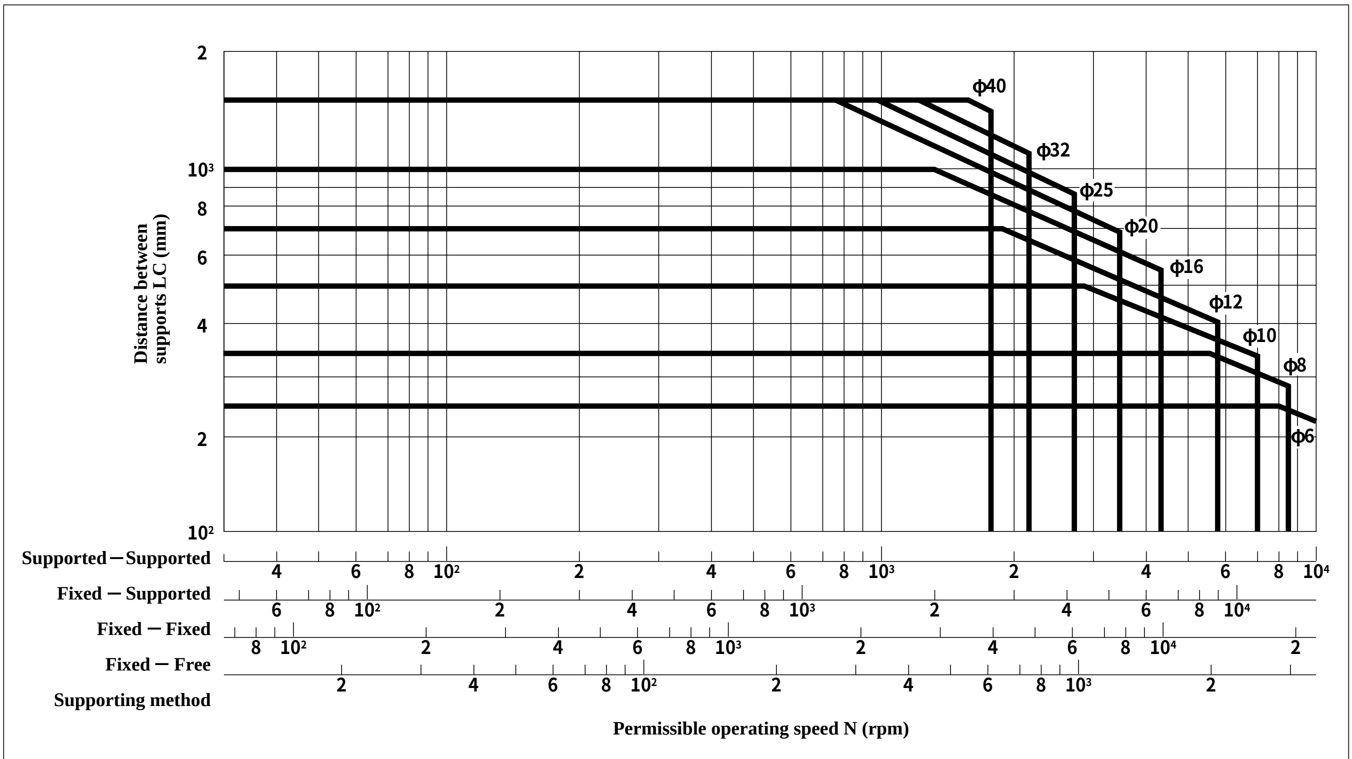
(2) Dm・N value (Perpendicular lines to permissible operating speed)
The critical speed is also limited by Dm・N value that is the limit of the peripheral speed of a ball screw.
Select a proper load value on the "Both ends fixed" scale.

$$Dm \cdot N \leqq 70{,}000$$

Where Dm : Ball circle dia. (BCD)
N : Number of revolutions (rpm)

(3) Parallel lines to the permissible operating speed represent the maximum length of screw shafts that can be manufactured in the standard operation for the nominal screw shaft outside diameter.
As the screw shaft length is limited by the grade, refer to Fig. 5 (Page 10).

Fig. 8 Permissible operating speed lines



4. DESIGN OF SCREW SHAFTS

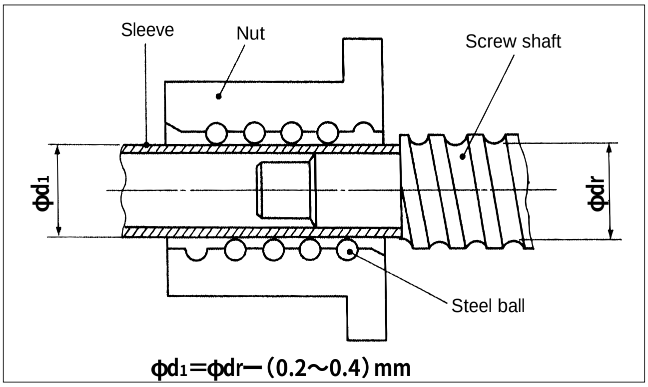
4.6 Hints on Designing a Screw Shaft

(1) Mounting

When mounting a ball screw, it is not advisable to select such a construction that the screw shaft has to be disconnected from the nut. If the screw shaft is disconnected from the nut, the steel ball may come off, the nut position accuracy and preload amount may fluctuate and the steel ball circulating part may be broken. When it is unavoidably necessary to employ such a construction, supply us with a part mountable between the screw shaft and the nut. We will fit the part to the ball screw in out factory before shipment.

When disconnecting the screw shaft from the nut in an unavoidable case, use a sleeve as shown in Fig. 9 to disconnect the screw shaft with the steel ball housed in the nut. In this case, the sleeve outside diameter should be less than the screw shaft root diameter by 0.2 － 0.4mm (refer to the dimension table).

Fig. 9 Nut removing sleeve

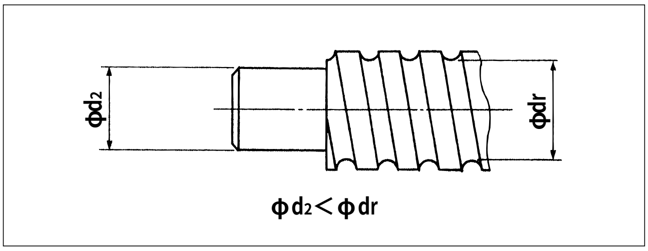


(2) Configuration of screw shaft end

When designing a configuration for the screw shaft end, reduce the diameter of one end of the shaft to less than the screw shaft root diameter (refer to the dimension table.) and completely thread to the shaft end.

Assembling of the return guide type ball screw is structurally impossible.

Fig. 10 Screw shaft end configuration



(3) Treatment of screw shaft end

When it is necessary to dowel the screw shaft after it is received, specify the position and size of the dowel pin. The product will be shipped with the specified portion unhardened for ease of post-treatment.

5. DESIGN OF NUTS

5.1 Construction of Nut

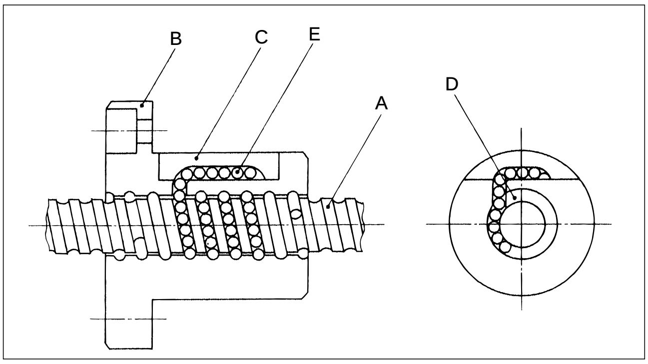
TOSOK Precision ball screws are available in two standard types - the internal circulating system using a return guide and the external circulating system using a tube.

(1) Circulating system

(a) Return guide type

In this circulating system, steel ball (E) rolling along the thread groove between screw shaft (A) and nut (B) is picked up by the end of deflector (D) and passes through the groove of return guide (C). Then, it returns to the thread groove.

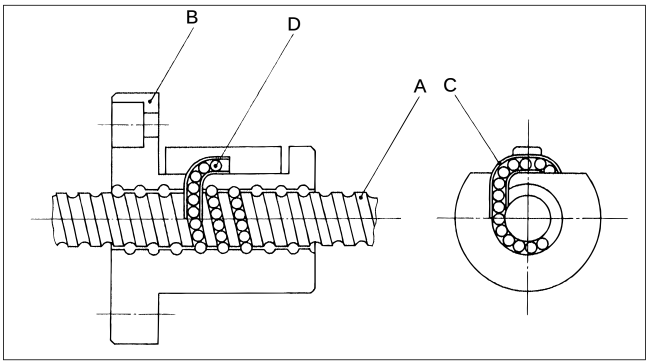
Fig. 11 Construction of return guide type



(b) Tube type

In this circulating system, steel ball (D) rolling along the thread groove between screw shaft (A) and nut (B) is picked up by the end of tube (C) put in from the outside of the nut and passes through the tube. Then, it returns to the thread groove.

Fig. 12 Construction of tube type

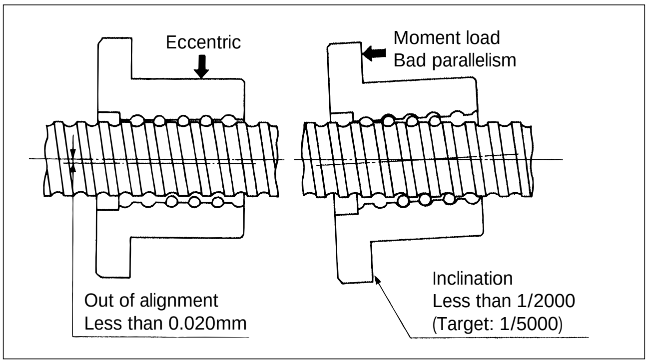


5.2 Hints of Designing the Nut Associated Parts

(1) Unbalanced load

A ball screw is designed to work most effectively when load to the steel ball that rolls between the screw shaft and nut is uniformly distributed. If unbalanced load is applied to the nut, concentrated load is applied to some steel balls, adversely affecting the operating performance and life. So, special care should be taken to the design and assembly of equipment.

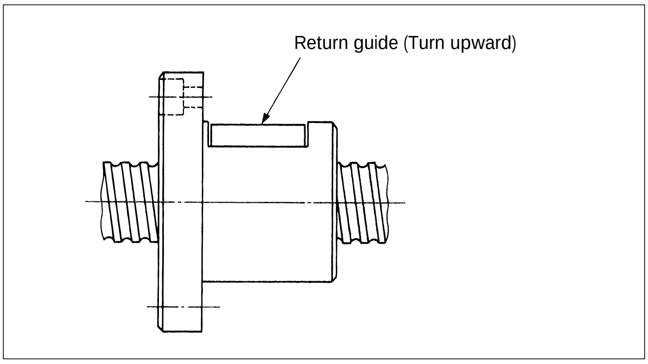
Fig. 13 Unbalanced load



(2) Mounting direction of return guide type nut

A return guide type ball screw should be mounted so that the return guide comes to the upside because of the construction of the steel ball circulating part.
As a result, smooth rotation can be obtained.

Fig. 14 Mounting direction of return guide type nut



6. DESIGN FOR ACCURACY

6.1 Rigidity of Feed Screw System

When accurate positioning is required for an automatic control machine or precision instrument incorporating a feed mechanism, the axial rigidity of each component of the feed screw system should be thoroughly examined.

6.1.1 Axial rigidity of feed screw system

(1) Axial rigidity of feed screw system: K_T

The axial rigidity of the feed screw system can be obtained from the following equation.

$$K_T = \frac{Fa}{\delta}$$

$$\frac{1}{K_T} = \frac{1}{K_S} + \frac{1}{K_N} + \frac{1}{K_B} + \frac{1}{K_H}$$

Where K_T: Axial rigidity of feed screw system (N/μm)
Fa: Axial load to feed screw system (N)
δ: Axial elastic displacement of feed screw system (μm)
K_S: Axial rigidity of screw shaft (N/μm)
K_N: Axial rigidity of nut (N/μm)
K_B: Axial rigidity of support bearing (N/μm)
K_H: Axial rigidity of nut and bearing mount (N/μm)

(2) Axial rigidity of screw shaft: K_S

(a) When "Both ends fixed" supporting method is not used:

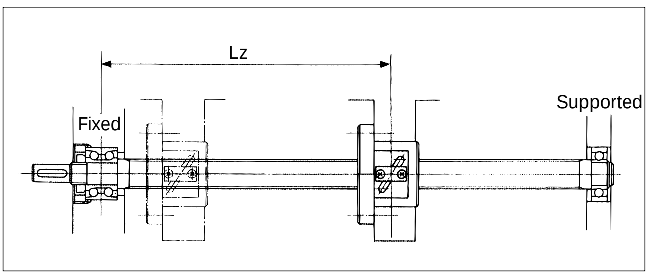
$$K_S = \frac{A \cdot E}{L_Z} \times 10^{-3}$$

Where K_S: Axial rigidity of screw shaft (N/μm)
A : Sectional area of screw shaft (mm²)

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

dr : Screw shaft root diameter (mm) (See Dimension Table)
E : Modulus of longitudinal elasticity (2.06×10^5 N/mm²)
L_Z: Distance between loading points (mm)

Fig. 15 When "Both ends fixed" supporting method is not used:

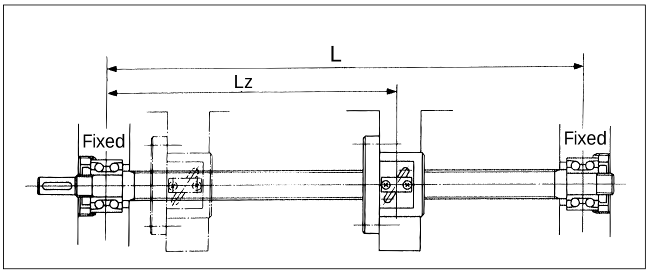


(b) When "Both ends fixed" supporting method is used:

$$K_S = \frac{A \cdot E \cdot L}{L_Z (L - L_Z)} \times 10^{-3}$$

Where K_S : Axial rigidity of screw shaft (N/μm)
L : Distance between supports (mm)

Fig. 16 When "Both ends fixed" supporting method is used:



(Note) Screw shaft displacement by axial load

(a) When "Both ends fixed" supporting method is used:

$$\delta_L = \frac{Fa}{K_S} = \frac{Fa \cdot L_Z}{A \cdot E} \times 10^3$$

Where δ_L: Displacement by axial load (μm)

(b) When "Both ends fixed" supporting method is not used:

$$\delta_L = \frac{Fa}{K_S} = \frac{Fa}{A \cdot E} \left(1 - \frac{L_Z}{L}\right) L_Z \times 10^3$$

Where δ_L: Displacement by axial load (μm)

When "Both ends fixed" supporting method is used, the axial displacement maximizes at position $L_Z = L/2$.

$$\left(\delta_L = \frac{Fa \cdot L}{4A \cdot E} \times 10^3\right)$$

Consequently, the maximum axial displacement for a case of "Both ends fixed" supporting method is reduced to 1/4 as compared with a case other than "Both ends fixed" supporting method.

(3) Rigidity of nut: K_N

(a) Rigidity of clearance ball screw

Dimension Table gives theoretical rigidity K obtained from elastic displacement between the thread groove and steel ball when axial load equivalent to 30% of basic dynamic load rating Ca is applied. Taking into consideration the nut, use of 80% of each value shown in the Table as a general rule. When axial load Fa differs from 0.3Ca, rigidity K_N can be obtained from the following equation.

$$K_N = 0.8 \times K \left(\frac{Fa}{0.3Ca}\right)^{1/3} (N/\mu m)$$

Where K : Rigidity in Dimension Table (N/μm)
Fa : Axial load (N)
Ca : Basic dynamic load rating (N)

(b) Rigidity of preloaded ball screw

Dimension Table gives theoretical rigidity K obtained from elastic displacement between the thread groove and steel ball when axial load equivalent to 10% (5% for oversize ball preloading type) of basic dynamic load rating is applied. Taking into consideration the nut, use of 80% of each value shown in the Table as a general rule. When axial load Fa_0 differs from 0.1Ca (0.05Ca), rigidity K_N can be obtained from the following equation.

$$K_N = 0.8 \times K \left(\frac{Fa_0}{\varepsilon Ca}\right)^{1/3} (N/\mu m)$$

Where K : Rigidity in Dimension Table (N/μm)
Fa_0 : Preload (N)
ε : Basic coefficient for calculating rigidity
ε =0.10
ε =0.05 (Oversize ball preload)

(4) Rigidity of support bearing: K_B

Rigidity is determined according to the type of bearing used (ball bearing, roller bearing), preload amount, etc. Rigidity K_B with roller bearing preloaded is obtained from the following equation.

$$K_B \quad \frac{3Fa_0}{\delta a_0} \quad (N/\mu m)$$

Where Fa_0 : Preload (N)
δa_0: Axial elastic displacement for preload (μm)
Provided 0 < Axial external load ≦ $3Fa_0$

(a) Axial elastic displacement of thrust angular ball bearing (for supporting ball screw) and angular ball bearing

$$\delta a = \frac{2}{\sin\alpha}\left(\frac{Q^2}{Da}\right)^{1/3} \quad Q = \frac{Fa}{Z \cdot \sin\alpha}$$

(b) Axial elastic displacement of tapered roller bearing

$$\delta a = \frac{0.6}{\sin\alpha} \times \frac{Q^{0.9}}{\ell a^{0.8}} \qquad Q = \frac{Fa}{Z \cdot \sin\alpha}$$

(c) Axial elastic displacement of thrust ball bearing

$$\delta a = 2.4\left(\frac{Q^2}{Da}\right)^{1/3} \qquad Q = \frac{Fa}{Z}$$

Where δa : Axial elastic displacement (μm)
α : Contact angle
Q : Load per rolling element (N)
Da : Steel ball diameter (mm)
ℓa : Effective contact length of roller (mm)
Fa : Axial load (N)
Z : Number of rolling element

(5) Rigidity of mounting part of nut and bearing: K_H

When designing a feed unit, try to provide high rigidity for the mounting part.

6.1.2 Torsional strength of screw shaft

Angle of torsion that will be produced by twisting moment of the screw shaft can be obtained from the following equation.

$$\theta = \frac{32T \cdot L}{\pi \cdot G \cdot dr^4} \times \frac{360}{2\pi} = 7.21 \times 10^{-2} \frac{T \cdot L}{dr^4}$$

Where θ : Angle of torsion (degree)
T : Twisting moment (N・mm)
L : Distance between torsional points (mm)
G : Modulus of traverse elasticity (7.9×10^4N/mm)
dr : Screw shaft root diameter (mm) (See Dimension Table.)

Lag Δ of axial movement by angle of torsion can be obtained from the following equation:

$$\Delta = \ell \times \frac{\theta}{360} \times 10^3 \ (\mu m)$$

Where ℓ : Lead of ball screw (mm)

6. DESIGN FOR ACCURACY

6.1.3 Preload of Ball Screws

When extremely accurate positioning is required, it is usual to preload the ball screw to increase the rigidity so that elastic displacement to the axial load may be minimized with the axial clearance of the ball screw zeroed.

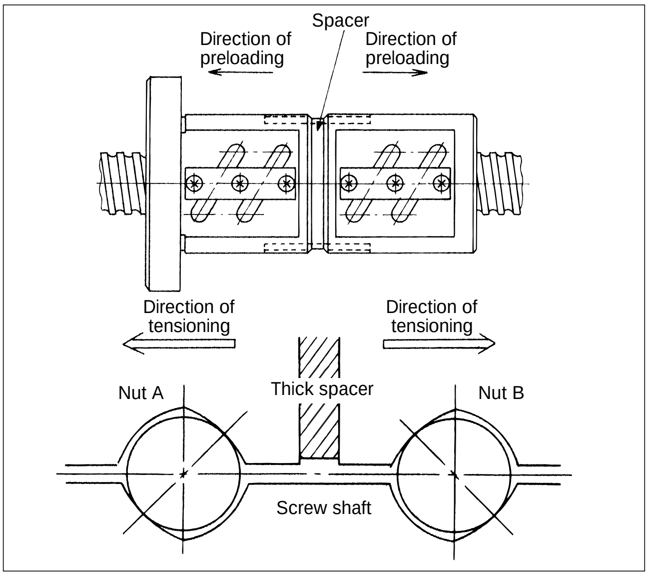
(1) Preloading

(a) Double nut preloading (Spacer preloading)

In this type, a spacer is inserted between two nuts to achieve correct preload. There are two methods of preloading. One method is called "Tension preloading" by which a thick spacer with a thickness equivalent to the amount of preload is inserted between the nuts to obtain correct preload as shown in Fig. 17.

