# 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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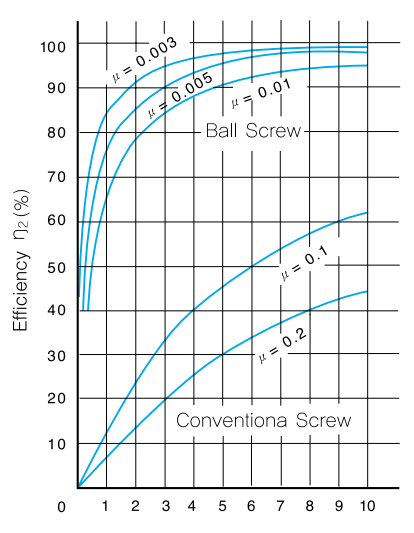
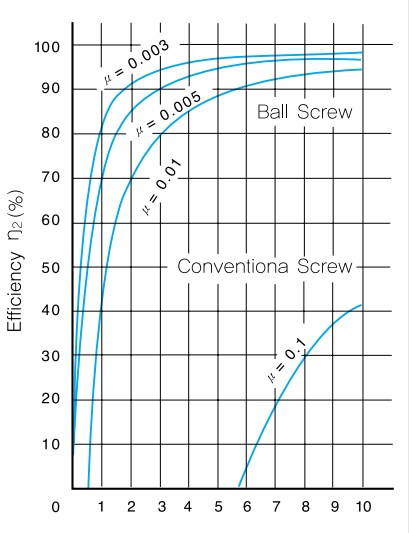
## Ball Screw Features

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.




(Load Angle)




(Load Angle)

[Calculating the Lead Angle]

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

β : Lead angle
L : Lead
dp : Ball circle diameter

## 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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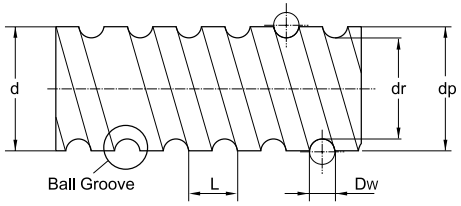
## 1-3. Structure of the Screw Shaft




### [Screw Diameter : d]

It means screw shaft outer diameter.

### [Lead : L]

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

### [Ball Diameter : Dw]

Ball diameter.

### [screw-shaft thread minor diameter : dr]

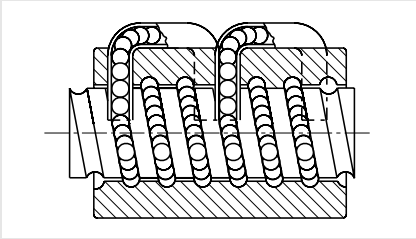
The diameter of the screw measured from the bottom of the thread form.

### [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.

## 2. Nuts

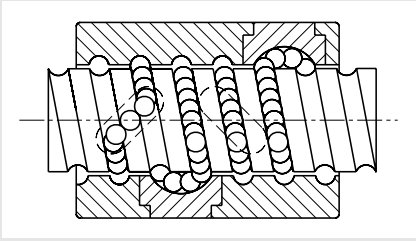
The nut is classified by Recirculation method.



### [Return Tube Type]

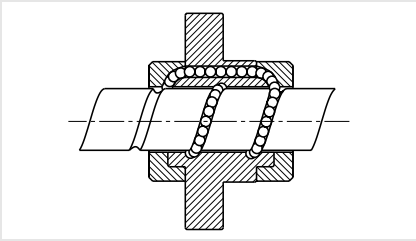
The most common type.

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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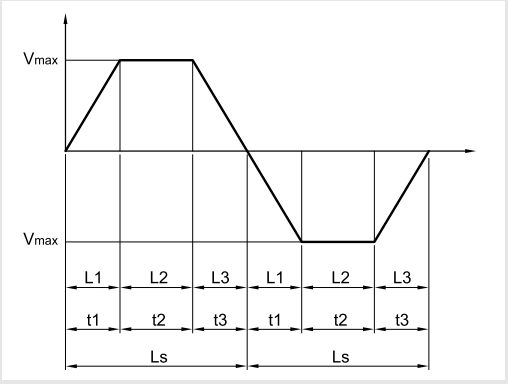
## Selecting a Ball screw

### [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 : Lh (h)
- Stroke length : Ls (mm)
- Operating Speed : $V_{max}$ (m/s)
- Acceleration time : t1 (sec)
- Constant velocity time : t2 (sec)
- Deceleration time : t3 (sec)
- Dwell time : td (sec)
- Acceleration : a ($m/s^2$)
- Acceleration distance : L1 (mm)
- Constant velocity distance : L2 (mm)
- Deceleration distance : L3 (mm)
- Number of revolutions per minute : n ($min^{-1}$)
- Positioning accuracy : - (mm)
- Positioning repeatability : - (mm)
- Backlash : - (mm)




### [Motor Requirements]

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

### ※ References

1) Acceleration $a = \frac{V_{max}}{t1}$

2) Acceleration distance $L1 = \frac{V_{max} \times t1 \times 1000}{2}$

3) Even speed distance $L2 = V_{max} \times t2 \times 1000$

4) Deceleration distance $L3 = \frac{V_{max} \times t3 \times 1000}{2}$

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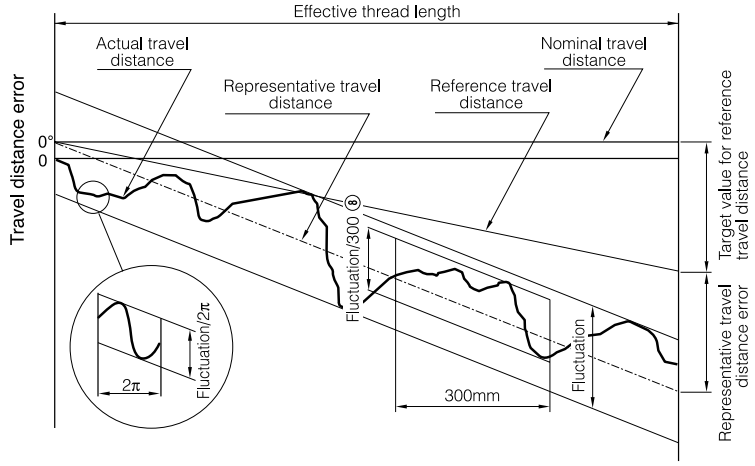
## Lead Accuracy

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)




### [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

### [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 / 2π]

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.

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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 | ± 50/300 | | ± 210/300 | |
| 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

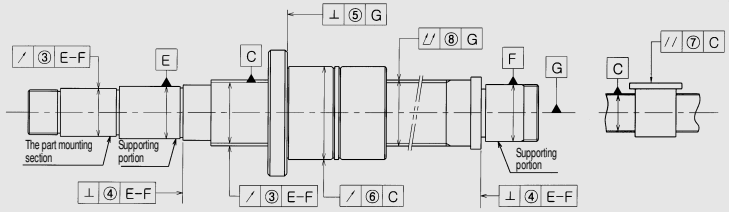
## [Permissible Value of the Lead Accuracy]

(Unit : μm)

