

# Ball screws

Technical Information



Gold National Award of Excellence 2005

### Ballscrew

- For Heavy-Load Drive



The National Award of Excellence 2004

### Intelligent Linear Guideway



Gold National Award of Excellence 2004

### Linear Synchronous Motor

- Coreless Type (LMC)
- Iron-core Type (LMS)



The National Award of Excellence 2002

### Linear Actuator

- LAN for Hospital
- LAM for Industrial
- LAS Compact Size
- LAK Controller



Gold National Award of Excellence 2003

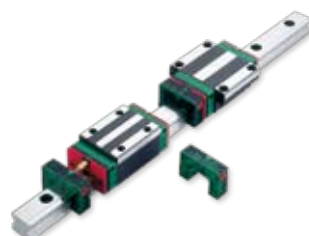
### Robot Series

- For Semiconductor & Electronic (KK Series)
- For Automation (KS, KA Series)



Silver National Award of Excellence 2006

### TMS Direct-Driven Positioning System



Silver National Award of Excellence 2002

### Linear Guideway

- HG/EG/RG/MG Type
- Self-Lubricating (E2)
- Low Noise (Q1)
- Air Jet (A1)



### Positioning Measurement System



Silver National Award of Excellence 1993, 2001, 2006

### Ballscrews

- Ground/Rolled
- High Speed (High Dm-N Value/Super S Series)
- Heavy Load (Cool type II)
- Self-Lubricating (E2)
- Rotating Nut (R1)



### Linear Motor X-Y Stage



### Motor Driver



### Linear Motor Gantry





# Ballscrews

## Technical Information Index

|  |     |
|--|-----|
| <b>1. Introduction</b>                                       | 1   |
| <b>2. Feature &amp; Application</b>                          | 1   |
| 2.1 Features   | 1   |
| 2.2 Applications   | 4   |
| <b>3. Classification of Standard Ballscrew</b>               | 5   |
| 3.1 Standard Ballscrew Spindle                               | 5   |
| 3.2 Nut Configuration  | 5   |
| 3.3 Spindle End & Journal Configuration                      | 7   |
| <b>4. Design &amp; Selection of HIWIN Ballscrew</b>          | 9   |
| 4.1 Fundamental Concepts for Selection & Installation        | 9   |
| 4.2 Ballscrews Selection Procedure                           | 12  |
| 4.3 Accuracy Grade of Ballscrews                             | 12  |
| 4.4 Preload Methods  | 19  |
| 4.5 Calculation Formulas                                     | 21  |
| 4.6 Temperature Rise Effect on Ballscrews                    | 34  |
| <b>5. Specification Illustration</b>                         | 36  |
| <b>6. Precision Ground Ballscrews</b>                        | 37  |
| 6.1 Ground Ballscrew Series                                  | 37  |
| 6.2 Dimension for Precision Ground Ballscrew                 | 39  |
| 6.3 Miniature Ground Ballscrew                               | 70  |
| 6.4 End Machining Ground Ballscrew Series                    | 86  |
| 6.5 High Lead Ground Ballscrew                               | 125 |
| 6.6 Ultra High Lead Ground Ballscrew                         | 131 |
| <b>7. Rolled Ballscrews</b>                                  | 134 |
| 7.1 Introduction   | 134 |
| 7.2 Precision Rolled Ballscrews                              | 134 |
| 7.3 High Precision Rolled Ballscrews                         | 134 |
| 7.4 General Type of Rolled Ballscrews                        | 137 |
| 7.5 Dimension for Rolled Ballscrews                          | 138 |
| 7.6 Dimension for Stock Rolled Ballscrews                    | 145 |
| <b>8. Ballscrew Retrofit Kits for Manual Milling Machine</b> | 148 |
| <b>9. Multi-Solutions</b>                                    | 150 |

|  |            |
|--|------------|
| 9.1 E2 Self-lubricant .....  | 150        |
| 9.2 R1 Rotating Nut .....  | 153        |
| 9.3 High Load Drive .....  | 154        |
| 9.4 High Speed (High $D_m$ -N Value) .....   | 155        |
| 9.5 Cool Type .....  | 157        |
| 9.6 Super S Series .....   | 161        |
| <b>10. Supplement Information .....</b>  | <b>164</b> |
| A. Ballscrew Failure Analysis .....  | 164        |
| A1 Preface .....   | 164        |
| A2 The Causes and Precautions of Ballscrew Problems .....                          | 164        |
| A3 Locating the Cause of Abnormal Backlash .....                                   | 167        |
| B. Standard Housing Dimension Tolerance .....                                      | 168        |
| C. Stand Spindle Dimension Tolerance .....   | 169        |
| D. HIWIN Ballscrew Data Inquiry .....  | 170        |
| E. HIWIN Ballscrew Request Form .....  | 171        |
| (The specifications in this catalogue are subject to change without notification.) |            |



# 1

## Introduction

Ballscrews, also called a ball bearing screws, recirculating ballscrews, etc., consist of a screw spindle and a nut integrated with balls and the balls' return mechanism, return tubes or return caps. Ballscrews are the most common type of screws used in industrial machinery and precision machines. The primary function of a ballscrew is to convert rotary motion to linear motion or torque to thrust, and vice versa, with the features of high accuracy, reversibility and efficiency. HIWIN provides a wide range of ballscrews to satisfy your special requirements.

The combination of state-of-the-art machining technology, manufacturing experiences, and engineering expertise makes HIWIN ballscrew users "High-Tech Winners". HIWIN uses precise procedures to create exact groove profiles, either by grinding or precision rolling. Accurate heat treatment is also used to ensure the hardness of our ballscrews. These result in maximum load capacity and service life.

HIWIN precision ballscrews provide the most smooth and accurate movement, together with low drive torque, high stiffness and quiet motion with predictable lengthened service life. HIWIN rolled ballscrews also provide smooth movement and long life for general applications with less precision in lower price. HIWIN has modern facilities, highly skilled engineers, quality manufacturing and assembly processes, and uses quality materials to meet your special requirements.

It is our pleasure to provide you with the technical information and selection procedure to choose the right ballscrews for your applications through this catalogue.

# 2

## Technological Features of HIWIN Ballscrews

### 2.1 Characteristics of HIWIN Ballscrews

There are many benefits in using HIWIN ballscrews, such as high efficiency and reversibility, backlash elimination, high stiffness, high lead accuracy, and many other advantages. Compared with the contact thread lead screws as shown in (Fig. 2.1), a ballscrew add balls between the nut and spindle. The sliding friction of the conventional screws is thus replaced by the rolling motion of the balls. The basic characteristics and resultant benefits of HIWIN ballscrews are listed in more details as follows:

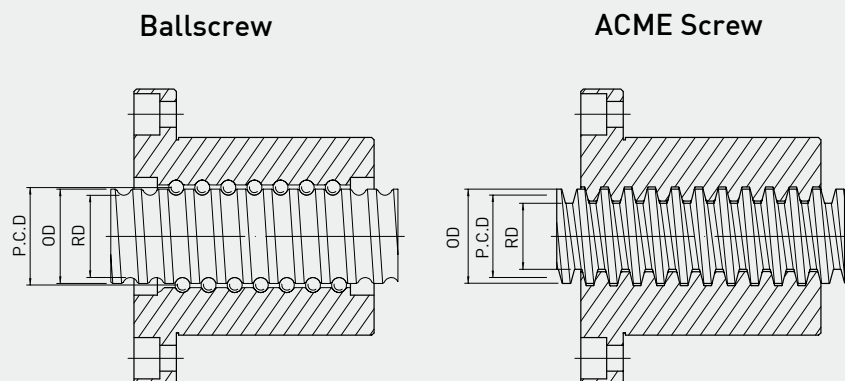


Fig 2.1 Basic configuration of ballscrews and contact thread lead screws

## (1) High efficiency and reversibility

Ball screws can reach an efficiency as high as 90% because of the rolling contact between the screw and the nut. Therefore, the torque requirement is approximately one third of that of conventional screws. It can be seen from Fig. 2.2 that the mechanical efficiency of ball screws are much higher than conventional lead screws.

HIWIN ball screws have super surface finish in the ball tracks which reduce the contact friction between the balls and the ball tracks. Through even contact and the rolling motion of the balls in the ball tracks, a low friction force is achieved and the efficiency of the ballscrew is increased. High efficiency renders low drive torque during ballscrew motion. Hence, less drive motor power is needed in operation resulting in lower operation cost.

HIWIN uses a series of test equipment and testing procedures to guarantee the efficiency.

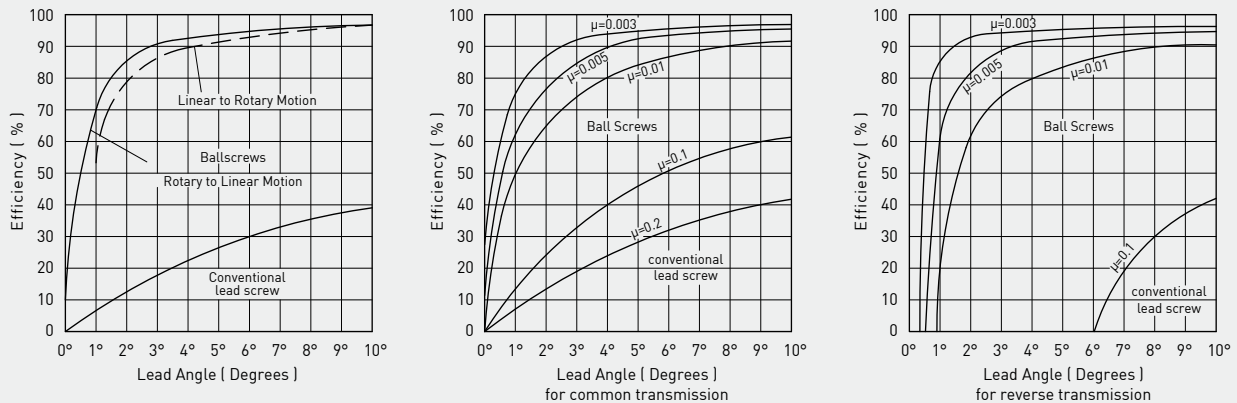


Fig 2.2 Mechanical efficiency of ballscrews

## (2) Backlash elimination and high stiffness

Computer Numerically Controlled (CNC) machine tools require ballscrews with zero axial backlash and minimal elastic deformation (high stiffness). Backlash is eliminated by our special designed Gothic arch form balltrack (Fig. 2.3) and preload.

In order to achieve high overall stiffness and repeatable positioning in CNC machines, preloading of the ballscrews is commonly used. However, excessive preload increases friction torque in operation. This induced friction torque will generate heat and reduce the life expectancy. With our special design and fabrication process, we provide optimized ballscrews with no backlash and less heat losses for your application.

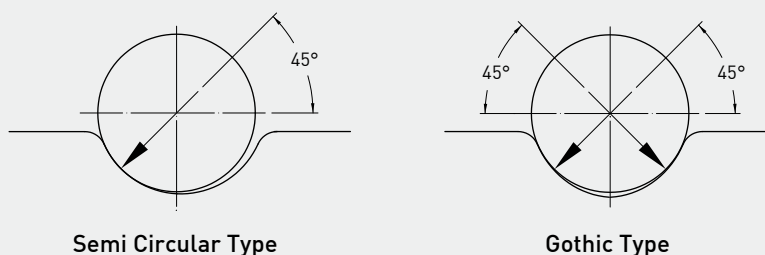


Fig2.3 Typical contact types for ballscrews

## (3) High lead accuracy

For applications where high accuracy is required, HIWIN modern facilities permit the achievement of ISO, JIS and DIN standards or specific customer requirements.

This accuracy is guaranteed by our precise laser measurement equipment and reported to each customer.

## (4) Predictable life expectancy

Unlike the useful life of conventional screws which is governed by the wear on the contact surfaces, HIWIN's ballscrews can usually be used till the metal fatigue. By careful attention to design, quality of materials, heat treatment and manufacture, HIWIN's ballscrews have proved to be reliable and trouble free during the period of expected service.

life. The life achieved by any ballscrew depends upon several factors including design, quality, maintenance, and the major factor, dynamic axial load (C).

Profile accuracy, material characteristics and the surface hardness are the basic factors which influence the dynamic axial load.

It is recommended that the life at average axial load should be a minimum of  $1 \times 10^6$  revs). High quality ballscrews are designed to conform with the B rating (i.e. 90% probability of achieving the design life). Fifty percent of the ballscrews can exceed 2 to 4 times of the design life.

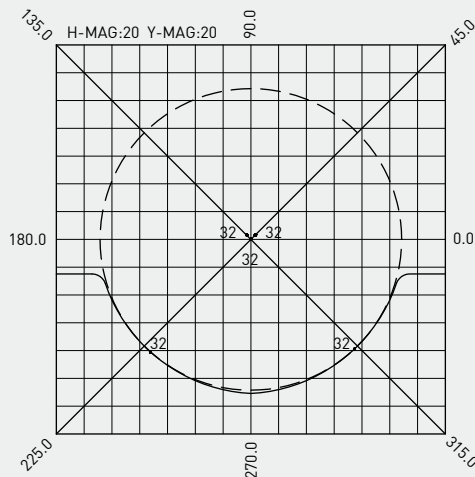
## (5) Low starting torque and smooth running

Due to metal to metal contact, conventional contact thread lead screws require high starting force to overcome the starting friction. However, due to rolling ball contact, ballscrews need only a small starting force to overcome their starting friction.

HIWIN uses a special design factor in the balltrack (conformance factor) and manufacturing technique to achieve a true balltrack. This guarantees the required motor torque to stay in the specified torque range.

HIWIN has special balltrack profile tracing equipment to check each balltrack profile during the manufacturing process. A sample trace is shown in Fig. 2.4.

HIWIN also uses computer measurement equipment to accurately measure the friction torque of ballscrews. A typical distance-torque diagram is shown in Fig. 2.5.



Work name : S.H

Measure node: X pitch

Model No. : 001H-2-3

Pick up radius: 0.0256mm

Lot No. : 201536

Horizontal mag: 20.0000

Operator : L.J.F.

Vertical mag: 20.0000

Comment :

Measure length: 7.0000 mm

Measure pitch: 0.0030 mm

No. code symbol actual

32 292 X: 0.1816 mm Z: 0.1980 mm RC : 3.4438 mm

32 292 X: -0.1911 mm Z: 0.2022 mm RC : 3.4532 mm

32 292 X: -2.1464 mm Z: -2.3399 mm A : -42.5259 mm

32 292 X: 2.1799 mm Z: -2.3084 mm A : 43.3615 mm

32 292 X: -0.0000 mm Z: -0.0000 mm RC : 3.1750 mm

\*Original point set

Fig 2.4 Balltrack checking by HIWIN profile tracer

## HIWIN Ball Screw Torque Test Report

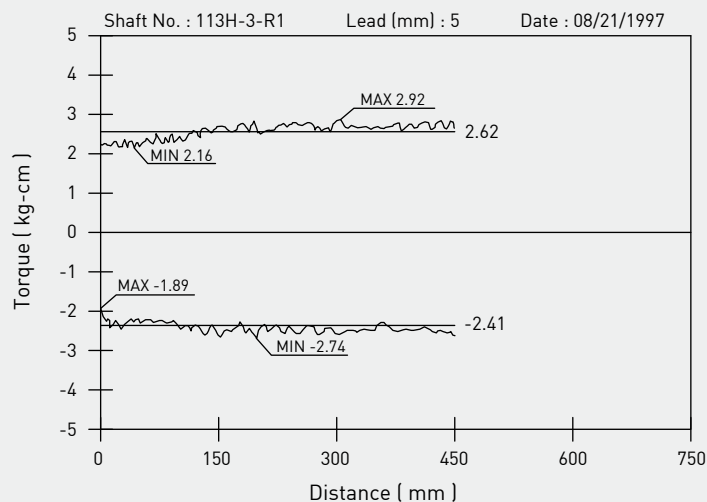


Fig 2.5 HIWIN preload checking diagram

## (6) Quietness

High quality machine tools require low noise during fast feeding and heavy load conditions.

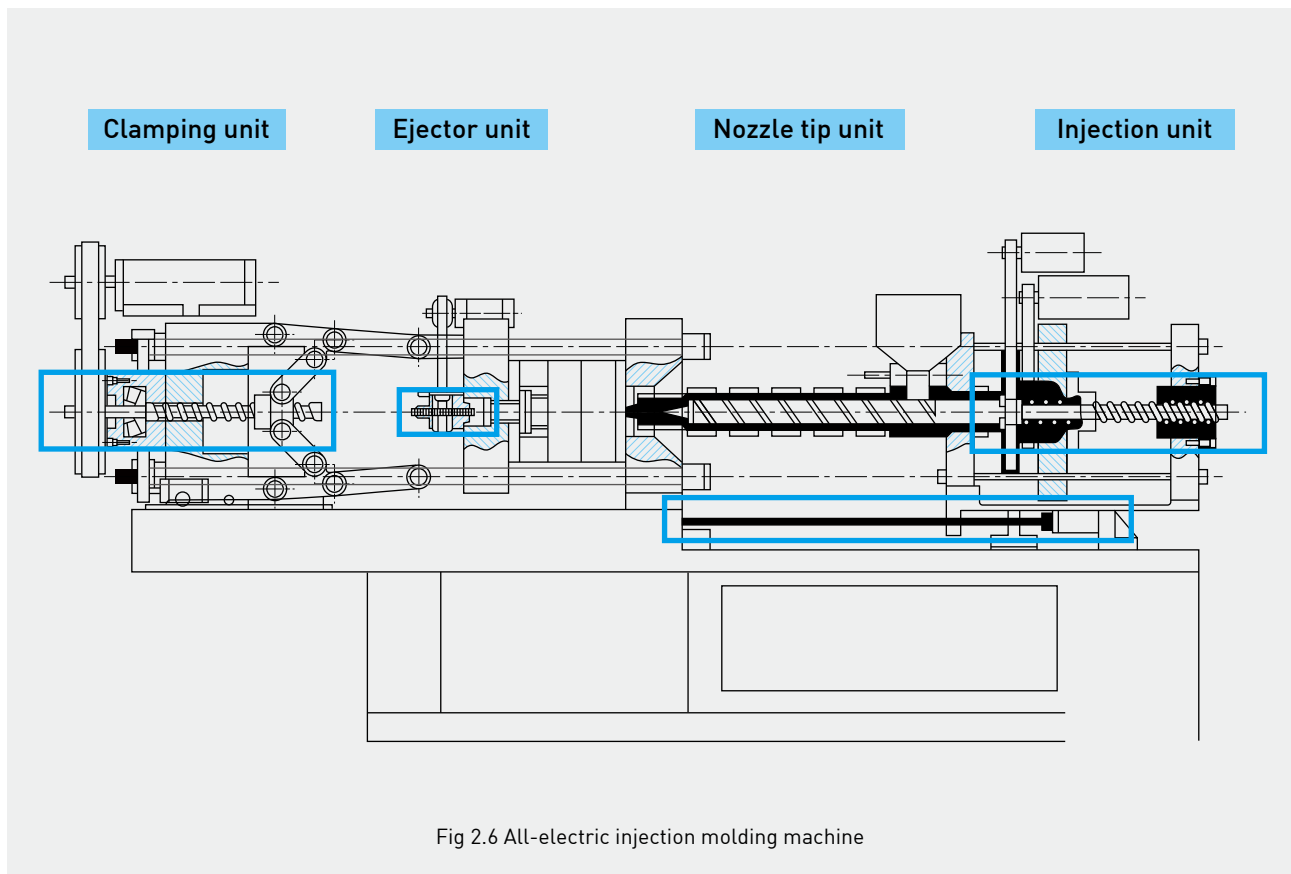
HIWIN achieves this by virtue of its return system, balltrack designs, assembly technique, and careful control of surface finish and dimensions.

## (7) Short lead time

HIWIN has a fast production line and can stock ballscrews to meet short lead times.

## (8) Advantages over hydraulic and pneumatic actuators

The ballscrew used in an actuator to replace the traditional hydraulic or pneumatic actuator has many advantages, i.e. fast response, no leakage, no filtering, energy savings and good repeatability.



## 2.2 Applications for Ballscrews

HIWIN ballscrews are used in the following fields and the recommended application grade can be found in Table 4.5.

1. **CNC machinery** : CNC machine center, CNC lathe, CNC milling machine, CNC EDM, CNC grinder, wire cutting machine, boring machine, etc.
2. **Precision machine tools** : Milling machine, grinder, EDM, tool grinder, gear manufacturing machine, drilling machine, planer, etc.
3. **Industrial machinery** : Printing machine, paper-processing machine, automatic machine, textile machine, drawing machine, special purpose machine, injection molding machine, etc.
4. **Electronic machinery** : Robot measuring instrument, X-Y table, medical equipment, surface mounting device, semi-conductor equipment, factory automation equipment, etc.
5. **Transport machinery** : Material handling equipment, elevated actuator, etc.
6. **Aerospace industry** : Aircraft flaps, thrust open-close reverser, airport loading equipment, fin actuator, etc.
7. **Miscellaneous** : Antenna leg actuator, valve operator, etc.

## 3 Classification of Standard Ballscrews

### 3.1 Standard Ballscrew Spindle

HIWIN recommends our standard regular ballscrews for your design. However, high lead, miniature or other special types of ballscrews, may also be available upon your request. Table 3.1 shows the standard ballscrew spindles which are available.

### 3.2 Nut Configuration

#### (1) Type of return tube design

HIWIN ballscrews have three basic ball recirculation designs. The first, called the external recirculation type ballscrew, consists of the screw spindle, the ball nut, the steel balls, the return tubes and the fixing plate. The steel balls are introduced into the space between the screw spindle and the ball nut. The balls are diverted from the balltrack and carried back by the ball guide return tube form a loop. Since the return tubes are located outside the nut body, this type is called the external recirculation type ballscrew Fig. 3.1.

The second design, called the internal recirculation type ballscrew, consists of the screw spindle, the ball nut, the steel balls and the ball return caps. The balls make only one revolution around the screw spindle. The circuit is closed by a ball return cap in the nut allowing the balls to cross over adjacent ball tracks. Since the ball return caps are located inside the nut body, this is called the internal recirculation type ballscrew Fig. 3.2.

The third design is called endcap recirculation type ballscrew Fig.. 3.3.

The basic design of this return system is the same as the external recirculation type nut Fig. 3.4 except that the return tube is made inside the nut body as a through hole. The balls in this design traverse the whole circuit of the balltracks within the nut length. Therefore, a short nut with the same load capacity as the conventional design can be used.

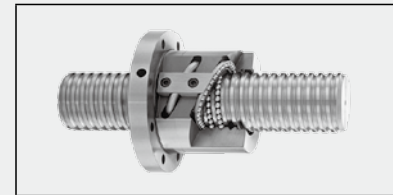


Fig3.1 External recirculation type nut with return tubes

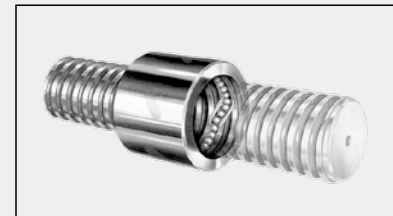


Fig3.2 Internal recirculation type nut with return caps

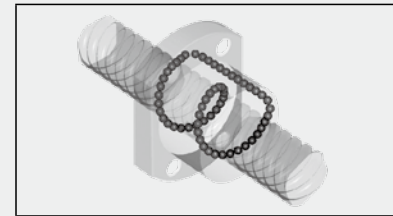


Fig3.3 Endcap recirculation type nut with return system

Table 3.1: HIWIN standard ballscrew spindle and lead

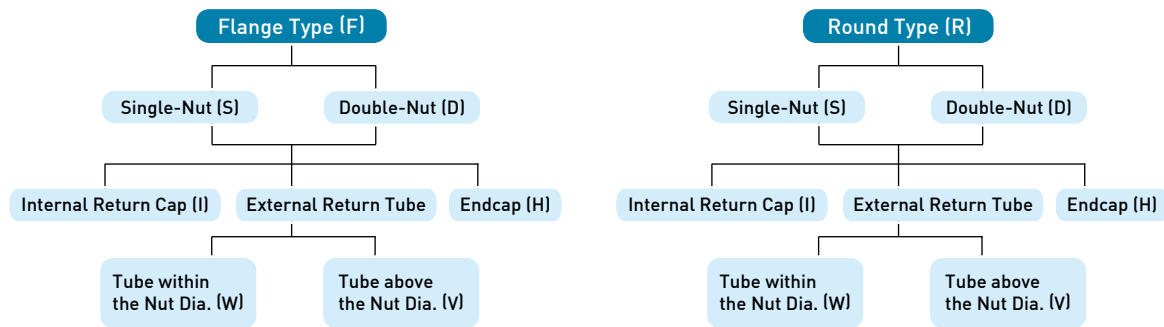
unit : mm

| Type         | Miniature |     |   |     |   | Regular |   |      |   |      |   |      |   | High lead |    |      |    | Super High Lead |    |    |      |    |    |    |  |
|--------------|-----------|-----|---|-----|---|---------|---|------|---|------|---|------|---|-----------|----|------|----|-----------------|----|----|------|----|----|----|--|
| lead<br>dia. | 1         | 1.5 | 2 | 2.5 | 3 | 3.175   | 4 | 4.23 | 5 | 5.08 | 6 | 6.35 | 8 | 10        | 12 | 12.7 | 16 | 20              | 24 | 25 | 25.4 | 32 | 40 | 50 |  |
| 6            | G         | G   | G |     |   |         |   |      |   |      |   |      |   |           |    |      |    |                 |    |    |      |    |    |    |  |
| 8            | G         | G   | G | G   |   |         |   |      |   |      |   |      | G |           |    |      |    |                 |    |    |      |    |    |    |  |
| 10           | G         | G   | G | G   |   |         | G |      |   |      |   |      |   | G         |    |      |    |                 |    |    |      |    |    |    |  |
| 12           |           | G   | G | G   |   |         | G |      | G |      |   |      |   | G         |    |      |    |                 |    |    |      |    |    |    |  |
| 15           |           |     |   |     |   |         |   |      |   |      |   |      |   | G         |    |      |    | G               |    |    |      |    |    |    |  |
| 16           |           |     | G | G   |   |         | G |      | G | G    |   |      | G | G         |    |      | G  |                 |    |    |      | G  |    |    |  |
| 20           |           |     | G | G   |   |         | G |      | G | G    | G |      |   | G         |    |      | G  | G               |    |    |      |    | G  |    |  |
| 22           |           |     |   |     |   |         |   |      | G | G    |   |      |   |           |    |      |    |                 |    |    |      |    |    |    |  |
| 25           |           |     |   | G   |   |         | G |      | G | G    | G | G    | G | G         |    | G    | G  | G               |    | G  |      |    |    | G  |  |
| 28           |           |     |   |     |   |         |   | G    | G | G    | G | G    |   | G         |    |      |    |                 |    |    |      |    |    |    |  |
| 32           |           |     |   |     |   | G       | G |      | G | G    | G | G    | G | G         | G  | G    |    | G               |    | G  | G    | G  |    |    |  |
| 36           |           |     |   |     |   |         |   |      | G |      | G |      | G | G         | G  |      |    |                 |    |    |      |    |    |    |  |
| 40           |           |     |   | G   | G |         | G |      | G | G    | G | G    | G | G         | G  | G    | G  | G               |    | G  |      |    | G  | G  |  |
| 45           |           |     |   |     |   |         |   |      | G | G    |   |      |   | G         | G  |      |    |                 |    |    |      |    |    |    |  |
| 50           |           |     |   |     |   |         |   |      | G | G    | G | G    | G | G         | G  | G    |    | G               |    | G  |      |    | G  | G  |  |
| 55           |           |     |   |     |   |         |   |      |   |      |   |      | G | G         | G  | G    |    |                 |    |    |      |    |    |    |  |
| 63           |           |     |   |     |   |         |   |      |   |      |   | G    | G | G         | G  | G    | G  | G               |    |    | G    |    | G  | G  |  |
| 70           |           |     |   |     |   |         |   |      |   |      |   |      |   | G         | G  |      |    |                 | G  |    |      |    |    |    |  |
| 80           |           |     |   |     |   |         |   |      |   |      |   |      |   | G         | G  | G    | G  | G               |    |    |      |    |    |    |  |
| 100          |           |     |   |     |   |         |   |      |   |      |   |      |   |           | G  |      | G  | G               |    |    |      |    |    |    |  |

\*G : Precision ground grade ballscrews, either left-hand or right-hand screws are available.

## (2) Type of nuts

The type of nuts to select depends on the application requirements. HIWIN standard nuts are classified by three letters as follows (see also Chapter 5 for details):



\* Other types of nut shape can also be made upon your design.

- The special high-lead double-start nut is classified by adding D in front of the above three letters.
- The compression preload nut is classified by adding P in front of the above three letters.
- The offset pitch preload single nut is classified by adding O in front of the above letters.

Examples :

**RDI** means round type, double nut with internal return caps.

**FSW** means flange type, single nut with external return tube within the nut diameter.

**DFSV** means two-start, flange, single nut with external return tube above the nut diameter.

## (3) Number of circuits

The HIWIN nomenclature for the number of circuits in the ballnut is described as follows:

**For the external type design:**

- A : 1.5 turns per circuit
- B : 2.5 turns per circuit
- C : 3.5 turns per circuit
- D : 4.5 turns per circuit
- E : 5.5 turns per circuit

**For the internal type design:**

- T : 1.0 turn per circuit

**For end cap type design:**

- U : 2.8 turns per circuit (high lead)
- S : 1.8 turns per circuit (super high lead)
- V : 0.7 turns per circuit (extra high lead)

**For Super S Series:**

- K : 1 turn per circuit

Example :

**B2** : designates 2 external return tube ball circuits. Each circuit has 2.5 turns.

**T3** : designates 3 internal return ball circuits. Each circuit has a maximum of 1 turn.

**S4** : designates 4 internal return ball circuits. Each circuit has 1.8 turns.

**K5** : designates 5 internal return ball circuits. Each circuit has 1 turn.

HIWIN recommends that number of circuits for the external type design be 2 for 2.5 or 3.5 turns ( that is, B2 or C2), and 3, 4 or 6 circuits for the internal type. Those shapes are shown in Fig. 3.4 and Fig. 3.5.

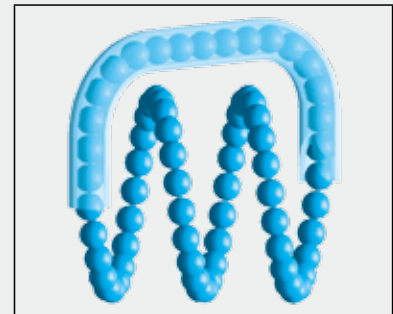


Fig 3.4 Circuit for external return tube

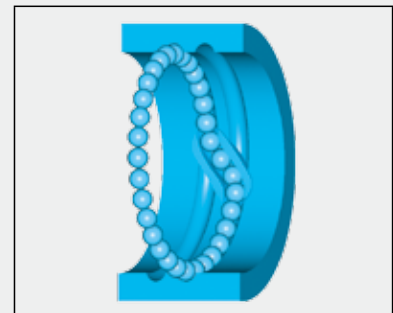


Fig 3.5 Circuit for internal return cap

### 3.3 Spindle End and Journal Configuration

#### Mounting methods

Bearing mounting methods on the end journals of ballscrews are crucial for stiffness, critical speed and column buckling load. Careful consideration is required when designing the mounting method. The basic mounting configuration are shown as follows Fig. 3.6.

#### Spindle end journal configurations

The most popular journal configurations are shown in Fig. 3.7.

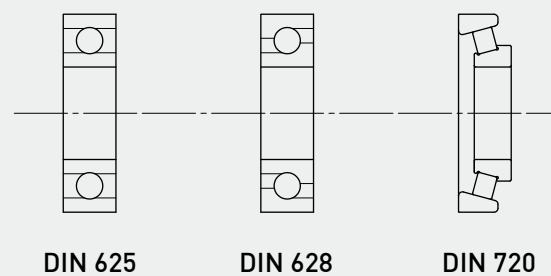
Table 3.2 lists the recommended dimensions and the bearings for the configurations of Fig. 3.7.

Table 3.2 Dimension for spindle ends

| Model | d1  | d5 | d6   | d7       | d8 | E  | L3 | L4 | L5  | L6  | L7   | L8  | L9  | L10 | L11 | L12 | L13 | bxt1     | Recommended Bearing  |                              |
|-------|-----|----|------|----------|----|----|----|----|-----|-----|------|-----|-----|-----|-----|-----|-----|----------|----------------------|------------------------------|
|       |     |    |      |          |    |    |    |    |     |     |      |     |     |     |     |     |     |          | I, II, III<br>DIN625 | III, IV, V<br>DIN625 628 720 |
| 10    | 10  | 8  | 7.6  | M8x0.75  | 6  | 6  | 16 | 7  | 29  | 26  | 0.9  | 39  | 50  | 56  | 18  | 10  | 12  | 3.0x1.8  | 608                  | 738B                         |
| 12    | 12  | 8  | 7.6  | M8x0.75  | 6  | 6  | 16 | 7  | 29  | 26  | 0.9  | 39  | 50  | 56  | 18  | 10  | 12  | 3.0x1.8  | 608                  | 738B                         |
| 14    | 14  | 10 | 9.6  | M10x0.75 | 8  | 8  | 20 | 9  | 37  | 34  | 1.15 | 45  | 54  | 62  | 20  | 10  | 14  | 3.0x1.8  | 6200                 | 7200BTVP                     |
| 16    | 16  | 12 | 11.5 | M12x1    | 10 | 8  | 21 | 10 | 41  | 38  | 1.15 | 46  | 56  | 66  | 20  | 10  | 14  | 4.0x2.5  | 6201                 | 7301BTVP                     |
| 20    | 20  | 15 | 14.3 | M15x1    | 12 | -  | 22 | 11 | 47  | 44  | 1.15 | 55  | 70  | 84  | 25  | 13  | 16  | 5.0x3.0  | 6202                 | 7202BTVP                     |
| 25    | 25  | 17 | 16.2 | M17x1    | 15 | -  | 23 | 12 | 49  | 46  | 1.15 | 56  | 72  | 86  | 25  | 13  | 16  | 5.0x3.0  | 6203                 | 7203BTVP                     |
| 28    | 28  | 20 | 19   | M20x1    | 16 | -  | 26 | 14 | 58  | 54  | 1.35 | 68  | 82  | 100 | 28  | 20  | 18  | 6.0x3.5  | 6204                 | 7602020TVP                   |
| 32    | 32  | 25 | 23.9 | M25x1.5  | 20 | -  | 27 | 15 | 64  | 60  | 1.35 | 79  | 94  | 116 | 36  | 22  | 26  | 7.0x4.0  | 6205                 | 7602025TVP                   |
| 36    | 36  | 25 | 23.9 | M25x1.5  | 20 | -  | 27 | 15 | 64  | 60  | 1.35 | 79  | 94  | 116 | 36  | 22  | 26  | 7.0x4.0  | 6205                 | 7602025TVP                   |
| 40    | 40  | 30 | 28.6 | M30x1.5  | 25 | -  | 28 | 16 | 68  | 64  | 1.65 | 86  | 102 | 126 | 42  | 22  | 32  | 8.0x4.0  | 6206                 | 7602030TVP                   |
| 45    | 45  | 35 | 33.3 | M35x1.5  | 30 | -  | 29 | 17 | 80  | 76  | 1.65 | 97  | 114 | 148 | 50  | 24  | 40  | 10.0x5.0 | 6207                 | 7602035TVP                   |
| 50    | 50  | 40 | 38   | M40x1.5  | 35 | -  | 36 | 23 | 93  | 88  | 1.95 | 113 | 126 | 160 | 60  | 24  | 45  | 12.0x5.0 | 6308                 | 7602040TVP                   |
| 55    | 55  | 45 | 42.5 | M45x1.5  | 40 | -  | 38 | 25 | 93  | 88  | 1.95 | 125 | 138 | 168 | 70  | 24  | 50  | 14.0x5.5 | 6309                 | 7602045TVP                   |
| 63    | 63  | 50 | 47   | M50x1.5  | 45 | -  | 33 | 27 | 102 | 97  | 2.2  | 140 | 153 | 188 | 80  | 27  | 60  | 14.0x5.5 | 6310                 | 7602050TVP                   |
| 70    | 70  | 55 | 52   | M55x2.0  | 50 | 10 | 44 | 29 | 118 | 113 | 2.2  | 154 | 167 | 212 | 90  | 27  | 70  | 16.0x6.0 | 6311                 | 7602055TVP                   |
| 80    | 80  | 65 | 62   | M65x2.0  | 60 | 10 | 49 | 33 | 132 | 126 | 2.7  | 171 | 184 | 234 | 100 | 30  | 80  | 18.0x7.0 | 6313                 | 7602065TVP                   |
| 100   | 100 | 75 | 72   | M75x2.0  | 70 | 10 | 53 | 37 | 140 | 134 | 2.7  | 195 | 208 | 258 | 120 | 30  | 90  | 20.0x7.5 | 6315                 | 7602075TVP                   |

\* We reserve the right to modify and improve data value without prior notice.

\* Different diameters and leads are available upon request.



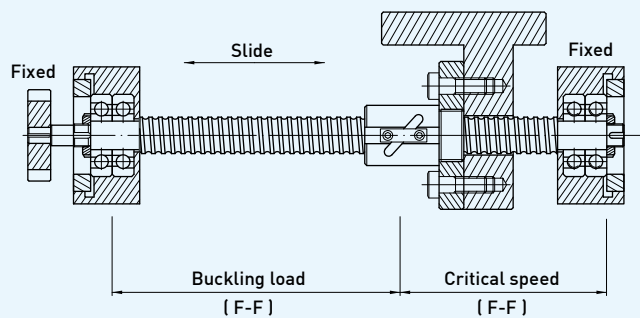
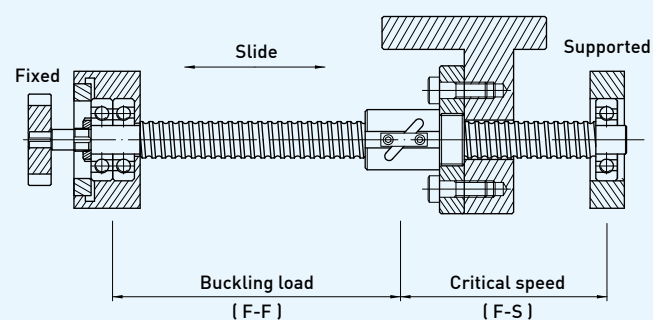
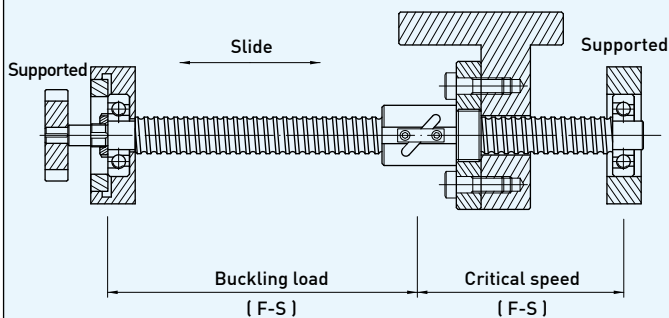
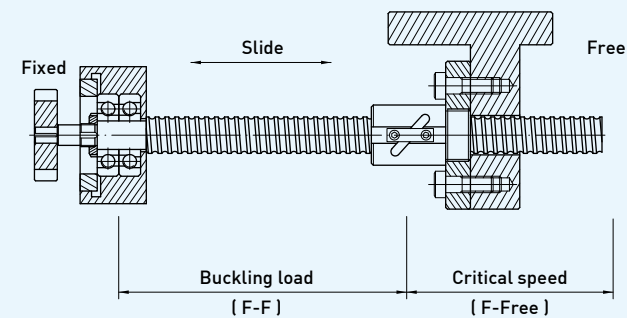
**A. Both ends fixed.****B. One end fixed other end supported.****C. Both ends supported.****D. One end fixed other end free.**

Fig 3.6 Recommended mounting methods for the ballscrew end journals

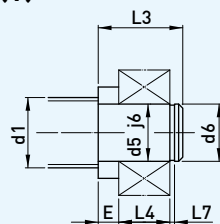
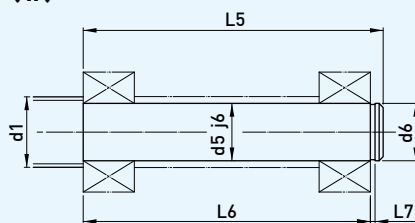
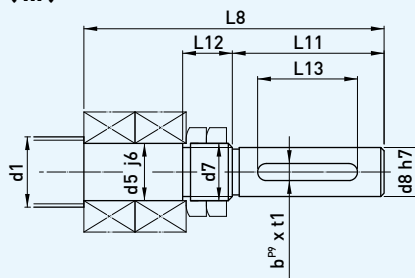
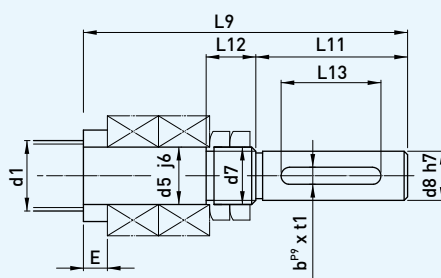
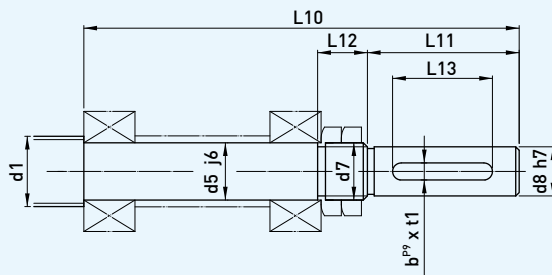
**(I)****(II)****(III)****(IV)****(V)**

Fig 3.7 Configurations of spindle ends



# 4

## Design and Selection of HIWIN Ballscrews

### 4.1 Fundamental Concepts for Selection & Installation

- (1) A ballscrew must be thoroughly cleaned in white spirit and oil to protect against corrosion. Trichloroethylene is an acceptable degreasing agent, ensuring the ball track free from dirt and damage (paraffin is not satisfactory). Great care must be taken to ensure that the ball track is not struck by a sharp edged component or tool, and metallic debris does not enter the ball nut (Fig. 4.1).
- (2) Select a suitable grade ballscrew for the application (ref. Table 4.5). Install with corresponding mounting disciplines. That is, precision ground ballscrews for CNC machine tools demand accurate alignment and precision bearing arrangement, where the rolled ballscrews for less precision applications, such as packaging machinery, require less precise support bearing arrangement.

It is especially important to eliminate misalignment between the bearing housing center and the ballnut center, which would result in unbalanced loads (Fig. 4.2). Unbalanced loads include radial loads and moment loads (Fig. 4.2a). These can cause malfunction and reduce service life (Fig.4.2b).

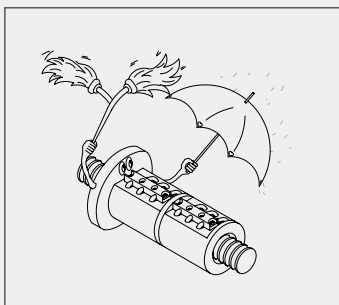


Fig 4.1 Carefully clean and protect

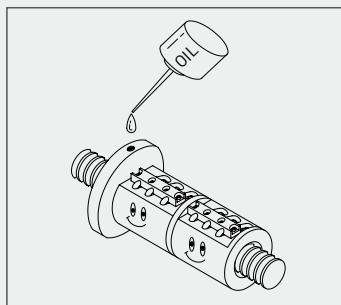


Fig 4.2 Oil lubrication method.

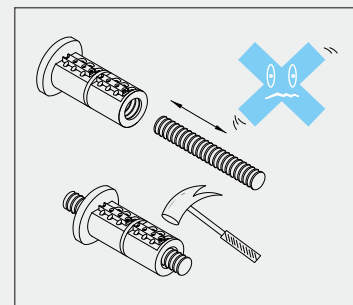


Fig 4.3 Carefully protect the nut

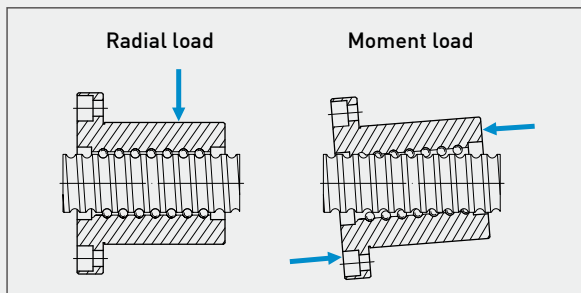


Fig 4.2(a) Unbalance load caused by misalignment of the support bearings and nut brackets, inaccurate alignment of the guide surface, inaccurate angle or alignment of the nut mounting surface

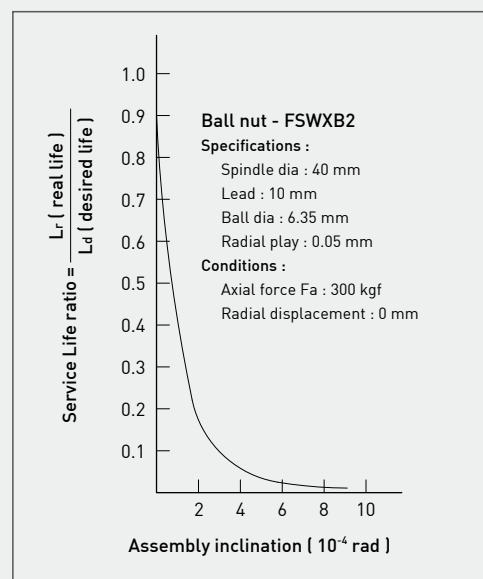


Fig 4.2(b) The effect on service life of a radial load caused by misalignment

- (3) To achieve the ballscrews' maximum life, recommend the use of antifriction bearing oils. Oil with graphite and MOS2 additives must not be used. The oil should be maintained over the balls and the balltracks.
- (4) Oil mist bath or drip feeds are acceptable. However, direct application to the ball nut is recommended (Fig. 4.3).
- (5) Select a suitable support bearing arrangement for the screw spindle. Angular contact ball bearings (angle=60°) are recommended for CNC machinery. Because of higher axial load capacity and ability to provide a clearance-free or preloaded assembly (Fig. 4.4).

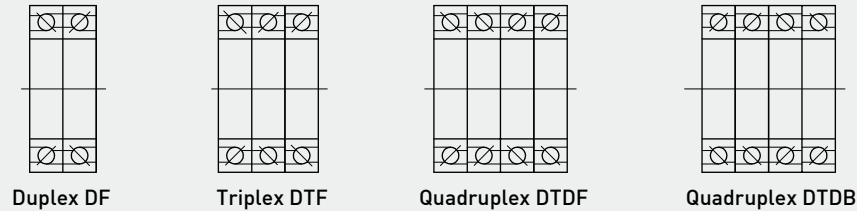


Fig 4.4 Different arrangement of ballscrew support bearings

- (6) A dog stopper should be installed at the end to prevent the nut from over-travelling which results in damage to ballscrew assembly (Fig 4.5).
- (7) In environments contaminated by dust or metallic debris, ballscrews should be protected using telescopic or bellow-type covers. The service life of a ballscrew will be reduced to about one-tenth normal condition if debris or chips enter the nut. The bellow type covers may need to have a threaded hole in the flange to fix the cover. Please contact engineers when special modifications are needed (Fig 4.6).

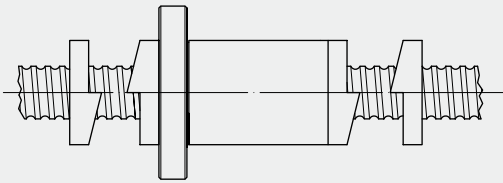


Fig 4.5 A dog stopper to prevent the nut from over travelling

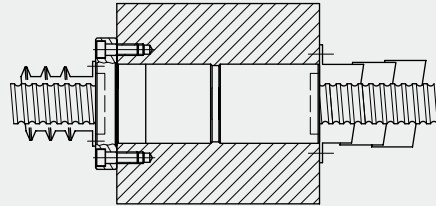


Fig 4.6 Ballscrew protection by telescopic or bellow type covers

- (8) If you select an internal recirculation type or an endcap recirculation type ballscrew, one end of the ball thread must be cut through to the end surface. The adjacent diameter on the end journal must be 0.5 ~ 1.0 mm less than the root diameter of the balltracks (Fig 4.7).
- (9) After heat treating the ballscrew spindle, both ends of the balltracks adjacent to the journal have about 2 to 3 leads left soft, for the purpose of machining. These regions are shown in (Fig. 4.8) with the mark "●" on HIWIN drawings.

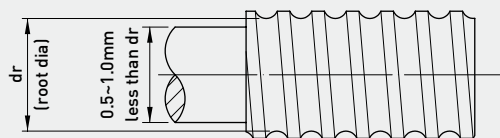


Fig 4.7 Special arrangement for the end journal of an internal recirculation screw

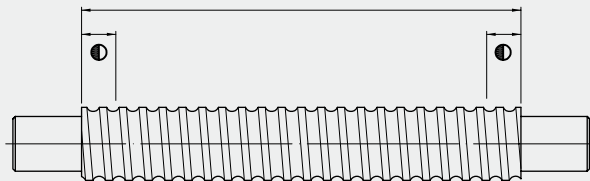


Fig 4.8 The heat treatment range of the ballscrew spindle

- (10) Excessive preload increases the friction torque and generates heat which reduces the life expectancy. But insufficient preload reduces stiffness and increases the possibility of lost motion. Recommends that the maximum preload used for CNC machine tools should not exceed 8% of the basic dynamic load C.
- (11) When the nut needs to be disassembled from/assembled to the screw spindle, a tube with an outer dia. 0.2 to 0.4 mm less than the root diameter (ref. M39) of the balltracks should be used to release/connect the nut to from/to the screw spindle via one end of the screw spindle shown in Fig. 4.9.
- (12) As shown in Fig 4.10, the support bearing must have a chamfer to allow it to seat properly and maintain proper alignment. suggests the DIN 509 chamfer as the standard construction for this design (Fig. 4.11).

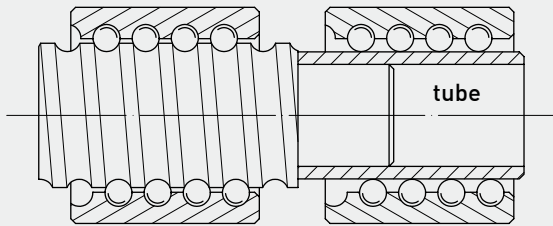


Fig 4.9 The method of separating the nut from the screw spindle

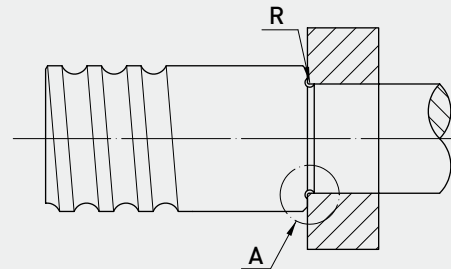


Fig 4.10 Chamfer for seating the face of bearing end

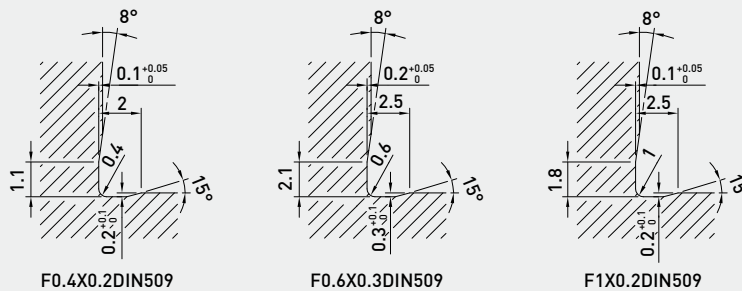


Fig 4.11 Suggested chamfer dimension per DIN 509 for the "A" dimension in Fig 4.10

## 4.2 Ballscrews Selection Procedure

The selection procedure for ballscrews is shown in (Table 4.1) From the known design operation condition, (A) select the appropriate parameter of ballscrew, (B) follow the selection procedure step by step via the reference formula, and (C) find the best ballscrew parameters which can be met for the design requirements.

Table 4.1 Ballscrew selection procedure

| Step    | Design operation condition (A)  | Ballscrew parameter (B)  | Reference formula(C)   |
|---------|---|--|--|
| Step 1  | Positioning accuracy  | Lead accuracy  | Table 5.2  |
| Step 2  | (1) Max. speed of DC motor (Nmax)<br>(2) Rapid feed rate (Vmax)                                       | Ballscrew lead   | $\ell \geq \frac{V_{\max}}{N_{\max}}$  |
| Step 3  | Total travel distance   | Total thread length  | Total length =<br>thread length+journal end length<br>Thread length =<br>stroke+nut length+100 mm<br>(unused thread) |
| Step 4  | (1) Load condition (%)<br>(2) Speed condition (%)   | Mean axial load<br>Mean speed                                      | M7~M10   |
| Step 5  | Mean axial force ( $\leq 1/5$ C is the best)  | Preload  | M1   |
| Step 6  | (1) Service life expectancy<br>(2) Mean axial load<br>(3) Mean speed                                  | Basic dynamic load   | M13~M14  |
| Step 7  | (1) Basic dynamic load<br>(2) Ballscrew lead<br>(3) Critical speed<br>(4) Speed limited by Dm-N value | Screw diameter and nut type<br>(select some range)                 | M31~M33 and dimension table  |
| Step 8  | (1) Ballscrew diameter<br>(2) Nut type<br>(3) Preload<br>(4) Dynamic load                             | Stiffness<br>(check the best one via lost<br>motion value)         | M34~M40  |
| Step 9  | (1) Surrounding temperature<br>(2) Ballscrew length   | Thermal displacement and target<br>value of cumulative<br>lead (T) | M41 and 4.6 temperature<br>rising effect   |
| Step 10 | (1) Stiffness of screw spindle<br>(2) Thermal displacement  | Pretension force   | M45  |
| Step 11 | (1) Max. table speed<br>(2) Max. rising time<br>(3) Ballscrew specification                           | Motor drive torque and<br>motor specification                      | M19~M28  |

## 4.3 Accuracy Grade of HIWIN Ballscrews

Precision ground ballscrews are used in applications requiring high positioning accuracy and repeatability, smooth movement and long service life. Ordinary rolled ballscrews are used for application grade less accurate but still requiring high efficiency and long service life. Precision grade rolled ballscrews have an accuracy between that of the ordinary grade rolled ballscrews and the higher grade precision ground ballscrews. They can be used to replace certain precision ground ballscrews with the same grade in many applications.

HIWIN makes precision grade rolled ballscrew up to C6 grade. Geometric tolerances are different from those of precision ground screws (See Chapter 6). Since the outside diameter of the screw spindle is not ground, the set-up procedure for assembling precision rolled ballscrews into the machine is different from that of ground ones. Chapter 7 contains the entire description of rolled ballscrews.

### (1) Accuracy grade

There are numerous applications for ballscrews from high precision grade ballscrews, used in precision measurement and aerospace equipment, to transport grade ballscrews used in packaging equipment. The quality and accuracy classifications are described as follows: lead deviation, surface roughness, geometrical tolerance, backlash, drag torque variation, heat generation and noise level.

HIWIN precision ground ballscrews are classified to 7 classes. In general, HIWIN precision grade ballscrews are defined by the so called " $\mathcal{V}_{300p}$ " value see Fig 4.12 and rolled grade ballscrews are defined differently as shown in Chapter 7.

Fig. 4.12 is the lead measuring chart according to the accuracy grade of the ballscrews. The same chart by the DIN system is illustrated in Fig. 4.13. From this diagram, the accuracy grade can be determined by selecting the suitable tolerance in Table 4.2. Fig. 4.14 shows HIWIN's measurement result according to the DIN standard. Table 4.2 shows the accuracy grade of precision grade ballscrews in HIWIN's specification. The relative international standard is shown in Table 4.3.

The positioning accuracy of machine tools is selected by  $e_p$  value with the  $\mathcal{V}_{300p}$  variation. The recommended accuracy grade for machine applications is shown in Table 4.5. This is the reference chart for selecting the suitable ballscrews in different application fields.

## (2) Axial play (Backlash)

If zero axial play ballscrews (no backlash) are needed, preload should be added and the preload drag torque is specified for testing purpose. The standard axial play of HIWIN ballscrews is shown in Table 4.4. For CNC machine tools, lost motion can occur in zero-backlash ballscrews through incorrect stiffness. Please consult our engineers when determining stiffness and backlash requirements.

## (3) Geometrical tolerance

It is crucial to select the ballscrew of the correct grade to meet machinery requirements. Table 4.6 and Fig 4.15 are helpful for you to determine the tolerance factors, which are based on certain required accuracy grades.

Table 4.2 HIWIN accuracy grade of precision ballscrew

Unit: 0.001mm

| Accuracy Grade       |             | C0    |                 | C1    |                 | C2    |                 | C3    |                 | C4    |                 | C5    |                 | C6    |                 |
|----------------------|-------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|
| $\mathcal{V}_{2p}$   |             | 3     |                 | 4     |                 | 4     |                 | 6     |                 | 8     |                 | 8     |                 | 8     |                 |
| $\mathcal{V}_{300p}$ |             | 3.5   |                 | 5     |                 | 6     |                 | 8     |                 | 12    |                 | 18    |                 | 23    |                 |
| Thread length        | Item        | $e_p$ | $\mathcal{V}_u$ | $e_p$ | $\mathcal{V}_u$ | $e_p$ | $\mathcal{V}_u$ | $e_p$ | $\mathcal{V}_u$ | $e_p$ | $\mathcal{V}_u$ | $e_p$ | $\mathcal{V}_u$ | $e_p$ | $\mathcal{V}_u$ |
|                      | above below |       |                 |       |                 |       |                 |       |                 |       |                 |       |                 |       |                 |
| -                    | 315         | 4     | 3.5             | 6     | 5               | 6     | 6               | 12    | 8               | 12    | 12              | 23    | 18              | 23    | 23              |
| 315                  | 400         | 5     | 3.5             | 7     | 5               | 7     | 6               | 13    | 10              | 13    | 12              | 25    | 20              | 25    | 25              |
| 400                  | 500         | 6     | 4               | 8     | 5               | 8     | 7               | 15    | 10              | 15    | 13              | 27    | 20              | 27    | 26              |
| 500                  | 630         | 6     | 4               | 9     | 6               | 9     | 7               | 16    | 12              | 16    | 14              | 30    | 23              | 30    | 29              |
| 630                  | 800         | 7     | 5               | 10    | 7               | 10    | 8               | 18    | 13              | 18    | 16              | 35    | 25              | 35    | 31              |
| 800                  | 1000        | 8     | 6               | 11    | 8               | 11    | 9               | 21    | 15              | 21    | 17              | 40    | 27              | 40    | 35              |
| 1000                 | 1250        | 9     | 6               | 13    | 9               | 13    | 10              | 24    | 16              | 24    | 19              | 46    | 30              | 46    | 39              |
| 1250                 | 1600        | 11    | 7               | 15    | 10              | 15    | 11              | 29    | 18              | 29    | 22              | 54    | 35              | 54    | 44              |
| 1600                 | 2000        |       |                 | 18    | 11              | 18    | 13              | 35    | 21              | 35    | 25              | 65    | 40              | 65    | 51              |
| 2000                 | 2500        |       |                 | 22    | 13              | 22    | 15              | 41    | 24              | 41    | 29              | 77    | 46              | 77    | 59              |
| 2500                 | 3150        |       |                 | 26    | 15              | 26    | 17              | 50    | 29              | 50    | 34              | 93    | 54              | 93    | 69              |
| 3150                 | 4000        |       |                 | 30    | 18              | 32    | 21              | 60    | 35              | 62    | 41              | 115   | 65              | 115   | 82              |
| 4000                 | 5000        |       |                 |       |                 |       |                 | 72    | 41              | 76    | 49              | 140   | 77              | 140   | 99              |
| 5000                 | 6300        |       |                 |       |                 |       |                 | 90    | 50              | 100   | 60              | 170   | 93              | 170   | 119             |
| 6300                 | 8000        |       |                 |       |                 |       |                 | 110   | 60              | 125   | 75              | 210   | 115             | 210   | 130             |
| 8000                 | 10000       |       |                 |       |                 |       |                 |       |                 |       |                 | 260   | 140             | 260   | 145             |
| 10000                | 12000       |       |                 |       |                 |       |                 |       |                 |       |                 | 320   | 170             | 320   | 180             |

Table 4.3 International standard of accuracy grade for ballscrews

Unit: 0.001mm

| Grade                |          | C0  | C1 | C2 | C3 | C4 | C5 | C6 |    |     |
|----------------------|----------|-----|----|----|----|----|----|----|----|-----|
| $\mathcal{V}_{300p}$ | ISO, DIN |     | 6  |    | 12 |    | 23 |    | 52 | 210 |
|                      | JIS      | 3.5 | 5  |    | 8  |    | 18 |    | 50 | 210 |
|                      | HIWIN    | 3.5 | 5  | 6  | 8  | 12 | 18 | 23 | 50 | 210 |

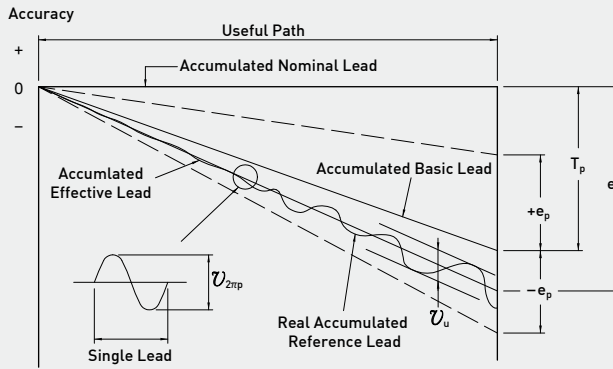
Table 4.4 Standard combination of grade and axial play

Unit: 0.001mm

| Grade      | C0 | C1 | C2 | C3 | C4 | C5 | C6 |
|------------|----|----|----|----|----|----|----|
| Axial Play | 5  | 5  | 5  | 10 | 15 | 20 | 25 |

Table 4.5 Recommended accuracy grade for machine applications

| Application grade   |  | AXIS | Accuracy grade |   |   |   |   |   |   |     |     |     |
|---------------------|--|------|----------------|---|---|---|---|---|---|-----|-----|-----|
|                     |  |      | 0              | 1 | 2 | 3 | 4 | 5 | 7 | PR1 | PR2 | PR3 |
| CNC Machinery Tools | Lathes                                 | X    | •              | • | • | • | • |   |   |     |     |     |
|                     |  | Z    |                |   |   | • | • | • |   |     |     |     |
|                     | Milling machines<br>Boring machines    | X    |                | • | • | • | • | • |   |     |     |     |
|                     |  | Y    |                | • | • | • | • | • |   |     |     |     |
|                     | Machine Center                         | Z    |                |   | • | • | • | • |   |     |     |     |
|                     |  | X    |                | • | • | • | • |   |   |     |     |     |
|                     |  | Y    |                | • | • | • | • |   |   |     |     |     |
|                     | Jig borers                             | Z    |                |   | • | • | • |   |   |     |     |     |
|                     |  | X    | •              | • |   |   |   |   |   |     |     |     |
|                     |  | Y    | •              | • |   |   |   |   |   |     |     |     |
|                     | Drilling machines                      | Z    | •              | • |   |   |   |   |   |     |     |     |
|                     |  | X    |                |   |   | • | • | • |   |     |     |     |
|                     |  | Y    |                |   |   | • | • | • |   |     |     |     |
|                     | Grinders                               | Z    |                |   |   |   | • | • | • |     |     |     |
|                     |  | X    | •              | • | • |   |   |   |   |     |     |     |
|                     |  | Y    |                | • | • | • |   |   |   |     |     |     |
|                     | EDM                                    | X    |                | • | • | • |   |   |   |     |     |     |
|                     |  | Y    |                | • | • | • |   |   |   |     |     |     |
|                     |  | Z    |                |   | • | • | • | • |   |     |     |     |
|                     | Wire cut EDM                           | X    |                | • | • | • |   |   |   |     |     |     |
|                     |  | Y    |                | • | • | • |   |   |   |     |     |     |
|                     |  | U    |                | • | • | • | • |   |   |     |     |     |
|                     |  | V    |                | • | • | • | • |   |   |     |     |     |
|                     | Laser Cutting Machine                  | X    |                |   | • | • | • |   |   |     |     |     |
|                     |  | Y    |                |   | • | • | • |   |   |     |     |     |
|                     |  | Z    |                |   | • | • | • |   |   |     |     |     |
| General Machinery   | Punching Press                         | X    |                |   |   | • | • | • |   |     |     |     |
|                     |  | Y    |                |   |   | • | • | • |   |     |     |     |
|                     | Single Purpose Machines                |      |                | • | • | • | • | • | • |     |     |     |
|                     | Wood working Machines                  |      |                |   |   |   |   |   | • | •   | •   | •   |
|                     | Industrial Robot ( Precision )         |      |                | • | • | • | • |   |   |     |     |     |
|                     | Industrial Robot ( General )           |      |                |   |   |   |   | • | • | •   | •   |     |
|                     | Coordinate Measuring Machine           |      | •              | • | • |   |   |   |   |     |     |     |
|                     | Non-CNC Machine                        |      |                |   |   | • | • | • |   |     |     |     |
|                     | Transport Equipment                    |      |                |   |   |   | • | • | • | •   | •   | •   |
|                     | X-Y Table                              |      |                | • | • | • | • | • |   |     |     |     |
|                     | Linear Actuator                        |      |                |   |   |   |   | • | • | •   | •   |     |
|                     | Aircraft Landing Gear                  |      |                |   |   |   |   | • | • | •   | •   |     |
|                     | Airfoil Control                        |      |                |   |   |   |   | • | • | •   | •   |     |
|                     | Gate Valve                             |      |                |   |   |   |   |   | • | •   | •   | •   |
|                     | Power steering                         |      |                |   |   |   |   |   | • | •   | •   |     |
|                     | Glass Grinder                          |      |                |   | • | • | • | • | • |     |     |     |
|                     | Surface Grinder                        |      |                |   |   |   | • | • |   |     |     |     |
|                     | Induction Hardening Machine            |      |                |   |   |   |   |   | • | •   | •   | •   |
|                     | Electromachine                         |      |                | • | • | • | • | • | • |     |     |     |
|                     | All-electric injection molding machine |      |                |   |   |   |   | • | • | •   | •   | •   |



$T_p$  : Target point of accumulated lead.  
This value is determined by customers' different application requirements.

$e_p$  : Total reference lead deviation.  
Maximum deviation for accumulated reference lead line over the full length.

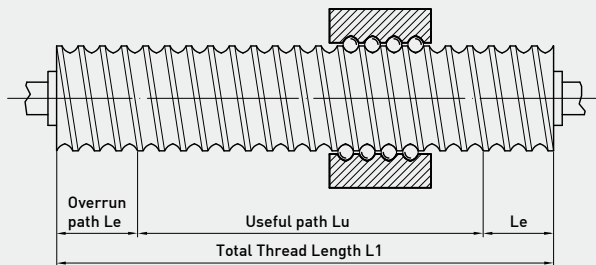
$v_{2\pi p}$  : Single lead variation.

$e_a$  : Real accumulated reference lead measured by laser system.

$v_u$  : Total relative lead deviation.  
Maximum deviation of the real accumulated lead from the real accumulated reference lead in the corresponding range.

$v_{300p}$  : Lead deviation over path of 300mm.  
The above deviation in random 300 mm within thread length.

Fig 4.12 HIWIN lead measuring curve of precision ballscrew



$e_{oa}$  : Average lead deviation over useful path Lu.  
A straight line representing the tendency of the cumulative actual lead.  
This is obtained by the least square method and measured by the laser system. The value is added by path compensation over the useful path and the mean travel deviation.

$C$  : Path compensation over useful path Lu.  
Selection parameter: This value is determined by customer and maker as it depends on different application requirements.

$e_p$  : Mean travel deviation.

