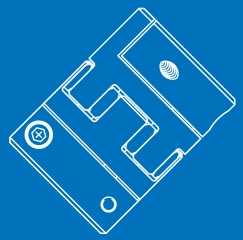

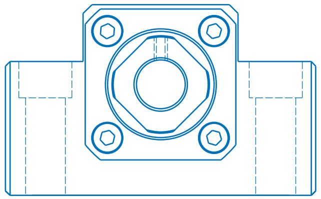

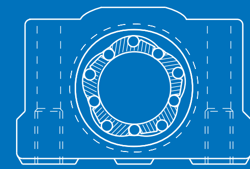

TBIMOTION


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TAIWAN EXCELLENCE


2016/08-3000-EN



NOTE : The appearance and specification may be changed without prior notice only if the requirement improves performance.



TBIMOTION

GENERAL PRODUCTS

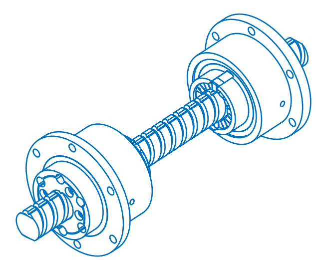
Linear Motion System

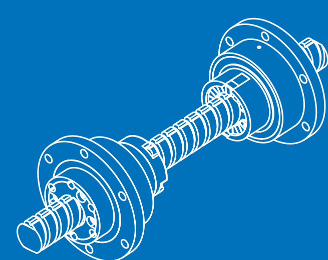

TBIMOTION

# GENERAL PRODUCTS

## Linear Motion System

- Linear Guide
- Ball Spline
- Ball Screw
- Rotary Series
- Linear Ball Bearing
- Support Unit of Ball Screw
- Coupling





# Company History

1986 TBI

Taiwan Ball Screw Industrial Co., Ltd. TBI was established in Tucheng Industrial District, Taipei, Taiwan. We are also the first manufacturer who produces rolled type of precise ball screws in Taiwan.

1988

TBI established Research & Development Department and finished constructing the factory in Taichung that focuses on innovative products and producing precise ground ball screws.

2002 COMTOP

COMTOP was established and exported ball screws to world wide based on a professional and successful marketing sales system.

2010 TBI TBIMOTION

TBI MOTION has integrated the technology of TBI and the marketing strategy of COMTOP to develop *TBI MOTION* in a leading place of Linear Motion Industry. The main products are Ball Screws, Linear Guides, Ball Splines, Rotary Ball Screw & Ball Spline, Single Axis Robot, Linear Ball Bearing, Couplings, and Ball Screw Accessaries ...... etc.




## GENERAL PRODUCTS



## APPENDIX

TBIMOTION

## B. Ball Spline

SLF (Flange Type)

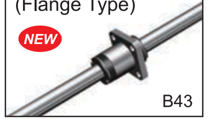
B33 TAIWAN

SLT (Cylinder Type)

B35 TAIWAN

SZF (Dust-proof) NEW

B37

SOF (Flange Type) NEW

B43

SOT (Cylinder Type) NEW

B45

## C. Ball Screw

SFNI (Dust-proof) NEW

Ground C43
Rolled C71

SFNU (Dust-proof) NEW

Ground C44
Rolled C72

SFH (Dust-proof) NEW

Ground C45
Rolled C73

SFY (High Dm-N Rating) NEW

Ground C46
Rolled C74

High Speed Low Noise SFS (DIN Standard)

Ground C47
Rolled C75

High Speed Low Noise DFS (DIN Standard)

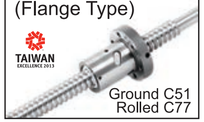
Ground C48

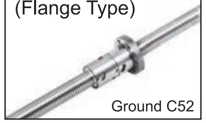
High Load External Circulation SFV

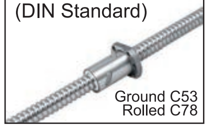
Ground C49
Rolled C76

High Load External Circulation DFV TAIWAN

Ground C50

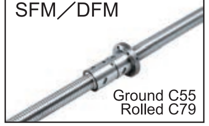
SFI (Flange Type) TAIWAN

Ground C51
Rolled C77

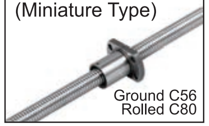
DFI (Flange Type)

Ground C52

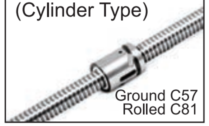
SFU (DIN Standard)

Ground C53
Rolled C78

DFU (DIN Standard)

Ground C54

Design of Milling SFM／DFM

Ground C55
Rolled C79

SFK (Miniature Type)

Ground C56
Rolled C80

SCI (Cylinder Type)

Ground C57
Rolled C81

BSH

Ground C58
Rolled C82

XSV

Ground C59

## D. Rotary Series

RFBY Type NEW

D15

RLBF Type NEW

D16

RBBY Type NEW

D17

RBLY Type NEW

D19

RFSY Type NEW

D21

RLSF Type NEW

D22

RSSY Type NEW

D23

RSLY Type NEW

D25

## E. Linear Ball Bearing

Standard LM

E01

LM-L (Extra long)

E02

LF (With Flange)

E03

LF-L (Extra long)

E04

LU/LP (Housing Type)

E05

SF/WV (Slide Shaft) Ø4~50

E06

SS

E07

TBI TBIMOTION®

## . Support Unit of Ball Screw

BK

F05

BF

F09

EK

F11

EF

F15

FK

F17

FF

F21

## . Coupling

SRJ

G01

# GENERAL PRODUCTS

www.tbimotion.com.tw

# B. Ball Spline

## 1. About Ball Spline



## 2. Technical Information



## 3. *TBI MOTION* Ball Spline



# C. Ball Screw

## 1. About Ball Screw



## 2. *TBI MOTION* Ball Screw



# D. Rotary Series

## 1. About Precision Rotary Ball Screw／Spline

# E. Linear Ball Bearing

## 1. About Linear Ball Bearing



# F. Support Unit of Ball Screw



# G. Coupling

## 1. About Coupling

# B. Ball Spline

www.tbimotion.com.tw

# 1. About Ball Spline



## 1-1 Structure and Benefits of *TBI MOTION* Ball Spline

### 1-1-1 Basic Structure of *TBI MOTION* Ball Spline

The design of TBI Ball spline is to utilize the friction force through the contact of steel balls within in the Spline Nut and the grooves on the Spline Shaft. With TBI MOTION's unique 40° angular contact design which enables the Ball spline delivers high sensitivity and extreme high load carrying capacity. The concept is optimal for the application involve with high speed, vibrates, impacts of loading and precise positioning requirements. Also when the Ball spline is used to function as linear bushing, the Ball spline provides ten times loading capacity than the linear bushing in the like dimensioned but with a compact profile. Namely, Durability and reliablility is the reason for choosing TBI Ball spline in your application.

### 1-1-2 *TBI MOTION* Nut Design and Shaft Specifications

*TBI MOTION* Spline Nut is available in five different designs: SLF (Flange design), SLT (Non-flange design), SZF (Dust-proof design), SOF (Cylindrical flange design), SOT (Round design), Point of contacts on the Spline shaft is provided in two grooves (180°) (SLF／SLT／SZF 6~20), (SOT／SOF 8~25) and four grooves (70°) (SLF／SLT／SZF 25 ~50) base on the diameter of the Spline shaft. Also TBI provides Hollow Spline shaft for alternative.

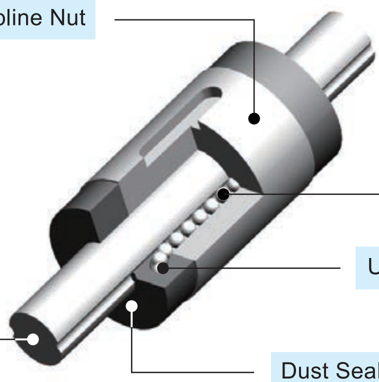



Fig 1.1.1

### 1-1-3 Features of *TBI MOTION* Ball Spline

**High Load-Carrying Capacity**

Every groove on the TBI Spline shaft is precision ground to form a perfect 40° angular contact point. The concept of 40° contact design is to increases the load carrying capacity and rigidity so that it is able to handle a greater moment load.

**Zero Angular Clearance／Backlash**

Grooves on the TBI Spline shaft is precision ground to form a perfect Gothic arch. The design eliminates clearance that could generate deflections and therefore best suited for the applications that requiring maximum precision.

**High Sensitivity**

The unique TBI 40° angular contact is design to drive with the minimum of friction force while the design performs not only the highest sensitivity but also the rigidity.

**High Rigidity**

A wide contact angle and an appropriate level off preload are combined to provide high rigidity and stiffness.

**Mount-Simple on Design**

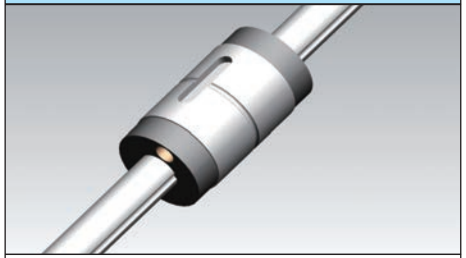
TBI Ball spline is low maintenance designed, therefore, even if disassembly is required. When the Spline Nut is necessary to remove for the spline shaft due to the ball retaining design the steel balls will not fall apart like the traditional Nut design.

BALL SPLINE

### 1-1-4 *TBI MOTION* Ball Spline Type and Feature

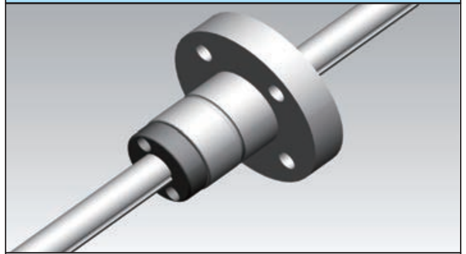
Spline Nut

#### SLT, SOT Non-flanged Spline Nut



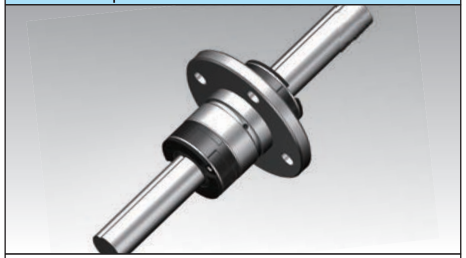
SLT, SOT Spline nut is with a straight cylindrical shape without flange. The standard mode of mounting a cylindrical nut is by using a key. The cylindrical nut will have a keyway and separate key. A matching keyway must be bored into the housing or block that will be mounted on the cylinder nut. The type SLT, SOT is the most compact profile Spline nut in TBI Ball Spline product line.

#### SLF, Flanged Spline Nut



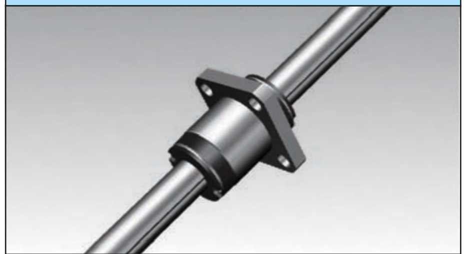
Flange nut is simpler to install because it only requires a rough bore and mounting holes drilled and tapped to secure the flange to the housing.

#### SZF, Flanged Spline Nut with Reinforced End Caps



The nut with reinforced end caps is suitable for the operation environment with high pollution. This is the design to avoid dirt going into the ball spline.

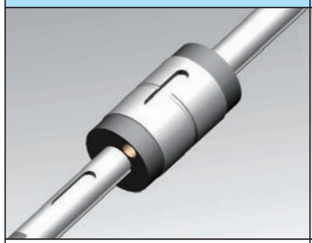
#### SOF, Square Flanged Spline Nut



The nut with square flange is easy to be installed to the housing through mounting holes and will be applied to 3C industry and semiconductor industry.

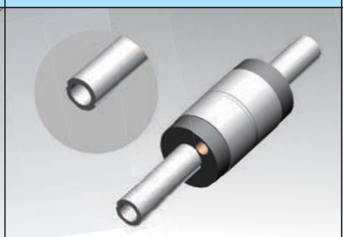
Spline Shaft

#### Standard Precision Spline Shaft



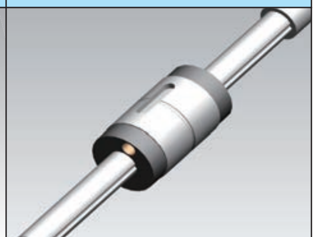
The Standard precision Spline shaft is precisely ground to reach high accuracy and smoothness.

#### Hollow Spline Shaft (H-Type)



Hollow Spline shaft is optional for the customer to choose for its application. Hollow Spline shaft is designed to reduce weight, accommodate pipes and ventilation.

#### Custom Machining Spline Shaft



TBI has the capability to manufacture custom made Spline shaft by machining it to meet the requirements of special Spline Shaft shape. For example, a shaft with a bigger diameter on both ends or on the center of Spline shaft can be manufactured upon request.



## 1-2 The Procedure of Select Ball Spline

Table 1.2.1

| Steps | Description |
|---|---|
| 1.Set the Operational conditions | ● Stroke Length：Ls<br>● Velocity：V<br>● The Applied Load：W<br>● Size<br>● Installation<br>● Operation environment<br>● Service life expectancy<br>● Accuracy<br>● Frequency of use (load cycle)<br>● Rigidity |
| 2.Select a Type | ● Refer to Type, Shaft Spec to determine the your Ball spline. |
| 3.Calculating the strength of Spline shaft | ● Spline Shaft Diameter<br>● Spline-Shaft Length<br>● End Fixity<br>● The permissible load of Ball spline<br>● The displacement under torque and delecting |
| 4.Service expectancy | IF: Calculating TBI Ball spline service life expectancy by using expectancy formula.<br>NO: NO Required service life. |
| 5.Determined the preload | ● Determined the permissible axial clearance／backlash |
| 6.Determine the Accuracy Grade | ● Accuracy Grades |
| 7.Operational condition | ● Lubrication<br>● Lubrication methods<br>● Surface treatment<br>● Dust prevention methods |
| | Selected |

## 2-1 The Strength of Spline Shaft

The Spline shaft is designed to absorb radial load and torque during operation. Therefore, the strength of Spline shaft must be taken into consideration when the Ball spline operates under extreme loading ortorque.

### 2-1-1 The Bending Load Applied on the Operating Ball Spline

The maximum of bending moment (M) can be attributed to multi factors such as the end fixity methods, length of Spline shaft, load capacity, etc. Equation (1) is equipped to help the user to obtain the ideal length of the Spline shaft in order to be the reference of obtaining the ideal strength of Ball spline.

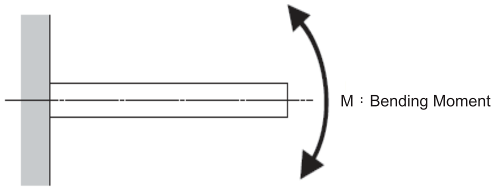



Fig 2.1.1

$$M = \sigma \cdot Z \text{ and } Z = \frac{M}{\sigma} \quad .....(1)$$

M：Bending moment (N-mm)

$\sigma$ ：Shaft permissible bending stress (98 N／mm$^2$)

Z：Shaft section modulus (mm$^3$)

※See Table 2.1.3, 2.1.4

### 2-1-2 The Torque Applied on the Operating Ball Spline

The maximum torque applied on the Spline shaft can be calculated through maximum twisting moment (T). Equation (2) is equipped to help the user to obtain the ideal length of the Spline shaft in order to be the reference of obtaining the ideal strength of Ball spline.

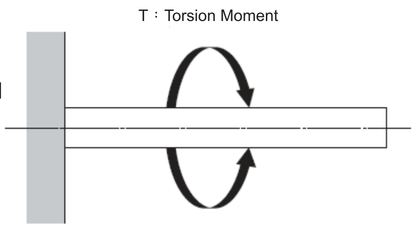



Fig 2.1.2

$$T = \tau a \cdot Z_P \text{ and } Z_P = \frac{T}{\tau a} \quad .....(2)$$

T：Maximum twisting moment (N・mm)

$\tau a$：Shaft permissible twisting Stress (49 N／mm$^2$)

Zp：Shaft polar section modulus (mm$^3$)

※See Table 2.1.3, 2.1.4

### 2-1-3 Both Bending Moment and Twisting Moment Applied Simultaneously on the Spline Shaft

To calculate the figure for both bending (M) and twisting moments (T) applied on the Spline shaft via equation (3) and (4) in order to get the equivalent bending moment (Me) and equivalent twisting moment (Te). Adopt the greater value from equation (3) and (4) to determine the ideal Spline-shaft length.

Equivalent Bending Moment

$$Me = \frac{M + \sqrt{M^2 + T^2}}{2} = \frac{M}{2}\left\{1 + \sqrt{1 + \left(\frac{T}{M}\right)^2}\right\} \quad .....(3)$$

$$Me = \sigma \cdot Z$$

Equivalent Twisting Moment

$$Te = \sqrt{M^2 + T^2} = M \cdot \sqrt{1 + \left(\frac{T}{M}\right)^2} \quad .....(4)$$

$$Te = \tau a \cdot Z_P$$

### 2-1-4 Rigidity of the Spline Shaft

The rigidity of the Spline Shaft is expressed in torsion angle caused by twisting moment. The twisting angle should be limited to no further than 0.25° per 1000 mm.

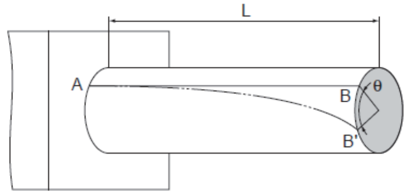



Fig 2.1.3

$$\theta = 57.3 \cdot \frac{T \cdot L}{G \cdot I_p} \quad .....(5)$$

$$\text{Shaft Rigidity} = \text{Torsion Angle／Unit Length} = \frac{\theta \cdot \ell}{L} < \frac{1°}{4}$$

$\theta$ ：Torsion Angle ( °)

L ：Shaft Length (mm)

G ：Shear Elastic Modulus (7.9・10$^4$N／mm$^2$)

$\ell$ ：Unit Length (1000mm)

Ip：Polar Moment of Inertia Ip (mm$^4$)

※See Table 2.1.3, 2.1.4

### 2-1-5 Deflection and Deflection Angle of the Spline Shaft

These should be calculated using equations satisfying the relevant operating conditions. Tables 2.1.1 & 2.1.2 present the operating conditions and the corresponding equations. Tables 2.1.3 & 2.1.4 presents the cross-section factors (Z) and cross-section secondary moments (I). Through the use of the Z, I values given in these tables, the strength and degree of displacement (deflection) of Ball spline model can be obtained.

Table 2.1.1 Deflection and Deflection-Angle Equation

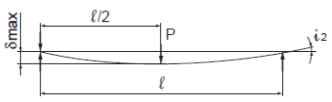
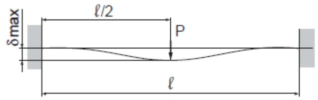
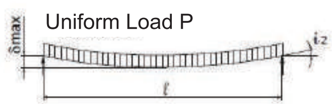
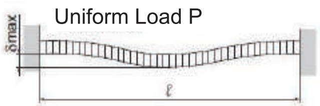
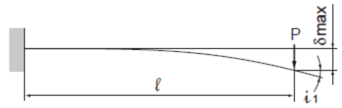
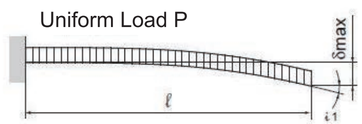
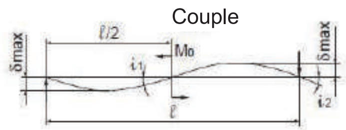
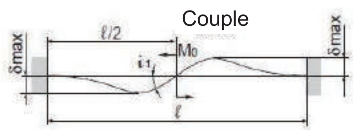
| End Fixity | Specification Conditions | Deflection Equation | Deflection-Angle Equation |
|---|---|---|---|
| Both Ends Free |  | $\delta_{max} = \frac{P\ell^3}{48EI}$ | $i_1 = 0$<br>$i_2 = \frac{P\ell^2}{16EI}$ |
| Both Ends Fixed |  | $\delta_{max} = \frac{P\ell^3}{192EI}$ | $i_1 = 0$<br>$i_2 = 0$ |
| Both Ends Free |  | $\delta_{max} = \frac{5P\ell^4}{384EI}$ | $i_2 = \frac{P\ell^3}{24EI}$ |
| Both Ends Fixed |  | $\delta_{max} = \frac{P\ell^4}{384EI}$ | $i_2 = 0$ |

Table 2.1.2 Deflection and Deflection-Angle Equation

| End Fixity | Specification Conditions | Deflection Equation | Deflection-Angle Equation |
|---|---|---|---|
| One Ends Free |  | $\delta_{max} = \frac{P\ell^3}{3EI}$ | $i_1 = \frac{P\ell^2}{2EI}$<br>$i_2 = 0$ |
| One Ends Fixed |  | $\delta_{max} = \frac{P\ell^4}{8EI}$ | $i_1 = \frac{P\ell^3}{6EI}$<br>$i_2 = 0$ |
| Both Ends Free |  | $\delta_{max} = \frac{\sqrt{3} M_0 \ell^2}{216EI}$ | $i_1 = \frac{M_0 \ell}{12EI}$<br>$i_2 = \frac{M_0 \ell}{24EI}$ |
| Both Ends Fixed |  | $\delta_{max} = \frac{M_0 \ell^2}{216EI}$ | $i_1 = \frac{M_0 \ell}{16EI}$<br>$i_2 = 0$ |

$\delta_{max}$ : Maximum Deflection (mm)

$i_1$ : Deflection Angle at a Loading Point (deg)

$i_2$ : Deflection Angle at a Supporting Point (deg)

$M_0$ : Moment (N-mm)

P : Concentrated Load (N)

p : Uniform Load (N／mm)

$\ell$ : Span (mm)

I : Geometrical Moment of Inertia ($mm^4$)

E : Longitudinal Elastic Modulus ($2.06 \cdot 10^5$ N／$mm^2$)

### 2-1-6 Critical Speed of Spline Shaft

When an operating Ball spline reaches critical speed, the mechanical resonance occurs and no further operation can be performed under mechanical resonance. Namely, to keep Ball Spline under ideal operational, the speed limit must be kept under monitor. Therefore, to set an ideal operational speed for safety factor must be settled as 80% of critical speed as shown on equation (6)

Critical Speed

$$N_c = \frac{60\,\lambda^2}{2\pi\cdot\ell_b^2}\cdot\sqrt{\frac{E\cdot 10^3\cdot I}{\gamma\cdot A}}\cdot 0.8 \quad .....(6)$$

$N_c$ : Critical Shaft Speed ($min^{-1}$)

$\ell_b$ : Center Distance (mm)

E : Young's Modulus ($2.06\cdot10^5$ N／$mm^2$)

I : Moment of Inertia of the Shaft ($mm^4$)

$$I = \frac{\pi}{64}d_1^4$$ $d_1$ : Diameter (mm)

$\gamma$ : Density (Specific Gravity) ($7.85\cdot10^{-6}$ kg／$mm^3$)

$$A = \frac{\pi}{4}d_1^2$$ $d_1$ : Diameter (mm)

A : Spline-Shaft Cross-Sectional Area ($mm^2$)

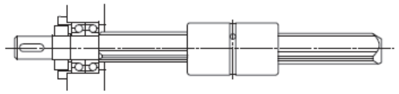
$\lambda$ : Installation-Method-Dependent Factor

(Fig 2.1.4) Fixed-Free $\lambda$ = 1.875

(Fig 2.1.5) Supported-Supported $\lambda$ = 3.142

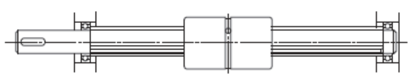
(Fig 2.1.6) Fixed-Supported $\lambda$ = 3.927

(Fig 2.1.7) Fixed-Fixed $\lambda$ = 4.73



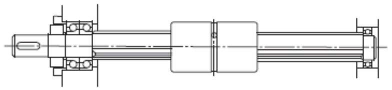

Fixed—Free

Fig 2.1.4



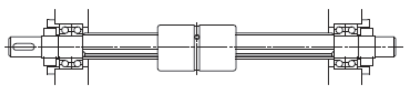

Simple — Simple

Fig 2.1.5




Fixed — Simple

Fig 2.1.6




Fixed — Fixed

Fig 2.1.7

### 2-1-7 Spline-Shaft Cross-Section

Table 2.1.3

| Nominal Diameter | | I ($mm^4$) | Ip ($mm^4$) | Z ($mm^3$) | Zp ($mm^3$) |
|---|---|---|---|---|---|
| SL 006 | Solid | 63.49 | 119.23 | 18.58 | 39.74 |
| | Hollow | 62.70 | 117.33 | 18.32 | 39.22 |
| SL 008 | Solid | 200.93 | 387.53 | 46.65 | 96.88 |
| | Hollow | 196.96 | 379.57 | 45.65 | 94.89 |
| SL 010 | Solid | 490.25 | 933.29 | 86.61 | 186.66 |
| | Hollow | 477.68 | 908.16 | 86.10 | 181.63 |
| SL 013 | Solid | 1400.81 | 2691.54 | 198.57 | 414.08 |
| | Hollow | 1282.96 | 2455.82 | 180.44 | 377.82 |
| SL 016 | Solid | 3215.60 | 6242.70 | 378.39 | 780.34 |
| | Hollow | 3014.53 | 5840.57 | 353.25 | 730.07 |
| SL 020 | Solid | 7851.80 | 15336.59 | 748.48 | 1533.66 |
| | Hollow | 7360.93 | 14354.84 | 699.39 | 1435.48 |
| SL 025 | Solid | 18466.30 | 36932.60 | 1477.30 | 2954.61 |
| | Hollow | 15981.25 | 31962.50 | 1278.50 | 2557.00 |
| SL 030 | Solid | 33122.31 | 77392.48 | 2579.75 | 4416.31 |
| | Hollow | 29905.32 | 70958.50 | 2365.28 | 3987.38 |
| SL 032 | Solid | 50322.85 | 100645.70 | 3145.18 | 6290.36 |
| | Hollow | 36586.19 | 73172.38 | 2286.64 | 4573.27 |
| SL 040 | Solid | 120667.43 | 241334.90 | 6033.37 | 12066.74 |
| | Hollow | 112813.45 | 225626.90 | 5640.67 | 11281.35 |
| SL 050 | Solid | 297123.73 | 594247.50 | 11884.95 | 23769.90 |
| | Hollow | 274691.98 | 549384.00 | 10987.68 | 21975.36 |

I : Geometrical moment of inertia ($mm^4$)　Ip : Polar moment of inertia ($mm^4$)

Z : Section modulus ($mm^3$)　Zp : Polar section modulus ($mm^3$)

Table 2.1.4

| Nominal Diameter | | I ($mm^4$) | Ip ($mm^4$) | Z ($mm^3$) | Zp ($mm^3$) |
|---|---|---|---|---|---|
| SO 008 | Solid | 200.95 | 389.81 | 47.22 | 97.45 |
| | Hollow | 196.97 | 381.86 | 46.22 | 95.46 |
| SO 010 | Solid | 490.68 | 956.77 | 93.22 | 191.35 |
| | Hollow | 478.11 | 931.64 | 90.71 | 186.33 |
| SO 012 | Solid | 1017.67 | 1998.75 | 163.51 | 333.13 |
| | Hollow | 954.05 | 1871.52 | 152.91 | 311.92 |
| SO 015 | Solid | 1678.22 | 3241.10 | 212.50 | 476.63 |
| SO 020 | Solid | 5382.92 | 10422.07 | 553.75 | 1145.28 |
| SO 025 | Solid | 12796.48 | 24659.94 | 1048.86 | 2182.30 |

I : Geometrical moment of inertia ($mm^4$)   Ip : Polar moment of inertia ($mm^4$)

Z : Section modulus ($mm^3$)   Zp : Polar section modulus ($mm^3$)

BALL SPLINE

## 2-2 Service Life Expectancy

### 2-2-1 Nominal Life

TBI define the nominal life of Ball Spline as 90% of the average running distance before flaking within in the Ball Spline on the same manufacture cycle. Please note that therefore the nominal life expectancy is only for reference use.

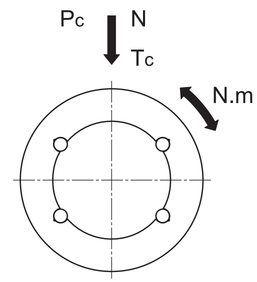



Fig 2.2.1

### 2-2-2 Calculating Nominal Life

The factors which influence the service life for Ball Splines can be attributed to three main aspects, the torque, radial load and moment. The influence of each aspect can be calculated through equations (7) to (10).

**Under a Torque**

$$L = \left( \frac{f_T \cdot f_C}{f_W} \cdot \frac{C_T}{T_C} \right)^3 \cdot 50 \quad .....(7)$$

**Under a Radial Load**

$$L = \left( \frac{f_T \cdot f_C}{f_W} \cdot \frac{C}{P_C} \right)^3 \cdot 50 \quad .....(8)$$

L : Nominal Life (km)

$C_T$ : Basic Dynamic-Torque (N-m)

$T_C$ : Calculated Torque Applied (N-m)

C : Basic Dynamic-Load Rating (N)

$P_C$ : Radial Load (N)

$f_T$ : Temperature (See Fig 2.2.2)

$f_C$ : Contact (See Table 2.2.1)

$f_W$ : Load Factor (See Table 2.2.2)

**Under both a torque and radial load applied simultaneously**

In this case, calculate the equivalent radial load to determine service life by equation (9).

$$P_E = P_C + \frac{4 \cdot T_C \cdot 10^3}{i \cdot BCD \cdot \cos\alpha} \quad .....(9)$$

$P_E$ : Equivalent radial Load (N)

$\cos\alpha$ : Contact Angle

$i$ : Number of Loaded Rows of Balls

BCD : Ball Center to Center Shaft Diameter (mm) (See Table 3.1.1)

**Under a moment on one spline nut or two closely linked to one another**

Obtain the equivalent radial load using the equation, and determine the service life by equation (10).

$P_u = K \cdot M$ .....(10)

$P_u$ : Equivalent Radial Load (N)(Moment Applied)

K : Equivalent Factor (See Table 2.2.3)

M : Applied Moment (N-mm)

Hower, M should be within the range of the stacic permissible moment.

**Under both a moment and radial load applied simultaneously**

Calculate the service life from the sum of the radial load and the equivalent radial load.

### Calculating Nominal Life

Once the nominal life (L) is obtained, if the stroke length and the number of reciprocal operations are consistent, the service life in hours can be obtained by using the following equation.

$$L_h = \frac{L \cdot 10^3}{2 \cdot \ell_s \cdot n_1 \cdot 60} \quad .....(11)$$

$L_h$ : Service Life in Hours (h)

$\ell_s$ : Stroke Length (m)

$n_1$ : Number of Reciprocal Operations per Minute ($min^{-1}$)

### Temperature Factor ( $f_T$ )

When the Ball Spline operates in an environment which the temperature reaches 100°C or higher, considering that the heat may adversely affect the operation of the Ball Spline. To avoid malfunction under extreme temperature, Fig 2.2.2 should be taken into account. In addition that the material of Ball Spline should be heat resistant and custom made when use under extreme environment.

※Please inform TBI sales for upgrading the material for the operation environment exceeds 80°C for the reason that the materials of seal and retainers should be upgraded to sustain the high-temperature.

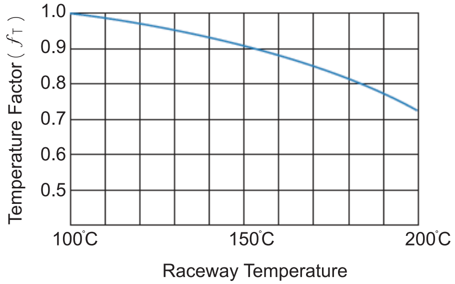



Fig 2.2.2 Temperature Factor ( $f_T$ )

### Contact Factor ( $f_C$ )

When one or multiple Spline nuts mounts on the Spline shaft closeley , their linear motion is affected by moments and mounting accuracy, resulting in nonuniform load distribution. When closely linked spline nuts are used, multiply the basic load rating ( C or $C_0$ ) by one of the contact factors specifiedbelow.

※If a non-uniform load distribution is expected, as in large equipment, take the contact factor explained in Table 4 into account.

Table 2.2.1 Contact Factor ( $f_C$ )

| No. of Spline nuts Linked | $f_C$ |
|---|---|
| 2 | 0.81 |
| 3 | 0.72 |
| 4 | 0.66 |
| 5 | 0.61 |
| In Normal Use | 1.0 |

### Load Factor ( $f_W$ )

The operation of reciprocal machines is likely to cause vibration and impact. It is difficult to determine the rating of vibration, impact in the event of vibration, and repeated impact during high speed operation, and triggering and ceasing of operation. Therefore, when loads exerted on a linear-motion or operation velocity and vibration is extreme.Take the basic load rating (C or $C_0$) and multiply the figure shown in table 2.2.2

Table 2.2.2 Load Factor ( $f_W$ )

| Vibration Impact | Velocity (V) | $f_W$ |
|---|---|---|
| Minor | Minor velocity $V \leqq 0.25$ m/s | 1-1.2 |
| Little | Low velocity $0.25 < V \leqq 1.0$ m/s | 1.2-1.5 |
| Medium | Medium Velocity $1.0 < V \leqq 2.0$ m/s | 1.5-2.0 |
| Heavy | High velocity $V > 2.0$ m/s | 2.0-3.5 |



## 2-2-3 Calculating the Average Applied Load

The Applied load fluctuates during the operation of Ball Spline, For example, the applied load during the activities of an industrial robotic arm is different before holding a workpiece and return without a machine tool, the spline nut of the Ball Spline receives varying loads. Therefore, variables of the applied which influence the to calculate the service life of Ball Spline under on the hose-system operating conditions. The service life of the Ball Spline should therefore be calculated in consideration of such fluctuations in load. The mean load ( Pm ) is the load under which the service life of the Ball Spline becomes equivalent to that under varying loads exerted on the spline nut while in operation.

### The Equation is as below

$$P_m = \sqrt[3]{\frac{1}{L} \cdot \sum_{n=1}^{n} ( P_n^3 \cdot L_n )}$$

$P_m$ : Mean Load (N)

$P_n$ : Fluctuating Load (N)

$L$ : Total Running Distance (mm)

$L_n$ : Running Distance Under Load $P_n$ (mm)

### For Loads That Change Stepwise

$$P_m = \sqrt[3]{\frac{1}{L} ( P_1^3 \cdot L_1 + P_2^3 \cdot L_2 .....P_n^3 \cdot L_n )}$$

$P_m$ : Mean Load (N)

$P_n$ : Fluctuating Load (N)

$L$ : Total Running Distance (mm)

$L_n$ : Running Distance Under Load Pn (mm)

### For Loads That Change Monotonically

$$P_m \fallingdotseq \frac{1}{3} ( P_{min} + 2 \cdot P_{max} )$$

$P_{min}$ : Minimum Load (N)

$P_{max}$ : Maximum Load (N)

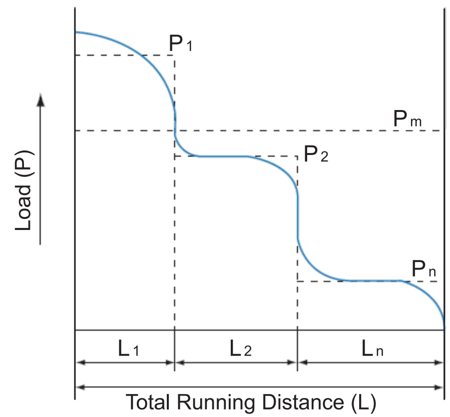



Fig 2.2.3

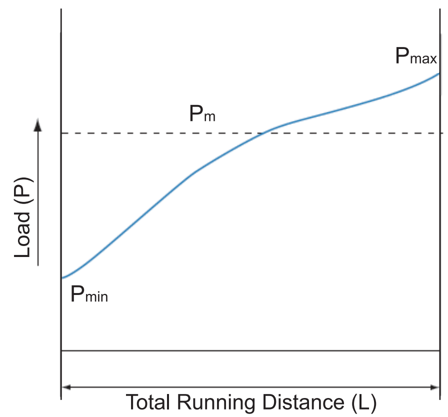



Fig 2.2.4

For Loads That Change Sinusoidal

(a) $P_m \fallingdotseq 0.65\ P_{max}$

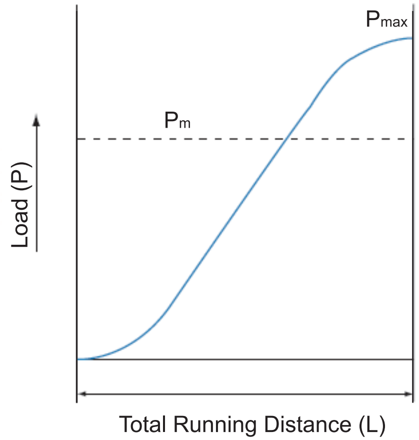



Fig 2.2.5

(b) $P_m \fallingdotseq 0.75\ P_{max}$

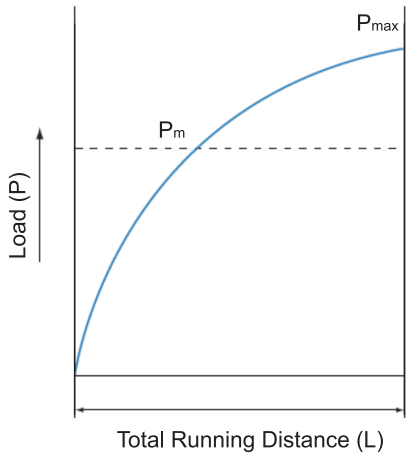



Fig 2.2.6

### 2-2-4 Equivalent Factor

Table 2.2.3 Equivalent Factor

| Model No. | Equivalent Factor : K | |
|---|---|---|
| | One Spline Nut | Two Spline Nuts |
| SL 06 | 0.577 | 0.065 |
| SL 08 | 0.577 | 0.059 |
| SL 10 | 0.418 | 0.047 |
| SL 13 | 0.360 | 0.043 |
| SL 16 | 0.229 | 0.033 |
| SL 20 | 0.201 | 0.029 |
| SL 25 | 0.154 | 0.023 |
| SL 30 | 0.126 | 0.021 |
| SL 32 | 0.114 | 0.019 |
| SL 40 | 0.110 | 0.016 |
| SL 50 | 0.109 | 0.013 |

| Model No. | Equivalent Factor : K | |
|---|---|---|
| | One Spline Nut | Two Spline Nuts |
| SZ 06 | 0.747 | 0.086 |
| SZ 08 | 0.710 | 0.077 |
| SZ 10 | 0.616 | 0.062 |
| SZ 13 | 0.454 | 0.057 |
| SZ 16 | 0.294 | 0.041 |
| SZ 20 | 0.248 | 0.037 |
| SZ 25 | 0.192 | 0.029 |
| SZ 30 | 0.163 | 0.026 |
| SZ 40 | 0.138 | 0.020 |
| SZ 50 | 0.130 | 0.017 |

| Model No. | Equivalent Factor : K | |
|---|---|---|
| | One Spline Nut | Two Spline Nuts |
| SO 08 | 0.400 | 0.061 |
| SO 10 | 0.308 | 0.052 |
| SO 12 | 0.253 | 0.046 |
| SO 15 | 0.219 | 0.040 |
| SO 20 | 0.186 | 0.031 |
| SO 25 | 0.154 | 0.026 |

## 2-3 Calculating the Service Life

### Horizontal Application

A 300 mm long Ball Spline supported by two fixed nuts on each end setup for an horizontal application, the load of the Spline falls vertically downward on the fixed side with 30 mm away from the center of ball spline with the gravity force of W = 30 kg. The figure is shown as Fig 2.3.1

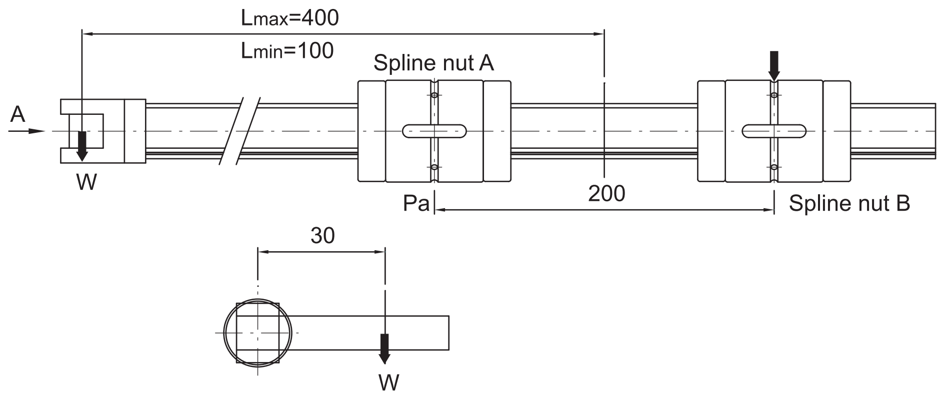



Fig 2.3.1

### A.Calculates the Spline Shaft Strength

The present structure of ball spline is an extended bridge, it is designed to absorb torque, therefore, the maxima bending load occurs on Spline nut A :

Maxima Bending Moment $M = 30 \cdot 9.81 \cdot 400 = 117720$ N-mm

Maxima Torsion Moment $T = 30 \cdot 9.81 \cdot 30 = 8829$ N-mm

For Ball Spline shafts subjected to the simultaneous application of torsion and bending loads, thus the calculation should include Equivalent Bending Moment, $M_e$ and Equivalent Torsion Moment $T_e$ :

$$M_e = \frac{M + \sqrt{M^2 + T^2}}{2} = 117885 \text{ N-mm} \qquad T_e = \sqrt{M^2 + T^2} = 118051 \text{ N-mm}$$

$T_e > M_e$

$\because T_e = \tau a \cdot Z_p$

$\therefore Z_p = T_e / \tau a = 118051 / 49 = 2409.2\ mm^3$

According to figure of cross section showed on the spline (Table 2.1.3, 2.1.4), the minimum of 25 mm in diameter is required to in order to gain enough of strength for Ball Spline, therefore, SLF25 matches the requirement above thus choose SLF25.

## B.Calculating the Mean Load

When the bridge extension reached Lmax = 400mm, it reaches it' maxima load ( Pmax )
When it retrieved back to Lmin = 100mm, it absorbed the minimum of load ( Pmin )
According to mechanics it allows us to find out the maxima and minimum Radial Load of Nut A and nut B :

$P_{Amax} = 30 \cdot 9.81 \cdot (400+200) / 200 = 882.9$ N $\qquad P_{Bmax} = 30 \cdot 9.81 \cdot 400 / 200 = 588.6$ N

$P_{Amin} = 30 \cdot 9.81 \cdot (100+200) / 200 = 441.5$ N $\qquad P_{Bmin} = 30 \cdot 9.81 \cdot 100 / 200 = 147.2$ N

When the movement of Ball Spline occurs, the load on the spline is gradual and repeated, according to Fig 2.2.4 the equation of the load on ball spline is shown as :

$P_{Am} = 1/3\ ( P_{Amin} + 2P_{Amax} ) = 735.8$ N $\qquad P_{Bm} = 1/3\ ( P_{Bmin} + 2P_{Bmax} ) = 441.5$ N

The nuts receive both torsion and bending load simultaneously, therefore assuming that the torsion lies equally on the nuts. The equation for torsion is shown as T ' :

$T' = T/2 = 30 \cdot 9.81 \cdot 30/2 = 4414.5$ N-mm

The equivalent factor Pe ( B12, equation (9) ) :

$$P_e = P_m + \frac{4 \cdot T'}{i \cdot dp \cdot \cos\alpha}$$

$$P_{AE} = 735.8 + \frac{4 \cdot 4414.5}{4 \cdot 27 \cdot \cos 50^\circ} = 990.2 \text{ N} \qquad P_{BE} = 441.5 + \frac{4 \cdot 4414.5}{4 \cdot 27 \cdot \cos 50^\circ} = 695.9 \text{ N}$$

## C.Service Life Ball Spline

Nut A life $L_A = \left( \frac{f_T \cdot f_C}{f_W} \cdot \frac{C}{P_{AE}} \right)^3 \cdot 50 = 14518$ km

Nut B life $L_B = \left( \frac{f_T \cdot f_C}{f_W} \cdot \frac{C}{P_{BE}} \right)^3 \cdot 50 = 41829$ km

Factors
$f_T$ : Temperature = 1
$f_C$ : Friction = 1
$f_W$ : Load = 1.5
C : Coa = 9835 N

The service life of Ball Spline is correlated with Nut A and the of service life is estimated as 14518 km.



## Vertical Application

A 1200 mm long ball spline with stroke of 1000 mm is mounted on a working platform supported by two fixed nuts on both end. The geometry is shown as Fig 2.3.2

The point of drive force F is $X_1$ = 50 mm, from the center of Ball Spline, the weight platform $W_1$ is 27 kg, the center of the weight is $X_2$ = 300 mm, away from the center of ball spline, the working cycle of platform is a carriage of $W_2$ = 5 kg, with a downward movement for 5 sec hold for 10 sec, and elevation for 5 sec hold for 10 sec to unload the carriage repeatedly. The center of gravity of carriage is $X_3$ = 500 mm, from the center of ball spline, the travelling of velocity is shown as Fig 2.3.2

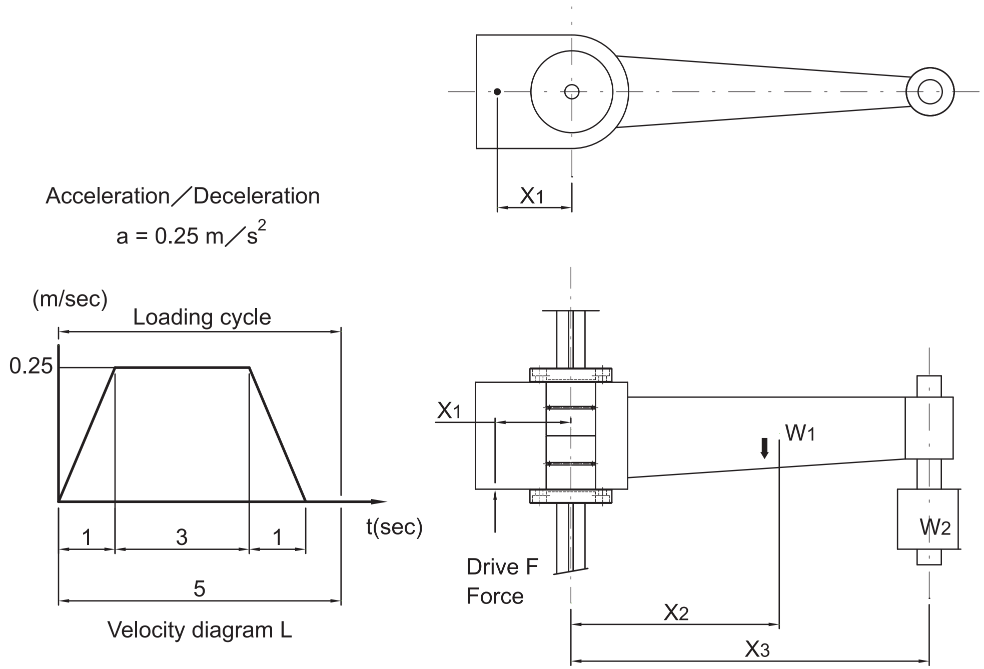



Fig 2.3.2

### A. Analysis on Different Stage of Exertion

Inertial force occurs when a platform is in working modes, drive force is the source of the inertial force.

Inertial force of a $m/s^2$ in acceleration ascent and deceleration decent : $F = W \cdot (9.81+a)$

Inertial force of Constant velocity in acceleration and deceleration : $F = W \cdot (9.81)$

Inertial force of a $m/s^2$ in acceleration decent and deceleration ascent : $F = W \cdot (9.81-a)$

Below are the equations of the bending force absorb by the nuts during acceleration, constant velocity, deceleration while ball ascent and decent.

(1) Without carriage (Acceleration while decent)

$M_{da} = W_1 \cdot (9.81-a) \cdot 300 + W_1 \cdot (9.81-a) \cdot 50 = 90342$ N-mm

(2) Without carriage (Constant velocity while decent)

$M_{dc} = W_1 \cdot (9.81) \cdot 300 + W_1 \cdot (9.81) \cdot 50 = 92704.5$ N-mm

(3) Without carriage (Deceleration while decent)

$M_{dd} = W_1 \cdot (9.81+a) \cdot 300 + W_1 \cdot (9.81+a) \cdot 50 = 95067$ N-mm

(4) With carriage (Acceleration while ascent)

$M_{aa} = W_1 \cdot (9.81+a) \cdot 300 + W_1 \cdot (9.81+a) \cdot 50 + W_2 \cdot (9.81+a) \cdot 500 + W_2 \cdot (9.81+a) \cdot 50$
$= 122732$ N-mm

(5) With carriage (Constant velocity while ascent)

$M_{ac} = W_1 \cdot (9.81) \cdot 300 + W_1 \cdot (9.81) \cdot 50 + W_2 \cdot (9.81) \cdot 500 + W_2 \cdot (9.81) \cdot 50$
$= 119682$ N-mm

(6) With carriage (Deceleration while ascent)

$M_{ad} = W_1 \cdot (9.81-a) \cdot 300 + W_1 \cdot (9.81-a) \cdot 50 + W_2 \cdot (9.81-a) \cdot 500 + W_2 \cdot (9.81-a) \cdot 50$
$= 116632$ N-mm

### B. The Calculation of Spline Strength

The present structure of ball spline is supported by two fixed nuts on both ends with an bridge of absorbing bending in the middle. it designed to absorb torque. According to mechanics the maxima bending load occurs on the supporting end. The Maxima Bending Moment should occur on at the end of acceleration.

Maxima Bending Moment $M = 122732$ N-mm

$\therefore Z = M / \sigma a = 122732 / 98 = 1252.4 \text{ mm}^3$

According to figure of cross section showed on the spline, the minimum of 25 mm in diameter is required to in order to gain enough of strength for Ball Spline, therefore SLF25 matches the requirement above thus choose SLF25.

### C. Calculating the Mean Load

The nuts and spline mainly affect by the force of bending, therefore represent ( B12, equation (10) ) by converting the force of bending into radial load.

$P_n = K \cdot M$

According to Table 2.2.3, when joint two SLF25 nuts, The equivalent factor K = 0.023

$P_{da} = 0.023 \cdot 90342 = 2078$ N　　$P_{aa} = 0.023 \cdot 122732 = 2822.8$ N

$P_{dc} = 0.023 \cdot 92704.5 = 2132.2$ N　　$P_{ac} = 0.023 \cdot 119682 = 2752.7$ N

$P_{dd} = 0.023 \cdot 95067 = 2186.5$ N　　$P_{ad} = 0.023 \cdot 116632 = 2682.5$ N

The average load in every time peroid can be calculate as $P_m$ :

| | | |
|---|---|---|
| $P_m = \sqrt[3]{\frac{1}{L} \cdot \sum_{n=1}^{n} (P_n^3 \cdot L_n)}$ | $P_m$ : Average Load<br>$P_n$ : Load in variable<br>L : Total service distances<br>$L_n$ : $P_n$ Service distances under loading | (N)<br>(N)<br>(mm)<br>(mm) |

$$P_m = \sqrt[3]{\frac{1}{1000} \left\{125 \cdot 2078^3 + 750 \cdot (2132.2)^3 + 125 \cdot (2822.8)^3 + 750 \cdot (2752.7)^3 + 125 \cdot (2682.5)^3\right\}}$$

$= 2481.6$ N

### D. Analysis of Ball Spline Service Life

$$\text{Service Life } L = \left( \frac{f_T \cdot f_C}{f_W} \cdot \frac{C}{P_m} \right)^3 \cdot 50 = 922 \text{ km}$$

$f_T$ : Temperature = 1

$f_C$ : Friction = 1

$f_W$ : Load = 1.5

$C$ : Coa = 9835 N

## 2-4 Determining the Preload

The preload a significant factor toward the accuracy, load resistance and rigidity of Ball Spline during operation. Therefore, it is very important to determine the most appropriate size of the clearance for your purpose of use. The size of the clearance is standardized for each type, enabling the one best-suited for operating conditions to be selected.

### 2-4-1 Clearance in the Rotational Direction

With the Ball Spline, the sum of clearances in the circumferential direction is standardized as the clearance in the rotational direction. Clearance in the Rotational Direction. (BCD)

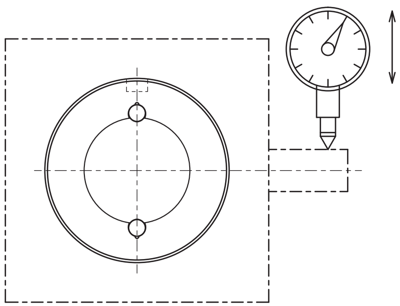


Fig 2.4.1

### 2-4-2 Preload and Rigidity

The preload is the load applied to balls prior to use for the purposes of eliminating angular backlash (clearance in the rotational direction) and improving rigidity. The application of a preload can eliminate angular backlash in the Ball Spline in accordance with the level of applied preload, and can improve rigidity. Fig 2.4.2 shows the amount of displacement in the rotational direction when a rotational torque is applied. As shown, the effect of pre-loading continues until the torque becomes Fig 2.4.2 times greater than the preload applied. Compared with a setting without a preload, displacement at the same rotational torque is half that under a preload or less, and the rigidity is twice as great.

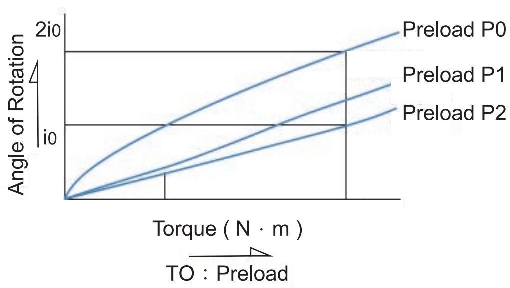



Fig 2.4.2



### 2-4-3 Operating Conditions and Determination of the Preload Level

Table 2.4.1 presents guidelines for determining the appropriate clearance in the rotational direction for the given operating conditions. The rotational clearance of the Ball Spline significantly affects the accuracy and rigidity of the Spline nut. Therefore, it is critical to select the clearance best suited for the intended uses of the Ball Spline. Normally, the Ball Spline in use is preloaded. When it is subjected to repeated swiveling and reciprocal linear motion, a system receives heavy vibration and impact. In such an environment, preloading prolongs the service life and improves accuracy.

Table 2.4.1 Guidelines for Determining an Appropriate Ball Spline Clearance according the Rotational Direction.

| | Preload | Operating conditions | Applications |
|---|---|---|---|
| Clearance in the Rotational Direction | Medium Preload P2 | • High rigidity is required. Vibration and impact are severe.<br>• The moment load must be borne by a single spline nut. | • Construction-work-vehicle steering shaft.<br>• Spot-welding-machine shaft.<br>• Automatic-lathe-tool rest indexing shaft. |
| | Light Preload P1 | • Hanging loads and moments are applied.<br>• Highly reproducible accuracy is required.<br>• Alternate loads are applied. | • Industrial robot arm Various automatic.<br>• loaders.<br>• Automatic-painting-machine guide shaft.<br>• Electric-discharge-machine spindle.<br>• Press die-set guide shaft.<br>• Drilling-machine spindle. |
| | No Preload P0 | • Smooth movement should be achieved with only a low magnitude of force.<br>• Torque is continually applied in a given direction. | • Various measuring instruments.<br>• Automatic drafting machine.<br>• Shape-measuring instrument.<br>• Dynamometer.<br>• Wire winder.<br>• Automatic arc cutter.<br>• Honing-machine spindle.<br>• Automatic packing machine. |

Table 2.4.2 Ball spline Clearance in the Rotational Direction

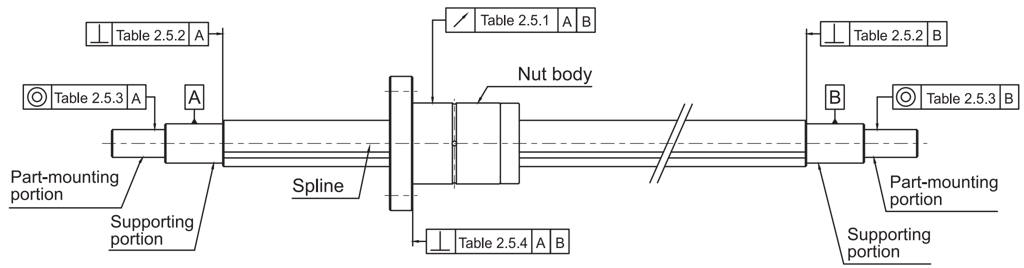
Unit : $\mu$m

| Nominal Diameter \ Preload | No Preload P0 | Slight Preload P1 | Medium Preload P2 |
|---|---|---|---|
| 6, 8, 10, 12, 13 | -2~+1 | -6~-2 | - |
| 15, 16, 20 | -2~+1 | -6~-2 | -9~-5 |
| 25, 30 | -3~+2 | -10~-4 | -14~-8 |
| 40, 50 | -4~+2 | -16~-8 | -22~-14 |

# 2-5 Accuracy

## 2-5-1 Accuracy Grade

The accuracy of the Ball Spline is determined by the spline-nut and thus divided into three accuracy grades of Normal(N), High(H), and Precision(P).




## 2-5-2 Accuracy Specifications

Tables 2.5.2~2.5.5 indicates the the tolerance of callout of the Ball Spline.

Table 2.5.1 The tolerance of Spline Nut on the Support Unit

Unit : μm

| Length (mm) \ Nominal Diameter (mm) | | 6, 8 | | | 10 | | | 13, 16, 20 | | | 25, 30 | | | 40, 50 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Above | Below | N | H | P | N | H | P | N | H | P | N | H | P | N | H | P |
| - | 200 | 72 | 46 | 26 | 59 | 36 | 20 | 56 | 34 | 18 | 53 | 32 | 18 | 53 | 32 | 16 |
| 200 | 315 | 133 | 89 | 57 | 83 | 54 | 32 | 71 | 45 | 25 | 58 | 39 | 21 | 58 | 36 | 19 |
| 315 | 400 | 185 | 126 | 82 | 103 | 68 | 41 | 83 | 53 | 31 | 70 | 44 | 25 | 63 | 39 | 21 |
| 400 | 500 | 236 | 163 | 108 | 123 | 82 | 51 | 95 | 62 | 38 | 78 | 50 | 29 | 68 | 43 | 24 |
| 500 | 630 | - | - | - | 151 | 102 | 65 | 112 | 75 | 46 | 88 | 57 | 34 | 74 | 47 | 27 |
| 630 | 800 | - | - | - | 190 | 130 | 85 | 137 | 92 | 58 | 103 | 68 | 42 | 84 | 54 | 32 |
| 800 | 1000 | - | - | - | - | - | - | 170 | 115 | 75 | 124 | 83 | 52 | 97 | 63 | 38 |
| 1000 | 1250 | - | - | - | - | - | - | - | - | - | 151 | 102 | 65 | 114 | 76 | 47 |

Table 2.5.2 The Maximum Perpendicularity of Spline Shaft End on the Journal Ends

Unit : μm

| Nominal Diameter (mm) \ Accuracy | Normal (N) | High (H) | Precision (P) |
|---|---|---|---|
| 6, 8, 10 | 22 | 9 | 6 |
| 12, 13, 15, 16, 20 | 27 | 11 | 8 |
| 25, 30 | 33 | 13 | 9 |
| 40, 50 | 39 | 16 | 11 |

Table 2.5.3 The Maximum Radial Call Out on the Attach Surface

Unit : μm

| Nominal Diameter (mm) \ Accuracy | Normal (N) | High (H) | Precision (P) |
|---|---|---|---|
| 6, 8 | 33 | 14 | 8 |
| 10 | 41 | 17 | 10 |
| 12, 13, 15, 16, 20 | 46 | 19 | 12 |
| 25, 30 | 53 | 22 | 13 |
| 40, 50 | 62 | 25 | 15 |

Table 2.5.4 The Perpendicularity of Flange on the Attach Surface

Unit : μm

| Nominal Diameter (mm) \ Accuracy | Normal (N) | High (H) | Precision (P) |
|---|---|---|---|
| 6, 8 | 17 | 11 | 8 |
| 10, 12, 13 | 33 | 13 | 9 |
| 15, 16, 20, 25, 30 | 30 | 16 | 11 |
| 40, 50 | 46 | 19 | 13 |

Table 2.5.5 The Accuracy Level on the Effective Length Accuracy

Unit : μm

| Accuracy | Normal (N) | High (H) | Precision (P) |
|---|---|---|---|
| Permissible | 33 | 13 | 6 |

※Measurement according to any 100mm on the Spline shaft.

BALL SPLINE

## 2-6 Lubrication

The spline nut is prelubricated prior to shipment for immediate use and the maintenance period is varied according to the operating conditions. TBI suggested that under normal operation condition re-lubricate your TBI Ball Spline after 100 Km (6-12 months) of operation. Apply lubricant within the nut body or on the groove of Spline shaft.

## 2-7 Material and Surface Treatment

***TBI MOTION*** provides customize material and surface treatment in order to meet extreme operation condition. Please contact ***TBI MOTION*** service window for customized surface treatment and material.



## 2-8 Precautions of Ball Spline

### 2-8-1 General Maintenance

(1) Disassemble ball spline without supervise of ***TBI MOTION*** certified engineer will cause malfunction on the ball spline.

(2) Gravity causes the spline nut slides when lining the ball spline, handle with care.

(3) Do not hammer, free fall the ball spline such action will damaging the ball spline and might hinder the performance of ball spline.

(4) Prevent debris, scraps from intervene the ball spline cause it will decrease the performance to ball spline or lead to malfunction.

(5) Prevent the ball spline operates under extreme condition. Contact ***TBI MOTION*** service window when the TBI ball spline is intend to use under extreme condition.

(6) Coolant might casue malfunction on the ball spline, please contact ***TBI MOTION*** certified engineer for consulting the use of coolant.

(7) Clean attached debris and scraps before relubrication.

(8) Please contact ***TBI MOTION*** certified engineer for consulting when the ball spline is designed to operates under frequently vibrates, vacuum, extreme high and low temperature condition.

(9) Please contact ***TBI MOTION*** certified engineer for consulting when mounting a through hole on the flanged ball spline.

### 2-8-2 Lubrication

(1) Remove anti-dust oil before seal the ball spline with grease.

(2) Prevent mix different kind of grease, it will cause unexpected chemical deform.

(3) Please contact ***TBI MOTION*** certified engineer for consulting the use of grease when the ball spline is designed to operates under frequently vibrates, vacuum, extreme high and low temperature condition.

(4) Please contact ***TBI MOTION*** certified engineer for consulting the use NON ***TBI MOTION*** certified grease.

(5) When using of motor oil to serve the purpose of lubrication, it might cause performance declining due to the un-proper installation. Please contact ***TBI MOTION*** certified engineer for consulting.

### 2-8-3 Storage

Prevent extreme temperature and humidity when store ball spline, also use ***TBI MOTION*** certified seal and storage and it in a horizontal position.

## 2-9 Mounting

### 2-9-1 Tolerance on Support Unit

Ball spline nut and its support unit is bore to minimize the clearance. If high accuracy is not required, then a clearance fit can be used.

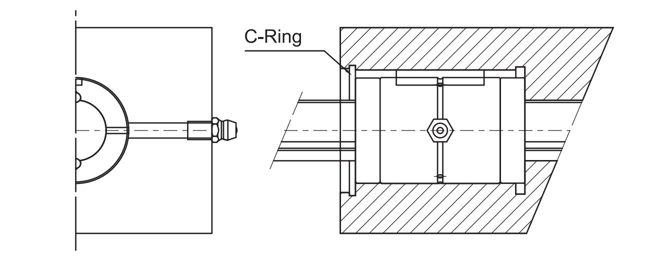
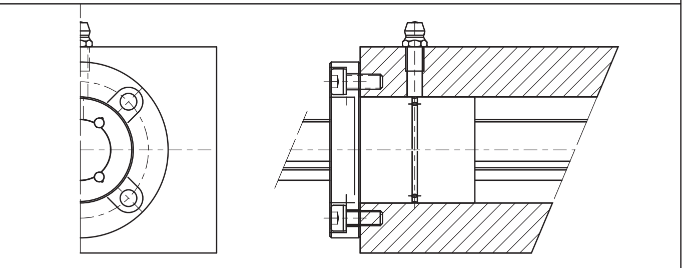
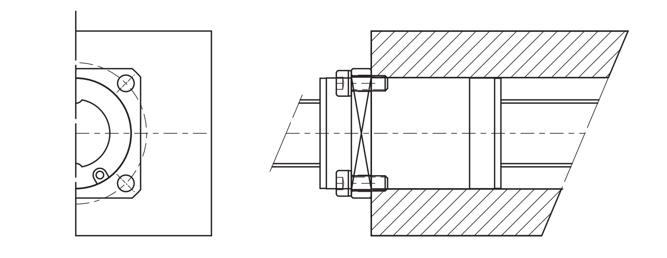
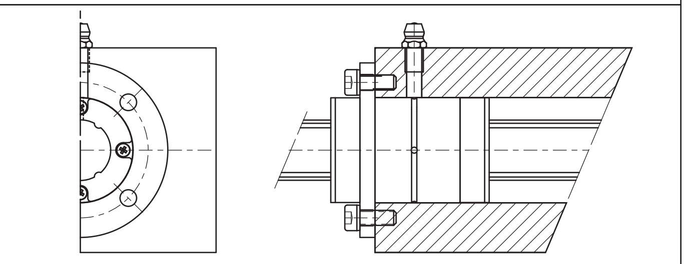
Table 2.9.1

| Condition | Tolerance within Support Unit |
|---|---|
| General Operation Condition | H7 |
| Operation Under Minimize of Axial Clearance | J6 |

## 2-9-2 Installation of Ball Spline

The installation of the ball spline is shown as Fig 2.9.2 Though the strength of mounting is not strictly standard, but it has to be certain that the the spline shaft has to be firmly fixed on the support unit.

