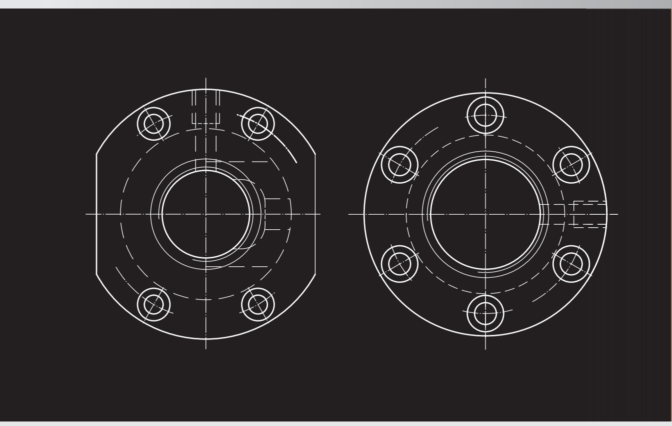
PMI

PMI Linear Motion Systems

Ballscrews General Catalog



PMI

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Ballscrews General Catalog

Company Introduction

PMI was established in 1990 and is specialized in designing and manufacturing of Ballscrews and Linear Guideways.

Our superior techniques, high production efficiency, along with good quality have made ***PMI*** products and brand very well-known in Taiwan and the world's transmission component market.

PMI basic information

Capital: NT$ 997,726,590.

Location: SHEN KANG HSIANG, TAICHUNG HSIEN, TAIWAN

The history of *PMI*

1990 • Company was established with capital of NT$ 7,000,000.

1991 • Produced the first Ballscrew (commercial grade)

1995 • Capital increased to NT$ 40,000,000.
• Started to produce precision ground Ballscrew.

1996 • The first high precision Japanese Mitsui Seiki grinding machine joined production line.

1997 • ISO 9001 certified.

1998 • Capital increased to NT$ 120,000,000.

1999 • Capital increased to NT$ 180,000,000.

2000 • Started to produce rolled Ballscrew.

2002 • Capital increased to NT$ 225,000,000.
• Established subdivision company-Advanced Motion Technologies Corp. (AMT) and started to produce Linear Guideways.

2003 • Capital increased to NT$ 281,000,000.

2004 • Capital increased to NT$ 330,000,000.

2005 • Construction for new headquarter building started on Jan. 19th
• Subdivision company : *PMI*(SHANGHAI) corporation was established

2006 • Capital increased to NT$ 530,000,000.
• New headquarter building finished and opened on Nov. 25th

2007 • DSI Barcode System on line in Feb.
• ISO 9000 certified by BSI in July.
• ISO 140001 certified by BSI in July.
• Capital increased to NT$ 63,000,000 in July.

2008 • Capital Increased NT$ 800,000,000 in May 2008.
• Plan and Consultation to OHSAS-18001.
• Capital Increased NT$ 997,726,590 after merging the Subsidiary AMT.

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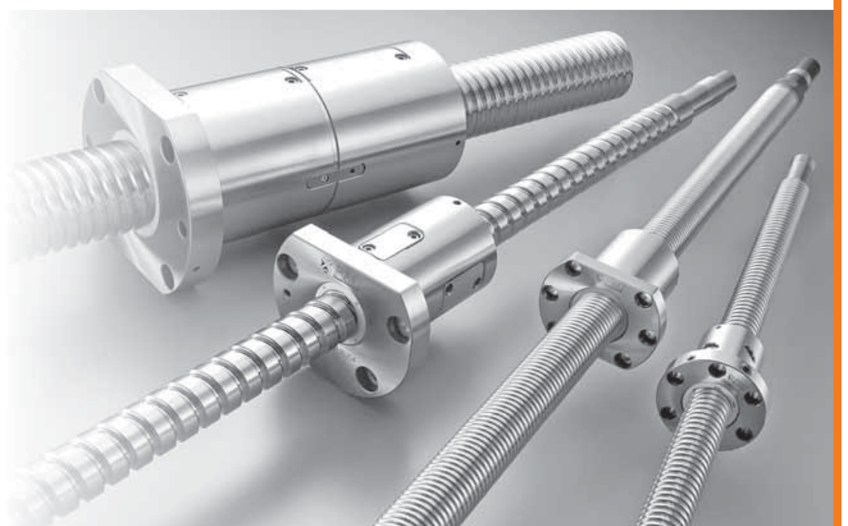
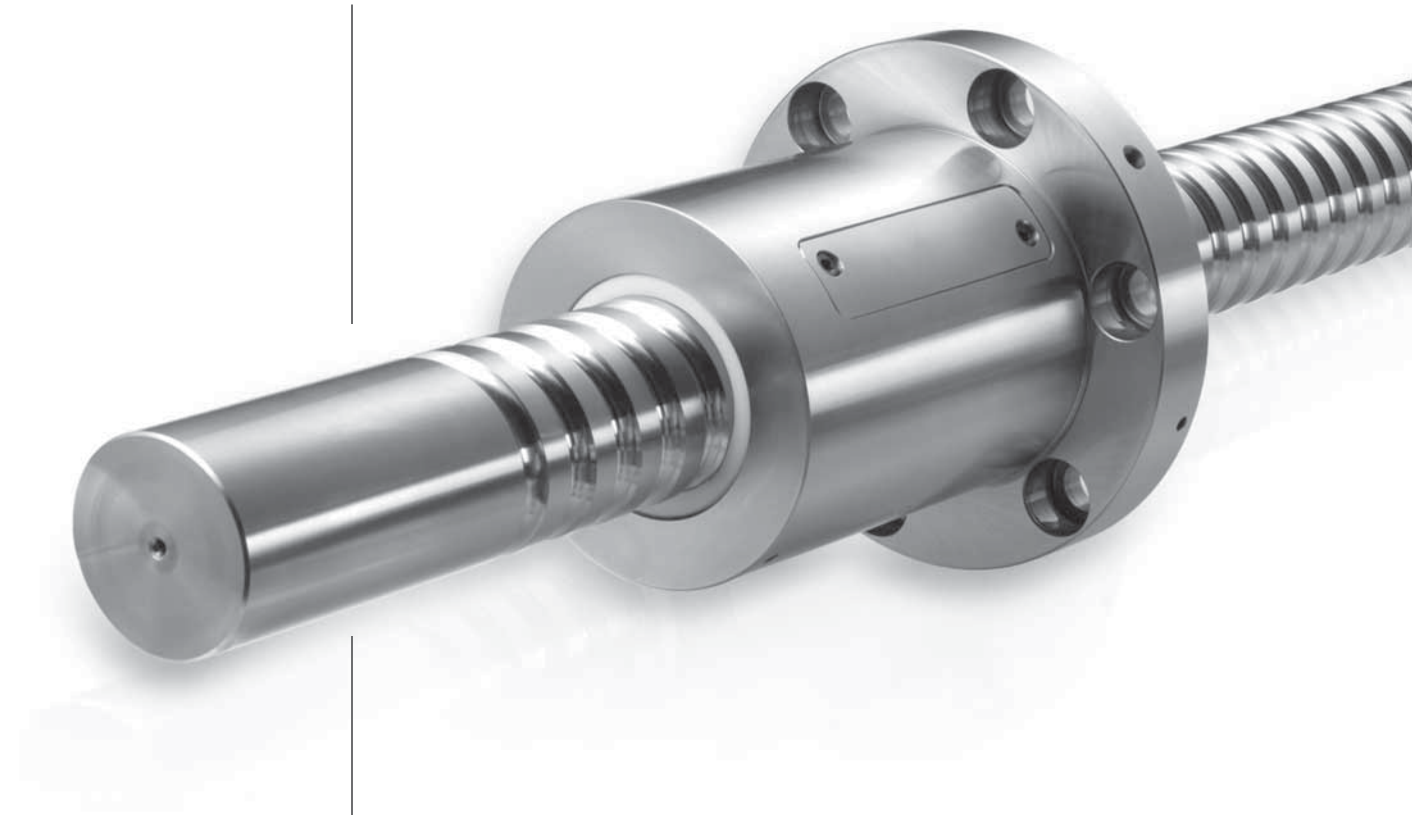


Ballscrews



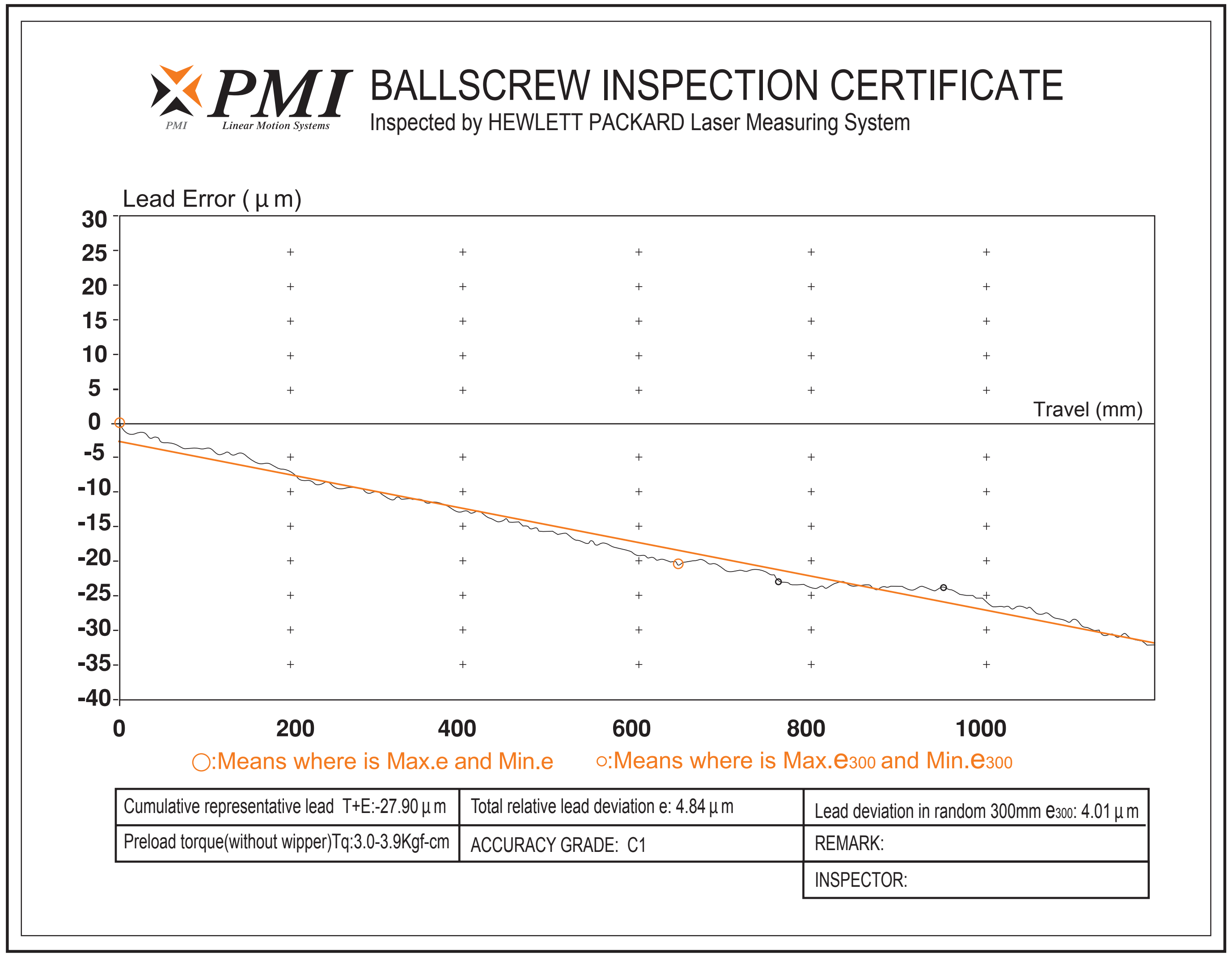
1 Features of *PMI* Ballscrews

(1) High reliability

PMI has accumulated many years experience in production managing. It covers the whole production sequence, from receiving the order, designing, material preparation, machining, heat treating, grinding, assembling, inspection, packaging and delivery. The systemized managing ensures high reliability of *PMI* Ballscrews.

(2) High accuracy

PMI Ballscrews are machined, ground, assembled and Q.C. inspected under the constant temperature control (20°C) to ensure high precision of Ballscrews. Fig.1.1 accuracy inspection certificate.



Cumulative representative lead T+E:-27.90 µ m	Total relative lead deviation e: 4.84 µ m	Lead deviation in random 300mm e300: 4.01 µ m
Preload torque(without wipper)Tq:3.0-3.9Kgf-cm	ACCURACY GRADE: C1	REMARK:
		INSPECTOR:

Fig.1.1 Accuracy inspection certificate.

(3) Long durability

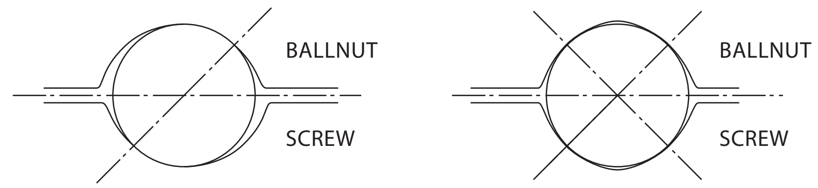
PMI Ballscrews are made of German Alloy steels, which are well quenching and tempering treated for good rigidity, along with suitable surface hardening to ensure long durability.

(4) High working efficiency

Balls are rotating inside the Ballscrew nut to offer high working efficiency. Comparing with the traditional ACME screws, which work by friction sliding between the nut and screw, the Ballscrews needs only 1/3 of driving torque. It is easy to transmit linear motion into rotation motion.

(5) No backlash and with high rigidity

The Gothic profile is applied by *PMI* Ballscrews. It offers best contact between balls and the grooves. If suitable preload is exerted on Ballscrew hence to eliminate clearance between the ball nut and screw and to reduce elastic deformation, the ballscrew shall get much better rigidity and accuracy.



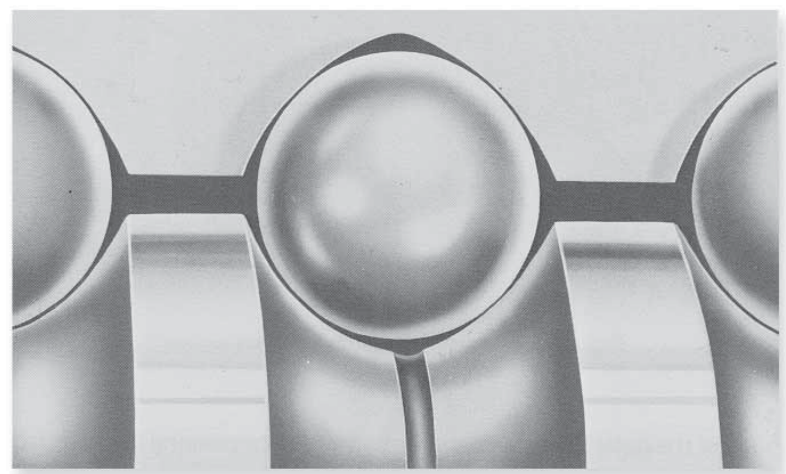


Fig.1.2 Gothic arch thread

2 Lead Accuracy and Torque

2.1 Lead Accuracy

PMI's precision ground Ballscrews are controlled in accordance with JIS B 1192.
The permissible values and each part of definitions are shown below.

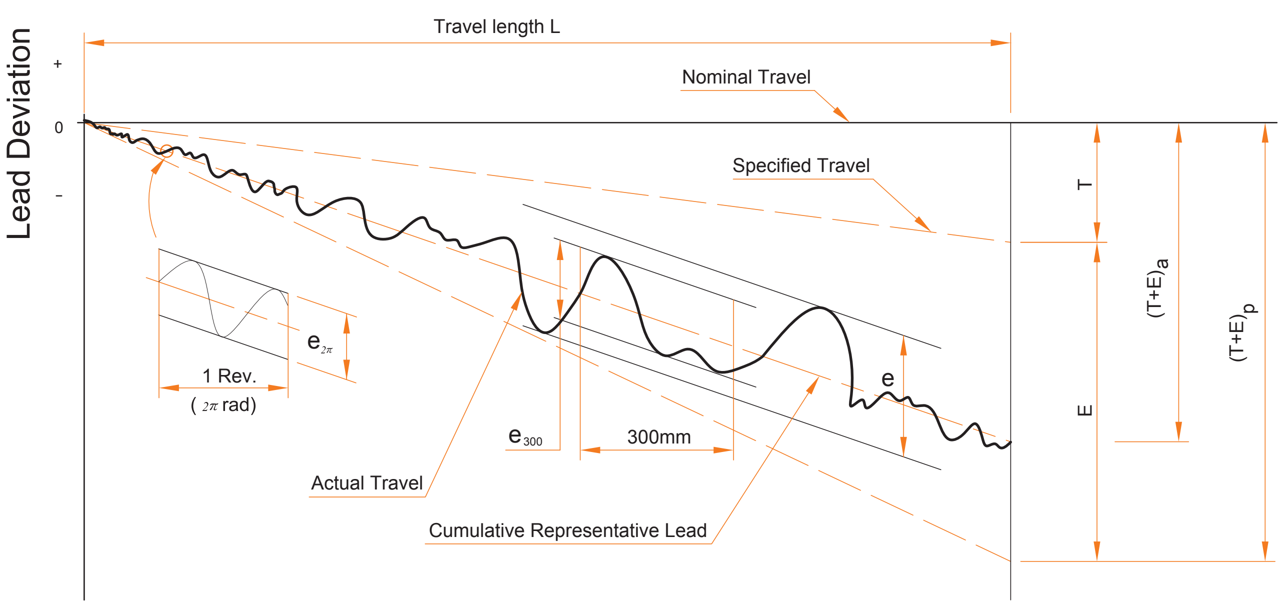


Fig.2.1 Technical Terms Concerning the Lead

Table2.1 Terms

T+E	Cumulative representative lead. A straight line representing the tendency of the cumulative actual lead. This is obtained by least square method and measured by laser system.
P	Permissible value.
a	Actual value.
T	Specified travel. This value is determined by customer and maker as it depends on different application requirements.
E	Accumulated reference lead deviation. This is allowable deviation of specified travel. It is decided by both of the accuracy grade and effective thread length.
e	Total relative lead variation Maximum width of variation over the travel length.
e_{300}	Lead deviation in random 300 mm.
$e_{2\pi}$	Lead deviation in random 1 revolution 2π rad.

Table 2.2 Accumulated reference lead deviation (±E) and total relative variation (e)

Unit: μm

Effective thread length (mm) GRADE		C0		C1		C2		C3		C4		C5	
OVER	UP TO	E	e	E	e	E	e	E	e	E	e	E	e
	315	4	3.5	6	5	8	7	12	8	12	12	23	18
315	400	5	3.5	7	5	9	7	13	10	14	12	25	20
400	500	6	4	8	5	10	7	15	10	16	12	27	20
500	630	6	4	9	6	11	8	16	12	18	14	30	23
630	800	7	5	10	7	13	9	18	13	20	14	35	25
800	1000	8	6	11	8	15	10	21	15	22	16	40	27
1000	1250	9	6	13	9	18	11	24	16	25	18	46	30
1250	1600	11	7	15	10	21	13	29	18	29	20	54	35
1600	2000			18	11	25	15	35	21	35	22	65	40
2000	2500			22	13	30	18	41	24	41	25	77	46
2500	3150			26	15	36	21	50	29	50	29	93	54
3150	4000			32	18	44	25	60	35	62	35	115	65
4000	5000					52	30	72	41	76	41	140	77
5000	6300					65	36	90	50	85	50	170	93
6300	8000							110	62	106	62	210	115
8000	10000									132	75	260	140

Table 2.3 Accuracy grade

Variation in random 300mm (e_{300}) and wobble ($e_{2\pi}$)

e_{300}

Unit: μm

GRADE	C0	C1	C2	C3	C4	C5	C6	C7	C10
JIS	3.5	5	-	8	-	18	-	50	210
PMI	3.5	5	7	8	12	18	25	50	210

$e_{2\pi}$

Unit: μm

GRADE	C0	C1	C2	C3	C4	C5
JIS	3	4	-	6	-	8
PMI	3	4	4	6	8	8

2.2 Preloading Torque

The preloading torque of the Ballscrew is controlled in accordance with JIS B 1192.

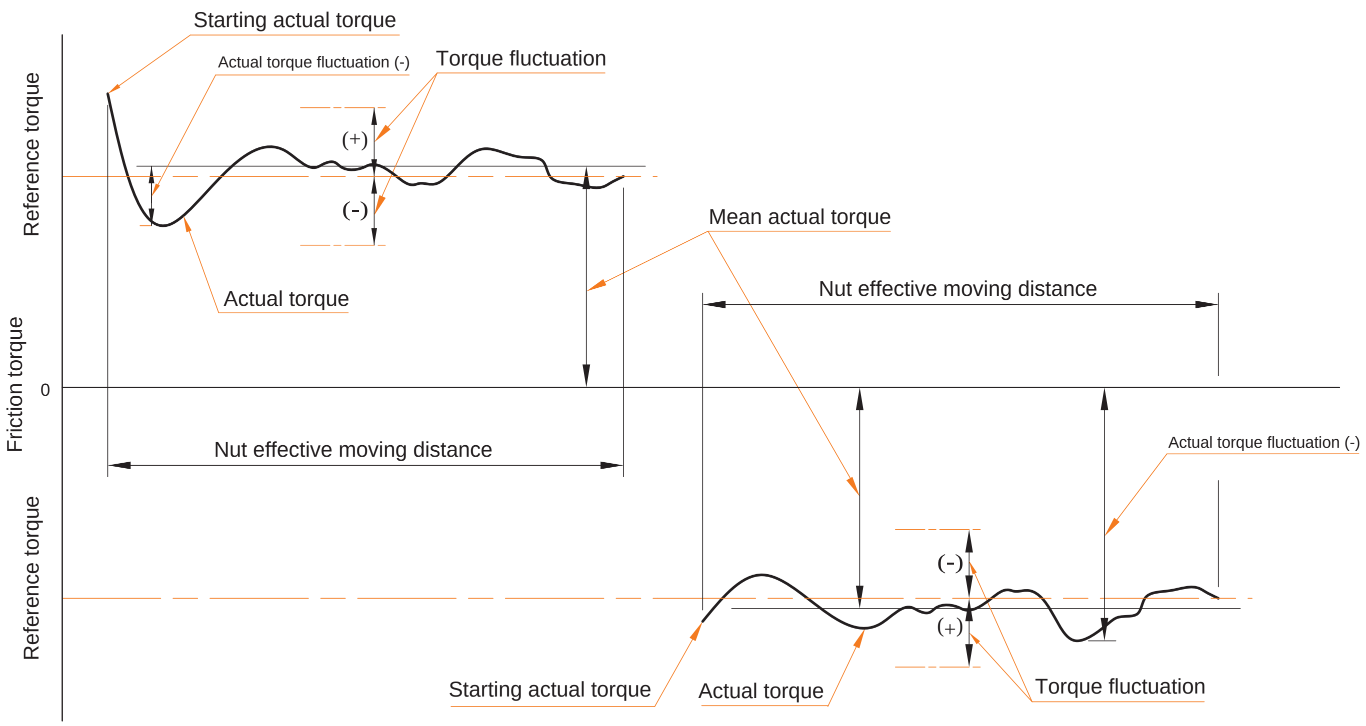


Fig.2.2 Technical terms concerning preload

Preload	The goal in preload is to clear axial play and increase rigidity of Ballscrew. Reference to 5.1.3
Preload torque	Torque needed to continuously turn a Ballscrew with preload with no other load applied to it.
Reference torque	Preload torque set as a goal.
Torque fluctuation	Fluctuation from a goal value of the preload torque. Defined as positive or negative in respect to the reference torque.
Rating of torque fluctuation	Rating on reference torque and torque fluctuation.
Actual torque	Preloaded dynamic torque measured by using an actual value of Ballscrew.
Mean actual torque	In the effective thread length, the net reciprocate to measure the maximum actual torque and minimum actual torque are doing count mean.
Actual torque fluctuation	In the effective thread length, the net reciprocate to measure the maximum fluctuant value.
Rating of Actual torque fluctuation	Rating on mean actual torque and actual torque fluctuation.

Table2.4 Allowable range of preload torque

Reference torque (*kgf.cm*)		Effective Thread Length (*mm*)										
		4000 or less								Over 4000 but less than 10000		
		Slenderness ratio: 40 or less				Slenderness ratio: 60 or less						
		Accuracy grade				Accuracy grade				Accuracy grade		
OVER	OR LESS	C0	C1	C3	C5	C0	C1	C3	C5	C1	C3	C5
2	4	±30%	±35%	±40%	±50%	±40%	±40%	±50%	±60%			
4	6	±25%	±30%	±35%	±40%	±35%	±35%	±40%	±45%			
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%	±15%	±20%			±20%	±25%		±25%	±30%

Reference torque

$$T_P = 0.05\,(\tan\beta)^{-0.5} \times \frac{Fao \times l}{2\pi} \quad \text{......} \quad (2.1)$$

在此

T_P Reference torque ($kgf \cdot cm$) l Lead (cm)

Fao Preload (kgf) β Lead angle

2.3 Tolerances on Various Areas of *PMI* Ballscrew

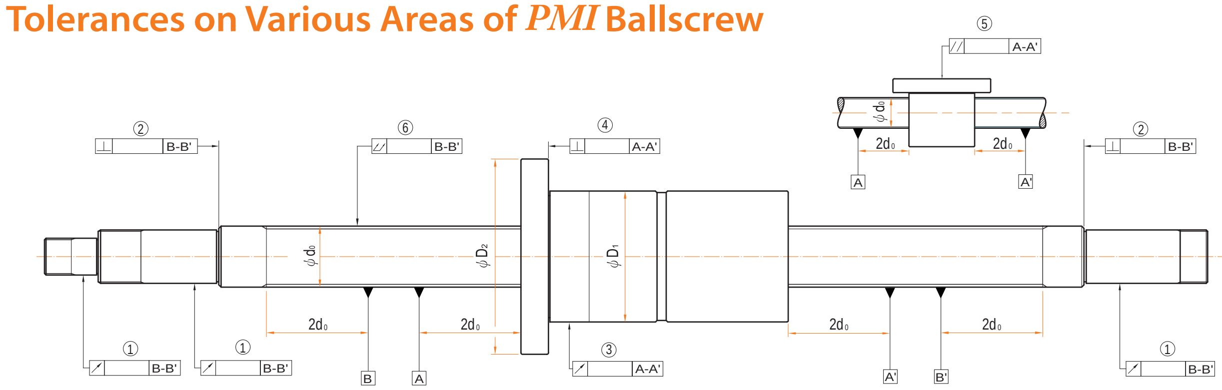


Fig.2.3

Those on above are samples of accuracy of tolerance on various areas of *PMI* Ballscrew.

⊥ : **Perpendicularity** ↗ : **Radial runout** // : **Parallel** ▼A : **Reference**

Accuracy on various areas of *PMI* Ballscrew has to measure items:

1. Radial run-out of the circumference of the screw shaft supported portion in respect to the B-B' line.
2. Perpendicularity of the screw shaft supported portion end face to the B-B' line.
3. Radial run-out of the nut circumference in respect to the A-A' line.
4. Perpendicularity of the flange mounting surface to the A-A' line.
5. Parallelism between the nut circumference to the A-A' line.
6. Overall radial run-out to the A-A' line.

Note: The mounting surface of the Ballscrew is finished to the accuracy specified in JIS B1192-1997

3 Design of Screw Shaft

3.1 Production Limit Length of Screw Shaft

Production limit length of precision ground Ballscrew:

When screw shaft O.D. is 8 mm, Limit length of Ballscrew is 300 mm.

When screw shaft O.D. is 100 mm, Limit length of Ballscrew is 8000 mm.

Note: Please contact with our sales people in case a very high $dm.n$ value is required.

Production limit length of rolled Ballscrew:

When screw shaft O.D. is 12 mm, Limit length of Ballscrew is 1000 mm.

When screw shaft O.D. is 50 mm, Limit length of Ballscrew is 5000 mm.

Note: Please contact with our sales people in case a special type is required.

3.2 Method for Mounting

The permissible axial load and permissible rotational speed vary with the screw-shaft mounting method used, so the mounting method should be determined in accordance with the operating conditions. Diagrams 3.1 through 3.3 illustrate a typical method for mounting a screw shaft.

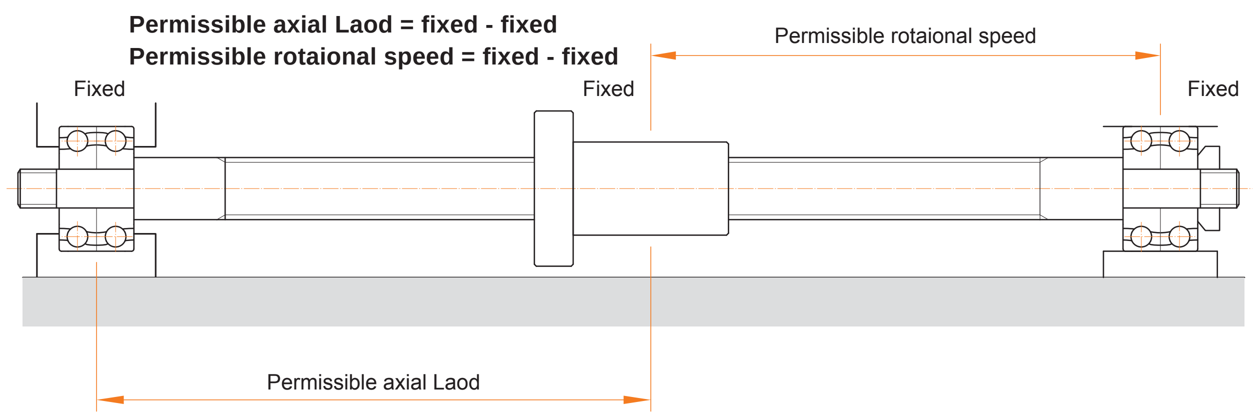


Fig.3.1 Mount method : fixed-fixed

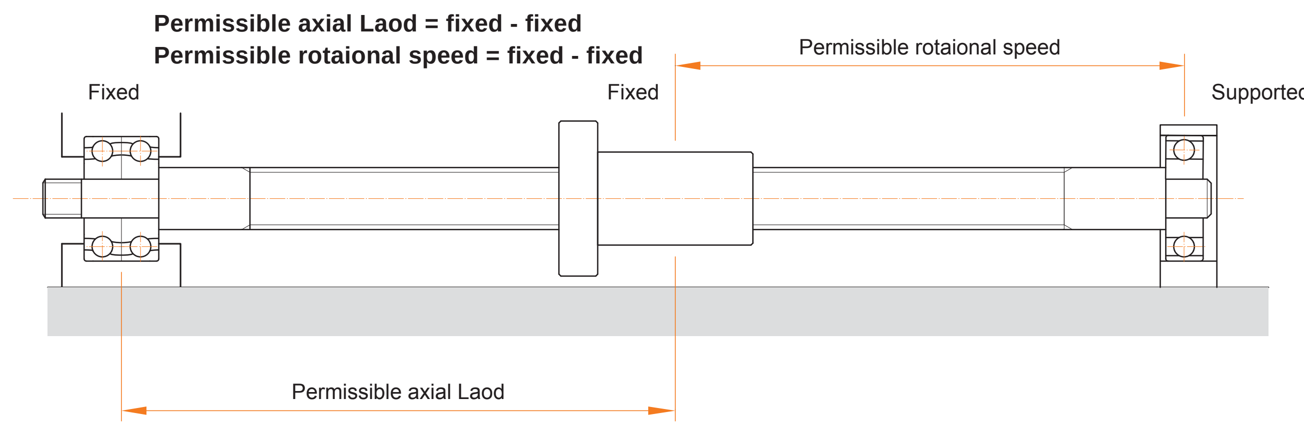


Fig.3.2 Mount method : fixed-supported

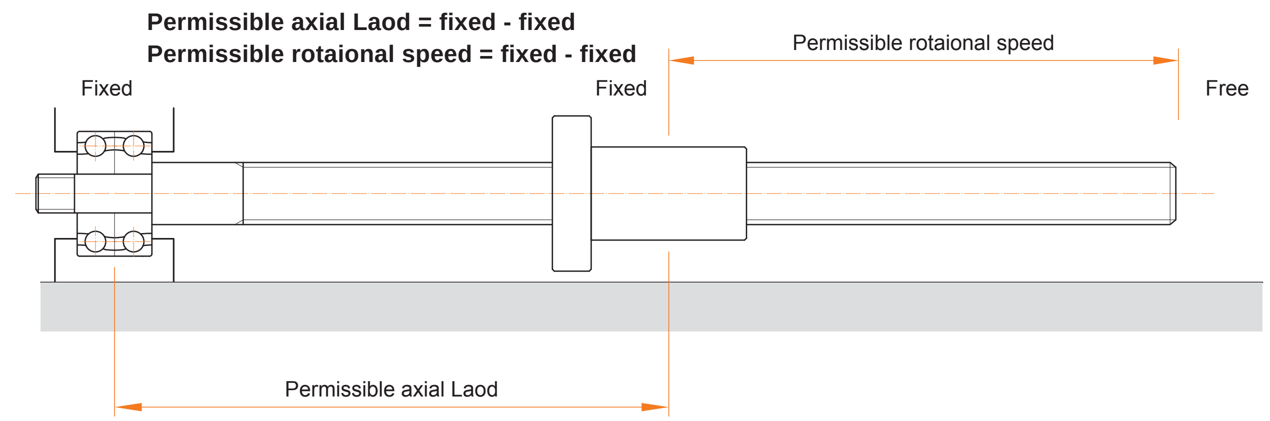


Fig.3.3 Mount method : fixed-free

3.3 Permissible Axial Load

(1) **Buckling load：**

The Ballscrew to be used should not buckle under the maximum compressive load applied in its axial direction. The buckling load can be calculated by using equation (3.1):

$$P=\alpha\frac{\pi^2 NEI}{L^2}=m\frac{dr^4}{L^2}\times 10^3 \quad (kgf) \cdots\cdots\cdots\cdots (3.1)$$

Here:

- α Safety factor (α=0.5)
- E Young's modulus (E=2.1×10^4 kgf/mm^2)
- I Minimum geometrical moment of inertia of the screw shaft cross section ($I=\pi dr^4/64$ mm^4)
- dr Screw shaft thread minor diameter (mm)
- L Distance between mounting positions (mm)
- m、N Coefficient depending on the mounting method

supported-supported	m=5.1	(N=1)
fixed-supported	m=10.2	(N=2)
fixed-fixed	m=20.3	(N=4)
fixed-free	m=1.3	(N=1/4)

(2) **Permissible tensile-compressive load of the screw shaft：**

Where the axial load is exerted on the Ballscrew, the screw shaft to be used should be determined in consideration of the permissible tensile-compressive load that can exert yielding stress on the screw shaft.

The permissible tensile-compressive load can be calculated using equation (3.2).

$$P=\sigma\cdot A=\sigma\cdot\pi\cdot dr^2/4 \cdots\cdots\cdots\cdots (3.2)$$

Here:

- σ Permissible tensile-compressive load (kgf/mm^2)
- A Permissible tensile-compressive stress (mm^2)
- dr Screw-shaft thread minor diameter (mm)

3.4 Permissible Rotational Speed

(1) **Critical rotation speed：**

When the rotation speed of driving motor coincides with the natural frequency of feed system (mainly the ballscrew), the resonance of vibration shall be triggered. This rotation speed is then called critical rotation speed. It shall make bad quality machining, since there is wave shape surface on the workpiece. It may also cause damage of machine. Hence it is very important to prevent the resonance of vibration from happening. We choose 80% of critical rotation speed as allowable speed. It is shown as formula (3.3).

It may be required to have additional supports in between the ends bearing supports to make the natural frequency of Ballscrew to be higher and hence to raise the allowable rotation speed.

$$n=\alpha\times\frac{60\lambda^2}{2\pi L^2}\sqrt{\frac{EIg}{\gamma A}}=f\frac{dr}{L^2}\times 10^7 \ (rpm) \cdots\cdots\cdots\cdots (3.3)$$

Here:

- n Permissible rational speed (rpm)
- α Safety factor (α=0.8)
- E Young's modulus (E=2.1×10^4 kgf/mm^2)
- I Minimum geometrical moment of inertia of the screw-shaft cross section ($I=\pi dr^4/64$ mm^4)
- dr Screw-shaft thread minor diameter (mm)
- A Screw shaft cross-sectional area ($A=\pi dr^2/4$ mm^2)
- L Distance between mounting positions (mm)
- g Gravitation acceleration (g =9.8×10^3 mm/s^2)
- γ Specific gravity (γ=7.8×10^{-6} kgf/mm^3)
- f、λ Coefficient depending on the mounting method

supported-supported	f=9.7	($\lambda=\pi$)
fixed-supported	f=15.1	(λ=3.927)
fixed-fixed	f=21.9	(λ=4.730)
fixed-free	f=3.4	(λ=1.875)

(2) **$dm.n$ Value of Ballscrew:**

dm is the BCD (ball circle diameter) of screw shaft, and n is the maximum rotation speed. The $dm.n$ value relates and affects the noise, temperature raise, working life, balls circulation of the ballscrew. In general cases, the $dm.n$ value is limited as follows: (See Note one)

Precision ground：$dm.n$≦70000

Rolled： $dm.n$≦50000

With better manufacturing technology currently, the $dm.n$ value is no longer limited as above. It is even higher than 100,000. (See Note two)

Note one:

These $dm.n$ values are for reference only. In fact, the $dm.n$ value shall be decided by the ways of end supporting and the distance between them.

Note two:

Please contact with our sales people in case a very high $dm.n$ value is required.

3.5 Notes on Screw shaft design

(1) **Through end thread:**

For the Ballscrews with internal ball circulation Ballnut, it is required to have at least one end with complete thread to the end of Ballscrew for Ballnut assembly to screw shaft. If it is impossible for through end thread, it is required to have at least one end with complete thread and the journal area is with diameter to be 0.2mm smaller than the diameter of thread root area.

(2) **Machine design for the area of Ballnut and ends area of Ballscrew:**

It is very important to check if there is enough space for assembly of Ballscrew onto the machine during machine design. In some cases, there is not enough space for assembly and the Ballnut has to be disassembled from the screw shaft for easier work. It may cause problems, such as the balls falling out from Ballnut, worse accuracy of squareness and roundout of Ballnut, change of preload and damage to external ball circulating tubes. In some more serious cases, the ballscrew may be damaged and not to be used. Please contact with our people if said above disassembling is required.

(3) **Not effective hardened area:**

The threads on screw shaft are hardened by induction hardening. It shall cause about 15mm at both ends of thread area are not hard enough. It is required to pay attention during machine design for the effective thread length of travel.

(4) **Extra support unit for long ballscrew:**

For a long ballscrew, the bending due to self weight might happen. It may cause radial direction load to ballscrew. The radial direction vibration during rotation might also be more serious. To prevent these problems from happening, it may be required to have extra supports for ballscrew in between the existing supports at both ends. There are two types of supports; one is movable to move along the Ballnut. The other one is fixed type; it is located in a fixed position. The Table must be designed not to hit with this support during moving.

4 Design of Ball Nut

4.1 Selecting the Type of Nut

(1) **Type:**

Selecting the type of Nut, please consider the accuracy; dimension (The length of Nut; internal diameter; external diameter), preload and the date of delivery.

(2) **Circulation:**

a. External ball circulation:

Advantages

- Lower noise due to longer ball circulation paths
- Offers smoother ball running.
- Offers better solution and quality for long lead or large diameter ballscrews.

b. Internal ball circulation:

Advantages:

- Good for limited space of machine.
- Better structure for small lead or small diameter ballscrews.

(3) **Effective turns:**

Selecting effective turns have to consider motion; life and rigidity. Refer to the Table 4.1.

(4) **Flange:**

PMI have three standard type (A type, B type and C type) Please make selection by area space for nut installation. *PMI* can also make special flange as per customers' requests.

(5) **Oil hole:**

Standard nuts have oil hole. Please dimension in the diagram to manufacture.

Table4.1 The character of effective turns

Character	External ball circulation	Internal ball circulation
Motion	1.5circuit ×2row, 1.5circuit ×3row, 2.5circuit ×1row	1circuit ×3row, 1circuit ×4row
Rigidity	2.5circuit ×2row, 2.5circuit ×3row	1circuit ×6row

4.2 Calculating the Axial Load

4.2.1 Horizontal reciprocating moving mechanism

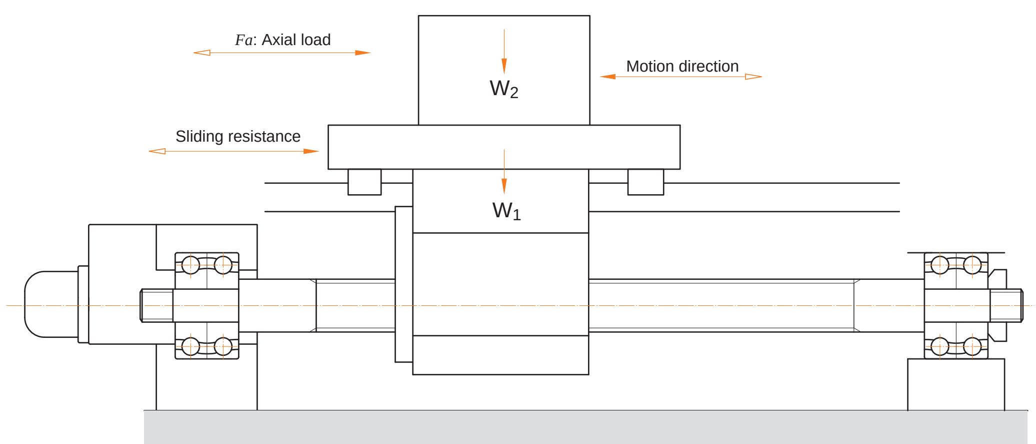


Fig.4.1 Horizontal reciprocating moving mechanism

For reciprocal operation to move work horizontally (back and forth) in an conveyance system, the axial load (Fa) can be gotten using the following equations:

Acceleration (leftward)	$Fa_1=\mu \times mg+f+ma$	(4.1)
Constant speed (leftward)	$Fa_2=\mu \times mg+f$	(4.2)
Deceleration (leftward)	$Fa_3=\mu \times mg+f-ma$	(4.3)
Acceleration (rightward)	$Fa_4=-\mu \times mg-f-ma$	(4.4)
Constant speed (rightward)	$Fa_5=-\mu \times mg-f$	(4.5)
Deceleration (rightward)	$Fa_6=-\mu \times mg-f+ma$	(4.6)

Here:

a Acceleration

$a=\frac{V_{max}}{t_a}$ V_{max} Rapid feed speed; t_a time

m Total weight (table weight + work piece weight)

μ Sliding surface friction coefficient

f Non-load resistance

4.2.2 Vertical reciprocating moving mechanism

For reciprocal operation to move work vertically (up and down) in an conveyance system, the axial load (Fa) can be gotten using the following equations:

Acceleration (upward)	$Fa_1=mg+f+ma$	(4.7)
Constant speed (upward)	$Fa_2=mg+f$	(4.8)
Deceleration (upward)	$Fa_3=mg+f-ma$	(4.9)
Acceleration (downward)	$Fa_4=mg-f-ma$	(4.10)
Constant speed (downward)	$Fa_5=mg-f$	(4.11)
Deceleration (downward)	$Fa_6=mg-f+ma$	(4.12)

Here:

a Acceleration

$a=\frac{V_{max}}{t_a}$ V_{max} Rapid feed speed; t_a time

m Total weight (table weight + work piece weight)

μ Sliding surface friction coefficient

f Non-load resistance

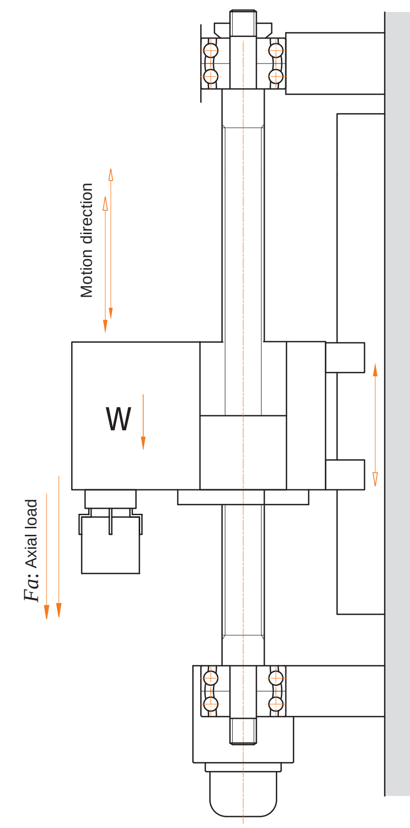


Fig.4.2 Vertical reciprocating moving mechanism

4.3 Notes on Ball Nut Design

Abnormal load: (torsional load or radial load)

When Ballscrew takes only axial load, the best performance of it shall be found; the balls on the groove in between the Ballnut and screw shaft shall evenly take the load and rotate smoothly. In case there is torsional load or radial load on Ballnut, this kind load shall be taken unevenly by some balls only. It shall badly affect Ballscrew performance and even shorten ballscrew life. It is recommended to pay more attention to the mechanism design and Ballscrew assembly.

5 Rigidity

5.1 Axial Rigidity

"Lost Motion" shall happen due to weakness of rigidity of screw shaft and mating components of it. In order to get good positioning accuracy, it is necessary to consider axial and torsional rigidity of screw shaft and mating components of it.

5.1.1 Axial rigidity of the feed-screw system

Let the axial rigidity of a feed-screw system be K. Then, the elastic displacement in the axial direction can be obtained using equation (5.1):

$$\delta = \frac{Fa}{K_T} \quad \cdots\cdots (5.1)$$

$$\frac{1}{K_T} = \frac{1}{K_S} + \frac{1}{K_N} + \frac{1}{K_B} + \frac{1}{K_H} \quad \cdots\cdots (5.2)$$

Here

- δ Feed-screw system elastic displacement in the axial direction (μm)
- Fa Axial load (kgf)
- K_T Axial rigidity of the feed-screw system ($kgf/\mu m$)
- K_S Axial rigidity of the screw shaft ($kgf/\mu m$)
- K_N Axial rigidity of the Nut ($kgf/\mu m$)
- K_B Axial rigidity of the support bearing ($kgf/\mu m$)
- K_H Rigidity of the Nut Bracket and support bearing bracket ($kgf/\mu m$)

(1) Axial rigidity of Screw shaft: K_S

The axial rigidity of a screw shaft varies depending on the shaft mounting method.

a. fixed - free (Axial direction)

$$K_S = \frac{A \times E}{x} \times 10^{-3} \quad \cdots\cdots (5.3)$$

Here

- K_S Axial rigidity of Screw shaft ($kgf/\mu m$)
- A Screw shaft cross-sectional area ($A = \pi \cdot dr^2/4 \ mm^2$)
- dr Screw shaft thread minor diameter (mm)
- E Young's modulus ($E = 2.1 \times 10^4 \ kgf/mm^2$)
- x Distance between mounting positions (mm)

b.fixed - fixed (Axial direction)

$$K_S = \frac{A \times E \times L}{x(L - x)} \times 10^{-3} \quad \cdots\cdots (5.4)$$

Here

- K_S Axial rigidity of Screw shaft ($kgf/\mu m$)
- L Distance between mounting positions (mm)

Note: Which $x=L/2$, KS becomes the minimum and the elastic displacement in the axial direction the maximum.

(2) Axial rigidity of Nut: K_N

a.Non-preload type

Computation of the elastic displacement can be using equation (5.1):

$$\delta_a = \frac{C}{\sin\alpha}\left(\frac{Q^2}{D_W}\right)^{1/3} \times \zeta \ (\mu m) \quad \cdots\cdots (5.5)$$

Here

- C A constant (reference C 2.4)
- α Contact angle of ball and grooved
- D_ω Ball diameter (mm)
- Q Load of each balls ($Q = Fa/Z \cdot \sin\alpha \ kgf$)
- Z Number of balls
- ξ A coefficient of accuracy and inter conformation

Dimension tables include theoretical axial rigidity values when the axial load with a magnitude of 30% of the basic dynamic load rating (Ca) is exerted on the Nut. These values, don't consider the rigidity of the Nut mounting brackets. Therefore, as a general rule, take 80% of the values given in the table.

When the axial load with a magnitude other than 30% of the basic dynamic load rating (Ca) is exerted on the Nut, rigidity value can be calculated using equation (5.6).

$$K_N = 0.8 \times K\left(\frac{Fa}{0.3Ca}\right)^{1/3} \quad \cdots\cdots (5.6)$$

here

- K Rigidity value given in the dimension table ($kgf/\mu m$)
- Fa Axial load (kgf)
- Ca Basic dynamic load rating (kgf)

b.Preloaded type

Dimension tables include theoretical axial rigidity values when the axial load with a magnitude of 10% of the basic dynamic load rating (Ca) is exerted on the Nut. These values, don't consider the rigidity of the Nut mounting brackets. Therefore, as a general rule, take 80% of the values given in the table.

When the axial load with a magnitude other than 10% of the basic dynamic load rating (Ca) is exerted on the Nut, rigidity value can be calculated using equation (5.7).

$$K_N = 0.8 \times K\left(\frac{Fao}{\varepsilon \times Ca}\right)^{1/3} \quad \cdots\cdots (5.7)$$

here

- K Rigidity value given in the dimension table ($kgf/\mu m$)
- Fao Preload
- ε A coefficient of rigidity

(3) Axial rigidity of support bearing: K_B

The axial rigidity of the support bearings for the Ballscrew varies by bearing type.

A typical calculation for determining the axial rigidity of an angular ball bearing can be made using equation (5.8).

$$K_B = \frac{3Fao}{\delta ao} \quad \cdots\cdots (5.8)$$

here

- δao Displacement in the axial direction.

$$\left.\begin{aligned} \delta ao &= \frac{2}{\sin\alpha}\left(\frac{Q^2}{D_W}\right)^{1/3} \\ Q &= \frac{Fao}{Z \times \sin\alpha} \end{aligned}\right\} \quad \cdots\cdots (5.9)$$

- α Initial contact angle of the support bearing
- D_ω Ball diameter of the support bearing
- Q Load of each balls
- Z Number of balls

(4)Axial rigidity of nut bracket and support bearing bracket :K_H

Take this into consideration in the design of your system. Setting the rigidity as high as possible.

5.1.2 Torsional rigidity of the feed-screw system

The factors of positions error caused by twisting are:

1. Torsional deformation of screw shaft.
2. Torsional deformation of coupling.
3. Torsional deformation of motor.

But above deformations are too small in general machine (non-high speed machine), they are then ignored.

5.1.3 Ballscrew's preload and effect

In order to get high positioning accuracy, there are two ways to reach it. One is commonly known as to clear axial play to zero. The other one is to increase Ballscrew rigidity to reduce elastic deformation while taking axial load. Both two ways are done by preloading.

(1) **Methods of preloading**

a.Double-nut method:

A spacer inserted between two nuts exerts a preload. There are two ways for it.

One is illustrated in Fig.5.1. That is to use a spacer with thickness complies with required magnitude of preload. The spacer makes the gap between Nut A and B to be bigger, hence to produce a tension force on Nut A and B. It is called "extensive preload".

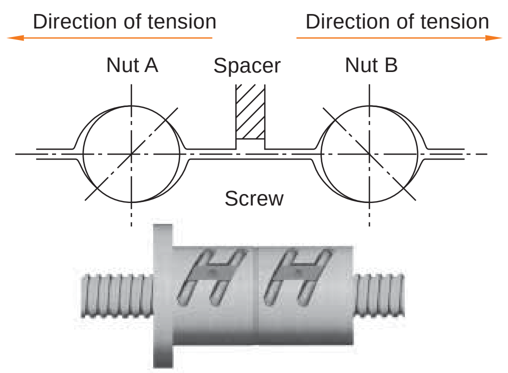


Fig.5.1 Extensive preload

Illustrated in Fig.5.2, is using a thinner spacer. The thickness complies with required magnitude of preload. The spacer is smaller than the gap between Nut A and B, compressing Nut A and B on opposite direction to preload Ballscrews. It's called "compressive preload".

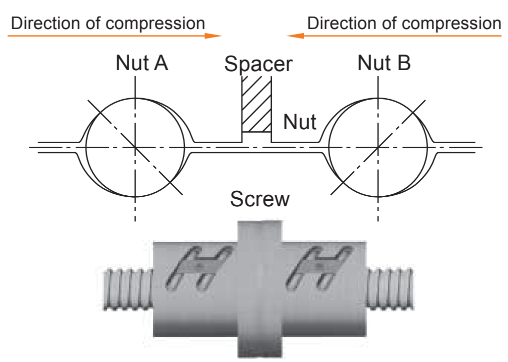


Fig.5.2 Compressive preload

b.Single-nut method:

As that illustrated on Fig. 5.3, using oversize balls onto the space between Ballnut and screw to get required preload. The balls shall make four-point contact with grooves of Ballnut and screw.