TOSOK precision ball screws use the "Tension preloading" as a standard method of preloading.

Fig. 17 Tension preloading

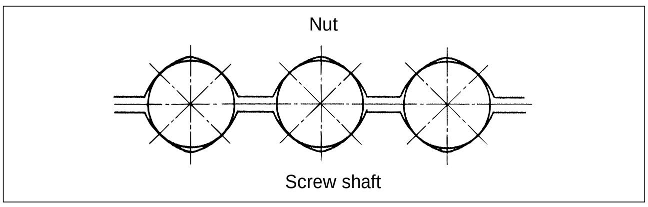


Another method of preloading is to insert a thin spacer with a thickness equivalent to the amount of preload between the nuts to obtain correct preload. It is called "Compression preloading".

(b) Single nut preloading (Oversize ball preloading)

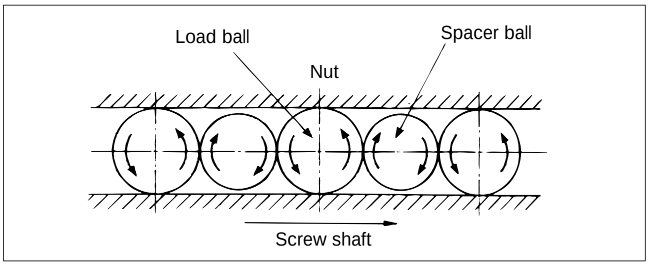
In this type, preload is applied by using one nut. As shown in Fig. 18, a steel ball (Oversize ball) which is slightly larger than the clearance in the thread groove is inserted and brought into contact at four points to attain correct preload.

Fig. 18 Oversize ball preloading



In order to improve the working efficiency, a spacer ball (1:1) is generally used. (Fig. 19)

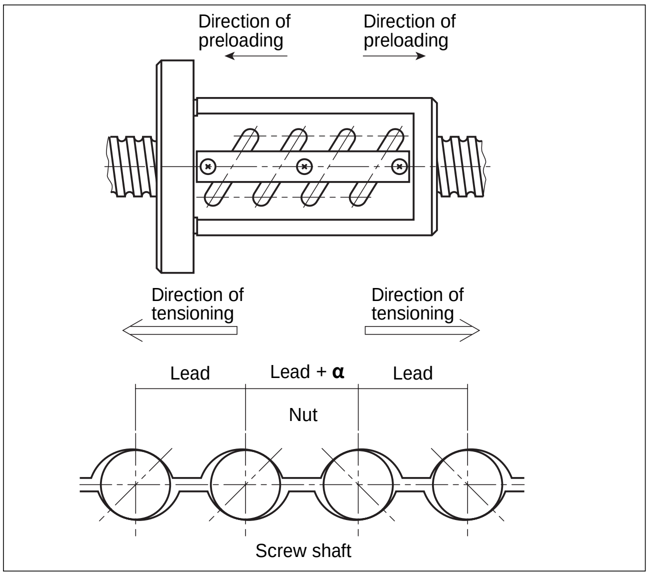
Fig. 19 Spacer ball



(c) Single nut preloading (Offset ball preloading)

In this type, preload is applied by using one nut. As shown in Fig. 20, the lead at the center of the nut is enlarged by an amount of preload a for preloading.

Fig. 20 Offset lead preloading



(2) Axial elastic deformation

When a ball screw receives axial load, the steel ball and the thread groove surface will deform. The relationship between the amount of axial elastic deformation δa and the axial load Fa is calculated from Herz's point contact theory similarly to ball bearings.

$$\delta a \propto Fa^{2/3}$$

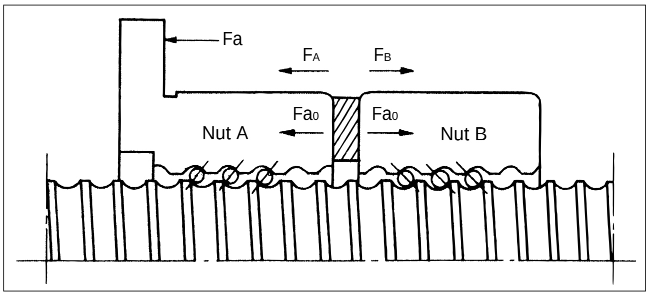
(a) Axial elastic deformation of single nut (Non-preload): δa

$$\delta a = \frac{2.6}{\sin\alpha}\left(\frac{Q^2}{Da}\right)^{1/3} \times \xi \quad (\mu m)$$

Where α : Contact angle of steel ball with thread groove (45°)
Da : Steel ball diameter (mm)
Q : Load per steel ball (N)
$Q = Fa/Z \cdot \sin\alpha$
Z : Number of steel balls
ξ : Coefficient for accuracy and construction

(b) Axial elastic deformation of preloaded ball screw

Fig. 21 Double nut preloading



As shown in Fig. 21, preload Fa0 is applied to nuts A and B, both nuts will be elastically deformed up to point X. When external force Fa is exerted in this state, nut A shifts from point X to point X1 and nut B from point X to point X2. (Fig. 22)
Assuming that proportional constant is k, formula $\delta a \propto Fa^{2/3}$ gives the following equation:

$$\delta a_0 = k \cdot Fa_0^{2/3}$$

The amount of deformation of nuts A and B is as follows:

$$\delta_A = k \cdot F_A^{2/3}$$

$$\delta_B = k \cdot F_B^{2/3}$$

Because the amount of deformation of nut A by the external force Fa is equal to that of nut B, the following equation is formed:

$$\delta_A - \delta a_0 = \delta a_0 - \delta_B$$

In addition, the external force applied to nut A and B is Fa alone. Therefore,

$$F_A - F_B = Fa$$

According as F_A increases, the external force appllied to nut B is reduced by the absorption of nut A until δ_B=0.
As a result, where δ_B=0

$$k \cdot F_A^{2/3} - k \cdot Fa_0^{2/3} = k \cdot Fa_0^{2/3}$$

$$F_A^{2/3} = 2Fa_0^{2/3}$$

$$F_A = \sqrt{8}\ Fa_0 \quad 3Fa_0$$

Also, from the equatio δ_A - δa_0= δa_0, the following equation is formed:

$$\delta a_0 = \tfrac{1}{2}\delta_A$$

Consequently, when axial load is three times as much as the amount of preload, the amount of deformation on the preloaded ball screw becomes half as much as that of a non-preloaded ball screw, while the rigidity doubles. (See Fig. 23.)

$$K = \frac{Fa}{\delta a_0} = \frac{3Fa_0}{0.5\,\delta a}$$

Where K : Rigidity (N/μ m)
Fa : Axial load (N)
δa_0: Axial elastic deformation of preloaded ball screw (μ m)
Fa_0 : Preload (N)
δa : Axial elastic deformation of non-preload ball screw (μ m)

Fig. 22 Preload lines

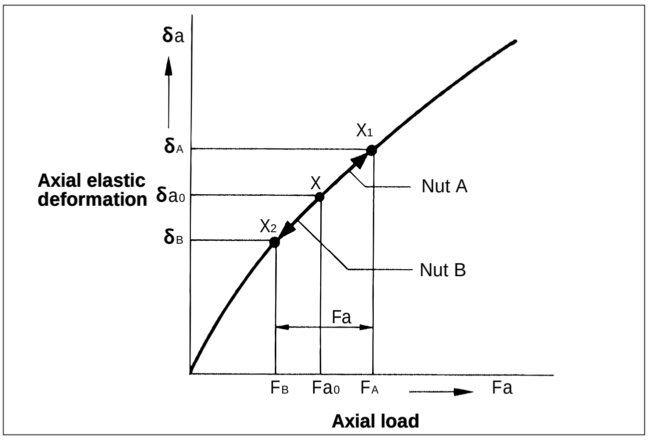
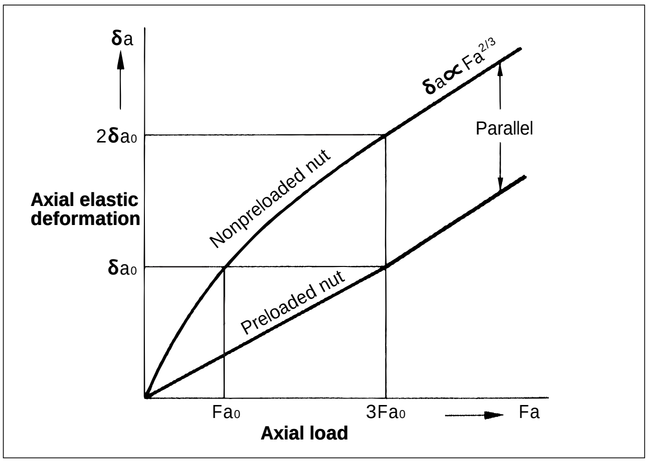


Fig. 23 Axial elastic deformation curves



(3) Preload setting

Recommendable preload is about 1/3 of the maximum axial load. Since excessive preload results in heating and adversely affects the service life, set the maximum preload at 10% of basic dynamic load rating Ca as a general rule.

Table 6 shows standard preload.

Table 6. Standard Preload

Unit: N

Classi-fication	Light preload	Medium and heavy preload
Preload	Less than 0.05Ca	Over 0.05 to 0.10Ca

7. DESIGN OF RATED LIFE

7.1 Life of Ball Screw

The life of a ball screw is classified into fatigue life caused by flaking and wear life resulting in the deterioration of accuracy.

7.2 Fatigue Life

The fatigue life can be estimated by using the basic rated dynamic load as in the case of rolling bearings.

7.2.1 Basic rated dynamic load: Ca

The basic rated dynamic load is an axial load at which, when a group of the same ball screws are revolved under the same condition, more than 90% of these ball screws can reach the rated life of 1,000,000 revolutions without flading. The basic rated dynamic load is given in Dimension Tables.

7.2.2 Fatigue Life

(1) Calculating the life

Fatigue life is generally expressed by a total number of revolutions, but it is sometimes expressed by total revolution time or total travel distance. Fatigue life can be calculated from the following formula:

$$L=\left(\frac{Ca}{Fa\cdot fw}\right)^3\times 10^6$$

$$Lt=\frac{L}{60n}$$

$$Ls=\frac{L\cdot \ell}{10^6}$$

Where
L : Rated fatigue life (rev)
Lt : Life time (hr)
Ls : Life in travel distance (km)
Ca : Basic rated dynamic load (N)
Fa : Axial load (N)
n : Number of revolutions (rpm)
ℓ : Lead (mm)
fw : Load factor
(Classified by operating conditions)

Shockless smooth operation	**1.0 — 1.2**
Ordinary operation	**1.2 — 1.5**
Vibratory operation	**1.5 — 3.0**

(2) Average load

(a) When load and number of revolutions are classified by stages (Fig. 24):

Axial load (N)	Number of revolutions (rpm)	Operating time or operating time ratio
F_1	n_1	f_1
F_2	n_2	f_2
⋮	⋮	⋮
F_n	n_n	f_n

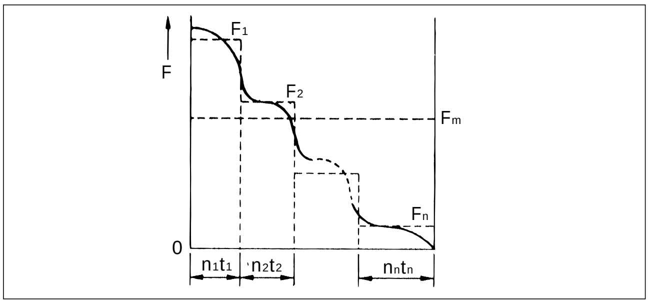
Average load Fm can be calculated from the following formula:

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

Average number of revolutions Nm can be calcurated from the following formula:

$$Nm=\frac{n_1\cdot t_1+n_2\cdot t_2+\cdots\cdots+n_n\cdot t_n}{t_1+t_2+\cdots\cdots+t_n}(rpm)$$

Fig. 24 Warying load by stages

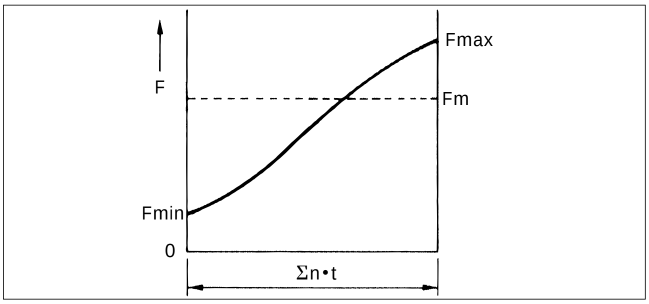


(b) When load varies almost linearly (Fig. 25):
Average load Fm can be proximately calculated from the following formula:

$$Fm=\frac{1}{3}(Fmin+2Fmax)\ (N)$$

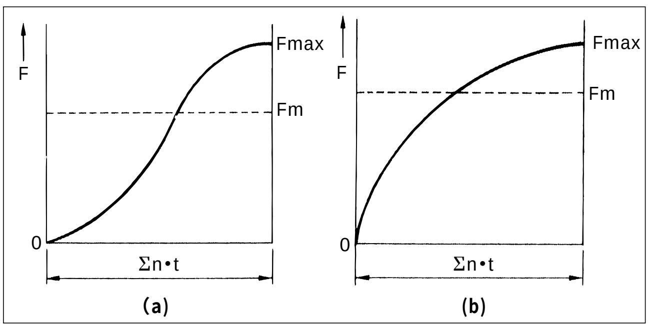
Where F min : Minimum axial load (N)
F max : Maximum axial load (N)

Fig. 25 Monotonouly varying load



(c) When load varies drawing a since curve (Fig. 26).:
Average load Fm can be calculated from the following formula:
Fm 0.65Fmax (N) for (a) in Fig. 26
Fm 0.75Fmax (N) for (b) in Fig. 26

Fig. 26 Varying load drawing a sine curve



7.2.3 Standard Life Time

If you request a long fatigue life unnecessarily when selecting a ball screw, you would get a large ball screw, resulting in poor economy. Some case examples of standard life requirements are given below for reference.

Machine tools	20,000 hours
Industrial machinery	10,000 hours
Automated control equipment	15,000 hours
Measuring instruments	15,000 hours

7.3 Permissible Load to Thread Groove

Even when a ball screw is not frequently used or is operated at low speed or other reasonable conditions meeting the fatigue life, it is necessary to select a ball screw so that the maximum axial load may be lower than the basic rated static load.

7.3.1 Basic Rated Static Load: C_0a

The basic rated static load is an axial static load under which the sum of permanent deformations of the following three factors may be equal to 0.01% of the steel ball diameter.

- Contact area of thread groove of screw shaft receiving the maximum stress.
- Contact area of thread groove of nut receiving the maximum stress.
- Steel ball receiving the maximum stress.

7.3.2 Permissible Load

The maximum permissible load Fmax can be calculated from the following formula:

$$F_{max} = C_0a / f_s \quad (N)$$

Where C_0a : Basic rated static load (N)
f_s : Safety factor
(Classified by operating conditions)

Ordinary operation	**1 — 2**
Vibratory operation	**2 — 3**

7.4 Materials and Harness

7.4.1 Standard Materials

Table 7. Materials and Hardness

Part name	Material	Heat-treatment	Hardness
Screw shaft Nut	SCM415H	Carburizing	H_RC58-62

*Ball screws made of special materials such as stainless steel for specific environment applications (SUS440C, SUS630) are manufactured upon order. We accept an order of surface-treatment.

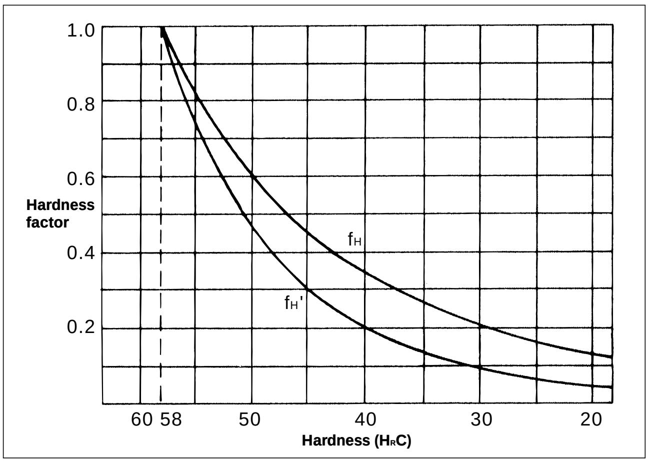
7.4.2 Hardness Factor

When some material other than the standard materials shown in Table 9 with surface hardness of less than H_RC58 is used, it is necessary to correct the basic rated dynamic load (Ca) and basic rated static load (C_0a). Correct Ca and C_0a values shown in Dimension Table by using the following formula:

$$Ca \fallingdotseq f_H \cdot Ca \quad (N)$$
$$C_0a \fallingdotseq f_H' \cdot C_0a \quad (N)$$

Where f_H : Hardness factor
f_H' : Static hardness factor

Fig. 27 Hardness factor



8. DRIVING TORQUE

8.1 Torque of Ball Screw

(1) Normal operation

When rotation is converted into linear motion (Normal operation), the torque can be obtained from the following formual:

$$T_a = \frac{F_a \cdot \ell}{2\pi \cdot \eta_1} \times 10^{-3}$$

Where T_a : Normal operation torque (N・m)
F_a : Axial load (N)
ℓ : Lead (mm)
: Normal efficiency (0.9 ―0.95)

(2) Reverse operation

When linear motion is converted into rotation (Reverse operation), the torque can be obtained from the following formula:

$$T_b = \frac{F_a \cdot \ell \cdot \eta_2}{2\pi} \times 10^{-3}$$

Where T_b : Reverse operation torque(N・m)
η_2 : Reverse efficiency (0.85 ―0.9)

(3) Preload torque

Basic torque of preloaded ball screw can be obtained from the following formula:

$$T_P = 0.05(\tan\beta)^{-0.5} \frac{F_{a0} \cdot \ell}{2\pi} \times 10^{-3}$$

Where T_p : Normal operation torque (N・m)
F_{a0} : Preload (N)
β : Lead angle (deg)

8.2 Driving Torque of motor

(1) Driving torque at constant speed

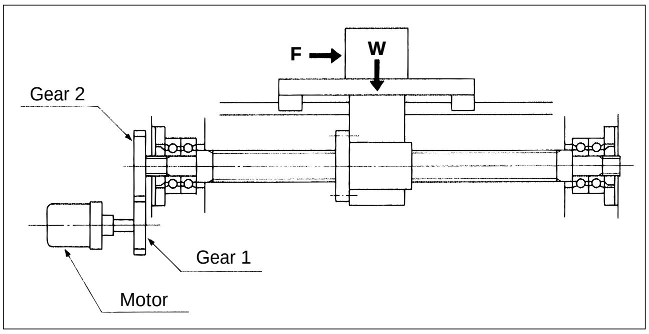
Torque T1 required for driving the ball screw at constant speed against the external load can be obtained from the following formula:

$$T_1 = (T_a + T_P + T_B) \times \frac{N_1}{N_2}$$

Where T_a : Driving torque at constant speed$= \frac{F_a \cdot \ell}{2\pi \cdot \eta}$ (N・m)

$F_a = F + \mu \cdot W$ (N)・・In case of horizontal position
F : Cutting force in screw shaft direction (N)
μ : Frictional coefficient of sliding surface
W : Weight of table and work (N)
(Weight of table+Weight of work)
T_B : Frictional torque of support bearing (N・m)
N_1 : Number of teeth of gear 1
N_2 : Number of teeth of gear 2

Fig. 28 Driving system



(2) Driving torque at acceleration

When the ball screw is driven with accelerated velocity against the axial load, the maximum load is required. Torque required at this time can be obtained from the following formula:

$$T_2 = T_1 + J \cdot \dot{\omega}$$

$$J = J_M + J_{G1} + \left(\frac{N_1}{N_2}\right)^2 \left[J_{G2} + J_S + m\left(\frac{\ell}{2\pi}\right)^2 \times 10^{-6}\right]$$

Where T_2 : Maximum driving torque at acceleration (N・m)
$\dot{\omega}$: Angular acceleration of motor (rad/sec²)
J : Moment of inertia to motor (kg・m²)
J_M : Moment of inertia of motor (kg・m²)
J_{G1} : Moment of inertia of gear 1 (kg・m²)
J_{G2} : Moment of inertia of gear 2 (kg・m²)
Js : Moment of inertia of screw shaft (kg・m²)
m : Mass of transfer material (kg)

(Note) Moment of inertia of cylindrical components

$$J = m\left(\frac{D^2}{8}\right) \times 10^{-6} \ (\mathrm{kg \cdot m^2})$$

Where m : Mass of cylinder (kg)
D : Diameter of cylinder (mm)

9. LUBRICATION AND DUST-PROOFING

9.1 Lubrication

Ball screws feature "No seizure under no lubricant" However a proper amount of lubridcant is required from the viewpoint of the life expectancy and machine efficiency. Generally, grease and oil are used as lubricants.
For lubrication with grease, lithium soap-based grease is used and for lubrication with oil, oil of ISO grade 32 — 100 is used.