Table 2.9.2 Sample of Spline-Nut Assembly

| | |
|---|---|
| SLT, SOT (C-Ring Type) |   |
| SLF (Flange One -Stage Type) |  |
| SOF (Flange One -Stage Type) |  |
| SZF (Flange One -Stage Type) |  |

## 2-9-3 Installation of Spline Nut

When intalling a spline nut into the spline shaft, use a jig like Fig 2.9.1 to insert the spline but with care.

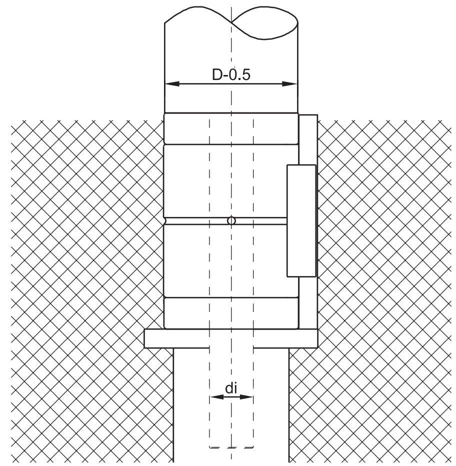



Fig 2.9.1

Table 2.9.3 Specifications of the jig

Unit : mm

| Model | Nominal Diameter | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 30 | 40 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL, SZF | di | 5.0 | 7.0 | 8.5 | 11.5 | 14.5 | 18.5 | 23 | 28 | 37.5 | 46.5 |
| Model | Nominal Diameter | - | 8 | 10 | 12 | 15 | 20 | 25 | - | - | - |
| SO | di | - | 7.0 | 8.5 | 10.5 | 11 | 16 | 20.5 | - | - | - |

## 3-1 Nominal Model Code of Ball Spline SL, SZ Series

### 3-1-1 Nominal Model Code

***TBI MOTION*** ball Splines can be classified into interchangeable and non- interchangeable types. Their dimensions are the same; the only difference between the two types is that for non-interchangeable series, ***TBI MOTION*** will finish every process in the production line and hit customers' demands for preload and accuracy. Interchangeable nuts and shafts can be freely exchanged and the standard of the preload is P0. Customers could adjust the preload by changing the steel balls inside of the nut by themselves. It is very convenient for customers to have ***TBI MOTION*** ball splines in inventory and make the preload and end machining by themselves. ***TBI MOTION*** is proud of internal quality control process which is under strict international regulation.

#### Non-interchangeable Type Code：

SLF 006 T2 N N S - 500 - P0 - B2 + N3 N3

Spline Nut
SLF：Flanged
SLT：Cylindrical
SZF：Dust-proofed

Nominal Diameter
Unit：mm

Groove
T2：2 Rows T4：4 Rows

Flange Type
N：Round (No Symbol When It is Without the Flange)

Accuracy Grade of Spline Shaft
N：Normal H：High P：Precision

Spline Shaft Type
S：Solid H：Hollow

Overall Length of Spline Shaft
Unit：mm

Preload Value
P0：No preload P1：Light preload P2：Medium preload

Number of Spline Nut
(Leave blank if only one nut is required) Ex：Two install two spline nuts in a shaft：B2

Nut Surface Treatment
S：Standard B1：Black Oxidation N1：Hard Chrome Plating P：Phosphating N3：Nickel Plating N4：Raydent

Shaft Surface Treatment
S：Standard B1：Black Oxidation N1：Hard Chrome Plating P：Phosphating N3：Nickel Plating N4：Raydent

※No symbol required when no plating is need.

## Nominal Model Code for Interchangable SL, SZ Type

#### Interchangeable Type of Spline Nut：

SLF 006 T2 N + N3

Spline Nut
SLF：Flanged
SLT：Cylindrical

Nominal Diameter
Unit：mm

Groove
T2：2 Rows T4：4 Rows

Flange Type
N：Round (No Symbol When It is Without the Flange)

Nut Surface Treatment
□：Standard B1：Black Oxidation N1：Hard Chrome Plating P：Phosphating N3：Nickel Plating N4：Raydent

#### Interchangeable Type of Spline Shaft：

SC 006 T2 N S - 500 + N3

Nominal Model Code

Nominal Diameter
Unit：mm

Groove
T2：2 Rows T4：4 Rows

Accuracy Grade of Spline Shaft
N：Normal

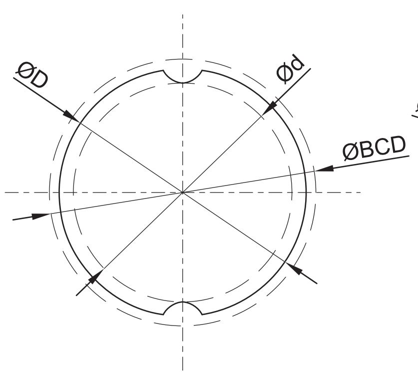
Spline Shaft Type
S：Solid H：Hollow

Overall Length of Spline Shaft
Unit：mm

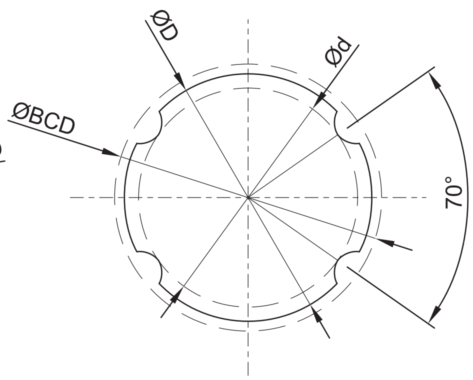
Shaft Surface Treatment
□：Standard B1：Black Oxidation N1：Hard Chrome Plating P：Phosphating N3：Nickel Plating N4：Raydent

## SLF, SLT, SZF Spline Shaft Cross-Sectional Shape

Table 3.1.1, 3.1.2 indicates the cross-section of spline shaft. When the shaft end is round pillar type the minor diameter must not be greater than the diameter of groove ridge.

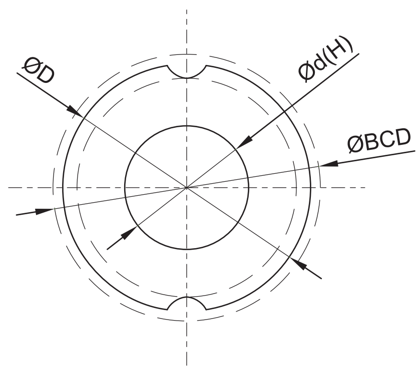



D ≦ 20

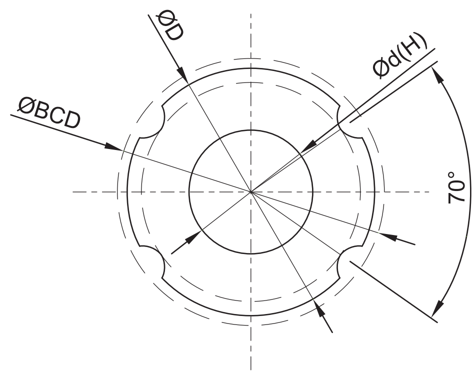



D ≧ 25

Solid Spline Shaft




D ≦ 20




D ≧ 25

Hollow Spline Shaft

Table 3.1.1 Solid Spline Shaft Cross-Sectional Shape

Unit：mm

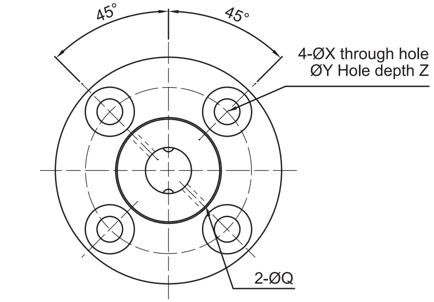
| Stats \ Nominal Diameter | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 30 | 40 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|
| Inner Diameter Ød | 5.25 | 7.27 | 8.97 | 11.82 | 14.72 | 18.63 | 23.43 | 28.53 | 37.3 | 47.05 |
| Outer Diameter ØD h7 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 30 | 40 | 50 |
| Mass (kg／m) | 0.22 | 0.39 | 0.6 | 1.03 | 1.56 | 2.44 | 3.8 | 5.49 | 9.69 | 15.19 |
| Ball Center ØBCD | 6.75 | 8.77 | 11.35 | 14.6 | 17.5 | 21.8 | 27 | 32.1 | 43.65 | 54.2 |
| Tolerance μm | 0<br>-15 | 0<br>-15 | 0<br>-18 | 0<br>-18 | 0<br>-18 | 0<br>-21 | 0<br>-21 | 0<br>-25 | 0<br>-25 | 0<br>-30 |

Table 3.1.2 Hollow Spline Shaft Cross-Sectional Shape

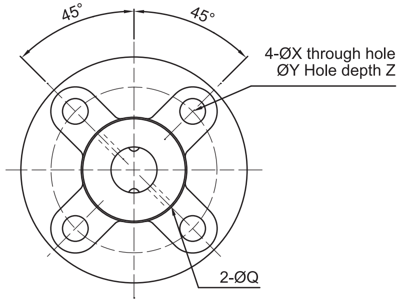
Unit：mm

| Stats \ Nominal Diameter | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 30 | 40 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|
| Inner Diameter Ød | 2 | 3 | 4 | 7 | 8 | 10 | 15 | 16 | 20 | 26 |
| Outer Diameter ØD h7 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 30 | 40 | 50 |
| Mass (kg／m) | 0.177 | 0.33 | 0.506 | 0.872 | 1.25 | 1.82 | 2.92 | 3.93 | 6.75 | 11.4 |
| Ball Center ØBCD | 6.75 | 8.77 | 11.35 | 14.6 | 17.5 | 21.8 | 27 | 32.1 | 43.65 | 54.2 |
| Tolerance μm | 0<br>-15 | 0<br>-15 | 0<br>-18 | 0<br>-18 | 0<br>-18 | 0<br>-21 | 0<br>-21 | 0<br>-25 | 0<br>-25 | 0<br>-30 |

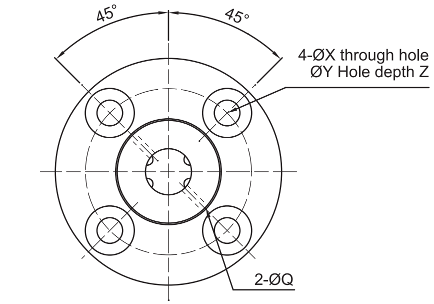
## SLF Series Specifications



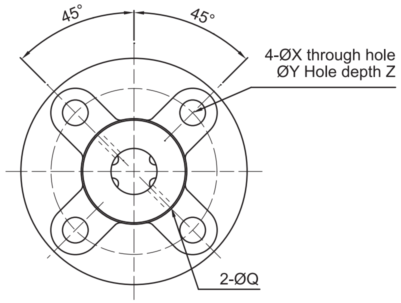

【Two Starts】Type：06、10、13



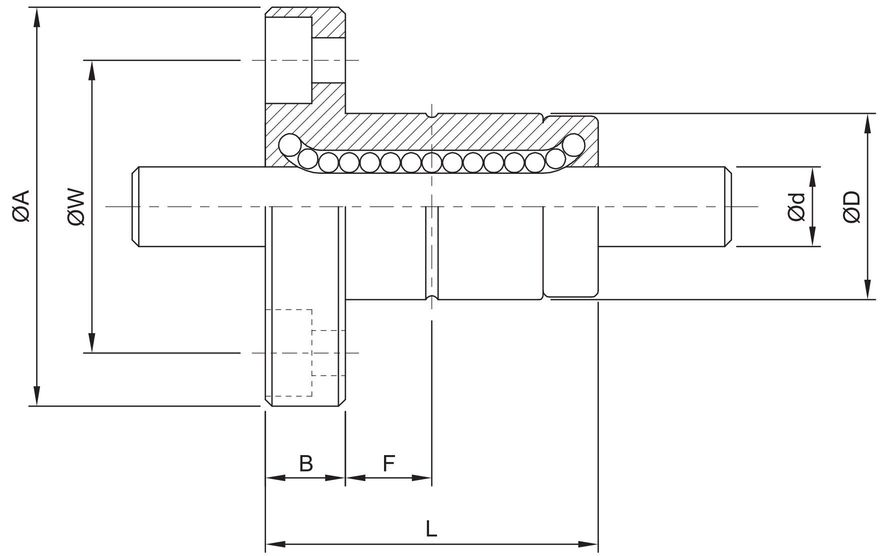

【Two Starts】Type：08、16、20




【Four Starts】Type：40、50



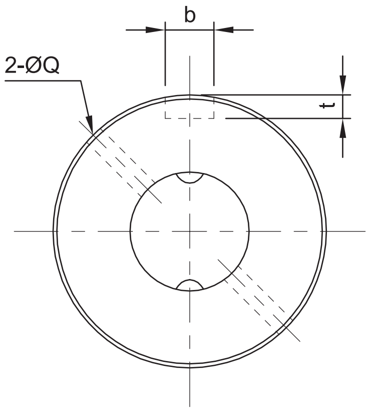

【Four Starts】Type：25、30




| Model No. | Diameter | Row | Spline Nut Dimension | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | d | | D | L | A | B | F | Oil | W | Mounting Hole |
| | h7 | | | | | | | Q | | X · Y · Z |
| SLF006 | 6 | 2 | 14 | 25 | 30 | 6 | 7.5 | 1 | 22 | 3.4 · 6.5 · 3.5 |
| SLF008 | 8 | 2 | 16 | 27 | 32 | 8 | 7.5 | 1.5 | 24 | 3.4 · 6.5 · 4.5 |
| SLF010 | 10 | 2 | 21 | 33 | 42 | 9 | 10.5 | 1.5 | 32 | 4.5 · 8 · 4 |
| SLF013 | 13 | 2 | 24 | 36 | 44 | 9 | 11 | 1.5 | 33 | 4.5 · 8 · 4.5 |
| SLF016 | 16 | 2 | 31 | 50 | 51 | 10 | 18 | 2 | 40 | 4.5 · 8 · 6 |
| SLF020 | 20 | 2 | 35 | 56 | 58 | 10 | 18 | 2 | 45 | 5.5 · 9.5 · 5.4 |
| SLF025 | 25 | 4 | 42 | 71 | 65 | 13 | 26.5 | 3 | 52 | 5.5 · 9.5 · 8 |
| SLF030 | 30 | 4 | 47 | 80 | 75 | 13 | 30 | 3 | 60 | 6.6 · 11 · 8 |
| SLF040 | 40 | 4 | 64 | 100 | 100 | 18 | 36 | 4 | 82 | 9 · 14 · 12 |
| SLF050 | 50 | 4 | 80 | 125 | 124 | 20 | 46.5 | 4 | 102 | 11 · 17.5 · 12 |

| Model No. | Basic Load Rating | | Basic Torsion | | Static Permissible Moment | | Mass | |
|---|---|---|---|---|---|---|---|---|
| | C | $C_0$ | $C_T$ | $C_{0T}$ | $M_{A1}$ | $M_{A2}$ | Spline Nut | Spline Shaft |
| | kgf | kgf | kgf · m | kgf · m | kgf · m | kgf · m | g | kg／m |
| SLF006 | 137 | 225 | 0.46 | 0.76 | 0.39 | 3.48 | 36.7 | 0.22 |
| SLF008 | 137 | 225 | 0.60 | 0.99 | 0.39 | 3.82 | 47 | 0.39 |
| SLF010 | 285 | 397 | 1.62 | 2.25 | 0.95 | 8.53 | 100 | 0.60 |
| SLF013 | 396 | 540 | 2.89 | 3.94 | 1.50 | 12.46 | 117 | 1.03 |
| SLF016 | 545 | 849 | 4.77 | 7.43 | 3.71 | 26.09 | 226 | 1.56 |
| SLF020 | 724 | 1109 | 7.90 | 12.09 | 5.53 | 38.00 | 303 | 2.44 |
| SLF025 | 1003 | 1593 | 21.99 | 43.01 | 10.35 | 68.59 | 458 | 3.80 |
| SLF030 | 1160 | 1980 | 30.26 | 62.93 | 15.68 | 93.27 | 633 | 5.49 |
| SLF040 | 2972 | 4033 | 105.37 | 176.05 | 36.59 | 246.34 | 1430 | 9.69 |
| SLF050 | 4086 | 5615 | 179.89 | 304.35 | 51.58 | 428.72 | 2756 | 15.19 |

## SLT Series Specifications

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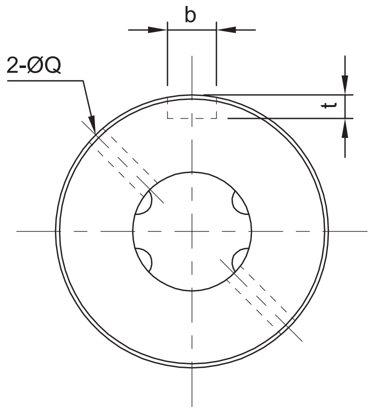
Shaft diameter d ≦ 20

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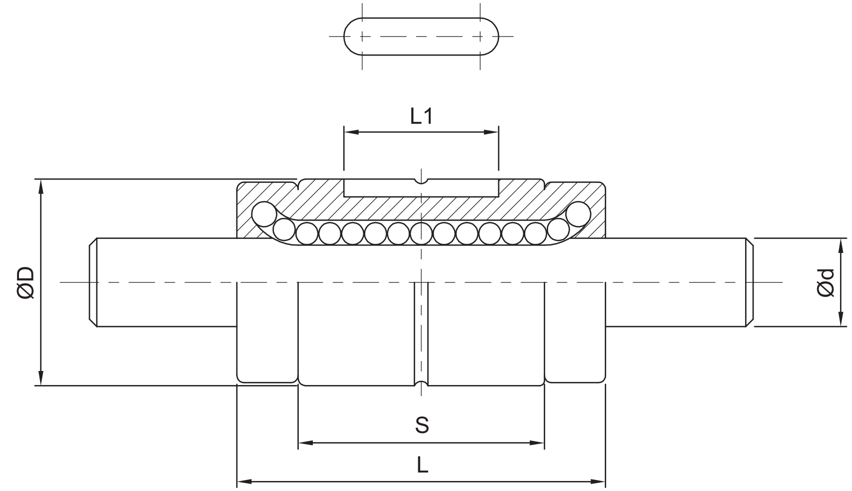
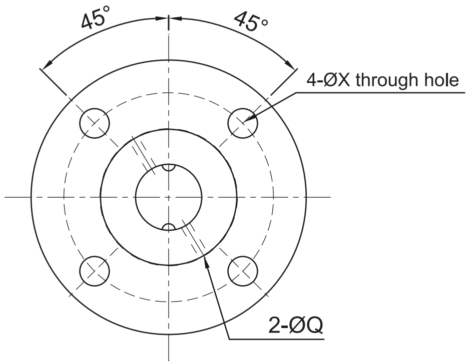
Shaft diameter d ≧ 25




| Model No. | Diameter | Row | Spline Nut Dimension | | | | | Keyway Dimensions | |
|---|---|---|---|---|---|---|---|---|---|
| | d | | D | L | S | L1 | Oil | b | t |
| | h7 | | | | | | Q | H8 | $^{+0.05}_{\sim 0}$ |
| SLT006 | 6 | 2 | 14 | 25 | 16.7 | 10.5 | 1 | 2.5 | 1.2 |
| SLT008 | 8 | 2 | 16 | 27 | 15.7 | 10.5 | 1.5 | 2.5 | 1.2 |
| SLT010 | 10 | 2 | 21 | 33 | 20 | 13 | 1.5 | 3 | 1.5 |
| SLT013 | 13 | 2 | 24 | 36 | 23 | 15 | 1.5 | 3 | 1.5 |
| SLT016 | 16 | 2 | 31 | 50 | 34 | 17.5 | 2 | 3.5 | 2 |
| SLT020 | 20 | 2 | 35 | 56 | 39.7 | 29 | 2 | 4 | 2.5 |
| SLT025 | 25 | 4 | 42 | 71 | 50.3 | 36 | 3 | 4 | 2.5 |
| SLT030 | 30 | 4 | 47 | 80 | 60 | 42 | 3 | 4 | 2.5 |
| SLT040 | 40 | 4 | 64 | 100 | 70 | 52 | 4 | 6 | 3.5 |
| SLT050 | 50 | 4 | 80 | 125 | 91 | 58 | 4 | 8 | 4 |

| Model No. | Basic Load Rating | | Basic Torsion | | Static Permissible Moment | | Mass | |
|---|---|---|---|---|---|---|---|---|
| | C | $C_0$ | $C_T$ | $C_{0T}$ | $M_{A1}$ | $M_{A2}$ | Spline Nut | Spline Shaft |
| | kgf | kgf | kgf · m | kgf · m | kgf · m | kgf · m | g | kg／m |
| SLT006 | 137 | 225 | 0.46 | 0.76 | 0.39 | 3.48 | 14 | 0.22 |
| SLT008 | 137 | 225 | 0.60 | 0.99 | 0.39 | 3.82 | 16 | 0.39 |
| SLT010 | 285 | 397 | 1.62 | 2.25 | 0.95 | 8.53 | 37 | 0.60 |
| SLT013 | 396 | 540 | 2.89 | 3.94 | 1.50 | 12.46 | 52 | 1.03 |
| SLT016 | 545 | 849 | 4.77 | 7.43 | 3.71 | 26.09 | 130 | 1.56 |
| SLT020 | 724 | 1109 | 7.90 | 12.09 | 5.53 | 38.00 | 188 | 2.44 |
| SLT025 | 1003 | 1593 | 21.99 | 43.01 | 10.35 | 68.59 | 285 | 3.80 |
| SLT030 | 1160 | 1960 | 30.26 | 62.93 | 15.68 | 93.27 | 395 | 5.49 |
| SLT040 | 2972 | 4033 | 105.37 | 176.05 | 36.59 | 264.34 | 843 | 9.69 |
| SLT050 | 4086 | 5615 | 179.89 | 304.35 | 51.58 | 428.72 | 1758 | 15.19 |

## SZF Series Specifications

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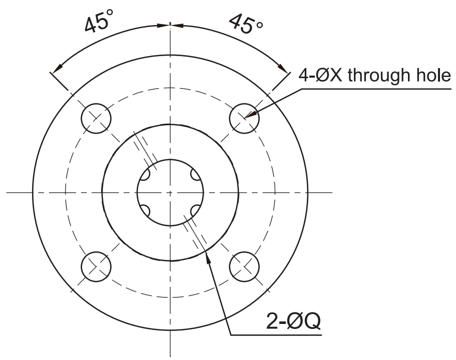
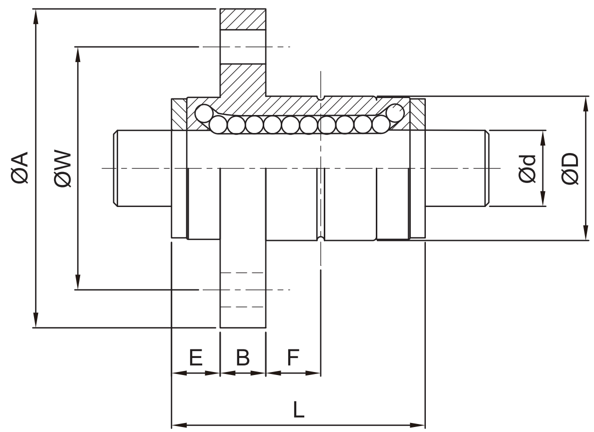
Shaft diameter d ≦ 20




< Four row >

Shaft diameter d ≧ 25




| Model No. | Diameter | Row | Spline Nut Dimension | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | | D | L | A | B | E | F | Oil | W | Mounting Hole |
| | h7 | | | | | | | | Q | | X |
| SZF006 | 6 | 2 | 14 | 25 | 30 | 3 | 5.7 | 4 | 1 | 22 | 3.4 |
| SZF008 | 8 | 2 | 16 | 27 | 32 | 3 | 7.2 | 4 | 1.5 | 24 | 3.4 |
| SZF010 | 10 | 2 | 21 | 33 | 42 | 4 | 8 | 5 | 1.5 | 32 | 4.5 |
| SZF013 | 13 | 2 | 24 | 36 | 44 | 5 | 8 | 6 | 1.5 | 33 | 4.5 |
| SZF016 | 16 | 2 | 31 | 50 | 51 | 5 | 9.5 | 12 | 2 | 40 | 4.5 |
| SZF020 | 20 | 2 | 35 | 56 | 58 | 5 | 9.7 | 15 | 2 | 45 | 5.5 |
| SZF025 | 25 | 4 | 42 | 71 | 65 | 6 | 11.9 | 20 | 3 | 52 | 5.5 |
| SZF030 | 30 | 4 | 47 | 80 | 75 | 6 | 12 | 24 | 3 | 60 | 6.6 |
| SZF040 | 40 | 4 | 64 | 100 | 100 | 8 | 17 | 27 | 4 | 82 | 9 |
| SZF050 | 50 | 4 | 80 | 125 | 124 | 10 | 19.5 | 40 | 4 | 102 | 11 |

| Model No. | Basic Load Rating | | Basic Torsion | | Static Permissible Moment | | Mass | |
|---|---|---|---|---|---|---|---|---|
| | C | $C_0$ | $C_T$ | $C_{0T}$ | $M_{A1}$ | $M_{A2}$ | Spline Nut | Spline Shaft |
| | kgf | kgf | kgf · m | kgf · m | kgf · m | kgf · m | g | kg／m |
| SZF006 | 100 | 142 | 0.34 | 0.49 | 0.19 | 1.65 | 25 | 0.22 |
| SZF008 | 100 | 142 | 0.44 | 0.62 | 0.20 | 1.86 | 28 | 0.39 |
| SZF010 | 233 | 314 | 1.32 | 1.78 | 0.51 | 5.04 | 64 | 0.60 |
| SZF013 | 342 | 463 | 2.50 | 3.38 | 1.02 | 8.08 | 87 | 1.03 |
| SZF016 | 469 | 728 | 4.10 | 6.37 | 2.48 | 17.79 | 179 | 1.56 |
| SZF020 | 653 | 951 | 7.12 | 10.37 | 3.84 | 26.00 | 240 | 2.44 |
| SZF025 | 943 | 1517 | 20.68 | 40.97 | 7.89 | 53.18 | 385 | 3.80 |
| SZF030 | 1089 | 1868 | 28.39 | 59.95 | 11.49 | 72.54 | 529 | 5.49 |
| SZF040 | 2854 | 3842 | 101.19 | 167.72 | 27.87 | 190.46 | 1151 | 9.69 |
| SZF050 | 4086 | 5615 | 179.89 | 304.35 | 43.03 | 323.43 | 2348 | 15.19 |

# 3-2 Nominal Model Code of Ball Spline SO Series

## 3-2-1 Nominal Model Code

***TBI MOTION*** ball Splines can be classified into interchangeable and non- interchangeable types. Their dimensions are the same; the only difference between the two types is that for non-interchangeable series, ***TBI MOTION*** will finish every process in the production line and hit customers' demands for preload and accuracy. Interchangeable nuts and shafts can be freely exchanged and the standard of the preload is P0. Customers could adjust the preload by changing the steel balls inside of the nut by themselves. It is very convenient for customers to have ***TBI MOTION*** ball splines in inventory and make the preload and end machining by themselves. ***TBI MOTION*** is proud of internal quality control process which is under strict international regulation.

### Non-interchangeable Type Code：

SOF 008 T2 D N S - 500 - P0 - B2 + N3 N3

- Spline Nut
  SOF：Flanged
  SOT：Cylindrical
- Nominal Diameter
  Unit：mm
- Groove
  T2：2 Rows
- Flange Type
  D：Flange cutting (No Symbol When It is Without the Flange)
- Accuracy Grade of Spline Shaft
  N：Normal H：High P：Precision
- Spline Shaft Type
  S：Solid H：Hollow
- Overall Length of Spline Shaft
  Unit：mm
- Preload Value
  P0：No preload P1：Light preload
- Number of Spline Nut
  (Leave blank if only one nut is required) Ex：Two install two spline nuts in a shaft：B2
- Nut Surface Treatment
  S：Standard B1：Black Oxidation N1：Hard Chrome Plating P：Phosphating N3：Nickel Plating N4：Raydent
- Shaft Surface Treatment
  S：Standard B1：Black Oxidation N1：Hard Chrome Plating P：Phosphating N3：Nickel Plating N4：Raydent

※No symbol required when no plating is need. (see B29)

# Nominal Model Code for Interchangable SO Type

### Interchangeable Type of Spline Nut：

SOF 013 T2 D + N3

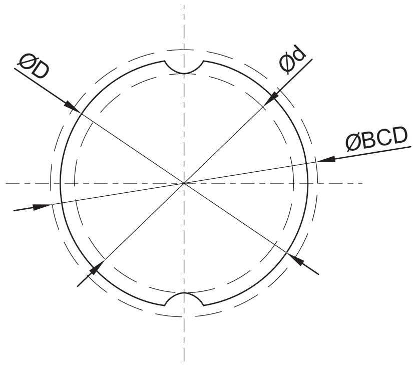
- Spline Nut
  SOF：Flanged
  SOT：Cylindrical
- Nominal Diameter
  Unit：mm
- Groove
  T2：2 Rows
- Flange Type
  D：Flange cutting (No Symbol When It is Without the Flange)
- Nut Surface Treatment
  □：Standard B1：Black Oxidation N1：Hard Chrome Plating P：Phosphating N3：Nickel Plating N4：Raydent

### Interchangeable Type of Spline Shaft：

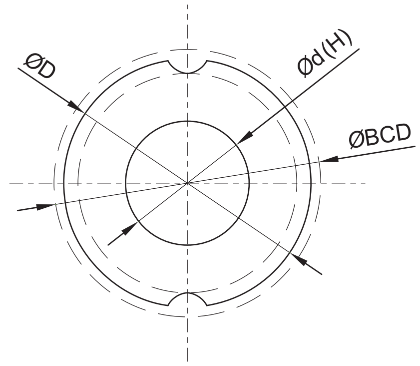
SK 008 T2 N S - 500 +N3

- Nominal Model Code
- Nominal Diameter
  Unit：mm
- Groove
  T2：2 Rows
- Accuracy Grade of Spline Shaft
  N：Normal
- Spline Shaft Type
  S：Solid H：Hollow
- Overall Length of Spline Shaft
  Unit：mm
- Shaft Surface Treatment
  □：Standard B1：Black Oxidation N1：Hard Chrome Plating P：Phosphating N3：Nickel Plating N4：Raydent

SOF,  SOT Spline Shaft Cross-Sectional Shape




Solid Spline Shaft




Hollow Spline Shaft

Table 3.2.1 Solid Spline Shaft Cross-Sectional Shape

Unit：mm

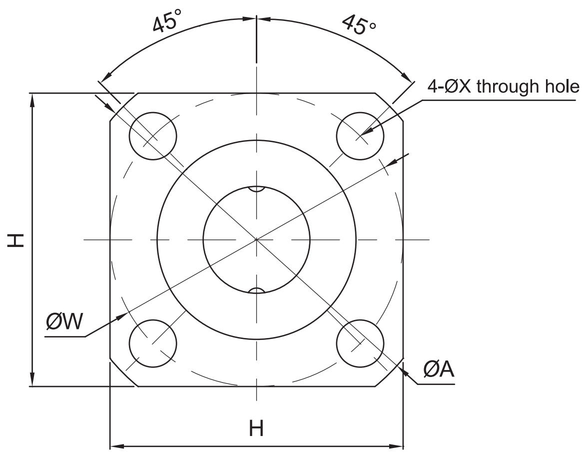
| Stats \ Nominal Diameter | 8 | 10 | 12 | 15 | 20 | 25 |
|---|---|---|---|---|---|---|
| Inner Diameter Ød | 7 | 8.9 | 10.9 | 11.6 | 15.7 | 19.4 |
| Outer Diameter ØD h7 | 8 | 10 | 12 | 13.6 | 18.2 | 22.6 |
| Mass(kg/m) | 0.39 | 0.605 | 0.875 | 1.11 | 2.02 | 3.1 |
| Ball Center ØBCD | 9.3 | 11.6 | 13.6 | 15 | 20 | 25 |
| Tolerance μm | 0<br>-15 | 0<br>-18 | 0<br>-18 | 0<br>-18 | 0<br>-21 | 0<br>-21 |

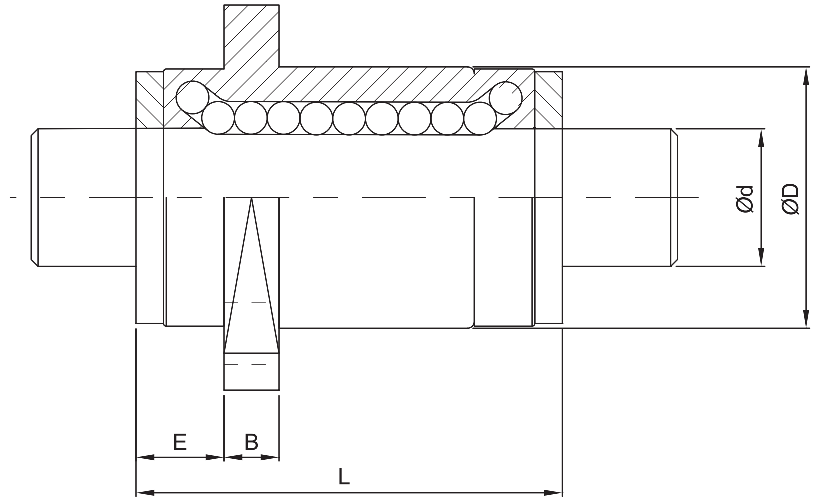
Table 3.2.2 Hollow Spline Shaft Cross-Sectional Shape

Unit：mm

| Stats \ Nominal Diameter | 8 | 10 | 12 |
|---|---|---|---|
| Inner Diameter Ød | 3 | 4 | 6 |
| Outer Diameter ØD h7 | 8 | 10 | 12 |
| Mass(kg/m) | 0.33 | 0.51 | 0.66 |
| Ball Center ØBCD | 9.3 | 11.6 | 13.6 |
| Tolerance μm | 0<br>-15 | 0<br>-18 | 0<br>-18 |

## SOF Series Specifications



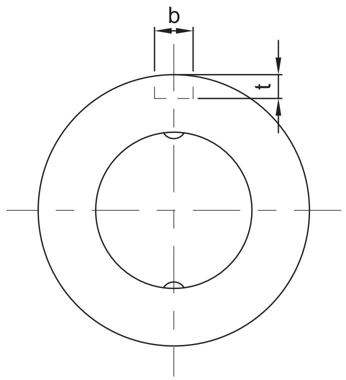




| Model No. | Diameter | Row | Spline Nut Dimension | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | d | | D | L | A | B | E | F | W | Mounting Hole |
| | h7 | | | | | | | | | X |
| SOF008 | 8 | 2 | 15 | 25 | 28 | 3.8 | 5.2 | 22 | 22 | 3.4 |
| SOF010 | 10 | 2 | 19 | 30 | 36 | 4.1 | 5.9 | 28 | 28 | 4.5 |
| SOF012 | 12 | 2 | 21 | 35 | 38 | 4 | 6 | 30 | 30 | 4.5 |
| SOF015 | 13.6 | 2 | 23 | 40 | 40 | 4.5 | 6.5 | 31 | 32 | 4.5 |
| SOF020 | 18.2 | 2 | 30 | 50 | 46 | 5.5 | 8.5 | 35 | 38 | 4.5 |
| SOF025 | 22.6 | 2 | 37 | 60 | 57 | 6.6 | 10.4 | 43 | 47 | 5.5 |

| Model No. | Basic Load Rating | | Basic Torsion | | Static Permissible Moment | | Mass | |
|---|---|---|---|---|---|---|---|---|
| | $C$ | $C_0$ | $C_T$ | $C_{0T}$ | $M_{A1}$ | $M_{A2}$ | Spline Nut | Spline Shaft |
| | kgf | kgf | kgf · m | kgf · m | kgf · m | kgf · m | g | kg/m |
| SOF008 | 121 | 136 | 0.56 | 0.63 | 0.34 | 2.24 | 23.5 | 0.39 |
| SOF010 | 192 | 219 | 1.11 | 1.27 | 0.71 | 4.23 | 45 | 0.61 |
| SOF013 | 222 | 274 | 1.51 | 1.87 | 1.08 | 6.02 | 59 | 0.88 |
| SOF016 | 426 | 619 | 3.19 | 4.65 | 2.83 | 15.49 | 77 | 1.11 |
| SOF020 | 673 | 922 | 6.73 | 9.22 | 4.95 | 29.36 | 150 | 2.02 |
| SOF025 | 1142 | 1458 | 14.17 | 18.14 | 9.46 | 56.17 | 255 | 3.10 |

BALL SPLINE

## SOT Series Specifications

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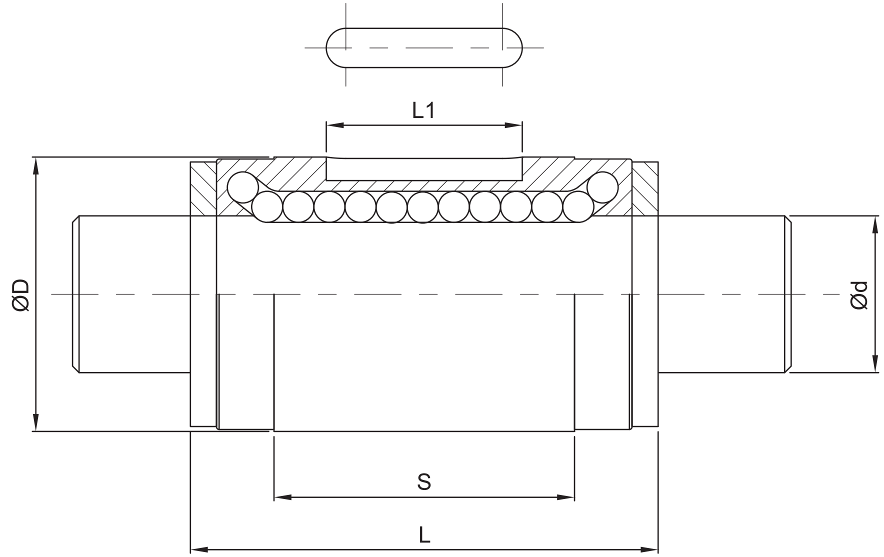
Shaft diameter




| Model No. | Diameter | Row | Spline Nut Dimension | | | | Keyway Dimensions | |
|---|---|---|---|---|---|---|---|---|
| | d | | D | L | S | L1 | b | t |
| | h7 | | | | | | H8 | +0.05 ~ 0 |
| SOT008 | 8 | 2 | 15 | 25 | 14.6 | 8.5 | 2.5 | 1.5 |
| SOT010 | 10 | 2 | 19 | 30 | 18.2 | 11 | 3 | 1.8 |
| SOT012 | 12 | 2 | 21 | 35 | 23 | 15 | 3 | 1.8 |
| SOT015 | 13.6 | 2 | 23 | 40 | 27 | 20 | 3.5 | 2 |
| SOT020 | 18.2 | 2 | 30 | 50 | 33 | 26 | 4 | 2.5 |
| SOT025 | 22.6 | 2 | 37 | 60 | 39.2 | 29 | 5 | 3 |

| Model No. | Basic Load Rating | | Basic Torsion | | Static Permissible Moment | | Mass | |
|---|---|---|---|---|---|---|---|---|
| | C | $C_0$ | $C_T$ | $C_{0T}$ | $M_{A1}$ | $M_{A2}$ | Spline Nut | Spline Shaft |
| | kgf | kgf | kgf · m | kgf · m | kgf · m | kgf · m | g | kg／m |
| SOT008 | 121 | 136 | 0.56 | 0.63 | 0.34 | 2.24 | 15.9 | 0.39 |
| SOT010 | 192 | 219 | 1.11 | 1.27 | 0.71 | 4.23 | 31.5 | 0.61 |
| SOT012 | 222 | 274 | 1.51 | 1.87 | 1.08 | 6.02 | 44 | 0.88 |
| SOT015 | 426 | 619 | 3.19 | 4.65 | 2.83 | 15.49 | 59.5 | 1.11 |
| SOT020 | 673 | 922 | 6.73 | 9.22 | 4.95 | 29.36 | 130 | 2.02 |
| SOT025 | 1142 | 1458 | 14.17 | 18.14 | 9.46 | 56.17 | 220 | 3.10 |

# C. Ball Screw

www.tbimotion.com.tw

# 1. About Ball Screw





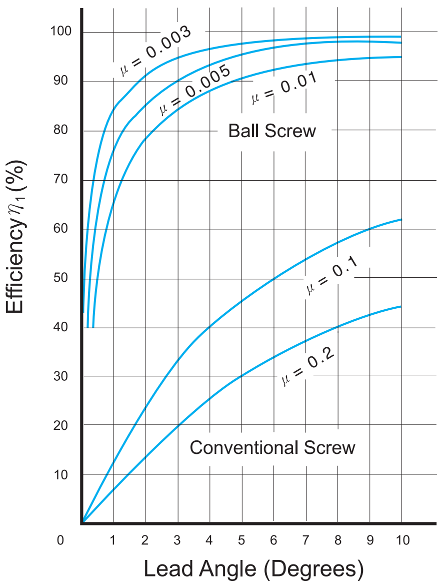
## 1-1 Features of *TBIMOTION* Ball Screw

### (1) High Reliability

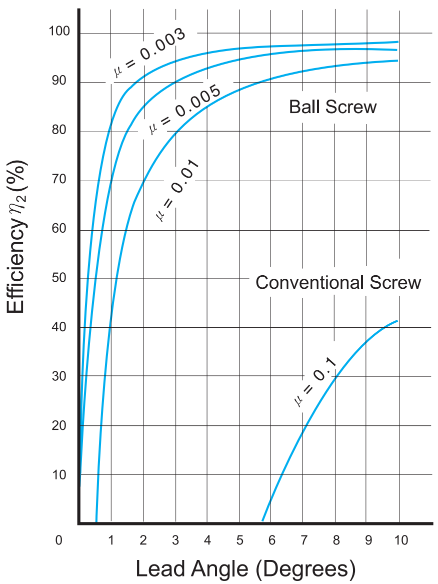
*TBI MOTION* has very stringent quality control standards covering every production process. With proper lubrication and use, trouble-free operation for an estented period of time is possible.

### (2) Smooth Operation

The high efficiency of ball screw is vastly superior to conventional screws as shown in Fig 1.1.1. The torque required is less than 30%. Linear motion can be easily changed from rotary motion.




Normal usage (to convert rotary motion to linear motion)




Special usage (to convert linear motion to rotary motion)

$\mu$ : friction coefficient

$$T = \frac{P \cdot \ell}{2\pi\eta_1}$$

T = Torque kgf · cm

P = Force kgf

$\ell$ = Lead cm

$\eta_1$ = Efficiency

$$T = \frac{P \cdot \ell}{2\pi\eta_2}$$

T = Torque kgf · cm

P = Force kgf

$\ell$ = Lead cm

$\eta_2$ = Efficiency

Fig 1.1.1 Mechanical Efficiency of Ball Screws

### (3) High Rigidity and Preload

When axial play is minimized in conventional screw-nut assemblies, the actuating torque becomes excessive and the operation is not smooth. The axial play in *TBI MOTION* precision ball screws may be reduced to zero by preloading and a light smooth operation is still possible. Therefore, both low torque and high rigidity can be obtained simultaneously. *TBI MOTION* ball screws have gothic arch groove profiles (Fig1.1.2) which allow these conditions to be achieved.

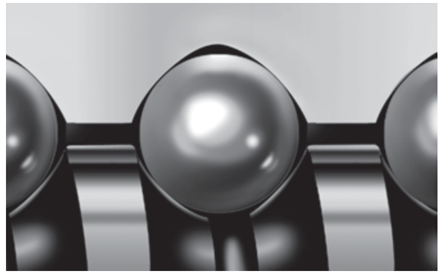


Fig 1.1.2 Groove Shape of *TBIMOTION* Precision Ball Screw

### (4) Circulation Method

Fig1.1.3 is ball return tube method.

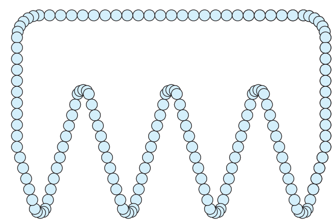


Fig 1.1.3 External Ball Circulation Nuts

Fig1.1.4 is ball defelector method.

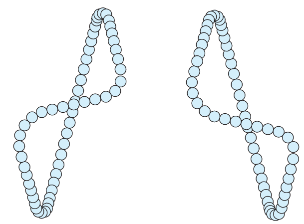


Fig 1.1.4 Internal Ball Circulation Nuts

### (5) High Durability

*TBI MOTION* Rigidly selected materials, intensive heat treating and processing techniques, backed by years of experience, have resulted in the most durable ball screws manufactured. (See Table1.1.1 & Fig1.1.5)

Table 1.1.1 Material and Heat Treatment

| ITEM | MATERIAL | HARDNESS |
|---|---|---|
| SCREW | SCM450<br>S55C | HRC 58°~64° |
| NUT | SCM415H | HRC 58°~64° |
| STELL BALL | SUJ2 | HRC 60° UP |

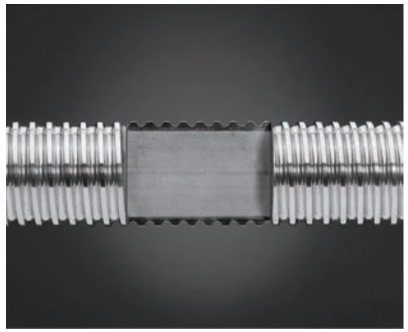
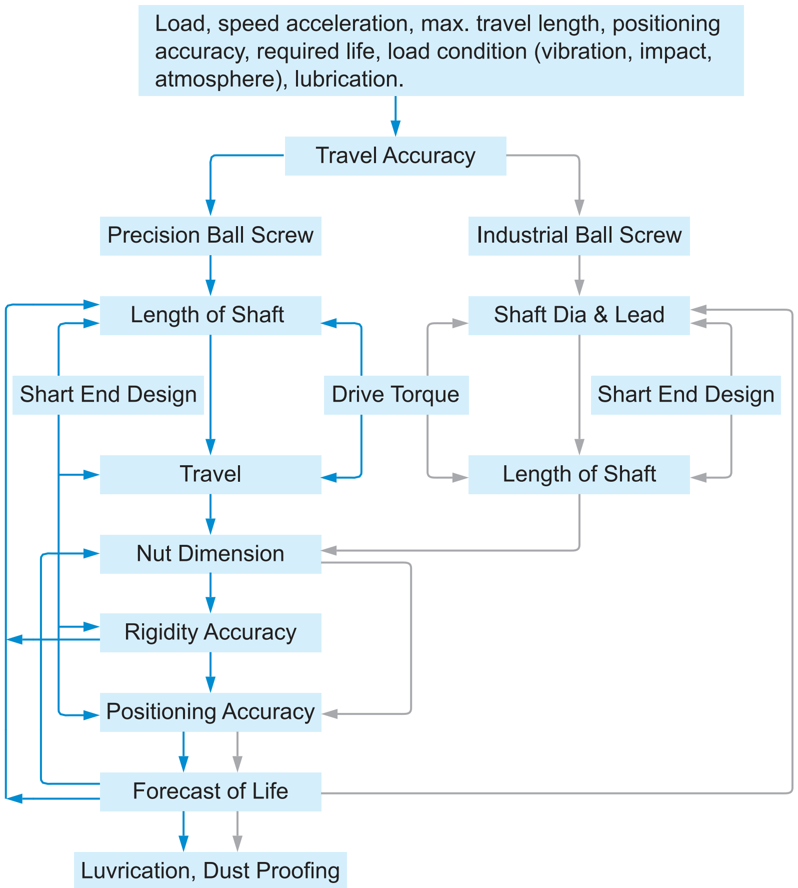


Fig 1.1.5 Heat Treatment

## 1-2 Ball Screw Selection Precedure




Accuracy (C04)

Screw Shart Design (C10)

Drive Torque (C16)

Nut Design (C17)

Rigidity (C20)

Positioning Accuracy (C23)

Life Design (C25)

Lubrication and safety design (C31)

BALL SCREW

## 1-3 Accuracy

### 1-3-1 Lead／Travel Accuracy

Lead accuracy of ***TBI MOTION*** ball screws (grade C0~C5) is specified in 4 basic terms (E, e, $e_{300}$, $e_{2\pi}$). There are defined in Fig 1.3.1 Tolerance of deviation (± E) and variation (e) of accumulated reference travel are shown in Table 1.3.1~1.3.3.

Accumulated travel deviations for grade C7 and C10 are specified only by the allowable value per 300mm measured within any portion of the thread length. They are 0.05mm for C7 and 0.21mm for C10.

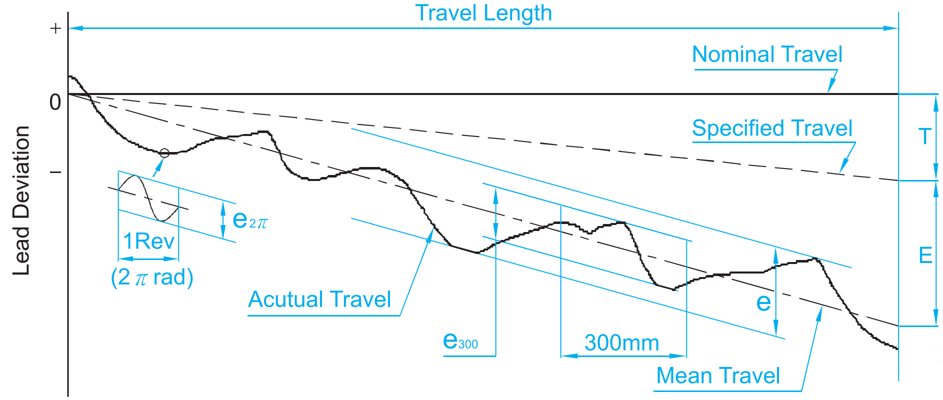



Fig 1.3.1 Diagram of Lead Accuracy

Table 1.3.1 Definition of terms for Lead Accuracy

| Terms | Reference | Definition | Allowable |
|---|---|---|---|
| Travel Compensation | T | Travel compensation is the difference between specified and nominal travel with in the useful travel. A slightly smaller value compared to the nominal travel is often selected by the customer to compensate for an expected elongation caused by temperature rise or external load. Therefore " T " is usually a negative value.<br>Note : if no compensation is needed, specified travel is the same as nominal travel. | |
| Actual Travel | | Actual travel is the axial displacement of the nut relative to the screw shaft. | |
| Mean Travel | | Mean travel is the linear best fit line of actual. This could be obtained by the least squares method. This line represents the tendency of actual travel. | |
| Mean Travel Deviation | E | Mean travel deviation is the difference beteen mean travel and specified travel within travel length. | Table 1.3.2 |
| Travel Variations | e<br>$e_{300}$<br>$e_{2\pi}$ | Travel variations is the band of 2 lines drawn parallel to the mean travel, on the plus and minus side.<br>Maximum width of varation over the travel length.<br>Actual width of variation for the length of 300mm taken anywhere within the travel length.Wobble error, actual width of variation for one revolution (2 $\pi$ radian) | Table 1.3.2<br>Table 1.3.3<br>Table 1.3.3 |

Table 1.3.2 Mean Travel Deviation (± E) and Travel Variation (e) (JIS B 1192)

Unit : μm

| Travel Length (mm) | | C0 | | C1 | | C2 | | C3 | | C5 | | C7 | C10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Over | Incl. | ±E | e | ±E | e | ±E | e | ±E | e | ±E | e | e | e |
| | 100 | 3 | 3 | 3.5 | 5 | 5 | 7 | 8 | 8 | 18 | 18 | | |
| 100 | 200 | 3.5 | 3 | 4.5 | 5 | 7 | 7 | 10 | 8 | 20 | 18 | | |
| 200 | 315 | 4 | 3.5 | 6 | 5 | 8 | 7 | 12 | 8 | 23 | 18 | | |
| 315 | 400 | 5 | 3.5 | 7 | 5 | 9 | 7 | 13 | 10 | 25 | 20 | | |
| 400 | 500 | 6 | 4 | 8 | 5 | 10 | 7 | 15 | 10 | 27 | 20 | | |
| 500 | 630 | 6 | 4 | 9 | 6 | 11 | 8 | 16 | 12 | 30 | 23 | | |
| 630 | 800 | 7 | 5 | 10 | 7 | 13 | 9 | 18 | 13 | 35 | 25 | | |
| 800 | 1000 | 8 | 6 | 11 | 8 | 15 | 10 | 21 | 15 | 40 | 27 | | |
| 1000 | 1250 | 9 | 6 | 13 | 9 | 18 | 11 | 24 | 16 | 46 | 30 | | |
| 1250 | 1600 | 11 | 7 | 15 | 10 | 21 | 13 | 29 | 18 | 54 | 35 | ±50/300mm | ±210/300mm |
| 1600 | 2000 | | | 18 | 11 | 25 | 15 | 35 | 21 | 65 | 40 | | |
| 2000 | 2500 | | | 22 | 13 | 30 | 18 | 41 | 24 | 77 | 46 | | |
| 2500 | 3150 | | | 26 | 15 | 36 | 21 | 50 | 29 | 93 | 54 | | |
| 3150 | 4000 | | | 30 | 18 | 44 | 25 | 60 | 35 | 115 | 65 | | |
| 4000 | 5000 | | | | | 52 | 30 | 72 | 41 | 140 | 77 | | |
| 5000 | 6300 | | | | | 65 | 36 | 90 | 50 | 170 | 93 | | |
| 6300 | 8000 | | | | | | | 110 | 60 | 210 | 115 | | |
| 8000 | 10000 | | | | | | | | | 260 | 140 | | |
| 10000 | 12500 | | | | | | | | | 320 | 170 | | |

Table 1.3.3 Varation per 300mm ($e_{300}$) and Wobble Error ($e_{2\pi}$) (JIS B 1192)

Unit : μm

| Grade | C0 | C1 | C2 | C3 | C5 | C7 | C10 |
|---|---|---|---|---|---|---|---|
| $e_{300}$ | 3.5 | 5 | 7 | 8 | 18 | 50 | 210 |
| $e_{2\pi}$ | 2.5 | 4 | 5 | 6 | 8 | | |

## 1-3-2 Axial Play

Accuracy grade and axial play of ***TBI MOTION*** 's precision ball screw is shown in Table 1.3.4

Table 1.3.4 Combination of Accuracy Grade and Axial Play

| Grade | P0 | P1 | P2 | P3 | P4 |
|---|---|---|---|---|---|
| Axial Play | Yes | No | No | No | No |
| Preload | No | No | Light | Medium | Heavy |

Table 1.3.5 Guidelines for selecting Accuracy, Preload, Axial Play, Nut and Screw shaft

| Accuracy | Preload and Axial Play | Nut Type | Screw Shaft Type |
|---|---|---|---|
| C10 | P0(With Axial Play) | Single Nut | Rolled screw shaft |
| C7 | (P1 or P0) ***TBI MOTION*** stand is (P1) | According to the demand | Rolled or Ground ( ***TBI MOTION*** standard is Ground) |
| C5 | According to the demand of customers. If no idea, ***TBI MOTION*** standard is (P2) | According to the demand | Rolled or Ground screw shaft with lead error inspection certificate |
| C3 | According to the demand of customers. If no idea, ***TBI MOTION*** standard is (P2) | According to the demand | Ground screw shaft with lead error inspection certificate |

Excessive preload increase the friction torque and generates heat which reduce the life expectancy. However, insufficient preload reduces stiffness and increase the possibility of lost motion. ***TBIMOTION*** recommends that the preload force applied on CNC machine tolls should not bigger than 8% of the dynamic load; 5% for industrial automation X-Y table.

Table 1.3.6 The reference spring force of (P2)

| Model No. | Spring Force (Kg) Single Nut | Spring Force(Kg) Double Nut |
|---|---|---|
| 1605 | 0.1~0.3 | 0.3~0.6 |
| 2005 | 0.1~0.3 | 0.3~0.6 |
| 2505 | 0.2~0.5 | 0.3~0.6 |
| 3205 | 0.2~0.5 | 0.5~0.8 |
| 4005 | 0.2~0.5 | 0.5~0.8 |
| 2510 | 0.2~0.5 | 0.5~0.8 |
| 3210 | 0.3~0.6 | 0.5~0.8 |
| 4010 | 0.3~0.6 | 0.5~0.8 |
| 5010 | 0.3~0.6 | 0.8~1.2 |
| 6310 | 0.6~1.0 | 0.8~1.2 |
| 8010 | 0.6~1.0 | 0.8~1.2 |

Table 1.3.7 Axial Play (P0) Clearance in the Axial Direction of Rolled and Ground Ball Screw

Unit : mm

| Nominal Diameter | Rolled Ball Screw Clearance in the Axial Direction (max.) | Ground Ball Screw Clearance in the Axial Direction (max.) |
|---|---|---|
| Ø04~Ø14 miniature ball screw | 0.05 | 0.015 |
| Ø15~Ø40 middle size of ball screw | 0.08 | 0.025 |
| Ø50~Ø100 big size of ball screw | 0.12 | 0.05 |

## 1-3-3 Definition of Mounting Accuracy and Tolerance on Ball Screw

To use a ball screw properly dimensional accuracy and tolerances are most important. ***TBI MOTION*** will help you determine the tolerance factors as they are subject to change according to accuracy grade.

(1) Periphery run-out of the supporting part of the screw shaft to tha screw groove.

(2) Concentricity of a mounting portion of the shaft to the adjacent ground portion of tha scraw shaft.

(3) Perpendicularity of the shoulders to the adjacent ground portion of tha scraw shaft.

(4) Perpendicularity of the nut flange to the axis of the screw shaft.

(5) Concentricity of the ball nut diameter to the screw groove.

(6) Parallelism of the mounting surface of a ball nut to the screw groove.

(7) Total run-out of the screw shaft to the axis of the screw shaft.

All ***TBI MOTION*** ball screws are manufactured, inspected and guaranteed to be within specifications.

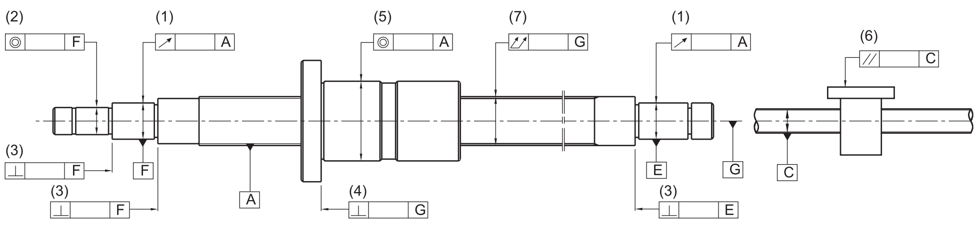


Fig 1.3.2 Mounting Accuracy and Tolerance

## 1-3-4 Preload Torque

Terms in relation to the preload torque generated during the rotation of the preload ball screws are shown in Fig 1.3.8.

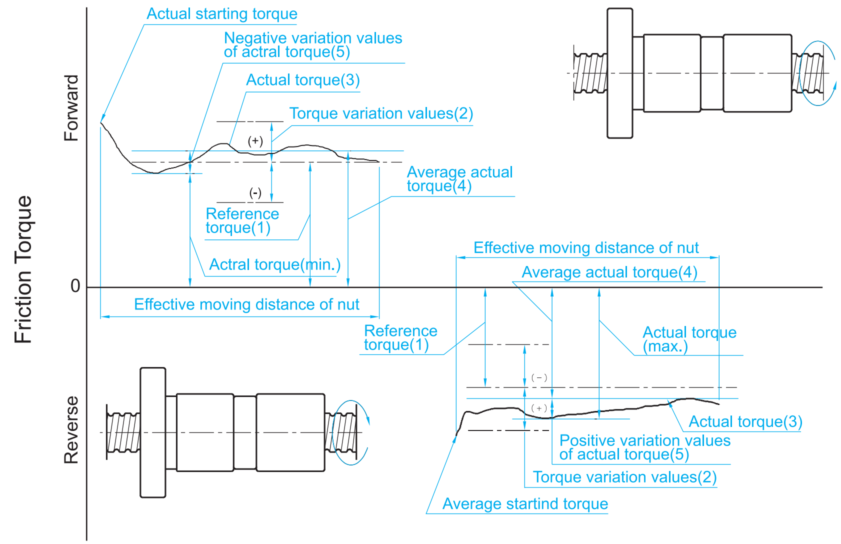



Fig 1.3.3 Descriptions of preload torque

### Glossary

**(1) Preload**
The stress generated inside the screws when inserting a set of steel balls of one gage (approximately 2$\mu$)larger into the nut or using them on the 2 nuts which exercise mutual displacements along the screws axis in order to eliminate the gaps of the screw or upgrade the rigidity of the screw.

**(2) Pewload dynamic torque**
The dynamic torque required for continuously rotating the screws shaft or the nuts under unload condition after the special preload has been applied upon the ball screws.

**(3) Reference**
The targeted preload dynamic torque Fig 1.3.3-(1)

**(4) Toque variation values**
The variation values of the targeted preload torque variation rates are specilied generally based on JIS standards as indicated in Table.

**(5) Torque variation rate**
The rate of variation values in relation to the referance torque.

**(6) Actual torque**
The actually measured preload dynamic torque of the ball screws.

**(7) Average actual torque**
The arithmetic average of the maximal and minimal actual torque values measured when the nuts are exercieing reciprocating movements.

**(8) Actual torque variation values**
The maximal variation values measured within the effective length of the threads when the nuts are exercising reciprocating movements, the positive or negative values relative to the actual torque are adopted.

**(9) Actual torque variation rate**
The rate of actual torque variation values in relation of the average actual torque.

Table 1.3.8 Permissible ranges of toque variation rates

| Reference torque kgf・cm | | Effective threading length mm | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Below 4000 | | | | | | | | 4000~10000 | | |
| | | Slenderness 1: below 40 | | | | Slenderness1:40~1:60 | | | | - | | |
| | | Grade | | | | Grade | | | | Grade | | |
| Over | Incl | C0 | C1 | C2, C3 | C5 | C0 | C1 | C2, C3 | C5 | C1 | C2, C3 | C5 |
| 2 | 4 | ±35% | ±40% | ±45% | ±55% | ±45% | ±45% | ±55% | ±65% | - | - | - |
| 4 | 6 | ±25% | ±30% | ±35% | ±45% | ±38% | ±38% | ±45% | ±50% | - | - | - |
| 6 | 10 | ±20% | ±25% | ±30% | ±35% | ±30% | ±30% | ±35% | ±40% | - | ±40% | ±45% |
| 10 | 25 | ±15% | ±20% | ±25% | ±30% | ±25% | ±25% | ±30% | ±35% | - | ±35% | ±40% |
| 25 | 63 | ±10% | ±15% | ±20% | ±25% | ±20% | ±20% | ±25% | ±30% | - | ±30% | ±35% |
| 63 | 100 | - | - | ±15% | ±20% | - | - | ±20% | ±25% | - | ±25% | ±30% |

Remarks : 1. Slenderness is the value of dividing the screws shaft outside diameter with the screws shaft threading length.
2. For reference torque less than 2 kgf・cm, ***TBIMOTION*** specifications will apply.

### Calculation of Reference Torque Tp

The formula for computing reference torque of the ball screws is given in following :

$$T_P = 0.05\,(\tan\beta)^{-0.5} \cdot \frac{Fao \cdot \ell}{2\pi}$$

Where, Fao = Preload (kgf)

$\beta$ = Lead angle

$\ell$ = Lead (cm)

### Measurement Conditions

The preload dynamic torque $T_P$ is determined first by adopting the following measurement conditions together with the method illustrated in Fig 1.3.4 for measuring the force (F) needed to rotate the screws shaft without bringing the nuts to rotate along with the shaft after the screws shaft has started rotating, then multiplying the measured value of (F) with the arm of force L, the product is $T_P$.

$T_P = F \cdot L$

Measure conditions

(1) Measurment is executed under the condition of not attaching with scraper.

(2) The rotating speed during measurement maintains at 100 rpm.

(3) According to JSK2001(industrial lubrication oil viscosity) be in compliance standard), the lubrication oil used should be in complience with IS0 VG68.

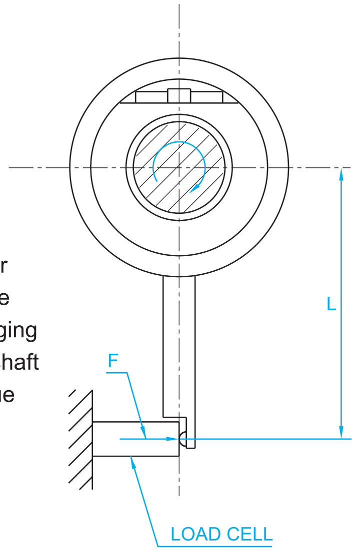



Fig 1.3.4 Preload dynamic torque measuring method



## 1-4 Screw Shaft Design

### 1-4-1 Mounting Methods

Both the critical speed and column bucking load depend upon the method of mounting and the unsupported length of the shaft, the most common mounting methods for ball screws are shown in Fig 1.4.1~1.4.8.