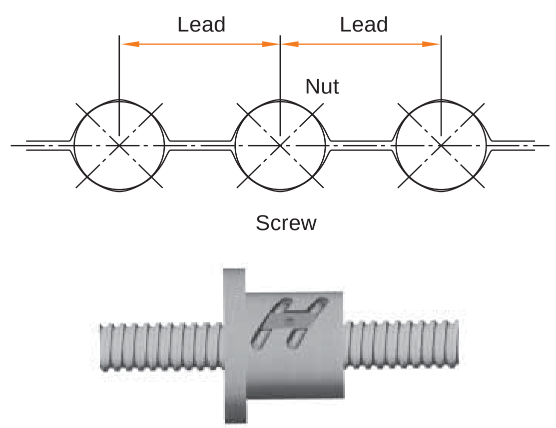


Fig.5.3 Four-point contact preload

There is another way for single nut Ballscrew preloading. That is to shift a very little distance, which complies with required magnitude of preload, on one lead of Ballnut as that illustrated on Fig. 5.4. to preload Ballscrew.

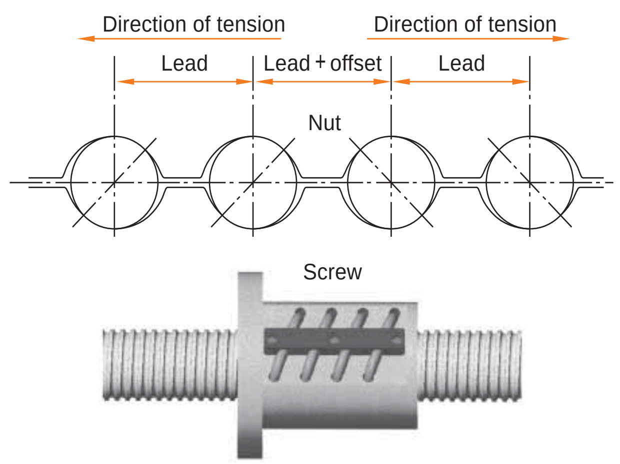


Fig.5.4 Lead offset preload

(2) **Relation between preload force and elastic deformation**

Fig 5.5, Nuts A and B are assembled with preloading spacer. The preload forces on Nut A and B are F_{ao}, but with reversed direction. The elastic deformation on both Nuts are δ_{ao}.

Then there is a external axial force F_a applied to Nut A as shown on Fig 5.6. The deformation of Nut A and B becomes:

$$\delta_A = \delta_{a0} + \delta_{a1}$$
$$\delta_B = \delta_{a0} - \delta_{a1}$$

The load in nut A and nut B are:

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

It means F_a is offset with an amount F_a' because of the deformation of Nut B decreases. As a result, the elastic deformation of Nut A is reduced. This effect shall be continued until the deformation of Nut B becomes zero, that is, until the elastic deformation δ_{a1} caused by the external axial force equals δ_{ao}, and the preload force applied to Nut B is completely released. The formula related the external axial force and elastic deformation is shown as below:

$$\delta_{a0} = K \times F_{ao}^{2/3} \text{ and } 2\delta_{a0} = K \times F_l^{2/3}$$
$$(F_l / F_{ao})^{2/3} = (2\delta_{a0} / \delta_{a0}) = 2$$
$$F_l = 2.8F_{ao} ≒ 3F_{ao}$$

Therefore, the preload amount of a ballscrew is recommended to set as 1/3 of its axial load. Too much preload for a Ballscrew shall cause temperature raise and badly affect its life. However, taking the life and efficiency into consideration, the maximum preload amount of a Ballscrew is commonly set to be 10% of its rated basic dynamic load.

Shown on Fig 5.7, with the axial load to be three times as the preload, the elastic displacement for the non-preloaded ball Nut is two times as that of the preloaded Nut.

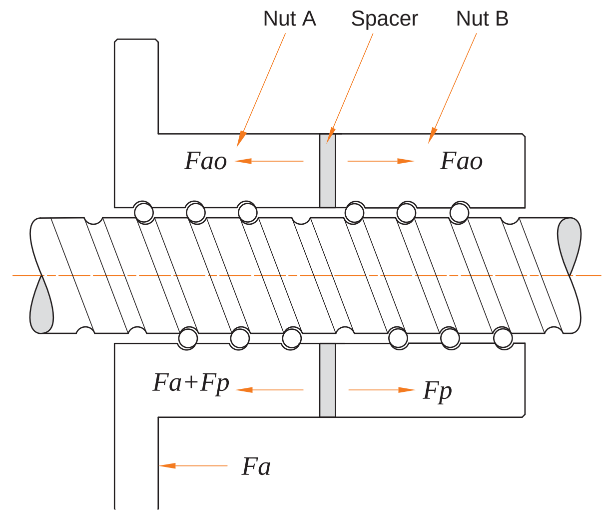


Fig.5.5 Double-nut positioning preload

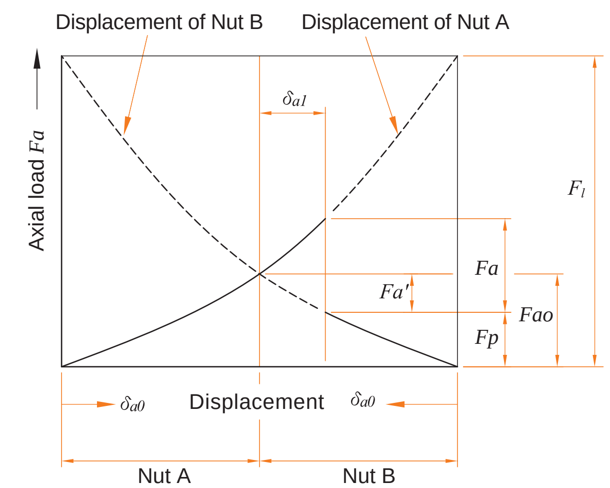


Fig.5.6 Positioning preload diagram

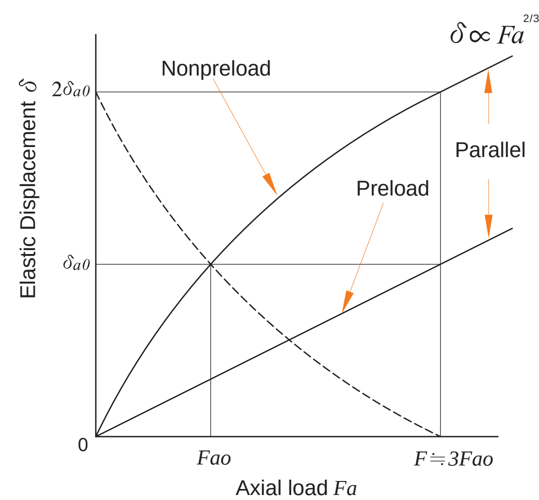


Fig.5.7 Elastic Displacement of the Ballscrew

5.2 Positioning Accuracy

5.2.1 Causes of error in positioning accuracy

Lead error and rigidity of feed system are common causes of feed accuracy error. Other causes like thermal deformation and feed system assembly are also playing important roles in feed accuracy.

5.2.2 Selecting the lead accuracy

Refer to page 10, the Specified travel line should coincide with the nominal travel line. However, in order to compensate either the elongation caused by the thermal expansion during machine operating or the shortening of length due to external load, the specified travel may be set to be positive or negative to the Nominal travel. Machine designer can show the value of Specified travel on the drawing for our manufacturing, or, we can help to decide it based on our more than ten years experience.
There is another way to compensate thermal effect by "pretension" to Ballscrew. Generally, the pretension force shall elongate the Ballscrew to be equivalent to the thermal expansion at about 2-3°C.

5.2.3 Considering thermal displacement

If the screw-shaft temperature increases during operation, the heat elongates the screw shaft, thereby reducing the positioning accuracy. Expansion and shrinkage of a screw shaft due to heat can be calculated using equation (5.10).

$$\Delta L_\theta = \rho \cdot \theta \cdot L \quad \text{.................................... (5.10)}$$

here

ΔL_θ Thermal displacement (μm)
ρ Thermal-expansion coefficient (12 $\mu m/m$°C)
θ Screw-shaft temperature change (°C)
L Ballscrew length (mm)

That is to say, an increase in the screw shaft temperature of 1**°C** expands the shaft by 12μm per meter. The higher the Ballscrew speed, the greater the heat generation. Thus, temperature increases reduce positioning accuracy. Where high accuracy is required, anti-temperature-elevation measures must be provided as follows:

(1) **To control temperature:**
- Selecting appropriate preload.
- Selecting correct and appropriate lubricant.
- Selecting larger lead for the Ballscrew and decrease the rotation speed.

(2) **Compulsory cooling:**
- Ballscrew with hollow cooling.
- Lubrication liquid or cooling air can be used to cool down external surface of Ballscrew.

(3) **To keep off effect upon temperature raise:**
- Set a negative cumulative lead target value for the Ballscrew.
- Warm up the machine to stable machine's operating temperature.
- Pretension by using on Ballscrew while installing onto the machine.
- Use the Closed-loop positioning control.

6.1 Life of the Ballscrew

Even though the Ballscrew has been used with correct manner, it shall naturally be worn out and can no longer be used for a specified period. Its life is defined by the period from starting use to ending use caused by nature fail.

a.Fatigue life - Time period for surface flaking off happened either on balls or on thread grooves.
b.Accuracy life - Time period for serious loosing of accuracy caused by wearing happened on thread groove surface, hence to make Ballscrew can no longer be used.

6.2 Fatigue Life

The basic dynamic rate load (C_a) of the Ballscrew is used to calculate its fatigue life when it is operated under a load.

6.2.1 Basic dynamic rate load Ca

The basic dynamic rate load (C_a) is the revolution of 10^6 that 90% of identical Ballscrew units in a group, when operated independently of one another under the same conditions, can achieve without developing flaking.

6.2.2 Fatigue life

(1) **Calculating life:**

There are three ways to show fatigue life:
a.Total number of revolutions
b.Total operating time.
c.Total travel.

$$L = \left(\frac{Ca}{Fa \times f_w}\right)^3 \times 10^6 \quad \text{............................ (6.1)}$$

$$L_t = \frac{L}{60 \times n} \quad \text{.................................... (6.2)}$$

$$L_s = \frac{L \times l}{10^6} \quad \text{.................................... (6.3)}$$

here

L Fatigue life (total number of revolutions)(rev)
Lt Fatigue life (total operating time)(hr)
Ls Fatigue life (total travel)(km)
Ca Basic dynamic rate load(kgf)
Fa Axial load(kgf)
n Rotation speed(rpm)
l Lead(mm)
fw Load factor (refer to Table6.1)

Table6.1 Load factor fw

Vibration and impact	Velocity (V)	fw
Light	V<15 (m/min)	1.0~1.2
Medium	15<V<60 (m/min)	1.2~1.5
Heavy	V>60 (m/min)	1.5~3.0

Too long or too short fatigue life are not suitable for Ballscrew selection. Using longer life make the Ballscrew's dimensions too large. It's an uneconomical result. Following table is a reference of the Ballscrew's fatigue life.

Machine center ....20,000 hours
Production machine...........................10,000 hours
Automatic controller..........................15,000 hours
Surveying instruments......................15,000 hours

(2)**Mean load:**

When axial load changed constantly. It is required to calculate the mean axial load (F_m) and the mean rotational speed (N_m) for fatigue life. Setting axial load (F_a) as Y-axis; rotational number ($n \cdot t$) as X-axis. Getting three kind curves or lines:

a.Gradational variation curve (Fig.6.1)

Mean load can be calculated by using equation (6.4):

$$F_m = \left(\frac{F_1^3 \cdot n_1 \cdot t_1 + F_2^3 \cdot n_2 \cdot t_2 + \cdots + F_n^3 \cdot n_n \cdot t_n}{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots + n_n \cdot t_n} \right)^{\frac{1}{3}} \cdots\cdots (6.4)$$

Mean rotational speed can be calculated by using equation (6.5):

$$N_m = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots + n_n \cdot t_n}{t_1 + t_2 + \cdots + t_n} \cdots\cdots (6.5)$$

Axial load (kgf)	Rotation speed (rpm)	Time Ratio (Sec or %)
F_1	n_1	t_1
F_2	n_2	t_2
.	.	.
.	.	.
F_n	n_n	t_n

b.Similar straight line (Fig.6.2)

When mean load variation curve like similar straight line. Mean rotational speed can be calculated using equation (6.6)

$$F_m = 1/3(F_{min} + F_{max}) \cdots\cdots (6.6)$$

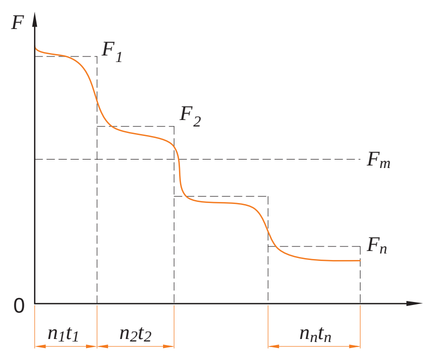


Fig. 6.1 Gradational variation curve's load

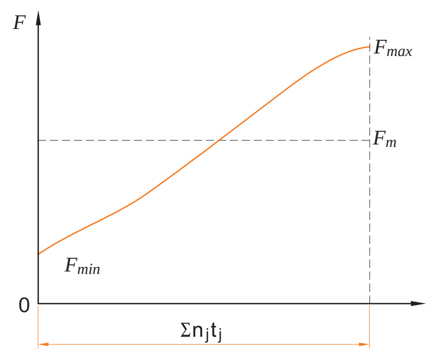


Fig. 6.2 Similar straight line's load

c.Sine curve there are two cases

1.When mean load variation curve shown as the diagram 6.3.1 below. Mean rotational speed can be calculated by using equation (6.7-1):

$$F_m = 0.65F_{max} \cdots\cdots (6.7\text{-}1)$$

2. When mean load variation curve shown as the diagram 6.3.2 below. Mean rotational speed can be calculated by using equation (6.7-2):

$$F_m = 0.75F_{max} \cdots\cdots (6.7\text{-}2)$$

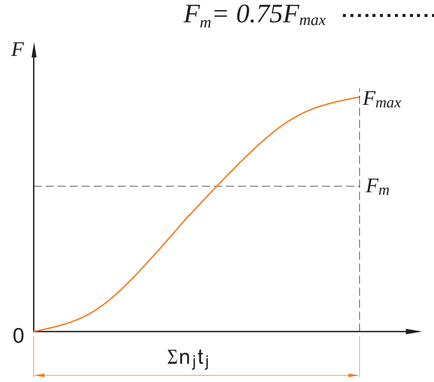


Fig. 6.3.1 Variation like Sine curve's load (1)

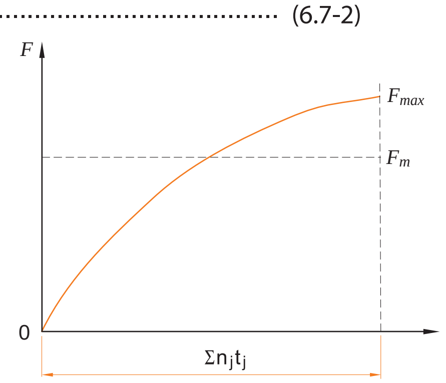


Fig. 6.3.2 Variation like Sine curve's load (2)

6.2.3 Affection of installation errors

When twist load or radial load is applied to Ballscrew, there shall be bad effect on ballscrew operation and its life, It is required to make the feed system (Ballscrew, support bearings, Guideways) to be more rigid. Hence to reduce. installation errors.

Ballscrews must be meticulously installed onto the Yoke (bracket) of machine to achieve precise pallelism and squareness along moving direction of moving parts. It is very important to ensure minimum backlash happens.

6.3 Permissible Load on Thread Grooves

Even though the Ballscrew is seldom operated and is operated under low velocity, it is required to make the maximum load to be far smaller than its rated basic static load when making selection.

6.3.1 Basic static rate load C_o

The basic static rate load is the static load with a non-varying direction and magnitude that makes the sum of the permanent deformation of the rolling elements and raceway 0.0001 times the rolling element diameter. With the Ballscrew, the basic static rate load is defined in relation to the axial load.

6.3.2 Permissible axial load

$$F_{max} = Co / fs$$

here

fs Static safety factor

General industrial machine..... ....1.2~2

Machine tool..1.5~3

6.4 Material and Hardness

Material and Hardness of *PMI* Ballscrews refer to Table 6.2

Table 6.2 Material and hardness of *PMI* Ballscrews

Denomination	Material	Heat treating	Hardness (HRC)
Precision ground	50CrMo4 QT	Induction hardening	58~62
Rolled	S55C	Induction hardening	58~62
Nut	SCM420H	Carburized hardening	58~62

6.5 Heat Treating Inspection Certificate

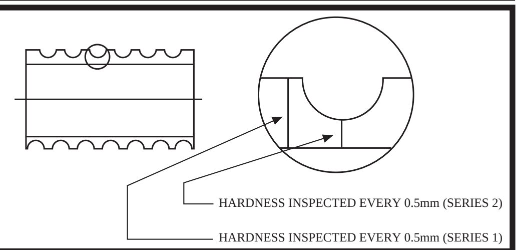
PRECISION MOTION INDUSTRIES, INC.

REPORT FOR HEAT TREATING INSPECTION

SPECIMEN#	P90227		
CUSTOMER		P.O.NUMBER	SPECIFICATION
PRODUCT	BALLSCREW	03-016030-1	R38-5IB2-FSVC-557-685.8-C4
MATERIAL	50CrMo4QT		
HEATTREAT	INDUCTION SURFACE HARDENING		

ITEM	INSPECTION DATA
HARDNESS	58 - 62 HRC AT SURFACE
CASEDEPTH	1.5 mm BELOW THREAD ROOT
MICRO-STRUCTURE	Martensite IN SURFACE AREA
	Sorbite IN CORE AREA
TEMPERING	AT 160 DEGREES CELCIUS

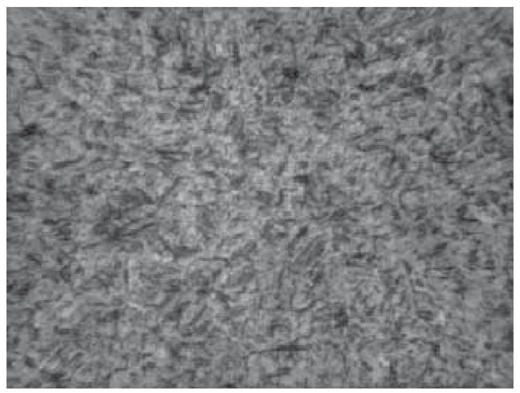
HEATTREATEDARE (SEESKETCH)

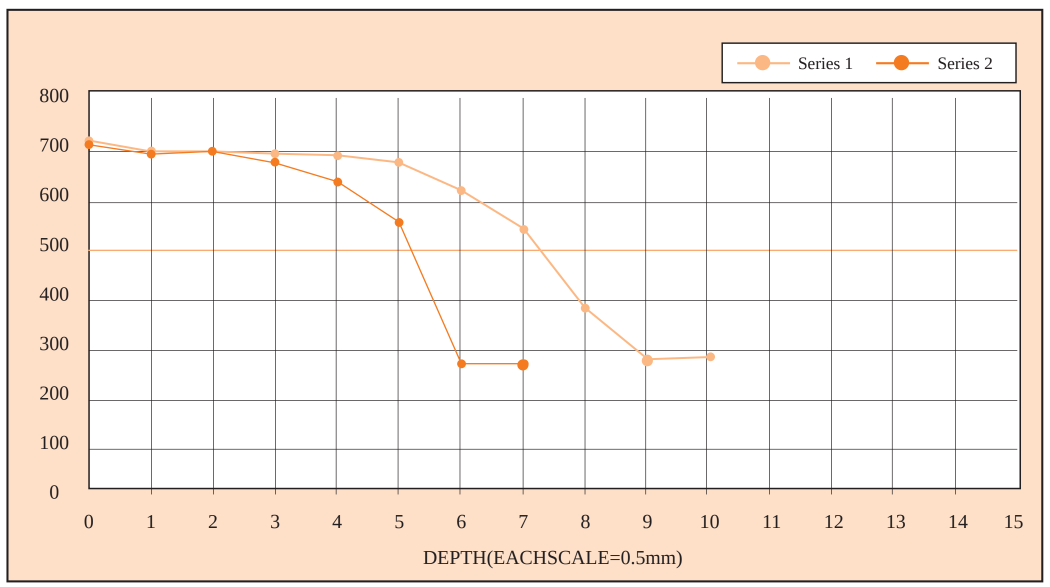


DEPTH	Series1	Series2
0	725	718
1	705	698
2	704	705
3	698	681
4	694	642
5	679	562
6	625	277
7	547	277
8	390	
9	286	
10	288	
11		
12		
13		
14		
15		

MICROSTRUCTURE

X500





HV VS. HRC	
HV	HRC
800	64.0
780	63.3
760	62.5
740	61.8
720	61.0
700	60.1
690	59.7
680	59.2
670	58.8
660	58.3
650	57.8
640	57.3
630	56.8
620	56.3
610	55.7
600	55.2
590	54.7
580	54.1
570	53.6
560	53.0
540	51.7
520	50.5
500	49.1
480	47.7
460	46.1
440	44.5
420	42.7
400	40.8
380	38.8
360	36.6
340	34.4
320	32.2
300	29.8
280	27.1
260	24.0
240	20.3

REMARKS		PASS OR NOT		Q.C.CHIEF		INSPECTOR	

6.6 Lubrication

Lithium base lubricants are used for Ballscrew lubrication.

Their viscosity are 30~140 cst (40 °C) and ISO grades of 32~100.

Selecting:

1.Low temperature application: Using the lower viscosity lubricant.

2.High temperature, high load and low speed application: Using the higher viscosity lubricant.

Table 6.3 Checking and supply interval of lubricant

Manner	Checking interval	Checking item	Supply or replacing interval
Automatic interval oil supply	every week	oil volume and purity	To supply on each check, its volume depends on oil tank capacity
Lubricating grease	Within 2-3 months after starting operation of machine	foreign matter	Normally supply once a year as per the result of check
Oil bath	everyday before operation of machine	oil surface	To supply as per wasting condition

6.7 Dustproof

Same as the rolling bearings, if there is the particles such as chips or water get into the ballscrew, the wearing problem shall be deteriorated. In some serious cases, ballscrew shall then be damaged. In order to prevent these problems from happening, there are wipers assembly at both ends of ballnut and please use the Screw cover or Bellows for better dustproof. Should there be any more information required, please contact us. There is also the "O-Ring" at the wipers to seal the lubrication oil from leaking from ballnut.

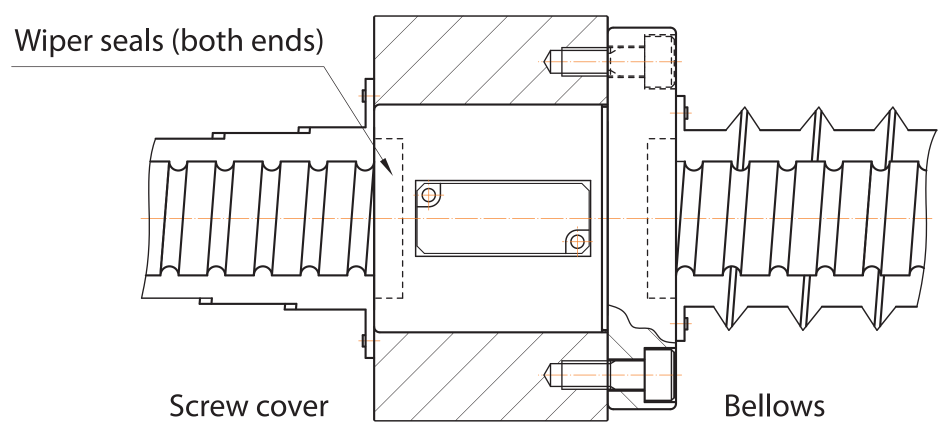


Fig. 6.4

7 Driving Torque

7.1 Operating Torque of Ballscrew

(1) Normal Drive

Rotational motion converted to linear motion is called normal drive. The torque required can be obtained by using equation (7.1)

$$T_a = \frac{Fa \times l}{2\pi \times \eta_1} \quad \cdots\cdots (7.1)$$

here

T_a Normal operation torque

F_a Axial load

l Lead

η Normal efficiency

(2) Reverse operation

Linear motion converted rotational motion is called reverse operation motion. The torque required can be obtained using equation (7.2):

$$T_b = \frac{Fa \times l \times \eta_2}{2\pi} \quad \cdots\cdots (7.2)$$

here

T_b Reverse operation torque

η_2 Reverse efficiency

(3) Preload torque

Friction torque due to preload on the Ballscrew, The torque required can be obtained by using equation (7.3):

$$T_p = k \times \frac{Fao \times l}{2\pi} \quad \cdots\cdots (7.3)$$

here

Ta Preload torque

Fao Preload

k Coefficient of preload torque see equation(2.1) $k = 0.05 \times (\tan\beta)^{-0.5}$

7.2 Drive Torque of Motor

(1) Driving torque at constant speed

The torque can counteract load and let Ballscrew to rotate uniformly is called driving torque for constant speed. Driving torque = preloading torque + friction torque for axial load + friction torque for bearing.

$$T_1 = \left(k \times \frac{Fao \cdot l}{2\pi} + \frac{Fa \cdot l}{2\pi \cdot \eta} + T_B \right) \times \frac{N_1}{N_2} \quad \cdots\cdots (7.4)$$

here

T_1 Driving torque at constant speed

Fao Preload

Fa Axial load

F Cutting resistance

μ Guiding surface friction coefficient

W Total weight (Working table weight + Working object weight)

T_B Friction torque for bearing

N_1 Gear one

N_2 Gear two

In general, driving torque of constant speed motion shall not over than 30% of rated torque of motor.

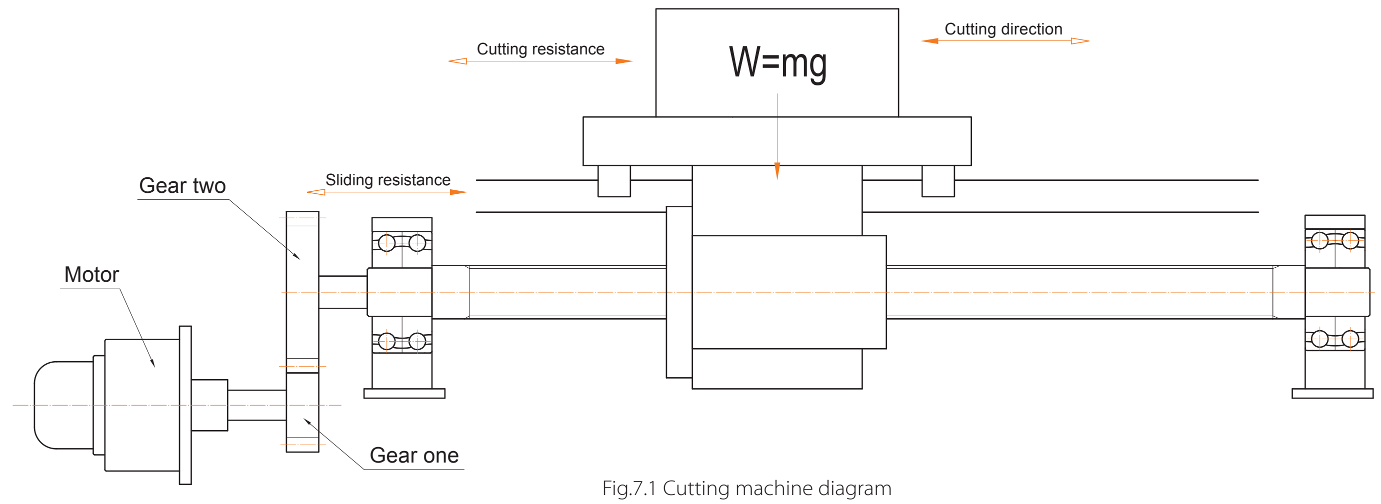


Fig.7.1 Cutting machine diagram

(2) Driving torque at constant acceleration

The torque required to counteract load and to let Ballscrew to rotate at constant acceleration is driving torque at constant acceleration.

$$T_2 = T_1 + J \cdot \dot{\omega} \quad \cdots\cdots (7.5)$$

$$J = J_M + J_{G1} + \left(\frac{N_1}{N_2} \right)^2 \times \left[J_{G2} + J_{SH} + J_w + J_C \right] \quad \cdots\cdots (7.6)$$

$$J_w = \frac{m}{g} \left(\frac{l}{2\pi} \right)^2 \quad \cdots\cdots (7.7)$$

here

T_2 Driving torque at constant acceleration

$\dot{\omega}$ Motor's angular acceleration

J Total inertial

J_M Inertial of motor

J_{G1} Inertial of gear one

J_{G2} Inertial of gear two

J_{SH} Inertial of screw shaft

J_w Inertial of moving parts (Ballscrew, Table)

J_C Inertial of Coupling

m Total Masses (Working table mass + working piece mass)

l Lead

g Gravitational acceleration

- Cylindric inertia (Ballscrew, gear)

$$J = \frac{1}{32} \rho \pi D^4 L \quad (kg \cdot m^2) \quad \cdots\cdots (7.8)$$

$$= \frac{\pi \gamma}{32 g} D^4 L \quad (kg \cdot m^2) \quad \cdots\cdots (7.9)$$

$$= \frac{m D^2}{8} \quad (kg \cdot m^2) \quad \cdots\cdots (7.10)$$

here

ρ Material Density

γ Specific Gravity

D Diameter of Cylinder

L Length of Cylinder

m Mass of Cylinder

8 Selecting Correct Type of Ballscrew

Lead Accuracy P.10

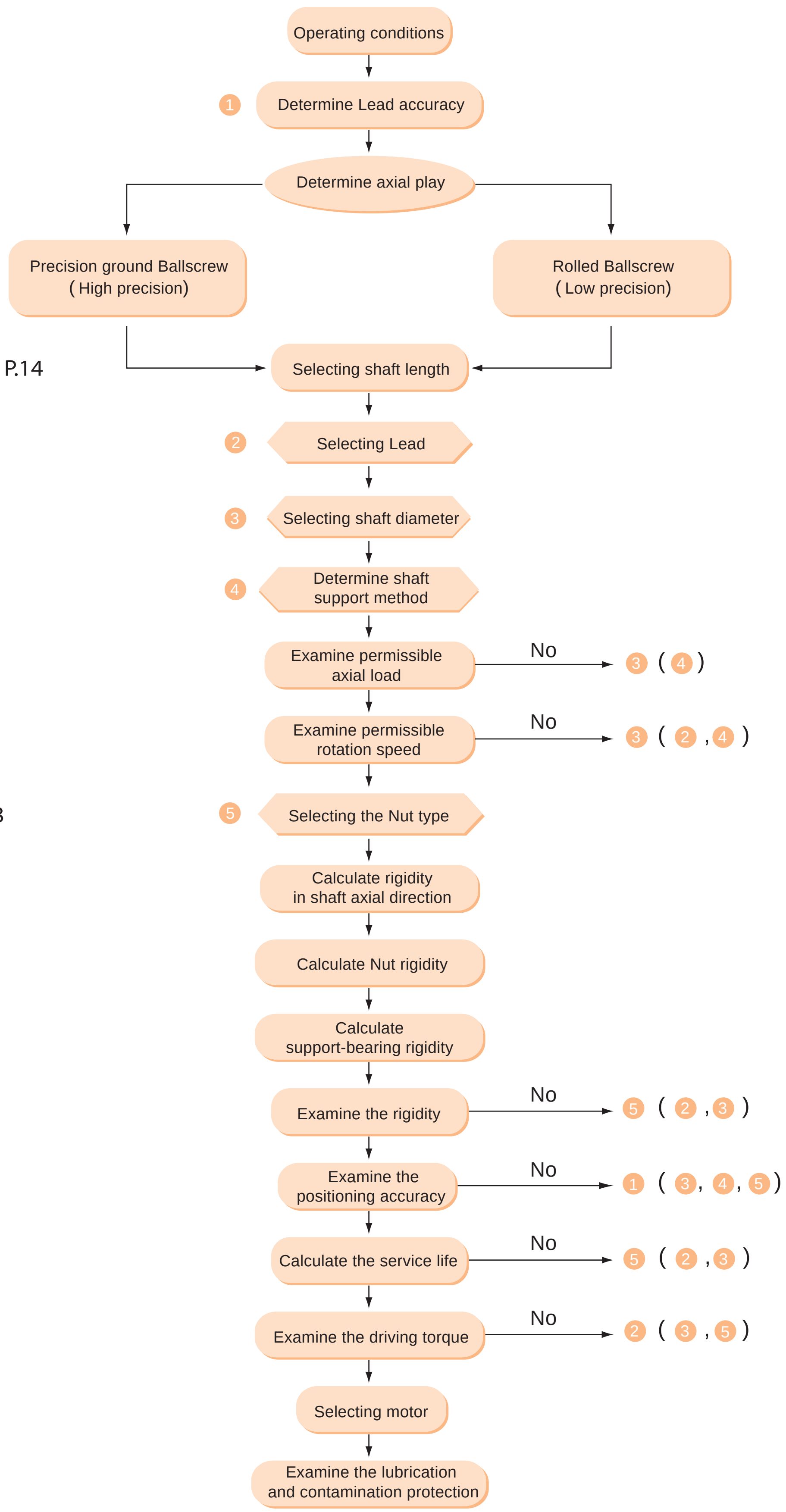
Design of Screw Shaft P.14

Design of Ball Nut P.18

Rigidity P.20

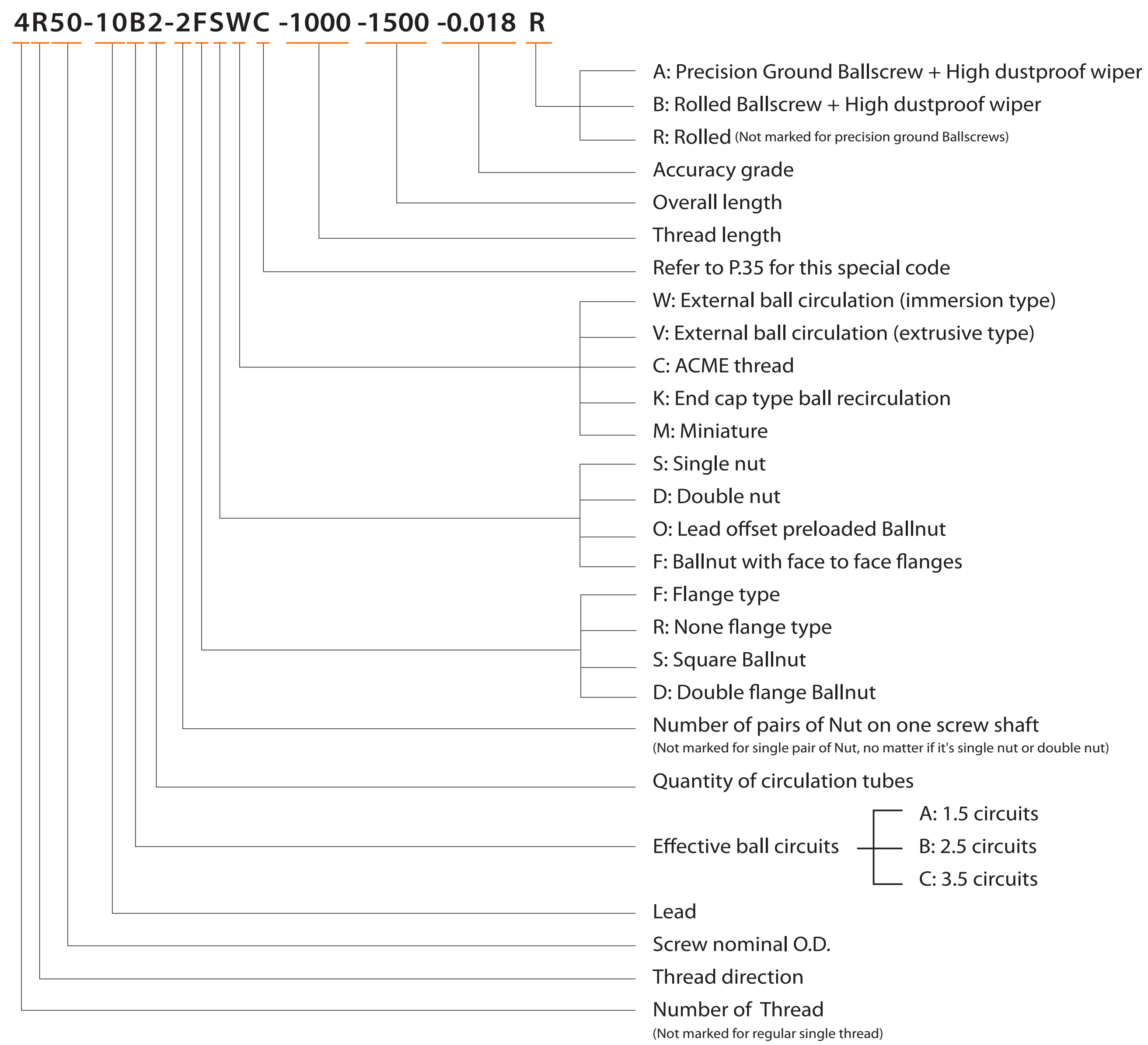
Life P.25

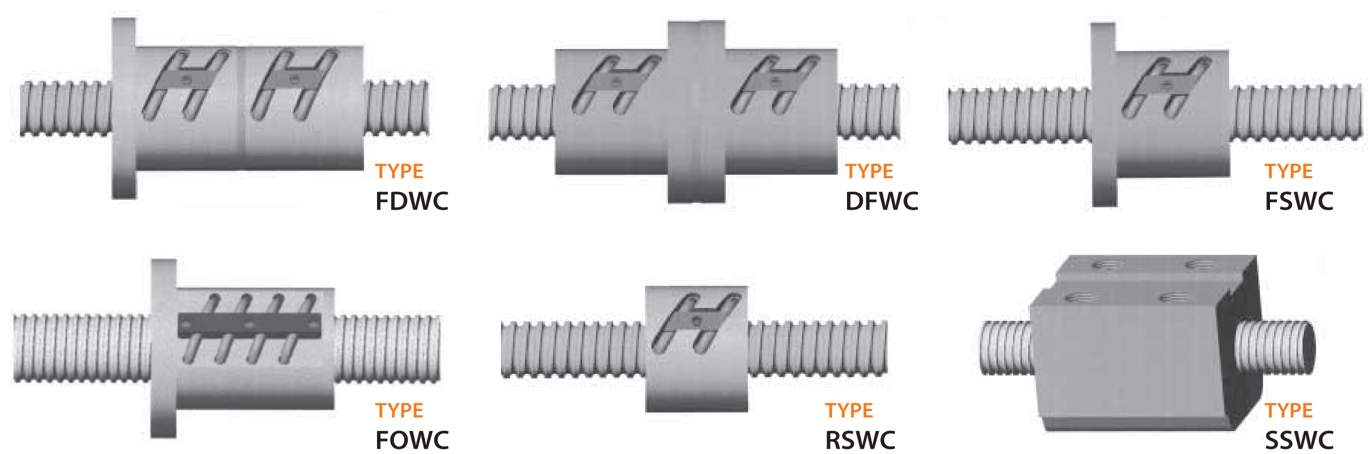
Driving Torque P.30



Nomenclature of *PMI* Ballscrew 9

9.1 Nomenclature of External Circulation Ballscrew

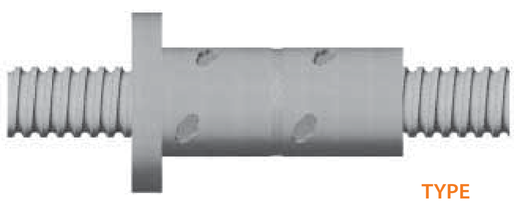




9.2 Nomenclature of Internal Circulation Ballscrew

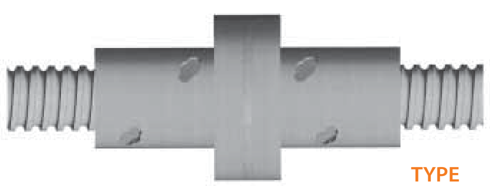
4R32 -10T 4-2FS I C -1000 -1500 -0.018 R

- A: Precision Ground Ballscrew + High dustproof wiper
- B: Rolled Ballscrew + High dustproof wiper
- R: Rolled (Not marked for precision ground Ballscrews)
- Accuracy grade
- Overall length
- Thread length
- Refer to P.35 for this special code
- I: Internal ball circulation
- D: End Deflector
- S: Single nut
- D: Double nut
- O: Lead offset preloaded Ballnut
- F: Ballnut with face to face flanges
- F: Flange type
- R: None flange type
- S: Square Ballnut
- D: Double flange Ballnut
- Number of pairs of Nut on one screw shaft (Not marked for single pair of Nut, no matter if it's single or double nut)
- Quantity of circulation deflectors (or inserts)
- T: Number of circuit = 1 circuit
- Lead
- Screw nominal O.D.
- Thread direction
- Number of Thread (Not marked for regular single thread)

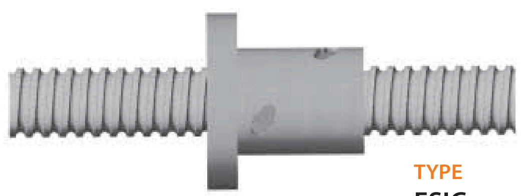


TYPE
FDIC

TYPE
RDIC



TYPE
DFIC



TYPE
FSIC

Table 9.1 Special code

C	Precision ground threads
W	Rolled threads
E	E type ball circulation tube (*PMI*'s patent)
Q	Self lubrication
B	Retainer (Located in between balls)
T	Ballnut rotation (Instead of regular screw shaft rotation type Ballscrew)
D	E type tube + Self lubrication
F	E type tube + Retainer
G	E type tube + Self lubrication + Retainer
H	Ballscrews For Heavy Load

10.1 Cutting Machine

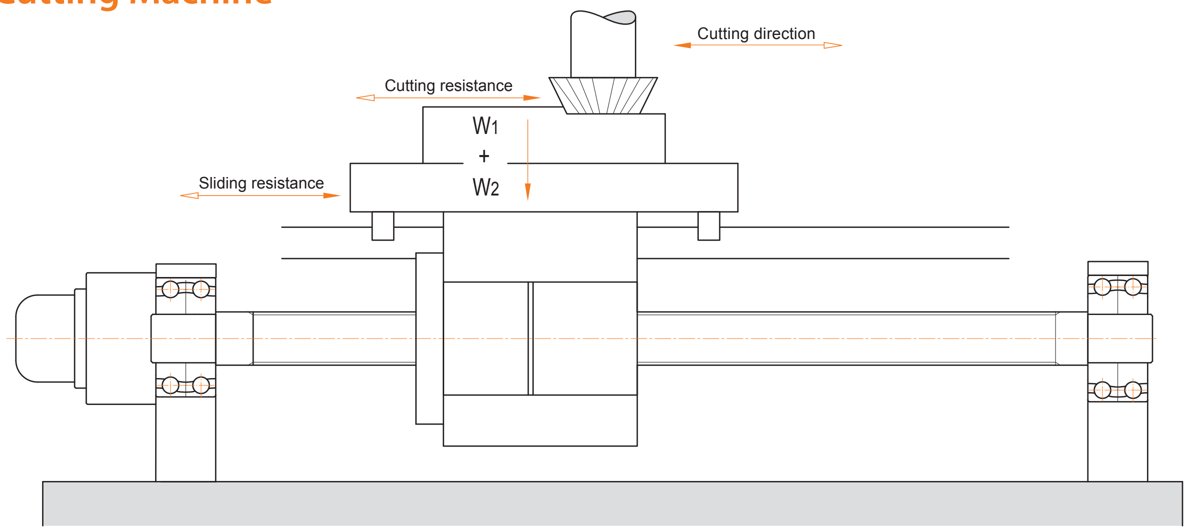


Fig.10.1 Cutting machine

1、Design Conditions

Table weight:	$W_1 = 1100\ kgf$	Driving motor:	$N_{max} = 2000\ rpm$
Work piece weight:	$W_2 = 800\ kgf$	Positioning accuracy:	±0.030/1000 mm (no load)
Max. travel:	$S_{max} = 1000\ mm$	Repeatability accuracy:	±0.005 mm (no load)
Rapid feed speed:	$V_{max} = 14\ m/min$	Lost motion:	0.02 mm (no load)
Life:	$L_t = 25000\ h$		
Sliding surface friction coefficient:	$\mu = 0.1$		

2、Mechanical Conditions

Calculation data / Kinds of Operation	Axial load (kgf)		Feed speed	Time
	Cutting resistance	Sliding resistance	mm/min	ratio(%)
Rapid feed	0	190	14000	30
Light cutting	500	190	600	55
Heavy cutting	950	190	120	15

Sliding resistance: $Fa = \mu\ (W_1 + W_2)$

$= 0.1 \times (1100 + 800)$

$= 190\ (kgf)$

3、Items to Be Decided

1. Screw nominal O.D., Lead, Type of Nut
2. Accuracy grade
3. Thermal displacement
4. Driving motor

1、Selecting Screw nominal O.D., Lead, Nut

(1) Lead(l)：

The highest rotation speed of motor

$$l \geqq \frac{V_{max}}{N_{max}} = \frac{14000}{2000} = 7\ (mm)$$

◎Lead have to be 7mm or more.

(As per *PMI* catalog: select 8 and 10 mm for further analysis)

(2) Basic dynamic rate load (Ca)

Calculation data / Kinds of Operation	Axial load	Feed speed		Time
		$l = 8$	$l = 10$	ratio(%)
Rapid feed	$F_1 = 190$	$N_1 = 1750$	$N_1 = 1400$	$t_1 = 30$
Light cutting	$F_2 = 690$	$N_2 = 75$	$N_2 = 60$	$t_2 = 55$
Heavy cutting	$F_3 = 1140$	$N_3 = 15$	$N_3 = 12$	$t_3 = 15$

Calculation of mean load and mean rotation

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

Mean rotation $$N_m = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots + n_n \cdot t_n}{t_1 + t_2 + \cdots + t_n}$$

Lead l (mm)	8	10
Mean load F_m (kgf)	330	330
Mean rotation N_m (rpm)	569	455

Calculation of basic dynamic rate load

$$L = \left(\frac{Ca}{Fa \times f_w} \right)^3 \times 10^6 \qquad L_t = \frac{L}{60 N_m}$$

$$\Rightarrow Ca = (60 N_m \times L_t)^{1/3} \times F_m \times f_w \times 10^{-2}$$

As per design Conditions:

$L_t = 25000\ (hours)$

$f_w = 1.2$

When l=8(mm) ....$Ca \geqq 3756\ (kgf)$
If life > 25000 $(hours)$ is needed,
Ca must be > 3756 (kgf)
When l=10(mm) ....$Ca \geqq 3487\ (kgf)$
If life > 25000 $(hours)$ is needed,
Ca must be > 3487 (kgf)

(3) Selecting the type of nut

In case stiffness is a major concern, lost motion becomes less important, following specifications are to be selected:

- External circulation Ballscrew
- Type: FDWC
- Number of circuit: B×2 or B×3

The value of Ca can be found as per this catalog:

(kgf)

Screw nominal O.D.(mm)	lead 8 (mm)		lead 10 (mm)	
	B×2	B×3	B×2	B×3
32	3210		4660	
36	3265		4930	
40	3410		5220	
45	3650	5175	5480	7760
50	3900	5520	5790	8200

(4) Selecting screw shaft diameter

Ballscrew shaft diameter can be decided by critical rotation speed of high speed feed.
Assume both of the supporting ends are fixed.
So the permissible rotational speed :

$$n = \alpha \times \frac{60\lambda^2}{2\pi L^2} \sqrt{\frac{EIg}{\gamma A}} = f \frac{dr}{L^2} \times 10^7$$

$$\Rightarrow dr \geqq \frac{n \times L^2}{f} \times 10^{-7}$$

L = Max. stroke + Nut length/2 + unthread area length
= 1000 + 100 + 200 = 1300 (mm)
Screw shaft supported method is fixed-fixed
⇒ $f = 21.9$

when l =8 (mm) ....$dr \geqq 13.5\ (mm)$
If the highest rotational speed reaches 1750 rpm,
screw shaft diameter at thread root area must be bigger than 14 mm.
◎So screw shaft diameter shall be ranged in between 20 and 50 mm.
When l =10 (mm) .... $dr \geqq 10.8\ (mm)$
If the highest rotational speed reaches 1400 rpm,
screw shaft diameter at thread root area must be bigger than 11 mm.
◎So screw shaft diameter shall be ranged in between 16 and 50 mm.

(5) Considering rigidity

By initial conditions:
Lost motion：0.02 mm (no load)
Assume total displacement of components (including screw shaft, ballnut and support bearing) of feed system is 0.016 mm.
Thus the unilateral elastic displacement of feed system is

$$\Delta L \leqq 8\ (\mu m)$$

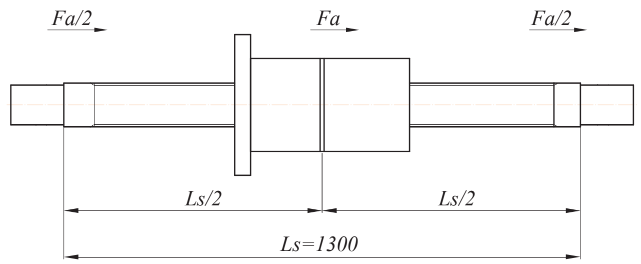
a.Axial rigidity of the screw shaft: Ks

Elastic displacement of the screw shaft: ΔL_S

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

The smallest elastic displacement is in the middle of screw shaft.

From following diagram Using $x=L/2$



$$\Rightarrow K_S = \frac{\pi \times dr^2 \times E}{Ls} \times 10^{3}$$

$$\Delta L_S = \frac{Fa}{K_S} = \frac{Fa \times L_S}{\pi \times dr^2 \times E} \times 10^{3}$$

Here Fa is sliding resistance of 190 (kgf)

The results are in the table 10.2.

b.Axial rigidity of the nut: K_n

Elastic displacement of the nut: ΔL_n

Setting the preload to be 1/3 of maximum axial load.

$$Fao = F_{max}/3 = 1140/3 = 380\ (kgf)$$

$$K_n = 0.8 \times K \left(\frac{Fao}{\varepsilon \times Ca}\right)^{1/3}$$

$\varepsilon = 0.1$, then

$$\Delta L_n = \frac{Fa}{K_n}$$

The results are in the table 10.2.

Table10.2

Nut model no.	dr	Ca	K	Screw		Nut		Total
				K_s	ΔL_s	K_n	ΔL_n	ΔL
32-FDWC-10B2	27.05	4660	125	37.1	5.1	93.0	2.0	7.1
36-FDWC-10B2	31.05	4930	138	48.9	3.9	101.2	1.9	5.8
40-FDWC-10B2	35.05	5220	151	62.3	3.0	108.7	1.7	4.7
45-FDWC-10B2	38.05	5480	167	73.5	2.6	118.3	1.6	4.2
50-FDWC-10B2	42.05	5790	182	89.7	2.1	126.5	1.5	3.6

◎ With the condition of $\Delta L \leqq 8\ (\mu m)$

Make following selection by ignoring the bearing rigidity, economical and safety consideration:

Type of Ballscrew：40-FDWC-10B2
Screw shaft diameter：40 (mm)
Lead：10 (mm)

(6)Length of Ballscrew

L = Max. travel + Nut length + Unthreaded area length (including journal ends length)

= 1000+180+100

= 1280

1300 (mm)

(7) Preliminary check

a. Fatigue life

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

$$= \left(\frac{4700}{330 \times 1.2}\right)^3 \times 10^6 \times \frac{1}{60 \times 455}$$

≒61000 $(hours)$ >25000 $(hours)$

b. Permissible rotational speed

$$n = f \times \frac{dr}{L^2} \times 10^7$$

= 4540 (rpm)

Critical speed of screw shaft is 4540(rpm). It is much bigger than the maximum rotational speed of design. So the Ballscrew selected is safe.

