



Ball Screw

Technical Data / SBC Precision Rolled Ball Screw /
DIN Standard SBC Precision Rolled Ball Screw /
Ground Ball Screw for FA- SFA Series

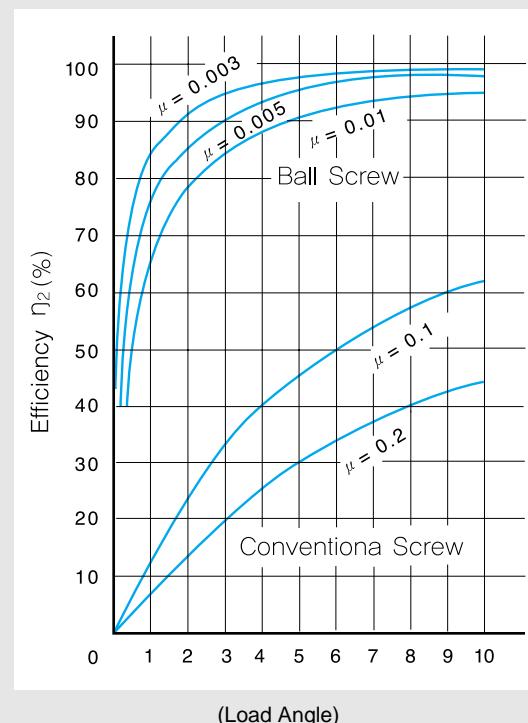
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Ball Screw Features

A ball screw achieves high efficiency even if driving torque is low because balls roll between the screw shaft and ball nut to obtain a lower coefficient of friction than a leadscrew.

- Low Coefficient of Friction and High efficiency
- High Velocity and Acceleration.
- Long Service Life Time.



[Calculating the Lead Angle]

$$\tan \beta = \frac{L}{\pi \cdot d_p}$$

: Lead angle
 L : Lead
 dp : Ball circle diameter

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Structures and Classification

The ball screw is composed of a screw, a nut and balls. Screws are classified by processing and Ball Nuts are classified by recirculation method.

1. Screw Shaft

1-1. Types by Manufacturing Method

There are 2 types, Rolled and Ground Screw Threads.

A rolled screw is manufactured by roll forming a thread form into a rod. A Ground screw is manufactured by grinding the thread form into a rod. Generally ground screws are much more precise and smooth.

1-2. Circular-arc groove and ball contact structures

Four-point and Two-point Contact Structure

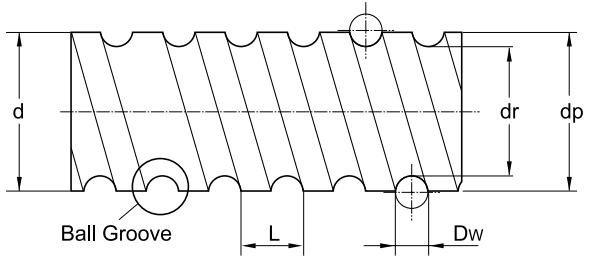


(Contact between ball and Circular-arc Groove)

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1-3. Structure of the Screw Shaft



[Screw Diameter : d]

It means screw shaft outer diameter.

[Ball Diameter : Dw]

Ball diameter.

[Ball center-to-center diameter : dp]

The screw diameter measured from the center of balls rolling in the thread form. This number is necessary to calculate maximum permissible speed and lifetime.

[Lead : L]

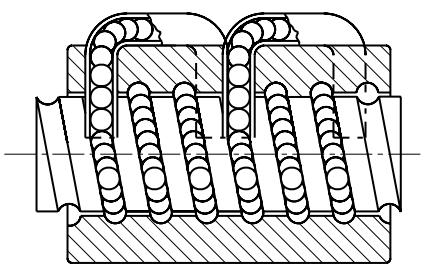
The amount of linear movement achieved by 1 revolution of screw movement.

[screw-shaft thread minor diameter : dr]

The diameter of the screw measured from the bottom of the thread form.

2. Nuts

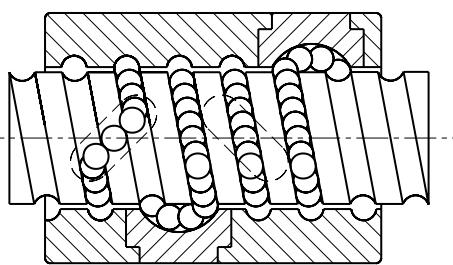
The nut is classified by Recirculation method.



[Return Tube Type]

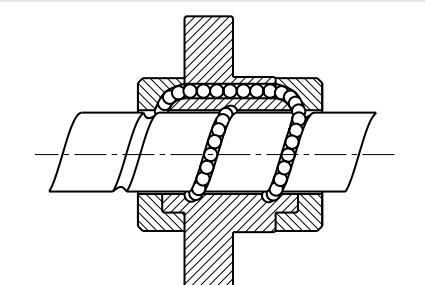
The most common type.

A return plate allows balls to recirculate.



[Deflector Type]

Compact type, Easy to install



[End-cap Type]

These nut are suitable for long-lead type.

Balls are recirculating in an end-cap.

[Inner-recirculation Type]

Similar to End-cap type.

There is a passage of balls circulating inside of the nut and return piece allows balls to circulate. It is suitable for high-speed.

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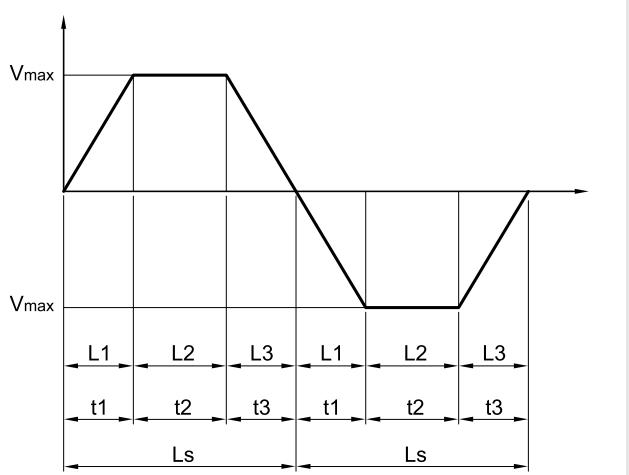
Selecting a Ball screw

[Ball Screw Requirements]

Orientation	: Horizontal / Vertical
Payload mass	: m (kg)
Linear Bearing Type	: Rolling / Sliding
Frictional coefficient of the Linear Bearing	: μ
Linear Bearing Resistance	: f (N)
External load in the axial direction	: F (N)
Support method of the screw shaft	: fixed-free / fixed-supported / fixed-fixed
Desired service life time	: L _h (h)
Stroke length	: L _s (mm)
Operating Speed	: V _{max} (m/s)
Acceleration time	: t ₁ (sec)
Constant velocity time	: t ₂ (sec)
Deceleration time	: t ₃ (sec)
Dwell time	: t _d (sec)
Acceleration	: a (m/s ²)
Acceleration distance	: L ₁ (mm)
Constant velocity distance	: L ₂ (mm)
Deceleration distance	: L ₃ (mm)
Number of revolutions per minute	: n (min ⁻¹)
Positioning accuracy	: - (mm)
Positioning repeatability	: - (mm)
Backlash	: - (mm)

References

- 1) Acceleration $a = \frac{V_{\max}}{t_1}$
- 2) Acceleration distance $L_1 = \frac{V_{\max} \times t_1 \times 1000}{2}$
- 3) Even speed distance $L_2 = V_{\max} \times t_2 \times 1000$
- 4) Deceleration distance $L_3 = \frac{V_{\max} \times t_3 \times 1000}{2}$



[Motor Requirements]

Motor Type	: AC servomotor / stepping motor, etc.
The rated speed of the motor	: - (min ⁻¹)
Moment of Inertia of the motor	: J _m (kg.m ²)
Motor resolution	: - (pulse / rev)
Reduction ratio	: A

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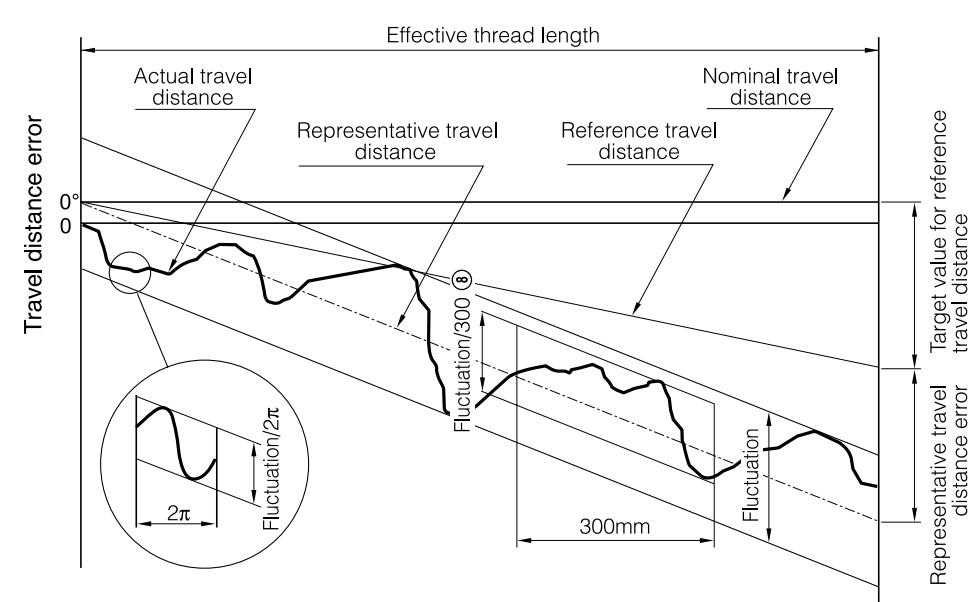
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Lead Accuracy

Accuracy grades C0 ~ C5 are described in the linearity and direction, and C7 ~ C10 in the travel distance error in relation to 300mm. By JIS (JIS B1192-1997)



[Representative Travel Distance]

A straight line approximating the actual travel that is calculated by using the least squares method of the actual travel distance curve.

[Representative Travel Distance Error]

Difference between the representative travel distance and the reference travel distance.

[Fluctuation]

The maximum error of the actual travel measured as the distance between two straight lines drawn in parallel with the representative travel distance.

[Fluctuation / 300]

Deviation of travel from representative over a given thread length (300mm)

[Fluctuation / 2]

Deviation of travel from representative over one rotation of the screw shaft.

[Target Value for Reference Travel Distance]

Indicating a target value for the reference travel distance.

[Effective thread length]

The Effective Thread Length is the length of thread over which Errors are measured.

[Nominal travel distance]

The Nominal Travel Distance is the ideal travel of screw without errors.

[Reference Travel Distance]

Intended correcting value of the nominal travel distance in relation to the measured use.

[Actual Travel distance]

The actual measured travel distance

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[Permissible Lead Accuracy Errors]

(Unit : μm)

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

* ± E: Representative travel distance error

* e: Fluctuation

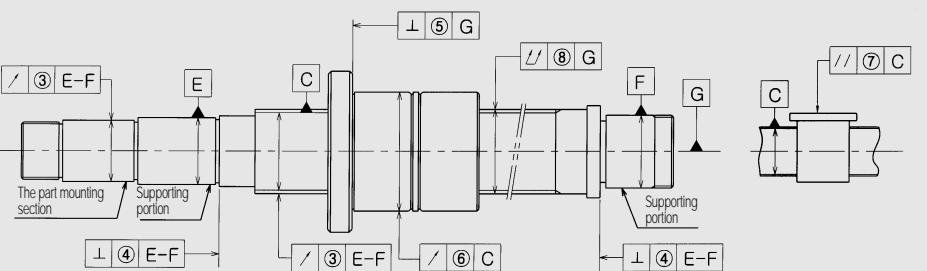
[Permissible Value of the Lead Accuracy]

(Unit : μm)

Fluctuation	C0	C1	C2	C3	C5	C7	C10
/ 300	3.5	5	7	8	18	50	210
/ 2	2.5	4	5	6	8	-	-

Mounting Surface Accuracy

[Mounting Surface Accuracy C0]



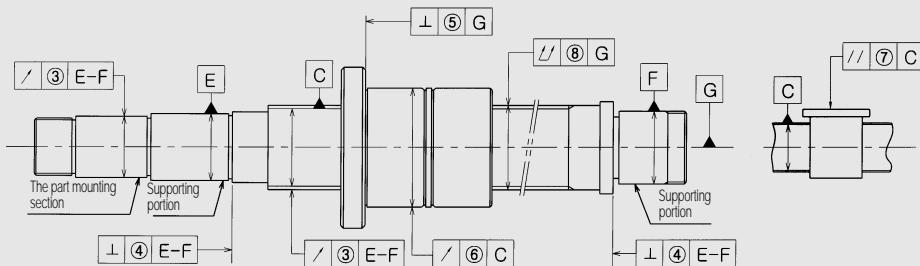
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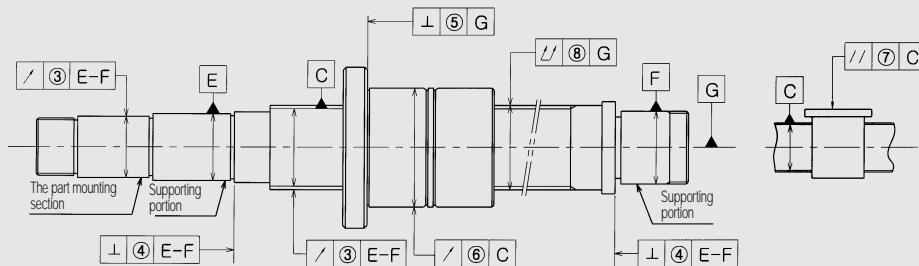
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[Mounting Surface Accuracy C1]



[Mounting Surface Accuracy C2]



Shaft outer diameter		Nut diameter		Reference length of mounting section							
Above	Less	Above	Less	Above	Less						
-	8	5	3	-	20						
8	12	5	3	20	32	6	6	50	100	8	10
12	20	6	3	32	50	7	8	100	200	10	
20	32	7	3	50	80	8	10				
32	50	8	3	80	125	9	12				
50	80	9	4	125	160	10	13				
80	125	10	4	160	200	11	16				
				200	250	12	18				

(Unit : μm)

Shaft outer diameter		Nut diameter		Reference length of mounting section							
Above	Less	Above	Less	Above	Less						
-	8	7	4	-	20						
8	12	7	4	20	32	7	9	50	100	8	10
12	20	8	4	32	50	8	10	100	200	10	12
20	32	9	4	50	80	9	13				
32	50	10	4	80	125	11	16				
50	80	11	5	125	160	12	18				
80	125	13	5	160	200	13	21				
				200	250	14	23				

(Unit : μm)

Screw shaft outer diameter		Above	-	8	12	20	32	50	80
Screw shaft length		Less	8	12	20	32	50	80	125
Above	Less								
-	125			0.020	0.020	0.015			
125	200			0.030	0.025	0.020	0.015		
200	315			0.040	0.030	0.025	0.020		
315	400			0.045	0.040	0.030	0.025		
400	500			0.050	0.040	0.030	0.025		
500	630			0.060	0.045	0.035	0.025	0.020	
630	800				0.060	0.040	0.030	0.025	
800	1000				0.075	0.055	0.040	0.030	0.025
1000	1250				0.095	0.065	0.045	0.035	0.030
1250	1600				0.130	0.085	0.060	0.045	0.035
1600	2000					0.120	0.080	0.055	0.040
2000	2500						0.100	0.070	0.050
2500	3150						0.130	0.090	0.060
3150	4000							0.120	0.080
4000	5000								
5000	6300								
6300	8000								
8000	10000								