(Mounting Screw and Nut)

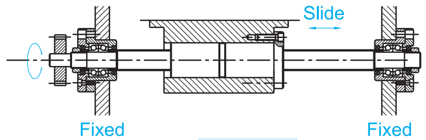



Fig 1.4.1

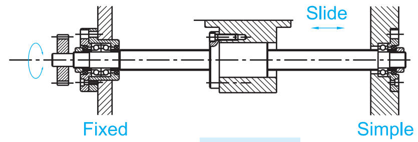



Fig 1.4.5

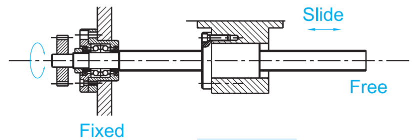



Fig 1.4.2

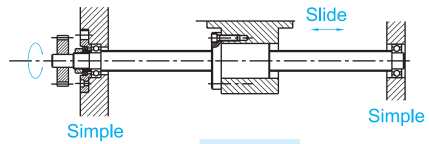



Fig 1.4.6

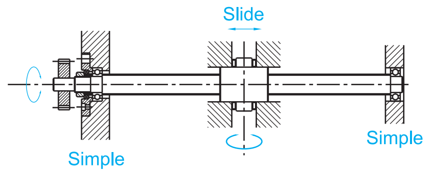



Fig 1.4.3

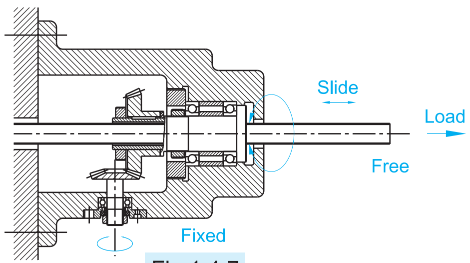



Fig 1.4.7

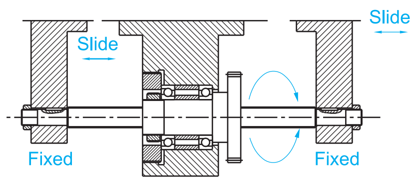



Fig 1.4.4

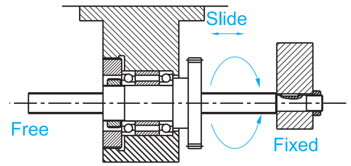



Fig 1.4.8

(Mounting Methods)

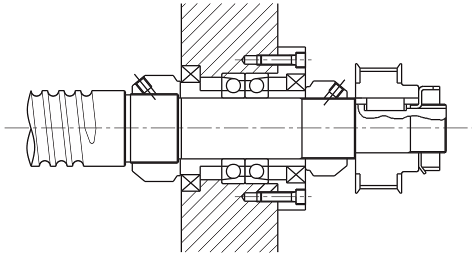


Fig 1.4.9

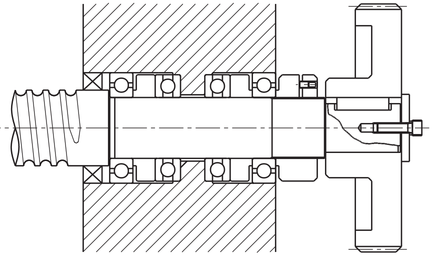


Fig 1.4.11

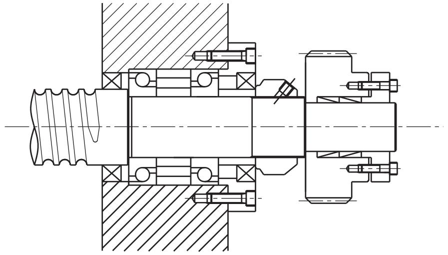


Fig 1.4.10

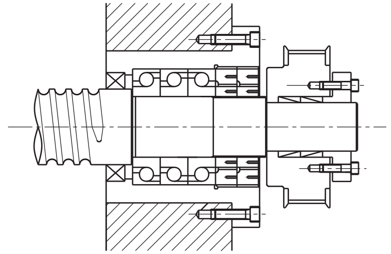


Fig 1.4.12

(Most Common Mounting Methods for Ball Screws)

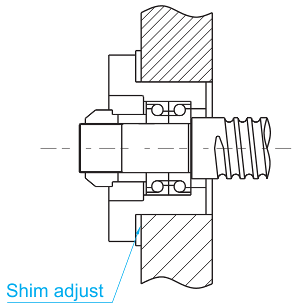



Fig 1.4.13

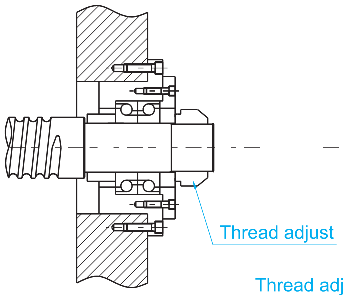



Fig 1.4.14

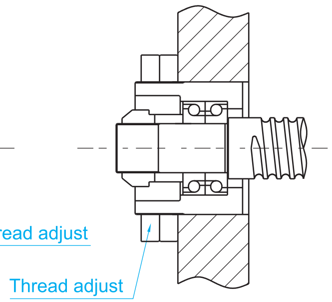



Fig 1.4.15

## 1-4-2 Allowable Axial Load

### (1) Buckling Load

The safety of the screw shaft against buckling needs to be checked when the shaft is expected to receive buckling loads.

Fig 1.4.16 shows a diagram which summarizes the allowable compressive load for buckling for each nominal outside diameter of screw shaft. (Calculate with the equation shown right when the nominal outside diameter of the screw shaft exceeds 125mm.)

Select the graduation of allowable axial load according to the method of ball screw support.

$$P = \alpha \cdot \frac{I \cdot N \cdot \pi^2 \cdot E}{L^2} = m \frac{dr^4}{L^2} \cdot 10^3$$

Where

$\alpha$ = Safty Factor ($\alpha$ = 0.5)

E ：Vertical elastic modules

($E = 2.1 \cdot 10^4$ kgf／mm$^2$)

I ：Min. secondary moment of screw shaft sectional area

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

dr：Screw shaft root diameter (mm)

L ：Mounting distance (mm)

m · N：Coefficient determined from mounting method of ball screw

| | | |
|---|---|---|
| Simple-Simple | m = 5.1 | (N = 1) |
| Fixed-Simple | m = 10.2 | (N = 2) |
| Fixed-Fixed | m = 20.3 | (N = 4) |
| Fixed-Free | m = 1.3 | (N = 1／4) |

### (2) Allowable Tensile／Buckling Load

Check the allowable tensile／buckling load (the formula shown below) and allowable load of the ball groove regardless of the mounting method when the mounting distance is short.

$P = \sigma A = 11.8\, dr^2$ (kgf)

Where,

P ：Buckling load (kgf)

$\sigma$ ：Allowable tensile compressive stress (kgf／mm$^2$)

A ：Sectional area of screw shaft root bottom diameter (mm$^2$)

dr : Screw shaft root diameter (mm)

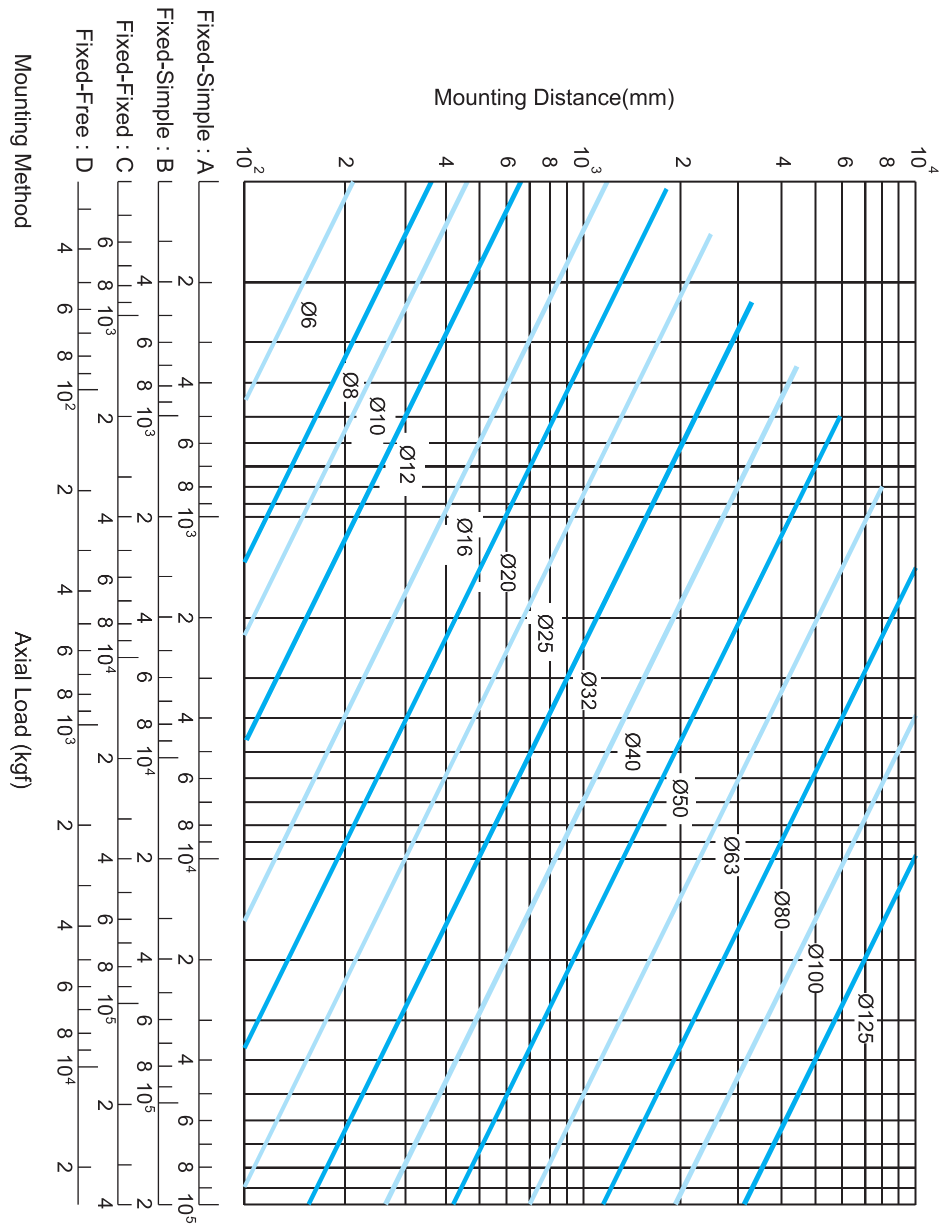



Fig 1.4.16 Buckling Load vs. Nominal Diameter and Length

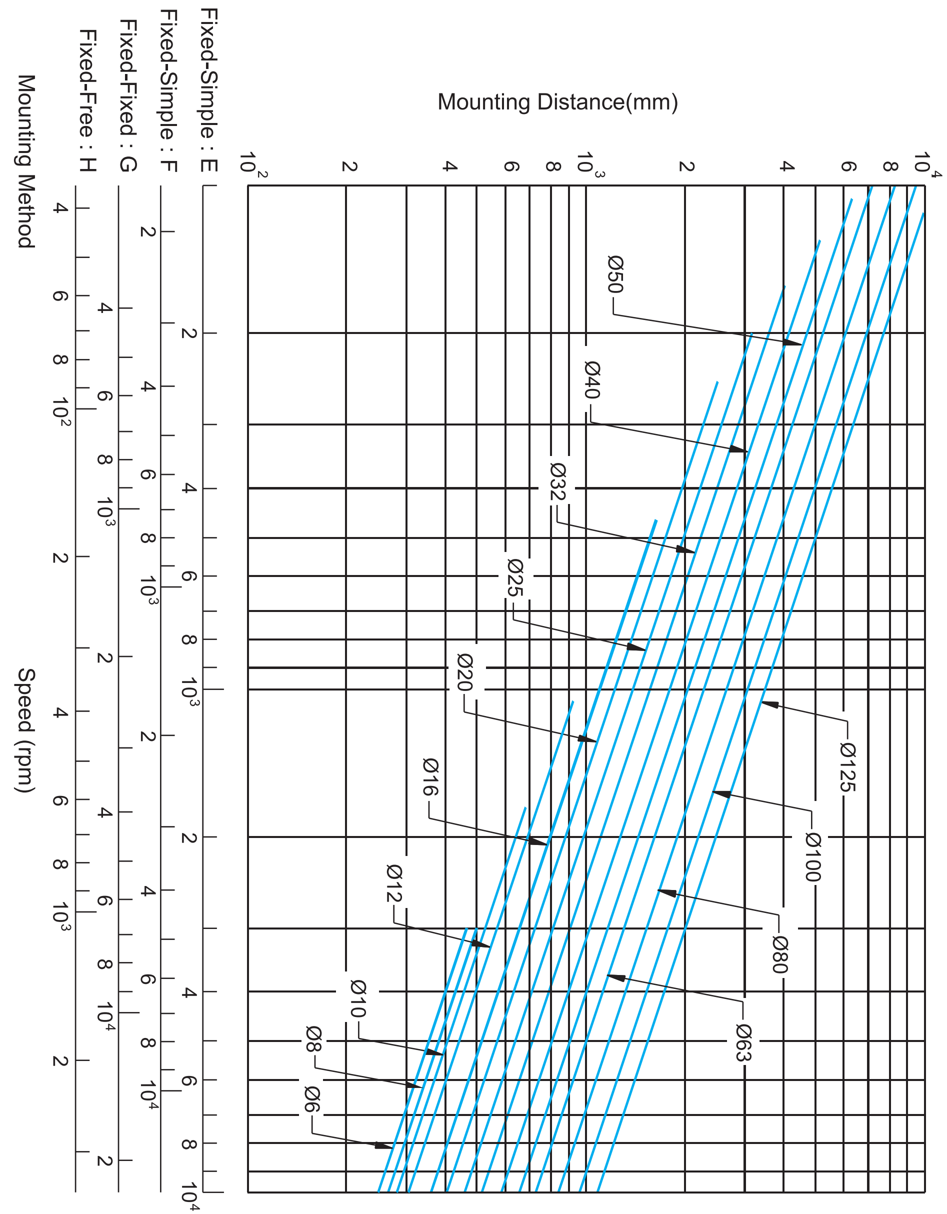



Fig 1.4.17 Critical Speed vs. Nominal Diameter

### 1-4-3 Critical Speed

#### (1) Dangerous speed

It is necessary to check if the ball screw rotation speed is resonant with the natural frequency of the screw shaft. *TBI MOTION* has determined 80% or less of this critical speed as an allowable rotation speed. Fig 1.4.17 shows a diagram which summarizes the allowable rotation speed for shaft nominal diameters up to outside diameter of the screw shaft exceeds 125mm.) Select the graduation of allowable rotation speed according to the method of supporting the ball screw. Where the working rotation speed presents a problem in terms of critical speed, it would be best to provide an intermediate support to increase the natural frequency of the screw shaft.

#### (2) dm · n value

The allowable rotation speed is regulated also by the dm · n value (dm : diameter of central circle of steel ball, n : Revolution speed, rpm) which expresses the peripheral speed.

Generally,

For precision (accuracy grade C7 to C0)

$dm \cdot n \leqq 70{,}000$

For general industry (C10)

$dm \cdot n \leqq 50{,}000$

Product exceeding the above limits can be produced, contact *TBI MOTION*.

※Particular consideration is necessary for manufacturing with the screw length／shaft dia. Ratio is $\varepsilon > 70$, In such an event, contact *TBI MOTION* .

$$n = \alpha \cdot \frac{60\lambda^2}{2\pi L^2}\sqrt{\frac{EIg}{\gamma A}} = f\,\frac{dr}{L^2}\cdot 10^7 \text{ (rpm)}$$

Where

$\alpha$ : Safty factor ( $\alpha$ = 0.8)

E : Verticle elastic modules (E = 2.1 · $10^4$ kgf／mm$^2$ )

I : Min. secondary moment of screw shaft sectional area

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

dr : Screw shaft root diameter (mm)

g : Acceleration of gravity (g = 9.8 · $10^3$ mm／s$^2$ )

$\gamma$ : Density ( $\gamma$ = 7.8 · $10^{-6}$ kgf／mm$^3$ )

A : Screw shaft sectional area (A = $\pi dr^2$／4 mm$^2$ )

L : Mounting distance (mm)

$f, \lambda$ : Coefficient determined from the ball screw mountung metnod

Simple-Simple $f$ = 9.7 ( $\lambda = \pi$ )

Fixed-Simple $f$ = 15.1 ( $\lambda$ = 3.927)

Fixed-Fixed $f$ = 21.9 ( $\lambda$ = 4.730)

Fixed-Free $f$ = 3.4 ( $\lambda$ = 1.875)



## 1-5 Driving Torque

### 1-5-1 Driving torque Ts of the transmission shaft

$T_S = T_P + T_D + T_F$ (in fixed speed)

$T_S = T_G + T_P + T_D + T_F$ (when accelerating)

$T_G$ : Acceleation torque (1)

$T_P$ : Load torque (2)

$T_D$ : Preload torque (3)

$T_F$ : Friction torque (4)

#### (1) Acceleration $T_G$

$T_G = J\alpha$ (kgf · cm)

$\alpha = \frac{2\pi n}{60 \triangle t}$ (rad／s$^2$)

J : Moment of inertia (kgf · cm · s$^2$)

$\alpha$ : Angular acceleration (rad／s$^2$)

n : Revolutions (min$^{-1}$)

$\triangle$t : Starting time (sec)

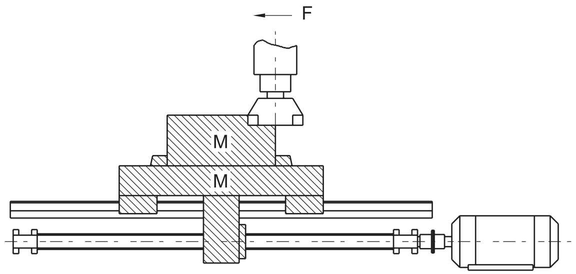



Fig 1.5.1 Momentof inertia of load

【For reference】Moment ot inertia of load (see Table 1.5.1)

$J = J_{BS} + J_{CU} + J_W + J_M$

$J_{BS}$ : Moment of inertia Ball screws shaft

$J_{CU}$ : Moment of inertia Coupler

$J_W$ : Moment of inertia Linear motion part

$J_M$ : Moment of inertia Roller shaft part of motor shaft

#### (2) Load torque $T_P$

$T_P = \frac{P \cdot \ell}{2\pi\eta_1}$ (kgf · cm)

$P = F + \mu M_g$

P : Axial load (kgf)

$\ell$ : Load (cm)

$\eta_1$ : Positive efficient

→ The efficient when rotating motion is altered to linear motion

F : Cutting force (kgf)

$\mu$ : Friction

M : Mass of moving object (kg)

g : Acceleration of gravity (9.8 m／s$^2$)

$T_P = \frac{P \cdot \ell \cdot \eta_2}{2\pi}$ (kgf · cm)

$\eta_2$ : Reverse efficiency

→ The efficiency when linear motion returns to rotating motion

#### (3) Preload torque $T_D$

$T_D = \frac{K \cdot P_{PL} \cdot \ell}{\sqrt{\tan\alpha} \cdot 2\pi}$ (kgf · cm)

K : Internal coefficient

(0.05 is usually adopted)

$P_{PL}$ : Preload (kgf)

$\ell$ : Lead (cm)

$\alpha$ : Lead angle

#### (4) Fricition torque $T_F$

$T_F = T_B + T_O + T_J$ (kgf · cm)

$T_B$ : Friction torque of bracing shaft

$T_O$ : Friction torque of free shaft

$T_J$ : Friction torque motor shaft

The friction torque of the bracing shaft would be affected by the lubrication oil. Or special attention has to be paid to unexpected excessive friction torque which may be generated when oil seal is overly tight, or may result in temperrature rise.

Table1.5.1 Conversion formula for moment of inertia of load

| Formula / Moment of inertia converted from motor shaft | J |
|---|---|
| Cylinder load | $\frac{\pi \rho L D^4}{32}$ |
| Linearly moving object | $\frac{M}{4}\left(\frac{V\ell}{\pi \cdot N_M}\right)^2 = \frac{M}{4}\left(\frac{P}{\pi}\right)^2$ |
| Unit | $kg \cdot m^2$ |
| Moment of inertia during deceleration | $J_M = \left(\frac{J\ell}{N_M}\right)^2 \cdot J\ell$ |

$\rho$ : Density ($kg/m^3$) $\rho = 7.8 \cdot 10^3$
L : Cylinder length (m)
D : Cylinder (m)
M : Mass of the linear motion part (kg)
$V\ell$ : Velocity of the linear moving object (m/min)
$N_M$ : Motor shaft revolutions ($min^{-1}$)
P : The moving magnitude of the linearly moving object per every rotation of the motor (m)
$N\ell$ : Rotations in longitudinal moving direction ($min^{-1}$)
$J\ell$ : Moment of inertia in load direction
$J_M$ : Moment of inertia in motor direction

## 1-6 Nut Design

### 1-6-1 Selection of Nut

(1) Series

When making selection of series, please take into consideration of demanded accuracy, intended delivery time, dimensions (the outside diameter of the screw, ratio of lead/the outside diameter of the screw,) preload load, etc.

(2) Circulation type

Selection of circulation type : Please focus on the economy of space for the nut installation portion.

(3) Number of loop circuits

Performance and life of service should be considered when selecting number of loop circuits.

(4) Shape of flanges (FLANGE)

Please make selection based on the available space for the installation of nuts.

(5) Oil hole

Oil holes are provided for the precision ball screws, please use them during machine assembling and regular furnishing.

Table1.6.1 Circulation type

| Circulation type | Model | | Characteristic |
|---|---|---|---|
| | Single Nut | Double Nuts | |
| Internal circulation type | SFU BSH<br>SFI SFNI<br>SFM SFNU<br>SFK | DFU<br>DFI<br>DFM | ●With nuts of finely crafted outside diameter (occupying small space)<br>●Applicable to those with smaller lead / the outside diameter of the screw |
| Externa circulation type | SFV<br>XSV<br>BSH | DFV | ●Economy<br>●Suitable for mass production<br>●Applicable to those with larger lead / the outside |
| End-caps circulation type | SFS<br>SFY<br>SFH | DFS | ●Suitable for high speed positioning |

### 1-6-2 Nut Types

#### U, I, M - Type Nut

In this type, the steel balls move along the grooves of the internal circulator, diagonally pass over the tooth tops of the scraws,than return to the origin point. It generally possesses one roll of steel balls and one single pass circulation. (see Fig 1.6.1) It is generally provided with several rolls of steel balls and a single pass circulation tube, both round type and projecting tube type of profile may be adopted.

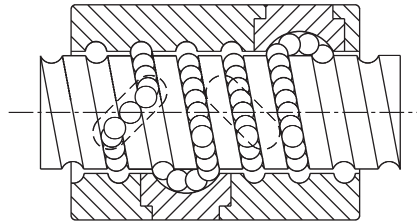


Fig 1.6.1 U, I, M - Type Nut

#### K - Type Nut

It applies the similar circulation as that of I-type, but circulation takes place in key slots of identical angle for different circulation. (see Fig 1.6.2)

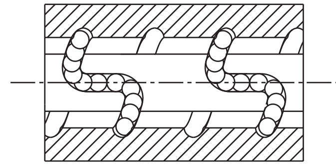


Fig 1.6.2 K - Type Nut

#### V - Type Nut

The recycle way of V - type is similar with T - type. Besides maintaining the advantages of T - type, the design of circulation of the steel ball is also along the direction of tangent of helix and can decrease the sound from the hitting between steel ball and the direction of tangent of helix and increase the smooth of recyle. V - type nut is suitable for the high-speed and heavy-load situations specially. (see Fig 1.6.3)

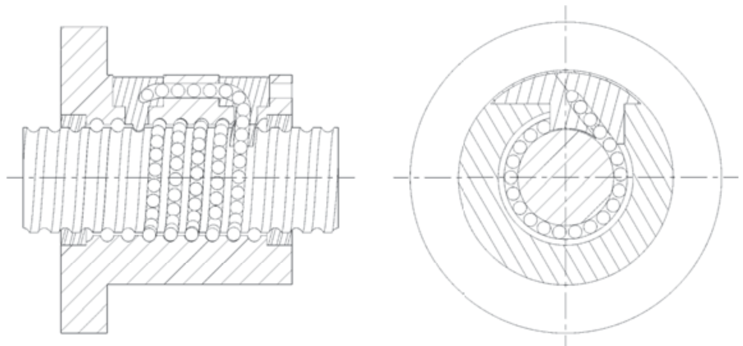


Fig 1.6.3 V - Type Nut

### Y, H - Type Nut

Type Y ball nut is dimensionally interchangeable with type E ball nut and type H ball nut shares the dimension with Type S ball nut. Both of the above ball nuts adopt the same design in circulation system. Moreover, type Y and H ball nut is designed to strengthen the performance by introducing the thin-flex material for better performance in wiping ability and higher rigidity in circulation with reinforced circulation parts. (see Fig 1.6.4)

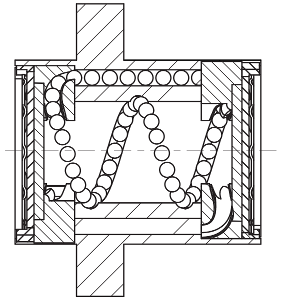


Fig 1.6.4 Y, H - type nut



### S - Type Nut

The steel balls of this type of nut forward along the groove between the screw and nut, and recycle through the circulators on both sides. The circulation way is similar with E - type. Hence, this way is the design of the circulation of the steel ball along the direction of tangent of helix, and there are sound-insulated and dust-free apparatuses on both sides of nut so the noise volume will be diminished. In addition, the assembly space is small so the S type nut is suitable for the high-speed and light-load situations specially. (see Fig 1.6.5)

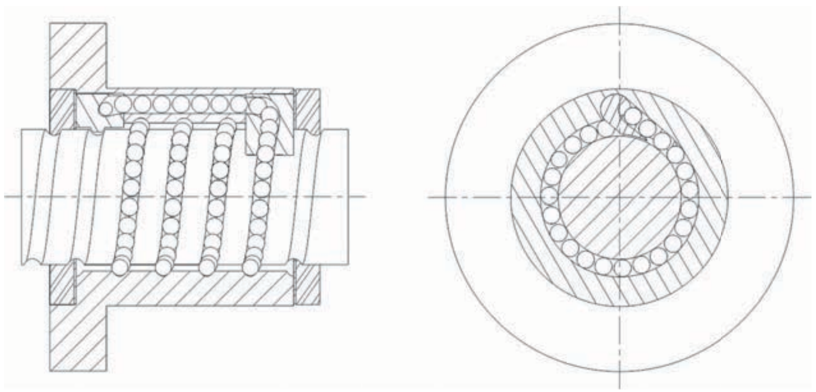


Fig 1.6.5 S -Type Nut

## 1-7 Rigidity

Excessively weak rigidity of the screw'speripheral structure is one of the primary causes that result in lost motion. Therefore, in order to achieve excellent positioning accuracy for the precison machines such as NC working machines, etc., axial rigidity balance as well as torsional rigidity for the parts at various portions of the transmission screw have to be taken into consideration at time of designing.

### Static Rigidity K

The axial elastic deformation and rigidity of the transmission screw system can be determined form the formula below.

$$K = \frac{P}{e} \text{ (kgf/mm)}$$

P：Axial load (kgf) borne by the transmission screw system

e：Axial flexural displacement (mm)

$$\frac{1}{K} = \frac{1}{K_S} + \frac{1}{K_N} + \frac{1}{K_B} + \frac{1}{K_H} \text{ (mm/kgf)}$$

$K_S$：Axial rigidity of screw shaft (1)

$K_N$：Axial rigidity of nut (2)

$K_B$： Axial rigidity of support shaft (3)

$K_H$：Axial rigidity of installation (4)

### (1) Axial rigidity Ks and displacement δ s

$$K_s = \frac{P}{\delta s} \text{ (kgf/mm)}$$

P：Axial load (kgf)

For places of Fixed - Fixed installation

$$\delta_{SF} = \frac{PL}{4AE} \text{ (mm)}$$

For places other than Fixed - Fixed installation

$$\delta_{SS} = \frac{PL_0}{AE} \text{ (mm)}$$

$\delta_{SS} = 4\,\delta_{SF}$

$\delta_{SF}$：Directional displacement at places of fixed-fixed

$\delta_{SS}$：Directional displacement at places other than fixed-fixed installation

A：Cross-sectional area of the screw shaft tooth root diameter ($mm^2$)

E：Longitudinal elastic modulus ($2.1 \cdot 10^4$ kgf/$mm^2$)

L：Distance between installations (mm)

$L_0$：Distance between load applying points (mm)

### (2) Axial rigidity $K_N$ and displacement $\delta_N$

$$K_N = \frac{P}{\delta_S} \ (\text{mm}/\text{kgf})$$

(a) In case of single nut

$$\delta_{NS} = \frac{K}{\sin\beta}\left(\frac{Q^2}{d}\right)^{\frac{1}{3}} \cdot \frac{1}{\zeta} \ (\text{mm})$$

$$Q = \frac{P}{n \cdot \sin\beta} \ (\text{kgf})$$

$$n = \frac{D_0 \pi m}{d} \ (\text{each})$$

Q：Load of one steel ball (kgf)

n：Number of steel ball

k：Constant determined based on material, shape, dimensions

$k \fallingdotseq 5.7 \cdot 10^{-4}$

$\beta$：Angle of contact (45°)

P：Axial load (kgf)

d：Steel ball diameter (mm)

$\zeta$：Accuracy, internal structure coefficient

m：Effective number of balls

$D_0$：Steel ball center diameter (mm)

$$D_0 = \frac{\ell}{\tan\alpha \cdot \pi}$$

$\ell$：Lead (mm)

$\alpha$：Lead angle

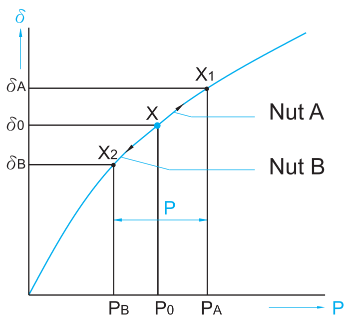



Fig 1.7.2

(b) In case of double nuts

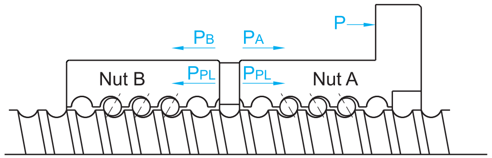



Fig 1.7.1 Preloaded for the double nuts

When an axial load P of approximately three times of preload load $P_{PL}$ is exerted, for the purpose of eliminating the preload $P_{PL}$ on nut B, please set the preload load $P_{PL}$ at no more than 1／3 of the maximal preload. (0.25Ca should be taken as the standard maximal preload load) With respect to the displacement malue, it should be of 1／2 of the single nut displacement when axial load is three times of the preload.

$$K_N = \frac{P}{\delta_{NW}} = \frac{3P_{PL}}{\delta_{NS/2}} = \frac{6P_{PL}}{\delta_{NS}} \ (\text{kgf}/\text{mm})$$

$\delta_{NS}$：Displacement of single nut(mm)

$\delta_{NW}$：Displacement of doulbe nuts(mm)

(Explancement of the rigidity of double nuts)

As show in Fig 1.7.1 and 1.7.2, when a preload $P_{PL}$ is applied on the 2 nuts A, B, both nuts A, B would produce flexural deformations that will reach point X. If an external force P is exerted from here, nut A would move from point X to point $X_1$, while nut B would move from X to $X_2$.

Then, based on the computing formula for displacement $\delta_{NS}$ of the single nut, we can obtain :

$$\delta_0 = aP_{PL}^{\frac{2}{3}}$$

while displacements of nuts A, B are $\delta_A = aP_{PL}^{\frac{2}{3}}$ since displacements of nuts A, B generated due to exertion of external force P are equal, therefore

$$\delta_A - \delta_0 = \delta_0 - \delta_B$$

Or if P is the only external force P applied on nuts A, B, if $P_A$ increases.

$$P_A - P_B = P$$

$$\delta_B = 0$$

For preventing the external force applied on nut B being absorbed by nut A thus decreaseing, so when $\delta_B = 0$

$$aP_A^{\frac{2}{3}} - aP_{PL}^{\frac{2}{3}} = aP_{PL}^{\frac{2}{3}}$$

$$P_A^{\frac{2}{3}} = 2P_{PL}^{\frac{2}{3}}$$

$$P_A = \sqrt{8}\,P_{PL} \fallingdotseq 3P_{PL}$$

or based on $\delta_A - \delta_0 = \delta_0$

$$\delta_0 = \frac{\delta_A}{2}$$

thus it can also be judged from Fig 1.7.3 that, with 1／2 displacement, the rigidity is two times as high.

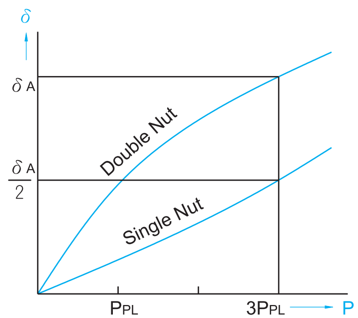



Fig 1.7.3

### (3) Axial rigidity $K_B$ and displacement $\delta_B$ of support shaft

$$K_B = \frac{P}{\delta_B} \ (\text{kgf}/\text{mm})$$

The rigidity of the assemble diagonal thrust bearind that is used as the support bearing for the ball screw and is widely unilized in the field of precision machines can be found from the following formula.

$$\delta_B = \frac{2}{\sin\beta}\left(\frac{Q^2}{d}\right)^{\frac{1}{3}}$$

$$Q = \frac{P}{n \cdot \sin\beta} \ (\text{kgf})$$

Q：Load of one steel ball (kgf)

n：Number of steel balls

$\beta$：Angle of contact (45°)

P：Axial load (kgf)

d：Steel ball diameter (mm)

$\ell a$：Effective stroke

### (4) Axial rigidity $K_H$ and displacement of $\delta_H$ portions of nuts and bearings. In early stage of machine development, special attentions should be paid to the requirement of high rigidity for the installation portion.

$$K_H = \frac{P}{\delta_H} \ (\text{kgf}/\text{mm})$$

# 1-8 Positioning Accuracy

Among the factors that cause feed accuracy errors, lead stroke accouracy and feed system rigidity are the key points for review, while other factors such as heat deformation due to temperature rise as well as assenbly accuracy for the guiding surface, etc. should also be into consideration.

## 1-8-1 Accuracy Selection

Table 1.8.1 shows the recommended application ranges for various ball screws accuracy classes based on different.

Table 1.8.1 Examples of ball screws accuracy classes for different uses

| Application | | | C0 | C1 | C2 | C3 | C5 | C7 | C10 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Accuracy Grade | | | | | | |
| NC Machine Tools | Lathe | X | ○ | ○ | ○ | ○ | ○ | ○ | |
| | | Y | | | | ○ | ○ | ○ | |
| | Milling Machine / Boring Machine | XY | | ○ | ○ | ○ | ○ | ○ | |
| | | Z | | | ○ | ○ | ○ | ○ | |
| | Machine Center | XY | | ○ | ○ | ○ | ○ | | |
| | | Z | | | ○ | ○ | ○ | | |
| | Jig Borer | Y | ○ | ○ | | | | | |
| | | Z | ○ | ○ | | | | | |
| | Drilling Machine | XY | | | | ○ | ○ | ○ | |
| | | Z | | | | | ○ | ○ | |
| | Grinding Machine | X | ○ | ○ | ○ | ○ | ○ | ○ | |
| | | Z | | ○ | ○ | ○ | ○ | ○ | |
| | Electro-discharge Machine (EDM) | XY | | ○ | ○ | ○ | ○ | ○ | |
| | | (Z) | | | ○ | ○ | ○ | ○ | |
| | Wire Cut (EDM) | Y | | ○ | ○ | ○ | | | |
| | | UV | | ○ | ○ | ○ | ○ | ○ | |
| | Punching Press | XY | | | | ○ | ○ | ○ | |
| | Laser Cutting Mathine | XY | | | | ○ | ○ | | |
| | | Z | | | | ○ | ○ | | |
| | Wood Working Machine | | | | | ○ | ○ | ○ | ○ |
| Machines of General use and special Use | | | | | ○ | ○ | ○ | ○ | ○ |
| Semiconductor Machines | Explosure Equipments | | ○ | ○ | | | | | |
| | Chemical Treatment | | | | | ○ | ○ | ○ | ○ |
| | Wire Bonder | | | ○ | ○ | ○ | | | |
| | Prober | | ○ | ○ | ○ | ○ | | | |
| | Inserter | | | | ○ | ○ | ○ | ○ | |
| | PCB Driller | | | ○ | ○ | ○ | ○ | ○ | |
| Industrial Robots | Orthogonal Type | As'sy | | ○ | ○ | ○ | ○ | ○ | |
| | | Others | | | | | ○ | ○ | ○ |
| | Muliti-joints Type | As'sy | | | ○ | ○ | ○ | | |
| | | Others | | | | ○ | ○ | ○ | |
| | SCARA Type | | | | ○ | ○ | ○ | ○ | |
| Machines for Steel molding | | | | | | | ○ | ○ | ○ |
| Injection Molding Machines | | | | | | | ○ | ○ | ○ |
| Three-Dimensonal Measuring Machines | | | ○ | ○ | ○ | | | | |
| Business Machines | | | | | | | ○ | ○ | ○ |
| Patterm Image Machines | | | ○ | ○ | | | | | |
| Nuclear | Rod Control | | | | | ○ | ○ | ○ | |
| | Mechnaical Snubber | | | | | | | ○ | ○ |
| Aircrafts | | | | | | ○ | ○ | | |

## 1-8-2 Countermeasure Against Thermal Displacement

Thermal displacement of the screw shaft results in deterioration of the positioning accuracy. The magnitude of the thermal displacement is calculated as follows :

$\triangle \ell = \alpha \cdot \triangle t \cdot L$

$\triangle \ell$ : Thermal displacement

$\alpha$ : Coefficient of thermal expansion

$\triangle t$ : Temperature rise (deg) at screw shaft

L : Screw shaft length

Namely, the screw shaft develops elongation of 12 $\mu$m per 1m when the temperature rises by 1°C. The ball screw, which lead has been machined to high accuracy, may fail to meet high level requirments because of the thermal displacement due to temperature rise. As the ball screw is operated at higher speeds, the heat generation grows to increase the influence of temperature.

The thermal displacement countermeasures for ball screws include the following :

(1) Control of heat generation

- Optimization of preload
- Correct selection and supply of lubricant
- Increase in ball screw lead, with reduced rotation speed

(2) Forced cooling

- Hollow screw shaft to allow cooling fluid to flow through
- Cooling of screw shaft exterior with cooling oil or air

(3) Aviod influence of temperature rise

High-speed warming up for use in a temperature stabilized size :

- Operates after the temperature become stable
- Pre-tension od screw shaft
- Negative travel compensation of cumulative lead
- Use of closed loop

# 1-9 Life Design

## 1-9-1 Life of Ball Screws

Even the ball screw is used under correct conditions, it would still fail after a period of time due to deteriotation. The elapse of time until is out of service is called the service life of the screw, which is generally classified into the fatigue life when delamination phenomenon occurs and the accuracy deterioation life caused by wear-out, etc.

## 1-9-2 Basic Static Load Rating Coa

The basic load rating is an axial static load which will produce a permanent combines deformation at contact points of the balls to ball grooves equal to 0.01% of ball diameter.

## 1-9-3 Basic Dynamic Load Rating Ca

The basic dynamic load rating is an axial load which allow 90% of a group of identical ball screws (rotated under the same condition) to rotate without flaking for $10^6$ revolutions.

This basic dynamic load rating is shown in the table of dimensions.

Relation berween load and service life $L_\alpha = \left(\frac{1}{P}\right)^3$ L : Service life P : Load

## 1-9-4 Fatigue Life

### Average load Pe

(1) When axial load keeps changing from time, please calcuate in order to find out the average load for the equivalent fatigue life under different load condition changes. (see Table 1.9.1)

$$P_e = \left(\frac{P_1^3 n_1 t_1 + P_2^3 n_2 t_2 + \ldots + P_n^3 n_n t_n}{n_1 t_1 + n_2 t_2 + \ldots + n_n t_n}\right)^{\frac{1}{3}} \text{(kgf)}$$

| Axial Load (kgf) | Rotating Speed (min$^{-1}$) | Time(%) |
|---|---|---|
| $P_1$ | $n_1$ | $t_1$ |
| $P_2$ | $n_2$ | $t_2$ |
| : | : | : |
| $P_n$ | $n_n$ | $t_n$ |

But, $t_1 + t_2 + t_3 + \ldots + t_n = 100$

Table 1.9.1 Service Life in Different Application.

| Usage | Life in hours (h) |
|---|---|
| Working machines | 20000 |
| General industrial machines | 10000 |
| Automatic control machines | 15000 |
| Measurement machines | 15000 |

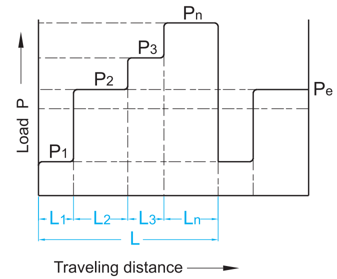



Fig 1.9.1

$$P_e = \frac{2P_{max} + P_{min}}{3} \text{ (kgf)}$$

$P_{max}$ : Maximal axial load (kgf)

$P_{min}$ : Minimal axial load (kgf)

(2) When load changes according to sine curve (see Fig 1.9.2)

$P_e \fallingdotseq 0.65\, P_{max}$ ..... (Fig A)

$P_e \fallingdotseq 0.75\, P_{max}$ ..... (Fig B)

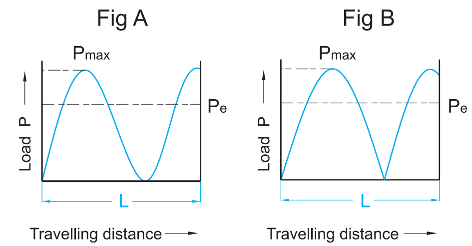



Fig 1.9.2

## 1-9-5 Calculation of Life

The fatigue life is generally expressed by the total number of revolutions. The total rotation hours or total travel distance may also be used to express life. The fatigue life is calualated as follow :

$$L = \left(\frac{C_a}{P_a \cdot f_w}\right)^3 \cdot 10^6 \qquad L_t = \frac{L}{60n} \qquad L_s = \frac{L \cdot \ell}{10^6}$$

Where

L : Rated fatigue life (rev)

$L_s$ : Life in travel distance (km)

$P_a$ : Axial (kgf)

$f_w$ : Load factor (Factor depending on operation conditions)

$L_t$ : Life in hours (h)

$C_a$ : Basic dynamic load rating (kgf)

n : Rotating speed (rpm)

$\ell$ : Lead (mm)

Table 1.9.2 Load Factor ($f_w$)

| Vibration and impact | Velocity (V) | $f_w$ |
|---|---|---|
| Very Slight | Very Low $V \leqq 0.25$ m/s | 1~1.2 |
| Slight | Low $0.25 < V \leqq 1$ m/s | 1.2~1.5 |
| Moderate | Medium $1 < V \leqq 2$ m/s | 1.5~2 |
| Strong | High $V > 2$ m/s | 2~3.5 |

Table 1.9.3 Factor of Safety ($f_s$)

| Usage | Operation | $f_s$ |
|---|---|---|
| Industrial machines | Normal operation | 1.0 ~ 1.3 |
| | Operation with impact and vibration | 2.0 ~ 3.0 |
| Work machines | Normal operation | 1.0 ~ 1.5 |
| | Operation with impact and vibration | 2.5 ~ 7.0 |

### Basic Dynamic Load Rating Ca

$C_a = P_e \cdot f_s$

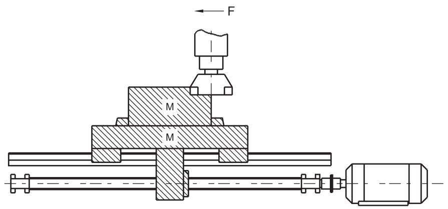
### Basic Static Load Rating Coa

$C_{oa} = P_{max} \cdot f_s$

## Key Points for Ball Screws Selection

When ball screws are subjected to selection, it is a most fundamental rule that you must first clearly find out what the operation conditions are before going ahead with the final design. Moreover, the elements of your selection include load weight, stroke, torque, position determination accuracy, tracking motion, hardness, lead stroke, nut inside diameter, etc., all elements are mutually related, any change to one of the elements will lead to the changes of other elements, special attention should always be paid to the balance among the elements.

## Calculation for Ball Screws Selection




Design conditions

| | |
|---|---|
| 1. Working table weight | 300 Kg |
| 2. Working object weight | 400 Kg |
| 3. Maxima | 700 mm |
| 4. Fast feed speed | 10 m／min |
| 5. Minimal disassembly ability | 10 $\mu$m／stroke |
| 6. Driving motor DC motor | (MAX 1000 $min^{-1}$) |
| 7. Guiding surface friction coefficient | ($\mu$ = 0.05~0.1) |
| 8. Running rate | 60 % |
| 9. Accuracy review items | |

10. Inertia generated during acceleration/deceleration can be neglected because the time periods involved are comparatively small.

### 1. Setting of operation conditions (Key Points)

(a) Machine servoce life time reckoning of H (hr)

H = ☐ hours／day ☐ days／year ☐ life years ☐ Running

(b) Mechanical conditions

| calculation Date / Difference Operations | Speed/rotations | Cutting resistance | Sliding resistance | Time used |
|---|---|---|---|---|
| Fast feed | m／min／$min^{-1}$ | kgf | kgf | % |
| Light cutting | ／ | | | |
| Medium cutting | ／ | | | |
| Heavy cutting | ／ | | | |

(c) Position determination accuracy

Feed accuracy error factor includes load accuracy and system rigidity. Thermal displacement due to heat generation and positional error of the guide system are also important factors.

### 1. Setting of operation conditions (Calculation)

(a) Machine service life time reckoning of H (hr)

H = 12 hr · 250 days · 10 years · 0.6 Running

= 18000 hr

(b) Mechanical conditions

| calculation Date / Difference Operations | Speed/rotations | Cutting resistance | Sliding resistance | Time used |
|---|---|---|---|---|
| Fast feed | 10 m／min／1000 $min^{-1}$ | 0 kgf | 70 kgf | 10 % |
| Light cutting | 6／600 | 100 | 70 | 50 |
| Medium cutting | 2／200 | 200 | 70 | 30 |
| Heavy cutting | 1／100 | 300 | 70 | 10 |

Sliding resistance = (300 + 400) · 0.1 = 70 kgf



## Key Points for Ball Screws Selection / Calculation for Ball Screws Selection

### 2. Ball screw lead stroke $\ell$ (mm)

$$\ell = \frac{\text{Fast feed stroke (m／min)} \cdot 1000}{\text{Max. Rotating speed } (min^{-1}) \text{ of motor}} \text{ (mm)}$$

Calculation:

$$\ell = \frac{10000}{1000} = 10 \text{ (mm)}$$

$$\text{Minimal disassembly} = \frac{10\text{mm}}{1000 \text{ stroke}}$$

= 0.01 mm／stroke

### 3. Computation of average load Pe (kgf)

$$P_e = \left(\frac{P_1^3 n_1 t_1 + P_2^3 n_2 t_2 + \ldots + P_n^3 n_n t_n}{n_1 t_1 + n_2 t_2 + \ldots + n_n t_n}\right)^{\frac{1}{3}}$$

$$P_e = \frac{2P_{max} + P_{min}}{3}$$

$P_e \fallingdotseq 0.65 P_{max}$

$P_e \fallingdotseq 0.75 P_{max}$

Calculation:

$$P_e = \left(\frac{70^3 \cdot 1000 \cdot 10 + 170^3 \cdot 600 \cdot 50 + 270^3 \cdot 200 \cdot 30 + 370^3 \cdot 100 \cdot 10}{1000 \cdot 10 + 600 \cdot 50 + 200 \cdot 30 + 100 \cdot 10}\right)^{\frac{1}{3}}$$

$$= \left(\frac{31.7 \cdot 10^{13}}{4.7 \cdot 10^{4}}\right)^{\frac{1}{3}}$$

$\fallingdotseq$ 189 kgf

### 4. Average number of rotations $n_m$

$$n_m = \frac{n_1 t_1 + n_2 t_2 + \ldots + n_n t_n}{100}$$

Calculation:

$$n_m = \frac{1000 \cdot 10 + 600 \cdot 50 + 200 \cdot 30 + 100 \cdot 10}{100}$$

$$= \frac{4.7 \cdot 10^4}{100} = 470 \ min^{-1}$$

### 5. Calculation of required dynamic rated load Ca

Ca = Pe · fs

Calculation: Ca = 189 · 5 = 945 (kgf)

### 6. Calculation of required static rated load Coa

Coa = Pmax · fs

Calculation: Coa = 369 · 5 = 1845 (kgf)

### 7. Selection of nut type

Ca＞945 Coa＞1845

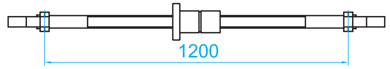
Select the nut types with basic dynamic rated load and and basic static rated load as specified above.

Calculation:

Choose SFI 2510 on the catalogue

Ca = 2954 (kgf)

Coa = 7295 (kgf)

| Key Point for Ball Screws Selection | Calculation for Ball Screws Selection |
|---|---|
| 8. Calculation of life confirmation Lt (h)<br>$L_t = \frac{L}{60n} = \left(\frac{C_a}{P_e \cdot f_w}\right)^3 \cdot 10^6 \cdot \frac{1}{60n}$ | 8. Calculation of life confirmation Lt (h)<br>$L_t = \left(\frac{2954}{189 \cdot 2}\right)^3 \cdot 10^6 \cdot \frac{1}{60 \cdot 470} = 42544(h)$ |
| 9. Mounting distance of screw length | 9. Mounting distance of screw length<br> |
| 10. Determination of screw length<br>Screw length = Maximal stroke + Nut length<br>+ Two reserved length at shaft end | 10. Determination of screw length<br>Screw length = 700 + 85 + 76 + 76 = 937 mm<br>937 mm < 1200 mm |
| 11. Permissible axial load | 11. Permissible axial load<br>Omitted because of F-F support |
| 12. Permissible revolution speed n and dm<br>$n = \alpha \cdot \frac{60\lambda^2}{2\pi L^2}\sqrt{\frac{EIg}{\gamma A}} = f \frac{dr}{L^2} \cdot 10^7$ (rpm)<br>dm = Shaft dia · Maximal speed | 12. Permissible revolution speed n and dm<br>$n = \frac{21.9 \cdot 21.86 \cdot 10^7}{1200^2} = 3324\ min^{-1} < n_{max}$<br>dm = 25 · 1000 = 25000 < 50000 |
| 13. Countermeasure against thermal displacement<br>$\triangle\ell = \alpha \cdot \triangle t \cdot L$<br>$\triangle\ell$ : Thermal displacement<br>$\alpha$ : Coefficient of thermal expansion<br>$\triangle t$ : Temperature rise (deg) at screw shaft<br>L : Screw shaft length | 13. Countermeasure against thermal displacement<br>It is estimated there would be a temperature rise 2~5°C with the ball screws of the general machinery, take temperature rise of 2°C to computer the extension of ball screw.<br>$\triangle\ell = \alpha \cdot \triangle t \cdot L = 11.7 \cdot 10^{-6} \cdot 2 \cdot 700mm$<br>$\fallingdotseq 0.016mm$<br>$F_p = \frac{EA\triangle\ell}{L}$<br>$= \frac{2.06 \cdot 10^4 \cdot \frac{\pi \cdot 21.86^2}{4} \cdot 0.016}{700} \fallingdotseq 177(kgf)$ |

| Key Point for Ball Screws Selection | Calculation for Ball Screws Selection |
|---|---|
| 14. Rigidity<br>(1) Axial rigidity Ks and displacement $\delta s$ of screw shaft<br>$K_s = \frac{P}{\delta s}$ (kgf/mm)<br>P : Axial load (kgf)<br>$\delta_{SF} = \frac{PL}{4AE}$ (mm).......(with reference to page C20)<br>(2) Axial rigidity KN and displacement $\delta s$ of nut<br>$\delta_{NS} = \frac{K}{\sin\beta}\left(\frac{Q^2}{d}\right)^{\frac{1}{3}} \cdot \frac{1}{\zeta}$ (mm)<br>$Q = \frac{P}{n \cdot \sin\beta}$ (kgf)<br>$n = \frac{D_0 \pi m}{d}$ (each).......(with reference to page C21)<br>(3) Axial rigidity KB and displacement $\delta B$ of bracing shaft<br>$K_B = \frac{P}{\delta B}$ (kgf/mm).......(with reference to page C22) | 14. Rigidity<br>Deviation can be corrected by estimating the temperature rise per extension of 0.016 mm, and taking into consideration of the pre-tension of 177 kgf.<br>(1) Directional rigidity<br>$\delta_{SF} = \frac{PL}{4AE} = \frac{27 \cdot 1200}{4 \cdot \frac{\pi \cdot 21.86^2}{4} \cdot 2.06 \cdot 10^4}$<br>$= 0.00105$ (mm)<br>$K_s = \frac{370}{0.00105} = 3.5 \cdot 10^5$ kgf/mm<br>(2) Rigidity of steel ball and nut groove<br>$n = \frac{26.62 \cdot \pi \cdot 4}{4.762} = 70$<br>$Q = \frac{370}{70\sin 45^\circ} = 10$<br>$\delta_{NS} = \frac{0.00057}{\sin 45^\circ}\left(\frac{10^2}{4.762}\right)^{\frac{1}{3}} \cdot \frac{1}{0.7}$<br>$= 3.2 \cdot 10^{-3}$ mm<br>$K_N = \frac{370}{3.2 \cdot 10^{-3}} = 1.27 \cdot 10^5$ kgf/mm<br>(3) Rigidity of support bearings<br>Where, nut rigidity 50 kgf/$\mu$m<br>$\delta_B = \frac{370}{51 \cdot 2} = 3.6\mu m$<br>$K_B = \frac{370}{0.0036} = 1 \cdot 10^5$ kgf/mm<br>● $\delta_{TOTAL} = 1.05 + 3.2 + 3.6 = 7.85\mu m$ |
| 15.Confirmation of the ball screw life | 15.Confirmation of the ball screw life<br>L = 42544 (h) > 18000 (h) |

## 1-10 Cautions About Use of Ball Screws

Ball screw assemblies are delicate components therefore; extra care must be taken to prevent the ball track from small particle and damages that caused by edged component or tools. Disassembling ball screw assembly without guidance or over travelling are strongly prohibited, if dismantle occurs, permanent damage will take place, please contact TBI Motion for after service. (as per Fig 1.10.1)

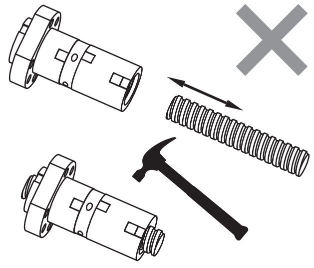


Fig 1.10.1 Error intallation

If disassembling is required, use the mandrel attached to ensure that steel balls does not fall. (Please refer to page C33)

### 1-10-1 Lubrication

Adequate lubrication must be provided when ball screw is used, insufficient lubrication will result in contact of metal, which in turn leads to increase of friction and friction loss, thus cause failure or shortening of service life.

Lubricants applied to ball screws can be divided into 2 types, namely lubricating oil and consistent grease. In general speaking, in respect of maintenance, consistent grease will lead to increase of dynamic friction torque linearly along with increase of rotating speed, hence oil lubrication is deemed the better way when speed exceeds 3-5 m/min; however, don't forget the fact that there have been examples that using grease has been capable of achieving speed of 10 m／min, with respect to the equipment.

Table 1.10.1 Inspection of lubrication and interval of refill

| Method | Interval | Check Item | Replenish or Change Interval |
|---|---|---|---|
| Auto. Intermittent oil supply | Weekly | Oil level, contamination | Add at each check, as required depending on tank level |
| Grease | nitially 2~3 months | Contamination on entry of chip | replenish yearly or according to the inspection result. |
| Oil bath | Daily | Oil level | To be determined according to consumption |

### 1-10-2 Dust Proof／Prevention

Any foreign matter or water, if allowed to enter the ball screw, may increase friction and cause damage.For example, the entry of chips or cutting oil may be expected with machine tools depending on the work environment. Where entry of foreign matter is anticipated, use a bellows or telescopic cover as shown in Fig 1.10.2, to cover the screw shaft completely.

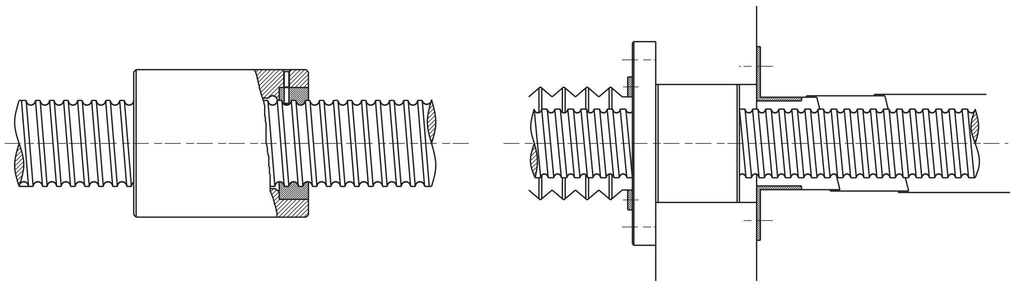


Fig 1.10.2 Dust proof Method by Telescopic Cover and Bellows

### 1-10-3 Offset Load

When offset load phenomenon occurs, screw life and noise tend to be directly affected, which would usually be accompanied with hand feel of rough running. In the event unload running and running right after assembling demonstrate different degree of cases, this should be ascribed to the poor assembly accuracy which will produce offset load phenomenon as shown in Fig 1.10.3

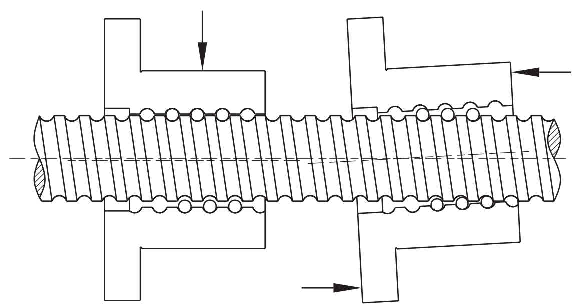


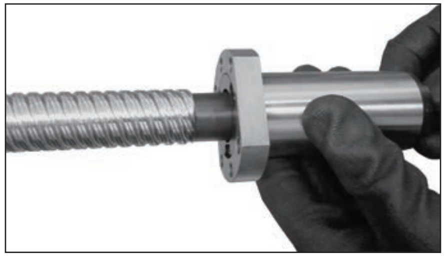
Fig 1.10.3 Offset Load

### 1-10-4 Assembling the Ball Screws

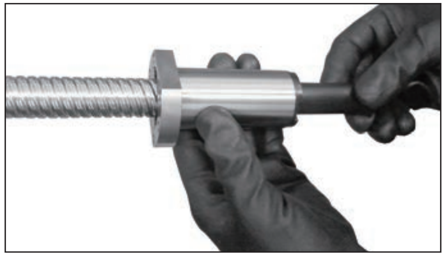
If ball nut is shipped un-assembled please follow the procedure as below.

Table 1.10.2 Procedure

(1) Remove the band.



(2) Attached the mandrel towards machine ends.



(3) Rotate the ball nut into the screw along the thread.

(4) Ensure that the ball nut is fully inserted before remove the mandrel.

### 1-10-5 Machining Specifications

(1) For the Ball Screws with internal ball circulation ball nut, it is required to have at least one end with complete thread to the end of screw, it is also required to have the journal area is with diameter to be smaller than the diameter of thread root as Fig 1.10.4 shown.

(2) The thread on screw shaft are hardened by induction hardening. It shall cause about 10~20mm at both ends journal purpose. The unhardened area will be labeled.

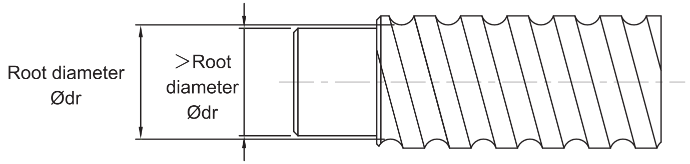



Fig 1.10.4 For Internal Circulation

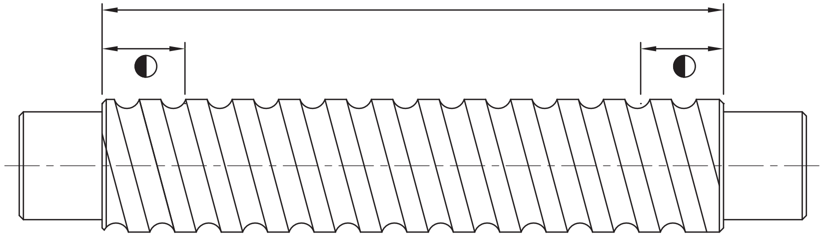


Fig 1.10.5 Harden Area

# 2. *TBI MOTION* Ball Screw

## 2-1 Nominal Model Code of Ball Screw

SFU R 025 05 T4 D G C5 - 600 - P1 - B2+N3 N3

**Nominal Model**

S
- S : Single nut
- D : Double nut

F
- F : With flange
- C : Without flange

U
- NI : NI type nut
- NU : NU type nut
- H : H type nut
- Y : Y type nut
- S : DIN nut
- V : V type nut
- I : I type nut
- U : DIN nut
- M : M type nut
- K : K type nut

**Threading Direction**
R : Right L : Left

**Nominal Diameter**
Unit : mm

**Lead**
Unit : mm

**Number of Turns (Turn · Row)**
Turn : T : 1 A : 1.5 ( or 1.7/1.8 ) B : 2.5/2.8 C : 3.5 D : 4.8
ex : ( 2.5 · 2 = B2 )

**Flange Type**
N : Not cutting S : Single cutting D : Double cutting

**Product Code**
G : Ground F : Rolled

**Accuracy Grade**
C0, C1, C2, C3, C5, C7, C10

**Overall Length of Shaft**
Unit : mm

**Axial Clearance and Preload Value**
P0, P1, P2, P3, P4

**Number of Nut**
(Leave blank if only one nut is required) Ex : Two install two nuts in a shaft : B2

**Nut Surface Treatment**
S : Standard B1 : Black Oxidation N1 : Hard Chrome Plating P : Phosphating N3 : Nickel Plating N4 : Raydent

**Shaft Surface Treatment**
S : Standard B1 : Black Oxidation N1 : Hard Chrome Plating P : Phosphating N3 : Nickel Plating N4 : Raydent

※No symbol required when no plating is need.