$v_{up}$  : Lead variation over useful path Lu.

$v_{300p}$  : Lead variation over path of 300 mm.

$v_{2\pi p}$  : Lead variation over 1 rotation.

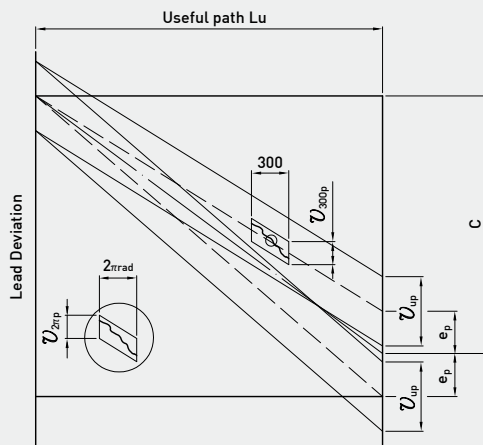
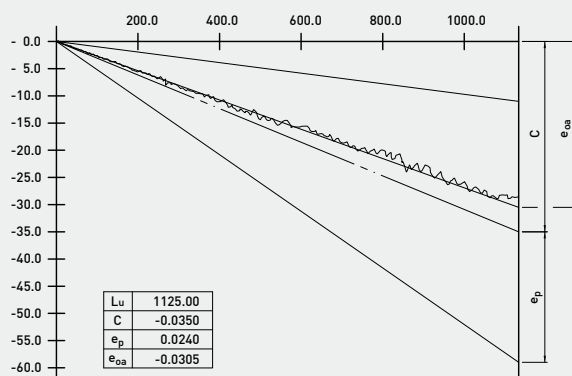


Fig 4.13 DIN lead measuring curve of precision ballscrew

## AVERAGE LEAD DEVIATION OVER USEFUL PATH LU

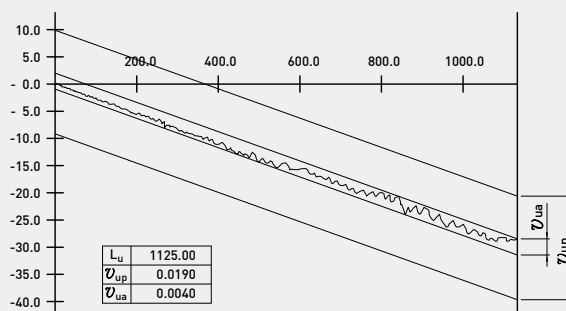
•  $e_{oa}(E_a)$  :

Lead deviation over useful thread length relative to the nominal deviation.

(This measurement is made according to DIN standard 69051-3-1).

$$C(T) - e_p(E_p) \leq e_{oa}(E_a) \leq C(T) + e_p(E_p)$$

## LEAD VARIATION OVER USEFUL PATH LU

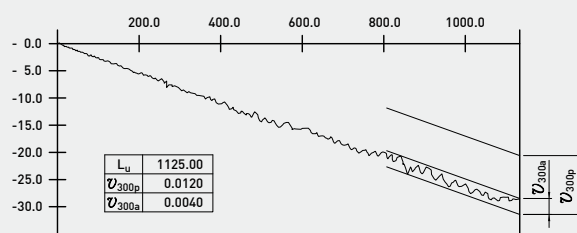
•  $v_{ua}(e_a)$  :

Total relative lead variation over useful thread length.

(This measurement is made according to DIN standard 69051-3-2).

$$v_{ua}(e_a) \leq v_{up}(e_p)$$

## LEAD VARIATION OVER PATH OF 300MM

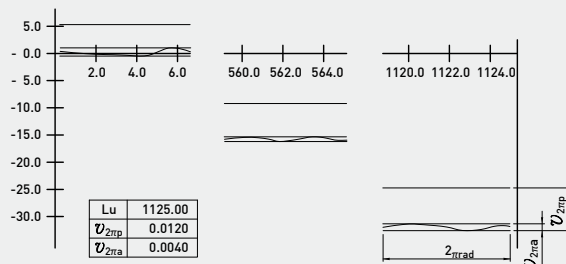
•  $v_{300a}(e_{300a})$  :

Relative lead variation in random 300mm length within thread length.

(This measurement is made according to DIN standard 69051-3-3).

$$v_{300a}(e_{300a}) \leq v_{300p}(e_{300p})$$

## LEAD VARIATION OVER 1 ROTATION

•  $v_{2\pi a}(e_{2\pi a})$  :

Single lead variation over  $2p$ .

(This measurement is made according to DIN standard 69051-3-4).

$$v_{2\pi a}(e_{2\pi a}) \leq v_{2\pi p}(e_{2\pi p})$$

Fig 4.14 Lead accuracy measuring chart from dynamic laser measurement equipment according to DIN 69051 standard

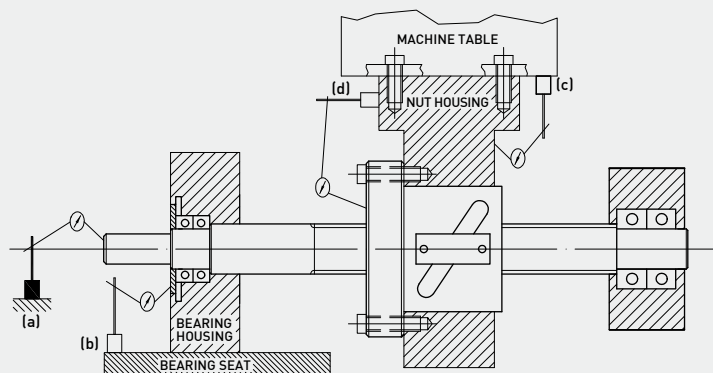
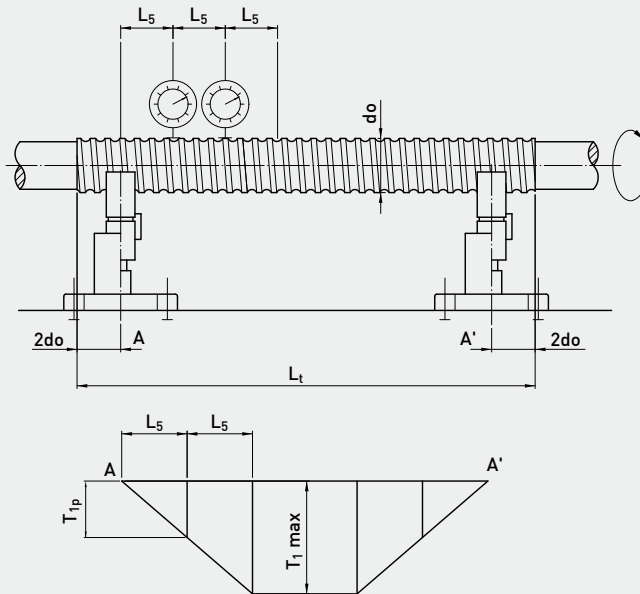


Fig 4.15 Geometrical tolerance of HIWIN precision ground ballscrew

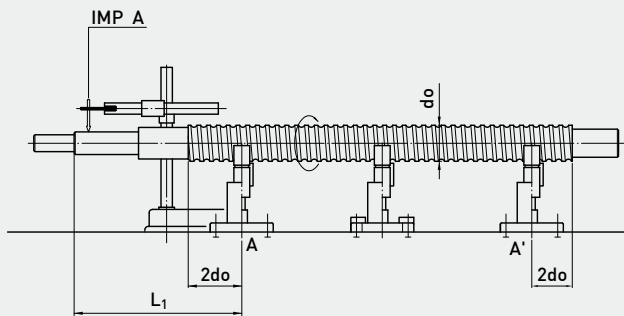


Table 4.6 Tolerance table and measurement method for HIWIN precision ballscrews



T1: True running deviation of external diameter relative to AA' (This measurement is made according to DIN 69051 and JIS B1192)

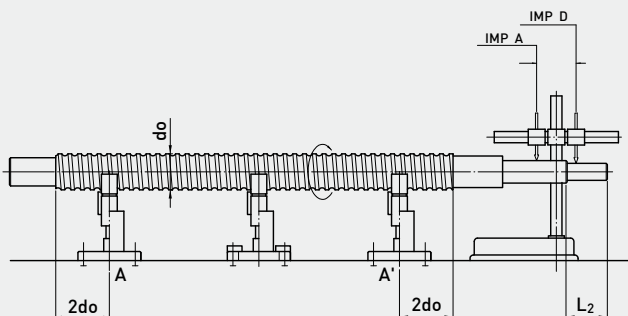
| Nominal Diameter<br>d <sub>o</sub> (mm) |       | reference<br>length | T <sub>1p</sub> [μm]<br>For HIWIN tolerance class   |     |     |     |     |     |     |     |
|---|-------|---------------------|---|-----|-----|-----|-----|-----|-----|-----|
| above                                   | up to | L <sub>5</sub>      | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   |
| 6                                       | 12    | 80                  |   |     |     |     |     |     |     |     |
| 12                                      | 25    | 160                 |   |     |     |     |     |     |     |     |
| 25                                      | 50    | 315                 | 20  | 20  | 20  | 23  | 25  | 28  | 32  | 40  |
| 50                                      | 100   | 630                 |   |     |     |     |     |     |     |     |
| 100                                     | 200   | 1250                |   |     |     |     |     |     |     |     |
| L <sub>t</sub> /d <sub>o</sub>          |       |                     | T <sub>1max</sub> [μm] (for L <sub>t</sub> ≥ 4L <sub>5</sub> )<br>For HIWIN tolerance class |     |     |     |     |     |     |     |
| above                                   | up to |                     | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   |
|   | 40    |                     | 40  | 40  | 40  | 45  | 50  | 60  | 64  | 80  |
| 40                                      | 60    |                     | 60  | 60  | 60  | 70  | 75  | 85  | 96  | 120 |
| 60                                      | 80    |                     | 100   | 100 | 100 | 115 | 125 | 140 | 160 | 200 |
| 80                                      | 100   |                     | 160   | 160 | 160 | 180 | 200 | 220 | 256 | 320 |



T2: Run out deviation of bearing relative to AA' (This measurement is made according to DIN 69051 and JIS B1192)

| Nominal Diameter<br>d <sub>o</sub> (mm) |       | reference<br>length | T <sub>2p</sub> [μm] (for L <sub>1</sub> ≤ L <sub>r</sub> )<br>For HIWIN tolerance class |    |    |    |    |    |    |    |
|---|-------|---------------------|--|----|----|----|----|----|----|----|
| above                                   | up to | L <sub>r</sub>      | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  |
| 6                                       | 20    | 80                  | 6  | 8  | 10 | 11 | 12 | 16 | 20 | 40 |
| 20                                      | 50    | 125                 | 8  | 10 | 12 | 14 | 16 | 20 | 25 | 50 |
| 50                                      | 125   | 200                 | 10   | 12 | 16 | 18 | 20 | 26 | 32 | 63 |
| 125                                     | 200   | 315                 | -  | -  | -  | 20 | 25 | 32 | 40 | 80 |

$$\text{if } L_1 > L_r, \text{ then } t_{2a} \leq T_{2p} \frac{L_1}{L_r}$$

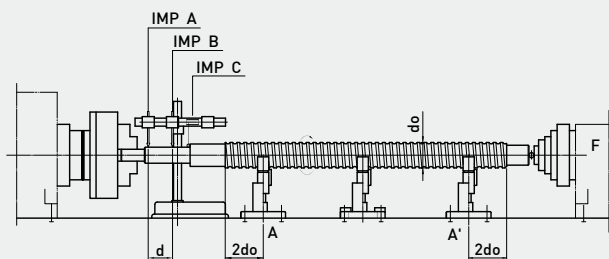


T3: Coaxial deviation relative to AA' (This measurement is made according to DIN 69051 and JIS B1192)

| Nominal Diameter<br>d <sub>o</sub> (mm) |       | reference<br>length | T <sub>3p</sub> [μm] (for L <sub>2</sub> ≤ L <sub>r</sub> )<br>For HIWIN tolerance class |   |   |    |    |    |    |    |
|---|-------|---------------------|--|---|---|----|----|----|----|----|
| above                                   | up to | L <sub>r</sub>      | 0  | 1 | 2 | 3  | 4  | 5  | 6  | 7  |
| 6                                       | 20    | 80                  | 4  | 5 | 5 | 6  | 6  | 7  | 8  | 12 |
| 20                                      | 50    | 125                 | 5  | 6 | 6 | 7  | 8  | 9  | 10 | 16 |
| 50                                      | 125   | 200                 | 6  | 7 | 8 | 9  | 10 | 11 | 12 | 20 |
| 125                                     | 200   | 315                 | -  | - | - | 10 | 12 | 14 | 16 | 25 |

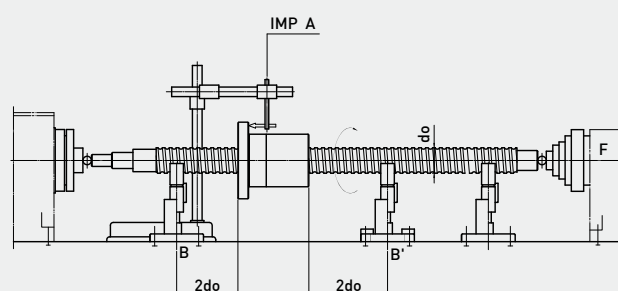
$$\text{if } L_2 > L_r, \text{ then } t_{3a} \leq T_{3p} \frac{L_2}{L_r}$$

Table 4.6 Tolerance table and measurement method for HIWIN precision ballscrews



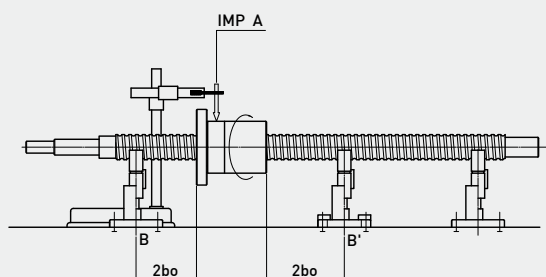
T4 : Run-out deviation of bearing end shoulder relative to AA' (This measurement is made according to DIN 69051 and JIS B1192)

| Nominal Diameter<br>do [ mm ] |       | T <sub>sp</sub> [ μm ]<br>For HIWIN tolerance class |   |   |   |   |   |   |    |
|-------------------------------|-------|---|---|---|---|---|---|---|----|
| above                         | up to | 0   | 1 | 2 | 3 | 4 | 5 | 6 | 7  |
| 6                             | 63    | 3   | 3 | 3 | 4 | 4 | 5 | 5 | 6  |
| 63                            | 125   | 3   | 4 | 4 | 5 | 5 | 6 | 6 | 8  |
| 125                           | 200   | -   | - | - | 6 | 6 | 8 | 8 | 10 |



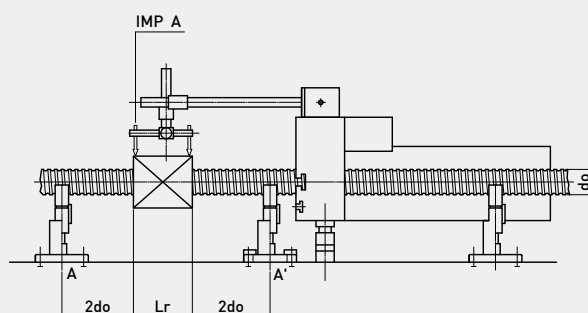
T5 : Face running deviation of locating face (only for nut) relative to BB' (This measurement is made according to DIN 69051 and JIS B1192)

| Nut Flange Diameter<br>do [ mm ] |       | T <sub>sp</sub> [ μm ]<br>For HIWIN tolerance class |    |    |    |    |    |    |    |
|----------------------------------|-------|---|----|----|----|----|----|----|----|
| above                            | up to | 0   | 1  | 2  | 3  | 4  | 5  | 6  | 7  |
| -                                | 20    | 5   | 6  | 7  | 8  | 9  | 10 | 12 | 14 |
| 20                               | 32    | 5   | 6  | 7  | 8  | 9  | 10 | 12 | 14 |
| 32                               | 50    | 6   | 7  | 8  | 8  | 10 | 11 | 15 | 18 |
| 50                               | 80    | 7   | 8  | 9  | 10 | 12 | 13 | 16 | 18 |
| 80                               | 125   | 7   | 9  | 10 | 12 | 14 | 15 | 18 | 20 |
| 125                              | 160   | 8   | 10 | 11 | 13 | 15 | 17 | 19 | 20 |
| 160                              | 200   | -   | 11 | 12 | 14 | 16 | 18 | 22 | 25 |
| 200                              | 250   | -   | 12 | 14 | 15 | 18 | 20 | 25 | 30 |



T6 : Run-out deviation of external diameter (only for nut) relative to BB' (This measurement is made according to DIN 69051 and JIS B1192)

| Nut Flange Diameter<br>do [ mm ] |       | T <sub>sp</sub> [ μm ]<br>For HIWIN tolerance class |    |    |    |    |    |    |    |
|----------------------------------|-------|---|----|----|----|----|----|----|----|
| above                            | up to | 0   | 1  | 2  | 3  | 4  | 5  | 6  | 7  |
| -                                | 20    | 5   | 6  | 7  | 9  | 10 | 12 | 16 | 20 |
| 20                               | 32    | 6   | 7  | 8  | 10 | 11 | 12 | 16 | 20 |
| 32                               | 50    | 7   | 8  | 10 | 12 | 14 | 15 | 20 | 25 |
| 50                               | 80    | 8   | 10 | 12 | 15 | 17 | 19 | 25 | 30 |
| 80                               | 125   | 9   | 12 | 16 | 20 | 24 | 22 | 25 | 40 |
| 125                              | 160   | 10  | 13 | 17 | 22 | 25 | 28 | 32 | 40 |
| 160                              | 200   | -   | 16 | 20 | 22 | 25 | 28 | 32 | 40 |
| 200                              | 250   | -   | 17 | 20 | 22 | 25 | 28 | 32 | 40 |



T7 : Deviation of parallelism (only for nut) relative to BB' (This measurement is made according to DIN 69051 and JIS B1192 )

| Mounting basic length<br>( mm ) L <sub>r</sub> |       | T <sub>sp</sub> [ μm ] / 100mm<br>For HIWIN tolerance class |    |    |    |    |    |    |    |
|--|-------|---|----|----|----|----|----|----|----|
| above  | up to | 0   | 1  | 2  | 3  | 4  | 5  | 6  | 7  |
| -  | 50    | 5   | 6  | 7  | 8  | 9  | 10 | 14 | 17 |
| 50   | 100   | 7   | 8  | 9  | 10 | 12 | 13 | 15 | 17 |
| 100  | 200   | -   | 10 | 11 | 13 | 15 | 17 | 24 | 30 |

## 4.4 Preload Methods

The specially designed Gothic ball track can make the ball contact angle around  $45^\circ$ . The axial force  $F_a$  which comes from an outside drive force or inside preload force, causes two kinds of backlash. One is the normal backlash,  $S_a$  caused by the manufacturing clearance between ball track and ball. The other is the deflection backlash,  $\Delta\ell$  caused by the normal force  $F_n$  which is perpendicular to the contact point.

The clearance backlash can be eliminated by the use of a preload internal force  $P$ . This preload can be obtained via a double nut, an offset pitch single nut, or by adjusting the ball size for preloaded single nuts (Fig. 5.7~ Fig. 5.8).

The deflection backlash is caused by the preload internal force and the external loading force and is related to that of the effect of lost motion.

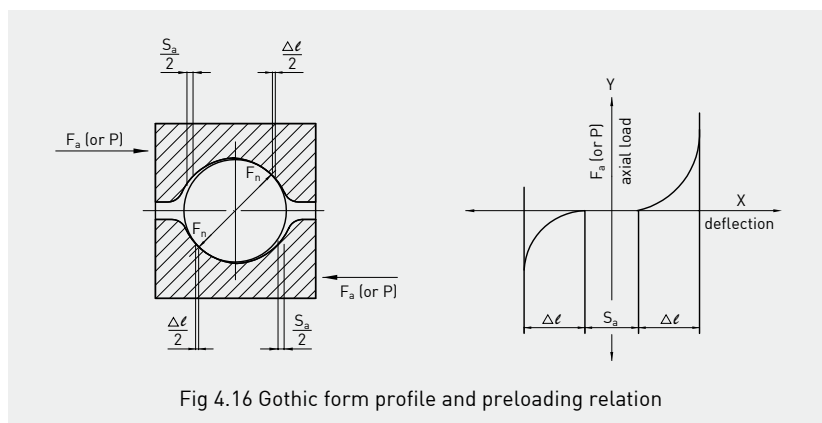


Fig 4.16 Gothic form profile and preloading relation

### (1) Double nut preloading

Preload is obtained by inserting a spacer between the 2 nuts (Fig. 4.17). “Tension preload” is created by inserting an oversize spacer and effectively pushing the nuts apart. “Compression pre-load” is created by inserting an undersize spacer and correspondingly pulling nuts together. Tension preload is primarily used for precision ballscrews. However, compression preload type ballscrews are also available upon your request. If pretension is necessary to increase stiffness, please contact us for the amount of pretension to be used in the ballscrew journal ends. (0.02mm to 0.03mm per meter is recommended, but the T value should be selected according to the compensation purpose).

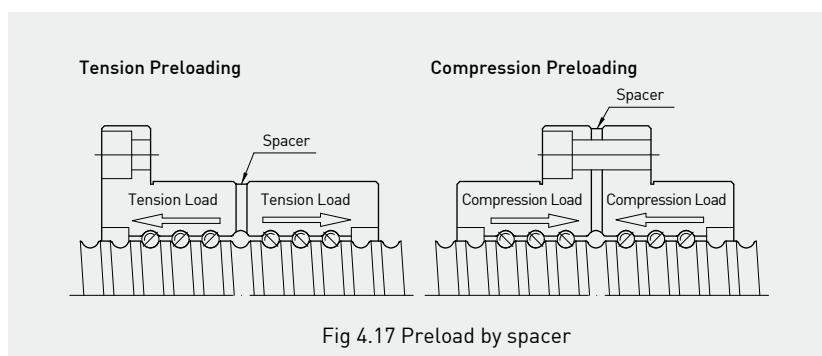


Fig 4.17 Preload by spacer

### (2) Single nut preloading

There are two ways of preloading a single nut. One is called “the oversized-ball preloading method”. The method is to insert balls slightly larger than the ball groove space (oversized balls) to allow balls to contact at four points (Fig. 4.18).

The other way is called “The offset pitch preloading method” as shown in Fig. 4.19. The nut is ground to have a  $\delta$  value offset on the center pitch. This method is used to replace the traditional double nut preloading method and has

the benefit of a compact single nut with high stiffness via small preload force. However, it should not be used in heavy duty preloading. The best preload force is below 5% of dynamic load (C).

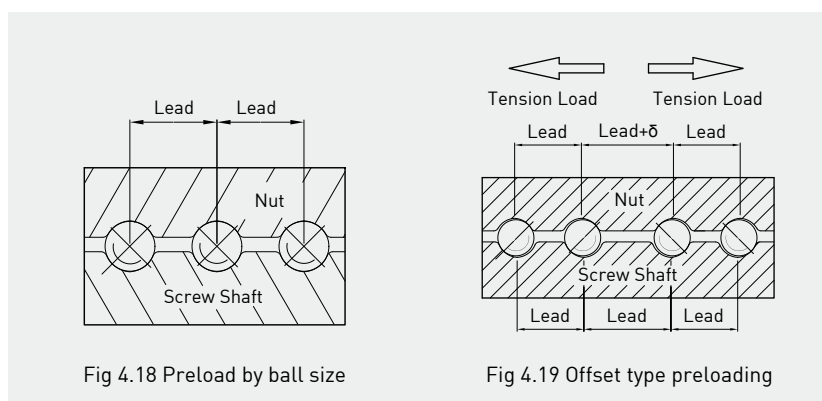


Fig 4.18 Preload by ball size

Fig 4.19 Offset type preloading

### (3) Preload calculation

$$p = \frac{F_{bm}}{2.8} \quad \text{M1}$$

P : preload force ( kgf )

$F_{bm}$  : Mean operating load(kgf)  
(Ref.M8~M10)

$$T_d = \frac{K_p \times P \times \ell}{2\pi} \quad \text{M2}$$

Preload drag torque (Fig. 4.20)

$T_d$  : preload drag torque (kgf-mm)

P : preload (kgf)

$\ell$  : lead (mm)

$K_p$  : preload torque coefficient

$K_p : \frac{1}{\eta_1} - \eta_2$  (is between 0.1 and 0.3)

$\eta_1, \eta_2$  are the mechanical efficiencies of the ballscrew.

#### (1) For common transmission (to convert rotary motion to linear motion)

$$\eta_1 = \frac{\tan(\alpha)}{\tan(\alpha + \beta)} = \frac{1 - \mu \tan \alpha}{1 + \mu / \tan \alpha} \quad \text{M3}$$

#### (2) For reverse transmission (to convert linear rotary motion to rotary motion)

$$\eta_2 = \frac{\tan(\alpha - \beta)}{\tan(\alpha)} = \frac{1 - \mu / \tan \alpha}{1 + \mu \tan \alpha} \quad \text{M4}$$

$$\alpha = \tan^{-1} \frac{\ell}{\pi D_m} \quad \text{M5}$$

$$\beta = \tan^{-1} \mu \quad \text{M6}$$

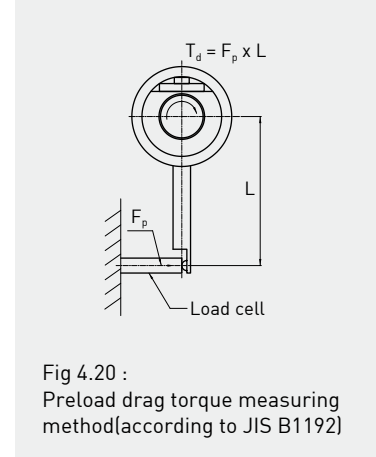
$\alpha$  : lead angle (degrees)

$D_m$  : pitch circle diameter of screw shaft (mm)

$\ell$  : lead (mm)

$\beta$  : friction angle (0.17°~0.57°)

$\mu$  : friction coefficient (0.003~0.01)



### (4) Uniformity of preload drag torque

#### (1) Measuring method

Preload creates drag torque between the nut and screw. It is measured by rotating the screw spindle at constant speed while restraining the nut with a special fixture as shown in Fig. 4.20. The load cell reading force  $F_p$  is used to calculate the preload drag torque of the ballscrew.

HIWIN has developed a computerized drag torque measuring machine which can accurately monitor the drag torque during screw rotation. Therefore, the drag torque can be adjusted to meet customer requirements (Fig. 2.5). The measurement standard for preload drag torque is shown in Fig. 4.21 and Table 4.7.

#### (2) Measuring conditions

1. Without wiper.
2. The rotating speed, 100 rpm.
3. The dynamic viscosity of lubricant, 61.2 ~74.8 cSt (mm/s) 40°C, that is, ISO VG 68 or JIS K2001.
4. The return tube up.

(3) The measurement result is illustrated by the standard drag torque chart. Its nomenclature is shown in Fig. 4.21.

(4) The allowable preload drag torque variation as a function of accuracy grade is shown in Table 4.7.

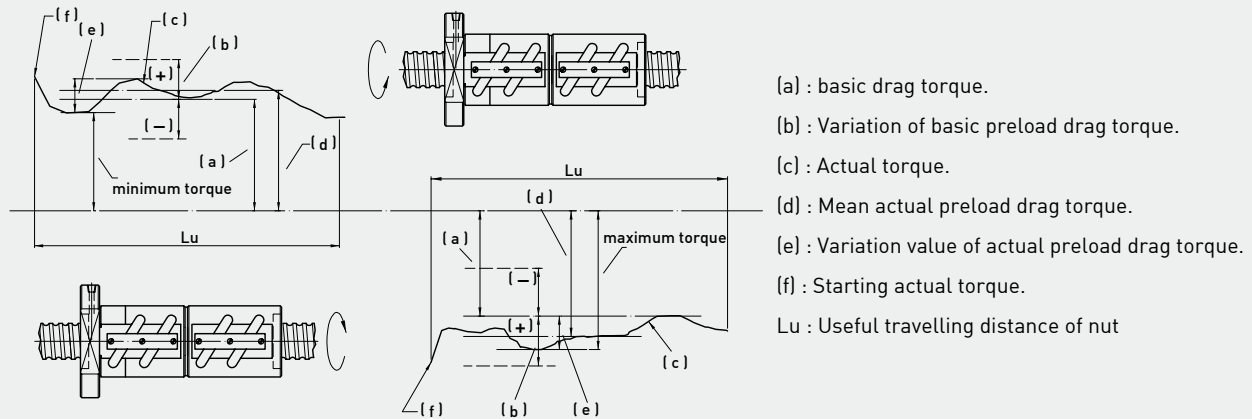


Fig 4.21 Nomenclature of drag torque measurement

Table 4.7 : Variation range for preload drag torque [According to JIS B1192]

Unit: ± %

| (1)<br>Basic<br>Dragtorque<br>(kgf - cm) |       | Useful stroke length of thread (mm) |    |    |    |    |    |    |    |    |                         |    |    |    |    |    |    |   |   |                |    |    |    |    |    |   |   |   |   |   |   |   |   |
|--|-------|-------------------------------------|----|----|----|----|----|----|----|----|-------------------------|----|----|----|----|----|----|---|---|----------------|----|----|----|----|----|---|---|---|---|---|---|---|---|
|  |       | 4000 mm maximum                     |    |    |    |    |    |    |    |    |                         |    |    |    |    |    |    |   |   | over 4000 mm   |    |    |    |    |    |   |   |   |   |   |   |   |   |
|  |       | Slender ratio ≤ 40                  |    |    |    |    |    |    |    |    | 40 < Slender ratio < 60 |    |    |    |    |    |    |   |   |                |    |    |    |    |    |   |   |   |   |   |   |   |   |
|  |       | Accuracy grade                      |    |    |    |    |    |    |    |    | Accuracy grade          |    |    |    |    |    |    |   |   | Accuracy grade |    |    |    |    |    |   |   |   |   |   |   |   |   |
| Above                                    | Up To | 0                                   | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 0  | 1                       | 2  | 3  | 4  | 5  | 6  | 7  | 0 | 1 | 2              | 3  | 4  | 5  | 6  | 7  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2  | 4     | 30                                  | 35 | 40 | 40 | 45 | 50 | 60 | -  | 40 | 40                      | 50 | 50 | 60 | 60 | 70 | -  | - | - | -              | -  | -  | -  | -  | -  | - | - | - | - | - | - | - | - |
| 4  | 6     | 25                                  | 30 | 35 | 35 | 40 | 40 | 50 | -  | 35 | 35                      | 40 | 40 | 45 | 45 | 60 | -  | - | - | -              | -  | -  | -  | -  | -  | - | - | - | - | - | - | - | - |
| 6  | 10    | 20                                  | 25 | 30 | 30 | 35 | 35 | 40 | 40 | 30 | 30                      | 35 | 35 | 40 | 40 | 45 | 45 | - | - | -              | 40 | 43 | 45 | 50 | 50 | - | - | - | - | - | - | - | - |
| 10                                       | 25    | 15                                  | 20 | 25 | 25 | 30 | 30 | 35 | 35 | 25 | 25                      | 30 | 30 | 35 | 35 | 40 | 40 | - | - | -              | 35 | 38 | 40 | 45 | 45 | - | - | - | - | - | - | - | - |
| 25                                       | 63    | 10                                  | 15 | 20 | 20 | 25 | 25 | 30 | 30 | 20 | 20                      | 25 | 25 | 30 | 30 | 35 | 35 | - | - | -              | 30 | 33 | 35 | 40 | 40 | - | - | - | - | - | - | - | - |
| 63                                       | 100   | -                                   | 15 | 15 | 15 | 20 | 20 | 25 | 30 | -  | -                       | 20 | 20 | 25 | 25 | 30 | 35 | - | - | -              | 25 | 23 | 30 | 35 | 35 | - | - | - | - | - | - | - | - |

- Note :
1. Slender ratio=Thread length of spindle/ Nominal spindle O.D.(mm)
  2. Refer to the designing section of the manual to determine the basic preload drag torque.
  3. Table 4.10 shows the conversion table for Nm.
  4. For more information, please contact our engineering department.

## 4.5 Calculation Formulas

### Service life

- The average number of rpm,  $n_{av}$

$$n_{av} = n_1 \times \frac{t_1}{100} + n_2 \times \frac{t_2}{100} + n_3 \times \frac{t_3}{100} + \dots$$

$n_{av}$  : average speed (rpm)

$n$  : speed (rpm)

$\frac{t_1}{100}$  : % of time at speed  $n_1$  etc.

M7

- The average operating load  $F_{bm}$   
(1) With variable load and constant speed

$$F_{bm} = \sqrt[3]{F_{b1}^3 \times \frac{t_1}{100} \times f_{p1}^3 + F_{b2}^3 \times \frac{t_2}{100} \times f_{p2}^3 + F_{b3}^3 \times \frac{t_3}{100} \times f_{p3}^3} \dots\dots \text{M8}$$

$F_{bm}$  : average operating load (kgf);  $F_b$  : working axial load

$f_p$  : operation condition factor

$f_p$  : 1.1 ~ 1.2 when running without impact

1.3 ~ 1.8 when running in the normal condition

2.0 ~ 3.0 when running with heavy impact and vibration

- (2) With variable load and variable speed

$$F_{bm} = \sqrt[3]{F_{b1}^3 \times \frac{n_1}{n_{av}} \times \frac{t_1}{100} \times f_{p1}^3 + F_{b2}^3 \times \frac{n_2}{n_{av}} \times \frac{t_2}{100} \times f_{p2}^3 + F_{b3}^3 \times \frac{n_3}{n_{av}} \times \frac{t_3}{100} \times f_{p3}^3} \dots\dots \text{M9}$$

- (3) With linear variable load and constant speed

$$F_{bm} \doteq \frac{F_{b \min} \times f_{p1} + 2 \times F_{b \max} \times f_{p2}}{3} \dots\dots \text{M10}$$

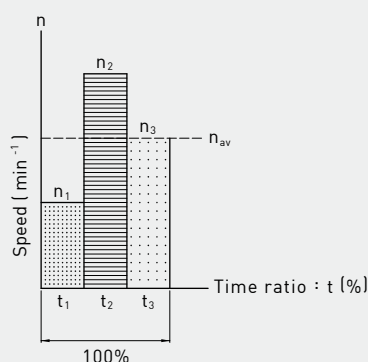


Fig 4.22 Equivalent speed

## Example 4.5 - 1

A HIWIN ballscrew is subjected to the following operating conditions. Calculate the average running speed and operating load.

Operating Condition :

For smooth running without impact  $f_p = 1.1$

| Condition | Axial load (kgf) | Revolution (rpm) | Loading time ratio (%) |
|-----------|------------------|------------------|------------------------|
|           | ( $F_b$ )        | ( $n$ )          | ( $t$ )                |
| 1         | 100              | 1000             | 45                     |
| 2         | 400              | 50               | 35                     |
| 3         | 800              | 100              | 20                     |

Calculation

$$n_{av} = 1000 \times \frac{45}{100} + 50 \times \frac{35}{100} + 100 \times \frac{20}{100} = 487.5 \text{ rpm (ref.M7)}$$

$$F_{bm} = \sqrt[3]{100^3 \times \frac{1000}{487.5} \times \frac{45}{100} \times 1.1^3 + 400^3 \times \frac{50}{487.5} \times \frac{35}{100} \times 1.1^3 + 800^3 \times \frac{100}{487.5} \times \frac{20}{100} \times 1.1^3} = 318.5 \text{ kgf}$$

## The resultant axial force, $F_a$

For a single nut without preload

$$F_a = F_{bm} \quad \text{M11}$$

For a single nut with preload P

$$F_a \leq F_{bm} + P \quad \text{M12}$$

## Expected service life for applications

Table 4.8 shows the recommended service life for general applications by service distance.

In the right of Table 4.8 is the formula for service life in hours.

Shock load, vibration, temperature, lubrication, position deviation, etc. must be taken into account also.

### For single nut

- Service life represented in revolutions :

$$L = \left( \frac{C}{F_a} \right)^3 \times 10^6 \quad \text{M13}$$

$L$  : Service life in running revolution (revolutions)

$C$  : dynamic load rating (kgf) ( $10^6$  rev)

### For symmetrical preload double nut arrangement

- (a) Service life represented in revolutions :

$$F_{bm}(1) = P \left( 1 + \frac{F_{bm}}{3P} \right)^{3/2} \quad L(1) = \left( \frac{C}{F_{bm}(1)} \right)^3 \times 10^6$$

$$F_{bm}(2) = F_{bm}(1) - F_{bm} \quad L(2) = \left( \frac{C}{F_{bm}(2)} \right)^3 \times 10^6$$

$$L = [L(1)^{-10/9} + L(2)^{-10/9}]^{-9/10} \quad \text{M14}$$

$L$  = Service life in running revolution (revolutions)

$C$  : Preload force (kgf)

- (b) conversion from revolutions to hours :

$$L_h = \frac{L}{n_{av} \times 60} \quad \text{M15}$$

$L_h$  : Service life in hours (hours)

$n_{av}$  : Average speed (rpm, Ref. M7)

- (c) Conversion from travel distance to hours:

$$L_h = \left( \frac{L_d \times 10^6}{\ell} \right) \times \frac{1}{n_{av} \times 60} \quad \text{M16}$$

$L_h$  : Running life (in hours)

$L_d$  : Running life (in distance, Km)

$\ell$  : Ballscrew lead (mm per rev)

$n_{av}$  : Average running speed (rpm)

(d) the modified service life for different reliability factors is calculated by

$$L_m = L \times f_r$$

M17

$$L_{hm} = L_h \times f_r$$

M18

with the reliability factor  $f_r$  ( Table 4.9)

Table 4.9 Reliability factor for service life

| Reliability % | $f_r$ |
|---------------|-------|
| 90            | 1     |
| 95            | 0.63  |
| 96            | 0.53  |
| 97            | 0.44  |
| 98            | 0.33  |
| 99            | 0.21  |

Example 4.5 - 2

By the example 5.4-1, if the design service life of the ballscrew is 3500 hours, lead = 10mm, single nut with zero backlash, find the nominal diameter of the HIWIN ballscrew.

Calculation

$$P = \frac{F_{bm}}{2.8} = \frac{318.5}{2.8} = 114 \text{ kgf}$$

(Assume zero backlash when  $F_{bm} = 318.5 \text{ kgf}$ )

$$F_a = F_{bm} + p = 318.5 + 114 = 432.5 \text{ kgf}$$

(Ref formula M1)

$$L = L_h \times n_{av} \times 60 = 3500 \times 487.5 \times 60 = 1.02375 \times 10^8 \text{ (revolutions)}$$

$$C' = F_a \left( \frac{L}{10^6} \right)^{1/3} = 432.5 \times \left( \frac{1.02375 \times 10^8}{10^6} \right)^{1/3} = 2023 \text{ kgf}$$

$C' \leq \text{rating}$

So, from the dimensions table of HIWIN ballscrews, select FSV type nut with spindle nominal diameters equals 32mm and C1 circuits which can satisfy this application.

Example 4.5 - 3

If the ballscrew nominal diameter=50mm, lead=8mm, and service life  $L=7 \times 10^6$  revolutions, find the permissible load on the screw spindle.

Calculation

From the dimensions table of HIWIN ballscrew, the FSV type ballscrew with nominal diameter=50 mm, lead=8 mm and B3 type return tube has the dynamic load rating  $C=5674$ .

$$Fa = C \div \left( \frac{L}{10^6} \right)^{1/3} = 5674 \div \left( \frac{7 \times 10^6}{10^6} \right)^{1/3} = 2966 \text{ kgf}$$

Drive torque and drive power for the motor

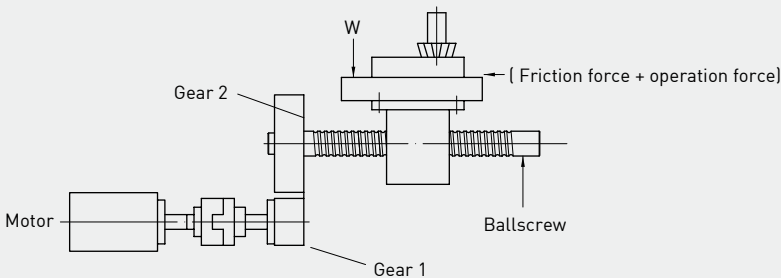


Fig 4.23 Load operation by ballscrew



Fig. 4.23 shows the terms for a feed system operated by ballscrew. The formula for motor drive torque is given below :

(a) Common transmission (to convert rotary motion to linear motion)

$$T_a = \frac{F_b \times \ell}{2\pi\eta_1} \quad \text{..... M19}$$

$T_a$  = Drive torque for common transmission (kgf-mm)

$F_b$  = Axial load (kgf)

$F_b$  =  $F_{bm} + \mu \times W$  (for horizontal motion)

$\ell$  = Lead (mm)

$\eta_1$  = Mechanical efficiency (0.9~0.95, Ref. M3)

$W$  = Table weight + Work piece weight (kgf)

$\mu$  = Friction coefficient of table guide way

(b) Reverse transmission (to convert linear motion to rotary motion)

$$T_c = \frac{F_b \times \ell \times \eta_2}{2\pi} \quad \text{..... M20}$$

$\eta_2$  = Mechanical efficiency (0.9~0.95, Ref. M4)

$T_c$  = Torque for reverse transmission (kgf-mm)

(c) Motor drive torque

For normal operation :

$$T_M = (T_a + T_b + T_d) \times \frac{N_1}{N_2} \quad \text{..... M21}$$

$T_M$  = Motor drive torque (kgf-mm)

$T_b$  = Friction torque of supporting bearing (kgf-mm)

$T_d$  = Preload drag torque (kgf-mm, Ref. M2)

$N_1$  = Number of teeth for driver gear

$N_2$  = Number of teeth for driven gear

For acceleration operation :

$$T'a = J\alpha \quad \text{..... M22}$$

$T'a$  : Motor drive torque during acceleration (kgf)

$J$  : System inertia (kgf-mm-sec<sup>2</sup>)

$\alpha$  : Angular acceleration (rad/sec<sup>2</sup>)

$$\alpha = \frac{2\pi N_{dif}}{60t_a} \quad \text{..... M23}$$

$N_{dif}$  = rpm<sub>stage2</sub> - rpm<sub>stage1</sub>

$t_a$  = acceleration rising time (sec)

$$J = J_M + J_{G1} + J_{G2} \left( \frac{N_1}{N_2} \right)^2 + \frac{1}{2g} W_s \left( \frac{D_N}{2} \right)^2 \left( \frac{N_1}{N_2} \right)^2 + \frac{W}{g} \left( \frac{\ell}{2\pi} \right)^2 \left( \frac{N_1}{N_2} \right)^2 \quad \text{..... M24}$$

= Motor inertia + Equivalent gear inertia + Ballscrew inertia + Load inertia (Fig.4.23)

$W_s$  : Ballscrew weight (kgf)

$D_N$  : Ballscrew nominal diameter (mm)

$g$  : Gravity coefficient (9800 mm/sec<sup>2</sup>)

$J_M$  : Inertia of motor (kgf-mm-sec<sup>2</sup>)

$J_{G1}$  : Inertia of driver gear (kgf-mm-sec<sup>2</sup>)

$J_{G2}$  : Inertia of driver gear (kgf-mm-sec<sup>2</sup>)

Total operating torque :

$$T_{Ma} = T_M + T'_a \quad \text{..... M25}$$

$T_{Ma}$  = Total operating torque (kgf)

The inertia of a disc is calculated as following :

For disc with concentric O.D.

$$J = \frac{1}{2g} \pi \rho_d R^4 L \quad \text{..... M26}$$

$J$  : Disc inertia (kgf • mm • sec<sup>2</sup>)

$\rho_d$  : Disc specific weight ( $7.8 \times 10^{-6}$  kgf/mm<sup>3</sup>) for steel

$R$  : Disc radius (mm)

$L$  : Disc length (mm)

$g$  : Gravity coefficient (9800 mm/sec<sup>2</sup>)

(d) Drive power

$$P_d = \frac{T_{pmax} \times N_{max}}{974} \quad \text{..... M27}$$

$P_d$  : Maximum drive power (watt) safety

$T_{pmax}$  : Maximum drive torque (safety factor  $\times T_{ma}$ , kgf-mm )

$T_{max}$  : Maximum rotation speed (rpm)

(e) Check the acceleration time

$$t_a = \frac{J}{T_{Ml} - T_L} \times \frac{2\pi N_{max}}{60} \cdot f \quad \text{..... M28}$$

$t_a$  = Acceleration rising time

$J$  = Total inertia moment

$T_{Ml} = 2 \times T_{mr}$

$T_{Mr}$  = Motor rated torque

$T_L$  = Drive torque at rated feed

$f$  = Safety factor = 1.5

Table 4.10 : Shows the conversion relationship of different measurement units for the motor torque or preload drag torque.

Table 4.10 Conversion table for motor torque

| kgf - cm                 | kgf - mm               | Nm                       | kpm [ kgf - m ]          | OZ - in               | ft - lbf                 |
|--------------------------|------------------------|--------------------------|--------------------------|-----------------------|--------------------------|
| 1                        | 10                     | $9.8 \times 10^{-2}$     | $10^{-2}$                | 13.8874               | $7.23301 \times 10^{-2}$ |
| 0.1                      | 1                      | $9.8 \times 10^{-3}$     | $1.0 \times 10^{-3}$     | 1.38874               | $7.23301 \times 10^{-3}$ |
| 10.19716                 | $1.019716 \times 10^2$ | 1                        | 0.1019716                | $1.41612 \times 10^2$ | 0.737562                 |
| $10^2$                   | $10^3$                 | 9.80665                  | 1                        | $1.38874 \times 10^3$ | 7.23301                  |
| $7.20077 \times 10^{-2}$ | 0.720077               | $7.06155 \times 10^{-3}$ | $7.20077 \times 10^{-4}$ | 1                     | $5.20833 \times 10^{-3}$ |
| 13.82548                 | $1.382548 \times 10^2$ | 1.35582                  | 0.1382548                | $1.92 \times 10^2$    | 1                        |

### Example 4.5 - 4

Consider the machining process driven by the motor and ballscrew as Fig. 4.24.

Table weight  $W_1 = 200$  kgf

Work weight  $W_2 = 100$  kgf

Friction coefficient of slider  $\mu = 0.02$

Operating condition : Smooth running without impact

| Axial feed force<br>(kgf) | Revolution<br>(rpm) | Loading time ratio<br>(%) |
|---------------------------|---------------------|---------------------------|
| 100                       | 500                 | 20                        |
| 300                       | 100                 | 50                        |
| 500                       | 50                  | 30                        |

Acceleration speed : 100 rad/sec<sup>2</sup>

Motor Condition : Motor diameter : 50 mm, Motor length : 200 mm,

Gear condition : Driver gear diameter G1 : 80 mm, Thickness : 20 mm, Teeth : 30  
Driven gear diameter G2 : 240 mm, Thickness : 20 mm, Teeth : 90

Ball screw condition :

Nominal diameter : 50 mm, Pitch : 10 mm

Length : 1200 mm, Weight : 18 kgf

No backlash when axial feed force = 300 kgf

Bearing torque  $T_b = 10 \text{ kgf}\cdot\text{mm}$

Mechanical efficiency  $\eta_l = 0.80$

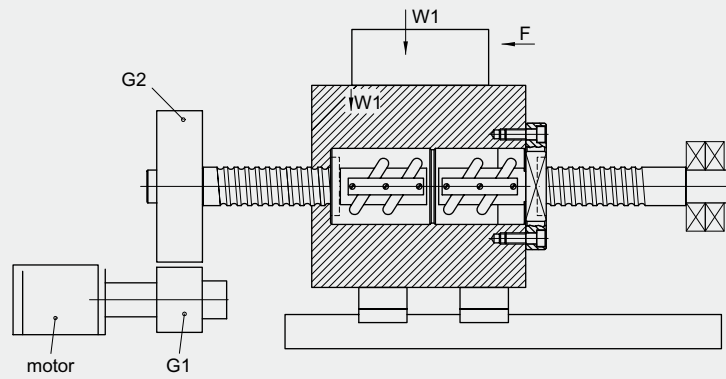


Fig 4.24 Milling process in the machine

#### Calculation

(1) Motor drive torque in normal rating condition :

$$n_{av} = 500 \times \frac{20}{100} + 100 \times \frac{20}{100} + 50 \times \frac{20}{100} = 165 \text{ rpm} \quad (\text{Ref. M7})$$

$$F_1 = 100, F_2 = 300, F_3 = 500$$

$$F_{bm} = \sqrt[3]{100^3 \times 1 \times \frac{20}{100} \times \frac{500}{165} \times 300^3 \times 1 \times \frac{50}{100} \times \frac{100}{165} + 500^3 \times 1 \times \frac{30}{100} \times \frac{50}{165}} = 272 \text{ kgf} \quad (\text{Ref. M9})$$

$$P = \frac{300}{2.8} \approx 110 \text{ kgf} \quad (\text{axial feed force} = 300 \text{ kgf}, \text{Ref. M1})$$

$$F_b = F_{bm} + \mu W = 270 + (200 + 100) \times 0.02 = 278 \text{ kgf}$$

$$T_a = \frac{F_b \times \ell}{2\pi\eta_l} = \frac{278 \times 10}{2\pi \times 0.80} = 553 \text{ kgf}\cdot\text{mm} \quad (\text{Ref. M19})$$

$$T_d = 0.2 \times \frac{P \times \ell}{2\pi} = \frac{0.2 \times 110 \times 10}{2\pi} = 35 \text{ kgf}\cdot\text{mm} \quad (\text{Ref. M2})$$

$$T_M = (T_a + T_b + T_d) \times \frac{N_1}{N_2} = (553 + 35 + 10) \times \frac{30}{90} = 199 \text{ kgf}\cdot\text{mm} \quad (\text{Ref. M21})$$

(2) Motor torque in acceleration operation :

(I) Inertia of motor

$$J_M = \frac{1}{2 \times 9800} \times \pi \times 7.8 \times 10^{-6} \times (25)^4 \times 200 = 0.1 \text{ kgf} \cdot \text{mm} \cdot \text{sec}^2$$

(II) Inertia of gear

$$J_{\text{Gear(eq)}} = J_{G1} + J_{G2} \times \left( \frac{N_1}{N_2} \right)^2$$

$$J_{G1} = \frac{1}{2 \times 9800} \times \pi \times 7.8 \times 10^{-6} \times \left( \frac{80}{2} \right)^4 \times 20 = 0.064 \text{ kgf} \cdot \text{mm} \cdot \text{sec}^2$$

$$J_{G2} = \frac{1}{2 \times 9800} \times \pi \times 7.8 \times 10^{-6} \times \left( \frac{240}{2} \right)^4 \times 20 = 5.18 \text{ kgf} \cdot \text{mm} \cdot \text{sec}^2$$

$$J_{\text{Gear(eq)}} = 0.064 + 5.18 \times \left( \frac{30}{90} \right)^2 = 0.640 \text{ kgf} \cdot \text{mm} \cdot \text{sec}^2$$

(III) Inertia of ballscrew

$$J_{\text{ballscrew}} = \frac{1}{2 \times 9800} \times 18 \times \left( \frac{50}{2} \right)^2 \left( \frac{30}{90} \right)^2 = 0.064 \text{ kgf} \cdot \text{mm} \cdot \text{sec}^2$$

(IV) Inertia of load

$$J_{\text{load}} = \frac{300}{9800} \times \left( \frac{10}{2 \times \pi} \right)^2 \times \left( \frac{30}{90} \right)^2 = 0.009 \text{ kgf} \cdot \text{mm} \cdot \text{sec}^2$$

(V) Total inertia

$$J = 0.1 + 0.64 + 0.064 + 0.009 = 0.813 \text{ kgf} \cdot \text{mm} \cdot \text{sec}^2$$

(3) Total motor torque:

$$T'_a = J \cdot \alpha = 0.813 \times 100 = 81.3 \text{ kgf} \cdot \text{mm}$$

$$T_{Ma} = T_M + T'_a = 199 + 81.3 = 280 \text{ kgf} \cdot \text{mm}$$

(4) Drive power:

$$T_{p \max} = 2 \times 280 = 560 \text{ kgf} \cdot \text{mm} \text{ (safety factor} = 2)$$

$$P_d = \frac{560 \times 1500}{974} = 862 \text{ W} = 1.16 \text{ Hp}$$

(5) Selection motor:

Select the DC motor rated torque :  $T_{Mr} > 1.5T_M$ , and maximum motor torque :  $T_{Max} > 1.5T_{pmax}$

Thus the DC servo motor with following specification can be chosen.

Rated output : 950 w

Rated torque : 30 kgf-cm (300 kgf • mm)

Rated rotational speed : 2000 rpm

Maximum torque : 65 kgf x cm (650 kgf • mm)

Moment of inertia of motor : 0.20 kgf • mm • sec<sup>2</sup>

(6) Check the acceleration time:

$$T_L = \left( \frac{F_d \times \ell}{2\pi\eta_1} + T_b + T_d \right) \times \frac{N_1}{N_2} = \left( \frac{100 \times 10}{2\pi \times 0.8} + 10 + 35 \right) \times \frac{30}{90} = 81.3 \text{ kgf} \cdot \text{mm}$$

$$t_a \geq \left( \frac{0.879}{300 \times 2 - 81.3} \right) \times \frac{2\pi \times 2000}{60} \times 1.5 = 0.53 \text{ sec}$$

## Buckling load

The ballscrew shaft when subjected to an axial compressive force may be undergo a visibly large deflection. The axial force is called the buckling load.

$$F_k = 40720 \left( \frac{N_f d_r^4}{L_t^2} \right) \quad \text{M29}$$

$$F_p = 0.5 F_k \quad \text{M30}$$

|   |                        |                |
|---|------------------------|----------------|
| $F_k$ : Permissible load (kgf)                | fixed - fixed          | $N_f = 1.0$    |
| $F_p$ : Maximum permissible speed (kgf)       | fixed - supported      | $N_f = 0.5$    |
| $d_r$ : Root diameter of screw shaft (mm)     | supported - supported  | $N_f = 0.25$   |
| $L_t$ : distance between support bearing (mm) | fixed - free           | $N_f = 0.0625$ |
| $N_f$ : Factor for different mounting types   | ◆1kgf = 9.8N; 1daN=10N |                |

The buckling load diagram for different spindle diameter and support method is shown in Fig 4.25.

## Critical speed

The critical speed is said to exist when the rotational frequency of a shaft equals the first natural frequency of the shaft. This will cause the ball screw to bend under the stress of vibration coupled with the centrifugal forces due to the rotation and cause the shaft to vibrate violently. Therefore, the rotational speed of the ball screw should be set to below the value indicated by critical speed.

$$N_c = 2.71 \times 10^8 \times \frac{M_f d_r}{L_t^2} \quad \text{M31}$$

$$N_p = 0.8 N_c \quad \text{M32}$$

|   |                       |               |
|---|-----------------------|---------------|
| $N_c$ : critical speed (rpm)                  | fixed - fixed         | $M_f = 1$     |
| $N_p$ : Maximum permissible load (rpm)        | fixed - supported     | $M_f = 0.692$ |
| $d_r$ : Root diameter of screw shaft (mm)     | supported - supported | $M_f = 0.446$ |
| $L_t$ : distance between support bearing (mm) | fixed - free          | $M_f = 0.147$ |
| $M_f$ : Factor for different mounting types   |                       |               |

The critical speed for different spindle and support method is shown in (Fig 4.26).

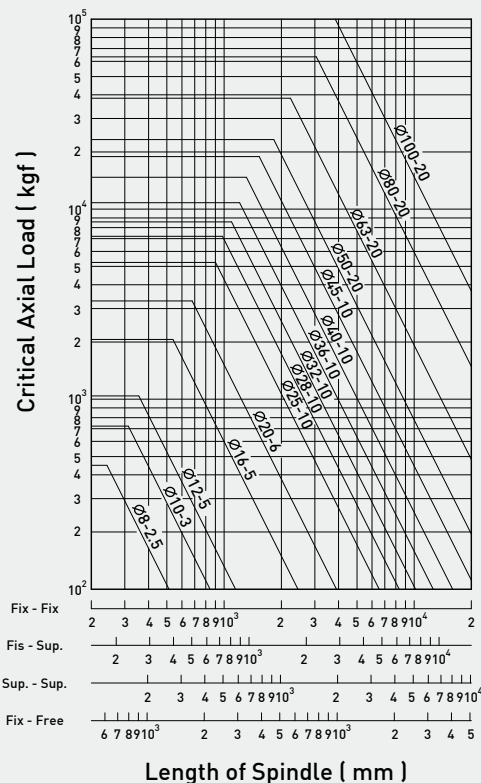


Fig 4.25 Shows the buckling load for different screw spindle diameter and length

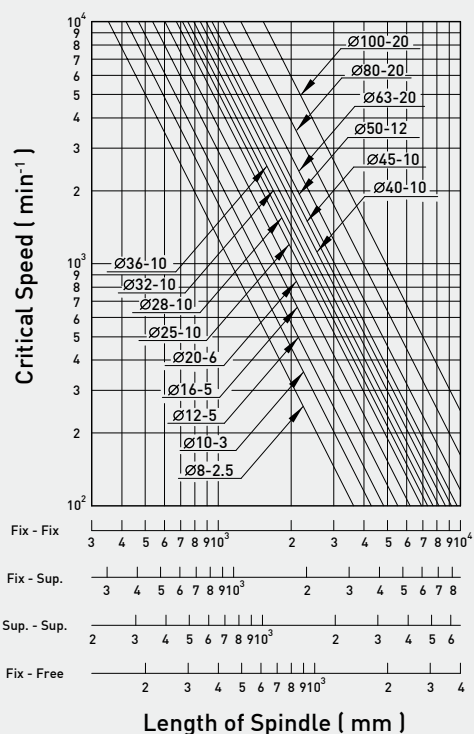


Fig 4.26 shows the critical speed for different screw spindle diameter and length

## D<sub>m</sub>-N value for ballscrew surface speed

D<sub>m</sub>-N value has a strong influence over ballscrew noise, working temperature and service life of return system.

For HIWIN ballscrew,

$$D_m \times N \leq 70,000 \quad \text{M33}$$

$D_m$  : Pitch circle diameter (mm)

$N$  : Maximum speed (rpm)

Ballscrew structure enhancement designed by HIWIN when Dm-N value ranges from 70,000 to 180,000 . If D<sub>m</sub>-N value above 180,000 , please consult our company.

## Stiffness

Stiffness is an indication of the rigidity of a machine. The stiffness of the ballscrew is determined by nut-spindle rigidity via axial load, balltrack contact rigidity and screw spindle rigidity. When assembling the ballscrew in the machine, the stiffness of support bearing, mounting condition of nut with machine table etc. also should be considered. Fig 4.27 shows the relation of total stiffness of the machine feed system.

From testing, the stiffness of nut-spindle relation and ball and balltrack relation can be combined into the stiffness of nut,  $K_n$ , and listed in dimension table of different nut type. The stiffness of the ballscrew is shown as :

$$\frac{1}{K_{bs}} = \frac{1}{K_s} + \frac{1}{K_n} \quad \text{M34}$$

$K_{bs}$  : Total stiffness of ballscrew (kgf/μm)

The stiffness of the screw spindle is shown as :

$$K_s = 67.4 \frac{d_r^2}{L_1} \text{ (Fixed-Fixed)} \quad \text{M35}$$

$$K_s = 16.8 \frac{d_r^2}{L_1} \text{ (Fixed-Free)} \quad \text{M36}$$

The stiffness chart is shown in Fig 4.28

$$d_r : \text{Root diameter of screw spindle (mm)} \approx D_m - D_b \quad \text{M37}$$

$D_b$  : Diameter of ball (mm)

$K_s$  : Screw spindle stiffness (kgf/μm)

$K_n$  : Nut stiffness (kgf/μm)

The stiffness of the nut is tested using an axial force equal to the highest possible preload of 10% dynamic load (C) and is shown in the dimension table of each nut. When the preload is less than this value, the stiffness of the nut is calculated by extrapolation method as :

$$K_n = 0.8 \times K \left( \frac{P}{0.1C} \right)^{1/3} \quad \text{M38}$$

$K_n$  : Stiffness of nut

$K$  : Stiffness in the dimension table

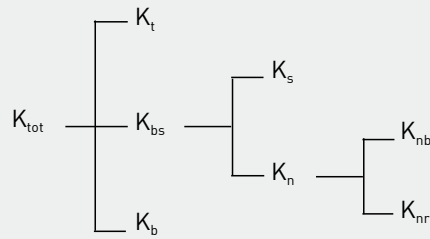
$P$  : Preload

$C$  : Dynamic load on dimension table

Single nut with backlash is calculated when the external axial force is equal to 0.28 C, thus :

$$K_n = 0.8 \times K \left( \frac{F_b}{2.8 \times 0.1C} \right)^{1/3} \quad \text{M39}$$

The axial stiffness of the whole feed system includes the stiffness of support bearings and nut mounting table. The designer should consider the total stiffness carefully.



$K_{tot}$  : Total stiffness of machine feed system  
 $K_t$  : Table mounting stiffness  
 $K_b$  : Support bearing stiffness  
 $K_{bs}$  : Ballscrew stiffness  
 $K_s$  : Ballscrew spindle stiffness  
 $K_n$  : Ballscrew nut stiffness  
 $K_{nb}$  : Ball and balltrack stiffness  
 $K_{nr}$  : Nut-spindle stiffness by radial load

Fig 4.27 Stiffness distribution for ballscrew feed system

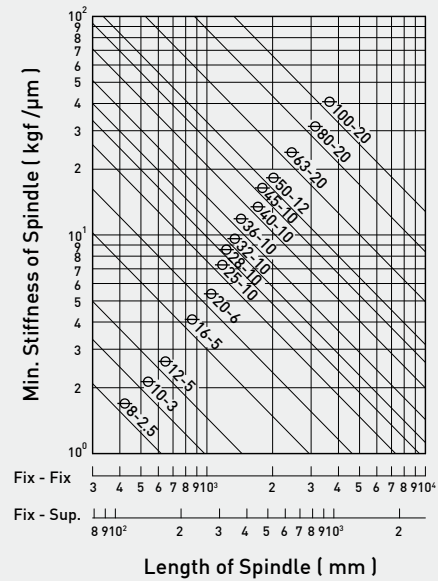


Fig 4.28 Stiffness chart for ballscrew spindle

## Thermal expansion

$$\Delta L = 11.6 \times 10^{-6} \times \Delta T \times L_s \quad \text{M40}$$

$\Delta L$  : Thermal expansion of screw spindle (mm)

$\Delta T$  : (°C) Temperature rise at screw spindle

$L_s$  : Total length of screw spindle (mm)

The T value should be chosen to compensate for the temperature rise of the ballscrew.

HIWIN recommends a T value of -0.02 ~ -0.03 per meter for CNC machine tools.

## Basic dynamic axial load rating C (theoretical)

The dynamic load is the load at which 90% of the ballscrews will achieve the service life of  $1 \times 10^6$  rev (C). The reliability factor can be adjusted by Table 4.9. The dynamic load is shown on the dimension table of each nut type.

## Basic static axial load rating Co (theoretical)

The static load is the load which will cause the balltrack to have a plastic deformation exceeding 0.0001x ball diameter. To calculate the maximum static load of a ballscrew, the static safety factor  $S_f$  of the application condition should be considered.

$$S_f \times F_a(\max) < Co \quad \text{M41}$$

$S_f$  : Static factor = 2.5 max

$Co$  : Static load from the dimension table of the nut type

$F_a(\max)$  : Maximum static axial load

### Example 4.5 - 5

|   |   |
|---|---|
| Ball screw specification: 1R40-10B2-FSW-1000-1200-0.012 | Lead $\ell = 10$ mm                           |
| Pitch circle diameter $D_m = 41.4$ mm                   | Turns = 2.5x2                                 |
| Ball diameter : 6.35 mm                                 | Lead angle $\alpha = 4.4^\circ$               |
| Root diameter $d_r = 34.91$ mm                          | Friction angle $\beta = 0.286^\circ$          |
| Column load : fixed - supported                         | Preload $P = 250$ kgf                         |
| Critical speed : fixed - supported                      | Mean axial force $F_b = 700$ kgf              |
| Stiffness of bearing $K_b = 105$ kgf/ $\mu m$           | $N_f = 0.5$ ; $L_t = 1000$ mm ; $M_f = 0.692$ |

#### Calculation

##### (1) Buckling load $F_p$

$$F_k = 40720 \times \frac{N_f d_r^4}{L_t^2} = 40720 \times \frac{0.5 \times 34.91^4}{1000^2} = 30240 \text{ kgf (Ref. M29)}$$

$$F_p = 0.5 \times F_k = 0.5 \times 30240 = 15120 \text{ kgf}$$

##### (2) Critical speed $N_p$

$$N_c = 2.71 \times 10^8 \times \frac{0.692 \times 34.90}{1000^2} = 6545 \text{ rpm}$$

$$N_p = 0.8 \times N_c = 0.8 \times 6545 = 5236 \text{ rpm}$$

##### (3) Mechanical efficiency $\eta$ [theoretical]

###### (I) Common transmission

$$\eta_1 = \frac{\tan \alpha}{\tan(\alpha + \beta)} = \frac{\tan(4.396^\circ)}{\tan(4.396^\circ + 0.286^\circ)} = 0.938 \text{ (Ref. M3)}$$

###### (II) Reverse transmission

$$\eta_2 = \frac{\tan(\alpha + \beta)}{\tan \alpha} = \frac{\tan(4.396^\circ + 0.286^\circ)}{\tan(4.396^\circ)} = 0.934 \text{ (Ref. M4)}$$

##### (4) Stiffness $K$

$$K_s = 16.8 \frac{d_r^2}{L_1} = 16.8 \times \frac{34.91^2}{1000} = 20.5 \text{ kgf} / \mu m \quad p = 250 < 0.1C (=537)$$

$$\therefore K_n = 0.8 \times \left( \frac{P}{0.1C} \right)^{1/3} = 0.8 \times 74 \times \left( \frac{250}{0.1 \times 5370} \right)^{1/3} = 46 \text{ kgf} / \mu m$$

$$\frac{1}{K} = \frac{1}{K_s} + \frac{1}{K_n} = \frac{1}{20.5} + \frac{1}{46} \quad K = 14.18 \text{ kgf} / \mu m$$

##### (5) Lost motion during axial force $F_b = 700$ kgf

$$\frac{1}{K_t} = \frac{1}{K} + \frac{1}{K_b} = \frac{1}{14} + \frac{1}{105} \quad K_t = 12.35 \text{ kgf} / \mu m$$

$$\delta / 2 = \frac{F}{K} = \frac{700}{12.4} = 56 \mu m = 0.056 \text{ mm} \quad (\text{each way}) \quad \text{Total lost motion } \delta = 2 \times 0.056 = 0.112 \text{ mm}$$

If the preload increases to  $2 \times 250 = 500$  kgf then  $K_n = 58$  kgf/ $\mu m$  and  $K = 15.1$  kgf/ $\mu m$ . Total stiffness  $K_t = 13.2$  kgf/ $\mu m$  and total lost motion  $\delta = 0.106$  mm. The difference is only  $6 \mu m$  (5% change). comparing with 250 kgf, preloaded nut, but the temperature rise caused by 500 kgf preload is heavy. The spindle stiffness is sometimes more important than the nut stiffness. The best way to increase the stiffness of the system is not in the heavy preloading of the ballscrew nut. If the support method changes to fixed-fixed, then  $K_s = 82$  kgf/ $\mu m$  and  $K_t$  becomes 23 kgf/ $\mu m$ . The total lost motion  $d = 0.061$  mm. The difference is  $51 \mu m$  (45%).



## Manufacturing range

The maximum length to which a ballscrew can be manufactured depends on spindle diameter and accuracy grade (Table 4.12). Since high accuracy ballscrews require a high degree of straightness to the screw spindle, the higher the slender ratio (length/diameter), the more difficult to manufacture and the less the spindle stiffness.