Screw shaft outer diameter		Above	-	8	12	20	32	50	80
Screw shaft length		Less	8	12	20	32	50	80	125
Above	Less								
-	125			0.023	0.023	0.018			
125	200			0.033	0.030	0.023	0.018		
200	315			0.045	0.035	0.028	0.025		
315	400			0.053	0.045	0.035	0.030	0.023	
400	500				0.058	0.045	0.035	0.028	
500	630				0.065	0.050	0.040	0.030	0.025
630	800					0.065	0.050	0.035	0.030
800	1000					0.085	0.060	0.045	0.035
1000	1250					0.110	0.075	0.055	0.040
1250	1600						0.145	0.100	0.070
1600	2000							0.130	0.090
2000	2500								0.110
2500	3150								0.145
3150	4000								0.100
4000	5000								0.200
5000	6300								0.135
6300	8000								0.180
8000	10000								0.115

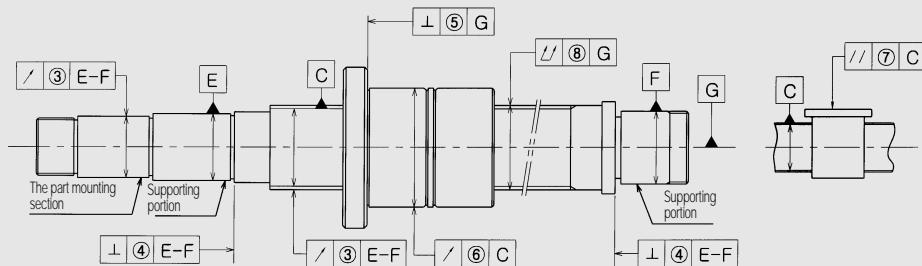
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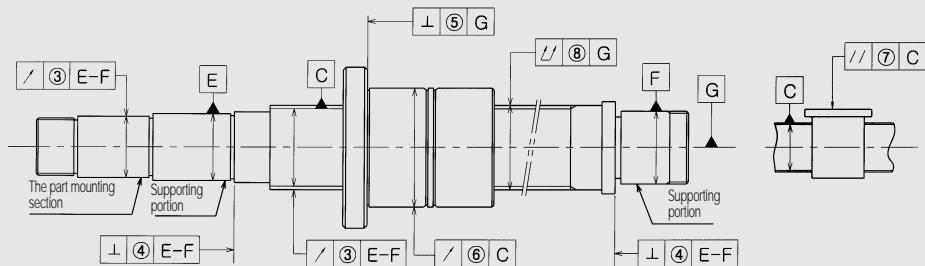
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[Mounting Surface Accuracy C3]



[Mounting Surface Accuracy C5]



Shaft outer diameter		Nut diameter		Reference length of mounting section						
Above	Less	Above	Less	Above	Less					
-	8	8	4	-	20	8	9	-	50	8
8	12	8	4	20	32	8	10	50	100	10
12	20	9	4	32	50	8	12	100	200	13
20	32	10	4	50	80	10	15			
32	50	12	4	80	125	12	20			
50	80	13	5	125	160	13	22			
80	125	15	6	160	200	14	25			
				200	250	15	28			

Screw shaft length	Screw shaft outer diameter	Above	-	8	12	20	32	50	80
		Less	8	12	20	32	50	80	125
Above	Less								
-	125			0.025	0.025	0.020			
125	200			0.035	0.035	0.025	0.020		
200	315			0.050	0.040	0.030	0.030		
315	400			0.060	0.050	0.040	0.035	0.025	
400	500				0.065	0.050	0.040	0.030	
500	630				0.070	0.055	0.045	0.035	0.030
630	800					0.070	0.055	0.040	0.035
800	1000					0.095	0.065	0.050	0.040
1000	1250					0.120	0.085	0.060	0.045
1250	1600					0.160	0.110	0.075	0.055
1600	2000						0.140	0.095	0.070
2000	2500							0.120	0.085
2500	3150							0.160	0.110
3150	4000							0.220	0.150
4000	5000								0.200
5000	6300								0.130
6300	8000								
8000	10000								

Shaft outer diameter		Nut diameter		Reference length of mounting section						
Above	Less	Above	Less	Above	Less					
-	8	10	5	-	20	10	12	-	50	10
8	12	11	5	20	32	10	12	50	100	13
12	20	12	5	32	50	11	15	100	200	17
20	32	13	5	50	80	13	19			
32	50	15	5	80	125	15	27			
50	80	17	7	125	160	17	30			
80	125	20	8	160	200	18	34			
				200	250	20	38			

Screw shaft length	Screw shaft outer diameter	Above	-	8	12	20	32	50	80
		Less	8	12	20	32	50	80	125
Above	Less								
-	125			0.035	0.035	0.035			
125	200			0.050	0.040	0.040	0.035		
200	315			0.065	0.055	0.045	0.040		
315	400			0.075	0.065	0.055	0.045	0.035	
400	500				0.080	0.060	0.050	0.045	
500	630				0.090	0.075	0.060	0.050	0.040
630	800					0.090	0.070	0.055	0.045
800	1000						0.120	0.085	0.065
1000	1250						0.150	0.100	0.075
1250	1600						0.190	0.130	0.095
1600	2000							0.170	0.120
2000	2500								0.150
2500	3150								0.200
3150	4000								0.260
4000	5000								0.240
5000	6300								0.310
6300	8000								0.280
8000	10000								0.370

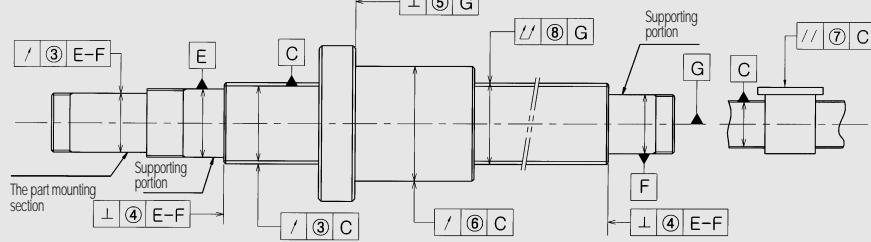
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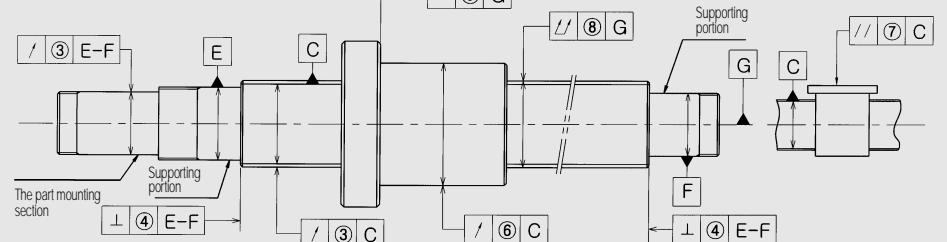
[Mounting Surface Accuracy C7]



Shaft outer diameter		Nut diameter		Reference length of mounting section		
Above	Less	Above	Less	Above	Less	
-	8	14	7	-	18	
8	12	14	7	8	30	14
12	20	14	7	30	50	20
20	32	20	7	50	80	18
32	50	20	8	80	120	30
50	80	20	10	120	150	20
80	125	30	11	150	180	25
125	200	30	13	180	250	25
			250	300	25	50

Screw shaft outer diameter	Above	-	8	12	20	32	50	80	125
Screw shaft length	Less	8	12	20	32	50	80	125	200
Above	Less								
-	125		0.060	0.055	0.055				
125	200		0.075	0.065	0.060	0.055			
200	315		0.100	0.080	0.070	0.060			
315	400		0.100	0.080	0.070	0.065			
400	500		0.120	0.095	0.080	0.070			
500	630		0.150	0.110	0.090	0.075	0.065		
630	800		0.140	0.100	0.085	0.070			
800	1000		0.170	0.130	0.100	0.080	0.070		
1000	1250		0.210	0.150	0.120	0.090	0.075		
1250	1600		0.270	0.190	0.140	0.110	0.085	0.070	
1600	2000			0.250	0.180	0.130	0.100	0.080	
2000	2500			0.320	0.220	0.160	0.120	0.090	
2500	3150				0.280	0.200	0.140	0.110	
3150	4000				0.380	0.260	0.180	0.130	
4000	5000				0.510	0.340	0.230	0.160	
5000	6300					0.440	0.300	0.200	
6300	8000					0.600	0.400	0.270	
8000	10000					0.530	0.350		
10000	12500					0.700	0.460		

[Mounting Surface Accuracy C10]



Shaft outer diameter		Nut diameter		Reference length of mounting section		
Above	Less	Above	Less	Above	Less	
-	8	40	10	-	18	
8	12	40	10	8	30	20
12	20	40	10	30	50	30
20	32	60	10	50	80	60
32	50	60	12	80	120	80
50	80	60	14	120	150	80
80	125	80	16	150	180	100
125	200	80	18	180	250	100
			250	300	50	100

Screw shaft outer diameter	Above	-	8	12	20	32	50	80	125
Screw shaft length	Less	8	12	20	32	50	80	125	200
Above	Less								
-	125		0.100	0.095	0.090				
125	200		0.140	0.120	0.110	0.095			
200	315		0.201	0.160	0.130	0.110			
315	400		0.210	0.060	0.130	0.110			
400	500		0.270	0.200	0.160	0.130			
500	630		0.350	0.250	0.190	0.150	0.120		
630	800		0.460	0.320	0.230	0.170	0.140		
800	1000			0.420	0.300	0.220	0.170	0.130	
1000	1250				0.550	0.380	0.270	0.200	0.150
1250	1600					0.730	0.500	0.340	0.250
1600	2000					1.000	0.690	0.460	0.320
2000	2500						0.930	0.610	0.420
2500	3150						1.300	0.820	0.550
3150	4000							1.100	0.750
4000	5000							1.600	1.000
5000	6300								1.400
6300	8000								2.000
8000	10000								1.800
10000	12500								2.500

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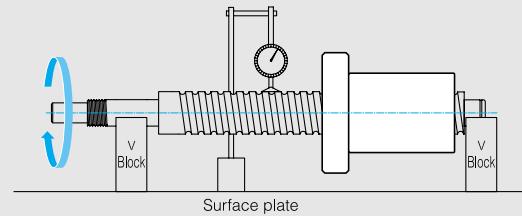
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Measuring the Mounting Surface Accuracy

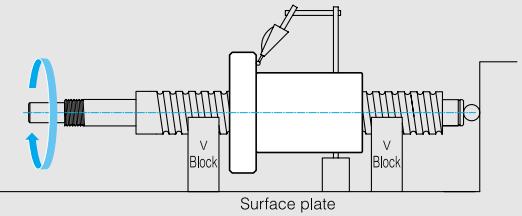
(1) Overall Radial Runout of the Screw Shaft Axis

Support the supporting part of the screw shaft with V blocks. Set a measuring instrument on the circumference of the screw shaft, and find the largest difference on the dial gauge at several points when turning the screw shaft by one rotation.



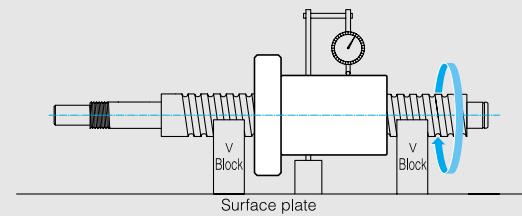
(3) Perpendicularity of the Flange Mounting Surface of the screw shaft to the screw shaft axis

Support the thread of the screw shaft with V blocks near the nut. Set a measuring instrument on the screw shaft's supporting portion end, and find the largest difference on the dial gauge when turning the screw shaft and the nut at the same time by one rotation at the same time.



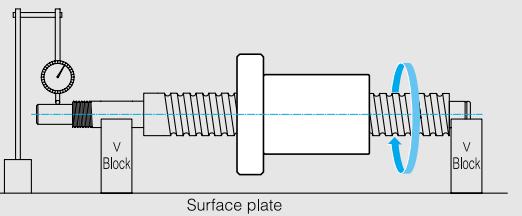
(2) Radial Runout of the Nut Circumference according to the screw shaft Axis

Support the thread of the screw shaft with V blocks near the nut. Set a measuring instrument on the circumference of the nut, and find the largest difference on the dial gauge when turning only the nut by one rotation (without turning the screw shaft).



(4) Runout of the Part Mounting section according to the Screw shaft

Set a measuring instrument on the part mounting section, and find the largest difference on the dial gauge when turning the screw shaft by one rotation.



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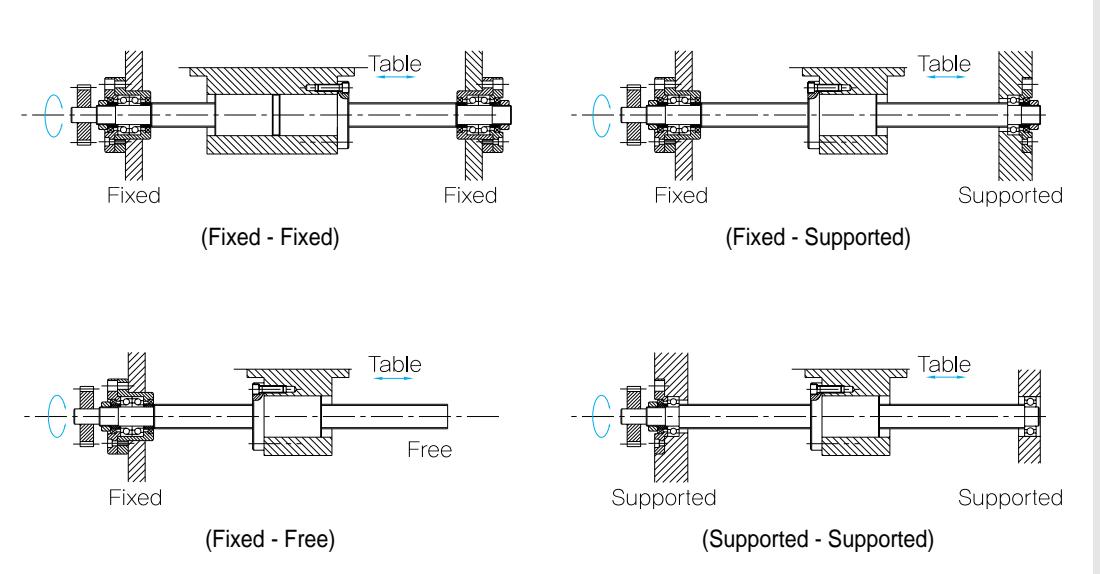
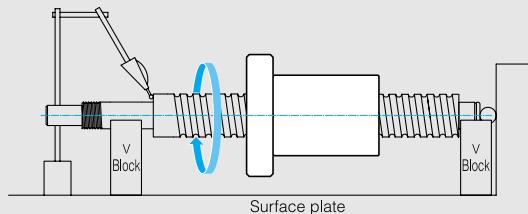
Mounting Method

There are four mounting methods for the Ball Screw. Select appropriate mounting method.

Permissible Axial load and numbers of rotation vary according to the mounting method.

(5) Perpendicularity of the supporting portion End of the screw shaft to the supporting portion axis.

Set a measuring instrument on the screw shaft's supporting portion end, and read the largest difference on the dial gauge when turning the screw shaft by one rotation.



[Mounting Method Based on Conditions]

Mounting	Conditions
Fixed - Fixed	High load and speed, Long distance
Fixed - Supported	Medium load and speed, Normal distance
Fixed - Free	Medium load, low speed, Short distance
Free - Free	Low load and speed, Short distance

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Technical Data

Preload

In order to remove the axial clearance and minimize the displacement under an axial load.