BALL SCREW

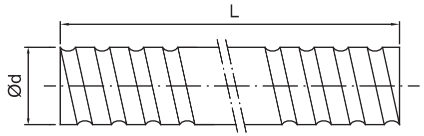



Fig 2.1.1 Screw Shaft Nominial Diameter

Table 2.1.1 Ground Ball Screw Specifications Ø4~32

Unit : mm

| Model No. | | | Accuracy Grade | Threading Direction | Number of Grooves | Standard Code of Shaft | Type of Nut |
|---|---|---|---|---|---|---|---|
| Ød | I | Da | | R : Right L : Left | | | |
| 4 | 1 | 0.8 | C7, C5, C3 | R | 1 | SCR00401 | K |
| 6 | 1 | 0.8 | C7, C5, C3 | R | 1 | SCR00601 | K |
| 8 | 1 | 0.8 | C7, C5, C3 | R／L | 1 | SCR00801 | K |
| | 2 | 1.2 | C7, C5, C3 | R／L | 1 | SCR00802 | K |
| | 2.5 | 1.2 | C7, C5, C3 | R | 1 | SCR0082.5 | K, BSH |
| 10 | 2 | 1.2 | C7, C5, C3 | R／L | 1 | SCR01002 | K, BSH |
| | 4 | 2 | C7, C5, C3 | R | 1 | SCR01004 | K, BSH |
| 12 | 2 | 1.2 | C7, C5, C3 | R／L | 1 | SCR01202 | K |
| | 4 | 2.5 | C7, C5, C3 | R | 1 | SCR01204 | U, BSH |
| | 5 | 2.5 | C7, C5, C3 | R | 1 | SCR01205-A | V, U, BSH, S, H |
| | 10 | 2.5 | C7, C5, C3 | R | 2 | SCR01210-B | V |
| 14 | 2 | 1.2 | C7, C5, C3 | R／L | 1 | SCR01402 | K |
| | 4 | 2.5 | C7, C5, C3 | R | 1 | SCR01404 | BSH |
| 16 | 2 | 1.2 | C7, C5, C3 | R／L | 1 | SCR01602 | K |
| | 4 | 2.381 | C7, C5, C3 | R | 1 | SCR01604(N) | V, I, U, BSH |
| | 5 | 3.175 | C7, C5, C3 | R／L | 1 | SCR01605 | V, I, U, BSH |
| | 10 | 3.175 | C7, C5, C3 | R／L | 2 | SCR01610 | V, I, U, BSH |
| | 16 | 2.778 | C7, C5, C3 | R | 2 | SCR01616 | Y |
| | 32 | 2.778 | C7, C5, C3 | R | 2 | SCR01632 | Y |
| 20 | 4 | 2.381 | C7, C5, C3 | R | 1 | SCR02004(N) | V, I, U |
| | 5 | 3.175 | C7, C5, C3 | R／L | 1 | SCR02005 | V, I, U, BSH, S, H |
| | 10 | 3.969 | C7, C5, C3 | R | 1 | SCR02010 | V, S, H |
| | 20 | 3.175 | C7, C5, C3 | R | 2 | SCR02020 | V, Y, S, H |
| | 40 | 3.175 | C7, C5, C3 | R | 2 | SCR02040 | Y |
| 25 | 4 | 2.381 | C7, C5, C3 | R | 1 | SCR02504(N) | I, U |
| | 5 | 3.175 | C7, C5, C3 | R／L | 1 | SCR02505 | V, I, U, BSH, S, H |
| | 6 | 3.969 | C7, C5, C3 | R | 1 | SCR02506 | V, U |
| | 8 | 4.762 | C7, C5, C3 | R | 1 | SCR02508 | V, U |
| | 10 | 4.762 | C7, C5, C3 | R | 1 | SCR02510-A | I, U, BSH |
| | 10 | 6.35 | C7, C5, C3 | R | 1 | SCR02510-B | V |
| | 25 | 3.969 | C7, C5, C3 | R | 2 | SCR02525 | V, Y |
| | 50 | 3.969 | C7, C5, C3 | R | 2 | SCR02550 | Y |
| 32 | 4 | 2.381 | C7, C5, C3 | R | 1 | SCR03204(N) | V, I, U |
| | 5 | 3.175 | C7, C5, C3 | R／L | 1 | SCR03205 | V, I, U, M, S, H |
| | 6 | 3.969 | C7, C5, C3 | R | 1 | SCR03206 | V, U |
| | 8 | 4.762 | C7, C5, C3 | R | 1 | SCR03208 | V, U |
| | 10 | 6.35 | C7, C5, C3 | R／L | 1 | SCR03210 | V, I, U |
| | 20 | 6.35 | C7, C5, C3 | R | 1 | SCR03220 | V |
| | 32 | 4.762 | C7, C5, C3 | R | 2 | SCR03232 | Y |
| | 64 | 4.762 | C7, C5, C3 | R | 2 | SCR03264 | Y |

Table 2.1.2 Standard Specifications Ø4~80

Unit：mm

| Model No. | | | Accuracy Grade | Threading Direction | Starts | Standard Code of Shaft | Type of Nut |
|---|---|---|---|---|---|---|---|
| Ød | l | Da | | R／L | | | |
| 40 | 5 | 3.175 | C7, C5, C3 | R／L | 1 | SCR04005 | V, I, U, S, H |
| | 6 | 3.969 | C7, C5, C3 | R | 1 | SCR04006 | V, U |
| | 8 | 4.762 | C7, C5, C3 | R | 1 | SCR04008 | V, U |
| | 10 | 6.35 | C7, C5, C3 | R／L | 1 | SCR04010 | V, I, U |
| | 20 | 6.35 | C7, C5, C3 | R | 2 | SCR04020 | V |
| | 40 | 6.35 | C7, C5, C3 | R | 2 | SCR04040 | Y |
| | 80 | 6.35 | C7, C5, C3 | R | 2 | SCR04080 | Y |
| 50 | 5 | 3.175 | C7, C5, C3 | R | 1 | SCR05005 | V, S, H |
| | 10 | 6.35 | C7, C5, C3 | R／L | 1 | SCR05010 | V, I, U |
| | 20 | 9.525 | C7, C5, C3 | R | 1 | SCR05020 | V |
| | 50 | 7.938 | C7, C5, C3 | R | 2 | SCR05050 | Y |
| | 100 | 7.938 | C7, C5, C3 | R | 2 | SCR050100 | Y |
| 63 | 10 | 6.35 | C7, C5, C3 | R | 1 | SCR06310 | V, I, U |
| | 20 | 9.525 | C7, C5, C3 | R | 1 | SCR06320 | V, U |
| 80 | 10 | 6.35 | C7, C5, C3 | R | 1 | SCR08010 | V, I, U |
| | 20 | 9.525 | C7, C5, C3 | R | 1 | SCR08020 | V, U |

Table 2.1.3 S-type Specifications Ø12~50

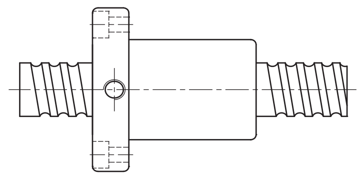
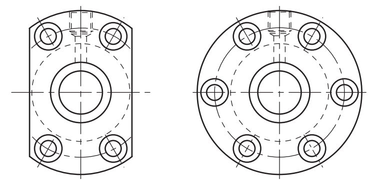
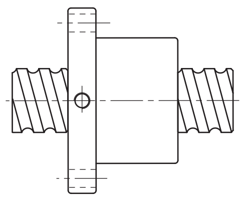
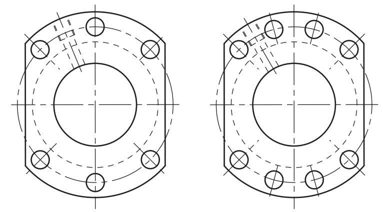
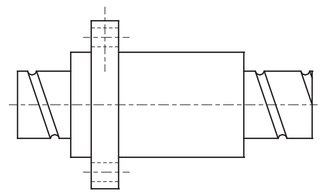
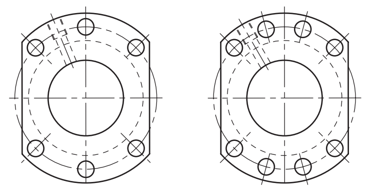
Unit：mm

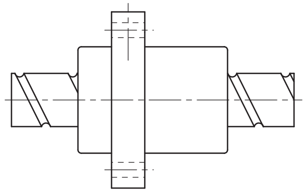
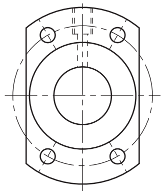
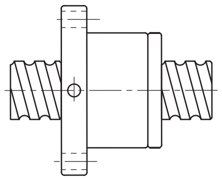
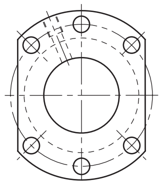
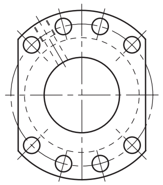
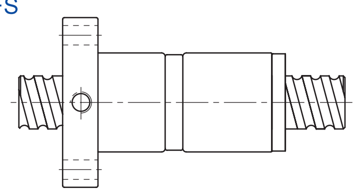
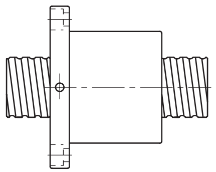
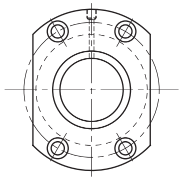
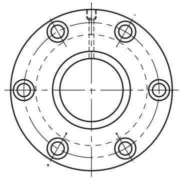
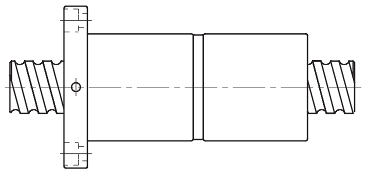
| Model No. | | | Accuracy Grade | Threading Direction | Starts | Type-S Code of Shaft | Type of Nut |
|---|---|---|---|---|---|---|---|
| Ød | l | Da | | R／L | | | |
| 12 | 10 | 2.5 | C7, C5, C3 | R | 1 | SSR01210 | S |
| 16 | 5 | 2.778 | C7, C5, C3 | R | 1 | SSR01605 | S, H |
| | 10 | 2.778 | C7, C5, C3 | R | 1 | SSR01610 | S, H |
| | 16 | 2.778 | C7, C5, C3 | R | 1 | SSR01616 | S, H |
| | 20 | 2.778 | C7, C5, C3 | R | 1 | SSR01620 | S |
| 20 | 10 | 3.175 | C7, C5, C3 | R | 1 | SSR02010 | S, H |
| 25 | 10 | 3.175 | C7, C5, C3 | R | 1 | SSR02510 | S, H |
| | 25 | 3.175 | C7, C5, C3 | R | 1 | SSR02525 | S, H |
| 32 | 10 | 3.969 | C7, C5, C3 | R | 1 | SSR03210 | S, H |
| | 20 | 3.969 | C7, C5, C3 | R | 1 | SSR03220 | S, H |
| | 32 | 3.969 | C7, C5, C3 | R | 1 | SSR03232 | S |
| 40 | 10 | 6.35 | C7, C5, C3 | R | 1 | SSR04010 | S, H |
| | 20 | 6.35 | C7, C5, C3 | R | 1 | SSR04020 | S |
| | 40 | 6.35 | C7, C5, C3 | R | 1 | SSR04040 | S |
| 50 | 10 | 6.35 | C7, C5, C3 | R | 1 | SSR05010 | S, H |
| | 20 | 6.35 | C7, C5, C3 | R | 1 | SSR05020 | S |
| | 50 | 6.35 | C7, C5, C3 | R | 1 | SSR05050 | S |

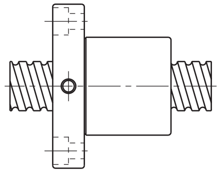
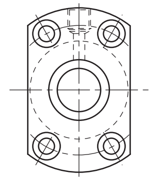
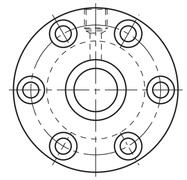
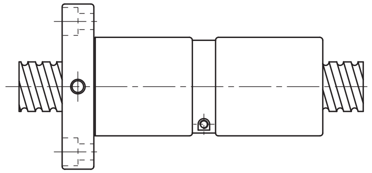
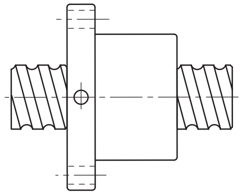
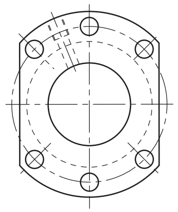
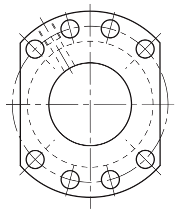
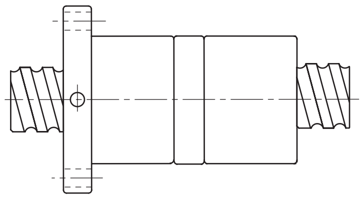
※The information is for standard production, if other needs please contact *TBIMOTION* .

## 2-2 Precision Ground Ball Screw Series

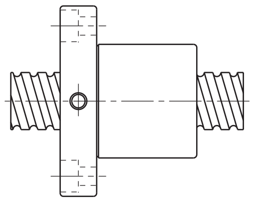
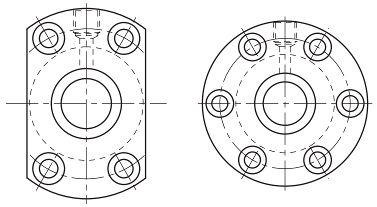
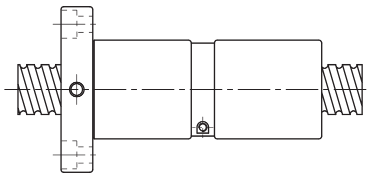
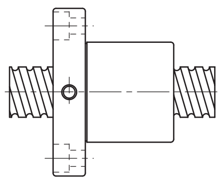
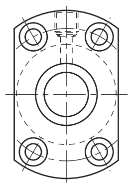
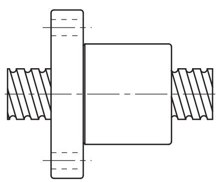
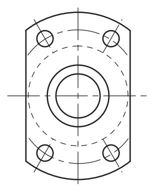
### 2-2-1 *TBIMOTION* Nut of Precision Ground Ball Screw Type

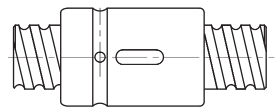
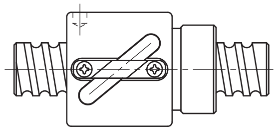
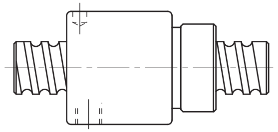
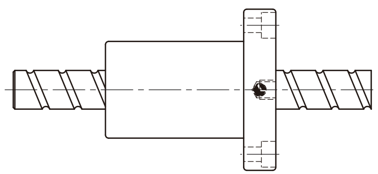
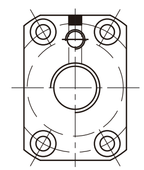
| | Nut Type | Flange Type |
|---|---|---|
| (Strong dust-proof type) NI | SFNI  C43 |  |
| (Strong dust-proof type) NU | SFNU  C44 |  d≦32 d≧40 |
| (High Speed/Strong dust-proof type) H | SFH  C45 |  Model No.≦3232 Model No.≧4005 |

| | Nut Type | Flange Type |
|---|---|---|
| (High DM-N Rating) Y | SFY  C46 |  |
| (High Speed / Low Noise type) S | SFS  C47 |  Model No.≦3232  Model No.≧4005 |
| | DFS  C48 | |
| (High Load External Circulation type) V | SFV  C49 |   |
| | DFV  C50 | |

| | Nut Type | Flange Type |
|---|---|---|
| (Standard) I | SFI  C51 |   |
| | DFI  C52 | |
| (DIN Standard) U | SFU  C53 |  d≦32  d≧40 |
| | DFU  C54 | |

BALL SCREW

| | Nut Type | Flange Type |
|---|---|---|
| M (Design for Milling) | SFM  C55 |  |
| | DFM  C55 | |
| K (Miniature type) | SFK  C56 |  (SFK 01004) (SFK 02002) (SFK 02502) |
| | SFK  C56 |  |

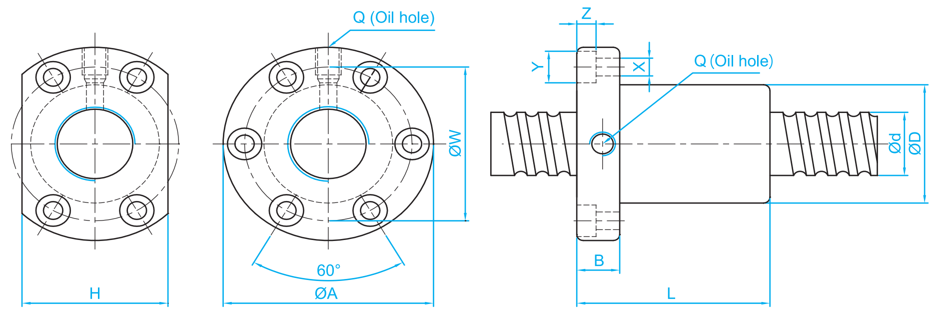
| | Nut Type | Flange Type |
|---|---|---|
| I (Standard) | SCI (No-Flange)  C57 | No-Flange |
| BSH | BSH  d≦12  d≧14 C58 | No-Flange |
| XSV (Design for factory automation) | XSV  C59~63 |  |

※The information is for standard production, if other needs please contact *TBIMOTION* .

Table 2.2.1 Preload Chart

| Preload | I, U, M-type | H, S-type | Y-type | V-type | BSH-type | K-type |
|---|---|---|---|---|---|---|
| P0 | | | | | | |
| P1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| P2 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| P3 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| P4 | | | | ✓ | | |

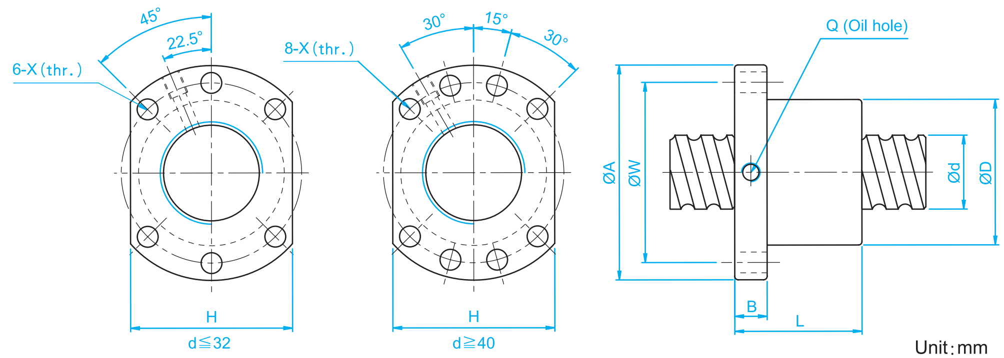
## SFNI Series Specifications




Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | | | Load Rating | | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Y | Z | Q | n | Ca (kgf) | Coa (kgf) | kgf／μm |
| SFNI01605-4 | 16 | 5 | 3.175 | 30 | 49 | 10 | 45 | 39 | 34 | 4.5 | 8 | 4.5 | M6 | 1x4 | 1380 | 3052 | 33 |
| SFNI01610-3 | | 10 | 3.175 | 34 | 58 | 10 | 57 | 45 | 34 | 5.5 | 9.5 | 5.5 | M6 | 1x3 | 1103 | 2401 | 27 |
| SFNI02005-4 | 20 | 5 | 3.175 | 34 | 57 | 11 | 51 | 45 | 40 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1551 | 3875 | 39 |
| SFNI02505-4 | 25 | 5 | 3.175 | 40 | 63 | 11 | 51 | 51 | 46 | 5.5 | 9.5 | 5.5 | M8 | 1x4 | 1724 | 4904 | 45 |
| SFNI02510-4 | | 10 | 4.762 | 46 | 72 | 12 | 80 | 58 | 52 | 6.5 | 11 | 6.5 | M6 | 1x4 | 2954 | 7295 | 51 |
| SFNI03205-4 | 32 | 5 | 3.175 | 46 | 72 | 12 | 52 | 58 | 52 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 52 |
| SFNI03210-4 | | 10 | 6.35 | 54 | 88 | 15 | 85 | 70 | 62 | 9 | 14 | 8.5 | M8 | 1x4 | 4805 | 12208 | 62 |
| SFNI04005-4 | 40 | 5 | 3.175 | 56 | 90 | 15 | 55 | 72 | 64 | 9 | 14 | 8.5 | M8 | 1x4 | 2110 | 7988 | 59 |
| SFNI04010-4 | | 10 | 6.35 | 62 | 104 | 18 | 88 | 82 | 70 | 11 | 17.5 | 11 | M8 | 1x4 | 5399 | 15500 | 72 |
| SFNI05010-4 | 50 | 10 | 6.35 | 72 | 114 | 18 | 88 | 92 | 82 | 11 | 17.5 | 11 | M8 | 1x4 | 6004 | 19614 | 83 |
| SFNI06310-4 | 63 | 10 | 6.35 | 85 | 131 | 22 | 93 | 107 | 95 | 14 | 20 | 13 | M8 | 1x4 | 6719 | 25358 | 95 |
| SFNI08010-4 | 80 | 10 | 6.35 | 105 | 150 | 22 | 93 | 127 | 115 | 14 | 20 | 13 | M8 | 1x4 | 7346 | 31953 | 109 |

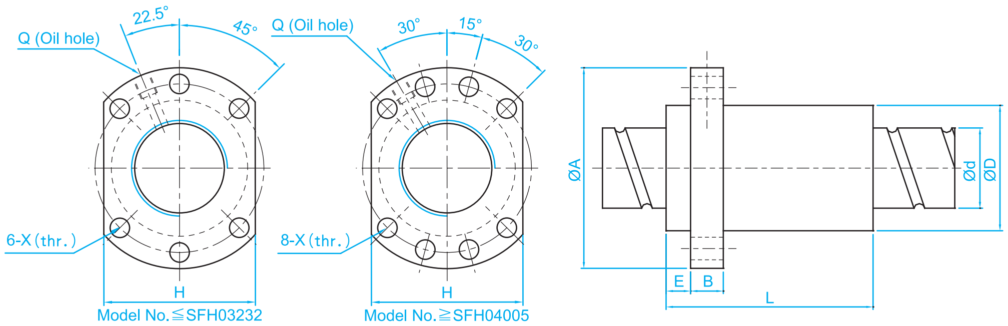
## SFNU Series Specifications




Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | Load Rating | | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Q | n | Ca (kgf) | Coa (kgf) | kgf／μm |
| SFNU01605-4 | 16 | 5 | 3.175 | 28 | 48 | 10 | 45 | 38 | 40 | 5.5 | M6 | 1x4 | 1380 | 3052 | 32 |
| SFNU01610-3 | | 10 | 3.175 | 28 | 48 | 10 | 57 | 38 | 40 | 5.5 | M6 | 1x3 | 1103 | 2401 | 26 |
| SFNU02005-4 | 20 | 5 | 3.175 | 36 | 58 | 10 | 51 | 47 | 44 | 6.6 | M6 | 1x4 | 1551 | 3875 | 39 |
| SFNU02505-4 | 25 | 5 | 3.175 | 40 | 62 | 10 | 51 | 51 | 48 | 6.6 | M6 | 1x4 | 1724 | 4904 | 45 |
| SFNU02510-4 | | 10 | 4.762 | 40 | 62 | 12 | 80 | 51 | 48 | 6.6 | M6 | 1x4 | 2954 | 7295 | 50 |
| SFNU03205-4 | 32 | 5 | 3.175 | 50 | 80 | 12 | 52 | 65 | 62 | 9 | M6 | 1x4 | 1922 | 6343 | 54 |
| SFNU03210-4 | | 10 | 6.35 | 50 | 80 | 12 | 85 | 65 | 62 | 9 | M6 | 1x4 | 4805 | 12208 | 61 |
| SFNU04005-4 | 40 | 5 | 3.175 | 63 | 93 | 14 | 55 | 78 | 70 | 9 | M8 | 1x4 | 2110 | 7988 | 63 |
| SFNU04010-4 | | 10 | 6.35 | 63 | 93 | 14 | 88 | 78 | 70 | 9 | M8 | 1x4 | 5399 | 15500 | 73 |
| SFNU05010-4 | 50 | 10 | 6.35 | 75 | 110 | 16 | 88 | 93 | 85 | 11 | M8 | 1x4 | 6004 | 19614 | 85 |
| SFNU06310-4 | 63 | 10 | 6.35 | 90 | 125 | 18 | 93 | 108 | 95 | 11 | M8 | 1x4 | 6719 | 25358 | 99 |
| SFNU08010-4 | 80 | 10 | 6.35 | 105 | 145 | 20 | 93 | 125 | 110 | 13.5 | M8 | 1x4 | 7346 | 31953 | 109 |

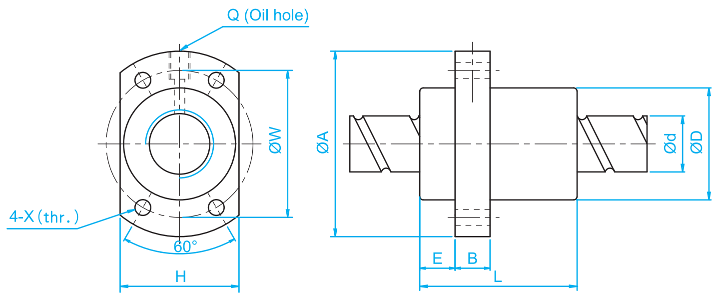
## SFH Series Specifications




Unit : mm

| Model No. | d | l | Da | Dimension | | | | | | | | | | Load Rating | | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | E | B | L | W | H | X | Q | n | Ca (kgf) | Coa (kgf) | kgf／μm |
| SFH01205-2.8 | 12 | 5 | 2.5 | 24 | 40 | 5 | 10 | 30 | 32 | 30 | 4.5 | | 2.8x1 | 661 | 1316 | 19 |
| SFH01210-2.8 | | 10 | 2.5 | 24 | 40 | 5 | 10 | 45 | 32 | 30 | 4.5 | | 2.8x1 | 642 | 1287 | 19 |
| SFH01605-3.8 | 15 | 5 | 2.778 | 28 | 48 | 5 | 10 | 37 | 38 | 40 | 5.5 | M6 | 3.8x1 | 1112 | 2507 | 30 |
| SFH01610-2.8 | | 10 | 2.778 | 28 | 48 | 5 | 10 | 45 | 38 | 40 | 5.5 | M6 | 2.8x1 | 839 | 1821 | 23 |
| SFH01616-1.8 | | 16 | 2.778 | 28 | 48 | 5 | 10 | 45 | 38 | 40 | 5.5 | M6 | 1.8x1 | 552 | 1137 | 14 |
| SFH01616-2.8 | | 16 | 2.778 | 28 | 48 | 5 | 10 | 61 | 38 | 40 | 5.5 | M6 | 2.8x1 | 808 | 1769 | 22 |
| SFH01620-1.8 | | 20 | 2.778 | 28 | 48 | 5 | 10 | 58 | 38 | 40 | 5.5 | M6 | 1.8x1 | 554 | 1170 | 14 |
| SFH02005-3.8 | 20 | 5 | 3.175 | 36 | 58 | 7 | 10 | 37 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1484 | 3681 | 37 |
| SFH02010-3.8 | | 10 | 3.175 | 36 | 58 | 7 | 10 | 55 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1516 | 3833 | 40 |
| SFH02020-1.8 | | 20 | 3.175 | 36 | 58 | 7 | 10 | 54 | 47 | 44 | 6.6 | M6 | 1.8x1 | 764 | 1758 | 19 |
| SFH02020-2.8 | | 20 | 3.175 | 36 | 58 | 7 | 10 | 74 | 47 | 44 | 6.6 | M6 | 2.8x1 | 1118 | 2734 | 29 |
| SFH02505-3.8 | 25 | 5 | 3.175 | 40 | 62 | 7 | 10 | 37 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1650 | 4658 | 43 |
| SFH02510-3.8 | | 10 | 3.175 | 40 | 62 | 7 | 12 | 55 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1638 | 4633 | 45 |
| SFH02525-1.8 | | 25 | 3.175 | 40 | 62 | 7 | 12 | 64 | 51 | 48 | 6.6 | M6 | 1.8x1 | 843 | 2199 | 22 |
| SFH02525-2.8 | | 25 | 3.175 | 40 | 62 | 7 | 12 | 89 | 51 | 48 | 6.6 | M6 | 2.8x1 | 1232 | 3421 | 34 |
| SFH03205-3.8 | 32 | 5 | 3.175 | 50 | 80 | 9 | 12 | 37 | 65 | 62 | 9 | M6 | 3.8x1 | 1839 | 6026 | 51 |
| SFH03210-3.8 | 31 | 10 | 3.969 | 50 | 80 | 9 | 12 | 57 | 65 | 62 | 9 | M6 | 3.8x1 | 2460 | 7255 | 55 |
| SFH03220-2.8 | | 20 | 3.969 | 50 | 80 | 9 | 12 | 76 | 65 | 62 | 9 | M6 | 2.8x1 | 1907 | 5482 | 43 |
| SFH03232-1.8 | | 32 | 3.969 | 50 | 80 | 9 | 12 | 80 | 65 | 62 | 9 | M6 | 1.8x1 | 1257 | 3426 | 27 |
| SFH03232-2.8 | | 32 | 3.969 | 50 | 80 | 9 | 12 | 112 | 65 | 62 | 9 | M6 | 2.8x1 | 1838 | 5329 | 42 |
| SFH04005-3.8 | 40 | 5 | 3.175 | 63 | 93 | 9 | 15 | 42 | 78 | 70 | 9 | M8 | 3.8x1 | 2018 | 7589 | 60 |
| SFH04010-3.8 | 38 | 10 | 6.35 | 63 | 93 | 9 | 14 | 60 | 78 | 70 | 9 | M8 | 3.8x1 | 5035 | 13943 | 67 |
| SFH04020-2.8 | | 20 | 6.35 | 63 | 93 | 9 | 14 | 80 | 78 | 70 | 9 | M8 | 2.8x1 | 3959 | 10715 | 54 |
| SFH04040-1.8 | | 40 | 6.35 | 63 | 93 | 9 | 14 | 98 | 78 | 70 | 9 | M8 | 1.8x1 | 2585 | 6648 | 34 |
| SFH04040-2.8 | | 40 | 6.35 | 63 | 93 | 9 | 14 | 138 | 78 | 70 | 9 | M8 | 2.8x1 | 3780 | 10341 | 52 |
| SFH05005-3.8 | 50 | 5 | 3.175 | 75 | 110 | 10.5 | 15 | 42 | 93 | 85 | 11 | M8 | 3.8x1 | 2207 | 9542 | 68 |
| SFH05010-3.8 | 48 | 10 | 6.35 | 75 | 110 | 10.5 | 18 | 60 | 93 | 85 | 11 | M8 | 3.8x1 | 5638 | 17852 | 79 |
| SFH05020-3.8 | | 20 | 6.35 | 75 | 110 | 10.5 | 18 | 100 | 93 | 85 | 11 | M8 | 3.8x1 | 5749 | 18485 | 87 |
| SFH05050-1.8 | | 50 | 6.35 | 75 | 110 | 10.5 | 18 | 120 | 93 | 85 | 11 | M8 | 1.8x1 | 2946 | 8749 | 42 |
| SFH05050-2.8 | | 50 | 6.35 | 75 | 110 | 10.5 | 18 | 170 | 93 | 85 | 11 | M8 | 2.8x1 | 4308 | 13610 | 65 |

## SFY Series Specifications

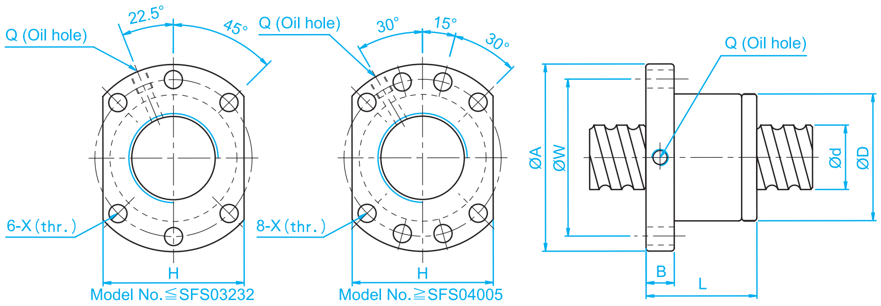



Unit : mm

| Large Lead Model No. | d | l | Da | Dimension | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | E | B | L | W | H | X | Q | n | | | |
| SFY01616-3.6 | 16 | 16 | 2.778 | 32 | 53 | 10.1 | 10 | 45 | 42 | 34 | 4.5 | M6 | 1.8x2 | 1073 | 2551 | 31 |
| SFY01616-5.6 | | 16 | 2.778 | 32 | 53 | 10.1 | 10 | 61 | 42 | 34 | 4.5 | M6 | 2.8x2 | 1568 | 3968 | 47 |
| SFY02020-3.6 | 20 | 20 | 3.175 | 39 | 62 | 13 | 10 | 52 | 50 | 41 | 5.5 | M6 | 1.8x2 | 1387 | 3515 | 37 |
| SFY02020-5.6 | | 20 | 3.175 | 39 | 62 | 13 | 10 | 72 | 50 | 41 | 5.5 | M6 | 2.8x2 | 2029 | 5468 | 56 |
| SFY02525-3.6 | 25 | 25 | 3.969 | 47 | 74 | 15 | 12 | 64 | 60 | 49 | 6.6 | M6 | 1.8x2 | 2074 | 5494 | 45 |
| SFY02525-5.6 | | 25 | 3.969 | 47 | 74 | 15 | 12 | 89 | 60 | 49 | 6.6 | M6 | 2.8x2 | 3032 | 8546 | 69 |
| SFY03232-3.6 | 32 | 32 | 4.762 | 58 | 92 | 17 | 12 | 78 | 74 | 60 | 9 | M6 | 1.8x2 | 3021 | 8690 | 58 |
| SFY03232-5.6 | | 32 | 4.762 | 58 | 92 | 17 | 12 | 110 | 74 | 60 | 9 | M6 | 2.8x2 | 4417 | 13517 | 88 |
| SFY04040-3.6 | 40 | 40 | 6.35 | 73 | 114 | 19.5 | 15 | 99 | 93 | 75 | 11 | M6 | 1.8x2 | 4831 | 14062 | 70 |
| SFY04040-5.6 | | 40 | 6.35 | 73 | 114 | 19.5 | 15 | 139 | 93 | 75 | 11 | M6 | 2.8x2 | 7065 | 21874 | 106 |
| SFY05050-3.6 | 50 | 50 | 7.938 | 90 | 135 | 21.5 | 20 | 117 | 112 | 92 | 14 | M6 | 1.8x2 | 7220 | 21974 | 86 |
| SFY05050-5.6 | | 50 | 7.938 | 90 | 135 | 21.5 | 20 | 167 | 112 | 92 | 14 | M6 | 2.8x2 | 10558 | 34182 | 131 |

| Twin Lead Model No. | d | l | Da | Dimension | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | E | B | L | W | H | X | Q | n | | | |
| SFY01632-1.6 | 16 | 32 | 2.778 | 32 | 53 | 10.1 | 10 | 42.5 | 42 | 34 | 4.5 | M6 | 0.8x2 | 493 | 1116 | 11 |
| SFY01632-3.6 | | 32 | 2.778 | 32 | 53 | 10.1 | 10 | 74.5 | 42 | 34 | 4.5 | M6 | 1.8x2 | 989 | 2511 | 23 |
| SFY02040-1.6 | 20 | 40 | 3.175 | 39 | 62 | 13 | 10 | 48 | 50 | 41 | 5.5 | M6 | 0.8x2 | 653 | 1597 | 15 |
| SFY02040-3.6 | | 40 | 3.175 | 39 | 62 | 13 | 10 | 88 | 50 | 41 | 5.5 | M6 | 1.8x2 | 1311 | 3592 | 30 |
| SFY02550-1.6 | 25 | 50 | 3.969 | 47 | 74 | 15 | 12 | 58 | 60 | 49 | 6.6 | M6 | 0.8x2 | 976 | 2495 | 19 |
| SFY02550-3.6 | | 50 | 3.969 | 47 | 74 | 15 | 12 | 108 | 60 | 49 | 6.6 | M6 | 1.8x2 | 1960 | 5614 | 32 |
| SFY03264-1.6 | 32 | 64 | 4.762 | 58 | 92 | 17 | 12 | 71 | 74 | 60 | 9 | M6 | 0.8x2 | 1374 | 3571 | 22 |
| SFY03264-3.6 | | 64 | 4.762 | 58 | 92 | 17 | 12 | 135 | 74 | 60 | 9 | M6 | 1.8x2 | 2759 | 8441 | 46 |
| SFY04080-1.6 | 40 | 80 | 6.35 | 73 | 114 | 19.5 | 15 | 90 | 93 | 75 | 11 | M6 | 0.8x2 | 2273 | 6387 | 29 |
| SFY04080-3.6 | | 80 | 6.35 | 73 | 114 | 19.5 | 15 | 170 | 93 | 75 | 11 | M6 | 1.8x2 | 4566 | 14370 | 50 |
| SFY050100-1.6 | 50 | 100 | 7.938 | 90 | 135 | 21.5 | 20 | 111 | 112 | 92 | 14 | M6 | 0.8x2 | 3398 | 9980 | 35 |
| SFY050100-3.6 | | 100 | 7.938 | 90 | 135 | 21.5 | 20 | 211 | 112 | 92 | 14 | M6 | 1.8x2 | 6824 | 22455 | 72 |

## SFS (DIN 69051 FORM B) Series Specifications

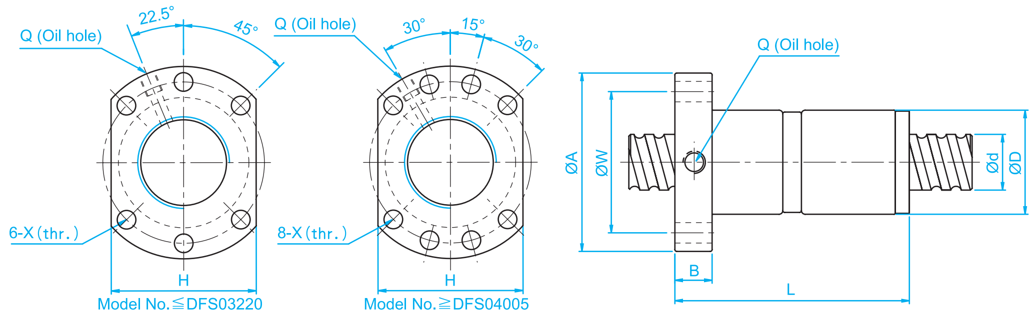



Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Q | n | | | |
| SFS01205-2.8 | 12 | 5 | 2.5 | 24 | 40 | 10 | 31 | 32 | 30 | 4.5 | | 2.8x1 | 661 | 1316 | 19 |
| SFS01210-2.8 | | 10 | 2.5 | 24 | 40 | 10 | 48.5 | 32 | 30 | 4.5 | | 2.8x1 | 642 | 1287 | 19 |
| SFS01605-3.8 | 15 | 5 | 2.778 | 28 | 48 | 10 | 38 | 38 | 40 | 5.5 | M6 | 3.8x1 | 1112 | 2507 | 30 |
| SFS01610-2.8 | | 10 | 2.778 | 28 | 48 | 10 | 47 | 38 | 40 | 5.5 | M6 | 2.8x1 | 839 | 1821 | 23 |
| SFS01616-1.8 | | 16 | 2.778 | 28 | 48 | 10 | 45 | 38 | 40 | 5.5 | M6 | 1.8x1 | 552 | 1137 | 14 |
| SFS01616-2.8 | | 16 | 2.778 | 28 | 48 | 10 | 61 | 38 | 40 | 5.5 | M6 | 2.8x1 | 808 | 1769 | 22 |
| SFS01620-1.8 | | 20 | 2.778 | 28 | 48 | 10 | 57 | 38 | 40 | 5.5 | M6 | 1.8x1 | 554 | 1170 | 14 |
| SFS02005-3.8 | 20 | 5 | 3.175 | 36 | 58 | 10 | 40 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1484 | 3681 | 37 |
| SFS02010-3.8 | | 10 | 3.175 | 36 | 58 | 10 | 60 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1516 | 3833 | 40 |
| SFS02020-1.8 | | 20 | 3.175 | 36 | 58 | 10 | 57 | 47 | 44 | 6.6 | M6 | 1.8x1 | 764 | 1758 | 19 |
| SFS02020-2.8 | | 20 | 3.175 | 36 | 58 | 10 | 77 | 47 | 44 | 6.6 | M6 | 2.8x1 | 1118 | 2734 | 29 |
| SFS02505-3.8 | 25 | 5 | 3.175 | 40 | 62 | 10 | 40 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1650 | 4658 | 43 |
| SFS02510-3.8 | | 10 | 3.175 | 40 | 62 | 12 | 62 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1638 | 4633 | 45 |
| SFS02525-1.8 | | 25 | 3.175 | 40 | 62 | 12 | 70 | 51 | 48 | 6.6 | M6 | 1.8x1 | 843 | 2199 | 22 |
| SFS02525-2.8 | | 25 | 3.175 | 40 | 62 | 12 | 95 | 51 | 48 | 6.6 | M6 | 2.8x1 | 1232 | 3421 | 34 |
| SFS03205-3.8 | 32 | 5 | 3.175 | 50 | 80 | 12 | 42 | 65 | 62 | 9 | M6 | 3.8x1 | 1839 | 6026 | 51 |
| SFS03210-3.8 | 31 | 10 | 3.969 | 50 | 80 | 13 | 62 | 65 | 62 | 9 | M6 | 3.8x1 | 2460 | 7255 | 55 |
| SFS03220-2.8 | | 20 | 3.969 | 50 | 80 | 12 | 80 | 65 | 62 | 9 | M6 | 2.8x1 | 1907 | 5482 | 43 |
| SFS03232-1.8 | | 32 | 3.969 | 50 | 80 | 13 | 84 | 65 | 62 | 9 | M6 | 1.8x1 | 1257 | 3426 | 27 |
| SFS03232-2.8 | | 32 | 3.969 | 50 | 80 | 13 | 116 | 65 | 62 | 9 | M6 | 2.8x1 | 1838 | 5329 | 42 |
| SFS04005-3.8 | 40 | 5 | 3.175 | 63 | 93 | 15 | 45 | 78 | 70 | 9 | M8 | 3.8x1 | 2018 | 7589 | 60 |
| SFS04010-3.8 | 38 | 10 | 6.35 | 63 | 93 | 14 | 63 | 78 | 70 | 9 | M8 | 3.8x1 | 5035 | 13943 | 67 |
| SFS04020-2.8 | | 20 | 6.35 | 63 | 93 | 14 | 82 | 78 | 70 | 9 | M8 | 2.8x1 | 3959 | 10715 | 54 |
| SFS04040-1.8 | | 40 | 6.35 | 63 | 93 | 15 | 105 | 78 | 70 | 9 | M8 | 1.8x1 | 2585 | 6648 | 34 |
| SFS04040-2.8 | | 40 | 6.35 | 63 | 93 | 15 | 145 | 78 | 70 | 9 | M8 | 2.8x1 | 3780 | 10341 | 52 |
| SFS05005-3.8 | 50 | 5 | 3.175 | 75 | 110 | 15 | 45 | 93 | 85 | 11 | M8 | 3.8x1 | 2207 | 9542 | 68 |
| SFS05010-3.8 | 48 | 10 | 6.35 | 75 | 110 | 18 | 68 | 93 | 85 | 11 | M8 | 3.8x1 | 5638 | 17852 | 79 |
| SFS05020-3.8 | | 20 | 6.35 | 75 | 110 | 18 | 108 | 93 | 85 | 11 | M8 | 3.8x1 | 5749 | 18485 | 87 |
| SFS05050-1.8 | | 50 | 6.35 | 75 | 110 | 18 | 125 | 93 | 85 | 11 | M8 | 1.8x1 | 2946 | 8749 | 42 |
| SFS05050-2.8 | | 50 | 6.35 | 75 | 110 | 18 | 175 | 93 | 85 | 11 | M8 | 2.8x1 | 4308 | 13610 | 65 |

※SFS series will be suspended from the production line, Please change to SFH.

## DFS (DIN 69051 FORM B) Series Specifications

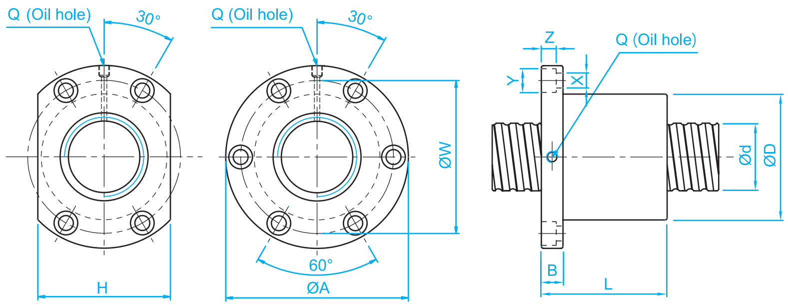



Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Q | n | | | |
| DFS01605-3.8 | 15 | 5 | 2.778 | 28 | 48 | 10 | 73 | 38 | 40 | 5.5 | M6 | 3.8x1 | 1112 | 2507 | 41 |
| DFS01610-2.8 | | 10 | 2.778 | 28 | 48 | 10 | 97 | 38 | 40 | 5.5 | M6 | 2.8x1 | 839 | 1821 | 31 |
| DFS02005-3.8 | 20 | 5 | 3.175 | 36 | 58 | 10 | 75 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1484 | 3681 | 50 |
| DFS02010-3.8 | | 10 | 3.175 | 36 | 58 | 10 | 120 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1516 | 3833 | 53 |
| DFS02505-3.8 | 25 | 5 | 3.175 | 40 | 62 | 10 | 75 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1650 | 4658 | 59 |
| DFS02510-3.8 | | 10 | 3.175 | 40 | 62 | 12 | 122 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1638 | 4633 | 61 |
| DFS03205-3.8 | 32 | 5 | 3.175 | 50 | 80 | 12 | 82 | 65 | 62 | 9 | M6 | 3.8x1 | 1839 | 6026 | 71 |
| DFS03210-3.8 | 31 | 10 | 3.969 | 50 | 80 | 13 | 122 | 65 | 62 | 9 | M6 | 3.8x1 | 2460 | 7255 | 75 |
| DFS03220-2.8 | | 20 | 3.969 | 50 | 80 | 12 | 160 | 65 | 62 | 9 | M6 | 2.8x1 | 1907 | 5482 | 58 |
| DFS04005-3.8 | 40 | 5 | 3.175 | 63 | 93 | 15 | 85 | 78 | 70 | 9 | M8 | 3.8x1 | 2018 | 7589 | 83 |
| DFS04010-3.8 | 38 | 10 | 6.35 | 63 | 93 | 14 | 123 | 78 | 70 | 9 | M8 | 3.8x1 | 5035 | 13943 | 91 |
| DFS04020-2.8 | | 20 | 6.35 | 63 | 93 | 14 | 162 | 78 | 70 | 9 | M8 | 2.8x1 | 3959 | 10715 | 73 |
| DFS05005-3.8 | 50 | 5 | 3.175 | 75 | 110 | 15 | 85 | 93 | 85 | 11 | M8 | 3.8x1 | 2207 | 9542 | 96 |
| DFS05010-3.8 | 48 | 10 | 6.35 | 75 | 110 | 18 | 138 | 93 | 85 | 11 | M8 | 3.8x1 | 5638 | 17852 | 109 |
| DFS05020-3.8 | | 20 | 6.35 | 75 | 110 | 18 | 218 | 93 | 85 | 11 | M8 | 3.8x1 | 5749 | 18485 | 116 |

Note : For double ball screw nut order, please contact ***TBIMOTION*** in advance.

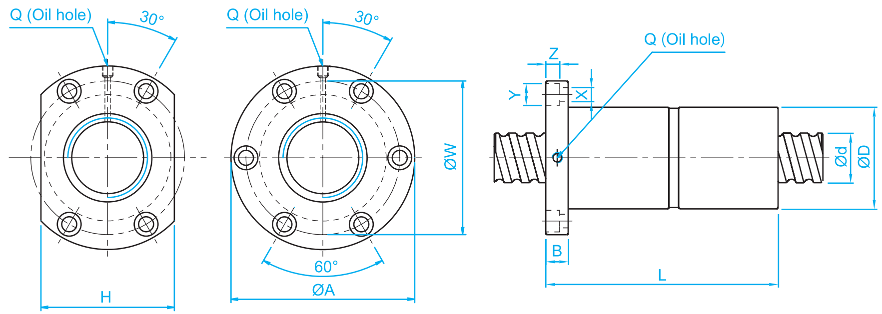
## SFV Series Specifications




Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| SFV01205-2.8 | 12 | 5 | 2.5 | 30 | 50 | 10 | 42 | 40 | 32 | 4.5 | 8 | 4.5 | M6 | 2.8x1 | 661 | 1316 | 19 |
| SFV01210-2.7 | | 10 | 2.5 | 30 | 50 | 10 | 53 | 40 | 32 | 4.5 | 8 | 4.5 | M6 | 2.7x1 | 623 | 1241 | 18 |
| SFV01510-2.7 | 15 | 10 | 3.175 | 34 | 58 | 10 | 57 | 45 | 34 | 5.5 | 9.5 | 5.5 | M6 | 2.7x1 | 972 | 2020 | 23 |
| SFV01604-3.8 | 16 | 4 | 2.381 | 34 | 57 | 11 | 45 | 45 | 34 | 5.5 | 9.5 | 5.5 | M6 | 3.8x1 | 931 | 2285 | 31 |
| SFV01605-4.8 | | 5 | 3.175 | 40 | 63 | 11 | 58 | 51 | 42 | 5.5 | 9.5 | 5.5 | M6 | 4.8x1 | 1614 | 3662 | 40 |
| SFV01610-2.7 | | 10 | 3.175 | 40 | 63 | 11 | 56 | 51 | 42 | 5.5 | 9.5 | 5.5 | M6 | 2.7x1 | 1008 | 2161 | 24 |
| SFV02004-4.8 | 20 | 4 | 2.381 | 40 | 60 | 10 | 50 | 50 | 40 | 4.5 | 8 | 4 | M6 | 4.8x1 | 1247 | 3584 | 45 |
| SFV02005-4.8 | | 5 | 3.175 | 44 | 67 | 11 | 57 | 55 | 52 | 5.5 | 9.5 | 5.5 | M6 | 4.8x1 | 1814 | 4650 | 47 |
| SFV02010-2.7 | | 10 | 3.969 | 46 | 74 | 13 | 57 | 59 | 46 | 6.6 | 11 | 6.5 | M6 | 2.7x1 | 1518 | 3398 | 30 |
| SFV02020-1.8 | | 20 | 3.175 | 46 | 74 | 13 | 70 | 59 | 46 | 6.6 | 11 | 6.5 | M6 | 1.8x1 | 764 | 1758 | 19 |
| SFV02505-4.8 | 25 | 5 | 3.175 | 50 | 73 | 11 | 55 | 61 | 52 | 5.5 | 9.5 | 5.5 | M8 | 4.8x1 | 2017 | 5884 | 56 |
| SFV02506-4.8 | | 6 | 3.969 | 53 | 76 | 11 | 62 | 64 | 58 | 5.5 | 9.5 | 5.5 | M6 | 4.8x1 | 2711 | 7268 | 58 |
| SFV02508-4.8 | | 8 | 4.762 | 56 | 85 | 13 | 70 | 71 | 64 | 6.5 | 11 | 6.5 | M6 | 4.8x1 | 3466 | 8776 | 61 |
| SFV02510-2.7 | | 10 | 6.35 | 68 | 102 | 15 | 70 | 84 | 82 | 9 | 14 | 8.5 | M8 | 2.7x1 | 3040 | 6547 | 37 |
| SFV02525-1.8 | | 25 | 3.175 | 50 | 73 | 13 | 83 | 61 | 52 | 5.5 | 9.5 | 5.5 | M8 | 1.8x1 | 843 | 2199 | 22 |
| SFV03204-4.8 | 32 | 4 | 2.381 | 54 | 81 | 12 | 50 | 67 | 64 | 6.6 | 11 | 6.5 | M6 | 4.8x1 | 1517 | 5806 | 62 |
| SFV03205-4.8 | | 5 | 3.175 | 58 | 85 | 12 | 56 | 71 | 64 | 6.6 | 11 | 6.5 | M8 | 4.8x1 | 2249 | 7612 | 66 |
| SFV03206-4.8 | | 6 | 3.969 | 62 | 89 | 12 | 60 | 75 | 68 | 6.6 | 11 | 6.5 | M8 | 4.8x1 | 3079 | 9575 | 70 |
| SFV03208-4.8 | | 8 | 4.762 | 66 | 100 | 15 | 75 | 82 | 76 | 9 | 14 | 8.5 | M8 | 4.8x1 | 3962 | 11547 | 74 |
| SFV03210-4.8 | | 10 | 6.35 | 74 | 108 | 15 | 96 | 90 | 82 | 9 | 14 | 9 | M8 | 4.8x1 | 5620 | 14649 | 76 |
| SFV03220-2.7 | | 20 | 6.35 | 74 | 108 | 16 | 100 | 90 | 82 | 9 | 14 | 8.5 | M8 | 2.7x1 | 3509 | 8644 | 46 |
| SFV04005-4.8 | 40 | 5 | 3.175 | 67 | 101 | 15 | 59 | 83 | 72 | 9 | 14 | 8.5 | M8 | 4.8x1 | 2468 | 9586 | 76 |
| SFV04010-4.8 | | 10 | 6.35 | 82 | 124 | 18 | 100 | 102 | 94 | 11 | 17.5 | 11 | M8 | 4.8x1 | 6316 | 18600 | 90 |
| SFV04020-2.7 | | 20 | 6.35 | 82 | 124 | 18 | 100 | 102 | 90 | 11 | 17.5 | 11 | M8 | 2.7x1 | 3935 | 10893 | 56 |
| SFV05005-4.8 | 50 | 5 | 3.175 | 80 | 114 | 15 | 60 | 96 | 82 | 9 | 14 | 8.5 | M8 | 4.8x1 | 2698 | 12053 | 87 |
| SFV05010-4.8 | | 10 | 6.35 | 93 | 135 | 16 | 93 | 113 | 98 | 11 | 17.5 | 11 | M8 | 4.8x1 | 7023 | 23537 | 106 |
| SFV05020-2.7 | | 20 | 9.525 | 105 | 152 | 28 | 121 | 128 | 110 | 14 | 20 | 13 | M8 | 2.7x1 | 7336 | 19700 | 68 |
| SFV06310-4.8 | 63 | 10 | 6.35 | 108 | 154 | 22 | 105 | 130 | 110 | 14 | 20 | 13 | M8 | 4.8x1 | 7860 | 30430 | 126 |
| SFV06320-2.7 | | 20 | 9.525 | 122 | 180 | 28 | 120 | 150 | 130 | 18 | 26 | 17.5 | M8 | 2.7x1 | 8162 | 24741 | 80 |
| SFV08010-4.8 | 80 | 10 | 6.35 | 130 | 176 | 22 | 105 | 152 | 132 | 14 | 20 | 13 | M8 | 4.8x1 | 8593 | 38344 | 145 |
| SFV08020-4.8 | | 20 | 9.525 | 143 | 204 | 28 | 180 | 172 | 148 | 18 | 26 | 18 | M8 | 4.8x1 | 15103 | 57296 | 168 |
| SFV08020-7.6 | | 20 | 9.525 | 143 | 204 | 28 | 240 | 172 | 148 | 18 | 26 | 18 | M8 | 3.8x2 | 22423 | 90719 | 260 |

## DFV Series Specifications



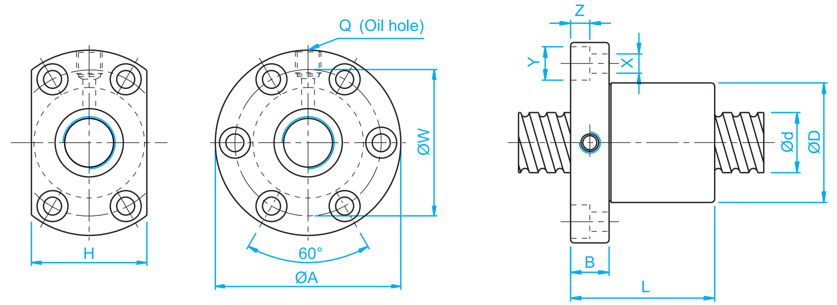

Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| DFV01510-2.7 | 15 | 10 | 3.175 | 34 | 58 | 10 | 107 | 45 | 34 | 5.5 | 9.5 | 5.5 | M6 | 2.7x1 | 972 | 2020 | 30 |
| DFV01604-3.8 | 16 | 4 | 2.381 | 34 | 57 | 11 | 89 | 45 | 34 | 5.5 | 9.5 | 5.5 | M6 | 3.8x1 | 931 | 2285 | 42 |
| DFV01605-4.8 | | 5 | 3.175 | 40 | 63 | 11 | 113 | 51 | 42 | 5.5 | 9.5 | 5.5 | M6 | 4.8x1 | 1614 | 3662 | 53 |
| DFV01610-2.7 | | 10 | 3.175 | 40 | 63 | 11 | 106 | 51 | 42 | 5.5 | 9.5 | 5.5 | M6 | 2.7x1 | 1008 | 2161 | 32 |
| DFV02004-4.8 | 20 | 4 | 2.381 | 40 | 60 | 10 | 94 | 50 | 40 | 4.5 | 8 | 4 | M6 | 4.8x1 | 1247 | 3584 | 61 |
| DFV02005-4.8 | | 5 | 3.175 | 44 | 67 | 11 | 112 | 55 | 52 | 5.5 | 9.5 | 5.5 | M6 | 4.8x1 | 1814 | 4650 | 63 |
| DFV02010-2.7 | | 10 | 3.969 | 46 | 74 | 13 | 117 | 59 | 46 | 6.6 | 11 | 6.5 | M6 | 2.7x1 | 1518 | 3398 | 40 |
| DFV02505-4.8 | 25 | 5 | 3.175 | 50 | 73 | 11 | 105 | 61 | 52 | 5.5 | 9.5 | 5.5 | M8 | 4.8x1 | 2017 | 5884 | 75 |
| DFV02506-4.8 | | 6 | 3.969 | 53 | 76 | 11 | 116 | 64 | 58 | 5.5 | 9.5 | 5.5 | M6 | 4.8x1 | 2711 | 7268 | 78 |
| DFV02508-4.8 | | 8 | 4.762 | 56 | 85 | 13 | 134 | 71 | 64 | 6.5 | 11 | 6.5 | M6 | 4.8x1 | 3466 | 8776 | 82 |
| DFV02510-2.7 | | 10 | 6.35 | 68 | 102 | 15 | 130 | 84 | 82 | 9 | 14 | 8.5 | M8 | 2.7x1 | 3040 | 6547 | 49 |
| DFV03204-4.8 | 32 | 4 | 2.381 | 54 | 81 | 12 | 94 | 67 | 64 | 6.6 | 11 | 6.5 | M6 | 4.8x1 | 1517 | 5806 | 85 |
| DFV03205-4.8 | | 5 | 3.175 | 58 | 85 | 12 | 106 | 71 | 64 | 6.6 | 11 | 6.5 | M8 | 4.8x1 | 2249 | 7612 | 90 |
| DFV03206-4.8 | | 6 | 3.969 | 62 | 89 | 12 | 114 | 75 | 68 | 6.6 | 11 | 6.5 | M8 | 4.8x1 | 3079 | 9575 | 95 |
| DFV03208-4.8 | | 8 | 4.762 | 66 | 100 | 15 | 139 | 82 | 76 | 9 | 14 | 8.5 | M8 | 4.8x1 | 3962 | 11547 | 100 |
| DFV03210-4.8 | | 10 | 6.35 | 74 | 108 | 15 | 186 | 90 | 82 | 9 | 14 | 9 | M8 | 4.8x1 | 5620 | 14649 | 101 |
| DFV03220-2.7 | | 20 | 6.35 | 74 | 108 | 16 | 200 | 90 | 82 | 9 | 14 | 8.5 | M8 | 2.7x1 | 3509 | 8644 | 61 |
| DFV04005-4.8 | 40 | 5 | 3.175 | 67 | 101 | 15 | 109 | 83 | 72 | 9 | 14 | 8.5 | M8 | 4.8x1 | 2468 | 9586 | 105 |
| DFV04010-4.8 | | 10 | 6.35 | 82 | 124 | 18 | 188 | 102 | 94 | 11 | 17.5 | 11 | M8 | 4.8x1 | 6316 | 18600 | 121 |
| DFV04020-2.7 | | 20 | 6.35 | 82 | 124 | 18 | 200 | 102 | 90 | 11 | 17.5 | 11 | M8 | 2.7x1 | 3935 | 10893 | 74 |
| DFV05005-4.8 | 50 | 5 | 3.175 | 80 | 114 | 15 | 115 | 96 | 82 | 9 | 14 | 8.5 | M8 | 4.8x1 | 2698 | 12053 | 122 |
| DFV05010-4.8 | | 10 | 6.35 | 93 | 135 | 16 | 173 | 113 | 98 | 11 | 17.5 | 11 | M8 | 4.8x1 | 7023 | 23537 | 144 |
| DFV05020-2.7 | | 20 | 9.525 | 105 | 152 | 28 | 221 | 128 | 110 | 14 | 20 | 13 | M8 | 2.7x1 | 7336 | 19700 | 90 |
| DFV06310-4.8 | 63 | 10 | 6.35 | 108 | 154 | 22 | 195 | 130 | 110 | 14 | 20 | 13 | M8 | 4.8x1 | 7860 | 30430 | 172 |
| DFV06320-2.7 | | 20 | 9.525 | 122 | 180 | 28 | 220 | 150 | 130 | 18 | 26 | 17.5 | M8 | 2.7x1 | 8162 | 24741 | 107 |
| DFV08010-4.8 | 80 | 10 | 6.35 | 130 | 176 | 22 | 195 | 152 | 132 | 14 | 20 | 13 | M8 | 4.8x1 | 8593 | 38344 | 201 |
| DFV08020-4.8 | | 20 | 9.525 | 143 | 204 | 28 | 340 | 172 | 148 | 18 | 26 | 18 | M8 | 4.8x1 | 15103 | 57296 | 226 |
| DFV08020-7.6 | | 20 | 9.525 | 143 | 204 | 28 | 460 | 172 | 148 | 18 | 26 | 18 | M8 | 3.8x2 | 22423 | 90719 | 351 |

Note : For double ball screw nut order, please contact ***TBIMOTION*** in advance.

BALL SCREW

## SFI Series Specifications



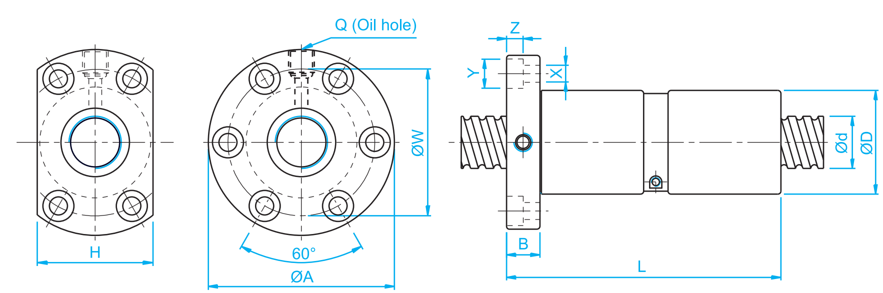

Unit：mm

| | Model No. | d | l | Da | D | A | B | L | W | H | X | Y | Z | Q | n | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SFI01604-4 | 16 | 4 | 2.381 | 30 | 49 | 10 | 45 | 39 | 34 | 4.5 | 8 | 4.5 | M6 | 1x4 | 973 | 2406 | 32 |
| ☆ | SFI01605-4 | | 5 | 3.175 | 30 | 49 | 10 | 50 | 39 | 34 | 4.5 | 8 | 4.5 | M6 | 1x4 | 1380 | 3052 | 33 |
| ☆ | SFI01610-3 | | 10 | 3.175 | 34 | 58 | 10 | 57 | 45 | 34 | 5.5 | 9.5 | 5.5 | M6 | 1x3 | 1103 | 2401 | 27 |
| | SFI02004-4 | 20 | 4 | 2.381 | 34 | 57 | 11 | 46 | 45 | 40 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1066 | 2987 | 37 |
| ☆ | SFI02005-4 | | 5 | 3.175 | 34 | 57 | 11 | 51 | 45 | 40 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1551 | 3875 | 39 |
| | SFI0205T-4 | | 5.08 | 3.175 | 34 | 57 | 11 | 51 | 45 | 40 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1550 | 3875 | 39 |
| ☆ | SFI02504-4 | 25 | 4 | 2.381 | 40 | 63 | 11 | 46 | 51 | 46 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1180 | 3795 | 43 |
| ☆ | SFI02505-4 | | 5 | 3.175 | 40 | 63 | 11 | 51 | 51 | 46 | 5.5 | 9.5 | 5.5 | M8 | 1x4 | 1724 | 4904 | 45 |
| | SFI0255T-4 | | 5.08 | 3.175 | 40 | 63 | 11 | 51 | 51 | 46 | 5.5 | 9.5 | 5.5 | M8 | 1x4 | 1724 | 4904 | 45 |
| ☆ | SFI02510-4 | | 10 | 4.762 | 46 | 72 | 12 | 85 | 58 | 52 | 6.5 | 11 | 6.5 | M6 | 1x4 | 2954 | 7295 | 51 |
| | SFI03204-4 | 32 | 4 | 2.381 | 46 | 72 | 12 | 47 | 58 | 52 | 6.5 | 11 | 6.5 | M6 | 1x4 | 1296 | 4838 | 49 |
| ☆ | SFI03205-4 | | 5 | 3.175 | 46 | 72 | 12 | 52 | 58 | 52 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 52 |
| ☆ | SFI03210-4 | | 10 | 6.35 | 54 | 88 | 15 | 90 | 70 | 62 | 9 | 14 | 8.5 | M8 | 1x4 | 4805 | 12208 | 62 |
| ☆ | SFI04005-4 | 40 | 5 | 3.175 | 56 | 90 | 15 | 55 | 72 | 64 | 9 | 14 | 8.5 | M8 | 1x4 | 2110 | 7988 | 59 |
| ☆ | SFI04010-4 | | 10 | 6.35 | 62 | 104 | 18 | 93 | 82 | 70 | 11 | 17.5 | 11 | M8 | 1x4 | 5399 | 15500 | 72 |
| ☆ | SFI05010-4 | 50 | 10 | 6.35 | 72 | 114 | 18 | 93 | 92 | 82 | 11 | 17.5 | 11 | M8 | 1x4 | 6004 | 19614 | 83 |
| ☆ | SFI06310-4 | 63 | 10 | 6.35 | 85 | 131 | 22 | 98 | 107 | 95 | 14 | 20 | 13 | M8 | 1x4 | 6719 | 25358 | 95 |
| | SFI08010-4 | 80 | 10 | 6.35 | 105 | 150 | 22 | 98 | 127 | 115 | 14 | 20 | 13 | M8 | 1x4 | 7346 | 31953 | 109 |

(D through n: Dimension)

※☆Left helix available

## DFI Series Specifications




Unit：mm

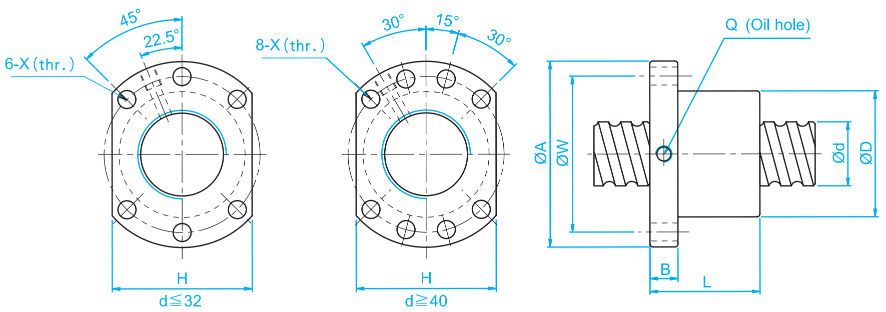
| | Model No. | d | l | Da | D | A | B | L | W | H | X | Y | Z | Q | n | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DFI01604-4 | 16 | 4 | 2.381 | 30 | 49 | 10 | 80 | 39 | 34 | 4.5 | 8 | 4.5 | M6 | 1x4 | 973 | 2406 | 44 |
| ☆ | DFI01605-4 | | 5 | 3.175 | 30 | 49 | 10 | 100 | 39 | 34 | 4.5 | 8 | 4.5 | M6 | 1x4 | 1380 | 3052 | 44 |
| | DFI02004-4 | 20 | 4 | 2.381 | 34 | 57 | 11 | 80 | 45 | 40 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1066 | 2987 | 51 |
| ☆ | DFI02005-4 | | 5 | 3.175 | 34 | 57 | 11 | 101 | 45 | 40 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1551 | 3875 | 52 |
| | DFI02504-4 | 25 | 4 | 2.381 | 40 | 63 | 11 | 80 | 51 | 46 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1180 | 3795 | 60 |
| ☆ | DFI02505-4 | | 5 | 3.175 | 40 | 63 | 11 | 101 | 51 | 46 | 5.5 | 9.5 | 5.5 | M8 | 1x4 | 1724 | 4094 | 62 |
| | DFI0255T-4 | | 5.08 | 3.175 | 40 | 63 | 11 | 101 | 51 | 46 | 5.5 | 9.5 | 5.5 | M8 | 1x4 | 1724 | 4094 | 62 |
| | DFI02510-4 | | 10 | 4.762 | 46 | 72 | 12 | 145 | 58 | 52 | 6.5 | 11 | 6.5 | M6 | 1x4 | 2954 | 7295 | 68 |
| | DFI03204-4 | 32 | 4 | 2.381 | 46 | 72 | 12 | 80 | 58 | 52 | 6.5 | 11 | 6.5 | M6 | 1x4 | 1296 | 4838 | 69 |
| ☆ | DFI03205-4 | | 5 | 3.175 | 46 | 72 | 12 | 102 | 58 | 52 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 72 |
| | DFI0325T-4 | | 5.08 | 3.175 | 46 | 72 | 12 | 102 | 58 | 52 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 72 |
| ☆ | DFI03210-4 | | 10 | 6.35 | 54 | 88 | 15 | 162 | 70 | 62 | 9 | 14 | 8.5 | M8 | 1x4 | 4805 | 12208 | 83 |
| ☆ | DFI04005-4 | 40 | 5 | 3.175 | 56 | 90 | 15 | 105 | 72 | 64 | 9 | 14 | 8.5 | M8 | 1x4 | 2110 | 7988 | 84 |
| ☆ | DFI04010-4 | | 10 | 6.35 | 62 | 104 | 18 | 165 | 82 | 70 | 11 | 17.5 | 11 | M8 | 1x4 | 5399 | 15500 | 99 |
| ☆ | DFI05010-4 | 50 | 10 | 6.35 | 72 | 114 | 18 | 171 | 92 | 82 | 11 | 17.5 | 11 | M8 | 1x4 | 6004 | 19614 | 115 |
| ☆ | DFI06310-4 | 63 | 10 | 6.35 | 85 | 131 | 22 | 182 | 107 | 95 | 14 | 20 | 13 | M8 | 1x4 | 6719 | 25358 | 135 |
| | DFI08010-4 | 80 | 10 | 6.35 | 105 | 150 | 22 | 182 | 127 | 115 | 14 | 20 | 13 | M8 | 1x4 | 7346 | 31953 | 156 |

(D through n: Dimension)

Note : For double ball screw nut order, please contact ***TBIMOTION*** in advance.