Usually, lubricants with low base oil viscosity are recommended for high-speed, low-temperature and light load applications. Lubricants with high base oil viscosity are recommended for sliding, low-speed, high-temperature and high load applications. Lubricants, Inspection Period and Supply are listed in table 8.

Table 8. List of recommended lubricants

Lubricant	Inspection period	Check point	Supply
Grease	Initial 2 — 3 months	Dirt and foreign matter	Supply (proper amount according to inspection results) every year. Wipe off old grease before supplying new grease.
Oil	Every week	Oil quantity and dirt	Supply new oil at the time of every inspection.

9.2 Dust-proofing

Similar to a roller bearing, if dust or foreign matter gets into the ball nut of a ball screw, it may cause damage to the thread groove surface or may hasten the wear of such parts, resulting in failure of the circulating mechanism and causing the ball screw to be inoperative. When entry of dust or foreign matter from the outside is anticipated, completely protect the screw shaft with bellows or a screw cover as shown in Fig. 29.
If it is impossible to mount these covers due to the design involved, fit seals (Fig. 30) at both ends of the ball nut for dust-proofing. However, the dust-proofing effect has its limit.
TOSOK Precision ball screws are provided with seals upon request.

Fig. 30 Seal

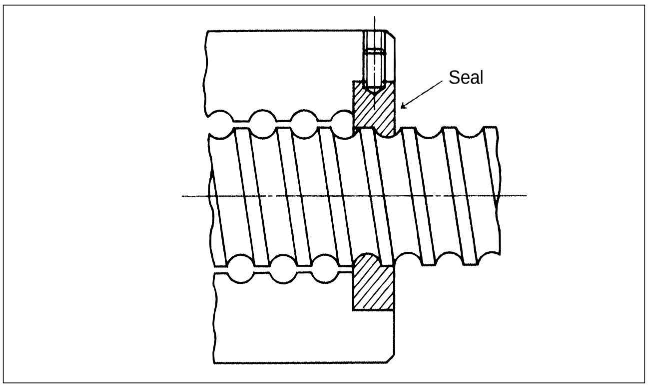
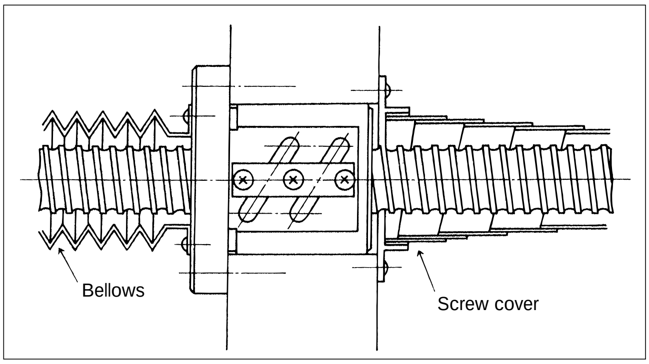


Fig. 29 Dust-proofing cover

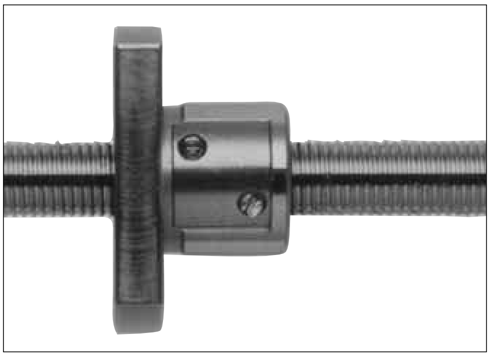


10. GEOMETRY OF NUTS

Type: DC ································ See Pages 24 and 25.

RETURN GUIDE TYPE SINGLE FLANGE SINGLE NUT (Non-preloaded)

Simplest type using a single nut. For use in slight axial clearance.



Type: DP ································ See Pages 26 and 27.

RETURN GUIDE TYPE SINGLE FLANGE SINGLE NUT (Over-size ball preloaded)

Designed to preload with a single nut. Steel balls whose diameter is slightly larger than clearance between screw shaft and thread groove of nut are put in the nut and preloaded. The ratio of load balls to spacer balls used there is 1:1 Suitable for light preload (See Page 16.)

Type: DD ································ See Pages 28 and 29.

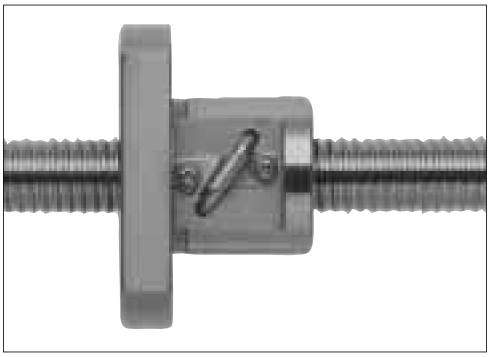
RETURN GUIDE TYPE SINGLE FLANGE DOUBLE NUT (Spacer preloaded)

Designed to preload with two nuts. A spacer with thickness equivalent to amount of preload is put between these two nuts and preloaded as prescribed. Suitable for medium preload. (See Page 16.)

Type: TCS ····························· See Pages 30 and 31.

TUBULAR TYPE SMALL LEAD, SINGLE FLANGE SINGLE NUT (Non-preloaded)

Simplest type using a single nut. For use in slight axial clearance.



Type: TPS ····························· See Pages 32 and 33.

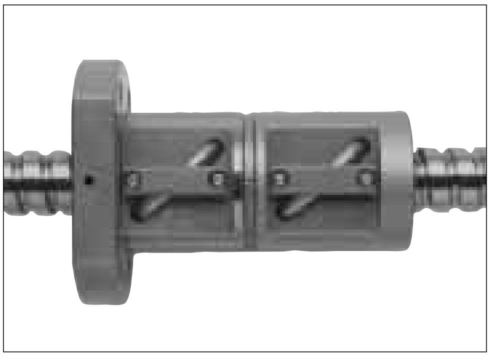
TUBULAR TYPE SMALL LEAD, SINGLE FLANGE SINGLE NUT (Over-size ball preloaded)

Designed to preload with a single nut. Steel balls whose diameter is slightly larger than clearance between screw shaft and thread groove of nut are put in the nut an preloaded. The ratio of load balls to spacer balls used there is 1:1. Suitable for light preload (See Page 16.)

Type: TDS ····························· See Pages 34 and 35.

TUBULAR TYPE SMALL LEAD, SINGLE FLANGE DOUBLE NUT (Spacer preloaded)

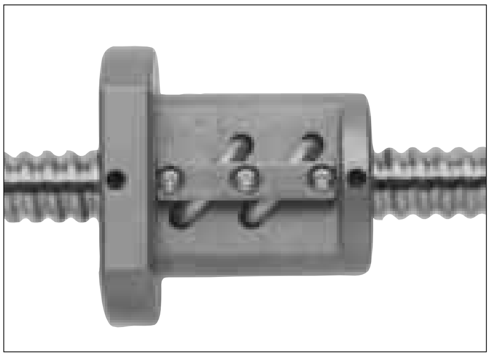
Designed to preload with two nuts. A spacer with thickness equivalent to amount of preload is put between these two nuts and preloaded as prescribed. Suitable for medium preload. (See Page 16.)



Type: TC ···································· See Pages 36 to 39.

TUBULAR TYPE SINGLE FLANGE SINGLE NUT (Non-preloaded)

Simplest type using a single nut. For use in slight axial clearance.



Type: TP ···································· See Pages 40 to 43.

TUBULAR TYPE SINGLE FLANGE SINGLE NUT (Over-size ball preloaded)

Designed to preload with a single nut. Steel balls whose diameter is slightly larger than clearance between screw shaft and thread groove of nut are put in the nut and pre-loaded. The ratio of load balls to spacer balls used there is 1:1. Suitable for light load. (See Page 16.)

Type: TF ···································· See Pages 44 to 47.

TUBULAR TYPE SINGLE FLANGE SINGLE NUT (Offset lead preloaded)

Designed to preload with a single nut. Lead along the center of nut is enlarged by an amount of preload and preloaded. Suitable for medium preload. (See Page 16.)

Type: TD ···································· See Pages 48 to 51.

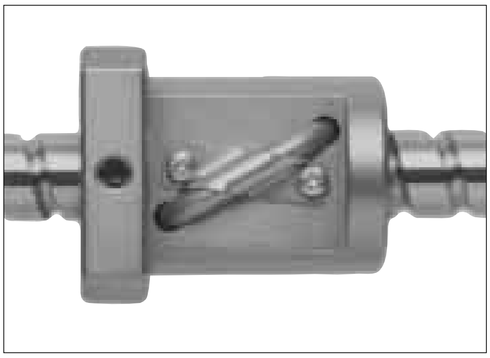
TUBULAR TYPE SINGLE FLANGE DOUBLE NUT (Spacer preloaded)

Designed to preload with two nuts. A spacer with thickness equivalent to amount of preload is put between these two nuts and preloaded as prescribed. Suitable for medium and heavy preload. (See Page 16.)

Type: TCL ······························ See Pages 52 and 53.

TUBULAR TYPE HIGH LEAD SINGLE FLANGE SINGLE NUT (Non-preloaded)

Simplest type using a single nut. For use in slight axial clearance.



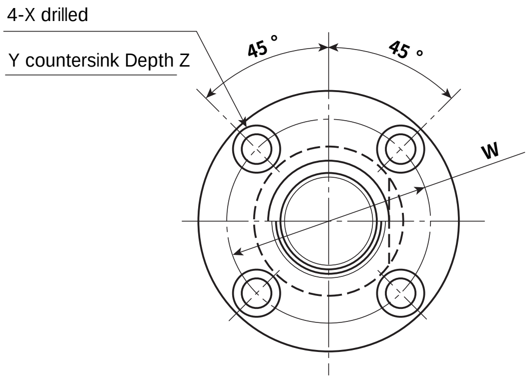
Type: TPL ······························ See Pages 54 and 55.

TUBULAR TYPE HIGH LEAD SINGLE FLANGE SINGLE NUT (Over-size ball preloaded)

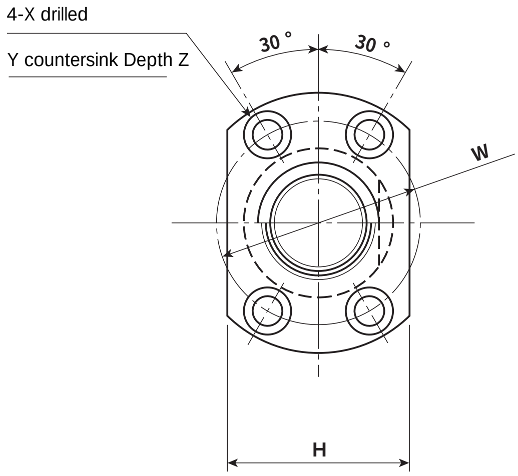
Designed to preload with a single nut. Steel balls whose diameter is slightly larger than clearance between screw shaft and thread groove of nut are put in the nut and pre-loaded. The ratio of load balls to spacer balls used there is 1:1. Suitable for light load (See Page 16.)

RETURN GUIDE TYPE SINGLE FLANGE SINGLE NUT

DC TYPE (Non-preloaded)

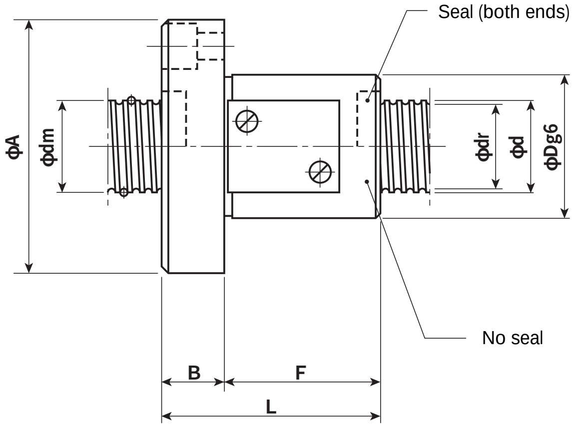


R type (standard)



H type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	 Static C_0a	Stiffness (N/μm) K
DC 0301	3	1	0.600	3.15	2.5	3.7×1	34	64	4.2
DC 0401	4	1	0.800	4.15	3.3	3.7×1	59	108	5.4
DC 0501	5	1	0.800	5.15	4.3	3.7×1	69	137	6.9
DC 0601	6	1	0.800	6.15	5.3	3.7×1	74	167	7.8
DC 0601.5		1.5	1.000	6.2	5.1		98	196	7.8
DC 0602		2	(1/16) 1.5875	6.3	4.6		177	304	8.3
DC 0801	8	1	0.800	8.15	7.3	3.7×1	83	206	9.8
DC 0801.5		1.5	1.000	8.2	7.1		108	265	9.8
DC 1001	10	1	0.800	10.15	9.3	3.7×1	88	265	12
DC 1001.5		1.5	1.000	10.2	9.1		127	343	12
DC 1201	12	1	0.800	12.15	11.3	3.7×1	98	314	14
DC 1401	14	1	0.800	14.15	13.3	3.7×1	108	363	16



Remarks

(1) Flange configuration

As shown in Fig. on the left side, two flange configurations R type (standard) and H type are available. Select the correct one according to the space for the nut mouting portion.

(2) Seal

The standard type is not provided with a seal.
However, it is also possible to attach seals to both ends of the nut.

(3) Stiffness

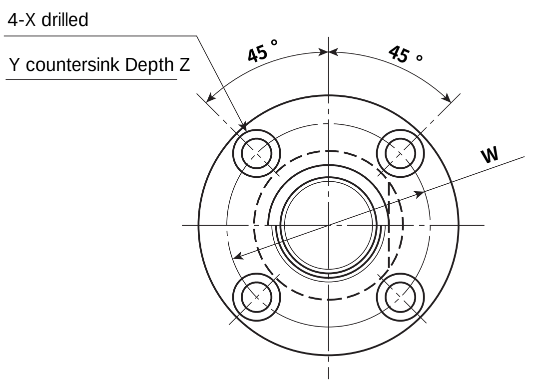
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is equivalent to 30% of basic rated dynamic load (Ca) is applied. It is recommended to use 80% of each value given in Table below.

Unit (mm)

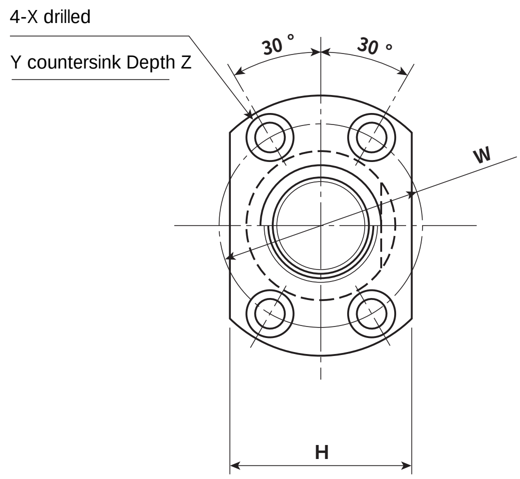
Nut dimensions										Nut type
D	A	B	F	L	W	X	Y	Z	H	
9	22	4	15	19	15	3	5.5	2	15	DC 0301
11	24	4	16	20	17	3	5.5	2	16	DC 0401
12	25	4	16	20	18	3	5.5	2	17	DC 0501
13	30	5	16	21	21.5	3.4	6.5	3	20	DC 0601
14	30	5	18	23	22	3.4	6.5	3	20	DC 0601.5
18	34	5	22	27	26	3.4	6.5	3	22	DC 0602
16	32	5	16	21	24	3.4	6.5	3	21	DC 0801
16	32	5	18	23	24	3.4	6.5	3	21	DC 0801.5
19	39	6	16	22	29	4.5	8	4	26	DC 1001
19	39	6	18	24	29	4.5	8	4	26	DC 1001.5
21	41	6	16	22	31	4.5	8	4	26	DC 1201
24	47	8	16	24	35	5.5	9.5	5.5	30	DC 1401

RETURN GUIDE TYPE SINGLE FLANGE SINGLE NUT

DP TYPE (Oversize ball preloaded)

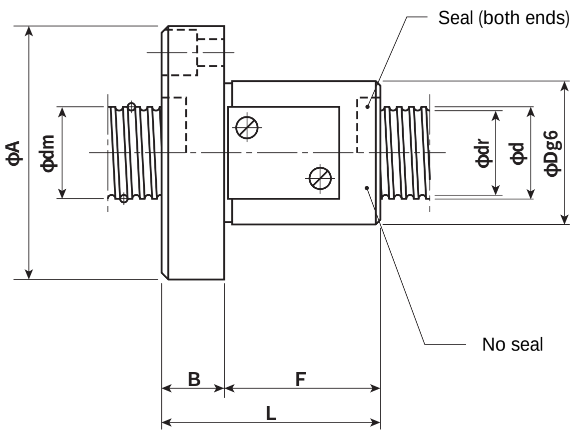


R type (standard)



H type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	 Static C_0a	Stiffness (N/μm) K
DP 0301	3	1	0.600	3.15	2.5	3.7×1	25	34	3.9
DP 0401	4	1	0.800	4.15	3.3	3.7×1	34	54	4.6
DP 0501	5	1	0.800	5.15	4.3	3.7×1	39	69	5.6
DP 0601	6	1	0.800	6.15	5.3	3.7×1	44	79	6.6
DP 0601.5		1.5	1.000	6.2	5.1		59	98	6.9
DP 0602		2	(1/16) 1.5875	6.3	4.6		113	162	7.4
DP 0801	8	1	0.800	8.15	7.3	3.7×1	49	108	8.1
DP 0801.5		1.5	1.000	8.2	7.1		69	132	8.5
DP 1001	10	1	0.800	10.15	9.3	3.7×1	59	132	9.8
DP 1001.5		1.5	1.000	10.2	9.1		79	167	11
DP 1201	12	1	0.800	12.15	11.3	3.7×1	64	157	12
DP 1401	14	1	0.800	14.15	13.3	3.7×1	69	181	13



Remarks

(1) Flange configuration
As shown in Fig. on the left side, two flange configurations R type (standard) and H type are available. Select the correct one according to the space for the nut mouting portion.

(2) Seal
The standard type is not provided with a seal.
However, it is also possible to attach seals to both ends of the nut.

(3) Basic rated load
Since sthe ratio of load balls to spacer balls put in the nut is 1:1, the basic rated load of this type differs from that of the other types.