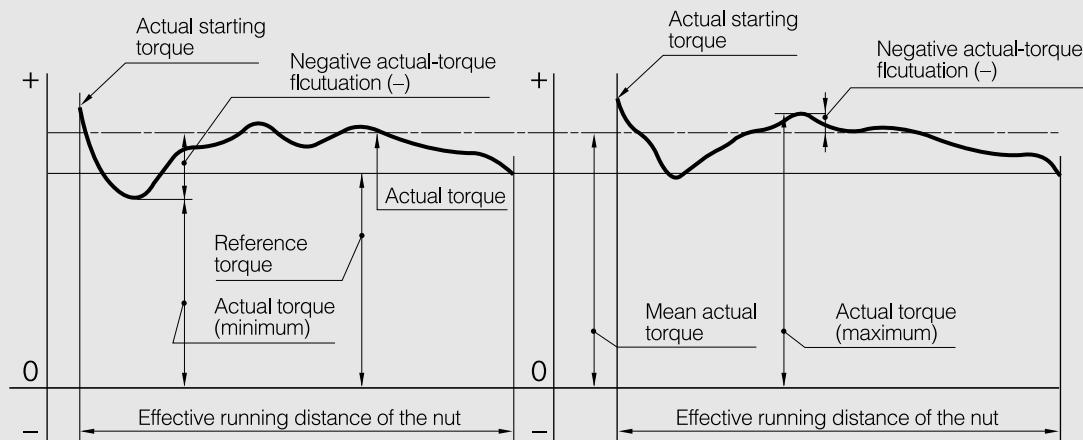
For a highly accurate positioning, a preload is generally provided.

[Clearance]

For the Axial clearance, refer to the specifications.

Preload Torque

The preload Torque follows the JIS Standard (B 1192-1997).



[Dynamic Preload Torque]

The torque necessary to rotate a screw shaft in a preloaded nut (without external load).

[Actual Torque]

Measured torque required to rotate a ball screw.

[Torque Fluctuation]

The variation of torque required to rotate a screw in a preloaded nut compared to the nominal torque.

[Reference Torque]

A dynamic preload torque set as a target.

[Calculating the Reference Torque]

Refer to an equation below.

$$T_p = 0.05(\tan\beta)^{-0.5} \frac{F_{ao} \cdot L}{2\pi}$$

T_p : Reference torque (N·mm)

β : Lead angle

F_{ao} : Applied preload (N)

L : Load (mm)

[Calculating the Torque Fluctuation]

Divide thread length by screw shaft outer diameter gives the torque fluctuation.

Tolerance range in torque fluctuation as the table below.

Reference torque N · mm	Effective thread length										Above 4,000m and 10,000m or less	
	4000m or less											
	Thread length		Screw shaft outer diameter	40	Thread length		Screw shaft outer diameter	60				
	Accuracy grades	Accuracy grades			Accuracy grades	Accuracy grades			Accuracy grades			
Above	Less	C0	C1	C2, C3	C5	C0	C1	C2, C3	C5	C2, C3	C5	
200	400	± 35%	± 40%	± 45%	± 55%	± 45%	± 45%	± 55%	± 65%	-	-	
400	600	± 25%	± 30%	± 35%	± 45%	± 38%	± 38%	± 45%	± 50%	-	-	
600	1000	± 20%	± 25%	± 30%	± 35%	± 30%	± 30%	± 35%	± 40%	± 40%	± 45%	
1000	2500	± 15%	± 20%	± 25%	± 30%	± 25%	± 25%	± 30%	± 35%	± 35%	± 40%	
2500	6300	± 10%	± 15%	± 20%	± 25%	± 20%	± 20%	± 25%	± 30%	± 30%	± 35%	
6300	10000	-	-	± 15%	± 20%	-	-	± 20%	± 25%	± 25%	± 30%	

Ball Screw

Ball Screw

Technical Data

Technical Data

[Example]

With a screw shaft length of 1500mm , shaft diameter of 31.6mm, ball circle diameter of 32mm, lead of 10mm, preload of 2000N, and Accuracy of C7, the preload torque is calculated as follows.

(1) Calculating the Reference Torque

$$\tan\beta = \frac{L}{\pi \cdot dp} \frac{10}{\pi \cdot 32} = 0.0995$$

: Lead angle

L : Lead (=10mm)

dp : Ball circle diameter (=32mm)

Fao : Preload (=2000N)

Tp : The reference torque

$$\begin{aligned} Tp &= 0.05(\tan\beta)^{-0.5} \frac{Fao \cdot L}{2\pi} \\ &= 0.05 \times (0.0995)^{-0.5} \frac{2000 \times 10}{2\pi} \\ &= 504.8 \text{ N} \cdot \text{mm} \end{aligned}$$

(2) Calculating the Torque Fluctuation

$$\frac{\text{Thread length}}{\text{Screw shaft outer diameter}} = \frac{1500}{31.6} = 47.4$$

The result is between 40 and 60, effective thread length, 4000mm or less and accuracy grade C5, the torque fluctuation is calculated as below.

$$504.8 \times (1 \pm 0.5) = 252.4 \sim 757.2 \text{ N} \cdot \text{mm}$$

Permissible Axial Load

[Buckling Load on the Screw Shaft]

It is important to choose a screw shaft so that it will not buckle when the maximum axial load is applied.

$$\begin{aligned} \text{Buckling load (N)} &= \frac{\eta_1 \cdot \pi \cdot 32 \cdot E \cdot I}{La^2} \times S \\ &= \eta_2 \frac{dr^4}{La^2} 10^4 \end{aligned}$$

La : Distance between two mounting surfaces (mm)

E : Young's modulus ($2.06 \times 10^5 \text{ N/mm}^2$)

dr : Radius of curvature of the screw shaft (mm)

S : Safety factor (Normal 0.5)

* I : Minimum geometrical moment of inertia of the shaft (mm^4)

$$I = \eta_2 \frac{\pi}{64} 10^4$$

Fixed - Free : $\eta_1 = 0.25$ $\eta_2 = 1.3$

Fixed - Supported : $\eta_1 = 2$ $\eta_2 = 10$

Fixed - Fixed : $\eta_1 = 4$ $\eta_2 = 20$

[Permissible Tensile Compressive Load on the Screw shaft]

It is necessary to consider not only the buckling load but also the permissible tensile compressive load according to the yielding stress on the screw shaft.

$$\text{Permissible tensile compressive load (N)} = \sigma \frac{\pi}{4} dr^4 = 116dr^2$$

σ : Permissible tensile compressive stress (N)

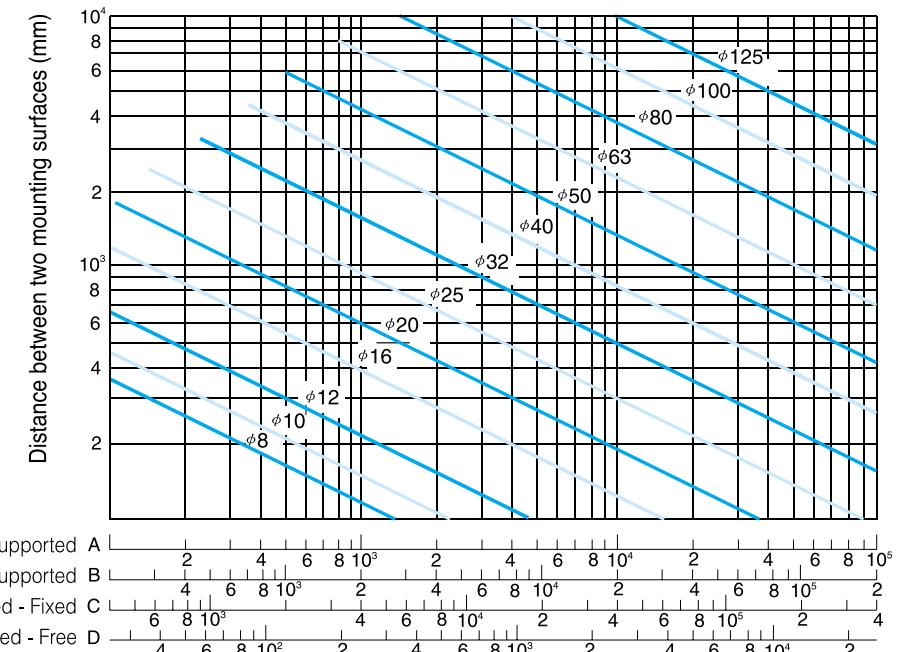
dr : Screw-shaft thread minor diameter (mm)

Ball Screw

Ball Screw

Technical Data

Technical Data



(Permissible tensile compressive load diagram)

Permissible Rotational Speed

[Critical Speed of the screw Shaft]

When the rotational speed increases, the ball screw might be unable to operate due to the screw shaft's natural frequency. It is important to use below the dangerous speed (resonance point)

$$\begin{aligned} \text{Dangerous speed } (\text{min}^{-1}) &= \frac{60 \cdot \lambda_1^2 \cdot I}{2\pi \cdot L_a^2} \times \sqrt{\frac{E \times 10^3 \cdot I}{\gamma \cdot A}} \times S \\ &= \lambda_2 \frac{dr^4}{L_a^2} \cdot 10^7 \end{aligned}$$

- La : Distance between two mounting surfaces (mm)
- E : Young's modulus ($2.06 \times 10^5 \text{ N/mm}^2$)
- dr : screw-shaft thread minor diameter (mm)
- S : Safety factor (Normal 0.8)
- : Density (Specific gravity) ($7.85 \times 10^6 \text{ kg/mm}^3$)

* I : Minimum geometrical moment of inertia of the shaft (mm⁴)

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

* A : Screw shaft cross-sectional area (mm²)

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

* λ_1, λ_2 : Factor according to the mounting method

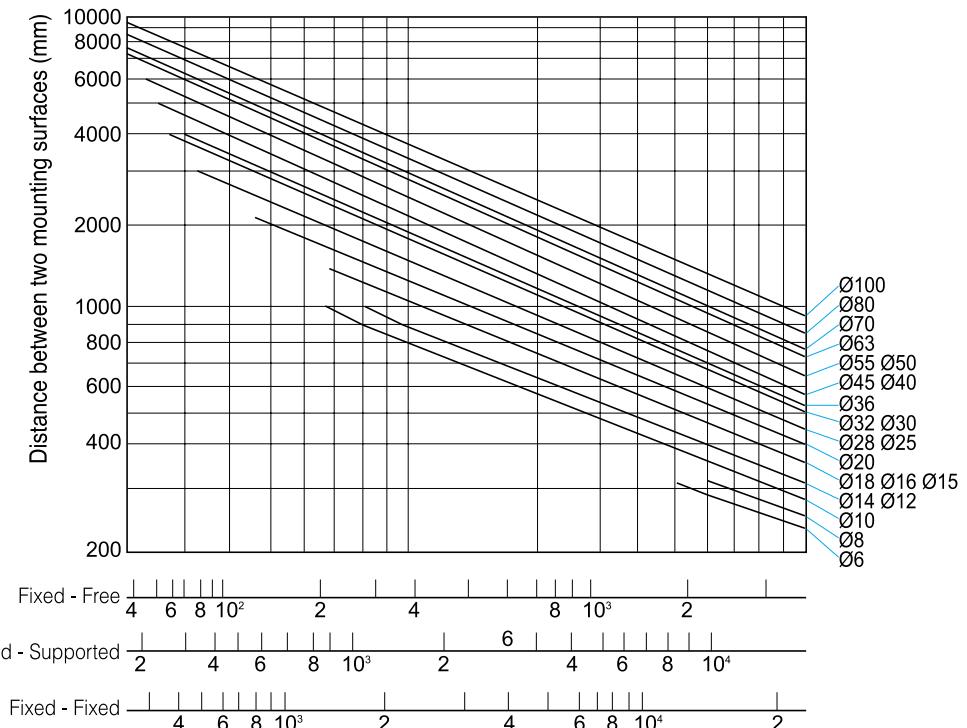
Fixed - Free	: $\lambda_1 = 1.875$	$\lambda_2 = 3.4$
Supported - Supported	: $\lambda_1 = 3.142$	$\lambda_2 = 9.7$
Fixed - Supported	: $\lambda_1 = 3.927$	$\lambda_2 = 15.1$
Fixed - Fixed	: $\lambda_1 = 4.73$	$\lambda_2 = 21.9$

Ball Screw

Ball Screw

Technical Data

Technical Data



(Permissible rotational speed diagram)

DN Value

The DN Value is the ball circle diameter multiplied by the rpm (revolutions per minute) (min⁻¹)

$$DN = D \times N$$

$$N(\text{min}^{-1}) = \frac{DN}{D}$$

N : Permissible rotational speed determined by the DN value (mm⁻¹)
 DN : DN coefficient

- : Precision Rolled ball screw : 90,000
- : Large Lead Rolled Ball Screw : 100,000
- : Ground Ball Screw : 70,000

D : Ball center-to-center diameter (mm)

Select the lesser value between critical speed and DN value for the maximum rotational speed.
 Set "The maximum working Rotational speed < The Permissible Rotational speed"
 Please consider the following precautions.

(1) Exceeding the Critical Speed

- Exceeding the critical speed will cause the screw to shake and will generate excessive noise.
- The noise will increase when the nut is at either end of the screw shaft.
- The noise will decrease when the nut is in the middle of the screw shaft.

(2) Exceeding the DN Value

- Exceeding the DN Value speed will cause noise and vibration in the nut.
- Exceeding the DN Value speed can damage the recirculation parts of the nut (Deflector, Return tube, End-cap, Return plate).

Ball Screw

Ball Screw

Technical Data

Basic load rating & lifetime

[Load rating & life]

Under normal conditions, the ball screw can be damaged by metal fatigue as the result of repeated stress. The repeated stress causes flaking of the raceways and steel balls. The life of ball screw is defined as the total number of rotations that the ball screw rotates until flaking occurs.

[1] Nominal life (total number of rotations): L

We define the nominal life as the total number of rotations (L =total number of rotations) without flaking by 90% of a group of an identical group of ball screws operating under the same condition.

$$L = \left(\frac{C_a}{F_a} \right)^3 \times 10^6$$

L : Nominal life (total number of rotations)
 F_a : Applied axial load
 C_a : Basic dynamic load rating

[2] Basic dynamic load rating : C_a (kN)

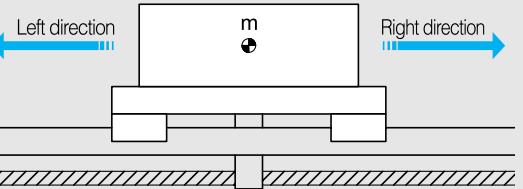
Basic dynamic load rating C_a is defined as load which is constant direction and volume, when operating one group of ball screw independently as $L=10^6$ under same condition.

[3] Basic static load rating : C_{sa} (kN)

If an excessive load or shock is applied to the ball screw system in the static or dynamic state, permanent but local deformation can occur to the steel balls and raceway.