2、Swlwcting lead accuracy

Positioning accuracy required: ±0.030/1000 mm (Max. travel) Refer to table 2.2, accumulated reference lead deviation (±E) and total relative variation (e)

Accuracy grades: C4
E = ±0.025/1250 (mm)
e = 0.018 (mm)

3、Considering thermal displacement

According to the load capability of support bearings, make the specified travel (T) compensation to be 3°C

1. Thermal displacement: ΔL_θ

$$\Delta L_\theta = \rho \cdot \theta \cdot L$$
$$= 12.0 \times 10^{-6} \times 3 \times 1300$$
$$= 0.047\ (mm)$$

2. Pretension force: F_θ

$$F_\theta = \Delta L_\theta \times K_S = \frac{\Delta L_\theta \cdot E \cdot \pi dr^2}{4L}$$
$$= \frac{0.047 \times 2.1 \times 10^4 \times \pi \times 27.05^2}{4 \times 1300}$$
$$= 436\ (kgf)$$

Specified Travel (T): -0.047/1300
Pretension force: 436 (kgf)
Stretching: -0.047 (mm)

4、Selecting driving motor

<Required specifications>

1. The highest rotation speeds is 1500 (rpm)
2. Time required to reach highest rotational speed is within 0.15 $sec.$

(1)Inertial

a.Screw shaft:

$$GD_S^2 = \frac{\pi\rho}{8} \times D^4 \times L$$
$$= \frac{\pi \times 7.8 \times 10^{-3}}{8} \times 4^4 \times 130$$
$$= 101.9\ (kgf \cdot cm^2)$$

b.Moving parts:

$$GD_w^2 = W\left(\frac{l}{\pi}\right)^2$$
$$= (1100+800) \times \left(\frac{1.0}{\pi}\right)^2$$
$$= 192.5\ (kgf \cdot cm^2)$$

c.Coupling:

$$GD_J^2 = 40\ (kgf \cdot cm^2)$$

d.Total of inertial:

$$GD_L^2 = GD_S^2 + GD_w^2 + GD_J^2$$
$$= 334.4\ (kgf \cdot cm^2)$$

(2)Driving torque

In this case, the time sharing of machine working at acceleration condition is limited. Assuming the machine works at constant speed, the torque caused by angular acceleration is then neglected.

a. Preloading torque

$$T_P = k \times \frac{Fao \times l}{2\pi} \qquad k = 0.3,\ Fao = F_{max}/3$$
$$= 0.3 \times \frac{380 \times 1.0}{2\pi}$$
$$= 18.1\ (kgf \cdot cm)$$

b. Friction torque

Rapid feed:

$$T_a = \frac{Fa \times l}{2\pi \times \eta}$$
$$= \frac{190 \times 1.0}{2\pi \times 0.9}$$
$$= 33.6\ (kgf \cdot cm)$$

Light cutting:

$$T_b = \frac{690 \times 1.0}{2\pi \times 0.9}$$
$$= 122.1\ (kgf \cdot cm)$$

Heavy cutting:

$$T_c = \frac{1140 \times 1.0}{2\pi \times 0.9}$$
$$= 201.7\ (kgf \cdot cm)$$

The maximum required driving torque is preloading torque plus friction torque of heavy cutting.

$$T_L = T_p + T_c$$
$$= 219.8\ (kgf \cdot cm)$$

(3) Selecting driving motor

<Selecting conditions>

a.The highest rotation speed: $N_{max} \geqq 1500\ (rpm)$

b.Rated torque: $T_M > T_L$

c.Rotor inertia: $J_M \geqq J_L / 3$

The specifications required for driving motor are then decided as per above conditions.

◎Motor specifications:

Output	W_M=3.6 (kW)
Highest rotation speeds	N_{max}=1500 (rpm)
Rated torque	T_M=22.6 $(N.m)$
Rotor inertia	GD^2_M=750 $(kgf.cm^2)$

(4) Check required time period for reaching highest rotation speed

$$t_a = \frac{J}{T'_M - T_L} \times \frac{2\pi N}{60} \times f$$

Here

J : Total inertia

$T'_M = 2 \times T_M$

T_L : Rotation Torque (rapid)

f : Safe factor (choose 1.4 for this case)

$$t_a = \frac{(274.3+750)}{4 \times 980 \times (2 \times 230 - (18.1+33.6))} \times \frac{2\pi \times 1400}{60} \times 1.4$$

$$= 0.13\ (sec) < 0.15\ (sec)$$

This above motor specifications match design needs.

5、Calculating the stress of the Ballscrew

$$\sigma = \frac{F}{A} = \frac{F_{max}}{\pi dr^2/4}$$

$$= \frac{1140 \times 9.8 \times 4}{\pi \times 35.05^2}$$

$$= 11.56\ N/mm^2$$

$$= 1.16 \times 10^7\ N/m^2$$

(dr is screw shaft thread root diameter)

$dr = 40 + 1.4 - 6.35 = 35.05\ (mm)$

$$\tau = \frac{T \times r}{J}$$

$$= \frac{21540 \times 20}{148167}$$

$$= 2.91\ N/mm^2$$

$$= 2.91 \times 10^6\ N/m^2$$

$T_{max} = T_L = 219.8 (kgf \cdot cm) = 21540\ (N \cdot mm)$

$J = \frac{\pi dr^4}{32} = \frac{\pi (35.05^4)}{32} = 148167\ (mm^4)$

$$\sigma_{max} = \sqrt{\sigma^2 + \tau^2}$$

$$= 11.9 \times 10^6\ N/m^2$$

50CrMo4 steel tension strength is $1.1 \times 10^8\ N/m^2 > \sigma_{max}$

Yield strength is $0.9 \times 10^8\ N/m^2 > \sigma_{max}$

◎So the Ballscrew selected is safe.

6、Calculating the buckling load of the screw shaft

$$P = \alpha \frac{\pi^2 nEI}{L^2} = m \frac{dr^4}{L^2} \times 10^3$$

$$= 20.3 \times \frac{35.05^4}{1100^2} \times 10^3$$

$$= 25300\ (kgf) > F_{max}\ (1140\ kgf)$$

◎So the Ballscrew selected is safe.

10.2 High Speed Porterage Apparatus (Horizontal application)

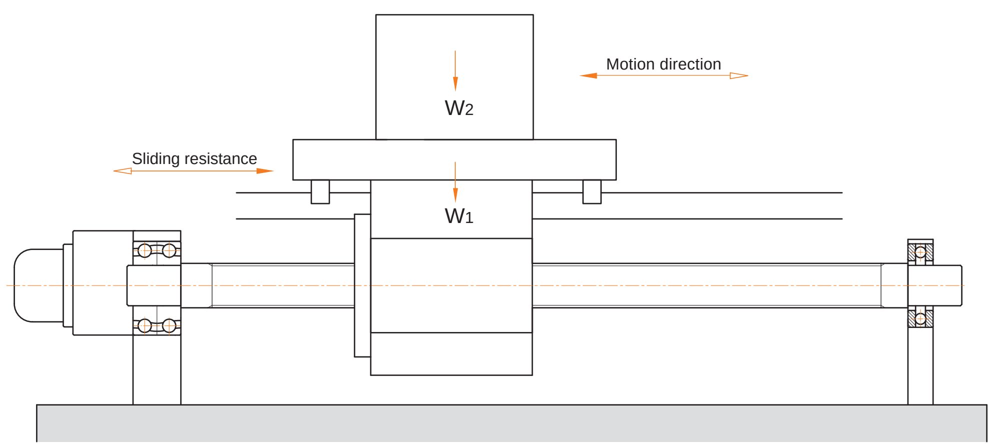


Fig.10.3 High speed porterage apparatus

1、Design Conditions:

Table weight:	W_1 = 50 kgf
Work piece weight:	W_2 = 25 kgf
Max. travel:	S_{max} = 1000 mm
Rapid feed speed:	V_{max} = 50 m/min
Life:	L_t = 25000 $hours$
Guiding surface friction coefficient:	μ = 0.01
Driving motor:	N_{max} = 3000 rpm
Positioning Accuracy:	±0.10/at max. travel
Repeatability Accuracy:	±0.01 mm

2、Motion Conditions:

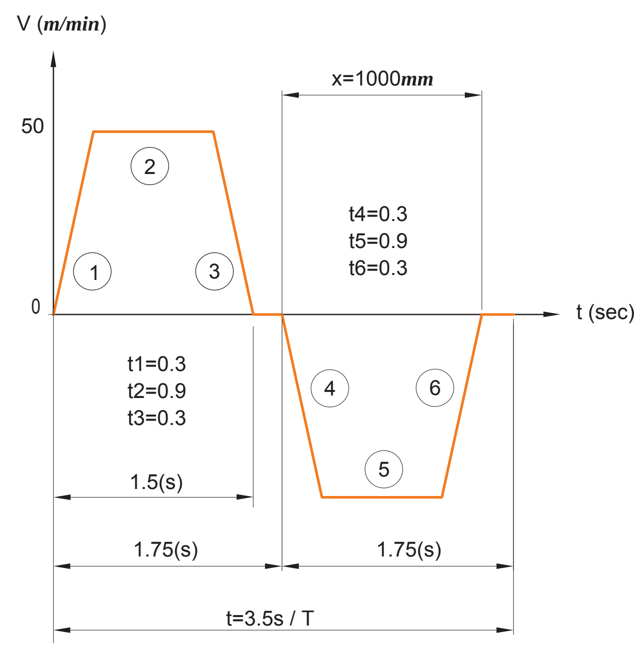


Fig.10.4 Porterage apparatus v-t diagram

3、Items to Be Decided

1. Screw nominal O.D., Lead
2. Accuracy grade
3. Type of nut
4. Driving motor

1、Selecting Screw nominal O.D., Lead

(1) Lead (l)

The highest rotation speed of motor

$$l \geqq \frac{V_{max}}{N_{max}} = \frac{50000}{3000} = 17\ (mm)$$

◎Lead have to be $18\ mm$ or more.

(As per PMI catalog : select 20 mm for further analysis)

If lead is 20 mm, the highest rapid feed speed 50 m/min shall be reached as long as the motor rotates at 2500 rpm.

(2) Initial selection of screw shaft length

L= Max. travel + Nut length + Unthreaded area length

= 1000 + 100 + 100 = 1200 (mm)

(3) Selecting screw shaft diameter

Ballscrew shaft diameter can be decided by critical rotation speed of high speed feed.

Assume the supporting ends are fixed-supported.

So the permissible rotational speed :

$$n = \alpha \times \frac{60\lambda^2}{2\pi L^2} \sqrt{\frac{EIg}{\gamma A}} = f \frac{dr}{L^2} \times 10^7$$

$$\Rightarrow dr \geqq \frac{n \times L^2}{f} \times 10^{-7}$$

L = Max. travel + Nut length/2 + Unthread area length

= 1000 + 50 + 100 = 1150 (mm)

Screw shaft support method is fixed-supported

f = 15.1

$dr \geqq 21.9\ (mm)$

If the high rotational speed is 2500 rpm,

Diameter at thread root area must be bigger than 22 mm.

◎So Screw-shaft diameter shall be ranged in between 25 and 36 mm

(4) Considering service life

First to analyze Fig.10.4 (V-t diagram)

The speed line is a straight one, hence it is a constant acceleration, periodically reciprocating motion.

Maximum velocity : V_{max} = 50 (m/min) = 0.83 (m/s)

Acceleration time : t_1 = 0.3 (s)

Deceleration time : t_3 = 0.3 (s)

a.Running distance during acceleration

$$x_1 = \left(\frac{V_0 + V}{2}\right) \times t = \left(\frac{0+0.83}{2}\right) \times 0.3 = 0.125\ (m) = 125\ (mm)$$

b. Running distance during constant speed

$$x_3 = \left(\frac{V_0 + V}{2}\right) \times t = \left(\frac{0.83+0}{2}\right) \times 0.3 = 0.125\ (m) = 125\ (mm)$$

d. The line segment ①

$$a_1 = \frac{V_{max}}{t_1} = \frac{0.833}{0.3} = 2.8\ (m/s^2)$$

$$F_1 = \mu\ (W_1 + W_2) \times g + (W_1 + W_2) \times a_1$$

$$= 0.01 \times (50+25) \times 9.8 + (50+25) \times 2.8$$

$$= 217\ (N)$$

$$N_1 = n_{max} / 2 = 2500 / 2 = 1250\ (rpm)$$

e. The line segment ②

$F_2 = f = \mu(W_1+W_2)\times g$
$= 0.01\times(50+25)\times 9.8$
$= 7.35\ (N)$
$N_2 = 2500\ (rpm)$

f. The line segment ③

$F_3 = \mu(W_1+W_2)\times g + (W_1+W_2)\times a_3$
$= 0.01\times(50+25)\times 9.8+(50+25)\times(-2.8)$
$= -203\ (N)$
$N_3 = n_{max}/2 = 2500/2 = 1250\ (rpm)$

Whence the relationship between the applied axial load, running distance, time and mean rotation can be as follows:

Motion	Axial load	Running distance	Time	Mean rotation
Acceleration forward	217	125	0.3	1250
Constant speed forward	7.35	750	0.9	2500
Deceleration forward	-203	125	0.3	1250
Acceleration returning	-217	125	0.3	1250
Constant speed returning	-7.35	750	0.9	2500
Deceleration returning	203	125	0.3	1250

g. Calculation of mean load and mean rotation:

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

$$= \left(\frac{217^3\times1250\times0.6+7.35^3\times2500\times1.8+203^3\times1250\times0.6}{1250\times0.6+2500\times1.8+1250\times0.6}\right)^{\frac{1}{3}}$$

$= 132.4\ (N)$

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

$$= \frac{1250\times0.6+2500\times1.8+1250\times0.6}{3.5}$$

$= 1714\ (rpm)$

h. Calculation of life

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

$$= \left(\frac{1170\times9.8}{132.4\times2.5}\right)^3 \times \frac{1}{60\times1714}\times 10^6$$

$= 404000\ (hours) \geqq 25000\ (hours)$

◎Above conforms design requirements.

2、Selecting accuracy grade

Positioning accuracy of ±0.1/1000 mm (Max. travel)
From P.11

Accuracy grade: C5
E = ±0.040/1000
e = 0.027

3、Selecting Ballscrew type

Considering operation conditions, effective turns of A1 is selected.
Selecting following type:
R25-20A1-FSWE-1000-1160-0.018
Screw-shaft support method is fixed-supported

4、Selecting driving motor

<Required specifications>

1.The highest rotation speed of 3000 (rpm)

2.Time required to reach highest rotational speed is within 0.30 sec

(1) Inertial

a. Screw shaft:

$$J_{SH} = \frac{\pi\rho}{32g}\times D^4\times L$$

$$= \frac{\pi\times7.8\times10^{-3}}{32\times980}\times 2.5^4\times 120$$

$= 0.0037\ (kgf\cdot cm\cdot sec^2)$

b. Moving parts:

$$J_w = \frac{W}{g}\left(\frac{l}{2\pi}\right)^2$$

$$= \frac{25+50}{980}\times\left(\frac{2}{2\pi}\right)^2$$

$= 0.0078\ (kgf\cdot cm\cdot sec^2)$

c. Coupling:

$J_C = 0.0005\ (kgf\cdot cm\cdot sec^2)$

d. Total of Inertial:

$J_L = J_{sh} + J_w + J_C$
$= 0.012\ \ (kgf\cdot cm\cdot sec^2)$

(2) Driving torque

a. During constant speed:

$$T_1 = \frac{F_2\times l}{2\times\eta} = \frac{7.35\times2}{2\times0.9} \qquad \eta = 0.9$$

$= 2.6 \fallingdotseq 3.00\ (N\cdot cm)$

b. During acceleration

$T_2 = T_1 + J\dot{w}$

$$= T_1 + (J_L + J_M)\times\frac{2\pi n}{60t_1} \qquad \left[J_M = 0.01\ (kgf\cdot cm\cdot sec^2)\right]$$

$$= 3+(0.009+0.01)\times9.8\times\left(\frac{2\pi\times2500}{60\times0.3}\right)$$

$= 166\ (N\cdot cm)$

c. During deceleration

$T_3 = T_1 - Jw$

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

$$= 3-(0.009+0.01)\times9.8\times\left(\frac{2\pi\times2500}{60\times0.3}\right)$$

$= -160\ (N\cdot cm)$

(3) Selecting driving motor

<Selecting conditions>

1. The highest rotation speed: $N_{max} \geqq 3000\ (rpm)$
2. Rated torque -------$T_M > T_L$
3. Rotor inertia -------$J_M \geqq J_L/3$

The specifications required for driving motor are then decided as per above conditions.

◎Motor specifications:

Output	$W_M = 400\ (kW)$
Highest rotation speeds	$N_{max} = 3000\ (rpm)$
Rated torque	$T_M = 1.27\ (N.m)$
Rotor inertia	$J_M = 0.01\ (kgf.cm.sec^2)$

(4) Effective torque:

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

$$= \sqrt{\frac{166^2\times0.6+3^2\times1.8+160^2\times0.6}{3.5}}$$

$= 95\ (N\cdot cm) < 127\ (N\cdot cm)$

◎ It conforms to design requirements.

(5) Time required to reach highest rotational speed.

$$t_a = \frac{J}{T_M' - T_L}\times\frac{2\pi n}{60}\times f$$

Here:

J : Total inertia
$T_M' = 2\times T_M$
T_L : Rotation Torque (rapid)
f : Safe factor (choose 1.4 for this case)

$$t_a = \frac{0.009+0.01}{2\times127\times3}\times 9.8\times\frac{2\pi\times2500}{60}\times 1.4$$

$= 0.27\ (s) < 0.3\ (s)$

◎It conforms to design requirements.

5、Calculating the stress of the Ballscrew

$$\sigma = \frac{F}{A} = \frac{F_{max}}{\pi dr^2/4}$$

$$= \frac{217\times4}{\pi\times22.425^2}$$

$= 0.61\ N/mm^2$
$= 6.1\times10^5\ N/m^2$

$dr = 25+1-4.762 = 21.238\ (mm)$
(dr is screw shaft thread minor diameter)

$$\tau = \frac{T\times r}{J}$$

$T_{max} = T_L = 166\ (N\cdot cm) = 1660\ (N\cdot mm)$

$$J = \frac{\pi dr^4}{32} = \frac{\pi(22.425^4)}{32} = 24827\ (mm^4)$$

$$= \frac{1660\times12.5}{24827}$$

$= 0.84\ N/mm^2$
$= 8.4\times10^5\ N/m^2$

$\sigma_{max} = \sqrt{\sigma^2+\tau^2}$
$= 0.10\times10^8\ N/m^2$

50CrMo4 steel tension strength is $1.5\times10^8\ N/m^2$
Yield strength is $0\ 9\times10^8\ N/m^2$

◎So the Ballscrew selected is safe.

6、Calculating the buckling load of the screw shaft

$$P = \alpha\frac{\pi^2 nEI}{L^2} = m\frac{dr^4}{L^2}\times10^3$$

$$= 10.2\times\frac{22.425^4}{1160^2}\times10^3$$

$= 1917\ (kgf) > F_{max}(22.14\ kgf)$

◎So the Ballscrew selected is safe.

10.3 Vertical Porterage Apparatus

1、 Design Conditions:

Table weight:	W_1 = 300 *kgf*
Work piece weight:	W_2 = 50 *kgf*
Max. travel:	S_{max} = 1500 *mm*
Rapid feed speed:	V_{max} = 15×10³ *mm/min*
Life:	*Lt* = 20000 *hours*
Guiding surface friction coefficient:	μ= 0.01
Driving motor:	N_{max} = 1500 *rpm*
Positioning accuracy:	±0.8/1500 *mm*
Repeatability accuracy:	±0.3 *mm*

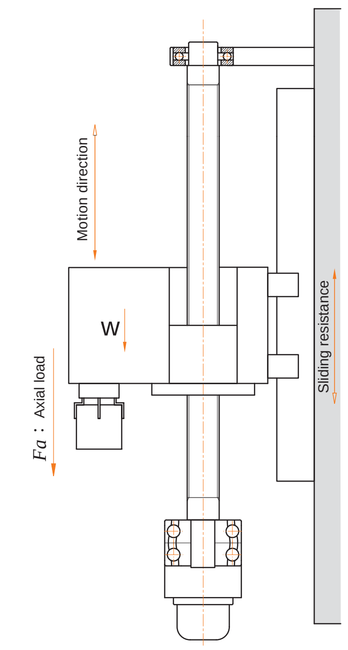


Fig.10.5 Vertical porterage apparatus

2、 Motion Conditions:

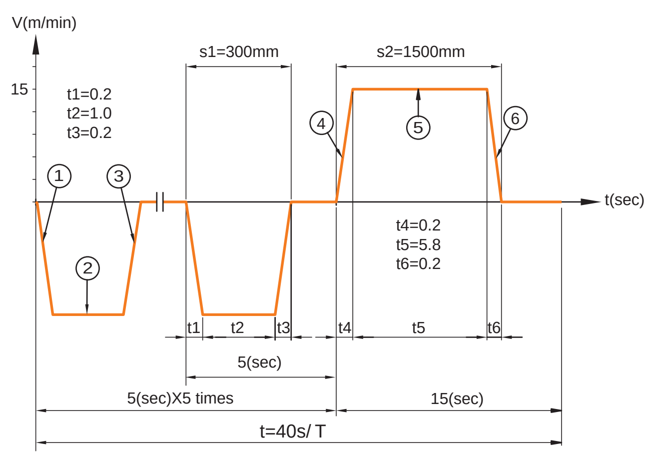


Fig.10.6 Porterage apparatus' v-t diagram

3、 Items to be Decided:

1. Accuracy grade
2. Screw nominal O.D., Lead
3. Driving motor

1、 Selecting accuracy grades

As per design condition: positioning accuracy required: 0.8/1500 *mm*

$$\frac{\pm 0.8}{1500} = \frac{\pm 0.16}{300}$$

Refer to table 2.2, accumulated reference lead deviation (±E) and total relative variation (e)

Accuracy grades C7
E=±0.05/300 *mm*
◎So the porterage apparatus can use Rolled Ballscrew.

2、 Selecting screw nominal O.D., Lead

(1) Lead (l) :

The highest rotation speed of motor

$$l \geqq \frac{V_{max}}{N_{max}} = \frac{15000}{1500} = 10\ (mm)$$

◎ Lead have to be 10 *mm* or more.

(As per ***PMI*** catalog : select 10 *mm* for further analysis)

(2) Permissible axial load

Setting up is positive.

a.Force during acceleration (downward) ①

$$a_1 = \frac{V_{max}}{t_1} = \frac{15000}{60\times0.2} = 1250\ (mm/s^2) = 1.25\ (m/s^2)$$

$$f = \mu\ (W_1+W_2)\times g = 0.01(300+500)\times9.8 \quad \text{(Friction)}$$

$$= 35\ (N)$$

$$F=ma \rightarrow F_1=(W_1+W_2)\times g-f-(W_1+W_2)\times a_1$$

$$= 2958\ (N)$$

b. Force during constant speed (downward) ②

$$F=0 \rightarrow F_2=(W_1+W_2)\times g-f$$

$$= 3395\ (N)$$

c. Force during deceleration (downward) ③

$$F=ma \rightarrow F_3=(W_1+W_2)\times g-f+(W_1+W_2)\times a_3$$

$$= 3833\ (N)$$

d. Force during acceleration (upward) ④

$$F=ma \rightarrow F_4=(W_1+W_2)\times g+f+(W_1+W_2)\times a_4$$

$$= 3903\ (N)$$

e. Force during constant speed (upward) ⑤

$$F=0 \rightarrow F_5=(W_1+W_2)\times g+f$$

$$= 3465\ (N)$$

f. Force during deceleration (upward) ⑥

$$F=ma \rightarrow F_6=(W_1+W_2)\times g+f-(W_1+W_2)\times a_6$$

$$= 3028\ (N)$$

So

$$Fa_{max}=F_4$$

$$= 3903\ (N)$$

(3)Buckling load:

$$P=\alpha\frac{\pi^2 nEI}{L^2} = m\frac{dr^4}{L^2}\times10^3$$

$$dr = \left(\frac{P\times L^2}{m}\times10^{-3}\right)^{1/4}$$

$$= \left(\frac{3903\times1800^2}{9.8\times10.2}\times10^{-3}\right)^{1/4}$$

$$= 19\ (mm)$$

Screw shaft diameter at thread root area must be bigger than 19 *mm*.

◎So screw shaft diameter shall be ranged in between 25 and 50 *mm*.

(4)The length of screw shaft

L = Max. travel + Nut length + Unthreaded area length

= 1500 + 100 + 200 = 1800 (*mm*)

Slenderness ratio: 60 or less

$$D \geqq \frac{L}{60} = \frac{1800}{60} = 30\ (mm)$$

◎ So screw shaft diameter shall be ranged in between 32 and 50 *mm*.

(5) Permissible rotational speed

Assume the supporting ends are fixed-supported

So the permissible rotational speed:

$$n = \alpha\times\frac{60\lambda^2}{2\pi L^2}\sqrt{\frac{EIg}{\gamma A}} = f\frac{dr}{L^2}\times10^7$$

$$\Rightarrow dr \geqq \frac{n\times L^2}{f}\times10^{-7} \quad (f=15.1,\ L=1800)$$

$$\geqq 30$$

If the highest rotational speed reaches 1500 *rpm*, screw shaft thread diameter at thread root area must be bigger than 30 *mm*.

◎So screw shaft diameter shall be ranged in between 36 and 50 *mm*.

(6)Calculating of basic dynamic rate load:

Motion	Axial load (*N*)	Mean rotation (*rpm*)	Time (*sec*)
Acceleration (down)	F_1=2958	N_1=750	t_1=1.0
Constant speed (down)	F_2=3395	N_2=1500	t_2=5.0
Deceleration (down)	F_3=3833	N_3=750	t_3=1.0
Acceleration (up)	F_4=3903	N_4=750	t_4=0.2
Constant speed (up)	F_5=3465	N_5=1500	t_5=5.8
Deceleration (up)	F_6=3028	N_6=750	t_6=0.2

Mean load

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

$$= 3436\ (N)$$

Mean rotation

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

$$= 450\ (rpm)$$

As per design condition:

Life required is 20000 hours, Let $f_w=1.2$

$$L_t = \left(\frac{Ca}{F_m\times f_w}\right)^3\times\frac{1}{60N_m}\times10^6$$

$$Ca=(60N_m\times L_t)^{1/3}\times F_m\times f_w\times10^{-2}$$

$$= 33576\ (N)$$

$$= 3426\ (kgf)$$

◎If the life required is > 20000 (*hours*),

Ca has to be > *3426* (*kgf*)

(7) Calculating basic static rate load:

$$Co=Fa_{max}\times fs \qquad \text{Let } f_s=2.0$$

$$= 7806\ (N)$$

$$= 800\ (kgf)$$

Co has to be > *800* (*kgf*)

◎Selection is made as follows:

Type of the Ballscrew: 40-FSWW-10B2
Screw shaft diameter: 40 (*mm*)
Lead:10 (*mm*)
Basic dynamic rate load: 3520 (*kgf*)

3、Selecting driving motor

<Required specifications>

1 The highest rotation speeds is 1500 *mm/min*

2 Time required to reach highest rotational speed is within 0.2 *sec.*

(1) Inertial

a. Screw shaft:

$$GD_S^2 = \frac{\pi\rho}{8}\times D^4\times L$$
$$= \frac{\pi\times 7.8\times 10^{-3}}{8}\times 4^4\times 180$$
$$= 141.1\ (kgf\cdot cm^2)$$

b. Moving parts:

$$GD_w^2 = W\left(\frac{l}{\pi}\right)^2$$
$$= (300+50)\times\left(\frac{1.0}{\pi}\right)^2$$
$$= 192.5\ (kgf\cdot cm^2)$$

c. Coupling:

$$GD_J^2 = 1.0\ (kgf\cdot cm^2)$$

d. Total of Inertial:

$$GD_L^2 = GD_S^2 + GD_w^2 + GD_J^2$$
$$= 178\ (kgf\cdot cm^2)$$

(2) Driving torque:

1.Friction torque

a.Acceleration (downward): ①

$$T_1 = \frac{Fa\times l}{2\pi\times\eta} = \frac{2950\times 1.0}{2\pi\times 0.9} = 520\ (N\cdot cm)$$

b.Constant speed (downward): ②

$$T_2 = \frac{Fa\times l}{2\pi\times\eta} = \frac{3395\times 1.0}{2\pi\times 0.9} = 600\ (N\cdot cm)$$

c.Deceleration (downward): ③

$$T_3 = \frac{Fa\times l}{2\pi\times\eta} = \frac{3833\times 1.0}{2\pi\times 0.9} = 680\ (N\cdot cm)$$

d.Acceleration (upward): ④

$$T_4 = 690\ (N\cdot cm)$$

e.Constant speed (upward): ⑤

$$T_5 = 610\ (N\cdot cm)$$

f.Deceleration (upward): ⑥

$$T_6 = 540\ (N\cdot cm)$$

2.Preloading torque

$$T_P = k\times\frac{Fao\times l}{2\pi}$$
$$\therefore Fao = 0$$
$$\because T_P = 0$$

3.Torque required for acceleration:

$$T_7 = J\cdot w$$
$$= (J_L + J_M)\times\frac{2\pi n}{60 t_1} \qquad GD_M = 120\ (kgf\cdot cm^2)$$
$$= \frac{(178+120)}{4\times 980}\times\left(\frac{2\pi\times 1500}{60\times 0.2}\right)$$
$$= 59.7\ (kgf\cdot cm) = 585\ (N\cdot cm)$$

4.Total torque:

a.Acceleration (downward):

$$T_{k1} = T_1 + T_7 = 520+585 = 1105\ (N\cdot cm)$$

b.Constant speed (downward):

$$T_{t1} = T_2 = 600\ (N\cdot cm)$$

c.Deceleration (downward):

$$T_{g1} = T_3 + T_7 = 680+585 = 1265\ (N\cdot cm)$$

d.Acceleration (upward):

$$T_{k2} = T_4 + T_7 = 690+585 = 1275\ (N\cdot cm)$$

e.Constant speed (upward):

$$T_{t2} = T_5 = 610\ (N\cdot cm)$$

f.Deceleration (upward):

$$T_{g2} = T_6 + T_7 = 540+585 = 1125\ (N\cdot cm)$$

$$T_{max} = T_{k2} = 1275\ (N\cdot cm)$$

(3) Selecting driving motor

<Selecting conditions>

a.The highest rotation speeds: $N_{max} \geqq 1500\ (rpm)$

b.Rated torque: $T_M = T_{rms}$

c.Rotor inertia: $J_M \geqq J_L/3$

The specifications required for driving motor are then decided as per above conditions

◎Motor specifications:

Output	$W_M = 2000\ (W)$
Highest rotation speeds	$N_{max} = 1500\ (rpm)$
Rated torque	$T_M = 13\ (N.m)$
Rotor inertia	$GD^2_M = 120\ (kgf.cm^2)$

(4) Effective torque:

$$T_{rms} = \sqrt{\frac{T_{k1}^2\times t_1 + T_{t1}^2\times t_2 + T_{g1}^2\times t_3 + T_{k2}^2\times t_4 + T_{t2}^2\times t_5 + T_{g2}^2\times t_6}{t}}$$
$$= \sqrt{\frac{1105^2\times 1.0 + 600^2\times 5 + 1265^2\times 1 + 1275^2\times 0.2 + 610^2\times 5.8 + 1125^2\times 0.2}{20}}$$
$$= 606\ (N\cdot cm) < 1300\ (N\cdot cm)$$

◎It conforms to design requirements.

4、Calculating the stress of the Ballscrew

$$\sigma = \frac{F}{A} = \frac{F_{max}}{\pi dr^2/4}$$
$$= \frac{3903\times 9.8\times 4}{\pi\times 35.05^2}$$
$$= 4.04\ N/mm^2$$
$$= 4.04\times 10^6\ N/m^2$$

(dr is screw shaft thread root diameter)

$dr = 40+1.4-6.35 = 35.05\ (mm)$

$$\tau = \frac{T\times r}{J}$$
$$= \frac{12750\times 20}{148167}$$
$$= 1.72\ N/mm^2$$
$$= 1.72\times 10^6\ N/m^2$$

$T_{max} = T_L = 1275\ (N\cdot cm) = 12750\ (N\cdot mm)$

$J = \frac{\pi dr^4}{32} = \frac{\pi(35.05^4)}{32} = 148167\ (mm^4)$

$$\sigma_{max} = \sqrt{\sigma^2 + \tau^2}$$
$$= 4.39\times 10^6\ N/m^2$$

50CrMo4 steel tension strength is $1.1\times 10^8\ N/m^2 > \sigma_{max}$

Yield strength is $0.9\times 10^8\ N/m^2 > \sigma_{max}$

◎So the Ballscrew selected is safe.

5、Calculating the buckling load of the screw shaft

$$P = \alpha\frac{\pi^2 nEI}{L^2} = m\frac{dr^4}{L^2}\times 10^3$$
$$= 10.2\times\frac{35.05^4}{1800^2}\times 10^3$$
$$= 4751\ (kgf) > F_{max}\ (398\ kgf)$$

◎So the Ballscrew selected is safe.

11 *PMI* Ballscrew With Hollow Cooling System

PMI's design of hollow cooling system is especially good for high speed Ballscrews. It shall well dissipate heat generated by friction between balls and grooves during Ballscrew running, and then to minimize thermal deformation as to ensure positioning accuracy.

11.1 Introduction to Hollow Cooling System

The hollow cooling system is designed by *PMI* (Fig.11.1) It uses a coolant pipe through the hollow hole of Ballscrew. The hollow hole is through all of the Ballscrew, and one end is clogged with the oil seal by *PMI* patent. The coolant is pumped into coolant pipe and flow to the end of coolant pipe. Coolant then flow reversely along the hollow hole back into the coolant collector. It can cool down the Ballscrew. The coolant is then sucked back to the cooling unit to drop coolant temperature and pumped again to the coolant pipe to complete circulation.

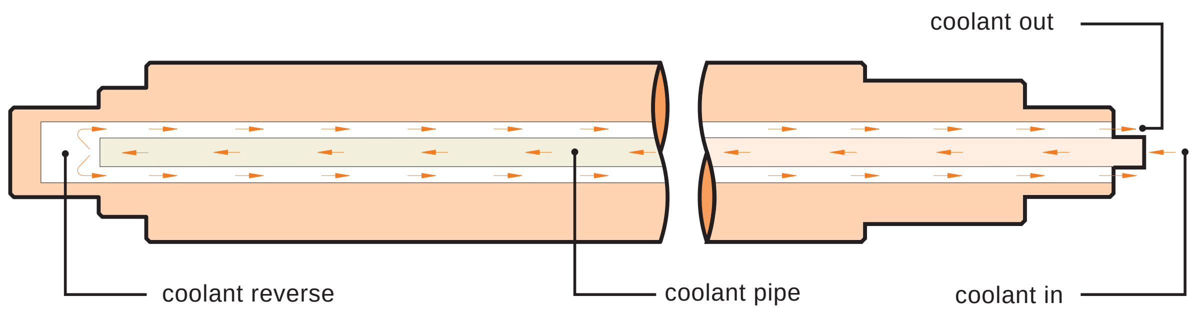


Fig.11.1 Hollow cooling diagram

11.2 Patent

11.2.1 Hollow cooling system

Features:

(i) Well and effectively control Ballscrew thermal expansion.

(ii) Simple design and structure to save cost.

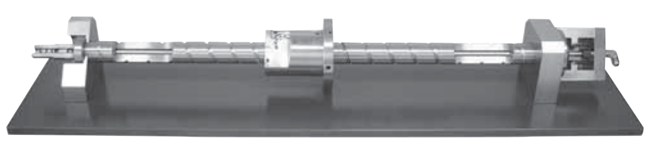


Fig.11.2 Hollow cooling system

11.2.2 Cooling entrance

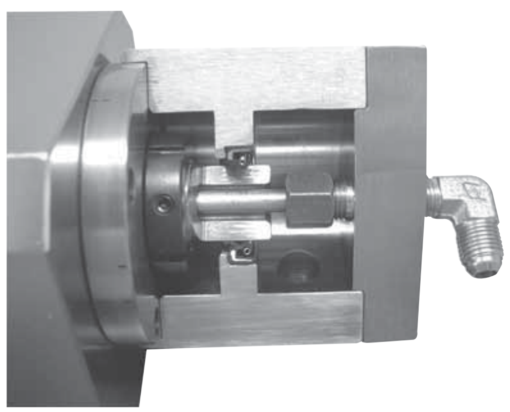


Fig.11.3 Cooling entrance

11.2.3 End sealing

Features:Easy for installing, disassembling and maintenance.

11.2.4 Coolant pipe support installation

Supported the coolant pipe. Let it don't touch Ballscrew.

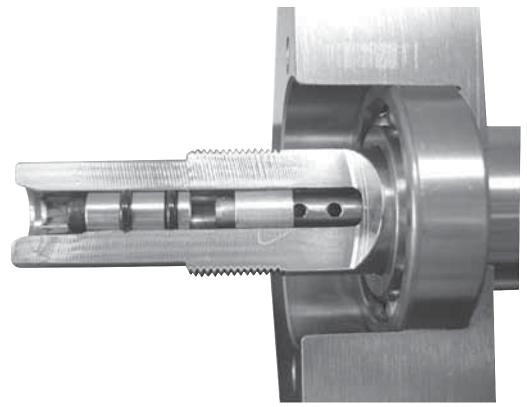


Fig 11.4 End sealing structure

11.2.5 Thermal control system test unit

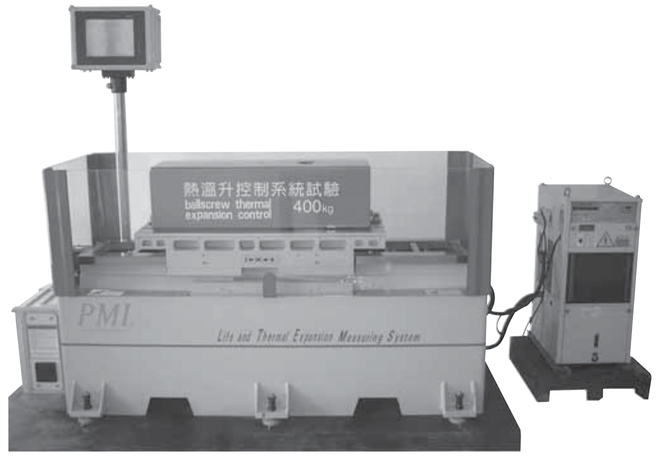


Fig.11.5 Thermal control system test unit

11.3 Thermal control experiment

11.3.1 Test condition

Screw nominal O.D. :	Ø40 *mm*
Lead:	10 *mm*
Rotation speed:	1000 *rpm*
Speed:	10 *m/min*
Load:	400 *kgf*
Slideways:	Hardened ways

11.3.2 The results of experiment

As per the results by experiment, *PMI*'s design of hollow cooling system proves an effective way for controlling the thermal expansion on the Ballscrew. Hence it is a very helpful design to high precision machine tools.

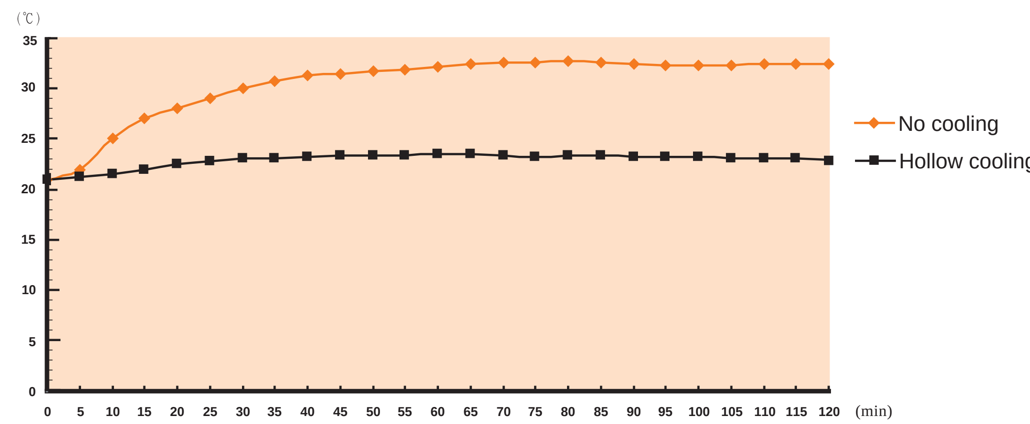
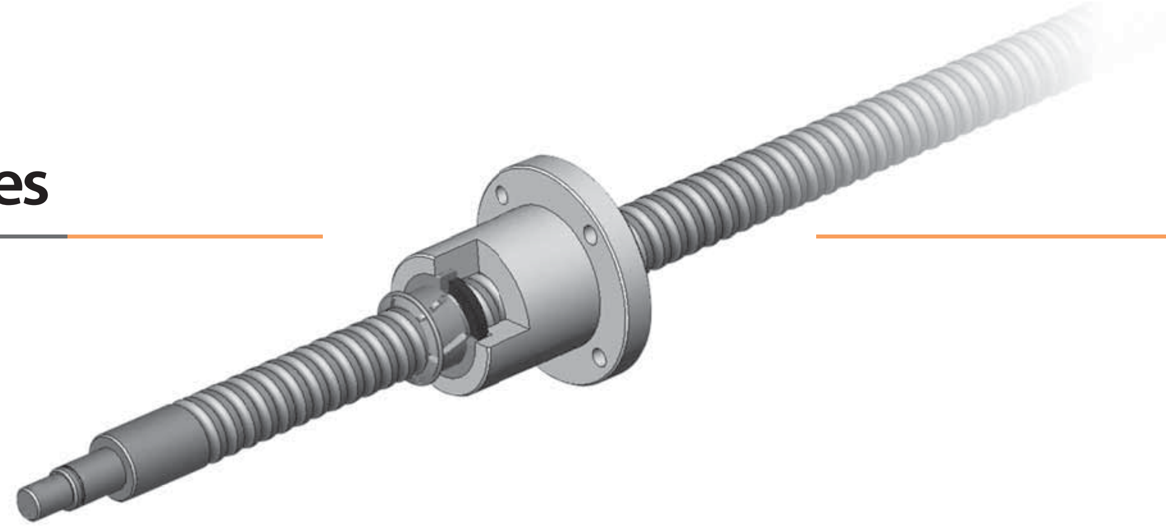


Fig.11.6The rule of experiment

12 *PMI* High Dustproof Series



Design Concept

Scrapers specially developed for ballscrews, with a multi-layered contact structure that ensures effective dust removal.

Features

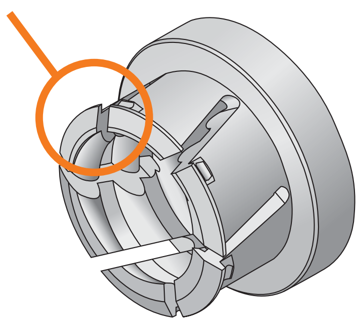
High Compatibility

High dustproof scrapers can be used with various *PMI* products, including external and internal ball circulation nuts such as the E-type and D-type nuts etc...

Improved Dustproof Capacity

With a reduced mounting surface of the scraper spring, threads are more closely matched, making for a better scraping capacity.

Pioneering Design
Greatly improves dustproof effect



Long Endurance

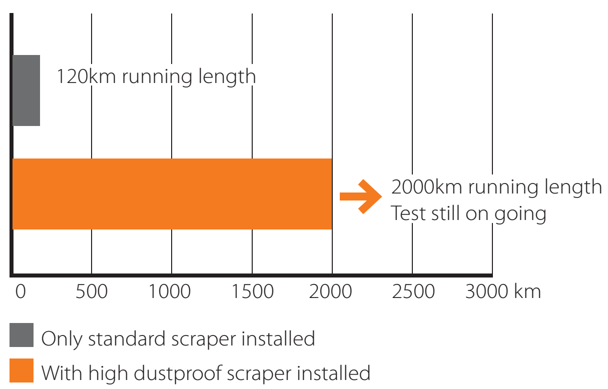
The outer ring of the scraper is clamped by a spring. As the scraper gradually wears, the preload of scraper is automatically adjusted.

High Durability

With scrapers that closely fits the threads of the ballscrew and seal pads that match the axial cross section, the inside of the nut is completely safe from dust.

Test Condition

Specifications	R32-10-FSVE
Running Length	300 *mm* (per cycle)
Motor Speed	150 *rpm*
Test Environment	Sawdust automatic circulation system
Minimal Size of Dust Particles	below 0.01*mm*



Characteristics

1.Seal Washer

As the ballscrew comes with specially designed grooves, the highly dustproof seal washer inside the scraper perfectly matches the threads, a feature that ensures the removal of scraps as well as insulation against dust.

2.Scraper Design

The thread matching design of the scraper greatly boosts its efficiency. If the length of the nut deviates from average specifications, please contact *PMI* engineers.

3.Shaft End Design

The shaft ends of the ballscrew should not be larger than the root diameter (*dr*). If you have any questions concerning the size of the rest area of the ballscrew, please contact *PMI* engineers.

Fits the Following Types of Nuts

FSWC.FDWC.FSVC.FDVC.

FSWE.FDWE.FSVE.FDVE.

FSDC.FDDC.FSIC.FDIC.

FOWC.FOVC.

(For detailed specifications, please refer to the specification table.)

For other specifications, please contact *PMI* engineers.

Nomenclature

Example: R 32-10 B2-F S V E- 600 – 700 - 0.008 A

A Precision Ground Ballscrew + High dustproof wiper

B Rolled Ballscrew + High dustproof wiper

R Rolled

Applications of High Dustproof Ballscrews

Woodworking machines, laser processing machines, high accuracy transportation equipment, mechanical arms, and other machines that require a dustproof environment.

Additional Remarks

1.Using the high dustproof scraper may induce an increase in preload. If your machine has a strict requirement on the range of preload, please contact *PMI* engineers.

2.High dustproof seal washers should not be used in an environment where the temperature exceeds 60°C.

3.Due to potential sealing problems with returning tubes, please contact *PMI* engineers if you need to use external ball circulation nuts (such as FSWC and FSVC).

13 *PMI* Precision Ground BallScrew

PMI Precision Ground BallScrew

13.1 Internal Ball Circulation Nuts

Features:

The advantage of internal ball circulation nut is that the outer diameter is smaller than that of external ball circulation nut. Hence it is suitable for the machine with limit space for Ballscrew installation.

It is strictly required that there is at least one end of screw shaft with complete threads. Also the rest area next to this complete thread must be with smaller diameter than the nominal diameter of the screw shaft. Above are required for easy assembling the ballnut onto the screw shaft.