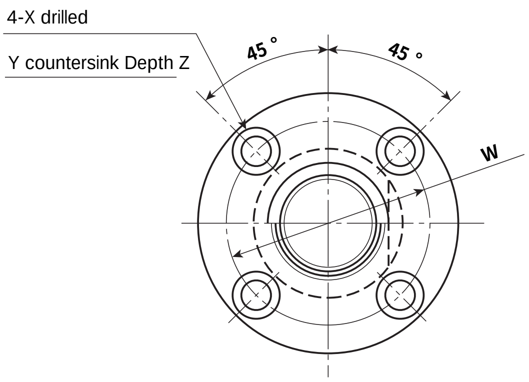
(4) Stiffness
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 5% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

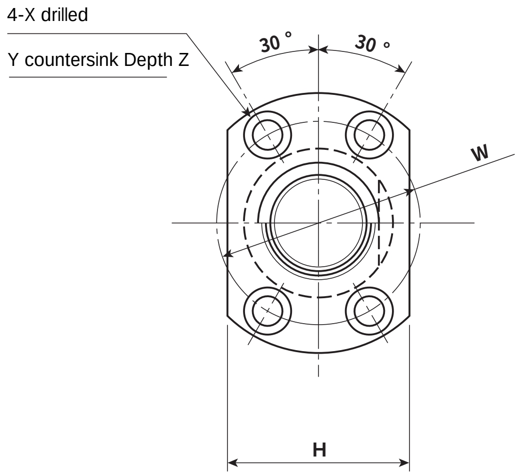
Nut dimensions										Nut type
D	A	B	F	L	W	X	Y	Z	H	
9	22	4	15	19	15	3	5.5	2	15	DP 0301
11	24	4	16	20	17	3	5.5	2	16	DP 0401
12	25	4	16	20	18	3	5.5	2	17	DP 0501
13	30	5	16	21	21.5	3.4	6.5	3	20	DP 0601
14	30	5	18	23	22	3.4	6.5	3	20	DP 0601.5
18	34	5	22	27	26	3.4	6.5	3	22	DP 0602
16	32	5	16	21	24	3.4	6.5	3	21	DP 0801
16	32	5	18	23	24	3.4	6.5	3	21	DP 0801.5
19	39	6	16	22	29	4.5	8	4	26	DP 1001
19	39	6	18	24	29	4.5	8	4	26	DP 1001.5
21	41	6	16	22	31	4.5	8	4	26	DP 1201
24	47	8	16	24	35	5.5	9.5	5.5	30	DP 1401

RETURN GUIDE TYPE SINGLE FLANGE SINGLE NUT

DD TYPE (Spacer preloaded)

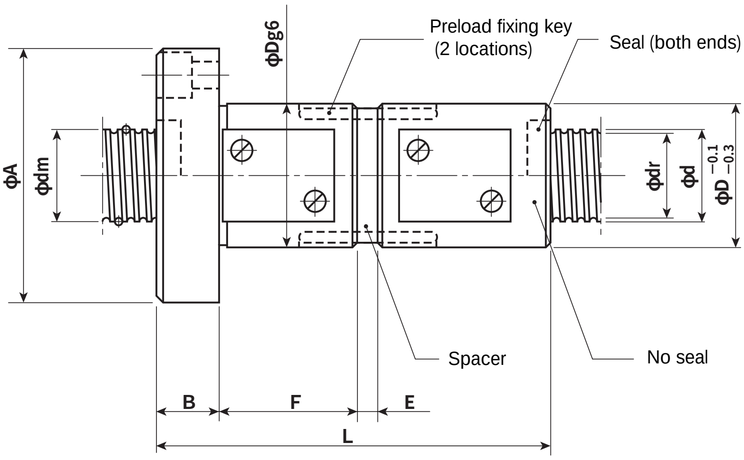


R type (standard)



H type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	 Static C_0a	Stiffness (N/μm) K
DD 0601	6	1	0.800	6.15	5.3	3.7 × 1	74	167	16
DD 0601.5		1.5	1.000	6.2	5.1		98	196	16
DD 0602		2	(1/16) 1.5875	6.3	4.6		177	304	17
DD 0801	8	1	0.800	8.15	7.3	3.7 × 1	83	206	20
DD 0801.5		1.5	1.000	8.2	7.1		108	265	20
DD 1001	10	1	0.800	10.15	9.3	3.7 × 1	88	265	24
DD 1001.5		1.5	1.000	10.2	9.1		127	343	25
DD 1201	12	1	0.800	12.15	11.3	3.7 × 1	98	314	27
DD 1401	14	1	0.800	14.15	13.3	3.7 × 1	108	363	30



Remarks

(1) Flange configuration

As shown in Fig. on the left side, two flange configurations R type (standard) and H type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal

The standard type is not provided with a seal. However, it is also possible to attach seals to both ends of the nut.

(3) Stiffness

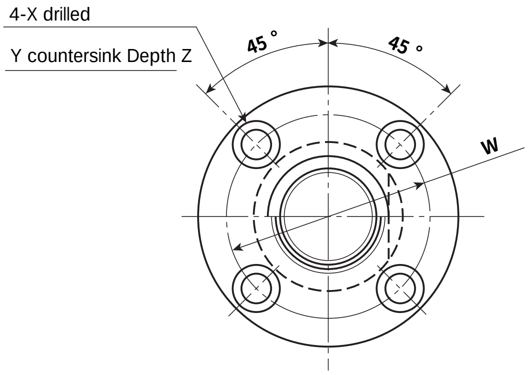
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 10% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

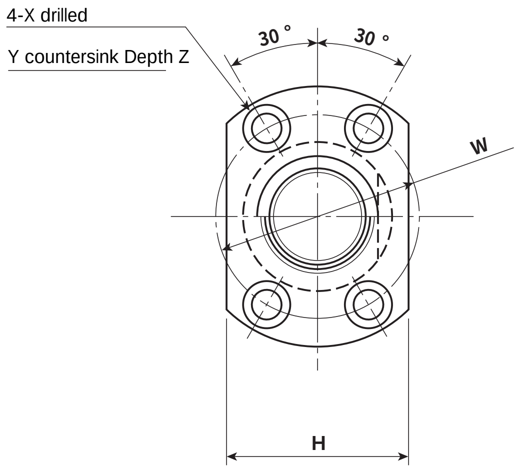
Nut dimensions											Nut type
D	A	B	F	E	L	W	X	Y	Z	H	
13	30	5	16	2	43	21.5	3.4	6.5	3	20	DD 0601
14	30	5	18	2	47	22	3.4	6.5	3	20	DD 0601.5
18	34	5	22	4	57	26	3.4	6.5	3	22	DD 0602
16	32	5	16	2	43	24	3.4	6.5	3	21	DD 0801
16	32	5	18	2	47	24	3.4	6.5	3	21	DD 0801.5
19	39	6	16	2	44	29	4.5	8	4	26	DD 1001
19	39	6	18	2	48	29	4.5	8	4	26	DD 1001.5
21	41	6	16	2	44	31	4.5	8	4	26	DD 1201
24	47	8	16	4	48	35	5.5	9.5	5.5	30	DD 1401

TUBULAR TYPE SMALL LEAD SINGLE FLANGE SINGLE NUT

TCS TYPE (Non-preloaded)

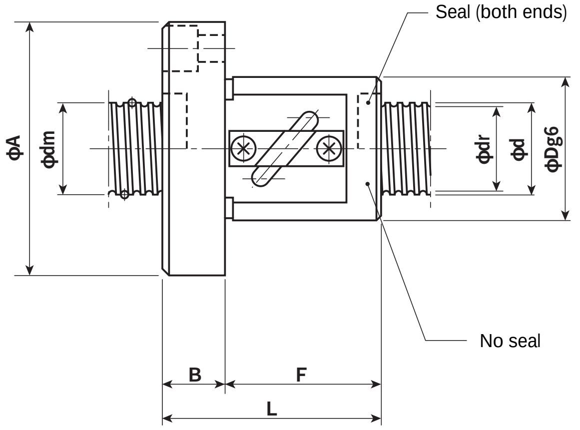


R type (standard)



H type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	 Static C_0a	Stiffness (N/μm) K
TCS 0802-3.5		2	(1/16) 1.5875	8.3	6.6		245	400	11
TCS 0802.5-3.5	8	2.5	2.000	8.3	6.2	3.5 × 1	320	495	11
TCS 0803-3.5		3	(3/32) 2.381	8.3	5.8		390	575	11
TCS 1002-3.5		2	(1/16) 1.5875	10.3	8.6		270	505	13
TCS 1002.5-3.5	10	2.5	2.000	10.3	8.2	3.5 × 1	365	630	13
TCS 1003-3.5		3	(3/32) 2.381	10.3	7.8		450	735	14
TCS 1202-3.5		2	(1/16) 1.5875	12.3	10.6		295	610	15
TCS 1202.5-3.5	12	2.5	2.000	12.3	10.2	3.5 × 1	400	760	16
TCS 1203-3.5		3	(3/32) 2.381	12.3	9.8		500	895	16
TCS 1402-3.5		2	(1/16) 1.5875	14.3	12.6		315	715	17
TCS 1402.5-3.5	14	2.5	2.000	14.3	12.2	3.5 × 1	430	890	18
TCS 1403-3.5		3	(3/32) 2.381	14.3	11.8		540	1050	18
TCS 1602-3.5	16	2	(1/16) 1.5875	16.3	14.6	3.5 × 1	335	820	19
TCS 1602.5-3.5		2.5	2.000	16.3	14.2		455	1030	20



Remarks

(1) Flange configuration
As shown in Fig. on the left side, two flange configurations R type (standard) and H type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal
The standard type is not provided with a seal.
However, it is also possible to attach seals to both ends of the nut.

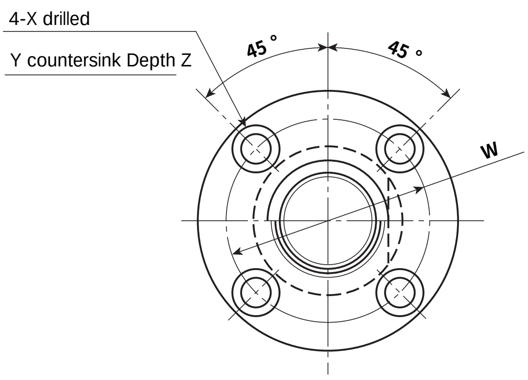
(3) Stiffness
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 30% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

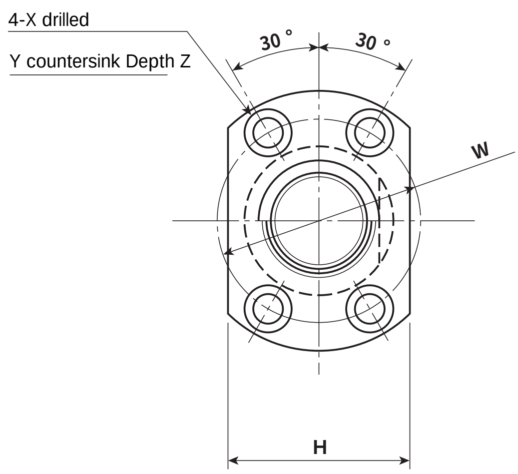
Nut dimensions										Nut type
D	A	B	F	L	W	X	Y	Z	H	
20	40	6	22	28	30	4.5	8	4	26	TCS 0802-3.5
20	40	6	25	31	30	4.5	8	4	26	TCS 0802.5-3.5
22	46	8	27	35	34	5.5	9.5	5.5	30	TCS 0803-3.5
23	43	6	22	28	33	4.5	8	4	28	TCS 1002-3.5
24	47	8	25	33	35	5.5	9.5	5.5	30	TCS 1002.5-3.5
26	49	8	27	35	37	5.5	9.5	5.5	31	TCS 1003-3.5
25	48	8	22	30	36	5.5	9.5	5.5	31	TCS 1202-3.5
26	49	8	25	33	37	5.5	9.5	5.5	31	TCS 1202.5-3.5
28	51	8	27	35	39	5.5	9.5	5.5	32	TCS 1203-3.5
26	49	8	22	30	37	5.5	9.5	5.5	31	TCS 1402-3.5
28	51	8	25	33	39	5.5	9.5	5.5	32	TCS 1402.5-3.5
30	54	8	27	35	42	5.5	9.5	5.5	34	TCS 1403-3.5
28	51	8	22	30	39	5.5	9.5	5.5	32	TCS 1602-3.5
32	55	8	25	33	43	5.5	9.5	5.5	34	TCS 1602.5-3.5

TUBULAR TYPE SMALL LEAD SINGLE FLANGE SINGLE NUT

TPS TYPE (Oversize ball preloaded)

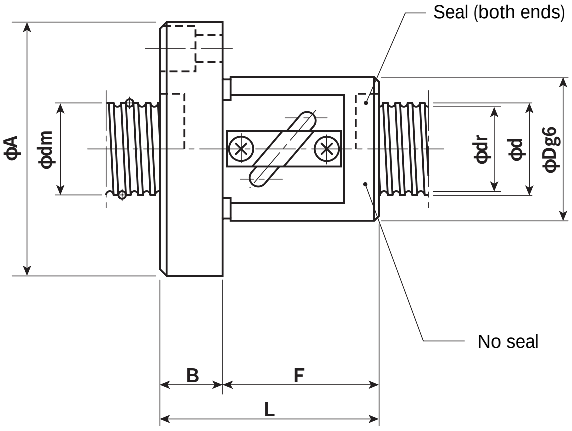


R type (standard)



H type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	 Static C_0a	Stiffness (N/μm) K
TPS 0802-3.5		2	(1/16) 1.5875	8.3	6.6		155	200	9.4
TPS 0802.5-3.5	8	2.5	2.000	8.3	6.2	3.5 × 1	200	245	9.5
TPS 0803-3.5		3	(3/32) 2.381	8.3	5.8		245	290	9.6
TPS 1002-3.5		2	(1/16) 1.5875	10.3	8.6		170	255	11
TPS 1002.5-3.5	10	2.5	2.000	10.3	8.2	3.5 × 1	230	315	12
TPS 1003-3.5		3	(3/32) 2.381	10.3	7.8		285	365	12
TPS 1202-3.5		2	(1/16) 1.5875	12.3	10.6		185	305	13
TPS 1202.5-3.5	12	2.5	2.000	12.3	10.2	3.5 × 1	250	380	13
TPS 1203-3.5		3	(3/32) 2.381	12.3	9.8		315	445	14
TPS 1402-3.5		2	(1/16) 1.5875	14.3	12.6		200	360	15
TPS 1402.5-3.5	14	2.5	2.000	14.3	12.2	3.5 × 1	270	445	15
TPS 1403-3.5		3	(3/32) 2.381	14.3	11.8		340	525	15
TPS 1602-3.5	16	2	(1/16) 1.5875	16.3	14.6	3.5 × 1	210	410	16
TPS 1602.5-3.5		2.5	2.000	16.3	14.2		290	510	17



Remarks

(1) Flange configuration
As shown in Fig. on the left side, two flange configurations R type (standard) and H type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal
The standard type is not provided with a seal.
However, it is also possible to attach seals to both ends of the nut.

(3) Basic rated load
Since the ratio of load balls to spacer balls put in the nut is 1:1, the basic rated load of this type differs from that of the other types.

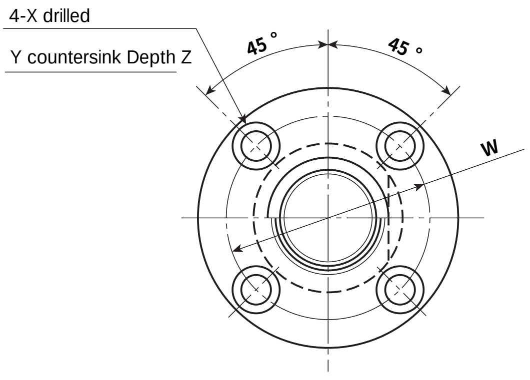
(4) Stiffness
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 5% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

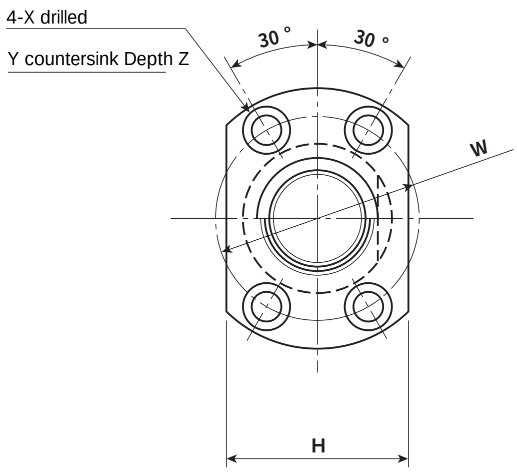
Nut dimensions										Nut type
D	A	B	F	L	W	X	Y	Z	H	
20	40	6	22	28	30	4.5	8	4	26	TPS 0802-3.5
20	40	6	25	31	30	4.5	8	4	26	TPS 0802.5-3.5
22	46	8	27	35	34	5.5	9.5	5.5	30	TPS 0803-3.5
23	43	6	22	28	33	4.5	8	4	28	TPS 1002-3.5
24	47	8	25	33	35	5.5	9.5	5.5	30	TPS 1002.5-3.5
26	49	8	27	35	37	5.5	9.5	5.5	31	TPS 1003-3.5
25	48	8	22	30	36	5.5	9.5	5.5	31	TPS 1202-3.5
26	49	8	25	33	37	5.5	9.5	5.5	31	TPS 1202.5-3.5
28	51	8	27	35	39	5.5	9.5	5.5	32	TPS 1203-3.5
26	49	8	22	30	37	5.5	9.5	5.5	31	TPS 1402-3.5
28	51	8	25	33	39	5.5	9.5	5.5	32	TPS 1402.5-3.5
30	54	8	27	35	42	5.5	9.5	5.5	34	TPS 1403-3.5
28	51	8	22	30	39	5.5	9.5	5.5	32	TPS 1602-3.5
32	55	8	25	33	43	5.5	9.5	5.5	34	TPS 1602.5-3.5

TUBULAR TYPE SMALL LEAD SINGLE FLANGE SINGLE NUT

TDS TYPE (Spacer preloaded)

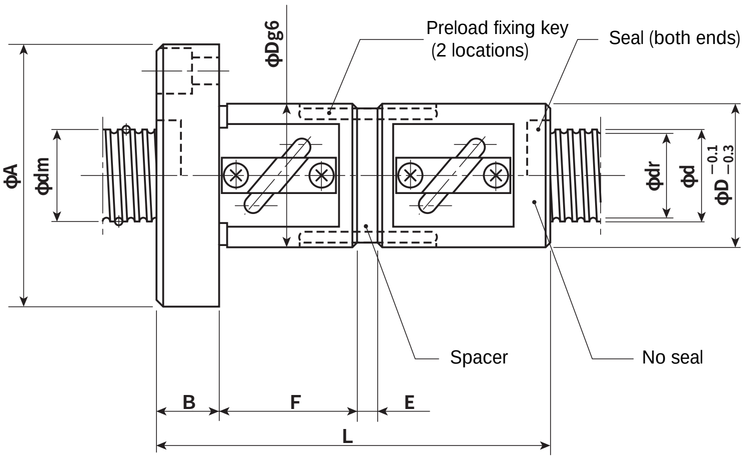


R type (standard)



H type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	 Static C_0a	Stiffness (N/μm) K
TDS 0802-3.5		2	(1/16) 1.5875	8.3	6.6		245	400	22
TDS 0802.5-3.5	8	2.5	2.000	8.3	6.2	3.5 × 1	320	495	22
TDS 0803-3.5		3	(3/32) 2.381	8.3	5.8		390	575	22
TDS 1002-3.5		2	(1/16) 1.5875	10.3	8.6		270	505	26
TDS 1002.5-3.5	10	2.5	2.000	10.3	8.2	3.5 × 1	365	630	27
TDS 1003-3.5		3	(3/32) 2.381	10.3	7.8		450	735	27
TDS 1202-3.5		2	(1/16) 1.5875	12.3	10.6		295	610	30
TDS 1202.5-3.5	12	2.5	2.000	12.3	10.2	3.5 × 1	400	760	31
TDS 1203-3.5		3	(3/32) 2.381	12.3	9.8		500	895	32
TDS 1402-3.5		2	(1/16) 1.5875	14.3	12.6		315	715	34
TDS 1402.5-3.5	14	2.5	2.000	14.3	12.2	3.5 × 1	430	890	35
TDS 1403-3.5		3	(3/32) 2.381	14.3	11.8		540	1050	36
TDS 1602-3.5	16	2	(1/16) 1.5875	16.3	14.6	3.5 × 1	335	820	38
TDS 1602.5-3.5		2.5	2.000	16.3	14.2		455	1030	39



Remarks

(1) Flange configuration

As shown in Fig. on the left side, two flange configurations R type (standard) and H type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal

The standard type is not provided with a seal. However, it is also possible to attach seals to both ends of the nut.