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

## Mounting Surface Accuracy

### [Mounting Surface Accuracy C0]




(Unit : μm)

| Shaft outer diameter | | ③ | ④ | Nut diameter | | ⑤ | ⑥ | Reference length of mounting section | | ⑦ |
|---|---|---|---|---|---|---|---|---|---|---|
| Above | Less | | | Above | Less | | | Above | Less | |
| - | 8 | 3 | 2 | - | 20 | 5 | 5 | - | 50 | 5 |
| 8 | 12 | 4 | 2 | 20 | 32 | 5 | 6 | 50 | 100 | 7 |
| 12 | 20 | 4 | 2 | 32 | 50 | 6 | 7 | 100 | 200 | - |
| 20 | 32 | 5 | 2 | 50 | 80 | 7 | 8 | | | |
| 32 | 50 | 6 | 2 | 80 | 125 | 7 | 9 | | | |
| 50 | 80 | 7 | 3 | 125 | 160 | 8 | 10 | | | |
| 80 | 125 | - | - | 160 | 200 | - | - | | | |
| | | | | 200 | 250 | - | - | | | |

| Screw shaft length \ Screw shaft outer diameter | | Above | - | 8 | 12 | 20 | 32 | 50 | 80 |
|---|---|---|---|---|---|---|---|---|---|
| Above | Less | Less | 8 | 12 | 20 | 32 | 50 | 80 | 125 |
| - | 125 | | 0.015 | 0.015 | 0.015 | | | | |
| 125 | 200 | | 0.025 | 0.020 | 0.020 | 0.015 | | | |
| 200 | 315 | | 0.035 | 0.025 | 0.020 | 0.020 | | | |
| 315 | 400 | | | 0.035 | 0.025 | 0.020 | 0.015 | | |
| 400 | 500 | | | 0.045 | 0.035 | 0.025 | 0.020 | | |
| 500 | 630 | | | 0.050 | 0.040 | 0.030 | 0.020 | 0.015 | |
| 630 | 800 | | | | 0.050 | 0.035 | 0.025 | 0.020 | |
| 800 | 1000 | | | | 0.065 | 0.045 | 0.030 | 0.025 | |
| 1000 | 1250 | | | | 0.085 | 0.055 | 0.040 | 0.030 | |
| 1250 | 1600 | | | | 0.110 | 0.070 | 0.050 | 0.040 | |
| 1600 | 2000 | | | | | 0.095 | 0.065 | 0.045 | |
| 2000 | 2500 | | | | | | | | |
| 2500 | 3150 | | | | | | | | |
| 3150 | 4000 | | | | | | | | |
| 4000 | 5000 | | | | | | | | |
| 5000 | 6300 | | | | | | | | |
| 6300 | 8000 | | | | | | | | |
| 8000 | 10000 | | | | | | | | |

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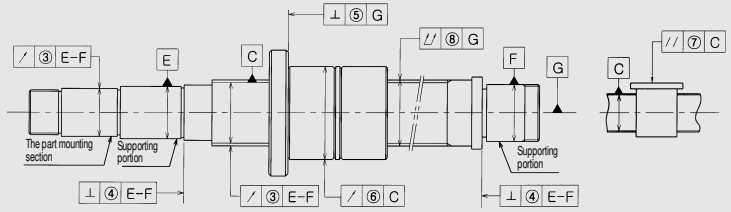
## [Mounting Surface Accuracy C1]

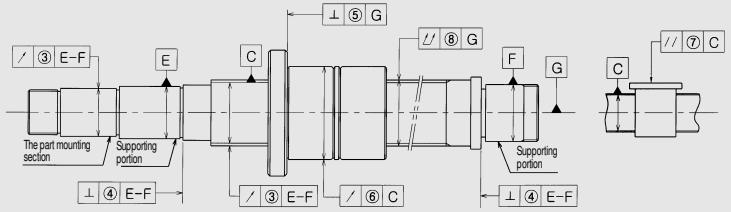



(Unit : μm)

| Shaft outer diameter | | ③ | ④ | Nut diameter | | ⑤ | ⑥ | Reference length of mounting section | | ⑦ |
|---|---|---|---|---|---|---|---|---|---|---|
| Above | Less | | | Above | Less | | | Above | Less | |
| - | 8 | 5 | 3 | - | 20 | 6 | 6 | - | 50 | 6 |
| 8 | 12 | 5 | 3 | 20 | 32 | 6 | 7 | 50 | 100 | 8 |
| 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 | | | |

| 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 | | 0.020 | 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 | 0.020 | | |
| 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 | | | | | | | | |

## [Mounting Surface Accuracy C2]




(Unit : μm)

| Shaft outer diameter | | ③ | ④ | Nut diameter | | ⑤ | ⑥ | Reference length of mounting section | | ⑦ |
|---|---|---|---|---|---|---|---|---|---|---|
| Above | Less | | | Above | Less | | | Above | Less | |
| - | 8 | 7 | 4 | - | 20 | 7 | 8 | - | 50 | 7 |
| 8 | 12 | 7 | 4 | 20 | 32 | 7 | 9 | 50 | 100 | 9 |
| 12 | 20 | 8 | 4 | 32 | 50 | 8 | 10 | 100 | 200 | 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 | | | |

| 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 | | 0.023 | 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 | 0.028 |
| 1000 | 1250 | | | | 0.110 | 0.075 | 0.055 | 0.040 | 0.033 |
| 1250 | 1600 | | | | 0.145 | 0.100 | 0.070 | 0.050 | 0.038 |
| 1600 | 2000 | | | | | 0.130 | 0.090 | 0.065 | 0.045 |
| 2000 | 2500 | | | | | | 0.110 | 0.080 | 0.055 |
| 2500 | 3150 | | | | | | 0.145 | 0.100 | 0.070 |
| 3150 | 4000 | | | | | | 0.200 | 0.135 | 0.090 |
| 4000 | 5000 | | | | | | | 0.180 | 0.115 |
| 5000 | 6300 | | | | | | | | |
| 6300 | 8000 | | | | | | | | |
| 8000 | 10000 | | | | | | | | |

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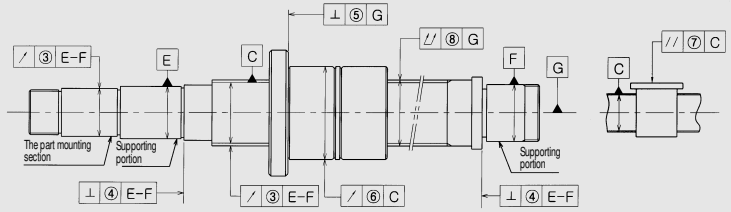
[Mounting Surface Accuracy C3]

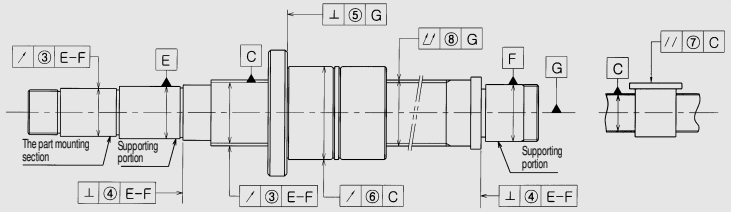



(Unit : μm)

| Shaft outer diameter | | ③ | ④ | Nut diameter | | ⑤ | ⑥ | Reference length of mounting section | | ⑦ |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 0.030 |
| 1000 | 1250 | | | | 0.120 | 0.085 | 0.060 | 0.045 | 0.035 |
| 1250 | 1600 | | | | 0.160 | 0.110 | 0.075 | 0.055 | 0.040 |
| 1600 | 2000 | | | | | 0.140 | 0.095 | 0.070 | 0.050 |
| 2000 | 2500 | | | | | | 0.120 | 0.085 | 0.060 |
| 2500 | 3150 | | | | | | 0.160 | 0.110 | 0.075 |
| 3150 | 4000 | | | | | | 0.220 | 0.150 | 0.100 |
| 4000 | 5000 | | | | | | | 0.200 | 0.130 |
| 5000 | 6300 | | | | | | | | |
| 6300 | 8000 | | | | | | | | |
| 8000 | 10000 | | | | | | | | |

[Mounting Surface Accuracy C5]




(Unit : μm)

| Shaft outer diameter | | ③ | ④ | Nut diameter | | ⑤ | ⑥ | Reference length of mounting section | | ⑦ |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 0.050 | 0.045 |
| 1000 | 1250 | | | | 0.150 | 0.100 | 0.075 | 0.060 | 0.050 |
| 1250 | 1600 | | | | 0.190 | 0.130 | 0.095 | 0.070 | 0.055 |
| 1600 | 2000 | | | | | 0.170 | 0.120 | 0.085 | 0.065 |
| 2000 | 2500 | | | | | | 0.150 | 0.110 | 0.080 |
| 2500 | 3150 | | | | | | 0.200 | 0.140 | 0.095 |
| 3150 | 4000 | | | | | | 0.260 | 0.180 | 0.120 |
| 4000 | 5000 | | | | | | | 0.240 | 0.160 |
| 5000 | 6300 | | | | | | | 0.310 | 0.210 |
| 6300 | 8000 | | | | | | | | 0.280 |
| 8000 | 10000 | | | | | | | | 0.370 |