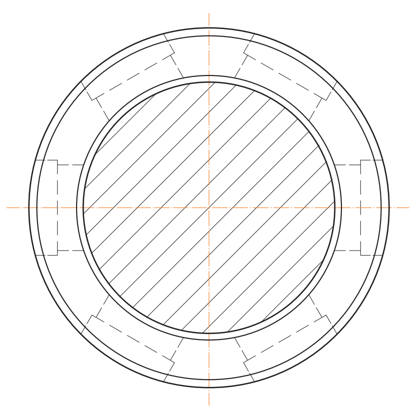
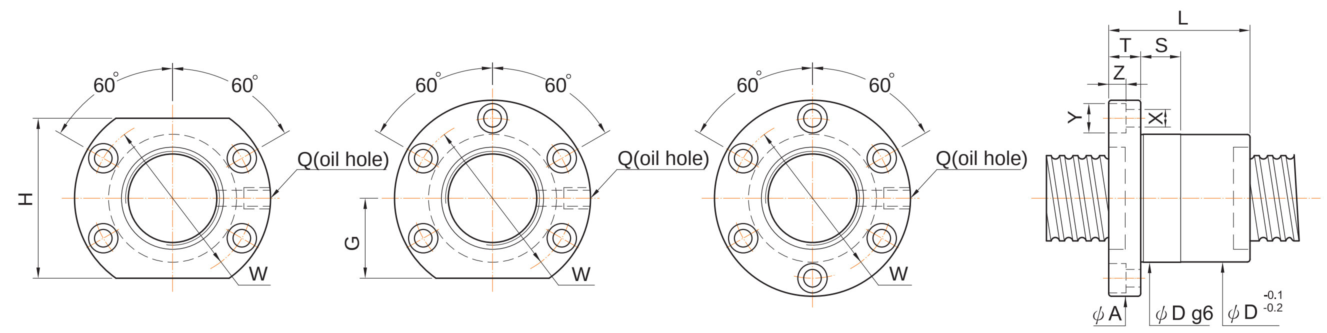


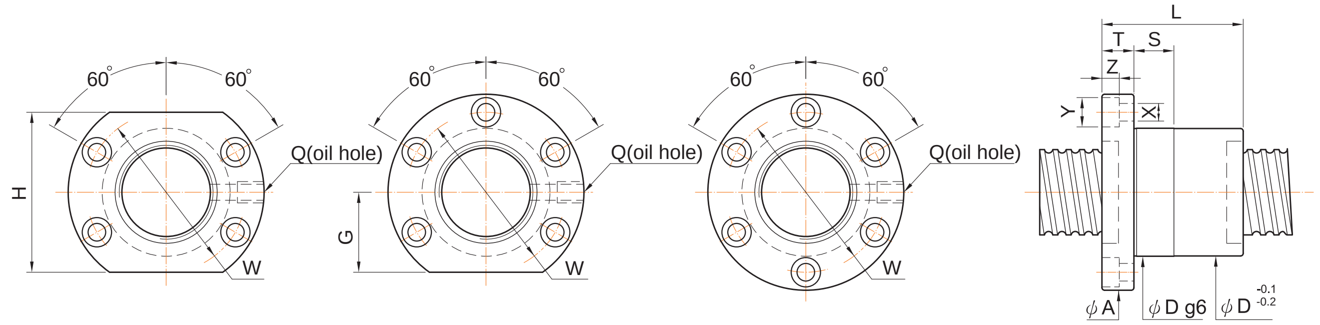
Fig. 13.1 Internal ball circulation's side view



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD			Dynamic (1×10^6 REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
14	3	2	3	260	460	26	37	46	10	36	~	~	10	4.5	8	4.5	M6x1P	13
	4	2.381	3	420	805	26	42	46	10	36	20	40	10	4.5	8	4.5	M6x1P	14
		2.778	4	840	1870		42											21
	5	3.175	3	720	1010	26	42	46	10	36	20	40	10	4.5	8	4.5	M6x1P	16
16	4	2.381	3	435	920	28	42	49	10	39	20	40	10	4.5	8	4.5	M6x1P	16
	5	3.175	3	765	1240	30	42	49	10	39	20	40	10	4.5	8	4.5	M6x1P	18
			4	980	1650		49	49	10	39	20	40	10	4.5	8	4.5		23
	6	3.175	4	980	1650	30	55	54	12	40	20	40	12	5.5	9.5	5.5	M6x1P	23
20	4	2.381	4	600	1530	34	44	60	12	48	22	44	12	5.5	9.5	5.5	M6x1P	25
	5	3.175	3	860	1710	34	47	57	12	45	20	40	12	5.5	9.5	5.5	M6x1P	21
			4	1100	2280		53											28
			6	1560	3420		62											42
	6	3.969	3	1080	2050	34	53	57	12	45	20	40	12	5.5	9.5	5.5	M6x1P	22
			4	1380	2730		61											28
	10	3.175	3	860	1710	36	66	57	12	45	20	40	12	5.5	9.5	5.5	M6x1P	21
25	4	2.381	3	500	1440	40	40	63	12	51	22	44	15	5.5	9.5	5.5	M8x1P	23
	5	3.175	3	980	2300	40	47	63.5	12	51	22	44	15	5.5	9.5	5.5	M8x1P	26
			4	1250	3070		53											33
			5	1520	3830		57											42
	6	3.969	3	1275	2740	40	53	63.5	12	51	22	44	15	5.5	9.5	5.5	M8x1P	26
			4	1630	3650		61											34
	8	3.969	4	1630	3650	40	69	63.5	12	51	22	44	15	5.5	9.5	5.5	M8x1P	34
			5	1970	4560		77											43
	10	3.175	3	980	2300	38	70	68	15	55	26	52	15	6.6	11	6.5	M8x1P	26
			4	1250	3070		81											33
		4.762	3	1620	3205	42	80	68.5	15	55	26	52	15	6.6	11	6.5	M8x1P	27
			4	2070	4270		85											35
			5	2510	5340		91											44
28	6	3.175	3	1030	2630	43	50	68	12	55	26	52	15	6.6	11	6.5	M8x1P	28
	10	3.175	4	1320	3510	45	77	73	12	60	30	60	15	6.6	11	6.5	M8x1P	37

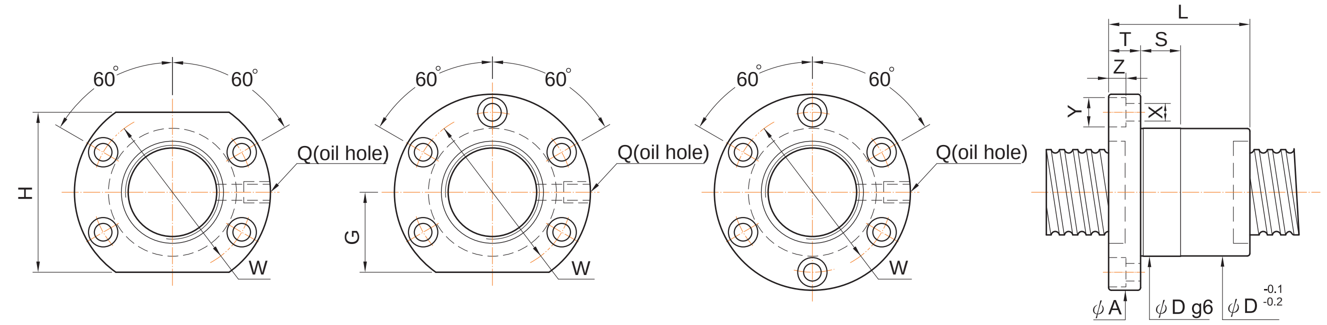
FSIC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	Static Co	NUT Dg6	L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
32	4	2.381	3	560	1840	43	40	68	15	55	26	52	15	6.6	11	6.5	M8x1P	28
			5	870	3070		49											45
	5	3.175	3	1095	3060	48	47	73.5	12	60	30	60	15	6.6	11	6.5	M8x1P	31
			4	1400	4080		53											41
			6	1980	6120		62											60
	6	3.969	3	1500	3750	48	53	73.5	12	60	30	60	15	6.6	11	6.5	M8x1P	32
			4	1920	5000		61											43
			6	2720	7500		73											63
	8	4.762	3	1820	4230	50	68	83	16	66	32	64	15	6.6	11	6.5	M8x1P	32
			4	2330	5640		77											43
	10	6.35	3	2605	5310	54	80	88	16	70	34	68	15	9	14	8.5	M8x1P	33
			4	3340	7080		90											45
	12	6.35	3	2605	5310	50	86	88	16	70	34	68	15	9	14	8.5	M8x1P	33
36	5	3.175	4	1490	4690	52	56	88	16	70	34	68	15	9	14	8.5	M8x1P	46
	8	4.762	4	2530	6630	55	73	88	16	72	29	58	15	9	14	8.5	M8x1P	48
	10	6.35	3	2810	6210	58	78	98	18	77	36	72	20	11	17.5	11	M8x1P	37
			4	3600	8280		89											49
40	5	3.175	4	1575	5290	55	56	88.5	16	72	29	58	15	9	14	8.5	M8x1P	49
			5	1910	6610		61											61
			6	2230	7940		65											73
	6	3.969	3	1660	4810	55	56	88.5	16	72	34	68	15	9	14	8.5	M8x1P	39
			4	2130	6410		65											51
			6	3020	9620		77											75
	8	4.762	3	2120	5720	60	64	93	16	76	36	72	20	9	14	8.5	M8x1P	40
			4	2720	7620		77											52
			6	3850	11430		94											77
	10	6.35	3	3010	7100	64	83	106	18	84	43	86	20	11	17.5	11	M8x1P	41
			4	3850	9470		93											53
			5	4670	11830		99											67
	12	6.35	3	3010	7100	63	82	106	18	84	43	86	20	11	17.5	11	M8x1P	41
			4	3850	9470		100											53
			5	4670	11830		107											67
		7.144	3	4010	9250	70	93	110	18	85	45	90	20	11	17.5	11	M8x1P	43
			4	5130	12330		103											56

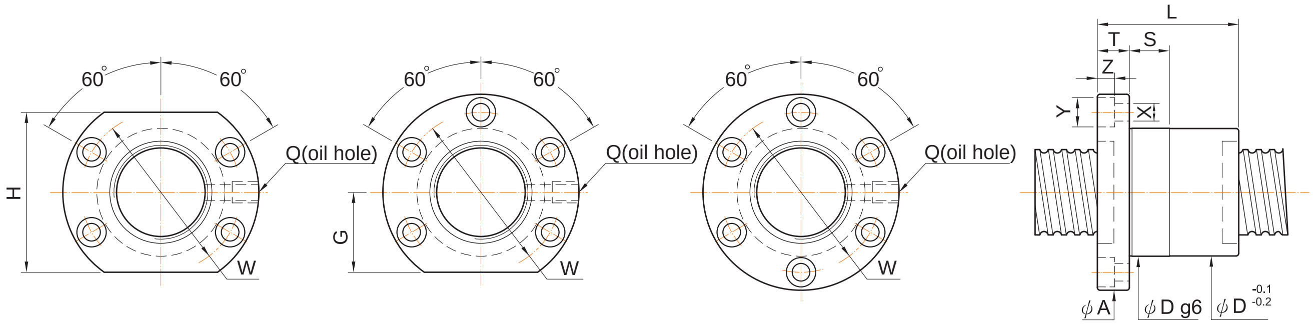
FSIC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	Static Co	NUT Dg6	L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
45	8	3.175	4	1650	6030	61	72	92	16	75	36	72	15	9	14.5	9	M6x1P	54
	12	7.144	3	4160	10750	70	86	110	16	90	42	84	20	11	17.5	11	PT1/8"	48
			4	5330	14330		99											62
	16	6.35	3	3220	8200	70	102	110	16	90	42	84	20	11	17.5	11	PT1/8"	45
50	5	3.175	4	1730	6760	66	55	98	16	82	36	72	20	9	14	8.5	PT1/8"	60
			5	2100	8450		61											74
			6	2450	10140		65											86
	6	3.969	4	2380	8250	66	65	98	16	82	36	72	20	9	14	8.5	PT1/8"	61
			5	2880	10310		64											76
			6	3370	12380		77											90
	8	4.762	4	3010	9610	70	79	113	18	90	42	84	20	11	17.5	11	PT1/8"	63
			5	3650	12010		84											77
			6	4260	14420		96											92
	10	6.35	3	3430	9300	74	83	116	18	94	42	84	20	11	17.5	11	M8x1P	49
			4	4390	12400		93											65
			5	5320	15500		99											80
			6	6220	18600		114											95
	12	7.144	4	5520	16330	75	104	121	22	97	47	94	20	14	20	13	PT1/8"	67
			5	6690	20410		117											84
		7.938	3	4510	11150	75	99	121	22	97	47	94	20	14	20	13	PT1/8"	50
			4	5770	14870		111											60
	16	6.35	3	3430	9300	74	104	116	18	94	42	84	20	11	17.5	11	PT1/8"	49
	20	7.938	3	4510	11150	78	146	121	28	97	47	94	20	14	20	13	PT1/8"	50

FSIC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	Static Co	NUT Dg6	L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
63	6	3.969	4	2610	10550	80	67	122	18	100	45	90	20	11	17.5	11	PT1/8"	73
			6	3700	15830		80											107
	8	4.762	4	3375	12200	82	80	124	18	102	46	92	20	11	17.5	11	PT1/8"	76
			6	4780	18300		96											111
	10	6.35	4	5020	16450	85	98	132	22	107	48	96	20	14	20	13	PT1/8"	79
			6	7110	24680		118											116
	12	7.938	4	6580	19430	90	111	136	22	112	52	104	20	14	20	13	PT1/8"	80
			6	9320	29150		136											111
	20	9.525	3	8490	23610	95	146	153	28	123	59	118	20	18	26	17.5	PT1/8"	79
			4	10870	31480		156											89
80	10	6.35	4	5510	21200	105	98	151	22	127	57	114	20	14	20	13	PT1/8"	95
			5	6670	26500		105											118
			6	7810	31800		118											140
	12	7.938	4	7500	25700	110	111	156	22	132	59	118	20	14	20	13	PT1/8"	98
			6	10620	38550		136											143
	20	9.525	3	9770	31700	115	146	173	28	143	66	132	20	18	26	17.5	PT1/8"	97
			4	12510	42270		168											127

Specifications

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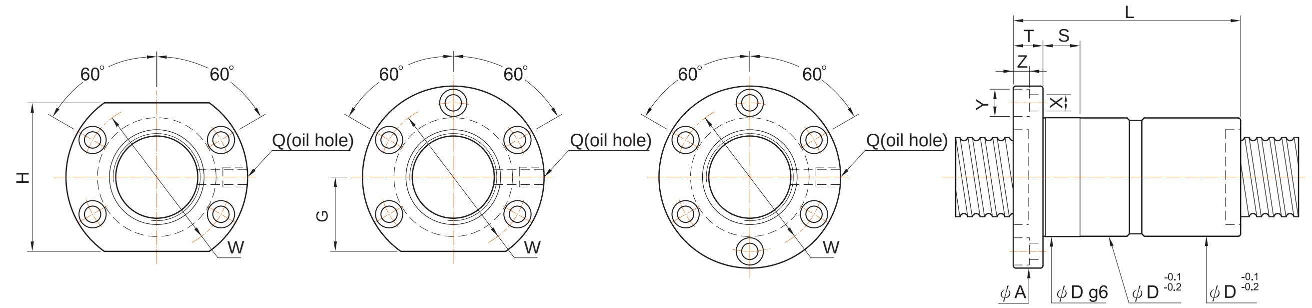

UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	Static Co	NUT Dg6	L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
16	4	2.381	3	435	920	30	66	46.5	10	39	20	40	10	4.5	8	4.5	M6x1P	31
	5	3.175	3	765	1240	30	80	49	10	39	20	40	10	4.5	8	4.5	M6x1P	35
			4	980	1650		89											47
20	5	3.175	3	860	1710	34	82	57	12	45	20	40	12	5.5	9.5	5.5	M6x1P	43
			4	1100	2280		92											56
	6	3.969	3	1080	2050	34	93	57	12	45	20	40	12	5.5	9.5	5.5	M6x1P	43
			4	1380	2730		107											56
25	5	3.175	3	980	2300	40	82	63.5	12	51	22	44	15	5.5	9.5	5.5	M8x1P	51
			4	1250	3070		92											67
	6	3.969	3	1275	2740	40	93	63.5	12	51	22	44	15	5.5	9.5	5.5	M8x1P	52
			4	1630	3650		107											68
	10	3.175	3	980	2300	38	129	68	15	55	26	52	15	6.6	11	6.5	M8x1P	51
		4.762	3	1620	3205	42	140	68.5	15	55	26	52	15	6.6	11	6.5	M8x1P	53
			4	2070	4270		155											70
32	5	3.175	3	1095	3060	48	82	73.5	12	60	30	60	15	6.6	11	6.5	M8x1P	63
			4	1400	4080		92											82
			6	1980	6120		118											122
	6	3.969	3	1500	3750	48	93	73.5	12	60	30	60	15	6.6	11	6.5	M8x1P	65
			4	1920	5000		109											86
			6	2720	7500		133											125
	8	4.762	3	1820	4230	50	117	83	16	66	32	64	15	6.6	11	6.5	M8x1P	66
			4	2330	5640		135											86
	10	6.35	3	2605	5310	54	139	88.5	16	70	34	68	15	9	14	8.5	M8x1P	67
			4	3340	7080		160											89
	12	6.35	3	2605	5310	50	153	88	16	70	34	68	15	9	14	8.5	M8x1P	67
			5	4040	8850		203											110
36	5	3.175	4	1490	4690	52	96	88	16	70	34	68	15	9	14	8.5	M8x1P	91
	8	4.762	4	2530	6630	55	138	88	16	72	34	68	15	9	14	8.5	M8x1P	95
	10	6.35	3	2810	6210	58	138	98	18	77	36	72	20	11	17.5	11	M8x1P	75
			4	3600	8280		159											98

Specifications

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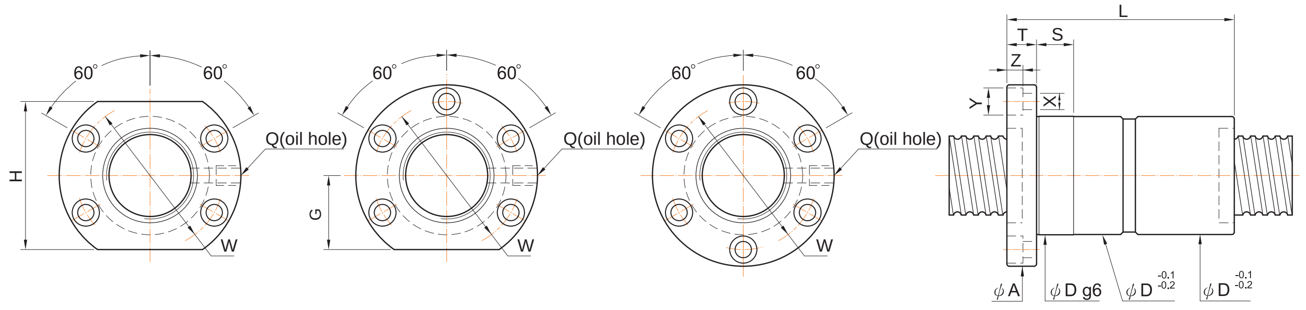
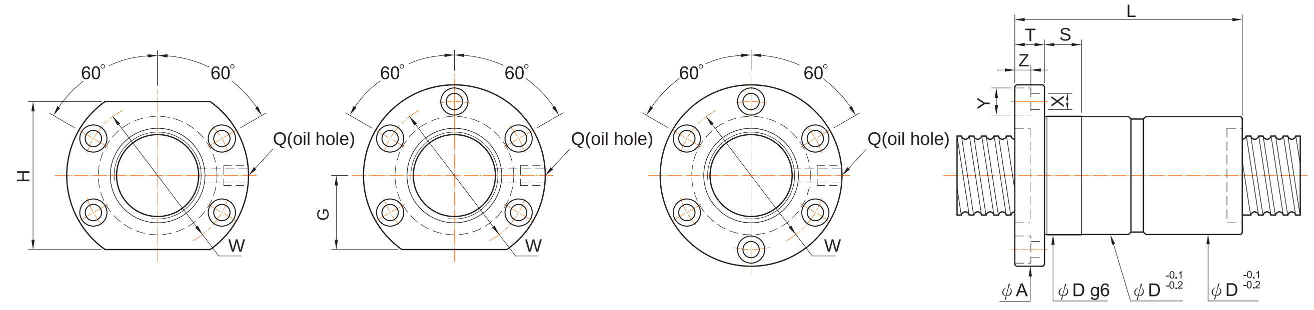


UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD			Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
40			4	1575	5290		96											100
	5	3.175	5	1910	6610	55	111	88.5	16	72	29	58	15	9	14	8.5	M8x1P	124
			6	2230	7940		122											147
			3	1660	4810		97											77
	6	3.969	4	2130	6410	55	113	88.5	16	72	34	68	15	9	14	8.5	M8x1P	103
			6	3020	9620		137											149
			3	2120	5720		121											80
	8	4.762	4	2720	7620	60	134	93	16	76	36	72	20	9	14	8.5	M8x1P	105
			6	3850	11430		172											154
			3	3010	7100		142											82
	10	6.35	4	3850	9470	64	162	106	18	84	43	86	20	11	17.5	11	M8x1P	107
			5	4670	11830		189											133
	12	6.35	3	3010	7100	63	154	106	18	84	43	86	20	11	17.5	11	M8x1P	82
			5	4670	11830		203											133
		7.144	3	4010	9250	70	160	110	18	85	45	90	20	11	17.5	11	M8x1P	86
			4	5130	12330		185											114
45	8	3.175	4	1650	6030	61	136	92	16	75	36	72	15	9	14.5	9	M6x1P	109
	12	7.144	3	4160	10750	70	158	110	16	90	45	90	20	11	17.5	11	PT1/8"	94
			4	5330	14330		183											124
	16	6.35	3	3220	8200	70	198	110	16	90	45	90	20	11	17.5	11	PT1/8"	90



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD			Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
50			4	1730	6760		96											119
	5	3.175	5	2100	8450	66	111	98	16	82	36	72	20	9	14	8.5	PT1/8"	178
			6	2450	10140		122											174
			4	2380	8250		111											123
	6	3.969	5	2880	10310	66	122	98	16	82	36	72	20	9	14	8.5	PT1/8"	151
			6	3370	12380		142											181
			4	3010	9610		136											125
	8	4.762	5	3650	12010	70	157	113	18	90	42	84	20	11	17.5	11.0	PT1/8"	155
			6	4260	14420		174											185
			3	3430	9300		143											99
	10	6.35	4	4390	12400	74	162	114	18	92	42	84	20	11	17.5	11	PT1/8"	129
			5	5320	15500		189											161
			6	6220	18600		205											191
	12	7.144	5	6680	20420	75	213	121	22	97	47	94	20	14	20	13	PT1/8"	166
		7.938	3	4510	11150	75	171	121	22	97	47	94	20	14	20	13	PT1/8"	101
			4	5770	14870		195											132
	16	6.35	3	3430	9300	74	201	114	18	92	42	84	20	11	17.5	11	PT1/8"	99
	20	7.938	3	4510	11150	78	253	121	28	97	47	94	20	14	20	13	PT1/8"	101

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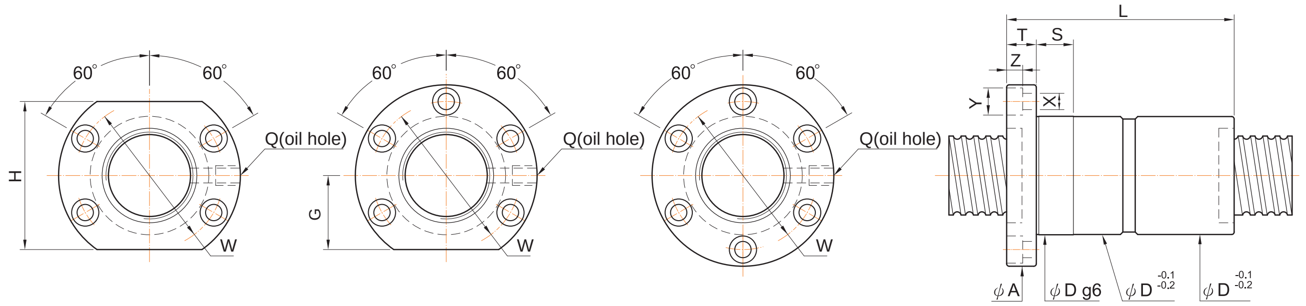

UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FLANGE G	FLANGE H	FIT S	BOLT X	BOLT Y	BOLT Z	OIL HOLE Q	STIFFNESS kgf/μm
63	6	3.969	4	2610	10550	80	120	122	18	100	45	90	20	11	17.5	11	PT1/8"	146
			6	3700	15830		144											217
	8	4.762	4	3375	12200	82	141	124	18	102	46	92	20	11	17.5	11	PT1/8"	151
			6	4780	18300		178											222
	10	6.35	4	5020	16450	85	166	132	22	107	48	96	20	14	20	13	PT1/8"	158
			6	7110	24680		209											232
	12	7.938	4	6580	19430	90	195	136	22	112	52	104	20	14	20	13	PT1/8"	161
			6	9320	29150		248											236
	20	9.525	3	8490	23610	95	255	153	28	123	59	118	20	18	26	17.5	PT1/8"	157
			4	10870	31480		296											207
80	10	6.35	4	5510	21200	105	166	151	22	127	57	114	20	14	20	13	PT1/8"	190
			5	6670	26500		185											235
			6	7810	31800		209											280
	12	7.938	4	7500	25700	110	195	156	22	132	59	118	20	14	20	13	PT1/8"	196
			6	10620	38550		248											288
	20	9.525	3	9770	31700	115	254	173	28	143	66	132	20	18	26	17.5	PT1/8"	193
			4	12510	42270		297											254
			6	17720	63410		376											373
100	10	6.35	8	11050	53580	123	244	168	22	145	~	~	20	14	20	14	PT1/8"	441
	16	9.525	6	20460	82440	140	311	188	25	163	~	~	20	13.5	22	13.5	PT1/8"	453
	20	9.525	5	17490	68700	134	336	188	25	163	~	~	20	13.5	22	13.5	PT1/8"	381

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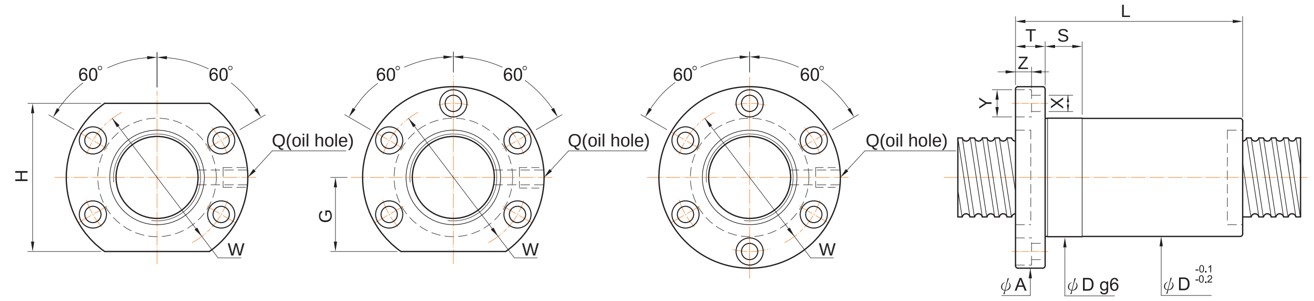
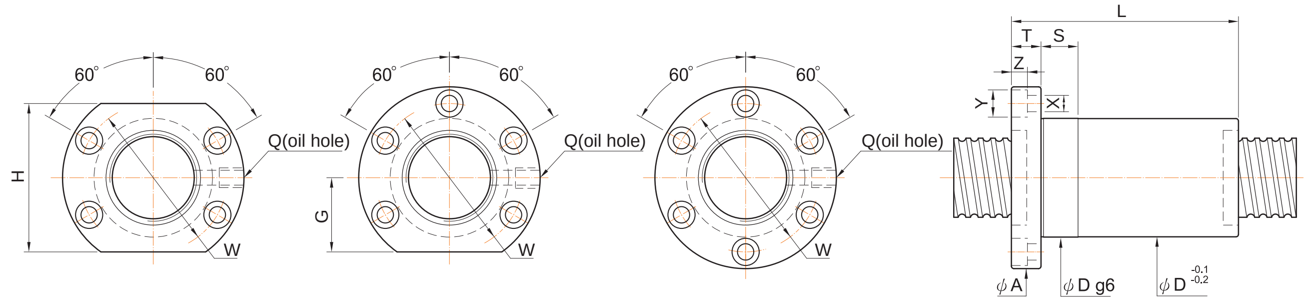


UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FLANGE G	FLANGE H	FIT S	BOLT X	BOLT Y	BOLT Z	OIL HOLE Q	STIFFNESS kgf/μm
20	5	3.175	2x(2)	610	1140	34	53	57	12	45	20	40	12	5.5	9.5	5.5	M6x1P	29
			3x(2)	860	1710		67											43
	6	3.969	2x(2)	760	1370	34	61	57	12	45	20	40	12	5.5	9.5	5.5	M6x1P	29
			3x(2)	1080	2050		77											50
25	4	2.381	2x(2)	350	960	40	44	63	12	51	22	44	15	5.5	9.5	5.5	M8x1P	30
			3x(2)	500	1440		56											46
			4x(2)	640	1920		64											59
	5	3.175	2x(2)	690	1530	40	53	63.5	12	51	22	44	15	5.5	9.5	5.5	M8x1P	35
			3x(2)	980	2300		67											51
			4x(2)	1250	3070		76											67
	6	3.969	3x(2)	1275	2740	40	77	63.5	12	51	22	44	15	5.5	9.5	5.5	M8x1P	52
	8	3.969	3x(2)	1275	2740	40	85	63.5	12	51	22	44	15	5.5	9.5	5.5	M8x1P	52
	10	4.762	2x(2)	1140	2140	42	88	69	15	55	26	52	15	6.6	11	6.5	M8x1P	36
			3x(2)	1610	3210		102											53
28	6	3.175	3x(2)	1030	2630	43	69	68	12	55	26	52	15	6.6	11	6.5	M8x1P	56
	10	3.175	2x(2)	730	1750	45	77	73	12	60	30	60	15	6.6	11	6.5	M8x1P	38
32	4	2.381	3x(2)	560	1840	43	56	68	12	55	26	52	15	6.6	11	6.5	M8x1P	55
			5x(2)	870	3070		73											89
	5	3.175	3x(2)	1095	3060	48	67	73.5	12	60	30	60	15	6.6	11	6.5	M8x1P	63
			4x(2)	1400	4080		77											82
	6	3.969	3x(2)	1500	3750	48	77	73.5	12	60	30	60	15	6.6	11	6.5	M8x1P	65
			4x(2)	1920	5000		90											86
	8	4.762	3x(2)	1820	4230	50	95	83	16	66	32	64	15	6.6	11	6.5	M8x1P	66
			4x(2)	2330	5640		112											86
	10	6.35	3x(2)	2605	5310	54	120	88	16	70	34	68	15	9	14	8.5	M8x1P	67
	12	6.35	3x(2)	2605	5310	50	124	88	16	70	34	68	15	9	14	8.5	M8x1P	67

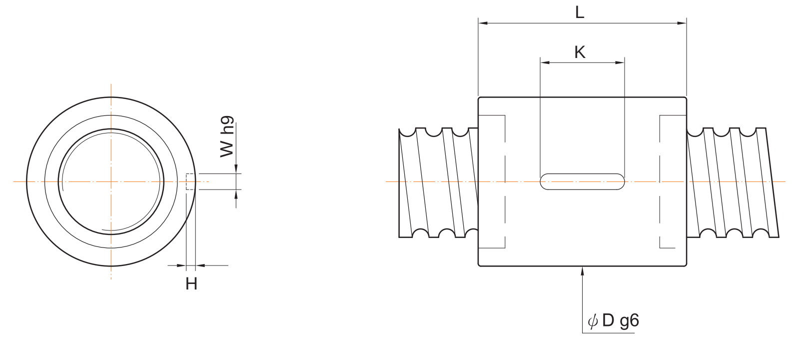
FOIC



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD			Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
40	5	3.175	3x(2)	1230	3970	50	65	88.5	16	72	29	58	15	9	14	8.5	M8x1P	75
			4x(2)	1575	5290		80											100
			6x(2)	2230	7940		101											147
	6	3.969	4x(2)	2130	6410	55	93	88.5	16	72	34	68	15	9	14	8.5	M8x1P	103
			6x(2)	3020	9620		118											149
	8	4.762	4x(2)	2720	7620	60	116	93	16	76	36	72	20	9	14	8.5	M8x1P	105
	10	6.35	3x(2)	3010	7100	64	123	106	18	84	43	86	20	11	17.5	11	PT1/8"	82
			4x(2)	3850	9470		143											107
	12	6.35	4x(2)	3850	9470	63	160	106	18	84	43	86	20	11	17.5	11	PT1/8"	107
50	5	3.175	3x(2)	1350	5070	66	65	98	16	82	36	72	20	9	14	8.5	PT1/8"	89
			4x(2)	1730	6760		80											119
			6x(2)	2450	10140		101											174
	6	3.969	4x(2)	2380	8250	66	93	98	16	82	36	72	20	9	14	8.5	PT1/8"	123
			6x(2)	3370	12380		118											181
	8	4.762	4x(2)	3010	9610	70	119	113	18	90	42	84	20	11	17.5	11	PT1/8"	125
	10	6.35	3x(2)	3430	9300	74	123	116	18	92	42	84	20	11	17.5	11	M8x1P	99
			4x(2)	4390	12400		143											129
	12	7.144	4x(2)	5530	16330	75	164	121	22	97	47	97	20	14	20	13	PT1/8"	135
		7.938	3x(2)	4510	11150		147											101
			4x(2)	5770	14870		164											132
63	6	3.969	4x(2)	2610	10550	80	96	122	18	100	45	90	20	11	17.5	11	PT1/8"	146
			6x(2)	3700	15830		121											217
	8	4.762	4x(2)	3375	12200	82	119	124	18	102	46	92	20	11	17.5	11	PT1/8"	151
	10	6.35	4x(2)	5020	16450	85	147	132	22	107	48	96	20	14	20	13	PT1/8"	158
	12	7.938	3x(2)	5140	14570	90	147	136	22	112	52	104	20	14	20	13	PT1/8"	122
			4x(2)	6580	19430		171											161
	20	9.525	2x(2)	5990	15740	95	156	153	28	123	59	118	20	18	26	17.5	PT1/8"	107

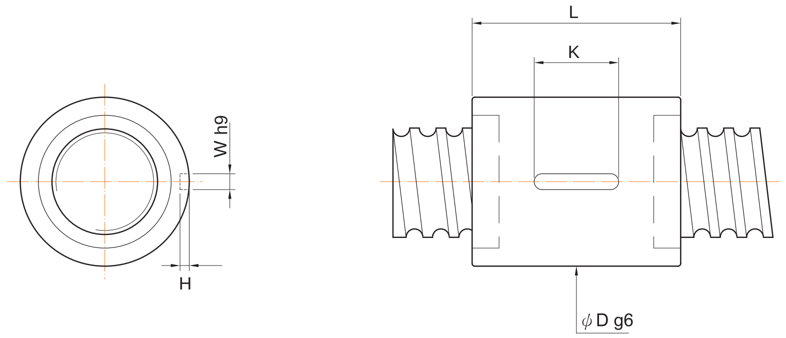
RSIC



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		KEYWAY			STIFFNESS
O.D.	LEAD			Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	K	W	H	kgf/μm
16	5	3.175	3	765	1240	30	40	20	3	1.8	18
20	5	3.175	3	860	1710	34	41	20	3	1.8	21
			4	1100	2280		48				28
	6	3.969	3	1080	2050	34	46	20	4	2.5	22
			4	1380	2730		56	25			28
25	5	3.175	3	980	2300	40	41	20	4	2.5	26
			4	1250	3070		48				33
	6	3.969	3	1275	2740	40	46	20	4	2.5	26
			4	1630	3650		56	25			34
32	5	3.175	3	1095	3060	48	41	20	4	2.5	31
			4	1400	4080		48	20			41
			6	1980	6120		61	25			60
	6	3.969	3	1500	3750	50	46	20	5	3.0	32
			4	1920	5000		56	25			43
			6	2720	7500		70	32			63
	8	4.762	3	1820	4230	50	59	25	5	3.0	32
			4	2330	5640		70				43
	10	6.35	3	2605	5310	54	68	25	6	3.5	33
			4	3340	7080		79	32			45
40	5	3.175	4	1575	5290	55	48	20	4	2.5	49
			6	2230	7940		61	25			73
	6	3.969	4	2130	6410	55	56	25	5	3.0	51
			6	3020	9620		70	32			75
	8	4.762	4	2720	7620	60	70	25	5	3.0	52
			6	3850	11430		91	40			77
	10	6.35	3	3010	7100	65	68	25	6	3.5	41
			4	3850	9470		79	32			53

RSIC

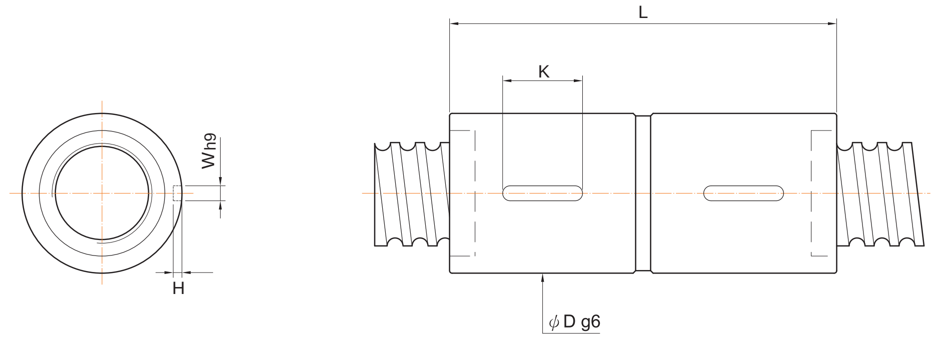


UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	KEYWAY K	KEYWAY W	KEYWAY H	STIFFNESS kgf/μm
50	5	3.175	4	1730	6750	66	48	20	4	2.5	60
			6	2450	10130		61	25			86
	6	3.969	4	2380	8250	66	56	25	5	3.0	61
			6	3370	12380		70	32			90
	8	4.762	4	3010	9610	70	70	32	5	3.0	63
			6	4260	14420		91				92
	10	6.35	3	3430	9300	74	68	32	6	3.5	49
			4	4390	12400		79				65
			6	6220	18600		102				95
	12	7.938	3	4510	11150	75	82	40	6	3.5	50
			4	5770	14870		70				66
63	6	3.969	4	2610	10550	80	56	25	6	3.5	73
			6	3700	15830		70	32			107
	8	4.762	4	3375	12200	82	70	32	6	3.5	76
			6	4780	18300		91	40			111
	10	6.35	4	5020	16450	85	79	32	8	4.0	79
			6	7110	24680		85	40			116
	12	7.938	4	6580	19430	90	95	40	8	4.0	80
			6	9320	29150		123	50			118
80	10	6.35	4	5510	21200	105	79	32	8	4.0	95
			6	7810	31800		102	40			140
	12	7.938	4	7500	25700	110	95	40	8	4.0	98
			6	10620	38550		123	50			143
	20	9.525	3	9770	31700	115	126	50	10	5.0	97
			4	12510	42270		149	63			127

Specifications

RDIC

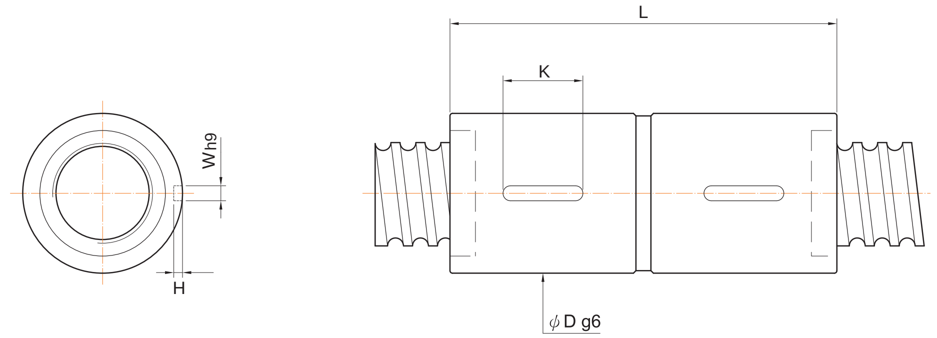


UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	KEYWAY K	KEYWAY W	KEYWAY H	STIFFNESS kgf/μm
16	5	3.175	3	765	1240	28	75	20	3	1.8	35
			4	980	1650		85				47
20	5	3.175	3	860	1710	34	75	20	3	1.8	43
			4	1100	2280		85				56
	6	3.969	3	1080	2050	34	87	20	4	2.5	43
			4	1380	2730		103	25			56
25	5	3.175	3	980	2300	40	75	20	4	2.5	51
			4	1250	3070		85				67
	6	3.969	3	1275	2740	40	87	20	4	2.5	52
			4	1630	3650		103	25			68
32	5	3.175	3	1095	3060	48	75	20	4	2.5	63
			4	1400	4080		85	20			82
			6	1980	6120		105	25			122
	6	3.969	3	1500	3750	50	87	20	5	3.0	65
			4	1920	5000		103	25			86
			6	2720	7500		127	32			125
	8	4.762	3	1820	4230	50	109	25	5	3.0	66
			4	2330	5640		127				86
	10	6.35	3	2605	5310	54	135	25	6	3.5	67
			4	3340	7080		155	32			89
40	5	3.175	4	1575	5290	55	85	20	4	2.5	100
			6	2230	7940		105	25			147
	6	3.969	4	2130	6410	55	103	25	5	3.0	103
			6	3020	9620		127	32			149
	8	4.762	4	2720	7620	60	127	25	5	3.0	105
			6	3850	11430		161	40			154
	10	6.35	3	3010	7100	65	135	25	6	3.5	82
			4	3850	9470		155	32			107

Specifications

RDIC



UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	KEYWAY K	KEYWAY W	KEYWAY H	STIFFNESS kgf/μm
50	5	3.175	4	1730	6750	66	85	20	4	2.5	119
			6	2450	10130		105	25			174
	6	3.969	4	2380	8250	66	103	25	5	3.0	123
			6	3370	12380		127	32			181
	8	4.762	4	3010	9610	70	127	32	5	3.0	125
			6	4260	14420		161				185
	10	6.35	3	3430	9300	74	135	32	6	3.5	99
			4	4390	12400		155	32			129
			6	6220	18600		197	40			191
	12	7.938	3	4510	11150	75	161	40	6	3.5	101
			4	5770	14870		185				132
63	6	3.969	4	2610	10550	80	106	25	6	3.5	146
			6	3700	15830		130	32			217
	8	4.762	4	3375	12200	82	131	32	6	3.5	151
			6	4780	18300		165	40			222
	10	6.35	4	5020	16450	85	160	32	8	4.0	158
			6	7110	24680		202	40			232
	12	7.938	4	6580	19430	90	185	40	8	4.0	161
			6	9320	29150		238	50			236
80	10	6.35	4	5510	21200	105	160	32	8	4.0	190
			6	7810	31800		202	40			280
	12	7.938	4	7500	25700	110	185	40	8	4.0	196
			6	10620	38550		238	50			288
	20	9.525	3	9770	31700	115	245	50	10	5.0	193
			4	12510	42270		289	63			254

PMI Precision Ground BallScrew

13.2 End Deflector Series

Features

It is important for a high-lead ballscrew to be with characteristics of high rigidity, low noise and thermal control.
PMI takes its patented design and treatments to achieve the following characteristics:

High DN Value

Max. DN Value: 220,000

Low Noise

The average and accurate ball circle diameter (BCD) through whole threads make the ballscrews to obtain the stable and consistent drag torque as well as to reduce the noise.
The audio frequency is low and deep due to the designed of plastic circulation system.

Space Saving

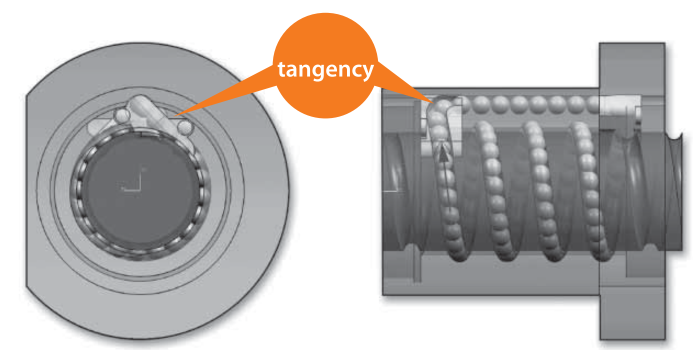
The ballnut diameter reduces 20%~25% substantially and the length of nut is shorter.
The total space shall be reduced to approximately 50% consequently.

Applications

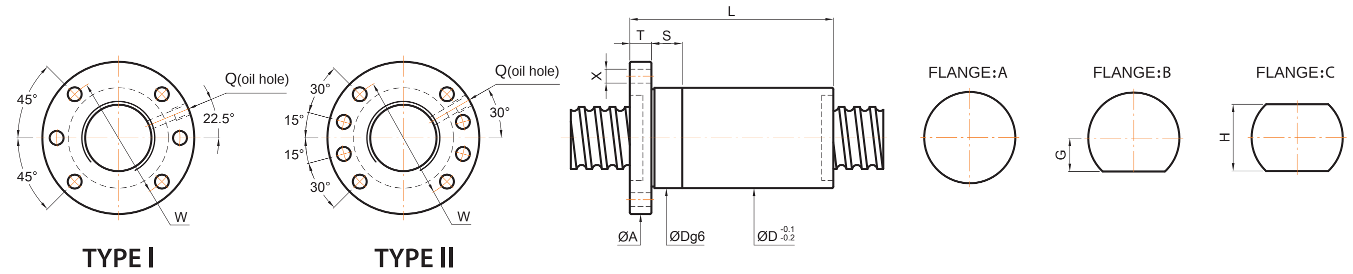
- CNC Machinery
- Precision Machinery
- High Speed Machinery
- Semi-Conductor Equipment
- Medical equipment

Circulation

The specially designed pathway of the Recirculation System makes a contact with lead angle and also with BCD in the same tangency, improving its smoothness effectively.



FSDC



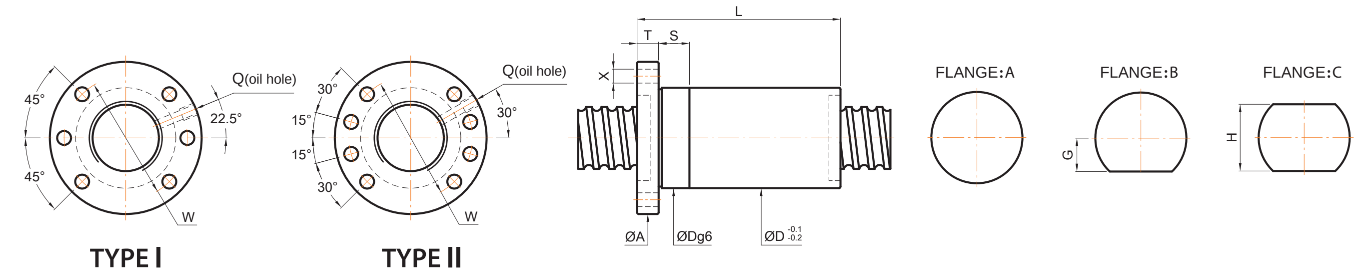
UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	Coam and Cam are the modified load capaity (kgf)		NUT		FLANGE						FIT	OIL HOLE	BOLT	STIFFNESS
O.D.	LEAD			Dynamic (1×10^6 REV.) Cam	Static Coam	Dg6	L	A	T	W	G	H	TYPE	S	Q	X	kgf/um
12	5	2.381	3	610	1190	24	32	44	10	34	14	28	I	10	M6X1P	4.5	21
	10		3	590	1160		45										21
15	5	3.175	3	850	1640	29	35	51	10	34	16	32	I	10	M6×1P	5.5	25
	10		3	840	1610		47										25
16	10	3.175	3	870	1740	29	50	51	10	34	16	32	I	10	M6X1P	5.5	26
20	5	3.175	4	1300	3030	36	40	62	12	49	19	38	I	12	M6×1P	6.6	40
	10		3	990	2220		47										31
	20		2	670	1450		56										21
25	5	3.175	4	1440	3840	40	41	62	12	51	24	48	I	15	M6X1P	6.6	48
	10		3	1100	2810		50										36
	20		2	750	1840		60										25
	25		2	730	1810		71										24
	6	3.969	4	2250	5710	42	45	63.5	12	51	22	44	I	15	M6X1P	6.6	52
	12		4	2240	5660	45	70	65									52
	10	4.762	4	2400	6870	45	63	65	15	54	25.5	51	I	15	M6X1P	6.6	54
	16		4	2830	6790		85										54
28	5	3.175	5	1850	5460	45	48	65	12	51	22	44	I	15	M8X1P	6.6	63
	10	6.35	5	5280	12530	54	78	87	16	72	34.5	69	I		M8X1P	9	76
32	5	3.175	4	1610	4970	50	41	87	16	72	34.5	69	I	15	M8X1P	9	57
	10	3.969	4	2550	7500	53	66	87		72	34.5	69					63
	8	4.762	5	3900	10930	53	67	87	16	72	34.5	69	I	15	M8X1P	9	80
	10		5	3890	10910	56	77	86		71	32.5	65					79
	12		5	3890	10890	56	87	86		71	32.5	65					80
	15		5	3860	10850	53	116	87		72	34.5	69					80
	10	6.35	5	5720	14490	57	78	87	16	72	34.5	69	I	15	M8X1P	9	84
	12		5	5710	14470		88										84
	16		4	4520	11100		92										68

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

Product

FSDC



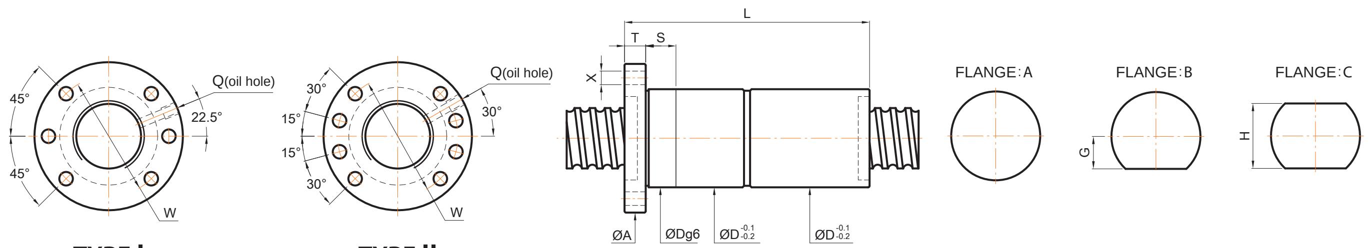
UNIT:mm

Specifications

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	Coam and Cam are the modified load capaity (kgf)		NUT		FLANGE						FIT	OIL HOLE	BOLT	STIFFNESS
O.D.	LEAD			Dynamic (1×10^6 REV.) Cam	Static Coam	Dg6	L	A	T	W	G	H	TYPE	S	Q	X	kgf/um
36	10	6.35	5	6050	16460	61	78	91	18	76	34	68	II	15	M8X1P	9	92
	12		5	6080	16430		88										92
	16		5	6050	16360		109										92
38	10	6.35	5	6260	17740	63	80	93	18	78	35	70	II	20	M8X1P	9	96
	12		5	6260	17410		88										96
	16		5	6220	17350		109										96
40	5	3.175	4	1760	6260	60	42	91	18	76	34	68	II	15	M8X1P	9	67
	10	6.35	5	6430	18440	65	78	95	18	80	36	72	II	20	M8X1P	9	100
	12		5	6420	18410		88										100
	15		5	6380	18350		121										99
	16		5	6390	18330		108										99
	20	6.35	4	5190	14450	68	110	98	18	83	37	74	II	20	M8X1P	11	80
45	10	6.35	5	6910	21330	70	78	105	18	88	40	80	II	20	M8X1P	11	110
	12		5	6910	21310		89										109
	16		5	6880	21250		111										109
50	10	6.35	5	7160	23320	82	78	118	18	100	46	92	II	20	M8X1P	11	118
	12		5	7150	23300		90										118
	16		5	7120	23250		109										118
55	12	6.35	5	7340	25280	80	108	118	18	100	46	92	II	20	M8X1P	11	126
63	10	6.35	5	7800	29210	95	84	135	22	115	50	100	II	20	M8X1P	14	139

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

FDDC



TYPE I　　TYPE II

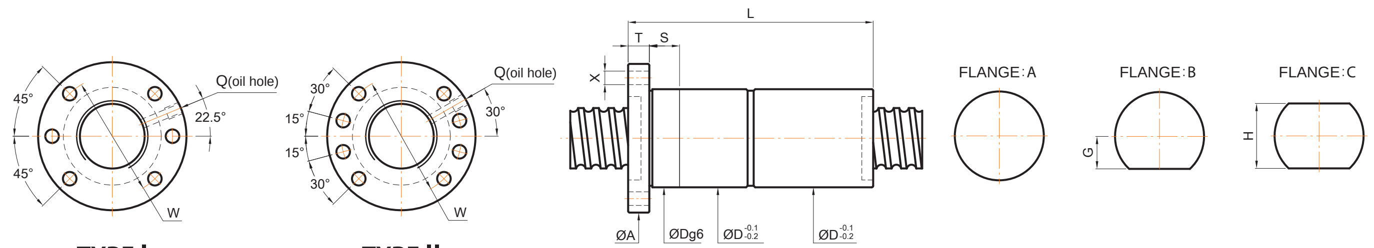
UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS	Dynamic (1×10^6 REV.) Cam	Static Coam	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FLANGE G	FLANGE H	FLANGE TYPE	FIT S	OIL HOLE Q	BOLT X	STIFFNESS kgf/um
20	5	3.175	4	1300	3030	36	80	62	12	49	19	38	I	12	M6X1P	6.6	64
	10		3	990	2220		97										49
	20		2	670	1450		116										33
25	5	3.175	4	1440	3840	40	81	62	12	51	24	48	I	15	M6X1P	6.6	75
	10		3	1100	2810		100										57
	20		2	750	1840		120										39
	25		2	730	1810		146										39
	6	3.969	4	2250	5710	42	87	63.5	12	51	22	44	I	15	M6X1P	6.6	83
	12		4	2240	5660	45	142	65									82
	10	4.762	4	2400	6870	45	128	65	15	54	25.5	51	I	15	M6X1P	6.6	86
	16		4	2830	6790		173										86
28	5	3.175	5	1850	5460	45	93	65	12	51	22	44	I	15	M8X1P	6.6	101
	10	6.35	5	5280	12530	54	158	87	16	72	34.5	69	I		M8X1P	9	120
32	5	3.175	4	1610	4970	50	81	87	16	72	34.5	69	I	15	M8X1P	9	90
	10	3.969	4	2550	7500	53	126	87		72	34.5	69					99
	8	4.762	5	3900	10930	53	132	87	16	72	34.5	69	I	15	M8X1P	9	126
	10		5	3890	10910	56	147	86		71	32.5	65					126
	12		5	3890	10890	56	171	86		71	32.5	65					126
	15		5	3860	10850	53	221	87		72	34.5	69					127
	10	6.35	5	5720	14490	57	153	87	16	72	34.5	69	I	15	M8X1P	9	134
	12		5	5710	14470		172										134
	16		4	4520	11100		180										108

Coam and Cam are the modified load capaity (kgf)

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

FDDC



TYPE I　　TYPE II

UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS	Dynamic (1×10^6 REV.) Cam	Static Coam	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FLANGE G	FLANGE H	FLANGE TYPE	FIT S	OIL HOLE Q	BOLT X	STIFFNESS kgf/um
36	10	6.35	5	6050	16460	61	153	91	18	76	34	68	II	15	M8X1P	9	146
	12		5	6080	16430		172										146
	16		5	6050	16360		213										145
38	10	6.35	5	6260	17740	63	155	93	18	78	35	70	II	15	M8X1P	9	152
	12		5	6260	17410		172										152
	16		5	6220	17350		213										152
40	5	3.175	4	1760	6260	60	87	91	18	76	34	58	II	15	M8X1P	9	107
	10	6.35	5	6430	18440	65	158	95	18	80	36	72	II	20	M8X1P	9	158
	12		5	6420	18410		172										158
	15		5	6380	18350		226										158
	16		5	6390	18330		212										158
	20	6.35	4	5190	14450	68	220	98	18	83	37	74	II	20	M8X1P	11	127
45	10	6.35	5	6910	21330	70	158	105	18	88	40	80	II	20	M8X1P	11	174
	12		5	6910	21310		171										174
	16		5	6880	21250		215										174
50	10	6.35	5	7160	23320	82	158	118	18	100	46	92	II	20	M8X1P	11	187
	12		5	7150	23300		174										187
	16		5	7120	23250		215										187
55	12	6.35	5	7340	25280	80	174	118	18	100	46	92	II	20	M8X1P	11	200
63	10	6.35	5	7800	29210	95	164	135	22	115	50	100	II	20	M8X1P	14	221

Coam and Cam are the modified load capaity (kgf)

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

PMI Precision Ground BallScrew

13.3 External Ball Circulation Nuts

Features:

- Lower noise due to longer ball circulation paths.
- Offers smoother ball running.
- Offers better solution and quality for long lead or large diameter ballscrews.

Type:

There are two types of Ballnut of the external circulation Ballscrews. They are "immersion type" of Fig.13.2 and "extrusive type" of Fig.13.3. The "immersion type" means the ball circulation tubes are inside the circular surface of Ballnut as shown on specifications of this catalogue are of "immersion type".

In some cases, as per designs on customer's drawings, there are smaller outer diameters ballnuts required. Then the ball circulation tubes shall extrude out of Ballnut circular surface.