(3) Stiffness

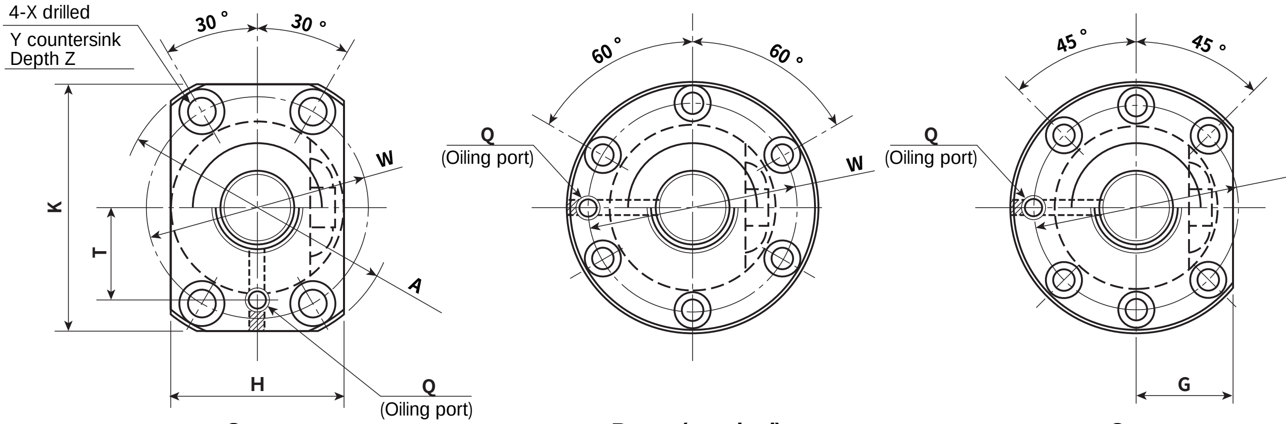
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 10% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

Nut dimensions											Nut type
D	A	B	F	E	L	W	X	Y	Z	H	
20	40	6	22	4	58	30	4.5	8	4	26	TDS 0802-3.5
20	40	6	25	5	66	30	4.5	8	4	26	TDS 0802.5-3.5
22	46	8	27	4	71	34	5.5	9.5	5.5	30	TDS 0803-3.5
23	43	6	22	4	58	33	4.5	8	4	28	TDS 1002-3.5
24	47	8	25	5	68	35	5.5	9.5	5.5	30	TDS 1002.5-3.5
26	49	8	27	4	71	37	5.5	9.5	5.5	31	TDS 1003-3.5
25	48	8	22	4	60	36	5.5	9.5	5.5	31	TDS 1202-3.5
26	49	8	25	5	68	37	5.5	9.5	5.5	31	TDS 1202.5-3.5
28	51	8	27	4	71	39	5.5	9.5	5.5	32	TDS 1203-3.5
26	49	8	22	4	60	37	5.5	9.5	5.5	31	TDS 1402-3.5
28	51	8	25	5	68	39	5.5	9.5	5.5	32	TDS 1402.5-3.5
30	54	8	27	4	71	42	5.5	9.5	5.5	34	TDS 1403-3.5
28	51	8	22	4	60	39	5.5	9.5	5.5	32	TDS 1602-3.5
32	55	8	25	5	68	43	5.5	9.5	5.5	34	TDS 1602.5-3.5

TUBULAR TYPE SINGLE FLANGE SINGLE NUT

TC TYPE (Non-preloaded)



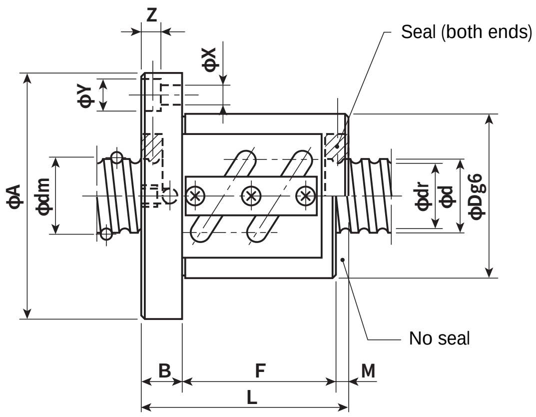
S type Screw shaft O.D. ʊ″≦14mm

R type (standard) Screw shaft O.D. ʊ″≧10mm

C type Screw shaft O.D. ʊ″≧16mm

[For screw shaft outside diameter ʊ″≦14mm, four mounting bolt holes (4 x 90°) provided]

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	 Static C_0a	Stiffness (N/μm) K
TC 1004-2.5	10	4	2.000	10.3	8.2	2.5×1	275	445	9.8
TC 1204-2.5	12	4	(3/32) 2.381	12.3	9.8	2.5×1	375	635	12
TC 1205-2.5		5	(3/32) 2.381	12.3	9.8	2.5×1	375	635	12
TC 1404-2.5	14	4	(3/32) 2.381	14.3	11.8	2.5×1	405	750	13
TC 1405-2.5		5	(1/8) 3.175	14.5	11.2	2.5×1	685	1190	14
TC 1604-2.5	16	4	(3/32) 2.381	16.3	13.8	2.5×1	435	860	15
TC 1605-3		5	(1/8) 3.175	16.5	13.2	1.5×2	860	1650	19
TC 1605-2.5						2.5×1	735	1370	16
TC 1605-5						2.5×2	1340	2740	31
TC 1606-3		6	(1/8) 3.175	16.5	13.2	1.5×2	860	1650	19
TC 1606-2.5						2.5×1	735	1370	16
TC 2004-2.5	20	4	(3/32) 2.381	20.3	17.8	2.5×1	480	1090	17
TC 2004-5						2.5×2	870	2170	34
TC 2005-3		5	(1/8) 3.175	20.5	17.2	1.5×2	965	2080	23
TC 2005-2.5						2.5×1	820	1730	19
TC 2005-5						2.5×2	1490	3470	37
TC 2006-3		6	(5/32) 3.969	20.5	16.3	1.5×2	1280	2560	23
TC 2006-2.5						2.5×1	1100	2130	20
TC 2006-5						2.5×2	1990	4260	38
TC 2504-2.5	25	4	(3/32) 2.381	25.3	22.8	2.5×1	525	1370	21
TC 2504-5						2.5×2	955	2740	40
TC 2505-3		5	(1/8) 3.175	25.5	22.2	1.5×2	1070	2620	27
TC 2505-2.5						2.5×1	910	2180	23
TC 2505-5						2.5×2	1650	4370	44
TC 2506-3		6	(5/32) 3.969	25.5	21.3	1.5×2	1440	3230	28
TC 2506-2.5						2.5×1	1230	2690	23
TC 2506-5						2.5×2	2230	5390	45



Remarks

(1) Flange configuration

As shown in Fig. on the left side, R type (standard) and S type for shaft outside diameters of less than 14mm and R type (standard) and C type for shaft outside diameters of more than 16mm are available. Select the correct one according to the space for the nut mounting portion. The R type with shaft outside diameters of less than 14mm is provided with four mounting bolt holes (4 x 90°).

(2) Seal

For the type with a seal, the nut length is longer than of the type without a seal by M. For the type with shaft outside diameters less than 16mm, the nut has the same length.

(3) Stiffness

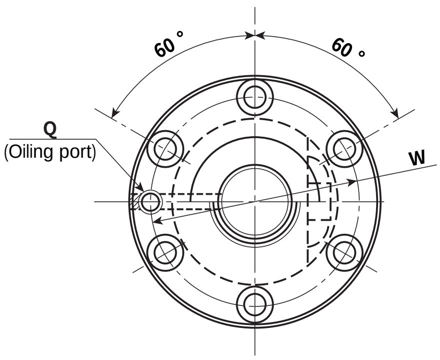
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load equivalent to 30% of basic rated dynamic load (Ca) is applied. It is recommended to use 80% of each value given in Table below.

Unit (mm)

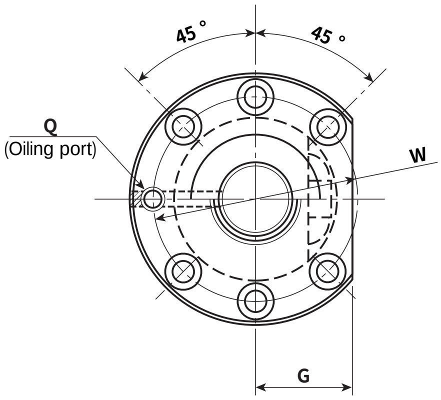
Nut dimensions															Nut type
D	A	G	B	F	L	M	W	X	Y	Z	Q	T	K	H	
26	46	—	10	27	37	0	36	4.5	8	4.5	M6	14	42	28	TC 1004-2.5
30	50	—	10	27	37	0	40	4.5	8	4.5	M6	15	45	32	TC 1204-2.5
30	50	—	10	30	40	0	40	4.5	8	4.5	M6	15	45	32	TC 1205-2.5
32	55	—	11	27	38	0	43	5.5	9.5	5.5	M6	16	50	34	TC 1404-2.5
34	57	—	11	30	41	0	45	5.5	9.5	5.5	M6	17	50	34	TC 1405-2.5
34	57	22	11	27	38	0	45	5.5	9.5	5.5	M6	—	—	—	TC 1604-2.5
40	63	24	11	41 31 46	52 42 57	0	51	5.5	9.5	5.5	M6	—	—	—	TC 1605-3 TC 1605-2.5 TC 1605-5
40	63	24	11	45 33	56 44	0	51	5.5	9.5	5.5	M6	—	—	—	TC 1606-3 TC 1606-2.5
40	63	24	11	23 35	37 49	3	51	5.5	9.5	5.5	M6	—	—	—	TC 2004-2.5 TC 2004-5
44	67	26	11	38 27 42	52 41 56	3	55	5.5	9.5	5.5	M6	—	—	—	TC 2005-3 TC 2005-2.5 TC 2005-5
48	71	27	11	42 30 48	56 44 62	3	59	5.5	9.5	5.5	M6	—	—	—	TC 2006-3 TC 2006-2.5 TC 2006-5
46	69	26	11	22 34	36 48	3	57	5.5	9.5	5.5	M6	—	—	—	TC 2504-2.5 TC 2504-5
50	73	28	11	38 26 41	52 40 55	3	61	5.5	9.5	5.5	M6	—	—	—	TC 2505-3 TC 2505-2.5 TC 2505-5
53	76	29	11	42 30 48	56 44 62	3	64	5.5	9.5	5.5	M6	—	—	—	TC 2506-3 TC 2506-2.5 TC 2506-5

TUBULAR TYPE SINGLE FLANGE SINGLE NUT

TC TYPE (Non-preloaded)

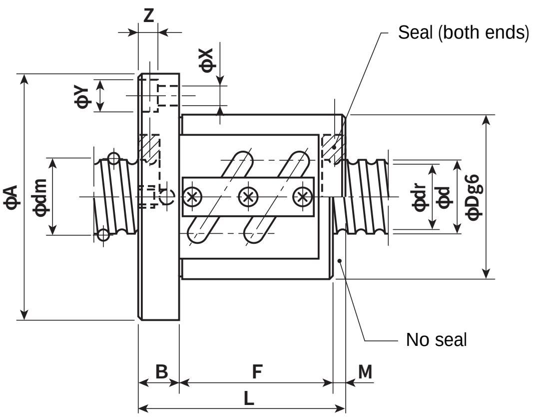


R type (standard)



C type

Nut type	Screw O.D	Lead	Steel ball dia.	Center-circle dia. of steel ball	Screw root dia.	Number of turns and circuits	Basic rated load (N) Dynamic	Static	Stiffness (N/µm)
	d	ℓ	Da	dm	dr	Turns×Circ.	Ca	C0a	K
TC 2805-2.5	28	5	(1/8) 3.175	28.5	25.2	2.5×1	955	2450	25
TC 2805-5						2.5×2	1740	4910	48
TC 2806-2.5		6	(5/32) 3.969	28.5	24.3	2.5×1	1290	3030	26
TC 2806-5						2.5×2	2350	6060	50
TC 3204-2.5	32	4	(3/32) 2.381	32.3	29.8	2.5×1	580	1760	25
TC 3204-5						2.5×2	1050	3520	49
TC 3205-3		5	(1/8) 3.175	32.5	29.2	1.5×2	1180	3380	33
TC 3205-2.5						2.5×1	1010	2810	28
TC 3205-5						2.5×2	1830	5630	54
TC 3206-3		6	(5/32) 3.969	32.5	28.3	1.5×2	1610	4180	34
TC 3206-2.5						2.5×1	1370	3480	29
TC 3206-5						2.5×2	2490	6970	55
TC 3208-3		8	(3/16) 4.7625	32.5	27.5	1.5×2	2050	4960	35
TC 3208-2.5						2.5×1	1750	4130	29
TC 3208-5						2.5×2	3180	8270	56
TC 3210-3		10	(1/4) 6.350	33.0	26.3	1.5×2	3000	6580	36
TC 3210-2.5						2.5×1	2560	5490	30
TC 3210-5						2.5×2	4650	11000	59
TC 3605-2.5	36	5	(1/8) 3.175	36.5	33.2	2.5×1	1060	3170	31
TC 3605-5						2.5×2	1920	6350	59
TC 3606-2.5		6	(5/32) 3.969	36.5	32.3	2.5×1	1440	3930	31
TC 3606-5						2.5×2	2620	7870	61
TC 3608-2.5		8	(3/16) 4.7625	36.5	31.5	2.5×1	1850	4680	32
TC 3608-5						2.5×2	3360	9350	62
TC 4005-3	40	5	(1/8) 3.175	40.5	37.2	1.5×2	1300	4240	40
TC 4005-2.5						2.5×1	1110	3530	33
TC 4005-5						2.5×2	2010	7070	64
TC 4005-7.5						2.5×3	2870	10600	95
TC 4006-3		6	(5/32) 3.969	40.5	36.3	1.5×2	1770	5260	41
TC 4006-2.5						2.5×1	1510	4380	34
TC 4006-5						2.5×2	2740	8770	66
TC 4006-7.5						2.5×3	3910	13100	98
TC 4008-3		8	(3/16) 4.7625	40.5	35.5	1.5×2	2270	6260	42
TC 4008-2.5						2.5×1	1940	5220	35
TC 4008-5						2.5×2	3520	10400	68
TC 4010-3		10	(1/4) 6.350	41.0	34.4	1.5×2	3360	8320	43
TC 4010-2.5						2.5×1	2860	6930	36
TC 4010-5						2.5×2	5200	13900	71



Remarks

(1) Flange configuration
As shown in Fig. on the left side, two flange configurations R type (standard) and H type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal
For the type with a seal, the nut length is longer than of the type without a seal by M.

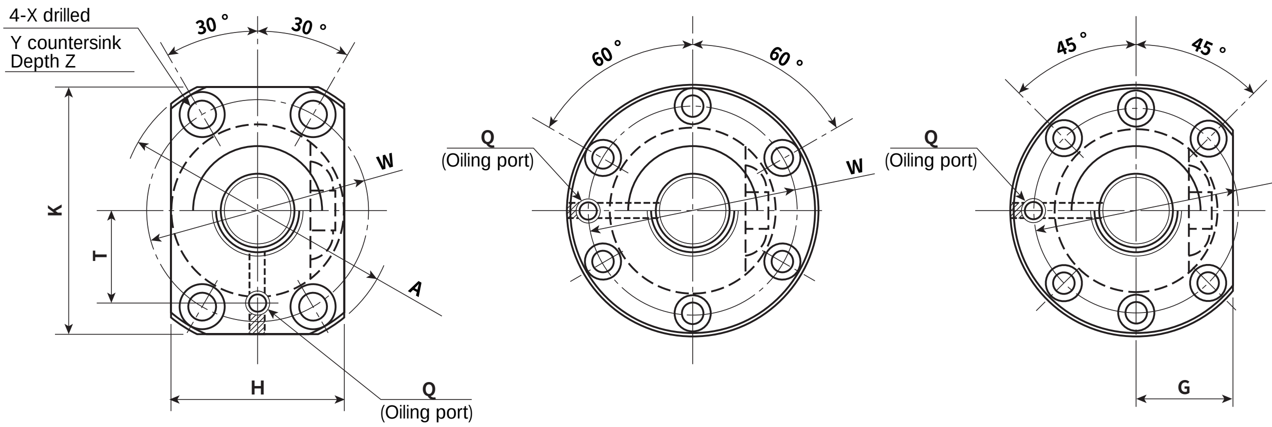
(3) Stiffness
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 30% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

Nut dimensions												Nut type
D	A	G	B	F	L	M	W	X	Y	Z	Q	
55	85	31	12	26	41	3	69	6.6	11	6.5	M6	TC 2805-2.5
				41	56							TC 2805-5
55	85	31	12	30	45	3	69	6.6	11	6.5	M6	TC 2806-2.5
				48	63							TC 2806-5
54	81	31	12	22	37	3	67	6.6	11	6.5	M6	TC 3204-2.5
				34	49							TC 3204-5
58	85	32	12	38	53	3	71	6.6	11	6.5	M6	TC 3205-3
				26	41							TC 3205-2.5
				41	56							TC 3205-5
62	89	34	12	42	57	3	75	6.6	11	6.5	M6	TC 3206-3
				30	45							TC 3206-2.5
				48	63							TC 3206-5
66	100	38	15	51	71	5	82	9	14	8.5	M6	TC 3208-3
				38	58							TC 3208-2.5
				62	82							TC 3208-5
74	108	41	15	65	87	7	90	9	14	8.5	M6	TC 3210-3
				48	70							TC 3210-2.5
				78	100							TC 3210-5
65	100	38	15	26	44	3	82	9	14	8.5	M6	TC 3605-2.5
				41	59							TC 3605-5
65	100	38	15	30	48	3	82	9	14	8.5	M6	TC 3606-2.5
				48	66							TC 3606-5
70	104	40	15	38	58	5	86	9	14	8.5	M6	TC 3608-2.5
				62	82							TC 3608-5
67	101	39	15	38	56	3	83	9	14	8.5	PT1/8	TC 4005-3
				26	44							TC 4005-2.5
				41	59							TC 4005-5
				56	74							TC 4005-7.5
70	104	40	15	42	60	3	86	9	14	8.5	PT1/8	TC 4006-3
				30	48							TC 4006-2.5
				48	66							TC 4006-5
				66	84							TC 4006-7.5
74	108	41	15	51	71	5	90	9	14	8.5	PT1/8	TC 4008-3
				38	58							TC 4008-2.5
				62	82							TC 4008-5
82	124	47	18	65	90	7	102	11	17.5	11	PT1/8	TC 4010-3
				48	73							TC 4010-2.5
				78	103							TC 4010-5

TUBULAR TYPE SINGLE FLANGE SINGLE NUT

TP TYPE (Oversize ball preloaded)



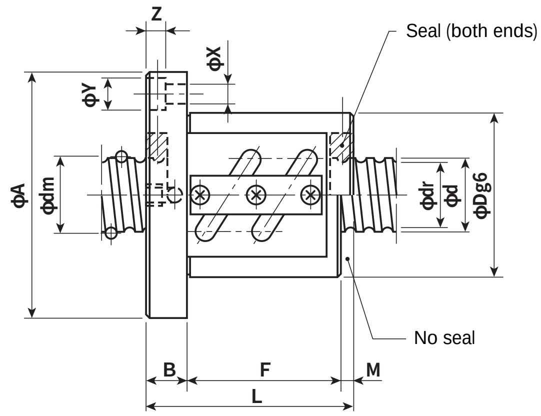
S type
Screw shaft O.D. d ≦ 14mm

R type (standard)
Screw shaft O.D. d ≧ 10mm

C type
Screw shaft O.D. d ≧ 16mm

[For screw shaft outside diameter d ≦ 14mm, four mounting bolt holes (4 x 90°) provided]

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	 Static C0a	Stiffness (N/μm) K
TP 1004-2.5	10	4	2.000	10.3	8.2	2.5 × 1	170	225	8.3
TP 1204-2.5	12	4	(3/32) 2.381	12.3	9.8	2.5 × 1	235	320	9.8
TP 1205-2.5		5	(3/32) 2.381	12.3	9.8	2.5 × 1	235	320	9.8
TP 1404-2.5	14	4	(3/32) 2.381	14.3	11.8	2.5 × 1	255	375	11
TP 1405-2.5		5	(1/8) 3.175	14.5	11.2	2.5 × 1	430	595	12
TP 1604-2.5	16	4	(3/32) 2.381	16.3	13.8	2.5 × 1	270	430	12
TP 1605-3		5	(1/8) 3.175	16.5	13.2	1.5 × 2	545	820	16
TP 1605-2.5						2.5 × 1	465	685	14
TP 1605-5						2.5 × 2	840	1370	26
TP 1606-3		6	(1/8) 3.175	16.5	13.2	1.5 × 2	545	820	16
TP 1606-2.5						2.5 × 1	465	685	14
TP 2004-2.5	20	4	(3/32) 2.381	20.3	17.8	2.5 × 1	300	545	15
TP 2004-5						2.5 × 2	545	1090	29
TP 2005-3		5	(1/8) 3.175	20.5	17.2	1.5 × 2	605	1040	19
TP 2005-2.5						2.5 × 1	520	865	16
TP 2005-5						2.5 × 2	940	1730	32
TP 2006-3		6	(5/32) 3.969	20.5	16.3	1.5 × 2	810	1280	20
TP 2006-2.5						2.5 × 1	690	1060	17
TP 2006-5						2.5 × 2	1250	2130	32
TP 2504-2.5	25	4	(3/32) 2.381	25.3	22.8	2.5 × 1	330	680	18
TP 2504-5						2.5 × 2	600	1370	35
TP 2505-3		5	(1/8) 3.175	25.5	22.2	1.5 × 2	670	1310	23
TP 2505-2.5						2.5 × 1	575	1090	20
TP 2505-5						2.5 × 2	1040	2180	38
TP 2506-3		6	(5/32) 3.969	25.5	21.3	1.5 × 2	905	1620	24
TP 2506-2.5						2.5 × 1	770	1350	20
TP 2506-5						2.5 × 2	1400	2690	39



Remarks

(1) Flange configuration
As shown in Fig. on the left side, R type (standard) and S type for shaft outside diameters of less than 14mm and R type (standard) and C type for shaft outside diameters of more than 16mm are available. Select the correct one according to the space for the nut mounting portion. The R type with shaft outside diameters of less than 14mm is provided with four mounting bolt holes (4 x 90。).