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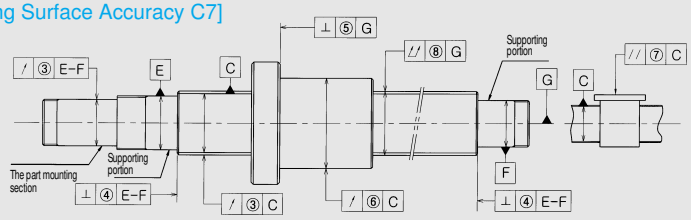
[Mounting Surface Accuracy C7]

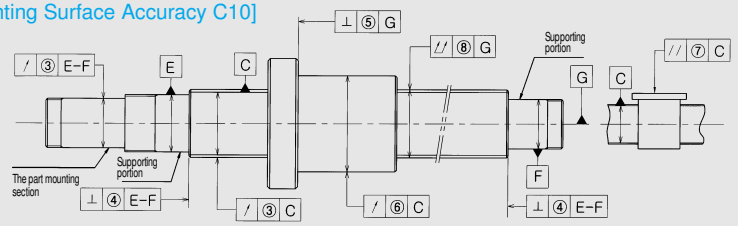



(Unit : μm)

| Shaft outer diameter | | ③ | ④ | Nut diameter | | ⑤ | ⑥ | Reference length of mounting section | | ⑦ |
|---|---|---|---|---|---|---|---|---|---|---|
| Above | Less | | | Above | Less | | | Above | Less | |
| - | 8 | 14 | 7 | - | 18 | 14 | 20 | - | 50 | 17 |
| 8 | 12 | 14 | 7 | 8 | 30 | 14 | 20 | 50 | 100 | 17 |
| 12 | 20 | 14 | 7 | 30 | 50 | 18 | 30 | 100 | 200 | 30 |
| 20 | 32 | 20 | 7 | 50 | 80 | 18 | 30 | 200 | 400 | 30 |
| 32 | 50 | 20 | 8 | 80 | 120 | 20 | 40 | | | |
| 50 | 80 | 20 | 10 | 120 | 150 | 20 | 40 | | | |
| 80 | 125 | 30 | 11 | 150 | 180 | 25 | 50 | | | |
| 125 | 200 | 30 | 13 | 180 | 250 | 25 | 50 | | | |
| | | | | 250 | 300 | 25 | 50 | | | |

| Screw shaft length \ Screw shaft outer diameter | | Above | - | 8 | 12 | 20 | 32 | 50 | 80 | 125 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 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]




(Unit : μm)

| Shaft outer diameter | | ③ | ④ | Nut diameter | | ⑤ | ⑥ | Reference length of mounting section | | ⑦ |
|---|---|---|---|---|---|---|---|---|---|---|
| Above | Less | | | Above | Less | | | Above | Less | |
| - | 8 | 40 | 10 | - | 18 | 20 | 40 | - | 50 | 30 |
| 8 | 12 | 40 | 10 | 8 | 30 | 20 | 40 | 50 | 100 | 30 |
| 12 | 20 | 40 | 10 | 30 | 50 | 30 | 60 | 100 | 200 | 50 |
| 20 | 32 | 60 | 10 | 50 | 80 | 30 | 60 | 200 | 400 | 50 |
| 32 | 50 | 60 | 12 | 80 | 120 | 40 | 80 | | | |
| 50 | 80 | 60 | 14 | 120 | 150 | 40 | 80 | | | |
| 80 | 125 | 80 | 16 | 150 | 180 | 50 | 100 | | | |
| 125 | 200 | 80 | 18 | 180 | 250 | 50 | 100 | | | |
| | | | | 250 | 300 | 50 | 100 | | | |

| Screw shaft length \ Screw shaft outer diameter | | Above | - | 8 | 12 | 20 | 32 | 50 | 80 | 125 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 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 | 0.180 | 0.150 |
| 1600 | 2000 | | | | 1.000 | 0.690 | 0.460 | 0.320 | 0.230 | 0.180 |
| 2000 | 2500 | | | | | 0.930 | 0.610 | 0.420 | 0.290 | 0.210 |
| 2500 | 3150 | | | | | 1.300 | 0.820 | 0.550 | 0.380 | 0.270 |
| 3150 | 4000 | | | | | | 1.100 | 0.750 | 0.500 | 0.340 |
| 4000 | 5000 | | | | | | 1.600 | 1.000 | 0.680 | 0.460 |
| 5000 | 6300 | | | | | | | 1.400 | 0.920 | 0.600 |
| 6300 | 8000 | | | | | | | 2.000 | 1.300 | 0.830 |
| 8000 | 10000 | | | | | | | | 1.800 | 1.100 |
| 10000 | 12500 | | | | | | | | 2.500 | 1.600 |

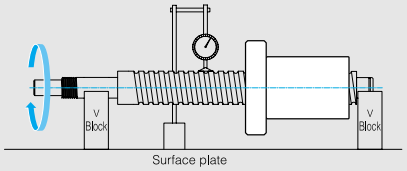
Ball Screw

Technical Data

## Measuring the Mounting Surface Accuracy

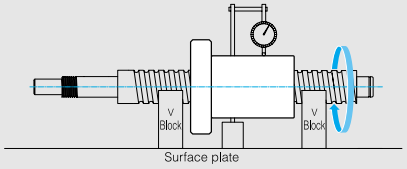
### (1) Overall Radial Runout of the Screw Shaft Axis

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.



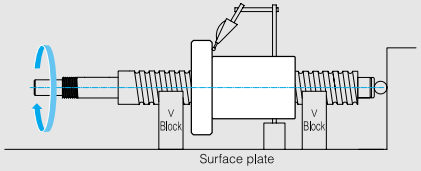

### (2) Radial Runout of the Nut Circumference according to the screw shaft Axis

Support the thread of the screw shaft with V blocks near the nut. Set a measuring instrument on the circumstance 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).



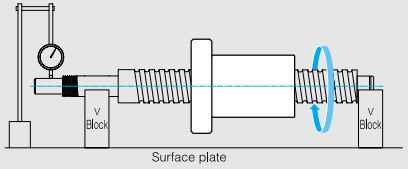

### (3) Perpendicularity of the Flange Mounting Surface of the screw shaft to the screw shaft axis

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.



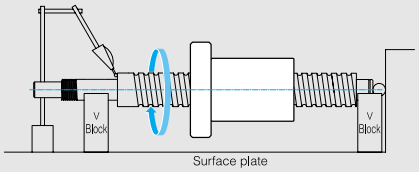

### (4) Runout of the Part Mounting section according to the Screw shaft

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.



### (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.

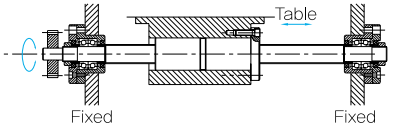




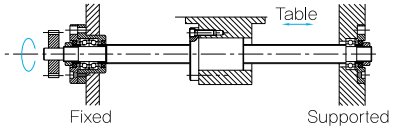

Ball Screw
Technical Data

## Mounting Method

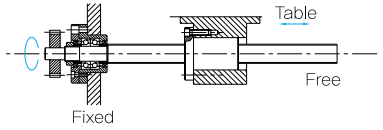
There four mounting methods for the Ball Screw. Select appropriate mounting method.
Permissible Axial load and numbers of rotation vary according to the mounting method.