HIWIN recommends the maximum lengths shown in Table 4.12.

If a longer length is required, please contact with HIWIN engineer.

Table 4.12 General manufacturing range of HIWIN screw spindle vs. diameter and accuracy grade

Unit : mm

| Total length<br>Grade \ O.D. | 6   | 8   | 10   | 12   | 16   | 20   | 25   | 28   | 32   | 36   | 40   | 45   | 50   | 55   | 63   | 70   | 80    | 100   |
|------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|
| C0                           | 110 | 170 | 300  | 400  | 600  | 700  | 1000 | 1000 | 1200 | 1300 | 1500 | 1600 | 1800 | 2000 | 2000 | 2000 | 2000  | 2000  |
| C1                           | 110 | 170 | 400  | 500  | 720  | 950  | 1300 | 1500 | 1800 | 1800 | 2300 | 2500 | 3100 | 3500 | 4000 | 4000 | 4000  | 4000  |
| C2                           | 140 | 200 | 500  | 630  | 900  | 1300 | 1700 | 1800 | 2200 | 2200 | 2900 | 3200 | 4000 | 5000 | 5200 | 5500 | 6300  | 6300  |
| C3                           | 170 | 250 | 500  | 630  | 1000 | 1400 | 1800 | 2000 | 250  | 3200 | 3500 | 4000 | 4500 | 5000 | 6000 | 7100 | 10000 | 10000 |
| C4                           | 170 | 250 | 500  | 630  | 1000 | 1400 | 1800 | 2000 | 2500 | 3200 | 3500 | 4000 | 4500 | 5000 | 6000 | 7100 | 10000 | 10000 |
| C5                           | 170 | 250 | 500  | 630  | 1410 | 1700 | 2400 | 2500 | 3000 | 3200 | 3800 | 4000 | 5000 | 5500 | 6900 | 7100 | 10000 | 10000 |
| C6                           | 400 | 800 | 1000 | 1200 | 1500 | 1800 | 2500 | 3000 | 3000 | 4000 | 4000 | 4000 | 5600 | 5600 | 6900 | 7100 | 10000 | 10000 |
| C7                           | 400 | 800 | 1000 | 1200 | 3000 | 3000 | 4000 | 4000 | 4500 | 4500 | 5600 | 5600 | 5600 | 5600 | 6900 | 7100 | 10000 | 10000 |

■ Please consult with HIWIN in this area

## Heat treatment

HIWIN's homogenous heat treatment technique gives the ballscrew maximum life capability. Table 4.13 shows the hardness value of hardness in each component of HIWIN ballscrews. The surface hardness of the ballscrew affects both dynamic and static load value. The dynamic and static values shown in the dimension table are the values for a surface hardness equal to HRC 60. If the surface hardness is lower than this value, the following formula will give you the calibration result.

$$C'o = Co \times f_{HO} \quad f_{HO} = \left( \frac{\text{Real Hardness (HRC)}}{60} \right)^3 \leq 1 \quad \text{M42}$$

$$C' = C \times f_H \quad f_H = \left( \frac{\text{Real Hardness (HRC)}}{60} \right)^2 \leq 1 \quad \text{M43}$$

Where  $f_H$  and  $f_{HO}$  are the hardness factor.

$C'o$  : Calibrated static load

$Co$  : Static load

$C'$  : Calibrated dynamic load

$C$  : Dynamic load

Table 4.13 Hardness of each component of HIWIN ballscrew

| Item    | Treat Method                          | Hardness (HRC) |
|---------|---------------------------------------|----------------|
| Spindle | Carburizing<br>or Induction Hardening | 58 - 62        |
| Nut     | Carburizing                           | 58 - 62        |
| Ball    |                                       | 62 - 66        |

## 4.6 Temperature Rise Effect on Ballscrews

The temperature rise of ballscrew during the working period will influence the accuracy of the machine feed system, especially in a machine designed for high speed and high accuracy.

The following factors have the effect of raising the temperature in a ballscrew.

- (1) Preload (2) Lubrication (3) Pretension

Fig 4.29 shows the relation of working speed, preload and temperature rise. Fig 4.30 shows the relation of nut temperature rise to preload friction torque. From Fig 4.29, Fig 4.30 and example 4.5-5, doubling the preload of the nut will increase the temperature about 5 degrees, but the stiffness increase only by about 5% (few  $\mu\text{m}$ ).

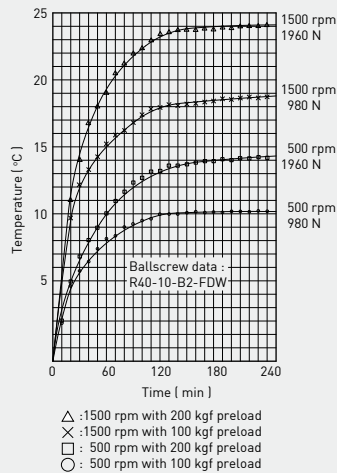


Fig 4.29 The relation of working speed, preload and temperature rise

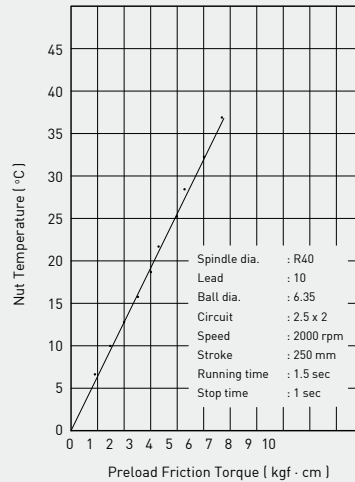


Fig 4.30 The relation of nut temperature rise to preload friction torque

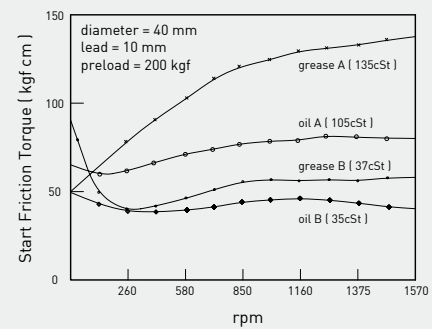


Fig 4.31 The influence of oil viscosity on the friction torque

### (1) Preload effect

To avoid any lost motion in the machine feed system, increasing the rigidity of the ballscrew nut is important. However, to increase the rigidity of the ballscrew nut, it is necessary to preload the nut to a certain level.

Preloading the nut will increase the friction torque of the screw, making it more sensitive to an increase in temperature during working period.

HIWIN recommends using a preload of 8% of the dynamic load for medium and heavy preload, 6% ~ 8% for medium preload, 4% ~ 6% for light and medium and below 4% for light preload.

The heaviest preload should not exceed 10% of the dynamic load for best service life and a low temperature rise effect.

### (2) Lubrication effect

The selection of lubricant will directly influence the temperature rise of the ballscrew.

HIWIN ballscrews require appropriate lubrication either by greasing or oiling. Antifriction bearing oil is recommended for ballscrew oil lubrication. Lithium soap based grease is recommended for ballscrew greasing. The basic oil viscosity requirement depends on the speed, working temperature and load condition of the application. (Fig 4.31) shows the relation of oil viscosity, working speed and rise in temperature.

When the working speed is higher and the working load is lower, a low viscosity oil is better. When the working speed is lower and the working load is heavy, a high viscosity oil is preferred.

Generally speaking, oil with a viscosity of 32 ~ 68 cSt at 40°C (ISO VG 32-68) is recommended for high speed lubrication (DIN 51519) and viscosity above 90 cSt at 40°C (ISO VG 90) is recommended for low speed lubrication.

In high speed and heavy load applications the use of a forced coolant is necessary to lessen the temperature. The forced lubrication of coolant can be done by a hollow ballscrew.

Fig 4.32 shows the comparison of a ballscrew applied with coolant and without coolant. Fig 4.33 shows a typical application for hollow ballscrew in machine tools. The inspection and replenishing of the ballscrew lubricant is listed in Table 4.14.

### [3] Pretension effect

When the temperature rises in the ballscrew, the effect of thermal stress will elongate the screw spindle. It can make the spindle length unstable. Ø

The elongating relationship can be calculated according to M41. This elongation can be compensated via the pretension force. For the purpose of pretension, there is a negative T value indicated in the design drawing to compensate the pretension value.

Since a large pretension force will cause the burn down of the supporting bearing, HIWIN recommends using pretension when the temperature rise is below 5°C. Also, if the diameter of the screw spindle is greater than 50 mm, it is not suitable for pretension. A large spindle diameter requires a high pretension force, causing burn down of the supporting bearing.

HIWIN recommends a T compensation value of about 3°, (about -0.02~0.03 for each 1000 mm screw spindle).

Since different applications require different T values, please contact HIWIN engineer.

The pretension force is calculated as :

$$P_f = K_s \times \Delta L$$

$K_s$  : Stiffness of screw spindle (kgf/μm)

$P_f$  : Pretension force (kgf)

$\Delta L$  : Pretension value (μm)

Table 4.14 : Inspection and replenishment of Lubricant

| Lubrication Method | Inspection & Replenishment Guide   |
|--------------------|--|
| Oil                | <ul style="list-style-type: none"> <li>Check the oil level and clean the contamination once a week.</li> <li>When contamination happens, replacing the oil is recommended.</li> </ul>  |
| Grease             | <ul style="list-style-type: none"> <li>Inspect for contamination of chips every 2 or 3 months.</li> <li>If contamination happens, remove old grease and replace with new grease.</li> <li>Replace grease once a year.</li> </ul> |

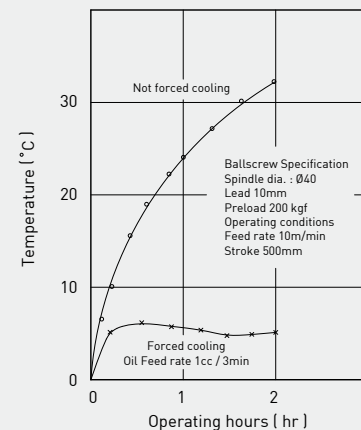


Fig 4.32 Ballscrew temperature rise with the coolant and without the coolant

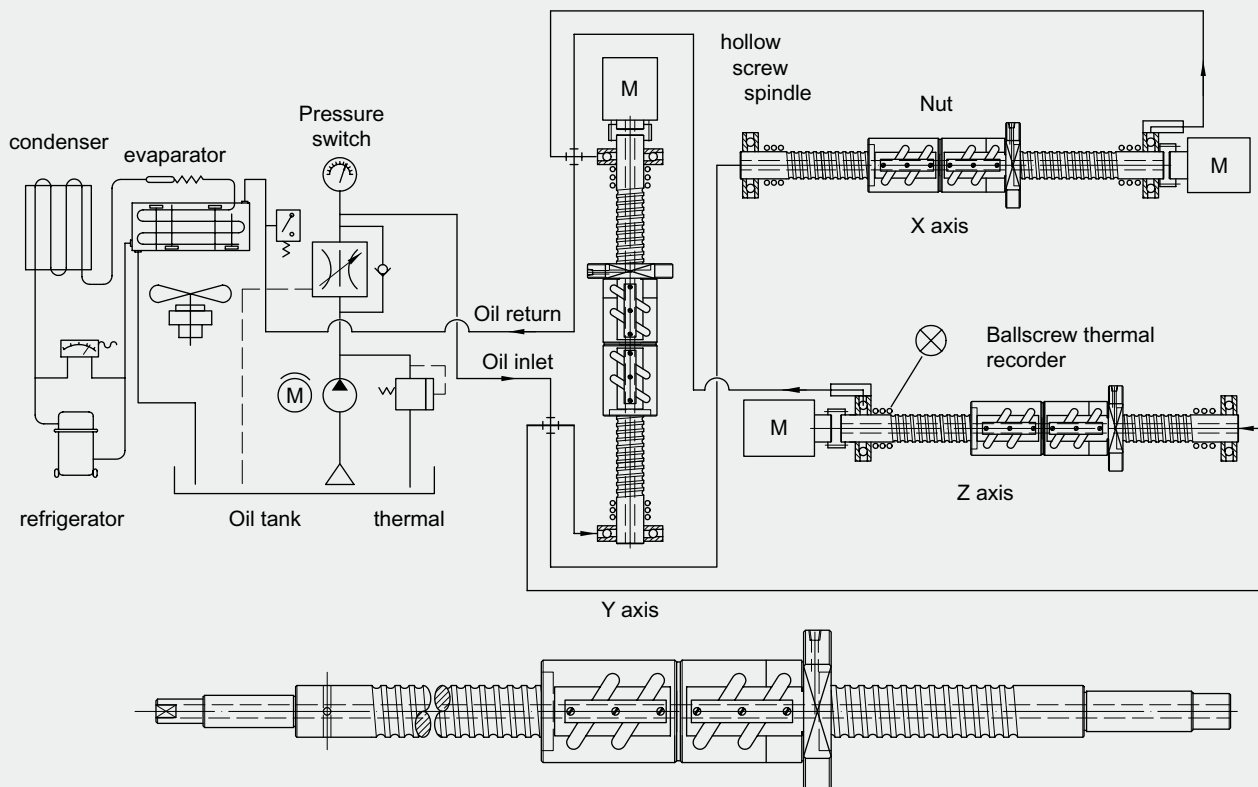


Fig 4.33 High accuracy machine tools with hollow ballscrew lubrication

## 5

## Specification Illustration

HIWIN manufactures ballscrews according to customers' blueprints or specifications. Please read the following information for understanding out ballscrew designing.

1. Nominal diameter.
2. Thread lead.
3. Thread length, total length.
4. End journal configuration.
5. Nut configuration
6. Accuracy grade (lead deviation, geometrical tolerance).
7. Working speed.
8. Maximum static load, working load, preload drag torque.
9. Nut safety requirements.
10. Lubrication hole position.

## HIWIN Ballscrew Nomenclature

HIWIN ballscrews can be specified as follows :

**1R40 - 10B2 - PFDWE2 - 800 - 1000 - 0.0035 - M**

### Start type

1. Single start
2. Double start
3. Triple start
4. Four start

### Right hand screw

### Nominal diameter

### Lead

### Number of turns

### Preload type

- P : Compression type  
O : Offset type  
D : High lead double start  
T : High lead triple start  
Q : High lead quaternary start

### Nut shape

- S : Square nut  
R : Round  
F : Nut with flange

### Note :

- M : Stainless  
H : Hollow Shaft  
Lead deviation in random 300mm travel path thread length

Total length

Thread length

### Optional Functions :

- E2 : Self-lubrication  
R1 : Rotating Nut  
C1,C2 : Cool Type

### Circulation type

- W : Tubes within nut body  
V : Tubes above nut body  
B : Bonded tube  
I : Internal cap  
H : End cap  
C : Super S series

### Nut type

- S : Single nut  
D : Double nut

Number of turns

|                         |        |            |            |        |
|-------------------------|--------|------------|------------|--------|
| A : 1.5, B: 2.5, C: 3.5 | T3 : 3 | S1 : 1.8x1 | U1 : 2.8x1 | K2 : 2 |
| A2 : 1.5x2              | T4 : 4 | S2 : 1.8x2 | U2 : 2.8x2 | K3 : 3 |
| B2 : 2.5x2              | T5 : 5 | S4 : 1.8x4 | V2 : 0.7x2 | K4 : 4 |
| C1 : 3.5x1              | T6 : 6 |            |            |        |

Note : 1. Different diameters and leads are available upon request.

2. Right hand thread is standard, left hand thread is available upon request.

3. Longer lengths are available upon request.

4. Stainless steel is available upon request, only if the ball size is less than 2.381 mm.

5. Complete questionnaire on page 170~171 and consult with HIWIN engineers.

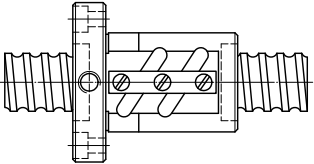
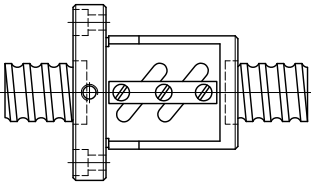
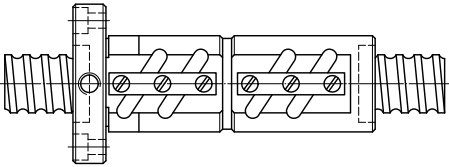
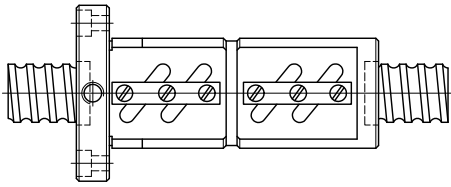
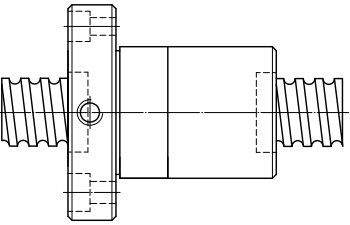
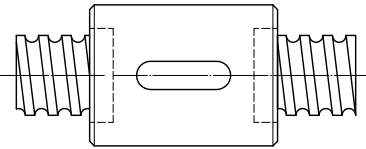
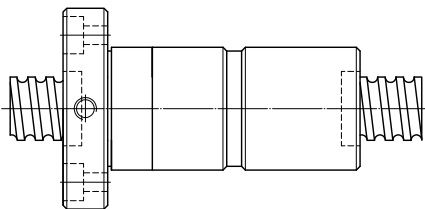
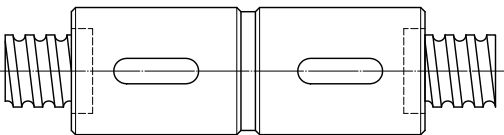
6. If you need to order DIN 69051 type, please mark "DIN".

7. Number of turns = turns per circuit x number of circuits.

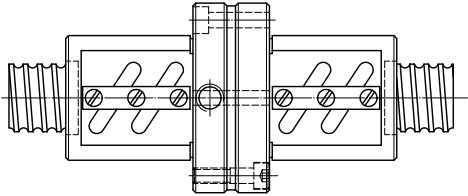
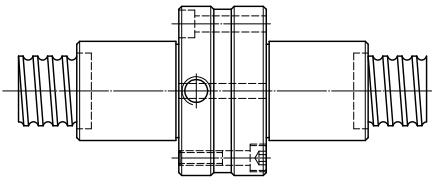
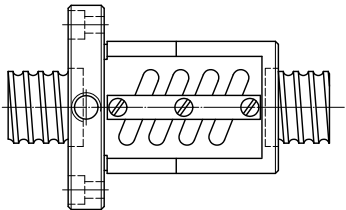
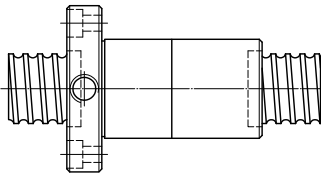
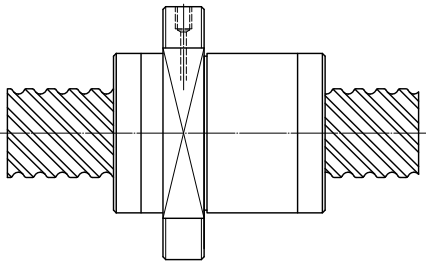
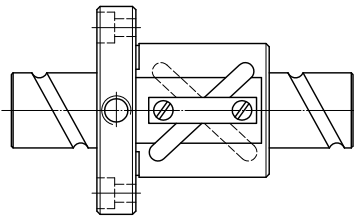
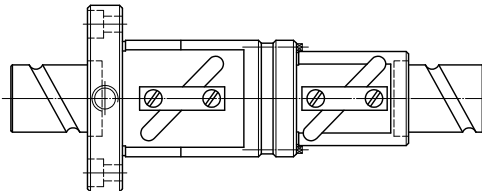
Please refer to page 6 for detailed illustration.

## 6 Precision Ground Ballscrews

### 6.1 Ground Ballscrew Series

| page          | General Type   |   | page          |
|---------------|--|---|---------------|
| 39<br>~<br>41 | <p>★ ★ <b>FSV</b></p>  <p>Flange end, single nut,<br/>tube above the nut diameter</p>   | <p>★ ★ <b>FSW</b></p>  <p>Flange end, single nut,<br/>tube within the nut diameter</p>  | 42<br>~<br>44 |
| 45<br>~<br>47 | <p>★ ★ <b>FDV</b></p>  <p>Flange end, double nut,<br/>tube above the nut diameter</p> | <p>★ ★ <b>FDW</b></p>  <p>Flange end, double nut,<br/>tube within the nut diameter</p> | 48<br>~<br>50 |
| 51<br>~<br>53 | <p>★ ★ <b>FSI</b></p>  <p>Flange end, single nut,<br/>internal recirculation cap</p>  | <p><b>RSI</b></p>  <p>Round, single nut,<br/>internal recirculation cap</p>           | 54<br>~<br>55 |
| 56<br>~<br>57 | <p>★ ★ <b>FDI</b></p>  <p>Flange end, double nut,<br/>internal recirculation cap</p>  | <p><b>RDI</b></p>  <p>Round, double nut,<br/>Internal recirculation cap</p>           | 58<br>~<br>59 |

## 6.1 Ground Ballscrew Series

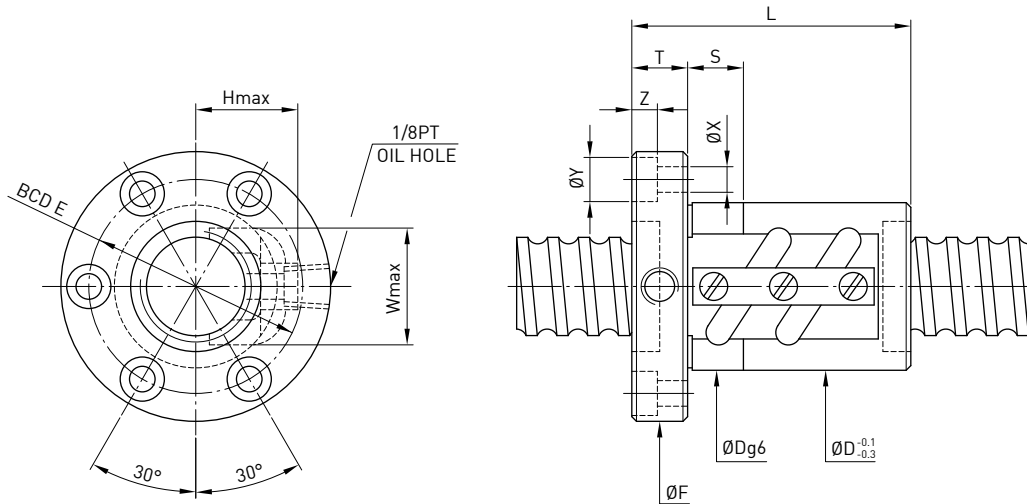
| page          | General Type  |   | page          |
|---------------|---|---|---------------|
| 60<br>~<br>61 | ★★ <b>PFDW -Type 1</b><br> <p>Flange to flange, double nut, tube within the nut diameter</p>                           | <b>PFDI</b><br> <p>Flange to flange, double nut, internal recirculation cap</p>                     | 63<br>~<br>64 |
| 65<br>~<br>66 | ★★ <b>OFSW</b><br> <p>Offset pitch preload, flange end, single nut, tube within the nut diameter</p>                  | ★★ <b>OFSI</b><br> <p>Offset pitch preload, flange end, single nut, internal recirculation cap</p> | 67            |
| page          | High Lead Type  |   | page          |
| 68            | ★★ <b>FSH</b><br> <p>Large lead, flange mounted, single nut, end cap</p>   | ★★ <b>DFSV</b><br> <p>Double start, flange end, single nut, tube above the nut diameter</p>       | 69            |
| 62            | ★★ <b>PFDW -Type 2</b><br> <p>Large lead, flange end, compression preload, double nut, tube within nut diameter</p> |   | 62            |

\*Different design required by the drawing approval, please contact with HIWIN engineers for the other type listed above.

\*Double asterisks(★★): Self-Lubricating Ballscrew E2 design is available, except the shaft diameter under 16mm or ball diameter under 2.381mm.

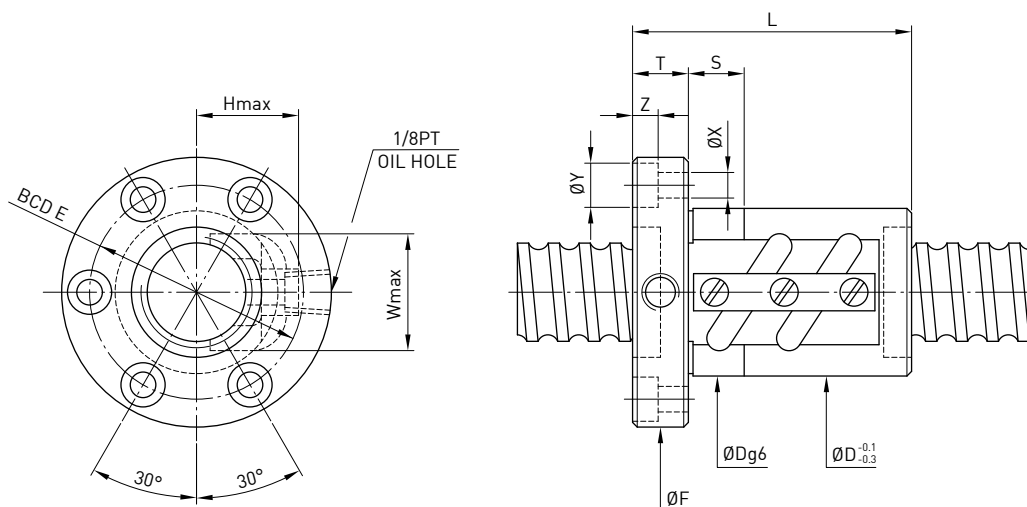
## 6.2 Dimension for Precision Ground Ballscrew

### F S V TYPE



| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     | Flange |    |       | Return Tube |    | Bolt |     |     | Fit |   |
|---------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|-----|--------|----|-------|-------------|----|------|-----|-----|-----|---|
|         | Nominal Dia. | Lead |           |          |                            |   |                          | D   | L   | F      | T  | BCD-E | W           | H  | X    | Y   | Z   |     | S |
| 16-4B2  | 16           | 4    | 2.381     | 2.5x2    | 26                         | 802   | 1722                     | 30  | 48  | 52     | 10 | 40    | 23          | 21 | 5.5  | 9.5 | 5.5 | 12  |   |
| 16-5B1  |              | 5    | 3.175     | 2.5x1    | 16                         | 763   | 1400                     | 31  | 45  | 54     | 12 | 41    | 27          | 22 | 5.5  | 9.5 | 5.5 | 12  |   |
| 16-5B2  |              |      |           | 2.5x2    | 33                         | 1385  | 2799                     | 31  | 60  | 54     | 12 | 41    | 27          | 22 | 5.5  | 9.5 | 5.5 | 12  |   |
| 16-5C1  |              |      |           | 3.5x1    | 22                         | 1013  | 1946                     | 31  | 50  | 54     | 12 | 41    | 27          | 22 | 5.5  | 9.5 | 5.5 | 12  |   |
| 16-10B1 |              | 10   |           | 2.5x1    | 16                         | 763   | 1399                     | 30  | 54  | 53     | 10 | 41    | 22.5        | 23 | 5.5  | 9.5 | 5.5 | 12  |   |
| 20-5B1  | 20           | 5    | 3.969     | 2.5x1    | 19                         | 837   | 1733                     | 35  | 45  | 58     | 12 | 46    | 27          | 25 | 5.5  | 9.5 | 5.5 | 12  |   |
| 20-5B2  |              |      |           | 2.5x2    | 39                         | 1519  | 3465                     | 35  | 60  | 58     | 12 | 46    | 27          | 25 | 5.5  | 9.5 | 5.5 | 12  |   |
| 20-6B1  |              | 6    |           | 2.5x1    | 20                         | 1139  | 2187                     | 36  | 48  | 60     | 12 | 47    | 28          | 27 | 5.5  | 9.5 | 5.5 | 12  |   |
| 20-6C1  |              |      |           | 3.5x1    | 28                         | 1512  | 3041                     | 36  | 66  | 60     | 12 | 47    | 28          | 27 | 5.5  | 9.5 | 5.5 | 12  |   |
| 20-20A1 |              | 20   |           | 1.5x1    | 13                         | 719   | 1281                     | 36  | 66  | 60     | 12 | 47    | 28          | 27 | 5.5  | 9.5 | 5.5 | 12  |   |
| 25-5B2  | 25           | 5    | 3.175     | 2.5x2    | 46                         | 1704  | 4417                     | 40  | 60  | 64     | 12 | 52    | 31          | 26 | 5.5  | 9.5 | 5.5 | 12  |   |
| 25-5C1  |              |      |           | 3.5x1    | 35                         | 1252  | 3085                     | 40  | 50  | 64     | 12 | 52    | 31          | 26 | 5.5  | 9.5 | 5.5 | 12  |   |
| 25-6B2  |              | 6    | 3.969     | 2.5x2    | 48                         | 2308  | 5523                     | 42  | 68  | 68     | 12 | 55    | 32          | 28 | 6.6  | 11  | 6.5 | 12  |   |
| 25-6C1  |              |      |           | 3.5x1    | 35                         | 1690  | 3844                     | 42  | 55  | 68     | 12 | 55    | 32          | 28 | 6.6  | 11  | 6.5 | 12  |   |
| 25-8B2  |              | 8    | 4.763     | 2.5x2    | 46                         | 2888  | 6472                     | 50  | 80  | 74     | 13 | 62    | 35          | 31 | 5.5  | 9.5 | 5.5 | 15  |   |
| 25-10B1 |              | 10   |           | 2.5x1    | 25                         | 1592  | 3237                     | 45  | 65  | 72     | 16 | 58    | 34          | 29 | 6.6  | 11  | 6.5 | 12  |   |
| 25-10B2 |              |      |           | 2.5x2    | 46                         | 2888  | 6472                     | 47  | 97  | 74     | 15 | 60    | 35          | 31 | 6.6  | 11  | 6.5 | 15  |   |
| 25-16B1 |              | 16   |           | 2.5x1    | 28                         | 1592  | 3237                     | 45  | 84  | 72     | 16 | 58    | 34          | 29 | 6.6  | 11  | 6.5 | 12  |   |
| 25-20B1 |              | 20   |           | 2.5x1    | 28                         | 1592  | 3237                     | 45  | 96  | 72     | 16 | 58    | 34          | 30 | 6.6  | 11  | 6.5 | 12  |   |
| 25-25A1 |              | 25   |           | 1.5x1    | 16                         | 1019  | 1927                     | 45  | 90  | 72     | 16 | 58    | 34          | 30 | 6.6  | 11  | 6.5 | 12  |   |
| 28-5B1  | 28           | 5    | 3.175     | 2.5x1    | 26                         | 984   | 2466                     | 44  | 45  | 70     | 12 | 56    | 34          | 28 | 6.6  | 11  | 6.5 | 12  |   |
| 28-5B2  |              |      |           | 2.5x2    | 50                         | 1785  | 4932                     | 44  | 60  | 70     | 12 | 56    | 34          | 28 | 6.6  | 11  | 6.5 | 12  |   |
| 28-6A2  |              | 6    |           | 1.5x2    | 29                         | 1150  | 2960                     | 44  | 55  | 70     | 12 | 56    | 34          | 28 | 6.6  | 11  | 6.5 | 12  |   |
| 28-6B2  |              |      |           | 2.5x2    | 48                         | 1784  | 4932                     | 50  | 61  | 74     | 12 | 60    | 36          | 29 | 6.6  | 11  | 6.5 | 15  |   |
| 32-5B2  | 32           | 5    | 3.969     | 2.5x2    | 55                         | 1886  | 5666                     | 50  | 60  | 76     | 12 | 63    | 38          | 30 | 6.6  | 11  | 6.5 | 12  |   |
| 32-5C1  |              |      |           | 3.5x1    | 39                         | 1388  | 3967                     | 50  | 50  | 76     | 12 | 63    | 38          | 30 | 6.6  | 11  | 6.5 | 12  |   |
| 32-6B2  |              | 6    |           | 2.5x2    | 56                         | 2556  | 7020                     | 52  | 68  | 78     | 12 | 65    | 39          | 32 | 6.6  | 11  | 6.5 | 12  |   |
| 32-6C1  |              |      |           | 3.5x1    | 39                         | 1888  | 4936                     | 52  | 55  | 78     | 12 | 65    | 39          | 32 | 6.6  | 11  | 6.5 | 12  |   |
| 32-8B2  |              | 8    | 4.763     | 2.5x2    | 59                         | 3284  | 8453                     | 54  | 86  | 88     | 16 | 70    | 40          | 33 | 9    | 14  | 8.5 | 15  |   |
| 32-8C1  |              |      |           | 3.5x1    | 41                         | 2428  | 5948                     | 54  | 70  | 88     | 16 | 70    | 40          | 33 | 9    | 14  | 8.5 | 15  |   |
| 32-10B1 |              | 10   | 6.350     | 2.5x1    | 30                         | 2650  | 5599                     | 54  | 70  | 88     | 16 | 70    | 44          | 37 | 9    | 14  | 8.5 | 15  |   |
| 32-10B2 |              |      |           | 2.5x2    | 60                         | 4810  | 11199                    | 57  | 98  | 91     | 16 | 73    | 44          | 37 | 9    | 14  | 8.5 | 15  |   |
| 32-10C1 |              |      |           | 3.5x1    | 44                         | 3519  | 7785                     | 57  | 78  | 91     | 16 | 73    | 44          | 37 | 9    | 14  | 8.5 | 15  |   |
| 32-16B1 |              | 16   | 4.763     | 2.5x1    | 30                         | 2650  | 5599                     | 54  | 100 | 88     | 16 | 70    | 45          | 38 | 9    | 14  | 8.5 | 15  |   |
| 32-20B1 |              | 20   |           | 2.5x1    | 33                         | 1810  | 4227                     | 54  | 100 | 88     | 16 | 70    | 40          | 33 | 9    | 14  | 8.5 | 15  |   |
| 32-25B1 |              | 25   |           | 2.5x1    | 33                         | 1810  | 4227                     | 54  | 118 | 88     | 16 | 70    | 40          | 33 | 9    | 14  | 8.5 | 15  |   |
| 32-32A1 |              | 32   |           | 1.5x1    | 18                         | 1154  | 2505                     | 54  | 110 | 88     | 16 | 70    | 40          | 33 | 9    | 14  | 8.5 | 15  |   |
| 36-6B1  | 36           | 6    | 3.969     | 2.5x1    | 35                         | 1486  | 3969                     | 55  | 50  | 82     | 12 | 68    | 42          | 32 | 6.6  | 11  | 6.5 | 12  |   |
| 36-6B2  |              |      |           | 2.5x2    | 60                         | 2696  | 7937                     | 55  | 68  | 82     | 12 | 68    | 42          | 32 | 6.6  | 11  | 6.5 | 12  |   |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

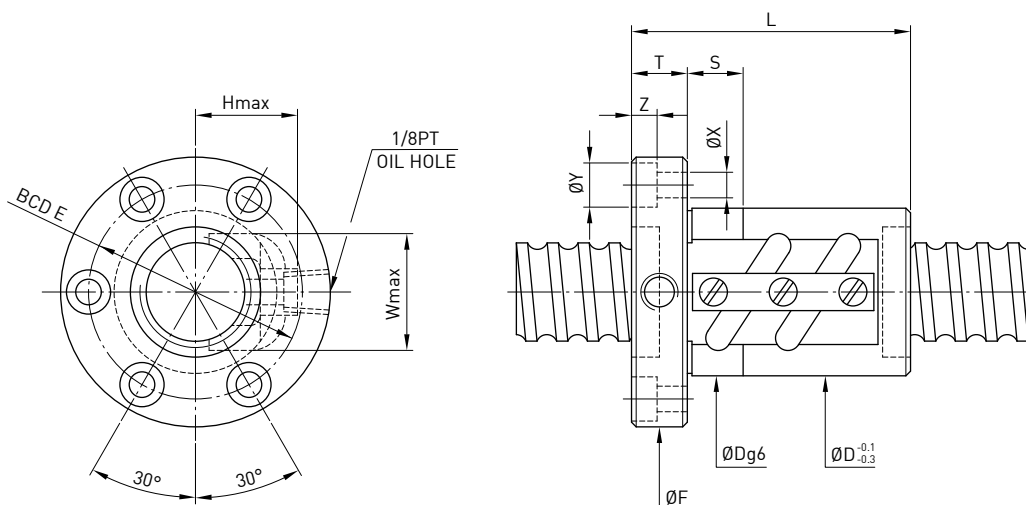
**F S V TYPE**


| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     | Flange |    |       | Return Tube |    | Bolt |      |     | Fit |
|---------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|-----|--------|----|-------|-------------|----|------|------|-----|-----|
|         | Nominal Dia. | Lead |           |          |                            |   |                          | D   | L   | F      | T  | BCD-E | W           | H  | X    | Y    | Z   | S   |
| 36-10B2 | 36           | 10   | 6.350     | 2.5x2    | 68                         | 5105  | 12669                    | 62  | 102 | 104    | 18 | 82    | 49          | 40 | 11   | 17.5 | 11  | 15  |
| 40-5B2  | 40           | 5    | 3.175     | 2.5x2    | 66                         | 2071  | 7134                     | 58  | 65  | 92     | 16 | 72    | 46          | 34 | 9    | 14   | 8.5 | 15  |
| 40-6B2  |              | 6    | 3.969     | 2.5x2    | 69                         | 2817  | 8855                     | 60  | 72  | 94     | 16 | 76    | 47          | 36 | 9    | 14   | 8.5 | 15  |
| 40-8B2  |              | 8    | 4.763     | 2.5x2    | 70                         | 3634  | 10603                    | 62  | 86  | 96     | 16 | 78    | 48          | 38 | 9    | 14   | 8.5 | 15  |
| 40-8C1  |              |      |           | 3.5x1    | 49                         | 2679  | 7438                     | 62  | 70  | 96     | 16 | 78    | 48          | 38 | 9    | 14   | 8.5 | 15  |
| 40-10B2 |              | 10   | 6.350     | 2.5x2    | 74                         | 5370  | 14138                    | 65  | 102 | 106    | 18 | 85    | 52          | 42 | 11   | 17.5 | 11  | 15  |
| 40-10C1 |              |      |           | 3.5x1    | 51                         | 3932  | 9841                     | 65  | 82  | 106    | 18 | 85    | 52          | 42 | 11   | 17.5 | 11  | 15  |
| 40-12B2 |              | 12   | 7.144     | 2.5x2    | 72                         | 6216  | 15674                    | 64  | 108 | 112    | 18 | 88    | 53          | 42 | 11   | 17.5 | 11  | 30  |
| 40-16B2 |              | 16   |           | 2.5x2    | 72                         | 6216  | 15674                    | 74  | 135 | 110    | 18 | 90    | 52          | 49 | 11   | 17.5 | 11  | 30  |
| 40-25B1 |              | 25   | 6.350     | 2.5x1    | 39                         | 2959  | 7069                     | 65  | 123 | 106    | 18 | 85    | 52          | 42 | 11   | 17.5 | 11  | 15  |
| 40-32B1 |              | 32   |           | 2.5x1    | 39                         | 2959  | 7069                     | 65  | 146 | 106    | 18 | 85    | 52          | 42 | 11   | 17.5 | 11  | 15  |
| 40-40A1 |              | 40   |           | 1.5x1    | 24                         | 1875  | 4159                     | 65  | 133 | 106    | 18 | 85    | 52          | 42 | 11   | 17.5 | 11  | 15  |
| 45-10B1 | 45           | 10   | 6.350     | 2.5x1    | 45                         | 4170  | 11161                    | 70  | 74  | 112    | 18 | 90    | 58          | 48 | 11   | 17.5 | 11  | 15  |
| 45-10B2 |              |      |           | 2.5x2    | 79                         | 5655  | 15905                    | 70  | 104 | 112    | 18 | 90    | 58          | 48 | 11   | 17.5 | 11  | 15  |
| 45-12B2 |              | 12   | 7.938     | 2.5x2    | 81                         | 7627  | 19799                    | 74  | 123 | 122    | 22 | 97    | 60          | 49 | 13   | 20   | 13  | 20  |
| 50-5A2  | 50           | 5    | 3.175     | 1.5x2    | 48                         | 1447  | 5382                     | 70  | 63  | 104    | 16 | 86    | 56          | 40 | 9    | 14   | 8.5 | 15  |
| 50-5A3  |              |      |           | 1.5x3    | 73                         | 2051  | 8072                     | 70  | 73  | 104    | 16 | 86    | 56          | 40 | 9    | 14   | 8.5 | 15  |
| 50-6B2  |              | 6    | 3.969     | 2.5x2    | 81                         | 3093  | 11149                    | 72  | 75  | 106    | 16 | 88    | 57          | 43 | 9    | 14   | 8.5 | 15  |
| 50-6B3  |              |      |           | 2.5x3    | 119                        | 4384  | 16723                    | 72  | 93  | 106    | 16 | 88    | 57          | 43 | 9    | 14   | 8.5 | 15  |
| 50-8B2  |              | 8    | 4.763     | 2.5x2    | 84                         | 4004  | 13409                    | 75  | 88  | 116    | 18 | 95    | 58          | 45 | 11   | 17.5 | 11  | 15  |
| 50-8B3  |              |      |           | 2.5x3    | 124                        | 5674  | 20114                    | 75  | 112 | 116    | 18 | 95    | 58          | 45 | 11   | 17.5 | 11  | 15  |
| 50-10B2 |              | 10   | 6.350     | 2.5x2    | 87                         | 5923  | 17670                    | 78  | 104 | 119    | 18 | 98    | 62          | 48 | 11   | 17.5 | 11  | 15  |
| 50-10B3 |              |      |           | 2.5x3    | 129                        | 8394  | 26505                    | 78  | 134 | 119    | 18 | 98    | 62          | 48 | 11   | 17.5 | 11  | 15  |
| 50-10C1 |              |      |           | 3.5x1    | 60                         | 4393  | 12481                    | 78  | 84  | 119    | 18 | 98    | 62          | 48 | 11   | 17.5 | 11  | 15  |
| 50-12B1 |              | 12   | 7.938     | 2.5x1    | 46                         | 4420  | 11047                    | 82  | 87  | 130    | 22 | 105   | 64          | 52 | 13   | 20   | 13  | 20  |
| 50-12B2 |              |      |           | 2.5x2    | 90                         | 8022  | 22094                    | 82  | 123 | 130    | 22 | 105   | 64          | 52 | 13   | 20   | 13  | 20  |
| 50-12C1 |              |      |           | 3.5x1    | 63                         | 5875  | 15380                    | 82  | 99  | 130    | 22 | 105   | 64          | 52 | 13   | 20   | 13  | 20  |
| 50-40A1 |              | 40   | 6.350     | 1.5x1    | 27                         | 2801  | 6499                     | 82  | 135 | 130    | 22 | 105   | 64          | 52 | 13   | 20   | 13  | 20  |
| 50-50A1 |              | 50   |           | 1.5x1    | 30                         | 2801  | 6499                     | 82  | 162 | 130    | 22 | 105   | 64          | 52 | 13   | 20   | 13  | 20  |
| 55-10C1 | 55           | 10   | 6.350     | 3.5x1    | 66                         | 4562  | 13661                    | 84  | 84  | 125    | 18 | 103   | 68          | 54 | 11   | 17.5 | 11  | 20  |
| 55-12B2 |              | 12   | 7.938     | 2.5x2    | 95                         | 8392  | 24390                    | 88  | 123 | 136    | 22 | 110   | 70          | 56 | 13   | 20   | 13  | 20  |
| 55-20B2 |              | 20   | 12.700    | 2.5x2    | 127                        | 20160   | 52439                    | 100 | 175 | 132    | 28 | 115   | 74          | 71 | 9    | 14   | 8.5 | 30  |
| 63-8A2  | 63           | 8    | 4.763     | 1.5x2    | 54                         | 2826  | 10129                    | 87  | 76  | 129    | 18 | 107   | 70          | 50 | 11   | 17.5 | 11  | 20  |
| 63-8A3  |              |      |           | 1.5x3    | 80                         | 4004  | 15193                    | 87  | 92  | 129    | 18 | 107   | 70          | 50 | 11   | 17.5 | 11  | 20  |
| 63-10B2 |              | 10   | 6.350     | 2.5x2    | 104                        | 6533  | 22371                    | 90  | 107 | 132    | 20 | 110   | 74          | 53 | 11   | 17.5 | 11  | 20  |
| 63-10B3 |              |      |           | 2.5x3    | 154                        | 9258  | 33556                    | 90  | 137 | 132    | 20 | 110   | 74          | 53 | 11   | 17.5 | 11  | 20  |
| 63-12B2 |              | 12   | 7.938     | 2.5x2    | 109                        | 8943  | 28062                    | 94  | 124 | 142    | 22 | 117   | 76          | 57 | 13   | 20   | 13  | 20  |
| 63-16B2 |              | 16   |           | 2.5x2    | 141                        | 14862   | 46009                    | 100 | 153 | 150    | 22 | 123   | 78          | 62 | 13   | 20   | 13  | 20  |
| 63-20B2 |              | 20   | 9.525     | 2.5x2    | 141                        | 14862   | 46009                    | 100 | 176 | 150    | 22 | 123   | 78          | 62 | 13   | 20   | 13  | 20  |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

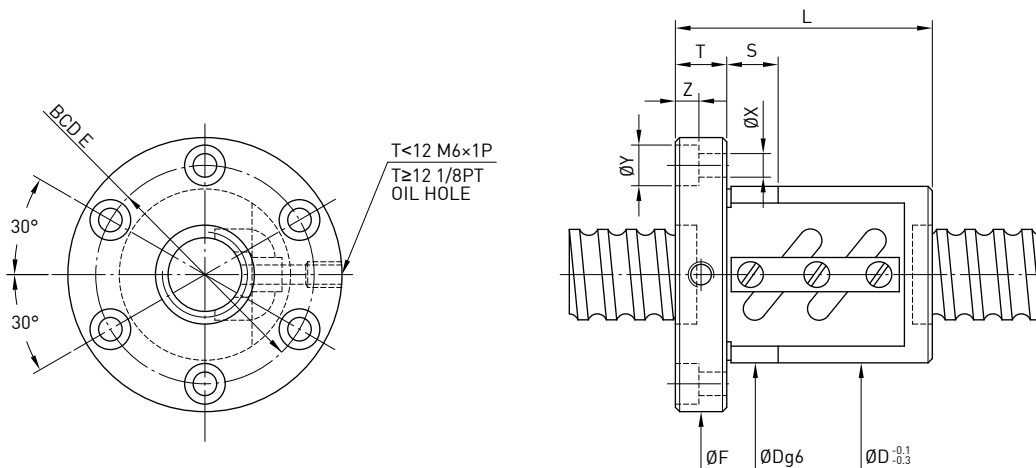


**F S V TYPE**



| Model    | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf) | Nut |     | Flange |    |       | Return Tube |    | Bolt |      |      | Fit |   |
|----------|--------------|------|-----------|----------|----------------------------|---|-------------------------|-----|-----|--------|----|-------|-------------|----|------|------|------|-----|---|
|          | Nominal Dia. | Lead |           |          |                            |   |                         | D   | L   | F      | T  | BCD-E | W           | H  | X    | Y    | Z    |     | S |
| 63-20B3  | 63           | 20   | 12.700    | 2.5x3    | 210                        | 30715   | 90887                   | 117 | 244 | 157    | 32 | 137   | 82          | 70 | 11   | 17.5 | 11   | 30  |   |
| 70-10B2  | 70           | 10   | 6.350     | 2.5x2    | 115                        | 6843  | 25011                   | 104 | 109 | 152    | 20 | 128   | 80          | 56 | 13   | 20   | 13   | 20  |   |
| 70-10B3  |              | 12   | 7.938     | 2.5x3    | 170                        | 9688  | 37516                   | 104 | 139 | 152    | 20 | 128   | 80          | 56 | 13   | 20   | 13   | 20  |   |
| 70-12B2  |              |      |           | 2.5x2    | 120                        | 9382  | 31275                   | 110 | 125 | 159    | 22 | 133   | 82          | 58 | 13   | 20   | 13   | 20  |   |
| 70-12B3  |              |      |           | 2.5x3    | 170                        | 13296   | 46912                   | 110 | 159 | 159    | 22 | 133   | 82          | 58 | 13   | 20   | 13   | 20  |   |
| 80-10B2  | 80           | 10   | 6.350     | 2.5x2    | 126                        | 7202  | 28538                   | 115 | 109 | 163    | 22 | 137   | 90          | 64 | 13   | 20   | 13   | 20  |   |
| 80-10B3  |              | 12   | 7.938     | 2.5x3    | 186                        | 10207   | 42807                   | 115 | 139 | 163    | 22 | 137   | 90          | 64 | 13   | 20   | 13   | 20  |   |
| 80-12B2  |              |      |           | 2.5x2    | 130                        | 9797  | 35422                   | 120 | 125 | 169    | 22 | 143   | 92          | 67 | 13   | 20   | 13   | 25  |   |
| 80-12B3  |              |      |           | 2.5x3    | 192                        | 13884   | 53132                   | 120 | 159 | 169    | 22 | 143   | 92          | 67 | 13   | 20   | 13   | 25  |   |
| 80-16B2  |              | 16   | 9.525     | 2.5x2    | 171                        | 16485   | 58851                   | 125 | 156 | 190    | 28 | 154   | 94          | 70 | 18   | 26   | 17.5 | 25  |   |
| 80-16B3  |              |      |           | 2.5x3    | 252                        | 23363   | 88276                   | 125 | 204 | 190    | 28 | 154   | 94          | 70 | 18   | 26   | 17.5 | 25  |   |
| 80-20B2  |              | 20   |           | 2.5x2    | 171                        | 16485   | 58851                   | 125 | 185 | 190    | 28 | 154   | 94          | 70 | 18   | 26   | 17.5 | 25  |   |
| 80-20B3  |              |      |           | 2.5x3    | 252                        | 23363   | 88276                   | 125 | 245 | 190    | 28 | 154   | 94          | 70 | 18   | 26   | 17.5 | 25  |   |
| 100-12B2 | 100          | 12   | 7.938     | 2.5x2    | 156                        | 10761   | 44586                   | 145 | 132 | 209    | 28 | 173   | 112         | 76 | 18   | 26   | 17.5 | 25  |   |
| 100-12B3 |              | 16   | 9.525     | 2.5x3    | 229                        | 15251   | 66894                   | 145 | 168 | 209    | 28 | 173   | 112         | 76 | 18   | 26   | 17.5 | 25  |   |
| 100-16B2 |              |      |           | 2.5x2    | 200                        | 18123   | 74425                   | 150 | 162 | 228    | 32 | 185   | 114         | 80 | 22   | 32   | 21.5 | 30  |   |
| 100-16B3 |              |      |           | 2.5x3    | 305                        | 25684   | 111637                  | 150 | 212 | 228    | 32 | 185   | 114         | 80 | 22   | 32   | 21.5 | 30  |   |
| 100-20B2 |              | 20   |           | 2.5x2    | 200                        | 18123   | 74425                   | 150 | 190 | 228    | 32 | 185   | 114         | 80 | 22   | 32   | 21.5 | 30  |   |
| 100-20B3 |              |      |           | 2.5x3    | 305                        | 25684   | 111637                  | 150 | 250 | 228    | 32 | 185   | 114         | 80 | 22   | 32   | 21.5 | 30  |   |

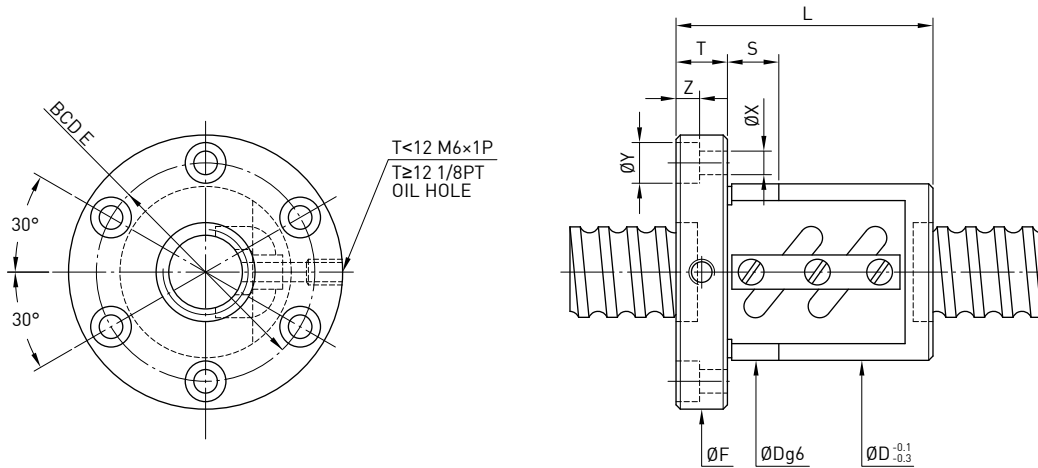
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

**F S W TYPE**


| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / $\mu$ m<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf) | Nut |     | Flange |    |       | Bolt |     |     | Fit |
|---------|--------------|------|-----------|----------|---------------------------------|---|-------------------------|-----|-----|--------|----|-------|------|-----|-----|-----|
|         | Nominal Dia. | Lead |           |          |                                 |   |                         | D   | L   | F      | T  | BCD-E | X    | Y   | Z   | S   |
| 12-4B1  | 12           | 4    | 2.381     | 2.5x1    | 8                               | 383   | 638                     | 30  | 38  | 50     | 10 | 40    | 4.5  | 8   | 4   | 12  |
| 12-4C1  |              |      |           | 3.5x1    | 9                               | 511   | 893                     | 30  | 44  | 50     | 10 | 40    | 4.5  | 8   | 4   | 12  |
| 12-5B1  |              |      |           | 2.5x1    | 8                               | 383   | 638                     | 30  | 40  | 50     | 10 | 40    | 4.5  | 8   | 4   | 12  |
| 14-5B1  | 14           | 5    |           | 2.5x1    | 10                              | 710   | 1216                    | 34  | 40  | 57     | 11 | 45    | 5.5  | 9.5 | 5.5 | 12  |
| 15-10A1 | 15           | 10   | 3.175     | 1.5x1    | 9                               | 474   | 781                     | 34  | 48  | 57     | 11 | 45    | 5.5  | 9.5 | 5.5 | 12  |
| 15-20A1 |              | 20   |           | 1.5x1    | 9                               | 474   | 781                     | 34  | 62  | 58     | 12 | 45    | 5.5  | 9.5 | 9.5 | 12  |
| 16-4B1  | 16           | 4    | 2.381     | 2.5x1    | 14                              | 439   | 870                     | 34  | 38  | 57     | 11 | 45    | 5.5  | 9.5 | 5.5 | 12  |
| 16-5B1  |              |      | 3.175     | 2.5x1    | 16                              | 763   | 1400                    | 40  | 45  | 64     | 12 | 51    | 5.5  | 9.5 | 5.5 | 12  |
| 16-5B2  |              |      |           | 2.5x2    | 33                              | 1385  | 2799                    | 40  | 60  | 64     | 12 | 51    | 5.5  | 9.5 | 5.5 | 12  |
| 16-5C1  |              | 5    |           | 3.5x1    | 22                              | 1013  | 1946                    | 40  | 50  | 64     | 12 | 51    | 5.5  | 9.5 | 5.5 | 12  |
| 20-5B1  | 20           |      | 3.175     | 2.5x1    | 19                              | 837   | 1733                    | 44  | 45  | 68     | 12 | 55    | 5.5  | 9.5 | 5.5 | 12  |
| 20-5B2  |              |      |           | 2.5x2    | 39                              | 1519  | 3465                    | 44  | 60  | 68     | 12 | 55    | 5.5  | 9.5 | 5.5 | 12  |
| 20-6B1  |              |      |           | 2.5x1    | 20                              | 1137  | 2187                    | 48  | 48  | 72     | 12 | 59    | 5.5  | 9.5 | 5.5 | 12  |
| 20-6C1  |              | 6    | 3.969     | 3.5x1    | 28                              | 1512  | 3041                    | 48  | 66  | 72     | 12 | 59    | 5.5  | 9.5 | 5.5 | 12  |
| 25-4B2  | 25           | 4    | 2.381     | 2.5x2    | 38                              | 976   | 2776                    | 46  | 48  | 69     | 11 | 57    | 5.5  | 9.5 | 5.5 | 12  |
| 25-5B2  |              |      | 3.175     | 2.5x2    | 46                              | 1704  | 4417                    | 50  | 60  | 74     | 12 | 62    | 5.5  | 9.5 | 5.5 | 12  |
| 25-5C1  |              |      |           | 3.5x1    | 35                              | 1252  | 3085                    | 50  | 50  | 74     | 12 | 62    | 5.5  | 9.5 | 5.5 | 12  |
| 25-6B1  |              |      | 3.969     | 2.5x1    | 24                              | 1255  | 2735                    | 53  | 44  | 76     | 11 | 64    | 5.5  | 9.5 | 5.5 | 12  |
| 25-6B2  |              |      |           | 2.5x2    | 48                              | 2308  | 5523                    | 56  | 68  | 82     | 12 | 69    | 6.6  | 11  | 6.5 | 12  |
| 25-6C1  |              |      |           | 3.5x1    | 35                              | 1690  | 3844                    | 56  | 55  | 82     | 12 | 69    | 6.6  | 11  | 6.5 | 12  |
| 25-10B1 |              |      | 4.763     | 2.5x1    | 25                              | 1592  | 3237                    | 60  | 65  | 86     | 16 | 73    | 6.6  | 11  | 6.5 | 12  |
| 25-10B2 |              |      |           | 2.5x2    | 46                              | 2888  | 6472                    | 58  | 97  | 85     | 15 | 71    | 6.6  | 11  | 6.5 | 12  |
| 25-12B1 |              | 12   | 3.969     | 2.5x1    | 24                              | 1271  | 2761                    | 53  | 60  | 78     | 11 | 64    | 6.6  | 11  | 6.5 | 12  |
| 28-5B1  | 28           | 5    | 3.175     | 2.5x1    | 26                              | 984   | 2466                    | 55  | 45  | 85     | 12 | 69    | 6.6  | 11  | 6.5 | 12  |
| 28-5B2  |              |      |           | 2.5x2    | 50                              | 1785  | 4932                    | 55  | 60  | 85     | 12 | 69    | 6.6  | 11  | 6.5 | 12  |
| 28-6A2  |              | 6    |           | 1.5x2    | 29                              | 1150  | 2960                    | 55  | 55  | 85     | 12 | 69    | 6.6  | 11  | 6.5 | 12  |
| 28-12B2 |              | 12   | 4.763     | 2.5x2    | 51                              | 3060  | 7299                    | 60  | 110 | 86     | 12 | 73    | 6.6  | 11  | 6.5 | 12  |
| 28-16B1 |              | 16   |           | 2.5x1    | 25                              | 1686  | 3649                    | 62  | 84  | 89     | 12 | 75    | 6.6  | 11  | 6.5 | 12  |
| 32-5B2  | 32           | 5    | 3.175     | 2.5x2    | 55                              | 1886  | 5666                    | 58  | 60  | 84     | 12 | 71    | 6.6  | 11  | 6.5 | 12  |
| 32-5C1  |              |      |           | 3.5x1    | 39                              | 1388  | 3967                    | 58  | 50  | 84     | 12 | 71    | 6.6  | 11  | 6.5 | 12  |
| 32-6B2  |              |      | 3.969     | 2.5x2    | 56                              | 2556  | 7020                    | 62  | 68  | 88     | 12 | 75    | 6.6  | 11  | 6.5 | 12  |
| 32-6C1  |              |      |           | 3.5x1    | 39                              | 1888  | 4936                    | 62  | 55  | 88     | 12 | 75    | 6.6  | 11  | 6.5 | 12  |
| 32-8B2  |              |      | 4.763     | 2.5x2    | 59                              | 3284  | 8453                    | 66  | 86  | 100    | 16 | 82    | 9    | 14  | 8.5 | 15  |
| 32-8C1  |              |      |           | 3.5x1    | 41                              | 2428  | 5948                    | 66  | 70  | 100    | 16 | 82    | 9    | 14  | 8.5 | 15  |
| 32-10B2 |              |      | 6.350     | 2.5x2    | 60                              | 4810  | 11199                   | 74  | 98  | 108    | 16 | 90    | 9    | 14  | 8.5 | 15  |
| 32-10C1 |              |      |           | 3.5x1    | 44                              | 3519  | 7785                    | 74  | 78  | 108    | 16 | 90    | 9    | 14  | 8.5 | 15  |
| 32-12A2 |              |      |           | 1.5x2    | 37                              | 3051  | 6612                    | 74  | 97  | 108    | 18 | 90    | 9    | 14  | 8.5 | 15  |
| 32-12B2 |              | 12   |           | 2.5x2    | 59                              | 4810  | 11199                   | 74  | 110 | 108    | 18 | 90    | 9    | 14  | 8.5 | 15  |

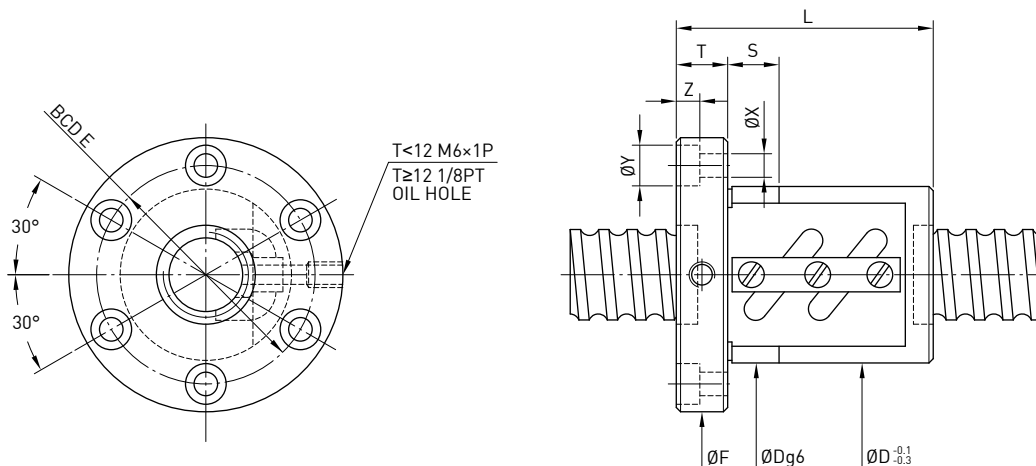
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

**F S W TYPE**



| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     | Flange |     |       | Bolt |      |     | Fit |
|---------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|-----|--------|-----|-------|------|------|-----|-----|
|         | Nominal Dia. | Lead |           |          |                            |   |                          | D   | L   | F      | T   | BCD-E | X    | Y    | Z   | S   |
| 32-16A2 | 32           | 16   | 6.350     | 1.5x2    | 36                         | 3035  | 6555                     | 74  | 99  | 108    | 16  | 90    | 9    | 14   | 8.5 | 15  |
| 32-16B1 |              |      |           | 2.5x1    | 30                         | 2650  | 5599                     | 74  | 94  | 108    | 16  | 90    | 9    | 14   | 8.5 | 15  |
| 32-16B2 |              |      |           | 2.5x2    | 59                         | 4810  | 11199                    | 74  | 130 | 108    | 16  | 90    | 9    | 14   | 8.5 | 15  |
| 32-20A2 |              | 20   |           | 1.5x2    | 37                         | 3035  | 6555                     | 74  | 120 | 108    | 16  | 90    | 9    | 14   | 8.5 | 15  |
| 32-20B1 |              |      |           | 2.5x1    | 30                         | 2650  | 5599                     | 74  | 98  | 108    | 16  | 90    | 9    | 14   | 8.5 | 15  |
| 36-6B1  | 36           | 6    | 3.969     | 2.5x1    | 35                         | 1486  | 3969                     | 65  | 50  | 100    | 12  | 82    | 6.6  | 11   | 6.5 | 12  |
| 36-6B2  |              |      |           | 2.5x2    | 60                         | 2696  | 7937                     | 65  | 68  | 100    | 12  | 82    | 6.6  | 11   | 6.5 | 12  |
| 36-10B2 |              | 10   | 2.5x2     | 68       | 5105                       | 12669   | 75                       | 102 | 125 | 18     | 98  | 11    | 17.5 | 11   | 15  |     |
| 36-12B2 |              | 12   | 2.5x2     | 65       | 5105                       | 12668   | 75                       | 110 | 125 | 18     | 98  | 11    | 17.5 | 11   | 15  |     |
| 36-16C1 |              | 16   | 3.5x1     | 46       | 3736                       | 8813  | 80                       | 105 | 120 | 18     | 100 | 11    | 17.5 | 11   | 15  |     |
| 40-5B2  | 40           | 5    | 3.175     | 2.5x2    | 66                         | 2071  | 7134                     | 68  | 65  | 102    | 16  | 84    | 9    | 14   | 8.5 | 15  |
| 40-6B2  |              | 6    | 3.969     | 2.5x2    | 69                         | 2817  | 8855                     | 70  | 72  | 104    | 16  | 86    | 9    | 14   | 8.5 | 15  |
| 40-8B2  |              | 8    | 4.763     | 2.5x2    | 70                         | 3634  | 10603                    | 74  | 86  | 108    | 16  | 90    | 9    | 14   | 8.5 | 15  |
| 40-8C1  |              |      |           | 3.5x1    | 49                         | 2679  | 7438                     | 74  | 70  | 108    | 16  | 90    | 9    | 14   | 8.5 | 15  |
| 40-10B2 |              | 10   | 6.350     | 2.5x2    | 74                         | 5370  | 14138                    | 84  | 102 | 125    | 18  | 104   | 11   | 17.5 | 11  | 15  |
| 40-10C1 |              |      |           | 3.5x1    | 51                         | 3932  | 9841                     | 84  | 82  | 125    | 18  | 104   | 11   | 17.5 | 11  | 15  |
| 40-12B1 |              | 12   | 7.144     | 2.5x1    | 36                         | 3425  | 7837                     | 86  | 81  | 128    | 18  | 106   | 11   | 17.5 | 11  | 20  |
| 40-12B2 |              |      |           | 2.5x2    | 72                         | 6217  | 15674                    | 86  | 117 | 128    | 18  | 106   | 11   | 17.5 | 11  | 20  |
| 40-16A2 |              | 16   |           | 1.5x2    | 42                         | 4007  | 9405                     | 86  | 118 | 128    | 18  | 106   | 11   | 17.5 | 11  | 20  |
| 40-16B1 |              |      |           | 2.5x1    | 37                         | 3425  | 7837                     | 86  | 102 | 128    | 18  | 106   | 11   | 17.5 | 11  | 20  |
| 45-10B1 | 45           | 10   | 6.350     | 2.5x1    | 45                         | 3116  | 7953                     | 88  | 74  | 132    | 18  | 110   | 11   | 17.5 | 11  | 15  |
| 45-10B2 |              |      |           | 2.5x2    | 79                         | 5655  | 15905                    | 88  | 104 | 132    | 18  | 110   | 11   | 17.5 | 11  | 15  |
| 45-12B2 |              | 12   | 7.938     | 2.5x2    | 81                         | 7627  | 19799                    | 96  | 123 | 142    | 22  | 117   | 13   | 20   | 13  | 20  |
| 50-5A2  | 50           | 5    | 3.175     | 1.5x2    | 48                         | 1447  | 5382                     | 80  | 63  | 114    | 16  | 96    | 9    | 14   | 8.5 | 15  |
| 50-5A3  |              |      |           | 1.5x3    | 73                         | 2051  | 8072                     | 80  | 73  | 114    | 16  | 96    | 9    | 14   | 8.5 | 15  |
| 50-6B2  |              | 6    | 3.969     | 2.5x2    | 81                         | 3093  | 11149                    | 84  | 75  | 118    | 16  | 100   | 9    | 14   | 8.5 | 15  |
| 50-6C2  |              |      |           | 3.5x2    | 109                        | 4131  | 15608                    | 84  | 80  | 118    | 15  | 100   | 9    | 14   | 8.5 | 15  |
| 50-6B3  |              |      |           | 2.5x3    | 119                        | 4384  | 16723                    | 84  | 93  | 118    | 16  | 100   | 9    | 14   | 8.5 | 15  |
| 50-8B2  |              | 8    | 4.763     | 2.5x2    | 84                         | 4004  | 13409                    | 87  | 88  | 128    | 18  | 107   | 11   | 17.5 | 11  | 15  |
| 50-8B3  |              |      |           | 2.5x3    | 124                        | 5674  | 20114                    | 87  | 112 | 128    | 18  | 107   | 11   | 17.5 | 11  | 15  |
| 50-10B2 |              | 10   | 6.350     | 2.5x2    | 87                         | 5923  | 17670                    | 94  | 104 | 135    | 18  | 114   | 11   | 17.5 | 11  | 15  |
| 50-10B3 |              |      |           | 2.5x3    | 129                        | 8394  | 26505                    | 94  | 134 | 135    | 18  | 114   | 11   | 17.5 | 11  | 15  |
| 50-10C1 |              |      |           | 3.5x1    | 60                         | 4393  | 12481                    | 94  | 84  | 135    | 18  | 114   | 11   | 17.5 | 11  | 15  |
| 50-12B1 |              | 12   | 7.938     | 2.5x1    | 46                         | 4420  | 11047                    | 102 | 87  | 150    | 22  | 125   | 13   | 20   | 13  | 20  |
| 50-12B2 |              |      |           | 2.5x2    | 90                         | 8022  | 22094                    | 102 | 123 | 150    | 22  | 125   | 13   | 20   | 13  | 20  |
| 50-12C1 |              |      |           | 3.5x1    | 63                         | 5875  | 15380                    | 102 | 99  | 150    | 22  | 125   | 13   | 20   | 13  | 20  |
| 50-30A2 |              | 30   | 6.350     | 1.5x2    | 52                         | 3834  | 10658                    | 94  | 160 | 135    | 18  | 140   | 11   | 17.5 | 11  | 15  |