Calculating the axial load

[Horizontal installation]



m : Mass (kg)
 g : Acceleration of gravity (m/s^2)
 a : Acceleration and deceleration (m/s^2)
 μ : Frictional coefficient of the guide surface
 f : Guide surface resistance (N)

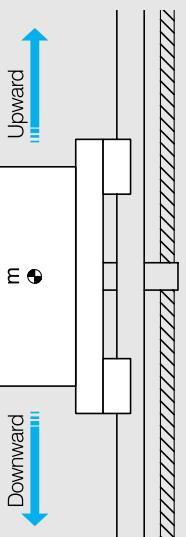
Axial load for left direction

$$\begin{aligned} Fa_1(\text{Acceleration}) &: N = \mu \cdot mg + f + ma \\ Fa_2(\text{Uniform motion}) &: N = \mu \cdot mg + f \\ Fa_3(\text{Deceleration}) &: N = \mu \cdot mg + f - ma \end{aligned}$$

Axial load for right direction

$$\begin{aligned} Fa_4(\text{Acceleration}) &: N = \mu \cdot mg - f - ma \\ Fa_5(\text{Uniform motion}) &: N = \mu \cdot mg - f \\ Fa_6(\text{Deceleration}) &: N = \mu \cdot mg - f + ma \end{aligned}$$

[Vertical installation]



Axial load for upward

$$\begin{aligned} Fa_1(\text{Acceleration}) &: N = mg + f + ma \\ Fa_2(\text{Uniform motion}) &: N = mg + f \\ Fa_3(\text{Deceleration}) &: N = mg + f - ma \end{aligned}$$

Axial load for downward

$$\begin{aligned} Fa_4(\text{Acceleration}) &: N = mg - f - ma \\ Fa_5(\text{Uniform motion}) &: N = mg - f \\ Fa_6(\text{Deceleration}) &: N = mg - f + ma \end{aligned}$$

m : Mass (kg)
 g : Acceleration of gravity (m/s^2)
 a : Acceleration and deceleration (m/s^2)
 f : Guide surface resistance (N)

Ball Screw

Ball Screw

Technical Data

Technical Data

Static safety factor

There are two ways to select a ball screw. One depends on the value of static load and the other is based on the required life. Usually, the later is preferred.

$$F_{a\ max.} = \frac{C_{oa}}{f_s}$$

Fa_{max.} : Max permissible axial load (kN)
 Co_a : Basic static load rating (kN)
 f_s : Safety factor

Checking life time

[Calculating the nominal life]

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

L : Nominal life (Total number of rotations) (rev)
 Fa : Applied axial load (N)
 Ca : Basic dynamic load rating (N)
 fw : Load factors

Applied machine	Load conditions	Lower limit of f _s
General industrial machinery	Without vibration or impact	1.0 ~ 1.3
	With vibration or impact	2.0 ~ 3.0
Machine tool	Without vibration or impact	1.0 ~ 1.5
	With vibration or impact	2.5 ~ 7.0

Vibrations / Impact	Speed (V)	Load factor fw
Faint	Very low V 0.25 m/s	1 ~ 1.2
Weak	Slow 0.25 V 1.0 m/s	1.2 ~ 1.5
Medium	Medium 1.0 V 2.0 m/s	1.5 ~ 2.0
Strong	High V 2.0 m/s	2.0 ~ 3.5

[Calculating life time]

Life time (Total number of rotations) calculation is as below.

$$L_h = \left(\frac{L}{60 \cdot N} \right)^3 = \left(\frac{L \cdot Ph}{2 \cdot 60 \cdot n \cdot S} \right)$$

L : Nominal life (Total number of rotations) (rev)
 N : Rotations per minute (min⁻¹)
 n : Number of reciprocations per minute (min⁻¹)
 Ph : Ball screw lead (mm)
 S : Stroke (mm)

Ball Screw

Ball Screw

Technical Data

Technical Data

[Calculating travel distance]

Calculating the travel distance is as below.

$$L_s = \left(\frac{L \cdot Ph}{10^6} \right)$$

Ls : Travel distance (km)
L : Nominal life (Total number of rotations) (rev)
Ph : Ball screw lead (mm)

[Calculating mean axial load]

The mean axial load is a constant load that is equivalent to nominal life in varying the load conditions.
If the load changes in stages, the mean axial load is as below.

$$F_m = \sqrt{\frac{(F_{a1}^6 L_1 + F_{a2}^6 L_2 + \dots + F_{an}^6 L_n)}{L}}$$

Fm : Mean axial load (N)
Fan : Varying load (N)
L : Total travel distance
Ln : Distance travel under load in stages

Checking the rotational torque

The rotational torque can be calculated by below equation.

[During uniform]

$$T_t = T_1 + T_2 + T_4$$

Tt : Rotational torque for uniform motion (N·mm)
T1 : Frictional torque by external load (N·mm)
T2 : Preload torque by ball screw (N·mm)
T4 : Other torque (N·mm)
 (Frictional torque by support unit or oil seal)

[During acceleration]

$$T_k = T_t + T_3$$

Tk : Rotational torque for acceleration (N·mm)
Tt : Torque for uniform (N·mm)
T3 : Torque for acceleration (N·mm)

[During deceleration]

$$T_g = T_t - T_3$$

Tg : Rotational torque for deceleration (N·mm)
Tt : Torque for uniform (N·mm)
T3 : Torque for deceleration (N·mm)

Frictional torque by external load

In case turning force for ball screw, Frictional torque by external load can be calculated as below.

$$T_1 = \frac{F_a \cdot Ph}{2\pi \cdot \eta} \times A$$

T1 : Frictional torque by external load (N·mm)
Fa : Axial load (N)
Ph : Ball screw lead (mm)
 : Ball screw efficiency (Normal: 0.9~0.95)
A : Reduction ratio

Ball Screw

Ball Screw

Technical Data

Technical Data

Frictional torque by ball screw preload

$$T_2 = T_d \times A$$

T₂ : Preload torque of ball screw (N·mm)
 T_d : Preload torque of ball screw
 (See the preload page)
 A : Reduction ratio

Torque for acceleration

$$T_3 = J \times \omega \times 10^3$$

T₃ : Torque for acceleration (N·mm)
 J : Inertia moment (kg·m²)
 : Angular acceleration (rad/s²)

* Equation of inertia moment (J)

$$J = m \left(\frac{Ph}{2\pi} \right)^2 \times A^2 \times 10^{-6} + Js \cdot A^2 + JA \cdot A^2 + JB$$

m : Mass (kg)
 Ph : Ball screw lead (mm)
 A : Reduction ratio
 Js : Inertia moment of the screw shaft (kg·m²)
 JA : Inertia moment of gear etc. which attached to screw shaft (kg·m²)
 JB : Inertia moment of gear etc. which attached to motor (kg·m²)

* Equation of angular acceleration ()

$$\omega = \frac{2\pi \cdot N}{60t}$$

N : Motor rotations per minute (mm⁻¹)
 t : Acceleration time (sec)

* Inertial moment of a round object

$$J = \frac{m \cdot D^2}{8 \times 10^6}$$

J : Inertial moment (kg·m²)
 m : Mass of a round object (kg)
 D : Screw shaft outer diameter (mm²)

Selecting motor

[In case of using servomotor]

Calculating rotational speed for motor

$$N = \frac{V \times 1000 \times 60}{Ph} \times \frac{1}{A}$$

N : Required rotational speed of the motor (min⁻¹)
 V : Feeding speed (m/s)
 Ph : Ball screw lead (mm)
 A : Reduction ratio

Calculating resolution for motor

$$R = \frac{Ph \cdot A}{S_{min}}$$

R : Required resolution (p/rev)
 Ph : Ball screw lead (mm)
 A : Reduction ratio
 S_{min} : Minimum feed amount (mm)

Calculating motor torque

The required torque for motor is various in accordance with acceleration, uniform and deceleration motion. See the page of rotational torque.

* Maximum torque

The required maximum torque for motor must be equal or lower to the peak torque of motor.

* Effective torque

Calculating effective torque is as below. The calculated value of effective torque must be equal or lower to rated torque of motor.

$$T_{rms} = \sqrt{\frac{(T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + T_3^2 \cdot t_3)}{t}}$$

T_{rms} : Effective torque (N·mm)
 T_n : Fluctuating torque (N·mm)
 t_n : Time for applying torque "T_n"(s)
 t : Cycle time (t₁+t₂+t₃) (s)

Ball Screw

Ball Screw

Technical Data

Technical Data

[In case of using a stepping motor]

Calculating minimum step angle

$$\theta = \frac{360 \cdot S_{\min}}{P_h \cdot A}$$

: Required step angle for motor (°)
 S_{\min} : Minimum feed amount/ per step (mm)
 P_h : Ball screw lead (mm)
A : Reduction ratio

Calculating pulse speed

$$f = \frac{V \times 1000}{S_{\min}}$$

f : Pulse speed (Hz)
V : Feeding speed (m/s)
 S_{\min} : Minimum feed amount (mm)

Calculating motor torque

The required torque for motor is various in accordance with acceleration, uniform and deceleration motion. See the page of rotational torque.

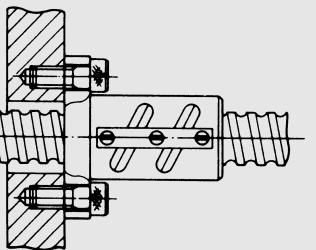
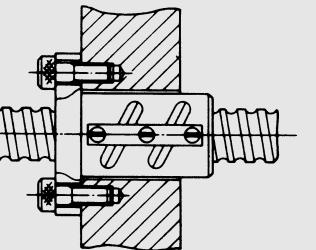
[Cautions for selecting motor]

When calculating required torque and pulse speed for selecting motor, the applied capacity of motor should be doubled for safety.

Precautions when mounting ball screw

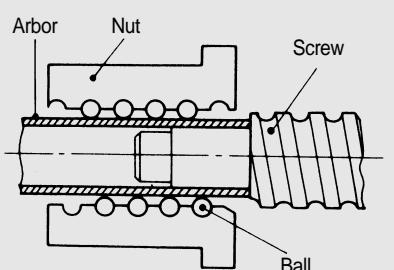
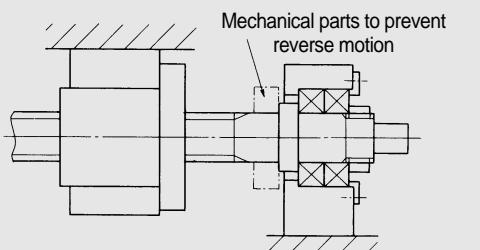
[Nut bracket design]

In case of deflector, return tube types have projected part on nut itself, therefore the nut bracket should be designed in accordance with nut type.



[End machining and designing nut environment]

When install the ball screw into machine, please avoid disassembling nut and screw type. Also, please install the components which prevent over-stroke of nut.



[When disassembling the nut from screw]

Please use temporary screw to put the nut during maintenance.

Cautions for disassembling the nut from screw

If there is mishandling while disassembling the nut from screw, it can cause the problem of nut position, preload, steel ball off and ball circulation part. Therefore, please contact SBC when you disassemble the nut from screw.

Ball Screw

Ball Screw

Technical Data

Technical Data

Safety Design

[Lubrication]

Lubrication for ball screw is a key part of its performance.

(2) Class of oil

Lubricant	Class
Oil	Turbine oil ISOVG32 ~ 68

(1) Lubricants interval

The lubrication interval varies according to working conditions of the machine. Therefore, the following lubrication intervals are recommended. Also, mixed oil or grease feeding is not recommended.

Item	Checking time	Lubricant interval	Working condition and outcome	Volume of feeding
Grease	3 ~ 6 months	6 months~1 year	Normal condition	One third in nut space
Oil	1 week	According to checking	According to contamination and volume	Recommended volume according to screw diameter (see below)
	Everyday	Any time	According to volume of oil before use	

Recommended volume according to screw diameter

Screw diameter (mm)	Volume (cc)
4 ~ 15	0.05 / 3 min.
16 ~ 25	0.1 / 3 min.
32 ~ 40	0.2 / 3 min.
50 ~ 63	0.4 / 3 min.
80 ~ 100	0.5 / 3 min.

(3) Classification and selection of lubrication

Lubricants for linear rail system must be selected after considering vibration, clean room, vacuum and working condition.

SBC supplies the two kinds of grease.

Item	Application	Brand [Company]
Normal working condition	Multipurpose industrial application	Shell Alvania EP(LF)0 [Korea shell]
Special working condition	Clean room	SNG 5050 [NTG Korea]
	Vibration	
	Wide temperature	

* Contact SBC if MSDS is required or a special purpose of grease is required.

When planning to use a special lubricant, contact SBC before using it.

Ball Screw

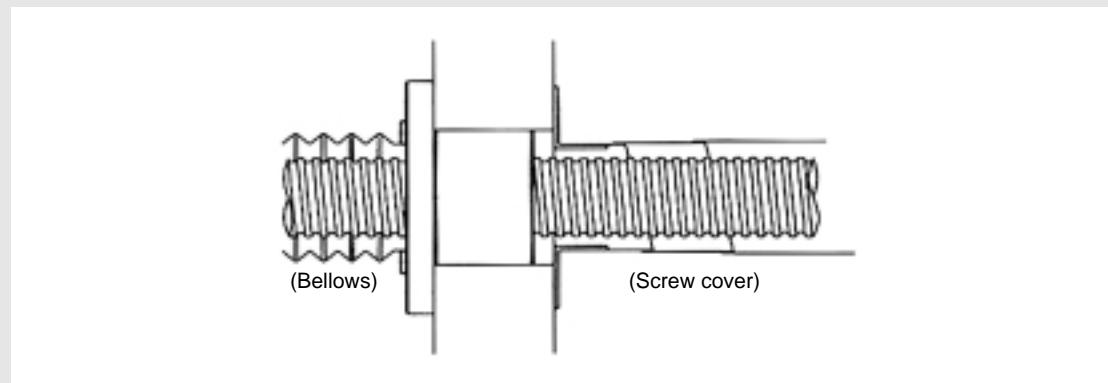
Ball Screw

Technical Data

Technical Data

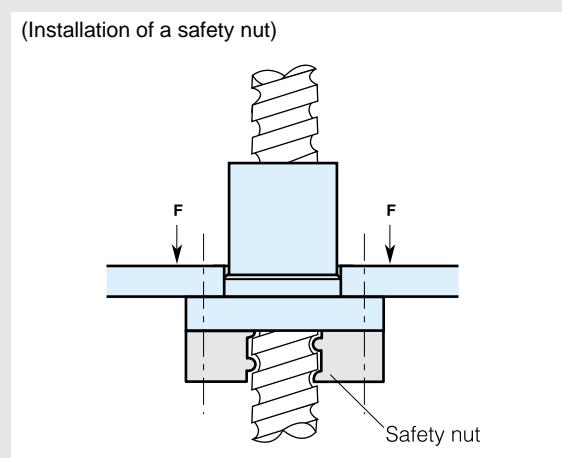
Safety design for dust proof

Ball screws have recirculating steel balls inside. Debris and other foreign objects such as cutting chips can damage the nut. Typically a seal is a standard part of the nut but if it is not available, please consider another method of protecting the nut for debris such as bellows.



[Safety nut]

If the ball screw is vertically installed, a safety nut should be applied. This nut blocks the load in case the ball nut has been destroyed by excessive force.



Anti-rust

3 types of surface treatment are available to prevent rust.

[Chrome plating]

Chrome plating achieves high rust resistance and wear resistance with the coating film of over 750HV.

[Raydent]

For corrosion resistance, raydent surface treatment is available. This treatment is suitable for corrosion resistance.

[Fluorocarbon raydent treatment]

Fluorocarbon coating on raydent-treatment is suitable where high corrosion resistance is required (water or salty water working condition).

Caution for surface treatment

Use a higher safety factor for load life calculations when a surface treated ball screw system is selected.

Except for the above surface treatments, other plating types usually cause performance problems.

Contact SBC for surface treatments.

Ball Screw

Ball Screw

SBC Precision Rolled Ball Screw**SBC Precision Rolled Ball Screw****Type**

SBC Precision Rolled Ball Screws are available in a variety of shaft diameters from Ø6mm to Ømm and a variety of Leads from 1mm to 40mm. Screws are available in P5 or T7 or both precision grades and lengths up to 7000mm depending on the particular screw.



STK Precision Rolled Ball Screw



SLK Long Lead Rolled Ball Screw



MBS Miniature Rolled Ball Screw

Ball Screw shaft Model No.