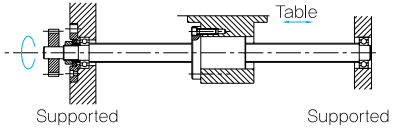

(Fixed - Fixed)




(Fixed - Supported)




(Fixed - Free)




(Supported - Supported)

### [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 |

Ball Screw

Technical Data

## Preload

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

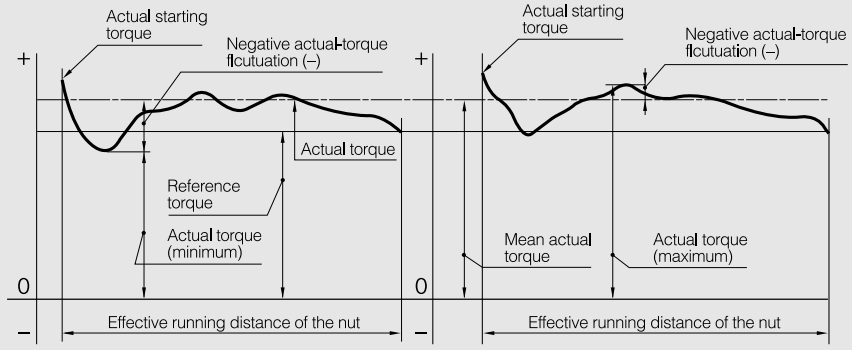
For a highly accurate positioning, a preload is generally provided.

### [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.

$$Tp = 0.05(\tan\beta)^{-0.5}\ \frac{Fao \cdot L}{2\pi}$$

Tp : Reference torque (N·mm)
β : Lead angle
Fao : 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 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4000m or less | | | | | | | | Above 4,000m and 10,000m or less | |
| | | Thread length / Screw shaft outer diameter ≤ 40 | | | | 40 < Thread length / Screw shaft outer diameter < 60 | | | | - | |
| | | 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% |

[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

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

$$Tp = 0.05(\tan\beta)^{-0.5}\ \frac{Fao \cdot L}{2\pi}$$

$$= 0.05 \times (0.0995)^{-0.5}\ \frac{2000 \times 10}{2\pi}$$

$$= 504.8\ N \cdot mm$$

β : Lead angle
L : Lead (=10mm)
dp : Ball circle diameter (=32mm)
Fao : Preload (=2000N)
Tp : The reference torque

## (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.

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





## 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.

$$\text{Buckling load (N)} = \frac{\eta_1 \cdot \pi \cdot 32 \cdot E \cdot I}{La^2} \times S$$

$$= \eta_2 \frac{dr^4}{La^2} 10^4$$

La : Distance between two mounting surfaces (mm)
E : Young's modulus ($2.06 \times 10^5$ N/mm²)
dr : Radius of curvature of the screw shaft (mm)
S : Safety factor (Normal 0.5)

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

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

| | | |
|---|---|---|
| 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]

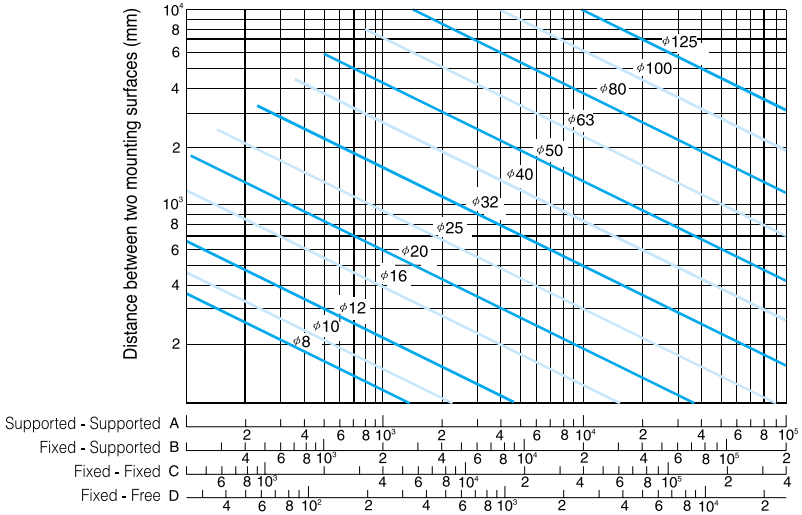
It is necessary to consider not only the buckling load but also the permissible tensile compressive load according to the yielding stress on the screw shaft.

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

σ : Permissible tensile compressive stress (N)
dr : Screw-shaft thread minor diameter (mm)

Ball Screw

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)

$$\text{Dangerous speed } (\text{min}^{-1}) = \frac{60 \cdot \lambda_1^2 \cdot I}{2\pi \cdot La^2} \times \sqrt{\frac{E \times 10^3 \cdot I}{\gamma \cdot A}} \times S$$

$$= \lambda_2 \frac{dr^4}{La^2} \cdot 10^7$$

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

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

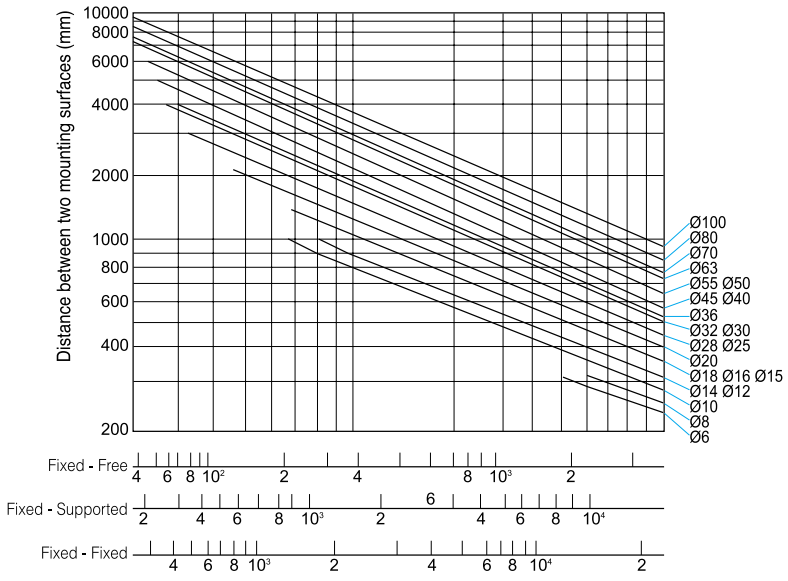
$$I = \frac{\pi}{64} dr^4$$

* A : Screw shaft cross-sectional area ($mm^2$)

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

* $\lambda_1$, $\lambda_2$ : 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 | : | $\lambda_1 = 4.73$ | $\lambda_2 = 21.9$ |




(Permissible rotational speed diagram)

## DN Value

The DN Value is the ball circle diameter multiplied by the rpm (revolutions per minute) ($min^{-1}$)

$$DN = D \times N$$

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

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

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)
Fa : Applied axial load
Ca : Basic dynamic load rating

### (2) Basic dynamic load rating : Ca ( kN)

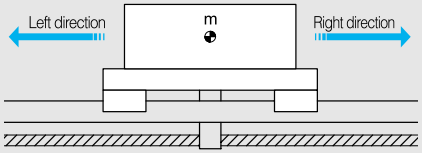
Basic dynamic load rating Ca is defined as load which is constant direction and volume, when operating one group of ball screw independently as L=106 under same condition.

### (3) Basic static load rating : Coa ( 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)

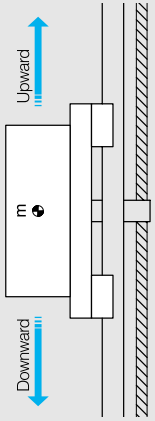
Axial load for left direction

Fa1(Acceleration : N) = $\mu$ · mg + f + ma
Fa2(Uniform motion : N) = $\mu$ · mg + f
Fa3(Deceleration : N) = $\mu$ · mg + f - ma

Axial load for right direction

Fa4(Acceleration : N) = $\mu$ · mg - f - ma
Fa5(Uniform motion : N) = $\mu$ · mg - f
Fa6(Deceleration : N) = $\mu$ · mg - f + ma

### [Vertical installation]




Axial load for upward

Fa1(Acceleration : N) = mg + f + ma
Fa2(Uniform motion : N) = mg + f
Fa3(Deceleration : N) = mg + f - ma

Axial load for downward

Fa4(Acceleration : N) = mg - f - ma
Fa5(Uniform motion : N) = mg - f
Fa6(Deceleration : N) = mg - f + ma

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

Ball Screw

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.