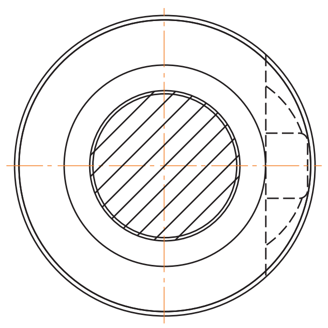


Fig.13.2 Immersion type

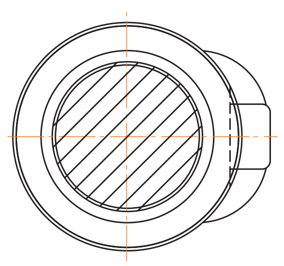
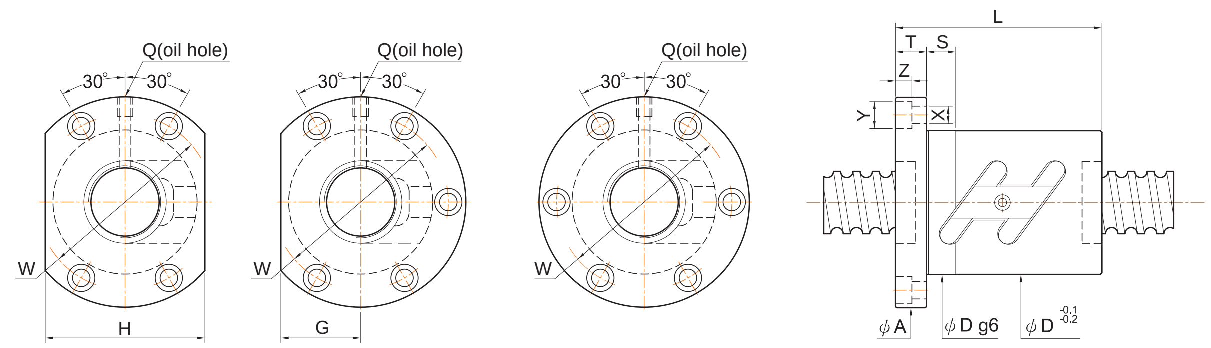


Fig.13.3 Extrusive type

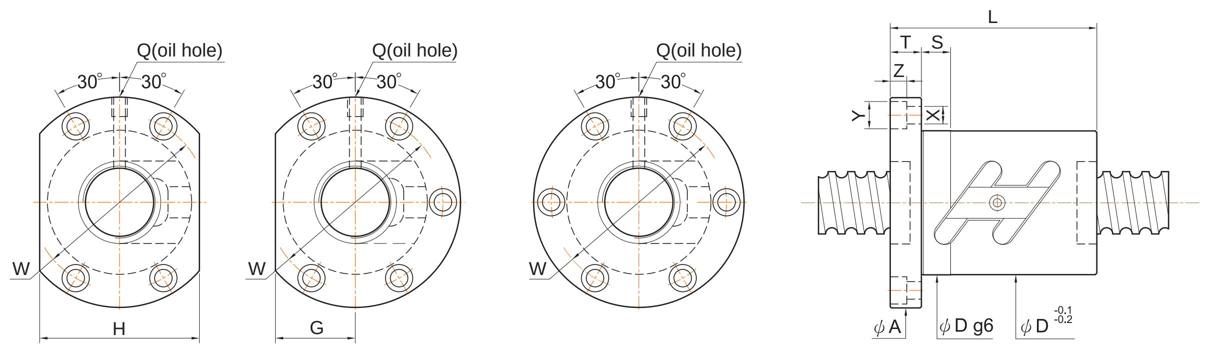


UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD		circuit × row	Dynamic (1×10^6 REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
10	3	2.000	2.5×1	250	430	26	37	46	10	36	14	28	10	4.5	8	4.5	M6×1P	9
	4	2.000	2.5×1	250	430		40											9
	5	2.000	2.5×1	250	430		42											9
12	4	2.381	2.5×1	380	640	30	40	50	10	40	16	32	10	4.5	8	4.5	M6×1P	12
	5	2.381	2.5×1	380	640		42											12
14	4	2.381	2.5×1	410	750	34	40	57	11	45	17	34	10	4.5	9.5	5.5	M6×1P	14
	5	3.175	2.5×1	675	1145		42											15
15	4	2.381	2.5×1	420	800	34	40	57	10	45	17	34	10	5.5	9.5	5.5	M6x1P	14
	5	3.175	2.5×1	680	1210		42											15
	10	3.175	2.5×1	680	1210		55											16
16	4	2.381	1.5×2	490	1010	34	44	57	11	45	17	34	10	5.5	9.5	5.5	M6×1P	18
			2.5×1	430	850		41											15
			3.5x1	560	1180		42											21
	5	3.175	1.5×2	805	1525	40	45	63	11	51	21	42	15	5.5	9.5	5.5	M6×1P	19
			2.5x1	690	1270		41											16
			2.5x2	1250	2540		56											31
			3.5x1	920	1780		46											22
	6	3.175	1.5x2	805	1525	40	52	63	11	51	21	42	15	5.5	9.5	5.5	M6×1P	19
			2.5x1	690	1270		44											16
			3.5x1	920	1780		52											22
	10	3.175	2.5x1	690	1270	40	56	63	11	51	21	42	15	5.5	9.5	5.5	M6x1P	16
20	4	2.381	1.5x2	530	1270	40	44	63.5	11	51	21	42	10	5.5	9.5	5.5	M6x1P	21
			2.5x1	480	1060		40											18
			2.5x2	820	2120		50						15					35
			3.5x1	600	1480		43						10					25
	5	3.175	1.5x2	965	2070	44	45	67	11	55	26	52	15	5.5	9.5	5.5	M6x1P	24
			2.5x1	830	1730		42						10					20
			2.5x2	1510	3460		56						15					39
			3.5x1	1110	2420		46						15					26
	6	3.969	1.5x2	1285	2545	48	56	71	11	59	27	54	15	5.5	9.5	5.5	M6x1P	24
			2.5x1	1100	2120		49						10					20
			3.5x1	1470	2970		56						15					28
	8	3.969	1.5x2	1285	2545	48	61	75	13	61	27	54	15	6.6	11	6.5	M6x1P	24
			2.5x1	1100	2120		54						15					20
			3.5x1	1470	2970		62						15					28

Specifications

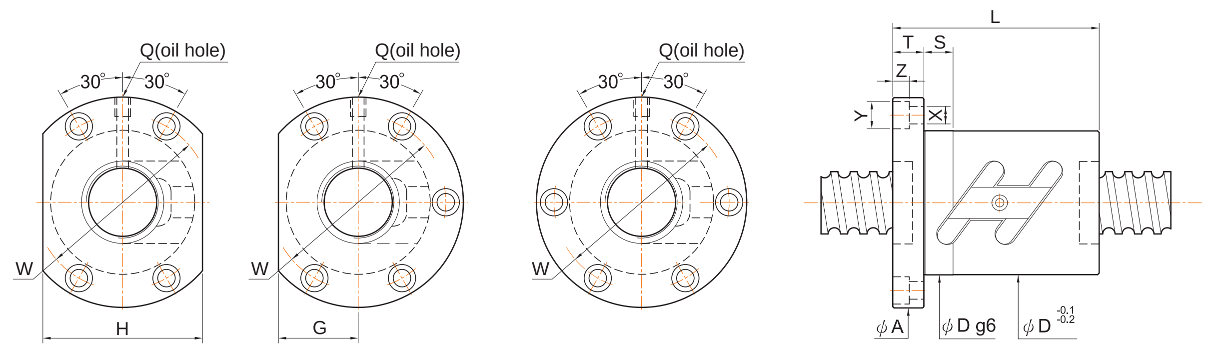
FSWC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	Static Co	NUT Dg6	NUT L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
25	4	2.381	1.5×2	600	1630	46	44	69	11	57	26	52	15	5.5	9.5	5.5	M6×1P	26
			2.5×1	510	1355		40											22
			2.5×2	930	2710		49											42
			3.5×1	680	1900		42											30
	5	3.175	1.5×2	1065	2575	50	45	73	11	61	28	56	15	5.5	9.5	5.5	M6×1P	28
			2.5×1	910	2150		41											24
			2.5×2	1650	4300		56											46
			3.5×1	1210	3010		46											33
	6	3.969	1.5×2	1420	3215	53	56	76	11	64	29	58	15	5.5	9.5	5.5	M6×1P	29
			2.5×1	1210	2680		49											24
			2.5×2	2190	5360		62											47
			3.5×1	1610	3750		56											34
	8	4.762	1.5×2	1820	3840	58	61	85	13	71	32	64	15	6.6	11	6.5	M6×1P	30
			2.5×1	1560	3200		61											25
			3.5×1	2080	4480		66											35
	10	4.762	1.5×2	1820	3840	58	71	85	15	71	32	64	15	6.6	11	6.5	M6×1P	30
			2.5×1	1560	3200		65											25
			3.5×1	2080	4480		75											35
	12	3.969	2.5×1	1210	2680	53	60	76	11	64	32	64	15	5.5	9.5	5.5	M6×1P	24
28	5	3.175	1.5×2	1110	2960	55	46	83	12	69	31	62	15	6.6	11	6.5	M8×1P	31
			2.5×1	950	2470		42											26
			2.5×2	1720	4940		56											50
			3.5×1	1270	3460		47											36
	6	3.969	1.5×2	1480	3605	55	57	83	12	69	31	62	15	6.6	11	6.5	M8×1P	32
			2.5×1	1270	3000		50											26
			2.5×2	2300	6000		63											51
			3.5×1	1690	4200		57											37
	8	4.762	1.5×2	1935	4325	60	65	93	15	76	36	72	15	9	14	8.5	M8×1P	33
			2.5×1	1650	3600		63											28
			3.5×1	2200	5040		68											38
	10	4.762	1.5×2	1935	4325	60	74	93	15	76	36	72	15	9	14	8.5	M8×1P	33
			2.5×1	1650	3600		67											28
			3.5×1	2200	5040		77											38

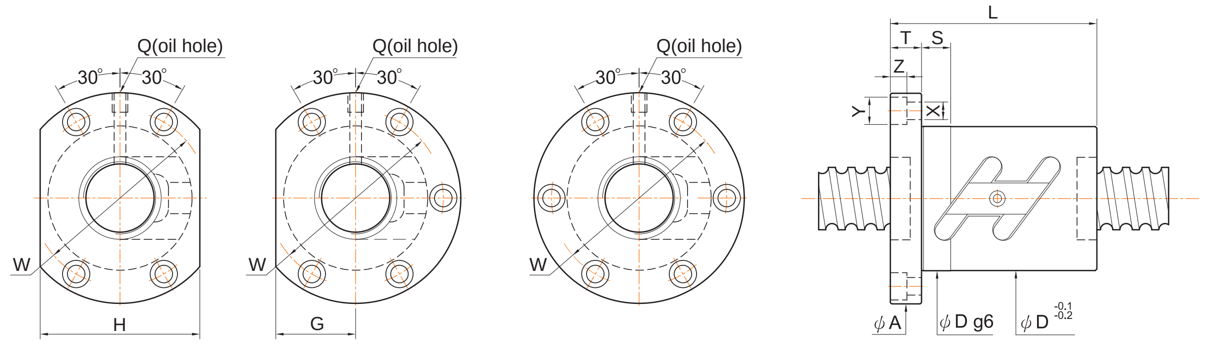
FSWC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	Static Co	NUT Dg6	NUT L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
32	4	2.381	2.5x1	565	1750	54	40	81	12	67	32	64	15	6.6	11	6.5	M6x1P	26
			2.5x2	1020	3500		50											50
	5	3.175	1.5x2	1180	3410	58	47	85	12	71	32	64	15	6.6	11	6.5	M8x1P	34
			2.5x1	1010	2840		43											29
			2.5x2	1830	5680		57											56
			2.5x3	2590	8520		72											82
			3.5x1	1350	3980		47											40
	6	3.969	1.5x2	1560	4135	62	57	88	12	75	34	68	15	6.6	11	6.5	M8×1P	35
			2.5x1	1330	3450		45											29
			2.5x2	2410	6900		63											57
			3.5x1	1770	4830		57											40
	8	4.762	1.5x2	2010	5010	66	64	98	15	82	38	76	15	9	14	8.5	M8×1P	36
			2.5x1	1720	4180		63											30
			2.5x2	3120	8360		80											59
			3.5x1	2300	5850		68											42
	10	6.35	1.5x2	3000	6530	74	78	108	15	90	41	82	15	9	14	8.5	M8×1P	38
			2.5x1	2570	5440		68											32
			2.5x2	4660	10880		97											61
			3.5x1	3430	7620		78											44
	12	6.35	1.5x2	3000	6530	74	88	108	18	90	41	82	15	9	14	8.5	M8×1P	38
			2.5x1	2570	5440		77											32
			2.5x2	4660	10880		110											62
			3.5x1	3430	7620		91											44
36	5	3.175	1.5x2	1240	3850	65	50	98	15	82	38	76	15	9	14	8.5	M8×1P	38
			2.5x2	1920	6420		60											62
			2.5x3	2720	9630		75											90
			3.5x1	1410	4490		50											44
	6	3.969	2.5x2	2600	7900	65	66	98	15	82	38	76	15	9	14	8.5	M8×1P	63
			2.5x3	3680	11850		84											93
	10	6.35	1.5x2	3180	7410	75	81	118	18	98	45	90	15	11	17.5	11	M8×1P	41
			2.5x1	2720	6180		71											35
			2.5x2	4930	12360		103											68
			3.5x1	3630	8650		81											48
	12	6.35	2.5x1	2720	6180	75	77	118	18	98	45	90	15	11	17.5	11	M8×1P	35
			2.5x2	4930	12360		110											68
			3.5x1	3630	8650		91											48

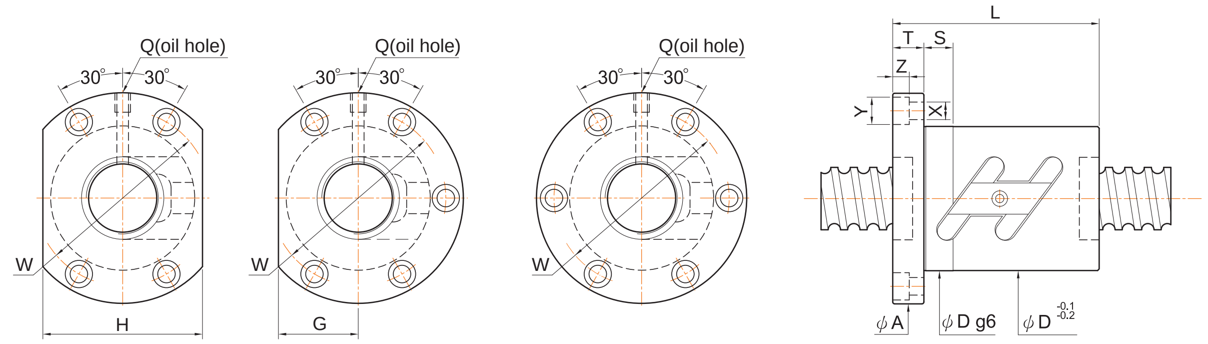
FSWC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit×row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	Static Co	NUT Dg6	L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
40	5	3.175	1.5x2	1280	4275	67	50	101	15	83	39	78	15	9	14	8.5	M8×1P	41
			2.5x1	1090	3560		48											34
			2.5x2	1980	7120		60											66
			2.5x3	2800	10680		75											98
			3.5x1	1450	4980		50											47
	6	3.969	1.5x2	1750	5300	70	60	104	15	86	40	80	15	9	14	8.5	PT1/8"	42
			2.5x1	1500	4420		53											35
			2.5x2	2720	8840		66											69
			2.5x3	3850	13260		84											101
			3.5x1	2000	6190		60											49
	8	4.762	1.5x2	2220	6320	74	64	108	15	90	41	82	15	9	14	8.5	PT1/8"	43
			2.5x1	1900	5270		63											36
			2.5x2	3450	10540		83											70
			3.5x1	2540	7380		68											50
	10	6.35	1.5x2	3370	8335	82	81	124	18	102	47	94	20	11	17.5	11	PT1/8"	45
			2.5x1	2880	6950		71											35
			2.5x2	5220	13900		103											74
			3.5x1	3840	9730		81											52
	12	6.35	2.5x1	2880	6950	86	77	128	18	106	48	96	20	11	17.5	11	PT1/8"	38
			2.5x2	5220	13900		112											74
			3.5x1	3840	9730		91											52
45	10	6.35	2.5x2	5480	15700	88	101	132	18	110	50	100	20	11	17.5	11	PT1/8"	81
			2.5x3	7760	23550		131											119
	12	7.144	2.5x1	3550	8950	90	84	132	18	110	50	100	20	11	17.5	11	PT1/8"	43
			2.5x2	6440	17900		112											82
			2.5x3	9120	26850		148											121

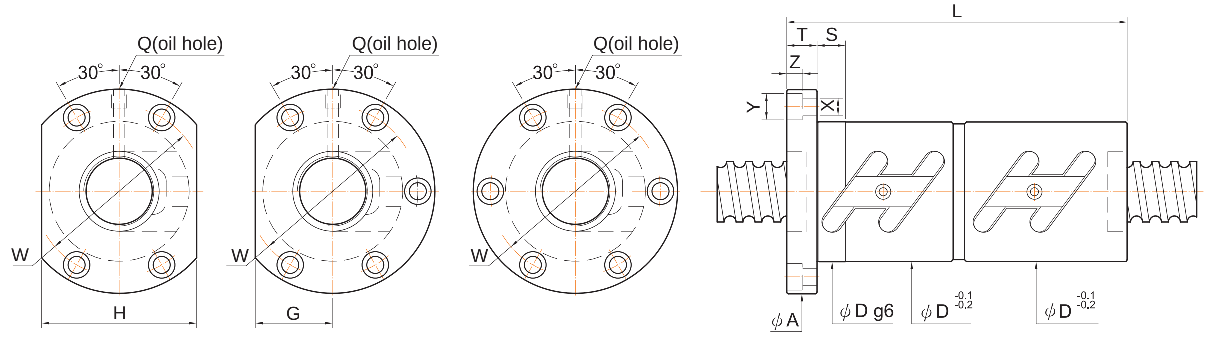
FSWC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit×row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	Static Co	NUT Dg6	L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
50	5	3.175	1.5x2	1410	5305	80	50	114	15	96	43	86	15	9	14	8.5	PT1/8"	49
			1.5x3	2000	7960		60											72
			2.5x2	2190	8840		60											80
			3.5x1	1610	6190		50											57
	6	3.969	1.5x2	1920	6600	84	60	118	15	100	45	90	15	9	14	8.5	PT1/8"	50
			2.5x2	2980	11000		67											82
			2.5x3	4220	16500		85											121
			3.5x1	2190	7700		60											58
	8	4.762	1.5x2	2515	7810	87	68	128	18	107	49	98	20	11	17.5	11	PT1/8"	52
			2.5x2	3900	13020		86											85
			2.5x3	5520	19530		109											125
			3.5x1	2870	9110		71											60
	10	6.35	1.5x2	3725	10450	93	81	135	18	113	51	102	20	11	17.5	11	PT1/8"	54
			2.5x1	3190	8710		71											45
			2.5x2	5790	17420		101											88
			2.5x3	8200	26130		131											130
			3.5x1	4260	12190		81											63
	12	7.144	2.5x1	3700	10050	100	88	146	22	122	55	110	20	14	20	13	PT1/8"	46
			2.5x2	6710	20100		116											89
55	10	6.35	2.5x2	6005	19540	102	101	144	18	122	54	108	20	11	17.5	11	PT1/8"	95
			2.5x3	8510	29310		131											140
63	10	6.35	2.5x1	3510	11200	108	75	154	22	130	58	116	20	14	20	13	PT1/8"	55
			2.5x2	6370	22400		105											106
			2.5x3	9020	33600		135											156
	12	7.938	2.5x1	4770	13780	115	88	161	22	137	61	122	20	14	20	13	PT1/8"	59
			2.5x2	8650	27560		124											113
			2.5x3	12250	41340		160											167
80	10	6.35	2.5x2	7130	28500	130	105	176	22	152	66	132	20	14	20	13	PT1/8"	129
			2.5x3	10100	42750		134											190
	12	7.938	2.5x2	9710	35560	136	124	182	22	158	68	136	20	14	20	13	PT1/8"	137
			2.5x3	13760	53340		160											202
	16	9.525	2.5x2	16450	59280	143	160	204	28	172	77	154	30	18	26	17.5	PT1/8"	170
			2.5x3	23300	88920		208											250

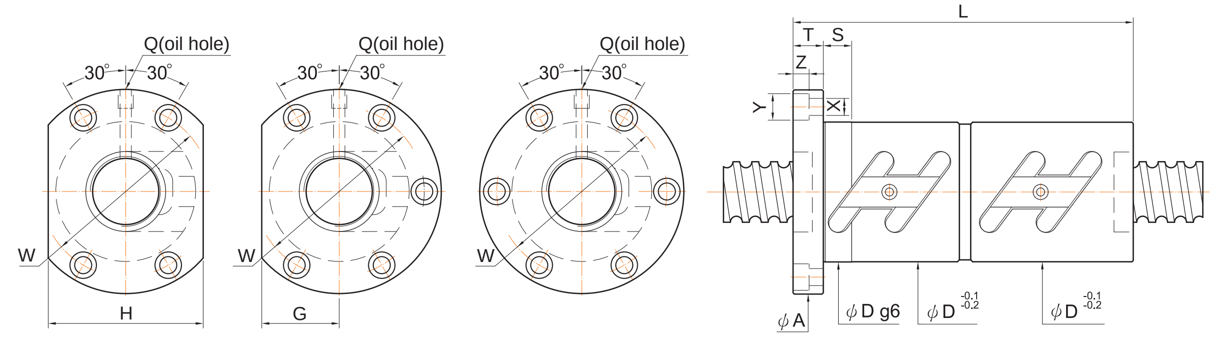
FDWC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	Static Co	NUT Dg6	NUT L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
16	4	2.381	1.5X2	490	1010	34	81	57	11	45	17	34	15	5.5	9.5	5.5	M6X1P	36
			2.5X1	430	850		70											30
			3.5X1	560	1180		78											42
	5	3.175	1.5x2	805	1525	40	89	63	11	51	20	40	15	5.5	9.5	5.5	M6X1P	39
			2.5x1	690	1270		77											33
			2.5x2	1250	2540		105											63
			3.5x1	920	1780		87											45
	6	3.175	1.5x2	805	1525	40	100	63	11	51	20	40	15	5.5	9.5	5.5	M6X1P	39
			2.5x1	690	1270		80											33
			3.5x1	920	1780		100											45
20	4	2.381	1.5x2	530	1270	40	75	63	11	51	24	48	15	5.5	9.5	5.5	M6X1P	42
			2.5x1	480	1060		67											36
			2.5x2	820	2120		89											69
			3.5x1	600	1480		75											49
	5	3.175	1.5x2	965	2070	44	80	67	11	55	26	52	15	5.5	9.5	5.5	M6X1P	47
			2.5x1	830	1730		76											40
			2.5x1	1510	3460		105											77
			3.5x1	1110	2420		80											55
	6	3.969	1.5x2	1285	2545	48	97	71	11	59	27	54	15	5.5	9.5	5.5	M6X1P	49
			2.5x1	1100	2120		82											41
			3.5x1	1470	2970		93											45
	8	3.969	1.5x2	1285	2545	48	108	75	13	61	28	56	15	6.6	11	6.5	M6X1P	49
			2.5x2	1100	2120		102											41
			3.5x1	1470	2970		110											56

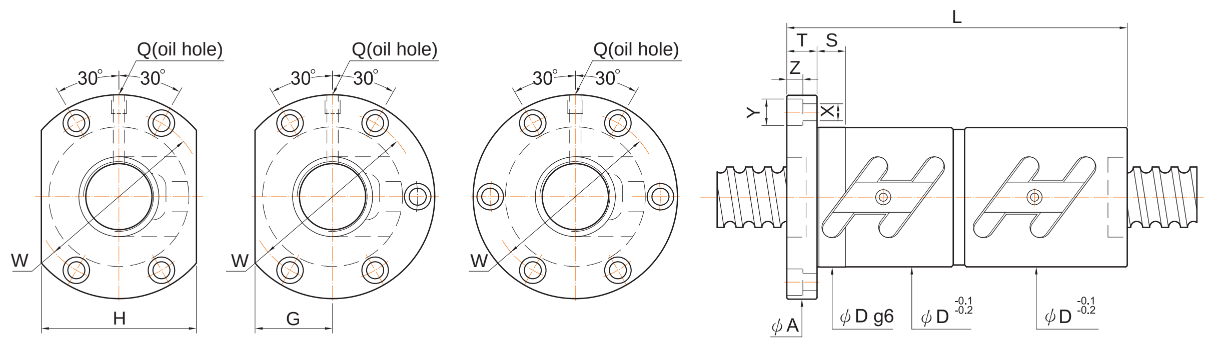
FDWC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	Static Co	NUT Dg6	NUT L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
25	4	2.381	1.5x2	600	1630	46	75	69	11	57	26	52	15	5.5	9.5	5.5	M6x1P	51
			2.5x1	510	1355		67											43
			2.5x2	930	2710		91											84
			3.5x1	680	1900		75											59
	5	3.175	1.5x2	1065	2575	50	80	73	11	61	28	56	15	5.5	9.5	5.5	M6x1P	57
			2.5x1	910	2150		77											48
			2.5x2	1650	4300		105											92
			3.5x1	1210	3010		86											65
	6	3.969	1.5x2	1420	3215	53	91	76	11	64	29	58	15	5.5	9.5	5.5	M6x1P	58
			2.5x1	1210	2680		82											49
			2.5x2	2190	5360		116											94
			3.5x1	1610	3750		93											67
	8	4.762	1.5x2	1820	3840	58	111	85	13	71	32	64	15	6.6	11	6.5	M6x1P	60
			2.5x1	1560	3200		95											50
			3.5x1	2080	4480		111											69
	10	4.762	1.5x2	1820	3840	58	134	85	15	71	32	64	15	6.6	11	6.5	M6x1P	60
			2.5x1	1560	3200		117											50
			3.5x1	2080	4480		138											69
28	5	3.175	1.5x2	1110	2960	55	86	83	12	69	31	62	15	6.6	11	6.5	M8x1P	62
			2.5x1	950	2470		78											52
			2.5x2	1720	4940		106											101
			3.5x1	1270	3460		86											72
	6	3.969	1.5x2	1480	3605	55	98	83	12	69	31	62	15	6.6	11	6.5	M8x1P	63
			2.5x1	1270	3000		89											53
			2.5x2	2300	6000		117											103
			3.5x1	1690	4200		94											73
	8	4.762	1.5x2	1935	4325	60	113	93	15	76	36	72	15	9	14	8.5	M8x1P	66
			2.5x1	1650	3600		97											55
			3.5x1	2200	5040		113											76
	10	4.762	1.5x2	1935	4325	60	134	93	15	76	36	72	15	9	14	8.5	M8x1P	66
			2.5x1	1635	3600		117											55
			3.5x1	2200	5040		138											76

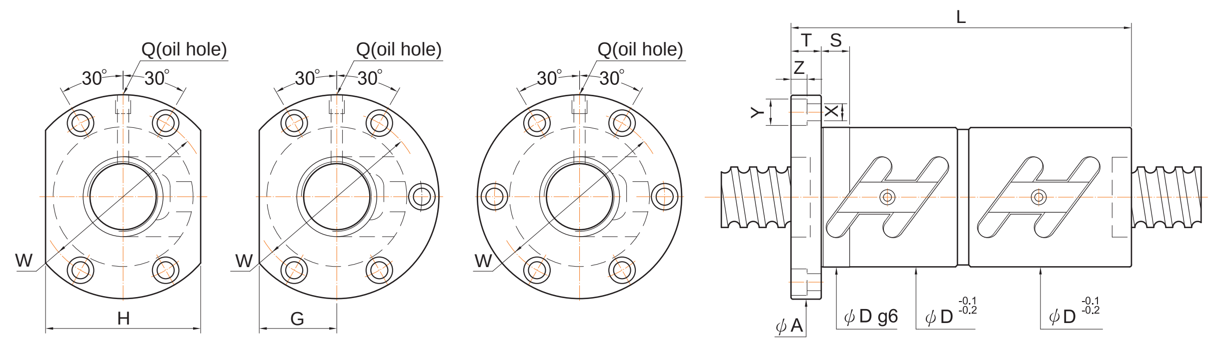
FDWC



UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FLANGE G	FLANGE H	FIT S	BOLT X	BOLT Y	BOLT Z	OIL HOLE Q	STIFFNESS kgf/μm
32	4	2.381	2.5x1	565	1750	54	68	81	12	67	32	64	15	6.6	11	6.5	M6x1P	52
			2.5x1	1020	3500		90											101
	5	3.175	1.5x2	1180	3410	58	82	85	12	71	32	64	15	6.6	11	6.5	M8x1P	69
			2.5x1	1010	2840		78											58
			2.5x2	1830	5680		105											112
			2.5x3	2590	8520		136											164
			3.5x1	1350	3980		82											80
	6	3.969	1.5x2	1560	4135	62	100	88	12	75	34	68	15	6.6	11	6.5	M8x1P	70
			2.5x1	1330	3450		87											59
			2.5x2	2410	6900		123											114
			3.5x1	1770	4830		100											81
	8	4.762	1.5x2	2010	5010	66	113	98	15	82	38	76	15	9	14	8.5	M8x1P	76
			2.5x1	1720	4180		106											64
			2.5x2	3120	8360		152											123
			3.5x1	2300	5850		113											88
	10	6.35	1.5x2	3000	6530	74	138	108	15	90	41	82	15	9	14	8.5	M8x1P	76
			2.5x1	2570	5440		118											64
			2.5x2	4660	10880		177											123
			3.5x1	3430	7620		148											88
	12	6.35	1.5x2	3000	6530	74	160	108	18	90	41	82	15	9	14	8.5	M8x1P	76
			2.5x1	2570	5440		137											64
			2.5x2	4660	10880		208											124
			3.5x1	3430	7620		160											88
36	5	3.175	1.5x2	1240	3850	65	91	98	15	82	38	76	15	9	14	8.5	M8x1P	75
			2.5x2	1920	6420		110											123
			2.5x3	2720	9630		139											181
			3.5x1	1410	4490		90											87
	6	3.969	2.5x2	2600	7900	65	123	98	15	82	38	76	15	9	14	8.5	M8x1P	126
			2.5x3	3680	11850		159											187
	8	4.762	2.5x2	3265	9450	70	153	114	18	92	46	92	20	11	17.5	11	M8x1P	129
	10	6.35	1.5x2	3180	7410	75	141	118	18	98	45	90	15	11	17.5	11	M8x1P	83
			2.5x1	2720	6180		131											70
			2.5x2	4930	12360		180											136
			3.5x1	3630	8650		151											96
	12	6.35	2.5x1	2720	6180	75	137	118	18	98	45	90	15	11	17.5	11	M8x1P	70
			2.5x2	4930	12360		208											136
			3.5x1	3630	8650		161											97

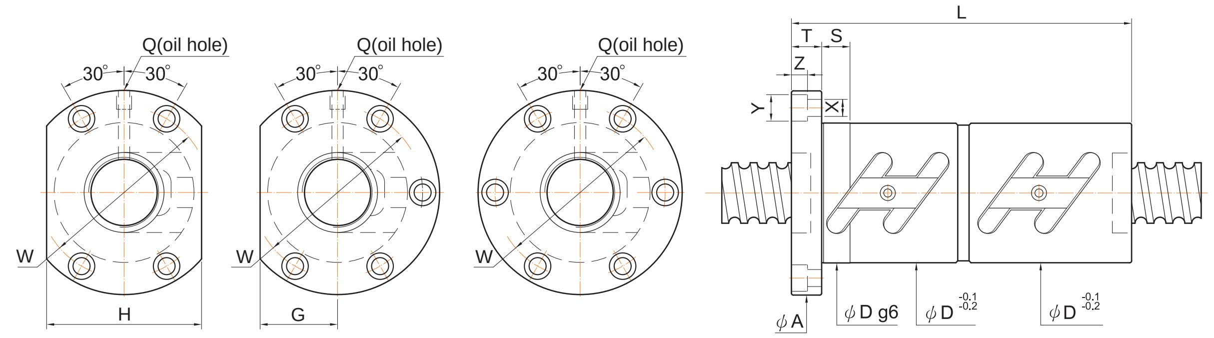
FDWC



UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FLANGE G	FLANGE H	FIT S	BOLT X	BOLT Y	BOLT Z	OIL HOLE Q	STIFFNESS kgf/μm
40	5	3.175	1.5x2	1280	4275	67	88	101	15	83	39	78	15	9	14	8.5	M8x1P	82
			2.5x1	1090	3560		84											69
			2.5x2	1980	7120		108											133
			2.5x3	2800	10680		139											196
			3.5x1	1450	4980		88											95
	6	3.969	1.5x1	1750	5300	70	103	104	15	86	40	80	15	9	14	8.5	PT1/8"	85
			2.5x1	1500	4420		90											71
			2.5x2	2720	8840		123											138
			2.5x3	3850	13260		159											202
			3.5x1	2000	6190		103											98
	8	4.762	1.5x2	2220	6320	74	124	108	15	90	41	82	15	9	14	8.5	PT1/8"	86
			2.5x1	1900	5270		108											73
			2.5x2	3450	10540		152											141
			3.5x1	2540	7380		125											100
	10	6.35	1.5x2	3370	8335	82	141	124	18	102	47	94	20	11	17.5	11	PT1/8"	91
			2.5x1	2880	6950		131											71
			2.5x2	5220	13900		180											148
			3.5x1	3840	9730		151											105
	12	6.35	2.5x1	2880	6950	86	137	128	18	106	48	96	20	11	17.5	11	PT1/8"	76
			2.5x2	5220	13900		208											148
			3.5x1	3840	9730		161											105
45	6	3.969	2.5x2	2850	9870	80	123	114	15	96	48	96	15	9	14	8.5	PT1/8"	151
			2.5x3	4035	14800		159											222
	8	4.762	2.5x2	3650	11780	85	158	127	18	105	52	104	20	11	17.5	11	PT1/8"	155
			2.5x3	5175	17670		206											228
	10	6.35	2.5x2	5480	15700	88	180	132	18	110	50	100	20	11	17.5	11	PT1/8"	163
			2.5x3	7760	23550		243											239
	12	7.144	2.5x1	3550	8950	90	140	132	18	110	50	100	20	11	17.5	11	PT1/8"	85
			2.5x2	6440	17900		210											165

FDWC

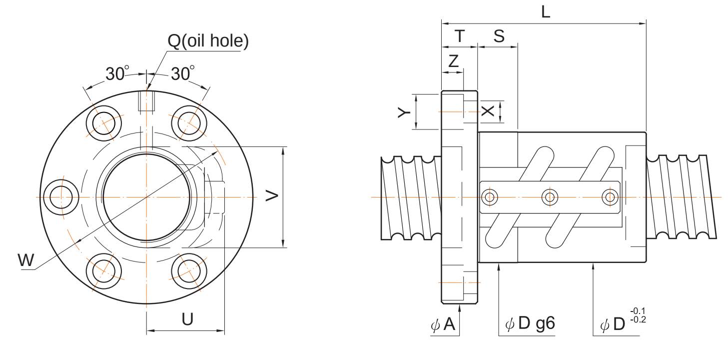


UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FLANGE G	FLANGE H	FIT S	BOLT X	BOLT Y	BOLT Z	OIL HOLE Q	STIFFNESS kgf/μm
50	5	3.175	1.5x2	1410	5305	80	108	114	15	96	43	86	15	9	14	8.5	PT1/8"	98
			1.5x3	2000	7960		128											144
			2.5x2	2190	8840		113											159
			3.5x1	1610	6190		108											114
	6	3.969	1.5x2	1920	6600	84	111	118	15	100	45	90	15	9	14	8.5	PT1/8"	101
			2.5x2	2980	11000		123											164
			2.5x3	4220	16500		159											242
			3.5x1	2190	7700		107											117
	8	4.762	1.5x2	2515	7810	87	127	128	18	107	49	98	20	11	17.5	11	PT1/8"	104
			2.5x2	3900	13020		156											170
			2.5x3	5520	19530		208											250
			3.5x1	2870	9110		127											121
	10	6.35	1.5x2	3725	10450	93	151	135	18	113	51	102	20	11	17.5	11	PT1/8"	108
			2.5x1	3190	8710		132											91
			2.5x2	5790	17420		180											177
			2.5x3	8200	26130		243											261
			3.5x1	4260	12190		151											126
	12	7.144	2.5x1	3700	10050	100	140	146	18	122	55	110	20	14	20	13	PT1/8"	92
			2.5x2	6710	20100		210											179
55	10	6.35	2.5x2	6005	19540	102	181	144	18	122	54	108	20	11	17.5	11	PT1/8"	191
			2.5x3	8510	29310		243											281
63	10	6.35	2.5x1	3510	11200	108	136	154	22	130	58	116	20	14	20	13	PT1/8"	110
			2.5x2	6370	22400		189											213
			2.5x3	9020	33600		249											313
	12	7.938	2.5x1	4760	13820	115	144	161	22	137	61	122	20	14	20	13	PT1/8"	112
			2.5x2	8630	27640		214											218
	16	9.525	2.5x1	8050	23100	122	200	178	28	150	69	138	20	18	26	17.5	PT1/8"	144
			2.5x2	14600	46200		296											280
80	10	6.35	2.5x2	7130	28500	130	189	176	22	152	66	132	20	14	20	13	PT1/8"	258
			2.5x3	10100	42750		249											380
	12	7.938	2.5x2	9710	35560	136	220	182	22	158	68	136	20	14	20	13	PT1/8"	265
			2.5x3	13760	53340		292											391
	16	9.525	2.5x2	16450	59280	143	290	204	28	172	77	154	30	18	26	17.5	PT1/8"	339
			2.5x3	23300	88920		386											500

Specifications

FSVC

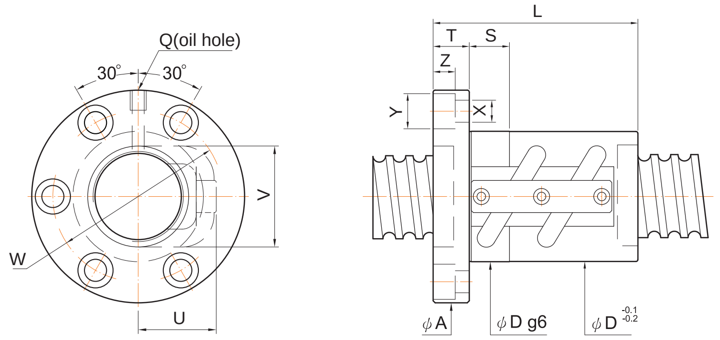


UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FIT S	BOLT X	BOLT Y	BOLT Z	RETURN TUBE U	RETURN TUBE V	OIL HOLE Q	STIFFNESS kgf/μm
14	4	2.381	2.5x1	410	750	25	40	45	10	35	10	5.5	9.5	5.5	19	21	M6x1P	14
	5	3.175	2.5x1	675	1145		42											15
15	4	2.381	2.5x1	420	800	28.5	40	48	10	38	10	5.5	9.5	5.5	17	22	M6x1P	14
	5	3.175	2.5x1	680	1210		42											15
16	5	3.175	1.5x2	805	1525	31	50	54	12	41	15	5.5	9.5	5.5	20	23	M6x1P	19
			2.5x1	690	1270		45											16
			2.5x2	1250	2540		60											31
			3.5x1	920	1780		50											22
20	5	3.175	1.5x2	965	2070	35	50	58	12	46	15	5.5	9.5	5.5	22	27	M6x1P	24
			2.5x1	830	1730		45				10							20
			2.5x2	1510	3460		60				15							39
			3.5x1	1110	2420		50				15							26
	6	3.969	1.5x2	1285	2545	36	66	60	12	47	15	5.5	9.5	5.5	27	28	M6x1P	24
			2.5x1	1100	2120		48				10							20
			3.5x1	1470	2970		66				15							28
25	6	3.969	1.5x2	1420	3215	42	65	68	12	55	15	5.5	9.5	5.5	28	33	M6x1P	29
			2.5x1	1210	2680		50											24
			2.5x2	2190	5360		68											47
			3.5x1	1610	3750		65											34
	10	4.762	1.5x2	1820	3840	45	75	72	16	58	15	6.6	11	6.5	29	34	M6x1P	30
			2.5x1	1560	3200		65											25
			3.5x1	2080	4480		75											35
28	5	3.175	1.5x2	1110	2960	44	50	70	12	56	15	6.6	11	6.5	28	34	M6x1P	31
			2.5x1	950	2470		45											26
			2.5x2	1720	4940		60											50
			3.5x1	1270	3460		50											36
	6	3.969	1.5x2	1480	3605	44	55	70	12	56	15	6.6	11	6.5	28	36	M6x1P	32
			2.5x1	1270	3000		50											26
			2.5x2	2300	6000		68											51
			3.5x1	4200	4200		55											37

Specifications

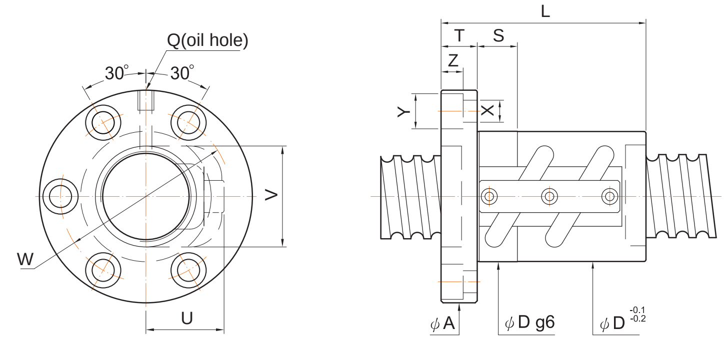
FSVC



UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FIT S	BOLT X	BOLT Y	BOLT Z	RETURN TUBE U	RETURN TUBE V	OIL HOLE Q	STIFFNESS kgf/μm
32	5	3.175	1.5x2	1180	3410	50	50	76	12	63	15	6.6	11	6.5	30	38	M6x1P	34
			2.5x1	1010	2840		45											29
			2.5x2	1830	5680		60											56
			2.5x3	2590	8520		75											82
			3.5x1	1350	3980		50											40
	6	3.969	1.5x2	1560	4135	52	55	78	12	65	15	6.6	11	6.5	32	39	M6x1P	35
			2.5x1	1330	3450		50											29
			2.5x2	2410	6900		68											57
			3.5x1	1770	4830		55											40
	8	4.762	1.5x2	2010	5010	54	70	88	16	70	15	9	14	8.5	33	40	M6x1P	36
			2.5x1	1720	4180		62											30
			2.5x2	3120	8360		86											59
			3.5x1	2300	5850		70											42
	10	6.35	1.5x2	3000	6530	57	78	91	16	73	15	9	14	8.5	37	44	M8x1P	38
			2.5x1	2570	5440		68											32
			2.5x2	4660	10880		98											61
			3.5x1	3430	7620		78											44
36	6	3.969	2.5x1	1430	3950	55	50	82	12	68	15	6.6	11	6.5	32	42	M6x1P	33
			2.5x2	2600	7900		68											63
	10	6.35	1.5x2	3180	7410	62	82	104	18	82	20	11	17.5	11	40	49	M6x1P	41
			2.5x1	2720	6180		72											35
			2.5x2	4930	12360		102											68
			3.5x1	3630	8650		82											48

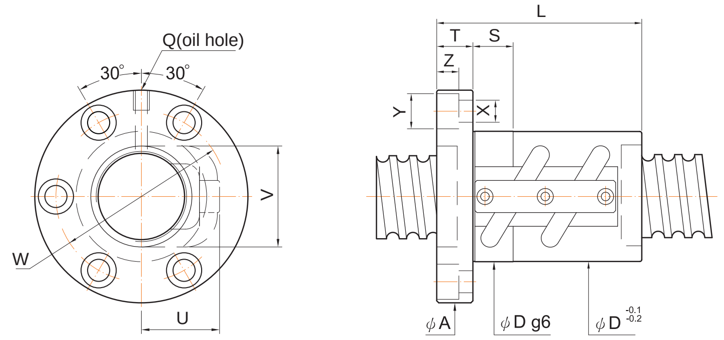
FSVC



UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FIT S	BOLT X	BOLT Y	BOLT Z	RETURN TUBE U	RETURN TUBE V	OIL HOLE Q	STIFFNESS kgf/μm
40	5	3.175	1.5x2	1280	4270	58	55	92	16	72	15	9	14	8.5	34	46	M8x1P	41
			2.5x1	1090	3560		50											34
			2.5x2	1980	7120		65											66
			2.5x3	2800	10680		80											98
			3.5x1	1450	4980		55											47
	6	3.969	1.5x2	1750	5300	60	60	94	16	76	15	9	14	8.5	36	47	PT1/8"	42
			2.5x1	1500	4420		54											35
			2.5x2	2720	8840		72											69
			2.5x3	3850	13260		90											101
			3.5x1	2000	6190		60											49
	8	4.762	1.5x2	2220	6320	62	70	96	16	78	15	9	14	85	38	48	PT1/8"	43
			2.5x1	1900	5270		62											36
			2.5x2	3450	10540		86											70
			3.5x1	2540	7380		70											50
	10	6.35	1.5x2	3370	8335	65	82	106	18	85	20	11	17.5	11	42	52	PT1/8"	45
			2.5x1	2880	6950		72											35
			2.5x2	5220	13900		102											74
			3.5x1	3840	9730		82											52
45	10	6.35	2.5x1	3020	7850	70	74	112	18	90	20	11	17.5	11	48	58	PT1/8"	42
			2.5x2	5480	15700		104											81
	12	7.144	2.5x1	3550	8950	74	87	122	18	97	20	14	20	13	49	60	PT1/8"	43
			2.5x2	6440	17900		123											82

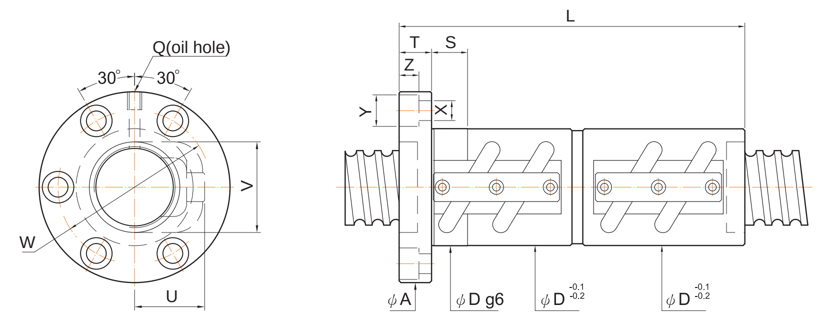
FSVC



UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FIT S	BOLT X	BOLT Y	BOLT Z	RETURN TUBE U	RETURN TUBE V	OIL HOLE Q	STIFFNESS kgf/μm
50	5	3.175	1.5x2	1410	5305	70	63	104	16	86	15	9	14	8.5	40	56	PT1/8"	49
			1.5x3	2000	7960		73											72
			3.5x1	1610	6190		63											57
	6	3.969	2.5x2	2980	11000	72	75	106	16	88	15	9	14	8.5	43	57	PT1/8"	82
			2.5x3	4220	16500		93											121
	8	4.762	2.5x2	3900	13020	75	88	116	18	95	20	11	17.5	11	45	59	PT1/8"	85
			2.5x3	5520	19530		112											125
	10	6.35	1.5x2	3725	10450	78	84	119	18	98	20	11	17.5	11	48	62	PT1/8"	54
			2.5x1	3190	8710		74											45
			2.5x2	5790	17420		104											88
			2.5x3	8200	26130		134											130
			3.5x1	4260	12190		84											63
	12	7.144	2.5x1	3700	10050	82	87	128	22	105	20	14	20	13	52	64	PT1/8"	46
			2.5x2	6710	20100		123											89
55	10	6.35	2.5x2	6005	19540	84	100	125	18	103	20	11	17.5	11	54	68	PT1/8"	95
			2.5x3	8150	29310		130											140
63	10	6.35	2.5x1	3510	11200	90	77	132	20	110	20	11	17.5	11	53	74	PT1/8"	55
			2.5x2	6370	22400		107											106
			2.5x3	9020	33600		137											156
	12	7.938	2.5x1	4770	13780	94	88	142	22	117	20	14	20	13	57	76	PT1/8"	59
			2.5x2	8650	27560		124											113
			2.5x3	12250	41340		160											167
	16	9.525	2.5x1	8050	23100	100	105	150	22	123	20	14	20	13	62	78	PT1/8"	72
			2.5x2	14600	46200		153											140
80	10	6.35	2.5x2	7130	28500	115	109	163	22	137	20	14	20	13	64	91	PT1/8"	129
			2.5x3	10100	42750		139											190
	12	7.938	2.5x2	9710	35560	120	125	169	22	143	25	14	20	13	67	93	PT1/8"	137
			2.5x3	13760	53340		159											202
	16	9.525	2.5x2	16450	59280	125	156	190	28	154	25	18	26	17.5	70	94	PT1/8"	170
			2.5x3	23300	88920		204											250

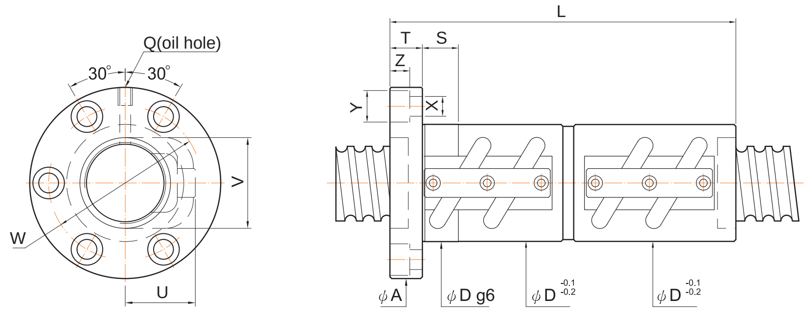
FDVC



UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FIT S	BOLT X	BOLT Y	BOLT Z	RETURN TUBE U	RETURN TUBE V	OIL HOLE Q	STIFFNESS kgf/μm
16	5	3.175	1.5x2	805	1525	31	90	54	12	41	15	5.5	9.5	5.5	20	23	M6x1P	39
			2.5x1	690	1270		80											33
			2.5x2	1250	2540		110											63
			3.5x1	920	1780		90											45
20	5	3.175	1.5x2	965	2070	35	90	58	12	46	15	5.5	9.5	5.5	22	27	M6x1P	47
			2.5x1	830	1730		80				10							40
			2.5x2	1510	3460		110				15							77
			3.5x1	1110	2420		90				15							55
	6	3.969	1.5x2	1285	2545	36	104	60	12	47	15	5.5	9.5	5.5	27	28	M6x1P	49
			2.5x1	1100	2120		92				10							41
			3.5x1	1470	2970		104				15							56
25	5	3.175	1.5x2	1065	2575	40	90	64	12	52	15	5.5	9.5	5.5	26	31	M6x1P	57
			2.5x1	910	2150		80											48
			2.5x2	1650	4300		110											92
			3.5x1	1210	3010		90											65
	6	3.969	1.5x2	1420	3215	42	104	68	12	55	15	5.5	9.5	5.5	28	33	M6x1P	58
			2.5x1	1210	2680		92											49
			2.5x2	2190	5360		128											94
			3.5x1	1610	3750		104											67
	10	4.762	1.5x2	1820	3840	45	136	72	16	58	15	6.6	11	6.5	29	34	M6x1P	60
			2.5x1	1560	3200		122											50
			3.5x1	2080	4480		136											69
28	5	3.175	1.5x2	1110	2960	44	90	70	12	56	15	6.6	11	6.5	28	34	M6x1P	62
			2.5x1	950	2470		80											52
			2.5x2	1720	4940		110											101
			3.5x1	1270	3460		90											72
	6	3.969	1.5x2	1480	3605	44	110	70	12	56	15	6.6	11	6.5	28	36	M6x1P	63
			2.5x1	1270	3000		98											53
			2.5x2	2300	6000		134											103
			3.5x1	1690	4200		110											73

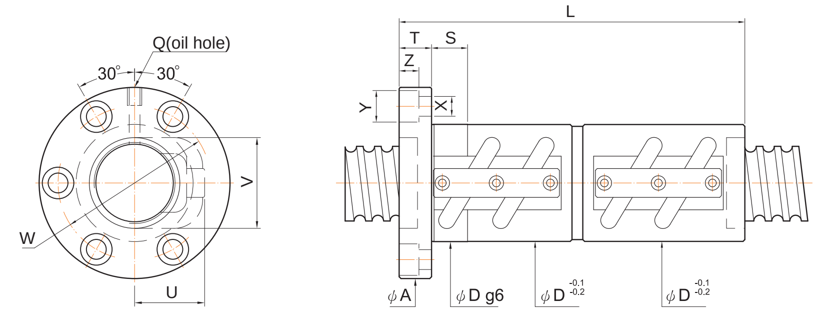
FDVC



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE			FIT	BOLT			RETURN TUBE		OIL HOLE	STIFFNESS
O.D.	LEAD		circuit × row	Dynamic (1×10^6 REV.) Ca	Static Co	Dg6	L	A	T	W	S	X	Y	Z	U	V	Q	kgf/μm
32	5	3.175	1.5x2	1180	3410	50	90	76	12	63	15	6.6	11	6.5	30	38	M6x1P	69
			2.5x1	1010	2840		80											58
			2.5x2	1830	5680		110											112
			2.5x3	2590	8520		140											164
			3.5x1	1350	3980		90											80
	6	3.969	1.5x2	1560	4135	52	104	78	12	65	15	6.6	11	6.5	32	39	M6x1P	70
			2.5x1	1330	3450		92											59
			2.5x2	2410	6900		128											114
			3.5x1	1770	4830		104											81
	8	4.762	1.5x2	2010	5010	54	126	88	16	70	15	9	14	8.5	33	40	M6x1P	73
			2.5x1	1720	4180		110											61
			2.5x2	3120	8360		158											118
			3.5x1	2300	5850		126											84
	10	6.35	1.5x2	3000	6530	57	142	91	16	73	15	9	14	8.5	37	44	M8x1P	76
			2.5x1	2570	5440		122											64
			2.5x2	4660	10880		182											123
			2.5x1	3430	7620		142											88
36	6	3.969	2.5x1	1430	3950	55	92	82	12	68	15	6.6	11	6.5	32	42	M6x1P	65
			2.5x2	2600	7900		128											126
	10	6.35	1.5x2	3180	7410	62	144	104	18	82	20	11	17.5	11	40	49	M6x1P	83
			2.5x1	2720	6180		124											70
			2.5x2	4930	12360		184											136
			3.5x1	3630	8650		144											90