※☆Left helix available

## SFU (DIN 69051 FORM B) Series Specifications

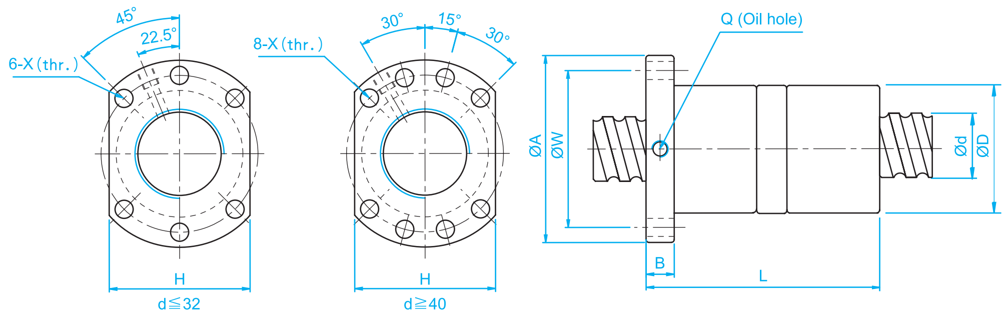



Unit: mm

| Model No. | d | l | Da | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Q | n | | | |
| SFU01204-4 | 12 | 4 | 2.5 | 24 | 40 | 10 | 40 | 32 | 30 | 4.5 | | 1x4 | 902 | 1884 | 26 |
| SFU01604-4 | 16 | 4 | 2.381 | 28 | 48 | 10 | 40 | 38 | 40 | 5.5 | M6 | 1x4 | 973 | 2406 | 32 |
| ☆SFU01605-4 | | 5 | 3.175 | 28 | 48 | 10 | 50 | 38 | 40 | 5.5 | M6 | 1x4 | 1380 | 3052 | 32 |
| ☆SFU01610-3 | | 10 | 3.175 | 28 | 48 | 10 | 57 | 38 | 40 | 5.5 | M6 | 1x3 | 1103 | 2401 | 26 |
| SFU02004-4 | 20 | 4 | 2.381 | 36 | 58 | 10 | 42 | 47 | 44 | 6.6 | M6 | 1x4 | 1066 | 2987 | 38 |
| ☆SFU02005-4 | | 5 | 3.175 | 36 | 58 | 10 | 51 | 47 | 44 | 6.6 | M6 | 1x4 | 1551 | 3875 | 39 |
| SFU02504-4 | 25 | 4 | 2.381 | 40 | 62 | 10 | 42 | 51 | 48 | 6.6 | M6 | 1x4 | 1180 | 3795 | 43 |
| ☆SFU02505-4 | | 5 | 3.175 | 40 | 62 | 10 | 51 | 51 | 48 | 6.6 | M6 | 1x4 | 1724 | 4904 | 45 |
| SFU02506-4 | | 6 | 3.969 | 40 | 62 | 10 | 54 | 51 | 48 | 6.6 | M6 | 1x4 | 2318 | 6057 | 47 |
| SFU02508-4 | | 8 | 4.762 | 40 | 62 | 10 | 63 | 51 | 48 | 6.6 | M6 | 1x4 | 2963 | 7313 | 49 |
| ☆SFU02510-4 | | 10 | 4.762 | 40 | 62 | 12 | 85 | 51 | 48 | 6.6 | M6 | 1x4 | 2954 | 7295 | 50 |
| SFU03204-4 | 32 | 4 | 2.381 | 50 | 80 | 12 | 44 | 65 | 62 | 9 | M6 | 1x4 | 1296 | 4838 | 51 |
| ☆SFU03205-4 | | 5 | 3.175 | 50 | 80 | 12 | 52 | 65 | 62 | 9 | M6 | 1x4 | 1922 | 6343 | 54 |
| SFU03206-4 | | 6 | 3.969 | 50 | 80 | 12 | 57 | 65 | 62 | 9 | M6 | 1x4 | 2632 | 7979 | 57 |
| SFU03208-4 | | 8 | 4.762 | 50 | 80 | 12 | 65 | 65 | 62 | 9 | M6 | 1x4 | 3387 | 9622 | 60 |
| ☆SFU03210-4 | | 10 | 6.35 | 50 | 80 | 12 | 90 | 65 | 62 | 9 | M6 | 1x4 | 4805 | 12208 | 61 |
| ☆SFU04005-4 | 40 | 5 | 3.175 | 63 | 93 | 14 | 55 | 78 | 70 | 9 | M8 | 1x4 | 2110 | 7988 | 63 |
| SFU04006-4 | | 6 | 3.969 | 63 | 93 | 14 | 60 | 78 | 70 | 9 | M6 | 1x4 | 2873 | 9913 | 66 |
| SFU04008-4 | | 8 | 4.762 | 63 | 93 | 14 | 67 | 78 | 70 | 9 | M6 | 1x4 | 3712 | 11947 | 70 |
| ☆SFU04010-4 | | 10 | 6.35 | 63 | 93 | 14 | 93 | 78 | 70 | 9 | M8 | 1x4 | 5399 | 15500 | 73 |
| ☆SFU05010-4 | 50 | 10 | 6.35 | 75 | 110 | 16 | 93 | 93 | 85 | 11 | M8 | 1x4 | 6004 | 19614 | 85 |
| ☆SFU05020-4 | | 20 | 7.144 | 75 | 110 | 16 | 138 | 93 | 85 | 11 | M8 | 1x4 | 7142 | 22588 | 94 |
| ☆SFU06310-4 | 63 | 10 | 6.35 | 90 | 125 | 18 | 98 | 108 | 95 | 11 | M8 | 1x4 | 6719 | 25358 | 99 |
| SFU06320-4 | | 20 | 9.525 | 95 | 135 | 20 | 149 | 115 | 100 | 13.5 | M8 | 1x4 | 11444 | 36653 | 112 |
| ☆SFU08010-4 | 80 | 10 | 6.35 | 105 | 145 | 20 | 98 | 125 | 110 | 13.5 | M8 | 1x4 | 7346 | 31953 | 109 |
| SFU08020-4 | | 20 | 9.525 | 125 | 165 | 25 | 154 | 145 | 130 | 13.5 | M8 | 1x4 | 12911 | 47747 | 138 |
| SFU10020-4 | 100 | 20 | 9.525 | 150 | 202 | 30 | 180 | 170 | 155 | 17.5 | M8 | 1x4 | 14303 | 60698 | 162 |

※☆Left helix available

## DFU (DIN 69051 FORM B) Series Specifications

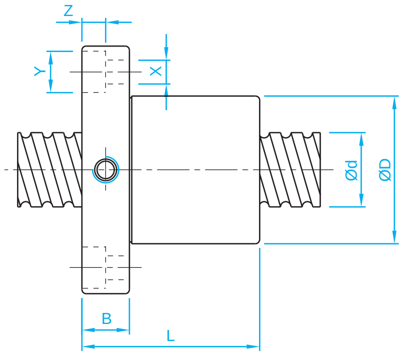



Unit: mm

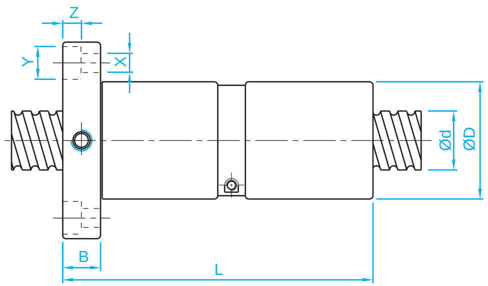
| Model No. | d | l | Da | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Q | n | | | |
| DFU01604-4 | 16 | 4 | 2.381 | 28 | 48 | 10 | 80 | 38 | 40 | 5.5 | M6 | 1x4 | 973 | 2406 | 43 |
| ☆DFU01605-4 | | 5 | 3.175 | 28 | 48 | 10 | 100 | 38 | 40 | 5.5 | M6 | 1x4 | 1380 | 3052 | 44 |
| ☆DFU01610-3 | | 10 | 3.175 | 28 | 48 | 10 | 118 | 38 | 40 | 5.5 | M6 | 1x3 | 1103 | 2401 | 35 |
| DFU02004-4 | 20 | 4 | 2.381 | 36 | 58 | 10 | 80 | 47 | 44 | 6.6 | M6 | 1x4 | 1066 | 2987 | 51 |
| ☆DFU02005-4 | | 5 | 3.175 | 36 | 58 | 10 | 101 | 47 | 44 | 6.6 | M6 | 1x4 | 1551 | 3875 | 53 |
| DFU02504-4 | 25 | 4 | 2.381 | 40 | 62 | 10 | 80 | 51 | 48 | 6.6 | M6 | 1x4 | 1180 | 3795 | 60 |
| ☆DFU02505-4 | | 5 | 3.175 | 40 | 62 | 10 | 101 | 51 | 48 | 6.6 | M6 | 1x4 | 1724 | 4904 | 62 |
| DFU02506-4 | | 6 | 3.969 | 40 | 62 | 10 | 105 | 51 | 48 | 6.6 | M6 | 1x4 | 2318 | 6057 | 64 |
| DFU02508-4 | | 8 | 4.762 | 40 | 62 | 10 | 120 | 51 | 48 | 6.6 | M6 | 1x4 | 2963 | 7313 | 67 |
| ☆DFU02510-4 | | 10 | 4.762 | 40 | 62 | 12 | 145 | 51 | 48 | 6.6 | M6 | 1x4 | 2954 | 7295 | 67 |
| DFU03204-4 | 32 | 4 | 2.381 | 50 | 80 | 12 | 80 | 65 | 62 | 9 | M6 | 1x4 | 1296 | 4838 | 71 |
| ☆DFU03205-4 | | 5 | 3.175 | 50 | 80 | 12 | 102 | 65 | 62 | 9 | M6 | 1x4 | 1922 | 6343 | 74 |
| DFU03206-4 | | 6 | 3.969 | 50 | 80 | 12 | 105 | 65 | 62 | 9 | M6 | 1x4 | 2632 | 7979 | 78 |
| DFU03208-4 | | 8 | 4.762 | 50 | 80 | 12 | 122 | 65 | 62 | 9 | M6 | 1x4 | 3387 | 9622 | 82 |
| ☆DFU03210-4 | | 10 | 6.35 | 50 | 80 | 12 | 162 | 65 | 62 | 9 | M6 | 1x4 | 4805 | 12208 | 82 |
| ☆DFU04005-4 | 40 | 5 | 3.175 | 63 | 93 | 14 | 105 | 78 | 70 | 9 | M8 | 1x4 | 2110 | 7988 | 87 |
| DFU04006-4 | | 6 | 3.969 | 63 | 93 | 14 | 108 | 78 | 70 | 9 | M6 | 1x4 | 2873 | 9913 | 91 |
| DFU04008-4 | | 8 | 4.762 | 63 | 93 | 14 | 132 | 78 | 70 | 9 | M6 | 1x4 | 3712 | 11947 | 96 |
| ☆DFU04010-4 | | 10 | 6.35 | 63 | 93 | 14 | 165 | 78 | 70 | 9 | M8 | 1x4 | 5399 | 15500 | 99 |
| ☆DFU05010-4 | 50 | 10 | 6.35 | 75 | 110 | 16 | 171 | 93 | 85 | 11 | M8 | 1x4 | 6004 | 19614 | 117 |
| DFU05020-4 | | 20 | 7.144 | 75 | 110 | 16 | 280 | 93 | 85 | 11 | M8 | 1x4 | 7142 | 22588 | 126 |
| ☆DFU06310-4 | 63 | 10 | 6.35 | 90 | 125 | 18 | 182 | 108 | 95 | 11 | M8 | 1x4 | 6719 | 25358 | 139 |
| DFU06320-4 | | 20 | 9.525 | 95 | 135 | 20 | 290 | 115 | 100 | 13.5 | M8 | 1x4 | 11444 | 36653 | 152 |
| DFU08010-4 | 80 | 10 | 6.35 | 105 | 145 | 20 | 182 | 125 | 110 | 13.5 | M8 | 1x4 | 7346 | 31953 | 156 |
| DFU08020-4 | | 20 | 9.525 | 125 | 165 | 25 | 295 | 145 | 130 | 13.5 | M8 | 1x4 | 12911 | 47747 | 187 |
| DFU10020-4 | 100 | 20 | 9.525 | 150 | 202 | 30 | 340 | 170 | 155 | 17.5 | M8 | 1x4 | 14303 | 60698 | 222 |

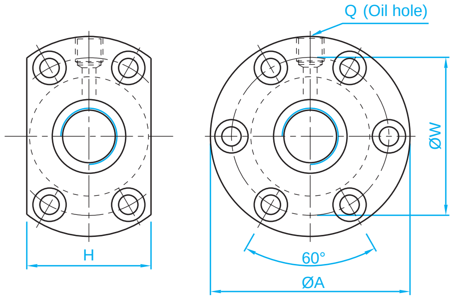
Note : For double ball screw nut order, please contact ***TBIMOTION*** in advance.
※☆Left helix available

## SFM Series Specifications (Design for Milling)




## DFM Series Specifications (Design for Milling)



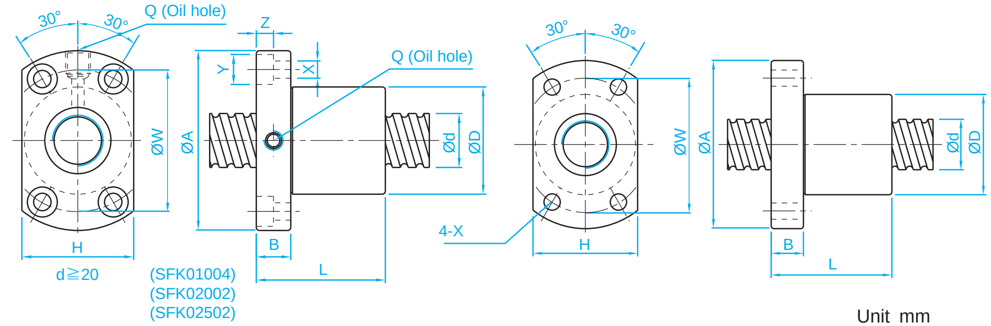




Unit mm

| | Model No. | d | I | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| ☆ | SFM03205-4 | 32 | 5 | 3.175 | 48 | 74 | 12 | 52 | 60 | 60 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 53 |
| ☆ | SFM0325T-4 | | 5.08 | 3.175 | 48 | 74 | 12 | 53 | 60 | 60 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 53 |
| ☆ | DFM03205-4 | 32 | 5 | 3.175 | 48 | 74 | 12 | 102 | 60 | 60 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 73 |
| ☆ | DFM0325T-4 | | 5.08 | 3.175 | 48 | 74 | 12 | 104 | 60 | 60 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 73 |

Note : For double ball screw nut order, please contact ***TBIMOTION*** in advance.
※☆Left helix available

## SFK Series Specifications




Unit mm

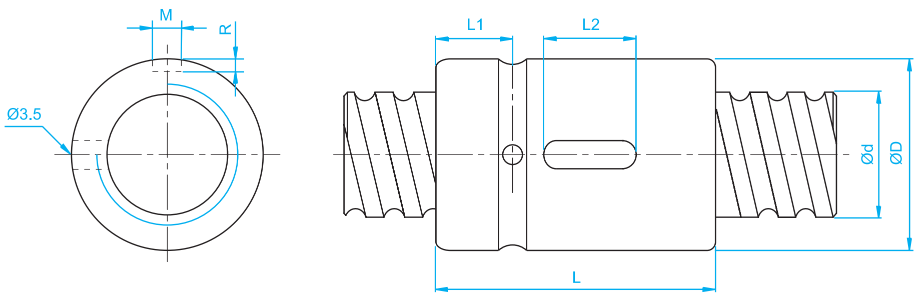
| | Model No. | d | I | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| | SFK00401 | 4 | 1 | 0.8 | 10 | 20 | 3 | 12 | 15 | 14 | 2.9 | — | — | — | 1x2 | 64 | 97 | 5 |
| | SFK00601 | 6 | 1 | 0.8 | 12 | 24 | 3.5 | 15 | 18 | 16 | 3.4 | — | — | — | 1x3 | 111 | 224 | 9 |
| ☆ | SFK00801 | 8 | 1 | 0.8 | 14 | 27 | 4 | 16 | 21 | 18 | 3.4 | — | — | — | 1x4 | 161 | 403 | 14 |
| ☆ | SFK00802 | | 2 | 1.2 | 14 | 27 | 4 | 16 | 21 | 18 | 3.4 | — | — | — | 1x3 | 222 | 458 | 13 |
| | SFK0082.5 | | 2.5 | 1.2 | 16 | 29 | 4 | 26 | 23 | 20 | 3.4 | — | — | — | 1x3 | 221 | 457 | 13 |
| ☆ | SFK01002 | 10 | 2 | 1.2 | 18 | 35 | 5 | 28 | 27 | 22 | 4.5 | — | — | — | 1x3 | 243 | 569 | 15 |
| | SFK01004 | | 4 | 2 | 26 | 46 | 10 | 34 | 36 | 28 | 4.5 | 8 | 45 | M6 | 1x3 | 468 | 905 | 17 |
| ☆ | SFK01202 | 12 | 2 | 1.2 | 20 | 37 | 5 | 28 | 29 | 24 | 4.5 | — | — | — | 1x4 | 334 | 906 | 22 |
| ☆ | SFK01402 | 14 | 2 | 1.2 | 21 | 40 | 6 | 23 | 31 | 26 | 5.5 | — | — | — | 1x4 | 354 | 1053 | 24 |
| ☆ | SFK01602 | 16 | 2 | 1.2 | 25 | 43 | 10 | 40 | 35 | 29 | 5.5 | — | — | M6 | 1x4 | 373 | 1200 | 26 |
| | SFK02002 | 20 | 2 | 1.2 | 50 | 80 | 15 | 55 | 65 | 68 | 6.5 | 10.5 | 6 | M6 | 1x6 | 581 | 2284 | 48 |
| | SFK02502 | 25 | 2 | 1.2 | 50 | 80 | 13 | 43 | 65 | 68 | 6.5 | 10.5 | 6 | M6 | 1x5 | 540 | 2381 | 46 |

※☆Left helix available

Unit mm

| Model No. | d | I | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| XSUR01204T3D-02 | 12 | 4 | 2.5 | 24 | 40 | 6 | 28 | 32 | 25 | 3.5 | — | — | — | 1x3 | 454 | 722 | — |
| XSUR01205T3D-00 | | 5 | 2.5 | 22 | 37 | 8 | 39 | 29 | 24 | 4.5 | — | — | — | 1x3 | 675 | 1316 | 17 |

## SCI Series Specifications

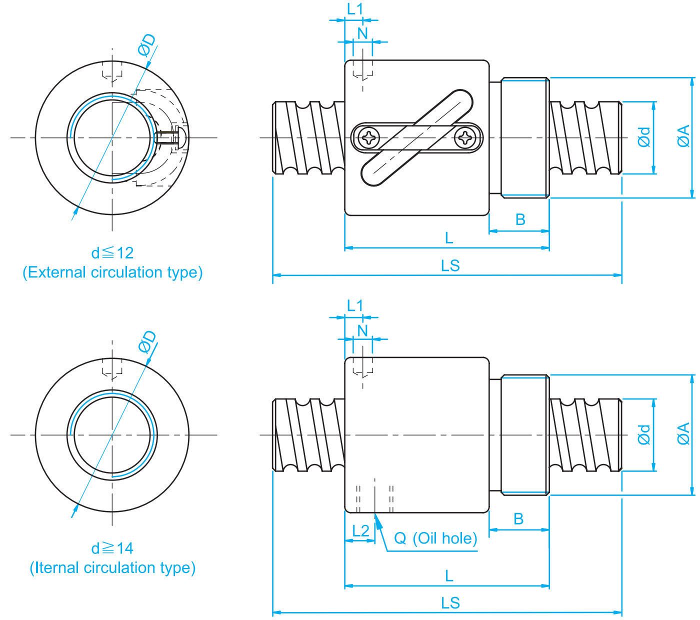



Unit：mm

| | Model No. | d | I | Da | Dimension | | | | | | | Ca (kgf) | Coa (kgf) | K kgf/μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | D | L | L1 | L2 | M | R | n | | | |
| | SCI01604-4 | 16 | 4 | 2.381 | 30 | 40 | 9 | 15 | 3 | 1.5 | 1x4 | 973 | 2406 | 32 |
| ☆ | SCI01605-4 | | 5 | 3.175 | 30 | 45 | 9 | 20 | 5 | 3 | 1x4 | 1380 | 3052 | 33 |
| | SCI02004-4 | 20 | 4 | 2.381 | 34 | 40 | 9 | 15 | 3 | 1.5 | 1x4 | 1066 | 2987 | 37 |
| ☆ | SCI02005-4 | | 5 | 3.175 | 34 | 45 | 9 | 20 | 5 | 3 | 1x4 | 1551 | 3875 | 39 |
| | SCI02504-4 | 25 | 4 | 2.381 | 40 | 40 | 9 | 15 | 3 | 1.5 | 1x4 | 1180 | 3795 | 43 |
| ☆ | SCI02505-4 | | 5 | 3.175 | 40 | 45 | 9 | 20 | 5 | 3 | 1x4 | 1724 | 4904 | 45 |
| | SCI02510-4 | | 10 | 4.762 | 46 | 85 | 13 | 30 | 5 | 3 | 1x4 | 2954 | 7295 | 51 |
| | SCI03204-4 | 32 | 4 | 2.381 | 46 | 40 | 9 | 15 | 3 | 1.5 | 1x4 | 1296 | 4838 | 49 |
| ☆ | SCI03205-4 | | 5 | 3.175 | 46 | 45 | 9 | 20 | 5 | 3 | 1x4 | 1922 | 6343 | 52 |
| ☆ | SCI03210-4 | | 10 | 6.35 | 54 | 85 | 13 | 30 | 5 | 3 | 1x4 | 4805 | 12208 | 62 |
| ☆ | SCI04005-4 | 40 | 5 | 3.175 | 56 | 45 | 9 | 20 | 5 | 3 | 1x4 | 2110 | 7988 | 59 |
| ☆ | SCI04010-4 | | 10 | 6.35 | 62 | 85 | 13 | 30 | 5 | 3 | 1x4 | 5399 | 15500 | 72 |
| | SCI05010-4 | 50 | 10 | 6.35 | 72 | 85 | 13 | 30 | 5 | 3 | 1x4 | 6004 | 19614 | 83 |
| ☆ | SCI06310-4 | 63 | 10 | 6.35 | 85 | 85 | 13 | 30 | 6 | 3.5 | 1x4 | 6719 | 25358 | 95 |
| ☆ | SCI08010-4 | 80 | 10 | 6.35 | 105 | 85 | 13 | 30 | 8 | 4.5 | 1x4 | 7346 | 31953 | 109 |

※☆Left helix available

## BSH Series Specifications

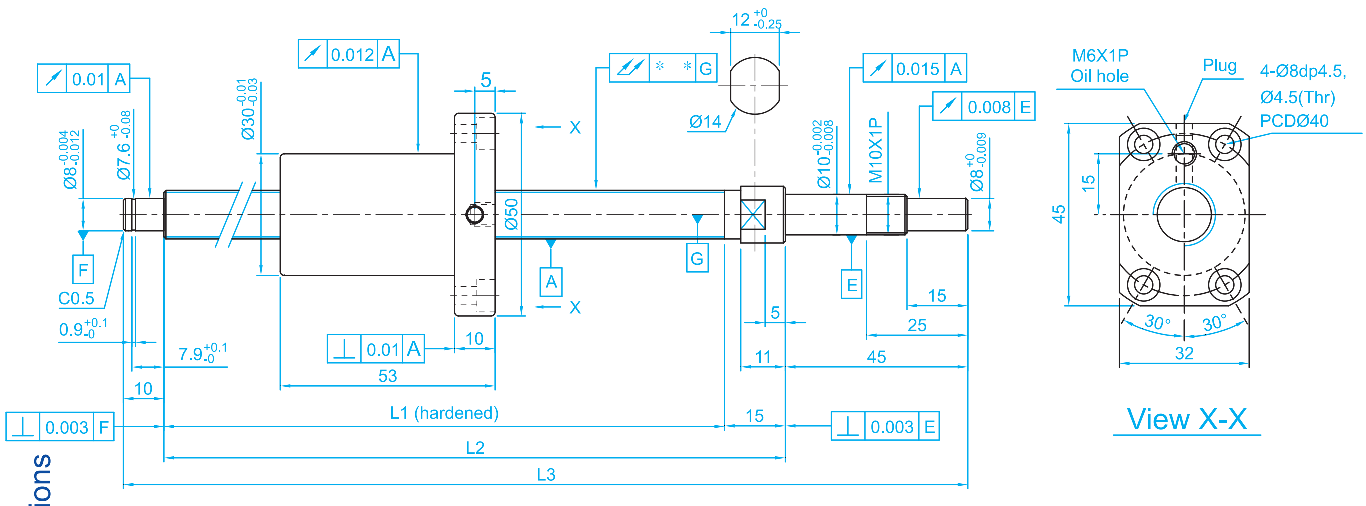



Unit：mm

| Model No. | d | I | Da | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf/μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | L1 | N | L2 | Q | n | | | |
| BSHR0082.5-2.5 | 8 | 2.5 | 1.2 | 17.5 | M15x1P | 7.5 | 23.5 | 10 | 3 | – | – | 2.5x1 | 189 | 381 | 11 |
| BSHR01002-3.5 | 10 | 2 | 1.2 | 19.5 | M17x1P | 7.5 | 22 | 3 | 3.2 | – | – | 3.5x1 | 277 | 664 | 17 |
| BSHR01004-2.5 | | 4 | 2 | 25 | M20x1P | 10 | 34 | 3 | 3 | – | – | 2.5x1 | 400 | 754 | 14 |
| BSHR01204-3.5 | 12 | 4 | 2.5 | 25.5 | M20x1P | 10 | 34 | 13 | 3 | – | – | 3.5x1 | 804 | 1649 | 23 |
| BSHR01205-3.5 | | 5 | 2.5 | 25.5 | M20x1P | 10 | 39 | 16.25 | 3 | – | – | 3.5x1 | 801 | 1644 | 24 |
| BSHR01404-3 | 14 | 4 | 2.5 | 32.1 | M25x1.5P | 10 | 35 | 11 | 3 | – | – | 1x3 | 748 | 1609 | 26 |
| BSHR01604-3 | 16 | 4 | 2.381 | 29 | M22x1.5P | 8 | 32 | 4 | 3.2 | – | – | 1x3 | 759 | 1804 | 24 |
| BSHR01605-3 | | 5 | 3.175 | 32.5 | M26x1.5P | 12 | 42 | 19.25 | 3 | – | – | 1x3 | 1077 | 2289 | 25 |
| BSHR01610-2 | | 10 | 3.175 | 32 | M26x1.5P | 12 | 50 | 3 | 4 | 3 | M4 | 1x2 | 675 | 1316 | 14 |
| BSHR02005-3 | 20 | 5 | 3.175 | 38 | M35x1.5P | 15 | 45 | 20.3 | 3 | – | – | 1x3 | 1211 | 2906 | 30 |
| BSHR02505-4 | 25 | 5 | 3.175 | 43 | M40x1.5P | 19 | 69 | 32.11 | 3 | 8 | M6 | 1x4 | 1724 | 4904 | 37 |
| BSHR02510-4 | | 10 | 4.762 | 43 | M40x1.5P | 19 | 84 | 8 | 6 | 8 | M6 | 1x4 | 2954 | 7295 | 41 |

※Standard ballnut from Ø8~Ø16 is assembled without wiper.

# XSVR01210-01 Series Specifications (Finish Shaft Ends)

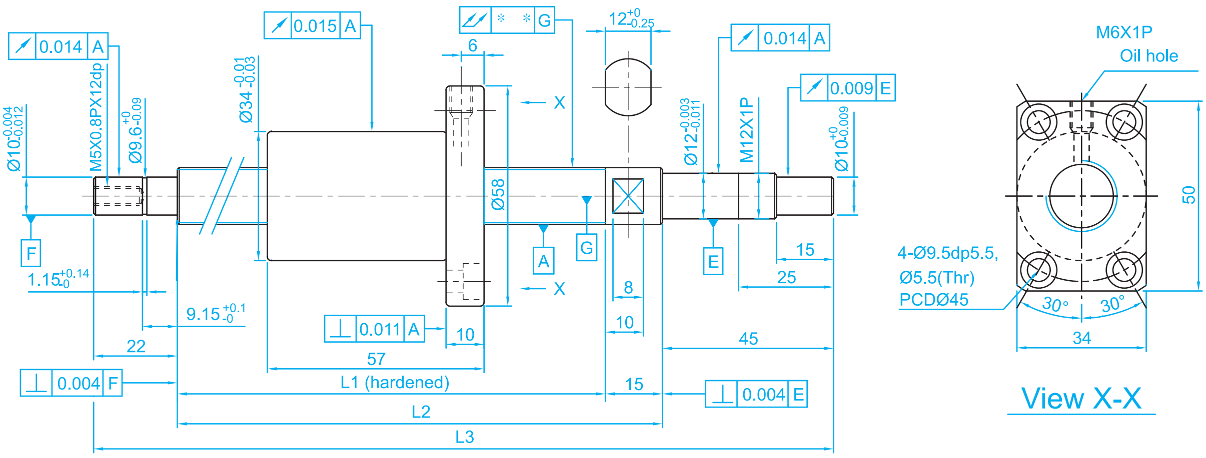



Unit: mm

| | |
|---|---|
| BCD | 12.85 |
| Ball Dia (mm) | 2.5 |
| Lead (mm) | 10 |
| No.of Turns | 2.7x1 |
| Lead Angle | 13.91° |
| Threading Direction | R |
| Spring Force (kg) | 0.1~0.2 |
| Preload (kgf) | 25 |
| Dynamic Load Rating Ca (kgf) | 623 |
| Static Load Rating Coa (kgf) | 1241 |
| Accuracy Grade | 0.018 |

| Travel Length (mm) | Model No. | Shaft Length(mm) L1 | L2 | L3 | Slant of Axle Center |
|---|---|---|---|---|---|
| 100 | XSVR01210B1DGC5-230-P1 | 160 | 175 | 230 | 0.035 |
| 150 | XSVR01210B1DGC5-280-P1 | 210 | 225 | 280 | 0.035 |
| 250 | XSVR01210B1DGC5-380-P1 | 310 | 325 | 380 | 0.050 |
| 350 | XSVR01210B1DGC5-480-P1 | 410 | 425 | 480 | 0.060 |
| 450 | XSVR01210B1DGC5-580-P1 | 510 | 525 | 580 | 0.075 |

# XSVR01510-00 Series Specifications (Finish Shaft Ends)

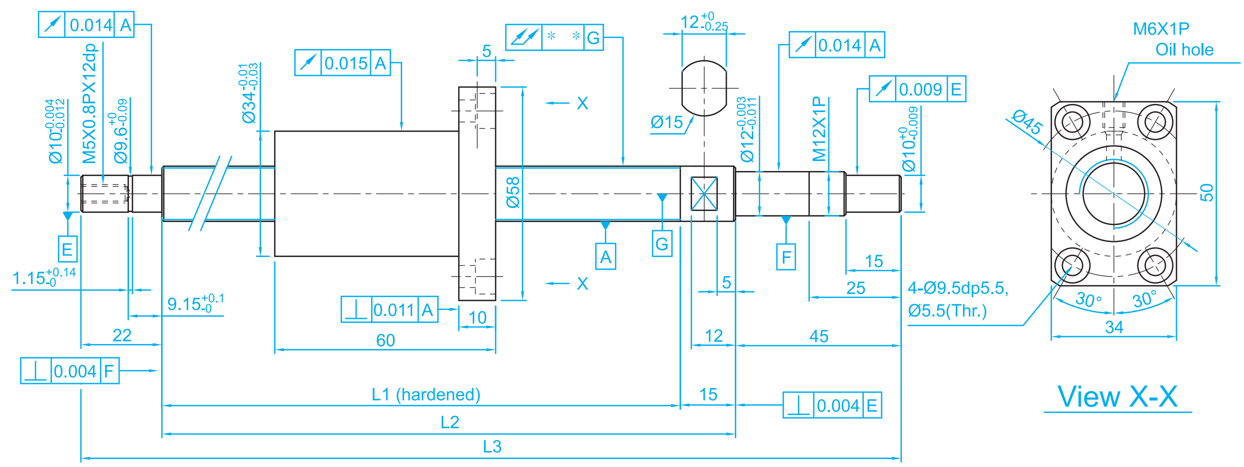



Unit: mm

| | |
|---|---|
| BCD | 15.5 |
| Ball Dia (mm) | 3.175 |
| Lead (mm) | 10 |
| No.of Turns | 2.7x1 |
| Lead Angle | 11.6° |
| Threading Direction | R |
| Spring Force (kg) | 0.1~0.3 |
| Preload (kgf) | 38 |
| Dynamic Load Rating Ca (kgf) | 933 |
| Static Load Rating Coa (kgf) | 1885 |
| Accuracy Grade | 0.018 |

| Travel Length (mm) | Model No. | Shaft Length(mm) L1 | L2 | L3 | Slant of Axle Center |
|---|---|---|---|---|---|
| 100 | XSVR01510B1DGC5-271-P1 | 189 | 204 | 271 | 0.025 |
| 150 | XSVR01510B1DGC5-321-P1 | 239 | 254 | 321 | 0.035 |
| 200 | XSVR01510B1DGC5-371-P1 | 289 | 304 | 371 | 0.035 |
| 250 | XSVR01510B1DGC5-421-P1 | 339 | 354 | 421 | 0.040 |
| 300 | XSVR01510B1DGC5-471-P1 | 389 | 404 | 471 | 0.040 |
| 350 | XSVR01510B1DGC5-521-P1 | 439 | 454 | 521 | 0.050 |
| 400 | XSVR01510B1DGC5-571-P1 | 489 | 504 | 571 | 0.050 |
| 450 | XSVR01510B1DGC5-621-P1 | 539 | 554 | 621 | 0.050 |
| 500 | XSVR01510B1DGC5-671-P1 | 589 | 604 | 671 | 0.065 |
| 550 | XSVR01510B1DGC5-721-P1 | 639 | 654 | 721 | 0.065 |
| 600 | XSVR01510B1DGC5-771-P1 | 689 | 704 | 771 | 0.065 |
| 700 | XSVR01510B1DGC5-871-P1 | 789 | 804 | 871 | 0.085 |
| 800 | XSVR01510B1DGC5-971-P1 | 889 | 904 | 971 | 0.085 |

## XSVR01520-01 Series Specifications (Finish Shaft Ends)

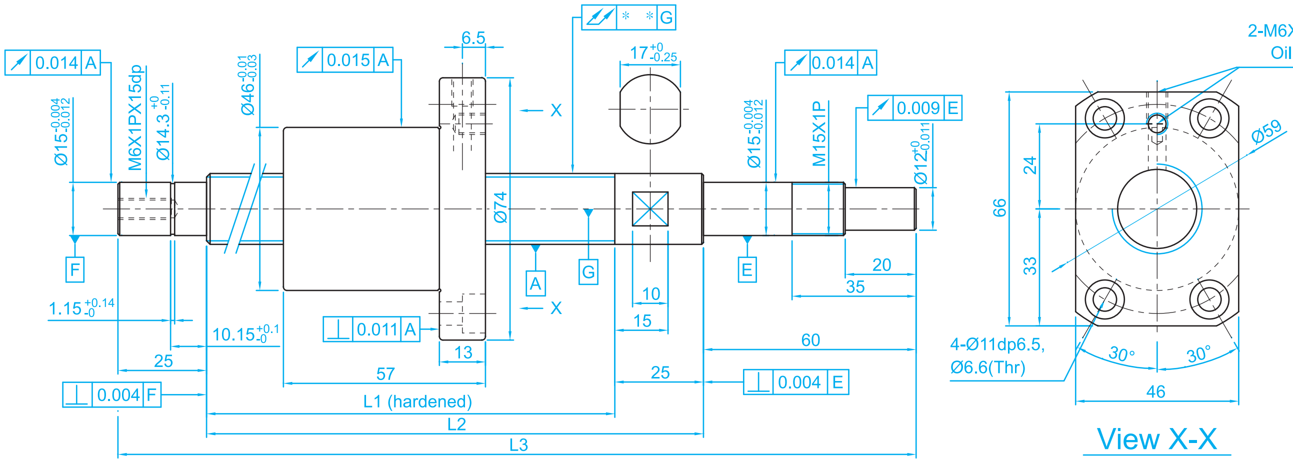



Unit : mm

| BCD | 15.5 |
|---|---|
| Ball Dia (mm) | 3.175 |
| Lead (mm) | 20 |
| No.of Turns | 1.8x1 |
| Lead Angle | 22.33° |
| Threading Direction | R |
| Spring Force (kg) | 0.1~0.3 |
| Preload (kgf) | 38 |
| Dynamic Load Rating Ca (kgf) | 638 |
| Static Load Rating Coa (kgf) | 1266 |
| Accuracy Grade | 0.018 |

| Travel Length (mm) | Model No. | Shaft Length(mm) | | | Slant of Axle Center |
|---|---|---|---|---|---|
| | | L1 | L2 | L3 | |
| 100 | XSVR01520A1DGC5-271-P1 | 189 | 204 | 271 | 0.025 |
| 150 | XSVR01520A1DGC5-321-P1 | 239 | 254 | 321 | 0.035 |
| 200 | XSVR01520A1DGC5-371-P1 | 289 | 304 | 371 | 0.035 |
| 250 | XSVR01520A1DGC5-421-P1 | 339 | 354 | 421 | 0.040 |
| 300 | XSVR01520A1DGC5-471-P1 | 389 | 404 | 471 | 0.040 |
| 350 | XSVR01520A1DGC5-521-P1 | 439 | 454 | 521 | 0.050 |
| 400 | XSVR01520A1DGC5-571-P1 | 489 | 504 | 571 | 0.050 |
| 450 | XSVR01520A1DGC5-621-P1 | 539 | 554 | 621 | 0.050 |
| 500 | XSVR01520A1DGC5-671-P1 | 589 | 604 | 671 | 0.065 |
| 550 | XSVR01520A1DGC5-721-P1 | 639 | 654 | 721 | 0.065 |
| 600 | XSVR01520A1DGC5-771-P1 | 689 | 704 | 771 | 0.065 |
| 700 | XSVR01520A1DGC5-871-P1 | 789 | 804 | 871 | 0.085 |
| 800 | XSVR01520A1DGC5-971-P1 | 889 | 904 | 971 | 0.085 |

## XSVR02010-00 Series Specifications (Finish Shaft Ends)




Unit : mm

| BCD | 21.35 |
|---|---|
| Ball Dia (mm) | 3.969 |
| Lead (mm) | 10 |
| No.of Turns | 2.7x1 |
| Lead Angle | 8.48° |
| Threading Direction | R |
| Spring Force (kg) | 0.1~0.3 |
| Preload (kgf) | 43 |
| Dynamic Load Rating Ca (kgf) | 1518 |
| Static Load Rating Coa (kgf) | 3398 |
| Accuracy Grade | 0.018 |

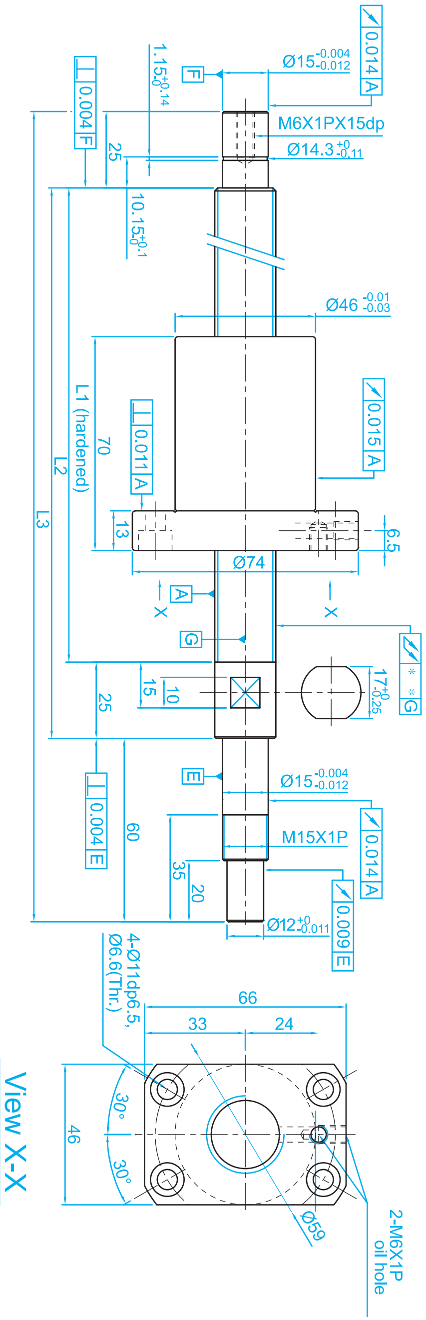
| Travel Length (mm) | Model No. | Shaft Length(mm) | | | Slant of Axle Center |
|---|---|---|---|---|---|
| | | L1 | L2 | L3 | |
| 200 | XSVR02010B1DGC5-399-P1 | 289 | 314 | 399 | 0.035 |
| 300 | XSVR02010B1DGC5-499-P1 | 389 | 414 | 499 | 0.040 |
| 400 | XSVR02010B1DGC5-599-P1 | 489 | 514 | 599 | 0.050 |
| 500 | XSVR02010B1DGC5-699-P1 | 589 | 614 | 699 | 0.065 |
| 600 | XSVR02010B1DGC5-799-P1 | 689 | 714 | 799 | 0.065 |
| 700 | XSVR02010B1DGC5-899-P1 | 789 | 814 | 899 | 0.085 |
| 800 | XSVR02010B1DGC5-999-P1 | 889 | 914 | 999 | 0.085 |
| 900 | XSVR02010B1DGC5-1099-P1 | 989 | 1014 | 1099 | 0.110 |
| 1000 | XSVR02010B1DGC5-1199-P1 | 1089 | 1114 | 1199 | 0.110 |

## XSVR02020-00 Series Specifications (Finish Shaft Ends)

| | |
|---|---|
| BCD | 20.75 |
| Ball Dia (mm) | 3.175 |
| Lead (mm) | 20 |
| No.of Turns | 1.8x1 |
| Lead Angle | 17.05° |
| Threading Direction | R |
| Spring Force (kg) | 0.1~0.3 |
| Preload (kgf) | 31 |
| Dynamic Load Rating Ca (kgf) | 764 |
| Static Load Rating Coa (kgf) | 1758 |
| Accuracy Grade | 0.018 |

Unit: mm

| Travel Length (mm) | Model No. | Shaft Length(mm) L1 | L2 | L3 | Slant of Axle Center |
|---|---|---|---|---|---|
| 200 | XSVR02020A1DGC5-399-P1 | 289 | 314 | 399 | 0.035 |
| 300 | XSVR02020A1DGC5-499-P1 | 389 | 414 | 499 | 0.040 |
| 400 | XSVR02020A1DGC5-599-P1 | 489 | 514 | 599 | 0.050 |
| 500 | XSVR02020A1DGC5-699-P1 | 589 | 614 | 699 | 0.065 |
| 600 | XSVR02020A1DGC5-799-P1 | 689 | 714 | 799 | 0.065 |
| 700 | XSVR02020A1DGC5-899-P1 | 789 | 814 | 899 | 0.085 |
| 800 | XSVR02020A1DGC5-999-P1 | 889 | 914 | 999 | 0.085 |
| 900 | XSVR02020A1DGC5-1099-P1 | 989 | 1014 | 1099 | 0.110 |
| 1000 | XSVR02020A1DGC5-1199-P1 | 1089 | 1114 | 1199 | 0.110 |




View X-X



## 2-3 Rolled Ball Screw

### 2-3-1 Rolled Screws

Rolled screws are made through thread roller. Generally rolled screw has a smoother operation while lowering friction and backlash. Therefore, it gradually replaced the traditional ACME screws and trapezoidal screws. Moreover, rolled screws can eliminate axial play by preloading nut with a cost effective pricing compare to ground screw.

### 2-3-2 The Features of *TBIMOTION* Rolled Ball Screw

(1) Lead Accuracy Up to Grade C5

C7 and C10 Screws have been Standardized. C5 on request.

(2) Precision Ground Ball Nut

*TBIMOTION* High Precision Ball Nut are interchangeable between ground and rolled screws.

(3) Maximize Interchangeability

*TBIMOTION* Ball screw and ball nuts can be shipped separated ensure shortest delivery time. The ball nuts are standardized with P0 preloaded, preload value can be adjusted through reballing.

### 2-3-3 Nominal Model Code of Rolled Ball Screws

Nominal Model Code of Shaft SC R 025 05 F C7 - 1000 + N3

- Type of Screw Shaft (SC)
  SC：standard SS：For SFS, DFS Only
- Threading Direction (R)
  R：Right L：Left
- Nominal Diameter (025)
  Unit：mm
- Lead (05)
  Unit：mm
- Product Code (F)
  F：Rolled
- Accuracy Grade (C7)
  C5, C7, C10
- Overall Length of Shaft (1000)
  Unit：mm
- Shaft Surface Treatment (N3)
  □：Standard B1：Black Oxidation N1：Hard Chrome Plating P：Phosphating N3：Nickel Plating N4：Raydent

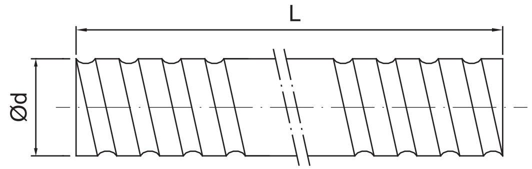



Fig 2.3.1 Screw Shaft Nominal Diameter

Table 2.3.1 Rolled Ball Screw Specifications Ø 6~32

Unit:mm

| Model No. d | Model No. l | Model No. Da | Accuracy Grade | Threading Direction (R:Right L:Left) | Number of Grooves | Standard Code of Shaft | Type of Nut | Overall Length of Shaft |
|---|---|---|---|---|---|---|---|---|
| 6 | 1 | 0.8 | C10, C7 | R | 1 | SCR00601 | K | 1000 |
| 8 | 1 | 0.8 | C10, C7, C5 | R | 1 | SCR00801 | K | 1000 |
| | 2 | 1.2 | C10, C7, C5 | R | 1 | SCR00802 | K | |
| | 2.5 | 1.2 | C10, C7, C5 | R | 1 | SCR00825 | K, BSH | |
| 10 | 2 | 1.2 | C10, C7, C5 | R | 1 | SCR01002 | K, BSH | 3000 |
| | 4 | 2 | C10, C7, C5 | R | 1 | SCR01004 | K, BSH | |
| 12 | 2 | 1.2 | C10, C7, C5 | R | 1 | SCR01202 | K | 3000 |
| | 4 | 2.5 | C10, C7, C5 | R | 1 | SCR01204 | U, BSH | |
| | 5 | 2.5 | C10, C7, C5 | R | 1 | SCR01205-A | V, U, BSH, S, H | |
| | 5 | 2.5 | C10, C7, C5 | R | 1 | SCR01205-B | K | |
| | 10 | 2.5 | C10, C7, C5 | R | 2 | SCR01210-B | V | |
| 14 | 2 | 1.2 | C10, C7, C5 | R | 1 | SCR01402 | K | 1800 |
| | 4 | 2.5 | C10, C7 | R | 1 | SCR01404 | BSH | 3000 |
| 16 | 4 | 2.381 | C10, C7, C5 | R | 1 | SCR01604(N) | V, I, U, BSH | 3000 |
| | 5 | 3.175 | C10, C7, C5 | R/L | 1 | SCR01605 | V, I, U, BSH | |
| | 10 | 3.175 | C10, C7, C5 | R | 2 | SCR01610 | V, I, U, BSH | |
| | 16 | 2.778 | C10, C7, C5 | R | 4 | SCR01616 | Y | |
| | 32 | 2.778 | C10, C7 | R | 8 | SCR01632 | Y | |
| 20 | 4 | 2.381 | C10, C7, C5 | R | 1 | SCR02004(N) | V, I, U | 3000 |
| | 5 | 3.175 | C10, C7, C5 | R/L | 1 | SCR02005 | V, I, U, BSH, S, H | |
| | 20 | 3.175 | C10, C7, C5 | R | 4 | SCR02020 | V, Y, S, H | |
| | 40 | 3.175 | C10, C7 | R | 8 | SCR02040 | Y | |
| 25 | 4 | 2.381 | C10, C7 | R | 1 | SCR02504(N) | I, U | 6000 |
| | 5 | 3.175 | C10, C7, C5 | R/L | 1 | SCR02505 | V, I, U, BSH, S, H | |
| | 10 | 4.762 | C10, C7, C5 | R | 1 | SCR02510-A | I, U, BSH | |
| | 10 | 6.35 | C10, C7, C5 | R | 1 | SCR02510-B | V | |
| | 25 | 3.969 | C10, C7, C5 | R | 4 | SCR02525 | V, Y | |
| | 50 | 3.969 | C10, C7 | R | 8 | SCR02550 | Y | |
| 32 | 4 | 2.381 | C10, C7, C5 | R | 1 | SCR03204(N) | V, I, U | 6000 |
| | 5 | 3.175 | C10, C7, C5 | R/L | 1 | SCR03205 | V, I, U, M, S, H | |
| | 10 | 6.35 | C10, C7, C5 | R/L | 1 | SCR03210 | V, I, U | |
| | 32 | 4.762 | C10, C7 | R | 4 | SCR03232 | Y | |
| | 64 | 4.762 | C10, C7 | R | 8 | SCR03264 | Y | |

Table2.3.2 Standard Specifications Ø40~80

Unit:mm

| Model No. d | Model No. l | Model No. Da | Accuracy Grade | Threading Direction L/R | Number of Grooves | Standard Code of Shaft | Type of Nut | Overall Length of Shaft |
|---|---|---|---|---|---|---|---|---|
| 40 | 5 | 3.175 | C10, C7, C5 | R/L | 1 | SCR04005 | V, I, U, S, H | 6000 |
| | 10 | 6.35 | C10, C7 | R/L | 1 | SCR04010 | V, I, U | |
| | 20 | 6.35 | C10, C7 | R | 2 | SCR04020 | V | |
| | 40 | 6.35 | C10, C7 | R | 4 | SCR04040 | Y | |
| | 80 | 6.35 | C10, C7 | R | 8 | SCR04080 | Y | |
| 50 | 5 | 3.175 | C10, C7, C5 | R | 1 | SCR05005 | V, S, H | 6000 |
| | 10 | 6.35 | C10, C7, C5 | R/L | 1 | SCR05010 | V, I, U | |
| | 20 | 9.525 | C10, C7 | R | 1 | SCR05020 | V | |
| | 50 | 7.938 | C10, C7 | R | 4 | SCR05050 | Y | |
| | 100 | 7.938 | C10, C7 | R | 8 | SCR050100 | Y | |
| 63 | 10 | 6.35 | C10, C7, C5 | R | 1 | SCR06310 | V, I, U | 7000 |
| | 20 | 9.525 | C10, C7 | R | 1 | SCR06320 | V, U | |
| 80 | 10 | 6.35 | C10, C7, C5 | R | 1 | SCR08010 | V, I, U | 7000 |
| | 20 | 9.525 | C10, C7 | R | 1 | SCR08020 | V, U | |

Table2.3.2 S-Type Specifications Ø12~50

Unit:mm

| Model No. d | Model No. l | Model No. Da | Accuracy Grade | Threading Direction L/R | Number of Grooves | Type-S Code of Shaft | Type of Nut | Overall Length of Shaft |
|---|---|---|---|---|---|---|---|---|
| 12 | 10 | 2.5 | C10, C7, C5 | R | 2 | SSR01210 | S | 3000 |
| 16 | 5 | 2.778 | C10, C7, C5 | R | 1 | SSR01605 | S, H | 3000 |
| | 10 | 2.778 | C10, C7, C5 | R | 2 | SSR01610 | S, H | |
| | 16 | 2.778 | C10, C7, C5 | R | 4 | SSR01616 | S, H | |
| | 20 | 2.778 | C10, C7, C5 | R | 4 | SSR01620 | S | |
| 20 | 10 | 3.175 | C10, C7, C5 | R | 2 | SSR02010 | S, H | 3000 |
| 25 | 10 | 3.175 | C10, C7, C5 | R | 2 | SSR02510 | S, H | 6000 |
| | 25 | 3.175 | C10, C7 | R | 4 | SSR02525 | S, H | |
| 32 | 10 | 3.969 | C10, C7, C5 | R | 1 | SSR03210 | S, H | 6000 |
| | 20 | 3.969 | C10, C7, C5 | R | 2 | SSR03220 | S, H | |
| | 32 | 3.969 | C10, C7 | R | 4 | SSR03232 | S | |
| 40 | 10 | 6.35 | C10, C7 | R | 1 | SSR04010 | S, H | 6000 |
| | 20 | 6.35 | C10, C7, C5 | R | 2 | SSR04020 | S | |
| | 40 | 6.35 | C10, C7 | R | 4 | SSR04040 | S | |
| 50 | 10 | 6.35 | C10, C7 | R | 1 | SSR05010 | S, H | 6000 |
| | 20 | 6.35 | C10, C7 | R | 2 | SSR05020 | S | |
| | 50 | 6.35 | C10, C7 | R | 4 | SSR05050 | S | |

※The information is for standard production, if required accuracy grade C5 or other needs, please contact *TBIMOTION*.

### Nominal Model Code of Nut

G SFU R 025 05 T4 D + N3

**Product Code**
G : Rolled

**Nominal Model**

S | S : Single nut
  | D : Double nut

F | F : With flange
  | C : Without flange

U | NI : NI type nut
  | NU : NU type nut
  | H : H type nut
  | Y : Y type nut
  | S : DIN nut
  | V : V type nut
  | I : I type nut
  | U : DIN nut
  | M : M type nut
  | K : K type nut

**Threading Direction**
R : Right L : Left

**Nominal Diameter**
Unit : mm

**Lead**
Unit : mm

**Number of Turns (Turn · Row)**
Turn : T : 1 A : 1.5 ( or 1.7/1.8 ) B : 2.5/2.8 C : 3.5 D : 4.8
ex : ( 2.5 · 2 = B2 )

**Flange Type**
N : Not cutting S : Single cutting D : Double cutting

**Nut Surface Treatment**
□ : Standard B1 : Black Oxidation N1 : Hard Chrome Plating P : Phosphating N3 : Nickel Plating N4 : Raydent

### 2-3-4 Preload of Rolled Ball Screw

The standard preloading for Rolled Ball Screw is P0. If P1 preloading is required, please contact *TBIMOTION* .

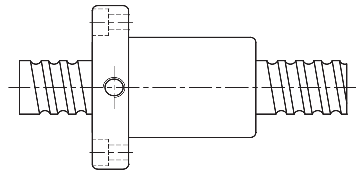
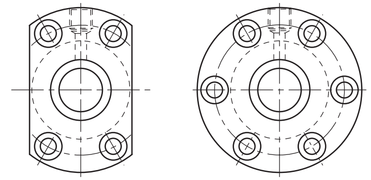
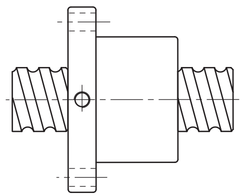
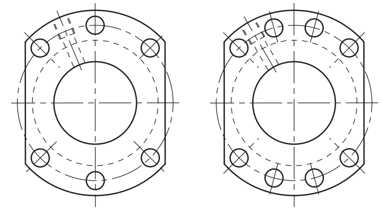
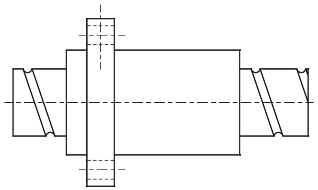
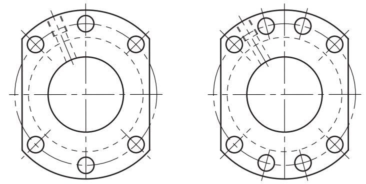
Table2.3.2 Rolled screw accuracy

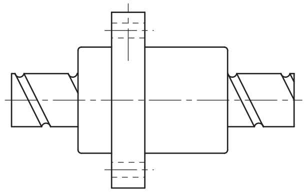
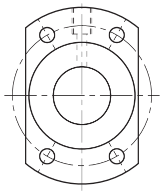
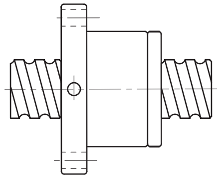
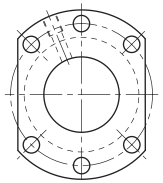
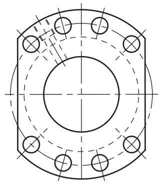
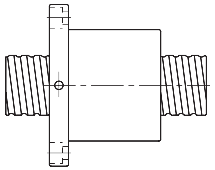
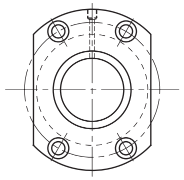
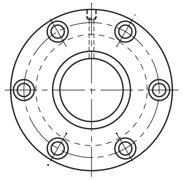
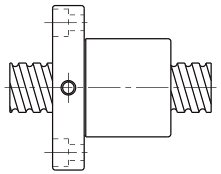
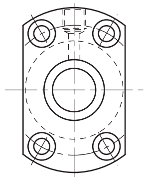
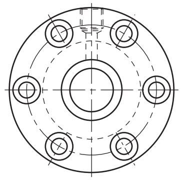
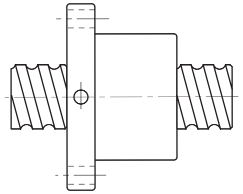
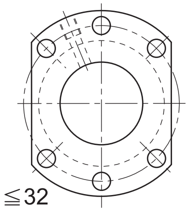
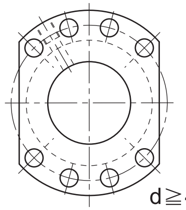
Unit: $\mu$m

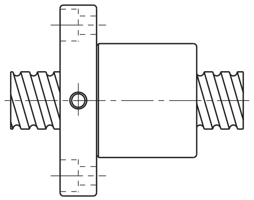
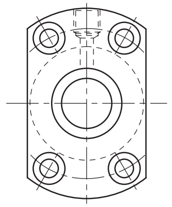
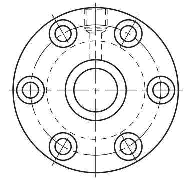
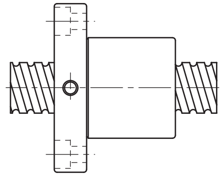
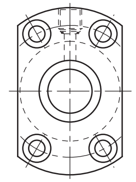
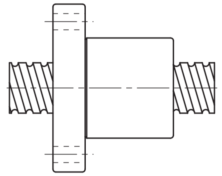
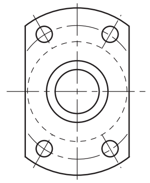
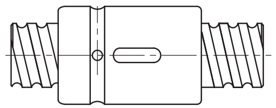
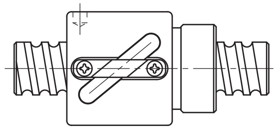
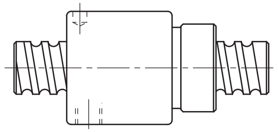
| Accuracy Grade | C5 (ISO, DIN) | C7 | C10 |
|---|---|---|---|
| $e_{300}$ | 23 | 50 | 210 |

## 2-4 Rolled Ball Screw Series

### 2-4-1 *TBIMOTION* Nut of Rolled Ball Screw Type

| | Nut Type | Flange Type |
|---|---|---|
| NI (Strong dust-proof type) | SFNI  C71 |  |
| NU (Strong dust-proof type) | SFNU  C72 |  d≦32 d≧40 |
| H (High speed／Strong dust-proof type) | SFH  C73 |  Model No.≦3232 Model No.≧4005 |

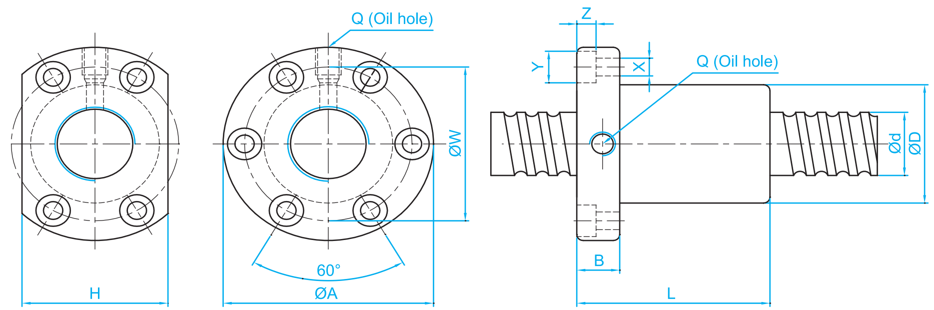
| | Nut Type | Flange Type |
|---|---|---|
| Y (High DM-N Rating) | SFY  C74 |  |
| S ( High Speed / Low Noise type ) | SFS  C75 |  Model No.≦3232  Model No.≧4005 |
| V (High Load External Circulation type) | SFV  C76 |   |
| I (Standard) | SFI  C77 |   |
| U (DIN Standard) | SFU  C78 | d≦32   d≧40 |

| | Nut Type | Flange Type |
|---|---|---|
| M (Design for Milling) | SFM  C79 |   |
| K (Miniature type) | SFK  C80 |  ( SFK01004 ) |
| | SFK  C80 |  |
| I (Standard) | SCI ( No-Flange )  C81 | No-Flange |
| BSH | BSH   C82 | No-Flange |

※If different dimension is required, please contact ***TBIMOTION***.