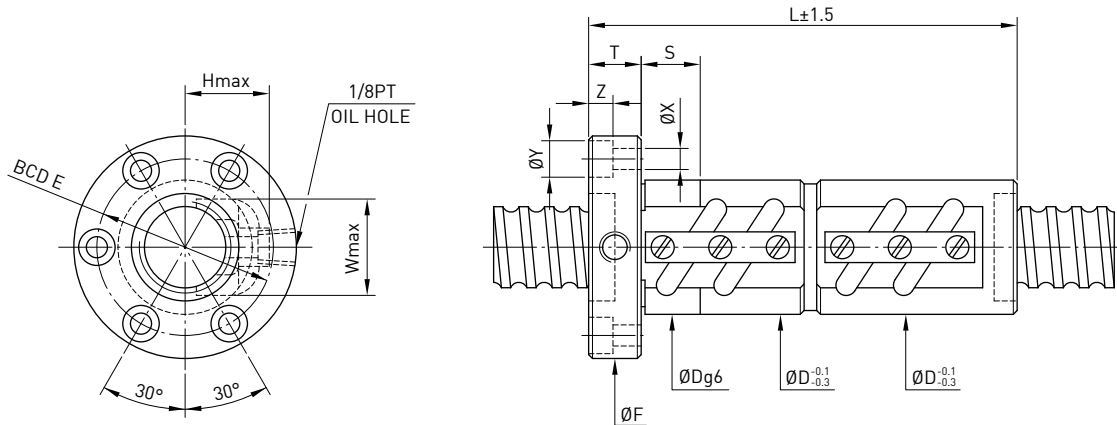
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

**F S W TYPE**


| Model    | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / $\mu$ m<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut   |        | Flange |     |       | Bolt |      |      | Fit  |
|----------|--------------|------|-----------|----------|---------------------------------|---|--------------------------|-------|--------|--------|-----|-------|------|------|------|------|
|          | Nominal Dia. | Lead |           |          |                                 |   |                          | D     | L      | F      | T   | BCD-E | X    | Y    | Z    | S    |
| 55-10B2  | 55           | 10   | 6.350     | 2.5x2    | 93                              | 6071  | 19592                    | 102   | 103    | 144    | 18  | 122   | 11   | 17.5 | 11   | 20   |
| 55-10C1  |              |      |           | 3.5x1    | 66                              | 4562  | 13661                    | 100   | 84     | 140    | 18  | 118   | 11   | 17.5 | 11   | 20   |
| 55-12B2  |              | 12   | 7.938     | 2.5x2    | 95                              | 8392  | 24390                    | 105   | 123    | 154    | 22  | 127   | 13   | 20   | 13   | 20   |
| 60-12B2  | 60           |      |           | 2.5x2    | 101                             | 8742  | 26685                    | 112   | 135    | 154    | 18  | 132   | 11   | 17.5 | 11   | 20   |
| 63-8A2   | 63           | 8    | 4.763     | 1.5x2    | 54                              | 2826  | 10129                    | 104   | 76     | 146    | 18  | 124   | 11   | 17.5 | 11   | 20   |
| 63-8A3   |              |      |           |          |                                 | 1.5x3   | 80                       | 4004  | 15193  | 104    | 92  | 146   | 18   | 124  | 11   | 17.5 |
| 63-10B2  |              | 10   | 6.350     | 2.5x2    | 104                             | 6533  | 22371                    | 110   | 107    | 152    | 20  | 130   | 11   | 17.5 | 11   | 20   |
| 63-10B3  |              |      |           |          |                                 | 2.5x3   | 154                      | 9528  | 33556  | 110    | 137 | 152   | 20   | 130  | 11   | 17.5 |
| 63-12B2  |              | 12   | 7.938     | 2.5x2    | 109                             | 8943  | 28062                    | 118   | 124    | 166    | 22  | 141   | 13   | 20   | 13   | 20   |
| 63-16B2  |              | 16   | 9.525     | 2.5x2    | 141                             | 14862   | 46009                    | 124   | 153    | 172    | 22  | 147   | 13   | 20   | 13   | 20   |
| 63-20B2  |              | 20   |           | 2.5x2    | 141                             | 14862   | 46009                    | 124   | 176    | 172    | 22  | 147   | 13   | 20   | 13   | 20   |
| 70-10B2  |              | 70   | 10        | 6.350    | 2.5x2                           | 115   | 6843                     | 25011 | 124    | 109    | 170 | 20    | 145  | 13   | 20   | 13   |
| 70-10B3  |              |      |           |          |                                 | 2.5x3   | 170                      | 9698  | 37516  | 124    | 139 | 170   | 20   | 145  | 13   | 20   |
| 70-12B2  | 12           |      | 7.938     | 2.5x2    | 120                             | 9382  | 31275                    | 130   | 125    | 178    | 22  | 152   | 13   | 20   | 13   | 20   |
| 70-12B3  |              |      |           |          |                                 | 2.5x3   | 170                      | 13296 | 46912  | 130    | 159 | 178   | 22   | 152  | 13   | 20   |
| 80-10B2  | 80           | 10   | 6.350     | 2.5x2    | 126                             | 7202  | 28538                    | 130   | 109    | 178    | 22  | 152   | 13   | 20   | 13   | 20   |
| 80-10B3  |              |      |           |          |                                 | 2.5x3   | 186                      | 10207 | 42807  | 130    | 139 | 178   | 22   | 152  | 13   | 20   |
| 80-12B2  |              | 12   | 7.938     | 2.5x2    | 130                             | 9797  | 35422                    | 136   | 125    | 185    | 22  | 159   | 13   | 20   | 13   | 20   |
| 80-12B3  |              |      |           |          |                                 | 2.5x3   | 192                      | 13844 | 53132  | 136    | 159 | 185   | 22   | 159  | 13   | 20   |
| 80-16B2  |              | 16   | 9.525     | 2.5x2    | 171                             | 16485   | 58851                    | 145   | 156    | 210    | 28  | 154   | 18   | 26   | 17.5 | 25   |
| 80-16B3  |              |      |           |          |                                 | 2.5x3   | 252                      | 23363 | 88276  | 145    | 204 | 210   | 28   | 154  | 18   | 26   |
| 80-20B2  |              | 20   | 9.525     | 2.5x2    | 171                             | 16485   | 58851                    | 145   | 185    | 210    | 28  | 154   | 18   | 26   | 17.5 | 25   |
| 80-20B3  |              |      |           |          |                                 | 2.5x3   | 252                      | 23363 | 88276  | 145    | 245 | 210   | 28   | 154  | 18   | 26   |
| 100-12B2 | 100          | 12   | 7.938     | 2.5x2    | 156                             | 10761   | 44596                    | 160   | 132    | 224    | 24  | 188   | 18   | 26   | 17.5 | 25   |
| 100-12B3 |              |      |           |          |                                 | 2.5x3   | 229                      | 15251 | 66894  | 160    | 168 | 224   | 24   | 188  | 18   | 26   |
| 100-16B2 |              | 16   | 9.525     | 2.5x2    | 200                             | 18123   | 77425                    | 170   | 162    | 248    | 32  | 205   | 22   | 32   | 21.5 | 30   |
| 100-16B3 |              |      |           |          |                                 | 2.5x3   | 305                      | 25684 | 111637 | 170    | 212 | 248   | 32   | 205  | 22   | 32   |
| 100-20B2 |              | 20   | 9.525     | 2.5x2    | 200                             | 18123   | 74425                    | 170   | 190    | 248    | 32  | 205   | 22   | 32   | 21.5 | 30   |
| 100-20B3 |              |      |           |          |                                 | 2.5x3   | 305                      | 25684 | 111637 | 170    | 250 | 248   | 32   | 205  | 22   | 32   |

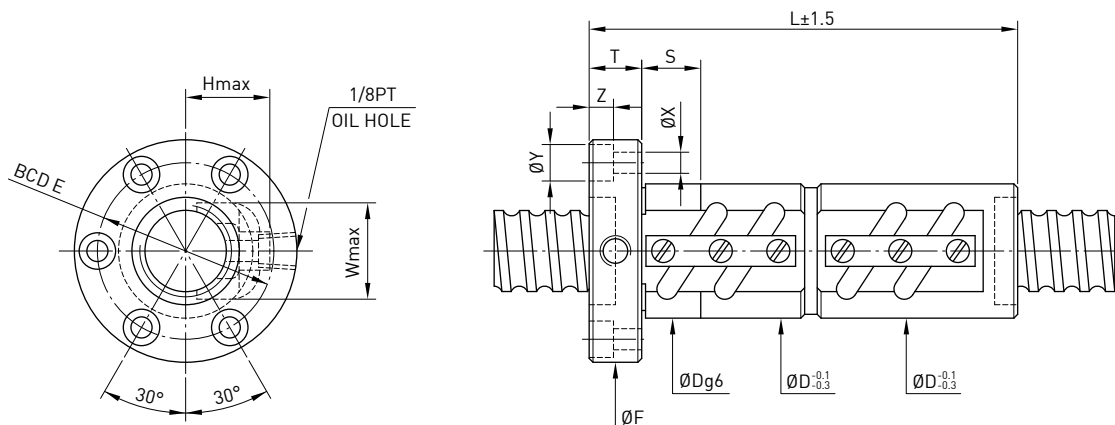
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

**F D V TYPE**



| Model   | Size         |       | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut  |       | Flange |     |       | Return Tube |     | Bolt |     |     | Fit  |
|---------|--------------|-------|-----------|----------|----------------------------|---|--------------------------|------|-------|--------|-----|-------|-------------|-----|------|-----|-----|------|
|         | Nominal Dia. | Lead  |           |          |                            |   |                          | D    | L     | F      | T   | BCD-E | W           | H   | X    | Y   | Z   | S    |
| 16-5B1  | 16           | 5     | 3.175     | 2.5x1    | 32                         | 763   | 1400                     | 31   | 80    | 54     | 12  | 41    | 24          | 22  | 5.5  | 9.5 | 5.5 | 24   |
| 16-5B2  |              |       |           | 2.5x2    | 65                         | 1385  | 2799                     | 31   | 110   | 54     | 12  | 41    | 24          | 22  | 5.5  | 9.5 | 5.5 | 24   |
| 16-5C1  |              |       |           | 3.5x1    | 46                         | 1013  | 1946                     | 31   | 90    | 54     | 12  | 41    | 24          | 22  | 5.5  | 9.5 | 5.5 | 24   |
| 20-5B1  | 20           | 6     | 3.969     | 2.5x1    | 38                         | 837   | 1733                     | 35   | 80    | 58     | 12  | 46    | 27          | 25  | 5.5  | 9.5 | 5.5 | 24   |
| 20-5B2  |              |       |           | 2.5x2    | 76                         | 1519  | 3465                     | 35   | 110   | 58     | 12  | 46    | 27          | 25  | 5.5  | 9.5 | 5.5 | 24   |
| 20-6B1  |              |       |           | 2.5x1    | 40                         | 1139  | 2187                     | 36   | 92    | 60     | 12  | 47    | 28          | 27  | 5.5  | 9.5 | 5.5 | 24   |
| 20-6C1  |              |       |           | 3.5x1    | 55                         | 1512  | 3041                     | 36   | 104   | 60     | 12  | 47    | 28          | 27  | 5.5  | 9.5 | 5.5 | 24   |
| 25-5B1  | 25           | 5     | 3.175     | 2.5x1    | 46                         | 939   | 2209                     | 40   | 80    | 64     | 12  | 52    | 31          | 26  | 5.5  | 9.5 | 5.5 | 24   |
| 25-5B2  |              |       |           | 2.5x2    | 90                         | 1704  | 4417                     | 40   | 110   | 64     | 12  | 52    | 31          | 26  | 5.5  | 9.5 | 5.5 | 24   |
| 25-5C1  |              |       |           | 3.5x1    | 68                         | 1252  | 3085                     | 40   | 90    | 64     | 12  | 52    | 31          | 26  | 5.5  | 9.5 | 5.5 | 24   |
| 25-6B2  | 25           | 6     | 3.969     | 2.5x2    | 94                         | 2308  | 5523                     | 42   | 128   | 68     | 12  | 55    | 32          | 28  | 6.6  | 11  | 6.5 | 24   |
| 25-6C1  |              |       |           | 3.5x1    | 66                         | 1690  | 3844                     | 42   | 104   | 68     | 12  | 55    | 32          | 28  | 6.6  | 11  | 6.5 | 24   |
| 25-10B1 |              |       |           | 10       | 4.763                      | 2.5x1   | 48                       | 1592 | 3237  | 45     | 122 | 72    | 16          | 58  | 34   | 29  | 6.6 | 11   |
| 28-5B1  | 28           | 5     | 3.175     | 2.5x1    | 51                         | 984   | 2466                     | 44   | 80    | 70     | 12  | 56    | 34          | 28  | 6.6  | 11  | 6.5 | 24   |
| 28-5B2  |              |       |           | 2.5x2    | 98                         | 1785  | 4932                     | 44   | 110   | 70     | 12  | 56    | 34          | 28  | 6.6  | 11  | 6.5 | 24   |
| 28-6A2  |              | 6     | 4.763     | 1.5x2    | 59                         | 1150  | 2960                     | 44   | 110   | 70     | 12  | 56    | 34          | 28  | 6.6  | 11  | 6.5 | 24   |
| 28-8A2  | 8            | 1.5x2 |           | 62       | 1960                       | 4348  | 50                       | 110  | 75    | 12     | 61  | 38    | 32          | 6.6 | 11   | 6.5 | 15  |      |
| 28-10B2 | 10           | 2.5x2 |           | 102      | 3060                       | 7299  | 54                       | 177  | 94    | 15     | 74  | 37    | 32          | 9   | 14   | 8.5 | 30  |      |
| 32-5B1  | 32           | 5     | 3.175     | 2.5x1    | 55                         | 1039  | 2833                     | 50   | 80    | 76     | 12  | 63    | 38          | 30  | 6.6  | 11  | 6.5 | 24   |
| 32-5B2  |              |       |           | 2.5x2    | 109                        | 1886  | 5666                     | 50   | 110   | 76     | 12  | 63    | 38          | 30  | 6.6  | 11  | 6.5 | 24   |
| 32-5C1  |              |       |           | 3.5x1    | 76                         | 1388  | 3967                     | 50   | 90    | 76     | 12  | 63    | 38          | 30  | 6.6  | 11  | 6.5 | 24   |
| 32-6B1  | 32           | 6     | 3.969     | 2.5x1    | 57                         | 1409  | 3510                     | 52   | 92    | 78     | 12  | 65    | 39          | 32  | 6.6  | 11  | 6.5 | 24   |
| 32-6B2  |              |       |           | 2.5x2    | 112                        | 2556  | 7020                     | 52   | 128   | 78     | 12  | 65    | 39          | 32  | 6.6  | 11  | 6.5 | 24   |
| 32-6C1  |              |       |           | 3.5x1    | 78                         | 1888  | 4936                     | 52   | 104   | 78     | 12  | 65    | 39          | 32  | 6.6  | 11  | 6.5 | 24   |
| 32-8B1  | 32           | 8     | 4.763     | 2.5x1    | 58                         | 1810  | 4227                     | 54   | 110   | 88     | 16  | 70    | 40          | 33  | 9    | 14  | 8.5 | 30   |
| 32-8B2  |              |       |           | 2.5x2    | 115                        | 3284  | 8453                     | 54   | 158   | 88     | 16  | 70    | 40          | 33  | 9    | 14  | 8.5 | 30   |
| 32-8C1  |              |       |           | 3.5x1    | 82                         | 2428  | 5948                     | 54   | 126   | 88     | 16  | 70    | 40          | 33  | 9    | 14  | 8.5 | 30   |
| 32-10B1 | 32           | 10    | 6.350     | 2.5x1    | 58                         | 2651  | 5600                     | 57   | 122   | 91     | 16  | 73    | 44          | 37  | 9    | 14  | 8.5 | 30   |
| 32-10B2 |              |       |           | 2.5x2    | 118                        | 4810  | 11199                    | 57   | 182   | 91     | 16  | 73    | 44          | 37  | 9    | 14  | 8.5 | 30   |
| 32-10C1 |              |       |           | 3.5x1    | 86                         | 3519  | 7785                     | 57   | 142   | 91     | 16  | 73    | 44          | 37  | 9    | 14  | 8.5 | 30   |
| 32-12A2 | 32           | 12    | 6.350     | 1.5x2    | 72                         | 3035  | 6555                     | 62   | 180   | 108    | 16  | 86    | 44          | 38  | 9    | 14  | 8.5 | 15   |
| 32-12B1 |              |       |           | 2.5x1    | 62                         | 2650  | 5599                     | 62   | 138   | 108    | 16  | 86    | 44          | 38  | 9    | 14  | 8.5 | 20   |
| 32-16A2 |              |       |           | 1.5x2    | 72                         | 3035  | 6555                     | 62   | 180   | 108    | 16  | 86    | 44          | 38  | 9    | 14  | 8.5 | 20   |
| 36-6B1  | 36           | 6     | 3.969     | 2.5x1    | 62                         | 1486  | 3969                     | 55   | 92    | 82     | 12  | 68    | 42          | 32  | 6.6  | 11  | 6.5 | 24   |
| 36-6B2  |              |       |           | 2.5x2    | 121                        | 2696  | 7937                     | 55   | 128   | 82     | 12  | 68    | 42          | 32  | 6.6  | 11  | 6.5 | 24   |
| 36-10B2 |              |       |           | 10       | 6.350                      | 2.5x2   | 132                      | 5105 | 12669 | 62     | 184 | 104   | 18          | 82  | 49   | 40  | 11  | 17.5 |

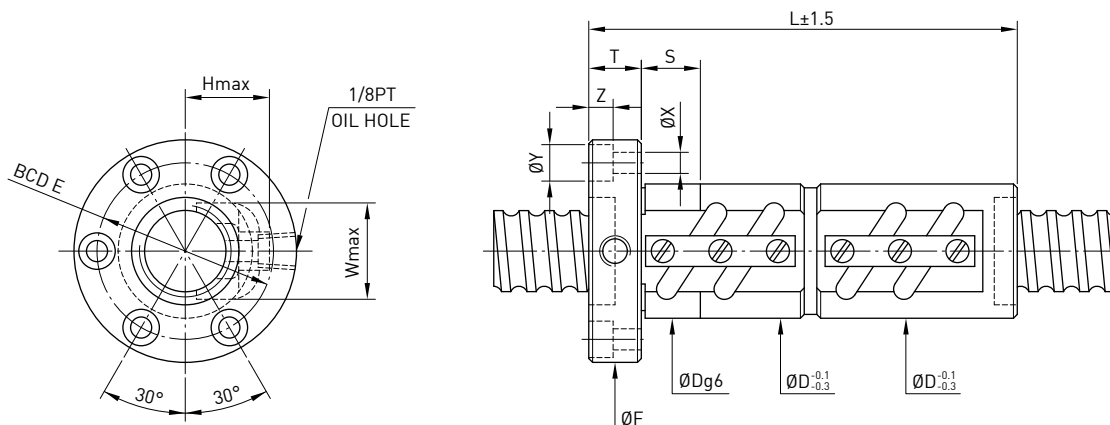
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

**F D V TYPE**


| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     | Flange |     |       | Return Tube |    | Bolt |      |     | Fit |
|---------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|-----|--------|-----|-------|-------------|----|------|------|-----|-----|
|         | Nominal Dia. | Lead |           |          |                            |   |                          | D   | L   | F      | T   | BCD-E | W           | H  | X    | Y    | Z   | S   |
| 40-5B1  | 40           | 5    | 3.175     | 2.5x1    | 65                         | 1141  | 3567                     | 58  | 84  | 92     | 16  | 72    | 46          | 34 | 9    | 14   | 8.5 | 30  |
| 40-5B2  |              |      |           | 2.5x2    | 132                        | 2071  | 7134                     | 58  | 114 | 92     | 16  | 72    | 46          | 34 | 9    | 14   | 8.5 | 30  |
| 40-6B2  |              | 6    | 3.969     | 2.5x2    | 136                        | 2817  | 8855                     | 60  | 132 | 94     | 16  | 76    | 47          | 36 | 9    | 14   | 8.5 | 30  |
| 40-8B1  |              |      |           | 2.5x1    | 69                         | 2003  | 5302                     | 62  | 110 | 96     | 16  | 78    | 48          | 38 | 9    | 14   | 8.5 | 30  |
| 40-8B2  |              | 8    | 4.763     | 2.5x2    | 137                        | 3634  | 10603                    | 62  | 158 | 96     | 16  | 78    | 48          | 38 | 9    | 14   | 8.5 | 30  |
| 40-8C1  |              |      |           | 3.5x1    | 96                         | 2679  | 7438                     | 62  | 126 | 96     | 16  | 78    | 48          | 38 | 9    | 14   | 8.5 | 30  |
| 40-10B1 |              | 10   | 6.350     | 2.5x1    | 72                         | 2959  | 7069                     | 65  | 132 | 106    | 18  | 85    | 52          | 42 | 11   | 17.5 | 11  | 30  |
| 40-10B2 |              |      |           | 2.5x2    | 145                        | 5370  | 14138                    | 65  | 192 | 106    | 18  | 85    | 52          | 42 | 11   | 17.5 | 11  | 30  |
| 40-10C1 |              | 12   | 6.350     | 3.5x1    | 102                        | 3932  | 9841                     | 65  | 152 | 106    | 18  | 85    | 52          | 42 | 11   | 17.5 | 11  | 30  |
| 40-12A2 |              |      |           | 1.5x2    | 88                         | 3402  | 8316                     | 65  | 160 | 106    | 18  | 84    | 52          | 42 | 11   | 17.5 | 11  | 20  |
| 40-12B1 |              | 12   | 7.144     | 2.5x1    | 70                         | 3425  | 7837                     | 70  | 153 | 112    | 18  | 90    | 55          | 43 | 11   | 17.5 | 11  | 40  |
| 40-12B2 |              |      |           | 2.5x2    | 141                        | 6217  | 15674                    | 70  | 225 | 112    | 18  | 90    | 55          | 43 | 11   | 17.5 | 11  | 40  |
| 40-12C1 |              | 16   | 7.144     | 3.5x1    | 103                        | 3932  | 9841                     | 65  | 158 | 106    | 18  | 85    | 52          | 42 | 11   | 17.5 | 11  | 30  |
| 40-16A2 |              |      |           | 1.5x2    | 88                         | 4006  | 9404                     | 75  | 209 | 117    | 18  | 95    | 53          | 43 | 11   | 17.5 | 11  | 40  |
| 40-16B1 |              | 20   | 6.350     | 2.5x1    | 118                        | 3425  | 7837                     | 75  | 153 | 117    | 18  | 95    | 53          | 43 | 11   | 17.5 | 11  | 40  |
| 40-20A1 |              |      |           | 1.5x1    | 44                         | 1874  | 4158                     | 65  | 152 | 106    | 18  | 85    | 52          | 42 | 11   | 17.5 | 11  | 30  |
| 45-10B1 | 45           | 10   | 6.350     | 2.5x1    | 76                         | 3116  | 7953                     | 70  | 134 | 112    | 18  | 90    | 58          | 48 | 11   | 17.5 | 11  | 30  |
| 45-10B2 |              |      |           | 2.5x2    | 156                        | 5655  | 15905                    | 70  | 194 | 112    | 18  | 90    | 58          | 48 | 11   | 17.5 | 11  | 30  |
| 45-12B2 |              | 12   | 7.938     | 2.5x2    | 162                        | 7627  | 19799                    | 74  | 230 | 122    | 22  | 97    | 60          | 49 | 13   | 20   | 13  | 40  |
| 50-5A2  | 50           | 5    | 3.175     | 1.5x2    | 96                         | 1447  | 5382                     | 70  | 107 | 104    | 16  | 86    | 56          | 40 | 9    | 14   | 8.5 | 30  |
| 50-5A3  |              |      |           | 1.5x3    | 143                        | 2051  | 8072                     | 70  | 127 | 104    | 16  | 86    | 56          | 40 | 9    | 14   | 8.5 | 30  |
| 50-5B2  |              | 6    | 3.969     | 2.5x2    | 153                        | 2245  | 8969                     | 70  | 116 | 104    | 16  | 86    | 56          | 40 | 9    | 14   | 8.5 | 30  |
| 50-6B2  |              |      |           | 2.5x2    | 161                        | 3093  | 11149                    | 72  | 134 | 106    | 16  | 88    | 57          | 43 | 9    | 14   | 8.5 | 30  |
| 50-6B3  |              | 8    | 4.763     | 2.5x3    | 235                        | 4384  | 16723                    | 72  | 170 | 106    | 16  | 88    | 57          | 43 | 9    | 14   | 8.5 | 30  |
| 50-8B1  |              |      |           | 2.5x1    | 81                         | 2206  | 6705                     | 75  | 112 | 116    | 18  | 95    | 58          | 45 | 11   | 17.5 | 11  | 30  |
| 50-8B2  |              | 10   | 6.350     | 2.5x2    | 165                        | 4004  | 13409                    | 75  | 160 | 116    | 18  | 95    | 58          | 45 | 11   | 17.5 | 11  | 30  |
| 50-8B3  |              |      |           | 2.5x3    | 244                        | 5674  | 20114                    | 75  | 208 | 116    | 18  | 95    | 58          | 45 | 11   | 17.5 | 11  | 30  |
| 50-10B2 |              | 12   | 7.938     | 2.5x2    | 173                        | 5923  | 17670                    | 78  | 194 | 119    | 18  | 98    | 62          | 48 | 11   | 17.5 | 11  | 30  |
| 50-10B3 |              |      |           | 2.5x3    | 255                        | 8394  | 26505                    | 78  | 254 | 119    | 18  | 98    | 62          | 48 | 11   | 17.5 | 11  | 30  |
| 50-10C1 |              | 12   | 7.938     | 3.5x1    | 120                        | 4393  | 12481                    | 78  | 154 | 119    | 18  | 98    | 62          | 48 | 11   | 17.5 | 11  | 30  |
| 50-12B2 |              |      |           | 2.5x2    | 178                        | 8022  | 22094                    | 82  | 232 | 130    | 22  | 105   | 64          | 52 | 13   | 20   | 13  | 40  |
| 50-12C1 | 3.5x1        |      |           | 123      | 5875                       | 15380   | 82                       | 184 | 130 | 22     | 105 | 64    | 52          | 13 | 20   | 13   | 40  |     |
| 55-10C1 | 55           | 10   | 6.350     | 3.5x1    | 132                        | 4562  | 13661                    | 84  | 154 | 125    | 18  | 103   | 68          | 54 | 11   | 17.5 | 11  | 40  |
| 55-12B2 |              | 12   | 7.938     | 2.5x2    | 185                        | 8392  | 24390                    | 88  | 232 | 136    | 22  | 110   | 70          | 56 | 13   | 20   | 13  | 40  |

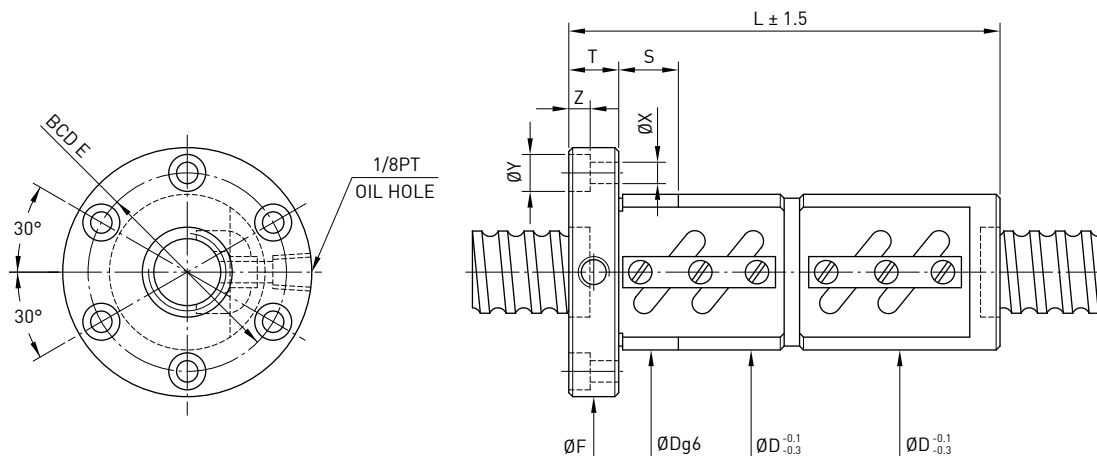
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

**F D V TYPE**



| Model    | Size         |       | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     | Flange |     |       | Return Tube |    | Bolt |      |      | Fit |  |
|----------|--------------|-------|-----------|----------|----------------------------|---|--------------------------|-----|-----|--------|-----|-------|-------------|----|------|------|------|-----|--|
|          | Nominal Dia. | Lead  |           |          |                            |   |                          | D   | L   | F      | T   | BCD-E | W           | H  | X    | Y    | Z    | S   |  |
| 63-8A2   | 63           | 8     | 4.763     | 1.5x2    | 107                        | 2826  | 10129                    | 87  | 142 | 129    | 18  | 107   | 70          | 50 | 11   | 17.5 | 11   | 40  |  |
| 63-8A3   |              |       |           | 1.5x3    | 154                        | 4004  | 15193                    | 87  | 171 | 129    | 18  | 107   | 70          | 50 | 11   | 17.5 | 11   | 40  |  |
| 63-10B2  |              | 10    | 6.350     | 2.5x2    | 206                        | 6533  | 22371                    | 90  | 196 | 132    | 20  | 110   | 74          | 53 | 11   | 17.5 | 11   | 30  |  |
| 63-10B3  |              |       |           | 2.5x3    | 305                        | 9258  | 33556                    | 90  | 256 | 132    | 20  | 110   | 74          | 53 | 11   | 17.5 | 11   | 30  |  |
| 63-12B2  |              | 12    | 7.938     | 2.5x2    | 214                        | 8943  | 28062                    | 94  | 232 | 142    | 22  | 117   | 76          | 57 | 13   | 20   | 13   | 40  |  |
| 63-16B2  |              | 16    | 9.525     | 2.5x2    | 280                        | 14862   | 46009                    | 100 | 296 | 150    | 22  | 123   | 78          | 62 | 13   | 20   | 13   | 40  |  |
| 63-20B2  | 20           | 2.5x2 |           | 280      | 14862                      | 46009   | 100                      | 334 | 150 | 22     | 123 | 78    | 62          | 13 | 20   | 13   | 40   |     |  |
| 70-10B2  | 70           | 10    | 6.350     | 2.5x2    | 228                        | 6843  | 25011                    | 104 | 196 | 152    | 20  | 128   | 80          | 56 | 13   | 20   | 13   | 40  |  |
| 70-10B3  |              |       |           | 2.5x3    | 334                        | 9698  | 37516                    | 104 | 256 | 152    | 20  | 128   | 80          | 56 | 13   | 20   | 13   | 40  |  |
| 70-12B2  |              | 12    | 7.938     | 2.5x2    | 236                        | 9382  | 31275                    | 110 | 232 | 159    | 22  | 133   | 82          | 58 | 13   | 20   | 13   | 40  |  |
| 70-12B3  |              |       |           | 2.5x3    | 336                        | 13296   | 46912                    | 110 | 302 | 159    | 22  | 133   | 82          | 58 | 13   | 20   | 13   | 40  |  |
| 80-10B2  | 80           | 10    | 6.350     | 2.5x2    | 251                        | 7202  | 28538                    | 115 | 200 | 163    | 22  | 137   | 90          | 64 | 13   | 20   | 13   | 40  |  |
| 80-10B3  |              |       |           | 2.5x3    | 368                        | 10207   | 42807                    | 115 | 260 | 163    | 22  | 137   | 90          | 64 | 13   | 20   | 13   | 40  |  |
| 80-12B2  |              | 12    | 7.938     | 2.5x2    | 257                        | 9797  | 35422                    | 120 | 232 | 169    | 22  | 143   | 92          | 67 | 13   | 20   | 13   | 40  |  |
| 80-12B3  |              |       |           | 2.5x3    | 380                        | 13884   | 53132                    | 120 | 302 | 169    | 22  | 143   | 92          | 67 | 13   | 20   | 13   | 40  |  |
| 80-16B2  |              | 16    | 9.525     | 2.5x2    | 340                        | 16485   | 58851                    | 125 | 302 | 190    | 28  | 154   | 94          | 70 | 18   | 26   | 17.5 | 50  |  |
| 80-16B3  |              |       |           | 2.5x3    | 498                        | 23363   | 88276                    | 125 | 398 | 190    | 28  | 154   | 94          | 70 | 18   | 26   | 17.5 | 50  |  |
| 80-20B2  |              | 20    |           | 2.5x2    | 338                        | 16485   | 58851                    | 125 | 345 | 190    | 28  | 154   | 94          | 70 | 18   | 26   | 17.5 | 50  |  |
| 80-20B3  |              |       |           | 2.5x3    | 498                        | 23363   | 88276                    | 125 | 470 | 190    | 28  | 154   | 94          | 70 | 18   | 26   | 17.5 | 50  |  |
| 100-12B2 | 100          | 12    | 7.938     | 2.5x2    | 301                        | 10761   | 44596                    | 145 | 240 | 209    | 28  | 173   | 112         | 76 | 18   | 26   | 17.5 | 50  |  |
| 100-12B3 |              |       |           | 2.5x3    | 452                        | 15251   | 66894                    | 145 | 312 | 209    | 28  | 173   | 112         | 76 | 18   | 26   | 17.5 | 50  |  |
| 100-16B2 |              | 16    | 9.525     | 2.5x2    | 400                        | 18125   | 74425                    | 150 | 308 | 228    | 32  | 185   | 114         | 80 | 22   | 32   | 21.5 | 60  |  |
| 100-16B3 |              |       |           | 2.5x3    | 595                        | 25684   | 111637                   | 150 | 404 | 228    | 32  | 185   | 114         | 80 | 22   | 32   | 21.5 | 60  |  |
| 100-20B2 |              | 20    |           | 2.5x2    | 400                        | 18123   | 74425                    | 150 | 350 | 228    | 32  | 185   | 114         | 80 | 22   | 32   | 21.5 | 60  |  |
| 100-20B3 |              |       |           | 2.5x3    | 595                        | 25684   | 111637                   | 150 | 475 | 228    | 32  | 185   | 114         | 80 | 22   | 32   | 21.5 | 60  |  |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

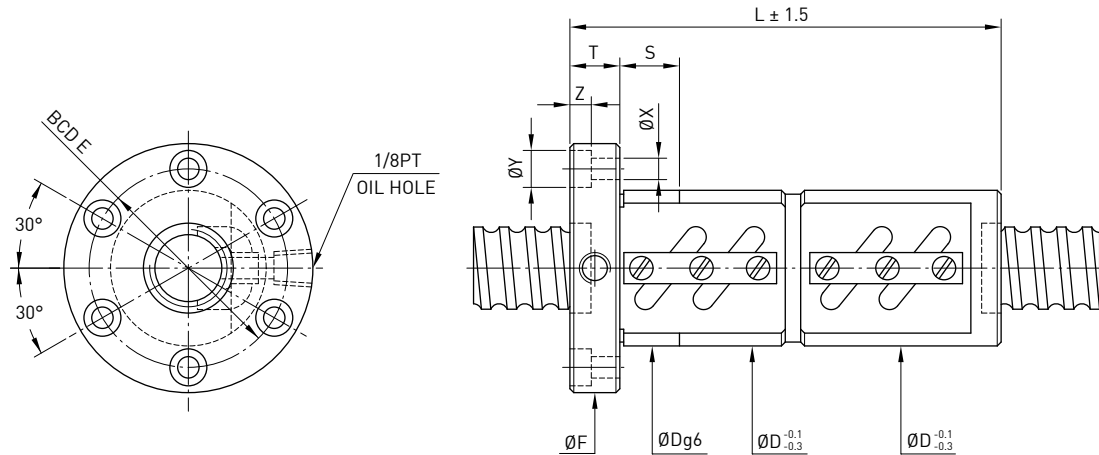
**F D W TYPE**


| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     | Flange |    |       | Bolt |     |     | Fit |
|---------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|-----|--------|----|-------|------|-----|-----|-----|
|         | Nominal Dia. | Lead |           |          |                            |   |                          | D   | L   | F      | T  | BCD-E | X    | Y   | Z   |     |
| 16-5B2  | 16           | 5    | 3.175     | 2.5x2    | 65                         | 1385  | 2799                     | 40  | 110 | 64     | 12 | 51    | 5.5  | 9.5 | 5.5 | 24  |
| 16-5B1  |              |      |           | 2.5x1    | 32                         | 763   | 1400                     | 40  | 80  | 64     | 12 | 51    | 5.5  | 9.5 | 5.5 | 24  |
| 16-5C1  |              |      |           | 3.5x1    | 46                         | 1013  | 1946                     | 40  | 90  | 64     | 12 | 51    | 5.5  | 9.5 | 5.5 | 24  |
| 20-5B1  | 20           | 6    | 3.969     | 2.5x1    | 38                         | 837   | 1733                     | 44  | 80  | 68     | 12 | 55    | 5.5  | 9.5 | 5.5 | 24  |
| 20-5B2  |              |      |           | 2.5x2    | 76                         | 1519  | 3465                     | 44  | 110 | 68     | 12 | 55    | 5.5  | 9.5 | 5.5 | 24  |
| 20-6B1  |              |      |           | 2.5x1    | 40                         | 1139  | 2187                     | 48  | 92  | 72     | 12 | 59    | 5.5  | 9.5 | 5.5 | 24  |
| 20-6C1  | 20           | 10   | 4.763     | 3.5x1    | 55                         | 1512  | 3041                     | 48  | 104 | 72     | 12 | 59    | 5.5  | 9.5 | 5.5 | 24  |
| 25-5A2  |              |      |           | 1.5x2    | 54                         | 1092  | 2622                     | 50  | 102 | 73     | 11 | 61    | 5.5  | 9.5 | 5.5 | 24  |
| 25-5B1  |              |      |           | 2.5x1    | 46                         | 939   | 2209                     | 50  | 80  | 74     | 12 | 62    | 5.5  | 9.5 | 5.5 | 24  |
| 25-5B2  | 25           | 5    | 3.175     | 2.5x2    | 90                         | 1704  | 4417                     | 50  | 110 | 74     | 12 | 62    | 5.5  | 9.5 | 5.5 | 24  |
| 25-5C1  |              |      |           | 3.5x1    | 68                         | 1252  | 3085                     | 50  | 90  | 74     | 12 | 62    | 5.5  | 9.5 | 5.5 | 24  |
| 25-6B2  |              |      |           | 2.5x2    | 94                         | 2304  | 5524                     | 56  | 128 | 82     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 25-6C1  | 25           | 6    | 3.969     | 3.5x1    | 66                         | 1690  | 3844                     | 56  | 104 | 82     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 25-10B1 |              |      |           | 2.5x1    | 48                         | 1592  | 3237                     | 60  | 122 | 86     | 16 | 73    | 6.6  | 11  | 6.5 | 24  |
| 28-5B1  |              |      |           | 2.5x1    | 51                         | 984   | 2466                     | 55  | 80  | 85     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 28-5B2  | 28           | 5    | 3.175     | 2.5x2    | 98                         | 1785  | 4932                     | 55  | 110 | 85     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 28-6A2  |              |      |           | 1.5x2    | 59                         | 1150  | 2960                     | 55  | 110 | 85     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 28-6B2  |              |      |           | 2.5x2    | 98                         | 1776  | 4980                     | 55  | 123 | 85     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 32-4B2  | 32           | 4    | 2.381     | 2.5x2    | 91                         | 1071  | 3582                     | 54  | 93  | 81     | 12 | 67    | 6.6  | 11  | 6.5 | 24  |
| 32-5B1  |              |      |           | 2.5x1    | 55                         | 1039  | 2833                     | 58  | 80  | 84     | 12 | 71    | 6.6  | 11  | 6.5 | 24  |
| 32-5B2  |              |      |           | 2.5x2    | 109                        | 1886  | 5666                     | 58  | 110 | 84     | 12 | 71    | 6.6  | 11  | 6.5 | 24  |
| 32-5C1  | 32           | 5    | 3.175     | 3.5x1    | 76                         | 1388  | 3967                     | 58  | 90  | 84     | 12 | 71    | 6.6  | 11  | 6.5 | 24  |
| 32-6B1  |              |      |           | 2.5x1    | 57                         | 1409  | 3510                     | 62  | 92  | 88     | 12 | 75    | 6.6  | 11  | 6.5 | 24  |
| 32-6B2  |              |      |           | 2.5x2    | 112                        | 2556  | 7020                     | 62  | 128 | 88     | 12 | 75    | 6.6  | 11  | 6.5 | 24  |
| 32-6C1  | 32           | 6    | 3.969     | 3.5x1    | 78                         | 1888  | 4936                     | 62  | 104 | 88     | 12 | 75    | 6.6  | 11  | 6.5 | 24  |
| 32-8A2  |              |      |           | 1.5x2    | 70                         | 2082  | 5151                     | 66  | 135 | 100    | 15 | 82    | 9    | 14  | 8.5 | 30  |
| 32-8B1  |              |      |           | 2.5x1    | 58                         | 1810  | 4227                     | 66  | 110 | 100    | 16 | 82    | 9    | 14  | 8.5 | 30  |
| 32-8B2  | 32           | 8    | 4.763     | 2.5x2    | 115                        | 3284  | 8453                     | 66  | 158 | 100    | 16 | 82    | 9    | 14  | 8.5 | 30  |
| 32-8B3  |              |      |           | 2.5x3    | 168                        | 4653  | 12678                    | 74  | 205 | 108    | 16 | 90    | 9    | 14  | 8.5 | 30  |
| 32-8C1  |              |      |           | 3.5x1    | 82                         | 2428  | 5948                     | 66  | 126 | 100    | 16 | 82    | 9    | 14  | 8.5 | 30  |
| 32-10A2 | 32           | 10   | 6.350     | 1.5x2    | 72                         | 3051  | 6612                     | 74  | 167 | 108    | 15 | 90    | 9    | 14  | 8.5 | 30  |
| 32-10B1 |              |      |           | 2.5x1    | 58                         | 2651  | 5600                     | 74  | 122 | 108    | 16 | 90    | 9    | 14  | 8.5 | 30  |
| 32-10B2 |              |      |           | 2.5x2    | 118                        | 4810  | 11199                    | 74  | 182 | 108    | 16 | 90    | 9    | 14  | 8.5 | 30  |
| 32-10C1 | 32           | 12   | 6.350     | 3.5x1    | 86                         | 3519  | 7785                     | 74  | 142 | 108    | 16 | 90    | 9    | 14  | 8.5 | 30  |
| 32-12B1 |              |      |           | 2.5x1    | 62                         | 2602  | 5510                     | 74  | 153 | 108    | 18 | 90    | 9    | 14  | 8.5 | 30  |
| 32-12B2 |              |      |           | 2.5x2    | 118                        | 4810  | 11199                    | 74  | 232 | 108    | 16 | 90    | 9    | 14  | 8.5 | 30  |
| 32-12C1 | 32           | 12   | 6.350     | 3.5x1    | 84                         | 3518  | 7784                     | 74  | 166 | 108    | 16 | 90    | 9    | 14  | 8.5 | 30  |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

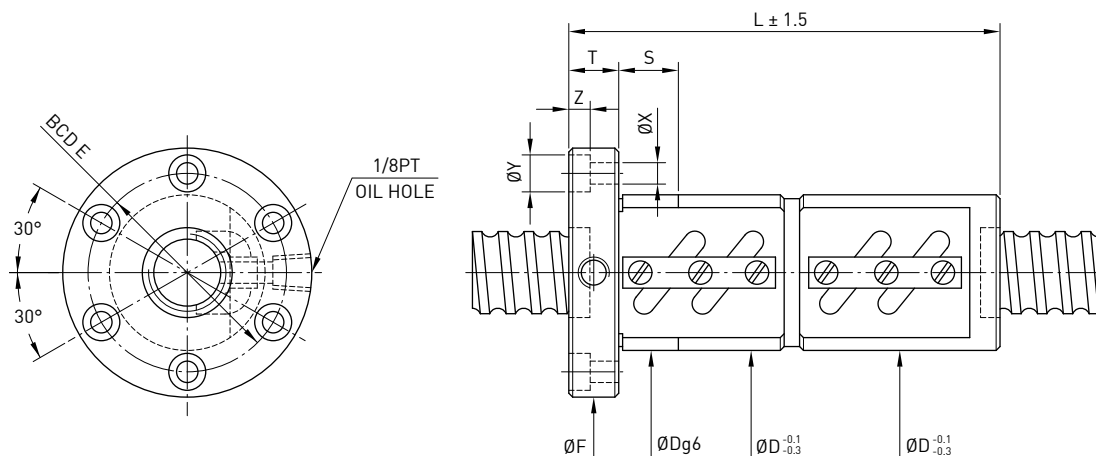


**F D W TYPE**



| Model   | Size            |      | Ball Dia. | Circuits | Stiffness<br>kgf / $\mu$ m<br>K | Dynamic<br>Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static<br>Load<br>Co (kgf) | Nut |     | Flange |    |       | Bolt |      |     | Fit |
|---------|-----------------|------|-----------|----------|---------------------------------|--|----------------------------|-----|-----|--------|----|-------|------|------|-----|-----|
|         | Nominal<br>Dia. | Lead |           |          |                                 |  |                            | D   | L   | F      | T  | BCD-E | X    | Y    | Z   | S   |
| 36-6B1  | 36              | 6    | 3.969     | 2.5x1    | 62                              | 1486   | 3969                       | 65  | 92  | 100    | 12 | 82    | 6.6  | 11   | 6.5 | 24  |
| 36-6B2  |                 |      |           | 2.5x2    | 121                             | 2696   | 7937                       | 65  | 128 | 100    | 12 | 82    | 6.6  | 11   | 6.5 | 24  |
| 36-12A2 |                 | 12   | 4.763     | 1.5x2    | 80                              | 2557   | 6693                       | 70  | 155 | 108    | 15 | 90    | 9    | 14   | 8.5 | 30  |
| 36-12B1 |                 |      |           | 2.5x1    | 67                              | 2812   | 6334                       | 75  | 126 | 120    | 16 | 98    | 11   | 17.5 | 11  | 30  |
| 36-10B2 |                 | 10   | 6.350     | 2.5x2    | 132                             | 5105   | 12669                      | 75  | 184 | 120    | 18 | 98    | 11   | 17.5 | 11  | 30  |
| 36-12B2 |                 | 12   |           | 2.5x2    | 130                             | 5105   | 12668                      | 75  | 206 | 120    | 18 | 98    | 11   | 17.5 | 11  | 30  |
| 36-8A2  | 36              | 8    | 4.763     | 1.5x2    | 77                              | 2217   | 5669                       | 70  | 135 | 108    | 15 | 90    | 9    | 14   | 8.5 | 30  |
| 36-8B2  |                 |      |           | 2.5x2    | 126                             | 3489   | 9606                       | 70  | 158 | 108    | 15 | 90    | 9    | 14   | 8.5 | 30  |
| 40-5B1  |                 | 5    | 3.175     | 2.5x1    | 65                              | 1141   | 3567                       | 68  | 84  | 102    | 16 | 84    | 9    | 14   | 8.5 | 30  |
| 40-5B2  |                 |      |           | 2.5x2    | 132                             | 2071   | 7134                       | 68  | 114 | 102    | 16 | 84    | 9    | 14   | 8.5 | 30  |
| 40-6B2  |                 | 6    | 3.969     | 2.5x2    | 136                             | 2817   | 8855                       | 70  | 132 | 104    | 16 | 86    | 9    | 14   | 8.5 | 30  |
| 40-8B1  |                 | 8    | 4.763     | 2.5x1    | 69                              | 2003   | 5302                       | 74  | 110 | 108    | 16 | 90    | 9    | 14   | 8.5 | 30  |
| 40-8B2  |                 |      |           | 2.5x2    | 137                             | 3634   | 10603                      | 74  | 158 | 108    | 16 | 90    | 9    | 14   | 8.5 | 30  |
| 40-8B3  |                 |      |           | 2.5x3    | 200                             | 5150   | 15904                      | 74  | 210 | 108    | 15 | 90    | 9    | 14   | 8.5 | 30  |
| 40-8C1  |                 |      |           | 3.5x1    | 96                              | 2679   | 7438                       | 74  | 126 | 108    | 16 | 90    | 9    | 14   | 8.5 | 30  |
| 40-10A2 | 40              | 10   | 6.350     | 1.5x2    | 87                              | 3418   | 8398                       | 82  | 170 | 124    | 18 | 102   | 11   | 17.5 | 11  | 30  |
| 40-10B1 |                 |      |           | 2.5x1    | 72                              | 2959   | 7069                       | 84  | 132 | 125    | 18 | 104   | 11   | 17.5 | 11  | 30  |
| 40-10B2 |                 |      |           | 2.5x2    | 145                             | 5370   | 14138                      | 84  | 192 | 125    | 18 | 104   | 11   | 17.5 | 11  | 30  |
| 40-10C1 |                 | 12   | 7.144     | 3.5x1    | 102                             | 3932   | 9841                       | 84  | 152 | 125    | 18 | 104   | 11   | 17.5 | 11  | 30  |
| 40-12A2 |                 |      |           | 1.5x2    | 88                              | 4006   | 9404                       | 86  | 160 | 128    | 18 | 106   | 11   | 17.5 | 11  | 30  |
| 40-12B1 |                 |      |           | 2.5x1    | 70                              | 3425   | 7837                       | 86  | 153 | 128    | 18 | 106   | 11   | 17.5 | 11  | 40  |
| 40-12B2 |                 |      |           | 2.5x2    | 141                             | 6217   | 15674                      | 86  | 225 | 128    | 18 | 106   | 11   | 17.5 | 11  | 40  |
| 40-12C1 |                 |      |           | 3.5x1    | 103                             | 4637   | 11146                      | 86  | 179 | 128    | 18 | 106   | 11   | 17.5 | 11  | 30  |
| 40-16A2 |                 | 16   | 7.144     | 1.5x2    | 83                              | 4007   | 9405                       | 86  | 214 | 128    | 18 | 106   | 11   | 17.5 | 11  | 40  |
| 40-16B1 |                 |      |           | 2.5x1    | 72                              | 3425   | 7837                       | 86  | 182 | 128    | 18 | 106   | 11   | 17.5 | 11  | 40  |
| 40-16B2 |                 |      |           | 2.5x2    | 143                             | 6216   | 15674                      | 86  | 272 | 128    | 22 | 106   | 11   | 17.5 | 11  | 30  |
| 45-10B1 | 45              | 10   | 6.350     | 2.5x1    | 76                              | 3111   | 7953                       | 88  | 134 | 132    | 18 | 110   | 11   | 17.5 | 11  | 30  |
| 45-10B2 |                 |      |           | 2.5x2    | 156                             | 5655   | 15905                      | 88  | 194 | 132    | 18 | 110   | 11   | 17.5 | 11  | 30  |
| 45-12B2 |                 | 12   | 7.938     | 2.5x2    | 162                             | 7627   | 19799                      | 96  | 230 | 142    | 22 | 117   | 13   | 20   | 13  | 40  |
| 45-16B2 |                 | 16   | 7.144     | 2.5x2    | 158                             | 6636   | 17895                      | 90  | 278 | 132    | 18 | 110   | 11   | 17.5 | 11  | 30  |
| 50-5A2  | 50              | 5    | 3.175     | 1.5x2    | 96                              | 1447   | 5382                       | 80  | 107 | 114    | 16 | 96    | 9    | 14   | 8.5 | 30  |
| 50-5A3  |                 |      |           | 1.5x3    | 143                             | 2051   | 8072                       | 80  | 127 | 114    | 16 | 96    | 9    | 14   | 8.5 | 30  |
| 50-6B2  |                 | 6    | 3.969     | 2.5x2    | 161                             | 3093   | 11149                      | 84  | 134 | 118    | 16 | 100   | 9    | 14   | 8.5 | 30  |
| 50-6B3  |                 |      |           | 2.5x3    | 235                             | 4384   | 16723                      | 84  | 170 | 118    | 16 | 100   | 9    | 14   | 8.5 | 30  |
| 50-8B1  |                 | 8    | 4.763     | 2.5x1    | 81                              | 2206   | 6705                       | 87  | 112 | 128    | 18 | 107   | 11   | 17.5 | 11  | 30  |
| 50-8B2  |                 |      |           | 2.5x2    | 165                             | 4004   | 13409                      | 87  | 160 | 128    | 18 | 107   | 11   | 17.5 | 11  | 30  |
| 50-8B3  |                 |      |           | 2.5x3    | 244                             | 5674   | 20114                      | 87  | 208 | 128    | 18 | 107   | 11   | 17.5 | 11  | 30  |
| 50-10B1 |                 | 10   | 6.350     | 2.5x1    | 88                              | 3245   | 8918                       | 93  | 133 | 135    | 18 | 113   | 11   | 17.5 | 11  | 30  |

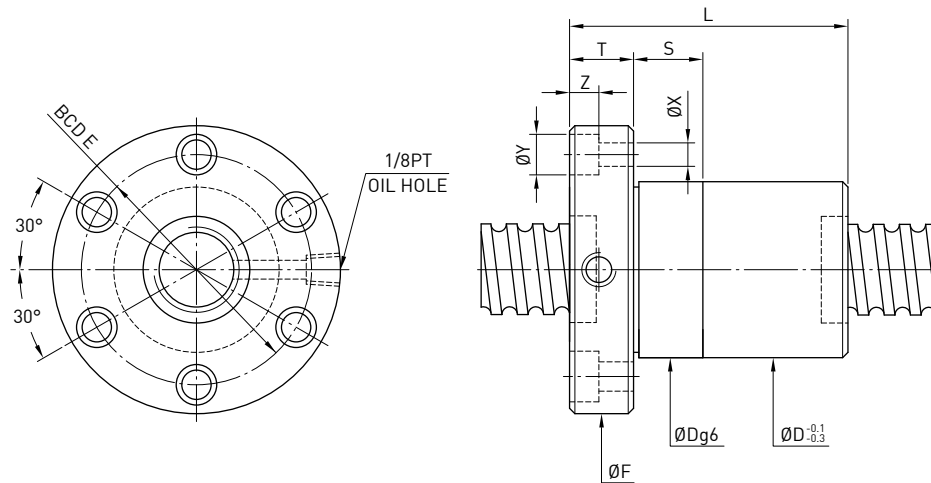
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

**F D W TYPE**


| Model    | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     | Flange |     |       | Bolt |      |      | Fit |   |
|----------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|-----|--------|-----|-------|------|------|------|-----|---|
|          | Nominal Dia. | Lead |           |          |                            |   |                          | D   | L   | F      | T   | BCD-E | X    | Y    | Z    |     | S |
| 50-10B2  | 50           | 10   | 6.350     | 2.5x2    | 173                        | 5923  | 17670                    | 94  | 194 | 135    | 18  | 114   | 11   | 17.5 | 11   | 30  |   |
| 50-10B3  |              |      |           | 2.5x3    | 255                        | 8394  | 26505                    | 94  | 254 | 135    | 18  | 114   | 11   | 17.5 | 11   | 30  |   |
| 50-10C1  |              |      |           | 3.5x1    | 120                        | 4393  | 12481                    | 94  | 154 | 135    | 18  | 114   | 11   | 17.5 | 11   | 30  |   |
| 50-12B1  |              | 12   | 7.938     | 2.5x1    | 90                         | 4367  | 10918                    | 100 | 159 | 146    | 22  | 122   | 14   | 20   | 13   | 40  |   |
| 50-12B2  |              |      |           | 2.5x2    | 178                        | 8022  | 22094                    | 102 | 232 | 150    | 22  | 125   | 13   | 20   | 13   | 40  |   |
| 50-12C1  |              |      |           | 3.5x1    | 123                        | 5875  | 15380                    | 102 | 184 | 150    | 22  | 125   | 13   | 20   | 13   | 40  |   |
| 50-16B2  |              |      |           | 2.5x2    | 174                        | 7918  | 21837                    | 100 | 280 | 146    | 22  | 122   | 14   | 20   | 13   | 40  |   |
| 50-20B1  |              | 20   | 2.5x1     | 90       | 4367                       | 10918   | 100                      | 227 | 146 | 28     | 122 | 14    | 20   | 13   | 40   |     |   |
| 55-10C1  | 55           | 10   | 6.350     | 3.5x1    | 132                        | 4562  | 13661                    | 100 | 154 | 140    | 18  | 118   | 11   | 17.5 | 11   | 40  |   |
| 55-12B2  |              | 12   | 7.938     | 2.5x2    | 185                        | 8392  | 24390                    | 105 | 232 | 154    | 22  | 127   | 13   | 20   | 13   | 40  |   |
| 63-8A2   | 63           | 8    | 4.763     | 1.5x2    | 107                        | 2826  | 10129                    | 104 | 142 | 146    | 18  | 124   | 11   | 17.5 | 11   | 40  |   |
| 63-8A3   |              |      |           | 1.5x3    | 154                        | 4004  | 15193                    | 104 | 174 | 146    | 18  | 124   | 11   | 17.5 | 11   | 40  |   |
| 63-10B2  |              | 10   | 6.350     | 2.5x2    | 206                        | 6533  | 22371                    | 110 | 196 | 152    | 20  | 130   | 11   | 17.5 | 11   | 30  |   |
| 63-10B3  |              |      |           | 2.5x3    | 305                        | 9258  | 33556                    | 110 | 256 | 152    | 20  | 130   | 11   | 17.5 | 11   | 30  |   |
| 63-12B2  |              | 12   | 7.938     | 2.5x2    | 214                        | 8943  | 28062                    | 118 | 232 | 166    | 22  | 141   | 13   | 20   | 13   | 40  |   |
| 63-16B2  |              | 16   | 9.525     | 2.5x2    | 280                        | 14862   | 46009                    | 124 | 296 | 172    | 22  | 147   | 13   | 20   | 13   | 40  |   |
| 63-20B2  |              | 20   |           | 2.5x2    | 280                        | 14862   | 46009                    | 124 | 334 | 172    | 22  | 147   | 13   | 20   | 13   | 40  |   |
| 70-10B2  | 70           | 10   | 6.350     | 2.5x2    | 228                        | 6843  | 25011                    | 124 | 196 | 170    | 20  | 145   | 13   | 20   | 13   | 40  |   |
| 70-10B3  |              |      |           | 2.5x3    | 334                        | 9698  | 37516                    | 124 | 256 | 170    | 20  | 145   | 13   | 20   | 13   | 40  |   |
| 70-12B2  |              | 12   | 7.938     | 2.5x2    | 236                        | 9382  | 31275                    | 130 | 232 | 178    | 22  | 152   | 13   | 20   | 13   | 40  |   |
| 70-12B3  |              |      |           | 2.5x3    | 336                        | 13296   | 46912                    | 130 | 302 | 178    | 22  | 152   | 13   | 20   | 13   | 40  |   |
| 70-20B2  |              | 20   | 9.525     | 2.5x2    | 300                        | 15644   | 51502                    | 130 | 325 | 186    | 28  | 158   | 18   | 26   | 17.5 | 60  |   |
| 80-10B2  | 80           | 10   | 6.350     | 2.5x2    | 251                        | 7202  | 28538                    | 130 | 200 | 178    | 22  | 152   | 13   | 20   | 13   | 40  |   |
| 80-10B3  |              |      |           | 2.5x3    | 368                        | 10207   | 42807                    | 130 | 260 | 178    | 22  | 152   | 13   | 20   | 13   | 40  |   |
| 80-12B2  |              | 12   | 7.938     | 2.5x2    | 257                        | 9797  | 35422                    | 136 | 232 | 185    | 22  | 159   | 13   | 20   | 13   | 40  |   |
| 80-12B3  |              |      |           | 2.5x3    | 380                        | 13884   | 53132                    | 136 | 302 | 185    | 22  | 159   | 13   | 20   | 13   | 40  |   |
| 80-16B2  |              | 16   | 9.525     | 2.5x2    | 340                        | 16485   | 58851                    | 145 | 302 | 210    | 28  | 174   | 18   | 26   | 17.5 | 50  |   |
| 80-16B3  |              |      |           | 2.5x3    | 498                        | 23363   | 88276                    | 145 | 398 | 210    | 28  | 174   | 18   | 26   | 17.5 | 50  |   |
| 80-20B2  |              | 20   |           | 2.5x2    | 338                        | 16485   | 58851                    | 145 | 345 | 210    | 28  | 174   | 18   | 26   | 17.5 | 50  |   |
| 80-20B3  |              |      |           | 2.5x3    | 498                        | 23363   | 88276                    | 145 | 470 | 210    | 28  | 174   | 18   | 26   | 17.5 | 50  |   |
| 100-12B2 | 100          | 12   | 7.938     | 2.5x2    | 301                        | 10761   | 44596                    | 160 | 240 | 224    | 28  | 188   | 18   | 26   | 17.5 | 50  |   |
| 100-12B3 |              |      |           | 2.5x3    | 452                        | 15251   | 66894                    | 160 | 312 | 224    | 28  | 188   | 18   | 26   | 17.5 | 50  |   |
| 100-16B2 |              | 16   | 9.525     | 2.5x2    | 400                        | 18123   | 74425                    | 170 | 308 | 248    | 32  | 205   | 22   | 32   | 21.5 | 60  |   |
| 100-16B3 |              |      |           | 2.5x3    | 595                        | 25684   | 11637                    | 170 | 404 | 248    | 32  | 205   | 22   | 32   | 21.5 | 60  |   |
| 100-20B2 |              | 20   |           | 2.5x2    | 400                        | 18123   | 74425                    | 170 | 350 | 248    | 32  | 205   | 22   | 32   | 21.5 | 60  |   |
| 100-20B3 |              |      |           | 2.5x3    | 595                        | 25684   | 11637                    | 170 | 475 | 248    | 32  | 205   | 22   | 32   | 21.5 | 60  |   |

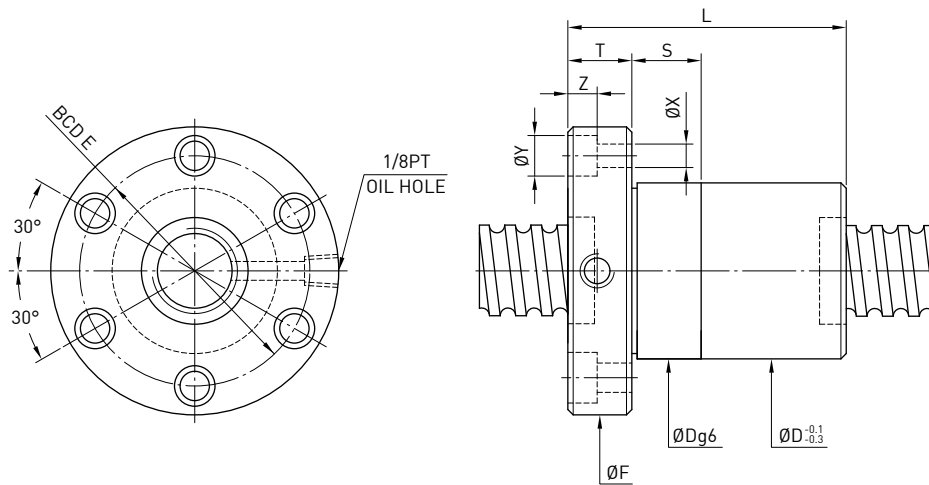
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