(Unit : mm)				
Model No.	Diameter	Lead	Max. Length	Accuracy
RM0601T	06	01	900	T7
RM0801T	08	01	1200	T7
RM0802T	08	02	1200	T7
RM0802.5T	08	02.5	1200	T7
RM1002T	10	02	1200	T7
RM1004T	10	04	1200	T7
RM1204T	12	04	1400	T7
RM1205T	12	05	1400	T7
RM1210T	12	10	3000	T7
RM1520T	15	20	3000	T7
RM1605	15.6	05	3000	P5, T7
RM1610T	16	10	3600	T7
RM1616T	16	16	3600	T7
RM2005	19.6	05	4000	P5, T7
RM2010	20	10	3000	T7
RM2020	19.6	20	4000	P5, T7
RM2505	24.6	05	5000	P5, T7
RM2510	24.6	10	5000	P5, T7
RM2525	24.6	25	5000	P5, T7
RM3205	31.6	05	6000	P5, T7
RM3210	31.6	10	6000	P5, T7
RM3220T	32	20	6000	T7
RM3232T	32	32	6000	T7
RM4005	39.6	05	6000	P5, T7
RM4010	39.6	10	6000	P5, T7
RM4020	39.6	20	6000	P5, T7
RM4040	39.6	40	6000	P5, T7
RM5010	49.5	10	6000	P5, T7
RM5020	49.5	20	6000	P5, T7
RM5050T	50	50	6000	T7
RM6310	62.5	10	6000	P5, T7
RM8010	79.5	10	7000	T7

SBC follows DIN and JIS Standards.

DIN Standard	JIS Standard
P5	C5
T7	C7

Ball Screw

Ball Screw

SBC Precision Rolled Ball Screw**SBC Precision Rolled Ball Screw****Ordering Example****[Nut Only Part Numbers]**

32 20 SLK - S

- [1] Diameter
- [2] Lead
- [3] Nut Type : STK, SLK
- [4] Preload : S (Clearance Type)

MBS type must be ordered as a screw and nut assembly.
When ordering only a nut, the preload is only S type (Clearance type).

[Screw Shaft Only Part Numbers]

RM 3220T - 1500L - T7

- [1] Model No.
- [2] Screw shaft length
- [3] Accuracy

Refer to the specifications for the Model No.
Individual screw shafts are only available in the T7 precision grade.
MBS type must be ordered as a screw and nut assembly.

[Nut and Screw Assembly Part Numbers]

3220 SLK - A - 1 - 1300 / 1500 - T7 - R

- [1] Model No. : STK, SLK, MBS
- [2] Preload : S (Clearance Type), A (Non-backlash Type)
- [3] Nut Quantity : Nut Quantity on Screw shaft
- [4] Thread Length : No Symbol (No processing)
- [5] Total Length
- [6] Accuracy : P5, T7
- [7] Surface treatment : No Symbol (Standard), R (Surface treatment)

A screw-nut assembly is recommended if high accuracy or rigidity is required.
For surface treatment, mark the type of surface treatment.
If end machining is required, please attach a drawing.
Refer to the specifications for the Accuracy.
MBS type can only be ordered as a screw-nut assembly.

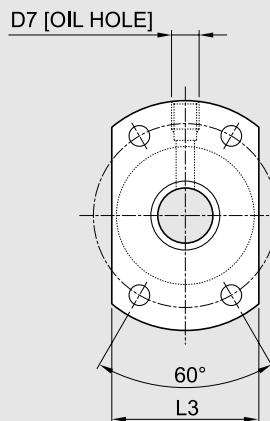
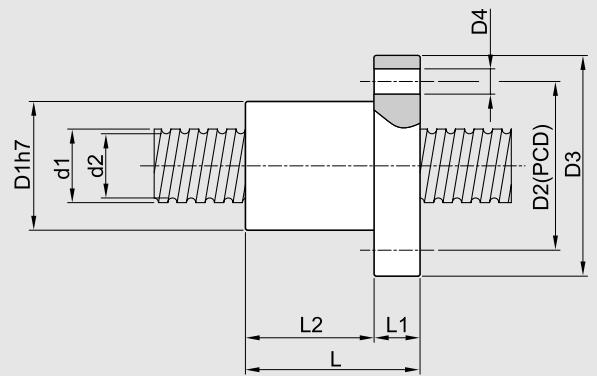
Ball Screw

Ball Screw

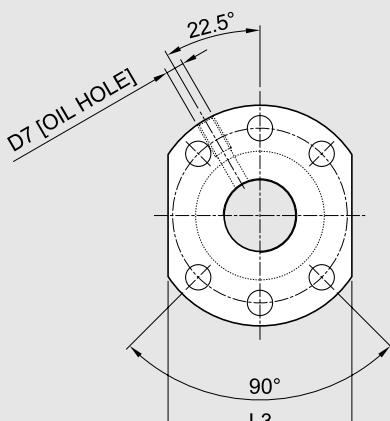
SBC Precision Rolled Ball Screw

SBC Precision Rolled Ball Screw

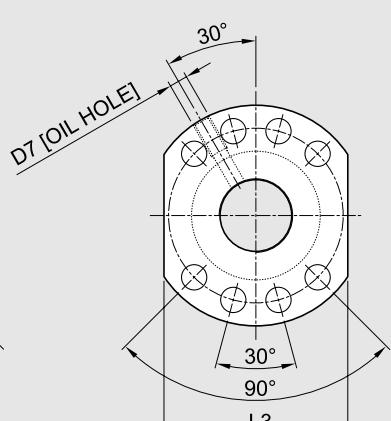
STK/STC Precision Rolled Ball Screw STK/STC Type



[STK1605~4010]



[STC2510]



[STK5010~8010]

Model No.	d_1 (Nominal diameter)	Ph (Lead)	do (Ball circle diameter)	Da (Ball Diameter)	d_2 (Root - diameter)	i (No. of circuits)	D_1	D_2 (PCD)	D_3
STK1605	15.6	5	16	3.5	12.7	3x1	34	44	54
STK2005	19.6	5	20	3.5	16.7	4x1	40	50	60
STK2505	24.6	5	25	3.5	21.7	4x1	43	55	67
STK2510	24.6	10	25	3.5	21.7	4x1	60	78	96
STC2510	24.6	10	25	3.5	21.7	4x1	40	51	62
STK3205	31.6	5	32	3.5	27.1	4x1	56	71	86
STK3210	31.6	10	32	5.556	27.1	4x1	67	85	103
STK4005	39.6	5	40	3.5	36.7	4x1	64	82	100
STK4010	39.6	10	40	7.144	36.7	4x1	76	96	116
STK5010	49.5	10	50	7.144	43	4x1	75	93	110
STK6310	62.5	10	63	7.144	56.9	6x1	90	108	125
STK8010	79.5	10	80	7.144	73.9	6x1	105	125	145

Ca (Basic Dynamic load rating), Coa (Basic static load rating)

D_4	D_7	L	L_1	L_2	L_3	Ca [kN]	Coa [kN]	Max. Length
4.5	M6x1	45	10	35	40	7.5	12.1	3000
4.5	M6x1	53	10	43	46	11.0	23.3	4000
5.5	M6x1	53	10	43	50	12.5	30.4	5000
9	M6x1	85	15	70	72	19.0	38.0	5000
6.6	M6x1	85	12	73	48	19.0	38.0	5000
6.6	M6x1	53	12	41	68	14.2	40.0	6000
9	M6x1	90	15	75	78	33.2	70.0	6000
9	M6x1	56	15	41	75	15.7	52.2	6000
11	M6x1	93	17	76	88	38.3	93.3	6000
11	M8x1	98	16	75	85	43.6	122.5	6000
11	M8x1	126	18	96	95	70.8	218.4	6000
13.5	M8x1	128	20	96	110	80.0	288.3	7000

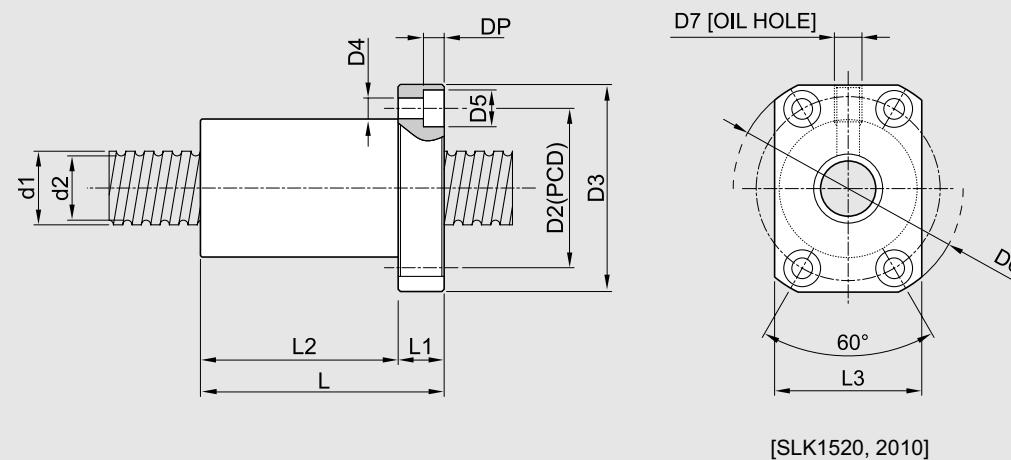
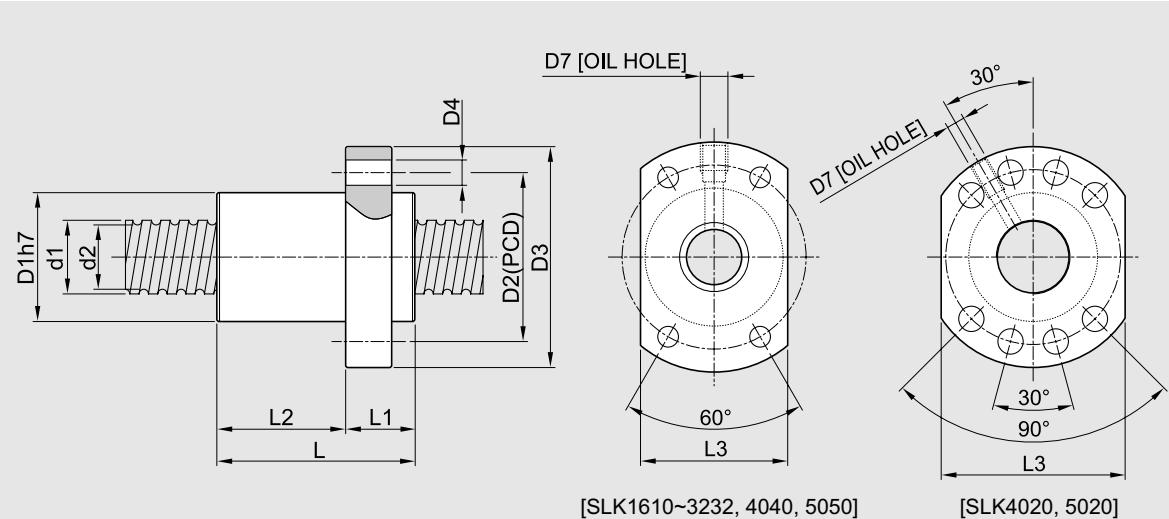
Ball Screw

Ball Screw

SBC Precision Rolled Ball Screw

SBC Precision Rolled Ball Screw

SLK Long Lead Rolled Ball Screw



Model No.	d1 (Nominal diameter)	Ph (Lead)	do (Ball circle diameter)	Da (Ball Diameter)	d2 (Root - diameter)	i (No. of circuits)	D1	D2 (PPCD)	D3	D4
SLK1520	15	20	15.5	3.175	12.4	1.5x1	34	45	50	6
SLK1610	16	10	16.6	3.175	13.4	3x1	34	45	57	5.5
SLK1616	16	16	16.6	3.175	13.4	1.8x2	32	42	53	4.5
SLK2010	20	10	21	3.969	17	2.5x1	46	59	66	5.5
SLK2020	19.6	20	20	3.5	16.7	1.8x2	39	50	62	5.5
SLK2525	24.6	25	25	3.5	21.7	1.8x2	47	60	74	6.6
SLK3220	32	20	32.7	3.969	28.7	3x1	50	65	80	9
SLK3232	32	32	33	4.762	28.2	1.8x2	58	74	92	9
SLK4020	39.6	20	40	5.556	35.2	3x1	63	78	93	9
SLK4040	39.6	40	40	7.144	34	1.8x2	73	93	114	11
SLK5020	49.5	20	50	6.350	44.6	5x1	75	93	110	11
SLK5050	50	50	52.2	7.938	44.3	1.8x2	90	112	135	14

Ca (Basic Dynamic load rating), Coa (Basic static load rating)

D5	DP	D6	D7	L	L1	L2	L3	Ca [kN]	Coa [kN]	Max. Length
-	-	55	M4x0.7	57	7	50	34	44.7	75.8	3000
-	-	-	M6x1	43.3	10	24	40	7	12	3600
-	-	-	M6x1	45	10	24.5	38	7.1	14	3600
11	6.6	74	M6x1	54	13	41	46	11.2	19.2	3000
-	-	-	M6x1	52	10	31.2	46	11.5	17.5	4000
-	-	-	M6x1	64	12	40.8	56	13	22.6	5000
-	-	-	M6x1	77	13	45	62	20.9	57.7	6000
-	-	-	M6x1	80	15	51	68	17.2	53.9	6000
-	-	-	M8x1	82	15	47.5	70	37.9	62.8	6000
-	-	-	M8x1	99	17	63	68	40.4	99.6	6000
-	-	-	M8x1	120	18	80	85	75.7	149.7	6000
-	-	-	M6x1	123	20	81.5	92	50	135.3	6000

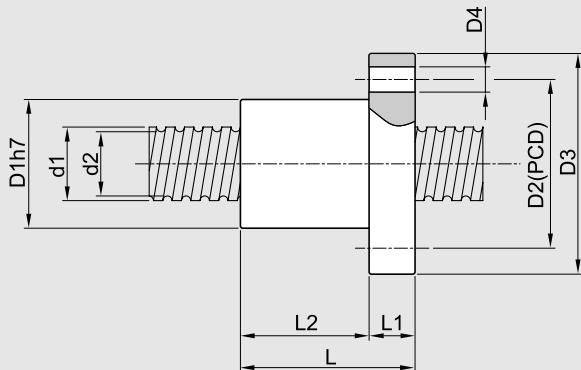
Ball Screw

Ball Screw

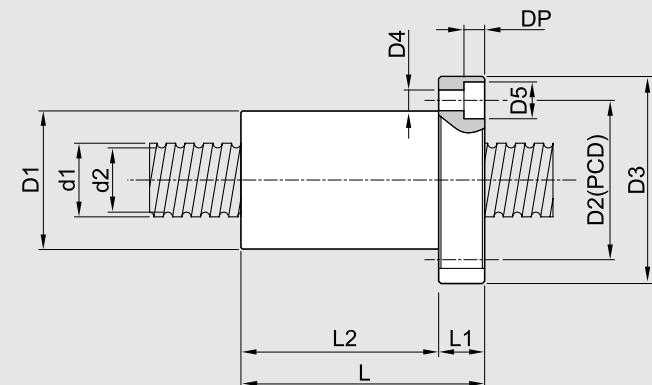
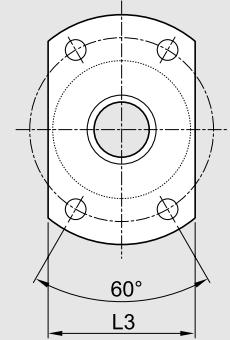
SBC Precision Rolled Ball Screw

SBC Precision Rolled Ball Screw

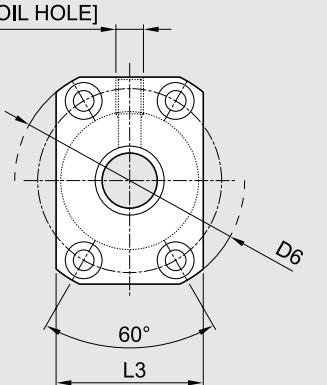
MBS Miniature Rolled Ball Screw



[MBS0601~1205]



[MBS1210]



Model No.	d1 (Nominal diameter)	Ph (Lead)	do (Ball circle diameter)	Da (Ball Diameter)	d2 (Root - diameter)	i (No. of circuits)	D1	D2 (PCD)	D3	D4
MBS 0601	6	1	6.3	0.8	5.5	3x1	13	21.5	27	3.4
MBS 0801	8	1	8.2	0.8	7.4	4x1	16	24	30	3.4
MBS 0802	8	2	8.4	1.2	7.2	3x1	16	24	30	3.4
MBS 0802.5	8	2.5	8.4	1.2	7.2	2.5x1	20	30	38	4.5
MBS 1002	10	2	10.4	2	8.4	3x1	18	27	35	4.5
MBS 1004	10	4	10.6	2	8.6	3x1	26	36	46	4.5
MBS 1204	12	4	12.4	2.381	10	3.5x1	28	39	48	5.5
MBS 1205	12	5	12.4	2	10.4	3.5x1	28	39	48	5.5
MBS 1210	12	10	12	2	10	2x1	30	40	45	4.5

Ca (Basic Dynamic load rating), Coa (Basic static load rating)

MBS0601~1205 do not contain a seal. It is necessary to use a dust-prevention device.