(2) Seal
For the type with a seal, the nut length is longer than of the type without a seal by M. For the type with shaft outside diameters less than 16mm, the nut has the same length.

(3) Basic rated load
Since the ratio of load balls to spacer balls put in the nut is 1:1, the basic rated load of this type differs from that of the other types.

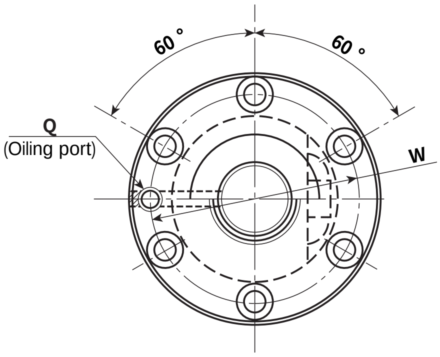
(4) Stiffness
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load equivalent to 30% of basic rated dynamic load (Ca) is applied. It is recommended to use 80% of each value given in Table below.

Unit (mm)

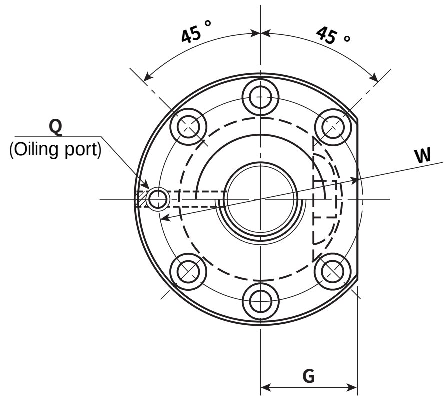
Nut dimensions															Nut type
D	A	G	B	F	L	M	W	X	Y	Z	Q	T	K	H	
26	46	—	10	27	37	0	36	4.5	8	4.5	M6	14	42	28	TP 1004-2.5
30	50	—	10	27	37	0	40	4.5	8	4.5	M6	15	45	32	TP 1204-2.5
30	50	—	10	30	40	0	40	4.5	8	4.5	M6	15	45	32	TP 1205-2.5
32	55	—	11	27	38	0	43	5.5	9.5	5.5	M6	16	50	34	TP 1404-2.5
34	57	—	11	30	41	0	45	5.5	9.5	5.5	M6	17	50	34	TP 1405-2.5
34	57	22	11	27	38	0	45	5.5	9.5	5.5	M6	—	—	—	TP 1604-2.5
40	63	24	11	41 31 46	52 42 57	0	51	5.5	9.5	5.5	M6	—	—	—	TP 1605-3 TP 1605-2.5 TP 1605-5
40	63	24	11	45 33	56 44	0	51	5.5	9.5	5.5	M6	—	—	—	TP 1606-3 TP 1606-2.5
40	63	24	11	23 35	37 49	3	51	5.5	9.5	5.5	M6	—	—	—	TP 2004-2.5 TP 2004-5
44	67	26	11	38 27 42	52 41 56	3	55	5.5	9.5	5.5	M6	—	—	—	TP 2005-3 TP 2005-2.5 TP 2005-5
48	71	27	11	42 30 48	56 44 62	3	59	5.5	9.5	5.5	M6	—	—	—	TP 2006-3 TP 2006-2.5 TP 2006-5
46	69	26	11	22 34	36 48	3	57	5.5	9.5	5.5	M6	—	—	—	TP 2504-2.5 TP 2504-5
50	73	28	11	38 26 41	52 40 55	3	61	5.5	9.5	5.5	M6	—	—	—	TP 2505-3 TP 2505-2.5 TP 2505-5
53	76	29	11	42 30 48	56 44 62	3	64	5.5	9.5	5.5	M6	—	—	—	TP 2506-3 TP 2506-2.5 TP 2506-5

TUBULAR TYPE SINGLE FLANGE SINGLE NUT

TP TYPE (Oversize ball preloaded)



R type (standard)

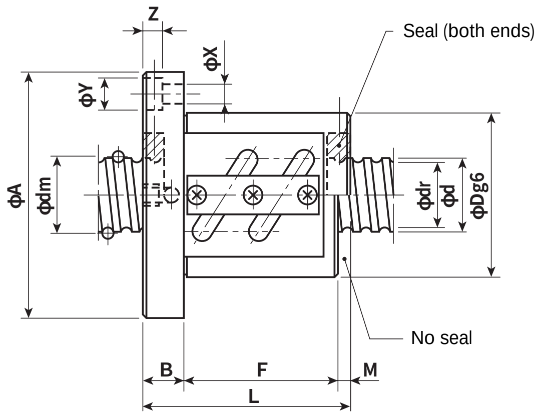


C type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	Basic rated load (N) Static C_0a	Stiffness (N/μm) K
TP 2805-2.5	28	5	(1/8) 3.175	28.5	25.2	2.5×1	600	1230	21
TP 2805-5						2.5×2	1090	2450	41
TP 2806-2.5		6	(5/32) 3.969	28.5	24.3	2.5×1	815	1520	22
TP 2806-5						2.5×2	1480	3030	43
TP 3204-2.5	32	4	(3/32) 2.381	32.3	29.8	2.5×1	365	880	22
TP 3204-5						2.5×2	665	1760	42
TP 3205-3		5	(1/8) 3.175	32.5	29.2	1.5×2	745	1690	28
TP 3205-2.5						2.5×1	635	1410	24
TP 3205-5						2.5×2	1160	2810	46
TP 3206-3		6	(5/32) 3.969	32.5	28.3	1.5×2	1010	2090	29
TP 3206-2.5						2.5×1	865	1740	25
TP 3206-5						2.5×2	1570	3480	47
TP 3208-3		8	(3/16) 4.7625	32.5	27.5	1.5×2	1290	2480	30
TP 3208-2.5						2.5×1	1100	2070	25
TP 3208-5						2.5×2	2000	4130	48
TP 3210-3		10	(1/4) 6.350	33.0	26.3	1.5×2	1890	3290	31
TP 3210-2.5						2.5×1	1610	2740	26
TP 3210-5						2.5×2	2930	5490	50
TP 3605-2.5	36	5	(1/8) 3.175	36.5	33.2	2.5×1	665	1590	26
TP 3605-5						2.5×2	1210	3170	51
TP 3606-2.5		6	(5/32) 3.969	36.5	32.3	2.5×1	910	1970	27
TP 3606-5						2.5×2	1650	3930	52
TP 3608-2.5		8	(3/16) 4.7625	36.5	31.5	2.5×1	1170	2340	28
TP 3608-5						2.5×2	2110	4680	53
TP 4005-3	40	5	(1/8) 3.175	40.5	37.2	1.5×2	815	2120	34
TP 4005-2.5						2.5×1	695	1770	28
TP 4005-5						2.5×2	1260	3530	55
TP 4005-7.5						2.5×3	1810	5300	81
TP 4006-3		6	(5/32) 3.969	40.5	36.3	1.5×2	1110	2630	35
TP 4006-2.5						2.5×1	950	2190	29
TP 4006-5						2.5×2	1720	4380	57
TP 4006-7.5						2.5×3	2460	6570	84
TP 4008-3		8	(3/16) 4.7625	40.5	35.5	1.5×2	1430	3130	36
TP 4008-2.5						2.5×1	1220	2610	30
TP 4008-5						2.5×2	2220	5220	58
TP 4010-3		10	(1/4) 6.350	41.0	34.4	1.5×2	2110	4160	37
TP 4010-2.5						2.5×1	1800	3470	31
TP 4010-5						2.5×2	3280	6930	61

Remarks

(1) Flange configuration
As shown in Fig. on the left side, two flange configurations R type (standard) and H type are available. Select the correct one according to the space for the nut mounting portion.



(2) Seal
For the type with a seal, the nut length is longer than of the type without a seal by M.

(3) Basic rated load
Since the ratio of load balls to spacer balls put in the nut is 1:1, the basic rated load of this type differs from that of the other types.

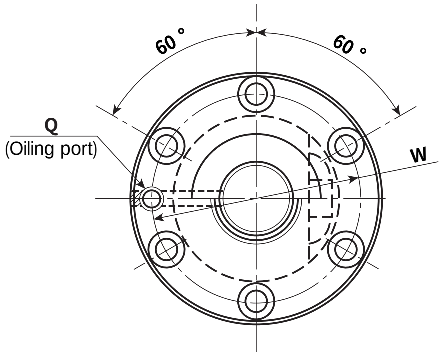
(4) Stiffness
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 5% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

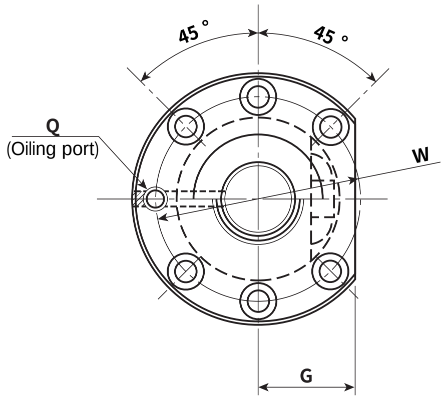
Nut dimensions												Nut type
D	A	G	B	F	L	M	W	X	Y	Z	Q	
55	85	31	12	26 41	41 56	3	69	6.6	11	6.5	M6	TP 2805-2.5 TP 2805-5
55	85	31	12	30 48	45 63	3	69	6.6	11	6.5	M6	TP 2806-2.5 TP 2806-5
54	81	31	12	22 34	37 49	3	67	6.6	11	6.5	M6	TP 3204-2.5 TP 3204-5
58	85	32	12	38 26 41	53 41 56	3	71	6.6	11	6.5	M6	TP 3205-3 TP 3205-2.5 TP 3205-5
62	89	34	12	42 30 48	57 45 63	3	75	6.6	11	6.5	M6	TP 3206-3 TP 3206-2.5 TP 3206-5
66	100	38	15	51 38 62	71 58 82	3	82	9	14	8.5	M6	TP 3208-3 TP 3208-2.5 TP 3208-5
74	108	41	15	65 48 78	87 70 100	7	90	9	14	8.5	M6	TP 3210-3 TP 3210-2.5 TP 3210-5
65	100	38	15	26 41	44 59	3	82	9	14	8.5	M6	TP 3605-2.5 TP 3605-5
65	100	38	15	30 48	48 66	3	82	9	14	8.5	M6	TP 3606-2.5 TP 3606-5
70	104	40	15	38 62	58 82	5	86	9	14	8.5	M6	TP 3608-2.5 TP 3608-5
67	101	39	15	38 26 41 56	56 44 59 74	3	83	9	14	8.5	PT1/8	TP 4005-3 TP 4005-2.5 TP 4005-5 TP 4005-7.5
70	104	40	15	42 30 48 66	60 48 66 84	3	86	9	14	8.5	PT1/8	TP 4006-3 TP 4006-2.5 TP 4006-5 TP 4006-7.5
74	108	41	15	51 38 62	71 58 82	5	90	9	14	8.5	PT1/8	TP 4008-3 TP 4008-2.5 TP 4008-5
82	124	47	18	65 48 78	90 73 103	7	102	11	17.5	11	PT1/8	TP 4010-3 TP 4010-2.5 TP 4010-5

TUBULAR TYPE SINGLE FLANGE SINGLE NUT

TF TYPE (Offset lead preloaded)

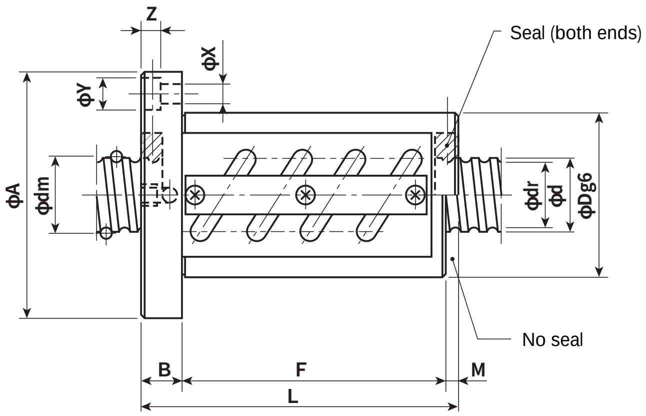


R type (standard)



C type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	Basic rated load (N) Static C_0a	Stiffness (N/μm) K
TF 1605-5	16	5	(1/8) 3.175	16.5	13.2	2.5×1(×2)	735	1370	32
TF 2004-5	20	4	(3/32) 2.381	20.3	17.8	2.5×1(×2)	480	1090	35
TF 2005-5		5	(1/8) 3.175	20.5	17.2	2.5×1(×2)	820	1730	38
TF 2006-5		6	(5/32) 3.969	20.5	16.3	2.5×1(×2)	1100	2130	39
TF 2504-5	25	4	(3/32) 2.381	25.3	22.8	2.5×1(×2)	525	1370	42
TF 2504-10						2.5×2(×2)	955	2740	81
TF 2505-5		5	(1/8) 3.175	25.5	22.2	2.5×1(×2)	910	2180	46
TF 2505-10						2.5×2(×2)	1650	4370	88
TF 2506-5		6	(5/32) 3.969	25.5	21.3	2.5×1(×2)	1230	2690	47
TF 2805-5	28	5	(1/8) 3.175	28.5	25.2	2.5×1(×2)	955	2450	50
TF 2805-10						2.5×2(×2)	1740	4910	97
TF 2806-5		6	(5/32) 3.969	28.5	24.3	2.5×1(×2)	1290	3030	51
TF 2806-10						2.5×2(×2)	2350	6060	99
TF 3204-5	32	4	(3/32) 2.381	32.3	29.8	2.5×1(×2)	580	1760	51
TF 3204-10						2.5×2(×2)	1050	3520	98
TF 3205-5		5	(1/8) 3.175	32.5	29.2	2.5×1(×2)	1010	2810	56
TF 3205-10						2.5×2(×2)	1830	5630	108
TF 3206-5		6	(5/32) 3.969	32.5	28.3	2.5×1(×2)	1370	3480	57
TF 3206-10						2.5×2(×2)	2490	6970	111
TF 3208-3		8	(3/16) 4.7625	32.5	27.5	1.5×1(×2)	2050	4960	69
TF 3208-5						2.5×1(×2)	1750	4130	58
TF 3210-3		10	(1/4) 6.350	33.0	26.4	1.5×1(×2)	3000	6580	72
TF 3210-5						2.5×1(×2)	2560	5490	61



Remarks

(1) Flange configuration

As shown in Fig. on the left side, two flange configurations R type (standard) and C type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal

For the type with a seal, the nut length is longer than of the type without a seal by M.

(3) Stiffness

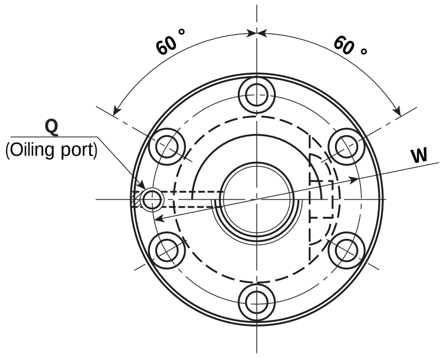
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 10% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

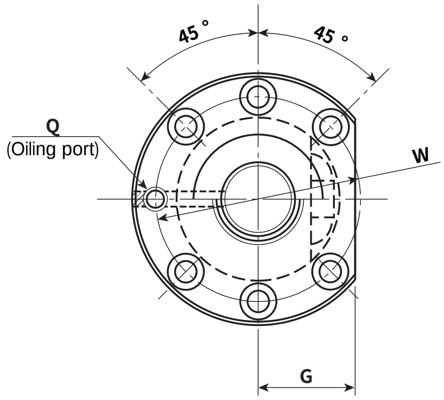
Nut dimensions												**Nut type**
D	A	G	B	F	L	M	W	X	Y	Z	Q	
40	63	24	11	46	57	0	51	5.5	9.5	5.5	M6	TF 1605-5
40	63	24	11	35	49	3	51	5.5	9.5	5.5	M6	TF 2004-5
44	67	26	11	42	56	3	55	5.5	9.5	5.5	M6	TF 2005-5
48	71	27	11	48	62	3	59	5.5	9.5	5.5	M6	TF 2006-5
46	69	26	11	34 58	48 72	3	57	5.5	9.5	5.5	M6	TF 2504-5 TF 2504-10
50	73	28	11	41 71	55 85	3	61	5.5	9.5	5.5	M6	TF 2505-5 TF 2505-10
53	76	29	11	48	62	3	64	5.5	9.5	5.5	M6	TF 2506-5
55	85	31	12	41 71	56 86	3	69	6.6	11	6.5	M6	TF 2805-5 TF 2805-10
55	85	31	12	48 84	63 99	3	69	6.6	11	6.5	M6	TF 2806-5 TF 2806-10
54	81	31	12	34 58	49 73	3	67	6.6	11	6.5	M6	TF 3204-5 TF 3204-10
58	85	32	12	41 71	56 86	3	71	6.6	11	6.5	M6	TF 3205-5 TF 3205-10
62	89	34	12	48 84	63 99	3	75	6.6	11	6.5	M6	TF 3206-5 TF 3206-10
66	100	38	15	51 62	71 82	5	82	9	14	8.5	M6	TF 3208-3 TF 3208-5
74	108	41	15	65 78	87 100	7	90	9	14	8.5	M6	TF 3210-3 TF 3210-5

TUBULAR TYPE SINGLE FLANGE SINGLE NUT

TF TYPE (Offset lead preloaded)

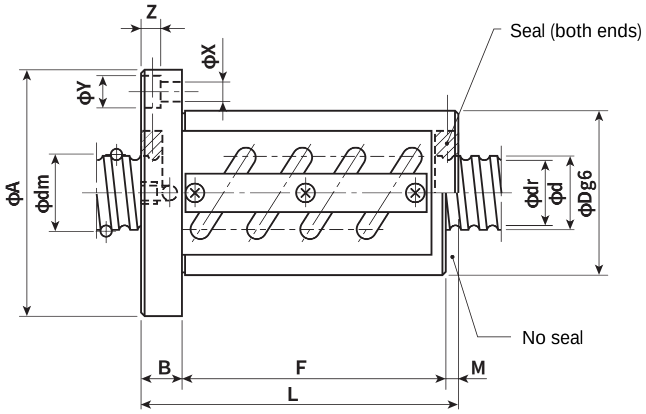


R type (standard)



C type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	Basic rated load (N) Static C0a	Stiffness (N/μm) K
TF 3605-5	36	5	(1/8) 3.175	36.5	33.2	2.5×1(×2)	1060	3170	61
TF 3605-10						2.5×2(×2)	1920	6350	118
TF 3606-5		6	(5/32) 3.969	36.5	32.3	2.5×1(×2)	1440	3930	63
TF 3606-10						2.5×2(×2)	2620	7870	122
TF 3608-5		8	(3/16) 4.7625	36.5	31.5	2.5×1(×2)	1850	4680	64
TF 4005-5	40	5	(1/8) 3.175	40.5	37.2	2.5×1(×2)	1110	3530	66
TF 4005-10						2.5×2(×2)	2010	7070	129
TF 4006-5		6	(5/32) 3.969	40.5	36.3	2.5×1(×2)	1510	4380	68
TF 4006-10						2.5×2(×2)	2740	8770	132
TF 4008-3		8	(3/16) 4.7625	40.5	35.5	1.5×1(×2)	2270	6260	83
TF 4008-5						2.5×1(×2)	1940	5220	70
TF 4010-3		10	(1/4) 6.350	41.0	34.4	1.5×1(×2)	3360	8320	87
TF 4010-5						2.5×1(×2)	2860	6930	73



Remarks

(1) Flange configuration

As shown in Fig. on the left side, two flange configurations R type (standard) and C type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal

For the type with a seal, the nut length is longer than of the type without a seal by M.