BALL SCREW

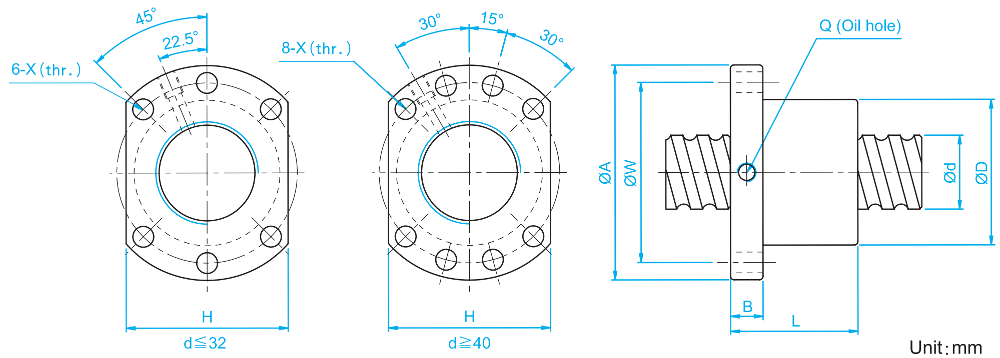
## SFNI Series Specifications




Unit:mm

| Model No. | d | l | Da | Dimension | | | | | | | | | | | Load Rating | | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Y | Z | Q | n | Ca (kgf) | Coa (kgf) | kgf／μm |
| SFNI01605-4 | 16 | 5 | 3.175 | 30 | 49 | 10 | 45 | 39 | 34 | 4.5 | 8 | 4.5 | M6 | 1x4 | 1380 | 3052 | 33 |
| SFNI01610-3 | | 10 | 3.175 | 34 | 58 | 10 | 57 | 45 | 34 | 5.5 | 9.5 | 5.5 | M6 | 1x3 | 1103 | 2401 | 27 |
| SFNI02005-4 | 20 | 5 | 3.175 | 34 | 57 | 11 | 51 | 45 | 40 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1551 | 3875 | 39 |
| SFNI02505-4 | 25 | 5 | 3.175 | 40 | 63 | 11 | 51 | 51 | 46 | 5.5 | 9.5 | 5.5 | M8 | 1x4 | 1724 | 4904 | 45 |
| SFNI02510-4 | | 10 | 4.762 | 46 | 72 | 12 | 80 | 58 | 52 | 6.5 | 11 | 6.5 | M6 | 1x4 | 2954 | 7295 | 51 |
| SFNI03205-4 | 32 | 5 | 3.175 | 46 | 72 | 12 | 52 | 58 | 52 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 52 |
| SFNI03210-4 | | 10 | 6.35 | 54 | 88 | 15 | 85 | 70 | 62 | 9 | 14 | 8.5 | M8 | 1x4 | 4805 | 12208 | 62 |
| SFNI04005-4 | 40 | 5 | 3.175 | 56 | 90 | 15 | 55 | 72 | 64 | 9 | 14 | 8.5 | M8 | 1x4 | 2110 | 7988 | 59 |
| SFNI04010-4 | | 10 | 6.35 | 62 | 104 | 18 | 88 | 82 | 70 | 11 | 17.5 | 11 | M8 | 1x4 | 5399 | 15500 | 72 |
| SFNI05010-4 | 50 | 10 | 6.35 | 72 | 114 | 18 | 88 | 92 | 82 | 11 | 17.5 | 11 | M8 | 1x4 | 6004 | 19614 | 83 |
| SFNI06310-4 | 63 | 10 | 6.35 | 85 | 131 | 22 | 93 | 107 | 95 | 14 | 20 | 13 | M8 | 1x4 | 6719 | 25358 | 95 |
| SFNI08010-4 | 80 | 10 | 6.35 | 105 | 150 | 22 | 93 | 127 | 115 | 14 | 20 | 13 | M8 | 1x4 | 7346 | 31953 | 109 |

## SFNU Series Specifications

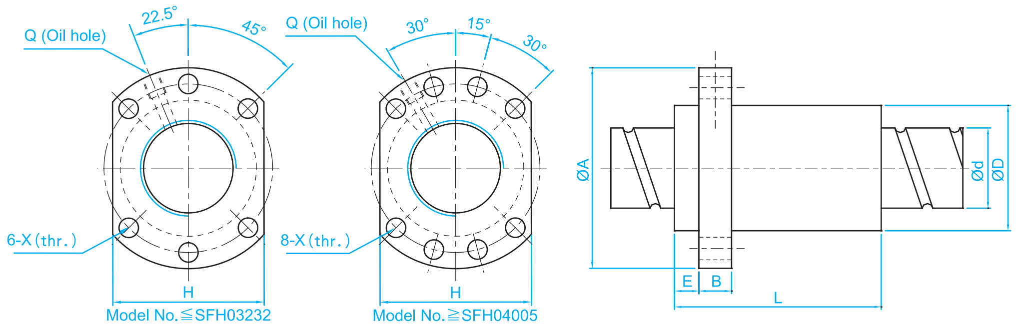



Unit:mm

| Model No. | d | l | Da | Dimension | | | | | | | | | Load Rating | | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Q | n | Ca (kgf) | Coa (kgf) | kgf／μm |
| SFNU01605-4 | 16 | 5 | 3.175 | 28 | 48 | 10 | 45 | 38 | 40 | 5.5 | M6 | 1x4 | 1380 | 3052 | 32 |
| SFNU01610-3 | | 10 | 3.175 | 28 | 48 | 10 | 57 | 38 | 40 | 5.5 | M6 | 1x3 | 1103 | 2401 | 26 |
| SFNU02005-4 | 20 | 5 | 3.175 | 36 | 58 | 10 | 51 | 47 | 44 | 6.6 | M6 | 1x4 | 1551 | 3875 | 39 |
| SFNU02505-4 | 25 | 5 | 3.175 | 40 | 62 | 10 | 51 | 51 | 48 | 6.6 | M6 | 1x4 | 1724 | 4904 | 45 |
| SFNU02510-4 | | 10 | 4.762 | 40 | 62 | 12 | 80 | 51 | 48 | 6.6 | M6 | 1x4 | 2954 | 7295 | 50 |
| SFNU03205-4 | 32 | 5 | 3.175 | 50 | 80 | 12 | 52 | 65 | 62 | 9 | M6 | 1x4 | 1922 | 6343 | 54 |
| SFNU03210-4 | | 10 | 6.35 | 50 | 80 | 12 | 85 | 65 | 62 | 9 | M6 | 1x4 | 4805 | 12208 | 61 |
| SFNU04005-4 | 40 | 5 | 3.175 | 63 | 93 | 14 | 55 | 78 | 70 | 9 | M8 | 1x4 | 2110 | 7988 | 63 |
| SFNU04010-4 | | 10 | 6.35 | 63 | 93 | 14 | 88 | 78 | 70 | 9 | M8 | 1x4 | 5399 | 15500 | 73 |
| SFNU05010-4 | 50 | 10 | 6.35 | 75 | 110 | 16 | 88 | 93 | 85 | 11 | M8 | 1x4 | 6004 | 19614 | 85 |
| SFNU06310-4 | 63 | 10 | 6.35 | 90 | 125 | 18 | 93 | 108 | 95 | 11 | M8 | 1x4 | 6719 | 25358 | 99 |
| SFNU08010-4 | 80 | 10 | 6.35 | 105 | 145 | 20 | 93 | 125 | 110 | 13.5 | M8 | 1x4 | 7346 | 31953 | 109 |

BALL SCREW

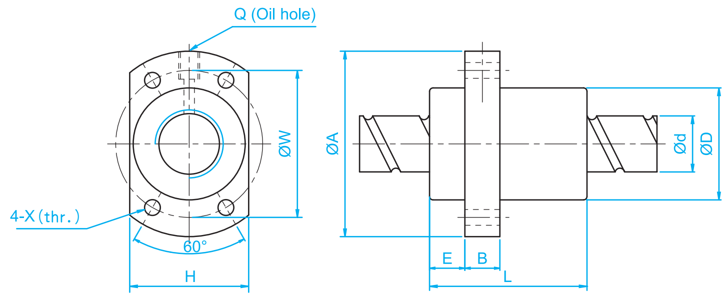
## SFH Series Specifications




Unit：mm

| Model No. | d | I | Da | Dimension | | | | | | | | | | Load Rating | | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | E | B | L | W | H | X | Q | n | Ca (kgf) | Coa (kgf) | kgf／μm |
| SFH01205-2.8 | 12 | 5 | 2.5 | 24 | 40 | 5 | 10 | 30 | 32 | 30 | 4.5 | | 2.8x1 | 661 | 1316 | 19 |
| SFH01210-2.8 | | 10 | 2.5 | 24 | 40 | 5 | 10 | 45 | 32 | 30 | 4.5 | | 2.8x1 | 642 | 1287 | 19 |
| SFH01605-3.8 | 15 | 5 | 2.778 | 28 | 48 | 5 | 10 | 37 | 38 | 40 | 5.5 | M6 | 3.8x1 | 1112 | 2507 | 30 |
| SFH01610-2.8 | | 10 | 2.778 | 28 | 48 | 5 | 10 | 45 | 38 | 40 | 5.5 | M6 | 2.8x1 | 839 | 1821 | 23 |
| SFH01616-1.8 | | 16 | 2.778 | 28 | 48 | 5 | 10 | 45 | 38 | 40 | 5.5 | M6 | 1.8x1 | 552 | 1137 | 14 |
| SFH01616-2.8 | | 16 | 2.778 | 28 | 48 | 5 | 10 | 61 | 38 | 40 | 5.5 | M6 | 2.8x1 | 808 | 1769 | 22 |
| SFH01620-1.8 | | 20 | 2.778 | 28 | 48 | 5 | 10 | 58 | 38 | 40 | 5.5 | M6 | 1.8x1 | 554 | 1170 | 14 |
| SFH02005-3.8 | 20 | 5 | 3.175 | 36 | 58 | 7 | 10 | 37 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1484 | 3681 | 37 |
| SFH02010-3.8 | | 10 | 3.175 | 36 | 58 | 7 | 10 | 55 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1516 | 3833 | 40 |
| SFH02020-1.8 | | 20 | 3.175 | 36 | 58 | 7 | 10 | 54 | 47 | 44 | 6.6 | M6 | 1.8x1 | 764 | 1758 | 19 |
| SFH02020-2.8 | | 20 | 3.175 | 36 | 58 | 7 | 10 | 74 | 47 | 44 | 6.6 | M6 | 2.8x1 | 1118 | 2734 | 29 |
| SFH02505-3.8 | 25 | 5 | 3.175 | 40 | 62 | 7 | 10 | 37 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1650 | 4658 | 43 |
| SFH02510-3.8 | | 10 | 3.175 | 40 | 62 | 7 | 12 | 55 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1638 | 4633 | 45 |
| SFH02525-1.8 | | 25 | 3.175 | 40 | 62 | 7 | 12 | 64 | 51 | 48 | 6.6 | M6 | 1.8x1 | 843 | 2199 | 22 |
| SFH02525-2.8 | | 25 | 3.175 | 40 | 62 | 7 | 12 | 89 | 51 | 48 | 6.6 | M6 | 2.8x1 | 1232 | 3421 | 34 |
| SFH03205-3.8 | 32 | 5 | 3.175 | 50 | 80 | 9 | 12 | 37 | 65 | 62 | 9 | M6 | 3.8x1 | 1839 | 6026 | 51 |
| SFH03210-3.8 | 31 | 10 | 3.969 | 50 | 80 | 9 | 12 | 57 | 65 | 62 | 9 | M6 | 3.8x1 | 2460 | 7255 | 55 |
| SFH03220-2.8 | | 20 | 3.969 | 50 | 80 | 9 | 12 | 76 | 65 | 62 | 9 | M6 | 2.8x1 | 1907 | 5482 | 43 |
| SFH03232-1.8 | | 32 | 3.969 | 50 | 80 | 9 | 12 | 80 | 65 | 62 | 9 | M6 | 1.8x1 | 1257 | 3426 | 27 |
| SFH03232-2.8 | | 32 | 3.969 | 50 | 80 | 9 | 12 | 112 | 65 | 62 | 9 | M6 | 2.8x1 | 1838 | 5329 | 42 |
| SFH04005-3.8 | 40 | 5 | 3.175 | 63 | 93 | 9 | 15 | 42 | 78 | 70 | 9 | M8 | 3.8x1 | 2018 | 7589 | 60 |
| SFH04010-3.8 | 38 | 10 | 6.35 | 63 | 93 | 9 | 14 | 60 | 78 | 70 | 9 | M8 | 3.8x1 | 5035 | 13943 | 67 |
| SFH04020-2.8 | | 20 | 6.35 | 63 | 93 | 9 | 14 | 80 | 78 | 70 | 9 | M8 | 2.8x1 | 3959 | 10715 | 54 |
| SFH04040-1.8 | | 40 | 6.35 | 63 | 93 | 9 | 14 | 98 | 78 | 70 | 9 | M8 | 1.8x1 | 2585 | 6648 | 34 |
| SFH04040-2.8 | | 40 | 6.35 | 63 | 93 | 9 | 14 | 138 | 78 | 70 | 9 | M8 | 2.8x1 | 3780 | 10341 | 52 |
| SFH05005-3.8 | 50 | 5 | 3.175 | 75 | 110 | 10.5 | 15 | 42 | 93 | 85 | 11 | M8 | 3.8x1 | 2207 | 9542 | 68 |
| SFH05010-3.8 | 48 | 10 | 6.35 | 75 | 110 | 10.5 | 18 | 60 | 93 | 85 | 11 | M8 | 3.8x1 | 5638 | 17852 | 79 |
| SFH05020-3.8 | | 20 | 6.35 | 75 | 110 | 10.5 | 18 | 100 | 93 | 85 | 11 | M8 | 3.8x1 | 5749 | 18485 | 87 |
| SFH05050-1.8 | | 50 | 6.35 | 75 | 110 | 10.5 | 18 | 120 | 93 | 85 | 11 | M8 | 1.8x1 | 2946 | 8749 | 42 |
| SFH05050-2.8 | | 50 | 6.35 | 75 | 110 | 10.5 | 18 | 170 | 93 | 85 | 11 | M8 | 2.8x1 | 4308 | 13610 | 65 |

## SFY Series Specifications

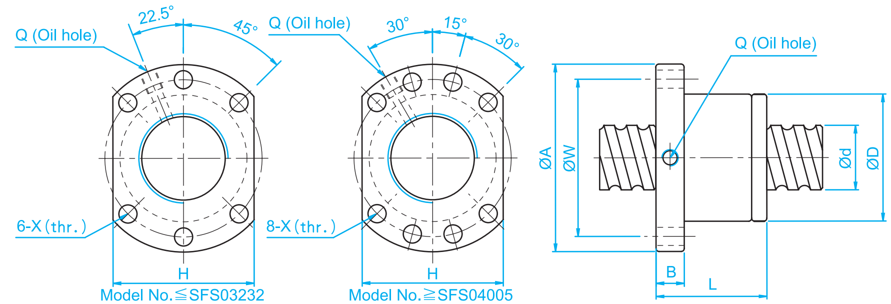



Unit：mm

| Large Lead Model No. | d | I | Da | Dimension | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | E | B | L | W | H | X | Q | n | | | |
| SFY01616-3.6 | 16 | 16 | 2.778 | 32 | 53 | 10.1 | 10 | 45 | 42 | 34 | 4.5 | M6 | 1.8x2 | 1073 | 2551 | 31 |
| SFY02020-3.6 | 20 | 20 | 3.175 | 39 | 62 | 13 | 10 | 52 | 50 | 41 | 5.5 | M6 | 1.8x2 | 1387 | 3515 | 37 |
| SFY02525-3.6 | 25 | 25 | 3.969 | 47 | 74 | 15 | 12 | 64 | 60 | 49 | 6.6 | M6 | 1.8x2 | 2074 | 5494 | 45 |
| SFY03232-3.6 | 32 | 32 | 4.762 | 58 | 92 | 17 | 12 | 78 | 74 | 60 | 9 | M6 | 1.8x2 | 3021 | 8690 | 58 |
| SFY04040-3.6 | 40 | 40 | 6.35 | 73 | 114 | 19.5 | 15 | 99 | 93 | 75 | 11 | M6 | 1.8x2 | 4831 | 14062 | 70 |
| SFY05050-3.6 | 50 | 50 | 7.938 | 90 | 135 | 21.5 | 20 | 117 | 112 | 92 | 14 | M6 | 1.8x2 | 7220 | 21974 | 86 |

| Twin Lead Model No. | d | I | Da | Dimension | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | E | B | L | W | H | X | Q | n | | | |
| SFY01632-1.6 | 16 | 32 | 2.778 | 32 | 53 | 10.1 | 10 | 42.5 | 42 | 34 | 4.5 | M6 | 0.8x2 | 493 | 1116 | 11 |
| SFY02040-1.6 | 20 | 40 | 3.175 | 39 | 62 | 13 | 10 | 48 | 50 | 41 | 5.5 | M6 | 0.8x2 | 653 | 1597 | 15 |
| SFY02550-1.6 | 25 | 50 | 3.969 | 47 | 74 | 15 | 12 | 58 | 60 | 49 | 6.6 | M6 | 0.8x2 | 976 | 2495 | 19 |
| SFY03264-1.6 | 32 | 64 | 4.762 | 58 | 92 | 17 | 12 | 71 | 74 | 60 | 9 | M6 | 0.8x2 | 1374 | 3571 | 22 |
| SFY04080-1.6 | 40 | 80 | 6.35 | 73 | 114 | 19.5 | 15 | 90 | 93 | 75 | 11 | M6 | 0.8x2 | 2273 | 6387 | 29 |
| SFY050100-1.6 | 50 | 100 | 7.938 | 90 | 135 | 21.5 | 20 | 111 | 112 | 92 | 14 | M6 | 0.8x2 | 3398 | 9980 | 35 |

## SFS (DIN 69051 FORM B) Series Specifications

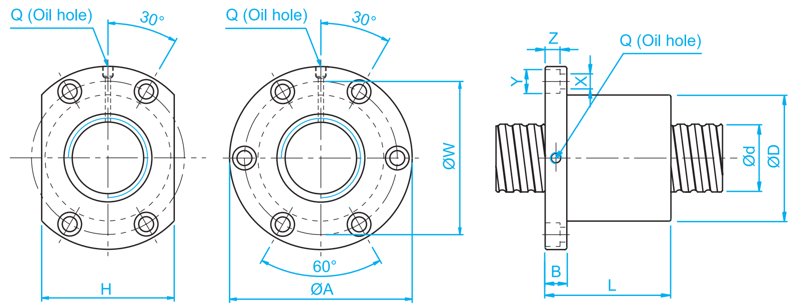



Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Q | n | | | |
| SFS01205-2.8 | 12 | 5 | 2.5 | 24 | 40 | 10 | 31 | 32 | 30 | 4.5 | | 2.8x1 | 661 | 1316 | 19 |
| SFS01210-2.8 | | 10 | 2.5 | 24 | 40 | 10 | 48.5 | 32 | 30 | 4.5 | | 2.8x1 | 642 | 1287 | 19 |
| SFS01605-3.8 | 15 | 5 | 2.778 | 28 | 48 | 10 | 38 | 38 | 40 | 5.5 | M6 | 3.8x1 | 1112 | 2507 | 30 |
| SFS01610-2.8 | | 10 | 2.778 | 28 | 48 | 10 | 47 | 38 | 40 | 5.5 | M6 | 2.8x1 | 839 | 1821 | 23 |
| SFS01616-1.8 | | 16 | 2.778 | 28 | 48 | 10 | 45 | 38 | 40 | 5.5 | M6 | 1.8x1 | 552 | 1137 | 14 |
| SFS01616-2.8 | | 16 | 2.778 | 28 | 48 | 10 | 61 | 38 | 40 | 5.5 | M6 | 2.8x1 | 808 | 1769 | 22 |
| SFS01620-1.8 | | 20 | 2.778 | 28 | 48 | 10 | 57 | 38 | 40 | 5.5 | M6 | 1.8x1 | 554 | 1170 | 14 |
| SFS02005-3.8 | 20 | 5 | 3.175 | 36 | 58 | 10 | 40 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1484 | 3681 | 37 |
| SFS02010-3.8 | | 10 | 3.175 | 36 | 58 | 10 | 60 | 47 | 44 | 6.6 | M6 | 3.8x1 | 1516 | 3833 | 40 |
| SFS02020-1.8 | | 20 | 3.175 | 36 | 58 | 10 | 57 | 47 | 44 | 6.6 | M6 | 1.8x1 | 764 | 1758 | 19 |
| SFS02020-2.8 | | 20 | 3.175 | 36 | 58 | 10 | 77 | 47 | 44 | 6.6 | M6 | 2.8x1 | 1118 | 2734 | 29 |
| SFS02505-3.8 | 25 | 5 | 3.175 | 40 | 62 | 10 | 40 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1650 | 4658 | 43 |
| SFS02510-3.8 | | 10 | 3.175 | 40 | 62 | 12 | 62 | 51 | 48 | 6.6 | M6 | 3.8x1 | 1638 | 4633 | 45 |
| SFS02525-1.8 | | 25 | 3.175 | 40 | 62 | 12 | 70 | 51 | 48 | 6.6 | M6 | 1.8x1 | 843 | 2199 | 22 |
| SFS02525-2.8 | | 25 | 3.175 | 40 | 62 | 12 | 95 | 51 | 48 | 6.6 | M6 | 2.8x1 | 1232 | 3421 | 34 |
| SFS03205-3.8 | 32 | 5 | 3.175 | 50 | 80 | 12 | 42 | 65 | 62 | 9 | M6 | 3.8x1 | 1839 | 6026 | 51 |
| SFS03210-3.8 | 31 | 10 | 3.969 | 50 | 80 | 13 | 62 | 65 | 62 | 9 | M6 | 3.8x1 | 2460 | 7255 | 55 |
| SFS03220-2.8 | | 20 | 3.969 | 50 | 80 | 12 | 80 | 65 | 62 | 9 | M6 | 2.8x1 | 1907 | 5482 | 43 |
| SFS03232-1.8 | | 32 | 3.969 | 50 | 80 | 13 | 84 | 65 | 62 | 9 | M6 | 1.8x1 | 1257 | 3426 | 27 |
| SFS03232-2.8 | | 32 | 3.969 | 50 | 80 | 13 | 116 | 65 | 62 | 9 | M6 | 2.8x1 | 1838 | 5329 | 42 |
| SFS04005-3.8 | 40 | 5 | 3.175 | 63 | 93 | 15 | 45 | 78 | 70 | 9 | M8 | 3.8x1 | 2018 | 7589 | 60 |
| SFS04010-3.8 | 38 | 10 | 6.35 | 63 | 93 | 14 | 63 | 78 | 70 | 9 | M8 | 3.8x1 | 5035 | 13943 | 67 |
| SFS04020-2.8 | | 20 | 6.35 | 63 | 93 | 14 | 82 | 78 | 70 | 9 | M8 | 2.8x1 | 3959 | 10715 | 54 |
| SFS04040-1.8 | | 40 | 6.35 | 63 | 93 | 15 | 105 | 78 | 70 | 9 | M8 | 1.8x1 | 2585 | 6648 | 34 |
| SFS04040-2.8 | | 40 | 6.35 | 63 | 93 | 15 | 145 | 78 | 70 | 9 | M8 | 2.8x1 | 3780 | 10341 | 52 |
| SFS05005-3.8 | 50 | 5 | 3.175 | 75 | 110 | 15 | 45 | 93 | 85 | 11 | M8 | 3.8x1 | 2207 | 9542 | 68 |
| SFS05010-3.8 | 48 | 10 | 6.35 | 75 | 110 | 18 | 68 | 93 | 85 | 11 | M8 | 3.8x1 | 5638 | 17852 | 79 |
| SFS05020-3.8 | | 20 | 6.35 | 75 | 110 | 18 | 108 | 93 | 85 | 11 | M8 | 3.8x1 | 5749 | 18485 | 87 |
| SFS05050-1.8 | | 50 | 6.35 | 75 | 110 | 18 | 125 | 93 | 85 | 11 | M8 | 1.8x1 | 2946 | 8749 | 42 |
| SFS05050-2.8 | | 50 | 6.35 | 75 | 110 | 18 | 175 | 93 | 85 | 11 | M8 | 2.8x1 | 4308 | 13610 | 65 |

※SFS series will be suspended from the production line, Please change to SFH.

## SFV Series Specifications

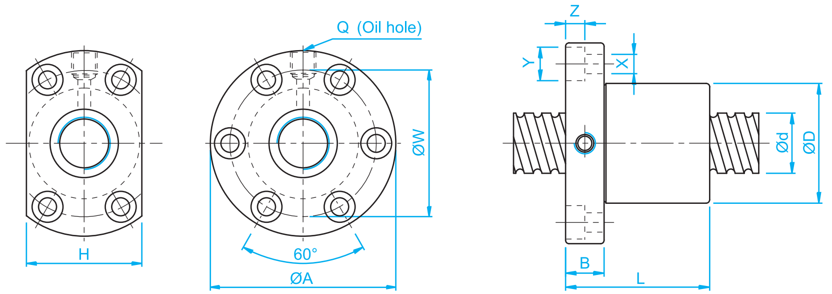



Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| SFV01205-2.8 | 12 | 5 | 2.5 | 30 | 50 | 10 | 42 | 40 | 32 | 4.5 | 8 | 4.5 | M6 | 2.8x1 | 661 | 1316 | 19 |
| SFV01210-2.7 | | 10 | 2.5 | 30 | 50 | 10 | 53 | 40 | 32 | 4.5 | 8 | 4.5 | M6 | 2.7x1 | 623 | 1241 | 18 |
| SFV01604-3.8 | 16 | 4 | 2.381 | 34 | 57 | 11 | 45 | 45 | 34 | 5.5 | 9.5 | 5.5 | M6 | 3.8x1 | 931 | 2285 | 31 |
| SFV01605-4.8 | | 5 | 3.175 | 40 | 63 | 11 | 58 | 51 | 42 | 5.5 | 9.5 | 5.5 | M6 | 4.8x1 | 1614 | 3662 | 40 |
| SFV01610-2.7 | | 10 | 3.175 | 40 | 63 | 11 | 56 | 51 | 42 | 5.5 | 9.5 | 5.5 | M6 | 2.7x1 | 1008 | 2161 | 24 |
| SFV02004-4.8 | 20 | 4 | 2.381 | 40 | 60 | 10 | 50 | 50 | 40 | 4.5 | 8 | 4 | M6 | 4.8x1 | 1247 | 3584 | 45 |
| SFV02005-4.8 | | 5 | 3.175 | 44 | 67 | 11 | 57 | 55 | 52 | 5.5 | 9.5 | 5.5 | M6 | 4.8x1 | 1814 | 4650 | 47 |
| SFV02020-1.8 | | 20 | 3.175 | 46 | 74 | 13 | 70 | 59 | 46 | 6.6 | 11 | 6.5 | M6 | 1.8x1 | 764 | 1758 | 19 |
| SFV02505-4.8 | 25 | 5 | 3.175 | 50 | 73 | 11 | 55 | 61 | 52 | 5.5 | 9.5 | 5.5 | M8 | 4.8x1 | 2017 | 5884 | 56 |
| SFV02510-2.7 | | 10 | 6.35 | 68 | 102 | 15 | 70 | 84 | 82 | 9 | 14 | 8.5 | M8 | 2.7x1 | 3040 | 6547 | 37 |
| SFV02525-1.8 | | 25 | 3.175 | 50 | 73 | 13 | 83 | 61 | 52 | 5.5 | 9.5 | 5.5 | M8 | 1.8x1 | 843 | 2199 | 22 |
| SFV03204-4.8 | 32 | 4 | 2.381 | 54 | 81 | 12 | 50 | 67 | 64 | 6.6 | 11 | 6.5 | M6 | 4.8x1 | 1517 | 5806 | 62 |
| SFV03205-4.8 | | 5 | 3.175 | 58 | 85 | 12 | 56 | 71 | 64 | 6.6 | 11 | 6.5 | M8 | 4.8x1 | 2249 | 7612 | 66 |
| SFV03210-4.8 | | 10 | 6.35 | 74 | 108 | 15 | 96 | 90 | 82 | 9 | 14 | 9 | M8 | 4.8x1 | 5620 | 14649 | 76 |
| SFV04005-4.8 | 40 | 5 | 3.175 | 67 | 101 | 15 | 59 | 83 | 72 | 9 | 14 | 8.5 | M8 | 4.8x1 | 2468 | 9586 | 76 |
| SFV04010-4.8 | | 10 | 6.35 | 82 | 124 | 18 | 100 | 102 | 94 | 11 | 17.5 | 11 | M8 | 4.8x1 | 6316 | 18600 | 90 |
| SFV04020-2.7 | | 20 | 6.35 | 82 | 124 | 18 | 100 | 102 | 90 | 11 | 17.5 | 11 | M8 | 2.7x1 | 3935 | 10893 | 56 |
| SFV05005-4.8 | 50 | 5 | 3.175 | 80 | 114 | 15 | 60 | 96 | 82 | 9 | 14 | 8.5 | M8 | 4.8x1 | 2698 | 12053 | 87 |
| SFV05010-4.8 | | 10 | 6.35 | 93 | 135 | 16 | 93 | 113 | 98 | 11 | 17.5 | 11 | M8 | 4.8x1 | 7023 | 23537 | 106 |
| SFV05020-2.7 | | 20 | 9.525 | 105 | 152 | 28 | 121 | 128 | 110 | 14 | 20 | 13 | M8 | 2.7x1 | 7336 | 19700 | 68 |
| SFV06310-4.8 | 63 | 10 | 6.35 | 108 | 154 | 22 | 105 | 130 | 110 | 14 | 20 | 13 | M8 | 4.8x1 | 7860 | 30430 | 126 |
| SFV06320-2.7 | | 20 | 9.525 | 122 | 180 | 28 | 120 | 150 | 130 | 18 | 26 | 17.5 | M8 | 2.7x1 | 8162 | 24741 | 80 |
| SFV08010-4.8 | 80 | 10 | 6.35 | 130 | 176 | 22 | 105 | 152 | 132 | 14 | 20 | 13 | M8 | 4.8x1 | 8593 | 38344 | 145 |
| SFV08020-4.8 | | 20 | 9.525 | 143 | 204 | 28 | 180 | 172 | 148 | 18 | 26 | 18 | M8 | 4.8x1 | 15103 | 57296 | 168 |
| SFV08020-7.6 | | 20 | 9.525 | 143 | 204 | 28 | 240 | 172 | 148 | 18 | 26 | 18 | M8 | 3.8x2 | 22423 | 90719 | 260 |

BALL SCREW

## SFI Series Specifications

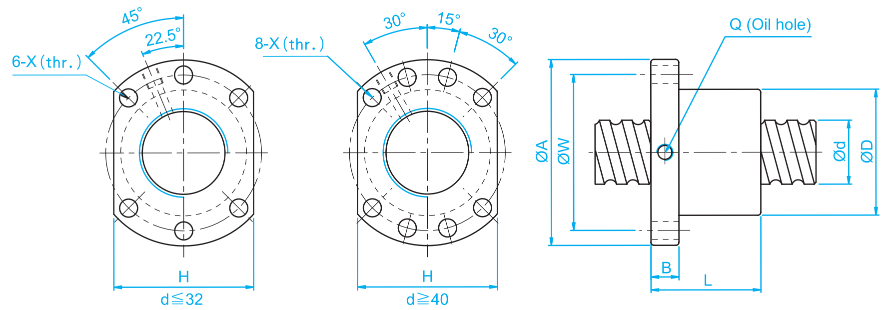



Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| SFI01604-4 | 16 | 4 | 2.381 | 30 | 49 | 10 | 45 | 39 | 34 | 4.5 | 8 | 4.5 | M6 | 1x4 | 973 | 2406 | 32 |
| ☆ SFI01605-4 | | 5 | 3.175 | 30 | 49 | 10 | 50 | 39 | 34 | 4.5 | 8 | 4.5 | M6 | 1x4 | 1380 | 3052 | 33 |
| SFI01610-3 | | 10 | 3.175 | 34 | 58 | 10 | 57 | 45 | 34 | 5.5 | 9.5 | 5.5 | M6 | 1x3 | 1103 | 2401 | 27 |
| SFI02004-4 | 20 | 4 | 2.381 | 34 | 57 | 11 | 46 | 45 | 40 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1066 | 2987 | 37 |
| ☆ SFI02005-4 | | 5 | 3.175 | 34 | 57 | 11 | 51 | 45 | 40 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1551 | 3875 | 39 |
| SFI02504-4 | 25 | 4 | 2.381 | 40 | 63 | 11 | 46 | 51 | 46 | 5.5 | 9.5 | 5.5 | M6 | 1x4 | 1180 | 3795 | 43 |
| ☆ SFI02505-4 | | 5 | 3.175 | 40 | 63 | 11 | 51 | 51 | 46 | 5.5 | 9.5 | 5.5 | M8 | 1x4 | 1724 | 4904 | 45 |
| SFI0255T-4 | | 5.08 | 3.175 | 40 | 63 | 11 | 51 | 51 | 46 | 5.5 | 9.5 | 5.5 | M8 | 1x4 | 1724 | 4904 | 45 |
| SFI02510-4 | | 10 | 4.762 | 46 | 72 | 12 | 85 | 58 | 52 | 6.5 | 11 | 6.5 | M6 | 1x4 | 2954 | 7295 | 51 |
| SFI03204-4 | 32 | 4 | 2.381 | 46 | 72 | 12 | 47 | 58 | 52 | 6.5 | 11 | 6.5 | M6 | 1x4 | 1296 | 4838 | 49 |
| ☆ SFI03205-4 | | 5 | 3.175 | 46 | 72 | 12 | 52 | 58 | 52 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 52 |
| ☆ SFI03210-4 | | 10 | 6.35 | 54 | 88 | 15 | 90 | 70 | 62 | 9 | 14 | 8.5 | M8 | 1x4 | 4805 | 12208 | 62 |
| ☆ SFI04005-4 | 40 | 5 | 3.175 | 56 | 90 | 15 | 55 | 72 | 64 | 9 | 14 | 8.5 | M8 | 1x4 | 2110 | 7988 | 59 |
| ☆ SFI04010-4 | | 10 | 6.35 | 62 | 104 | 18 | 93 | 82 | 70 | 11 | 17.5 | 11 | M8 | 1x4 | 5399 | 15500 | 72 |
| ☆ SFI05010-4 | 50 | 10 | 6.35 | 72 | 114 | 18 | 93 | 92 | 82 | 11 | 17.5 | 11 | M8 | 1x4 | 6004 | 19614 | 83 |
| SFI06310-4 | 63 | 10 | 6.35 | 85 | 131 | 22 | 98 | 107 | 95 | 14 | 20 | 13 | M8 | 1x4 | 6719 | 25358 | 95 |
| SFI08010-4 | 80 | 10 | 6.35 | 105 | 150 | 22 | 98 | 127 | 115 | 14 | 20 | 13 | M8 | 1x4 | 7346 | 31953 | 109 |

※☆Left helix available

## SFU (DIN 69051 FORM B) Series Specifications

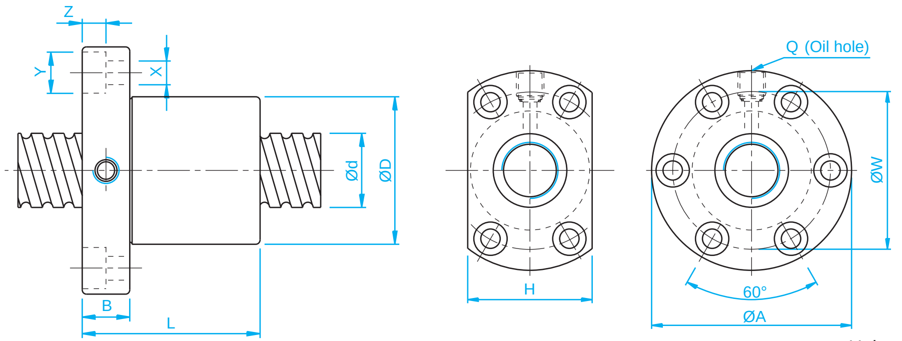



Unit：mm

| Model No. | d | l | Da | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Q | n | | | |
| SFU01204-4 | 12 | 4 | 2.5 | 24 | 40 | 10 | 40 | 32 | 30 | 4.5 | | 1x4 | 902 | 1884 | 26 |
| SFU01604-4 | 16 | 4 | 2.381 | 28 | 48 | 10 | 40 | 38 | 40 | 5.5 | M6 | 1x4 | 973 | 2406 | 32 |
| ☆ SFU01605-4 | | 5 | 3.175 | 28 | 48 | 10 | 50 | 38 | 40 | 5.5 | M6 | 1x4 | 1380 | 3052 | 32 |
| SFU01610-3 | | 10 | 3.175 | 28 | 48 | 10 | 57 | 38 | 40 | 5.5 | M6 | 1x3 | 1103 | 2401 | 26 |
| SFU02004-4 | 20 | 4 | 2.381 | 36 | 58 | 10 | 42 | 47 | 44 | 6.6 | M6 | 1x4 | 1066 | 2987 | 38 |
| ☆ SFU02005-4 | | 5 | 3.175 | 36 | 58 | 10 | 51 | 47 | 44 | 6.6 | M6 | 1x4 | 1551 | 3875 | 39 |
| SFU02504-4 | 25 | 4 | 2.381 | 40 | 62 | 10 | 42 | 51 | 48 | 6.6 | M6 | 1x4 | 1180 | 3795 | 43 |
| ☆ SFU02505-4 | | 5 | 3.175 | 40 | 62 | 10 | 51 | 51 | 48 | 6.6 | M6 | 1x4 | 1724 | 4904 | 45 |
| SFU02510-4 | | 10 | 4.762 | 40 | 62 | 12 | 85 | 51 | 48 | 6.6 | M6 | 1x4 | 2954 | 7295 | 50 |
| SFU03204-4 | 32 | 4 | 2.381 | 50 | 80 | 12 | 44 | 65 | 62 | 9 | M6 | 1x4 | 1296 | 4838 | 51 |
| ☆ SFU03205-4 | | 5 | 3.175 | 50 | 80 | 12 | 52 | 65 | 62 | 9 | M6 | 1x4 | 1922 | 6343 | 54 |
| ☆ SFU03210-4 | | 10 | 6.35 | 50 | 80 | 12 | 90 | 65 | 62 | 9 | M6 | 1x4 | 4805 | 12208 | 61 |
| ☆ SFU04005-4 | 40 | 5 | 3.175 | 63 | 93 | 14 | 55 | 78 | 70 | 9 | M8 | 1x4 | 2110 | 7988 | 63 |
| ☆ SFU04010-4 | | 10 | 6.35 | 63 | 93 | 14 | 93 | 78 | 70 | 9 | M8 | 1x4 | 5399 | 15500 | 73 |
| ☆ SFU05010-4 | 50 | 10 | 6.35 | 75 | 110 | 16 | 93 | 93 | 85 | 11 | M8 | 1x4 | 6004 | 19614 | 85 |
| SFU06310-4 | 63 | 10 | 6.35 | 90 | 125 | 18 | 98 | 108 | 95 | 11 | M8 | 1x4 | 6719 | 25358 | 99 |
| SFU06320-4 | | 20 | 9.525 | 95 | 135 | 20 | 149 | 115 | 100 | 13.5 | M8 | 1x4 | 11444 | 36653 | 112 |
| SFU08010-4 | 80 | 10 | 6.35 | 105 | 145 | 20 | 98 | 125 | 110 | 13.5 | M8 | 1x4 | 7346 | 31953 | 109 |
| SFU08020-4 | | 20 | 9.525 | 125 | 165 | 25 | 154 | 145 | 130 | 13.5 | M8 | 1x4 | 12911 | 47747 | 138 |

※☆Left helix available

## SFM Series Specifications (Designed for Milling Machine)

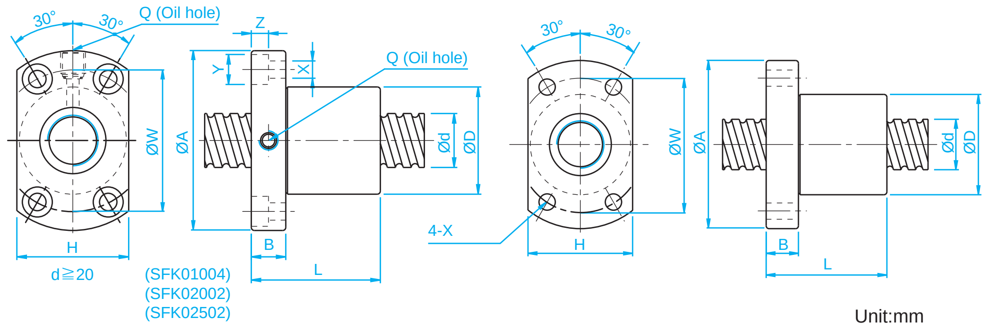



Unit mm

| | Model No. | d | I | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| ☆ | SFM03205-4 | 32 | 5 | 3.175 | 48 | 74 | 12 | 52 | 60 | 60 | 6.5 | 11 | 6.5 | M8 | 1x4 | 1922 | 6343 | 53 |

※☆Left helix available

## SFK Series Specifications




Unit:mm

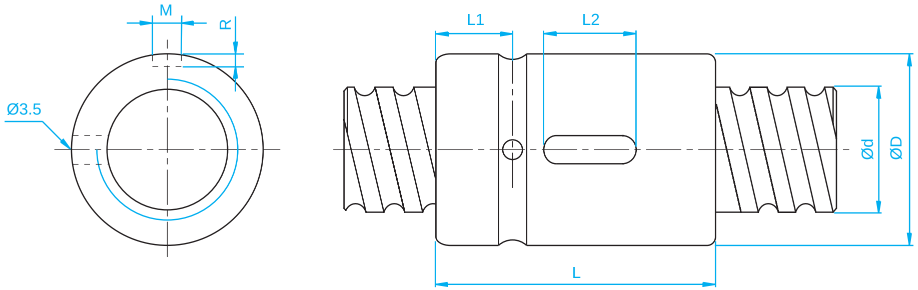
| Model No. | d | I | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| SFK00601 | 6 | 1 | 0.8 | 12 | 24 | 3.5 | 15 | 18 | 16 | 3.4 | — | — | — | 1x3 | 111 | 224 | 9 |
| SFK00801 | 8 | 1 | 0.8 | 14 | 27 | 4 | 16 | 21 | 18 | 3.4 | — | — | — | 1x4 | 161 | 403 | 14 |
| SFK00802 | | 2 | 1.2 | 14 | 27 | 4 | 16 | 21 | 18 | 3.4 | — | — | — | 1x3 | 222 | 458 | 13 |
| SFK0082.5 | | 2.5 | 1.2 | 16 | 29 | 4 | 26 | 23 | 20 | 3.4 | — | — | — | 1x3 | 221 | 457 | 13 |
| SFK01002 | 10 | 2 | 1.2 | 18 | 35 | 5 | 28 | 27 | 22 | 4.5 | — | — | — | 1x3 | 243 | 569 | 15 |
| SFK01004 | | 4 | 2 | 26 | 46 | 10 | 34 | 36 | 28 | 4.5 | 8 | 4.5 | M6 | 1x3 | 468 | 905 | 17 |
| SFK01202 | 12 | 2 | 1.2 | 20 | 37 | 5 | 28 | 29 | 24 | 4.5 | — | — | — | 1x4 | 334 | 906 | 22 |
| SFK01402 | 14 | 2 | 1.2 | 21 | 40 | 6 | 23 | 31 | 26 | 5.5 | — | — | — | 1x4 | 354 | 1053 | 24 |

Unit:mm

| Model No. | d | I | Da | Dimension | | | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf／μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | W | H | X | Y | Z | Q | n | | | |
| XSUR01204T3D-02 | 12 | 4 | 2.5 | 24 | 40 | 6 | 28 | 32 | 25 | 3.5 | — | — | — | 1x3 | 454 | 722 | — |
| XSUR01205T3D-00 | | 5 | | 22 | 37 | 8 | 39 | 29 | 24 | 4.5 | — | — | — | 1x3 | 675 | 1316 | 17 |

BALL SCREW

## SCI Series Specifications

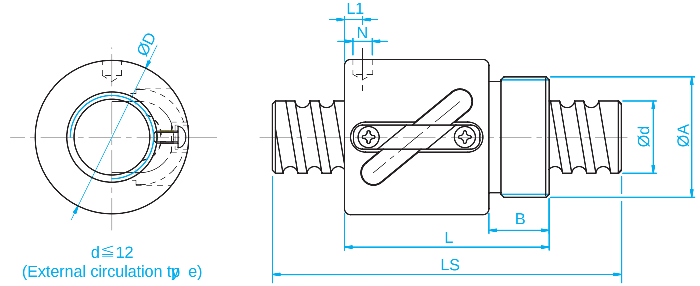


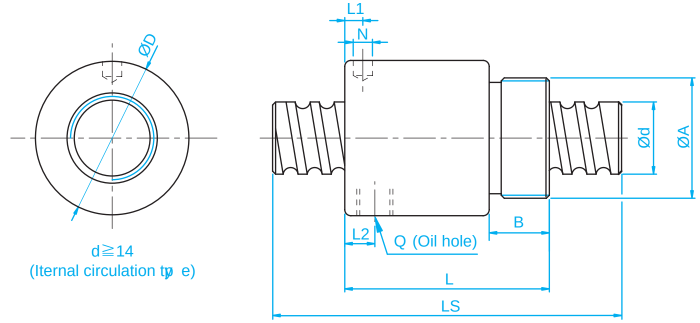

Unit mm

| | Model No. | d | l | Da | Dimension | | | | | | | Ca (kgf) | Coa (kgf) | K kgf/μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | D | L | L1 | L2 | M | R | n | | | |
| | SCI01604-4 | 16 | 4 | 2.381 | 30 | 40 | 9 | 15 | 3 | 1.5 | 1x4 | 973 | 2406 | 32 |
| ☆ | SCI01605-4 | | 5 | 3.175 | 30 | 45 | 9 | 20 | 5 | 3 | 1x4 | 1380 | 3052 | 33 |
| | SCI02004-4 | 20 | 4 | 2.381 | 34 | 40 | 9 | 15 | 3 | 1.5 | 1x4 | 1066 | 2987 | 37 |
| ☆ | SCI02005-4 | | 5 | 3.175 | 34 | 45 | 9 | 20 | 5 | 3 | 1x4 | 1551 | 3875 | 39 |
| | SCI02504-4 | 25 | 4 | 2.381 | 40 | 40 | 9 | 15 | 3 | 1.5 | 1x4 | 1180 | 3795 | 43 |
| ☆ | SCI02505-4 | | 5 | 3.175 | 40 | 45 | 9 | 20 | 5 | 3 | 1x4 | 1724 | 4904 | 45 |
| | SCI02510-4 | | 10 | 4.762 | 46 | 85 | 13 | 30 | 5 | 3 | 1x4 | 2954 | 7295 | 51 |
| | SCI03204-4 | 32 | 4 | 2.381 | 46 | 40 | 9 | 15 | 3 | 1.5 | 1x4 | 1296 | 4838 | 49 |
| ☆ | SCI03205-4 | | 5 | 3.175 | 46 | 45 | 9 | 20 | 5 | 3 | 1x4 | 1922 | 6343 | 52 |
| ☆ | SCI03210-4 | | 10 | 6.35 | 54 | 85 | 13 | 30 | 5 | 3 | 1x4 | 4805 | 12208 | 62 |
| ☆ | SCI04005-4 | 40 | 5 | 3.175 | 56 | 45 | 9 | 20 | 5 | 3 | 1x4 | 2110 | 7988 | 59 |
| ☆ | SCI04010-4 | | 10 | 6.35 | 62 | 85 | 13 | 30 | 5 | 3 | 1x4 | 5399 | 15500 | 72 |
| | SCI05010-4 | 50 | 10 | 6.35 | 72 | 85 | 13 | 30 | 5 | 3 | 1x4 | 6004 | 19614 | 83 |
| ☆ | SCI06310-4 | 63 | 10 | 6.35 | 85 | 85 | 13 | 30 | 6 | 3.5 | 1x4 | 6719 | 25358 | 95 |
| ☆ | SCI08010-4 | 80 | 10 | 6.35 | 105 | 85 | 13 | 30 | 8 | 4.5 | 1x4 | 7346 | 31953 | 109 |

※☆Left helix available

## BSH Series Specifications




Unit mm

| Model No. | d | l | Da | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | K kgf/μm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D | A | B | L | L1 | N | L2 | Q | n | | | |
| BSHR0082.5-2.5 | 8 | 2.5 | 1.2 | 17.5 | M15x1P | 7.5 | 23.5 | 10 | 3 | – | – | 2.5x1 | 189 | 381 | 11 |
| BSHR01002-3.5 | 10 | 2 | 1.2 | 19.5 | M17x1P | 7.5 | 22 | 3 | 3.2 | – | – | 3.5x1 | 277 | 664 | 17 |
| BSHR01004-2.5 | | 4 | 2 | 25 | M20x1P | 10 | 34 | 3 | 3 | – | – | 2.5x1 | 400 | 754 | 14 |
| BSHR01204-3.5 | 12 | 4 | 2.5 | 25.5 | M20x1P | 10 | 34 | 13 | 3 | – | – | 3.5x1 | 804 | 1649 | 23 |
| BSHR01205-3.5 | | 5 | 2.5 | 25.5 | M20x1P | 10 | 39 | 16.25 | 3 | – | – | 3.5x1 | 801 | 1644 | 24 |
| BSHR01404-3 | 14 | 4 | 2.5 | 32.1 | M25x1.5P | 10 | 35 | 11 | 3 | – | – | 1x3 | 748 | 1609 | 26 |
| BSHR01604-3 | 16 | 4 | 2.381 | 29 | M22x1.5P | 8 | 32 | 4 | 3.2 | – | – | 1x3 | 759 | 1804 | 24 |
| BSHR01605-3 | | 5 | 3.175 | 32.5 | M26x1.5P | 12 | 42 | 19.25 | 3 | – | – | 1x3 | 1077 | 2289 | 25 |
| BSHR01610-2 | | 10 | 3.175 | 32 | M26x1.5P | 12 | 50 | 3 | 4 | 3 | M4 | 1x2 | 675 | 1316 | 14 |
| BSHR02005-3 | 20 | 5 | 3.175 | 38 | M35x1.5P | 15 | 45 | 20.3 | 3 | – | – | 1x3 | 1211 | 2906 | 30 |
| BSHR02505-4 | 25 | 5 | 3.175 | 43 | M40x1.5P | 19 | 69 | 32.11 | 3 | 8 | M6 | 1x4 | 1724 | 4904 | 37 |
| BSHR02510-4 | | 10 | 4.762 | 43 | M40x1.5P | 19 | 84 | 8 | 6 | 8 | M6 | 1x4 | 2954 | 7295 | 41 |

※Standard ballnut from Ø8~Ø16 is assembled without wiper.

# D. Precision Rotary Series

www.tbimotion.com.tw

# About Precision Rotary Ball Screw／Spline

## 1-1 Features of *TBI MOTION* Precision Rotary Ball Screw／Spline

*TBI MOTION* rotatry ball screw and spline line is designed to enable the application to move linearly and rotationally in one assembly, with symmetrical orientation design between the outer and inner ball screw or spline nut. Both rotary and spiral movement can be achieved simultaneously.

*TBI MOTION* rotary line Is the most ideal key component in scara robots, industrial robots, pick & place, laser engraving, transporting and many other multi-directional application.

### Feature

#### Zero clearance／High rigidity

*TBI MOTION* rotary line featured 40° angular (Back to back) contact angle within in the bearing. It enables self-aligning with minor mounting error and bears higher axial load to achieve better accuracy. Custom preload can be applied to reduce clearance and increase high rigidity. (as shown in Fig 1.1.1)

#### High speed／Smooth running performance

The rotary line uses *TBI MOTION* super lead screw to maintain high speed with smoothness in performance.

#### Noise reduction

The precision ground screw thread and spline groove make sure the ball bearing travel fluently during operations which reduce the skidding, friction and noise level and thus increase the service performance and life.

#### Plug and run／Compactness

*TBI MOTION* rotary line features a one-piece compact and easy mounting design.

#### Accuracy

Please refer to chart D05~10 for detail.

#### Spline alternative

Ball spline offers customized end journal according to print. Hollow spline is available on request for special operation environment in rentilation, piping on weight reduction.

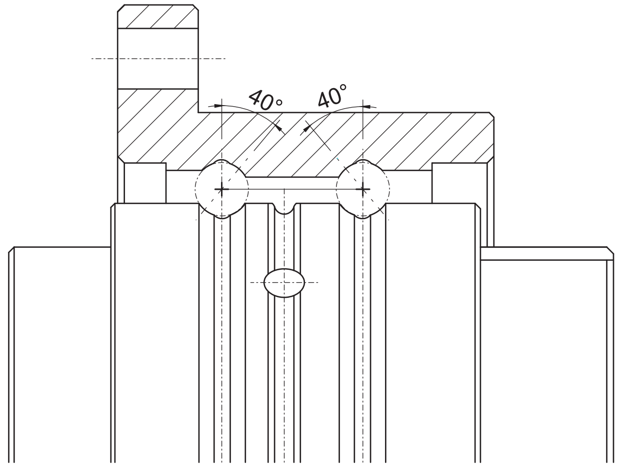



Fig 1.1.1 DB-type (Back to back)

ROTARY BALL SCREW／SPLINE

Table 1.1.1 Mass series

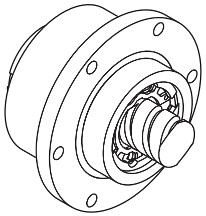
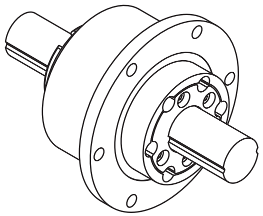
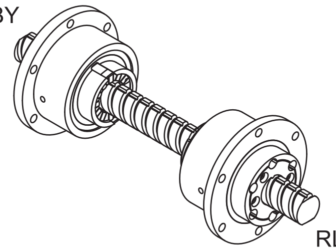
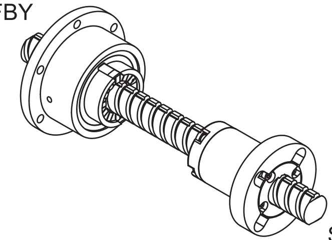
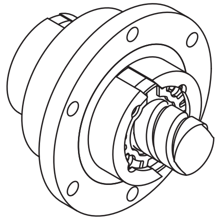
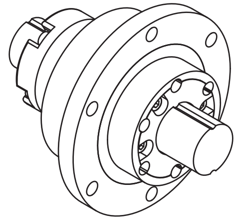
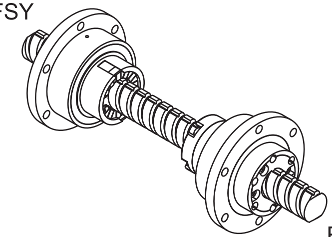
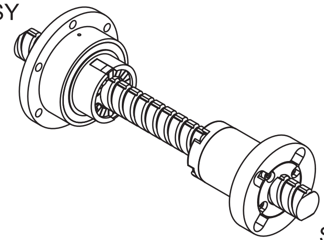
| Rotary Ball Screw - RFBY Type | Rotary Ball Spline - RLBF Type |
| --- | --- |
|  |  |
| **Ball Screw／Spline - RBBY Type** | **Ball Screw／Spline - RBLY Type** |
|   |   |

Table 1.1.2 Compact series

| Rotary Ball Screw - RFSY Type | Rotary Ball Spline - RLSF Type |
| --- | --- |
|  |  |
| **Ball Screw／Spline - RSSY Type** | **Ball Screw／Spline - RSLY Type** |
|   |   |

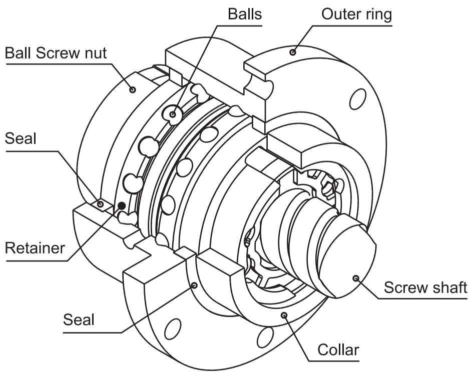



Fig 1.1.2 The Structure of RFBY - series

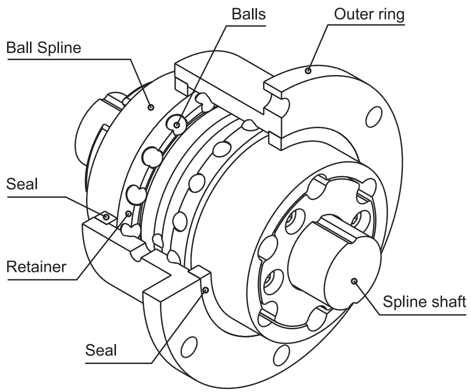



Fig 1.1.3 The Structure of RLBF - series

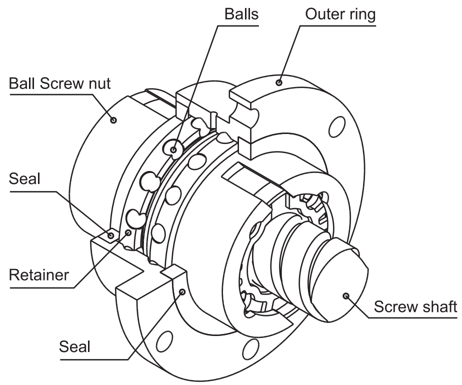



Fig 1.1.4 The Structure of RFSY - series

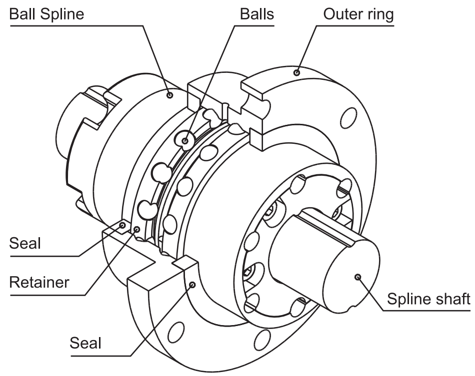



Fig 1.1.5 The Structure of RLSF - series

# 1-2 Accuracy

## 1-2-1 RBBY, RBLY Accuracy Standards

The Ball Screw／Spline is manufactured with the following specifications.

【Ball Screw】

Axial clearance : 0 or less

Lead accuracy : C5

(For detailed specifications, see C05)

【Ball Spline】

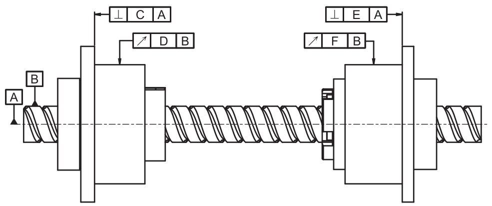
Clearance in the rotational direction : 0 or less

(CL : light preload)

(For detailed specifications, see B21~22)

Accuracy grade : class H

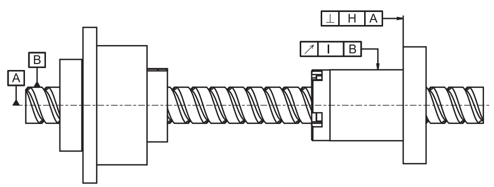
(For detailed specifications, see B23)




RFBY
Rotary Ball screw nut

RLBF
Rotary Ball Spline nut

Fig 1.2.1 RBBY - series




RFBY
Rotary Ball screw nut

SLF
Ball Spline nut

Fig 1.2.2 RBLY - series

| Model No. | C | D | E | F | H | I |
|---|---|---|---|---|---|---|
| RBBY01616<br>RBLY01616 | 0.018 | 0.021 | 0.016 | 0.020 | 0.013 | 0.016 |
| RBBY02020<br>RBLY02020 | 0.018 | 0.021 | 0.016 | 0.020 | 0.013 | 0.016 |
| RBBY02525<br>RBLY02525 | 0.021 | 0.021 | 0.018 | 0.024 | 0.016 | 0.016 |
| RBBY03232<br>RBLY03232 | 0.021 | 0.021 | 0.018 | 0.024 | 0.016 | 0.016 |
| RBBY04040<br>RBLY04040 | 0.025 | 0.025 | 0.021 | 0.033 | 0.019 | 0.019 |
| RBBY05050<br>RBLY05050 | 0.025 | 0.025 | 0.021 | 0.033 | 0.019 | 0.019 |

## 1-2-2 RFBY Accuracy Standards

The accuracy of model RFBY is compliant with JIS standard (JIS B 1192-1997) except for the radial runout of the circumference of the ball screw nut from the screw axis (D) and the perpendicularity of the flange-mounting surface against the screw axis (C).

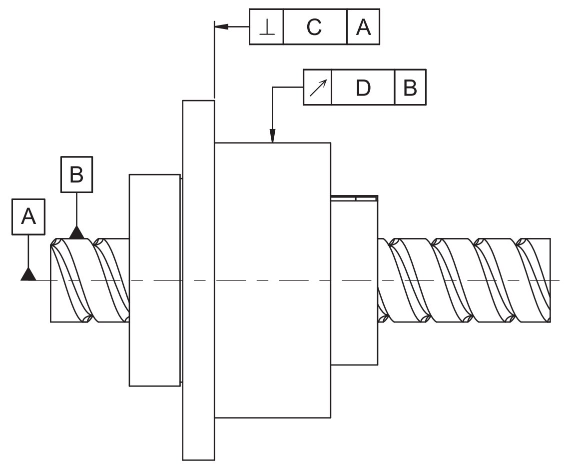



Fig 1.2.3 RFBY - series

Unit：mm

| Lead angle accuracy | Rolled C7 | | Rolled C10 | | Ground C7 | | Ground C5 | | Ground C3 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model No. | C | D | C | D | C | D | C | D | C | D |
| RFBY01616 | 0.035 | 0.065 | 0.035 | 0.065 | 0.023 | 0.035 | 0.016 | 0.020 | 0.013 | 0.017 |
| RFBY02020 | 0.035 | 0.065 | 0.035 | 0.065 | 0.023 | 0.035 | 0.016 | 0.020 | 0.013 | 0.017 |
| RFBY02525 | 0.035 | 0.065 | 0.035 | 0.065 | 0.023 | 0.035 | 0.018 | 0.024 | 0.015 | 0.020 |
| RFBY03232 | 0.035 | 0.065 | 0.035 | 0.065 | 0.023 | 0.035 | 0.018 | 0.024 | 0.015 | 0.020 |
| RFBY04040 | 0.046 | 0.086 | 0.046 | 0.086 | 0.026 | 0.046 | 0.021 | 0.033 | 0.018 | 0.026 |
| RFBY05050 | 0.046 | 0.086 | 0.046 | 0.086 | 0.026 | 0.046 | 0.021 | 0.033 | 0.018 | 0.026 |

### 1-2-3 RSSY, RSLY Accuracy Standards

The Ball Screw／Spline is manufactured with the following specifications.

【Ball Screw】

Axial clearance : 0 or less

Lead accuracy : C5

(For detailed specifications, see C05)

【Ball Spline】

Clearance in the rotational direction : 0 or less

(CL : light preload)

(For detailed specifications, see B21~22)

Accuracy grade : class H

(For detailed specifications, see B23)

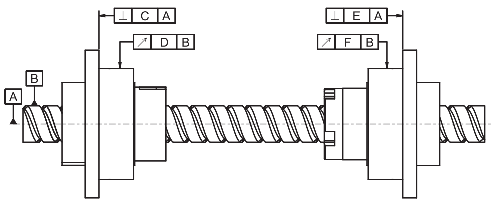



Fig 1.2.4 RSSY - series

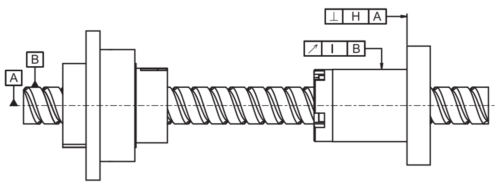



Fig 1.2.5 RSLY - series

| Model No. | C | D | E | F | H | I |
|---|---|---|---|---|---|---|
| RSSY01616<br>RSLY01616 | 0.018 | 0.021 | 0.016 | 0.020 | 0.013 | 0.016 |
| RSSY02020<br>RSLY02020 | 0.018 | 0.021 | 0.016 | 0.020 | 0.013 | 0.016 |
| RSSY02525<br>RSLY02525 | 0.021 | 0.021 | 0.018 | 0.024 | 0.016 | 0.016 |
| RSSY03232<br>RSLY03232 | 0.021 | 0.021 | 0.018 | 0.024 | 0.016 | 0.016 |
| RSSY04040<br>RSLY04040 | 0.025 | 0.025 | 0.021 | 0.033 | 0.019 | 0.019 |

### 1-2-4 RFSY Accuracy Standards

The accuracy of model RFSY is compliant with JIS standard (JIS B 1192-1997) except for the radial runout of the circumference of the ball screw nut from the screw axis (D) and the perpendicularity of the flange-mounting surface against the screw axis (C).

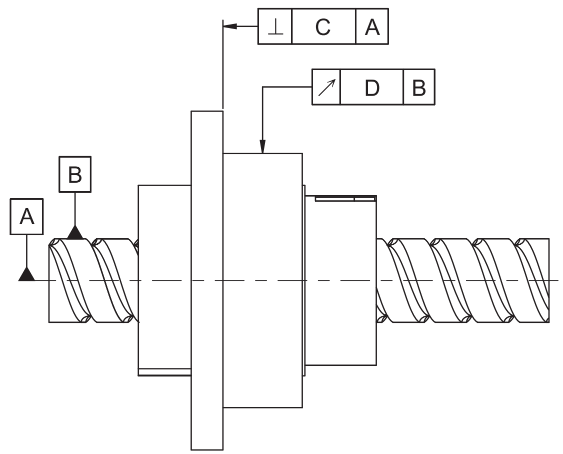



Fig 1.2.6 RFSY - series

Unit：mm

| Lead angle accuracy | Rolled C7 | | Rolled C10 | | Ground C7 | | Ground C5 | | Ground C3 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model No. | C | D | C | D | C | D | C | D | C | D |
| RFSY01616 | 0.035 | 0.065 | 0.035 | 0.065 | 0.023 | 0.035 | 0.016 | 0.020 | 0.013 | 0.017 |
| RFSY02020 | 0.035 | 0.065 | 0.035 | 0.065 | 0.023 | 0.035 | 0.016 | 0.020 | 0.013 | 0.017 |
| RFSY02525 | 0.035 | 0.065 | 0.035 | 0.065 | 0.023 | 0.035 | 0.018 | 0.024 | 0.015 | 0.020 |
| RFSY03232 | 0.035 | 0.065 | 0.035 | 0.065 | 0.023 | 0.035 | 0.018 | 0.024 | 0.015 | 0.020 |
| RFSY04040 | 0.046 | 0.086 | 0.046 | 0.086 | 0.026 | 0.046 | 0.021 | 0.033 | 0.018 | 0.026 |

## 1-2-5 RLBF, RLSF Accuracy Standards

### Accuracy Grades

The accuracy of the Ball Spline is determined by the callout of the spline-nut and thus divided into three accuracy grades of Normal (N), High (H), and Precision (P).