D5	DP	D6	D7	L	L1	L2	L3	Ca [kN]	Coa [kN]	Max. Length
-	-	-	-	15	3.5	11.5	17	0.71	1.18	1200
-	-	-	-	16	4	12	18	0.91	1.69	1200
-	-	-	-	16	4	12	18	1.32	2.2	1200
-	-	-	-	21	5	16	23	1.48	2.27	1200
-	-	-	-	28	5	23	22	1.81	2.99	1200
-	-	-	-	34	10	24	28	3.87	5.78	1200
-	-	-	-	30	6	24	30	4.16	7.23	1400
-	-	-	-	35	6	29	30	6.49	10.15	1400
8	4.5	50	M6x1	40	10	30	32	2.5	3.59	3000

Ball Screw

Ball Screw

DIN Standard SBC Precision Rolled Ball Screw

DIN Standard SBC Precision Rolled Ball Screw

Types and features

SBC Precision Rolled Ball Screw follows European DIN standards.

The screw shaft is rolled with high accuracy and then the raceways are ground to meet the P3(JIS: C3) grade.

These ball screws provide high rigidity, high accuracy, and smooth motion.

[1] European DIN standards

European DIN standard products follow the DIN 69 051/5 standard.

[2] High accuracy lead (P3, P5, T7)

High Accuracy lead s are available in P3, P5, and T7 grades.

[3] The ball raceways of the ball screw nut are all thread-ground

The thread form is finish ground to provide high rigidity, high accuracy and smooth motion.

[4] Always in stock

Ball Screws are always available for fast delivery time.

[5] High quality control

SBC provides high Quality Control to ensure the ball screws meet your expectations.



DK (Precision rolled Ball Screw)



DH (Long lead rolled Ball Screw)

Screw Shaft Model No.

(Unit : mm)				
Model No.	Diameter	Lead	Max. Length	Accuracy
RM1605	15.6	05	3000	P3, P5, T7
RM2005	19.6	05	4000	P3, P5, T7
RM2020	19.6	20	4000	P3, P5, T7
RM2505	24.6	05	5000	P3, P5, T7
RM2510	24.6	10	5000	P3, P5, T7
RM2525	24.6	25	5000	P3, P5, T7
RM3205	31.6	05	6000	P3, P5, T7
RM3210	31.6	10	6000	P3, P5, T7
RM3220	31.6	20	6000	P3, P5, T7
RM4005	39.6	05	6000	P3, P5, T7
RM4010	39.6	10	6000	P3, P5, T7
RM4020	39.6	20	6000	P3, P5, T7
RM4040	39.6	40	6000	P3, P5, T7
RM5010	49.5	10	6000	P3, P5, T7
RM5020	49.5	20	6000	P3, P5, T7
RM6310	62.5	10	6000	P3, P5, T7
RM6320	62.5	20	6000	P3, P5, T7
RM8010	79.5	10	7000	P3, P5, T7
RM8020	80	20	7000	P3, P5, T7

SBC follows DIN and JIS Standards.

DIN Standard	JIS Standard
P3	C3
P5	C5
T7	C7

Ball Screw

Ball Screw

DIN Standard SBC Precision Rolled Ball Screw**DIN Standard SBC Precision Rolled Ball Screw****Ordering Example****[The Nut Ordering]**

20 05 DK - S

- [1] Diameter
- [2] Lead
- [3] Nut Type : DK, DH
- [4] Preload : S (Clearance Type)

When ordering only a nut, the preload is only S type (Clearance type).

[The Screw shaft Ordering]

RM 2005 - 1500L - T7

- [1] Model No.
- [2] Screw shaft length
- [3] Accuracy

Refer to the specifications for the Model No.

Individual screw shafts are only available in the T7 precision grade.

[Ordering]

2005 DK - A - 1 - 1300 / 1500 - T7 - R

- [1] Model No. : DK, DH
- [2] Preload : S (Clearance Type), A (Non-backlash Type)
- [3] Nut Quantity : Nut Quantity on Screw shaft
- [4] Thread Length : No Symbol (No processing)
- [5] Total Length
- [6] Accuracy : P3, P5, T7
- [7] Surface treatment : No Symbol (Standard), R (Surface treatment)

A screw-nut assembly is recommended if high accuracy or rigidity is required.

For surface treatment, mark the type of surface treatment.

If end machining is required, please attach a drawing.

Refer to the specifications for the Accuracy.

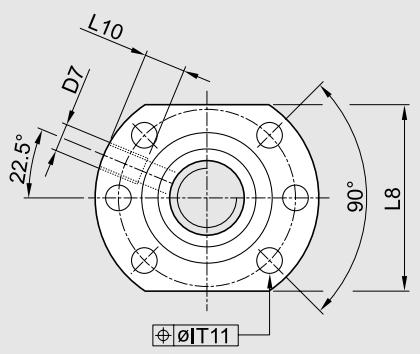
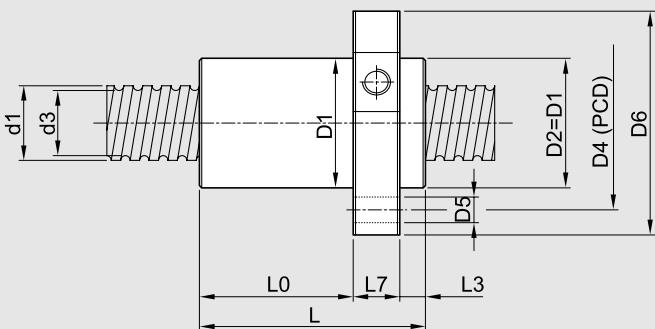
Ball Screw

Ball Screw

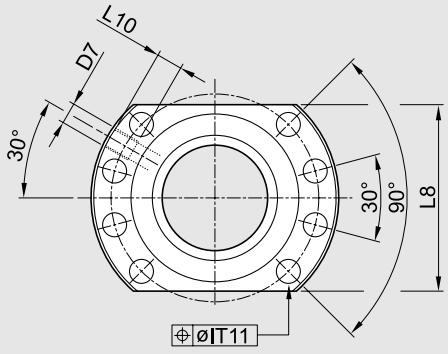
DIN Standard SBC Precision Rolled Ball Screw

DIN Standard SBC Precision Rolled Ball Screw

DK Type Precision Rolled Ball Screw



[DK1605~3210]



[DK4005~8010]

Model No.	d1 (Screw shaft outer diameter)	Ph (Lead)	do (Ball circle diameter)	Da (Ball Diameter)	d3 (Root - diameter)	i (No. of circuits)	Sa	D1g6	D4 (PCD)	D5	D6 h13
DK 1605	15.6	5	16	3.5	12.7	3	0.09	28	38	5.5	48
DK 2005	19.6	5	20	3.5	16.7	3	0.09	36	47	6.6	58
DK 2505	24.6	5	25	3.5	21.7	3	0.09	40	51	6.6	62
DK 3205	31.6	5	32	3.5	28.7	4	0.09	50	65	9	80
DK 3210	31.6	10	32	5.556	27.1	3	0.15	50	65	9	80
DK 4005	39.6	5	40	3.5	36.7	5	0.09	63	78	9	93
DK 4010	39.6	10	40	7.144	34.0	4	0.18	63	78	9	93
DK 5010	49.5	10	50	7.144	43	4	0.18	75	93	11	110
DK 6310	62.5	10	63	7.144	56.9	5	0.18	90	108	11	125
DK 8010	79.5	10	80	7.144	73.9	6	0.18	105	125	13.5	145

Ca (Basic Dynamic load rating), Coa (Basic static load rating)

L ± 1	L0 ± 1	L3-0.5	L7h13	L8h13	D7	L10	Ca [kN]	Coa [kN]	Max. Length	Nut Mass [kg]	Screw shaft Mass [kg/m]	Screw shaft Moment of Inertia [kg · m ² /m]
48.5	33	5.5	10	40	M6x1	8	9.5	10.9	3000	0.25	1.2	32
48.5	33	5.5	10	44	M6x1	8	11.5	15.5	4000	0.35	2.0	85
49	33	6.0	10	48	M6x1	8	13.1	20.2	5000	0.37	3.3	225
57	39	6.0	12	62	M6x1	8	19.3	36.3	6000	0.7	5.6	645
73	55	6.0	12	62	M6x1	8	26.4	39	6000	0.8	5.3	580
66	45	7.0	14	70	M8x1	10	26.3	59.2	6000	1.2	9.0	1650
88.5	67.5	7.0	14	70	M8x1	10	64.9	109	6000	1.4	8.3	1400
92	69	7.0	16	85	M8x1	10	66.4	134.3	6000	2	13.5	3700
103.5	78.5	7.0	18	95	M8x1	10	93.8	229.7	6000	3	22	9870
121	92	9.0	20	110	M8x1	10	121.9	374.9	7000	3.9	36.4	26850

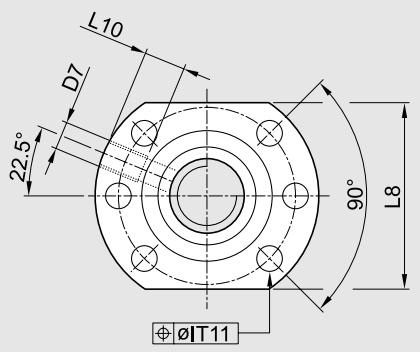
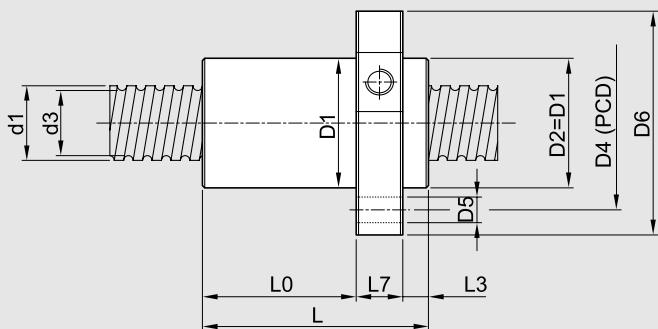
Ball Screw

Ball Screw

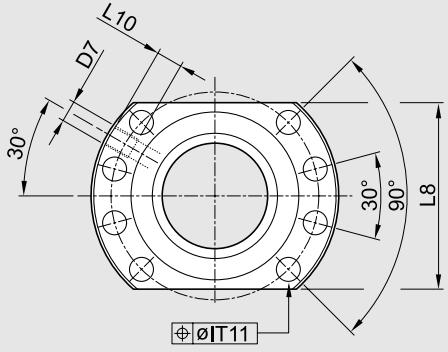
DIN Standard SBC Precision Rolled Ball Screw

DIN Standard SBC Precision Rolled Ball Screw

DH Type Long Lead Rolled Ball Screw



[DH2020~3220]



[DH4020~8020]

Model No.	d1 (Screw shaft outer diameter)	Ph (Lead)	do (Ball circle diameter)	Da (Ball Diameter)	d3 (Root - diameter)	i (No. of circuits)	Sa	D1g6	D4 (PCD)	D5	D6 h13
DH 2020	19.6	20	20.5	3.5	16.7	3.6	0.08	36	47	6.6	58
DH 2510	24.6	10	25.5	3.5	21.7	5.6	0.09	40	51	6.6	62
DH 2525	24.6	25	25.5	3.5	21.7	3	0.08	40	51	6.6	62
DH 3220	31.6	20	33	5.556	27.1	5.6	0.15	56	71	9	86
DH 4020	39.6	20	41	5.556	35.2	5.6	0.15	63	78	9	93
DH 4040	39.6	40	41.5	7.144	34	3.6	0.18	70	85	9	100
DH 5020	49.5	20	51.5	6.35	44.6	5.6	0.16	75	93	11	110
DH 6320	62.5	20	64.5	7.144	56.9	5.6	0.18	95	115	13.5	135
DH 8020	80	20	83.2	9.525	73.7	4	0.18	125	145	13.5	165

Ca (Basic Dynamic load rating), Coa (Basic static load rating)

L ± 1	L0 ± 1	L3-0.5	L7h13	L8h13	D7	L10	Ca [kN]	Coa [kN]	Max. Length	Nut Mass [kg]	Screw shaft Mass [kg/m]	Screw shaft Moment of Inertia [kg · m ² /m]
61	37	14	10	44	M6x1	8	10.8	18.6	4000	0.24	1.9	73
53	27	16	10	48	M6x1	8	22.9	41.2	5000	0.45	3.3	225
71	45.5	16	10	48	M6x1	8	13.1	26	5000	0.3	3.3	225
87	56	19	12	68	M6x1	8	47.2	83.2	6000	1.4	5.3	580
87	53.5	20	14	70	M8x1	10	52.2	103.6	6000	1.6	7.6	1520
110	75	21	14	77	M8x1	10	59.7	108.9	6000	2.4	8.4	1430
91	53	22	16	85	M8x1	10	78.8	188.7	6000	2.2	13.6	3730
92	48	24	20	100	M8x1	10	103.1	270.8	6000	3.8	22	9050
154	129	-	25	130	M8x1	10	83.2	302.9	7000	5.2	36.4	26850

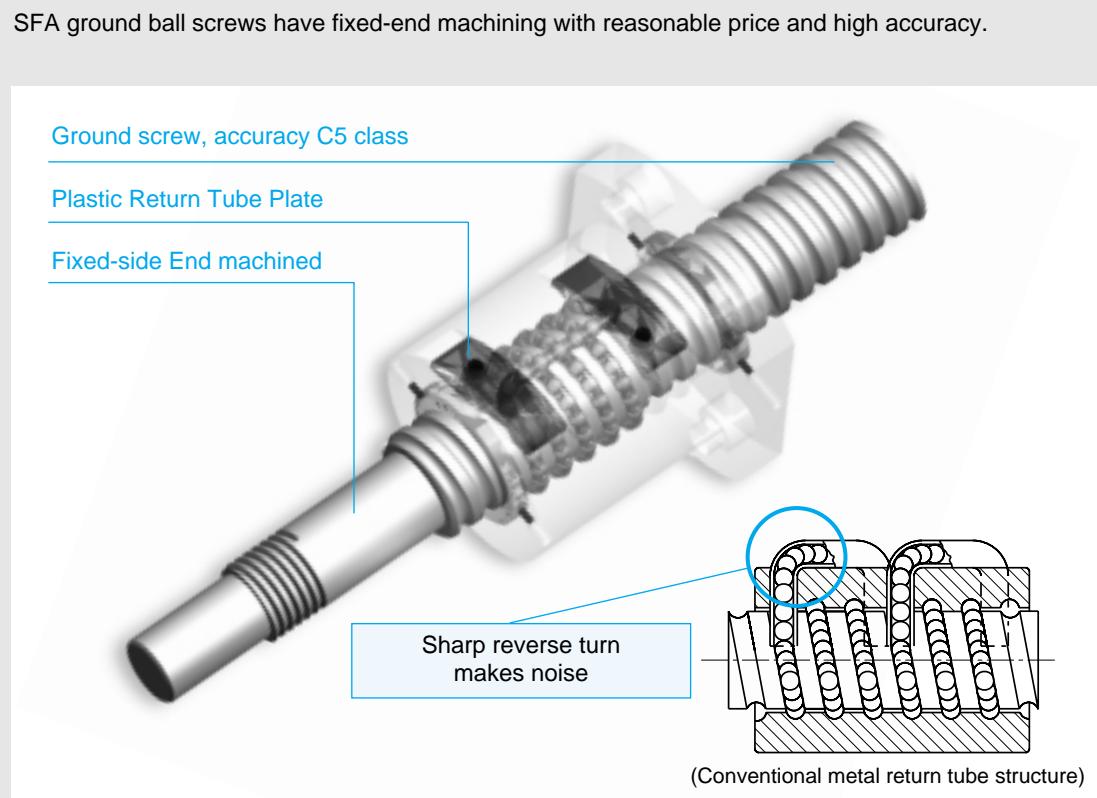
Ball Screw

Ball Screw

Ground Ball Screw for FA-SFA Series

Ground Ball Screw for FA-SFA Series

Products



[Resin return tube plate]

Resin return plate dramatically reduces the noise which occurs in conventional metal return plate and achieves smooth ball circulation.