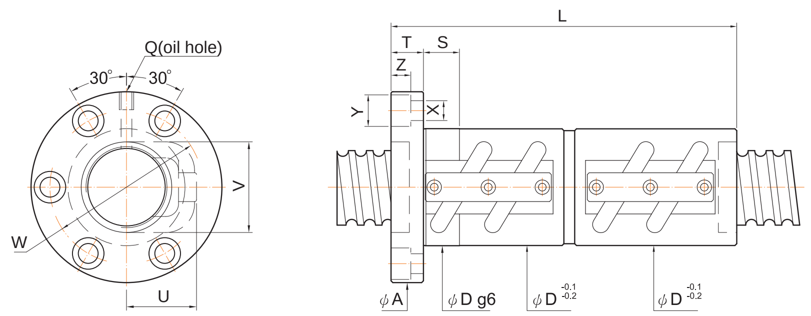
FDVC



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE			FIT	BOLT			RETURN TUBE		OIL HOLE	STIFFNESS
O.D.	LEAD		circuit × row	Dynamic (1×10^6 REV.) Ca	Static Co	Dg6	L	A	T	W	S	X	Y	Z	U	V	Q	kgf/μm
40	5	3.175	1.5x2	1280	4275	58	94	92	16	72	15	9	14	8.5	34	46	PT1/8"	82
			2.5x1	1090	3560		84											69
			2.5x2	1980	7120		114											133
			2.5x3	2800	10680		144											196
			3.5x1	1450	4980		94											95
	6	3.969	1.5x2	1750	5300	60	108	94	16	76	15	9	14	8.5	36	47	PT1/8"	85
			2.5x1	1500	4420		96											71
			2.5x2	2720	8840		132											138
			2.5x3	3850	13260		168											202
			3.5x1	2000	6190		108											98
	8	4.762	1.5x2	2220	6320	62	126	96	16	78	15	9	14	8.5	38	48	PT1/8"	86
			2.5x1	1900	5270		110											73
			2.5x2	3450	10540		158											141
			3.5x1	2540	7380		126											100
	10	6.35	1.5x2	3370	8335	65	152	106	18	85	20	11	17.5	11	42	52	PT1/8"	91
			2.5x1	2880	6950		132											71
			2.5x2	5220	13900		192											148
			3.5x1	3840	9730		152											105
45	10	6.35	2.5x1	3020	7850	70	134	112	18	90	20	11	17.5	11	48	58	PT1/8"	84
			2.5x2	5480	15700		194											163
	12	7.144	2.5x1	3550	8950	74	158	122	18	97	20	14	20	13	49	60	PT1/8"	85
			2.5x2	6440	17900		230											165

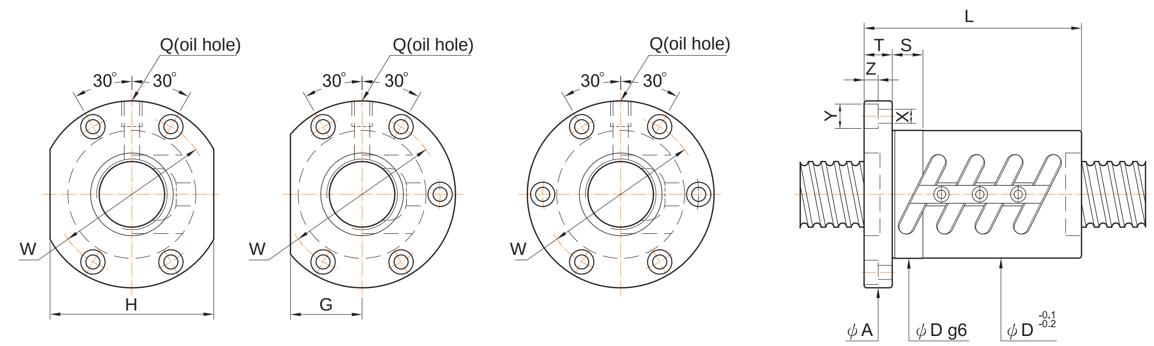
FDVC



UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FIT S	BOLT X	BOLT Y	BOLT Z	RETURN TUBE U	RETURN TUBE V	OIL HOLE Q	STIFFNESS kgf/μm
50	5	3.175	1.5x2	1410	5305	70	107	104	16	86	15	9	14	8.5	40	56	PT1/8"	98
			1.5x3	2000	7960		127											144
			3.5x1	1610	6190		107											114
	6	3.969	2.5x2	2980	11000	72	134	106	16	88	15	9	14	8.5	43	57	PT1/8"	164
			2.5x3	4220	16500		170											242
	8	4.762	2.5x2	3900	13020	75	160	116	18	95	20	11	17.5	11	45	59	PT1/8"	170
			2.5x3	5520	19530		208											250
	10	6.35	1.5x2	3725	10450	78	154	119	18	98	20	11	17.5	11	48	62	PT1/8"	119
			2.5x1	3190	8710		134											91
			2.5x2	5790	17420		194											177
			2.5x3	8200	26130		254											261
			3.5x1	4260	12190		154											126
	12	7.144	2.5x1	3700	10050	82	160	128	22	105	20	14	20	13	52	64	PT1/8"	92
			2.5x2	6710	20100		232											179
55	10	6.35	2.5x2	6005	19540	84	194	125	18	103	20	11	17.5	11	54	68	PT1/8"	191
			2.5x3	8510	29310		254											281
63	10	6.35	2.5x1	3510	11200	90	136	132	20	110	20	11	17.5	11	53	74	PT1/8"	110
			2.5x2	6370	22400		196											213
			2.5x3	9020	33600		256											313
	12	7.938	2.5x1	4760	13820	94	160	142	22	117	20	14	20	13	57	76	PT1/8"	112
			2.5x2	8630	27640		232											218
			2.5x3	12250	41340		304											322
	16	9.528	2.5x1	8050	23100	100	200	150	22	123	20	14	20	13	62	78	PT1/8"	144
			2.5x2	14600	46200		296											280
80	10	6.35	2.5x2	7130	28500	115	200	163	22	137	20	14	20	13	64	91	PT1/8"	258
			2.5x3	10100	42750		260											380
	12	7.938	2.5x2	9710	35560	120	232	169	22	143	25	14	20	13	67	93	PT1/8"	265
			2.5x3	13760	53340		302											391
	16	9.525	2.5x2	16450	59280	125	302	190	28	154	25	18	26	17.5	70	94	PT1/8"	339
			2.5x3	23300	88920		398											500

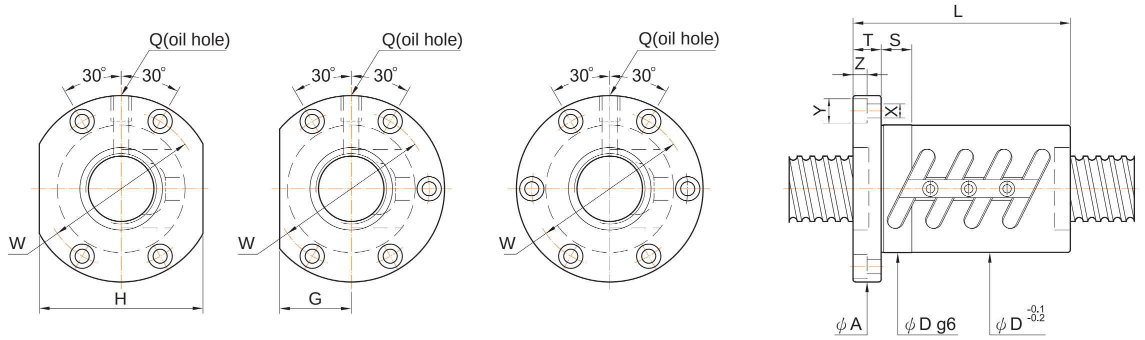
FOWC



UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD(kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FLANGE G	FLANGE H	FIT S	BOLT X	BOLT Y	BOLT Z	OIL HOLE Q	STIFFNESS kgf/μm
20	4	2.381	2.5x1x(2)	450	1060	40	50	63.5	11	51	21	42	10	5.5	9.5	5.5	M6x1P	32
			3.5x1x(2)	600	1480		60											49
	5	3.175	2.5x1x(2)	830	1730	44	56	67	11	55	26	52	15	5.5	9.5	5.5	M6x1P	40
			3.5x1x(2)	1110	2420		65											55
	6	3.969	2.5x1x(2)	1100	2120	48	67	71	11	59	27	54	15	5.5	9.5	5.5	M6x1P	41
	8	3.969	2.5x1x(2)	1100	2120	48	78	75	13	61	27	54	15	6.6	11	6.5	M6x1P	41
25	4	2.381	2.5x1x(2)	510	1355	46	50	69	11	57	26	52	15	5.5	9.5	5.5	M6x1P	43
			2.5x2x(2)	930	2710		74											84
	5	3.175	2.5x1x(2)	910	2150	50	55	73	11	61	28	56	15	5.5	9.5	5.5	M6x1P	48
			2.5x2x(2)	1650	4300		85											92
	6	3.969	2.5x1x(2)	1210	2680	53	62	76	11	64	29	58	15	5.5	9.5	5.5	M6x1P	49
			2.5x2x(2)	2190	5360		98											94
	8	4.762	2.5x1x(2)	1560	3200	58	77	85	13	71	32	64	15	6.6	11	6.5	M6x1P	50
	10	4.762	2.5x1x(2)	1560	3200	58	100	85	15	71	32	64	15	6.6	11	6.5	M6x1P	50
28	5	3.175	2.5x1x(2)	950	2470	55	56	83	12	69	31	62	15	6.6	11	6.5	M8x1P	52
			2.5x2x(2)	1720	4940		86											101
	6	3.969	2.5x1x(2)	1270	3000	55	63	83	12	69	31	62	15	6.6	11	6.5	M8x1P	53
			2.5x2x(2)	2300	6000		100											103
	10	4.762	1.5x1x(2)	1045	2120	60	74	93	15	76	36	72	15	9	14	8.5	M8x1P	34
32	4	2.381	2.5x1x(2)	565	1750	54	50	81	12	67	32	64	15	6.6	11	6.5	M6x1P	52
			2.5x2x(2)	1020	3500		76											101
	5	3.175	2.5x1x(2)	1010	2840	58	57	85	12	71	32	64	15	6.6	11	6.5	M8x1P	58
			2.5x2x(2)	1830	5680		87											112
	6	3.969	2.5x1x(2)	1330	3450	62	63	88	12	75	34	68	15	6.6	11	6.5	M8x1P	59
			2.5x2x(2)	2410	6900		99											114
	8	4.762	1.5x1x(2)	1110	2510	66	64	100	15	82	38	76	15	9	14	8.5	M8x1P	37
			2.5x1x(2)	1720	4180		80											61
	10	6.35	1.5x1x(2)	1660	3260	74	78	108	15	90	41	82	15	9	14	8.5	M6x1P	39
			2.5x1x(2)	2570	5440		97											64
	12	6.35	1.5x1x(2)	1660	3260	74	88	108	18	90	41	82	15	9	14	8.5	M8x1P	39
			2.5x1x(2)	2570	5440		110											64

FOWC



UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	Static Co	NUT Dg6	L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
36	5	3.175	2.5x1x(2)	1060	3210	65	60	98	15	82	38	76	15	9	14	8.5	M8x1P	64
			2.5x2x(2)	1920	6420		90											123
	6	3.969	2.5x1x(2)	1430	3950	65	66	98	15	82	38	76	15	9	14	8.5	M8x1P	65
			2.5x2x(2)	2600	7900		102											126
	10	6.35	1.5x1x(2)	1750	3710	75	81	118	18	98	45	90	15	11	17.5	11	M8x1P	43
			2.5x1x(2)	2720	6180		103											70
40	5	3.175	2.5x1x(2)	1090	3560	67	60	101	15	83	39	78	15	9	14	8.5	M8x1P	69
			2.5x2x(2)	1980	7120		90											133
	6	3.969	2.5x1x(2)	1500	4420	70	66	104	15	86	40	80	15	9	14	8.5	PT1/8"	71
			2.5x2x(2)	2720	8840		102											138
	8	4.762	2.5x1x(2)	1900	5270	74	83	108	15	90	41	82	15	9	14	8.5	PT1/8"	73
			2.5x2x(2)	3450	10540		131											141
	10	6.35	1.5x1x(2)	1860	4710	82	81	124	18	102	47	94	20	11	17.5	11	PT1/8"	47
			2.5x1x(2)	2880	6950		103											76
			3.5x1x(2)	3850	9730		121											105
	12	6.35	2.5x1x(2)	2880	6950	86	112	128	18	106	48	96	20	11	17.5	11	PT1/8"	76
45	10	6.35	2.5x1x(2)	3020	7850	88	101	132	18	110	50	100	20	11	17.5	11	PT1/8"	84
	12	7.144	2.5x1x(2)	3550	8950	90	112	132	18	110	50	100	20	11	17.5	11	PT1/8"	85
50	5	3.175	2.5x1x(2)	1210	4420	80	60	114	15	96	43	86	15	9	14	8.5	PT1/8"	83
	6	3.969	2.5x2x(2)	2980	11000	84	103	118	15	100	45	90	15	9	14	8.5	PT1/8"	164
	8	4.762	2.5x2x(2)	3900	13020	87	134	129	18	107	49	98	20	11	17.5	11	PT1/8"	170
	10	6.35	2.5x1x(2)	3190	8710	93	101	135	18	113	51	102	20	11	17.5	11	PT1/8"	91
			2.5x2x(2)	5790	17420		161											177
			3.5x1x(2)	4260	12190		121											126
	12	7.144	2.5x1x(2)	3700	10050	100	116	146	22	122	55	110	20	14	20	13	PT1/8"	92
55	10	6.35	2.5x1x(2)	3310	9770	102	101	144	18	122	54	108	20	11	17.5	11	PT1/8"	98
			2.5x2x(2)	6005	19540		161											191
63	10	6.35	2.5x1x(2)	3510	11200	108	105	154	22	130	58	116	20	14	20	13	PT1/8"	110
			2.5x2x(2)	6370	22400		165											213
	12	7.938	2.5x1x(2)	4770	13780	115	124	161	22	137	61	122	20	14	20	13	PT1/8"	113

PMI Precision Ground BallScrew

13.4 High Lead Ballscrews

High-lead Ballscrews are essential elements and parts for high-speed machine tools of next century.

Features:

It is important for a High-lead Ballscrew to be with characteristics of high rigidity, low noise and thermal control. *PMI*'s designs and treatments are taken for following:

High DN Value

The DN value can be 130,000 in normal case. For some special cases, for example in a fixed ends case, the DN value can be as high as 140,000. Please contact our engineers for this special application.

High Speed

PMI's High-speed Ballscrews provide 100 *m/min* and even higher traverse speed for machine tools for high performance cutting.

High Rigidity

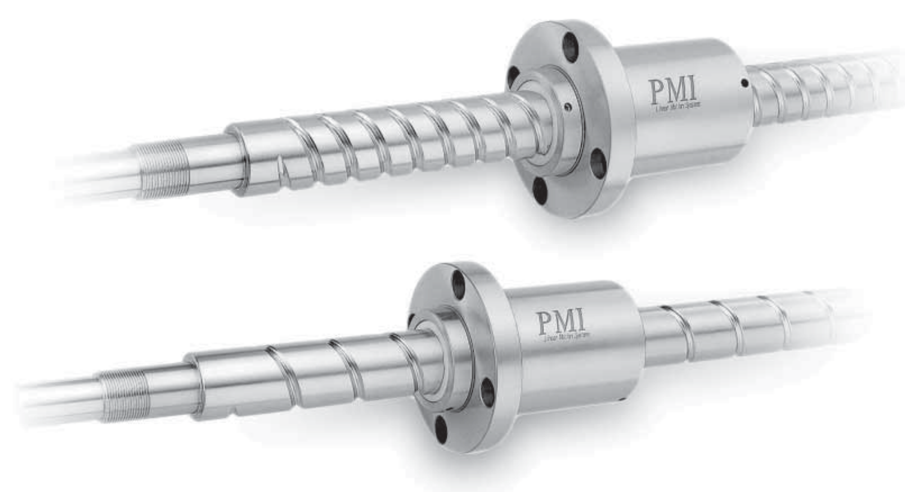
Both the screw and ballnut are surface hardened to a specific hardness and case depth to maintain high rigidity and durability.

Multiple thread starts are available to make more steel balls loaded in the ballnut for higher rigidity and durability.

Low Noise

Special design of ball circulation tubes offer smooth ball circulation inside the ballnut. It also makes safe ball fast running into the tubes without damaging the tubes.

Accurate ball circle diameter (BCD) through whole threads for consistent drag torque and low noise.



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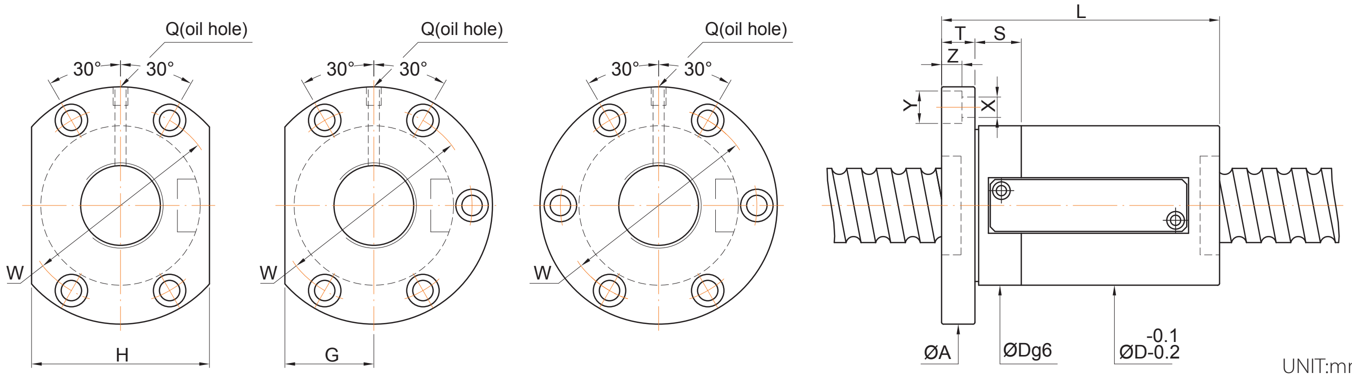

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	Static Co	NUT Dg6	NUT L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
12	10	2.381	2.5x1	420	720	30	50	50	10	40	16	32	10	4.5	8	4.4	M6x1P	20
20	10	3.969	2.5x1	1210	2380	46	63	73.5	13	59	25	50	10	5.5	9.5	5.5	M6x1P	36
			3.5x1	1580	3230		73											49
	16	3.969	1.5x1	830	1530	46	63	73.5	13	59	25	50	10	5.5	9.5	5.5	M6x1P	24
			2.5x1	1210	2380		79											37
	20	3.969	1.5x1	830	1530	46	70	73	13	59	25	50	10	5.5	9.5	5.5	M6x1P	24
25	16	3.969	1.5x1	920	1930	54	62	76	15	64	32	64	15	6.6	11	6.5	M6x1P	25
			2.5x1	1340	3000		78											38
	20	4.762	1.5x1	1170	2300	58	74	85	15	71	32	64	15	6.6	11	6.5	M6x1P	30
			2.5x1	1710	3580		94											45
			3.5x1	2220	4860		114											61
32	16	3.969	1.5x1	1010	2480	62	63	88	15	75	34	68	15	6.6	11	6.5	M8x1P	35
			2.5x1	1470	3860		79											53
			3.5x1	1910	5240		95											70
			5x1	2340	6620		111											88
	16	6.35	2.5x1	2830	6090	74	92	108	18	90	41	82	15	11	17.5	11	M8x1P	57
			3.5x1	3680	8270		108											76
			5x1	4490	10450		124											95
	20	3.969	1.5x1	1010	2480	62	70	88	15	75	34	68	15	6.6	11	6.5	M8x1P	35
			2.5x1	1470	3860		90											53
			3.5x1	1910	5240		110											70
			5x1	2350	6610		130											88
	20	6.35	2.5x1	2830	6090	74	104	108	18	90	41	82	15	11	17.5	11	M8x1P	57
			3.5x1	3680	8270		124											76
			5x1	4490	10450		144											95

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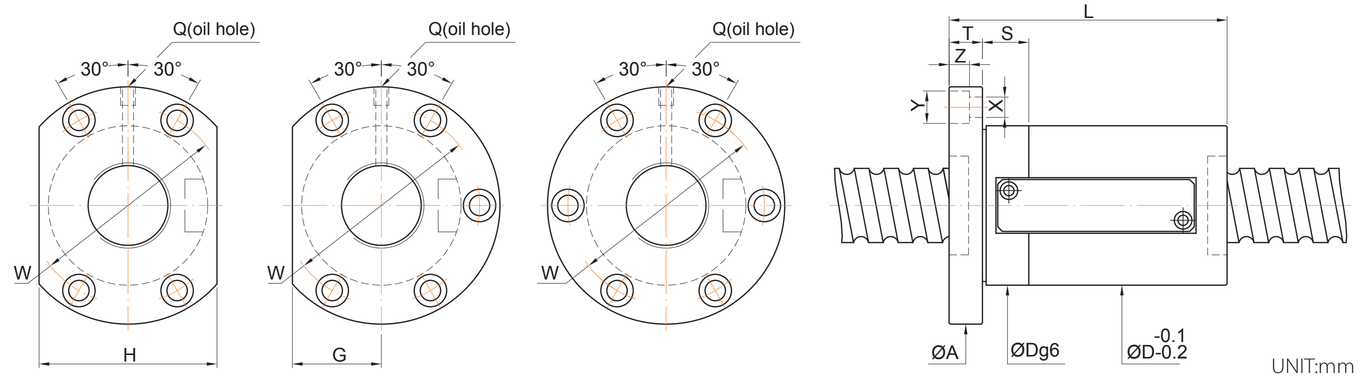

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10⁶ REV.) Ca	Static Co	NUT Dg6	NUT L	FLANGE A	T	W	G	H	FIT S	BOLT X	Y	Z	OIL HOLE Q	STIFFNESS kgf/μm
36	10	6.35	3.5x1	3890	9390	75	84	118	18	98	45	90	15	11	17.5	11	M8x1P	83
			5x1	4750	11860		94											104
	12	6.35	2.5x1	2990	6920	75	85	118	18	98	45	90	15	11	17.5	11	M8x1P	62
			3.5x1	3890	9390		97											83
			5x1	4750	11860		109											104
	16	6.35	2.5x1	2990	6920	75	91	118	18	98	45	90	15	11	17.5	11	M8x1P	62
			3.5x1	3890	9390		107											83
			5x1	4750	11860		123											104
	20	6.35	1.5x1	2050	4450	75	91	118	18	98	45	90	15	11	17.5	11	PT1/8"	41
			2.5x1	2990	6920		111											63
			3.5x1	3890	9390		131											83
			5x1	4750	11860		151											104
40	10	6.35	3.5x1	4130	10560	86	86	128	18	106	49	98	15	11	17.5	11	PT1/8"	91
			5x1	5050	13340		96											113
	12	6.35	2.5x1	3180	7780	86	86	128	18	106	49	98	15	11	17.5	11	PT1/8"	68
			3.5x1	4130	10560		98											91
			5x1	5050	13340		110											113
	16	6.35	2.5x1	3180	7780	86	93	128	18	106	49	98	15	11	17.5	11	PT1/8"	68
			3.5x1	4130	10560		109											91
			5x1	5050	13340		125											114
	16	7.144	2.5x1	3740	8790	86	92	128	18	106	49	98	15	11	17.5	11	PT1/8"	69
			3.5x1	4870	11930		108											92
			5x1	5950	15070		124											115
	20	6.35	1.5x1	2180	5000	86	84	128	18	106	49	98	15	11	17.5	11	PT1/8"	45
			2.5x1	3180	7780		104											68
			3.5x1	4130	10560		124											91
			5x1	5050	13340		144											114
	40	6.35	1.5x1	2180	5000	86	130	128	18	106	49	98	15	11	17.5	11	PT1/8"	46

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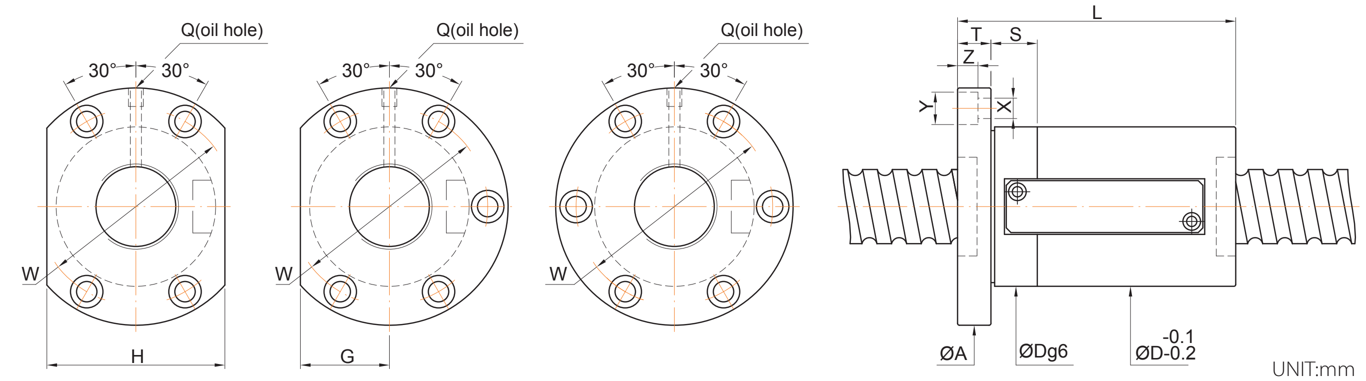
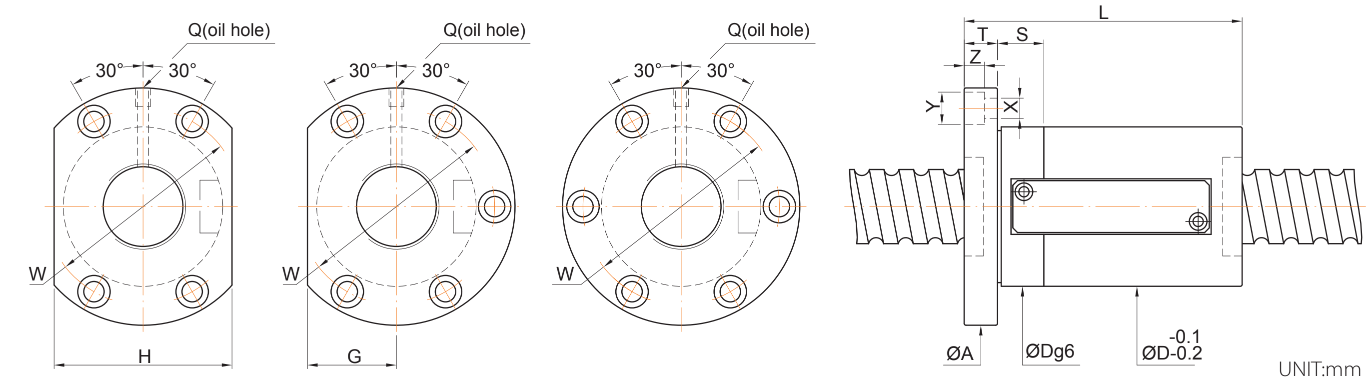


UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD		circuit × row	Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
50	10	6.35	3.5x1	4560	13230	93	85	135	18	113	51	102	20	11	17.5	11	PT1/8"	108
			5x1	5580	16710		95											135
	12	6.35	2.5x1	3510	9750	93	80	135	18	113	51	102	20	11	17.5	11	PT1/8"	81
			3.5x1	4560	13230		92											108
			5x1	5580	16710		104											135
	12	7.144	2.5x1	4080	11260	100	93	146	25	122	55	110	20	14	20	13	PT1/8"	82
			3.5x1	5300	15280		105											109
			5x1	6480	19300		117											137
	16	6.35	2.5x1	3510	9750	93	94	135	18	113	51	102	20	11	17.5	11	PT1/8"	81
			3.5x1	4560	13230		110											108
			5x1	5580	16710		126											135
	16	7.144	2.5x1	4080	11260	100	100	146	25	122	55	110	20	14	20	13	PT1/8"	82
			3.5x1	5300	15280		116											109
			5x1	6480	19300		132											137
	20	7.144	1.5x1	2790	7240	100	98	146	25	122	55	110	20	14	20	13	PT1/8"	54
			2.5x1	4080	11260		118											82
			3.5x1	5300	15280		138											110
			5x1	6480	19300		158											137
	20	7.938	2.5x1	4750	12090	105	119	152	25	128	58	116	20	14	20	13	PT1/8"	83
			3.5x1	6180	16400		139											112
			5x1	7550	20720		159											139
	50	7.938	1.5x1	3250	7770	105	115	152	25	128	58	116	20	14	20	13	PT1/8"	56



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD		circuit × row	Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
63	10	6.35	3.5x1	5030	17020	108	86	154	22	130	58	116	20	14	20	13	PT1/8"	130
			5x1	6150	21500		96											162
	12	6.35	2.5x1	3870	12540	108	84	154	22	130	58	116	20	14	20	13	PT1/8"	97
			3.5x1	5030	17020		96											130
			5x1	6150	21500		108											162
	12	7.144	2.5x1	4540	14460	115	90	161	22	137	61	122	20	14	20	13	PT1/8"	99
			3.5x1	5900	19620		102											132
			5x1	19620	24780		114											229
	16	7.144	2.5x1	4540	14460	115	97	161	22	137	61	122	20	14	20	13	PT1/8"	99
			3.5x1	5900	19620		113											132
			5x1	19620	24780		129											230
	16	7.938	2.5x1	5260	15430	120	112	180	28	150	72	144	25	18	26	17.5	PT1/8"	100
			3.5x1	6840	20940		128											134
			5x1	8360	26450		144											167
	20	6.35	2.5x1	3870	12540	108	104	154	22	130	58	116	20	14	20	13	PT1/8"	97
			3.5x1	5030	17020		124											130
			5x1	6150	21500		144											162
	20	9.525	2.5x1	8870	25870	122	120	182	28	150	72	144	25	18	26	17.5	PT1/8"	128
			3.5x1	11530	35110		140											171
			5x1	14090	44350		160											213
80	10	6.35	3.5x1	5630	21660	130	90	176	22	152	66	132	20	14	20	13	PT1/8"	152
			5x1	6880	27360		100											189
	12	7.938	3.5x1	7670	27030	136	101	182	22	158	68	136	20	14	20	13	PT1/8"	162
			5x1	9380	34140		113											202
	16	9.525	2.5x1	9990	33200	143	108	204	28	172	77	154	30	18	26	17.5	PT1/8"	155
			3.5x1	12990	45050		124											207
			5x1	15880	56910		140											259
	20	9.525	2.5x1	9990	33200	143	120	204	28	172	77	154	30	18	26	17.5	PT1/8"	155
			3.5x1	12990	45050		140											208
			5x1	15880	56910		160											259
100	16	9.525	2.5x1	9400	33100	170	115	243	32	205	91	182	30	22	32	21.5	PT1/8"	175
			3.5x1	12220	44920		131											235
			5x1	14940	56740		147											294
	20	9.525	2.5x1	9400	33100	170	128	243	32	205	91	182	30	22	32	21.5	PT1/8"	175
			3.5x1	12220	44920		148											235
			5x1	14940	56740		168											294

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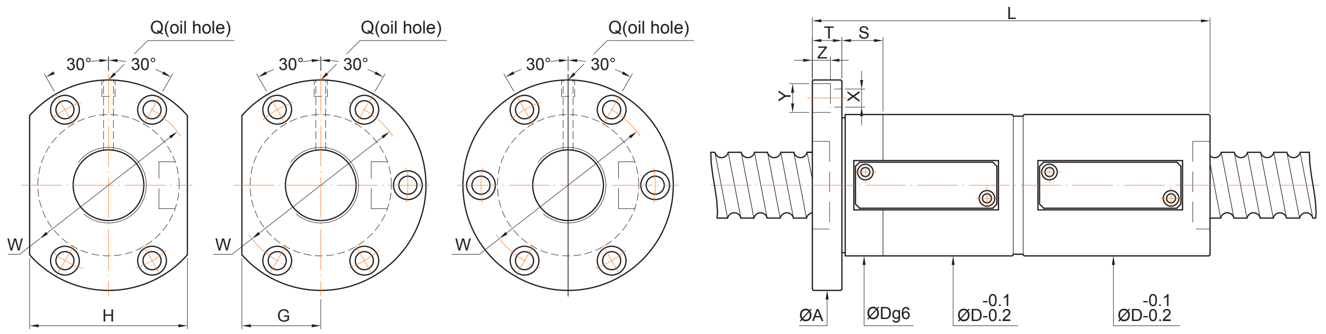
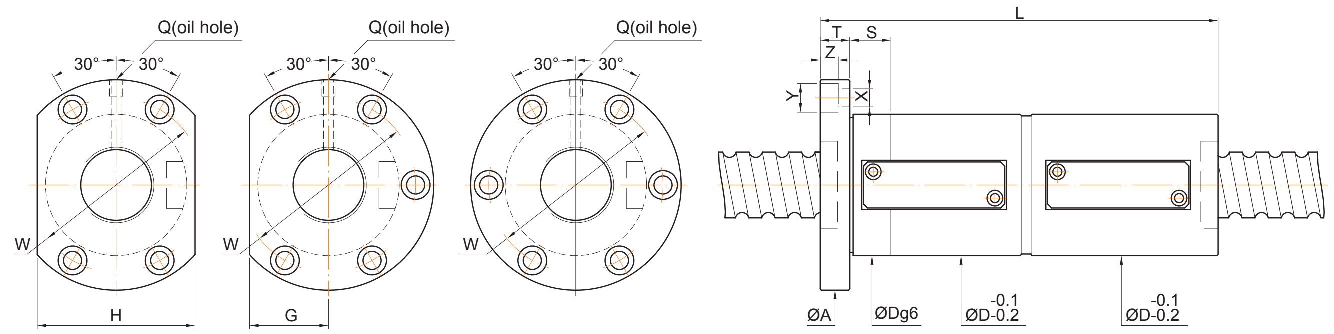


UNIT:mm

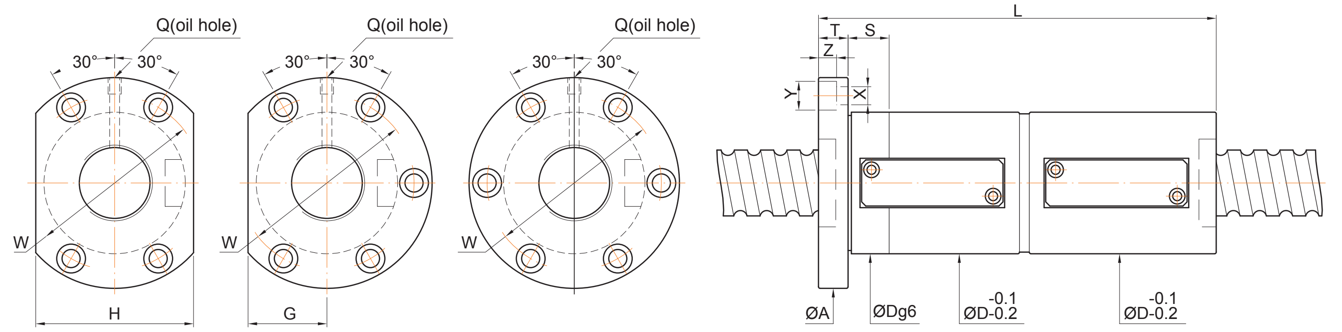
SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD		circuit × row	Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
12	10	2.381	2.5x1	420	720	30	102	50	10	40	16	32	10	4.5	8	4.4	M6x1P	25
20	10	3.969	2.5x1	1210	2380	46	113	73.5	13	59	25	50	10	5.5	9.5	5.5	M6x1P	46
			3.5x1	1580	3230		133											61
	16	3.969	1.5x1	830	1530	46	128	73.5	13	59	25	50	10	5.5	9.5	5.5	M6x1P	30
			2.5x1	1210	2380		160											46
	20	3.969	1.5x1	830	1530	46	130	73	13	59	25	50	10	5.5	9.5	5.5	M6x1P	31
25	16	3.969	1.5x1	920	1930	54	126	76	15	64	32	64	15	6.6	11	6.5	M6x1P	31
			2.5x1	1340	3000		158											48
	20	4.762	1.5x1	1170	2300	58	154	85	15	71	32	64	15	6.6	11	6.5	M6x1P	37
			2.5x1	1710	3580		194											57
			3.5x1	2220	4860		234											76
32	16	3.969	1.5x1	1010	2480	62	130	88	15	75	34	68	15	6.6	11	6.5	M8x1P	44
			2.5x1	1470	3860		162											66
			3.5x1	1910	5240		194											89
			5x1	2340	6620		226											111
	16	6.35	2.5x1	2830	6090	74	173	108	18	90	41	82	15	11	17.5	11	M8x1P	71
			3.5x1	3680	8270		205											96
			5x1	4490	10450		237											119
	20	3.969	1.5x1	1010	2480	62	93	88	15	75	34	68	15	6.6	11	6.5	M8x1P	44
			2.5x1	1470	3860		133											67
			3.5x1	1910	5240		173											89
			5x1	2350	6610		213											112
	20	6.35	2.5x1	2830	6090	74	204	108	18	90	41	82	15	11	17.5	11	M8x1P	72
			3.5x1	3680	8270		244											96
			5x1	4490	10450		284											120



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD		circuit × row	Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
36	10	6.35	3.5x1	3890	9390	75	155	118	18	98	45	90	15	11	17.5	11	M8x1P	105
			5x1	4750	11860		175											131
	12	6.35	2.5x1	2990	6920	75	140	118	18	98	45	90	15	11	17.5	11	M8x1P	78
			3.5x1	3890	9390		164											105
			5x1	4750	11860		188											131
	16	6.35	2.5x1	2990	6920	75	171	118	18	98	45	90	15	11	17.5	11	M8x1P	78
			3.5x1	3890	9390		203											105
			5x1	4750	11860		235											131
	20	6.35	1.5x1	2050	4450	75	164	118	18	98	45	90	15	11	17.5	11	PT1/8"	51
			2.5x1	2990	6920		204											79
			3.5x1	3890	9390		244											105
			5x1	4750	11860		284											131
40	10	6.35	3.5x1	4130	10560	86	155	128	18	106	49	98	15	11	17.5	11	PT1/8"	114
			5x1	5050	13340		175											143
	12	6.35	2.5x1	3180	7780	86	141	128	18	106	49	98	15	11	17.5	11	PT1/8"	85
			3.5x1	4130	10560		165											114
			5x1	5050	13340		189											143
	16	6.35	2.5x1	3180	7780	86	173	128	18	106	49	98	15	11	17.5	11	PT1/8"	85
			3.5x1	4130	10560		205											114
			5x1	5050	13340		237											143
	16	7.144	2.5x1	3740	8790	86	173	128	18	106	49	98	15	11	17.5	11	PT1/8"	86
			3.5x1	4870	11930		205											116
			5x1	5950	15070		237											145
	20	6.35	1.5x1	2180	5000	86	164	128	18	106	49	98	15	11	17.5	11	PT1/8"	56
			2.5x1	3180	7780		204											86
			3.5x1	4130	10560		244											115
			5x1	5050	13340		284											143
	40	6.35	1.5x1	2180	5000	86	242	128	18	106	49	98	15	11	17.5	11	PT1/8"	58

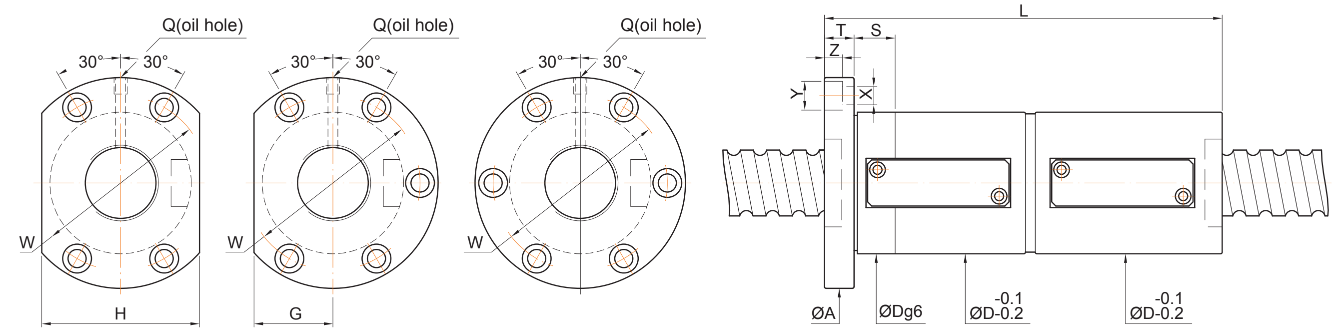
FDWE



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD		circuit × row	Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
50	10	6.35	3.5x1	4560	13230	93	155	135	18	113	51	102	20	11	17.5	11	PT1/8"	136
			5x1	5580	16710		175											170
	12	6.35	2.5x1	3510	9750		141											102
			3.5x1	4560	13230	93	165	135	18	113	51	102	20	11	17.5	11	PT1/8"	136
			5x1	5580	16710		189											170
	12	7.144	2.5x1	4080	11260		161											103
			3.5x1	5300	15280	100	185	146	25	122	55	110	20	14	20	13	PT1/8"	138
			5x1	6480	19300		209											173
	16	6.35	2.5x1	3510	9750		174											102
			3.5x1	4560	13230	93	206	135	18	113	51	102	20	11	17.5	11	PT1/8"	137
			5x1	5580	16710		238											171
	16	7.144	2.5x1	4080	11260		180											103
			3.5x1	5300	15280	100	212	146	25	122	55	110	20	14	20	13	PT1/8"	138
			5x1	6480	19300		244											173
	20	7.144	1.5x1	2790	7240		179											68
			2.5x1	4080	11260	100	219	146	25	122	55	110	20	14	20	13	PT1/8"	103
			3.5x1	5300	15280		259											138
			5x1	6480	19300		299											173
	20	7.938	2.5x1	4750	12090		219											105
			3.5x1	6180	16400	105	259	152	25	128	58	116	20	14	20	13	PT1/8"	141
			5x1	7550	20720		299											176
	50	7.938	1.5x1	3250	7770	105	305	152	25	128	58	116	20	14	20	13	PT1/8"	70

FDWE



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		NUT		FLANGE					FIT	BOLT			OIL HOLE	STIFFNESS
O.D.	LEAD		circuit × row	Dynamic (1×10⁶ REV.) Ca	Static Co	Dg6	L	A	T	W	G	H	S	X	Y	Z	Q	kgf/μm
63	10	6.35	3.5x1	5030	17020	108	155	154	22	130	58	116	20	14	20	13	PT1/8"	163
			5x1	6150	21500		175											205
	12	6.35	2.5x1	3870	12540		153											122
			3.5x1	5030	17020	108	177	154	22	130	58	116	20	14	20	13	PT1/8"	163
			5x1	6150	21500		201											205
	12	7.144	2.5x1	4540	14460		158											124
			3.5x1	5900	19620	115	182	161	22	137	61	122	20	14	20	13	PT1/8"	166
			5x1	19620	24780		206											289
	16	7.144	2.5x1	4540	14460		177											124
			3.5x1	5900	19620	115	209	161	22	137	61	122	20	14	20	13	PT1/8"	166
			5x1	19620	24780		241											290
	16	7.938	2.5x1	5260	15430		207											126
			3.5x1	6840	20940	120	239	180	28	150	72	144	25	18	26	17.5	PT1/8"	168
			5x1	8360	26450		271											210
	20	6.35	2.5x1	3870	12540		205											122
			3.5x1	5030	17020	108	245	154	22	130	58	116	20	14	20	13	PT1/8"	164
			5x1	6150	21500		285											205
	20	9.525	2.5x1	8870	25870		219											161
			3.5x1	11530	35110	122	259	182	28	150	72	144	25	18	26	17.5	PT1/8"	215
			5x1	14090	44350		299											269
80	10	6.35	3.5x1	5630	21660	130	159	176	22	152	66	132	20	14	20	13	PT1/8"	191
			5x1	6880	27360		179											239
	12	7.938	3.5x1	7670	27030	136	184	182	22	158	68	136	20	14	20	13	PT1/8"	204
			5x1	9380	34140		208											255
	16	9.525	2.5x1	9990	33200		188											195
			3.5x1	12990	45050	143	220	204	28	172	77	154	30	18	26	17.5	PT1/8"	261
			5x1	15880	56910		252											327
	20	9.525	2.5x1	9990	33200		220											195
			3.5x1	12990	45050	143	260	204	28	172	77	154	30	18	26	17.5	PT1/8"	262
			5x1	15880	56910		300											327
100	16	9.525	2.5x1	9400	33100		211											221
			3.5x1	12220	44920	170	243	243	32	205	91	182	30	22	32	21.5	PT1/8"	296
			5x1	14940	56740		259											371
	20	9.525	2.5x1	9400	33100		228											221
			3.5x1	12220	44920	170	268	243	32	205	91	182	30	22	32	21.5	PT1/8"	297
			5x1	14940	56740		308											371

PMI Precision Ground BallScrew

13.5 Ballscrews For Heavy Load

Features

Focused on improvements of contact points of balls and thread grooves, ball diameter and circulation system for new type, FSVH. The rated dynamic load has been increased to as two times as that of conventional type, FSVC.

Long Life

Structure of the newly developed circulation system is designed to distribute the load uniformly to the load balls and it also increases the life of ballscrews.
On conventional circulation system, FSVC, the returning tube is inserted into the holes on ballnut perpendicularly which forms an advancing angle. While ball moves into returning tube, it will hit tube end area and then move into returning tube.
New circulation system, FSVH, ball will move into returning tube smoothly by tangent line as the same direction as lead angle. It can increase the life of circulation system structure.

High DN Value

With the newly developed circulation system, ballscrews can meet the demands of high speed running with high DN value.

Low Noise

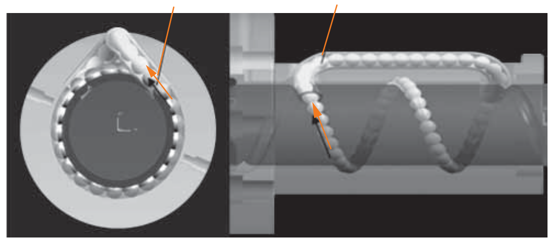
To use tangential circulation system structure, it can eliminate the noise while balls run into the returning tube.