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

- $F_{a\ max.}$ : Max permissible axial load (kN)
- Coa : Basic static load rating (kN)
- fs : Safety factor

| 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 |

## 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

| Vibrations / Impact | Speed (V) | Load factor $f_w$ |
|---|---|---|
| Faint | Very low<br>$V \leqq 0.25$ m/s | 1 ~ 1.2 |
| Weak | Slow<br>$0.25 < V \leqq 1.0$ m/s | 1.2 ~ 1.5 |
| Medium | Medium<br>$1.0 < V \leqq 2.0$ m/s | 1.5 ~ 2.0 |
| Strong | High<br>$V > 2.0$ m/s | 2.0 ~ 3.5 |

### [Calculating life time]

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

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

- 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

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.

$$Fm = \sqrt{\frac{(F_{a1}{}^6L_1 + F_{a2}{}^3L_2 + .... + F_{an}{}^3L_n)}{L}}$$

- 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]

Tt = T1 + T2 +T4

- 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]

Tk = Tt + T3

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

### [During deceleration]

Tg = Tt - T3

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

### ❶ Frictional torque by external load

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

$$T1 = \frac{Fa \cdot Ph}{2\pi \cdot \eta} \times A$$

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

Ball Screw

Technical Data

❷ Frictional torque by ball screw preload

$$T2 = Td \times A$$

| | | |
|---|---|---|
| T2 | : | Preload torque of ball screw (N·mm) |
| Td | : | Preload torque of ball screw (※ See the preload page) |
| A | : | Reduction ratio |

❸ Torque for acceleration

$$T3 = J \times \omega \times 10^3$$

| | | |
|---|---|---|
| T3 | : | Torque for acceleration (N·mm) |
| J | : | Inertia moment (kg.m²) |
| ω | : | 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 (ω)

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

| | | |
|---|---|---|
| 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]

❶ 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

❷ 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)

❸ 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 pear 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.

$$T_{rms} = \sqrt{\frac{(T1^2 \cdot t1 + T2^2 \cdot t2 + T3^2 \cdot t3)}{t}}$$

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

Ball Screw

Technical Data

[In case of using a stepping motor]

❶ Calculating minimum step angle

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

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

❷ 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)

❸ Calculating motor torque

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

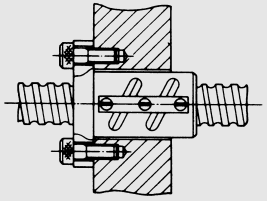
[Cautions for selecting motor]

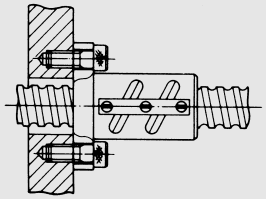
When calculating required torque and pulse speed for selecting motor, the applied capacity of motor should be doubled for safety.

## Precautions when mounting ball screw

[Nut bracket design]

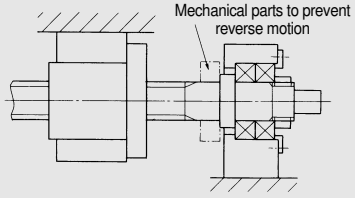
In case of deflector, return tube types have projected part on nut itself, therefore the nut bracket should be designed in accordance with nut type.





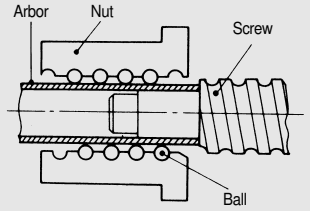
[End machining and designing nut environment]

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

Technical Data



## Safety Design

[Lubrication]

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

### (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. |

### (2) Class of oil

| Lubricant | Class |
|---|---|
| Oil | Turbine oil ISOVG32 ~ 68 |

### (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.

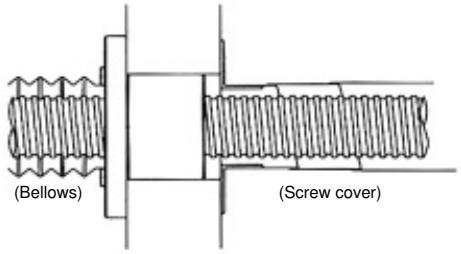
- When planning to use a special lubricant, contact SBC before using it.

Ball Screw

Technical Data

## Safety design for dust proof

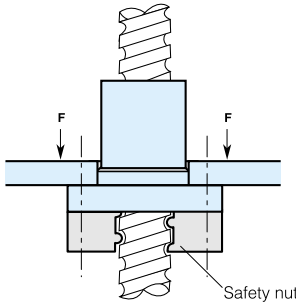
Ball screws have recirculating steel balls inside. Debris and other foreign objects such as cutting chips can damage the nut. Typically a seal is a standard part of the nut but if it is not available, please consider another method of protecting the nut for debris such as bellows.




### [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.

(Installation of a safety nut)




## 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

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

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

❸ Contact SBC for surface treatments.

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

## SBC Precision Rolled Ball Screw

SBC Precision Rolled Ball Screw

### Ordering Example

[Nut Only Part Numbers]

**32 20 SLK – S**
[1] [2] [3] [4]

[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] [2] [3]

[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] [2] [3] [4] [5] [6] [7]

[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)

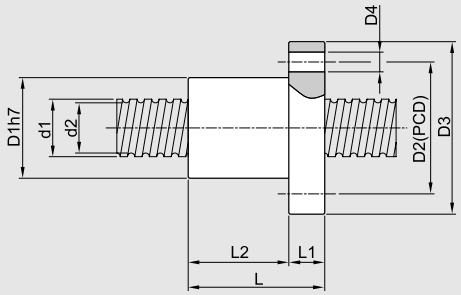
※ A screw-nut assembly is recommended if high accuracy or rigidity is required.
※ For surface treatment, mark the type of surface treatment.
※ If end machining is required, please attach a drawing.
※ Refer to the specifications for the Accuracy.
※ MBS type can only be ordered as a screw-nut assembly.

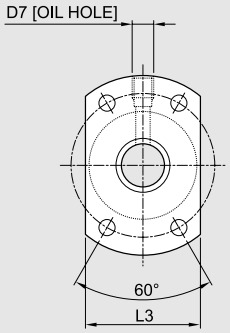
Ball Screw

## SBC Precision Rolled Ball Screw

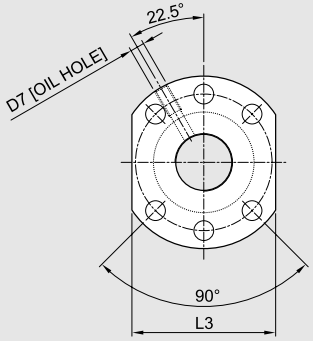
SBC Precision Rolled Ball Screw

### STK/STC Precision Rolled Ball Screw STK/STC Type

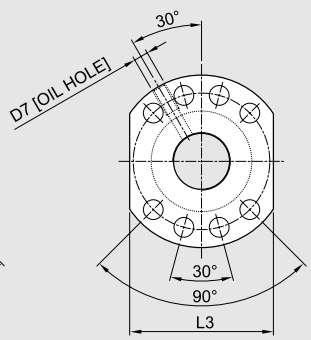



[STK1605~4010]




[STC2510]




[STK5010~8010]

(Unit : mm)

| 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 |
|---|---|---|---|---|---|---|---|---|---|
| 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 |