**F S I TYPE**



| Model     | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut  |    |    | Flange |       |    | Bolt |     |     | Fit |
|-----------|--------------|------|-----------|----------|----------------------------|---|--------------------------|------|----|----|--------|-------|----|------|-----|-----|-----|
|           | Nominal Dia. | Lead |           |          |                            |   |                          | D    | L  | F  | T      | BCD-E | X  | Y    | Z   | S   |     |
| 8-2.5T3   | 8            | 2.5  | 1.500     | 3        | 8                          | 170   | 267                      | 16   | 18 | 28 | 35     | 5     | 27 | 4.5  | 0   | 0   | 0   |
| 14-2.54T3 | 14           | 2.54 | 2.000     | 3        | 12                         | 339   | 655                      | 28   | 30 | 39 | 50     | 10.6  | 40 | 5    | 7   | 5   | 0   |
| 14-4T3    |              | 4    |           | 3        | 12                         | 339   | 655                      | 24   | 26 | 33 | 48     | 6     | 36 | 5.5  | 9.5 | 5.5 | 0   |
| 16-2T3    | 16           | 2    | 1.500     | 3        | 14                         | 252   | 593                      | 25   | 27 | 36 | 44     | 10    | 35 | 5.5  | 9.5 | 5.5 | 0   |
| 16-2.5T4  |              | 2.5  |           | 4        | 19                         | 358   | 862                      | 25   | 27 | 44 | 44     | 10    | 35 | 5.5  | 9.5 | 5.5 | 12  |
| 16-5T3    |              | 5    | 3.175     | 3        | 11                         | 731   | 1331                     | 28   | 30 | 46 | 54     | 12    | 41 | 5.5  | 9.5 | 5.5 | 12  |
| 16-5T4    |              |      |           | 4        | 12                         | 936   | 1775                     | 28   | 30 | 52 | 54     | 12    | 41 | 5.5  | 9.5 | 5.5 | 12  |
| 16-6T4    |              |      |           | 6        | 4                          | 21  | 936                      | 1775 | 30 | 32 | 58     | 54    | 12 | 42   | 5.5 | 9.5 | 5.5 |
| 20-2T6    | 20           | 2    | 1.500     | 6        | 32                         | 518   | 1551                     | 30   | 32 | 52 | 52     | 10    | 40 | 5.5  | 9.5 | 5.5 | 12  |
| 20-2T4    |              |      |           | 4        | 36                         | 399   | 1112                     | 30   | 32 | 40 | 52     | 10    | 40 | 5.5  | 9.5 | 5.5 | 12  |
| 20-2.5T5  |              | 2.5  | 2.000     | 5        | 28                         | 637   | 1635                     | 34   | 36 | 51 | 59     | 12    | 47 | 5.5  | 9.5 | 5.5 | 12  |
| 20-2.54T6 |              |      |           | 6        | 33                         | 745   | 1962                     | 34   | 36 | 55 | 59     | 12    | 47 | 5.5  | 9.5 | 5.5 | 12  |
| 20-4T3    |              | 4    | 2.381     | 3        | 17                         | 509   | 1134                     | 34   | 36 | 40 | 59     | 10    | 47 | 5.5  | 9.5 | 5.5 | 12  |
| 20-5T3    |              |      |           | 3        | 20                         | 852   | 1767                     | 32   | 34 | 46 | 57     | 12    | 45 | 5.5  | 9.5 | 5.5 | 12  |
| 20-5T4    |              | 5    | 3.175     | 4        | 27                         | 1091  | 2356                     | 32   | 34 | 53 | 57     | 12    | 45 | 5.5  | 9.5 | 5.5 | 12  |
| 20-6T3    |              |      |           | 3        | 20                         | 1091  | 2081                     | 34   | 36 | 51 | 60     | 12    | 48 | 5.5  | 9.5 | 5.5 | 12  |
| 20-6T4    |              | 6    | 3.969     | 4        | 27                         | 1398  | 2774                     | 34   | 36 | 61 | 60     | 12    | 48 | 5.5  | 9.5 | 5.5 | 12  |
| 20-10T3   |              |      |           | 10       | 3                          | 20  | 1091                     | 2080 | 33 | 35 | 64     | 57    | 12 | 45   | 5.5 | 9.5 | 5.5 |
| 25-2T6    | 25           | 2    | 1.500     | 6        | 39                         | 560   | 1960                     | 34   | 36 | 50 | 55     | 10    | 46 | 5.5  | 9.5 | 5.5 | 12  |
| 25-2T4    |              |      |           | 4        | 27                         | 395   | 1307                     | 34   | 36 | 40 | 55     | 10    | 46 | 5.5  | 9.5 | 5.5 | 12  |
| 25-2T3    |              |      |           | 3        | 20                         | 309   | 980                      | 34   | 36 | 35 | 55     | 10    | 46 | 5.5  | 9.5 | 5.5 | 12  |
| 25-2.5T5  |              | 2.5  | 2.000     | 5        | 34                         | 716   | 2117                     | 38   | 40 | 52 | 62     | 10    | 51 | 6.6  | 11  | 6.5 | 12  |
| 25-4T4    |              | 4    | 2.381     | 4        | 28                         | 747   | 1989                     | 38   | 40 | 53 | 64     | 12    | 51 | 5.5  | 9.5 | 5.5 | 12  |
| 25-5T3    |              | 5    | 3.175     | 3        | 28                         | 977   | 2314                     | 37   | 40 | 46 | 64     | 12    | 52 | 5.5  | 9.5 | 5.5 | 12  |
| 25-5T4    |              |      |           | 4        | 37                         | 1252  | 3085                     | 37   | 40 | 53 | 64     | 12    | 52 | 5.5  | 9.5 | 5.5 | 12  |
| 25-5T5    |              |      |           | 5        | 40                         | 1516  | 3856                     | 38   | 40 | 56 | 63     | 11    | 51 | 5.5  | 9.5 | 5.5 | 12  |
| 25-5T6    |              |      |           | 6        | 48                         | 1773  | 4627                     | 38   | 40 | 65 | 63     | 11    | 51 | 5.5  | 9.5 | 5.5 | 12  |
| 25-6T3    |              | 6    | 3.969     | 3        | 28                         | 1272  | 2762                     | 38   | 42 | 51 | 65     | 12    | 53 | 5.5  | 9.5 | 5.5 | 12  |
| 25-6T4    |              |      |           | 4        | 37                         | 1628  | 3682                     | 38   | 42 | 61 | 65     | 12    | 53 | 5.5  | 9.5 | 5.5 | 12  |
| 25-10T3   |              | 10   | 4.763     | 3        | 25                         | 1591  | 3236                     | 42   | 45 | 80 | 69     | 15    | 55 | 6.6  | 11  | 6.5 | 12  |
| 25-10T4   |              |      |           | 4        | 33                         | 2038  | 4315                     | 42   | 45 | 85 | 69     | 15    | 55 | 6.6  | 11  | 6.5 | 12  |

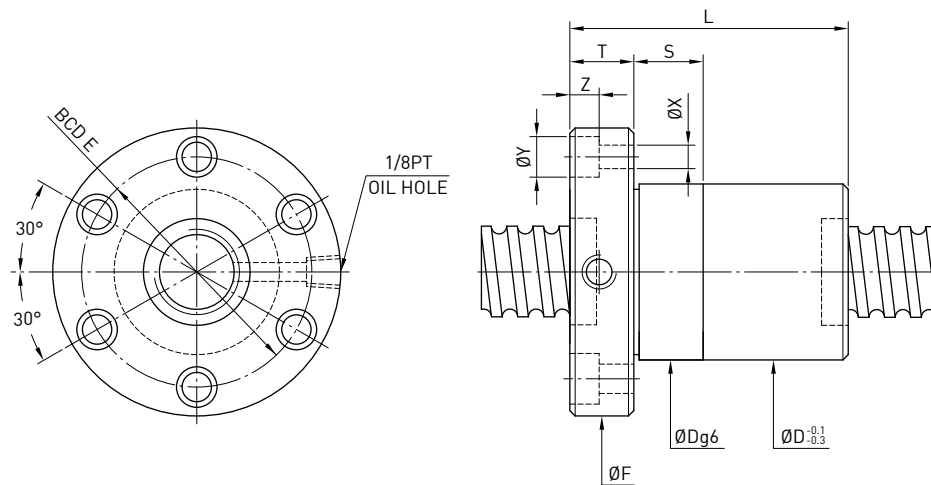
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

**F S I TYPE**


| Model     | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / $\mu$ m<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf) | Nut |    |     | Flange |       |     | Bolt |      |     | Fit |
|-----------|--------------|------|-----------|----------|---------------------------------|---|-------------------------|-----|----|-----|--------|-------|-----|------|------|-----|-----|
|           | Nominal Dia. | Lead |           |          |                                 |   |                         | D   | L  | F   | T      | BCD-E | X   | Y    | Z    | S   |     |
| 32-5T3    | 32           | 5    | 3.175     | 3        | 33                              | 1117  | 3081                    | 44  | 48 | 46  | 74     | 12    | 60  | 6.6  | 11   | 6.5 | 12  |
| 32-5T4    |              |      |           | 4        | 42                              | 1431  | 4108                    | 44  | 48 | 53  | 74     | 12    | 60  | 6.6  | 11   | 6.5 | 12  |
| 32-5T6    |              |      |           | 6        | 63                              | 2027  | 6162                    | 44  | 48 | 66  | 74     | 12    | 60  | 6.6  | 11   | 6.5 | 12  |
| 32-6T3    |              | 6    | 3.969     | 3        | 33                              | 1446  | 3620                    | 45  | 50 | 51  | 76     | 12    | 62  | 6.6  | 11   | 6.5 | 12  |
| 32-6T4    |              |      |           | 4        | 43                              | 1852  | 4826                    | 45  | 50 | 61  | 76     | 12    | 62  | 6.6  | 11   | 6.5 | 12  |
| 32-6T6    |              |      |           | 6        | 65                              | 2625  | 7239                    | 45  | 50 | 75  | 76     | 12    | 62  | 6.6  | 11   | 6.5 | 12  |
| 32-8T3    |              | 8    | 4.763     | 3        | 35                              | 1810  | 4227                    | 47  | 52 | 63  | 78     | 16    | 64  | 6.6  | 11   | 6.5 | 12  |
| 32-8T4    |              |      |           | 4        | 47                              | 2317  | 5635                    | 47  | 52 | 74  | 78     | 16    | 64  | 6.6  | 11   | 6.5 | 12  |
| 32-10T3   |              | 10   | 6.350     | 3        | 35                              | 2539  | 5327                    | 51  | 56 | 72  | 82     | 16    | 68  | 6.6  | 11   | 6.5 | 12  |
| 32-10T4   |              |      |           | 4        | 48                              | 3252  | 7102                    | 51  | 56 | 83  | 82     | 16    | 68  | 6.6  | 11   | 6.5 | 12  |
| 40-5T4    | 40           | 5    | 3.175     | 4        | 50                              | 1599  | 5280                    | 51  | 54 | 53  | 80     | 16    | 66  | 6.6  | 11   | 6.5 | 12  |
| 40-5T6    |              |      |           | 6        | 74                              | 2265  | 7919                    | 51  | 54 | 66  | 80     | 16    | 66  | 6.6  | 11   | 6.5 | 12  |
| 40-5.08T6 |              | 5.08 | 3.175     | 6        | 74                              | 2265  | 7919                    | 53  | 56 | 65  | 90     | 15    | 72  | 9    | 14   | 8.5 | 15  |
| 40-6T4    |              | 6    | 3.969     | 4        | 50                              | 2136  | 6420                    | 53  | 56 | 65  | 88     | 16    | 72  | 9    | 14   | 8.5 | 15  |
| 40-6T6    |              |      |           | 6        | 74                              | 3028  | 9630                    | 53  | 56 | 79  | 88     | 16    | 72  | 9    | 14   | 8.5 | 15  |
| 40-8T4    |              | 8    | 4.763     | 4        | 52                              | 2728  | 7596                    | 55  | 60 | 78  | 92     | 16    | 75  | 9    | 14   | 8.5 | 15  |
| 40-8T6    |              |      |           | 6        | 76                              | 3866  | 11394                   | 55  | 60 | 99  | 92     | 16    | 75  | 9    | 14   | 8.5 | 15  |
| 40-10T3   |              | 10   | 6.350     | 3        | 40                              | 2959  | 7069                    | 60  | 65 | 76  | 96     | 16    | 80  | 9    | 14   | 8.5 | 15  |
| 40-10T4   |              |      |           | 4        | 51                              | 3789  | 9426                    | 60  | 65 | 87  | 96     | 16    | 80  | 9    | 14   | 8.5 | 15  |
| 50-5T4    | 50           | 5    | 3.175     | 4        | 62                              | 1757  | 6745                    | 62  | 65 | 57  | 96     | 16    | 80  | 9    | 14   | 8.5 | 15  |
| 50-5T6    |              |      |           | 6        | 91                              | 2490  | 10117                   | 62  | 65 | 70  | 96     | 16    | 80  | 9    | 14   | 8.5 | 15  |
| 50-6T4    |              | 6    | 3.969     | 4        | 62                              | 2388  | 8250                    | 64  | 68 | 65  | 100    | 16    | 84  | 9    | 14   | 8.5 | 15  |
| 50-6T6    |              |      |           | 6        | 93                              | 3384  | 12375                   | 64  | 68 | 79  | 100    | 16    | 84  | 9    | 14   | 8.5 | 15  |
| 50-8T4    |              | 8    | 4.763     | 4        | 62                              | 2998  | 9578                    | 65  | 70 | 78  | 102    | 16    | 85  | 9    | 14   | 8.5 | 15  |
| 50-8T6    |              |      |           | 6        | 92                              | 4249  | 14367                   | 65  | 70 | 99  | 102    | 16    | 85  | 9    | 14   | 8.5 | 15  |
| 50-10T3   |              | 10   | 6.350     | 3        | 50                              | 3397  | 9256                    | 69  | 74 | 78  | 114    | 18    | 92  | 11   | 17.5 | 11  | 20  |
| 50-10T4   |              |      |           | 4        | 63                              | 4350  | 12341                   | 69  | 74 | 89  | 114    | 18    | 92  | 11   | 17.5 | 11  | 20  |
| 50-10T6   |              |      |           | 6        | 94                              | 6165  | 18511                   | 69  | 74 | 112 | 114    | 18    | 92  | 11   | 17.5 | 11  | 20  |
| 50-12T3   |              | 12   | 7.938     | 3        | 50                              | 4420  | 11047                   | 73  | 78 | 90  | 118    | 18    | 96  | 11   | 17.5 | 11  | 20  |
| 50-12T4   |              |      |           | 4        | 63                              | 5660  | 14730                   | 73  | 78 | 103 | 118    | 18    | 96  | 11   | 17.5 | 11  | 20  |
| 50-20T4   |              | 20   | 9.525     | 4        | 80                              | 9327  | 23955                   | 75  | 78 | 186 | 129    | 28    | 105 | 14   | 20   | 13  | 30  |

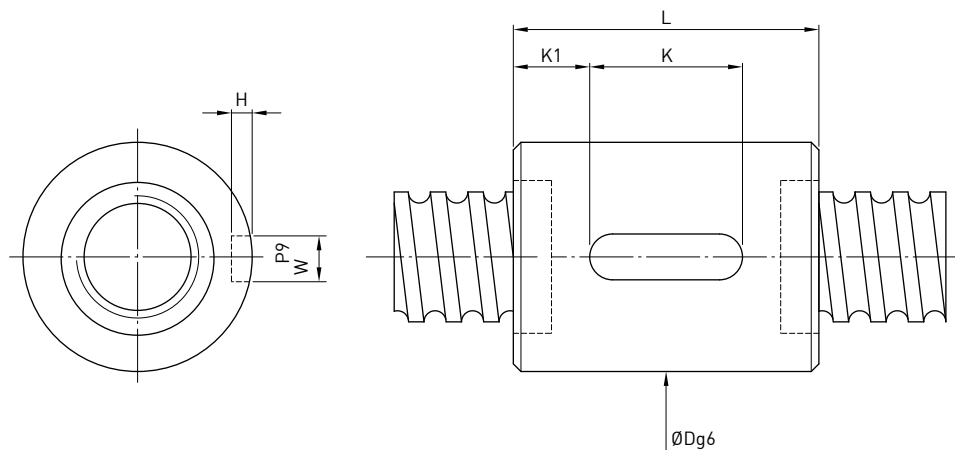
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

**F S I TYPE**



| Model    | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     |     | Flange |       |     | Bolt |      |      | Fit |
|----------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|-----|-----|--------|-------|-----|------|------|------|-----|
|          | Nominal Dia. | Lead |           |          |                            |   |                          | D   | L   | F   | T      | BCD-E | X   | Y    | Z    | S    |     |
| 63-6T4   | 63           | 6    | 3.969     | 4        | 75                         | 2614  | 10542                    | 78  | 80  | 66  | 119    | 18    | 98  | 11   | 17.5 | 11   | 20  |
| 63-6T6   |              |      |           | 6        | 113                        | 3704  | 15813                    | 78  | 80  | 81  | 119    | 18    | 98  | 11   | 17.5 | 11   | 20  |
| 63-8T4   |              | 8    | 4.763     | 4        | 77                         | 3395  | 12541                    | 79  | 82  | 80  | 122    | 18    | 100 | 11   | 17.5 | 11   | 20  |
| 63-8T6   |              |      |           | 6        | 114                        | 4812  | 18811                    | 79  | 82  | 101 | 122    | 18    | 100 | 11   | 17.5 | 11   | 20  |
| 63-10T4  |              | 10   | 6.350     | 4        | 79                         | 4860  | 15858                    | 82  | 88  | 91  | 134    | 20    | 110 | 14   | 20   | 13   | 20  |
| 63-10T6  |              |      |           | 6        | 115                        | 6887  | 23786                    | 82  | 88  | 114 | 134    | 20    | 110 | 14   | 20   | 13   | 20  |
| 63-12T4  |              | 12   | 7.938     | 4        | 78                         | 6479  | 19293                    | 86  | 92  | 105 | 138    | 20    | 114 | 14   | 20   | 13   | 20  |
| 63-12T6  |              |      |           | 6        | 113                        | 9182  | 28939                    | 86  | 92  | 133 | 138    | 20    | 114 | 14   | 20   | 13   | 20  |
| 80-10T4  | 80           | 10   | 6.350     | 4        | 96                         | 5559  | 21118                    | 99  | 105 | 91  | 152    | 20    | 127 | 14   | 20   | 13   | 20  |
| 80-10T6  |              |      |           | 6        | 140                        | 7879  | 31677                    | 99  | 105 | 114 | 152    | 20    | 127 | 14   | 20   | 13   | 20  |
| 80-12T4  |              | 12   | 7.938     | 4        | 97                         | 7430  | 25681                    | 103 | 110 | 109 | 170    | 24    | 138 | 18   | 26   | 17.5 | 25  |
| 80-12T6  |              |      |           | 6        | 141                        | 10530   | 38521                    | 103 | 110 | 137 | 170    | 24    | 138 | 18   | 26   | 17.5 | 25  |
| 80-16T3  |              | 16   | 9.525     | 3        | 95                         | 9663  | 31622                    | 108 | 115 | 118 | 174    | 24    | 143 | 18   | 26   | 17.5 | 25  |
| 80-16T4  |              |      |           | 4        | 130                        | 12375   | 42162                    | 108 | 115 | 136 | 174    | 24    | 143 | 18   | 26   | 17.5 | 25  |
| 80-20T3  |              | 20   |           | 3        | 95                         | 9663  | 31622                    | 108 | 115 | 138 | 174    | 24    | 143 | 18   | 26   | 17.5 | 25  |
| 80-20T4  |              |      |           | 4        | 125                        | 12375   | 42162                    | 108 | 115 | 161 | 174    | 24    | 143 | 18   | 26   | 17.5 | 25  |
| 100-12T4 | 100          | 12   | 7.938     | 4        | 105                        | 8306  | 33001                    | 123 | 130 | 109 | 190    | 24    | 158 | 18   | 26   | 17.5 | 25  |
| 100-12T6 |              |      |           | 6        | 175                        | 11772   | 49502                    | 123 | 130 | 137 | 190    | 24    | 158 | 18   | 26   | 17.5 | 25  |
| 100-16T4 |              | 16   | 9.525     | 4        | 107                        | 13569   | 53161                    | 125 | 135 | 136 | 194    | 24    | 163 | 18   | 26   | 17.5 | 30  |
| 100-16T6 |              |      |           | 6        | 140                        | 19230   | 79741                    | 125 | 135 | 173 | 194    | 24    | 163 | 18   | 26   | 17.5 | 30  |
| 100-20T4 |              | 20   |           | 4        | 155                        | 13569   | 53161                    | 125 | 135 | 161 | 194    | 24    | 163 | 18   | 26   | 17.5 | 30  |

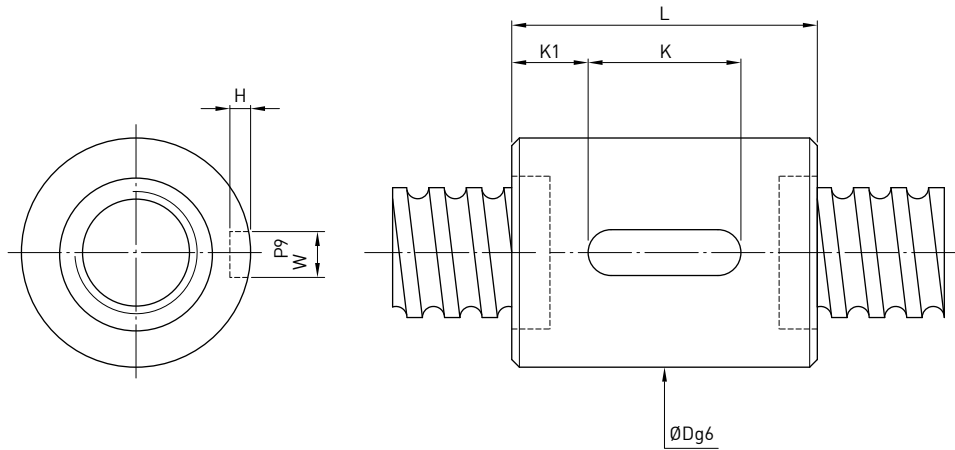
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

**R S I TYPE**


| Model   | Size         |       | Ball Dia. | Circuits | Stiffness<br>kgf / $\mu\text{m}$<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut  |    |    | Keyway |     |      |      |
|---------|--------------|-------|-----------|----------|---------------------------------------|---|--------------------------|------|----|----|--------|-----|------|------|
|         | Nominal Dia. | Lead  |           |          |                                       |   |                          | D    | L  | K  | W      | H   | K1   |      |
| 16-2T4  | 16           | 2     | 1.500     | 4        | 15                                    | 178   | 395                      | 25   | 25 | 25 | 20     | 3   | 1.8  | 2.5  |
| 16-5T3  |              | 5     | 3.175     | 3        | 11                                    | 731   | 1331                     | 28   | 30 | 40 | 20     | 3   | 1.8  | 10   |
| 16-5T4  |              |       |           | 4        | 12                                    | 936   | 1775                     | 28   | 30 | 46 | 20     | 3   | 1.8  | 13   |
| 20-5T3  | 20           |       |           | 3.969    | 3                                     | 20  | 852                      | 1767 | 32 | 34 | 41     | 20  | 3    | 1.8  |
| 20-5T4  |              | 4     | 27        |          | 1091                                  | 2356  | 32                       | 34   | 48 | 20 | 3      | 1.8 | 14   |      |
| 20-6T3  |              | 3     | 20        |          | 1091                                  | 2081  | 34                       | 36   | 46 | 20 | 4      | 2.5 | 13   |      |
| 20-6T4  | 25           | 6     | 3.969     | 4        | 27                                    | 1398  | 2774                     | 34   | 36 | 56 | 25     | 4   | 2.5  | 15.5 |
| 25-5T3  |              |       |           | 3        | 28                                    | 977   | 2314                     | 37   | 40 | 41 | 20     | 4   | 2.5  | 10.5 |
| 25-5T4  |              | 4     | 37        | 1252     | 3085                                  | 37  | 40                       | 48   | 20 | 4  | 2.5    | 14  |      |      |
| 25-6T3  |              | 6     | 3.969     | 3        | 28                                    | 1272  | 2762                     | 38   | 42 | 46 | 20     | 4   | 2.5  | 13   |
| 25-6T4  |              |       |           | 4        | 37                                    | 1628  | 3682                     | 38   | 42 | 56 | 25     | 4   | 2.5  | 15.5 |
| 32-5T3  |              | 32    | 5         | 3.175    | 3                                     | 33  | 1117                     | 3081 | 44 | 48 | 41     | 20  | 4    | 2.5  |
| 32-5T4  | 4            |       |           |          | 42                                    | 1431  | 4108                     | 44   | 48 | 48 | 20     | 4   | 2.5  | 14   |
| 32-5T6  | 6            |       |           |          | 63                                    | 2027  | 6162                     | 44   | 48 | 61 | 25     | 4   | 2.5  | 18   |
| 32-6T3  | 6            |       | 3.969     | 3        | 33                                    | 1446  | 3620                     | 45   | 50 | 46 | 20     | 5   | 3    | 13   |
| 32-6T4  |              |       |           | 4        | 43                                    | 1852  | 4826                     | 45   | 50 | 56 | 25     | 5   | 3    | 15.5 |
| 32-6T6  |              |       |           | 6        | 65                                    | 2625  | 7239                     | 45   | 50 | 70 | 32     | 5   | 3    | 19   |
| 32-8T3  | 8            |       | 4.763     | 3        | 35                                    | 1810  | 4227                     | 47   | 52 | 59 | 25     | 5   | 3    | 17   |
| 32-8T4  |              |       |           | 4        | 47                                    | 2317  | 5635                     | 47   | 52 | 70 | 25     | 5   | 3    | 22.5 |
| 32-10T3 |              |       |           | 3        | 35                                    | 2539  | 5327                     | 51   | 56 | 68 | 25     | 6   | 3.5  | 21.5 |
| 32-10T4 | 10           |       | 6.350     | 4        | 48                                    | 3252  | 7102                     | 51   | 56 | 79 | 32     | 6   | 3.5  | 23.5 |
| 40-5T4  |              | 5     |           | 3.175    | 4                                     | 50  | 1599                     | 5280 | 51 | 54 | 48     | 20  | 4    | 2.5  |
| 40-5T6  | 6            |       | 74        |          | 2265                                  | 7919  | 51                       | 54   | 61 | 25 | 4      | 2.5 | 18   |      |
| 40-6T4  | 6            | 3.969 | 4         | 50       | 2136                                  | 6420  | 53                       | 56   | 56 | 25 | 5      | 3   | 15.5 |      |
| 40-6T6  |              |       | 6         | 74       | 3028                                  | 9630  | 53                       | 56   | 70 | 32 | 5      | 3   | 19   |      |
| 40-8T4  |              |       | 8         | 4.763    | 4                                     | 52  | 2728                     | 7596 | 55 | 60 | 70     | 25  | 5    | 3    |
| 40-8T6  | 6            | 76    |           |          | 3866                                  | 11394   | 55                       | 60   | 91 | 40 | 5      | 3   | 25.5 |      |
| 40-10T3 | 10           | 6.350 | 3         | 40       | 2959                                  | 7069  | 60                       | 65   | 68 | 25 | 6      | 3.5 | 21.5 |      |
| 40-10T4 |              |       | 4         | 51       | 3789                                  | 9426  | 60                       | 65   | 79 | 32 | 6      | 3.5 | 23.5 |      |
| 50-5T4  | 50           | 5     | 3.175     | 4        | 62                                    | 1757  | 6745                     | 62   | 65 | 48 | 20     | 4   | 2.5  | 14   |
| 50-5T6  |              |       |           | 6        | 91                                    | 2490  | 10117                    | 62   | 65 | 61 | 25     | 4   | 2.5  | 18   |
| 50-6T4  |              | 6     | 3.969     | 4        | 62                                    | 2388  | 8250                     | 64   | 68 | 56 | 25     | 5   | 3    | 15.5 |
| 50-6T6  |              |       |           | 6        | 93                                    | 3384  | 12375                    | 64   | 68 | 70 | 32     | 5   | 3    | 19   |
| 50-8T4  |              | 8     | 4.763     | 4        | 62                                    | 2998  | 9578                     | 65   | 70 | 70 | 32     | 5   | 3    | 19   |
| 50-8T6  |              |       |           | 6        | 92                                    | 4249  | 14367                    | 65   | 70 | 91 | 40     | 5   | 3    | 25.5 |
| 50-10T3 |              | 10    | 6.350     | 3        | 50                                    | 3397  | 9256                     | 69   | 74 | 68 | 32     | 6   | 3.5  | 18   |
| 50-10T4 |              |       |           | 4        | 63                                    | 4350  | 12341                    | 69   | 74 | 79 | 32     | 6   | 3.5  | 23.5 |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

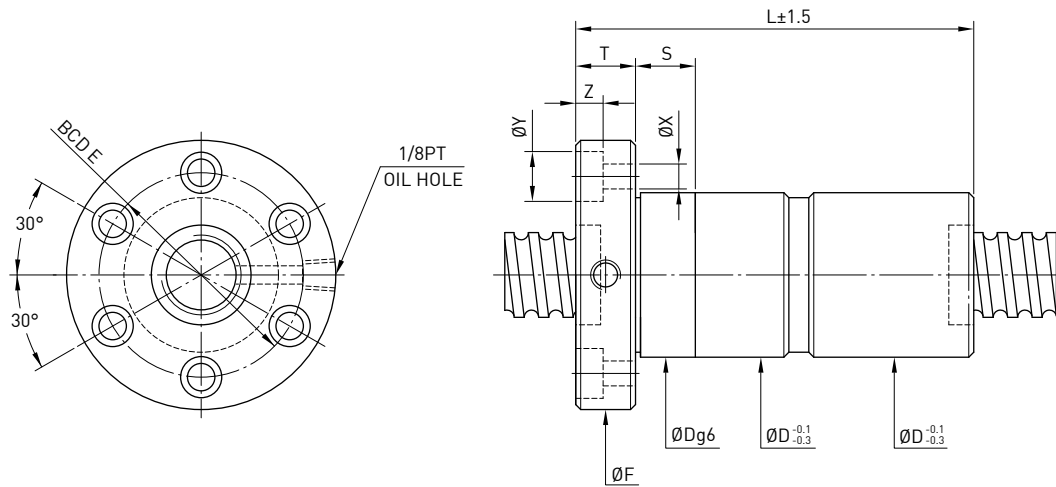
**R S I TYPE**



| Model    | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     |     | Keyway |     |      |      |  |
|----------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|-----|-----|--------|-----|------|------|--|
|          | Nominal Dia. | Lead |           |          |                            |   |                          | D   | L   | K   | W      | H   | K1   |      |  |
| 50-10T6  | 50           | 12   | 6.350     | 6        | 94                         | 6165  | 18511                    | 69  | 74  | 102 | 40     | 6   | 3.5  | 31   |  |
| 50-12T3  |              |      | 7.938     | 3        | 50                         | 4420  | 11047                    | 73  | 78  | 82  | 40     | 6   | 3.5  | 21   |  |
| 50-12T4  |              |      |           | 4        | 63                         | 5660  | 14730                    | 73  | 78  | 95  | 40     | 6   | 3.5  | 27.5 |  |
| 63-6T4   | 63           | 6    | 3.969     | 4        | 75                         | 2674  | 10542                    | 78  | 80  | 56  | 25     | 6   | 3.5  | 15.5 |  |
| 63-6T6   |              |      | 6         | 113      | 3704                       | 15813   | 78                       | 80  | 70  | 32  | 6      | 3.5 | 19   |      |  |
| 63-8T4   |              | 8    | 4.763     | 4        | 77                         | 3395  | 12541                    | 79  | 82  | 70  | 32     | 6   | 3.5  | 19   |  |
| 63-8T6   |              |      | 6         | 114      | 4812                       | 18811   | 79                       | 82  | 91  | 40  | 6      | 3.5 | 25.5 |      |  |
| 63-10T4  |              | 10   | 6.350     | 4        | 79                         | 4860  | 15858                    | 82  | 88  | 79  | 32     | 8   | 4    | 23.5 |  |
| 63-10T6  |              |      | 6         | 115      | 6887                       | 23786   | 82                       | 88  | 102 | 40  | 8      | 4   | 31   |      |  |
| 63-12T4  |              | 12   | 7.938     | 4        | 78                         | 6479  | 19293                    | 86  | 92  | 95  | 40     | 8   | 4    | 27.5 |  |
| 63-12T6  |              |      | 6         | 113      | 9182                       | 28939   | 86                       | 92  | 123 | 50  | 8      | 4   | 36.5 |      |  |
| 80-10T4  | 80           | 10   | 6.350     | 4        | 96                         | 5559  | 21118                    | 99  | 105 | 79  | 32     | 8   | 4    | 23.5 |  |
| 80-10T6  |              |      | 6         | 140      | 7879                       | 31677   | 99                       | 105 | 102 | 40  | 8      | 4   | 62   |      |  |
| 80-12T4  |              | 12   | 7.938     | 4        | 97                         | 7430  | 25681                    | 103 | 110 | 95  | 40     | 8   | 4    | 27.5 |  |
| 80-12T6  |              |      | 6         | 141      | 10530                      | 38521   | 103                      | 110 | 123 | 50  | 8      | 4   | 36.5 |      |  |
| 80-16T3  |              | 16   | 9.525     | 3        | 95                         | 9663  | 31622                    | 108 | 115 | 106 | 40     | 10  | 5    | 33   |  |
| 80-16T4  |              |      |           | 4        | 130                        | 12375   | 42162                    | 108 | 115 | 124 | 50     | 10  | 5    | 37   |  |
| 80-20T3  |              | 20   |           | 3        | 95                         | 9663  | 31622                    | 108 | 115 | 126 | 50     | 10  | 5    | 38   |  |
| 80-20T4  |              |      |           | 4        | 125                        | 12375   | 42162                    | 108 | 115 | 149 | 63     | 10  | 5    | 43   |  |
| 100-12T4 | 100          | 12   | 7.938     | 4        | 105                        | 8306  | 33001                    | 123 | 130 | 95  | 40     | 8   | 4    | 27.5 |  |
| 100-12T6 |              |      |           | 6        | 175                        | 11772   | 49502                    | 123 | 130 | 123 | 50     | 8   | 4    | 36.5 |  |
| 100-16T4 |              | 16   | 9.525     | 4        | 107                        | 13569   | 53161                    | 125 | 135 | 124 | 50     | 10  | 5    | 37   |  |
| 100-16T6 |              |      |           | 6        | 140                        | 19230   | 79741                    | 125 | 135 | 161 | 63     | 10  | 5    | 49   |  |
| 100-20T4 |              | 20   |           | 4        | 155                        | 13569   | 53161                    | 125 | 135 | 149 | 63     | 10  | 5    | 43   |  |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while axial load is 30% of dynamic load rating.

# F D I TYPE

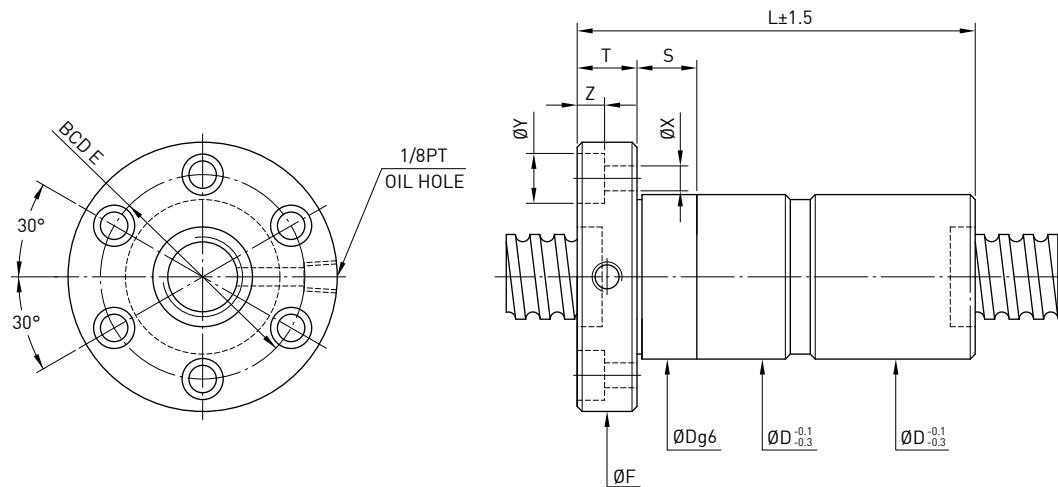


| Model     | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut  |      |      | Flange |     |       | Bolt |     |     | Fit |
|-----------|--------------|------|-----------|----------|----------------------------|---|--------------------------|------|------|------|--------|-----|-------|------|-----|-----|-----|
|           | Nominal Dia. | Lead |           |          |                            |   |                          | D    |      | L    | F      | T   | BCD-E | X    | Y   | Z   |     |
| 16-5T3    | 16           | 5    | 3.175     | 3        | 20                         | 731   | 1331                     | 28   | 30   | 78   | 54     | 12  | 41    | 5.5  | 9.5 | 5.5 | 24  |
| 16-5T4    |              |      |           | 4        | 23                         | 936   | 1775                     | 28   | 30   | 90   | 54     | 12  | 41    | 5.5  | 9.5 | 5.5 | 24  |
| 20-5T3    | 20           | 5    | 3.175     | 3        | 39                         | 852   | 1767                     | 32   | 34   | 78   | 57     | 12  | 45    | 5.5  | 9.5 | 5.5 | 24  |
| 20-5T4    |              |      |           | 4        | 54                         | 1091  | 2356                     | 32   | 34   | 92   | 57     | 12  | 45    | 5.5  | 9.5 | 5.5 | 24  |
| 20-6T3    | 20           | 6    | 3.969     | 3        | 39                         | 1091  | 2081                     | 34   | 36   | 89   | 60     | 12  | 48    | 5.5  | 9.5 | 5.5 | 24  |
| 20-6T4    |              |      |           | 4        | 54                         | 1398  | 2774                     | 34   | 36   | 109  | 60     | 12  | 48    | 5.5  | 9.5 | 5.5 | 24  |
| 25-2.5T5  | 25           | 2.5  | 2.000     | 5        | 66                         | 716   | 2117                     | 35   | 40   | 87   | 65     | 10  | 51    | 6.6  | 11  | 6.5 | 24  |
| 25-5T3    |              | 5    | 3.175     | 3        | 55                         | 977   | 2314                     | 37   | 40   | 78   | 64     | 12  | 52    | 5.5  | 9.5 | 5.5 | 24  |
| 25-5T4    |              |      |           | 4        | 73                         | 1252  | 3085                     | 37   | 40   | 96   | 64     | 12  | 52    | 5.5  | 9.5 | 5.5 | 24  |
| 25-6T3    | 25           | 6    | 3.969     | 3        | 56                         | 1272  | 2762                     | 38   | 42   | 89   | 65     | 12  | 53    | 5.5  | 9.5 | 5.5 | 24  |
| 25-6T4    |              |      |           | 4        | 75                         | 1628  | 3682                     | 38   | 42   | 109  | 65     | 12  | 53    | 5.5  | 9.5 | 5.5 | 24  |
| 25-10T3   | 25           | 10   | 4.763     | 3        | 49                         | 1643  | 3265                     | 47   | 51   | 140  | 74     | 15  | 60    | 6.6  | 11  | 6.5 | 24  |
| 28-5T5    |              | 5    | 3.175     | 5        | 86                         | 1619  | 4404                     | 45   | 50   | 110  | 74     | 12  | 62    | 5.5  | 9.5 | 5.5 | 24  |
| 28-10T4   | 28           |      |           | 10       | 4.763                      | 4   | 70                       | 2199 | 4969 | 45   | 50     | 150 | 74    | 12   | 61  | 6.6 | 11  |
| 32-2.5T6  |              | 32   | 2.5       |          |                            | 2.000   | 6                        | 97   | 928  | 3339 | 45     | 51  | 106   | 74   | 12  | 62  | 5.5 |
| 32-5T3    | 32           |      | 5         | 3.175    | 3                          | 64  | 1117                     | 3081 | 44   | 48   | 78     | 74  | 12    | 60   | 6.6 | 11  | 6.5 |
| 32-5T4    |              | 4    |           |          | 82                         | 1431  | 4108                     | 44   | 48   | 96   | 74     | 12  | 60    | 6.6  | 11  | 6.5 | 24  |
| 32-5T6    | 32           | 5.08 | 3.175     | 6        | 121                        | 2027  | 6162                     | 44   | 48   | 118  | 74     | 12  | 60    | 6.6  | 11  | 6.5 | 24  |
| 32-5.08T4 |              |      |           | 4        | 82                         | 1430  | 4108                     | 44   | 48   | 96   | 74     | 12  | 60    | 6.6  | 11  | 6.5 | 24  |
| 32-6T3    | 32           | 6    | 3.969     | 3        | 65                         | 1446  | 3620                     | 45   | 50   | 89   | 76     | 12  | 62    | 6.6  | 11  | 6.5 | 24  |
| 32-6T4    |              |      |           | 4        | 84                         | 1852  | 4826                     | 45   | 50   | 109  | 76     | 12  | 62    | 6.6  | 11  | 6.5 | 24  |
| 32-6T6    | 32           | 6    | 3.969     | 6        | 125                        | 2625  | 7239                     | 45   | 50   | 137  | 76     | 12  | 62    | 6.6  | 11  | 6.5 | 24  |
| 32-8T3    |              |      |           | 8        | 4.763                      | 3   | 68                       | 1810 | 4227 | 47   | 52     | 110 | 78    | 16   | 64  | 6.6 | 11  |
| 32-8T4    |              |      |           |          |                            | 4   | 82                       | 2317 | 5635 | 47   | 52     | 136 | 78    | 16   | 64  | 6.6 | 11  |
| 32-10T3   | 32           | 10   | 6.350     | 3        | 68                         | 2539  | 5327                     | 51   | 56   | 129  | 82     | 16  | 68    | 6.6  | 11  | 6.5 | 24  |
| 32-10T4   |              |      |           | 4        | 82                         | 3252  | 7102                     | 51   | 56   | 155  | 82     | 16  | 68    | 6.6  | 11  | 6.5 | 24  |
| 40-5T4    | 40           | 5    | 3.175     | 4        | 99                         | 1599  | 5280                     | 51   | 54   | 96   | 80     | 16  | 66    | 6.6  | 11  | 6.5 | 24  |
| 40-5T6    |              |      |           | 6        | 146                        | 2265  | 7919                     | 51   | 54   | 122  | 80     | 16  | 66    | 6.6  | 11  | 6.5 | 24  |
| 40-6T4    | 40           | 6    | 3.969     | 4        | 100                        | 2136  | 6420                     | 53   | 56   | 113  | 88     | 16  | 72    | 9    | 14  | 8.5 | 30  |
| 40-6T6    |              |      |           | 6        | 148                        | 3028  | 9630                     | 53   | 56   | 141  | 88     | 16  | 72    | 9    | 14  | 8.5 | 30  |
| 40-8T4    | 40           | 8    | 4.763     | 4        | 102                        | 2728  | 7596                     | 55   | 60   | 136  | 92     | 16  | 75    | 9    | 14  | 8.5 | 30  |
| 40-8T6    |              |      |           | 6        | 150                        | 3866  | 11394                    | 55   | 60   | 178  | 92     | 16  | 75    | 9    | 14  | 8.5 | 30  |
| 40-10T3   | 40           | 10   | 6.350     | 3        | 76                         | 2959  | 7069                     | 60   | 65   | 133  | 96     | 16  | 80    | 9    | 14  | 8.5 | 30  |
| 40-10T4   |              |      |           | 4        | 101                        | 3789  | 9426                     | 60   | 65   | 155  | 96     | 16  | 80    | 9    | 14  | 8.5 | 30  |
| 40-10T5   | 40           | 10   | 6.350     | 5        | 119                        | 4590  | 1178                     | 60   | 65   | 192  | 96     | 16  | 80    | 9    | 14  | 8.5 | 30  |
| 40-12T3   |              |      |           | 12       |                            | 3   | 73                       | 2958 | 7069 | 58   | 60     | 160 | 96    | 18   | 80  | 9   | 14  |
| 40-12T4   | 4            | 101  | 3789      |          |                            | 9425  | 58                       | 60   | 186  | 96   | 18     | 80  | 9     | 14   | 8.5 | 30  |     |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

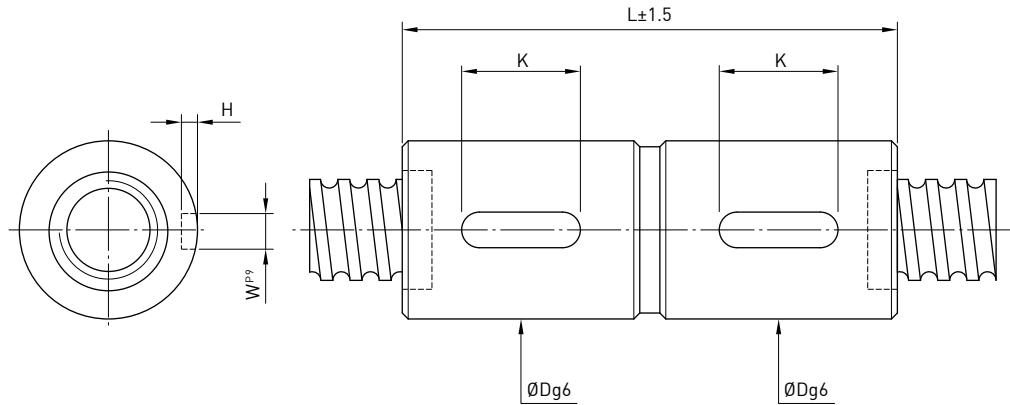


**F D I TYPE**



| Model    | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     |     | Flange |       |     | Bolt |      |      | Fit |
|----------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|-----|-----|--------|-------|-----|------|------|------|-----|
|          | Nominal Dia. | Lead |           |          |                            |   |                          | D   | L   | F   | T      | BCD-E | X   | Y    | Z    | S    |     |
| 45-10T4  | 45           | 10   | 7.144     | 4        | 108                        | 4683  | 11930                    | 68  | 70  | 160 | 110    | 18    | 90  | 11   | 17.5 | 11   | 30  |
| 45-12T3  |              | 12   | 6.350     | 3        | 80                         | 3115  | 7952                     | 68  | 70  | 183 | 110    | 16    | 90  | 11   | 17.5 | 11   | 30  |
| 45-16T3  |              | 16   | 7.144     | 3        | 82                         | 3656  | 8947                     | 68  | 70  | 183 | 110    | 16    | 90  | 11   | 17.5 | 11   | 30  |
| 50-5T4   | 50           | 5    | 3.175     | 4        | 121                        | 1757  | 6745                     | 62  | 65  | 96  | 96     | 16    | 80  | 9    | 14   | 8.5  | 30  |
| 50-5T6   |              |      |           | 6        | 177                        | 2490  | 10117                    | 62  | 65  | 122 | 96     | 16    | 80  | 9    | 14   | 8.5  | 30  |
| 50-6T4   |              | 6    | 3.969     | 4        | 123                        | 2388  | 8250                     | 64  | 68  | 113 | 100    | 16    | 84  | 9    | 14   | 8.5  | 30  |
| 50-6T6   |              |      |           | 6        | 179                        | 3384  | 12375                    | 64  | 68  | 147 | 100    | 16    | 84  | 9    | 14   | 8.5  | 30  |
| 50-8T4   |              | 8    | 4.763     | 4        | 122                        | 2998  | 9578                     | 65  | 70  | 136 | 102    | 16    | 85  | 9    | 14   | 8.5  | 30  |
| 50-8T6   |              |      |           | 6        | 178                        | 4249  | 14367                    | 65  | 70  | 178 | 102    | 16    | 85  | 9    | 14   | 8.5  | 30  |
| 50-10T3  |              | 10   | 6.350     | 3        | 95                         | 3397  | 9256                     | 69  | 74  | 135 | 114    | 18    | 92  | 11   | 17.5 | 11   | 40  |
| 50-10T4  |              |      |           | 4        | 124                        | 4350  | 12341                    | 69  | 74  | 157 | 114    | 18    | 92  | 11   | 17.5 | 11   | 40  |
| 50-10T6  |              |      |           | 6        | 184                        | 6165  | 18511                    | 69  | 74  | 203 | 114    | 18    | 92  | 11   | 17.5 | 11   | 40  |
| 50-12T3  |              | 12   | 7.938     | 3        | 94                         | 4420  | 11047                    | 73  | 78  | 158 | 118    | 18    | 96  | 11   | 17.5 | 11   | 40  |
| 50-12T4  |              |      |           | 4        | 124                        | 5660  | 14730                    | 73  | 78  | 184 | 118    | 18    | 96  | 11   | 17.5 | 11   | 40  |
| 63-6T4   | 63           | 6    | 3.969     | 4        | 148                        | 2674  | 10542                    | 78  | 80  | 115 | 119    | 18    | 98  | 11   | 17.5 | 11   | 40  |
| 63-6T6   |              |      |           | 6        | 220                        | 3704  | 15813                    | 78  | 80  | 143 | 119    | 18    | 98  | 11   | 17.5 | 11   | 40  |
| 63-8T4   |              | 8    | 4.763     | 4        | 152                        | 3395  | 12541                    | 79  | 82  | 138 | 122    | 18    | 100 | 11   | 17.5 | 11   | 40  |
| 63-8T6   |              |      |           | 6        | 222                        | 4812  | 18811                    | 79  | 82  | 180 | 122    | 18    | 100 | 11   | 17.5 | 11   | 40  |
| 63-10T4  |              | 10   | 6.350     | 4        | 158                        | 4860  | 15858                    | 82  | 88  | 159 | 134    | 20    | 110 | 14   | 20   | 13   | 40  |
| 63-10T6  |              |      |           | 6        | 228                        | 6887  | 23786                    | 82  | 88  | 205 | 134    | 20    | 110 | 14   | 20   | 13   | 40  |
| 63-12T4  |              | 12   | 7.938     | 4        | 152                        | 6479  | 19293                    | 86  | 92  | 186 | 138    | 20    | 114 | 14   | 20   | 13   | 40  |
| 63-12T6  |              |      |           | 6        | 224                        | 9182  | 28939                    | 86  | 92  | 242 | 138    | 20    | 114 | 14   | 20   | 13   | 40  |
| 80-10T4  | 80           | 10   | 6.350     | 4        | 190                        | 5559  | 21118                    | 99  | 105 | 172 | 152    | 20    | 127 | 14   | 20   | 13   | 40  |
| 80-10T6  |              |      |           | 6        | 277                        | 7879  | 31677                    | 99  | 105 | 214 | 152    | 20    | 127 | 14   | 20   | 13   | 40  |
| 80-12T4  |              | 12   | 7.938     | 4        | 192                        | 7430  | 25681                    | 103 | 110 | 190 | 170    | 24    | 138 | 18   | 26   | 17.5 | 50  |
| 80-12T6  |              |      |           | 6        | 280                        | 10530   | 38521                    | 103 | 110 | 246 | 170    | 24    | 138 | 18   | 26   | 17.5 | 50  |
| 80-16T3  |              | 16   | 9.525     | 3        | 188                        | 9663  | 31622                    | 108 | 115 | 208 | 174    | 24    | 143 | 18   | 26   | 17.5 | 50  |
| 80-16T4  |              |      |           | 4        | 254                        | 12375   | 42162                    | 108 | 115 | 244 | 174    | 24    | 143 | 18   | 26   | 17.5 | 50  |
| 80-20T3  |              |      |           | 3        | 189                        | 9663  | 31622                    | 108 | 115 | 250 | 174    | 24    | 143 | 18   | 26   | 17.5 | 50  |
| 80-20T4  |              |      |           | 4        | 248                        | 12375   | 42162                    | 108 | 115 | 296 | 174    | 24    | 143 | 18   | 26   | 17.5 | 50  |
| 100-12T4 | 100          | 12   | 7.938     | 4        | 206                        | 8306  | 33001                    | 123 | 130 | 190 | 190    | 24    | 158 | 18   | 26   | 17.5 | 50  |
| 100-12T6 |              |      |           | 6        | 343                        | 11772   | 49502                    | 123 | 130 | 246 | 190    | 24    | 158 | 18   | 26   | 17.5 | 50  |
| 100-16T4 |              | 16   | 9.525     | 4        | 212                        | 13569   | 53161                    | 125 | 135 | 244 | 194    | 24    | 163 | 18   | 26   | 17.5 | 60  |
| 100-16T6 |              |      |           | 6        | 276                        | 19230   | 79741                    | 125 | 135 | 318 | 194    | 24    | 163 | 18   | 26   | 17.5 | 60  |
| 100-20T4 | 20           |      | 4         | 300      | 13569                      | 53161   | 125                      | 135 | 296 | 194 | 24     | 163   | 18  | 26   | 17.5 | 60   |     |

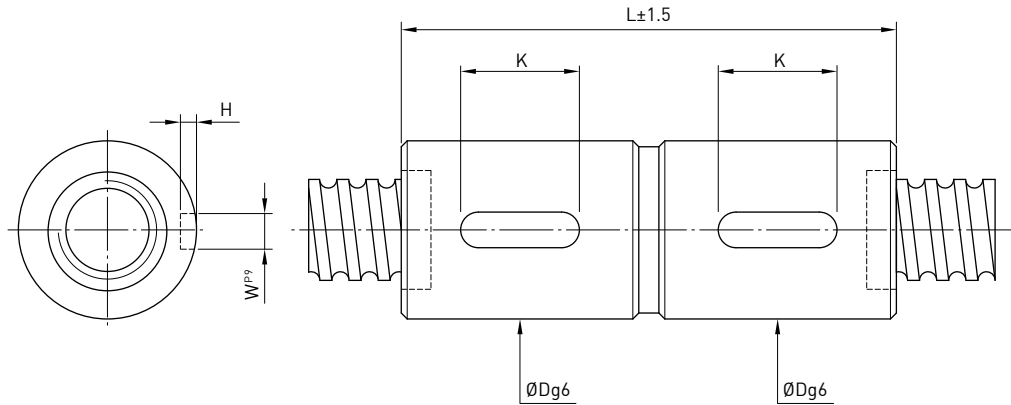
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

**R D I TYPE**


| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |    |     | Keyway |   |     |
|---------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|----|-----|--------|---|-----|
|         | Nominal Dia. | Lead |           |          |                            |   |                          | D   |    | L   | K      | W | H   |
| 16-5T3  | 16           | 5    | 3.175     | 3        | 20                         | 731   | 1331                     | 28  | 30 | 72  | 20     | 3 | 1.8 |
| 16-5T4  |              |      |           | 4        | 23                         | 936   | 1775                     | 28  | 30 | 85  | 20     | 3 | 1.8 |
| 20-5T3  | 20           | 5    |           | 3        | 39                         | 852   | 1767                     | 32  | 34 | 75  | 20     | 3 | 1.8 |
| 20-5T4  |              |      |           | 4        | 54                         | 1091  | 2356                     | 32  | 34 | 85  | 20     | 3 | 1.8 |
| 20-6T3  |              | 6    | 3.969     | 3        | 39                         | 1091  | 2081                     | 34  | 36 | 87  | 20     | 4 | 2.5 |
| 20-6T4  |              |      |           | 4        | 54                         | 1398  | 2774                     | 34  | 36 | 103 | 25     | 4 | 2.5 |
| 25-5T3  | 25           | 5    | 3.175     | 3        | 55                         | 977   | 2314                     | 37  | 40 | 75  | 20     | 4 | 2.5 |
| 25-5T4  |              |      |           | 4        | 73                         | 1252  | 3085                     | 37  | 40 | 85  | 20     | 4 | 2.5 |
| 25-6T3  |              | 6    | 3.969     | 3        | 56                         | 1272  | 2762                     | 38  | 42 | 87  | 20     | 4 | 2.5 |
| 25-6T4  |              |      |           | 4        | 75                         | 1628  | 3682                     | 38  | 42 | 103 | 25     | 4 | 2.5 |
| 32-5T3  | 32           | 5    | 3.175     | 3        | 64                         | 1117  | 3081                     | 44  | 48 | 75  | 20     | 4 | 2.5 |
| 32-5T4  |              |      |           | 4        | 82                         | 1431  | 4108                     | 44  | 48 | 85  | 20     | 4 | 2.5 |
| 32-5T6  |              |      |           | 6        | 121                        | 2027  | 6162                     | 44  | 48 | 105 | 25     | 4 | 2.5 |
| 32-6T3  |              | 6    | 3.969     | 3        | 65                         | 1446  | 3620                     | 45  | 50 | 87  | 20     | 5 | 3   |
| 32-6T4  |              |      |           | 4        | 84                         | 1852  | 4826                     | 45  | 50 | 103 | 25     | 5 | 3   |
| 32-6T6  |              |      |           | 6        | 125                        | 2625  | 7239                     | 45  | 50 | 127 | 32     | 5 | 3   |
| 32-8T3  |              | 8    | 4.763     | 3        | 68                         | 1810  | 4227                     | 47  | 52 | 109 | 25     | 5 | 3   |
| 32-8T4  |              |      |           | 4        | 82                         | 2317  | 5635                     | 47  | 52 | 127 | 25     | 5 | 3   |
| 32-10T3 |              | 10   | 6.350     | 3        | 68                         | 2539  | 5327                     | 51  | 56 | 135 | 25     | 6 | 3.5 |
| 32-10T4 |              |      |           | 4        | 82                         | 3252  | 7102                     | 51  | 56 | 155 | 32     | 6 | 3.5 |
| 40-5T4  | 40           | 5    | 3.175     | 4        | 99                         | 1599  | 5280                     | 51  | 54 | 85  | 20     | 4 | 2.5 |
| 40-5T6  |              |      |           | 6        | 146                        | 2265  | 7919                     | 51  | 54 | 105 | 25     | 4 | 2.5 |
| 40-6T4  |              | 6    | 3.969     | 4        | 100                        | 2136  | 6420                     | 53  | 56 | 103 | 25     | 5 | 3   |
| 40-6T6  |              |      |           | 6        | 148                        | 3028  | 9630                     | 53  | 56 | 127 | 32     | 5 | 3   |
| 40-8T4  |              | 8    | 4.763     | 4        | 102                        | 2728  | 7596                     | 55  | 60 | 127 | 25     | 5 | 3   |
| 40-8T6  |              |      |           | 6        | 150                        | 3866  | 11394                    | 55  | 60 | 161 | 40     | 5 | 3   |
| 40-10T3 |              | 10   | 6.350     | 3        | 76                         | 2959  | 7069                     | 60  | 65 | 135 | 25     | 6 | 3.5 |
| 40-10T4 |              |      |           | 4        | 101                        | 3789  | 9426                     | 60  | 65 | 155 | 32     | 6 | 3.5 |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

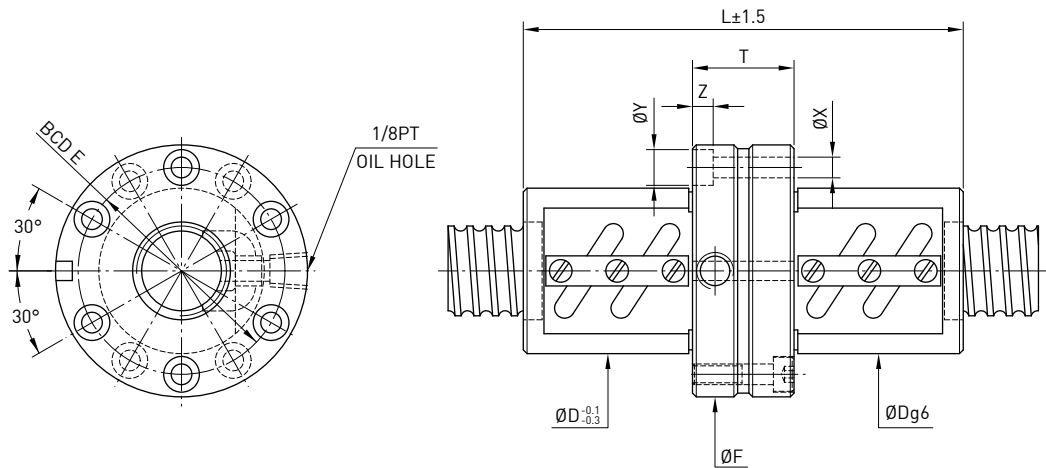
**R D I TYPE**



| Model    | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / $\mu$ m<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf) | Nut |     |     | Keyway |    |     |
|----------|--------------|------|-----------|----------|---------------------------------|---|-------------------------|-----|-----|-----|--------|----|-----|
|          | Nominal Dia. | Lead |           |          |                                 |   |                         | D   |     | L   | K      | W  | H   |
| 50-5T4   | 50           | 5    | 3.175     | 4        | 121                             | 1757  | 6745                    | 62  | 65  | 85  | 20     | 4  | 2.5 |
| 50-5T6   |              |      |           | 6        | 177                             | 2490  | 10117                   | 62  | 65  | 105 | 25     | 4  | 2.5 |
| 50-6T4   |              | 6    | 3.969     | 4        | 123                             | 2388  | 8250                    | 64  | 68  | 103 | 25     | 5  | 3   |
| 50-6T6   |              |      |           | 6        | 179                             | 3384  | 12375                   | 64  | 68  | 127 | 32     | 5  | 3   |
| 50-8T4   |              | 8    | 4.763     | 4        | 122                             | 2998  | 9578                    | 65  | 70  | 127 | 32     | 5  | 3   |
| 50-8T6   |              |      |           | 6        | 178                             | 4249  | 14367                   | 65  | 70  | 161 | 40     | 5  | 3   |
| 50-10T3  |              | 10   | 6.350     | 3        | 95                              | 3397  | 9256                    | 69  | 74  | 135 | 32     | 6  | 3.5 |
| 50-10T4  |              |      |           | 4        | 124                             | 4350  | 12341                   | 69  | 74  | 155 | 32     | 6  | 3.5 |
| 50-10T6  |              | 12   | 7.938     | 6        | 184                             | 6165  | 18511                   | 69  | 74  | 197 | 40     | 6  | 3.5 |
| 50-12T3  |              |      |           | 3        | 94                              | 4420  | 11047                   | 73  | 78  | 161 | 40     | 6  | 3.5 |
| 50-12T4  | 63           | 6    | 3.969     | 4        | 148                             | 2614  | 10542                   | 78  | 80  | 106 | 25     | 6  | 3.5 |
| 50-12T6  |              |      |           | 6        | 220                             | 3704  | 15813                   | 78  | 80  | 130 | 32     | 6  | 3.5 |
| 63-8T4   |              | 8    | 4.763     | 4        | 152                             | 3395  | 12541                   | 79  | 82  | 131 | 32     | 6  | 3.5 |
| 63-8T6   |              |      |           | 6        | 222                             | 4812  | 18811                   | 79  | 82  | 165 | 40     | 6  | 3.5 |
| 63-10T4  |              | 10   | 6.350     | 4        | 158                             | 4860  | 15858                   | 82  | 88  | 160 | 32     | 8  | 4   |
| 63-10T6  |              |      |           | 6        | 228                             | 6887  | 23786                   | 82  | 88  | 202 | 40     | 8  | 4   |
| 63-12T4  |              | 12   | 7.938     | 4        | 152                             | 6479  | 19293                   | 86  | 92  | 185 | 40     | 8  | 4   |
| 63-12T6  |              |      |           | 6        | 224                             | 9182  | 28939                   | 86  | 92  | 238 | 50     | 8  | 4   |
| 63-20T4  |              | 20   | 9.525     | 4        | 189                             | 10657   | 31251                   | 90  | 95  | 260 | 50     | 8  | 4   |
| 80-10T4  | 80           | 10   | 6.350     | 4        | 190                             | 5559  | 21118                   | 99  | 105 | 160 | 32     | 8  | 4   |
| 80-10T6  |              |      |           | 6        | 277                             | 7879  | 31677                   | 99  | 105 | 202 | 40     | 8  | 4   |
| 80-12T4  |              | 12   | 7.938     | 4        | 192                             | 7430  | 25681                   | 103 | 110 | 185 | 40     | 8  | 4   |
| 80-12T6  |              |      |           | 6        | 280                             | 10530   | 38521                   | 103 | 110 | 238 | 50     | 8  | 4   |
| 80-16T3  |              | 16   | 9.525     | 3        | 188                             | 9663  | 31622                   | 108 | 115 | 200 | 40     | 10 | 5   |
| 80-16T4  |              |      |           | 4        | 254                             | 12375   | 42162                   | 108 | 115 | 236 | 50     | 10 | 5   |
| 80-20T3  |              | 20   | 9.525     | 3        | 189                             | 9663  | 31622                   | 108 | 115 | 245 | 50     | 10 | 5   |
| 80-20T4  |              |      |           | 4        | 248                             | 12375   | 42162                   | 108 | 115 | 289 | 63     | 10 | 5   |
| 100-12T4 | 100          | 12   | 7.938     | 4        | 206                             | 8306  | 33001                   | 123 | 130 | 185 | 40     | 8  | 4   |
| 100-12T6 |              |      |           | 6        | 343                             | 11772   | 49502                   | 123 | 130 | 238 | 50     | 8  | 4   |
| 100-16T4 |              | 16   | 9.525     | 4        | 212                             | 13569   | 53161                   | 125 | 135 | 236 | 50     | 10 | 5   |
| 100-16T6 |              |      |           | 6        | 276                             | 19230   | 79741                   | 125 | 135 | 310 | 63     | 10 | 5   |
| 100-20T4 |              | 20   | 9.525     | 4        | 300                             | 13569   | 53161                   | 125 | 135 | 289 | 63     | 10 | 5   |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

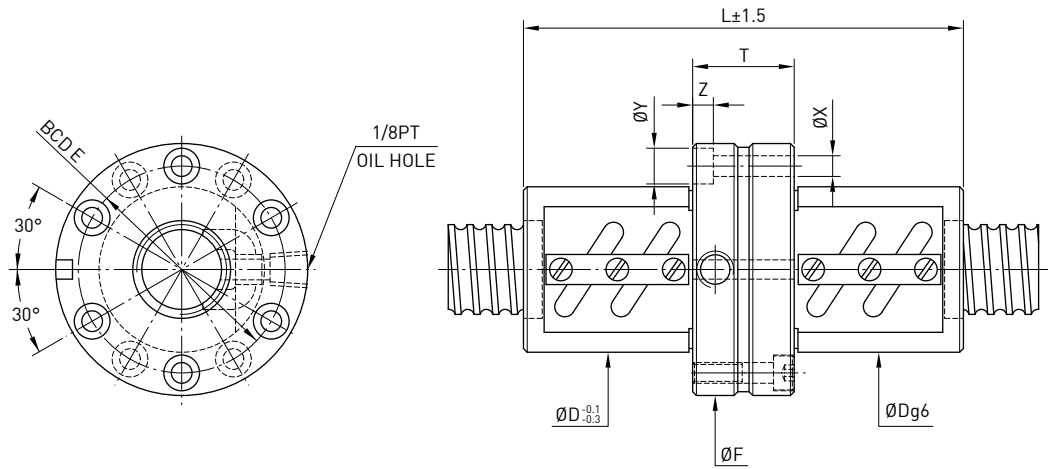
**P F D W TYPE 1**



| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / $\mu$ m<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf) | Nut |     | Flange |     |       | Bolt |      |     |
|---------|--------------|------|-----------|----------|---------------------------------|---|-------------------------|-----|-----|--------|-----|-------|------|------|-----|
|         | Nominal Dia. | Lead |           |          |                                 |   |                         | D   | L   | T      | F   | BCD-E | X    | Y    | Z   |
| 20-5B1  | 20           | 5    | 3.175     | 2.5x1    | 38                              | 837   | 1733                    | 44  | 87  | 27     | 67  | 55    | 5.5  | 9.5  | 5.5 |
| 20-5B2  |              |      |           | 2.5x2    | 76                              | 1519  | 3465                    | 44  | 117 | 27     | 67  | 55    | 5.5  | 9.5  | 5.5 |
| 20-6B1  |              | 6    | 3.969     | 2.5x1    | 40                              | 1139  | 2187                    | 48  | 95  | 29     | 71  | 59    | 5.5  | 9.5  | 5.5 |
| 20-6C1  |              |      |           | 3.5x1    | 55                              | 1512  | 3041                    | 48  | 107 | 29     | 71  | 59    | 5.5  | 9.5  | 5.5 |
| 25-5B1  | 25           | 5    | 3.175     | 2.5x1    | 46                              | 939   | 2209                    | 50  | 86  | 28     | 73  | 61    | 5.5  | 9.5  | 5.5 |
| 25-5B2  |              |      |           | 2.5x2    | 90                              | 1704  | 4417                    | 50  | 116 | 28     | 73  | 61    | 5.5  | 9.5  | 5.5 |
| 25-5C1  |              | 6    | 3.969     | 3.5x1    | 68                              | 1252  | 3085                    | 50  | 96  | 28     | 73  | 61    | 5.5  | 9.5  | 5.5 |
| 25-6B2  |              |      |           | 2.5x2    | 94                              | 2308  | 5523                    | 56  | 131 | 29     | 76  | 64    | 5.5  | 9.5  | 5.5 |
| 25-6C1  |              | 6    | 3.969     | 3.5x1    | 66                              | 1690  | 3844                    | 56  | 107 | 29     | 76  | 64    | 5.5  | 9.5  | 5.5 |
| 32-5B1  | 32           | 5    | 3.175     | 2.5x1    | 55                              | 1039  | 2833                    | 58  | 91  | 33     | 85  | 71    | 6.6  | 11   | 6.5 |
| 32-5B2  |              |      |           | 2.5x2    | 109                             | 1886  | 5666                    | 58  | 121 | 33     | 85  | 71    | 6.6  | 11   | 6.5 |
| 32-6B1  |              | 6    | 3.969     | 2.5x1    | 57                              | 1409  | 3510                    | 62  | 95  | 29     | 89  | 75    | 6.6  | 11   | 6.5 |
| 32-6B2  |              |      |           | 2.5x2    | 112                             | 2556  | 7020                    | 62  | 131 | 29     | 89  | 75    | 6.6  | 11   | 6.5 |
| 32-8B1  |              | 8    | 4.763     | 2.5x1    | 58                              | 1810  | 4227                    | 66  | 125 | 39     | 100 | 82    | 9    | 14   | 8.5 |
| 32-8B2  |              |      |           | 2.5x2    | 115                             | 3284  | 8453                    | 66  | 173 | 39     | 100 | 82    | 9    | 14   | 8.5 |
| 32-10B1 |              | 10   | 6.350     | 2.5x1    | 58                              | 2651  | 5600                    | 74  | 185 | 38     | 108 | 90    | 9    | 14   | 8.5 |
| 32-10B2 |              |      |           | 2.5x2    | 118                             | 4810  | 11199                   | 74  | 108 | 38     | 108 | 90    | 9    | 14   | 8.5 |
| 32-10C1 |              | 10   | 6.350     | 3.5x1    | 86                              | 3519  | 7785                    | 74  | 168 | 38     | 108 | 90    | 9    | 14   | 8.5 |
| 40-5B1  | 40           | 5    | 3.175     | 2.5x1    | 65                              | 1141  | 3567                    | 68  | 96  | 38     | 101 | 83    | 9    | 14   | 8.5 |
| 40-5B2  |              |      |           | 2.5x2    | 132                             | 2071  | 7134                    | 68  | 126 | 38     | 101 | 83    | 9    | 14   | 8.5 |
| 40-6B1  |              | 6    | 3.969     | 2.5x1    | 67                              | 1552  | 4428                    | 70  | 101 | 35     | 104 | 86    | 9    | 14   | 8.5 |
| 40-6B2  |              |      |           | 2.5x2    | 136                             | 2817  | 8855                    | 70  | 137 | 35     | 104 | 86    | 9    | 14   | 8.5 |
| 40-8B1  |              | 8    | 4.763     | 2.5x1    | 69                              | 2003  | 5302                    | 74  | 125 | 39     | 108 | 90    | 9    | 14   | 8.5 |
| 40-8B2  |              |      |           | 2.5x2    | 137                             | 3634  | 10603                   | 74  | 173 | 39     | 108 | 90    | 9    | 14   | 8.5 |
| 40-10B1 |              | 10   | 6.350     | 2.5x1    | 72                              | 2959  | 7069                    | 84  | 158 | 48     | 124 | 102   | 11   | 17.5 | 11  |
| 40-10B2 |              |      |           | 2.5x2    | 145                             | 5370  | 14138                   | 84  | 218 | 48     | 124 | 102   | 11   | 17.5 | 11  |
| 40-10C1 |              | 10   | 6.350     | 3.5x1    | 102                             | 3932  | 9841                    | 84  | 178 | 48     | 124 | 102   | 11   | 17.5 | 11  |
| 40-12B1 |              | 12   | 7.144     | 2.5x1    | 70                              | 3425  | 7837                    | 86  | 174 | 48     | 128 | 106   | 11   | 17.5 | 11  |
| 40-12B2 |              |      |           | 2.5x2    | 141                             | 6217  | 15674                   | 86  | 246 | 48     | 128 | 106   | 11   | 17.5 | 11  |