Various Specifications Combination

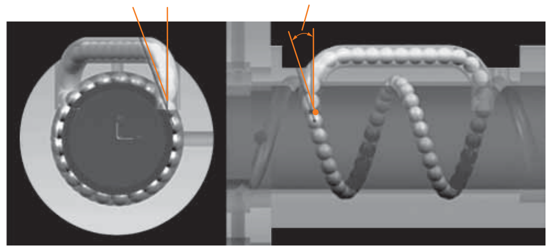
PMI can supply various ballscrews with diameter 50~100*mm* and lead 16*mm* to 25*mm* (Please contact *PMI* for your specific design requirement)

Application

Plastic Injection Machines / Press and Forging Machines
Semi-conductor Equipments / General Machines



FSVH circulation system structure(NEW)

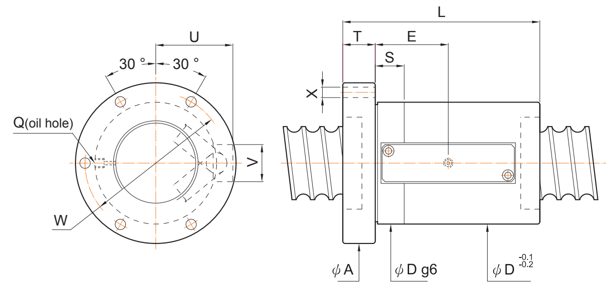


FSVC circulation system structure

FSVH

Product

TYPE I



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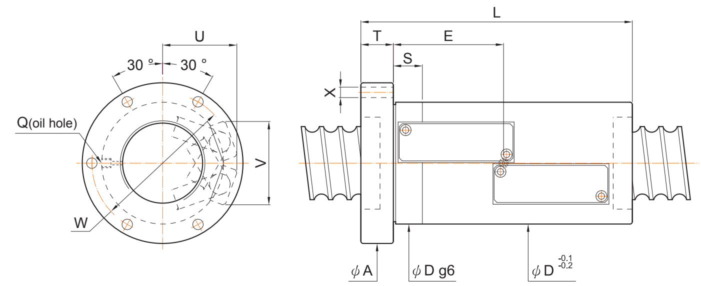


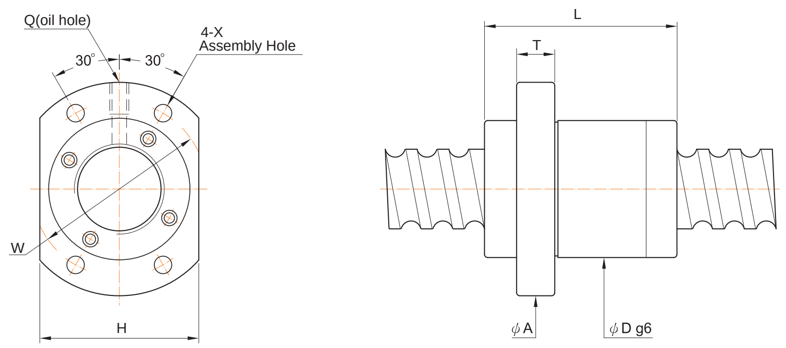
UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD *(kgf)*		NUT		FLANGE			FIT	OIL HOLE		BOLT	RETURN TUBE		TYPE
O.D.	LEAD		circuit x row	Dynamic (1×10^6 REV.) Ca	Static Co	Dg6	L	A	T	W	S	Q	E	X	V	U	
50	16	12.7	6x1	24800	63700	95	168	128	28	112	20	PT1/8"	62	9	32	60	I
		12.7	3.5x2	31200	83500		200	128	28	112	20		78	9	72	62	II
55	16	12.7	6x1	25800	71800	100	168	133	28	115	20	PT1/8"	62	9	32	63	I
		12.7	3.5x2	32600	94000	100	200	133	28	115	20		78	9	74	64	II
63	16	12.7	6x1	27800	81700	105	168	138	28	122	25	PT1/8"	62	9	32	67	I
		12.7	3.5x2	35000	107000	105	202	138	28	122	25		79	9	77	68	II
		12.7	6x2	50300	164000	105	266	138	28	122	25		111	9	77	68	II
	20	15.875	2.5x2	35900	99300	116	210	157	32	137	25	PT1/8"	81	11	86	75	II
		15.875	3.5x2	46600	134700	116	246	157	32	137	25		97	11	86	75	II
	25	15.875	2.5x2	35900	99300	116	235	157	32	137	25	PT1/8"	91	11	86	75	II
80	16	12.7	6x1	30900	104400	120	172	158	32	139	25	PT1/8"	62	9	36	73	I
		12.7	3.5x2	39000	136700	120	205	158	32	139	25		78	9	85	75	II
		12.7	6x2	56000	208700	120	275	158	32	139	25		116	9	85	75	II
	20	15.875	2.5x2	40100	127000	130	210	168	32	150	25	PT1/8"	80	11	90	82	II
		15.875	3.5x2	52100	172400	130	250	168	32	150	25		100	11	90	82	II
		15.875	6x2	75000	263200	130	330	168	32	150	30		140	11	90	82	II
	25	19.05	3.5x2	67700	206100	145	305	188	40	165	25	PT1/8"	119	11	106	94	II
		19.05	6x2	97200	314600	145	402	188	40	165	30		168	11	106	94	II
100	16	12.7	6x1	34200	133200	145	172	185	32	165	25	PT1/8"	62	11	40	86	I
		12.7	3.5x2	43200	174500	145	205	185	32	165	25		78	11	97	88	II
		12.7	6x2	62000	266300	145	275	185	32	165	25		116	11	97	88	II
	20	15.875	2.5x2	44800	160900	150	205	194	32	172	30	PT1/8"	76	11	106	94	II
		15.875	3.5x2	58300	218400	150	245	194	32	172	30		96	11	106	94	II
		15.875	6x2	83800	333300	150	330	194	32	172	30		141	11	106	94	II
	25	19.05	3.5x2	74900	260200	165	305	218	40	190	30	PT1/8"	119	11	117	104	II
		19.05	6x2	107700	397100	165	410	218	40	190	30		174	11	117	104	II

Specifications

13.6 End Cap Series

FSKC

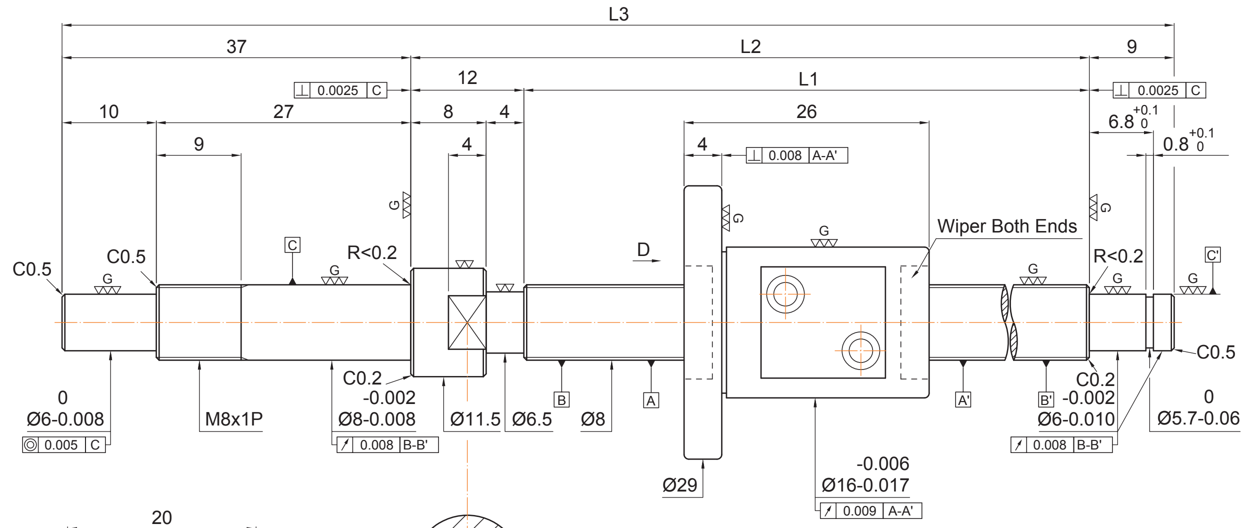


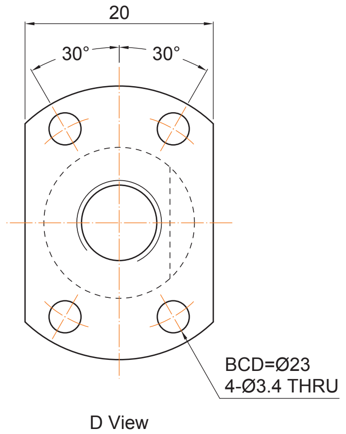
UNIT:mm

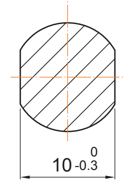
SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD (kgf) Dynamic (1×10⁶ REV.) Ca	BASIC RATE LOAD (kgf) Static Co	NUT Dg6	NUT L	FLANGE A	FLANGE T	FLANGE W	FLANGE H	Assembly Hole X	OIL HOLE Q	STIFFNESS kgf/μm
15	10	3.715	2.8x2	1410	2800	34	44	57	10	40	45	5.5	M6x1P	34
16	16	3.175	1.8x2	700	1400	32	38	53	10	38	42	4.5	M6x1P	18
20	20	3.175	1.8x2	1100	2500	39	52	62	10	46	50	5.5	M6x1P	29
25	25	3.969	1.8x2	1650	3900	47	62	74	12	56	60	6.6	M6x1P	35
			1.8x4	2830	7800									69
32	32	4.762	1.8x2	2360	5940	58	78	92	15	68	74	9	M6x1P	44
			1.8x4	4280	11800									87
36	24	7.144	2.8x2	6450	15220	75	94	115	18	86	94	11	M6x1P	77
40	40	6.35	1.8x2	3860	9900	73	95	114	17	84	93	11	M6x1P	55
			1.8x4	7000	19880									108
50	50	7.938	1.8x2	5800	15800	90	120	135	20	104	112	14	M6x1P	68
			1.8x4	10520	31600									

13.7 Miniature Series

Miniature Ballscrews
Screw Dia.Ø8 Lead02 **FSMC**



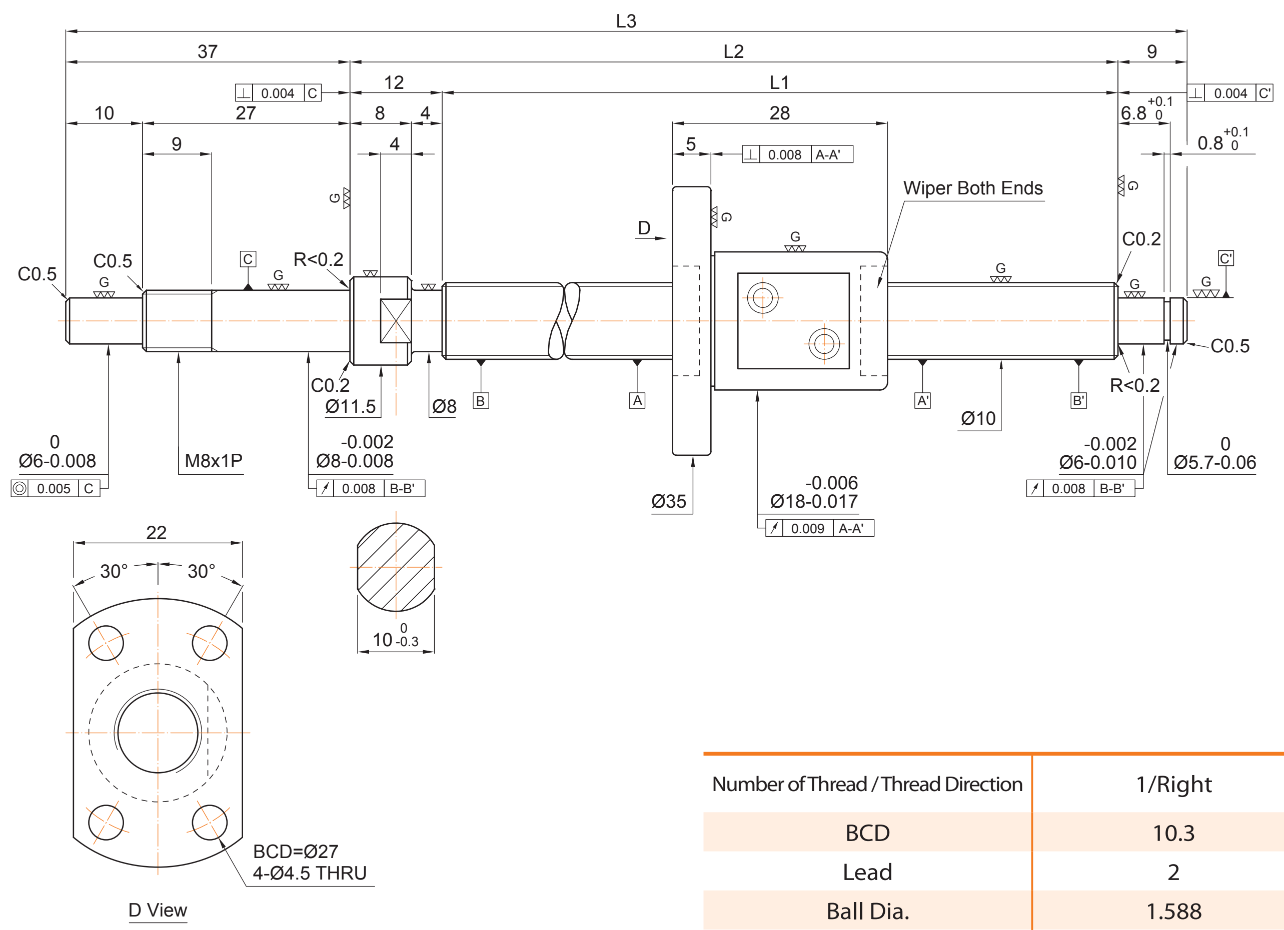




Number of Thread / Thread Direction	1/Right	
BCD	8.3	
Lead	2	
Ball Dia.	1.588	
Effective Turns (Circuit × Row)	2.5	
Lead Angle	4.39	
Dynamic Rate Load Ca (kgf)	190	
Static Rate Load Co (kgf)	290	
Axial Play	0	0.005 or less
Preloading Torque (kgf-cm)	0.01~0.2	0.05 or less

UNIT:mm

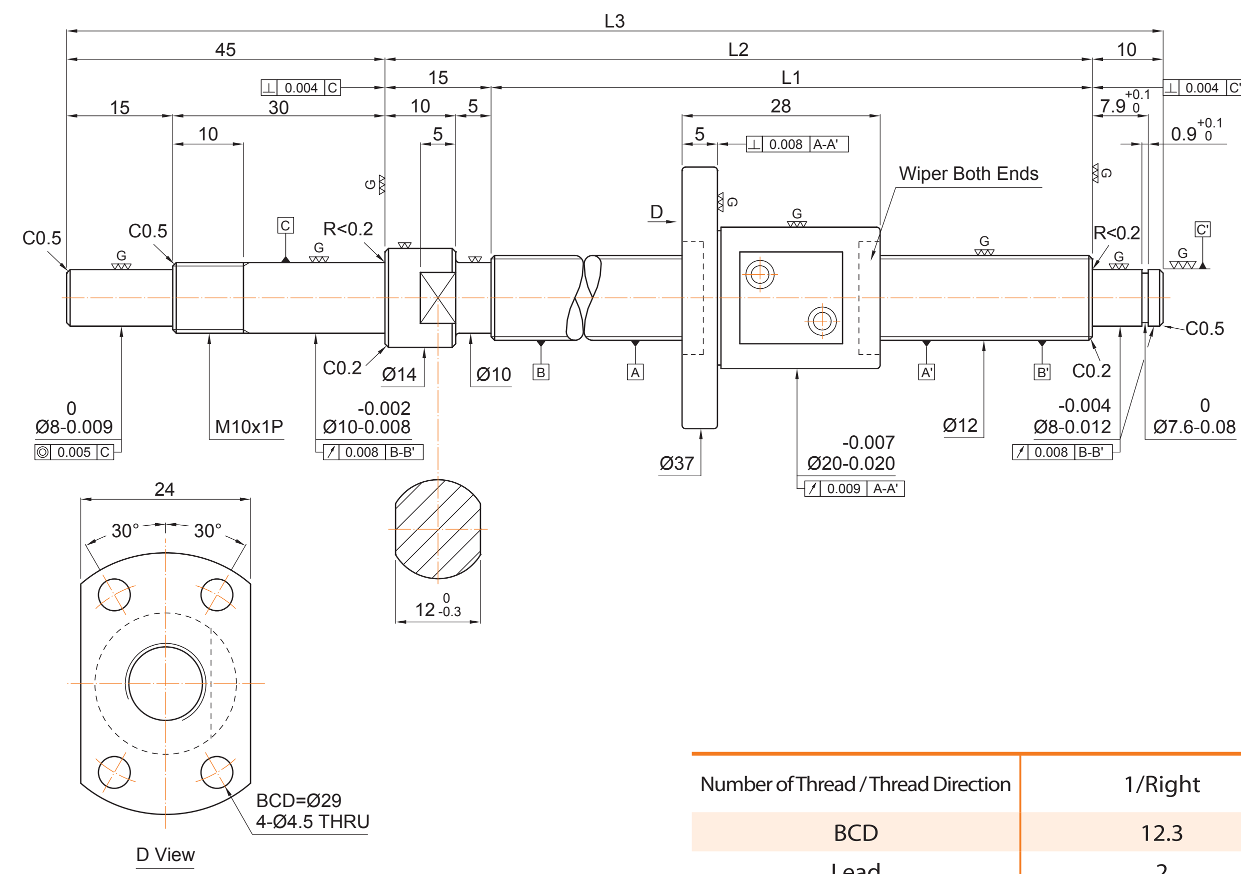
Model No.	Screw Spindle (Shaft) Length L1	L2	L3	Accuracy Grade	Lead Accuracy Specified Travel (T)	Accumulated reference lead deviation E	Lead Deriation in random 300mm e_{300}
FSM0802-C3-1R-0138	80	92	138	3	0	0.012	0.008
FSM0802-C3-1R-0168	110	122	168	3	0	0.012	0.008
FSM0802-C3-1R-0198	140	152	198	3	0	0.012	0.008
FSM0802-C3-1R-0248	190	202	248	3	0	0.012	0.008



Number of Thread / Thread Direction	1/Right	
BCD	10.3	
Lead	2	
Ball Dia.	1.588	
Effective Turns (Circuit × Row)	2.5	
Lead Angle	3.54	
Dynamic Rate Load Ca (kgf)	220	
Static Rate Load Co (kgf)	370	
Axial Play	0	0.005 or less
Preloading Torque (kgf-cm)	0.01~0.3	0.05 or less

UNIT:mm

Model No.	Screw Spindle (Shaft) Length			Accuracy Grade	Lead Accuracy		
	L1	L2	L3		Specified Travel (T)	Accumulated reference lead deviation E	Lead Deriation in random 300mm e_{300}
FSM1002-C3-1R-0168	110	122	168	3	0	0.012	0.008
FSM1002-C3-1R-0218	160	172	218	3	0	0.012	0.008
FSM1002-C3-1R-0268	210	222	268	3	0	0.012	0.008
FSM1002-C3-1R-0318	260	272	318	3	0	0.012	0.008
FSM1002-C3-1R-0368	310	322	368	3	0	0.012	0.008



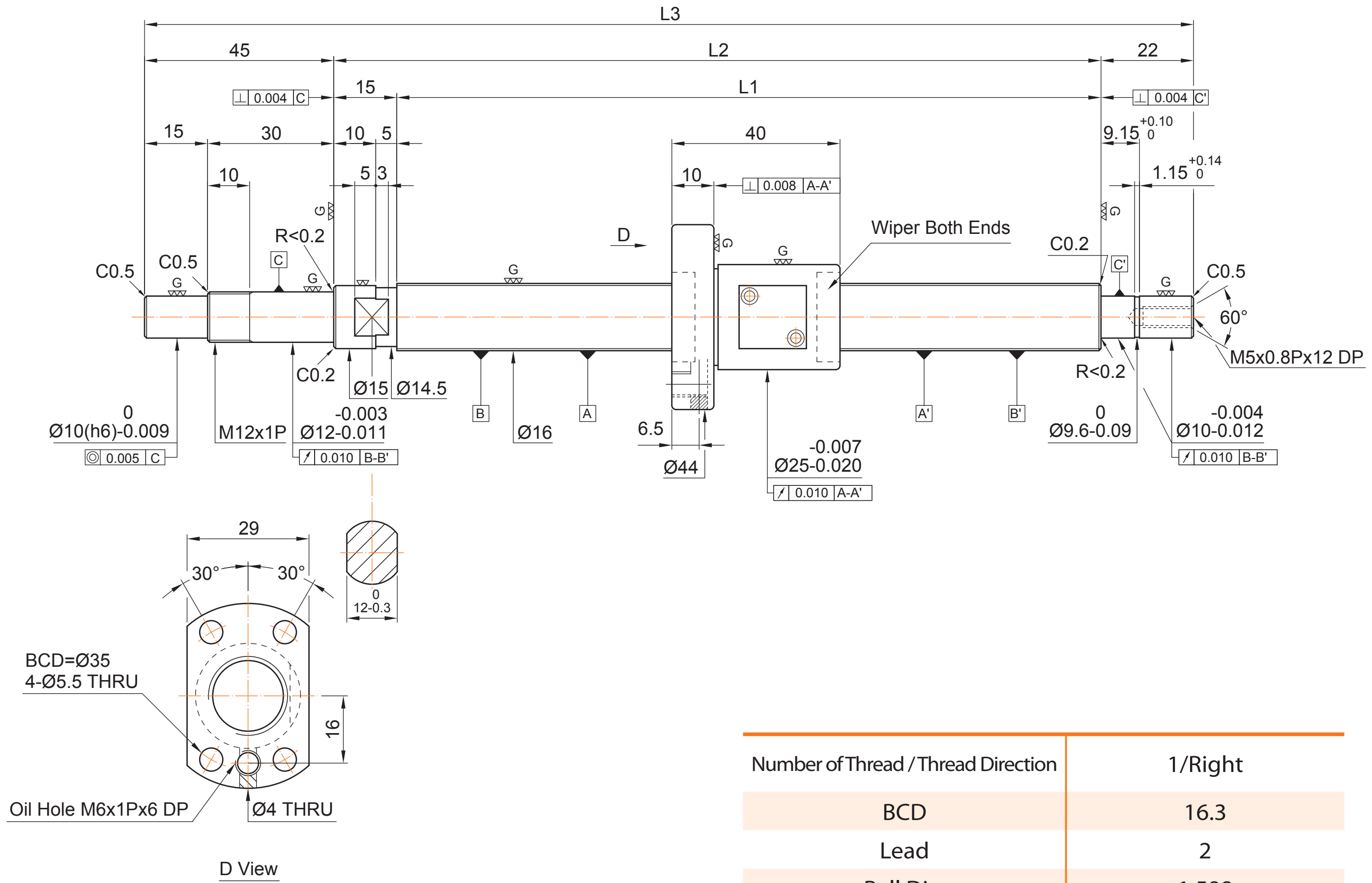
Number of Thread / Thread Direction	1/Right	
BCD	12.3	
Lead	2	
Ball Dia.	1.588	
Effective Turns (Circuit × Row)	2.5	
Lead Angle	2.96	
Dynamic Rate Load Ca (kgf)	240	
Static Rate Load Co (kgf)	450	
Axial Play	0	0.005 or less
Preloading Torque (kgf-cm)	0.04~0.4	0.1or less

UNIT:mm

Model No.	Screw Spindle (Shaft) Length			Accuracy Grade	Lead Accuracy		
	L1	L2	L3		Specified Travel (T)	Accumulated reference lead deviation E	Lead Deriation in random 300mm e_{300}
FSM1202-C3-1R-0180	110	125	180	3	0	0.012	0.008
FSM1202-C3-1R-0230	160	175	230	3	0	0.012	0.008
FSM1202-C3-1R-0280	210	225	280	3	0	0.012	0.008
FSM1202-C3-1R-0330	260	275	330	3	0	0.012	0.008
FSM1202-C3-1R-0380	310	325	380	3	0	0.012	0.008

FSMC

Miniature Ballscrews
Screw Dia.Ø16 Lead02



Number of Thread / Thread Direction	1/Right	
BCD	16.3	
Lead	2	
Ball Dia.	1.588	
Effective Turns (Circuit × Row)	3.5	
Lead Angle	2.24	
Dynamic Rate Load Ca (kgf)	360	
Static Rate Load Co (kgf)	850	
Axial Play	0	0.005 or less
Preloading Torque (kgf-cm)	0.05~0.5	0.15 or less

UNIT:mm

Model No.	Screw Spindle (Shaft) Length			Accuracy Grade	Lead Accuracy		
	L1	L2	L3		Specified Travel (T)	Accumulated reference lead deviation E	Lead Deriation in random 300mm e_{300}
FSM1602-C3-1R-0221	139	154	221	3	0	0.012	0.008
FSM1602-C3-1R-0271	189	204	271	3	0	0.012	0.008
FSM1602-C3-1R-0321	239	254	321	3	0	0.012	0.008
FSM1602-C3-1R-0371	289	304	371	3	0	0.012	0.008
FSM1602-C3-1R-0471	389	404	471	3	0	0.013	0.008

14 *PMI* Rolled BallScrews

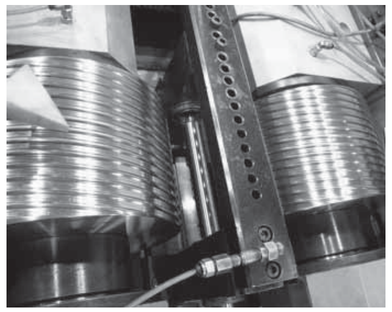
14 *PMI* Rolled BallScrews

14.1 Introduction to Rolled Ballscrew

The production of the *PMI* rolled ballscrews has adopted a manufacturing process and equipment unlike other manufacturers. Combining advanced skills and the Bad Düben digital electric screw thread rolling machine, we adhere to a strict quality control policy at every stage of production, from the selection of ballscrew material and rolled processing to induction hardening heat treatment and post production. We are committed to providing clients with products of the best quality.

The combination of rolled ballscrews and ground nuts has replaced the traditional ACME screws and trapezoidal screws. This makes for a smoother operation while lowering friction and backlash. Moreover, the new technology has the advantage of faster production speed and lower prices.

Besides differences in the definition of lead deviation and geometric tolerance, rolled and ground ballscrews can both eliminate axial play by preloading. Please contact us for related technical information.



We employ the most advanced digital electric screw thread rolling machine. During the manufacturing process, the oil cylinders on the two axes of the thread rolling dies employ a servo hydraulic system for the correction of oil pressure and positioning precision.

We employ Germany-imported Bad Düben roller in order to maintain the stability of the thread rolling machine and the quality of the rolled product.

14.2 Features of the *PMI* Rolled Ballscrew

C7, C8, and C10 Screws have been Standardized

The lead accuracy of our rolled ballscrews is in accordance with JIS B1192 -1997, and our C7, C8, and C10 products have been standardized.

Lead Accuracy Up to Grade C5

Lead accuracy grade can be as good as JIS Grade C5 and C6. Please contact us if you have need for such high accuracy grades.

High Precision Rolled Nuts

The manufacturing process of rolled nuts is identical to that of ground nuts. Surface hardening treatment and internal thread grinding ensure durability and smoothness.

Nuts are Interchangeable

Without preload and within the maximum permissible axial play, different types of nuts can be used on the same screw.

14.3 Lead Accuracy of Rolled Screws (e_{300})

According to JIS B1192 -1997, the definition of lead accuracy for *PMI* rolled ballscrews is as follows: Within the effective thread length, the permissible value of accumulated lead deviation in random 300*mm*. As shown in table 14.1:

Table 14.1 Lead Accuracy

e_{300} (Within the effective thread length, the permissible value of accumulated lead deviation in random 300mm)

UNIT: *μm*

Grade	C5	C6	C7	C8	C10
ISO, DIN	23		52		210
JIS	18		50		210
PMI	18	25	50	100	210

e_p (Within the effective thread length, the permissible value of accumulated lead deviation) UNIT: *μm*

Grade	C5	C6	C7	C8	C10
PMI	e_p=(L/300)×e_{300} L: Effective thread length (Unit: *mm*)				

UNIT: *μm*

e_{300} Grade / Measured length	C5	C6	C7	C8	C10
0~100	15	20	44	84	178
101~200	16	22	48	92	194
201~315	18	25	50	100	210

P.S. Please contact us for PMI C5 and C6 requirements.

14.4 Reference Table of the Nominal Outer Diameter and Lead of the *PMI* Rolled Screws

PMI rolled ballscrews offer a variety of specifications, lead accuracies, and maximum rolling length, as shown in table 14.2~14.3:

Table 14.2 Specifications of Rolled Ballscrews

Screw nominal outer diameter Ø	Lead										Maximum rolled ballscrew length
	4	5	5.08	6	10	16	20	25	32	40	
12	●	●									1400
14	●	●									2800
15					●						4400
16	●	●			●	●					3600
20	●	●			●		●				4400
25	●	●/○	●/○		●			●			4400
28		●		●							4400
32		●/○	●/○		●		●		●		5700
40		●			●		●			●	5400
50					●						5200

● : right-hand thread ○ : left-hand thread

P.S. Rolled ballscrews are limited in length and accuracy, please contact us for other requirements.

Table 14.3 Lead Accuracy and Maximum Rolled Length

Screw nominal outer diameter Ø(*mm*)	Lead Accuracy Grade (e_{300}) Maximum Rolling Length (*mm*)				
	C5	C6	C7	C8	C10
12	Please contact our sales representatives		1400	1400	1400
14			2800	2800	2800
15			4400	4400	4400
16			3600	3600	3600
20			4400	4400	4400
25~28			4400	4400	4400
32			5700	5700	5700
40			5400	5400	5400
50			5200	5200	5200

14.5 Axial Play

The maximum axial play under normal non-preload condition, as shown in table 14.4

Table 14.4 Maximum Axial Play

Screw O.D. Ød (*mm*)	6~12	14~28	30~32	36~45	50
Maximum Axial Play (*mm*)	0.05	0.10	0.14	0.17	0.20

PMI rolled ballscrews can eliminate axial play by preloading. Please contact our sales representatives if preloading is required.

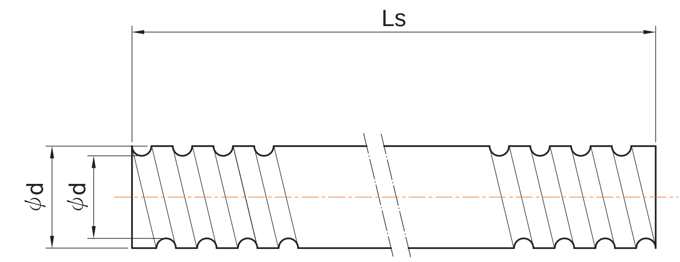
14.6 Material and Hardness

Standard material and surface hardness for *PMI* rolled screw, as shown in table 14.5

Table 14.5

Denomination	Material	Heat Treatment	Hardness (HRC)
Rolled screw	S55C	Induction hardening	58~62
Nuts	SCM420H	Carburized hardening	58~62

14.7 Types and Dimensions of Rolled Screws



UNIT:mm

SCREW SIZE			Lead Accuracy Grade	Thread Direction L: Left / R: Right	Number of Threads	Maximum Rolling Length	Screw Number
O.D.	LEAD	BALL DIA.					
12	4	2.381	C7, C8, C10	R	1	1400	R1204A
	5	2.000		R	1		R1205B
14	4	2.381		R	1	2800	R1404A
	5	3.175		R	1		R1405B
15	10	3.175		R	2	4400	2R1510B
16	4	2.381		R	1	3600	R1604A
	5	3.175		R	1		R1605B
	10	3.175		R	2		2R1610B
	16	3.175		R	2		2R1610B
20	4	2.381		R	1	4400	R2004A
	5	3.175		R	1		R2005B
	10	4.762		R	1		R2010D
	20	3.175		R	2		2R2020B
25	4	2.381		R	1		R2504A
	5	3.175		R/L	1		R(L)2505B
	5.08	3.175		R/L	1		R(L)2515B
	10	4.762		R	1		R2510D
	10	6.350		R	1		R22510E
	25	3.969		R	4		4R2525C
28	5	3.175		R	1		R2805B
	6	3.175		R	1		R2806B
32	5	3.175		R/L	1	5700	R(L)3205B
	5.08	3.175		R/L	1		R(L)3215B
	10	6.350		R	1		R3210E
	20	6.350		R	2		2R3220E
	32	4.762		R	4		4R3232D
40	5	3.175		R	1	5400	R4005B
	10	6.350		R	1		R4010E
	20	6.350		R	2		2R4020E
	40	6.350		R	4		4R4040E
50	10	6.350		R	1	5200	R5010E

Order Code: 4 R 15 10 A -1500 -C7

- -C7: Lead Accuracy Grade
- 1500: Custom Length of Screw (*mm*)
- A: Ball Diameter(*mm*) (A: 2.381 B: 3.175 C: 3.969 D: 4.762 F: 6.35 Z: 2.0)
- 10: Lead (*mm*)
- 15: Screw Nominal O.D. (*mm*)
- R: Thread Direction (R: Right L: Left)
- 4: Number of Threads (N/A for single thread screws)

14.8 Rolled Ballscrew Nuts

Standard Models:

FSIN

FSIW

FSKW

Optional Models：

FSWW

FSVW

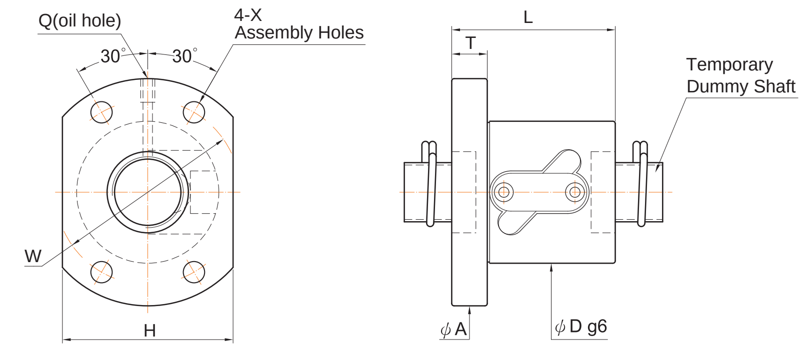
RSVW

SSVW

FSBW

Order Code: L F S I N 25 05 -5.6P

- -5.6P: Effective Turns (Circuit × Row)
- 05: Lead
- 25: Screw nominal outer diameter
- N: W: Rolled Ballscrew N: European Standard Model
- I: Ball Circulation Types W: Immersion type; V : Extrusive type; I : Internal Ball Circulation Nuts; K : End Cap Series
- S: Single Nut
- F: Type of Nut (F: with flange R: without flange S: square nuts)
- L: Thread Direction (R: Right L: Left)

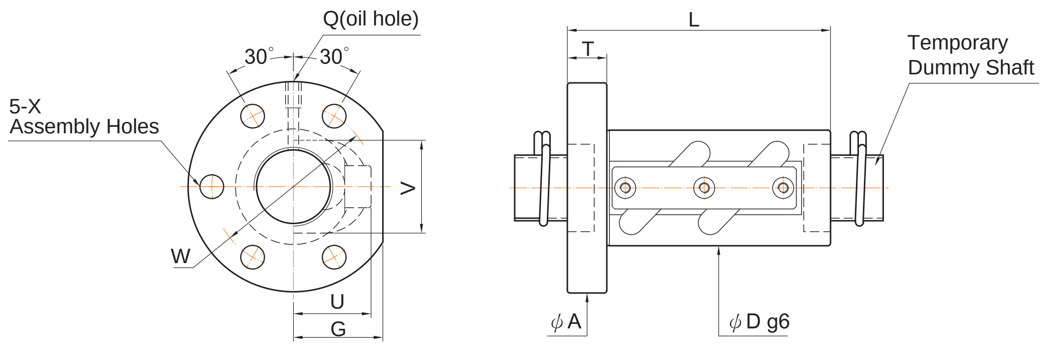


UNIT:mm

SCREW SIZE O.D.	LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(*kgf*) Dynamic (1×10⁶ REV.) Ca	Static Co	O.D. D	Length L	Flange A	T	W	H	Assembly Hole X	Oil Hole Q	STIFFNESS *kgf/μm*	Nut Model NO.
12	4	2.381	2.5x1	285	533	30	40	52	10	40	31	4.5	M6x1P	9	FSWW1204-2.5P
	5	2.000	2.5x1	270	350	26	40	47	10	37	30	4.5	M6x1P	8.2	FSWW1205-2.5P
14	4	2.381	3.5x1	500	1100	35	42	57	10	45	40	4.5	M6x1P	15	FSWW1404-3.5P
	5	3.175	2.5x1	515	990	40	40	57	10	45	40	4.5	M6x1P	11	FSWW1405-2.5P
20	5	3.175	2.5x1	625	1450	44	41	67	10	55	52	5.5	M6x1P	15	FSWW2005-2.5P
	10	4.762	2.5x1	1100	2200	52	61	82	12	67	64	6.6	M6x1P	16	FSWW2010-2.5P
25	5	3.175	2.5x1	720	1830	50	41	73	11	61	56	6.6	M6x1P	18	FSWW2505-2.5P
			2.5x2	1120	3710		56							37	FSWW2505-5.0P
	10	6.350	2.5x1	1720	3590	60	69	96	15	78	72	9	M6x1P	21	FSWW2510-2.5P
			2.5x2	3200	7170		97							40	FSWW2510-5.0P
32	10	6.350	2.5x1	1930	4680	67	69	103	15	85	78	9	M6x1P	25	FSWW3210-2.5P
			2.5x2	3130	9410		97							49	FSWW3210-5.0P
40	10	6.350	2.5x2	3520	12000	76	100	116	17	96	88	11	M6x1P	59	FSWW4010-5.0P
50	10	6.350	2.5x2	3900	15000	88	101	128	18	108	100	11	M6x1P	72	FSWW5010-5.0P
			3.5x2	4940	21000		126							98	FSWW5010-7.0P

Note:
Stiffness of nut:
Stiffness values listed above are derived from theoretical formula to the elastic deformation between thread grooves and balls while axial load is 30% dynamic load rating. Refer to P.20.

FSVW

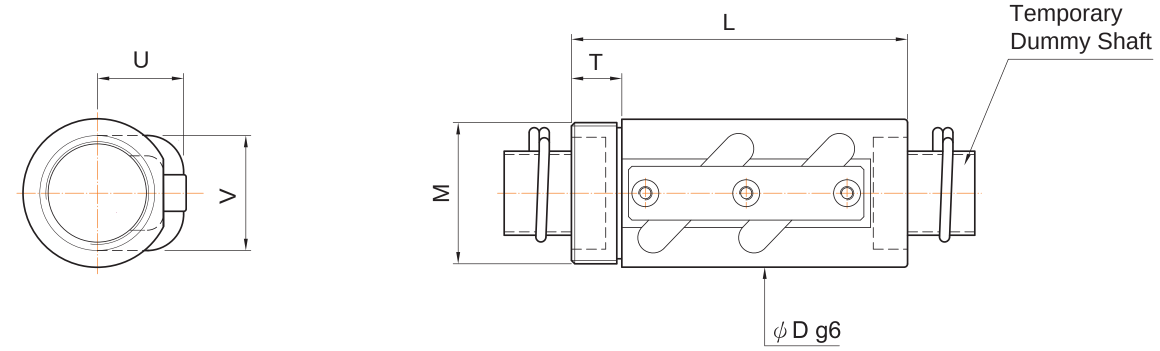


UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf)		BALLNUT DIMENSION											
O.D.	LEAD			Dynamic (1×10⁶ REV.) Ca	Static Co	O.D. D	Length L	Flange A	T	W	G	Return tube U	V	Assembly Hole X	Oil Hole Q	STIFFNESS kgf/μm	Nut Model NO.
14	4	2.381	3.5x1	500	1100	25	42	55	10	40	19	19	21	4.5	M6x1P	15	FSVW1404-3.5P
	5	3.175	2.5x1	515	990	30	43	50	10	40	22	22	21	4.5	M6x1P	11	FSVW1405-2.5P
16	5	3.175	2.5x1	550	1140	34	43	54	10	44	24	20	22	4.5	M6x1P	13	FSVW1605-2.5P
20	5	3.175	2.5x1	625	1450	40	43	60	12	50	28	28	27	4.5	M6x1P	15	FSVW2005-2.5P
	10	4.762	2.5x1	1100	2200	40	60	67	12	53	30	30	30	6.6	M6x1P	16	FSVW2010-2.5P
25	5	3.175	2.5x1	720	1830	42	45	71	12	57	28	28	32	6.6	M6x1P	18	FSVW2505-2.5P
			2.5x2	1120	3710		60									37	FSVW2505-5.0P
	10	6.350	2.5x1	1720	3590	44	68	79	15	62	34	34	37	9.0	M6x1P	21	FSVW2510-2.5P
			2.5x2	3200	7170		98									40	FSVW2510-5.0P
32	10	6.350	2.5x1	1930	4680	55	72	97	18	75	39	39	44	11	M6x1P	25	FSVW3210-2.5P
			2.5x2	3130	9410		101									49	FSVW3210-5.0P
40	10	6.350	3.5x2	4450	16800	65	123	114	20	90	44	44	52	14	M6x1P	81	FSVW4010-7.0P
50	10	6.350	3.5x2	4940	21000	80	125	138	22	110	52	52	62	18	M6x1P	98	FSVW5010-7.0P

Note:
Stiffness of nut:
Stiffness values listed above are derived from theoretical formula to the elastic deformation between thread grooves and balls while axial load is 30% dynamic load rating. Refer to P.20.

RSVW

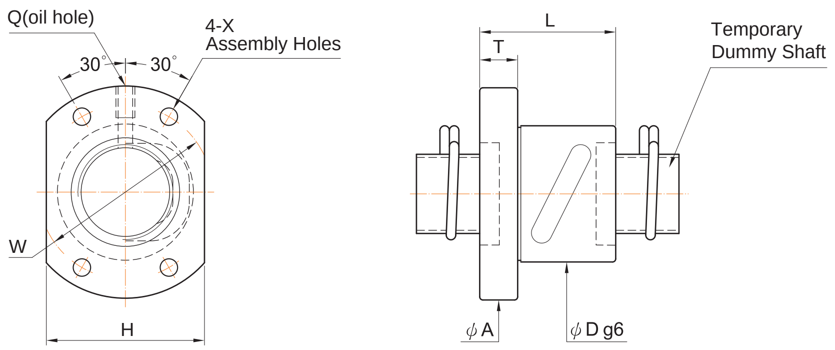


UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf)		BALLNUT DIMENSION							
O.D.	LEAD			Dynamic (1×10⁶ REV.) Ca	Static Co	O.D. D	Length L	Flange M	T	Return tube U	V	STIFFNESS kgf/μm	Nut Model NO.
14	4	2.381	3.5x1	500	1100	25	42	M24x1.0P	10	19	21	15	RSVW1404-3.5P
	5	3.175	2.5x1	515	990	30	43	M26x1.5P	10	22	21	11	RSVW1405-2.5P
20	5	3.175	2.5x1	625	1450	40	43	M36x1.5P	12	28	27	15	RSVW1605-2.5P
25	5	3.175	2.5x1	720	1830	42	48	M40x1.5P	15	28	32	18	RSVW2505-2.5P
			2.5x2	1120	3710		63					37	RSVW2505-5.0P
	10	6.350	2.5x1	1720	3590	44	68	M42x1.5P	15	34	37	21	RSVW2510-2.5P
			2.5x2	3200	7170		98					40	RSVW2510-5.0P
32	10	6.350	2.5x1	1930	4680	55	72	M50x1.5P	18	39	44	25	RSVW3210-2.5P
			2.5x2	3130	9410		101					49	RSVW3210-5.0P
40	10	6.350	3.5x2	4450	16800	65	128	M60x2.0P	25	44	52	81	RSVW4010-7.0P
50	10	6.350	3.5x2	4940	21000	80	143	M75x2.0P	40	52	62	98	RSVW5010-7.0P

Note:
Stiffness of nut:
Stiffness values listed above are derived from theoretical formula to the elastic deformation between thread grooves and balls while axial load is 30% dynamic load rating. Refer to P.20.

FSBW

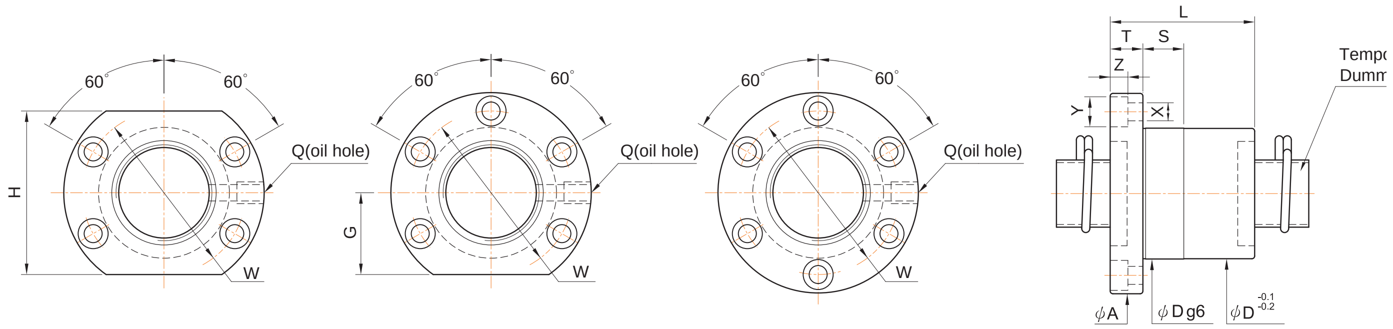


UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	BASIC RATE LOAD(kgf) Static Co	O.D. D	Length L	Flange A	Flange T	Flange W	Flange H	Assembly Hole X	Oil Hole Q	STIFFNESS kgf/μm	Nut Model NO.
12	5	2.000	2.5x1	270	350	26	40	47	10	37	30	4.5	M6x1P	8.2	FSBW1205-2.5P
14	4	2.381	3.5x1	500	1100	31	40	50	10	40	37	4.5	M6x1P	15	FSBW1404-3.5P
	5	3.175	2.5x1	515	990	32	40	50	10	40	38	4.5	M6x1P	11	FSBW1405-2.5P
16	5	3.175	2.5x1	570	1130	34	40	54	10	44	40	4.5	M6x1P	13	FSBW1605-2.5P
20	4	2.381	2.5x1	415	850	40	41	59	10	50	46	4.5	M6x1P	14	FSBW2004-2.5P
	5	3.175	2.5x1	620	1450	40	40	59	10	50	46	4.5	M6x1P	16	FSBW2005-2.5P
25	4	2.381	2.5x1	450	980	43	41	67	10	55	50	4.5	M6x1P	17	FSBW2504-2.5P
	5	3.175	2.5x1	720	1830	43	40	67	10	55	50	5.5	M6x1P	18	FSBW2505-2.5P

Note:
Stiffness of nut:
Stiffness values listed above are derived from theoretical formula to the elastic deformation between thread grooves and balls while axial load is 30% dynamic load rating. Refer to P.20.

FSIW

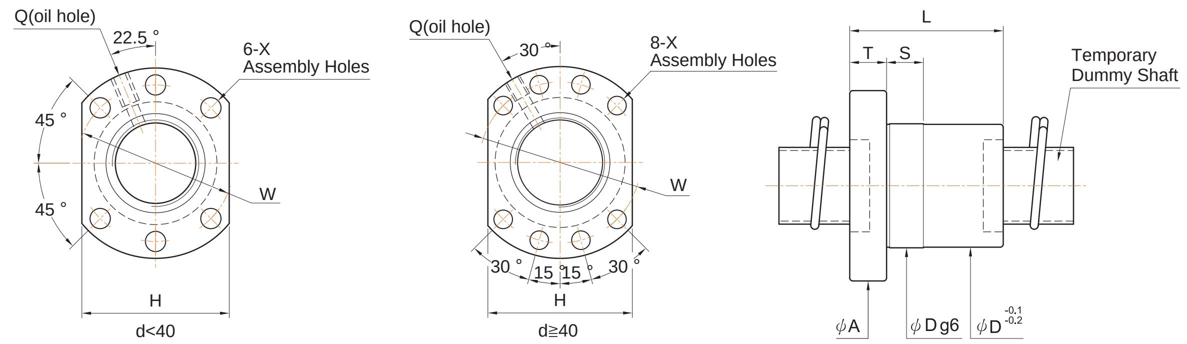


UNIT:mm

SCREW SIZE O.D.	SCREW SIZE LEAD	BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf) Dynamic (1×10^6 REV.) Ca	BASIC RATE LOAD(kgf) Static Co	O.D. D	Length L	Flange A	Flange T	Flange W	Flange G	Flange H	Fit S	Assembly Hole X	Assembly Hole Y	Assembly Hole Z	Oil Hole Q	STIFFNESS kgf/μm	Nut Model NO.
14	4	2.381	4	400	890	26	47	46	10	36	-	-	10	4.5	8	4..5	M6x1P	18	FSIW1404-4.0P
16	5	3.175	3	570	1030	30	42	49	10	39	20	40	10	4.5	-	-	M6x1P	17	FSIW1605-3.0P
20	5	3.175	4	830	1890	34	53	57	12	45	20	40	12	5.5	9.5	5.5	M6x1P	21	FSIW2005-4.0P
25	5	3.175	4	940	2420	40	53	63.5	12	51	22	44	15	5.5	9.5	5.5	M8x1P	26	FSIW2505-4.0P
32	5	3.175	4	1050	3390	48	53	73.5	12	60	30	60	15	6.6	11	6.5	M8x1P	32	FSIW3205-4.0P
	10	6.350	4	2510	5880	54	90	88	16	70	34	68	15	9	14	8.5	M8x1P	34	FSIW3210-4.0P
40	5	3.175	4	1180	4390	55	56	88.5	16	72	29	58	15	9	14	8.5	M8x1P	38	FSIW4005-4.0P
	10	6.350	4	2630	7860	64	93	106	18	84	43	86	20	11	17.5	11	M8x1P	41	FSIW4010-4.0P
50	10	6.350	4	2770	10290	74	93	116	18	94	42	84	20	11	17.5	11	M8x1P	50	FSIW5010-4.0P

Note:
Stiffness of nut:
Stiffness values listed above are derived from theoretical formula to the elastic deformation between thread grooves and balls while axial load is 30% dynamic load rating. Refer to P.20.

FSIN

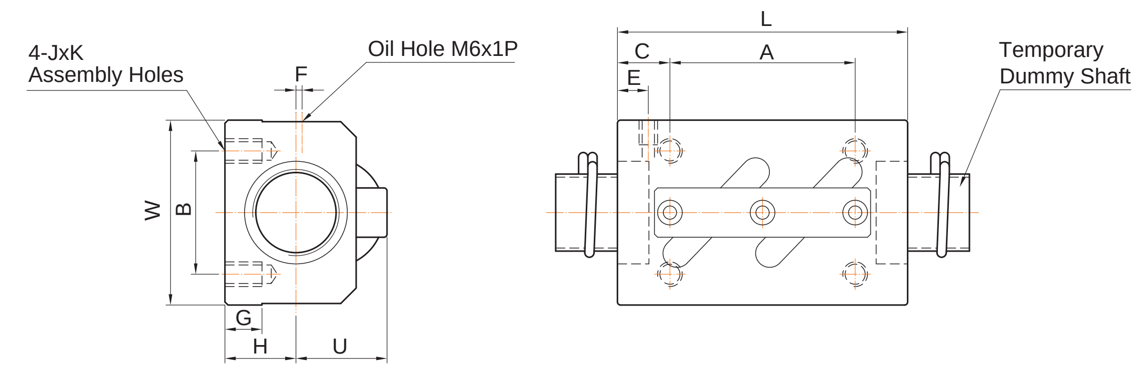


UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS	BASIC RATE LOAD(kgf)		BALLNUT DIMENSION										
O.D.	LEAD			Dynamic (1×10⁶ REV.) Ca	Static Co	O.D. D	Length L	Flange A	T	W	H	Assembly Hole X	Fit S	Oil Hole Q	STIFFNESS kgf/μm	Nut Model NO.
16	5	3.175	3	570	1030	28	42	48	10	38	40	5.5	12	M6x1P	17	FSIN1605-3.0P
20	5	3.175	4	830	1890	36	50	58	12	47	44	5.5	12	M6x1P	21	FSIN2005-4.0P
25	5	3.175	4	940	2420	40	50	62	12	51	48	6.5	12	M6x1P	26	FSIN2505-4.0P
	10	4.762	4	1560	3550	40	85	62	12	51	48	6.5	15	M6x1P	27	FSIN2510-4.0P
32	5	3.175	4	1050	3390	50	50	80	12	65	62	9	12	M6x1P	32	FSIN3205-4.0P
	10	6.35	4	2510	5880	50	80	80	13	65	62	9	16	M6x1P	34	FSIN3210-4.0P
40	5	3.175	4	1180	4390	63	54	93	15	78	70	9	12	M8x1P	38	FSIN4005-4.0P
	10	6.35	4	2430	7860	63	82	93	15	78	70	9	15	M8x1P	41	FSIN4010-4.0P
50	10	6.35	4	2770	10290	75	88	110	18	93	85	11	16	M8x1P	50	FSIN5010-4.0P
	10	6.35	6	3920	15440	75	106	110	18	93	85	11	16	M8x1P	73	FSIN5010-6.0P

Note:
Stiffness of nut:
Stiffness values listed above are derived from theoretical formula to the elastic deformation between thread grooves and balls while axial load is 30% dynamic load rating. Refer to P.20.

SSVW

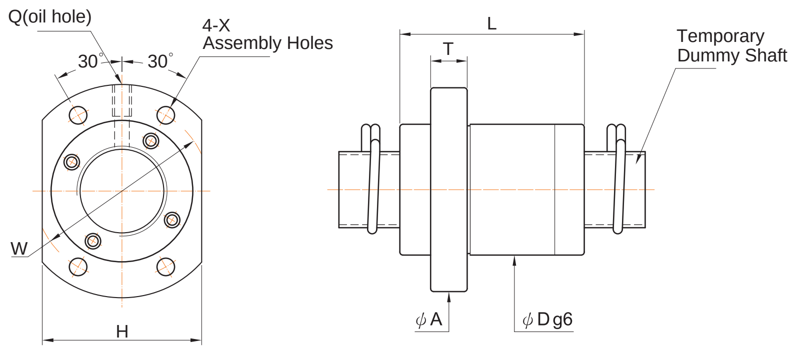


UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(kgf)		BALLNUT DIMENSION													
O.D.	LEAD			Dynamic (1×10⁶ REV.) Ca	Static Co	Length L	Width W	Height H	Assembly Hole A	B	C	J×K	Position of Oil Hole E	F	Height from Reference Surface G	U	STIFFNESS kgf/μm	Nut Model NO.
14	4	2.381	3.5x1	500	1110	35	34	13	22	26	6.5	M4x7	6	2	6	18	15	SSVW1404-3.5P
	5	3.175	2.5x1	515	990	35	34	13	22	26	6.5	M4x7	6	2	6	18	11	SSVW1405-2.5P
16	5	3.175	2.5x1	590	1210	35	42	16	22	32	6.5	M5x8	6	2	8	21	13	SSVW1605-2.5P
20	5	3.175	2.5x1	625	1450	35	48	17	22	35	6.5	M6x10	6	3	9.15	22	15	SSVW2005-2.5P
	10	4.762	2.5x1	1100	2220	58	48	18	35	35	11.5	M6x10	10	2	9.5	25	16	SSVW2010-2.5P
25	5	3.175	2.5x1	720	1830	35	60	20	22	40	6.5	M8x12	7	5	9.5	25	18	SSVW2505-2.5P
	10	6.350	2.5x2	3240	7170	94	60	23	60	40	17	M8x12	10	-	10	30	40	SSVW2510-5.0P
28	6	3.175	2.5x2	1380	4140	67	60	22	40	40	13.5	M8x12	8	5	10	27	39	SSVW2806-5.0P
32	10	6.350	2.5x1	2010	4700	64	70	26	45	50	9.5	M8x12	10	-	12	36	25	SSVW3210-2.5P
			2.5x2	3640	9410	94			60		17						49	SSVW3210-5.0P

Note:
Stiffness of nut:
Stiffness values listed above are derived from theoretical formula to the elastic deformation between thread grooves and balls while axial load is 30% dynamic load rating. Refer to P.20.

FSKW



UNIT:mm

SCREW SIZE		BALL DIA.	EFFECTIVE TURNS circuit × row	BASIC RATE LOAD(*kgf*)		BALLNUT DIMENSION									
				Dynamic (1×10^6 REV.)	Static	O.D.	Length	Flange				Assembly Hole	Oil Hole	STIFFNESS	Nut Model
O.D.	LEAD			Ca	Co	D	L	A	T	W	H	X	Q	*kgf/μm*	NO.
15	10	3.175	2.8x2	1000	2570	34	44	57	10	45	40	5.5	M6x1P	26	FSKW1510-5.6P
16	16	3.175	1.8x1	330	640	32	38	53	10	42	38	4.5	M6x1P	9	FSKW1616-1.8P
20	20	3.175	1.8x2	780	2280	39	52	62	10	50	46	5.5	M6x1P	21	FSKW2020-3.6P
25	25	3.969	1.8x2	1230	3570	47	62	74	12	60	56	6.6	M6x1P	27	FSKW2525-3.6P
			1.8x4	2230	7140									52	FSKW2525-7.2P
32	32	4.762	1.8x2	1760	5500	58	78	92	15	74	68	9	M6x1P	33	FSKW3232-3.6P
			1.8x4	3200	11000									65	FSKW3232-7.2P
40	40	6.350	1.8x2	2870	9170	73	95	114	17	93	84	11	M6x1P	42	FSKW4040-3.6P
			1.8x4	5220	18340									81	FSKW4040-7.2P

Note:

Stiffness of nut:

Stiffness values listed above are derived from theoretical formula to the elastic deformation between thread grooves and balls while axial load is 30% dynamic load rating. Refer to P.20.

The new circulation design of *PMI* FA series of precision ballscrews carried out the advantages of High Speed, Low Noise, Efficiency, and Standardization for different kinds of application.

Features

Short Delivery

In order to achieve the purpose of standardized stock for short delivery time, the precise outer diameter of screw shaft is used for support bearing seat.

Flexibility of stroke length

Due to the precise outer diameter of screw shaft is used for support bearing seat, the specific length of shaft can be freely cut from standardized screw shaft. Therefore, the flexible stroke length is allowable for simple support end.

High accuracy with reasonable price

The accuracy can be as higher as JIS C5 grade and with axial clearance within 5 *μm*.

Space saving

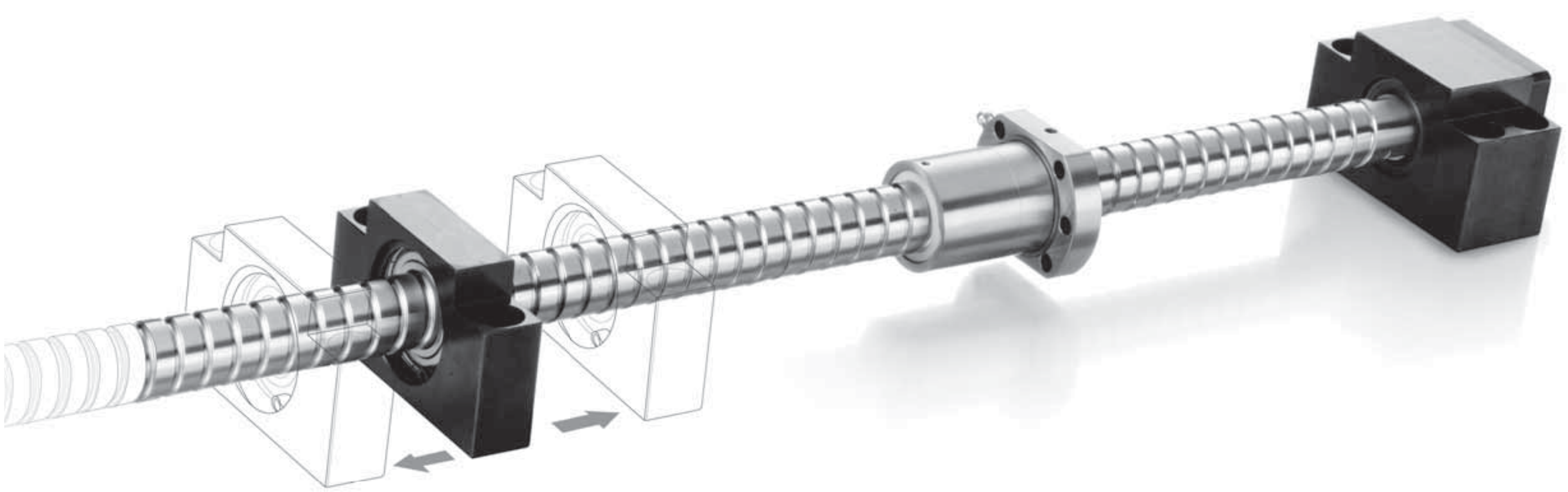
Comparing with conventional ballscrew, the outer diameter of nut is reduced as 20~25% as much, and the nut length is also shorter than usual. Therefore, the mounting space can be saved from engineering design.