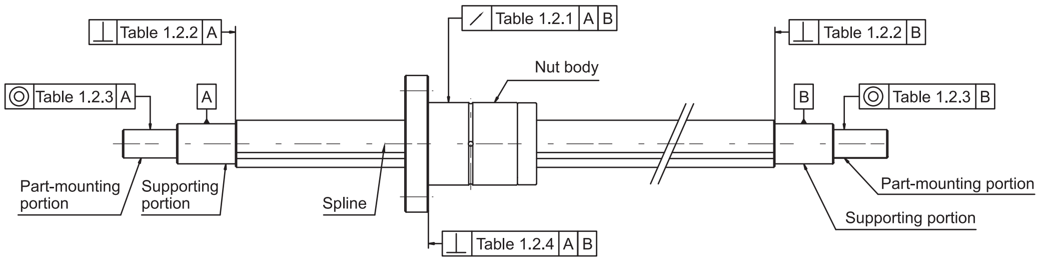



Fig 1.2.7

### Accuracy Specification

Tables 1.2.1 ~ 5 indicates the the measurement items of the Ball Spline.

Table1.2.1 The Maximum callout of Spline Nut on the support unit

Unit : μm

| Length \ Nominal Diameter | | 16, 20 | | | 25, 32 | | | 40, 50 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Above | Below | N | H | P | N | H | P | N | H | P |
| - | 200 | 56 | 34 | 18 | 53 | 32 | 18 | 53 | 32 | 16 |
| 200 | 315 | 71 | 45 | 25 | 58 | 39 | 21 | 58 | 36 | 19 |
| 315 | 400 | 83 | 53 | 31 | 70 | 44 | 25 | 63 | 39 | 21 |
| 400 | 500 | 95 | 62 | 38 | 78 | 50 | 29 | 68 | 43 | 24 |
| 500 | 630 | 112 | - | - | 88 | 57 | 34 | 74 | 47 | 27 |
| 630 | 800 | - | - | - | 103 | 68 | 42 | 84 | 54 | 32 |

Table1.2.2 The Maximum perpendicularity of Spline-shaft end on the journal ends

Unit : μm

| Nominal Diameter \ Accuracy | | Normal (N) | High (H) | Precision (P) |
|---|---|---|---|---|
| 16 | 20 | 27 | 11 | 8 |
| 25 | 32 | 33 | 13 | 9 |
| 40 | 50 | 39 | 16 | 11 |

Table1.2.3 The maximum radial callout on the attach surface

Unit : μm

| Nominal Diameter \ Accuracy | | Normal (N) | High (H) | Precision (P) |
|---|---|---|---|---|
| 16 | 20 | 46 | 19 | 12 |
| 25 | 32 | 53 | 22 | 13 |
| 40 | 50 | 62 | 25 | 15 |

Table1.2.4 The perpendicularity of flange on the attach surface

Unit : μm

| Nominal Diameter \ Accuracy | | | | Normal (N) | High (H) | Precision (P) |
|---|---|---|---|---|---|---|
| 16 | 20 | 25 | 32 | 30 | 16 | 11 |
| 40 | | 50 | | 46 | 19 | 13 |

Table1.2.5 The accuracy grade on the effective length accuracy

Unit : μm

| Accuracy | Normal (N) | High (H) | Precision (P) |
|---|---|---|---|
| Permissible | 33 | 13 | 6 |

Note：Measurement according to any 100 mm on the Spline shaft.

## 1-3 Example of Assembly - RFBY

### 1-3-1 Example of Mounting Rotary Ball Screw Nut Model RFBY

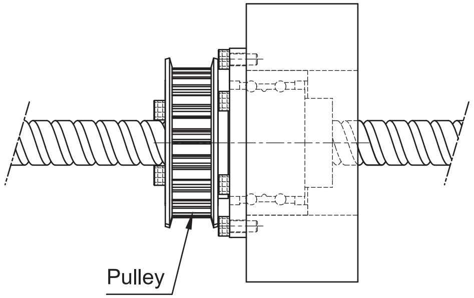



Fig 1.3.1

### Example of Mounting Model RFBY on the Table

(1) Ball screw nut fixed, screw shaft free. (Suitable for a long table)

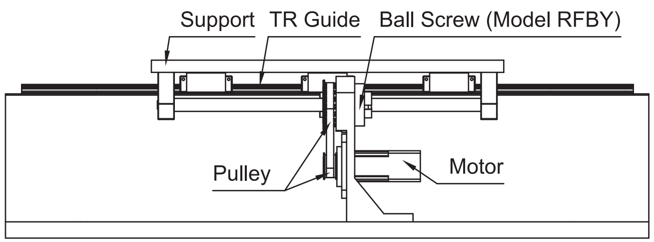



Fig 1.3.2

(2) Ball screw nut free, screw shaft fixed. (Suitable for a short table and a long stroke)

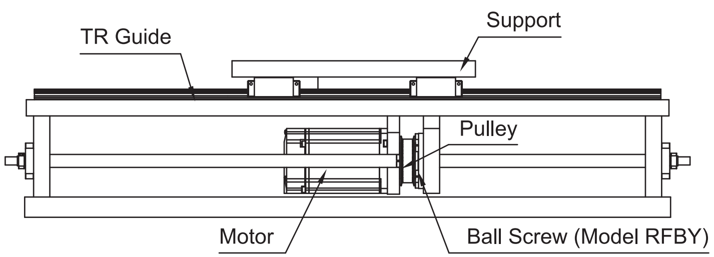



Fig 1.3.3

## 1-4 Example of Assembly - RBBY

### 1-4-1 Example of Mounting Precision Ball Screw／Spline Model RBBY

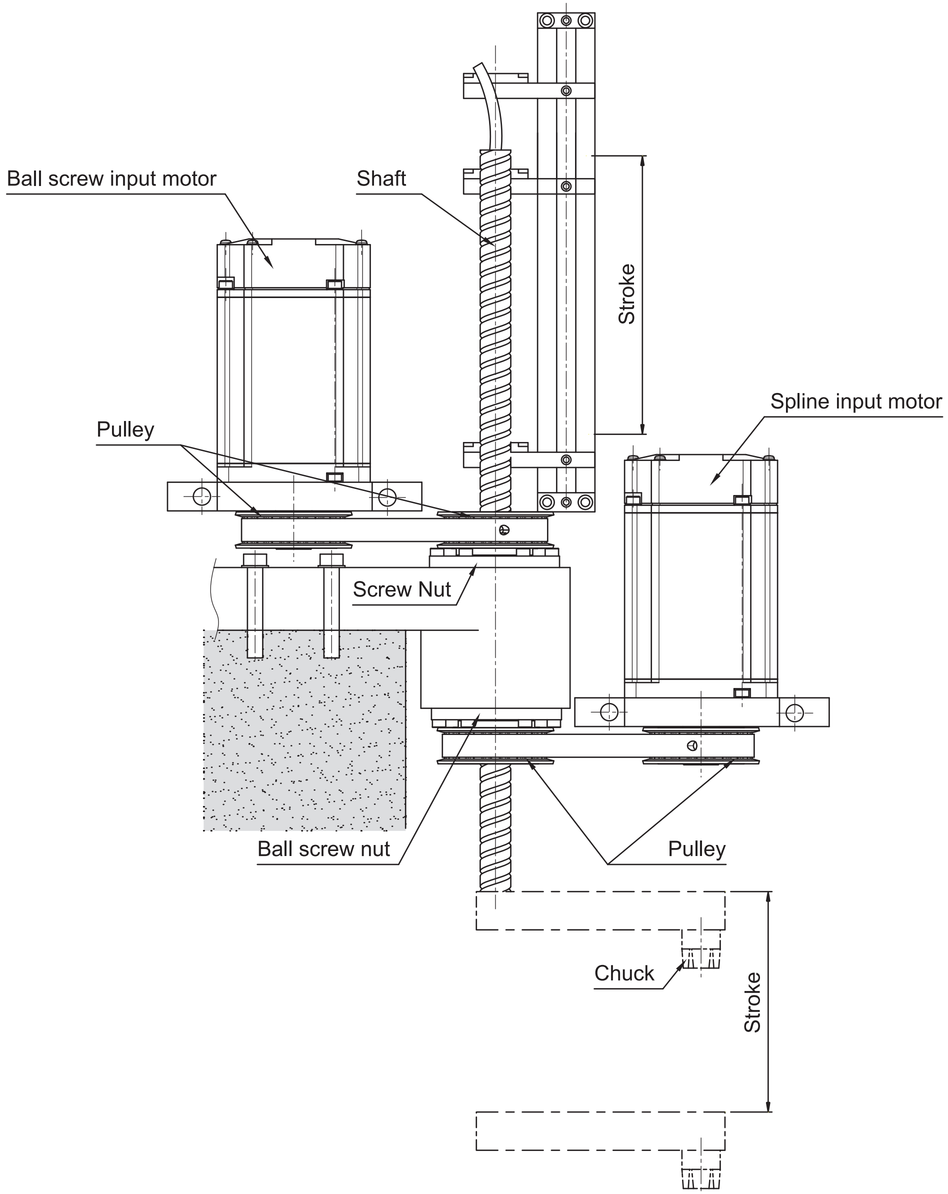



Fig 1.4.1

## 1-5 Nominal Model Code of Rotary Series

### Nominal Model Code of Rotary Ball Screw

RFSY R 016 16 A2 N G C5 - 500 - P0 (1A) + B1 B1

| | | |
|---|---|---|
| RFSY | Nominal Model | RFSY, RFBY |
| R | Threading Direction | R：Right |
| 016 | Nominal Diameter | Unit：mm |
| 16 | Lead | Unit：mm |
| A2 | Number of Turns (Turn · Row) | Turn： A：1.7<br>ex：( 1.7 · 2 = A2 ) |
| N | Flange Type | N：Round |
| G | Product Code | G：Ground F：Rolled |
| C5 | Accuracy Grade | C0, C1, C2, C3, C5, C7, C10 |
| 500 | Overall Length of Shaft | Unit：mm |
| P0 | Axial Clearance and Preload Value | P0, P1, P2, P3, P4 |
| (1A) | Number of Grooves | 1A：Single start screw 2A：Doube start screw |
| B1 | Nut Special Machining | S：Standard B1：Black Oxidation |
| B1 | Shaft Special Machining | S：Standard B1：Black Oxidation |

※No symbol required when no plating is needed.

### Nominal Model Code of Rotary Ball Spline

RLSF 016 T2 N N H - 500 - P0 + B1 B1

| | | |
|---|---|---|
| RLSF | Nominal Model | RLSF, RLBF |
| 016 | Nominal Diameter | Unit：mm |
| T2 | Groove | T2：2 Rows T4：4 Rows |
| N | Flange Type | N：Round |
| N | Accuracy Grade of Spline Shaft | N：Normal H：High P：Precision |
| H | Spline Shaft Type | S：Solid H：Hollow |
| 500 | Overall Length of Spline Shaft | Unit：mm |
| P0 | Preload Value | P0：No preload P1：Light preload P2：Medium preload |
| B1 | Nut Special Machining | S：Standard B1：Black Oxidation |
| B1 | Shaft Special Machining | S：Standard B1：Black Oxidation |

※No symbol required when no plating is needed.

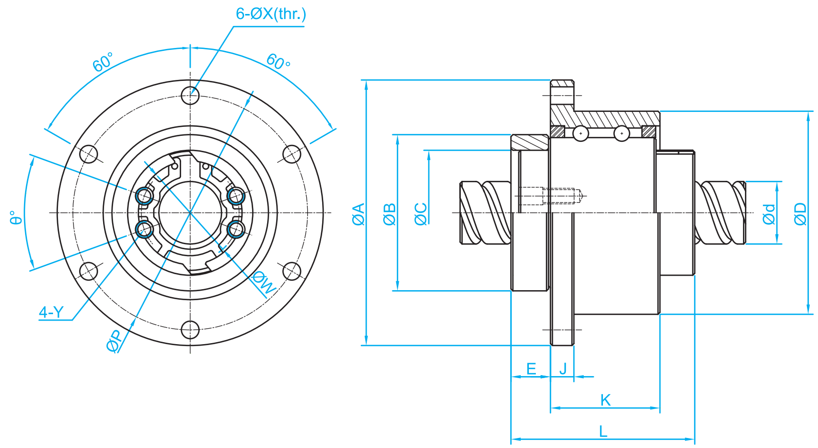
### Nominal Model Code of Rotary Ball Screw and Ball Spline

RSSY R 016 16 A2 G C5 H H - 500 - P1 (1A)

| | | |
|---|---|---|
| RSSY | Nominal Model | RSSY (RFSY+RLSF)<br>RSLY (RFSY+SLF)<br>RBBY (RFBY+RLBF)<br>RBLY (RFBY+SLF) |
| R | Threading Direction | R：Right |
| 016 | Nominal Diameter | Unit：mm |
| 16 | Lead | Unit：mm |
| A2 | Number of Turns (Turn · Row) | Turn： A：1.7<br>ex：( 1.7 · 2 = A2 ) |
| G | Product Code | G：Ground |
| C5 | Accuracy Grade of Ball Screw | C5 |
| H | Accuracy Grade of Spline Shaft | H：High |
| H | Spline Shaft Type | S：Solid H：Hollow |
| 500 | Overall Length of Assembly | Unit：mm |
| P1 | Preload Value | P1：Light preload |
| (1A) | Number of Grooves | 1A：Single start screw 2A：Doube start screw |

ROTARY BALL SCREW／SPLINE

## RFBY Series Specifications

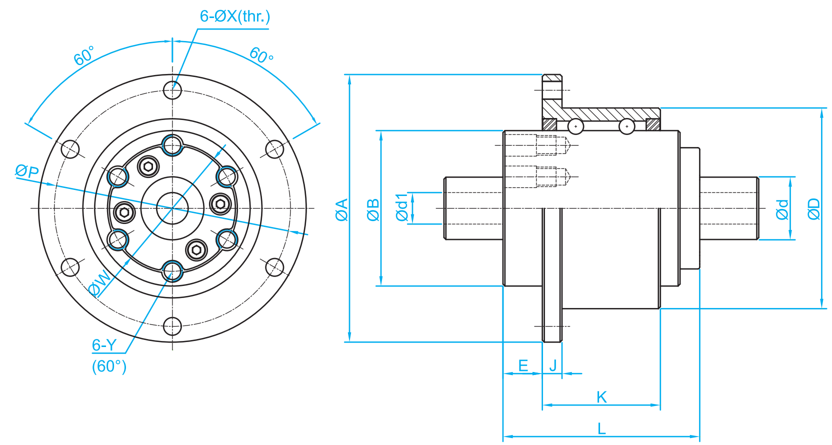



Unit：mm

| Model No. | d | l | Da | n | Support Bearing Load Rating | | Ball Screw Nut Dimension | | | | | | | | | | | | | | Screw Nut Load Rating | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ca (kgf) | Coa (kgf) | D | A | B | L | C | E | J | K | P | X | W | Y | θ | | Ca (kgf) | Coa (kgf) |
| RFBY01616-1.8 | 16 | 16 | 2.778 | 1.8x1 | 750 | 1593 | $52^{\ 0}_{-0.007}$ | 68 | $40^{\ 0}_{-0.025}$ | 47 | $32^{+0.025}_{\ 0}$ | 10.1 | 6 | 28 | 60 | 4.5 | 25 | M4 | 40 | | 591 | 1275 |
| RFBY01616-3.6 | 16 | 16 | 2.778 | 1.8x2 | 750 | 1593 | $52^{\ 0}_{-0.007}$ | 68 | $40^{\ 0}_{-0.025}$ | 47 | $32^{+0.025}_{\ 0}$ | 10.1 | 6 | 28 | 60 | 4.5 | 25 | M4 | 40 | | 1073 | 2551 |
| RFBY02020-1.8 | 20 | 20 | 3.175 | 1.8x1 | 1066 | 2452 | $62^{\ 0}_{-0.007}$ | 78 | $50^{\ 0}_{-0.025}$ | 53.5 | $39^{+0.025}_{\ 0}$ | 11 | 7 | 34.5 | 70 | 4.5 | 31 | M5 | 40 | | 764 | 1758 |
| RFBY02020-3.6 | 20 | 20 | 3.175 | 1.8x2 | 1066 | 2452 | $62^{\ 0}_{-0.007}$ | 78 | $50^{\ 0}_{-0.025}$ | 53.5 | $39^{+0.025}_{\ 0}$ | 11 | 7 | 34.5 | 70 | 4.5 | 31 | M5 | 40 | | 1387 | 3515 |
| RFBY02525-1.8 | 25 | 25 | 3.969 | 1.8x1 | 1119 | 2765 | $72^{\ 0}_{-0.007}$ | 92 | $58^{\ 0}_{-0.03}$ | 65 | $47^{+0.025}_{\ 0}$ | 15.8 | 8 | 35 | 81 | 5.5 | 38 | M6 | 40 | | 1142 | 2747 |
| RFBY02525-3.6 | 25 | 25 | 3.969 | 1.8x2 | 1119 | 2765 | $72^{\ 0}_{-0.007}$ | 92 | $58^{\ 0}_{-0.03}$ | 65 | $47^{+0.025}_{\ 0}$ | 15.8 | 8 | 35 | 81 | 5.5 | 38 | M6 | 40 | | 2074 | 5494 |
| ◆ RFBY03232-1.8 | 32 | 32 | 4.762 | 1.8x1 | 2087 | 5586 | $80^{\ 0}_{-0.007}$ | 105 | $66^{\ 0}_{-0.03}$ | 81 | $58^{+0.03}_{\ 0}$ | 21.5 | 9 | 42.5 | 91 | 6.6 | 48 | M6 | 40 | | 1664 | 4345 |
| ◆ RFBY04040-1.8 | 40 | 40 | 6.35 | 1.8x1 | 3183 | 9306 | $110^{\ 0}_{-0.008}$ | 140 | $90^{\ 0}_{-0.035}$ | 102 | $73^{+0.03}_{\ 0}$ | 16.5 | 11 | 64.5 | 123 | 9 | 61 | M8 | 50 | | 2662 | 7031 |
| ◆ RFBY05050-1.8 | 50 | 50 | 7.938 | 1.8x1 | 4328 | 12573 | $120^{\ 0}_{-0.008}$ | 156 | $100^{\ 0}_{-0.035}$ | 121 | $90^{+0.035}_{\ 0}$ | 29 | 12 | 70 | 136 | 11 | 75 | M10 | 50 | | 3978 | 10987 |

※ Items labeled with ◆ are customized products.
For these purchase orders, please contact TBI in advance.

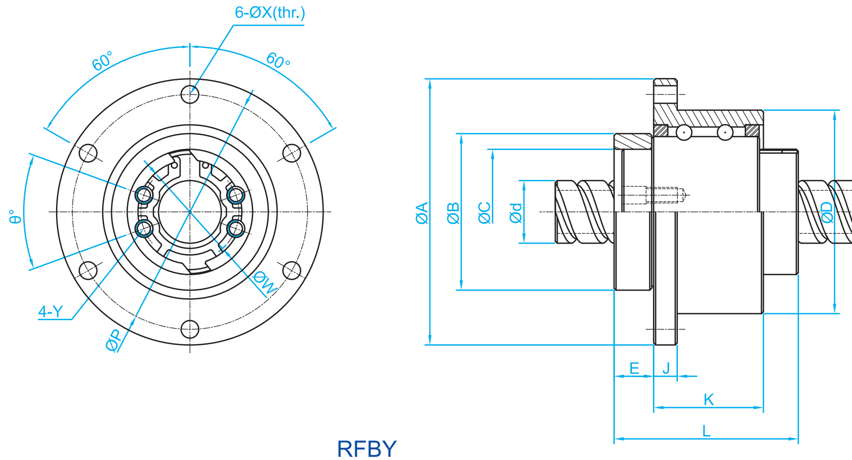
## RLBF Series Specifications



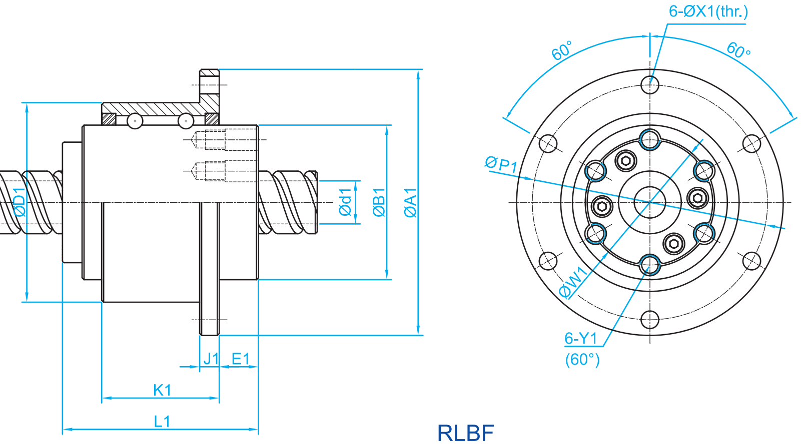

Unit：mm

| Model No. | d | d1 | Row | Support Bearing Load Rating | | Spline Nut Dimension | | | | | | | | | | | | Ball Spline Load Rating | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ca (kgf) | Coa (kgf) | D | A | B | L | E | J | K | P | X | W | Y | | Ca (kgf) | Coa (kgf) |
| RLBF016 | 16 | 8 | 2 | 746 | 1597 | $52^{\ 0}_{-0.007}$ | 68 | $39.5^{\ 0}_{-0.025}$ | 50 | 10 | 5 | 30 | 60 | 4.5 | 32 | M5 | | 545 | 849 |
| RLBF020 | 20 | 10 | 2 | 1011 | 2138 | $56^{\ 0}_{-0.007}$ | 72 | $43.5^{\ 0}_{-0.025}$ | 63 | 12 | 6 | 42 | 64 | 4.5 | 36 | M5 | | 736 | 1124 |
| RLBF025 | 25 | 15 | 4 | 1558 | 4616 | $62^{\ 0}_{-0.007}$ | 78 | $53^{\ 0}_{-0.03}$ | 71 | 13 | 6 | 49 | 70 | 4.5 | 45 | M6 | | 1003 | 1593 |
| RLBF032 | 32 | 16 | 4 | 2087 | 5586 | $80^{\ 0}_{-0.007}$ | 105 | $65.5^{\ 0}_{-0.03}$ | 80 | 17 | 9 | 54 | 91 | 6.6 | 55 | M6 | | 1324 | 2251 |
| RLBF040 | 40 | 20 | 4 | 3141 | 8705 | $100^{\ 0}_{-0.008}$ | 130 | $79.5^{\ 0}_{-0.03}$ | 100 | 23 | 11 | 63 | 113 | 9 | 68 | M6 | | 2972 | 4033 |
| RLBF050 | 50 | 26 | 4 | 4317 | 12585 | $120^{\ 0}_{-0.008}$ | 156 | $99.5^{\ 0}_{-0.035}$ | 125 | 25 | 12 | 87 | 136 | 11 | 85 | M10 | | 4086 | 5615 |

## RBBY Series Specifications




RFBY




RLBF

Unit：mm

| Model No. | d | l | Da | n | Support Bearing Load Rating Ca (kgf) | Support Bearing Load Rating Coa (kgf) | Ball Screw Nut Dimension D | A | B | L | C | E | J | K | P | X | W | Y | θ | Screw Nut Load Rating Ca (kgf) | Screw Nut Load Rating Coa (kgf) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RBBY01616-1.8 | 16 | 16 | 2.778 | 1.8x1 | 750 | 1593 | 52 $^{0}_{-0.007}$ | 68 | 40 $^{0}_{-0.025}$ | 47 | 32 $^{+0.025}_{0}$ | 10.1 | 6 | 28 | 60 | 4.5 | 25 | M4 | 40 | 591 | 1275 |
| RBBY01616-3.6 | 16 | 16 | 2.778 | 1.8x2 | 750 | 1593 | 52 $^{0}_{-0.007}$ | 68 | 40 $^{0}_{-0.025}$ | 47 | 32 $^{+0.025}_{0}$ | 10.1 | 6 | 28 | 60 | 4.5 | 25 | M4 | 40 | 1073 | 2551 |
| RBBY02020-1.8 | 20 | 20 | 3.175 | 1.8x1 | 1066 | 2452 | 62 $^{0}_{-0.007}$ | 78 | 50 $^{0}_{-0.025}$ | 53.5 | 39 $^{+0.025}_{0}$ | 11 | 7 | 34.5 | 70 | 4.5 | 31 | M5 | 40 | 764 | 1758 |
| RBBY02020-3.6 | 20 | 20 | 3.175 | 1.8x2 | 1066 | 2452 | 62 $^{0}_{-0.007}$ | 78 | 50 $^{0}_{-0.025}$ | 53.5 | 39 $^{+0.025}_{0}$ | 11 | 7 | 34.5 | 70 | 4.5 | 31 | M5 | 40 | 1387 | 3515 |
| RBBY02525-1.8 | 25 | 25 | 3.969 | 1.8x1 | 1119 | 2765 | 72 $^{0}_{-0.007}$ | 92 | 58 $^{0}_{-0.03}$ | 65 | 47 $^{+0.025}_{0}$ | 15.8 | 8 | 35 | 81 | 5.5 | 38 | M6 | 40 | 1142 | 2747 |
| RBBY02525-3.6 | 25 | 25 | 3.969 | 1.8x2 | 1119 | 2765 | 72 $^{0}_{-0.007}$ | 92 | 58 $^{0}_{-0.03}$ | 65 | 47 $^{+0.025}_{0}$ | 15.8 | 8 | 35 | 81 | 5.5 | 38 | M6 | 40 | 2074 | 5494 |
| ◆ RBBY03232-1.8 | 32 | 32 | 4.762 | 1.8x1 | 2087 | 5586 | 80 $^{0}_{-0.007}$ | 105 | 66 $^{0}_{-0.03}$ | 81 | 58 $^{+0.03}_{0}$ | 21.5 | 9 | 42.5 | 91 | 6.6 | 48 | M6 | 40 | 1664 | 4345 |
| ◆ RBBY04040-1.8 | 40 | 40 | 6.35 | 1.8x1 | 3183 | 9306 | 110 $^{0}_{-0.008}$ | 140 | 90 $^{0}_{-0.035}$ | 102 | 73 $^{+0.03}_{0}$ | 16.5 | 11 | 64.5 | 123 | 9 | 61 | M8 | 50 | 2662 | 7031 |
| ◆ RBBY05050-1.8 | 50 | 50 | 7.938 | 1.8x1 | 4328 | 12573 | 120 $^{0}_{-0.008}$ | 156 | 100 $^{0}_{-0.035}$ | 121 | 90 $^{+0.035}_{0}$ | 29 | 12 | 70 | 136 | 11 | 75 | M10 | 50 | 3978 | 10987 |

※ Items labeled with ◆ are customized products.
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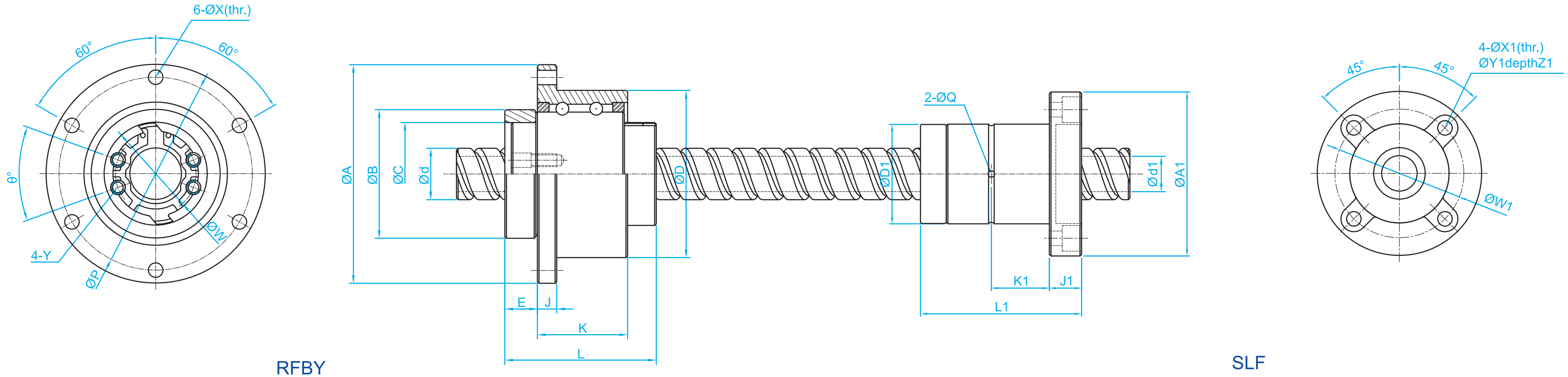
Unit：mm

| Model No. | d | d1 | Row | Support Bearing Load Rating Ca (kgf) | Support Bearing Load Rating Coa (kgf) | Spline Nut Dimension D1 | A1 | B1 | L1 | E1 | J1 | K1 | P1 | X1 | W1 | Y1 | Ball Spline Load Rating Ca (kgf) | Ball Spline Load Rating Coa (kgf) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RBBY01616 | 16 | 11 | 2 | 746 | 1597 | 52 $^{0}_{-0.007}$ | 68 | 39.5 $^{0}_{-0.025}$ | 50 | 10 | 5 | 30 | 60 | 4.5 | 32 | M5 | 545 | 849 |
| RBBY02020 | 20 | 14 | 2 | 1011 | 2138 | 56 $^{0}_{-0.007}$ | 72 | 43.5 $^{0}_{-0.025}$ | 63 | 12 | 6 | 42 | 64 | 4.5 | 36 | M5 | 736 | 1124 |
| RBBY02525 | 25 | 18 | 4 | 1558 | 4616 | 62 $^{0}_{-0.007}$ | 78 | 53 $^{0}_{-0.03}$ | 71 | 13 | 6 | 49 | 70 | 4.5 | 45 | M6 | 1003 | 1593 |
| RBBY03232 | 32 | 23 | 4 | 2087 | 5586 | 80 $^{0}_{-0.007}$ | 105 | 65.5 $^{0}_{-0.03}$ | 80 | 17 | 9 | 54 | 91 | 6.6 | 55 | M6 | 1324 | 2251 |
| RBBY04040 | 40 | 29 | 4 | 3141 | 8705 | 100 $^{0}_{-0.008}$ | 130 | 79.5 $^{0}_{-0.03}$ | 100 | 23 | 11 | 63 | 113 | 9 | 68 | M6 | 2972 | 4033 |
| RBBY05050 | 50 | 36 | 4 | 4317 | 12585 | 120 $^{0}_{-0.008}$ | 156 | 99.5 $^{0}_{-0.035}$ | 125 | 25 | 12 | 87 | 136 | 11 | 85 | M10 | 4086 | 5615 |

## RBLY Series Specifications




RFBY

SLF

Unit：mm

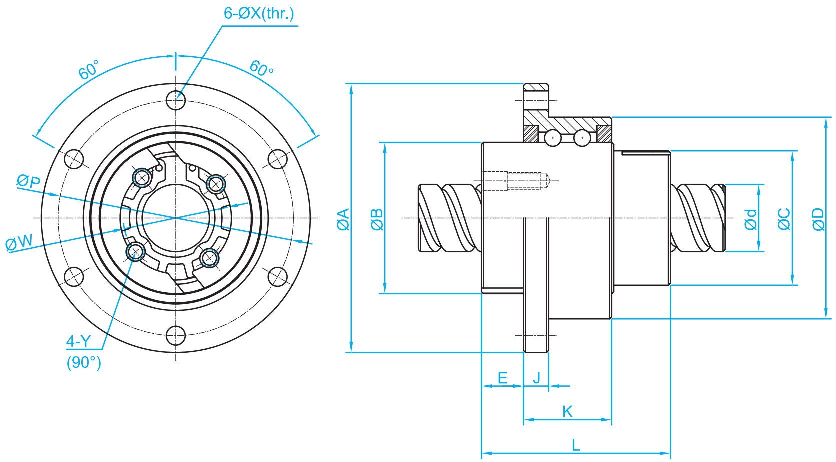
| Model No. | d | l | Da | n | Support Bearing Load Rating | | Ball Screw Nut Dimension | | | | | | | | | | | | | | Screw Nut Load Rating | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ca (kgf) | Coa (kgf) | D | A | B | L | C | E | J | K | P | X | W | Y | θ | | Ca (kgf) | Coa (kgf) |
| RBLY01616-1.8 | 16 | 16 | 2.778 | 1.8x1 | 750 | 1593 | $52^{\ 0}_{-0.007}$ | 68 | $40^{\ 0}_{-0.025}$ | 47 | $32^{+0.025}_{\ 0}$ | 10.1 | 6 | 28 | 60 | 4.5 | 25 | M4 | 40 | | 591 | 1275 |
| RBLY01616-3.6 | 16 | 16 | 2.778 | 1.8x2 | 750 | 1593 | $52^{\ 0}_{-0.007}$ | 68 | $40^{\ 0}_{-0.025}$ | 47 | $32^{+0.025}_{\ 0}$ | 10.1 | 6 | 28 | 60 | 4.5 | 25 | M4 | 40 | | 1073 | 2551 |
| RBLY02020-1.8 | 20 | 20 | 3.175 | 1.8x1 | 1066 | 2452 | $62^{\ 0}_{-0.007}$ | 78 | $50^{\ 0}_{-0.025}$ | 53.5 | $39^{+0.025}_{\ 0}$ | 11 | 7 | 34.5 | 70 | 4.5 | 31 | M5 | 40 | | 764 | 1758 |
| RBLY02020-3.6 | 20 | 20 | 3.175 | 1.8x2 | 1066 | 2452 | $62^{\ 0}_{-0.007}$ | 78 | $50^{\ 0}_{-0.025}$ | 53.5 | $39^{+0.025}_{\ 0}$ | 11 | 7 | 34.5 | 70 | 4.5 | 31 | M5 | 40 | | 1387 | 3515 |
| RBLY02525-1.8 | 25 | 25 | 3.969 | 1.8x1 | 1119 | 2765 | $72^{\ 0}_{-0.007}$ | 92 | $58^{\ 0}_{-0.03}$ | 65 | $47^{+0.025}_{\ 0}$ | 15.8 | 8 | 35 | 81 | 5.5 | 38 | M6 | 40 | | 1142 | 2747 |
| RBLY02525-3.6 | 25 | 25 | 3.969 | 1.8x2 | 1119 | 2765 | $72^{\ 0}_{-0.007}$ | 92 | $58^{\ 0}_{-0.03}$ | 65 | $47^{+0.025}_{\ 0}$ | 15.8 | 8 | 35 | 81 | 5.5 | 38 | M6 | 40 | | 2074 | 5494 |
| ◆ RBLY03232-1.8 | 32 | 32 | 4.762 | 1.8x1 | 2087 | 5586 | $80^{\ 0}_{-0.007}$ | 105 | $66^{\ 0}_{-0.03}$ | 81 | $58^{+0.03}_{\ 0}$ | 21.5 | 9 | 42.5 | 91 | 6.6 | 48 | M6 | 40 | | 1664 | 4345 |
| ◆ RBLY04040-1.8 | 40 | 40 | 6.35 | 1.8x1 | 3183 | 9306 | $110^{\ 0}_{-0.008}$ | 140 | $90^{\ 0}_{-0.035}$ | 102 | $73^{+0.03}_{\ 0}$ | 16.5 | 11 | 64.5 | 123 | 9 | 61 | M8 | 50 | | 2662 | 7031 |
| ◆ RBLY05050-1.8 | 50 | 50 | 7.938 | 1.8x1 | 4328 | 12573 | $120^{\ 0}_{-0.008}$ | 156 | $100^{\ 0}_{-0.035}$ | 121 | $90^{+0.035}_{\ 0}$ | 29 | 12 | 70 | 136 | 11 | 75 | M10 | 50 | | 3978 | 10987 |

※ Items labeled with ◆ are customized products.
For these purchase orders, please contact TBI in advance.

Unit：mm

| Model No. | d | d1 | Row | Spline Nut Dimension | | | | | | | | | | Ball Spline Load Rating | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D1 | A1 | L1 | J1 | K1 | W1 | X1 | Y1 | Z1 | Q | Ca (kgf) | Coa (kgf) |
| RBLY01616 | 16 | 11 | 2 | $31^{\ 0}_{-0.016}$ | 51 | 50 | 10 | 18 | 40 | 4.5 | 8 | 6 | 2 | 545 | 849 |
| RBLY02020 | 20 | 14 | 2 | $35^{\ 0}_{-0.016}$ | 58 | 56 | 10 | 18 | 45 | 5.5 | 9.5 | 5.4 | 2 | 724 | 1109 |
| RBLY02525 | 25 | 18 | 4 | $42^{\ 0}_{-0.016}$ | 65 | 71 | 13 | 26.5 | 52 | 5.5 | 9.5 | 8 | 3 | 1003 | 1593 |
| RBLY03232 | 32 | 23 | 4 | $49^{\ 0}_{-0.016}$ | 77 | 80 | 13 | 30 | 62 | 6.6 | 11 | 6.5 | 3 | 1324 | 2251 |
| RBLY04040 | 40 | 29 | 4 | $64^{\ 0}_{-0.019}$ | 100 | 100 | 18 | 36 | 82 | 9 | 14 | 12 | 4 | 2972 | 4033 |
| RBLY05050 | 50 | 36 | 4 | $80^{\ 0}_{-0.019}$ | 124 | 125 | 20 | 46.5 | 102 | 11 | 17.5 | 12 | 4 | 4086 | 5615 |

## RFSY Series Specifications

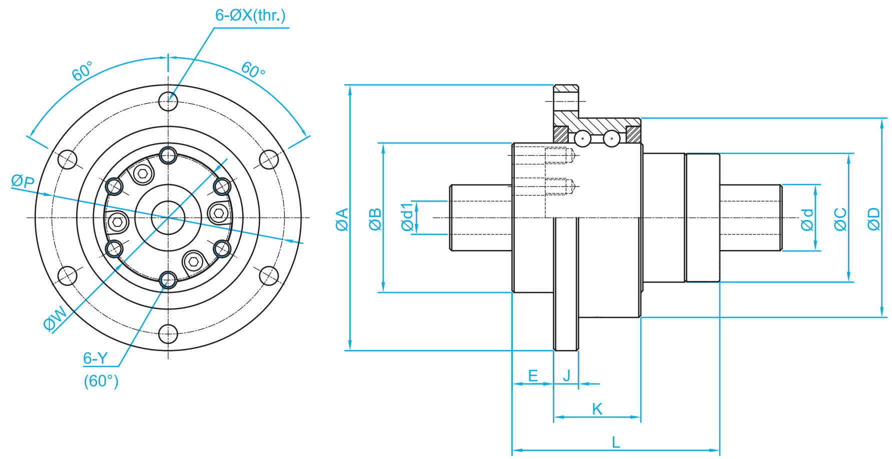



Unit：mm

| Model No. | d | l | Da | n | Support Bearing Load Rating Ca (kgf) | Support Bearing Load Rating Coa (kgf) | Ball Screw Nut Dimension D | A | B | L | C | E | J | K | P | X | W | Y | Screw Nut Load Rating Ca (kgf) | Screw Nut Load Rating Coa (kgf) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RFSY01616-1.8 | 16 | 16 | 2.778 | 1.8x1 | 730 | 1484 | $48^{-0.009}_{-0.025}$ | 64 | $36^{0}_{-0.025}$ | 45 | 32 | 10 | 6 | 21 | 56 | 4.5 | 25 | M4 | 591 | 1275 |
| RFSY01616-3.6 | 16 | 16 | 2.778 | 1.8x2 | 730 | 1484 | $48^{-0.009}_{-0.025}$ | 64 | $36^{0}_{-0.025}$ | 45 | 32 | 10 | 6 | 21 | 56 | 4.5 | 25 | M4 | 1073 | 2551 |
| RFSY02020-1.8 | 20 | 20 | 3.175 | 1.8x1 | 788 | 1811 | $56^{-0.01}_{-0.029}$ | 72 | $43.5^{0}_{-0.025}$ | 52 | 39 | 11 | 6 | 21 | 64 | 4.5 | 31 | M5 | 764 | 1758 |
| RFSY02020-3.6 | 20 | 20 | 3.175 | 1.8x2 | 788 | 1811 | $56^{-0.01}_{-0.029}$ | 72 | $43.5^{0}_{-0.025}$ | 52 | 39 | 11 | 6 | 21 | 64 | 4.5 | 31 | M5 | 1387 | 3515 |
| RFSY02525-1.8 | 25 | 25 | 3.969 | 1.8x1 | 1094 | 2607 | $66^{-0.01}_{-0.029}$ | 86 | $52^{0}_{-0.03}$ | 64 | 47 | 13 | 7 | 25 | 75 | 5.5 | 38 | M6 | 1142 | 2747 |
| RFSY02525-3.6 | 25 | 25 | 3.969 | 1.8x2 | 1094 | 2607 | $66^{-0.01}_{-0.029}$ | 86 | $52^{0}_{-0.03}$ | 64 | 47 | 13 | 7 | 25 | 75 | 5.5 | 38 | M6 | 2074 | 5494 |
| ◆ RFSY03232-1.8 | 32 | 32 | 4.762 | 1.8x1 | 1191 | 3233 | $78^{-0.01}_{-0.029}$ | 103 | $63^{0}_{-0.03}$ | 78 | 58 | 14 | 8 | 25 | 89 | 6.6 | 48 | M6 | 1664 | 4345 |
| ◆ RFSY04040-1.8 | 40 | 40 | 6.35 | 1.8x1 | 2216 | 6685 | $100^{-0.012}_{-0.034}$ | 130 | $79.5^{0}_{-0.035}$ | 99 | 73 | 16.5 | 10 | 33 | 113 | 9 | 61 | M8 | 2662 | 7031 |

※ Items labeled with ◆ are customized products.
For these purchase orders, please contact TBI in advance.

## RLSF Series Specifications

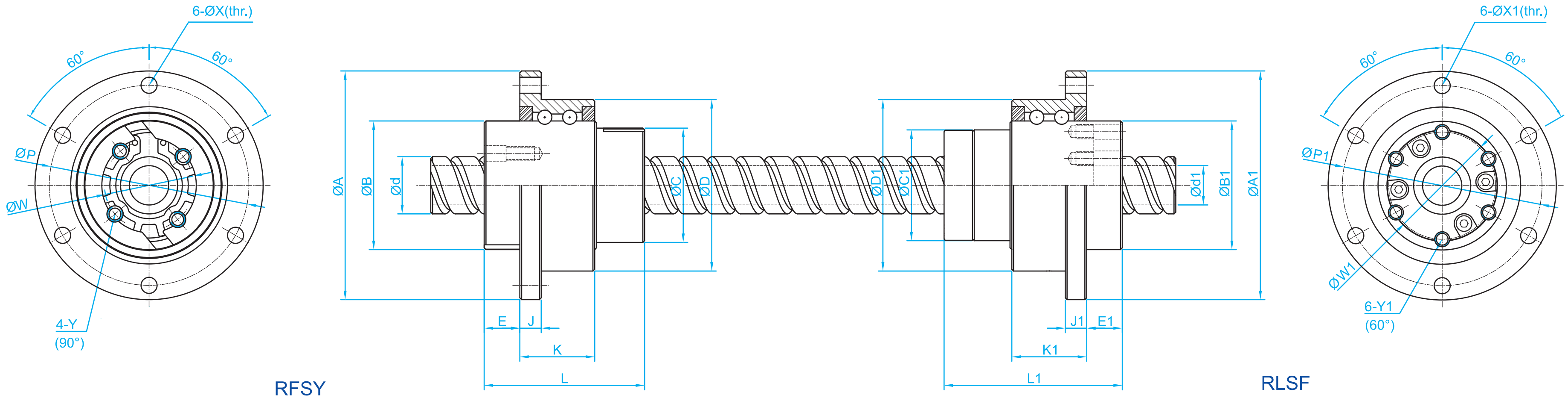



Unit：mm

| Model No. | d | d1 | Row | Support Bearing Load Rating Ca (kgf) | Support Bearing Load Rating Coa (kgf) | Spline Nut Dimension D | A | B | L | C | E | J | K | P | X | W | Y | Ball Spline Load Rating Ca (kgf) | Ball Spline Load Rating Coa (kgf) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RLSF016 | 16 | 8 | 2 | 730 | 1484 | $48^{-0.009}_{-0.025}$ | 64 | $36^{0}_{-0.025}$ | 50 | 31 | 10 | 6 | 21 | 56 | 4.5 | 30 | M4 | 545 | 849 |
| RLSF020 | 20 | 10 | 2 | 788 | 1811 | $56^{-0.01}_{-0.029}$ | 72 | $43.5^{0}_{-0.025}$ | 63 | 35 | 12 | 6 | 21 | 64 | 4.5 | 36 | M5 | 736 | 1124 |
| RLSF025 | 25 | 15 | 4 | 1094 | 2607 | $66^{-0.01}_{-0.029}$ | 86 | $52^{0}_{-0.03}$ | 71 | 42 | 13 | 7 | 25 | 75 | 5.5 | 44 | M5 | 1003 | 1593 |
| RLSF032 | 32 | 16 | 4 | 1191 | 3233 | $78^{-0.01}_{-0.029}$ | 103 | $63^{0}_{-0.03}$ | 80 | 52 | 17 | 8 | 25 | 89 | 6.6 | 54 | M6 | 1324 | 2251 |
| RLSF040 | 40 | 20 | 4 | 2216 | 6685 | $100^{-0.012}_{-0.034}$ | 130 | $79.5^{0}_{-0.035}$ | 100 | 64 | 20 | 10 | 33 | 113 | 9 | 68 | M6 | 2972 | 4033 |

ROTARY BALL SCREW／SPLINE

# RSSY Series Specifications




RFSY

RLSF

Unit：mm

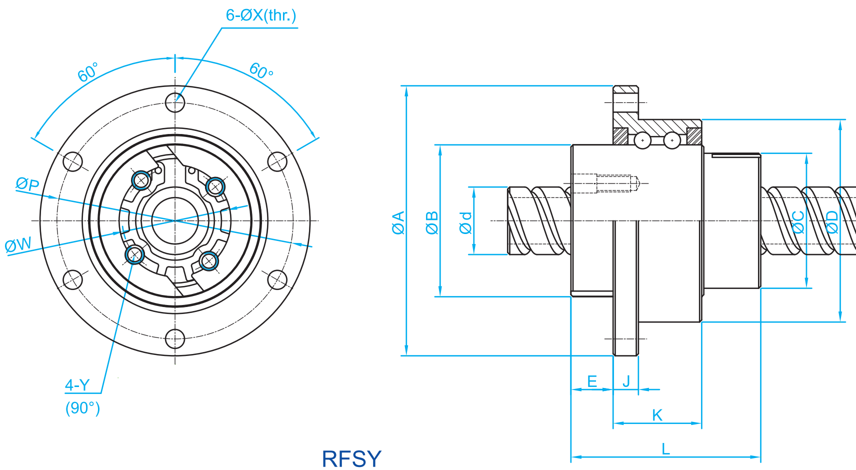
| Model No. | d | l | Da | n | Support Bearing Load Rating | | Ball Screw Nut Dimension | | | | | | | | | | | | | Screw Nut Load Rating | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ca (kgf) | Coa (kgf) | D | A | B | L | C | E | J | K | P | X | W | Y | | Ca (kgf) | Coa (kgf) |
| RSSY01616-1.8 | 16 | 16 | 2.778 | 1.8x1 | 730 | 1484 | $48^{-0.009}_{-0.025}$ | 64 | $36^{0}_{-0.025}$ | 45 | 32 | 10 | 6 | 21 | 56 | 4.5 | 25 | M4 | | 591 | 1275 |
| RSSY01616-3.6 | 16 | 16 | 2.778 | 1.8x2 | 730 | 1484 | $48^{-0.009}_{-0.025}$ | 64 | $36^{0}_{-0.025}$ | 45 | 32 | 10 | 6 | 21 | 56 | 4.5 | 25 | M4 | | 1073 | 2551 |
| RSSY02020-1.8 | 20 | 20 | 3.175 | 1.8x1 | 788 | 1811 | $56^{-0.01}_{-0.029}$ | 72 | $43.5^{0}_{-0.025}$ | 52 | 39 | 11 | 6 | 21 | 64 | 4.5 | 31 | M5 | | 764 | 1758 |
| RSSY02020-3.6 | 20 | 20 | 3.175 | 1.8x2 | 788 | 1811 | $56^{-0.01}_{-0.029}$ | 72 | $43.5^{0}_{-0.025}$ | 52 | 39 | 11 | 6 | 21 | 64 | 4.5 | 31 | M5 | | 1387 | 3515 |
| RSSY02525-1.8 | 25 | 25 | 3.969 | 1.8x1 | 1094 | 2607 | $66^{-0.01}_{-0.029}$ | 86 | $52^{0}_{-0.03}$ | 64 | 47 | 13 | 7 | 25 | 75 | 5.5 | 38 | M6 | | 1142 | 2747 |
| RSSY02525-3.6 | 25 | 25 | 3.969 | 1.8x2 | 1094 | 2607 | $66^{-0.01}_{-0.029}$ | 86 | $52^{0}_{-0.03}$ | 64 | 47 | 13 | 7 | 25 | 75 | 5.5 | 38 | M6 | | 2074 | 5494 |
| ◆ RSSY03232-1.8 | 32 | 32 | 4.762 | 1.8x1 | 1191 | 3233 | $78^{-0.01}_{-0.029}$ | 103 | $63^{0}_{-0.03}$ | 78 | 58 | 14 | 8 | 25 | 89 | 6.6 | 48 | M6 | | 1664 | 4345 |
| ◆ RSSY04040-1.8 | 40 | 40 | 6.35 | 1.8x1 | 2216 | 6685 | $100^{-0.012}_{-0.034}$ | 130 | $79.5^{0}_{-0.035}$ | 99 | 73 | 16.5 | 10 | 33 | 113 | 9 | 61 | M8 | | 2662 | 7031 |

※ Items labeled with ◆ are customized products.
For these purchase orders, please contact TBI in advance.

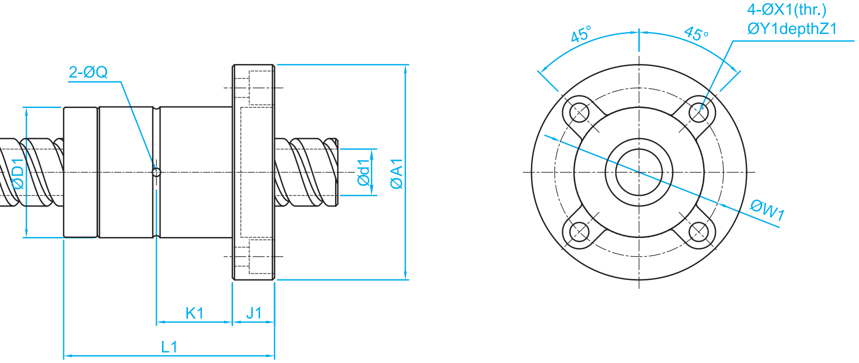
Unit：mm

| Model No. | d | d1 | Row | Support Bearing Load Rating | | Spline Nut Dimension | | | | | | | | | | | | Ball Spline Load Rating | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ca (kgf) | Coa (kgf) | D | A | B | L | C | E | J | K | P | X | W | Y | Ca (kgf) | Coa (kgf) |
| RSSY01616 | 16 | 11 | 2 | 730 | 1484 | $48^{-0.009}_{-0.025}$ | 64 | $36^{0}_{-0.025}$ | 50 | 31 | 10 | 6 | 21 | 56 | 4.5 | 30 | M4 | 545 | 849 |
| RSSY02020 | 20 | 14 | 2 | 788 | 1811 | $56^{-0.01}_{-0.029}$ | 72 | $43.5^{0}_{-0.025}$ | 63 | 35 | 12 | 6 | 21 | 64 | 4.5 | 36 | M5 | 736 | 1124 |
| RSSY02525 | 25 | 18 | 4 | 1094 | 2607 | $66^{-0.01}_{-0.029}$ | 86 | $52^{0}_{-0.03}$ | 71 | 42 | 13 | 7 | 25 | 75 | 5.5 | 44 | M5 | 1003 | 1593 |
| RSSY03232 | 32 | 23 | 4 | 1191 | 3233 | $78^{-0.01}_{-0.029}$ | 103 | $63^{0}_{-0.03}$ | 80 | 52 | 17 | 8 | 25 | 89 | 6.6 | 54 | M6 | 1324 | 2251 |
| RSSY04040 | 40 | 29 | 4 | 2216 | 6685 | $100^{-0.012}_{-0.034}$ | 130 | $79.5^{0}_{-0.035}$ | 100 | 64 | 20 | 10 | 33 | 113 | 9 | 68 | M6 | 2972 | 4033 |

## RSLY Series Specifications




RFSY




SLF

Unit：mm

| Model No. | d | l | Da | n | Support Bearing Load Rating | | Ball Screw Nut Dimension | | | | | | | | | | | | Screw Nut Load Rating | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ca (kgf) | Coa (kgf) | D | A | B | L | C | E | J | K | P | X | W | Y | Ca (kgf) | Coa (kgf) |
| RSLY01616-1.8 | 16 | 16 | 2.778 | 1.8x1 | 730 | 1484 | 48 $^{-0.009}_{-0.025}$ | 64 | 36 $^{0}_{-0.025}$ | 45 | 32 | 10 | 6 | 21 | 56 | 4.5 | 25 | M4 | 591 | 1275 |
| RSLY01616-3.6 | 16 | 16 | 2.778 | 1.8x2 | 730 | 1484 | 48 $^{-0.009}_{-0.025}$ | 64 | 36 $^{0}_{-0.025}$ | 45 | 32 | 10 | 6 | 21 | 56 | 4.5 | 25 | M4 | 1073 | 2551 |
| RSLY02020-1.8 | 20 | 20 | 3.175 | 1.8x1 | 788 | 1811 | 56 $^{-0.01}_{-0.029}$ | 72 | 43.5 $^{0}_{-0.025}$ | 52 | 39 | 11 | 6 | 21 | 64 | 4.5 | 31 | M5 | 764 | 1758 |
| RSLY02020-3.6 | 20 | 20 | 3.175 | 1.8x2 | 788 | 1811 | 56 $^{-0.01}_{-0.029}$ | 72 | 43.5 $^{0}_{-0.025}$ | 52 | 39 | 11 | 6 | 21 | 64 | 4.5 | 31 | M5 | 1387 | 3515 |
| RSLY02525-1.8 | 25 | 25 | 3.969 | 1.8x1 | 1094 | 2607 | 66 $^{-0.01}_{-0.029}$ | 86 | 52 $^{0}_{-0.03}$ | 64 | 47 | 13 | 7 | 25 | 75 | 5.5 | 38 | M6 | 1142 | 2747 |
| RSLY02525-3.6 | 25 | 25 | 3.969 | 1.8x2 | 1094 | 2607 | 66 $^{-0.01}_{-0.029}$ | 86 | 52 $^{0}_{-0.03}$ | 64 | 47 | 13 | 7 | 25 | 75 | 5.5 | 38 | M6 | 2074 | 5494 |
| ◆ RSLY03232-1.8 | 32 | 32 | 4.762 | 1.8x1 | 1191 | 3233 | 78 $^{-0.01}_{-0.029}$ | 103 | 63 $^{0}_{-0.03}$ | 78 | 58 | 14 | 8 | 25 | 89 | 6.6 | 48 | M6 | 1664 | 4345 |
| ◆ RSLY04040-1.8 | 40 | 40 | 6.35 | 1.8x1 | 2216 | 6685 | 100 $^{-0.012}_{-0.034}$ | 130 | 79.5 $^{0}_{-0.035}$ | 99 | 73 | 16.5 | 10 | 33 | 113 | 9 | 61 | M8 | 2662 | 7031 |

※ Items labeled with ◆ are customized products.
For these purchase orders, please contact TBI in advance.

Unit：mm

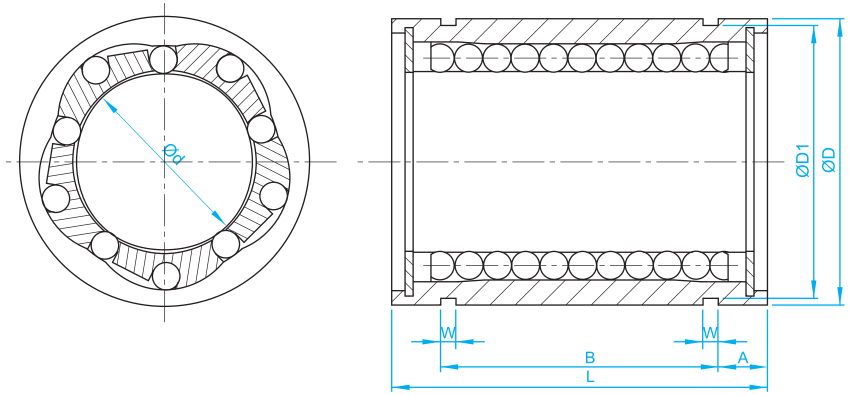
| Model No. | d | d1 | Row | Spline Nut Dimension | | | | | | | | | | Ball Spline Load Rating | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D1 | A1 | L1 | J1 | K1 | W1 | X1 | Y1 | Z1 | Q | Ca (kgf) | Coa (kgf) |
| RSLY01616 | 16 | 11 | 2 | 31 $^{0}_{-0.016}$ | 51 | 50 | 10 | 18 | 40 | 4.5 | 8 | 6 | 2 | 545 | 849 |
| RSLY02020 | 20 | 14 | 2 | 35 $^{0}_{-0.016}$ | 58 | 56 | 10 | 18 | 45 | 5.5 | 9.5 | 5.4 | 2 | 724 | 1109 |
| RSLY02525 | 25 | 18 | 4 | 42 $^{0}_{-0.016}$ | 65 | 71 | 13 | 26.5 | 52 | 5.5 | 9.5 | 8 | 3 | 1003 | 1593 |
| RSLY03232 | 32 | 23 | 4 | 49 $^{0}_{-0.016}$ | 77 | 80 | 13 | 30 | 62 | 6.6 | 11 | 6.5 | 3 | 1324 | 2251 |
| RSLY04040 | 40 | 29 | 4 | 64 $^{0}_{-0.019}$ | 100 | 100 | 18 | 36 | 82 | 9 | 14 | 12 | 4 | 2972 | 4033 |

ROTARY BALL SCREW／SPLINE

# E. Linear Ball Bearing

# 1. About Linear Ball Bearing

## LM Series Specifications (Standard)

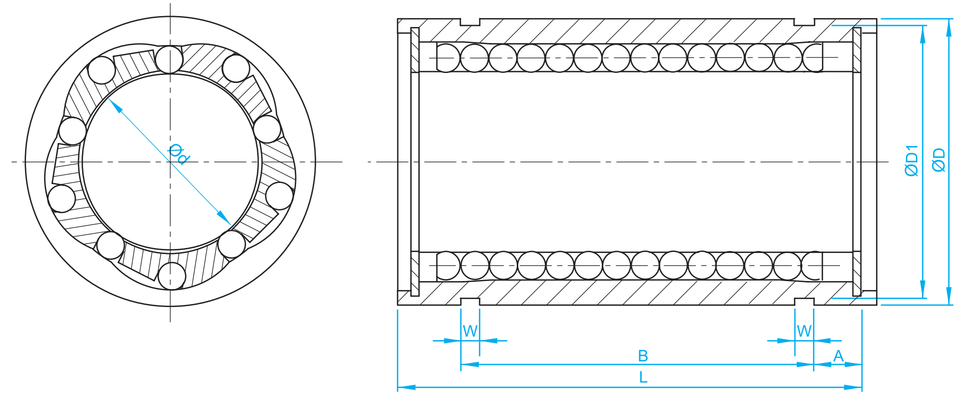



Unit：mm

| Model No. | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | Weight(g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | D | D Tolerance (μm) | L | L Tolerance (μm) | W | D1 | B | A | | | |
| LM-04UU | 4 | 8 | 0 / -11 | 12 | 0 / -20 | — | — | — | — | 9 | 13 | 2 |
| LM-06UU | 6 | 12 | | 19 | | 1.1 | 11.5 | 13.5 | 2.75 | 21 | 27 | 8 |
| LM-08UU | 8 | 15 | | 24 | | 1.1 | 14.3 | 17.5 | 3.25 | 27 | 41 | 16 |
| LM-10UU | 10 | 19 | 0 / -13 | 29 | | 1.3 | 18 | 22 | 3.5 | 38 | 56 | 30 |
| LM-12UU | 12 | 21 | | 30 | | 1.3 | 20 | 23 | 3.5 | 42 | 61 | 31.5 |
| LM-16UU | 16 | 28 | | 37 | | 1.6 | 27 | 26.5 | 5.25 | 79 | 120 | 69 |
| LM-20UU | 20 | 32 | 0 / -16 | 42 | | 1.6 | 30.5 | 30.5 | 5.75 | 88 | 140 | 87 |
| LM-25UU | 25 | 40 | | 59 | 0 / -30 | 1.85 | 38 | 41 | 9 | 100 | 159 | 220 |
| LM-30UU | 30 | 45 | | 64 | | 1.85 | 43 | 44.5 | 9.75 | 159 | 279 | 250 |
| LM-40UU | 40 | 60 | 0 / -19 | 80 | | 2.1 | 57 | 60.5 | 9.75 | 219 | 409 | 585 |
| LM-50UU | 50 | 80 | | 100 | | 2.6 | 76.5 | 74 | 13 | 389 | 808 | 1580 |

※ UU with oil seals in ends

## LM-L Series Specifications (Lengthen)

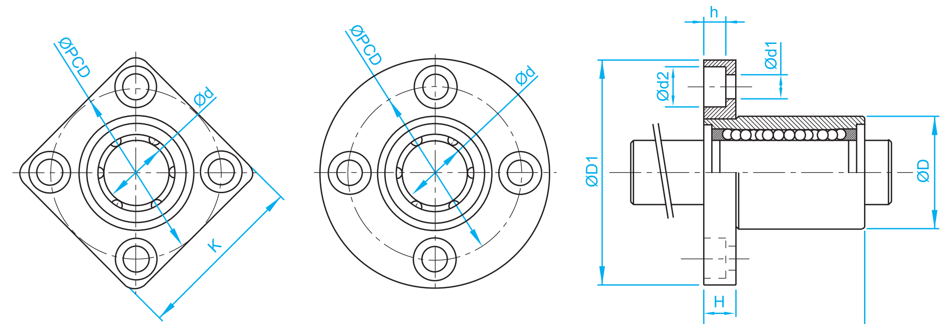



Unit：mm

| Model No. | Dimension | | | | | | | | | Ca (kgf) | Coa (kgf) | Weight(g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | D | D Tolerance (μm) | L | L Tolerance (μm) | W | D1 | B | A | | | |
| LM-06LUU | 6 | 12 | 0 / -13 | 35 | 0 / -30 | 1.1 | 11.5 | 27 | 4 | 33 | 54 | 16 |
| LM-08LUU | 8 | 15 | | 45 | | 1.1 | 14.3 | 35 | 5 | 44 | 80 | 31 |
| LM-10LUU | 10 | 19 | 0 / -16 | 55 | | 1.3 | 18 | 44 | 5.5 | 60 | 112 | 62 |
| LM-12LUU | 12 | 21 | | 57 | | 1.3 | 20 | 46 | 5.5 | 83 | 160 | 80 |
| LM-16LUU | 16 | 28 | | 70 | | 1.6 | 27 | 53 | 8.5 | 126 | 240 | 145 |
| LM-20LUU | 20 | 32 | 0 / -19 | 80 | | 1.6 | 30.5 | 61 | 9.5 | 143 | 280 | 180 |
| LM-25LUU | 25 | 40 | | 112 | 0 / -40 | 1.85 | 38 | 82 | 15 | 159 | 320 | 440 |
| LM-30LUU | 30 | 45 | | 123 | | 1.85 | 43 | 89 | 17 | 254 | 560 | 580 |
| LM-40LUU | 40 | 60 | 0 / -22 | 151 | | 2.1 | 57 | 121 | 15 | 350 | 820 | 1170 |
| LM-50LUU | 50 | 80 | | 192 | | 2.6 | 76.5 | 148 | 22 | 620 | 1622 | 3100 |

※ UU with oil seals in ends

## LF Series Specifications (Flange Type)



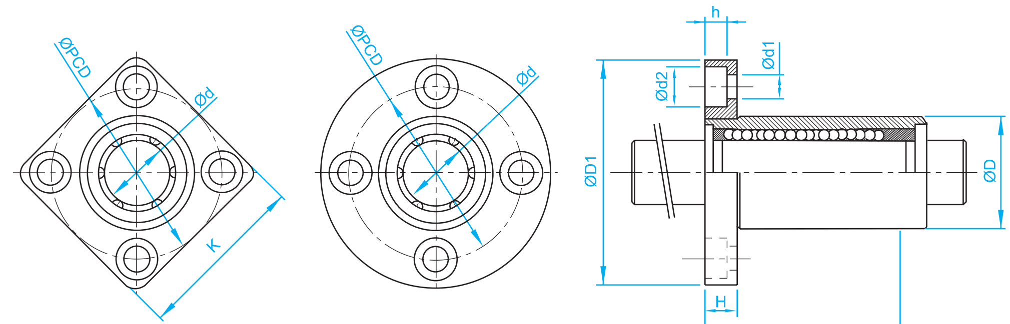

Type : D　　Type : N

Unit : mm

| Model No. | Dimension | | | | | | | | | | | | Ca (kgf) | Coa (kgf) | Weight(g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | D | D Tolerance (μm) | L | L Tolerance (μm) | D1 | PCD | H | K | d1 | d2 | h | | | |
| LF-06UU | 6 | 12 | 0 / -11 | 19 | 0 / -20 | 28 | 20 | 5 | 22 | 3.5 | 6 | 3.1 | 21 | 27 | 8 |
| LF-08UU | 8 | 15 | | 24 | | 32 | 24 | 5 | 25 | 3.5 | 6 | 3.1 | 28 | 40 | 16 |
| LF-10UU | 10 | 19 | 0 / -13 | 29 | | 40 | 29 | 6 | 30 | 4.5 | 7.5 | 4.1 | 38 | 56 | 30 |
| LF-12UU | 12 | 21 | | 30 | | 42 | 32 | 6 | 32 | 4.5 | 7.5 | 4.1 | 52 | 80 | 31.5 |
| LF-16UU | 16 | 28 | | 37 | | 48 | 38 | 6 | 37 | 4.5 | 7.5 | 4.1 | 79 | 120 | 69 |
| LF-20UU | 20 | 32 | 0 / -16 | 42 | | 54 | 43 | 8 | 42 | 5.5 | 9 | 5.1 | 90 | 140 | 87 |
| LF-25UU | 25 | 40 | | 59 | 0 / -30 | 62 | 51 | 8 | 50 | 5.5 | 9 | 5.1 | 100 | 159 | 220 |
| LF-30UU | 30 | 45 | | 64 | | 74 | 60 | 10 | 58 | 6.6 | 11 | 6.1 | 159 | 279 | 250 |
| LF-40UU | 40 | 60 | 0 / -19 | 80 | | 96 | 78 | 13 | 75 | 9 | 14 | 8.1 | 218 | 409 | 585 |
| LF-50UU | 50 | 80 | | 100 | | 116 | 98 | 13 | 92 | 9 | 14 | 8.1 | 389 | 808 | 1580 |

※ UU with oil seals in ends

## LF-L Series Specifications (Flange Type with Lengthen Nut)



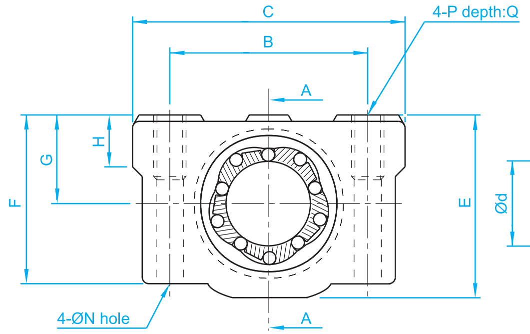

Type : D　　Type : N

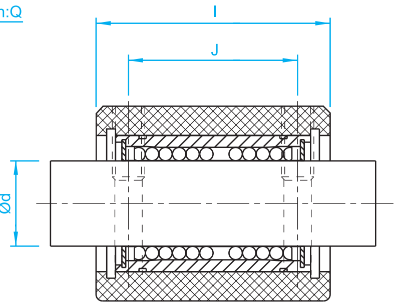
Unit : mm

| Model No. | Dimension | | | | | | | | | | | | Ca (kgf) | Coa (kgf) | Weight(g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | D | D Tolerance (μm) | L | L Tolerance (μm) | D1 | PCD | H | K | d1 | d2 | h | | | |
| LF-06LUU | 6 | 12 | 0 / -13 | 35 | 0 / -30 | 28 | 20 | 5 | 22 | 3.5 | 6 | 3.1 | 33 | 54 | 16 |
| LF-08LUU | 8 | 15 | | 45 | | 32 | 24 | 5 | 25 | 3.5 | 6 | 3.1 | 44 | 80 | 31 |
| LF-10LUU | 10 | 19 | 0 / -16 | 55 | | 40 | 29 | 6 | 30 | 4.5 | 7.5 | 4.1 | 60 | 112 | 62 |
| LF-12LUU | 12 | 21 | | 57 | | 42 | 32 | 6 | 32 | 4.5 | 7.5 | 4.1 | 83 | 160 | 80 |
| LF-16LUU | 16 | 28 | | 70 | | 48 | 38 | 6 | 37 | 4.5 | 7.5 | 4.1 | 126 | 240 | 145 |
| LF-20LUU | 20 | 32 | 0 / -19 | 80 | | 54 | 43 | 8 | 42 | 5.5 | 9 | 5.1 | 143 | 280 | 180 |
| LF-25LUU | 25 | 40 | | 112 | 0 / -40 | 62 | 51 | 8 | 50 | 5.5 | 9 | 5.1 | 159 | 320 | 440 |
| LF-30LUU | 30 | 45 | | 123 | | 74 | 60 | 10 | 58 | 6.6 | 11 | 6.1 | 254 | 560 | 580 |
| LF-40LUU | 40 | 60 | 0 / -22 | 151 | | 96 | 78 | 13 | 75 | 9 | 14 | 8.1 | 350 | 820 | 1170 |
| LF-50LUU | 50 | 80 | | 192 | | 116 | 98 | 13 | 92 | 9 | 14 | 8.1 | 620 | 1622 | 3100 |

※ UU with oil seals in ends

## LU／LP Series Specifications (Aluminum Housing Type)



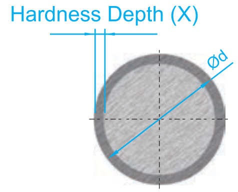

View A-A

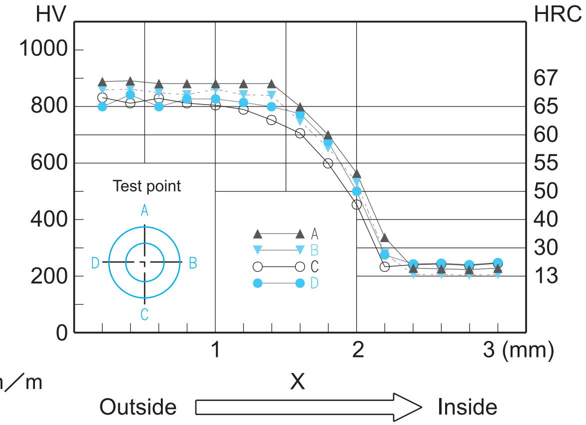
Unit：mm

| Model No. | Dimension | | | | | | | | | | | | Ca (kgf) | Coa (kgf) | Weight(g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | B | C | E | F | G ±0.02 | H | I | J | N | P | Q | | | |
| LU-08UU LP-08 | 8 | 24 | 34 | 22 | 18 | 11 | 6 | 30 | 18 | 3.4 | M4 | 8 | 28 | 40 | 52 |
| LU-10UU LP-10 | 10 | 28 | 40 | 26 | 21 | 13 | 8 | 35 | 21 | 4.3 | M5 | 12 | 38 | 56 | 92 |
| LU-12UU LP-12 | 12 | 30.5 | 42 | 28 | 24 | 15 | 8 | 36 | 26 | 4.3 | M5 | 12 | 52 | 80 | 102 |
| LU-16UU LP-16 | 16 | 36 | 50 | 38.5 | 32.5 | 19 | 9 | 44 | 34 | 4.3 | M5 | 12 | 79 | 120 | 200 |
| LU-20UU LP-20 | 20 | 40 | 54 | 41 | 35 | 21 | 11 | 50 | 40 | 5.2 | M6 | 12 | 90 | 140 | 255 |
| LU-25UU LP-25 | 25 | 54 | 76 | 51.5 | 42 | 26 | 12 | 67 | 50 | 7 | M8 | 18 | 100 | 160 | 600 |
| LU-30UU LP-30 | 30 | 58 | 78 | 59.5 | 49 | 30 | 15 | 72 | 58 | 7 | M8 | 18 | 160 | 280 | 735 |
| LU-40UU LP-40 | 40 | 80 | 102 | 78 | 62 | 40 | 20 | 90 | 60 | 8.7 | M10 | 25 | 220 | 410 | 1590 |
| LU-50UU LP-50 | 50 | 100 | 122 | 102 | 80 | 50 | 25 | 110 | 80 | 8.7 | M10 | 25 | 390 | 810 | 3340 |

※ LP-No Linear ball bearing is included.