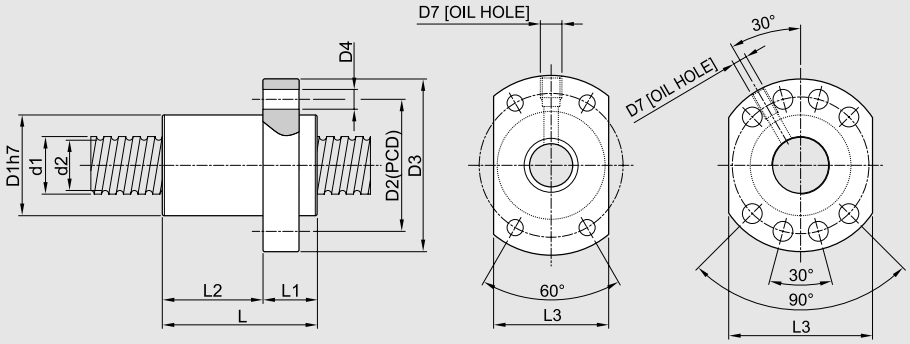
| D4 | D7 | L | L1 | L2 | L3 | Ca [kN] | Coa [kN] | Max. Length |
|---|---|---|---|---|---|---|---|---|
| 4.5 | M6x1 | 45 | 10 | 35 | 40 | 7.5 | 12.1 | 3000 |
| 4.5 | M6x1 | 53 | 10 | 43 | 46 | 11.0 | 23.3 | 4000 |
| 5.5 | M6x1 | 53 | 10 | 43 | 50 | 12.5 | 30.4 | 5000 |
| 9 | M6x1 | 85 | 15 | 70 | 72 | 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 |

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

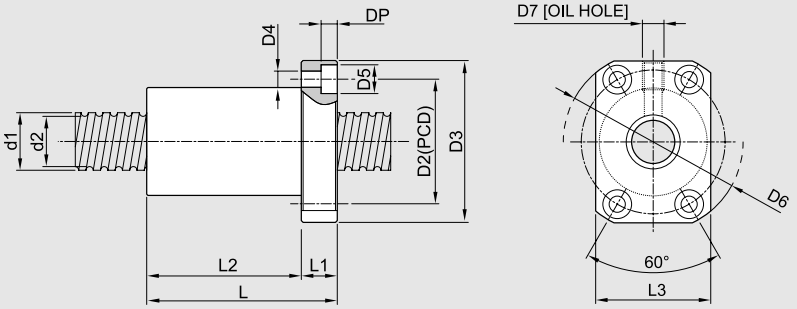
Ball Screw

## SBC Precision Rolled Ball Screw
SBC Precision Rolled Ball Screw

### SLK Long Lead Rolled Ball Screw




[SLK1610~3232, 4040, 5050] [SLK4020, 5020]




[SLK1520, 2010]

(Unit : mm)

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

| 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 |

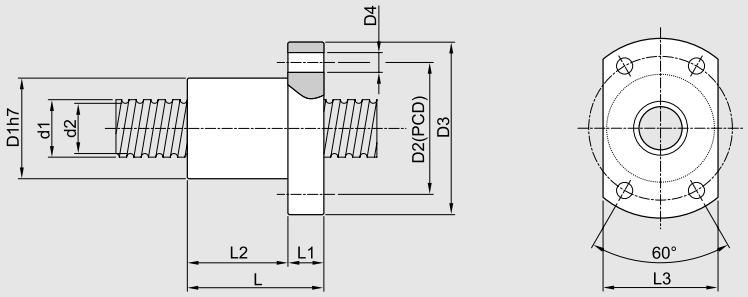
❶ Ca (Basic Dynamic load rating), Coa (Basic static load rating)

Ball Screw

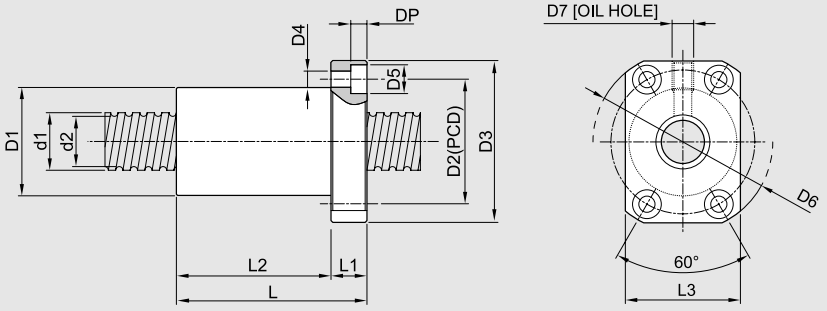
## SBC Precision Rolled Ball Screw

SBC Precision Rolled Ball Screw

### MBS Miniature Rolled Ball Screw




[MBS0601~1205]




[MBS1210]

(Unit : mm)

| 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 |

| 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 |

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

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

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

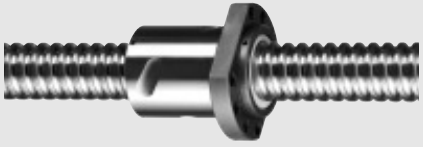
The thread form is finish ground to provide high rigidity, high accuracy and smooth motion.

#### (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

## DIN Standard SBC Precision Rolled Ball Screw

DIN Standard SBC Precision Rolled Ball Screw

### Ordering Example

[The Nut Ordering]

**20 05 DK – S**
[1] [2] [3] [4]

[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] [2] [3]

[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] [2] [3] [4] [5] [6] [7]

[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)

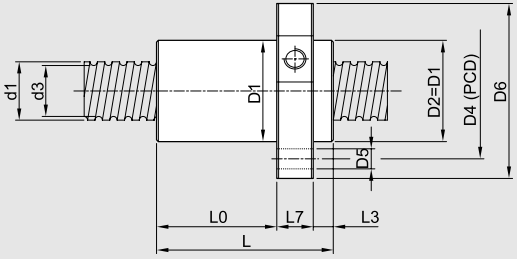
※ A screw-nut assembly is recommended if high accuracy or rigidity is required.
※ For surface treatment, mark the type of surface treatment.
※ If end machining is required, please attach a drawing.
※ Refer to the specifications for the Accuracy.

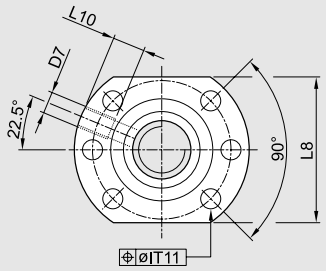
Ball Screw

## DIN Standard SBC Precision Rolled Ball Screw

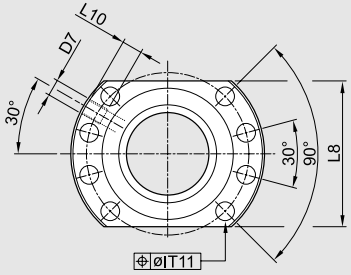
DIN Standard SBC Precision Rolled Ball Screw

### DK Type Precision Rolled Ball Screw




[DK1605~3210]




[DK4005~8010]

(Unit : mm)

| 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 |

| 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 m²/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 |

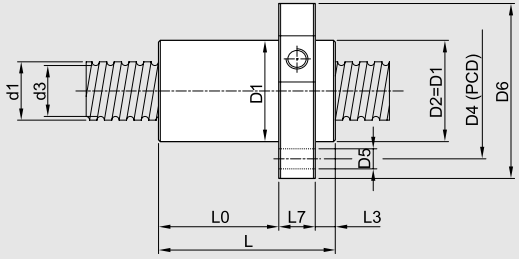
❶ Ca (Basic Dynamic load rating), Coa (Basic static load rating)

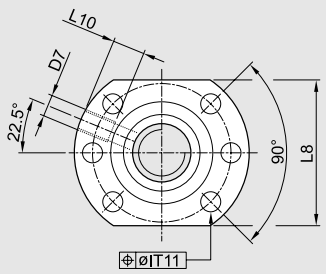
Ball Screw

## DIN Standard SBC Precision Rolled Ball Screw

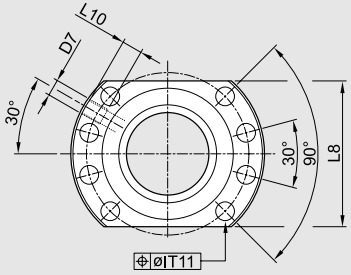
DIN Standard SBC Precision Rolled Ball Screw