High speed and lower noise

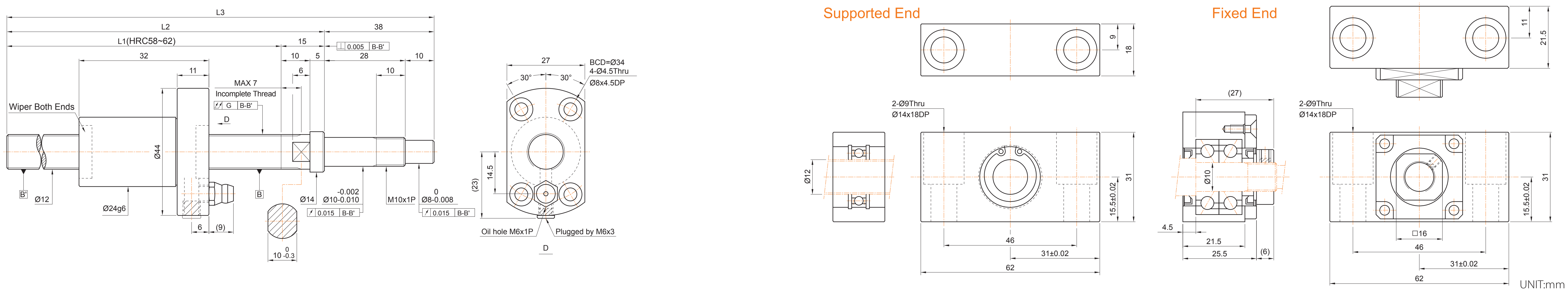
Taking advantage of *PMI* unique technology of high-speed, noise reduction, the rotation speed can be as higher as 5000 *rpm*. Moreover, due to the design of special circulation system, the vibration and noise(6 db less) are much lower than conventional type of ballscrew.

Application range

Semiconductor equipments, Measuring devices, Inspection equipments, Medical equipments, Automation, Light load machining, Glue depositing, and other precision motion and positioning applications.



FA
FA Series Ballscrews
Screw Dia.Ø12 Lead05

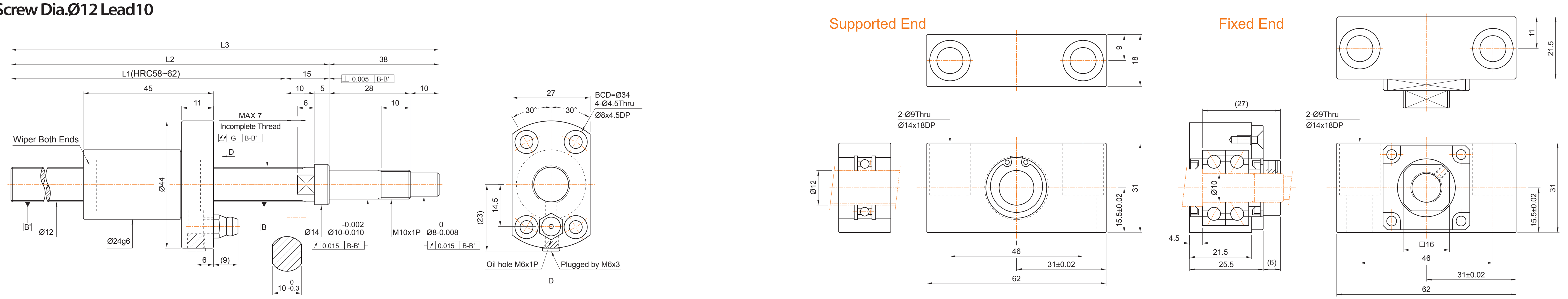


UNIT:mm

Model No.	Screw Dia.	Lead	Basic Rated Load(kgf)		Screw Shaft Length			Accuracy Grade	Axial Play	Lead Accuracy			Tolerances	Fixed End–bearing (kgf)		Supported End–bearing (kgf)	
	d	l	Dynamic Cam	Static Coam	L1	L2	L3			Specified Travel (T)	Accumulated reference lead deviation (E)	Lead Deriation in random 300mm (e300)	Overall Radial Runout	Dynamic Ca	Static Co	Dynamic Ca	Static Co
BL012050400+A000	12	05	610	1190	347	362	400	C5	<0.005	0	0.023	0.018	0.065	546	265	196	106
BL012050600+A000	12	05	610	1190	547	562	600	C5	<0.005	0	0.027	0.018	0.090	546	265	196	106
BL012050900+A000	12	05	610	1190	847	862	900	C5	<0.005	0	0.035	0.018	0.150	546	265	196	106

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

FA
FA Series Ballscrews
Screw Dia.Ø12 Lead10



UNIT:mm

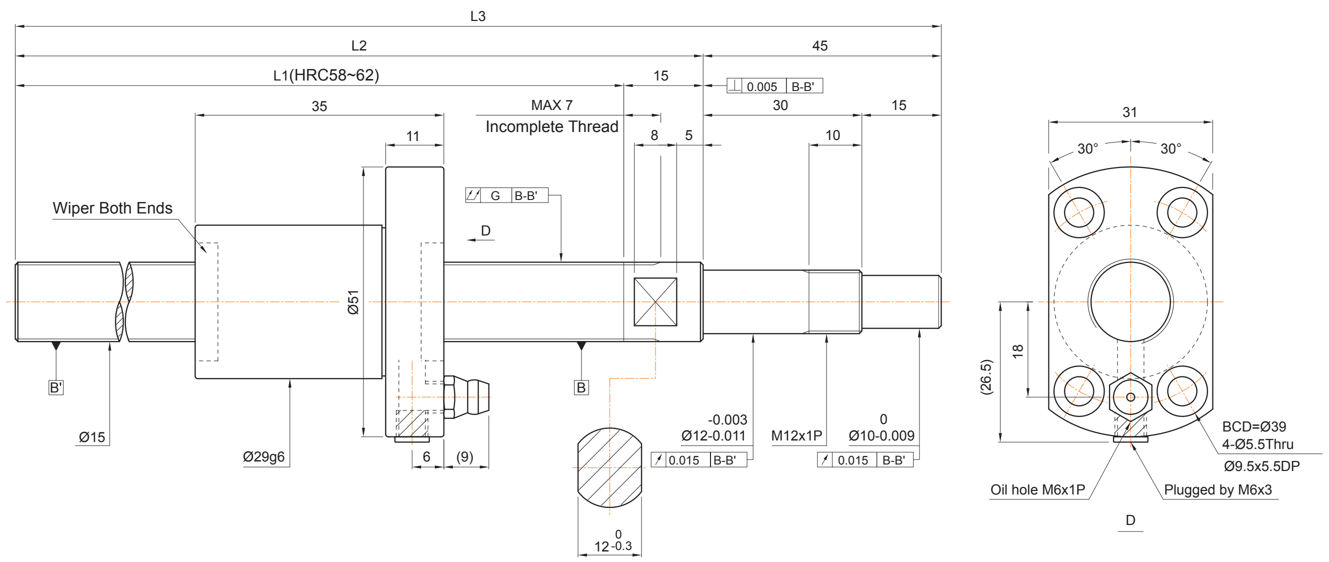
Model No.	Screw Dia.	Lead	Basic Rated Load(kgf)		Screw Shaft Length			Accuracy Grade	Axial Play	Lead Accuracy			Tolerances	Fixed End–bearing (kgf)		Supported End–bearing (kgf)	
	d	l	Dynamic Cam	Static Coam	L1	L2	L3			Specified Travel (T)	Accumulated reference lead deviation (E)	Lead Deriation in random 300mm (e300)	Overall Radial Runout	Dynamic Ca	Static Co	Dynamic Ca	Static Co
BL012100400+A000	12	10	590	1160	347	362	400	C5	<0.005	0	0.023	0.018	0.065	546	265	196	106
BL012100600+A000	12	10	590	1160	547	562	600	C5	<0.005	0	0.027	0.018	0.090	546	265	196	106
BL012100900+A000	12	10	590	1160	847	862	900	C5	<0.005	0	0.035	0.018	0.150	546	265	196	106

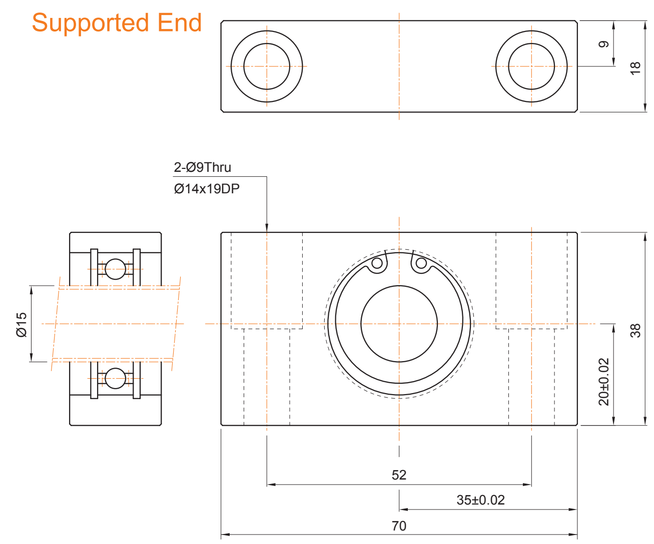
Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

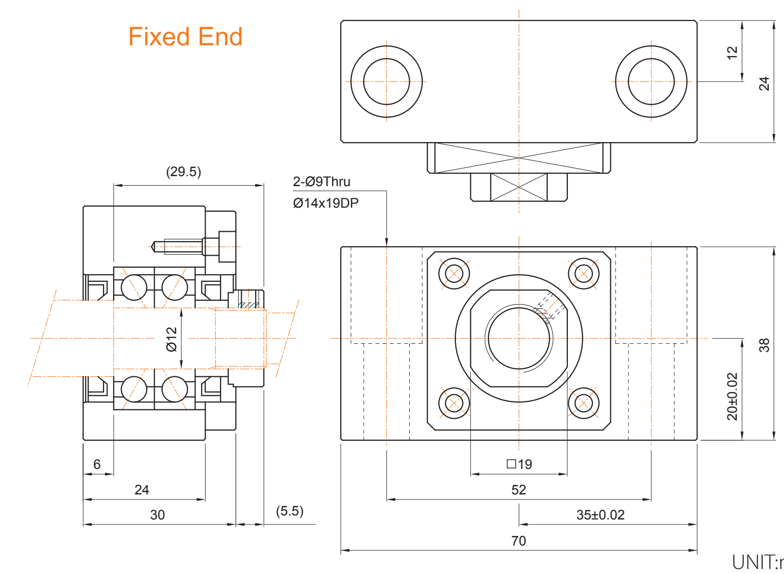
FA

FA Series Ballscrews

Screw Dia.Ø15 Lead05







UNIT:mm

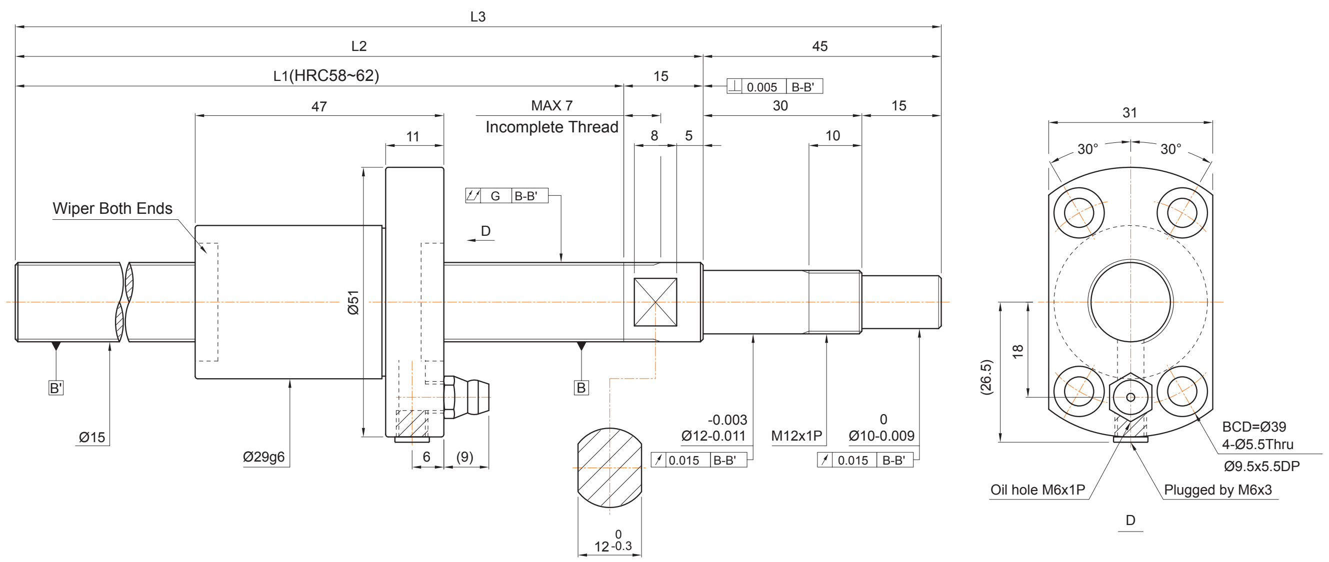
Model No.	Screw Dia.	Lead	Basic Rated Load(kgf)		Screw Shaft Length			Accuracy Grade	Axial Play	Lead Accuracy			Tolerances	Fixed End–bearing (kgf)		Supported End–bearing (kgf)	
	d	l	Dynamic Cam	Static Coam	L1	L2	L3			Specified Travel (T)	Accumulated reference lead deviation (E)	Lead Deriation in random 300mm (e300)	Overall Radial Runout	Dynamic Ca	Static Co	Dynamic Ca	Static Co
BL015050500+A000	15	05	850	1640	440	455	500	C5	<0.005	0	0.025	0.018	0.060	592	304	372	204
BL015051000+A000	15	05	850	1640	940	955	1000	C5	<0.005	0	0.040	0.018	0.120	592	304	372	204
BL015051450+A000	15	05	850	1640	1390	1405	1450	C5	<0.005	0	0.054	0.018	0.190	592	304	372	204

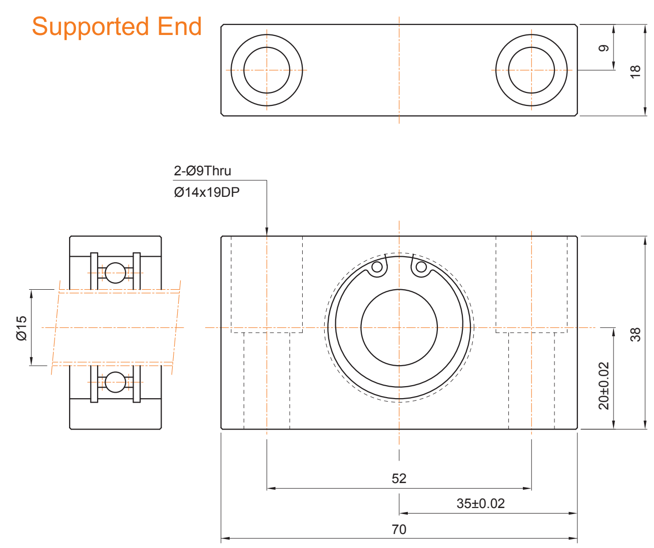
Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

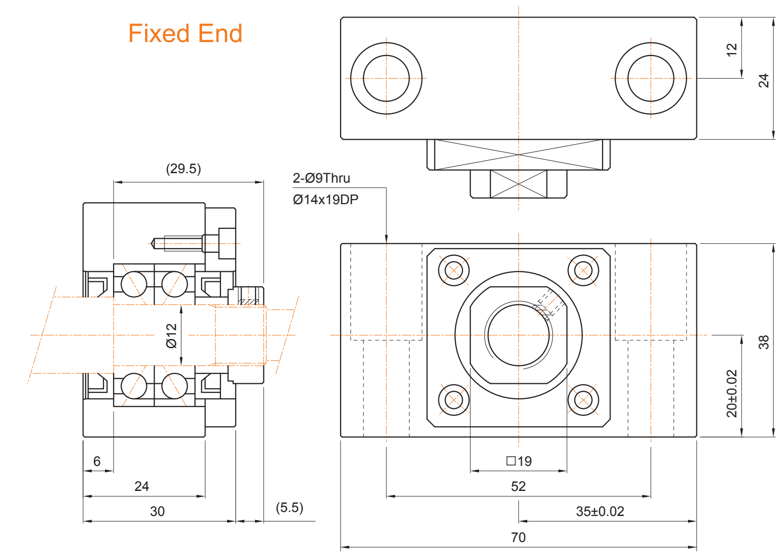
FA

FA Series Ballscrews

Screw Dia.Ø15 Lead10





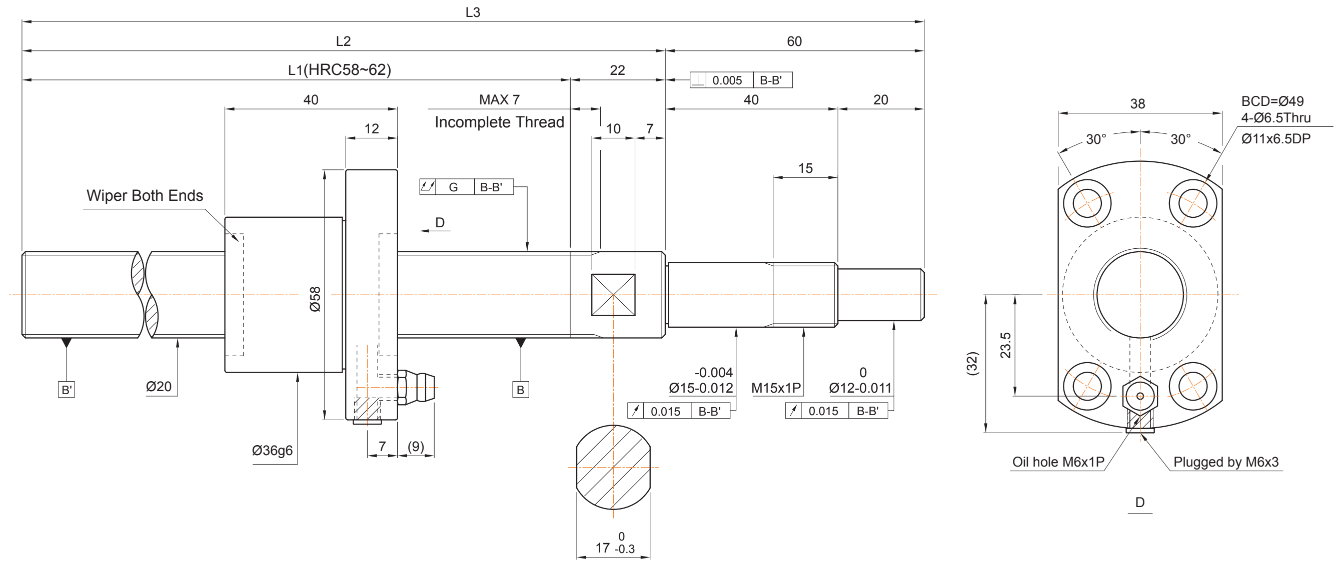


UNIT:mm

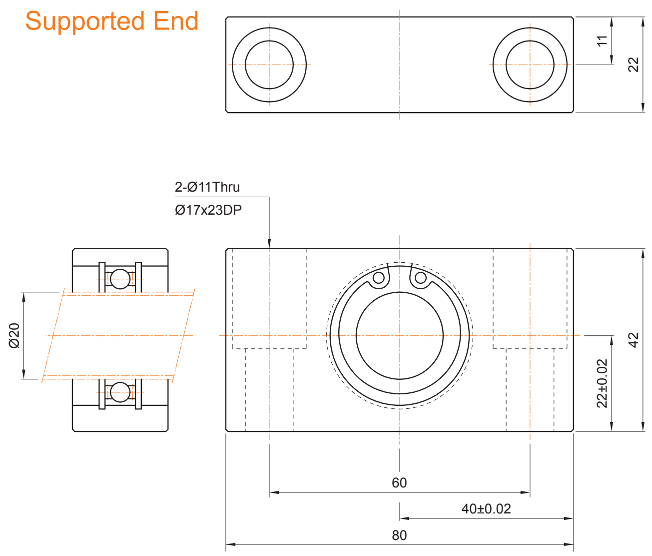
Model No.	Screw Dia.	Lead	Basic Rated Load(kgf)		Screw Shaft Length			Accuracy Grade	Axial Play	Lead Accuracy			Tolerances	Fixed End–bearing (kgf)		Supported End–bearing (kgf)	
	d	l	Dynamic Cam	Static Coam	L1	L2	L3			Specified Travel (T)	Accumulated reference lead deviation (E)	Lead Deriation in random 300mm (e300)	Overall Radial Runout	Dynamic Ca	Static Co	Dynamic Ca	Static Co
BL015100500+A000	15	10	840	1610	440	455	500	C5	<0.005	0	0.025	0.018	0.060	592	304	372	204
BL015101000+A000	15	10	840	1610	940	955	1000	C5	<0.005	0	0.040	0.018	0.120	592	304	372	204
BL015101450+A000	15	10	840	1610	1390	1405	1450	C5	<0.005	0	0.054	0.018	0.190	592	304	372	204

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

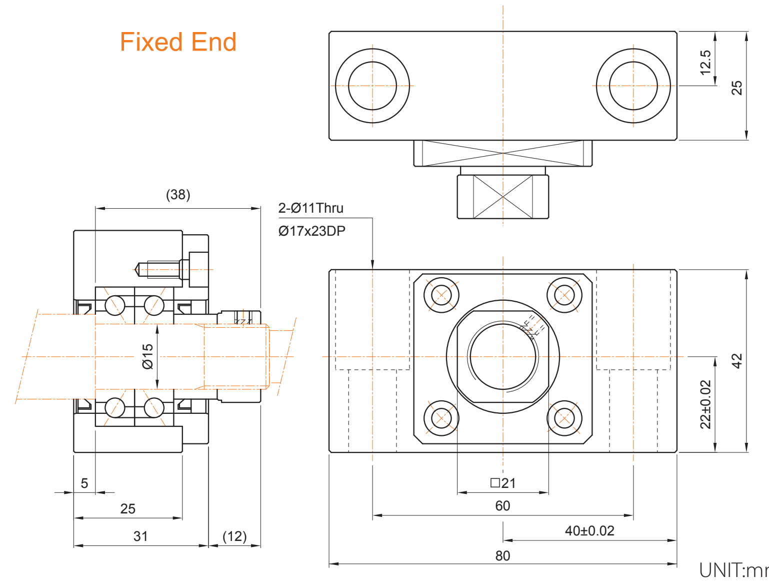
FA FA Series Ballscrews Screw Dia.Ø20 Lead05



Supported End



Fixed End

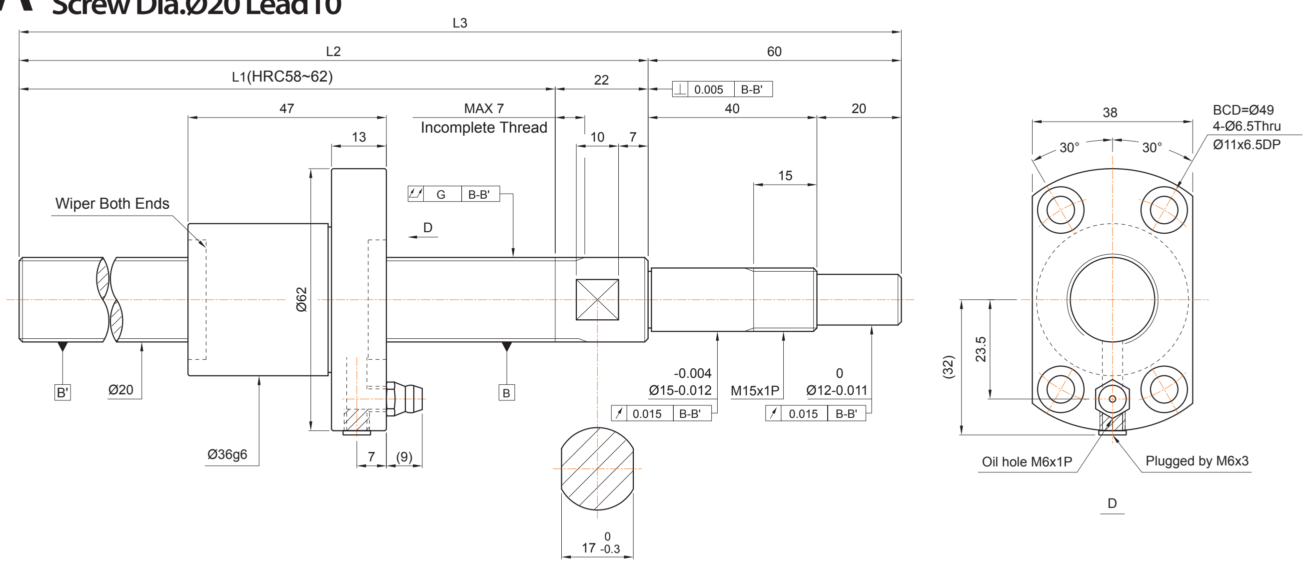


UNIT:mm

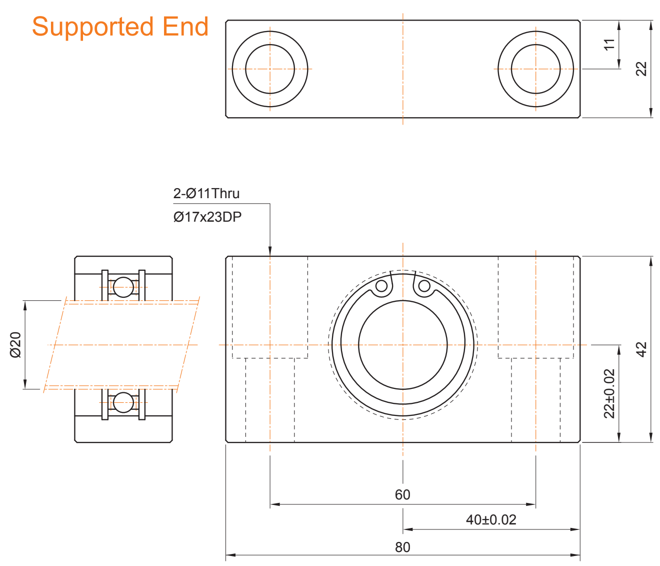
Model No.	Screw Dia.	Lead	Basic Rated Load(kgf)		Screw Shaft Length			Accuracy Grade	Axial Play	Lead Accuracy			Tolerances	Fixed End–bearing (kgf)		Supported End–bearing (kgf)	
	d	l	Dynamic Cam	Static Coam	L1	L2	L3			Specified Travel (T)	Accumulated reference lead deviation (E)	Lead Deriation in random 300mm (e300)	Overall Radial Runout	Dynamic Ca	Static Co	Dynamic Ca	Static Co
BL020050600+A000	20	05	1300	3030	518	540	600	C5	<0.005	0	0.030	0.018	0.075	622	352	408	252
BL020051000+A000	20	05	1300	3030	918	940	1000	C5	<0.005	0	0.040	0.018	0.120	622	352	408	252
BL020051450+A000	20	05	1300	3030	1368	1390	1450	C5	<0.005	0	0.054	0.018	0.190	622	352	408	252

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

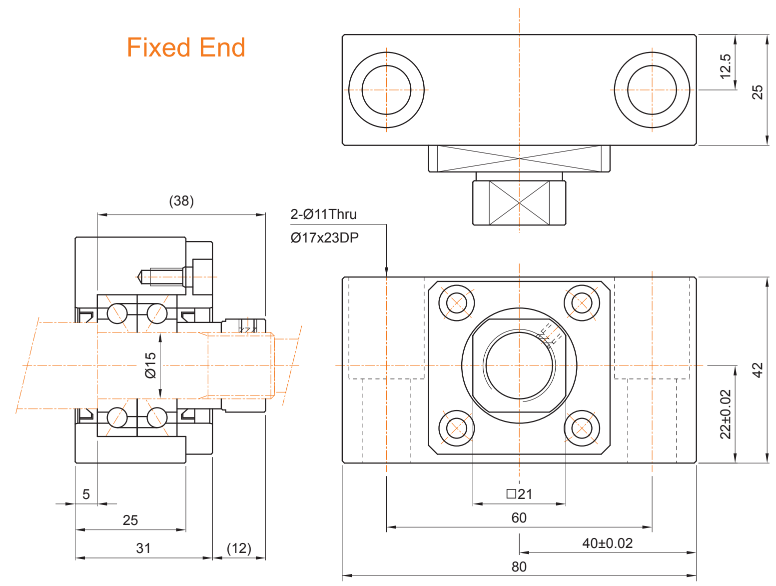
FA FA Series Ballscrews Screw Dia.Ø20 Lead10



Supported End



Fixed End



UNIT:mm

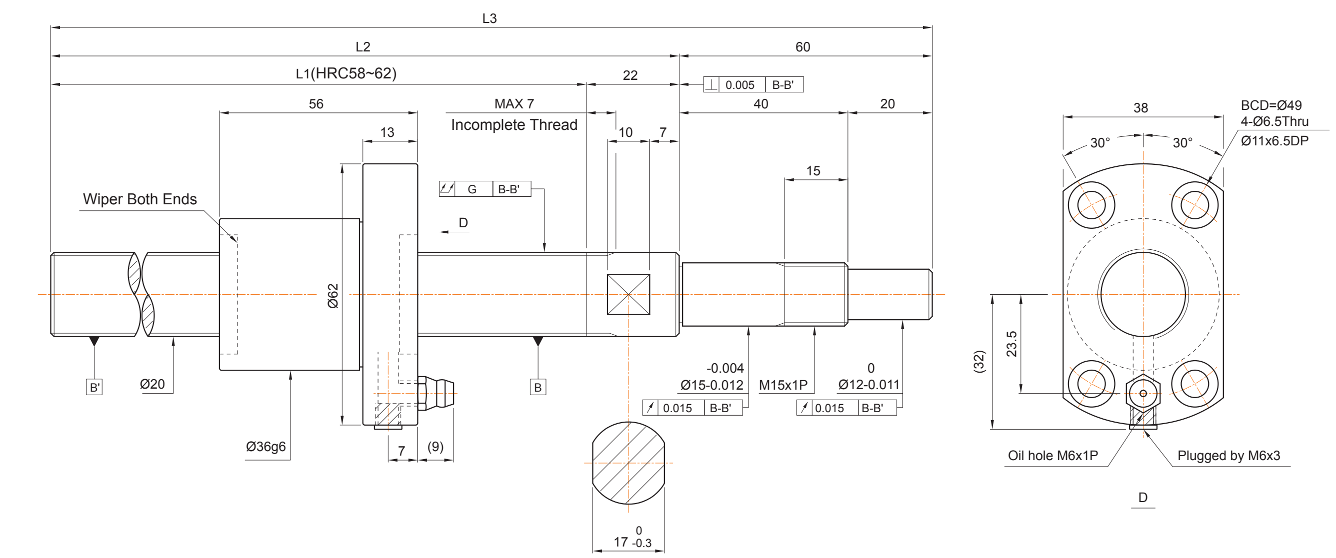
Model No.	Screw Dia.	Lead	Basic Rated Load(kgf)		Screw Shaft Length			Accuracy Grade	Axial Play	Lead Accuracy			Tolerances	Fixed End–bearing (kgf)		Supported End–bearing (kgf)	
	d	l	Dynamic Cam	Static Coam	L1	L2	L3			Specified Travel (T)	Accumulated reference lead deviation (E)	Lead Deriation in random 300mm (e300)	Overall Radial Runout	Dynamic Ca	Static Co	Dynamic Ca	Static Co
BL020100600+A000	20	10	990	2220	518	540	600	C5	<0.005	0	0.030	0.018	0.075	622	352	408	252
BL020101000+A000	20	10	990	2220	918	940	1000	C5	<0.005	0	0.040	0.018	0.120	622	352	408	252
BL020101450+A000	20	10	990	2220	1368	1390	1450	C5	<0.005	0	0.054	0.018	0.190	622	352	408	252

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

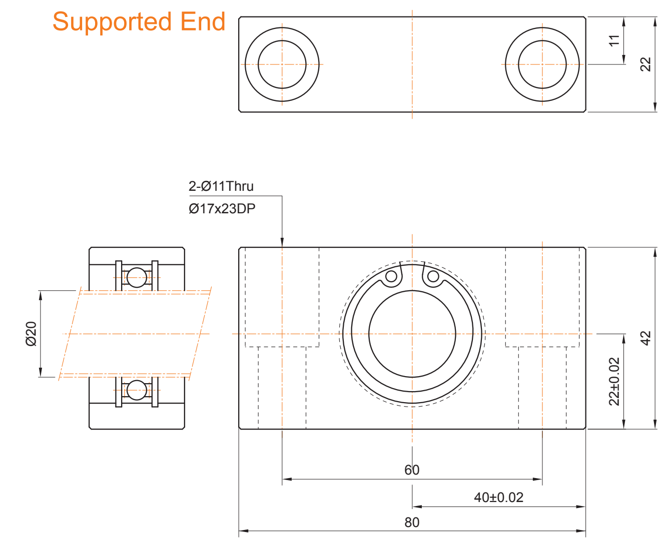
FA

FA Series Ballscrews

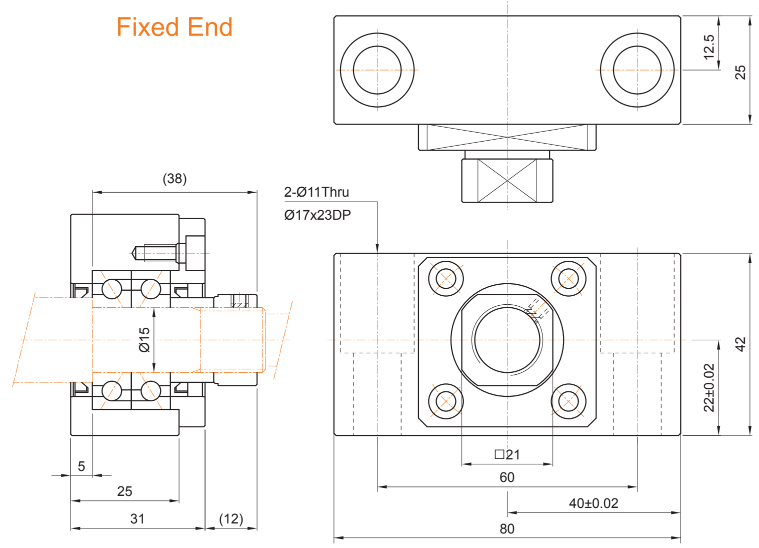
Screw Dia.Ø20 Lead20



Supported End



Fixed End



UNIT:mm

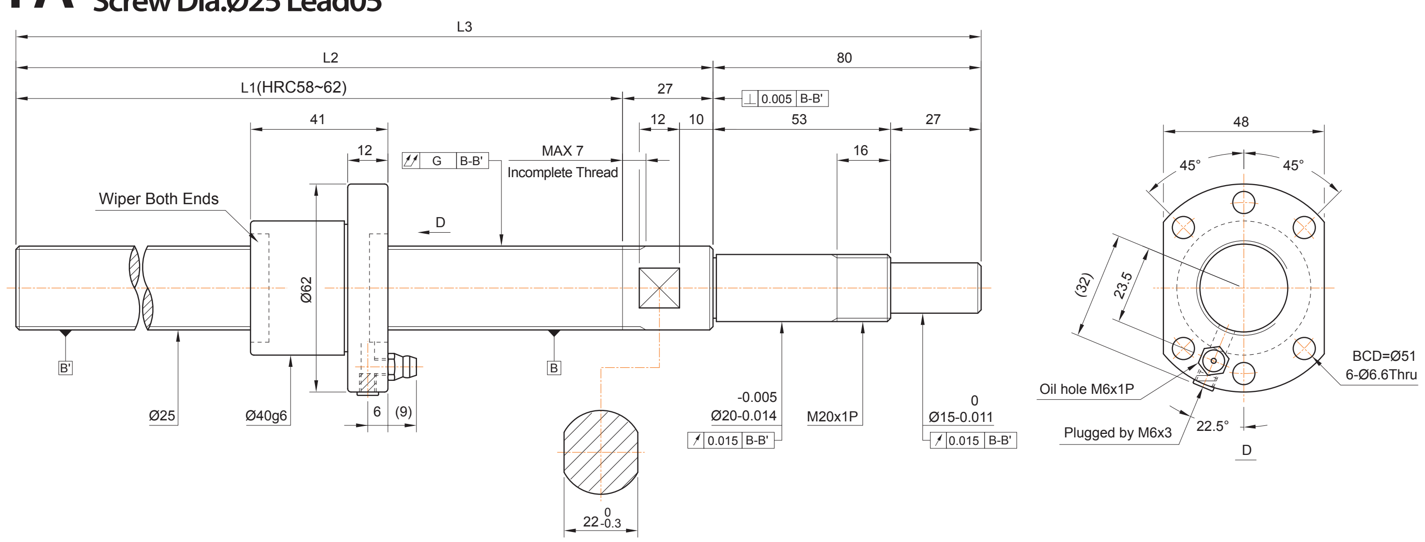
Model No.	Screw Dia.	Lead	Basic Rated Load(kgf)		Screw Shaft Length			Accuracy Grade	Axial Play	Lead Accuracy			Tolerances	Fixed End–bearing (kgf)		Supported End–bearing (kgf)	
	d	l	Dynamic Cam	Static Coam	L1	L2	L3			Specified Travel (T)	Accumulated reference lead deviation (E)	Lead Deriation in random 300mm (e300)	Overall Radial Runout	Dynamic Ca	Static Co	Dynamic Ca	Static Co
BL020200600+A000	20	20	670	1450	518	540	600	C5	<0.005	0	0.027	0.018	0.075	622	352	408	252
BL020201000+A000	20	20	670	1450	918	940	1000	C5	<0.005	0	0.040	0.018	0.120	622	352	408	252
BL020201450+A000	20	20	670	1450	1368	1390	1450	C5	<0.005	0	0.054	0.018	0.190	622	352	408	252

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

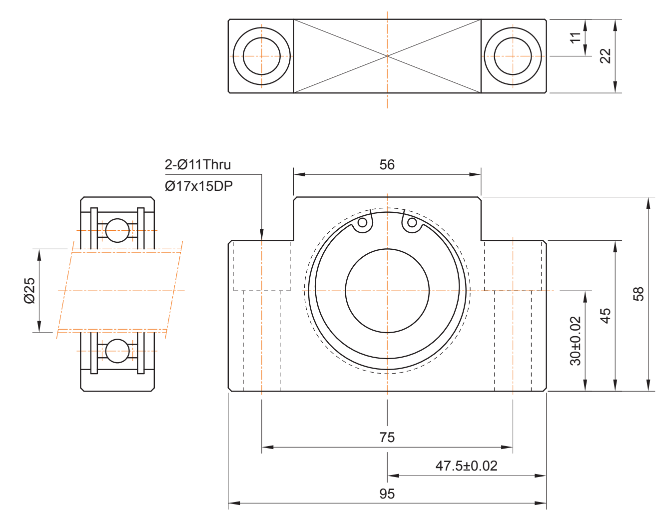
FA

FA Series Ballscrews

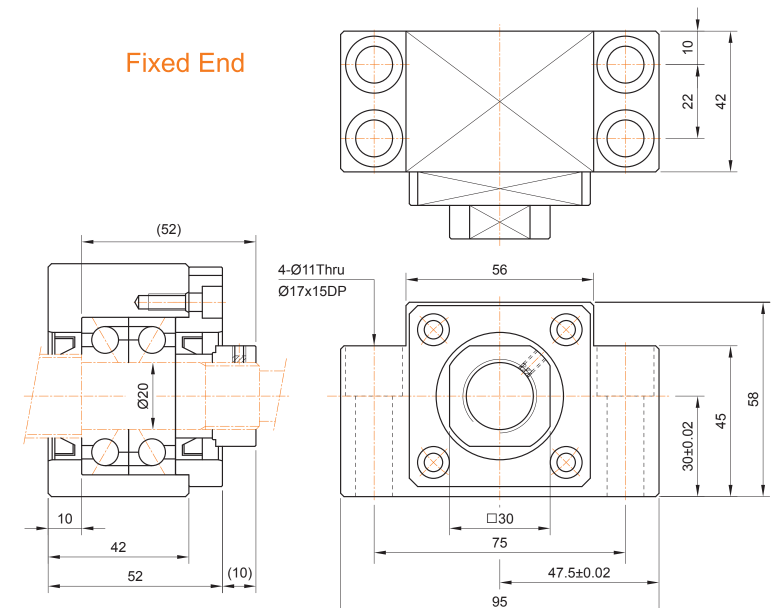
Screw Dia.Ø25 Lead05



Supported End



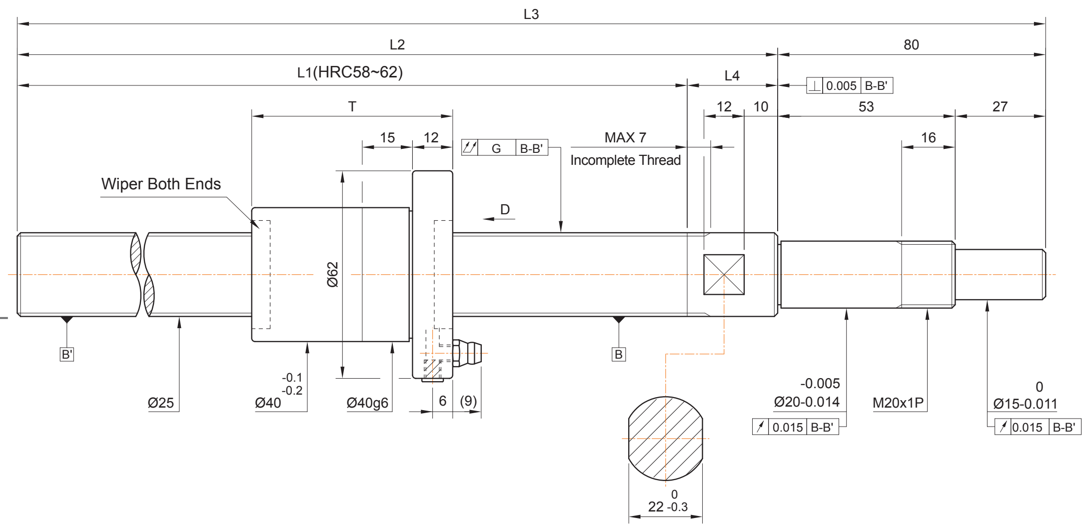
Fixed End

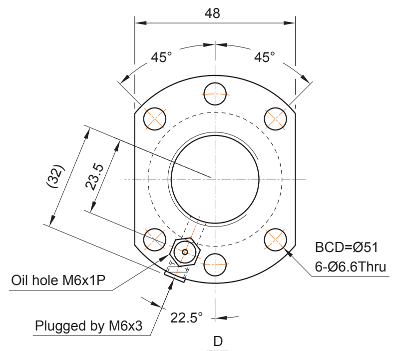


UNIT:mm

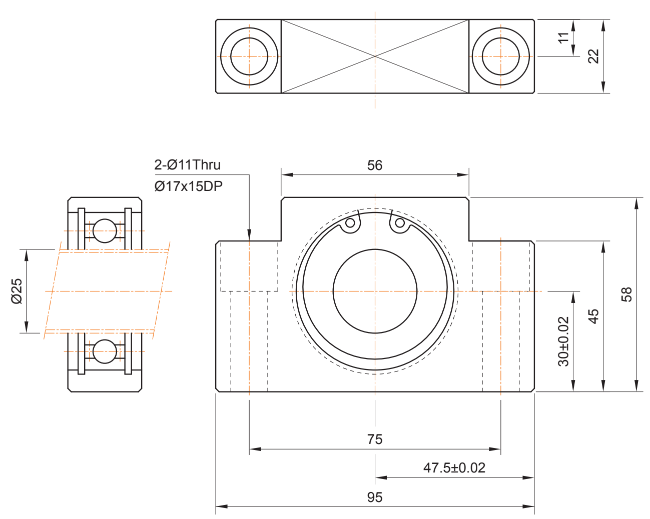
Model No.	Screw Dia.	Lead	Basic Rated Load(kgf)		Screw Shaft Length			Accuracy Grade	Axial Play	Lead Accuracy			Tolerances	Fixed End–bearing (kgf)		Supported End–bearing (kgf)	
	d	l	Dynamic Cam	Static Coam	L1	L2	L3			Specified Travel (T)	Accumulated reference lead deviation (E)	Lead Deriation in random 300mm (e300)	Overall Radial Runout	Dynamic Ca	Static Co	Dynamic Ca	Static Co
BL025050600+A000	25	05	1440	3840	493	520	600	C5	<0.005	0	0.027	0.018	0.050	1480	847	1030	597
BL025051000+A000	25	05	1440	3840	893	920	1000	C5	<0.005	0	0.040	0.018	0.085	1480	847	1030	597
BL025051450+A000	25	05	1440	3840	1343	1370	1450	C5	<0.005	0	0.054	0.018	0.130	1480	847	1030	597

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

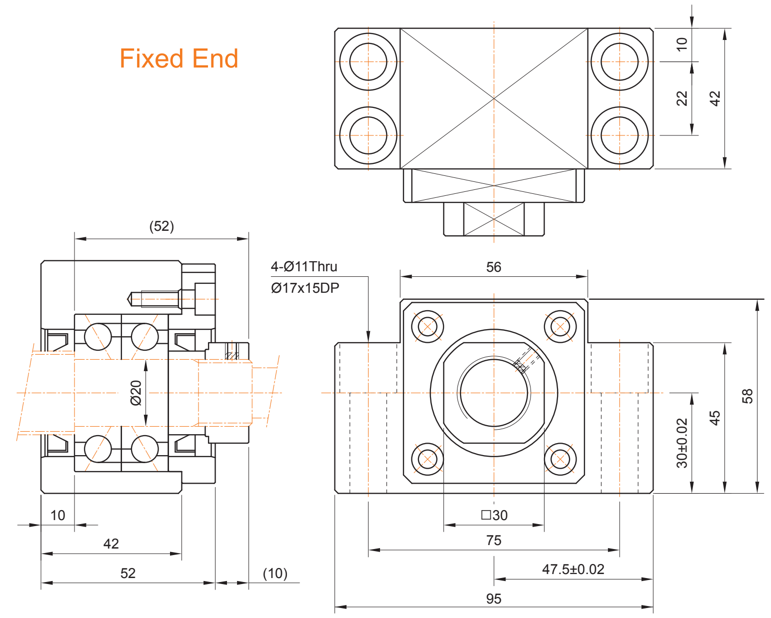




Supported End



Fixed End



UNIT:mm

Model No.	Screw Dia.	Lead	Basic Rated Load(kgf)		Screw Shaft Length				Nut	Accuracy Grade	Axial Play	Lead Accuracy			Tolerances	Fixed End–bearing (kgf)		Supported End–bearing (kgf)	
	d	l	Dynamic Cam	Static Coam	L1	L2	L3	L4	T			Specified Travel (T)	Accumulated reference lead deviation (E)	Lead Deriation in random 300mm (e300)	Overall Radial Runout	Dynamic Ca	Static Co	Dynamic Ca	Static Co
BL025100600+A000	25	10	1440	3840	493	520	600	27	60	C5	<0.005	0	0.027	0.018	0.050	1480	847	1030	597
BL025101000+A000	25	10	1440	3840	893	920	1000	27	60	C5	<0.005	0	0.040	0.018	0.085	1480	847	1030	597
BL025101450+A000	25	10	1440	3840	1343	1370	1450	27	60	C5	<0.005	0	0.054	0.018	0.130	1480	847	1030	597
BL025200600+A000	25	20	750	1840	494	520	600	26	60	C5	<0.005	0	0.027	0.018	0.050	1480	847	1030	597
BL025201000+A000	25	20	750	1840	894	920	1000	26	60	C5	<0.005	0	0.040	0.018	0.085	1480	847	1030	597
BL025201450+A000	25	20	750	1840	1344	1370	1450	26	60	C5	<0.005	0	0.054	0.018	0.130	1480	847	1030	597
BL025250600+A000	25	25	730	1810	490	520	600	30	71	C5	<0.005	0	0.027	0.018	0.050	1480	847	1030	597
BL025251000+A000	25	25	730	1810	890	920	1000	30	71	C5	<0.005	0	0.040	0.018	0.085	1480	847	1030	597
BL025251450+A000	25	25	730	1810	1340	1370	1450	30	71	C5	<0.005	0	0.054	0.018	0.130	1480	847	1030	597

Coam and Cam are the modified static and dynamic load capacities,calculated according to ISO-3408-5

16 *PMI* Ballscrew Request Form

Date：

Company：	Address：	
Tel：		
Fax：	Country：	
Machine Type：	Delivery Point：	
Application：	Desired Delivery Date：	Quantity：

1 Required Specifications

A. Thread Direction：☐ L ☐ R   Number Of Thread (1~4)：

B. Screw Nominal O.D： | Lead： | Effective Turns：

C. Thread Length： | Overall Length： | Accuracy Grade：

D. Nut Type：☐ Miniature Series ☐ End Deflector Series ☐ External Ball Circulation Series ☐ Internal Ball Circulation Series ☐ High Lead Series ☐ Heavy Load Series ☐ End Cap Series

2 Load Condition

A. Stroke： *mm* | Max. Rotation Speed： *r.p.m* | Motor Specifications： *kw*

B. Mounting Method：☐ Vertical ☐ Horizontal ☐ Obligue Declining Angle： | Mounting Span： *mm*

C. Accelereation Time： *S* | Accelereation Speed： m/s^2 | Rapid Feed Speed： *m/min*

D. Life： $\times 10^6$ *revs* | *km* | *hr*

E. Working Axial Load：

Rapid Feed： *kgf*	Feed Speed： *mm/min*	Time：	Ratio(%)
Light Cutting： *kgf*	Feed Speed： *mm/min*	Time：	Ratio(%)
Heavy Cutting： *kgf*	Feed Speed： *mm/min*	Time：	Ratio(%)

F. Max. Axial Static Load： *kgf*

G. Table Weight： *kg* | Work Piece Weight： *kg*

H. Linear Guide Way：☐ Ball Type ☐ Roller Type | ☐ Box Way

I. Mount Method：☐ Fixed-Fixed ☐ Fixed-Supported ☐ Fixed-Free ☐ Supported-Supported

3 Lead Accuracy, Axial Clearance, Preload and Stiffness

A. Specified Travel (T)： *mm*

B. Positioning Accuracy： *mm*(No Load) | Repeatability Accuracy： *mm*(No Load)

C. Preload： *kgf* (Preload Torque： *kgf/cm*)

D. Axial play： *mm* (No Load)

E. Nut Stiffness： *kgf/μm*

4 Other Conditions

A. Lubrication Oil： | Grease： | Other：

B. Ambient Temperature： ☐ °C ☐ °F

C. Special Conditions：

P.S. The specifications in this cataloguea are subject to change without notification, For other special requirements, please contact us.

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Linear Motion Systems

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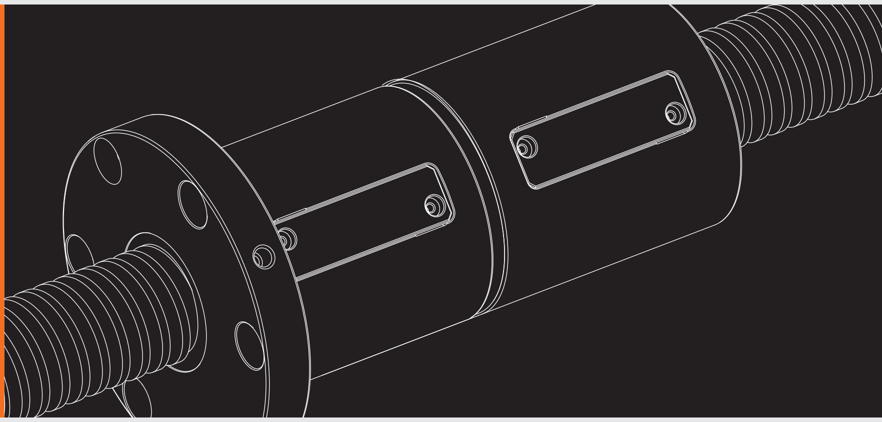

PET/MD02/09.02

Printed in Taiwan

Designed by Point / +886-4-2296-2988 | +886-932-604960