(3) Stiffness

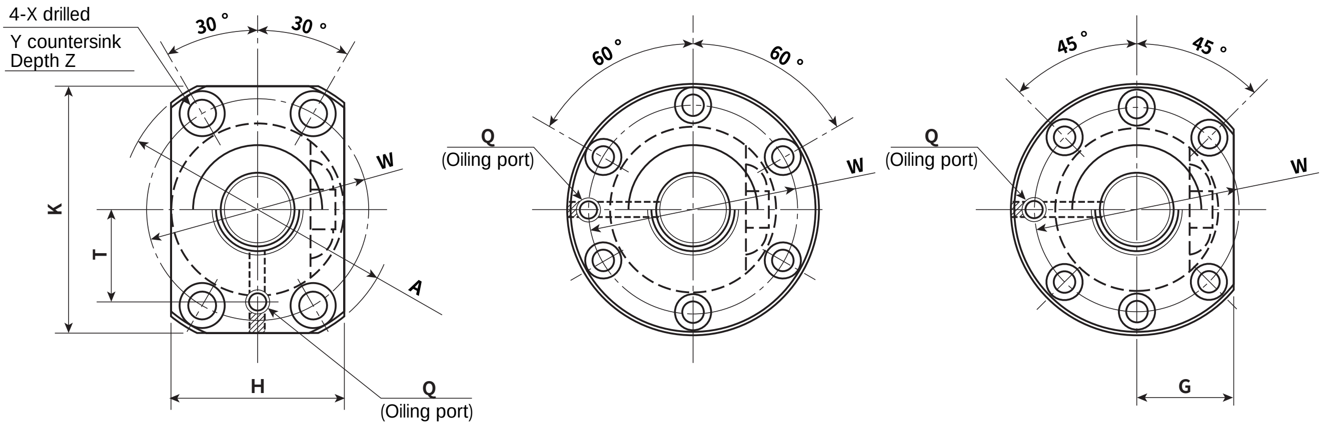
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 10% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

Nut dimensions												**Nut type**
D	A	G	B	F	L	M	W	X	Y	Z	Q	
65	100	38	15	41 71	59 89	3	82	9	14	8.5	M6	TF 3605-5 TF 3605-10
65	100	38	15	48 84	66 102	3	82	9	14	8.5	M6	TF 3606-5 TF 3606-10
70	104	40	15	62	82	5	86	9	14	8.5	M6	TF 3608-5
67	101	39	15	41 71	59 89	3	83	9	14	8.5	PT1/8	TF 4005-5 TF 4005-10
70	104	40	15	48 84	66 102	3	86	9	14	8.5	PT1/8	TF 4006-5 TF 4006-10
74	108	41	15	51 62	71 82	5	90	9	14	8.5	PT1/8	TF 4008-3 TF 4008-5
82	124	47	18	65 78	90 103	7	102	11	17.5	11	PT1/8	TF 4010-3 TF 4010-5

TUBULAR TYPE SINGLE FLANGE DOUBLE NUT

TD TYPE (Spacer preloaded)



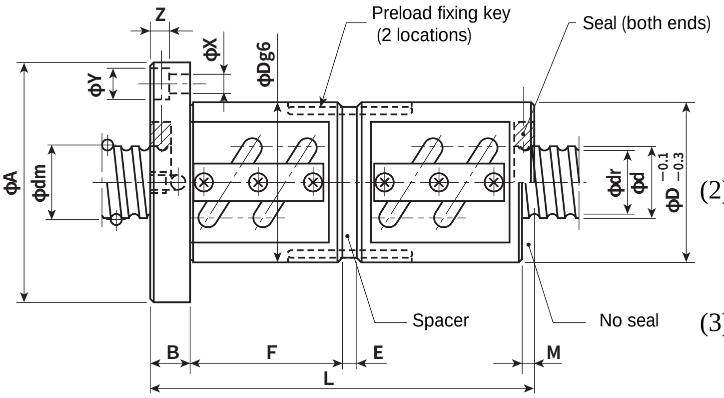
S type
Screw shaft O.D. d ≦ 14mm

R type (standard)
Screw shaft O.D. d ≧ 10mm

C type
Screw shaft O.D. d ≧ 16mm

[For screw shaft outside diameter d ≦ 14mm, four mounting bolt holes (4 x 90°) provided]

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	Static C_0a	Stiffness (N/μm) K
TD 1004-2.5	10	4	2.000	10.3	8.2	2.5 × 1	275	445	20
TD 1204-2.5	12	4	(3/32) 2.381	12.3	9.8	2.5 × 1	375	635	23
TD 1205-2.5		5	(3/32) 2.381	12.3	9.8	2.5 × 1	375	635	23
TD 1404-2.5	14	4	(3/32) 2.381	14.3	11.8	2.5 × 1	405	750	26
TD 1405-2.5		5	(1/8) 3.175	14.5	11.2	2.5 × 1	685	1190	29
TD 1604-2.5	16	4	(3/32) 2.381	16.3	13.8	2.5 × 1	435	860	29
TD 1605-3		5	(1/8) 3.175	16.5	13.2	1.5 × 2	860	1650	38
TD 1605-2.5						2.5 × 1	735	1370	32
TD 1605-5						2.5 × 2	1340	2740	62
TD 1606-3		6	(1/8) 3.175	16.5	13.2	1.5 × 2	860	1650	38
TD 1606-2.5						2.5 × 1	735	1370	32
TD 2004-2.5	20	4	(3/32) 2.381	20.3	17.8	2.5 × 1	480	1090	35
TD 2004-5						2.5 × 2	870	2170	68
TD 2005-3		5	(1/8) 3.175	20.5	17.2	1.5 × 2	965	2080	45
TD 2005-2.5						2.5 × 1	820	1730	38
TD 2005-5						2.5 × 2	1490	3470	74
TD 2006-3		6	(5/32) 3.969	20.5	16.3	1.5 × 2	1280	2560	46
TD 2006-2.5						2.5 × 1	1100	2130	39
TD 2006-5						2.5 × 2	1990	4260	76
TD 2504-2.5	25	4	(3/32) 2.381	25.3	22.8	2.5 × 1	525	1370	42
TD 2504-5						2.5 × 2	955	2740	81
TD 2505-3		5	(1/8) 3.175	25.5	22.2	1.5 × 2	1070	2620	54
TD 2505-2.5						2.5 × 1	910	2180	46
TD 2505-5						2.5 × 2	1650	4370	88
TD 2506-3		6	(5/32) 3.969	25.5	21.3	1.5 × 2	1440	3230	56
TD 2506-2.5						2.5 × 1	1230	2690	47
TD 2506-5						2.5 × 2	2230	5390	91



Remarks

(1) Flange configuration

As shown in Fig. on the left side, R type (standard) and S type for shaft outside diameters of less than 14mm and R type (standard) and C type for shaft outside diameters of more than 16mm are available. Select the correct one according to the space for the nut mounting portion. The R type with shaft outside diameters of less than 14mm is provided with four mounting bolt holes (4 x 90。).

(2) Seal

For the type with a seal, the nut length is longer than of the type without a seal by M. For the type with shaft outside diameters less than 16mm, the nut has the same length.

(3) Stiffness

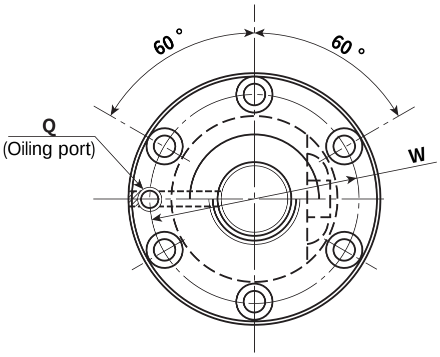
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load equivalent to 10% of basic rated dynamic load (Ca) is applied. It is recommended to use 80% of each value given in Table below.

Unit (mm)

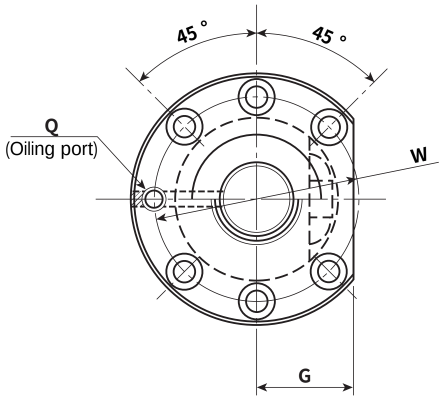
Nut dimensions																Nut type
D	A	G	B	F	E	L	M	W	X	Y	Z	Q	T	K	H	
26	46	—	10	24	4	69	0	36	4.5	8	4.5	M6	14	42	28	TD 1004-2.5
30	50	—	10	24	4	69	0	40	4.5	8	4.5	M6	15	45	32	TD 1204-2.5
30	50	—	10	28	3	76	0	40	4.5	8	4.5	M6	15	45	32	TD 1205-2.5
32	55	—	11	24	4	70	0	43	5.5	9.5	5.5	M6	16	50	34	TD 1404-2.5
34	57	—	11	28	3	77	0	45	5.5	9.5	5.5	M6	17	50	34	TD 1405-2.5
34	57	22	11	24	4	70	0	45	5.5	9.5	5.5	M6	—	—	—	TD 1604-2.5
40	63	24	11	38 28 43	3	97 77 107	0	51	5.5	9.5	5.5	M6	—	—	—	TD 1605-3 TD 1605-2.5 TD 1605-5
40	63	24	11	42 30	7	110 86	3	51	5.5	9.5	5.5	M6	—	—	—	TD 1606-3 TD 1606-2.5
40	63	24	11	23 35	5	69 93	3	51	5.5	9.5	5.5	M6	—	—	—	TD 2004-2.5 TD 2004-5
44	67	26	11	38 27 42	3 4 4	97 76 106	3	55	5.5	9.5	5.5	M6	—	—	—	TD 2005-3 TD 2005-2.5 TD 2005-5
48	71	27	11	42 30 48	7	110 86 133	3	59	5.5	9.5	5.5	M6	—	—	—	TD 2006-3 TD 2006-2.5 TD 2006-5
46	69	26	11	22 34	6	68 92	3	57	5.5	9.5	5.5	M6	—	—	—	TD 2504-2.5 TD 2504-5
50	73	28	11	38 26 41	8 5 5	102 75 105	3	61	5.5	9.5	5.5	M6	—	—	—	TD 2505-3 TD 2505-2.5 TD 2505-5
53	76	29	11	42 30 48	7	110 86 122	3	64	5.5	9.5	5.5	M6	—	—	—	TD 2506-3 TD 2506-2.5 TD 2506-5

TUBULAR TYPE SINGLE FLANGE DOUBLE NUT

TD TYPE (Spacer preloaded)

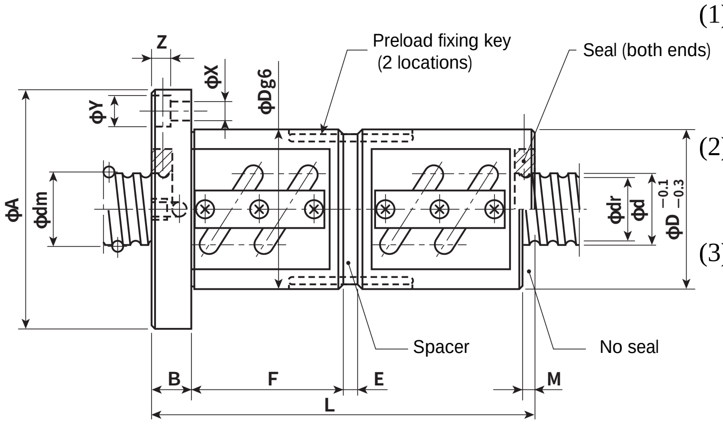


R type (standard)



C type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	Static C_0a	Stiffness (N/μm) K
TD 2805-2.5	28	5	(1/8) 3.175	28.5	25.2	2.5×1	955	2450	50
TD 2805-5						2.5×2	1740	4910	97
TD 2806-2.5		6	(5/32) 3.969	28.5	24.3	2.5×1	1290	3030	51
TD 2806-5						2.5×2	2350	6060	99
TD 3204-2.5	32	4	(3/32) 2.381	32.3	29.8	2.5×1	580	1760	51
TD 3204-5						2.5×2	1050	3520	98
TD 3205-3		5	(1/8) 3.175	32.5	29.2	1.5×2	1180	3380	66
TD 3205-2.5						2.5×1	1010	2810	56
TD 3205-5						2.5×2	1830	5630	108
TD 3206-3		6	(5/32) 3.969	32.5	28.3	1.5×2	1610	4180	68
TD 3206-2.5						2.5×1	1370	3480	57
TD 3206-5						2.5×2	2490	6970	111
TD 3208-3		8	(3/16) 4.7625	32.5	27.5	1.5×2	2050	4960	69
TD 3208-2.5						2.5×1	1750	4130	58
TD 3208-5						2.5×2	3180	8270	113
TD 3210-3		10	(1/4) 6.350	33.0	26.4	1.5×2	3000	6580	72
TD 3210-2.5						2.5×1	2560	5490	61
TD 3210-5						2.5×2	4650	11000	118
TD 3605-2.5	36	5	(1/8) 3.175	36.5	33.2	2.5×1	1060	3170	61
TD 3605-5						2.5×2	1920	6350	118
TD 3606-2.5		6	(5/32) 3.969	36.5	32.3	2.5×1	1440	3930	63
TD 3606-5						2.5×2	2620	7870	122
TD 3608-2.5		8	(3/16) 4.7625	36.5	31.5	2.5×1	1850	4680	64
TD 3608-5						2.5×2	3360	9350	124
TD 4005-3	40	5	(1/8) 3.175	40.5	37.2	1.5×2	1300	4240	79
TD 4005-2.5						2.5×1	1110	3530	66
TD 4005-5						2.5×2	2010	7070	129
TD 4005-7.5						2.5×3	2870	10600	190
TD 4006-3		6	(5/32) 3.969	40.5	36.3	1.5×2	1770	5260	81
TD 4006-2.5						2.5×1	1510	4380	68
TD 4006-5						2.5×2	2740	8770	132
TD 4006-7.5						2.5×3	3910	13100	195
TD 4008-3		8	(3/16) 4.7625	40.5	35.5	1.5×2	2270	6260	83
TD 4008-2.5						2.5×1	1940	5220	70
TD 4008-5						2.5×2	3520	10400	135
TD 4010-3		10	(1/4) 6.350	41.0	34.4	1.5×2	3360	8320	87
TD 4010-2.5						2.5×1	2860	6930	73
TD 4010-5						2.5×2	5200	13900	141



Remarks

(1) Flange configuration

As shown in Fig. on the left side, two flange configurations R type (standard) and C type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal

For the type with a seal, the nut length is longer than of the type without a seal by M.

(3) Stiffness

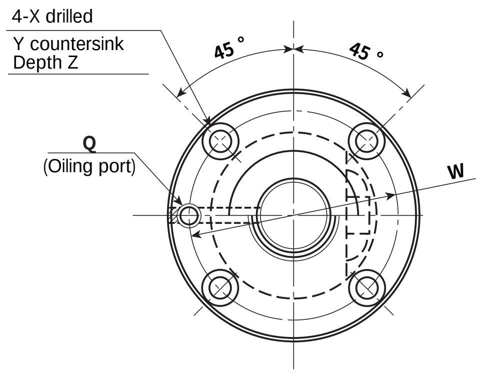
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load equivalent to 10% of basic rated dynamic load (Ca) is applied. It is recommended to use 80% of each value given in Table below.