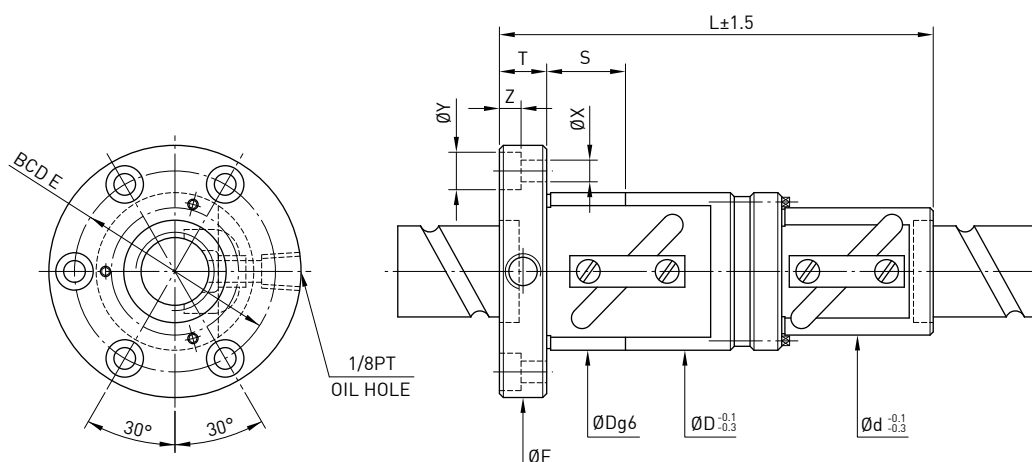
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

**P F D W TYPE 1**



| Model    | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut   |       | Flange |     |       | Bolt |      |    |
|----------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-------|-------|--------|-----|-------|------|------|----|
|          | Nominal Dia. | Lead |           |          |                            |   |                          | D     | L     | T      | F   | BCD-E | X    | Y    | Z  |
| 50-8B1   | 50           | 8    | 4.763     | 2.5x1    | 81                         | 2206  | 6705                     | 87    | 133   | 47     | 129 | 107   | 11   | 17.5 | 11 |
| 50-8B2   |              |      |           | 2.5x2    | 165                        | 4004  | 13409                    | 87    | 181   | 47     | 129 | 107   | 11   | 17.5 | 11 |
| 50-10B1  |              | 10   | 6.350     | 2.5x1    | 87                         | 3264  | 8835                     | 94    | 158   | 48     | 135 | 113   | 11   | 17.5 | 11 |
| 50-10B2  |              |      |           | 2.5x2    | 173                        | 5923  | 17670                    | 94    | 218   | 48     | 135 | 113   | 11   | 17.5 | 11 |
| 50-12B2  |              | 12   | 7.938     | 2.5x2    | 178                        | 8022  | 22094                    | 102   | 188   | 58     | 146 | 122   | 14   | 20   | 13 |
| 50-12C1  |              |      |           | 3.5x1    | 123                        | 5875  | 15380                    | 102   | 166   | 58     | 146 | 122   | 14   | 20   | 13 |
| 63-10B2  | 63           | 10   | 6.350     | 2.5x2    | 206                        | 6533  | 22371                    | 110   | 228   | 58     | 154 | 130   | 14   | 20   | 13 |
| 63-10B3  |              |      |           | 2.5x3    | 305                        | 9258  | 33556                    | 110   | 288   | 58     | 154 | 130   | 14   | 20   | 13 |
| 63-12B2  |              | 12   | 7.938     | 2.5x2    | 214                        | 8943  | 28062                    | 118   | 260   | 58     | 161 | 137   | 14   | 20   | 13 |
| 80-12B2  | 2.5x2        |      |           | 257      | 9797                       | 35422   | 136                      | 228   | 58    | 176    | 152 | 14    | 20   | 13   |    |
| 80-12B3  | 80           | 12   | 7.938     | 2.5x3    | 380                        | 13884   | 53132                    | 136   | 288   | 58     | 176 | 152   | 14   | 20   | 13 |
| 80-20B2  |              |      |           | 20       | 9.525                      | 2.5x2   | 338                      | 16485 | 58851 | 145    | 504 | 66    | 204  | 172  | 18 |
| 100-20B2 | 100          | 20   | 9.525     |          |                            | 2.5x2   | 400                      | 18123 | 74425 | 170    | 404 | 86    | 243  | 205  | 22 |

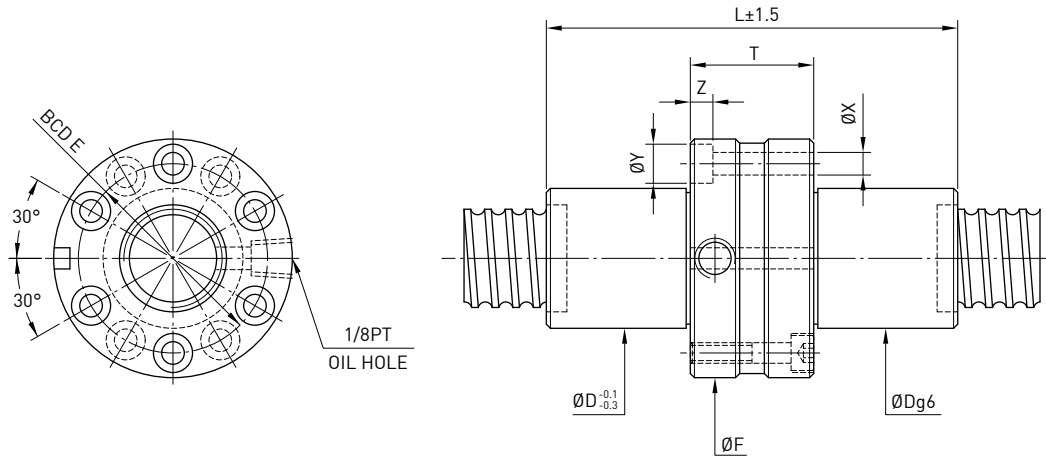
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

**P F D W TYPE 2**


| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / $\mu\text{m}$<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf) | Nut |    |     | Flange |    |       | Bolt |      |     | Fit |
|---------|--------------|------|-----------|----------|---------------------------------------|---|-------------------------|-----|----|-----|--------|----|-------|------|------|-----|-----|
|         | Nominal Dia. | Lead |           |          |                                       |   |                         | D   | d  | L   | F      | T  | BCD-E | X    | Y    | Z   |     |
| 20-20A1 | 20           | 20   | 3.969     | 1.5x1    | 26                                    | 719   | 1281                    | 48  | 36 | 140 | 72     | 12 | 59    | 5.5  | 9.5  | 5.5 | 24  |
| 25-16B1 | 25           | 16   | 4.763     | 2.5x1    | 56                                    | 1592  | 3237                    | 62  | 45 | 148 | 89     | 16 | 75    | 6.6  | 11   | 6.5 | 24  |
| 25-20B1 |              | 20   |           | 2.5x1    | 56                                    | 1592  | 3237                    | 62  | 45 | 178 | 89     | 16 | 75    | 6.6  | 11   | 6.5 | 24  |
| 25-25A1 | 32           | 25   |           | 1.5x1    | 32                                    | 1019  | 1927                    | 62  | 45 | 166 | 89     | 16 | 75    | 6.6  | 11   | 6.5 | 24  |
| 32-20B1 |              | 20   |           | 2.5x1    | 66                                    | 1810  | 4227                    | 68  | 54 | 181 | 102    | 16 | 84    | 9    | 14   | 8.5 | 30  |
| 32-25B1 |              | 25   |           | 2.5x1    | 66                                    | 1810  | 4227                    | 68  | 54 | 218 | 102    | 16 | 84    | 9    | 14   | 8.5 | 30  |
| 32-32A1 |              | 32   |           | 1.5x1    | 36                                    | 1154  | 2505                    | 68  | 54 | 205 | 102    | 16 | 84    | 9    | 14   | 8.5 | 30  |
| 40-25B1 | 40           | 25   | 6.350     | 2.5x1    | 78                                    | 2959  | 7069                    | 84  | 65 | 224 | 126    | 18 | 104   | 11   | 17.5 | 11  | 30  |
| 40-32B1 |              | 32   |           | 2.5x1    | 78                                    | 2959  | 7069                    | 84  | 65 | 276 | 126    | 18 | 104   | 11   | 17.5 | 11  | 30  |
| 40-40A1 |              | 40   |           | 1.5x1    | 48                                    | 1875  | 4159                    | 84  | 65 | 274 | 126    | 18 | 104   | 11   | 17.5 | 11  | 30  |
| 50-40A1 | 50           | 40   | 7.938     | 1.5x1    | 54                                    | 2801  | 6499                    | 106 | 82 | 264 | 152    | 22 | 128   | 13   | 20   | 13  | 40  |
| 50-50A1 |              | 50   |           | 1.5x1    | 60                                    | 2801  | 6499                    | 106 | 82 | 320 | 152    | 22 | 128   | 13   | 20   | 13  | 40  |

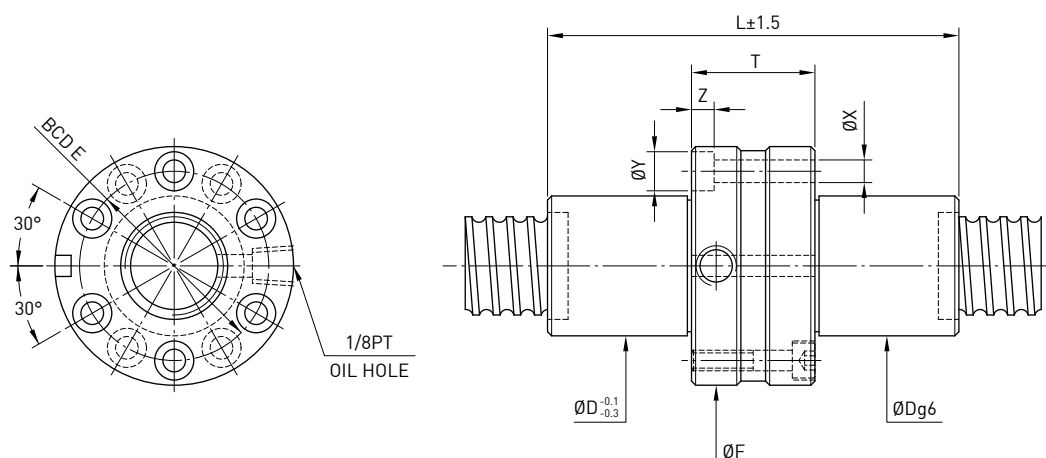
Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

**P F D I TYPE**



| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |    |     | Flange |    |       | Bolt |      |     |
|---------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-----|----|-----|--------|----|-------|------|------|-----|
|         | Nominal Dia. | Lead |           |          |                            |   |                          | D   |    | L   | F      | T  | BCD-E | X    | Y    | Z   |
| 20-5T3  | 20           | 5    | 3.175     | 3        | 39                         | 852   | 1767                     | 32  | 34 | 100 | 58     | 30 | 46    | 5.5  | 9.5  | 5.5 |
| 20-5T4  |              |      |           | 4        | 54                         | 1091  | 2356                     | 32  | 34 | 110 | 58     | 30 | 46    | 5.5  | 9.5  | 5.5 |
| 20-6T3  |              | 6    | 3.969     | 3        | 39                         | 1091  | 2081                     | 34  | 36 | 111 | 58     | 29 | 46    | 5.5  | 9.5  | 5.5 |
| 20-6T4  |              |      |           | 4        | 54                         | 1398  | 2774                     | 34  | 36 | 127 | 58     | 29 | 46    | 5.5  | 9.5  | 5.5 |
| 25-5T3  | 25           | 5    | 3.175     | 3        | 55                         | 977   | 2314                     | 37  | 40 | 100 | 63     | 30 | 51    | 5.5  | 9.5  | 5.5 |
| 25-5T4  |              |      |           | 4        | 73                         | 1252  | 3085                     | 37  | 40 | 110 | 63     | 30 | 51    | 5.5  | 9.5  | 5.5 |
| 25-6T3  |              | 6    | 3.969     | 3        | 56                         | 1272  | 2762                     | 38  | 42 | 111 | 63     | 29 | 51    | 5.5  | 9.5  | 5.5 |
| 25-6T4  |              |      |           | 4        | 75                         | 1628  | 3682                     | 38  | 42 | 127 | 63     | 29 | 51    | 5.5  | 9.5  | 5.5 |
| 32-5T3  | 32           | 5    | 3.175     | 3        | 64                         | 1117  | 3081                     | 44  | 48 | 100 | 75     | 30 | 61    | 6.6  | 11   | 6.5 |
| 32-5T4  |              |      |           | 4        | 82                         | 1431  | 4108                     | 44  | 48 | 110 | 75     | 30 | 61    | 6.6  | 11   | 6.5 |
| 32-6T3  |              | 6    | 3.969     | 3        | 65                         | 1446  | 3620                     | 45  | 50 | 111 | 75     | 29 | 61    | 6.6  | 11   | 6.5 |
| 32-6T4  |              |      |           | 4        | 84                         | 1852  | 4826                     | 45  | 50 | 127 | 75     | 29 | 61    | 6.6  | 11   | 6.5 |
| 32-8T3  |              | 8    | 4.763     | 3        | 68                         | 1810  | 4227                     | 47  | 52 | 139 | 84     | 35 | 70    | 9    | 14   | 8.5 |
| 32-8T4  |              |      |           | 4        | 82                         | 2317  | 5635                     | 47  | 52 | 157 | 84     | 35 | 70    | 9    | 14   | 8.5 |
| 32-10T3 |              | 10   | 6.350     | 3        | 68                         | 2539  | 5327                     | 51  | 56 | 165 | 88     | 35 | 70    | 9    | 14   | 8.5 |
| 32-10T4 |              |      |           | 4        | 82                         | 3252  | 7102                     | 51  | 56 | 185 | 88     | 35 | 70    | 9    | 14   | 8.5 |
| 40-5T4  | 40           | 5    | 3.175     | 4        | 99                         | 1599  | 5280                     | 51  | 54 | 115 | 90     | 35 | 72    | 9    | 14   | 8.5 |
| 40-5T6  |              |      |           | 6        | 146                        | 2265  | 7919                     | 51  | 54 | 135 | 90     | 35 | 72    | 9    | 14   | 8.5 |
| 40-6T4  |              | 6    | 3.969     | 4        | 100                        | 2136  | 6420                     | 53  | 56 | 133 | 90     | 35 | 72    | 9    | 14   | 8.5 |
| 40-6T6  |              |      |           | 6        | 148                        | 3028  | 9630                     | 53  | 56 | 157 | 90     | 35 | 72    | 9    | 14   | 8.5 |
| 40-8T4  |              | 8    | 4.763     | 4        | 102                        | 2728  | 7596                     | 55  | 60 | 157 | 94     | 35 | 76    | 9    | 14   | 8.5 |
| 40-8T6  |              |      |           | 6        | 150                        | 3866  | 11394                    | 55  | 60 | 191 | 94     | 35 | 76    | 9    | 14   | 8.5 |
| 40-10T3 |              | 10   | 6.350     | 3        | 76                         | 2529  | 7069                     | 60  | 65 | 175 | 104    | 45 | 82    | 11   | 17.5 | 11  |
| 40-10T4 |              |      |           | 4        | 101                        | 3789  | 9426                     | 60  | 65 | 195 | 104    | 45 | 82    | 11   | 17.5 | 11  |
| 50-5T4  | 50           | 5    | 3.175     | 4        | 121                        | 1757  | 6745                     | 62  | 65 | 115 | 100    | 35 | 82    | 9    | 14   | 8.5 |
| 50-5T6  |              |      |           | 6        | 177                        | 2490  | 10117                    | 62  | 65 | 135 | 100    | 35 | 82    | 9    | 14   | 8.5 |
| 50-6T4  |              | 6    | 3.969     | 4        | 123                        | 2388  | 8250                     | 64  | 68 | 136 | 100    | 38 | 82    | 9    | 14   | 8.5 |
| 50-6T6  |              |      |           | 6        | 179                        | 3384  | 12375                    | 64  | 68 | 160 | 100    | 38 | 82    | 9    | 14   | 8.5 |
| 50-8T4  |              | 8    | 4.763     | 4        | 122                        | 2998  | 9578                     | 65  | 70 | 165 | 112    | 43 | 90    | 11   | 17.5 | 11  |
| 50-8T6  |              |      |           | 6        | 178                        | 4249  | 14367                    | 65  | 70 | 199 | 112    | 43 | 90    | 11   | 17.5 | 11  |
| 50-10T3 |              | 10   | 6.350     | 3        | 95                         | 3397  | 9256                     | 69  | 74 | 175 | 114    | 45 | 92    | 11   | 17.5 | 11  |
| 50-10T4 |              |      |           | 4        | 124                        | 4350  | 12341                    | 69  | 74 | 195 | 114    | 45 | 92    | 11   | 17.5 | 11  |
| 50-10T6 |              | 12   | 7.938     | 6        | 184                        | 6165  | 18511                    | 69  | 74 | 235 | 114    | 43 | 92    | 11   | 17.5 | 11  |
| 50-12T3 |              |      |           | 3        | 94                         | 4420  | 11047                    | 73  | 78 | 203 | 121    | 49 | 97    | 14   | 20   | 13  |
| 50-12T4 |              |      |           | 4        | 124                        | 5660  | 14730                    | 73  | 78 | 227 | 121    | 49 | 97    | 14   | 20   | 13  |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

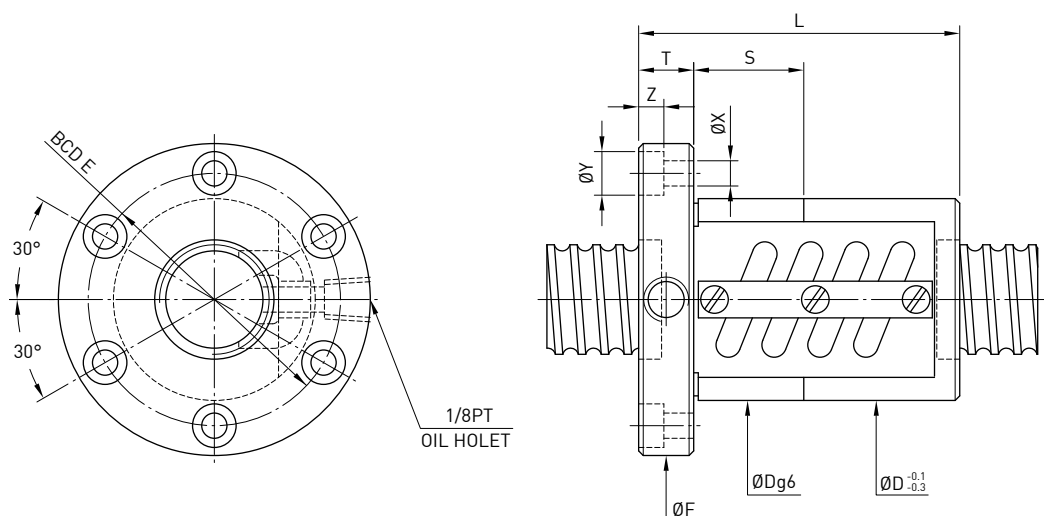
**P F D I TYPE**


| Model    | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut   |     |     | Flange |     |       | Bolt |      |      |      |
|----------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-------|-----|-----|--------|-----|-------|------|------|------|------|
|          | Nominal Dia. | Lead |           |          |                            |   |                          | D     |     | L   | F      | T   | BCD-E | X    | Y    | Z    |      |
| 63-6T4   | 63           | 6    | 3.969     | 4        | 148                        | 2614  | 10542                    | 78    | 80  | 142 | 122    | 44  | 100   | 11   | 17.5 | 11   |      |
| 63-6T6   |              |      |           | 6        | 220                        | 3704  | 15813                    | 78    | 80  | 166 | 122    | 44  | 100   | 11   | 17.5 | 11   |      |
| 63-8T4   |              | 8    | 4.763     | 4        | 152                        | 3395  | 12541                    | 79    | 82  | 165 | 124    | 43  | 102   | 11   | 17.5 | 11   |      |
| 63-8T6   |              |      |           | 6        | 222                        | 4812  | 18811                    | 79    | 82  | 199 | 124    | 43  | 102   | 11   | 17.5 | 11   |      |
| 63-10T4  |              | 10   | 6.350     | 4        | 158                        | 4860  | 15858                    | 82    | 88  | 205 | 131    | 55  | 107   | 14   | 20   | 13   |      |
| 63-10T6  |              |      |           | 6        | 228                        | 6887  | 23786                    | 82    | 88  | 245 | 131    | 53  | 107   | 14   | 20   | 13   |      |
| 63-12T4  |              | 12   | 7.938     | 4        | 152                        | 6479  | 19293                    | 86    | 92  | 230 | 136    | 52  | 112   | 14   | 20   | 13   |      |
| 63-12T6  |              |      |           | 6        | 224                        | 9182  | 28939                    | 86    | 92  | 280 | 136    | 52  | 112   | 14   | 20   | 13   |      |
| 80-10T4  | 80           | 10   | 6.350     | 4        | 190                        | 5559  | 21118                    | 99    | 105 | 205 | 151    | 55  | 127   | 14   | 20   | 13   |      |
| 80-10T6  |              |      |           | 6        | 277                        | 7879  | 31677                    | 99    | 105 | 245 | 151    | 53  | 127   | 14   | 20   | 13   |      |
| 80-12T4  |              | 12   | 7.938     | 4        | 192                        | 7430  | 25681                    | 103   | 110 | 230 | 156    | 52  | 132   | 14   | 20   | 13   |      |
| 80-12T6  |              |      |           | 6        | 280                        | 10530   | 38521                    | 103   | 110 | 280 | 156    | 52  | 132   | 14   | 20   | 13   |      |
| 80-20T3  |              | 20   | 9.525     | 3        | 189                        | 9663  | 31622                    | 108   | 115 | 301 | 173    | 65  | 143   | 18   | 26   | 17.5 |      |
| 80-20T4  |              |      |           | 4        | 248                        | 12375   | 42162                    | 108   | 115 | 346 | 173    | 66  | 143   | 18   | 26   | 17.5 |      |
| 100-10T6 |              | 100  | 10        | 6.350    | 6                          | 236   | 8662                     | 40469 | 120 | 125 | 245    | 171 | 53    | 147  | 14   | 20   | 13   |
| 100-12T6 |              |      | 12        | 9.525    | 6                          | 343   | 19230                    | 79741 | 125 | 135 | 292    | 188 | 64    | 158  | 18   | 26   | 17.5 |
| 100-20T4 | 20           |      | 4         |          | 300                        | 13569   | 53161                    | 125   | 135 | 356 | 205    | 76  | 169   | 22   | 32   | 21.5 |      |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.



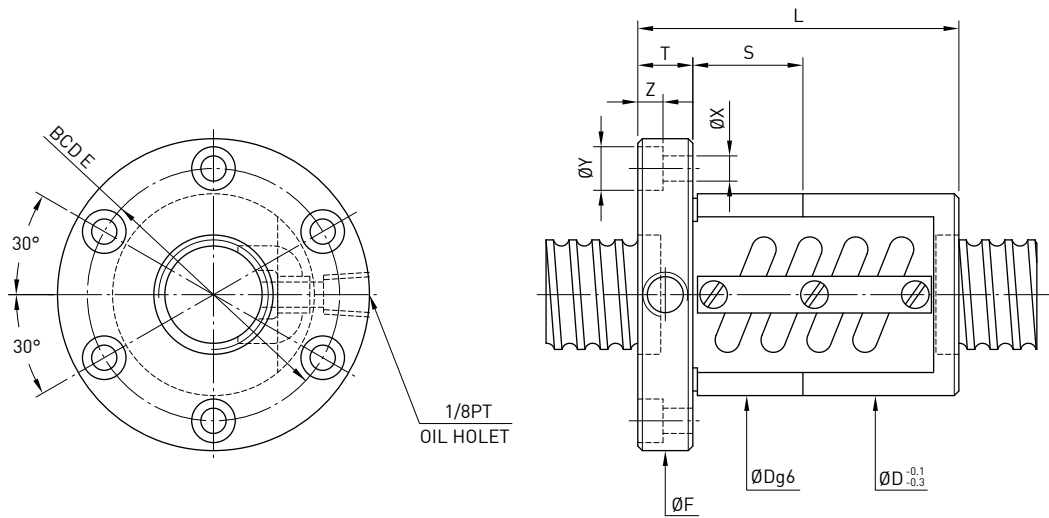
**O F S W TYPE**



| Model   | Size         |       | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut |     | Flange |    |       | Bolt |     |     | Fit |
|---------|--------------|-------|-----------|----------|----------------------------|---|--------------------------|-----|-----|--------|----|-------|------|-----|-----|-----|
|         | Nominal Dia. | Lead  |           |          |                            |   |                          | D   | L   | F      | T  | BCD-E | X    | Y   | Z   | S   |
| 16-5B1  | 16           | 5     | 3.175     | 2.5x1    | 32                         | 763   | 1400                     | 40  | 58  | 64     | 12 | 51    | 5.5  | 9.5 | 5.5 | 24  |
| 16-5A1  |              |       |           | 1.5x1    | 20                         | 482   | 820                      | 40  | 50  | 64     | 12 | 51    | 5.5  | 9.5 | 5.5 | 24  |
| 20-5B1  | 20           |       |           | 2.5x1    | 38                         | 837   | 1733                     | 44  | 60  | 68     | 12 | 55    | 5.5  | 9.5 | 5.5 | 24  |
| 20-5A2  |              |       |           | 1.5x2    | 46                         | 979   | 2079                     | 44  | 70  | 68     | 12 | 55    | 5.5  | 9.5 | 5.5 | 24  |
| 20-6B1  |              | 6     | 3.969     | 2.5x1    | 40                         | 1139  | 2187                     | 48  | 69  | 72     | 12 | 59    | 5.5  | 9.5 | 5.5 | 24  |
| 25-4B1  | 25           | 4     | 2.381     | 2.5x1    | 38                         | 544   | 1376                     | 46  | 48  | 69     | 11 | 57    | 5.5  | 9.5 | 5.5 | 12  |
| 25-4B2  |              |       |           | 2.5x2    | 74                         | 988   | 2752                     | 46  | 72  | 69     | 11 | 57    | 5.5  | 9.5 | 5.5 | 12  |
| 25-5B1  |              | 5     | 3.175     | 2.5x1    | 46                         | 939   | 2209                     | 50  | 60  | 74     | 12 | 62    | 5.5  | 9.5 | 5.5 | 24  |
| 25-5A2  |              |       |           | 1.5x2    | 48                         | 1078  | 2594                     | 50  | 70  | 74     | 12 | 62    | 5.5  | 9.5 | 5.5 | 24  |
| 25-5C1  |              |       |           | 3.5x1    | 68                         | 1252  | 3085                     | 50  | 72  | 74     | 12 | 62    | 5.5  | 9.5 | 5.5 | 24  |
| 25-6A2  |              | 6     | 3.969     | 1.5x2    | 56                         | 1462  | 3249                     | 56  | 82  | 82     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 25-6C1  |              |       |           | 3.5x1    | 66                         | 1690  | 3844                     | 56  | 81  | 82     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 25-10A1 |              | 10    | 4.763     | 1.5x1    | 29                         | 1019  | 1927                     | 60  | 81  | 86     | 16 | 73    | 6.6  | 11  | 6.5 | 24  |
| 28-5B1  | 28           | 5     | 3.175     | 2.5x1    | 51                         | 984   | 2466                     | 55  | 60  | 85     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 28-5B2  |              |       |           | 2.5x2    | 98                         | 1785  | 4932                     | 55  | 96  | 85     | 12 | 69    | 6.6  | 11  | 6.5 | 24  |
| 28-6A2  | 6            | 1.5x2 |           | 59       | 1150                       | 2960  | 55                       | 80  | 85  | 12     | 69 | 6.6   | 11   | 6.5 | 24  |     |
| 32-5B1  | 5            | 2.5x1 |           | 55       | 1039                       | 2833  | 58                       | 62  | 84  | 12     | 71 | 6.6   | 11   | 6.5 | 24  |     |
| 32-5A2  |              | 1.5x2 |           | 65       | 1216                       | 3400  | 58                       | 70  | 84  | 12     | 71 | 6.6   | 11   | 6.5 | 24  |     |
| 32-5C1  |              |       |           | 3.5x1    | 76                         | 1388  | 3967                     | 58  | 72  | 84     | 12 | 71    | 6.6  | 11  | 6.5 | 24  |
| 32-6B1  | 6            | 3.969 | 2.5x1     | 57       | 1409                       | 3510  | 62                       | 70  | 88  | 12     | 75 | 6.6   | 11   | 6.5 | 24  |     |
| 32-6A2  |              |       | 1.5x2     | 67       | 1633                       | 4168  | 62                       | 81  | 88  | 12     | 75 | 6.6   | 11   | 6.5 | 24  |     |
| 32-6C1  |              |       | 3.5x1     | 78       | 1888                       | 4936  | 62                       | 83  | 88  | 12     | 75 | 6.6   | 11   | 6.5 | 24  |     |
| 32-8B1  | 8            | 4.763 | 2.5x1     | 58       | 1810                       | 4227  | 66                       | 92  | 100 | 16     | 82 | 9     | 14   | 8.5 | 30  |     |
| 32-8A2  |              |       | 1.5x2     | 69       | 2094                       | 5009  | 66                       | 106 | 100 | 16     | 82 | 9     | 14   | 8.5 | 30  |     |
| 32-8C1  |              |       | 3.5x1     | 82       | 2428                       | 5948  | 66                       | 108 | 100 | 16     | 82 | 9     | 14   | 8.5 | 30  |     |
| 32-10B1 | 10           | 6.350 | 2.5x1     | 58       | 2651                       | 5600  | 74                       | 110 | 108 | 16     | 90 | 9     | 14   | 8.5 | 30  |     |
| 32-10A1 |              |       | 1.5x1     | 36       | 1673                       | 3278  | 74                       | 90  | 108 | 16     | 90 | 9     | 14   | 8.5 | 30  |     |
| 32-12A1 | 12           |       | 1.5x1     | 37       | 1672                       | 3278  | 74                       | 97  | 108 | 18     | 90 | 9     | 14   | 8.5 | 15  |     |
| 32-12B1 |              | 2.5x1 | 61        | 2650     | 5599                       | 74  | 117                      | 108 | 18  | 90     | 9  | 14    | 8.5  | 15  |     |     |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

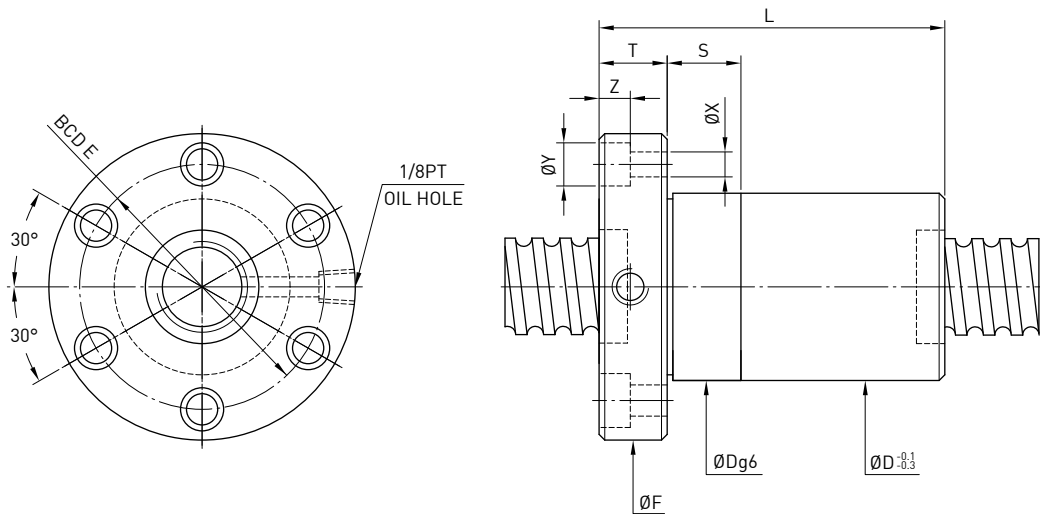
# O F S W TYPE



| Model   | Size         |       | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut   |      | Flange |     |       | Bolt |      |      | Fit  |
|---------|--------------|-------|-----------|----------|----------------------------|---|--------------------------|-------|------|--------|-----|-------|------|------|------|------|
|         | Nominal Dia. | Lead  |           |          |                            |   |                          | D     | L    | F      | T   | BCD-E | X    | Y    | Z    |      |
| 36-6B1  | 36           | 6     | 3.175     | 2.5x1    | 62                         | 1486  | 3969                     | 65    | 68   | 100    | 12  | 82    | 6.6  | 11   | 6.5  | 24   |
| 36-6B2  |              |       |           | 2.5x2    | 121                        | 2696  | 7937                     | 65    | 103  | 100    | 12  | 82    | 6.6  | 11   | 6.5  | 24   |
| 36-10A1 |              | 16    | 6.350     | 1.5x1    | 40                         | 1779  | 3718                     | 75    | 90   | 120    | 18  | 98    | 11   | 17.5 | 11   | 30   |
| 36-16B1 |              |       |           | 2.5x1    | 67                         | 2812  | 6334                     | 74    | 136  | 114    | 18  | 90    | 9    | 14   | 8.5  | 15   |
| 40-5B1  | 40           | 5     | 3.175     | 2.5x1    | 65                         | 1141  | 3567                     | 68    | 65   | 102    | 16  | 84    | 9    | 14   | 8.5  | 30   |
| 40-5B2  |              |       |           | 2.5x2    | 132                        | 2071  | 7134                     | 68    | 95   | 102    | 16  | 84    | 9    | 14   | 8.5  | 30   |
| 40-6B2  |              | 6     | 3.969     | 2.5x2    | 136                        | 2817  | 8855                     | 70    | 109  | 104    | 16  | 86    | 9    | 14   | 8.5  | 30   |
| 40-8B1  |              |       |           | 2.5x1    | 69                         | 2003  | 5302                     | 74    | 90   | 108    | 16  | 90    | 9    | 14   | 8.5  | 30   |
| 40-8C1  |              | 8     | 4.763     | 3.5x1    | 96                         | 2679  | 7438                     | 74    | 108  | 108    | 16  | 90    | 9    | 14   | 8.5  | 30   |
| 40-10B1 |              |       |           | 2.5x1    | 72                         | 2959  | 7069                     | 84    | 110  | 125    | 18  | 104   | 11   | 17.5 | 11   | 30   |
| 40-10C1 |              | 10    | 6.350     | 3.5x1    | 102                        | 3932  | 9841                     | 84    | 132  | 125    | 18  | 104   | 11   | 17.5 | 11   | 30   |
| 40-12B1 |              |       |           | 12       | 7.144                      | 2.5x1   | 72                       | 3425  | 7837 | 86     | 117 | 128   | 18   | 106  | 11   | 17.5 |
| 40-16A1 |              | 16    | 1.5x1     | 46       |                            | 2208  | 4703                     | 86    | 117  | 128    | 18  | 106   | 11   | 17.5 | 11   | 40   |
| 45-10B1 |              | 45    | 10        | 6.350    | 2.5x1                      | 76  | 3111                     | 7953  | 88   | 110    | 132 | 18    | 110  | 11   | 17.5 | 11   |
| 45-12B1 | 12           |       | 7.938     | 2.5x1    | 81                         | 4202  | 9900                     | 96    | 132  | 142    | 22  | 117   | 13   | 20   | 13   | 40   |
| 50-5A2  | 50           | 5     | 3.175     | 1.5x2    | 96                         | 1447  | 5382                     | 80    | 74   | 114    | 16  | 96    | 9    | 14   | 8.5  | 30   |
| 50-5A3  |              |       |           | 1.5x3    | 143                        | 2051  | 8072                     | 80    | 103  | 114    | 16  | 96    | 9    | 14   | 8.5  | 30   |
| 50-6B2  |              | 6     | 3.969     | 2.5x2    | 161                        | 3093  | 11149                    | 84    | 110  | 118    | 16  | 100   | 9    | 14   | 8.5  | 30   |
| 50-8B1  |              |       |           | 8        | 4.763                      | 2.5x1   | 81                       | 2206  | 6705 | 87     | 92  | 128   | 18   | 107  | 11   | 17.5 |
| 50-8B2  |              | 2.5x2 | 165       |          |                            | 4004  | 13409                    | 87    | 140  | 128    | 18  | 107   | 11   | 17.5 | 11   | 30   |
| 50-10B2 |              | 10    | 6.350     | 2.5x2    | 173                        | 5923  | 17670                    | 94    | 170  | 135    | 18  | 114   | 11   | 17.5 | 11   | 30   |
| 50-10C1 |              |       |           | 3.5x1    | 120                        | 4393  | 12481                    | 94    | 130  | 135    | 18  | 114   | 11   | 17.5 | 11   | 30   |
| 50-12B1 |              | 12    | 7.938     | 2.5x1    | 123                        | 4420  | 11047                    | 102   | 132  | 150    | 22  | 125   | 13   | 20   | 13   | 40   |
| 55-10C1 | 55           | 10    | 6.350     | 3.5x1    | 132                        | 4562  | 13661                    | 100   | 130  | 140    | 18  | 118   | 11   | 17.5 | 11   | 40   |
| 55-12B1 |              | 12    | 7.938     | 2.5x1    | 128                        | 4624  | 12195                    | 105   | 132  | 154    | 22  | 127   | 13   | 20   | 13   | 40   |
| 63-8A2  | 63           | 8     | 4.763     | 1.5x2    | 107                        | 2826  | 10129                    | 104   | 108  | 146    | 18  | 124   | 11   | 17.5 | 11   | 40   |
| 63-10B2 |              | 10    | 6.350     | 2.5x2    | 206                        | 6533  | 22371                    | 110   | 172  | 152    | 20  | 130   | 11   | 17.5 | 11   | 40   |
| 63-12B1 |              | 12    | 7.938     | 2.5x1    | 107                        | 4927  | 14031                    | 118   | 135  | 166    | 22  | 141   | 13   | 20   | 13   | 40   |
| 63-16B1 |              | 16    | 9.525     | 2.5x1    | 140                        | 8189  | 23005                    | 124   | 158  | 172    | 22  | 147   | 13   | 20   | 13   | 40   |
| 63-20A1 |              |       |           | 20       | 1.5x1                      | 84  | 5306                     | 13890 | 124  | 147    | 172 | 22    | 147  | 13   | 20   | 13   |
| 70-10B1 | 70           | 10    | 6.350     | 2.5x1    | 114                        | 3770  | 12506                    | 124   | 112  | 170    | 20  | 145   | 13   | 20   | 13   | 40   |
| 70-12B1 |              | 12    | 7.938     | 2.5x1    | 118                        | 5169  | 15638                    | 130   | 132  | 178    | 22  | 152   | 13   | 20   | 13   | 40   |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

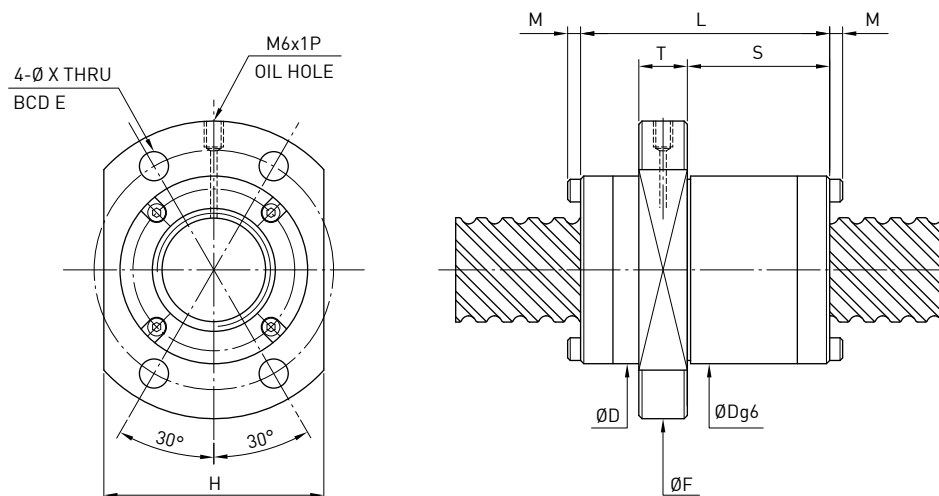
**O F S I TYPE**



| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut   |     | Flange |     |       | Bolt |      |      | Fit |    |
|---------|--------------|------|-----------|----------|----------------------------|---|--------------------------|-------|-----|--------|-----|-------|------|------|------|-----|----|
|         | Nominal Dia. | Lead |           |          |                            |   |                          | D     | L   | F      | T   | BCD-E | X    | Y    | Z    |     | S  |
| 20-5T3  | 20           | 5    | 3.175     | 3x2      | 39                         | 852   | 1767                     | 34    | 67  | 57     | 12  | 45    | 5.5  | 9.5  | 5.5  | 24  |    |
| 20-6T3  |              | 6    | 3.969     | 3x2      | 39                         | 1091  | 2081                     | 36    | 77  | 60     | 12  | 48    | 5.5  | 9.5  | 5.5  | 24  |    |
| 25-5T3  | 25           | 5    | 3.175     | 3x2      | 55                         | 977   | 2314                     | 40    | 67  | 64     | 12  | 52    | 5.5  | 9.5  | 5.5  | 24  |    |
| 25-6T3  |              | 6    | 3.969     | 3x2      | 56                         | 1272  | 2762                     | 42    | 77  | 65     | 12  | 53    | 5.5  | 9.5  | 5.5  | 24  |    |
| 32-5T3  | 32           | 5    | 3.175     | 3x2      | 64                         | 1117  | 3081                     | 48    | 67  | 74     | 12  | 60    | 6.5  | 11   | 6.5  | 24  |    |
| 32-5T4  |              |      |           | 4x2      | 82                         | 1431  | 4108                     | 48    | 77  | 74     | 12  | 60    | 6.5  | 11   | 6.5  | 24  |    |
| 32-6T3  |              | 6    | 3.969     | 3x2      | 65                         | 1446  | 3620                     | 50    | 67  | 76     | 12  | 62    | 6.5  | 11   | 6.5  | 24  |    |
| 32-6T4  |              |      |           | 4x2      | 84                         | 1852  | 4826                     | 50    | 90  | 76     | 12  | 62    | 6.5  | 11   | 6.5  | 24  |    |
| 32-8T3  |              | 8    | 4.763     | 3x2      | 68                         | 1810  | 4227                     | 52    | 100 | 78     | 16  | 64    | 6.6  | 11   | 6.5  | 24  |    |
| 32-8T4  |              |      |           | 4x2      | 82                         | 2317  | 5635                     | 52    | 117 | 78     | 16  | 64    | 6.6  | 11   | 6.5  | 24  |    |
| 32-10T3 |              | 10   | 6.350     | 3x2      | 68                         | 2539  | 5327                     | 56    | 120 | 82     | 16  | 68    | 6.6  | 11   | 6.5  | 24  |    |
| 36-8T4  |              | 36   | 8         | 4.763    | 4                          | 88  | 2531                     | 6614  | 56  | 116    | 86  | 15    | 70   | 9    | 14   | 8.5 | 25 |
| 40-5T4  |              | 40   | 5         | 3.175    | 4x2                        | 99  | 1599                     | 5280  | 54  | 81     | 80  | 16    | 66   | 6.6  | 11   | 6.5 | 24 |
| 40-5T6  |              |      |           |          | 6x2                        | 146   | 2265                     | 7919  | 54  | 102    | 80  | 16    | 66   | 6.6  | 11   | 6.5 | 24 |
| 40-6T4  | 6            |      | 3.969     | 4x2      | 100                        | 2136  | 6420                     | 56    | 94  | 88     | 16  | 72    | 9    | 14   | 8.5  | 30  |    |
| 40-6T6  |              |      |           | 6x2      | 148                        | 3028  | 9630                     | 56    | 119 | 88     | 16  | 72    | 9    | 14   | 8.5  | 30  |    |
| 40-8T4  | 8            |      | 4.763     | 4x2      | 102                        | 2728  | 7596                     | 60    | 117 | 92     | 16  | 75    | 9    | 14   | 8.5  | 30  |    |
| 40-10T3 | 10           |      | 6.350     | 3x2      | 76                         | 2959  | 7069                     | 65    | 123 | 96     | 16  | 80    | 9    | 14   | 8.5  | 30  |    |
| 40-10T4 |              |      |           | 4x2      | 101                        | 3789  | 9426                     | 65    | 143 | 96     | 16  | 80    | 9    | 14   | 8.5  | 30  |    |
| 50-5T4  | 50           |      | 5         | 3.175    | 4x2                        | 121   | 1757                     | 6745  | 65  | 81     | 96  | 16    | 80   | 9    | 14   | 8.5 | 30 |
| 50-5T6  |              | 6x2  |           |          | 177                        | 2490  | 10117                    | 65    | 102 | 96     | 16  | 80    | 9    | 14   | 8.5  | 30  |    |
| 50-6T4  |              | 6    | 3.969     | 4x2      | 123                        | 2388  | 8250                     | 68    | 94  | 100    | 16  | 84    | 9    | 14   | 8.5  | 30  |    |
| 50-6T6  |              |      |           | 6x2      | 179                        | 3384  | 12375                    | 68    | 119 | 100    | 16  | 84    | 9    | 14   | 8.5  | 30  |    |
| 50-8T4  |              | 8    | 4.763     | 4x2      | 122                        | 2998  | 9578                     | 70    | 120 | 102    | 16  | 85    | 9    | 14   | 8.8  | 30  |    |
| 50-10T3 |              | 10   | 6.350     | 3x2      | 95                         | 3397  | 9256                     | 74    | 123 | 114    | 18  | 92    | 11   | 17.5 | 11   | 40  |    |
| 50-10T4 |              |      |           | 4x2      | 124                        | 4350  | 12341                    | 74    | 143 | 114    | 18  | 92    | 11   | 17.5 | 11   | 40  |    |
| 50-12T3 |              | 12   | 7.938     | 3x2      | 94                         | 4420  | 11047                    | 78    | 147 | 118    | 18  | 96    | 11   | 17.5 | 11   | 40  |    |
| 63-6T4  |              | 63   | 6         | 3.969    | 4x2                        | 148   | 2614                     | 10542 | 80  | 96     | 119 | 18    | 98   | 11   | 17.5 | 11  | 40 |
| 63-6T3  |              |      |           |          | 3x2                        | 220   | 3704                     | 15813 | 80  | 121    | 119 | 18    | 98   | 11   | 17.5 | 11  | 40 |
| 63-8T4  | 8            |      | 4.763     | 4x2      | 152                        | 3395  | 12541                    | 82    | 119 | 122    | 18  | 100   | 11   | 17.5 | 11   | 40  |    |
| 63-10T4 | 10           |      | 6.350     | 4x2      | 158                        | 4860  | 15858                    | 88    | 147 | 134    | 20  | 110   | 14   | 20   | 13   | 40  |    |
| 63-12T3 | 12           |      | 7.938     | 3x2      | 114                        | 5059  | 14470                    | 92    | 150 | 138    | 20  | 114   | 14   | 20   | 13   | 40  |    |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 10% of dynamic load rating and axial load is applied.

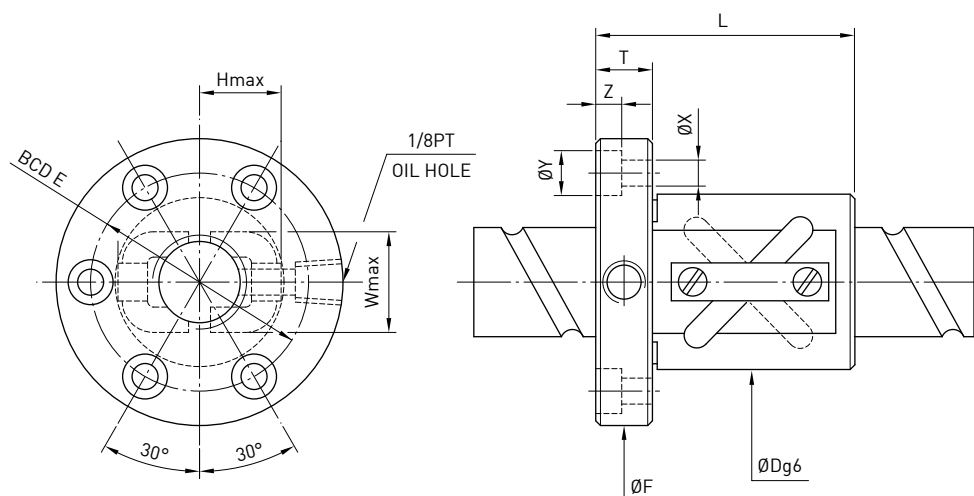
# F S H TYPE



| Model   | Size         |      | Ball Dia. | Circuits | Stiffness<br>kgf / μm<br>K | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf ) | Nut  |      | Flange |    |       |     | Bolt | Fit  |     |
|---------|--------------|------|-----------|----------|----------------------------|---|--------------------------|------|------|--------|----|-------|-----|------|------|-----|
|         | Nominal Dia. | Lead |           |          |                            |   |                          | D    | L    | F      | T  | BCD-E | H   |      | X    | S   |
| 15-20S1 | 15           | 20   | 3.175     | 1.8x1    | 18                         | 543   | 917                      | 34   | 45   | 55     | 10 | 45    | 36  | 5.5  | 24   | 0   |
| 16-16S2 | 16           | 16   |           | 1.8x2    | 35                         | 860   | 1690                     | 32   | 48   | 53     | 10 | 42    | 38  | 4.5  | 26   | 0   |
| 16-16S4 |              |      |           | 1.8x4    | 68                         | 1570  | 3370                     |      |      |        |    |       |     |      |      |     |
| 16-16S2 |              |      |           | 1.8x2    | 35                         | 860   | 1690                     | 33   | 48   | 58     | 10 | 45    | 38  | 6.6  | 26   | 0   |
| 16-16S4 |              |      |           | 1.8x4    | 68                         | 1570  | 3370                     |      |      |        |    |       |     |      |      |     |
| 20-20S2 | 20           | 20   |           | 1.8x2    | 42                         | 970   | 2120                     | 39   | 48   | 62     | 10 | 50    | 46  | 5.5  | 27.5 | 0   |
| 20-20S2 |              |      |           | 1.8x2    | 42                         | 970   | 2120                     | 38   | 58   | 62     | 10 | 50    | 46  | 5.5  | 32.5 | 3   |
| 20-20S4 |              |      |           | 1.8x4    | 81                         | 1760  | 4240                     |      |      |        |    |       |     |      |      |     |
| 25-25S2 |              |      | 25        | 25       | 3.969                      | 1.8x2   | 53                       | 1470 | 3410 | 47     | 67 | 74    | 12  | 60   | 56   | 6.6 |
| 25-25S4 | 1.8x4        | 105  |           |          |                            | 2670  | 6830                     |      |      |        |    |       |     |      |      |     |
| 32-32S2 | 32           | 32   | 4.763     | 1.8x2    | 66                         | 2090  | 5200                     | 58   | 85   | 92     | 15 | 74    | 68  | 9    | 48   | 0   |
| 32-32S4 |              |      |           | 1.8x4    | 128                        | 3800  | 10400                    |      |      |        |    |       |     |      |      |     |
| 40-40S2 | 40           | 40   | 6.350     | 1.8x2    | 82                         | 3420  | 8740                     | 72   | 102  | 114    | 17 | 93    | 84  | 11   | 60   | 0   |
| 40-40S4 |              |      |           | 1.8x4    | 159                        | 6220  | 17480                    |      |      |        |    |       |     |      |      |     |
| 50-50S2 | 50           | 50   | 7.938     | 1.8x2    | 100                        | 5030  | 13280                    | 90   | 125  | 135    | 20 | 112   | 104 | 14   | 83.5 | 0   |
| 50-50S4 |              |      |           | 1.8x4    | 193                        | 9110  | 26560                    |      |      |        |    |       |     |      |      |     |

Remark : Stiffness values listed above are derived from theoretical formula to the elastic deformation between balltrack and balls while preload is 5% of dynamic load rating and axial load is applied.

**D F S V TYPE**

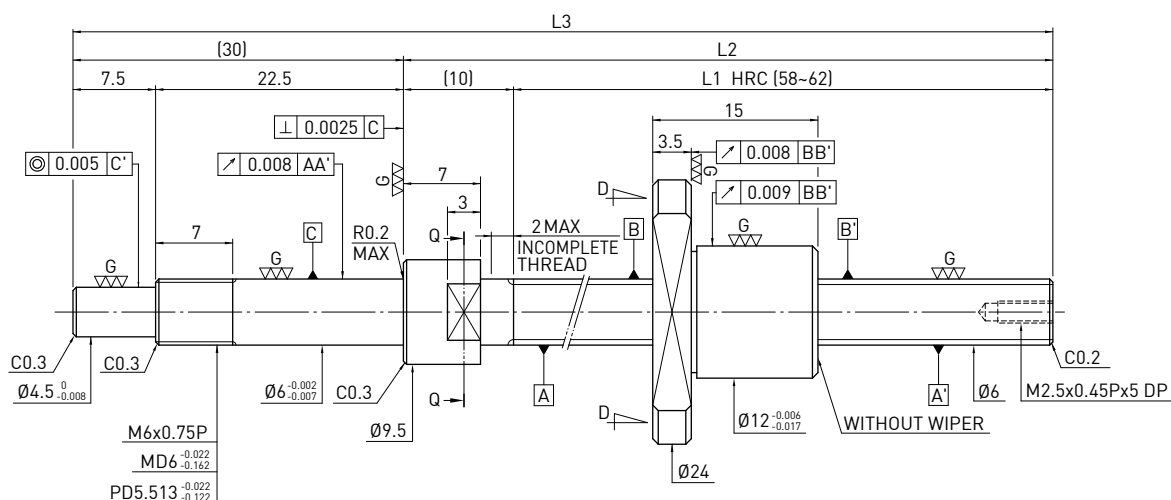


| Model   | Size         |      | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C (kgf) | Static Load<br>Co (kgf) | Nut |     | Flange |    |       | Return Tube |    | Bolt |      |     |
|---------|--------------|------|-----------|----------|---|-------------------------|-----|-----|--------|----|-------|-------------|----|------|------|-----|
|         | Nominal Dia. | Lead |           |          |   |                         | D   | L   | F      | T  | BCD-E | W           | H  | X    | Y    | Z   |
| 16-16A2 | 16           | 16   | 3.175     | 1.5x2    | 704   | 1376                    | 32  | 50  | 55     | 12 | 43    | 22          | 22 | 5.5  | 9.5  | 5.5 |
| 20-20A2 | 20           | 20   |           | 1.5x2    | 793   | 1745                    | 36  | 59  | 60     | 12 | 47    | 28          | 27 | 5.5  | 9.5  | 5.5 |
| 25-25A2 | 25           | 25   | 3.969     | 1.5x2    | 1174  | 2730                    | 42  | 69  | 70     | 12 | 55    | 32          | 28 | 6.6  | 11   | 6.5 |
| 32-32A2 | 32           | 32   | 4.763     | 1.5x2    | 1682  | 4208                    | 54  | 84  | 100    | 15 | 80    | 40          | 37 | 9    | 14   | 8.5 |
| 40-40A2 | 40           | 40   | 6.350     | 1.5x2    | 2806  | 7222                    | 65  | 105 | 106    | 18 | 85    | 52          | 42 | 11   | 17.5 | 11  |

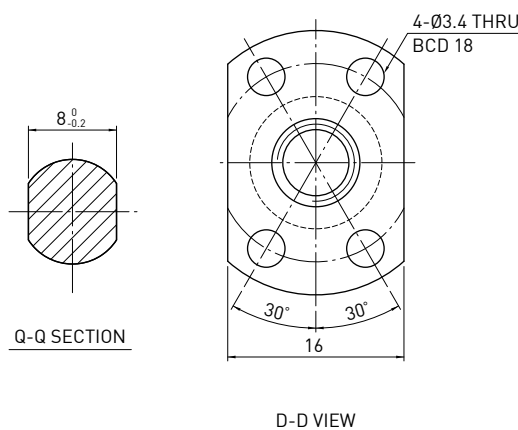
## 6.3 Miniature Ground Ballscrew

**F S I TYPE** (SHAFT OD 6, LEAD 1)

◀ Miniature



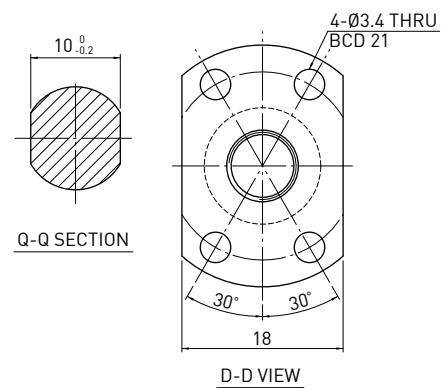
| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 1.0        |           |
| Lead Angle           | 2.99°      |           |
| P.C.D (mm)           | 6.1        |           |
| Steel Ball (mm)      | Ø0.8       |           |
| Circuits             | 1x3        |           |
| Dynamic Load C (Kgf) | 66         |           |
| Static Load Co (Kgf) | 111        |           |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.13 MAX   | 0.03 MAX  |
| Spacer Ball          | -          | -         |



Unit : mm

| Stroke | HIWIN Code                 | L1  | L2  | L3  | Accuracy grade |
|--------|----------------------------|-----|-----|-----|----------------|
| 40     | R6-1.0T3-FSI-65-105-0.008  | 65  | 75  | 105 | 3              |
| 70     | R6-1.0T3-FSI-95-135-0.008  | 95  | 105 | 135 | 3              |
| 100    | R6-1.0T3-FSI-125-165-0.008 | 125 | 135 | 165 | 3              |

## ◀ Miniature



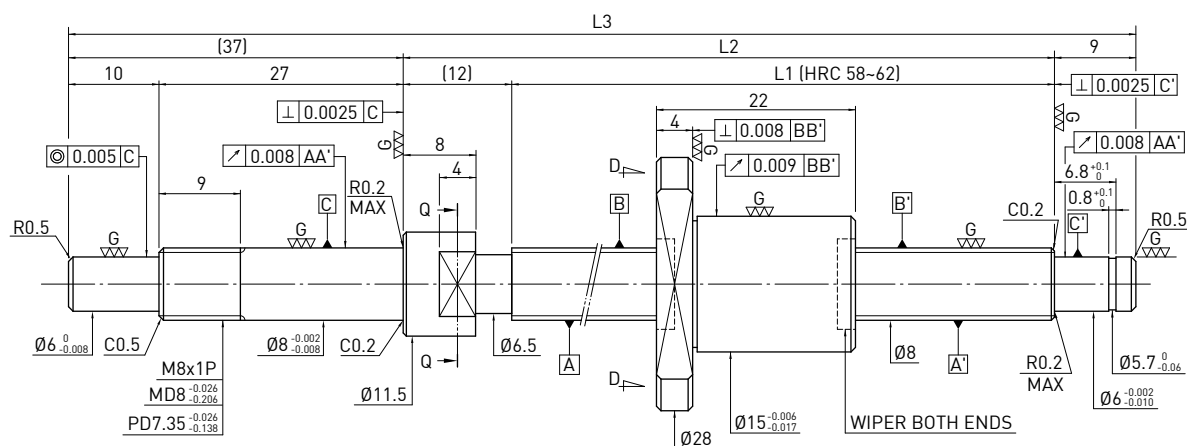
| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 1.0        |           |
| Lead Angle           | 2.25°      |           |
| P.C.D (mm)           | 8.1        |           |
| Steel Ball (mm)      | Ø0.8       |           |
| Circuits             | 1x3        |           |
| Dynamic Load C (Kgf) | 79         |           |
| Static Load Co (Kgf) | 157        |           |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.18 MAX   | 0.05 MAX  |
| Spacer Ball          | -          | -         |

Unit : mm

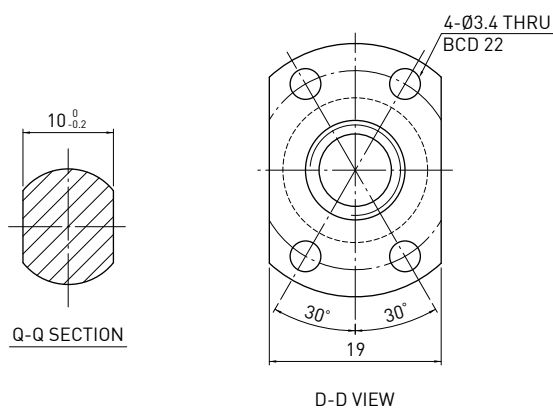
| Stroke | HIWIN Code                 | L1  | L2  | L3  | Accuracy grade |
|--------|----------------------------|-----|-----|-----|----------------|
| 40     | R8-1.0T3-FSI-80-138-0.008  | 80  | 92  | 138 | 3              |
| 70     | R8-1.0T3-FSI-110-168-0.008 | 110 | 122 | 168 | 3              |
| 100    | R8-1.0T3-FSI-140-198-0.008 | 140 | 152 | 198 | 3              |
| 150    | R8-1.0T3-FSI-190-248-0.008 | 190 | 202 | 248 | 3              |

**F S I TYPE (SHAFT OD 8, LEAD 1.5)**

◀ Miniature


**Ballscrew Data**

| Direction            | Right Hand |           |
|----------------------|------------|-----------|
| Lead (mm)            | 1.5        |           |
| Lead Angle           | 3.37°      |           |
| P.C.D (mm)           | 8.1        |           |
| Steel Ball (mm)      | Ø1         |           |
| Circuits             | 1x3        |           |
| Dynamic Load C (Kgf) | 105        |           |
| Static Load Co (Kgf) | 191        |           |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.2 MAX    | 0.05 MAX  |
| Spacer Ball          | -          | -         |

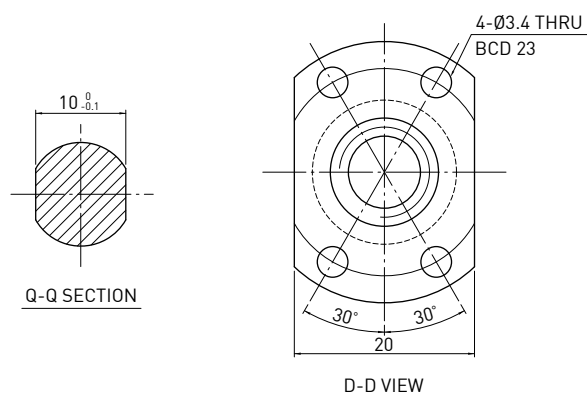
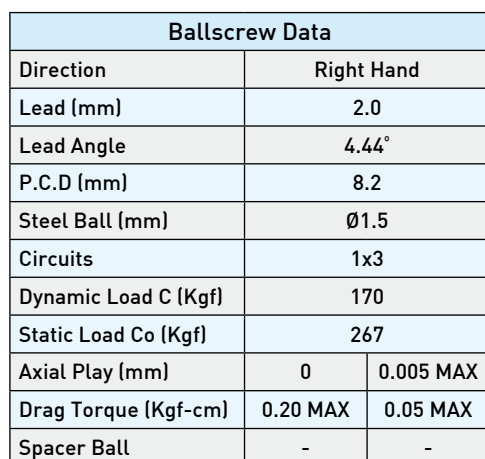


Unit : mm

| Stroke | HIWIN Code                 | L1  | L2  | L3  | Accuracy grade |
|--------|----------------------------|-----|-----|-----|----------------|
| 40     | R8-1.5T3-FSI-80-138-0.008  | 80  | 92  | 138 | 3              |
| 70     | R8-1.5T3-FSI-110-168-0.008 | 110 | 122 | 168 | 3              |
| 100    | R8-1.5T3-FSI-140-198-0.008 | 140 | 152 | 198 | 3              |
| 150    | R8-1.5T3-FSI-190-248-0.008 | 190 | 202 | 248 | 3              |



## ◀ Miniature

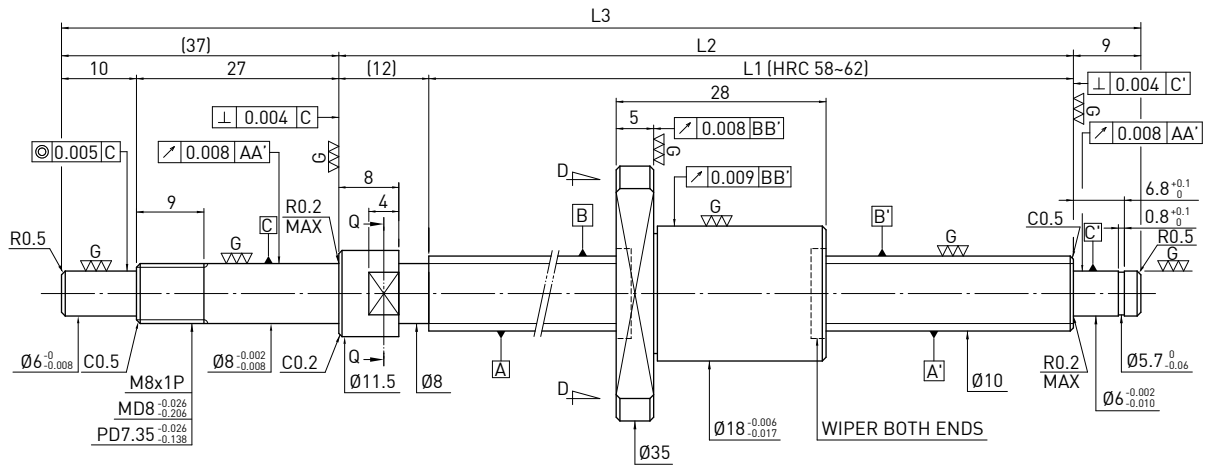


Unit : mm

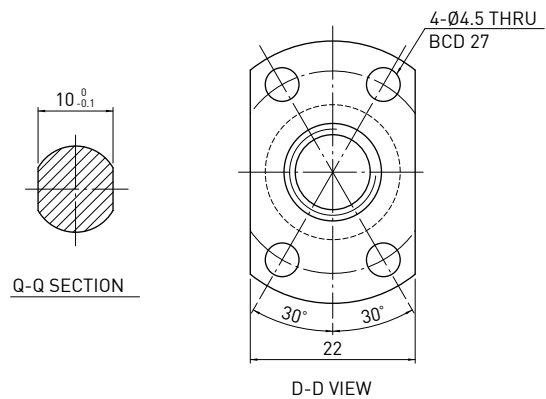
| Stroke | HIWIN Code               | L1  | L2  | L3  | Accuracy grade |
|--------|--------------------------|-----|-----|-----|----------------|
| 40     | R8-2T3-FSI-80-138-0.008  | 80  | 92  | 138 | 3              |
| 70     | R8-2T3-FSI-110-168-0.008 | 110 | 122 | 168 | 3              |
| 100    | R8-2T3-FSI-140-198-0.008 | 140 | 152 | 198 | 3              |
| 150    | R8-2T3-FSI-190-248-0.008 | 190 | 202 | 248 | 3              |