Screw diameter 12~20mm and lead 10, 20mm

Model No.	Diameter (mm)	Lead (mm)	Length (mm)	Preload	Accuracy
SFA1210	12	10	410	P2	C5
			610		
SFA1510	15	10	500	P2	C5
			700		
SFA1520	15	20	1000	P2	C5
			500		
SFA2010	20	10	700	P2	C5
			1000		
SFA2020	20	20	1200	P1	C7
			700		
			1000	P2	C5
			1200		
				P1	C7

[Preload combination according to lead]

Accuracy	Preload	Axial Clarence
C7	P1 (Clearance)	X
C5	P2 (Light Preload)	X

Refer to the specifications for preload

SFA type follows JIS Standard.

Contact SBC for higher preload.

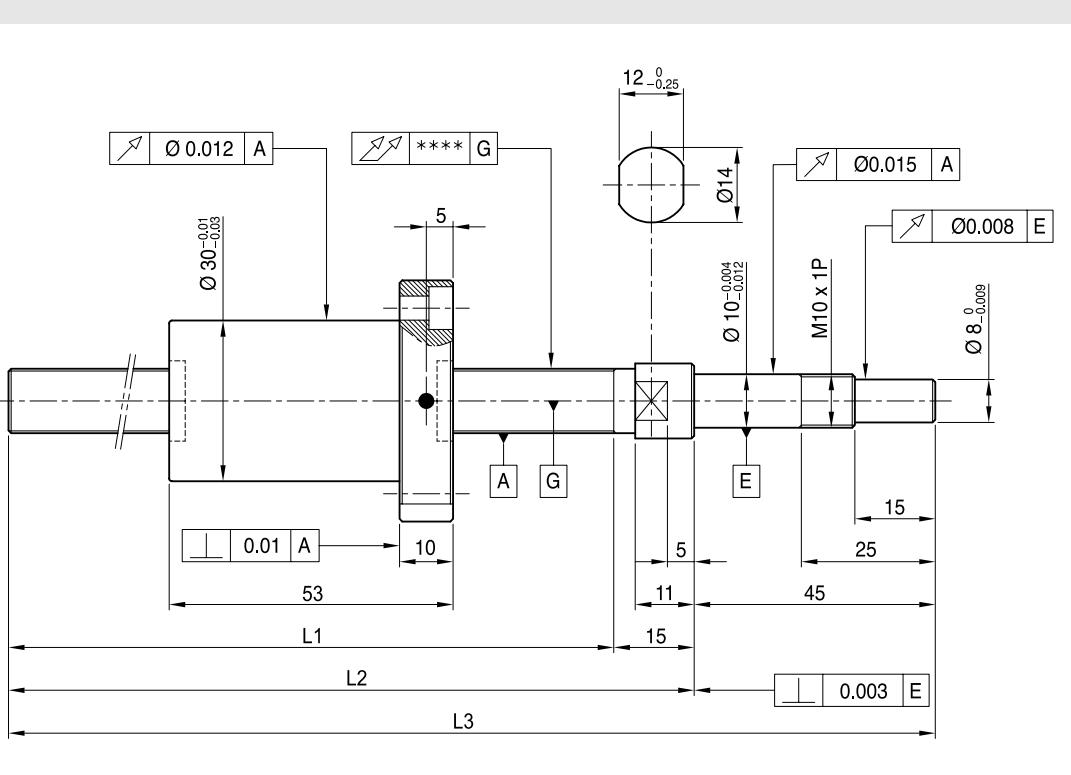
Ball Screw

Ball Screw

Ground Ball Screw for FA- SFA Series

Ground Ball Screw for FA- SFA Series

SFA1210-Screw diameter Ø12 and lead 10mm



(Unit : mm)				
Model No.	L1	L2	L3	Shaft run-out 
SFA1210-P2-410	350	365	410	0.060
SFA1210-P2-610	550	565	610	0.075

Ball circle diameter	12.85
Diameter x lead	12 x 10
Ball Diameter	2.5
Thread direction	RIGHT
No. of circuits	2.7x1
Lead Angle	13.91°
Accuracy	C5 (0.018)
Preload	0.24 (kN)
Basic dynamic load rating (Ca)	4 (kN)
Basic static load rating (Coa)	6.2 (kN)

Ordering

SFA1210 - P2 - 640 - C5

- [1] Model No.
- [2] Preload
- [3] Length
- [4] Accuracy

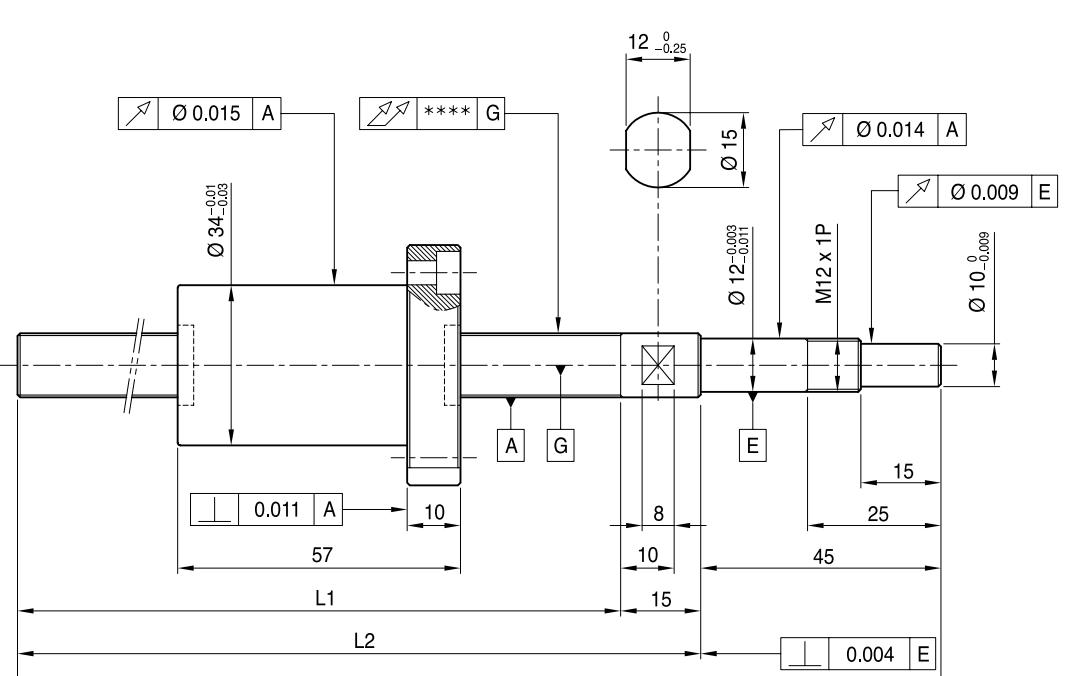
Ball Screw

Ball Screw

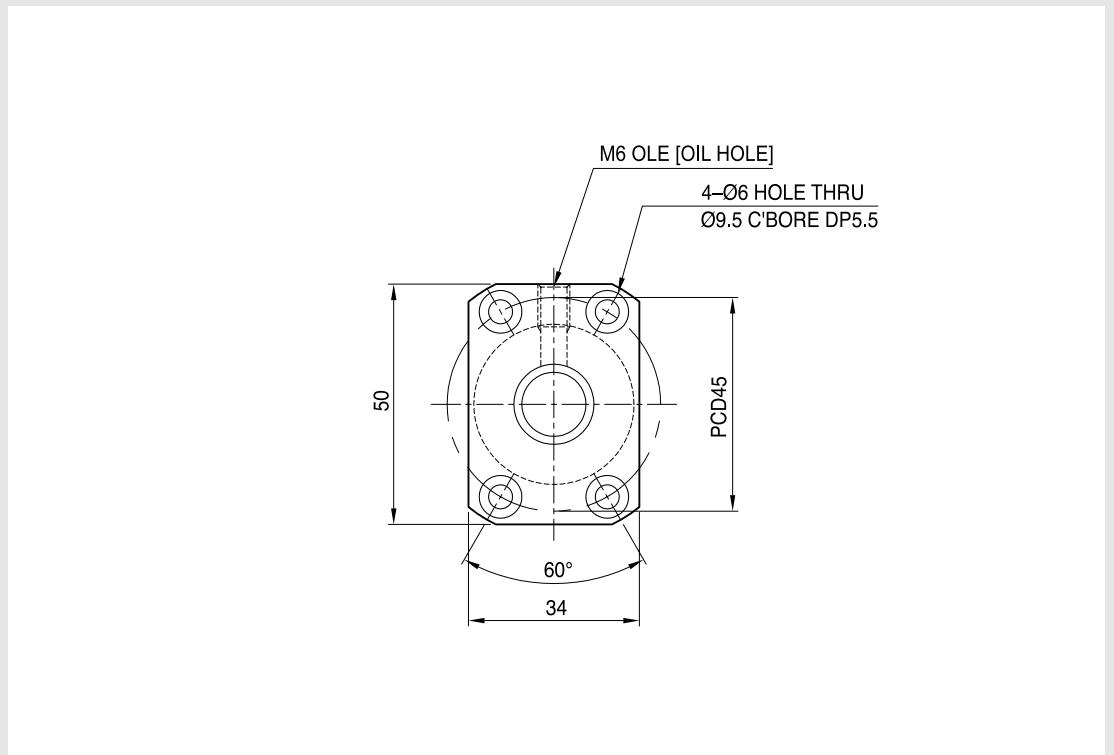
Ground Ball Screw for FA- SFA Series

Ground Ball Screw for FA- SFA Series

SFA1510-Screw diameter Ø15 and lead 10mm



(Unit : mm)				
Model No.	L1	L2	L3	Shaft run-out
SFA1510-P2-500	440	455	500	0.040
SFA1510-P2-700	640	655	700	0.065
SFA1510-P2-1000	940	955	1000	0.085



Ball circle diameter	15.5
Diameter x lead	15 x 10
Ball Diameter	3.175
Thread direction	RIGHT
No. of circuits	2.7 x 1
Lead Angle	11.6°
Accuracy	C5 (0.018)
Preload	0.37 (kN)
Basic dynamic load rating (Ca)	5.9 (kN)
Basic static load rating (Coa)	9.3 (kN)

Ordering

SFA1510 - P2 - 500 - C5
[1] [2] [3] [4]