Unit (mm)

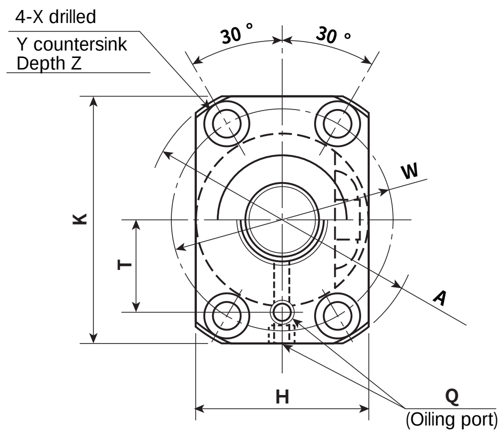
Nut dimensions													Nut type
D	A	G	B	F	E	L	M	W	X	Y	Z	Q	
55	85	31	12	26	5	76	3	69	6.6	11	6.5	M6	TD 2805-2.5
				41		106							TD 2805-5
55	85	31	12	30	7	87	3	69	6.6	11	6.5	M6	TD 2806-2.5
				48		123							TD 2806-5
54	81	31	12	22	6	69	3	67	6.6	11	6.5	M6	TD 3204-2.5
				34		93							TD 3204-5
58	85	32	12	38	8	103	3	71	6.6	11	6.5	M6	TD 3205-3
				26	5	76							TD 3205-2.5
				41	5	106							TD 3205-5
62	89	34	12	42	7	111	3	75	6.6	11	6.5	M6	TD 3206-3
				30		87							TD 3206-2.5
				48		123							TD 3206-5
66	100	38	15	51	8	135	3	82	9	14	8.5	M6	TD 3208-3
				38	5	106							TD 3208-2.5
				62	5	154							TD 3208-5
74	108	41	15	65	9	167	5	90	9	14	8.5	M6	TD 3210-3
				48	6	130							TD 3210-2.5
				78	6	190							TD 3210-5
65	100	38	15	26	5	78	7	82	9	14	8.5	M6	TD 3605-2.5
				41		109							TD 3605-5
65	100	38	15	30	7	90	3	82	9	14	8.5	M6	TD 3606-2.5
				48		126							TD 3606-5
70	104	40	15	38	5	106	5	86	9	14	8.5	M6	TD 3608-2.5
				62		154							TD 3608-5
67	101	39	15	38	8	106	3	83	9	14	8.5	PT1/8	TD 4005-3
				26	5	79							TD 4005-2.5
				41	5	109							TD 4005-5
				56	5	138							TD 4005-7.5
70	104	40	15	42	7	114	3	86	9	14	8.5	PT1/8	TD 4006-3
				30		90							TD 4006-2.5
				48		126							TD 4006-5
				66		162							TD 4006-7.5
74	108	41	15	51	8	135	5	90	9	14	8.5	PT1/8	TD 4008-3
				38	5	106							TD 4008-2.5
				62	5	154							TD 4008-5
82	124	47	18	65	9	170	7	102	11	17.5	11	PT1/8	TD 4010-3
				48	6	133							TD 4010-2.5
				78	6	193							TD 4010-5

TUBULAR TYPE HIGH LEAD SINGLE FLANGE SINGLE NUT

TCL TYPE (Non-preloaded)

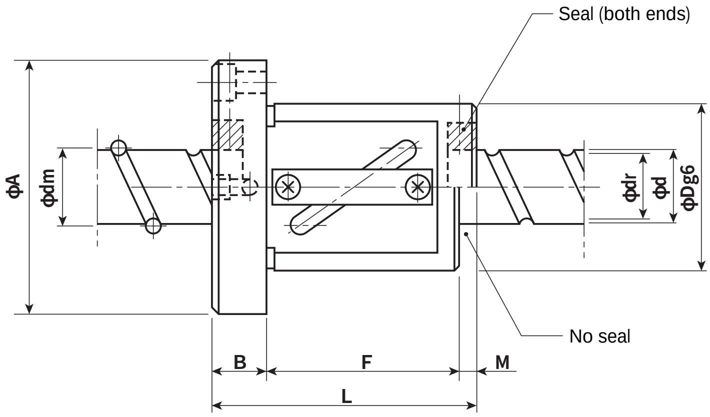


R type (standard)



S type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns×Circ.	Basic rated load (N) Dynamic Ca	 Static C_0a	Stiffness (N/μm) K
TCL 1206-2.5	12	6	(3/32) 2.381	12.5	10.0	2.5×1	380	630	12
TCL 1208-2.5		8	(3/32) 2.381	12.5	10.0	2.5×1	380	630	12
TCL 1210-2.5		10	(3/32) 2.381	12.5	10.0	2.5×1	380	630	12
TCL 1216-1.5		16	(3/32) 2.381	12.5	10.0	1.5×1	240	350	7.1
TCL 1220-1.5		20	(3/32) 2.381	12.5	10.0	1.5×1	240	350	7.1
TCL 1410-1.5 TCL 1410-2.5	14	10	(1/8) 3.175	14.5	11.2	1.5×1 2.5×1	685	1170	14
TCL 1510-1.5 TCL 1510-2.5	15	10	(1/8) 3.175	15.5	12.2	1.5×1 2.5×1	710	1260	15
TCL 1810-1.5 TCL 1810-2.5	18	10	(1/8) 3.175	18.5	15.2	1.5×1 2.5×1	780	1540	18
TCL 2012-1.5 TCL 2012-2.5	20	12	(1/8) 3.175	20.5	17.2	1.5×1 2.5×1	705	1260	12
TCL 2020-1.5		20	(5/32) 3.969	21.0	16.8	1.5×1	705	1260	12
TCL 2520-1.5	25	20	(3/16) 4.7625	25.5	20.5	1.5×1	1000	1900	15
TCL 2525-1.5		25	(3/16) 4.7625	25.5	20.5	1.5×1	1000	1900	15



Remarks

(1) Flange configuration

As shown in Fig. on the left side, two flange configurations R type (standard) and S type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal

For the type with a seal, the nut length is longer than of the type without a seal by M.

(3) Stiffness

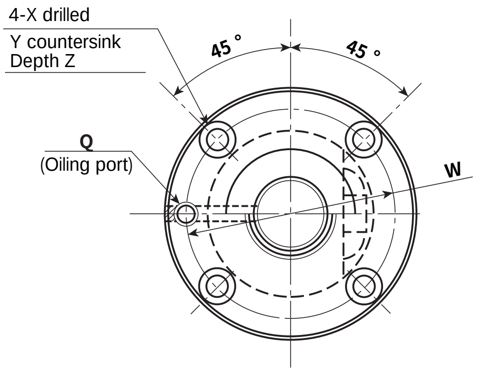
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load equivalent to 30% of basic rated dynamic load (Ca) is applied. It is recommended to use 80% of each value given in Table below.

Unit (mm)

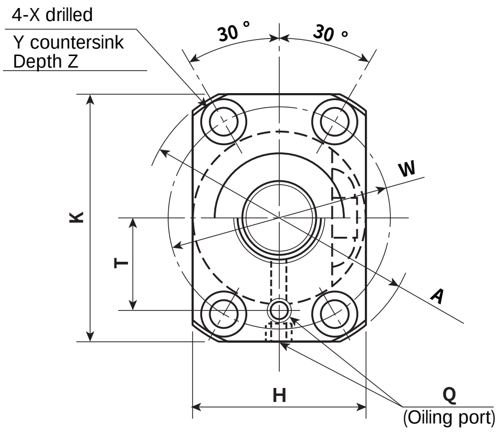
Nut dimensions														Nut type
D	A	B	F	L	M	W	X	Y	Z	Q	T	K	H	
30	50	10	30	40	0	40	4.5	8	4.5	M6	15	45	32	TCL 1206-2.5
30	50	10	35	45	0	40	4.5	8	4.5	M6	15	45	32	TCL 1208-2.5
30	50	10	40	50	0	40	4.5	8	4.5	M6	15	45	32	TCL 1210-2.5
30	50	10	44	54	0	40	4.5	8	4.5	M6	15	45	32	TCL 1216-1.5
30	50	10	50	60	0	40	4.5	8	4.5	M6	15	45	32	TCL 1220-1.5
34	57	11	29 41	44 56	4	45	5.5	9.5	5.5	M6	17	50	34	TCL 1410-1.5 TCL 1410-2.5
34	57	11	31 39	46 54	4	45	5.5	9.5	5.5	M6	17	50	34	TCL 1510-1.5 TCL 1510-2.5
42	65	11	31 39	46 54	4	53	5.5	9.5	5.5	M6	21	58	42	TCL 1810-1.5 TCL 1810-2.5
44	67	12	33 45	49 61	4	55	5.5	9.5	5.5	M6	22	60	44	TCL 2012-1.5 TCL 2012-2.5
46	74	15	47	70	8	59	6.6	11	6.5	M6	24	66	46	TCL 2020-1.5
58	85	15	49	72	8	71	6.6	11	6.5	M6	29	76	58	TCL 2520-1.5
58	85	15	57	80	8	71	6.6	11	6.5	M6	29	76	58	TCL 2525-1.5

TUBULAR TYPE HIGH LEAD SINGLE FLANGE SINGLE NUT

TPL TYPE (Oversize ball preloaded)

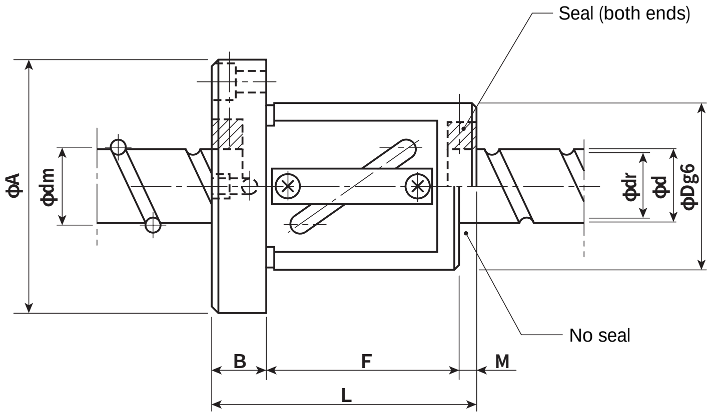


R type (standard)



S type

Nut type	Screw O.D d	Lead ℓ	Steel ball dia. Da	Center-circle dia. of steel ball dm	Screw root dia. dr	Number of turns and circuits Turns× Circ.	Basic rated load (N) Dynamic Ca	 Static C_{0a}	Stiffness (N/ μm) K
TPL 1206-2.5		6	(3/32) 2.381	12.5	10.0	2.5 × 1	380	630	12
TPL 1208-2.5		8	(3/32) 2.381	12.5	10.0	2.5 × 1	380	630	12
TPL 1210-2.5	12	10	(3/32) 2.381	12.5	10.0	2.5 × 1	380	630	12
TPL 1216-1.5		16	(3/32) 2.381	12.5	10.0	1.5 × 1	240	350	7.1
TPL 1220-1.5		20	(3/32) 2.381	12.5	10.0	1.5 × 1	240	350	7.1
TPL 1410-1.5 TPL 1410-2.5	14	10	(1/8) 3.175	14.5	11.2	1.5 × 1 2.5 × 1	685	1170	14
TPL 1510-1.5 TPL 1510-2.5	15	10	(1/8) 3.175	15.5	12.2	1.5 × 1 2.5 × 1	710	1260	15
TPL 1810-1.5 TPL 1810-2.5	18	10	(1/8) 3.175	18.5	15.2	1.5 × 1 2.5 × 1	780	1540	18
TPL 2012-1.5 TPL 2012-2.5	20	12	(1/8) 3.175	20.5	17.2	1.5 × 1 2.5 × 1	705	1260	12
TPL 2020-1.5		20	(5/32) 3.969	21.0	16.8	1.5 × 1	705	1260	12
TPL 2520-1.5	25	20	(3/16) 4.7625	25.5	20.5	1.5 × 1	1000	1900	15
TPL 2525-1.5		25	(3/16) 4.7625	25.5	20.5	1.5 × 1	1000	1900	15



Remarks

(1) Flange configuration
As shown in Fig. on the left side, two flange configurations R type (standard) and S type are available. Select the correct one according to the space for the nut mounting portion.

(2) Seal
For the type with a seal, the nut length is longer than of the type without a seal by M.

(3) Basic rated load
Since the ratio of load balls to spacer balls put in the nut is 1:1, the basic rated load of this type differs from that of non-preloaded.

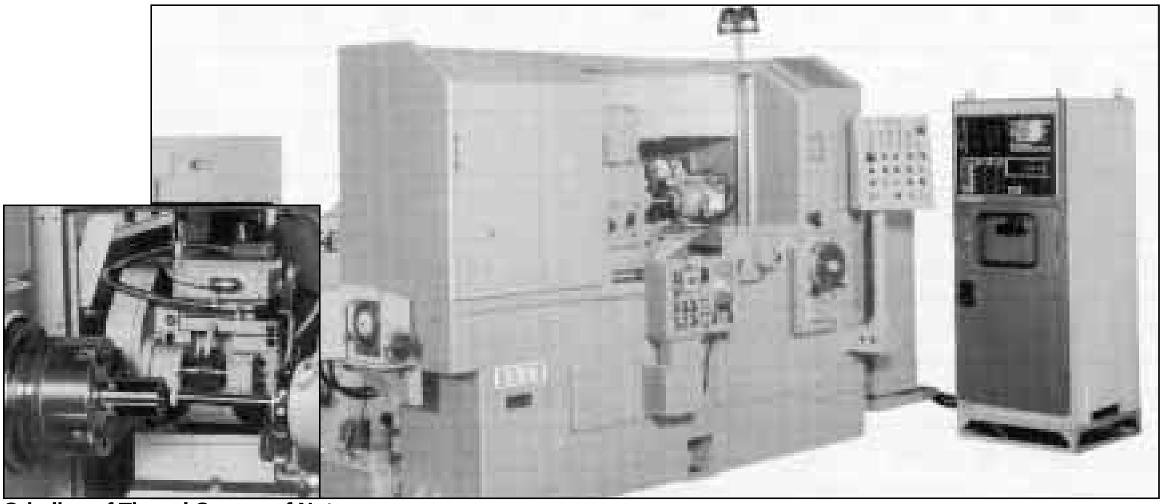
(4) Stiffness
Stiffness shown in Table below is a theoretical value obtained from elastic deformation between the thread groove and steel ball when an axial load is applied, assuming that the preload is 5% of basic rated dynamic load (Ca). It is recommended to use 80% of each value given in Table below.

Unit (mm)

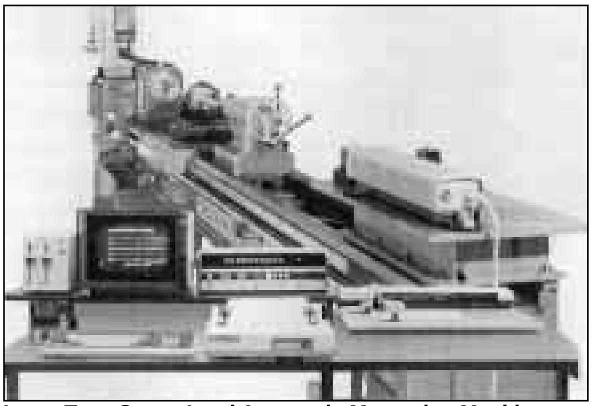
Nut dimensions														Nut type
D	A	B	F	L	M	W	X	Y	Z	Q	T	K	H	
30	50	10	30	40	0	40	4.5	8	4.5	M6	15	45	32	TPL 1206-2.5
30	50	10	35	45	0	40	4.5	8	4.5	M6	15	45	32	TPL 1208-2.5
30	50	10	40	50	0	40	4.5	8	4.5	M6	15	45	32	TPL 1210-2.5
30	50	10	44	54	0	40	4.5	8	4.5	M6	15	45	32	TPL 1216-1.5
30	50	10	50	60	0	40	4.5	8	4.5	M6	15	45	32	TPL 1220-1.5
34	57	11	29 41	44 56	4	45	5.5	9.5	5.5	M6	17	50	34	TPL 1410-1.5 TPL 1410-2.5
34	57	11	31 39	46 54	4	45	5.5	9.5	5.5	M6	17	50	34	TPL 1510-1.5 TPL 1510-2.5
42	65	11	31 39	46 54	4	53	5.5	9.5	5.5	M6	21	58	42	TPL 1810-1.5 TPL 1810-2.5
44	67	12	33 45	49 61	4	55	5.5	9.5	5.5	M6	22	60	44	TPL 2012-1.5 TPL 2012-2.5
46	74	15	47	70	8	59	6.6	11	6.5	M6	24	66	46	TPL 2020-1.5
58	85	15	49	72	8	71	6.6	11	6.5	M6	29	76	58	TPL 2520-1.5
58	85	15	57	80	8	71	6.6	11	6.5	M6	29	76	58	TPL 2525-1.5

11. MANUFACTURING, ASSEMBLING & INSPECTION FACILITIES

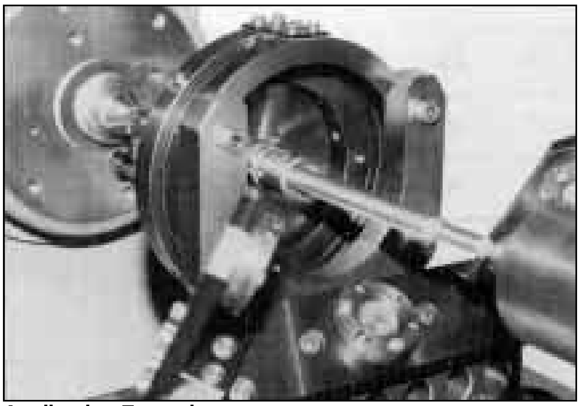
Precision Long Size Thread Grinding Machine



Grinding of Thread Groove of Nut



Laser Type Screw Lead Automatic Measuring Machine



Application Example:
Measurement of Lead and Nut Assembly (PAT.)

HANDLING PRECAUTIONS FOR BALL SCREWS

As Ball Screws are precision parts, carefully handle them by referring to the following instructions:

Lubrication

1. Thoroughly check the lubricant condition before use.
   Improper lubrication will shorten the service life of Ball Screw.
2. When lubricating grease is applied to Ball Screw, use the Ball Screw directly.
   However, if dust and chips accumulate on the surface of grease coating, clean it with pure kerosene or degrease, and then apply new lubricating grease of the same type as coated on the Ball Screw before use.
   When degreasing Ball Screw, avoid using organic solvent which may melt acrylic adhesives.
3. Check the grease 2 to 3 months after Ball Screw is used for the first time. If the grease is extremely dirty, wipe off old grease and apply a sufficient amount of new grease. Thereafter, check and replenish every year, but perform periodic check and maintenance according to operating conditions for the Ball Screw.

Handling

1. Never disassemble Ball Screw. Other wise, dust may enter it, resulting in an accient and degrading accuracy.
2. Avoid reassembling Ball Screw on the user side. Otherwise the function of the Ball Screw may be lost due to incorrect assembling. Send the Ball Screw to our company for repair and reassembly at your expense.
3. As Ball Screw or Nut may sometimes drop spontaneously, be careful not to get hurt. If Ball Screw drops, its function may be lost due to a damage to the circulating parts etc.
   In this case, the Ball Screw should be checked by our company.
   Be sure to send it to our company for check and repair at your expense.
4. When Ball Screw drops, the circulating parts, shaft outside surface, ball groove, etc, may be flawed or scratched.

Operating Precautions

1. Use Ball Screw in a clean environment. Prevent dust and chips from entering Ball Screw by using a dustproof cover. Dust and chips which enter Ball Screw due to insufficient dustproofing may adversely affect the performance of the Ball Screw, causing to lock it or damage the circulating parts or sometimes drop the table.
2. For operating speed of Ball Screw, refer to ”Permissible Operating Speed” given in TOSOK BALL SCREW CATALOG or specifications and drawings supplied by our company.
   If the permissible operating speed is exceeded during operation, the circulating parts may be damaged, sometimes resulting in a lock or an accidental drop of the table.
   When Ball Screw is mounted on a vertical axis, it is recommended that safety nuts or drop prevention be provided. For details of a safety device, contact our company.
3. If Ball Screw Nut is overrun, the ball may drop, the circulating part may be damaged or the ball groove may dent, causing a malfunction.
   Be careful not to overrun Ball Screw without fail.
   If your Ball Screw is overrun, contact our company. We will check it or take proper countermeasures at your expense.
4. The operating temperature limit is usually set at less than 80℃. Avoid operating Ball Screw at higher temperature than the temperature limit. Otherwise, the circulating parts and sealing parts may be damaged.

Storage

1. When storing Ball Screw, keep it in the original package supplied by our company. Do not unpack or tear the package except in case of need. Otherwise, dust may enter Ball Screw, resulting in resting and deterioration of the performance.
2. It is recommendable to store Ball Screw as follows;
   (1) Place it horizontally in the original package supplied by our company.
   (2) Put a sleeper on Ball Screw and place them horizontally in a clean place.
   (3) Suspend Ball Screw in a clean place.

TOSOK
Precision Ball Screw Ordering Information

Name:
Title:
Company Name:
Company Address:
Name of machine in use:
Drawing or sketch: Attached
Not attached (Draw rough sketch below.)

1. Loading conditions

1-1 Max. axial load ____________ N   No. of rev.____________ rpm   Operating ratio____________%
Normal axial load____________ N   No. of rev.____________ rpm   Operating ratio____________%
Min. axial load ____________ N   No. of rev.____________ rpm   Operating ratio____________%
1-2 Max. axial static load____________ N   Total ____________%
1-3 Existence of one-side load (Avoid if possible.)
No_________ Yes_________ Moment load____________ N•m   Radial load____________ N

2. Installation

2-1 Supported length____________mm   Supporting method____________

3. Operating conditions

3-1 Max. stroke ____________mm
3-2 Life required ____________hr.   km ____________ × 10rev
3-3 Shaft rotation ____________   Nut rotation
3-4 Shockless smooth operation____________   Ordinary operation____________   Vibratory operation____________

4. Dimensions

4-1 Nominal shaft outside diameter____________ mm
4-2 Nominal lead__________mm (Pitch__________mm)   Right-hand thread   Left-hand thread__________
4-3 Overall shaft length __________ mm   Effective thread length__________mm
4-4 Nut type____________   Flange configuration____________
4-5 Seal   Provided ____________   Not provided____________

5. Lead accuracy

5-1 Target value of specified travel____________mm
5-2 Grade symbol____________

6. Axial clearance, preload and stiffness

6-1 Existence of axial clearance   Yes _________ mm Max.   No. _________
6-2 Amount of preload ____________ N   Torque required____________ N•m
Stiffness of Nut K ____________ N•m

7. Operating conditions

7-1 Lubrication   Grease____________   Oil ____________
7-2 Dustproof cover____________
7-3 Operating temperature____________℃
7-4 Corrosion prevention   Required______   Not required______   Material_________   Surface treatment_________

8. Quantities

8-1 Set per unit
8-2 Scheduled date of trial manufacture________________
8-3 Scheduled date of mass-production ________________   Q'ty/lot ____________

9. Rough sketch________________Sheets