**TYPE (SHAFT OD 10, LEAD 2)**

◀ Miniature


**Ball screw Data**

| Direction            | Right Hand |           |
|----------------------|------------|-----------|
| Lead (mm)            | 2          |           |
| Lead Angle           | 3.57°      |           |
| P.C.D (mm)           | 10.2       |           |
| Steel Ball (mm)      | Ø1.5       |           |
| Circuits             | 1x3        |           |
| Dynamic Load C (Kgf) | 196        |           |
| Static Load Co (Kgf) | 348        |           |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.01~0.24  | 0.05 MAX  |
| Spacer Ball          | -          | -         |

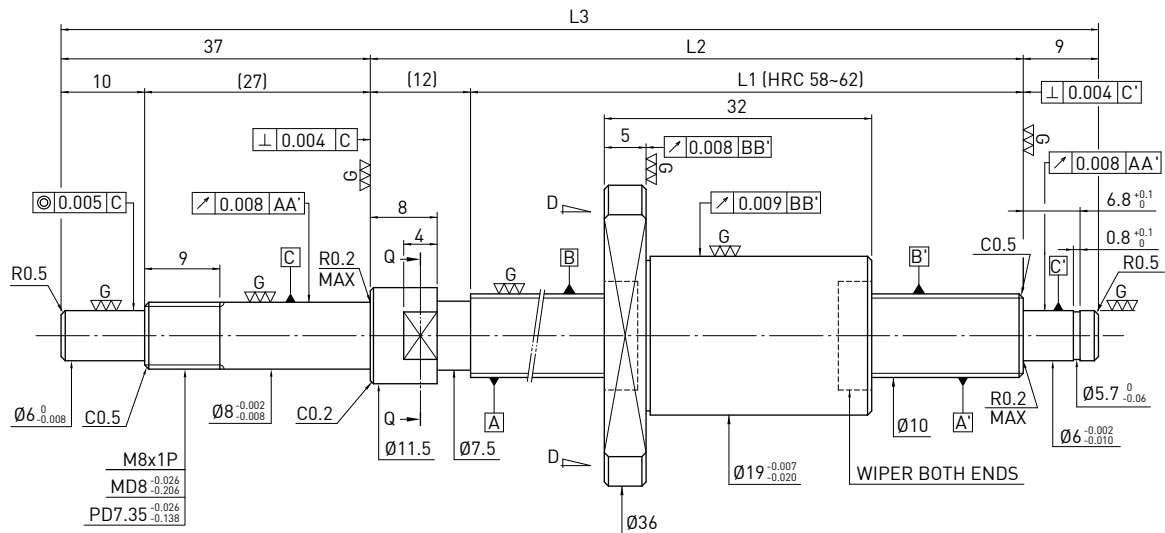


Unit : mm

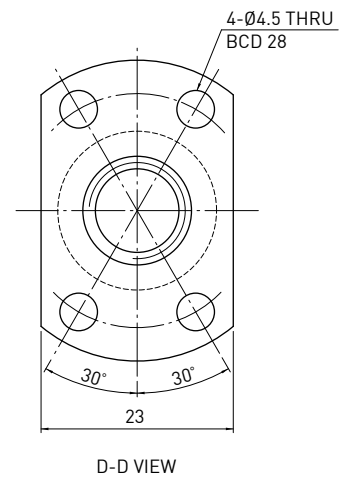
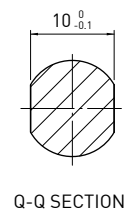
| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 50     | R10-2T3-FSI-100-158-0.008 | 100 | 112 | 158 | 3              |
| 100    | R10-2T3-FSI-150-208-0.008 | 150 | 162 | 208 | 3              |
| 150    | R10-2T3-FSI-200-258-0.008 | 200 | 212 | 258 | 3              |
| 200    | R10-2T3-FSI-250-308-0.008 | 250 | 262 | 308 | 3              |

**F S I TYPE** (SHAFT OD 10, LEAD 2.5)

◀ Miniature



| Ball screw Data      |                 |           |
|----------------------|-----------------|-----------|
| Direction            | Right Hand      |           |
| Lead (mm)            | 2.5             |           |
| Lead Angle           | 4.46°           |           |
| P.C.D (mm)           | 10.2            |           |
| Steel Ball (mm)      | $\varnothing 2$ |           |
| Circuits             | 1x3             |           |
| Dynamic Load C (Kgf) | 274             |           |
| Static Load Co (Kgf) | 438             |           |
| Axial Play (mm)      | 0               | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.02~0.3        | 0.05 MAX  |
| Spacer Ball          | -               | -         |

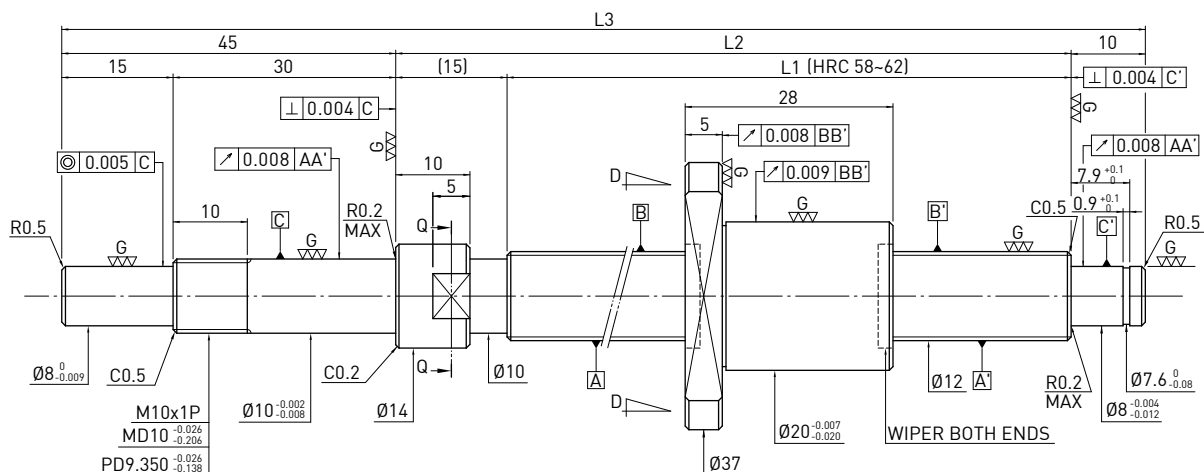


Unit : mm

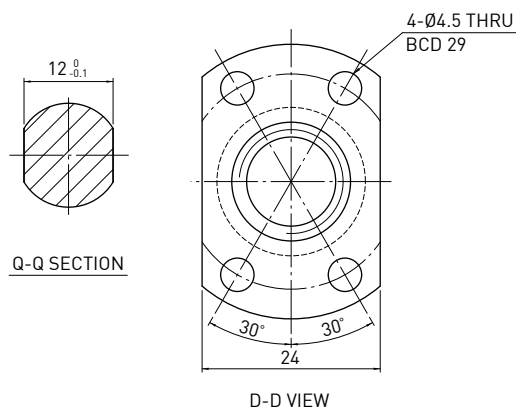
| Stroke | HIWIN Code                  | L1  | L2  | L3  | Accuracy grade |
|--------|-----------------------------|-----|-----|-----|----------------|
| 50     | R10-2.5T3-FSI-100-158-0.008 | 100 | 112 | 158 | 3              |
| 100    | R10-2.5T3-FSI-150-208-0.008 | 150 | 162 | 208 | 3              |
| 150    | R10-2.5T3-FSI-200-258-0.008 | 200 | 212 | 258 | 3              |
| 200    | R10-2.5T3-FSI-250-308-0.008 | 250 | 262 | 308 | 3              |

**F S I TYPE** (SHAFT OD 12, LEAD 2)

◀ Miniature



| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 2          |           |
| Lead Angle           | 2.99°      |           |
| P.C.D (mm)           | 12.2       |           |
| Steel Ball (mm)      | Ø1.5       |           |
| Circuits             | 1x3        |           |
| Dynamic Load C (Kgf) | 217        |           |
| Static Load Co (Kgf) | 430        |           |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.04~0.35  | 0.05 MAX  |
| Spacer Ball          | -          | -         |

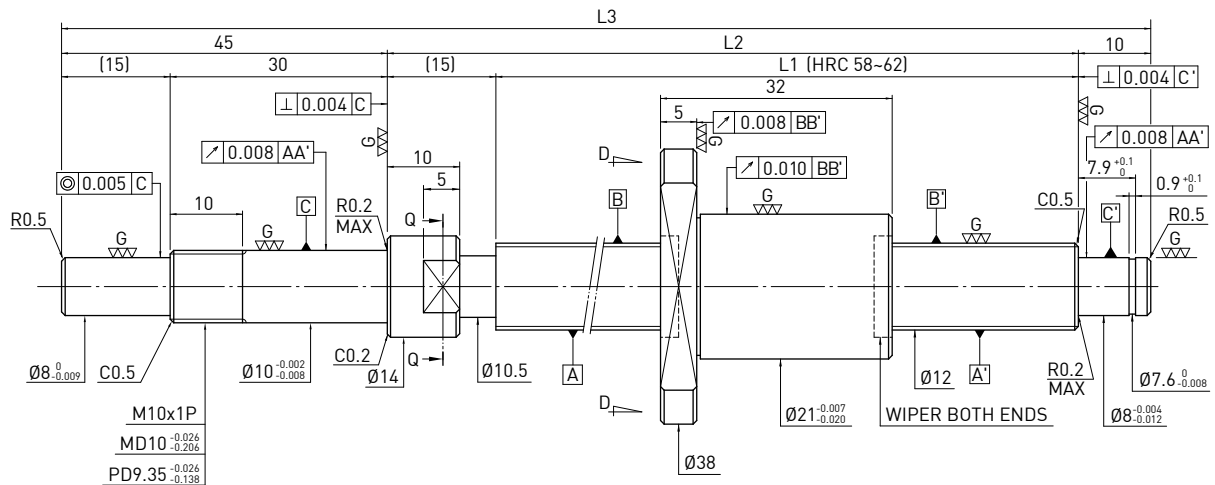


Unit : mm

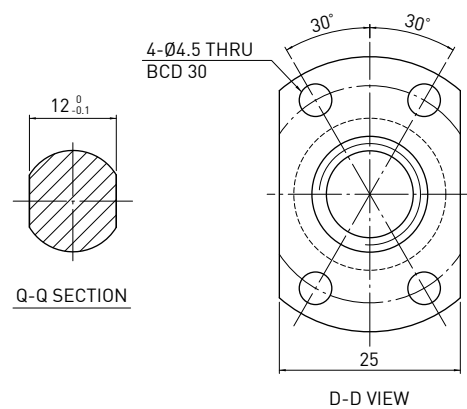
| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 50     | R12-2T3-FSI-110-180-0.008 | 110 | 125 | 180 | 3              |
| 100    | R12-2T3-FSI-160-230-0.008 | 160 | 175 | 230 | 3              |
| 150    | R12-2T3-FSI-210-280-0.008 | 210 | 225 | 280 | 3              |
| 200    | R12-2T3-FSI-260-330-0.008 | 260 | 275 | 330 | 3              |
| 250    | R12-2T3-FSI-310-380-0.008 | 310 | 325 | 380 | 3              |

**F S I TYPE** (SHAFT OD 12, LEAD 2.5)

◀ Miniature



| Ball screw Data      |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 2.5        |           |
| Lead Angle           | 3.73°      |           |
| P.C.D (mm)           | 12.2       |           |
| Steel Ball (mm)      | Ø2         |           |
| Circuits             | 1x3        |           |
| Dynamic Load C (Kgf) | 309        |           |
| Static Load Co (Kgf) | 546        |           |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.04~0.35  | 0.1 MAX   |
| Spacer Ball          | -          | -         |

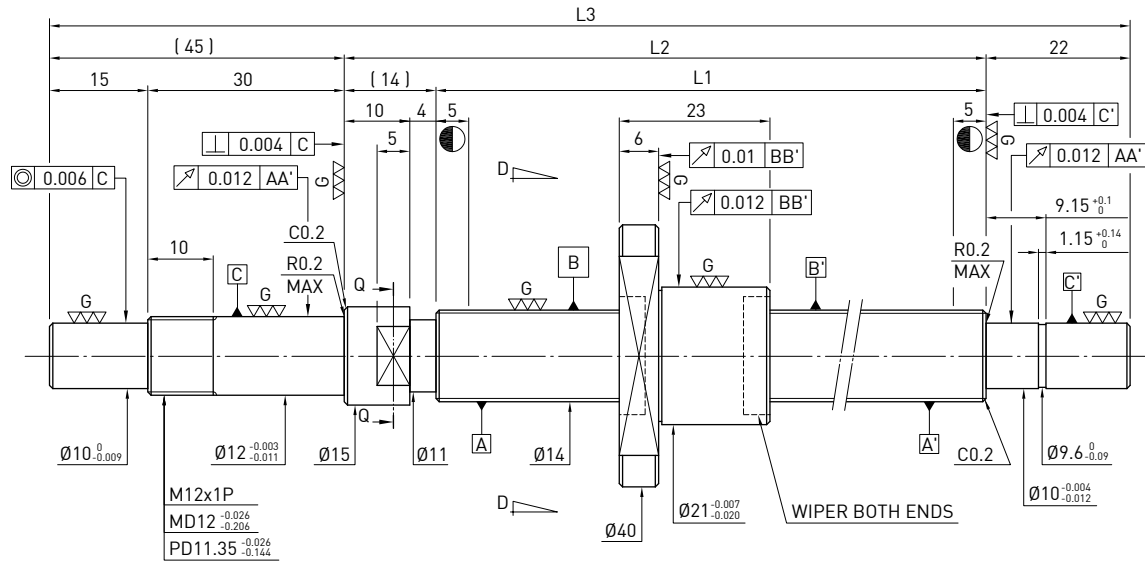


Unit : mm

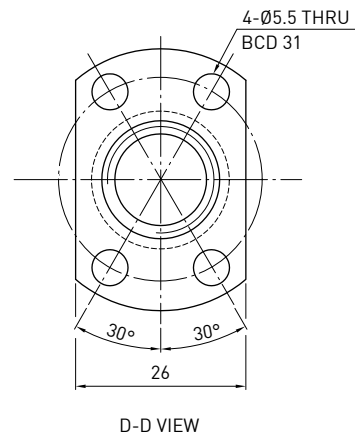
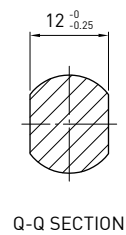
| Stroke | HIWIN Code                  | L1  | L2  | L3  | Accuracy grade |
|--------|-----------------------------|-----|-----|-----|----------------|
| 50     | R12-2.5T3-FSI-110-180-0.008 | 110 | 125 | 180 | 3              |
| 100    | R12-2.5T3-FSI-160-230-0.008 | 160 | 175 | 230 | 3              |
| 150    | R12-2.5T3-FSI-210-280-0.008 | 210 | 225 | 280 | 3              |
| 200    | R12-2.5T3-FSI-260-330-0.008 | 260 | 275 | 330 | 3              |
| 250    | R12-2.5T3-FSI-310-380-0.008 | 310 | 325 | 380 | 3              |

**F S I TYPE (SHAFT OD 14, LEAD 2)**

◀ Miniature



| Ball screw Data      |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 2          |               |
| Lead Angle           | 2.57°      |               |
| P.C.D (mm)           | 14.2       |               |
| Steel Ball (mm)      | Ø1.5       |               |
| Circuits             | 1x3        |               |
| Dynamic Load C (Kgf) | 236        |               |
| Static Load Co (Kgf) | 511        |               |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.05~0.5   | -             |
| Spacer Ball          | -          | -             |

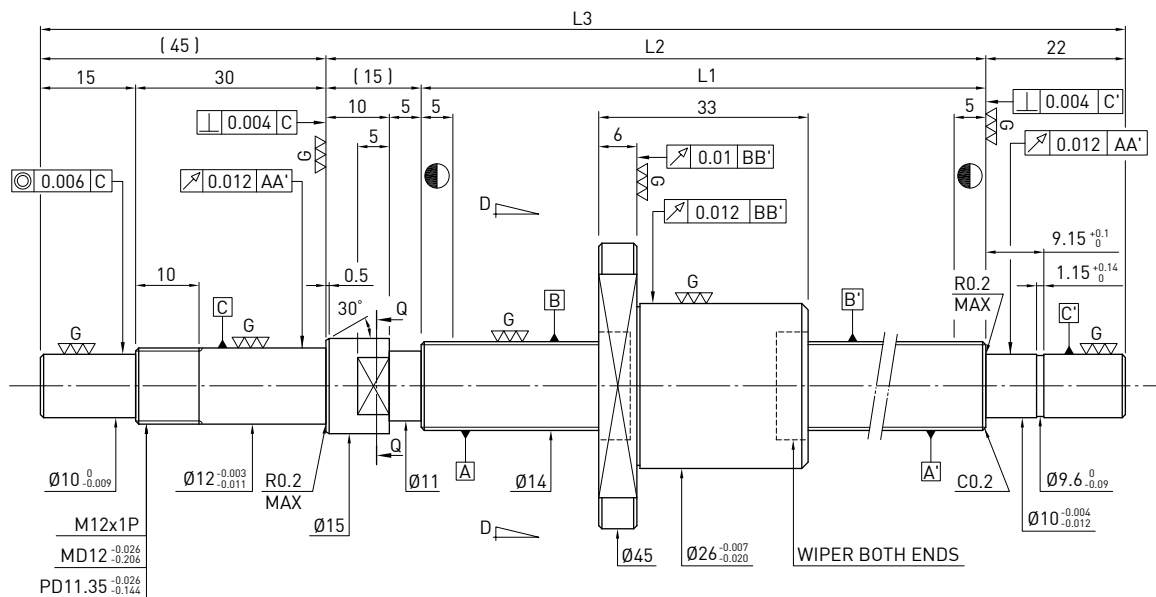


Unit : mm

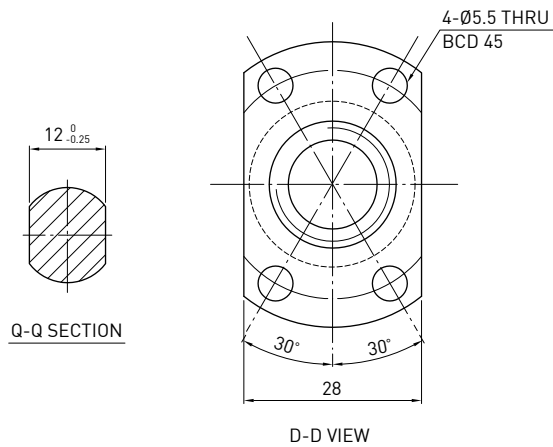
| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 50     | R14-2T3-FSI-85-166-0.008  | 85  | 99  | 166 | 3              |
| 100    | R14-2T3-FSI-135-216-0.008 | 135 | 149 | 216 | 3              |
| 150    | R14-2T3-FSI-185-266-0.008 | 185 | 199 | 266 | 3              |
| 200    | R14-2T3-FSI-235-316-0.008 | 235 | 249 | 316 | 3              |
| 250    | R14-2T3-FSI-335-416-0.008 | 335 | 349 | 416 | 3              |

**F S I TYPE (SHAFT OD 14, LEAD 4)**

◀ Miniature



| Ball screw Data      |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 4          |               |
| Lead Angle           | 5.11°      |               |
| P.C.D (mm)           | 14.25      |               |
| Steel Ball (mm)      | Ø2.381     |               |
| Circuits             | 1x3        |               |
| Dynamic Load C (Kgf) | 403        |               |
| Static Load Co (Kgf) | 725        |               |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.1~0.7    | -             |
| Spacer Ball          | -          | -             |

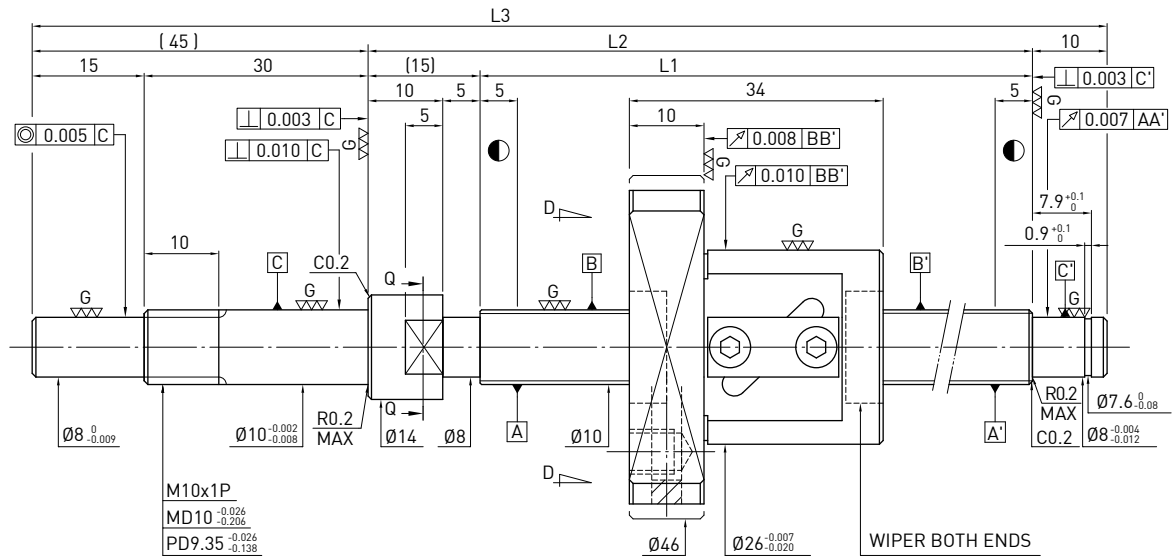


Unit : mm

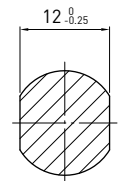
| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 100    | R14-4T3-FSI-148-230-0.008 | 148 | 163 | 230 | 3              |
| 150    | R14-4T3-FSI-198-280-0.008 | 198 | 213 | 280 | 3              |
| 200    | R14-4T3-FSI-248-330-0.008 | 248 | 263 | 330 | 3              |
| 300    | R14-4T3-FSI-348-430-0.008 | 348 | 363 | 430 | 3              |
| 400    | R14-4T3-FSI-448-530-0.008 | 448 | 463 | 530 | 3              |

**F S W TYPE (SHAFT OD 10, LEAD 4)**

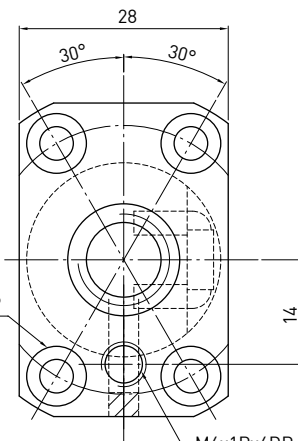
◀ Miniature



| Ball screw Data      |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 4          |               |
| Lead Angle           | 7.11°      |               |
| P.C.D (mm)           | 10.2       |               |
| Steel Ball (mm)      | Ø2         |               |
| Circuits             | 2.5x1      |               |
| Dynamic Load C (Kgf) | 176        | 280           |
| Static Load Co (Kgf) | 225        | 449           |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.05~0.4   | ~0.1          |
| Spacer Ball          | 1 : 1      | -             |



Q-Q SECTION

 4-Ø4.5THRU, Ø8x4.5DP  
 BCD 36


D-D VIEW

Unit : mm

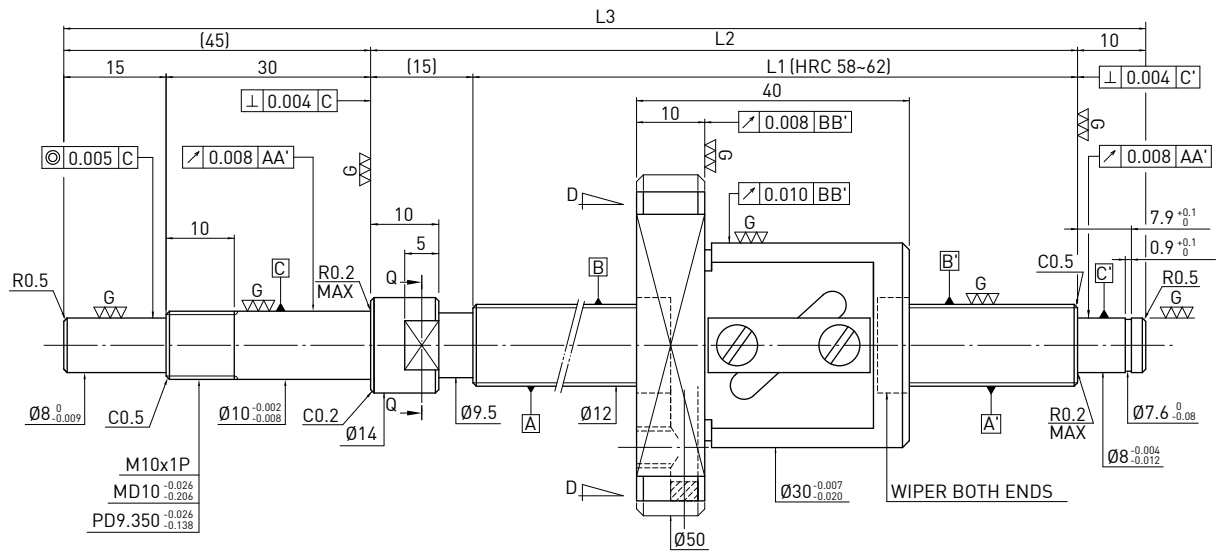
| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 50     | R10-4B1-FSW-110-180-0.008 | 110 | 125 | 180 | 3              |
| 100    | R10-4B1-FSW-160-230-0.008 | 160 | 175 | 230 | 3              |
| 150    | R10-4B1-FSW-210-280-0.008 | 210 | 225 | 280 | 3              |
| 200    | R10-4B1-FSW-260-330-0.008 | 260 | 275 | 330 | 3              |
| 250    | R10-4B1-FSW-310-380-0.008 | 310 | 325 | 380 | 3              |
| 300    | R10-4B1-FSW-360-430-0.008 | 360 | 375 | 430 | 3              |



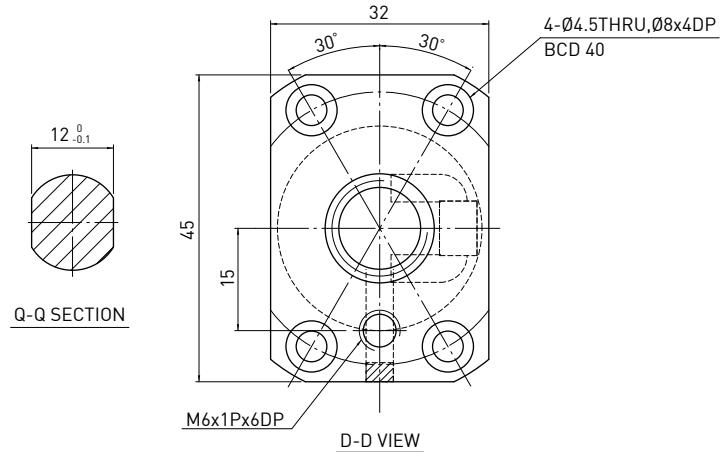


# TYPE (SHAFT OD 12, LEAD 5)

◀ Miniature



| Ball screw Data      |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 5          |           |
| Lead Angle           | 7.4°       |           |
| P.C.D (mm)           | 12.25      |           |
| Steel Ball (mm)      | Ø2.381     |           |
| Circuits             | 2.5x1      |           |
| Dynamic Load C (Kgf) | 241        | 382       |
| Static Load Co (Kgf) | 319        | 637       |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.1~0.45   | 0.1 MAX   |
| Spacer Ball          | 1 : 1      | -         |

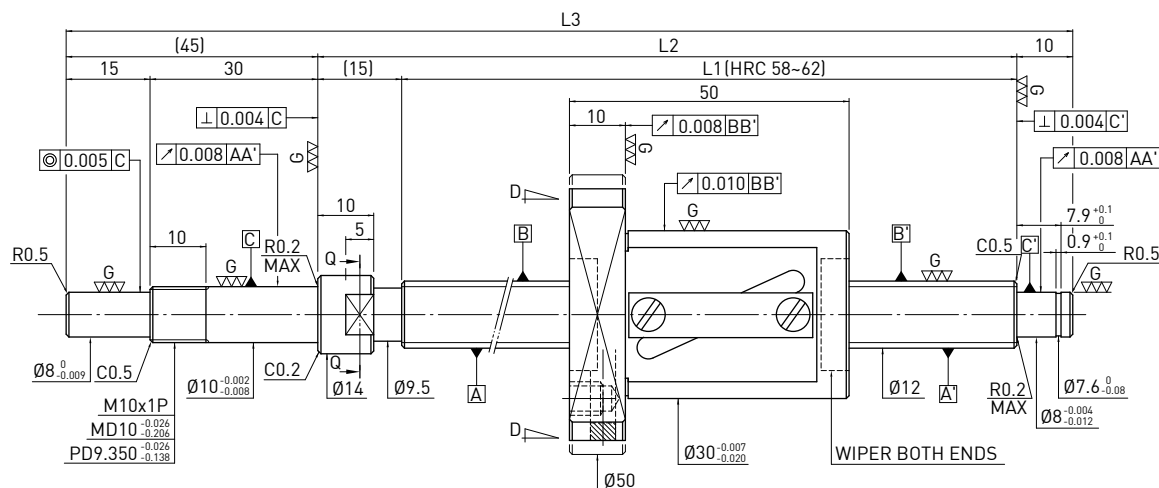


Unit : mm

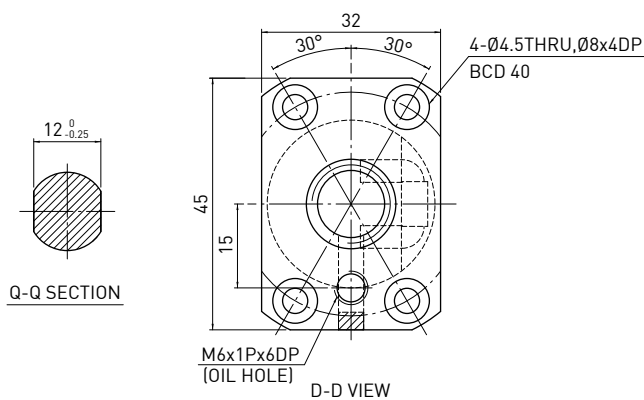
| Stroke | HIWIN Code                 | L1  | L2  | L3  | Accuracy grade |
|--------|----------------------------|-----|-----|-----|----------------|
| 50     | R12-5B1-FSW -110-180-0.008 | 110 | 125 | 180 | 3              |
| 100    | R12-5B1-FSW -160-230-0.008 | 160 | 175 | 230 | 3              |
| 150    | R12-5B1-FSW -210-280-0.008 | 210 | 225 | 280 | 3              |
| 200    | R12-5B1-FSW -260-330-0.008 | 260 | 275 | 330 | 3              |
| 250    | R12-5B1-FSW -310-380-0.008 | 310 | 325 | 380 | 3              |
| 350    | R12-5B1-FSW -410-480-0.008 | 410 | 425 | 480 | 3              |
| 450    | R12-5B1-FSW -510-580-0.008 | 510 | 525 | 580 | 3              |

**F S W TYPE** (SHAFT OD 12, LEAD 10)

◀ Miniature


**Ball screw Data**

| Direction            | Right Hand |           |
|----------------------|------------|-----------|
| Lead (mm)            | 10         |           |
| Lead Angle           | 14.57°     |           |
| P.C.D (mm)           | 12.25      |           |
| Steel Ball (mm)      | Ø2.381     |           |
| Circuits             | 2.5x1      |           |
| Dynamic Load C (Kgf) | 241        | 382       |
| Static Load Co (Kgf) | 319        | 637       |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.1~0.5    | 0.5 MAX   |
| Spacer Ball          | 1 : 1      | -         |



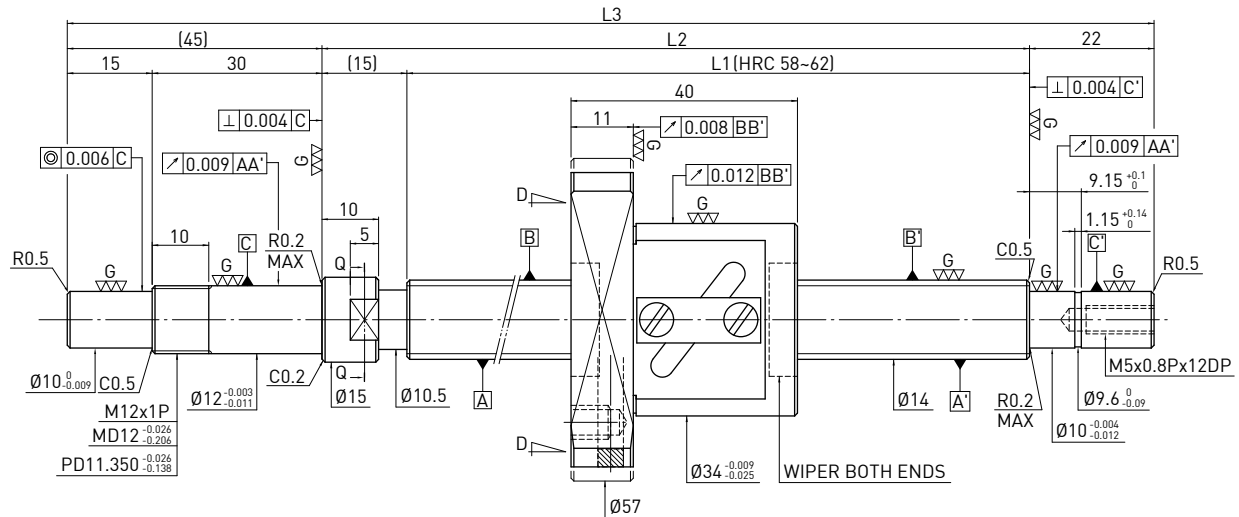
Unit : mm

| Stroke | HIWIN Code                 | L1  | L2  | L3  | Accuracy grade |
|--------|----------------------------|-----|-----|-----|----------------|
| 100    | R12-10B1-FSW-160-230-0.008 | 160 | 175 | 230 | 3              |
| 150    | R12-10B1-FSW-210-280-0.008 | 210 | 225 | 280 | 3              |
| 250    | R12-10B1-FSW-310-380-0.008 | 310 | 325 | 380 | 3              |
| 350    | R12-10B1-FSW-410-480-0.008 | 410 | 425 | 480 | 3              |
| 450    | R12-10B1-FSW-510-580-0.008 | 510 | 525 | 580 | 3              |

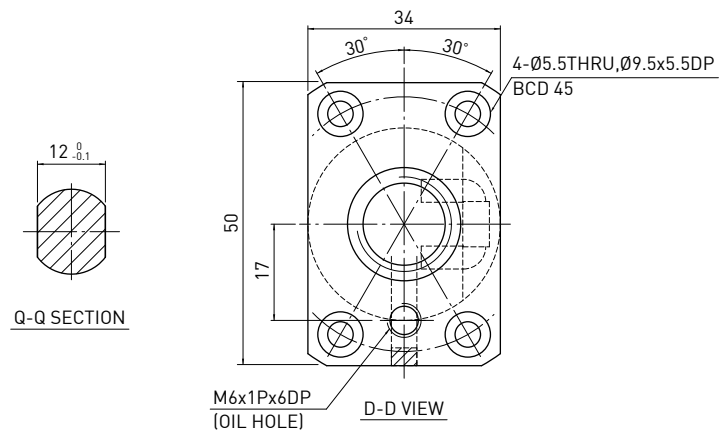


# TYPE (SHAFT OD 14, LEAD 5)

◀ Miniature

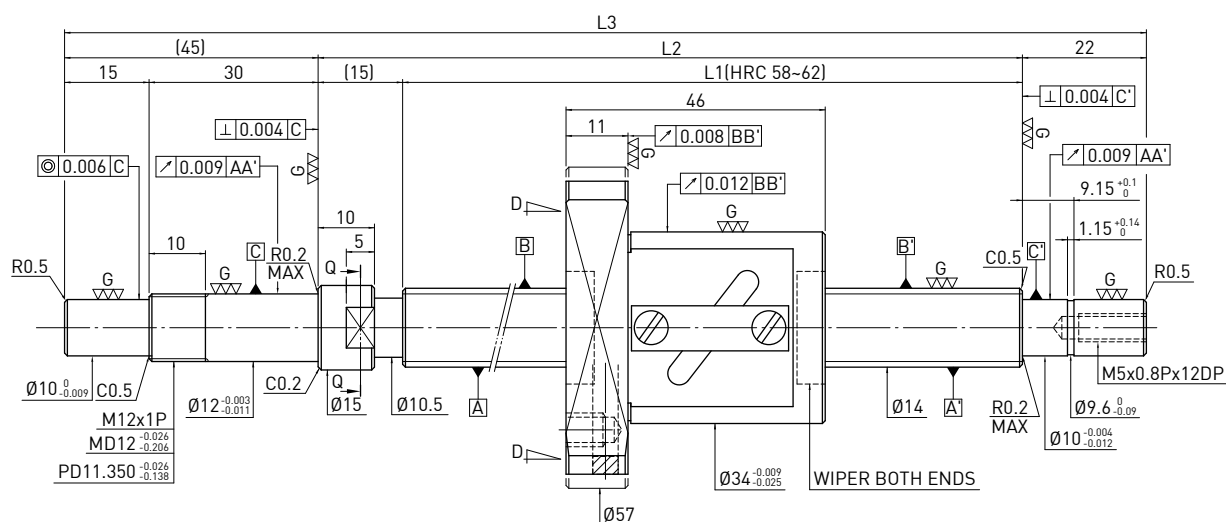


| Ball screw Data      |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 5          |           |
| Lead Angle           | 6.22°      |           |
| P.C.D (mm)           | 14.6       |           |
| Steel Ball (mm)      | Ø3.175     |           |
| Circuits             | 2.5x1      |           |
| Dynamic Load C (Kgf) | 448        | 710       |
| Static Load Co (Kgf) | 608        | 1215      |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.15~0.70  | 0.2 MAX   |
| Spacer Ball          | 1 : 1      | -         |

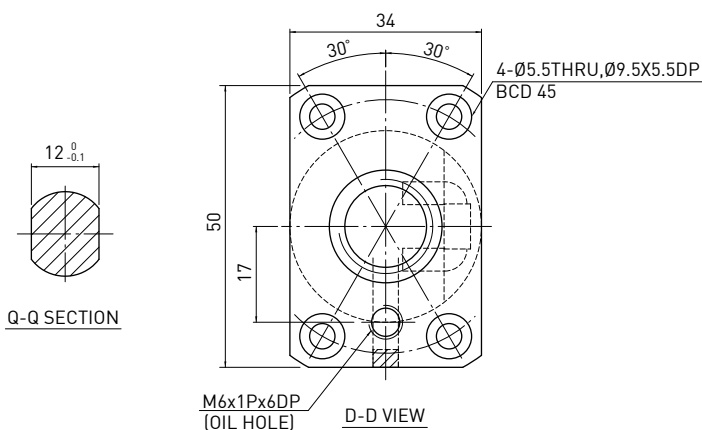


Unit : mm

| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 100    | R14-5B1-FSW-189-271-0.008 | 189 | 204 | 271 | 3              |
| 150    | R14-5B1-FSW-239-321-0.008 | 239 | 254 | 321 | 3              |
| 250    | R14-5B1-FSW-339-421-0.008 | 339 | 354 | 421 | 3              |
| 350    | R14-5B1-FSW-439-521-0.008 | 439 | 454 | 521 | 3              |
| 450    | R14-5B1-FSW-539-621-0.008 | 539 | 554 | 621 | 3              |
| 600    | R14-5B1-FSW-689-771-0.008 | 689 | 704 | 771 | 3              |



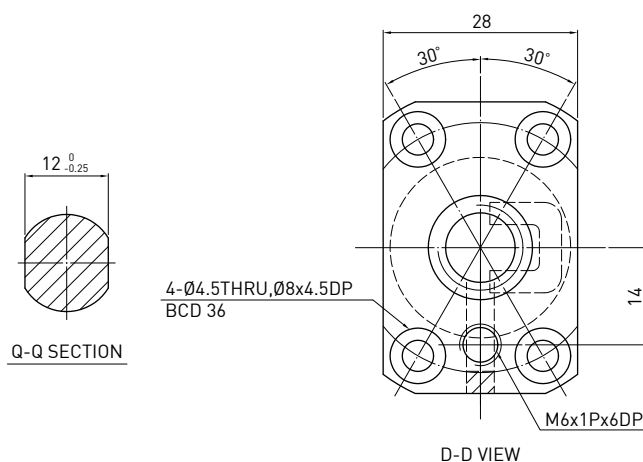
| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 8          |           |
| Lead Angle           | 9.89°      |           |
| P.C.D (mm)           | 14.6       |           |
| Steel Ball (mm)      | Ø3.175     |           |
| Circuits             | 2.5x1      |           |
| Dynamic Load C (Kgf) | 448        | 710       |
| Static Load Co (Kgf) | 608        | 1215      |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.15~0.79  | 0.24 MAX  |
| Spacer Ball          | 1 : 1      | -         |



Unit : mm

| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 100    | R14-8B1-FSW-189-271-0.008 | 189 | 204 | 271 | 3              |
| 150    | R14-8B1-FSW-239-321-0.008 | 239 | 254 | 321 | 3              |
| 200    | R14-8B1-FSW-289-371-0.008 | 289 | 304 | 371 | 3              |
| 250    | R14-8B1-FSW-339-421-0.008 | 339 | 354 | 421 | 3              |
| 300    | R14-8B1-FSW-389-471-0.008 | 389 | 404 | 471 | 3              |
| 350    | R14-8B1-FSW-439-521-0.008 | 439 | 454 | 521 | 3              |
| 400    | R14-8B1-FSW-489-571-0.008 | 489 | 504 | 571 | 3              |
| 450    | R14-8B1-FSW-539-621-0.008 | 539 | 554 | 621 | 3              |
| 500    | R14-8B1-FSW-589-671-0.008 | 589 | 604 | 671 | 3              |
| 550    | R14-8B1-FSW-639-721-0.008 | 639 | 654 | 721 | 3              |
| 600    | R14-8B1-FSW-689-771-0.008 | 689 | 704 | 771 | 3              |
| 700    | R14-8B1-FSW-789-871-0.008 | 789 | 804 | 871 | 3              |

## ◀ Miniature

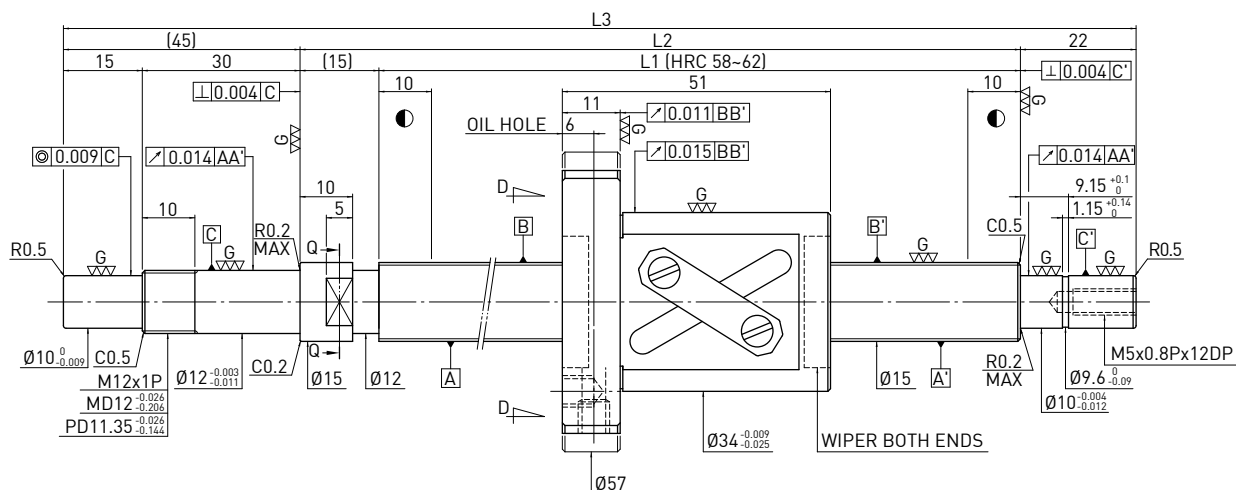
Unit : mm

| Stroke | HIWIN Code                 | L1  | L2  | L3  | Accuracy grade |
|--------|----------------------------|-----|-----|-----|----------------|
| 100    | R10-10A1-FSB-167-240-0.008 | 167 | 185 | 240 | 3              |
| 150    | R10-10A1-FSB-217-290-0.008 | 217 | 235 | 290 | 3              |
| 200    | R10-10A1-FSB-267-340-0.008 | 267 | 285 | 340 | 3              |
| 250    | R10-10A1-FSB-317-390-0.008 | 317 | 335 | 390 | 3              |
| 300    | R10-10A1-FSB-367-440-0.008 | 367 | 385 | 440 | 3              |

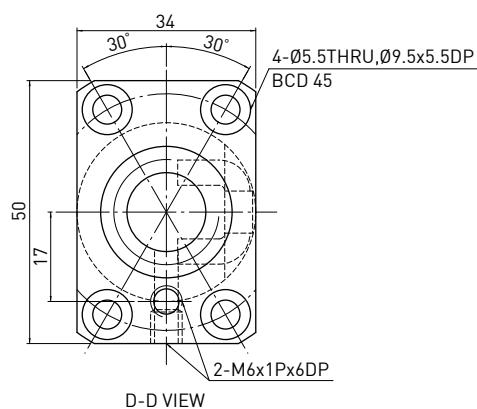
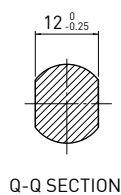
## 6.4 End Machining Ground Ballscrew Series

**F S W TYPE** (SHAFT OD 15, LEAD 10)

◀ Standard



| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 10         |           |
| Lead Angle           | 11.53°     |           |
| P.C.D (mm)           | 15.6       |           |
| Steel Ball (mm)      | Ø3.175     |           |
| Circuits             | 2.5x1      |           |
| Dynamic Load C (Kgf) | 460        | 729       |
| Static Load Co (Kgf) | 645        | 1290      |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.15~0.79  | 0.24 MAX  |
| Spacer Ball          | 1 : 1      | -         |



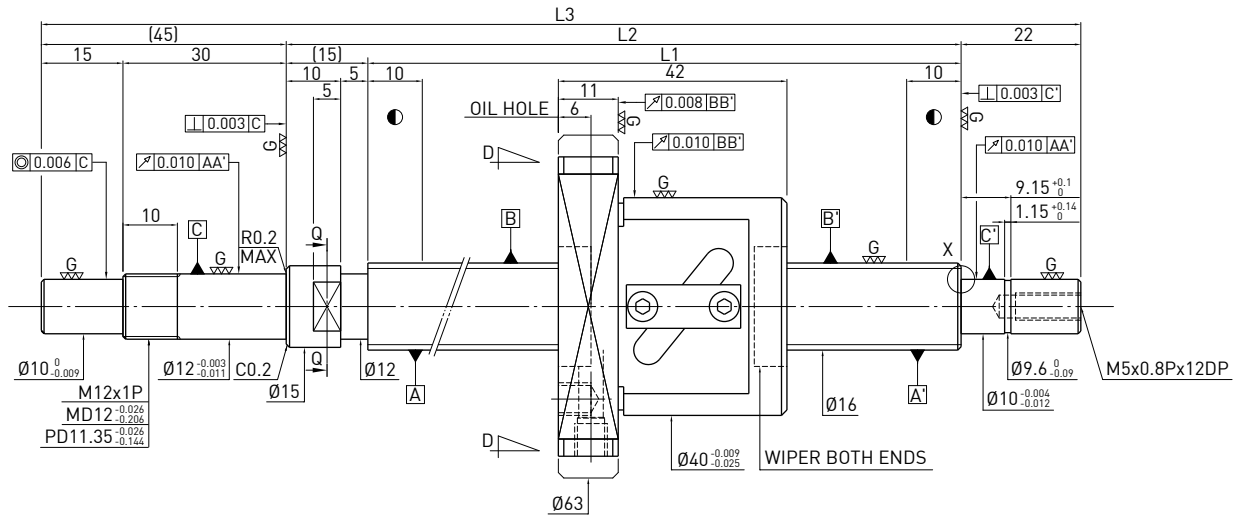
Unit : mm

| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 100    | R15-10B1-FSW-189-271-0.018   | 189  | 204  | 271  | 5              |
| 150    | R15-10B1-FSW-239-321-0.018   | 239  | 254  | 321  | 5              |
| 200    | R15-10B1-FSW-289-371-0.018   | 289  | 304  | 371  | 5              |
| 250    | R15-10B1-FSW-339-421-0.018   | 339  | 354  | 421  | 5              |
| 300    | R15-10B1-FSW-389-471-0.018   | 389  | 404  | 471  | 5              |
| 350    | R15-10B1-FSW-439-521-0.018   | 439  | 454  | 521  | 5              |
| 400    | R15-10B1-FSW-489-571-0.018   | 489  | 504  | 571  | 5              |
| 450    | R15-10B1-FSW-539-621-0.018   | 539  | 554  | 621  | 5              |
| 500    | R15-10B1-FSW-589-671-0.018   | 589  | 604  | 671  | 5              |
| 550    | R15-10B1-FSW-639-721-0.018   | 639  | 654  | 721  | 5              |
| 600    | R15-10B1-FSW-689-771-0.018   | 689  | 704  | 771  | 5              |
| 700    | R15-10B1-FSW-789-871-0.018   | 789  | 804  | 871  | 5              |
| 800    | R15-10B1-FSW-889-971-0.018   | 889  | 904  | 971  | 5              |
| 1000   | R15-10B1-FSW-1089-1171-0.018 | 1089 | 1104 | 1171 | 5              |

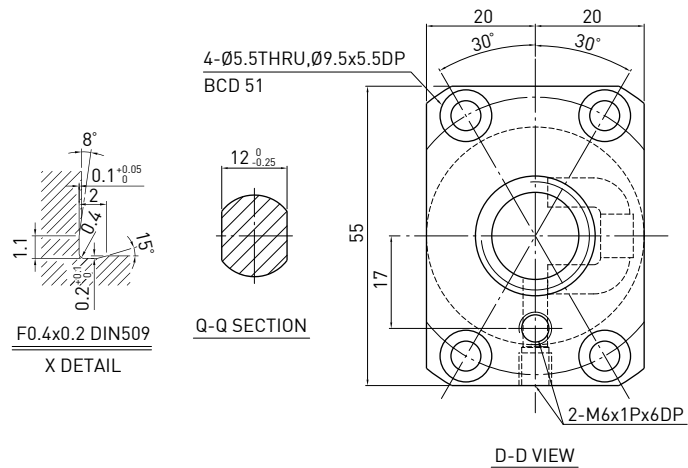


# TYPE (SHAFT OD 16, LEAD 5)

◀ Standard



| Ballscrew Data       |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 5          |               |
| Lead Angle           | 5.48°      |               |
| P.C.D (mm)           | 16.6       |               |
| Steel Ball (mm)      | Ø3.175     |               |
| Circuits             | 2.5x1      |               |
| Dynamic Load C (Kgf) | 481        | 763           |
| Static Load Co (Kgf) | 670        | 1399          |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.15~0.8   | ~0.2          |
| Spacer Ball          | 1 : 1      | -             |

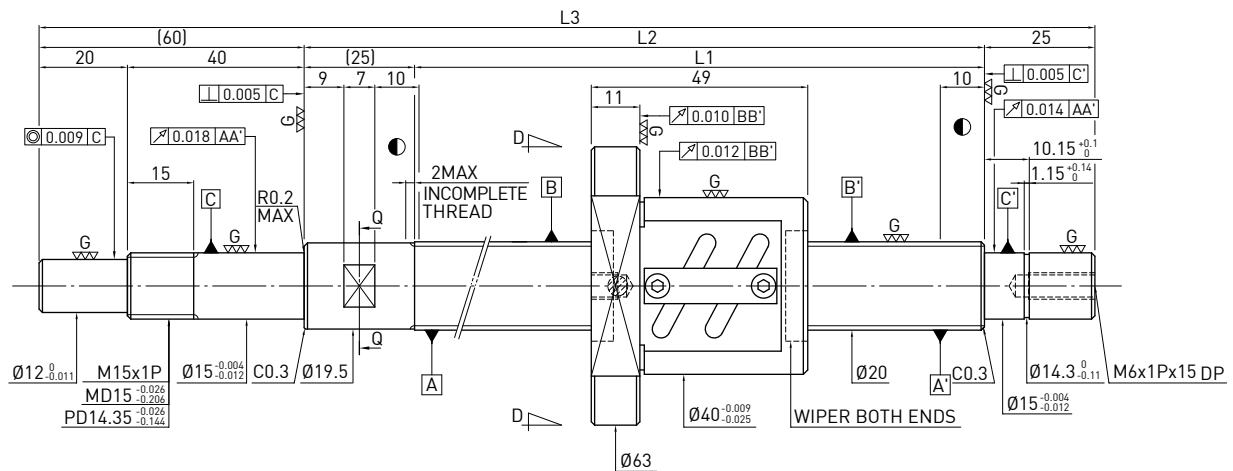


Unit : mm

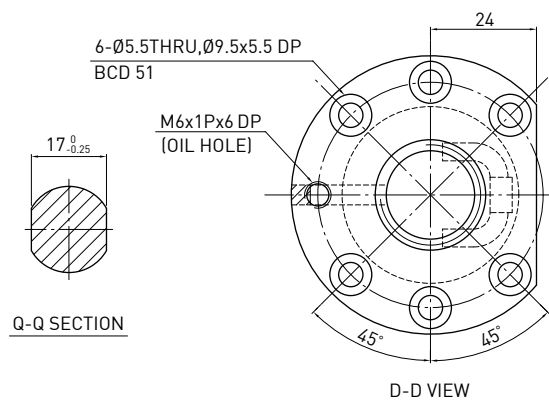
| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 100    | R16-5B1-FSW-189-271-0.018 | 189 | 204 | 271 | 5              |
| 200    | R16-5B1-FSW-289-371-0.018 | 289 | 304 | 371 | 5              |
| 300    | R16-5B1-FSW-389-471-0.018 | 389 | 404 | 471 | 5              |
| 400    | R16-5B1-FSW-489-571-0.018 | 489 | 504 | 571 | 5              |
| 600    | R16-5B1-FSW-689-771-0.018 | 689 | 704 | 771 | 5              |
| 800    | R16-5B1-FSW-889-971-0.018 | 889 | 904 | 971 | 5              |

**F S W TYPE** (SHAFT OD 20, LEAD 4)

◀ Standard



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 4          |
| Lead Angle           | 3.6°       |
| P.C.D (mm)           | 20.25      |
| Steel Ball (mm)      | Ø2.381     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 561        |
| Static Load Co (Kgf) | 1085       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 0.12~0.68  |
| Spacer Ball          | 1 : 1      |

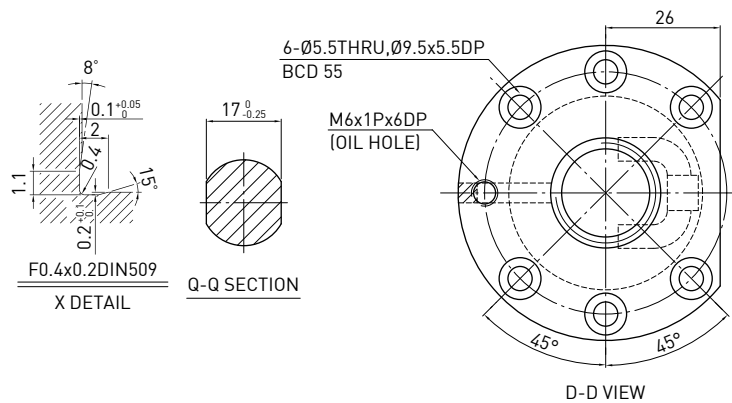
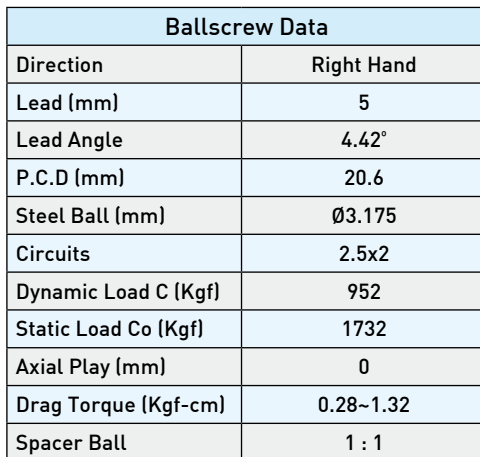


Unit : mm

| Stroke | HIWIN Code                 | L1  | L2  | L3  | Accuracy grade |
|--------|----------------------------|-----|-----|-----|----------------|
| 150    | R20-4B2-FSW-225-335-0.018  | 225 | 250 | 335 | 5              |
| 200    | R20-4B2-FSW-275-385-0.018  | 275 | 300 | 385 | 5              |
| 300    | R20-4B2-FSW-375-485-0.018  | 375 | 400 | 485 | 5              |
| 400    | R20-4B2-FSW-475-585-0.018  | 475 | 500 | 585 | 5              |
| 500    | R20-4B2-FSW-575-685-0.018  | 575 | 600 | 685 | 5              |
| 350    | R15-10B1-FSW-439-521-0.018 | 439 | 454 | 521 | 5              |



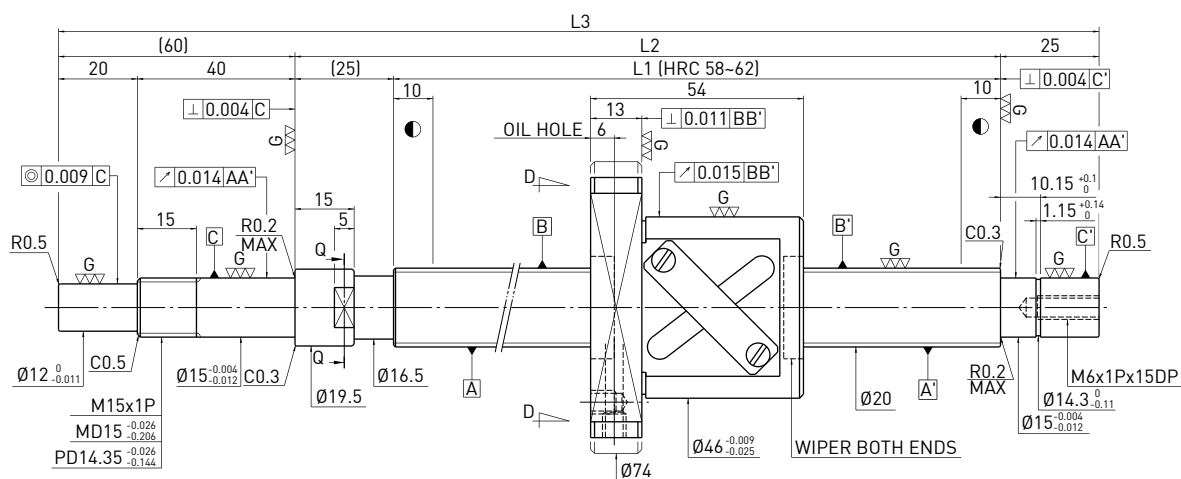
## ◀ Standard



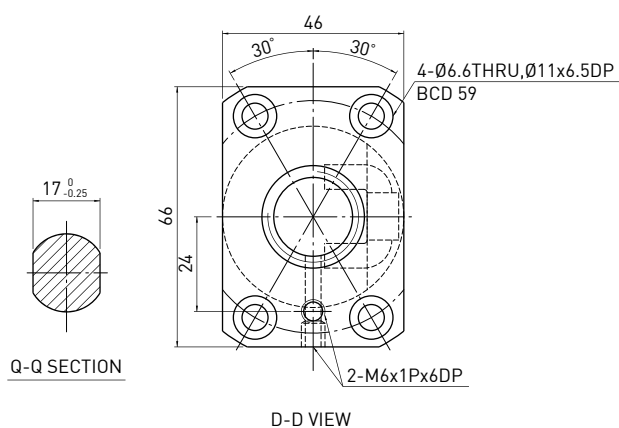
| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 150    | R20-5B2-FSW-225-335-0.018 | 225 | 250 | 335 | 5              |
| 200    | R20-5B2-FSW-275-385-0.018 | 275 | 300 | 385 | 5              |
| 300    | R20-5B2-FSW-375-485-0.018 | 375 | 400 | 485 | 5              |
| 400    | R20-5B2-FSW-475-585-0.018 | 475 | 500 | 585 | 5              |
| 500    | R20-5B2-FSW-575-685-0.018 | 575 | 600 | 685 | 5              |
| 700    | R20-5B2-FSW-775-885-0.018 | 775 | 800 | 885 | 5              |

**F S W TYPE** (SHAFT OD 20, LEAD 10)

◀ Standard



| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 10         |           |
| Lead Angle           | 8.7°       |           |
| P.C.D (mm)           | 20.8       |           |
| Steel Ball (mm)      | Ø3.969     |           |
| Circuits             | 2.5x1      |           |
| Dynamic Load C (Kgf) | 718        | 1139      |
| Static Load Co (Kgf) | 1094       | 2187      |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.2~1.2    | 0.3 MAX   |
| Spacer Ball          | 1 : 1      | -         |



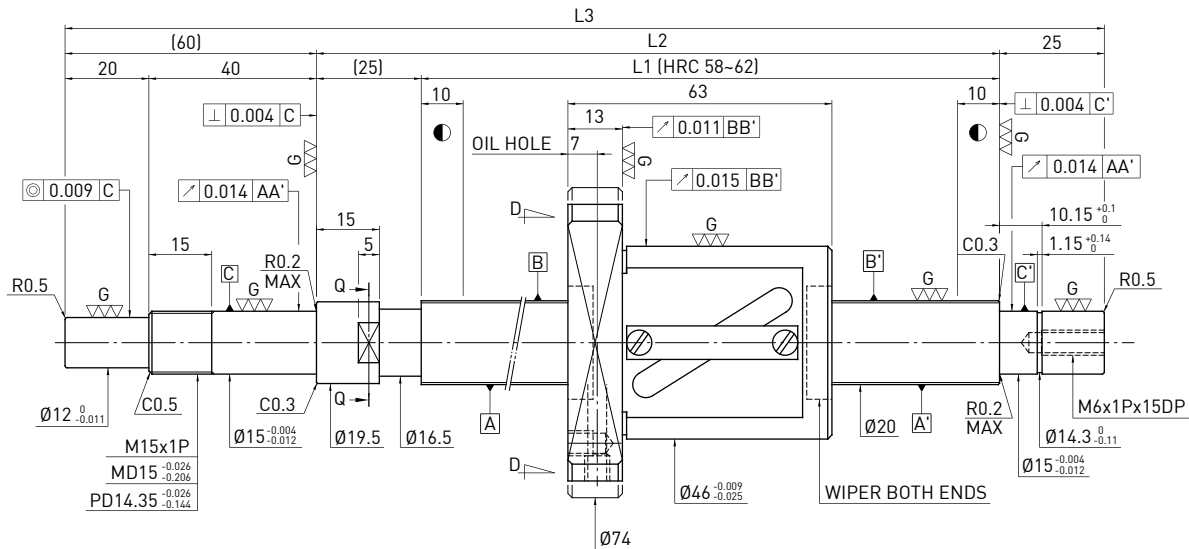
Unit : mm

| Stroke | HIWIN Code                      | L1   | L2   | L3   | Accuracy grade |
|--------|---------------------------------|------|------|------|----------------|
| 200    | R20-10B1-FSW- 289 - 399-0.018   | 289  | 314  | 399  | 5              |
| 300    | R20-10B1-FSW- 389 - 499-0.018   | 389  | 414  | 499  | 5              |
| 400    | R20-10B1-FSW- 489 - 599-0.018   | 489  | 514  | 599  | 5              |
| 500    | R20-10B1-FSW- 589 - 699-0.018   | 589  | 614  | 699  | 5              |
| 600    | R20-10B1-FSW- 689 - 799-0.018   | 689  | 714  | 799  | 5              |
| 700    | R20-10B1-FSW- 789 - 899-0.018   | 789  | 814  | 899  | 5              |
| 800    | R20-10B1-FSW- 889 -999-0.018    | 889  | 914  | 999  | 5              |
| 900    | R20-10B1-FSW- 989 -1099-0.018   | 989  | 1014 | 1099 | 5              |
| 1000   | R20-10B1-FSW- 1089 -1199-0.018  | 1089 | 1114 | 1199 | 5              |
| 1100   | R20-10B1-FSW- 1189 - 1299-0.018 | 1189 | 1214 | 1299 | 5              |
| 1400   | R20-10B1-FSW- 1289 -1399-0.018  | 1289 | 1314 | 1399 | 5              |

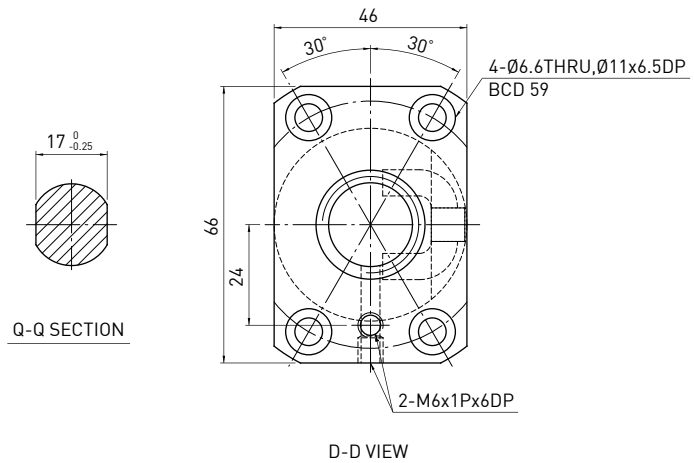


# TYPE (SHAFT OD 20, LEAD 20)

Standard



| Ball screw Data      |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 20         |           |
| Lead Angle           | 17.01°     |           |
| P.C.D (mm)           | 20.8       |           |
| Steel Ball (mm)      | Ø3.969     |           |
| Circuits             | 1.5x1      |           |
| Dynamic Load C (Kgf) | 453        | 719       |
| Static Load Co (Kgf) | 641        | 1280      |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.2~1.2    | 0.3 MAX   |
| Spacer Ball          | 1 : 1      | -         |