### DH Type Long Lead Rolled Ball Screw




[DH2020~3220]




[DH4020~8020]

(Unit : mm)

| 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 |

| 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 m²/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 |

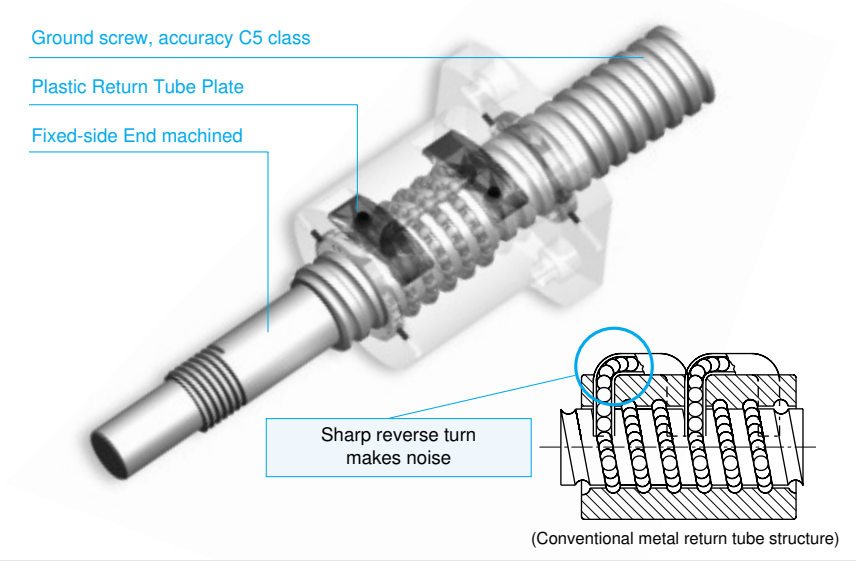
❶ Ca (Basic Dynamic load rating), Coa (Basic static load rating)

Ball Screw

## Ground Ball Screw for FA- SFA Series

Ground Ball Screw for FA- SFA Series

SFA ground ball screws have fixed-end machining with reasonable price and high accuracy.




(Conventional metal return tube structure)

### [Resin return tube plate]

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

### Products

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 | | |
| | | | 1000 | | |
| SFA1520 | 15 | 20 | 500 | P2 | C5 |
| | | | 700 | | |
| | | | 1000 | | |
| SFA2010 | 20 | 10 | 700 | P2 | C5 |
| | | | 1000 | | |
| | | | 1200 | P1 | C7 |
| SFA2020 | 20 | 20 | 700 | P2 | C5 |
| | | | 1000 | | |
| | | | 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.

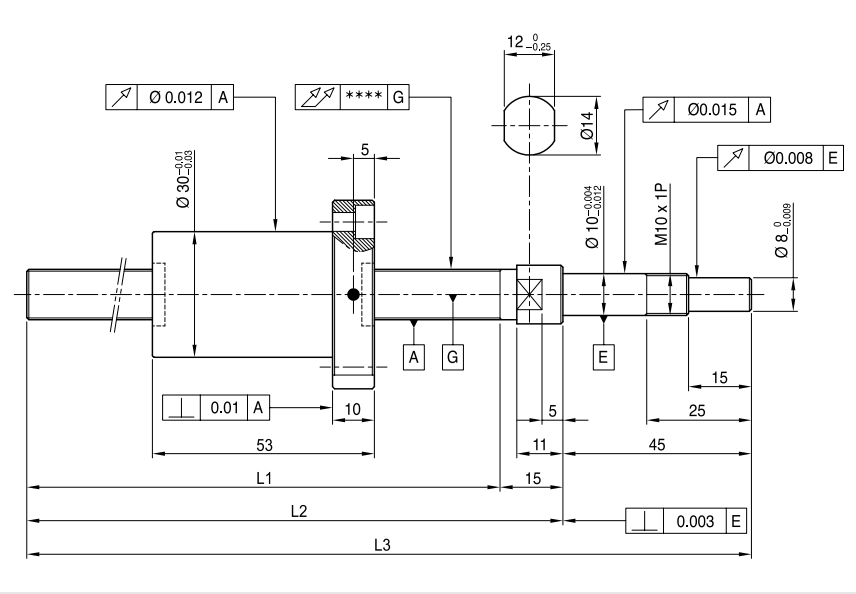
※ Contact SBC for higher preload.

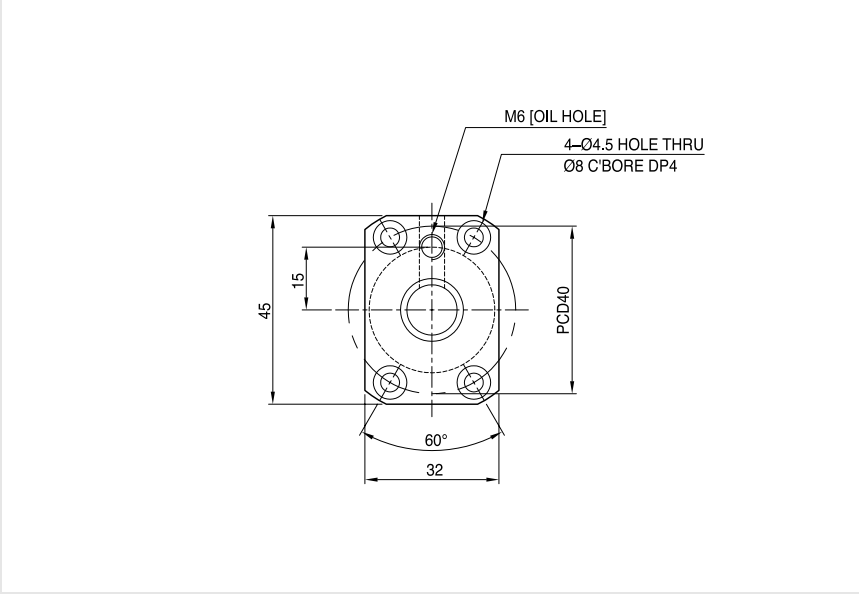
Ball Screw

## 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] [2] [3] [4]

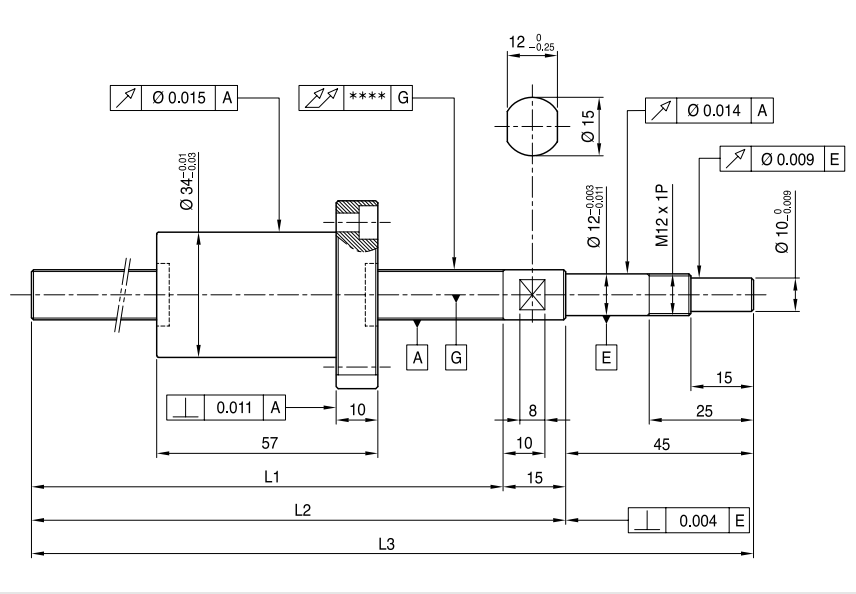
[1] Model No.
[2] Preload
[3] Length
[4] Accuracy