## SF／WV Series Specifications (Shaft)




Material：S55C／SUJ2

Hardness：HRC 60 Up

Surface：Ra 0.15-0.35 $\mu$m

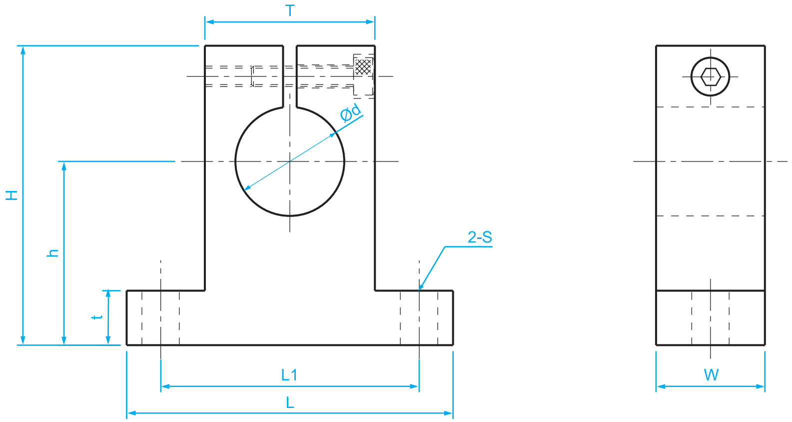
Shaft Straightness：approx. 0.1 mm／m

Unit：mm

| | Model No. | d | Hardness Depth (X) |
|---|---|---|---|
| ★ | SF-04 | 4 | 1.0 |
| ★ | SF-06 | 6 | 1.0 |
| ★ | SF-08 | 8 | 1.0 |
| ★ | SF-10 | 10 | 1.0 |
| ★ | SF-12 | 12 | 1.6 |
| ★ | SF-16 | 16 | 1.6 |
| ★ | SF-20 | 20 | 2.2 |
| ★ | SF-25 | 25 | 2.2 |
| ★ | SF-30 | 30 | 2.2 |
| ★ | SF-32 | 32 | 2.2 |
| ★ | SF-40 | 40 | 3.5 |
| ★ | SF-50 | 50 | 3.5 |

※★can supply Chromium plated slide shaft (Model No. WV).

## SS Series Specifications (Shaft Support)




Unit：mm

| Model No. | Dimension | | | | | | | | | Weight(g) |
|---|---|---|---|---|---|---|---|---|---|---|
| | d | h | L | W | H | t | T | L1 | S | |
| SS-04 | 4 | 20 | 42 | 14 | 32.8 | 6 | 18 | 32 | 5.5 | 24 |
| SS-06 | 6 | 20 | 42 | 14 | 32.8 | 6 | 18 | 32 | 5.5 | 24 |
| SS-08 | 8 | 20 | 42 | 14 | 32.8 | 6 | 18 | 32 | 5.5 | 24 |
| SS-10 | 10 | 20 | 42 | 14 | 32.8 | 6 | 18 | 32 | 5.5 | 24 |
| SS-12 | 12 | 23 | 42 | 14 | 37.5 | 6 | 20 | 32 | 5.5 | 30 |
| SS-16 | 16 | 27 | 48 | 16 | 44 | 8 | 25 | 38 | 5.5 | 40 |
| SS-20 | 20 | 31 | 60 | 20 | 51 | 10 | 30 | 45 | 6.6 | 70 |
| SS-25 | 25 | 35 | 70 | 24 | 60 | 12 | 38 | 56 | 6.6 | 130 |
| SS-30 | 30 | 42 | 84 | 28 | 70 | 12 | 44 | 64 | 9 | 180 |
| SS-40 | 40 | 60 | 114 | 36 | 96 | 15 | 60 | 90 | 11 | 420 |
| SS-50 | 50 | 70 | 126 | 40 | 120 | 18 | 74 | 100 | 14 | 750 |

# F. Support Unit of Ball Screw

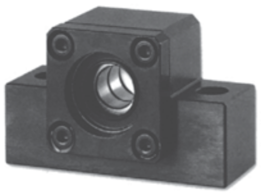
# 1. About Support Unit of Ball Screw

## BK／EK／FK／BF／EF／FF

### Fixed End

BK Series

EK Series



FK Series

Surface Treatment：Black Oxidation

### Simple End

BF Series

EF Series

FF Series

Surface Treatment：Black Oxidation

Table 1.1.1 Types of Support and Suggested Diameter of Ball Screw

| Fixed End Model | | | Simple End Model | | | Suggested Diameter |
|---|---|---|---|---|---|---|
| Flange Type | Square Type | | Flange Type | Square Type | | |
| - | EK-6 | - | FF-6 | EF-6 | - | Ø4, Ø6 |
| FK-8 | EK-8 | - | FF-8 | EF-8 | - | Ø8, Ø10, Ø12 |
| FK-10 | EK-10 | BK-10 | FF-10 | EF-10 | BF-10 | Ø10, Ø12, Ø14, Ø15 |
| FK-12 | EK-12 | BK-12 | FF-12 | EF-12 | BF-12 | Ø14, Ø15, Ø16 |
| FK-15 | EK-15 | BK-15 | FF-15 | EF-15 | BF-15 | Ø18, Ø20 |
| - | - | BK-17 | - | - | BF-17 | Ø20, Ø25 |
| FK-20 | EK-20 | BK-20 | FF-20 | EF-20 | BF-20 | Ø25, Ø28 |
| FK-25 | EK-25 | BK-25 | FF-25 | EF-25 | BF-25 | Ø32, Ø36 |
| FK-30 | - | BK-30 | FF-30 | - | BF-30 | Ø36, Ø40 |
| - | - | BK-35 | - | - | BF-35 | Ø40, Ø45, Ø50 |
| - | - | BK-40 | - | - | BF-40 | Ø50, Ø55 |

Table 1.1.2 Function

| Fixed End | | | | Simple End | | | |
|---|---|---|---|---|---|---|---|
| Support Model | Bearing Model | Axial Ca (kgf) | Axial K kgf/μm | Support Model | Bearing Model | Radial Ca (kgf) | Radial Coa (kgf) |
| EK-6 | 706ATYDF | 273 | 2.9 | EF-6, FF-6 | 606ZZ | 231 | 88 |
| EK-8, FK-8 | 708ATYDF | 450 | 5.4 | EF-8, FF-8 | 606ZZ | 231 | 88 |
| BK-10, EK-10, FK-10 | 7000ATYDF | 620 | 9.6 | BF-10, EF-10, FF-10 | 608ZZ | 335 | 142 |
| BK-12, EK-12, FK-12 | 7001ATYDF | 679 | 10.6 | BF-12, EF-12, FF-12 | 6000ZZ | 465 | 200 |
| BK-15, EK-15, FK-15 | 7002ATYDF | 775 | 11.5 | BF-15, EF-15, FF-15 | 6002ZZ | 570 | 289 |
| BK-17 | 7203ATYDF | 1397 | 12.7 | BF-17 | 6203ZZ | 979 | 469 |
| BK-20 | 7004ATYDF | 1295 | 14.2 | BF-20 | 6004ZZ | 958 | 515 |
| EK-20, FK-20 | 7204ATYDF | 1820 | 15.8 | EF-20, FF-20 | 6204ZZ | 1300 | 702 |
| BK-25, EK-25, FK-25 | 7205ATYDF | 2060 | 19.4 | BF-25, EF-25, FF25 | 6205ZZ | 1430 | 800 |
| BK-30, FK-30 | 7206ATYDF | 2856 | 19.8 | BF-30, FF30 | 6206ZZ | 1989 | 1152 |
| BK-35 | 7207ATYDF | 3794 | 26.0 | BF-35 | 6207ZZ | 2621 | 1560 |
| BK-40 | 7208ATYDF | 4498 | 27.5 | BF-40 | 6208ZZ | 2968 | 1815 |

## 1-1 Installing Ball Screw with Support Units

(1) Install the fixed end Support Unit with the screw shaft.

※ Do not disassemble the Support Unit.

※ When assembling the screw shaft to the Support Unit, make sure that the dimension between machine ends and bearing are matched.

(2) After inserting the fixed end Support Unit, secure the lock nut using the fastening set piece and the hexagonal socket-head set screws.

※ Please contact TBI for special condition of mounting methods.

(3) Attach the simple end bearing to the screw shaft and secure the bearing using the C-Ring.

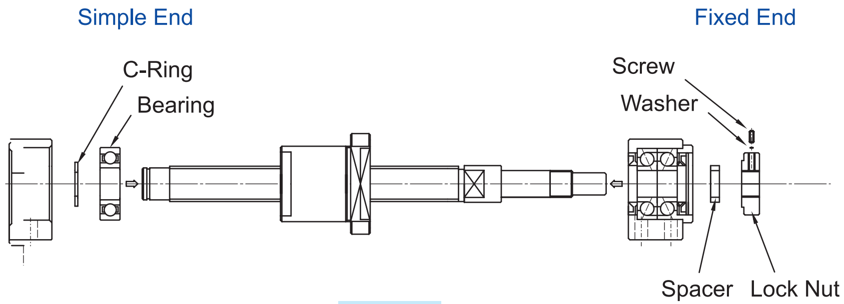



Fig 1.1.1

## 1-2 Assemble the Nut Bracket

(1) If using a bracket when mounting the ball screw nut to the table, insert the nut into the bracket and fasten it temporarily.

(2) Fasten the fixed end Support Unit to the base.

(3) Ensure parallelism through reference face (linear guide) and ballscrew, than tighten both fixed and simple ends.

(4) Move the table between both ends the Unit to align the axial center, and adjust the table so that the table can travel smoothly.

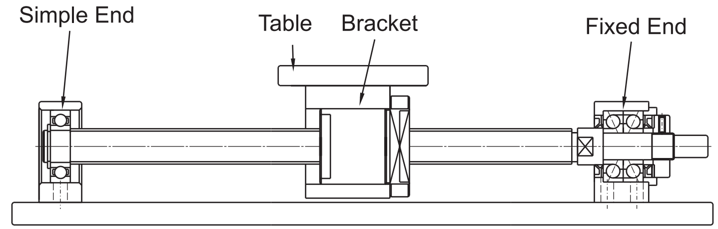



Fig 1.2.1

## 1-3 Checking Geometric Accuracy

(1) While checking the runout of the ball screw shaft end and the axial clearance using a dial gauge.

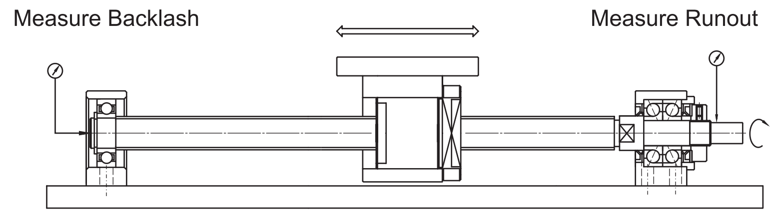



Fig 1.3.1

## 1-4 Connect Ball Screw Motor

(1) Mount the motor bracket to the base.

(2) Connect the motor and the ball screw using a coupling.

(Make sure the mounting accuracy is maintained)

(3) Thoroughly perform the break-in for the system.

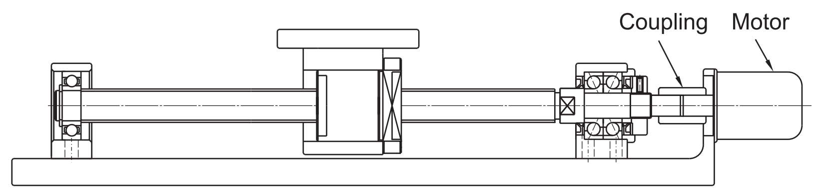
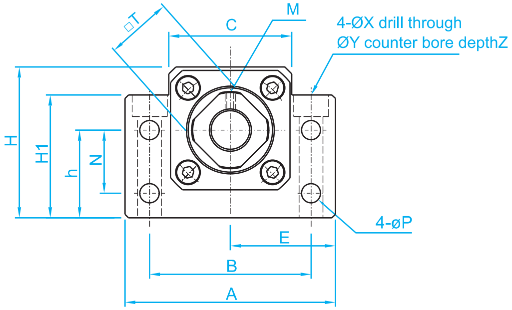
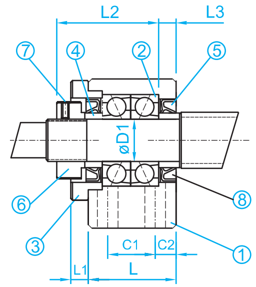



Fig 1.4.1

## BK Series (Fixed End)



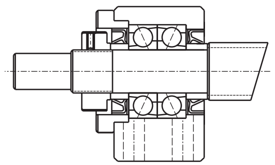

| Code | Items | pcs |
|---|---|---|
| 1 | Housing | 1 PCS |
| 2 | Bearing | 1 SET |
| 3 | Lid | 1 PCS |
| 4 | Spacer | 2 PCS |
| 5 | Seal | 2 PCS |
| 6 | Lock Nut | 1 PCS |
| 7 | Screw with Washer | 1 PCS |

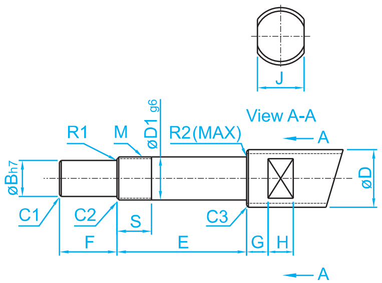
Unit：mm

| Model No. | D1 | A | B | C | C1 | C2 | E ±0.02 | H1 | h ±0.02 | H |
|---|---|---|---|---|---|---|---|---|---|---|
| BK-10 | 10 | 60 | 46 | 34 | 13 | 6 | 30 | 32.5 | 22 | 39 |
| BK-12 | 12 | 60 | 46 | 35 | 13 | 6 | 30 | 32.5 | 25 | 43 |
| BK-15 | 15 | 70 | 54 | 40 | 15 | 6 | 35 | 38 | 28 | 48 |
| BK-17 | 17 | 86 | 68 | 50 | 19 | 8 | 43 | 55 | 39 | 64 |
| BK-20 | 20 | 88 | 70 | 52 | 19 | 8 | 44 | 50 | 34 | 60 |

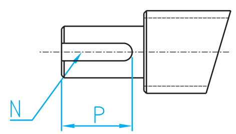
| L | L1 | L2 | L3 | T | P | N | M | X | Y | Z | Bearing Model |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 5 | 29 | 5 | 16 | 5.5 | 15 | M3 | 6.6 | 11 | 5 | 7000ATYDFC8P5 |
| 25 | 5 | 29 | 5 | 19 | 5.5 | 18 | M3 | 6.6 | 11 | 1.5 | 7001ATYDFC8P5 |
| 27 | 6 | 32 | 6 | 22 | 5.5 | 18 | M3 | 6.6 | 11 | 6.5 | 7002ATYDFC8P5 |
| 35 | 9 | 44 | 7 | 24 | 6.6 | 28 | M4 | 9 | 14 | 8.5 | 7203ATYDFC8P5 |
| 35 | 8 | 43 | 8 | 30 | 6.6 | 22 | M4 | 9 | 14 | 8.5 | 7004ATYDFC8P5 |

## Suggest Dimension of End Machining

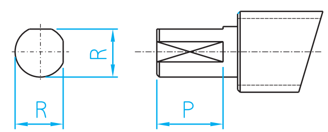





H1 Type




H2 Type



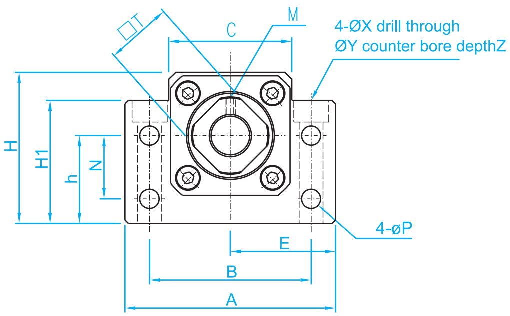

Tolerance

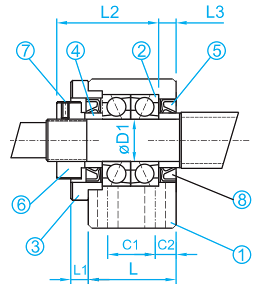
| Dimension (mm) | | h unit 0.001 |
|---|---|---|
| Above | Under | h |
| 6 | 10 | -2<br>-15 |
| 10 | 18 | -3<br>-18 |
| 18 | 24 | -3<br>-21 |

| Model No. | Diameter | D1 | B | E | F | M |
|---|---|---|---|---|---|---|
| BK-10 | Ø12, Ø14, Ø15 | 10 | 8 | 39 | 15 | M10×1 |
| BK-12 | Ø14, Ø15, Ø16, Ø18 | 12 | 10 | 39 | 15 | M12×1 |
| BK-15 | Ø18, Ø20 | 15 | 12 | 40 | 20 | M15×1 |
| BK-17 | Ø20, Ø25 | 17 | 15 | 53 | 23 | M17×1 |
| BK-20 | Ø25, Ø28 | 20 | 17 | 53 | 25 | M20×1 |

| S | J | G | H | Chamfering | | | Circular Radius | | H1 Keyway(W×D×L) | | H2 | | Model BK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | C1 | C2 | C3 | R1 | R2 | N | P | R | P | |
| 16 | 10 | 5 | 7 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 2×1.2 | 11 | 7.5 | 11 | BK-10 |
| 14 | 13 | 6 | 8 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 3×1.8 | 12 | 9.5 | 12 | BK-12 |
| 12 | 16 | 6 | 9 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 4×2.5 | 16 | 11.3 | 16 | BK-15 |
| 17 | 18 | 7 | 10 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 5×3.0 | 21 | 14.3 | 21 | BK-17 |
| 15 | 21 | 8 | 11 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 5×3.0 | 21 | 16 | 21 | BK-20 |

## BK Series (Fixed End)



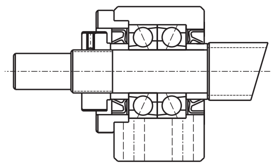

| Code | Items | pcs |
|---|---|---|
| 1 | Housing | 1 PCS |
| 2 | Bearing | 1 SET |
| 3 | Lid | 1 PCS |
| 4 | Spacer | 2 PCS |
| 5 | Seal | 2 PCS |
| 6 | Lock Nut | 1 PCS |
| 7 | Screw with Washer | 1 PCS |

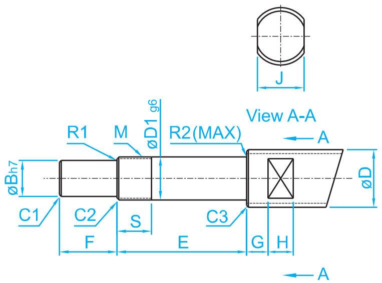
Unit : mm

| Model No. | D1 | A | B | C | C1 | C2 | E ±0.02 | H1 | h ±0.02 | H |
|---|---|---|---|---|---|---|---|---|---|---|
| BK-25 | 25 | 106 | 85 | 64 | 22 | 10 | 53 | 70 | 48 | 80 |
| BK-30 | 30 | 128 | 102 | 76 | 23 | 11 | 64 | 78 | 51 | 89 |
| BK-35 | 35 | 140 | 114 | 88 | 26 | 12 | 70 | 79 | 52 | 96 |
| BK-40 | 40 | 160 | 130 | 100 | 33 | 14 | 80 | 90 | 60 | 110 |

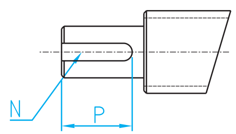
| L | L1 | L2 | L3 | T | P | N | M | X | Y | Z | Bearing Model |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | 12 | 54 | 9 | 35 | 9 | 33 | M5 | 11 | 17.5 | 11 | 7205ATYDFC8P5 |
| 45 | 14 | 61 | 9 | 40 | 11 | 33 | M6 | 14 | 20 | 13 | 7206ATYDFC8P5 |
| 50 | 14 | 67 | 12 | 50 | 11 | 35 | M8 | 14 | 20 | 13 | 7207ATYDFC8P5 |
| 61 | 18 | 76 | 15 | 50 | 14 | 37 | M8 | 18 | 26 | 17.5 | 7208ATYDFC8P5 |

## Suggest Dimension of End Machining

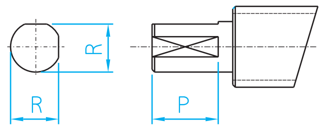





H1 Type




H2 Type



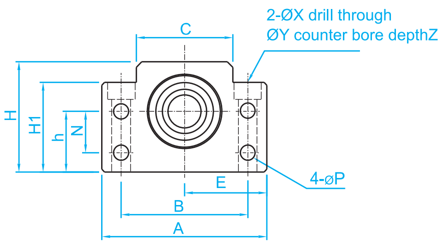

Tolerance

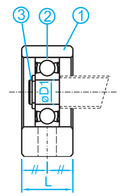
| Dimension (mm) | | h unit 0.001 |
|---|---|---|
| Above | Under | h |
| 18 | 30 | -3<br>-21 |
| 30 | 50 | -4<br>-25 |

| Model No. | Diameter | D1 | B | E | F | M |
|---|---|---|---|---|---|---|
| BK-25 | Ø32, Ø36 | 25 | 20 | 65 | 30 | M25×1.5 |
| BK-30 | Ø36, Ø40 | 30 | 25 | 72 | 38 | M30×1.5 |
| BK-35 | Ø40, Ø45, Ø50 | 35 | 30 | 83 | 45 | M35×1.5 |
| BK-40 | Ø50, Ø55 | 40 | 35 | 98 | 50 | M40×1.5 |

| S | J | G | H | Chamfering | | | Circular Radius | | H1 Keyway(W×D×L) | | H2 | | Model BK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | C1 | C2 | C3 | R1 | R2 | N | P | R | P | |
| 18 | 27 | 10 | 13 | 0.5 | 0.7 | 1.0 | 0.5 | 0.6 | 6×3.5 | 25 | 19 | 25 | BK-25 |
| 25 | 32 | 10 | 15 | 0.5 | 0.7 | 1.0 | 0.5 | 1.0 | 8×4.0 | 32 | 23.5 | 32 | BK-30 |
| 28 | 36 | 12 | 15 | 0.5 | 1.0 | 1.0 | 0.5 | 1.0 | 8×4.0 | 40 | 28.5 | 40 | BK-35 |
| 35 | 41 | 14 | 19 | 0.5 | 1.0 | 1.0 | 0.5 | 1.0 | 10×5.0 | 45 | 33 | 45 | BK-40 |

## BF Series (Simple End)



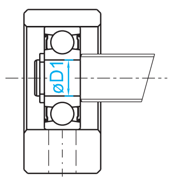



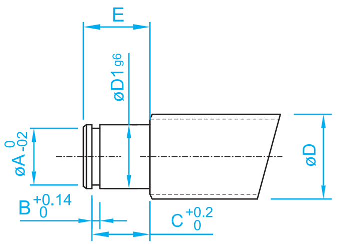

| Code | Items | pcs |
|---|---|---|
| ① | Housing | 1 PCS |
| ② | Bearing | 1 PCS |
| ③ | C-Ring | 1 PCS |

Unit：mm

| Model No. | D1 | A | B | C | E ±0.02 | H1 | h ±0.02 | H | L | N | P | X | Y | Z | C-Ring | Bearing Model |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BF-10 | 8 | 60 | 46 | 34 | 30 | 32.5 | 22 | 39 | 20 | 15 | 5.5 | 6.6 | 11 | 5 | C8 | 608ZZ |
| BF-12 | 10 | 60 | 46 | 35 | 30 | 32.5 | 25 | 43 | 20 | 18 | 5.5 | 6.6 | 11 | 1.5 | C10 | 6000ZZ |
| BF-15 | 15 | 70 | 54 | 40 | 35 | 38 | 28 | 48 | 20 | 18 | 5.5 | 6.6 | 11 | 6.5 | C15 | 6002ZZ |
| BF-17 | 17 | 86 | 68 | 50 | 43 | 55 | 39 | 64 | 23 | 28 | 6.6 | 9 | 14 | 8.5 | C17 | 6203ZZ |
| BF-20 | 20 | 88 | 70 | 52 | 44 | 50 | 34 | 60 | 26 | 22 | 6.6 | 9 | 14 | 8.5 | C20 | 6004ZZ |
| BF-25 | 25 | 106 | 85 | 64 | 53 | 70 | 48 | 80 | 30 | 33 | 9 | 11 | 17.5 | 11 | C25 | 6205ZZ |
| BF-30 | 30 | 128 | 102 | 76 | 64 | 78 | 51 | 89 | 32 | 33 | 11 | 14 | 20 | 13 | C30 | 6206ZZ |
| BF-35 | 35 | 140 | 114 | 88 | 70 | 79 | 52 | 96 | 32 | 35 | 11 | 14 | 20 | 13 | C35 | 6207ZZ |
| BF-40 | 40 | 160 | 130 | 100 | 80 | 90 | 60 | 110 | 37 | 37 | 14 | 18 | 26 | 17.5 | C40 | 6208ZZ |

## Suggest Dimension of End Machining



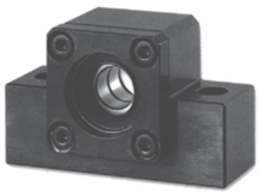

Tolerance

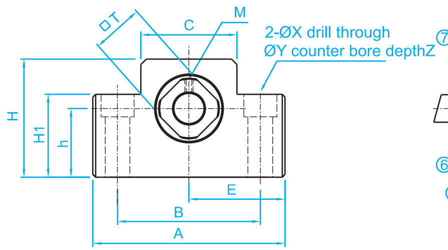
| Dimension (mm) | | h unit 0.001 |
|---|---|---|
| Above | Under | h |
| 6 | 10 | -2<br>-15 |
| 10 | 18 | -3<br>-18 |
| 18 | 30 | -3<br>-21 |
| 30 | 50 | -4<br>-25 |

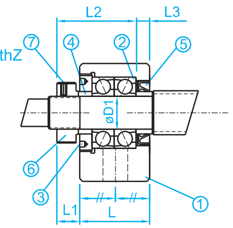
| Model No. | Diameter | D1 | E |
|---|---|---|---|
| BF-10 | Ø12, Ø14, Ø15 | 8 | 10 |
| BF-12 | Ø14, Ø15, Ø16 | 10 | 11 |
| BF-15 | Ø18, Ø20 | 15 | 13 |
| BF-17 | Ø20, Ø25 | 17 | 16 |
| BF-20 | Ø25, Ø28 | 20 | 16 |
| BF-25 | Ø32, Ø36 | 25 | 20 |
| BF-30 | Ø36, Ø40 | 30 | 21 |
| BF-35 | Ø40, Ø45, Ø50 | 35 | 22 |
| BF-40 | Ø50, Ø55 | 40 | 23 |

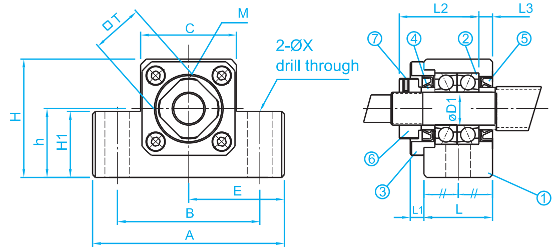
| C-Ring | | | Model BF |
|---|---|---|---|
| A | B | C | |
| 7.6 | 0.9 | 7.9 | BF-10 |
| 9.6 | 1.15 | 9.15 | BF-12 |
| 14.3 | 1.15 | 10.15 | BF-15 |
| 16.2 | 1.15 | 13.15 | BF-17 |
| 19.0 | 1.35 | 13.35 | BF-20 |
| 23.9 | 1.35 | 16.35 | BF-25 |
| 28.6 | 1.75 | 17.75 | BF-30 |
| 33.0 | 1.75 | 18.75 | BF-35 |
| 38.0 | 1.95 | 19.95 | BF-40 |

## EK Series (Fixed End)





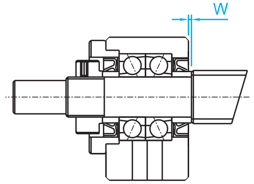

EK10~15

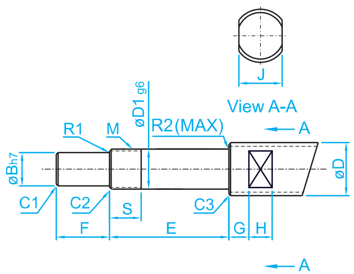
| Code | Items | pcs |
|---|---|---|
| ① | Housing | 1 PCS |
| ② | Bearing | 1 SET |
| ③ | Lid | 1 PCS |
| ④ | Spacer | 2 PCS |
| ⑤ | Seal | 2 PCS |
| ⑥ | Lock Nut | 1 PCS |
| ⑦ | Screw with Washer | 1 PCS |

Unit：mm

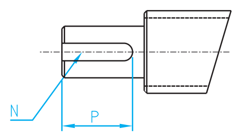
| Model No. | D1 | A | B | C | E ±0.02 | H1 | h ±0.02 | H | L | L1 | L2 | L3 | M | X | Y | Z | T | Bearing Model |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EK-6 | 6 | 42 | 30 | 18 | 21 | 20 | 13 | 25 | 20 | 5.5 | 22 | 3.5 | M3 | 5.5 | 9.5 | 11 | 12 | 706ATYDFC7P5 |
| EK-8 | 8 | 52 | 38 | 25 | 26 | 26 | 17 | 32 | 23 | 7 | 26 | 4 | M3 | 6.6 | 11 | 12 | 14 | 708ATYDFC8P5 |
| EK-10 | 10 | 70 | 52 | 36 | 35 | 24 | 25 | 43 | 24 | 6 | 29.5 | 6 | M3 | 9 | - | - | 16 | 7000ATYDFC8P5 |
| EK-12 | 12 | 70 | 52 | 36 | 35 | 24 | 25 | 43 | 24 | 6 | 29.5 | 6 | M3 | 9 | - | - | 19 | 7001ATYDFC8P5 |
| EK-15 | 15 | 80 | 60 | 41 | 40 | 25 | 30 | 49 | 25 | 6 | 36 | 5 | M3 | 11 | - | - | 22 | 7002ATYDFC8P5 |

## Suggest Dimension of End Machining

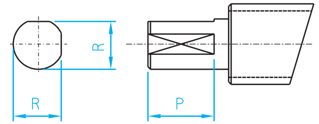



H1 Type




H2 Type




Tolerance

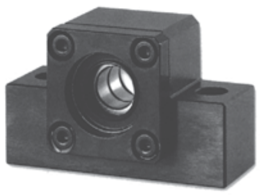
| Dimension (mm) | | h unit 0.001 |
|---|---|---|
| Above | Under | h |
| 6 | 10 | -2<br>-15 |
| 10 | 18 | -3<br>-18 |
| 18 | 24 | -3<br>-21 |

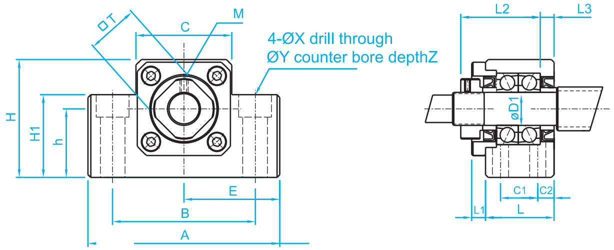
| Model No. | Diameter | D1 | B | E | F | M |
|---|---|---|---|---|---|---|
| EK-6 | Ø6, Ø8 | 6 | 4 | 30 | 8 | M6×0.75 |
| EK-8 | Ø10, Ø12 | 8 | 6 | 35 | 9 | M8×1 |
| EK-10 | Ø12, Ø14, Ø15 | 10 | 8 | 36 | 15 | M10×1 |
| EK-12 | Ø14, Ø15, Ø16 | 12 | 10 | 36 | 15 | M12×1 |
| EK-15 | Ø18, Ø20 | 15 | 12 | 49 | 20 | M15×1 |

| S | J | G | H | Chamfering | | | Circular Radius | | H1 Keyway(W×D×L) | | H2 | | W | Model EK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | C1 | C2 | C3 | R1 | R2 | N | P | R | P | | |
| 10 | 5 | 4 | 4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.6 | - | - | 3.7 | 6 | 1.5 | EK-6 |
| 10 | 8 | 5 | 5 | 0.3 | 0.3 | 0.3 | 0.3 | 0.6 | - | - | 5.6 | 7 | 1.5 | EK-8 |
| 11 | 10 | 5 | 7 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 2×1.2 | 11 | 7.5 | 11 | -0.5 | EK-10 |
| 11 | 13 | 6 | 8 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 3×1.8 | 12 | 9.5 | 12 | -0.5 | EK-12 |
| 13 | 16 | 6 | 9 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 4×2.5 | 16 | 11.3 | 16 | 5.0 | EK-15 |

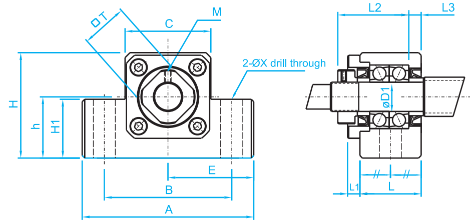
※When the nominal diameter Ø6, and using EK06 or EF06 is precision ground ball screw type.

## EK Series (Fixed End)

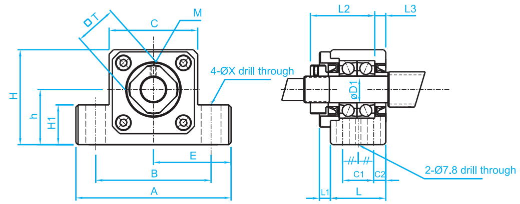





EK-20S




EK-20



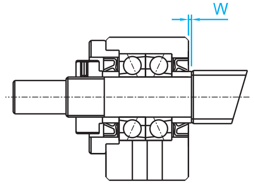

EK-25

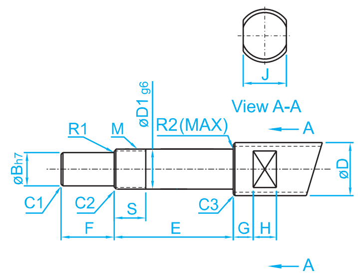
Unit : mm

| Model No. | D1 | A | B | C | E | H1 | h |
|---|---|---|---|---|---|---|---|
| | | | | | ±0.02 | | ±0.02 |
| EK-20 | 20 | 95 | 75 | 56 | 47.5 | 25 | 30 |
| EK-25 | 25 | 105 | 85 | 66 | 52.5 | 25 | 35 |

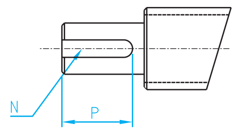
| C2 | C1 | H | L | L1 | L2 | L3 | M | X | Y | Z | T | Bearing Model |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - | - | 58 | 42 | 10 | 50 | 10 | M4 | 11 | - | - | 30 | 7204ATYDFC8P5 |
| 9 | 30 | 68 | 48 | 13 | 60 | 14 | M5 | 11 | - | - | 35 | 7205ATYDFC8P5 |

## Suggest Dimension of End Machining

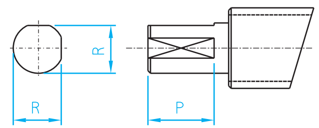





H1 Type



H2 Type



Tolerance

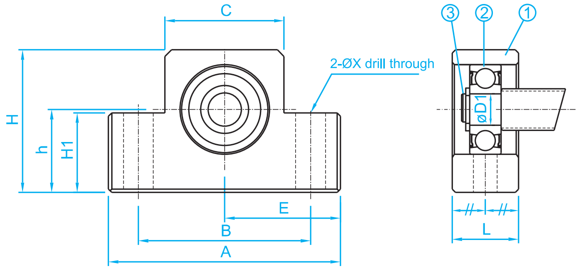
| Dimension (mm) | | h unit 0.001 |
|---|---|---|
| Above | Under | h |
| 6 | 10 | -2<br>-15 |
| 10 | 18 | -3<br>-18 |
| 18 | 24 | -3<br>-21 |

| Model No. | Diameter | D1 | B | E | F | M |
|---|---|---|---|---|---|---|
| EK-20 | Ø25, Ø28, Ø32 | 20 | 17 | 64 | 25 | M20×1 |
| EK-25 | Ø32, Ø36 | 25 | 20 | 65 | 30 | M25×1.5 |

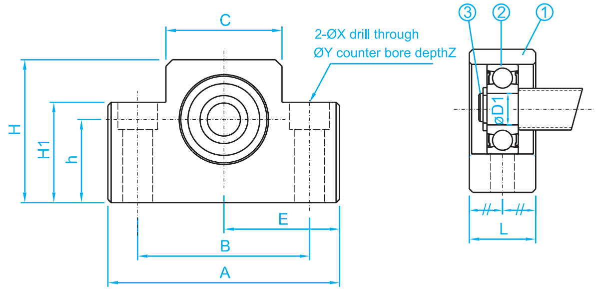
| S | J | G | H | Chamfering | | | Circular Radius | | H1 Keyway(W×D×L) | | H2 | | W | Model EK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | C1 | C2 | C3 | R1 | R2 | N | P | R | P | | |
| 17 | 21 | 8 | 11 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 5×3.0 | 21 | 16 | 21 | 1.0 | EK-20 |
| 18 | 27 | 10 | 13 | 0.5 | 0.7 | 1.0 | 0.5 | 0.6 | 6×3.5 | 25 | 19 | 25 | 1.0 | EK-25 |

SUPPORT UNIT OF BALL SCREW

## EF Series (Simple End)




EF10~15, EF20~25



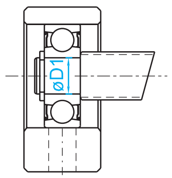

EF6~8

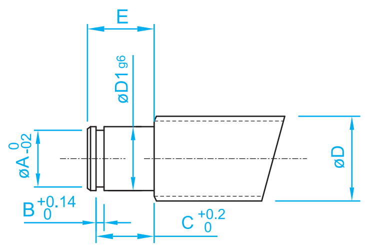
| Code | Items | pcs |
|---|---|---|
| 1 | Housing | 1 PCS |
| 2 | Bearing | 1 PCS |
| 3 | C-Ring | 1 PCS |

Unit：mm

| Model No. | D1 | A | B | C | E ±0.02 | H1 | h ±0.02 | H | L | X | Y | Z | C-Ring | Bearing Model |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EF-6 | 6 | 42 | 30 | 18 | 21 | 20 | 13 | 25 | 12 | 5.5 | 9.5 | 11 | C6 | 606ZZ |
| EF-8 | 6 | 52 | 38 | 25 | 26 | 26 | 17 | 32 | 14 | 6.6 | 11 | 12 | C6 | 606ZZ |
| EF-10 | 8 | 70 | 52 | 36 | 35 | 24 | 25 | 43 | 20 | 9 | - | - | C8 | 608ZZ |
| EF-12 | 10 | 70 | 52 | 36 | 35 | 24 | 25 | 43 | 20 | 9 | - | - | C10 | 6000ZZ |
| EF-15 | 15 | 80 | 60 | 41 | 40 | 25 | 30 | 49 | 20 | 9 | - | - | C15 | 6002ZZ |
| EF-20 | 20 | 95 | 75 | 56 | 47.5 | 25 | 30 | 58 | 26 | 11 | - | - | C20 | 6204ZZ |
| EF-25 | 25 | 105 | 85 | 66 | 52.5 | 25 | 35 | 68 | 30 | - | 11 | - | C25 | 6205ZZ |

## Suggest Dimension of End Machining




Tolerance

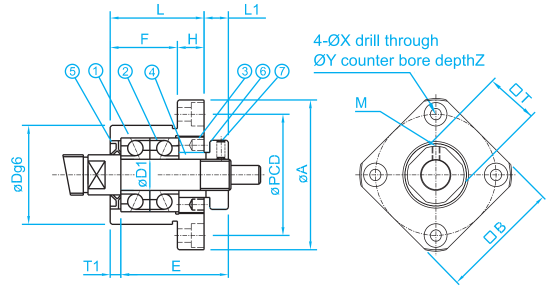
| Dimension (mm) | | h unit 0.001 |
|---|---|---|
| Above | Under | h |
| 6 | 10 | -2<br>-15 |
| 10 | 18 | -3<br>-18 |
| 18 | 24 | -3<br>-21 |

| Model No. | Diameter | D1 | E |
|---|---|---|---|
| EF-6 | Ø6, Ø8 | 6 | 9 |
| EF-8 | Ø10, Ø12 | 6 | 9 |
| EF-10 | Ø12, Ø14, Ø15 | 8 | 10 |
| EF-12 | Ø14, Ø15, Ø16 | 10 | 11 |
| EF-15 | Ø18, Ø20 | 15 | 13 |
| EF-20 | Ø25, Ø28 | 20 | 19 |
| EF-25 | Ø32, Ø36 | 25 | 20 |

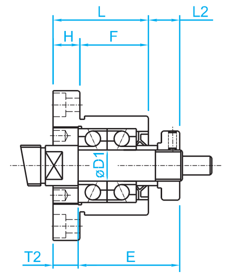
※When the nominal diameter Ø6, and using EK06 or EF06 is precision ground ball screw type.

| C-Ring A | C-Ring B | C-Ring C | Model EF |
|---|---|---|---|
| 5.7 | 0.8 | 6.8 | EF-6 |
| 5.7 | 0.8 | 6.8 | EF-8 |
| 7.6 | 0.9 | 7.9 | EF-10 |
| 9.6 | 1.15 | 9.15 | EF-12 |
| 14.3 | 1.15 | 10.15 | EF-15 |
| 19 | 1.35 | 15.35 | EF-20 |
| 23.9 | 1.35 | 16.35 | EF-25 |

## FK Series (Fixed End)




Method A




Method B

| D | g6 |
|---|---|
| 28 | -0.007<br>-0.020 |

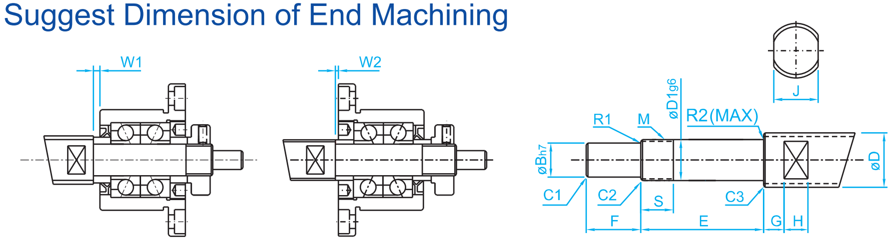
| Code | Items | pcs |
|---|---|---|
| ① | Housing | 1 PCS |
| ② | Bearing | 1 SET |
| ③ | Lid | 1 PCS |
| ④ | Spacer | 2 PCS |
| ⑤ | Seal | 2 PCS |
| ⑥ | Lock Nut | 1 PCS |
| ⑦ | Screw with Washer | 1 PCS |

Unit : mm

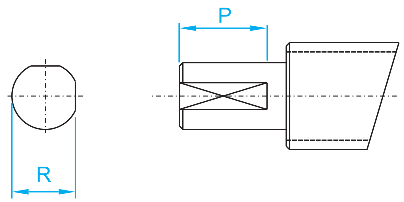
| Model No. | D1 | A | F | L | E | Dg6 | H | PCD | M | B | L1 | T1 | L2 | T2 | X | Y | Z | T | Bearing Model |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FK-8 | 8 | 43 | 14 | 23 | 26 | 28 | 9 | 35 | M3 | 35 | 7 | 4 | 8 | 5 | 3.4 | 6.5 | 4 | 14 | 708ATYDFC8P5 |

SUPPORT UNIT OF BALL SCREW

## Suggest Dimension of End Machining




H1 Type



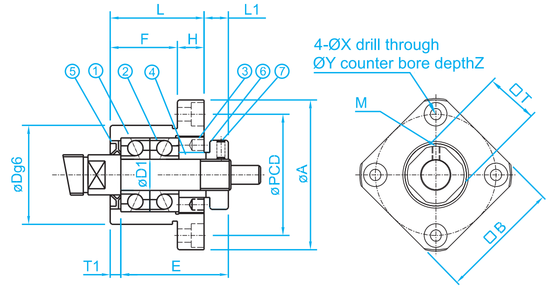

Tolerance

| Dimension (mm) | | h<br>unit 0.001 |
|---|---|---|
| Above | Under | h |
| 6 | 10 | -2<br>-15 |

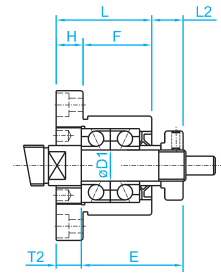
| Model No. | Diameter | D1 | B | E | F | M |
|---|---|---|---|---|---|---|
| FK-8 | Ø10, Ø12 | 8 | 6 | 35 | 9 | M8×1 |

| S | Chamfering | | | Circular Radius | | H1 | | W1 | W2 | Model FK |
|---|---|---|---|---|---|---|---|---|---|---|
| | C1 | C2 | C3 | R1 | R2 | R | P | | | |
| 15 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 5.6 | 7 | 1.5 | 0.5 | FK-8 |

## FK Series (Fixed End)




Method A




Method B

| D | g6 |
|---|---|
| 34 | -0.009<br>-0.025 |
| 36 | -0.009<br>-0.025 |
| 40 | -0.009<br>-0.025 |
| 57 | -0.010<br>-0.029 |
| 63 | -0.010<br>-0.029 |
| 75 | -0.010<br>-0.029 |

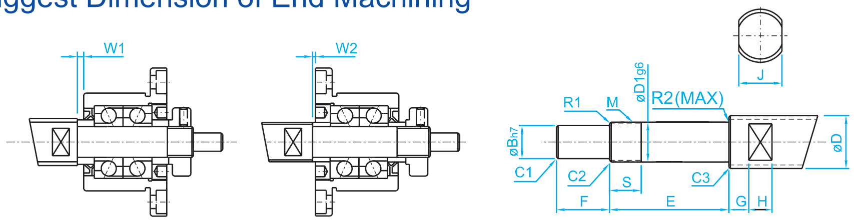
| Code | Items | pcs |
|---|---|---|
| 1 | Housing | 1 PCS |
| 2 | Bearing | 1 SET |
| 3 | Lid | 1 PCS |
| 4 | Spacer | 2 PCS |
| 5 | Seal | 2 PCS |
| 6 | Lock Nut | 1 PCS |
| 7 | Screw with Washer | 1 PCS |

Unit : mm

| Model No. | D1 | A | F | L | E | Dg6 | H | PCD |
|---|---|---|---|---|---|---|---|---|
| FK-10 | 10 | 52 | 17 | 27 | 29.5 | 34 | 10 | 42 |
| FK-12 | 12 | 54 | 17 | 27 | 29.5 | 36 | 10 | 44 |
| FK-15 | 15 | 63 | 17 | 32 | 36 | 40 | 15 | 50 |
| FK-20 | 20 | 85 | 30 | 52 | 50 | 57 | 22 | 70 |
| FK-25 | 25 | 98 | 30 | 57 | 60 | 63 | 27 | 80 |
| FK-30 | 30 | 117 | 32 | 62 | 61 | 75 | 30 | 95 |

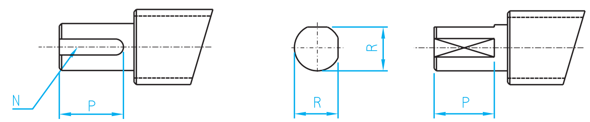
| M | B | L1 | T1 | L2 | T2 | X | Y | Z | T | Bearing Model |
|---|---|---|---|---|---|---|---|---|---|---|
| M3 | 42 | 7.5 | 5 | 8.5 | 6 | 4.5 | 8 | 4 | 16 | 7000ATYDFC8P5 |
| M3 | 44 | 7.5 | 5 | 8.5 | 6 | 4.5 | 8 | 4 | 19 | 7001ATYDFC8P5 |
| M3 | 52 | 10 | 6 | 12 | 8 | 5.5 | 9.5 | 6 | 22 | 7002ATYDFC8P5 |
| M4 | 68 | 8 | 10 | 12 | 14 | 6.6 | 11 | 10 | 30 | 7204ATYDFC8P5 |
| M5 | 79 | 13 | 10 | 20 | 17 | 9 | 15 | 13 | 35 | 7205ATYDFC8P5 |
| M6 | 93 | 14 | 12 | 17 | 18 | 11 | 17.5 | 15 | 40 | 7206ATYDFC8P5 |

## Suggest Dimension of End Machining




H1 Type

H2 Type



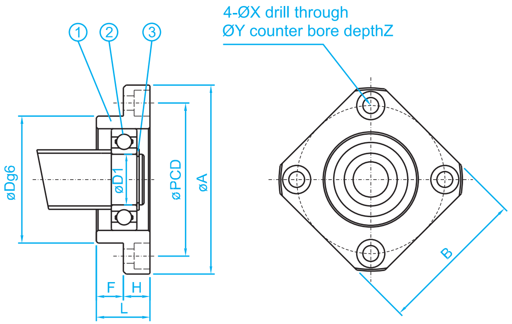

Tolerance

| Dimension (mm) | | h<br>unit 0.001 |
|---|---|---|
| Above | Under | h |
| 6 | 10 | -2<br>-15 |
| 10 | 18 | -3<br>-18 |
| 18 | 30 | -3<br>-21 |

| Model No. | Diameter | D1 | B | E | F | M |
|---|---|---|---|---|---|---|
| FK-10 | Ø12, Ø14, Ø15 | 10 | 8 | 36 | 15 | M10×1 |
| FK-12 | Ø14, Ø15, Ø16 | 12 | 10 | 36 | 15 | M12×1 |
| FK-15 | Ø18, Ø20 | 15 | 12 | 49 | 20 | M15×1 |
| FK-20 | Ø25, Ø28 | 20 | 17 | 64 | 25 | M20×1 |
| FK-25 | Ø32, Ø36 | 25 | 20 | 76 | 30 | M25×1.5 |
| FK-30 | Ø40, Ø50 | 30 | 25 | 72 | 38 | M30×1.5 |

| S | J | G | H | Chamfering | | | Circular Radius | | H1 | | H2 | | W1 | W2 | Model FK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | C1 | C2 | C3 | R1 | R2 | N | P | R | P | | | |
| 11 | 10 | 5 | 7 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 2×1.2 | 11 | 7.5 | 11 | 0.5 | 0.5 | FK-10 |
| 11 | 13 | 6 | 8 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 3×1.8 | 12 | 9.5 | 12 | 0.5 | 0.5 | FK-12 |
| 13 | 16 | 6 | 9 | 0.5 | 0.5 | 0.5 | 0.3 | 0.6 | 4×2.5 | 16 | 11.6 | 16 | 4 | 2 | FK-15 |
| 17 | 21 | 8 | 11 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 5×3.0 | 21 | 16 | 21 | 1 | -3 | FK-20 |
| 20 | 27 | 10 | 13 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 6×3.5 | 25 | 19 | 25 | 5 | -2 | FK-25 |
| 25 | 32 | 10 | 15 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 8×4 | 32 | 23.5 | 32 | -3 | -6 | FK-30 |

## FF Series (Simple End)



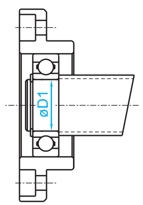

| D | g6 |
|---|---|
| 22 | -0.007<br>-0.020 |
| 28 | -0.007<br>-0.020 |
| 34 | -0.009<br>-0.025 |
| 40 | -0.009<br>-0.025 |
| 57 | -0.010<br>-0.029 |
| 63 | -0.010<br>-0.029 |
| 75 | -0.010<br>-0.029 |

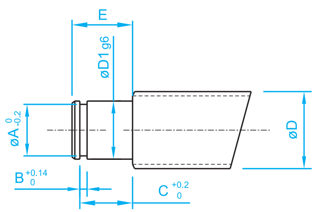
| Code | Items | pcs |
|---|---|---|
| 1 | Housing | 1 PCS |
| 2 | Bearing | 1 PCS |
| 3 | C-Ring | 1 PCS |

Unit:mm

| Model No. | D1 | L | H | F | Dg6 | A | PCD | B | X | Y | Z | C-Ring | Bearing Model |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FF-6 | 6 | 10 | 6 | 4 | 22 | 36 | 28 | 28 | 3.4 | 6.5 | 4 | C6 | 606ZZ |
| FF-10 | 8 | 12 | 7 | 5 | 28 | 43 | 35 | 35 | 3.4 | 6.5 | 4 | C8 | 608ZZ |
| FF-12 | 10 | 15 | 7 | 8 | 34 | 52 | 42 | 42 | 4.5 | 8 | 4 | C10 | 6000ZZ |
| FF-15 | 15 | 17 | 9 | 8 | 40 | 63 | 50 | 52 | 5.5 | 9.5 | 5.5 | C15 | 6002ZZ |
| FF-20 | 20 | 20 | 11 | 9 | 57 | 85 | 70 | 68 | 6.6 | 11 | 6.5 | C20 | 6204ZZ |
| FF-25 | 25 | 24 | 14 | 10 | 63 | 98 | 80 | 79 | 9 | 14 | 8.5 | C25 | 6205ZZ |
| FF-30 | 30 | 27 | 18 | 9 | 75 | 117 | 95 | 93 | 11 | 17.5 | 11 | C30 | 6206ZZ |

## Suggest Dimension of End Machining




Tolerance

| Dimension (mm) | | h unit 0.001 |
|---|---|---|
| Above | Under | h |
| 6 | 10 | -2<br>-15 |
| 10 | 18 | -3<br>-18 |
| 18 | 24 | -3<br>-21 |

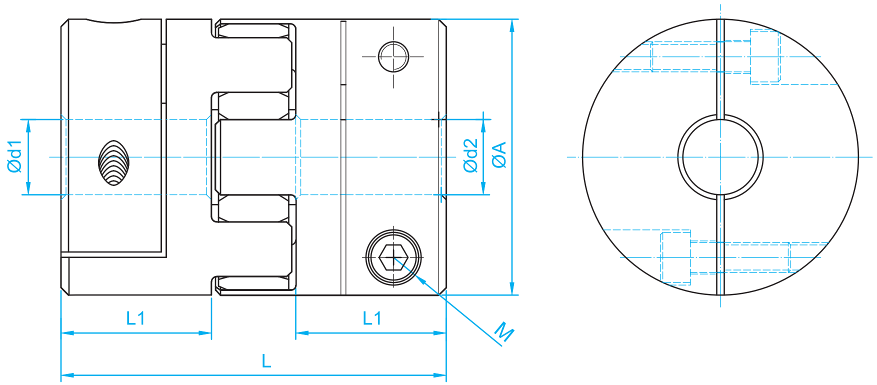
| Model No. | Diameter | D1 | E |
|---|---|---|---|
| FF-6 | Ø10, Ø12 | 6 | 9 |
| FF-10 | Ø12, Ø14, Ø15 | 8 | 10 |
| FF-12 | Ø14, Ø15, Ø16 | 10 | 11 |
| FF-15 | Ø18, Ø20 | 15 | 13 |
| FF-20 | Ø25, Ø28 | 20 | 19 |
| FF-25 | Ø32, Ø36 | 25 | 20 |
| FF-30 | Ø40, Ø50 | 30 | 21 |

| C-Ring | | | Model |
|---|---|---|---|
| A | B | C | FF |
| 5.7 | 0.8 | 6.8 | FF-6 |
| 7.6 | 0.9 | 7.9 | FF-10 |
| 9.6 | 1.15 | 9.15 | FF-12 |
| 14.3 | 1.15 | 10.15 | FF-15 |
| 19 | 1.35 | 15.35 | FF-20 |
| 23.9 | 1.35 | 16.35 | FF-25 |
| 28.6 | 1.75 | 17.75 | FF-30 |

# G. Coupling

www.tbimotion.com.tw

## SRJ Specifications




## Function

Unit：mm

| Model No. | A | L | L1 | dmax | (H8) d1xd2 | | M |
|---|---|---|---|---|---|---|---|
| | | | | | d1 | d2 | |
| SRJ-20C | 20 | 30 | 10 | 8 | 5, 6, 6.35, 7, 8 | | M3 |
| SRJ-30C | 30 | 35 | 11 | 14 | 6, 6.35, 8, 9, 9.5, 10, 11, 12, 14 | | M4 |
| SRJ-40C | 40 | 66 | 25 | 20 | 10, 11, 12, 14, 15, 16, 18, 19, 20 | | M5 |
| SRJ-55C | 55 | 78 | 30 | 25 | 15, 16, 18, 19, 20, 22, 24, 25 | | M6 |
| SRJ-65C | 65 | 90 | 35 | 35 | 15, 16, 18, 19, 20, 22, 24, 25, 28, 30, 32, 35 | | M8 |

※ Specifications Number：SRJ-AC-d1 x d2

※ Material：Aluminum Alloy

※ Buffer Material：Engineering Class Plastic

| Model No. | Rate Torque (N · m) | Max Torque (N · m) | Max Rotational Spring Rigidity ($min^{-1}$) | Static Torsion Spring Rigidity (N · m/rad) | Dynamic Torsion Spring Rigidity (N · m/rad) |
|---|---|---|---|---|---|
| SRJ-20C | 5 | 10 | 15200 | 51.0 | 151 |
| SRJ-30C | 12.5 | 25 | 10200 | 170.9 | 505 |
| SRJ-40C | 17 | 34 | 7600 | 857.5 | 2571 |
| SRJ-55C | 60 | 120 | 5600 | 2060 | 6163 |
| SRJ-65C | 160 | 320 | 4700 | 3430 | 10291 |

| Model No. | Weight (g) | | Mass Moment of Inertia J (kg-$m^2$) | | Radial (mm) | Angular (°) | Axial (mm) |
|---|---|---|---|---|---|---|---|
| | each hub | spider | each hub | spider | | | |
| SRJ-20C | 8.5 | 1.7 | $0.46\times10^{-3}$ | $0.073\times10^{-3}$ | 0.10 | 1.0 | 0.8 |
| SRJ-30C | 18 | 4.2 | $2.5\times10^{-3}$ | $0.45\times10^{-3}$ | 0.15 | 1.0 | 1 |
| SRJ-40C | 64 | 6.5 | $20.1\times10^{-3}$ | $1.44\times10^{-3}$ | 0.15 | 1.0 | 1.2 |
| SRJ-55C | 130 | 17.4 | $50.5\times10^{-3}$ | $7.3\times10^{-3}$ | 0.2 | 1.0 | 1.4 |
| SRJ-65C | 250 | 28.6 | $200.1\times10^{-3}$ | $16.3\times10^{-3}$ | 0.2 | 1.0 | 1.5 |