- [1] Model No.
- [2] Preload
- [3] Length
- [4] Accuracy

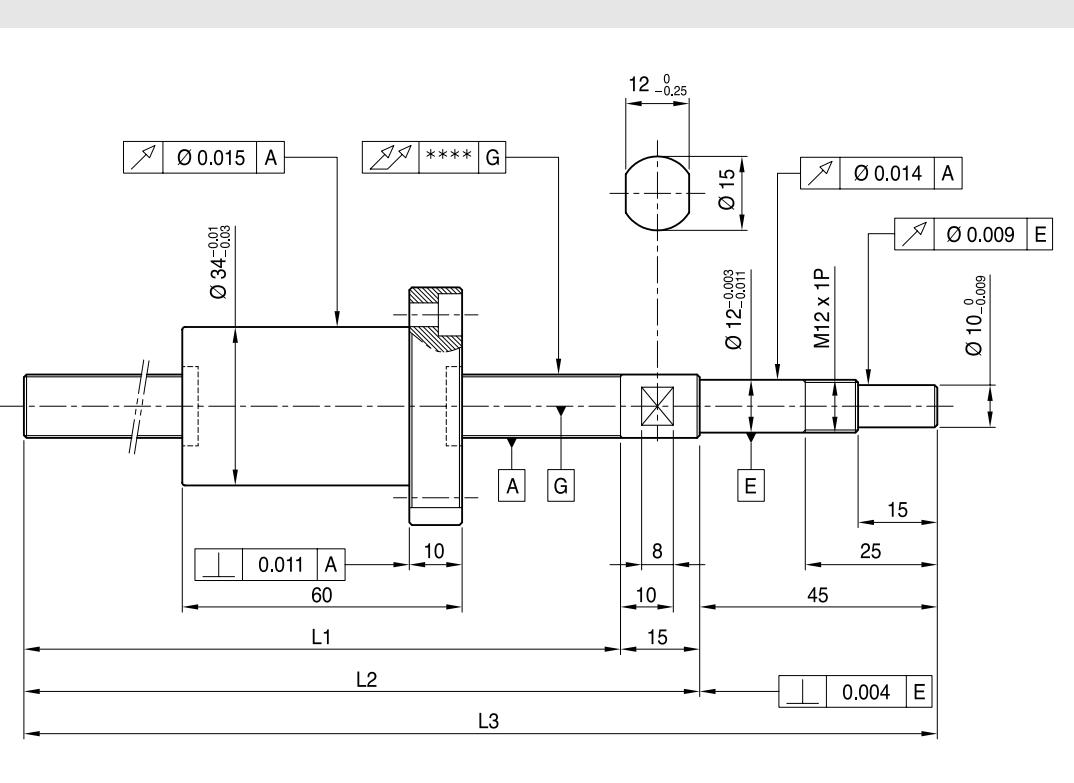
Ball Screw

Ball Screw

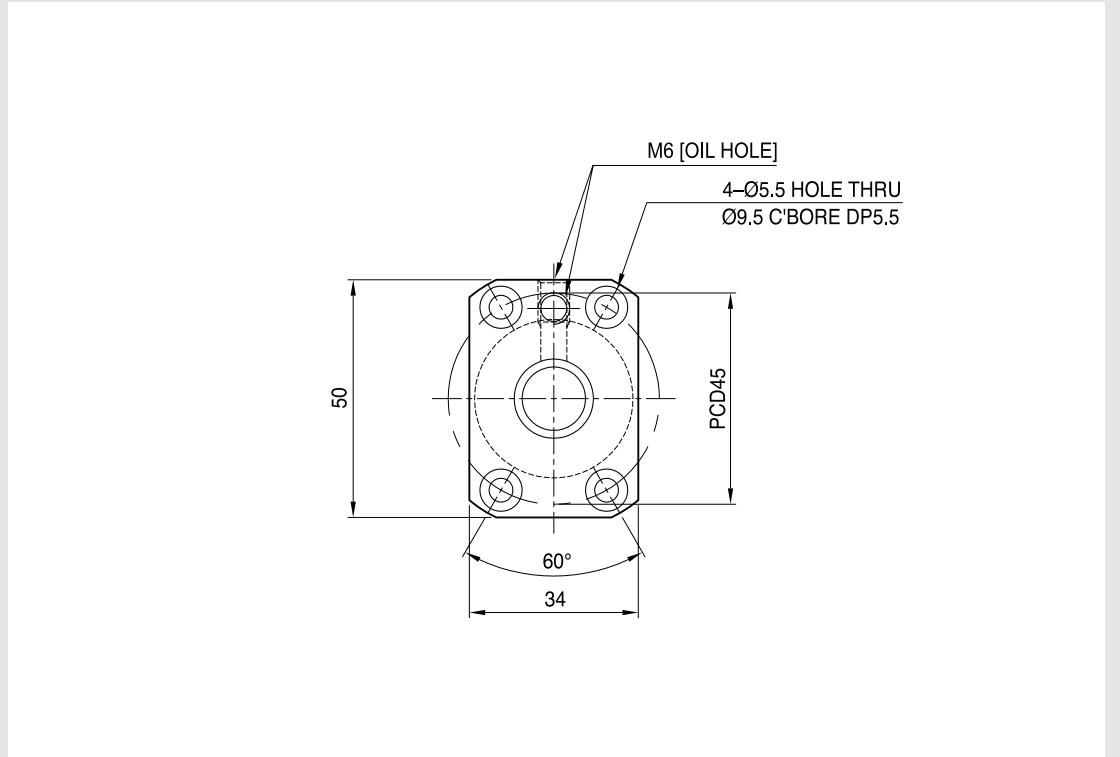
Ground Ball Screw for FA- SFA Series

Ground Ball Screw for FA- SFA Series

SFA1520-Screw diameter Ø15 and lead 20mm



(Unit : mm)				
Model No.	L1	L2	L3	Shaft run-out 
SFA1520-P2-500	440	455	500	0.040
SFA1520-P2-700	640	655	700	0.065
SFA1520-P2-1000	940	955	1000	0.085



Ball circle diameter	15.5
Diameter x lead	15 x 20
Ball Diameter	3.175
Thread direction	RIGHT
No. of circuits	1.8 x 1
Lead Angle	22.33°
Accuracy	C5 (0.018)
Preload	0.37 (kN)
Basic dynamic load rating (Ca)	5.68 (kN)
Basic static load rating (Coa)	8.58 (kN)

Ordering

SFA1520 - P2 - 500 - C5

- [1] Model No.
- [2] Preload
- [3] Length
- [4] Accuracy

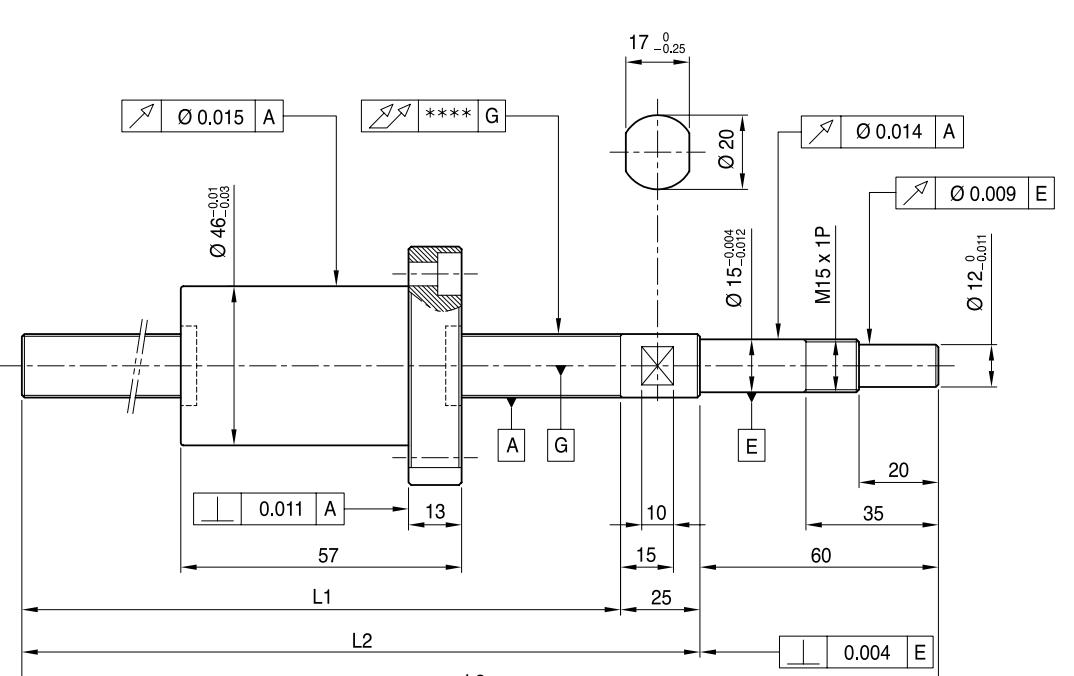
Ball Screw

Ball Screw

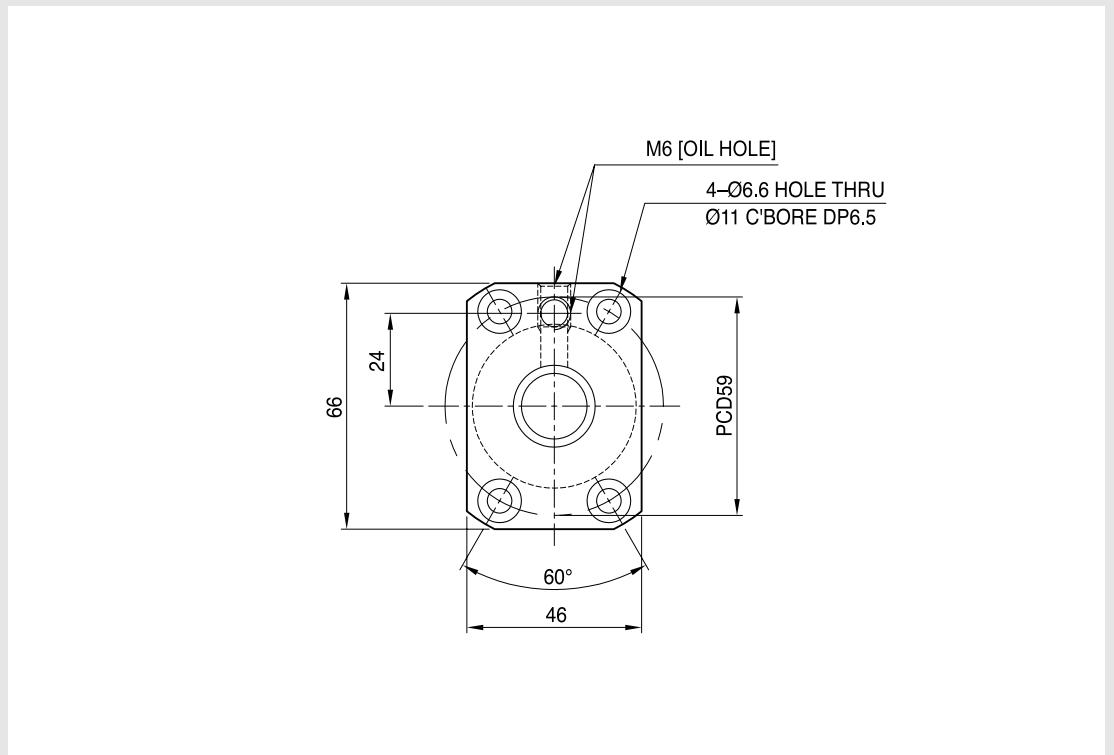
Ground Ball Screw for FA-SFA Series

Ground Ball Screw for FA-SFA Series

SFA2010-Screw diameter Ø20 and lead 10mm



(Unit : mm)				
Model No.	L1	L2	L3	Shaft run-out
SFA2010-P2-700	615	640	700	0.065
SFA2010-P2-1000	915	940	1000	0.085
SFA2010-P1-1200	1115	1140	1200	0.110



Shaft length	700, 1000	1200
Ball circle diameter	21.35	
Diameter x lead	20 x 10	
Ball Diameter	3.969	
Thread direction	RIGHT	
No. of circuits	2.7 x 1	
Lead Angle	8.48°	
Accuracy	C5	C7
Preload	0.42 (kN)	0
Basic dynamic load rating (Ca)	9.58 (kN)	
Basic static load rating (Coa)	16.98 (kN)	

Ordering

SFA2010 - P2 - 700 - C5
[1] [2] [3] [4]

- [1] Model No.
- [2] Preload
- [3] Length
- [4] Accuracy

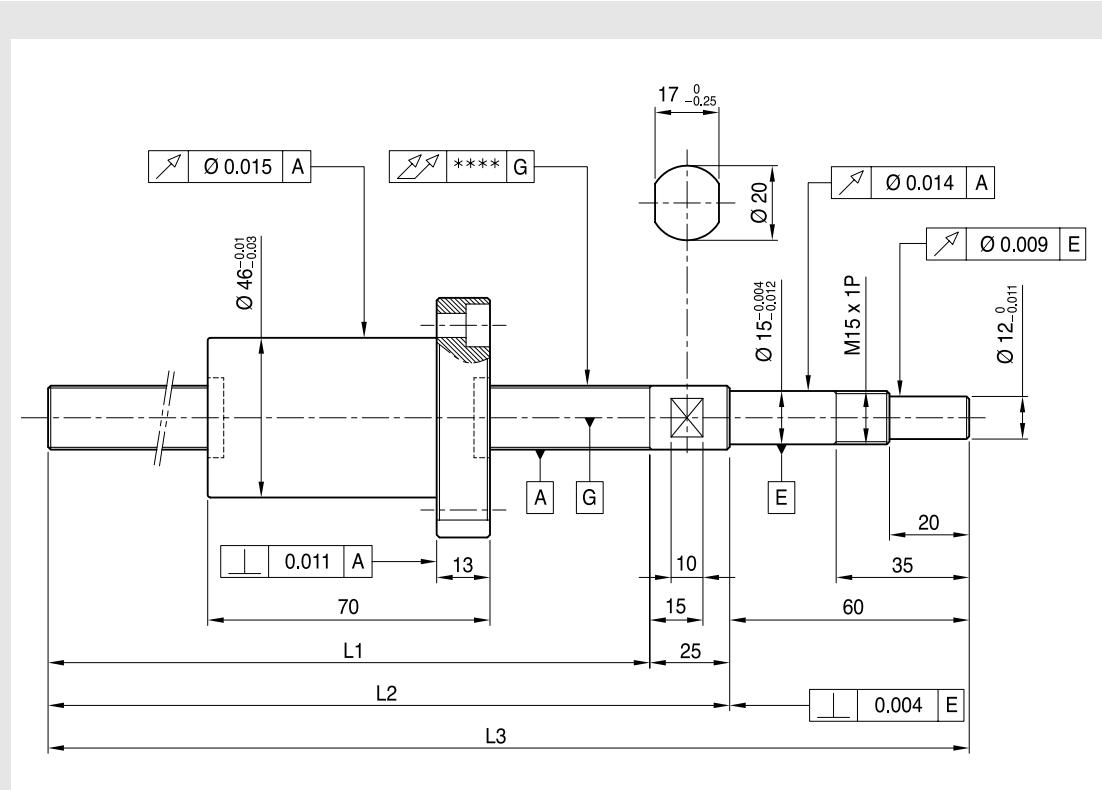
Ball Screw

Ball Screw

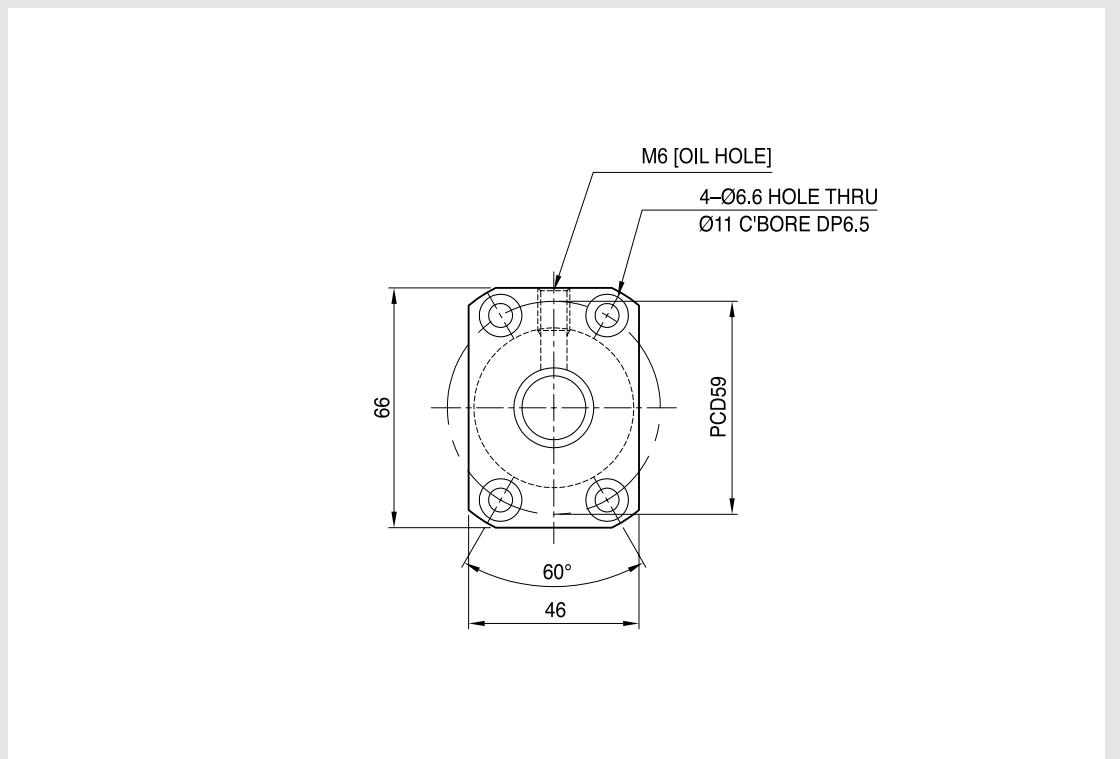
Ground Ball Screw for FA-SFA Series

Ground Ball Screw for FA-SFA Series

SFA2020-Screw diameter Ø20 and lead 20mm



(Unit : mm)				
Model No.	L1	L2	L3	Shaft run-out
SFA2020-P2-700	615	640	700	0.065
SFA2020-P2-1000	915	940	1000	0.085
SFA2020-P1-1200	1115	1140	1200	0.110



Shaft length	700, 1000	1200
Ball circle diameter	20.75	
Diameter x lead	20 x 20	
Ball Diameter	3.175	
Thread direction	RIGHT	
No. of circuits	1.8 x 1	
Lead Angle	17.05°	
Accuracy	C5	C7
Preload	0.42 (kN)	0
Basic dynamic load rating (Ca)	4.97 (kN)	
Basic static load rating (Coa)	9.39 (kN)	

Ordering

SFA2020 - P2 - 700 - C5
[1] [2] [3] [4]

- [1] Model No.
- [2] Preload
- [3] Length
- [4] Accuracy