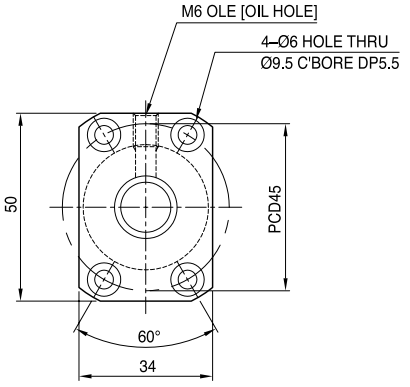
Ball Screw

## 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]

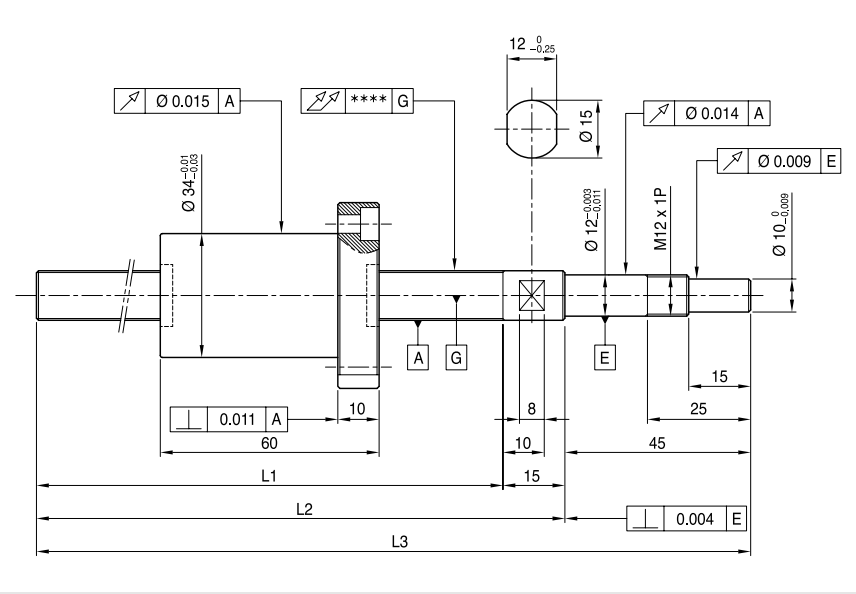
[1] Model No.
[2] Preload
[3] Length
[4] Accuracy

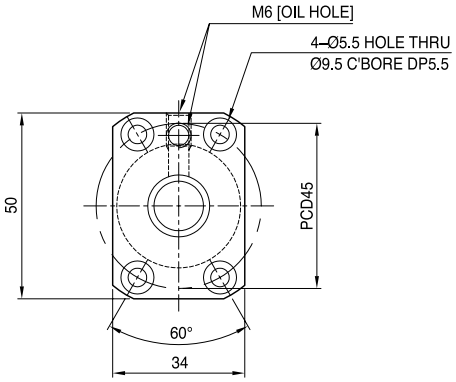
Ball Screw

## 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 |

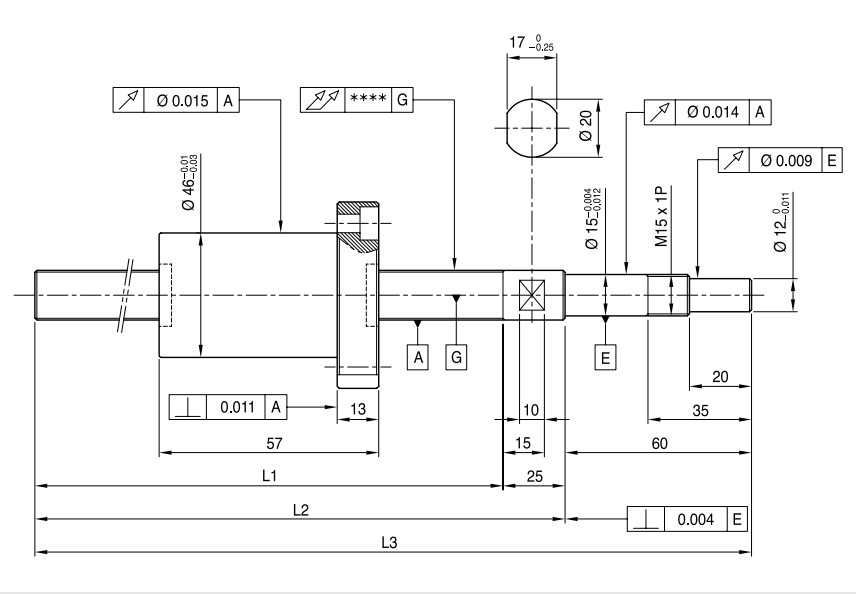
| | |
|---|---|
| Ball circle diameter | 15.5 |
| Diameter x lead | 15 x 20 |
| Ball Diameter | 3.175 |
| Thread direction | RIGHT |
| No. of circuits | 1.8 x 1 |
| Lead Angle | 22.33° |
| Accuracy | C5 (0.018) |
| Preload | 0.37 (kN) |
| Basic dynamic load rating (Ca) | 5.68 (kN) |
| Basic static load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

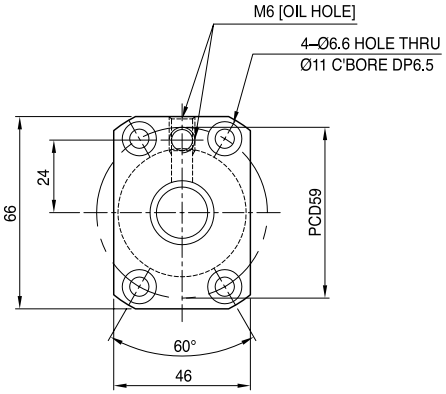
### Ordering

**SFA1520 – P2 – 500 – C5**
[1] [2] [3] [4]

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

## 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]

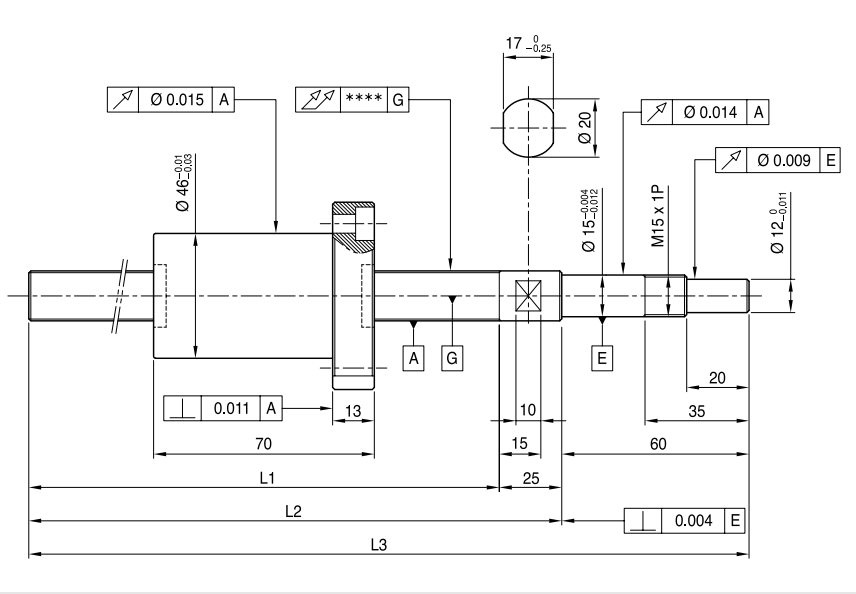
[1] Model No.
[2] Preload
[3] Length
[4] Accuracy

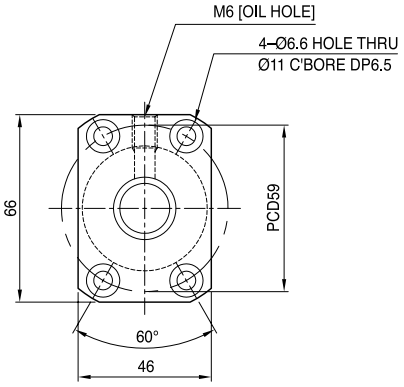
Ball Screw

## 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