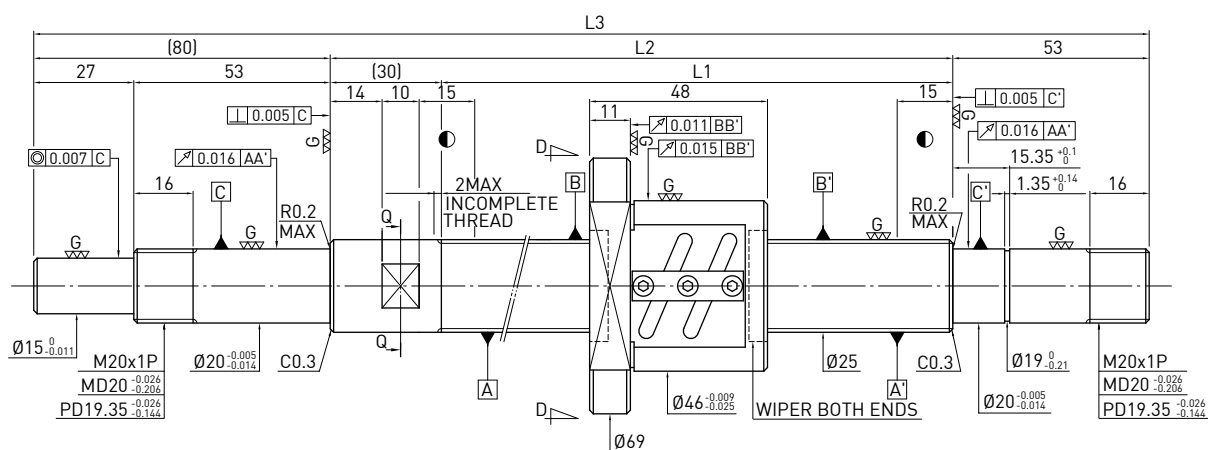


Unit : mm

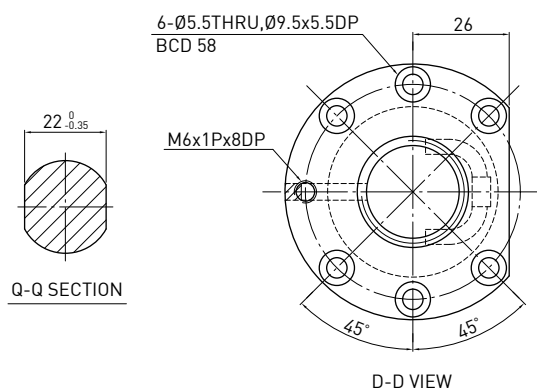
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 200    | R20-20A1-FSW-310-420-0.018   | 310  | 335  | 420  | 5              |
| 300    | R20-20A1-FSW-410-520-0.018   | 410  | 435  | 520  | 5              |
| 400    | R20-20A1-FSW-510-620-0.018   | 510  | 535  | 620  | 5              |
| 500    | R20-20A1-FSW-610-720-0.018   | 610  | 635  | 720  | 5              |
| 600    | R20-20A1-FSW-710-820-0.018   | 710  | 735  | 820  | 5              |
| 700    | R20-20A1-FSW-810-920-0.018   | 810  | 835  | 920  | 5              |
| 800    | R20-20A1-FSW-910-1020-0.018  | 910  | 935  | 1020 | 5              |
| 900    | R20-20A1-FSW-1010-1120-0.018 | 1010 | 1035 | 1120 | 5              |
| 1000   | R20-20A1-FSW-1110-1220-0.018 | 1110 | 1135 | 1220 | 5              |
| 1100   | R20-20A1-FSW-1210-1320-0.018 | 1210 | 1235 | 1320 | 5              |
| 1400   | R20-20A1-FSW-1510-1620-0.018 | 1510 | 1535 | 1620 | 5              |

**F S W TYPE** (SHAFT OD 25, LEAD 4)

◀ Standard

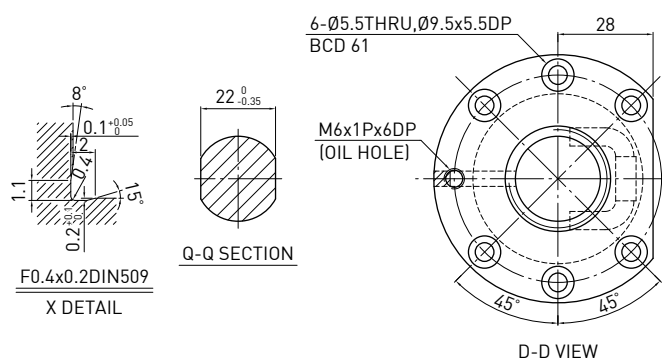
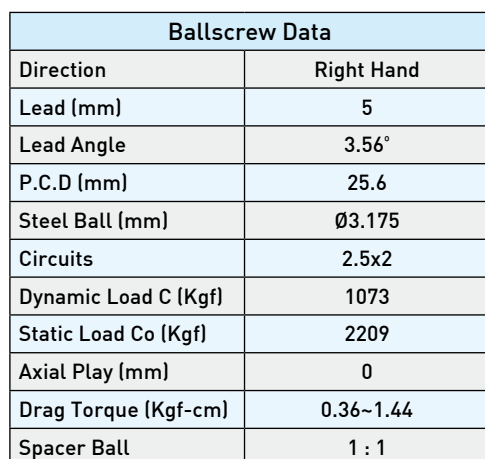


| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 4          |
| Lead Angle           | 2.89°      |
| P.C.D (mm)           | 25.25      |
| Steel Ball (mm)      | Ø2.381     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 622        |
| Static Load Co (Kgf) | 1376       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 0.15~0.85  |
| Spacer Ball          | 1 : 1      |

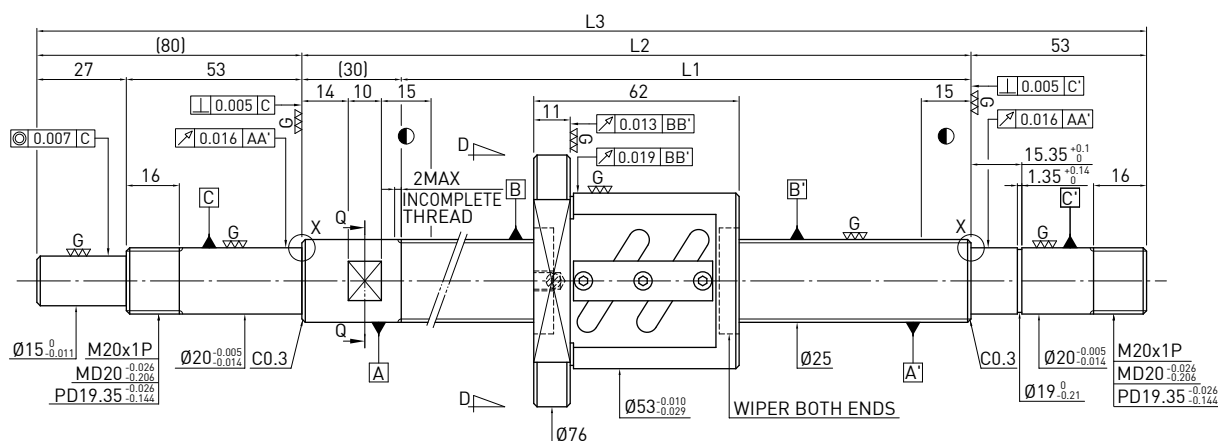


Unit : mm

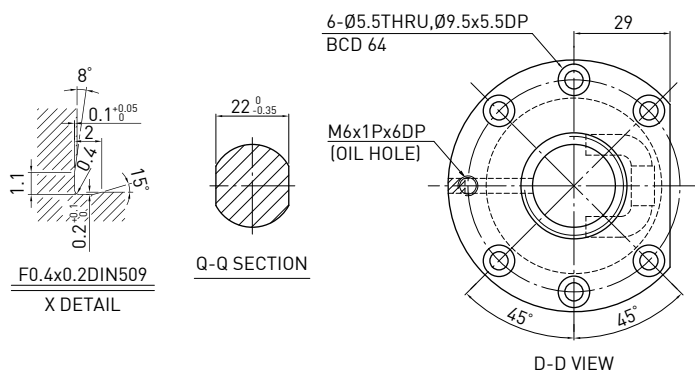
| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 150    | R25-4B2-FSW-220-349-0.018 | 220 | 250 | 349 | 5              |
| 200    | R25-4B2-FSW-270-399-0.018 | 270 | 300 | 399 | 5              |
| 300    | R25-4B2-FSW-370-499-0.018 | 370 | 400 | 499 | 5              |
| 400    | R25-4B2-FSW-470-599-0.018 | 470 | 500 | 599 | 5              |
| 500    | R25-4B2-FSW-570-733-0.018 | 570 | 600 | 733 | 5              |



| Stroke | HIWIN Code                  | L1   | L2   | L3   | Accuracy grade |
|--------|-----------------------------|------|------|------|----------------|
| 150    | R25-5B2-FSW-220-349-0.018   | 220  | 250  | 349  | 5              |
| 200    | R25-5B2-FSW-270-399-0.018   | 270  | 300  | 399  | 5              |
| 300    | R25-5B2-FSW-370-499-0.018   | 370  | 400  | 499  | 5              |
| 400    | R25-5B2-FSW-470-599-0.018   | 470  | 500  | 599  | 5              |
| 500    | R25-5B2-FSW-570-733-0.018   | 570  | 600  | 733  | 5              |
| 600    | R25-5B2-FSW-670-833-0.018   | 670  | 700  | 833  | 5              |
| 700    | R25-5B2-FSW-770-933-0.018   | 770  | 800  | 933  | 5              |
| 900    | R25-5B2-FSW-970-1133-0.018  | 970  | 1000 | 1133 | 5              |
| 1000   | R25-5B2-FSW-1170-1333-0.018 | 1170 | 1200 | 1333 | 5              |



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 6          |
| Lead Angle           | 4.23°      |
| P.C.D (mm)           | 25.8       |
| Steel Ball (mm)      | Ø3.969     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 1453       |
| Static Load Co (Kgf) | 2761       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 0.42~2.4   |
| Spacer Ball          | 1 : 1      |

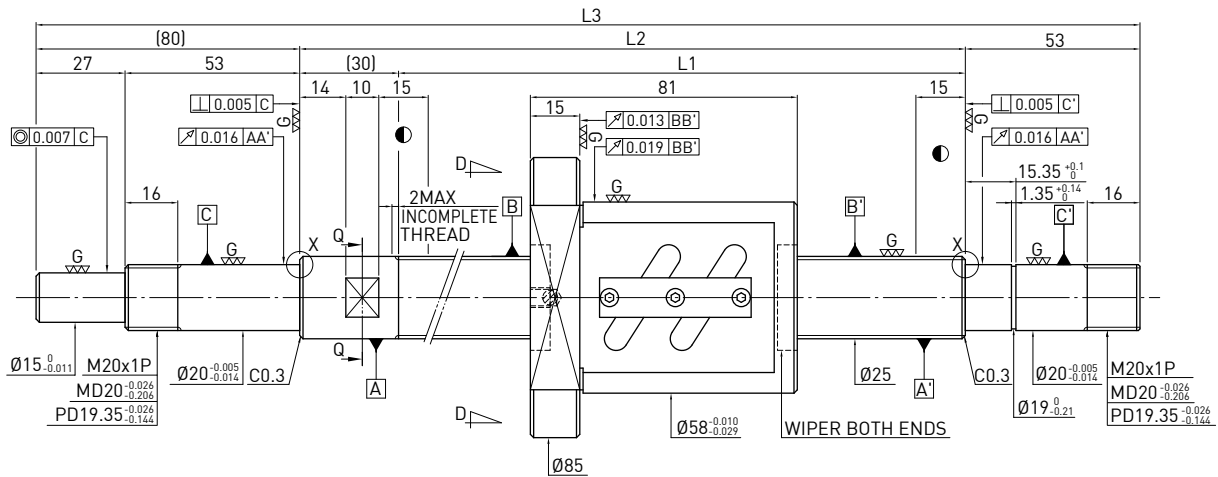


Unit : mm

| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 250    | R25-6B2-FSW-370-533-0.018 | 370 | 400 | 533 | 5              |
| 450    | R25-6B2-FSW-570-733-0.018 | 570 | 600 | 733 | 5              |
| 650    | R25-6B2-FSW-770-933-0.018 | 770 | 800 | 933 | 5              |

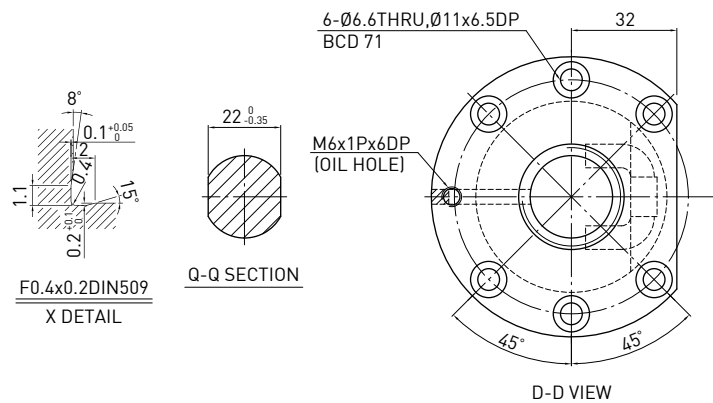
**F S W TYPE** (SHAFT OD 25, LEAD 10)

◀ Standard



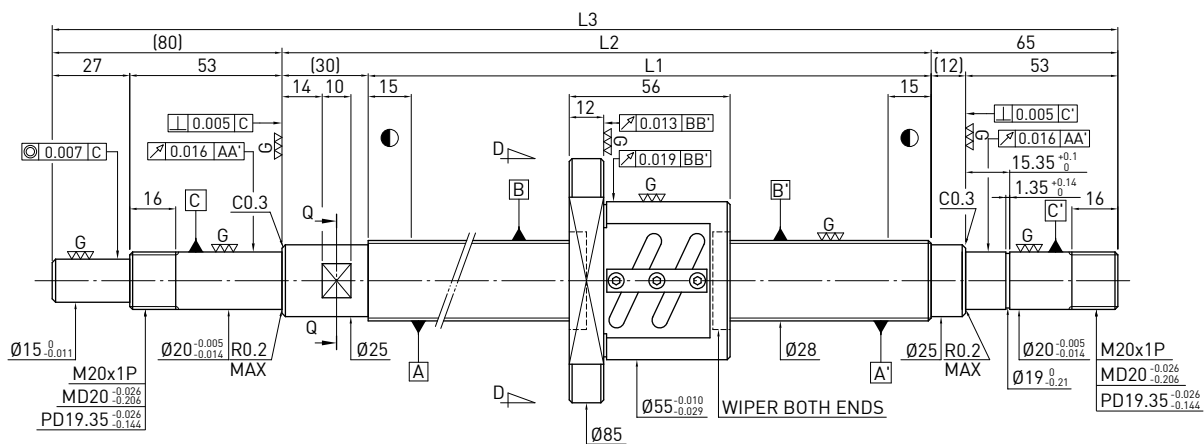
**Ballscrew Data**

| Direction            | Right Hand |
|----------------------|------------|
| Lead (mm)            | 10         |
| Lead Angle           | 6.98°      |
| P.C.D (mm)           | 26         |
| Steel Ball (mm)      | Ø4.763     |
| Circuits             | 1.5x2      |
| Dynamic Load C (Kgf) | 1164       |
| Static Load Co (Kgf) | 1927       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 0.42~2.4   |
| Spacer Ball          | 1 : 1      |

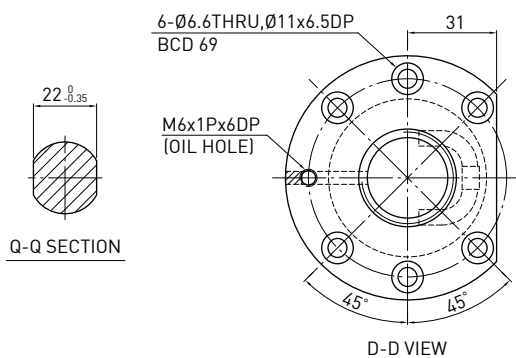


Unit : mm

| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 250    | R25-10A2-FSW-370-533-0.018   | 370  | 400  | 533  | 5              |
| 450    | R25-10A2-FSW-570-733-0.018   | 570  | 600  | 733  | 5              |
| 650    | R25-10A2-FSW-770-933-0.018   | 770  | 800  | 933  | 5              |
| 850    | R25-10A2-FSW-970-1133-0.018  | 970  | 1000 | 1133 | 5              |
| 1050   | R25-10A2-FSW-1170-1333-0.018 | 1170 | 1200 | 1333 | 5              |



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 5          |
| Lead Angle           | 3.19°      |
| P.C.D (mm)           | 28.6       |
| Steel Ball (mm)      | Ø3.175     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 1124       |
| Static Load Co (Kgf) | 2466       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 0.3~1.7    |
| Spacer Ball          | 1 : 1      |



Unit : mm

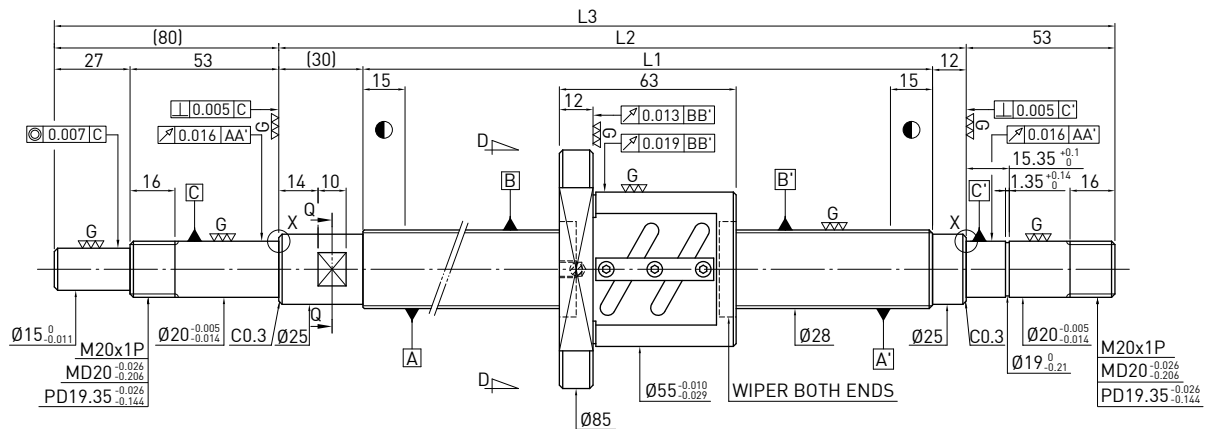
| Stroke | HIWIN Code                  | L1   | L2   | L3   | Accuracy grade |
|--------|-----------------------------|------|------|------|----------------|
| 200    | R28-5B2-FSW-270-399-0.018   | 270  | 300  | 399  | 5              |
| 300    | R28-5B2-FSW-370-499-0.018   | 370  | 400  | 499  | 5              |
| 400    | R28-5B2-FSW-470-599-0.018   | 470  | 500  | 599  | 5              |
| 450    | R28-5B2-FSW-558-733-0.018   | 558  | 600  | 733  | 5              |
| 650    | R28-5B2-FSW-758-933-0.018   | 758  | 800  | 933  | 5              |
| 850    | R28-5B2-FSW-958-1133-0.018  | 958  | 1000 | 1133 | 5              |
| 1050   | R28-5B2-FSW-1158-1333-0.018 | 1158 | 1200 | 1333 | 5              |



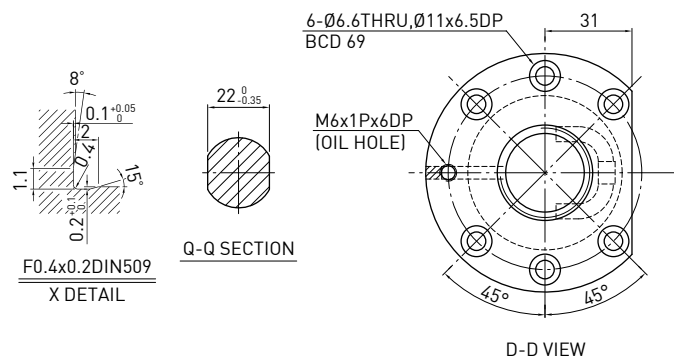


# TYPE (SHAFT OD 28, LEAD 6)

◀ Standard

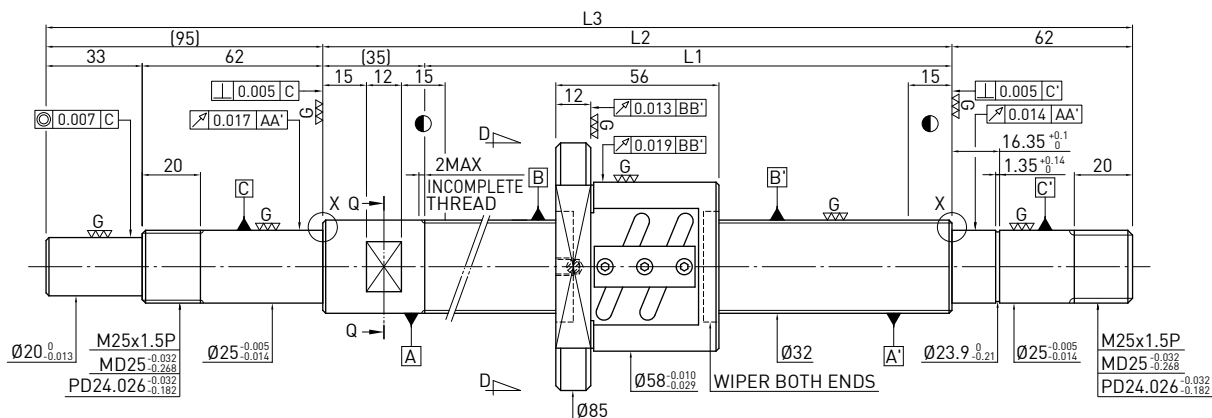


| Ball screw Data      |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 6          |
| Lead Angle           | 3.82°      |
| P.C.D (mm)           | 28.6       |
| Steel Ball (mm)      | Ø3.175     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 1124       |
| Static Load Co (Kgf) | 2466       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 0.36~2.04  |
| Spacer Ball          | 1 : 1      |

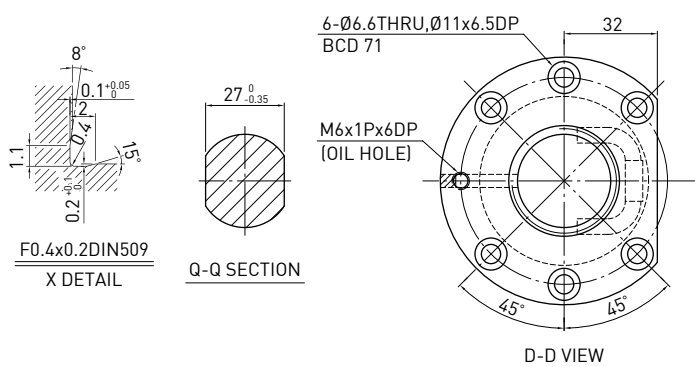


Unit : mm

| Stroke | HIWIN Code                  | L1   | L2   | L3   | Accuracy grade |
|--------|-----------------------------|------|------|------|----------------|
| 250    | R28-6B2-FSW-370-499-0.018   | 370  | 400  | 499  | 5              |
| 450    | R28-6B2-FSW-570-699-0.018   | 570  | 600  | 699  | 5              |
| 650    | R28-6B2-FSW-758-933-0.018   | 758  | 800  | 933  | 5              |
| 850    | R28-6B2-FSW-958-1133-0.018  | 958  | 1000 | 1133 | 5              |
| 1050   | R28-6B2-FSW-1158-1333-0.018 | 1158 | 1200 | 1333 | 5              |



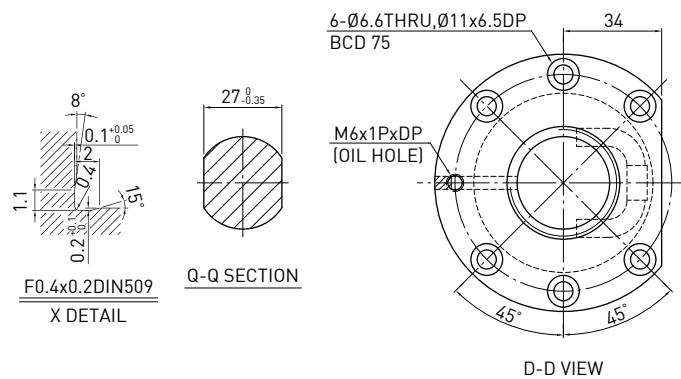
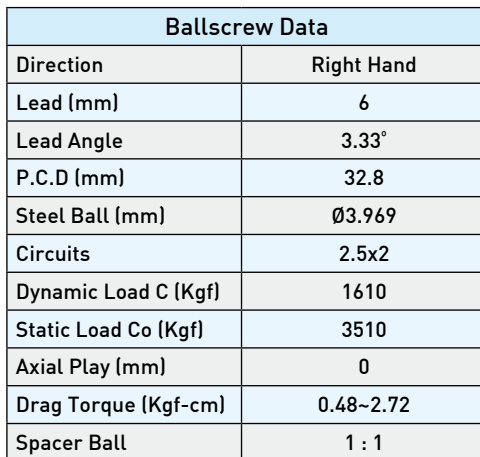
| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 5          |
| Lead Angle           | 2.79°      |
| P.C.D (mm)           | 32.6       |
| Steel Ball (mm)      | Ø3.175     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 1188       |
| Static Load Co (Kgf) | 2833       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 0.48~1.92  |
| Spacer Ball          | 1 : 1      |



Unit : mm

| Stroke | HIWIN Code                  | L1   | L2   | L3   | Accuracy grade |
|--------|-----------------------------|------|------|------|----------------|
| 150    | R32-5B2-FSW-265-415-0.018   | 265  | 300  | 415  | 5              |
| 250    | R32-5B2-FSW-365-515-0.018   | 365  | 400  | 515  | 5              |
| 350    | R32-5B2-FSW-465-615-0.018   | 465  | 500  | 615  | 5              |
| 450    | R32-5B2-FSW-565-715-0.018   | 565  | 600  | 715  | 5              |
| 550    | R32-5B2-FSW-665-857-0.018   | 665  | 700  | 857  | 5              |
| 650    | R32-5B2-FSW-765-957-0.018   | 765  | 800  | 957  | 5              |
| 850    | R32-5B2-FSW-965-1157-0.018  | 965  | 1000 | 1157 | 5              |
| 1050   | R32-5B2-FSW-1165-1357-0.018 | 1165 | 1200 | 1357 | 5              |

## ◀ Standard

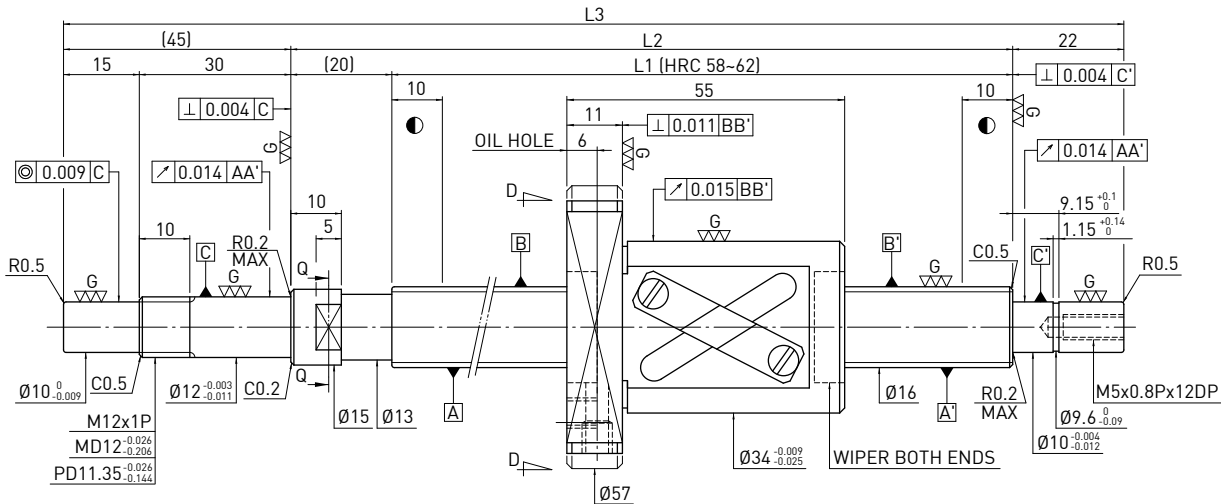


| Stroke | HIWIN Code                  | L1   | L2   | L3   | Accuracy grade |
|--------|-----------------------------|------|------|------|----------------|
| 250    | R32-6B2-FSW-365-515-0.018   | 365  | 400  | 515  | 5              |
| 450    | R32-6B2-FSW-565-715-0.018   | 565  | 600  | 715  | 5              |
| 650    | R32-6B2-FSW-765-957-0.018   | 765  | 800  | 957  | 5              |
| 850    | R32-6B2-FSW-965-1157-0.018  | 965  | 1000 | 1157 | 5              |
| 1050   | R32-6B2-FSW-1165-1357-0.018 | 1165 | 1200 | 1357 | 5              |
| 1350   | R32-6B2-FSW-1465-1657-0.018 | 1465 | 1500 | 1657 | 5              |

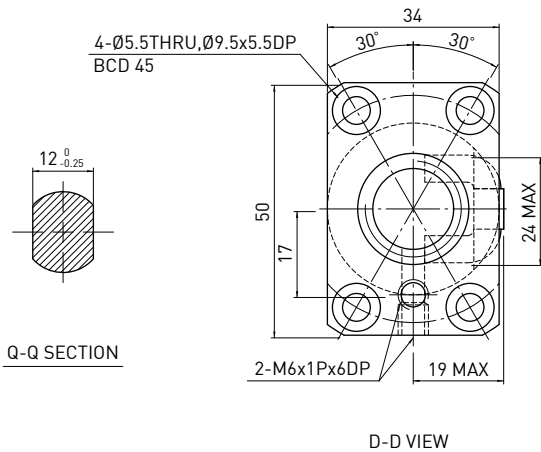


**TYPE** (SHAFT OD 16, LEAD 16)

◀ Standard



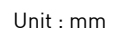
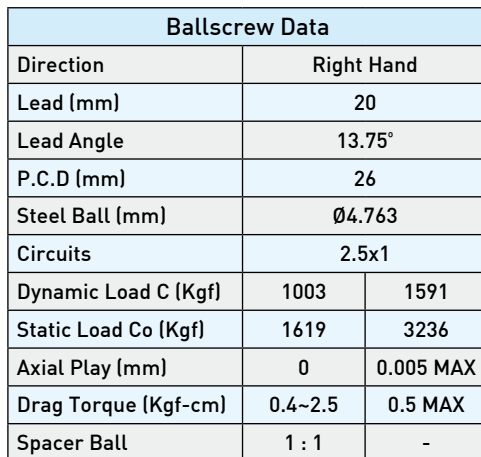
| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 16         |           |
| Lead Angle           | 17.05°     |           |
| P.C.D (mm)           | 16.6       |           |
| Steel Ball (mm)      | Ø3.175     |           |
| Circuits             | 1.5x1      |           |
| Dynamic Load C (Kgf) | 304        | 481       |
| Static Load Co (Kgf) | 410        | 819       |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.15~0.79  | 0.24 MAX  |
| Spacer Ball          | 1 : 1      | -         |



Unit : mm

| Stroke | HIWIN Code                  | L1  | L2  | L3  | Accuracy grade |
|--------|-----------------------------|-----|-----|-----|----------------|
| 100    | R16-16A1-FSV-184- 271-0.018 | 184 | 204 | 271 | 5              |
| 150    | R16-16A1-FSV-234- 321-0.018 | 234 | 254 | 321 | 5              |
| 200    | R16-16A1-FSV-284- 371-0.018 | 284 | 304 | 371 | 5              |
| 250    | R16-16A1-FSV-334- 421-0.018 | 334 | 354 | 421 | 5              |
| 300    | R16-16A1-FSV-384- 471-0.018 | 384 | 404 | 471 | 5              |
| 350    | R16-16A1-FSV-434- 521-0.018 | 434 | 454 | 521 | 5              |
| 400    | R16-16A1-FSV-484- 571-0.018 | 484 | 504 | 571 | 5              |
| 450    | R16-16A1-FSV-534- 621-0.018 | 534 | 554 | 621 | 5              |
| 500    | R16-16A1-FSV-584- 671-0.018 | 584 | 604 | 671 | 5              |
| 550    | R16-16A1-FSV-634- 721-0.018 | 634 | 654 | 721 | 5              |
| 600    | R16-16A1-FSV- 684-771-0.018 | 684 | 704 | 771 | 5              |
| 700    | R16-16A1-FSV- 784-871-0.018 | 784 | 804 | 871 | 5              |
| 800    | R16-16A1-FSV- 884-971-0.018 | 884 | 904 | 971 | 5              |

## ◀ Standard

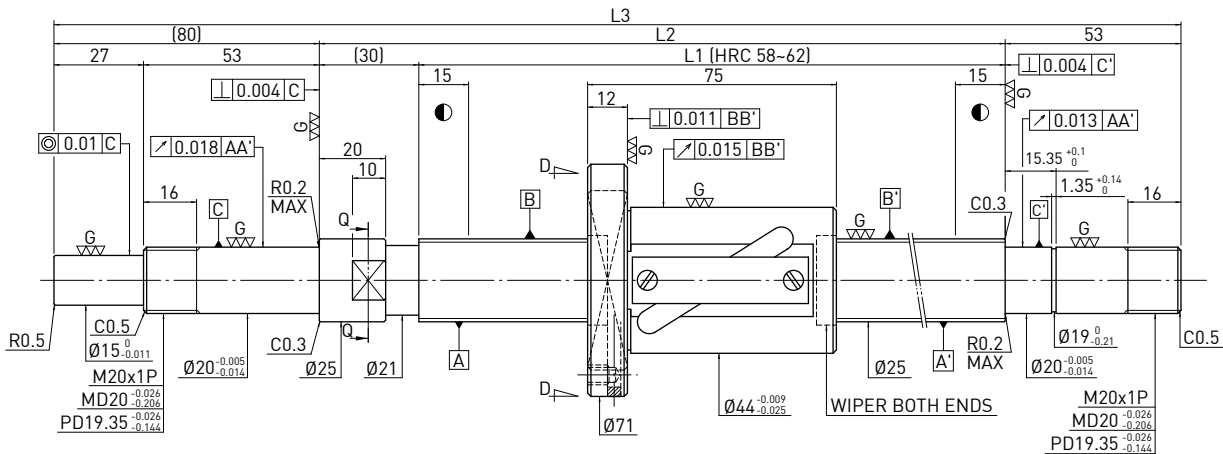


| Stroke | HIWIN Code                     | L1   | L2   | L3   | Accuracy grade |
|--------|--------------------------------|------|------|------|----------------|
| 600    | R25-20B1-FSV- 750- 913-0.018   | 750  | 780  | 913  | 5              |
| 800    | R25-20B1-FSV- 950- 1113-0.018  | 950  | 980  | 1113 | 5              |
| 1000   | R25-20B1-FSV- 1150- 1313-0.018 | 1150 | 1180 | 1313 | 5              |
| 1200   | R25-20B1-FSV- 1350- 1513-0.018 | 1350 | 1380 | 1513 | 5              |
| 1400   | R25-20B1-FSV- 1550- 1713-0.018 | 1550 | 1580 | 1713 | 5              |
| 1600   | R25-20B1-FSV- 1750- 1913-0.018 | 1750 | 1780 | 1913 | 5              |

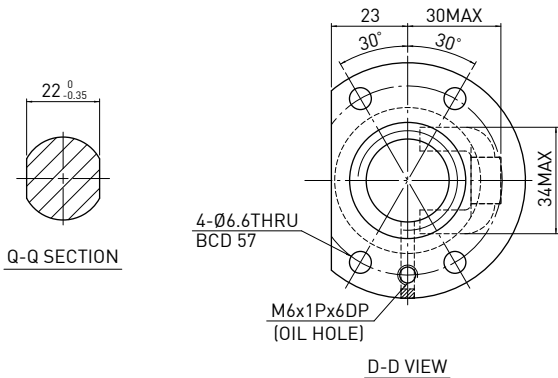


**TYPE** (SHAFT OD 25, LEAD 25)

◀ Standard



| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 25         |           |
| Lead Angle           | 17.01°     |           |
| P.C.D (mm)           | 26         |           |
| Steel Ball (mm)      | Ø4.763     |           |
| Circuits             | 1.5x1      |           |
| Dynamic Load C (Kgf) | 642        | 1018      |
| Static Load Co (Kgf) | 964        | 1926      |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.4~2.5    | 0.25 MAX  |
| Spacer Ball          | 1 : 1      | -         |

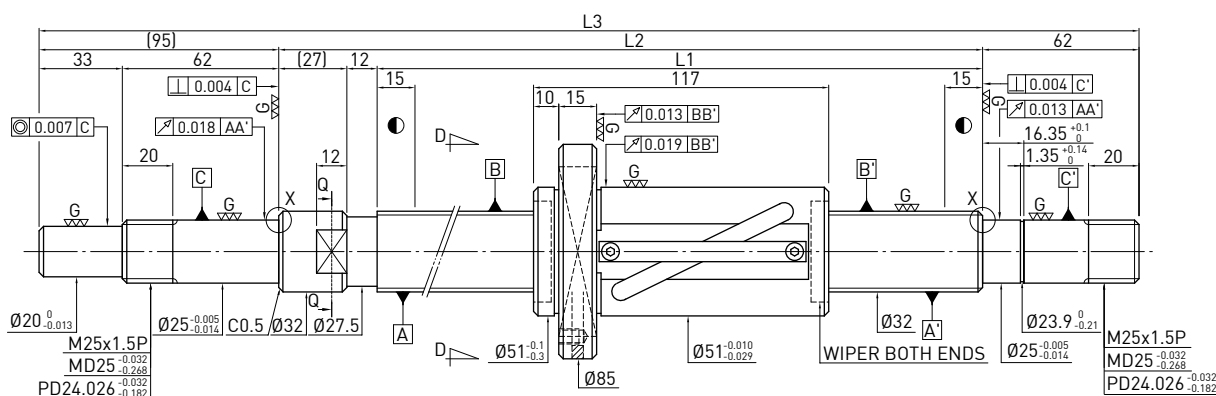


Unit : mm

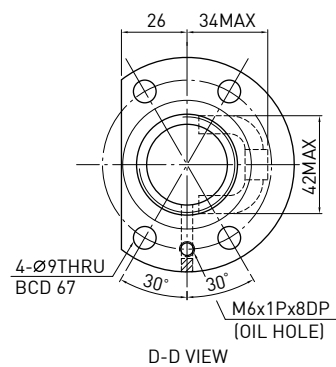
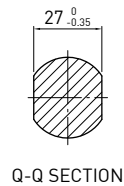
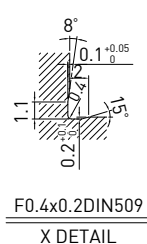
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 600    | R25-25A1-FSV-750-913-0.018   | 750  | 780  | 913  | 5              |
| 800    | R25-25A1-FSV-950-1113-0.018  | 950  | 980  | 1113 | 5              |
| 1000   | R25-25A1-FSV-1150-1313-0.018 | 1150 | 1180 | 1313 | 5              |
| 1200   | R25-25A1-FSV-1350-1513-0.018 | 1350 | 1380 | 1513 | 5              |
| 1400   | R25-25A1-FSV-1550-1713-0.018 | 1550 | 1580 | 1713 | 5              |
| 1600   | R25-25A1-FSV-1750-1913-0.018 | 1750 | 1780 | 1913 | 5              |
| 2000   | R25-25A1-FSV-2150-2313-0.018 | 2150 | 2180 | 2313 | 5              |

**F S V TYPE** (SHAFT OD 32, LEAD 25)

◀ Standard



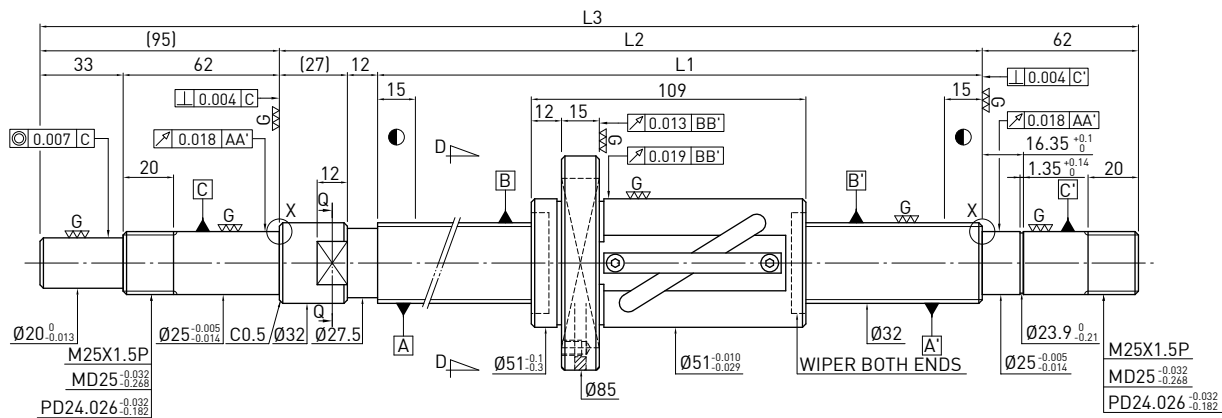
| Ballscrew Data       |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 25         |               |
| Lead Angle           | 13.56°     |               |
| P.C.D (mm)           | 33         |               |
| Steel Ball (mm)      | Ø4.763     |               |
| Circuits             | 2.5x1      |               |
| Dynamic Load C (Kgf) | 1140       | 1809          |
| Static Load Co (Kgf) | 2113       | 4226          |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.69~3.21  | ~0.8          |
| Spacer Ball          | 1 : 1      | -             |



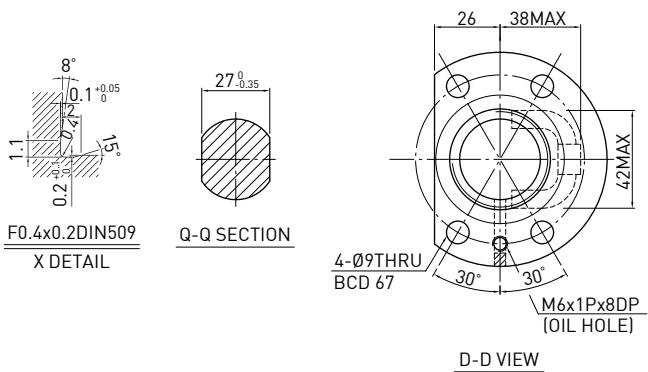
Unit : mm

| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 1000   | R32-25B1-FSV-1180-1376-0.018 | 1180 | 1219 | 1376 | 5              |
| 1500   | R32-25B1-FSV-1680-1876-0.018 | 1680 | 1719 | 1876 | 5              |
| 2000   | R32-25B1-FSV-2180-2376-0.018 | 2180 | 2219 | 2376 | 5              |
| 2600   | R32-25B1-FSV-2780-2976-0.018 | 2780 | 2819 | 2976 | 5              |

## ◀ Standard



| Ballscrew Data       |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 32         |               |
| Lead Angle           | 17.15°     |               |
| P.C.D (mm)           | 33         |               |
| Steel Ball (mm)      | Ø4.763     |               |
| Circuits             | 1.5x1      |               |
| Dynamic Load C (Kgf) | 726        | 1153          |
| Static Load Co (Kgf) | 1252       | 2504          |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.7~3.21   | ~0.8          |
| Spacer Ball          | 1 : 1      | -             |

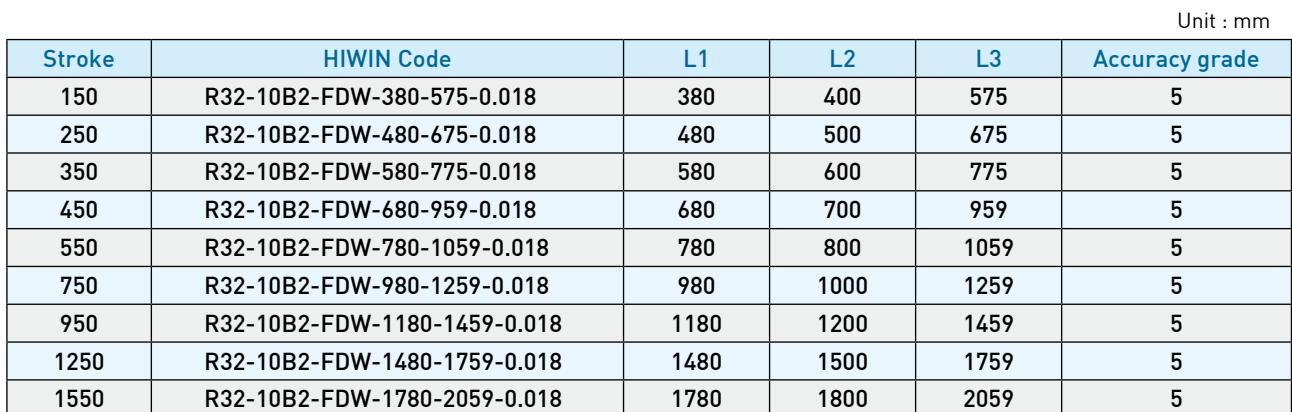
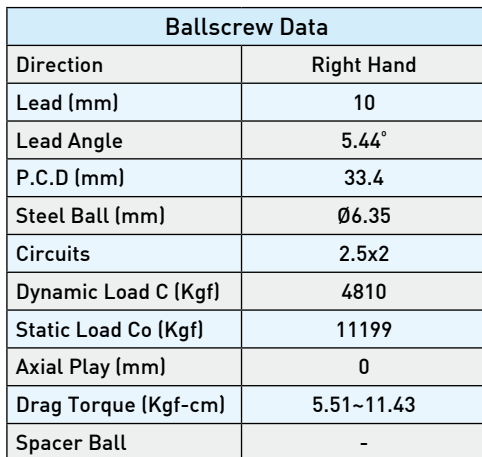


Unit : mm

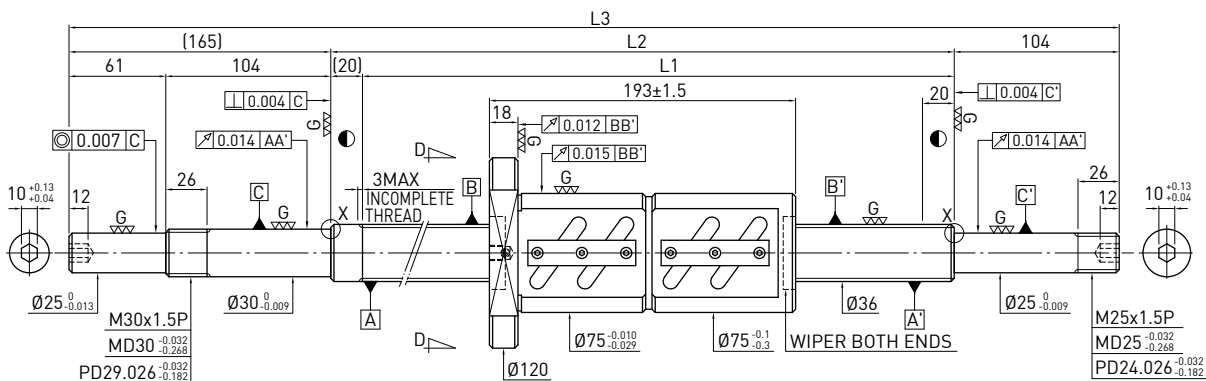
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 1000   | R32-32A1-FSV-1180-1376-0.018 | 1180 | 1219 | 1376 | 5              |
| 1500   | R32-32A1-FSV-1680-1876-0.018 | 1680 | 1719 | 1876 | 5              |
| 2000   | R32-32A1-FSV-2180-2376-0.018 | 2180 | 2219 | 2376 | 5              |
| 2600   | R32-32A1-FSV-2780-2976-0.018 | 2780 | 2819 | 2976 | 5              |



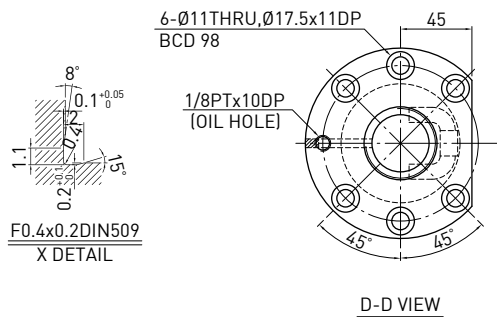
## ◀ Standard



## ◀ Standard



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 10         |
| Lead Angle           | 4.86°      |
| P.C.D (mm)           | 37.4       |
| Steel Ball (mm)      | Ø6.35      |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 5105       |
| Static Load Co (Kgf) | 12668      |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 6.64~12.34 |
| Spacer Ball          | -          |

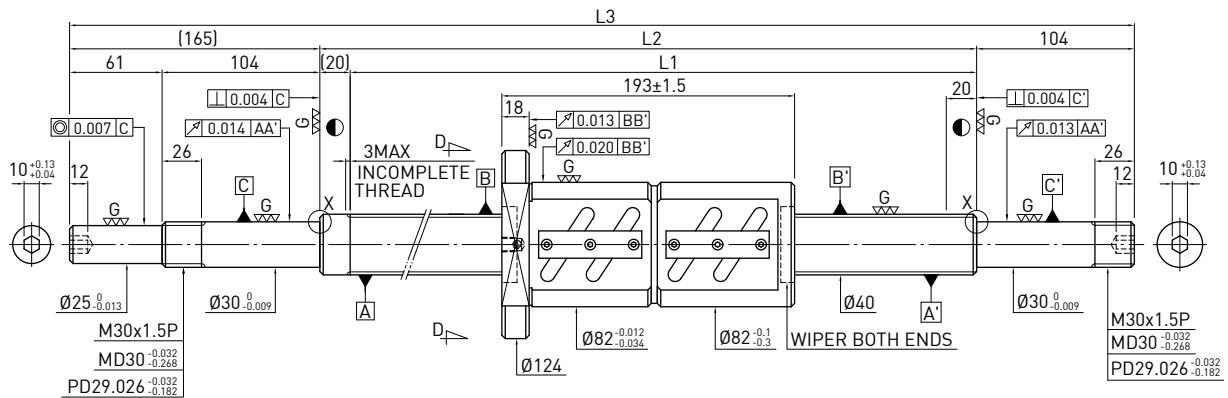


Unit : mm

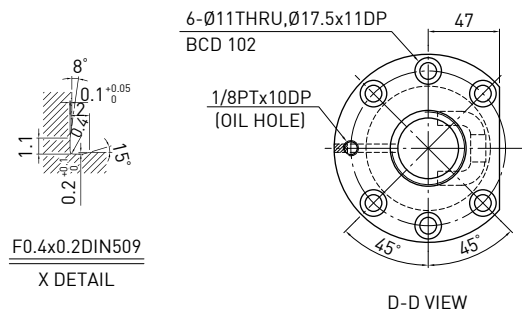
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 250    | R36-10B2-FDW-480-685-0.018   | 480  | 500  | 685  | 5              |
| 450    | R36-10B2-FDW-680-885-0.018   | 680  | 700  | 885  | 5              |
| 750    | R36-10B2-FDW-980-1269-0.018  | 980  | 1000 | 1269 | 5              |
| 1150   | R36-10B2-FDW-1380-1669-0.018 | 1380 | 1400 | 1669 | 5              |
| 1550   | R36-10B2-FDW-1780-2069-0.018 | 1780 | 1800 | 2069 | 5              |

**F D W TYPE** (SHAFT OD 40, LEAD 10)

◀ Standard



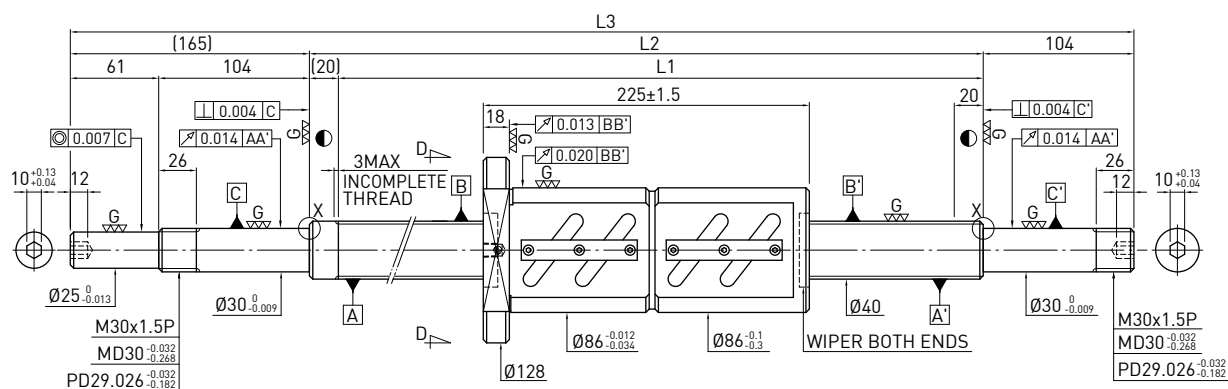
| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 10         |
| Lead Angle           | 4.4°       |
| P.C.D (mm)           | 41.4       |
| Steel Ball (mm)      | Ø6.35      |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 5369       |
| Static Load Co (Kgf) | 14138      |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 8.26~13.78 |
| Spacer Ball          | -          |



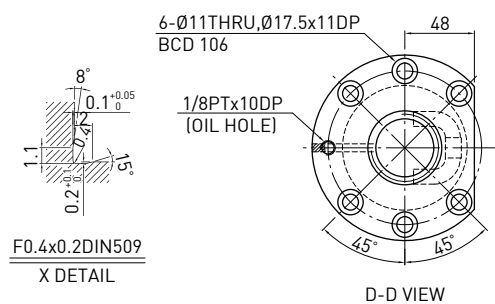
Unit : mm

| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 250    | R40-10B2-FDW-480-687-0.018   | 480  | 500  | 687  | 5              |
| 350    | R40-10B2-FDW-580-787-0.018   | 580  | 600  | 787  | 5              |
| 450    | R40-10B2-FDW-680-887-0.018   | 680  | 700  | 887  | 5              |
| 550    | R40-10B2-FDW-780-1069-0.018  | 780  | 800  | 1069 | 5              |
| 750    | R40-10B2-FDW-980-1269-0.018  | 980  | 1000 | 1269 | 5              |
| 950    | R40-10B2-FDW-1180-1469-0.018 | 1180 | 1200 | 1469 | 5              |
| 1150   | R40-10B2-FDW-1380-1669-0.018 | 1380 | 1400 | 1669 | 5              |
| 1350   | R40-10B2-FDW-1580-1869-0.018 | 1580 | 1600 | 1869 | 5              |
| 1550   | R40-10B2-FDW-1780-2069-0.018 | 1780 | 1800 | 2069 | 5              |
| 2150   | R40-10B2-FDW-2380-2669-0.018 | 2380 | 2400 | 2669 | 5              |

## ◀ Standard



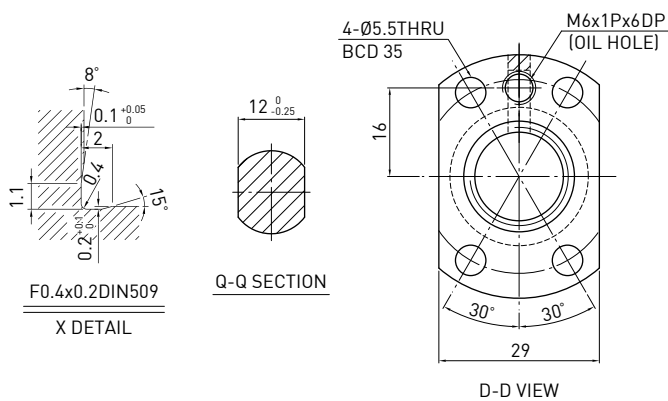
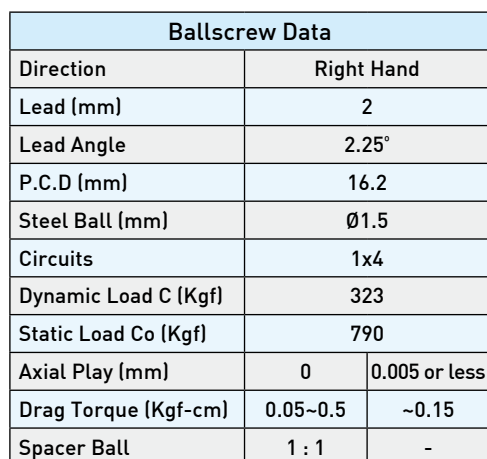
| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 12         |
| Lead Angle           | 5.25°      |
| P.C.D (mm)           | 41.6       |
| Steel Ball (mm)      | Ø7.144     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 6216       |
| Static Load Co (Kgf) | 15614      |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 9.79~18.17 |
| Spacer Ball          | -          |



Unit : mm

| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 400    | R40-12B2-FDW-680-969-0.018   | 680  | 700  | 969  | 5              |
| 700    | R40-12B2-FDW-980-1269-0.018  | 980  | 1000 | 1269 | 5              |
| 1100   | R40-12B2-FDW-1380-1669-0.018 | 1380 | 1400 | 1669 | 5              |
| 1500   | R40-12B2-FDW-1780-2069-0.018 | 1780 | 1800 | 2069 | 5              |
| 2200   | R40-12B2-FDW-2480-2769-0.018 | 2480 | 2500 | 2769 | 5              |

## ◀ Standard



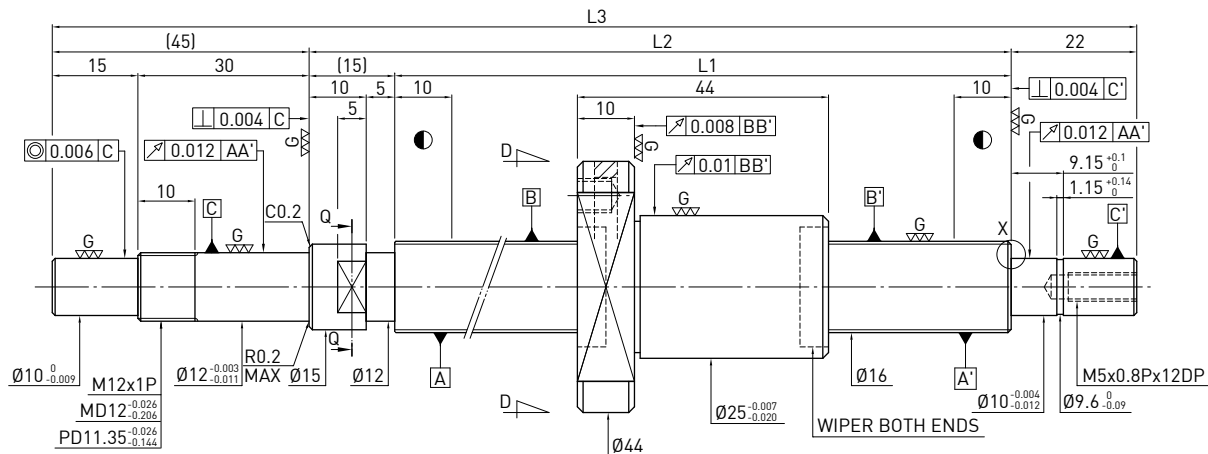
Unit : mm

| Stroke | HIWIN Code                | L1  | L2  | L3  | Accuracy grade |
|--------|---------------------------|-----|-----|-----|----------------|
| 50     | R16-2T4-FSI-139-221-0.008 | 139 | 154 | 221 | 3              |
| 100    | R16-2T4-FSI-189-271-0.008 | 189 | 204 | 271 | 3              |
| 150    | R16-2T4-FSI-239-321-0.008 | 239 | 254 | 321 | 3              |
| 200    | R16-2T4-FSI-289-371-0.008 | 289 | 304 | 371 | 3              |
| 300    | R16-2T4-FSI-389-471-0.008 | 389 | 404 | 471 | 3              |

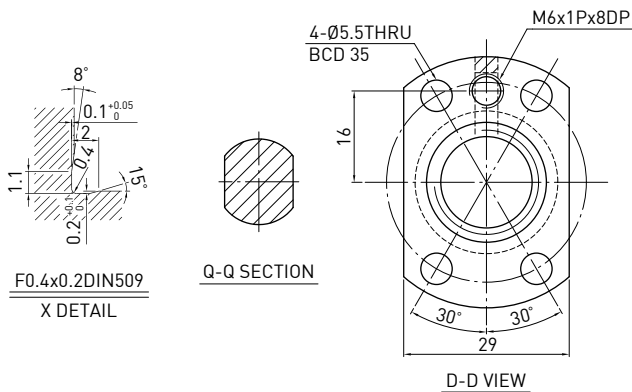


**TYPE** (SHAFT OD 16, LEAD 2.5)

◀ Standard



| Ball screw Data      |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 2.5        |               |
| Lead Angle           | 2.81°      |               |
| P.C.D (mm)           | 16.2       |               |
| Steel Ball (mm)      | Ø1.5       |               |
| Circuits             | 1x4        |               |
| Dynamic Load C (Kgf) | 323        |               |
| Static Load Co (Kgf) | 790        |               |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.05~0.5   | ~0.15         |
| Spacer Ball          | -          | -             |

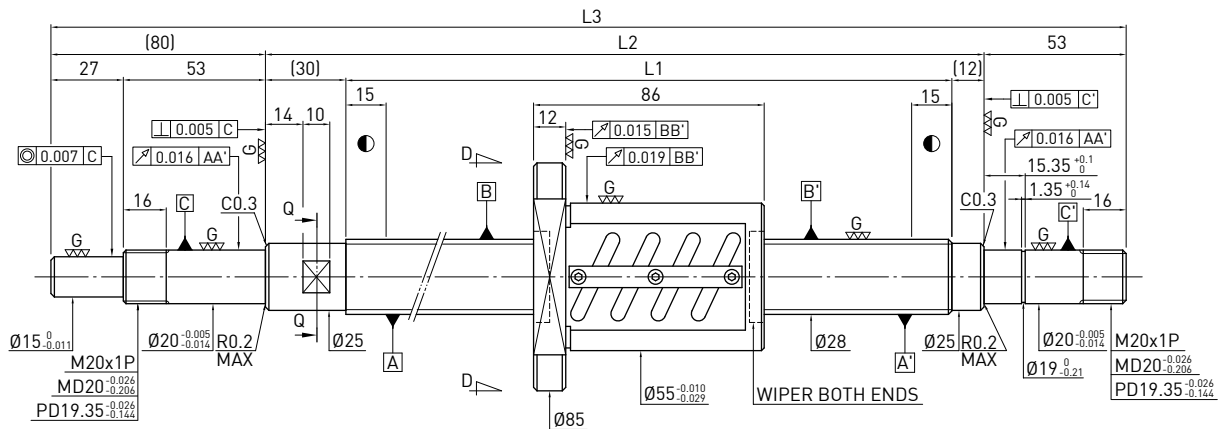


Unit : mm

| Stroke | HIWIN Code                  | L1  | L2  | L3  | Accuracy grade |
|--------|-----------------------------|-----|-----|-----|----------------|
| 50     | R16-2.5T4-FSI-139-221-0.008 | 139 | 154 | 221 | 3              |
| 100    | R16-2.5T4-FSI-189-271-0.008 | 189 | 204 | 271 | 3              |
| 150    | R16-2.5T4-FSI-239-321-0.008 | 239 | 254 | 321 | 3              |
| 200    | R16-2.5T4-FSI-289-371-0.008 | 289 | 304 | 371 | 3              |
| 300    | R16-2.5T4-FSI-389-471-0.008 | 389 | 404 | 471 | 3              |

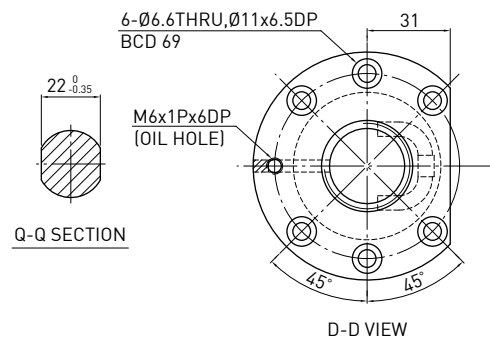
**O F S W TYPE** (SHAFT OD 16, LEAD 2)

◀ Standard



**Ball screw Data**

| Direction            | Right Hand |
|----------------------|------------|
| Lead (mm)            | 5          |
| Lead Angle           | 3.19°      |
| P.C.D (mm)           | 28.6       |
| Steel Ball (mm)      | Ø3.175     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 1784       |
| Static Load Co (Kgf) | 4932       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 1.1~3.3    |
| Spacer Ball          | -          |

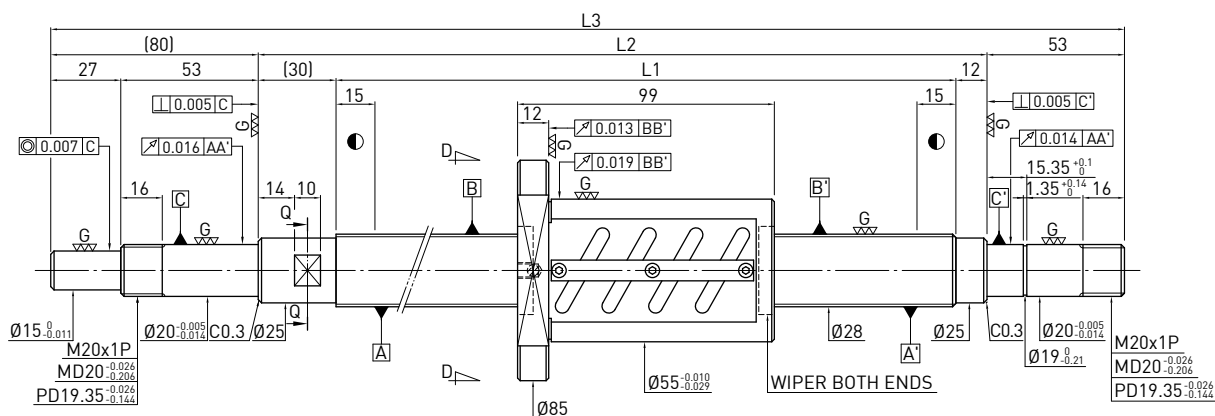


Unit : mm

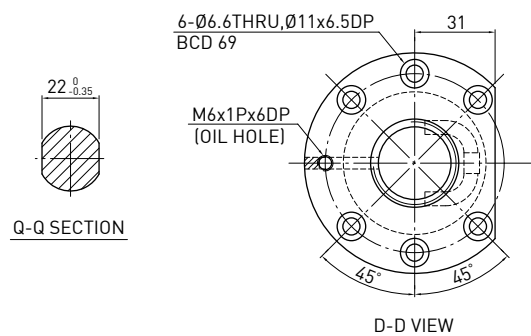
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 150    | R28-5B2-OFSW-270-399-0.018   | 270  | 300  | 399  | 5              |
| 250    | R28-5B2-OFSW-370-499-0.018   | 370  | 400  | 499  | 5              |
| 350    | R28-5B2-OFSW-470-599-0.018   | 470  | 500  | 599  | 5              |
| 450    | R28-5B2-OFSW-558-733-0.018   | 558  | 600  | 733  | 5              |
| 650    | R28-5B2-OFSW-758-933-0.018   | 758  | 800  | 933  | 5              |
| 850    | R28-5B2-OFSW-958-1133-0.018  | 958  | 1000 | 1133 | 5              |
| 1050   | R28-5B2-OFSW-1158-1333-0.018 | 1158 | 1200 | 1333 | 5              |

**O F S W TYPE (SHAFT OD 28, LEAD 6)**

◀ Standard



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 6          |
| Lead Angle           | 3.82°      |
| P.C.D (mm)           | 28.6       |
| Steel Ball (mm)      | Ø3.175     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 1784       |
| Static Load Co (Kgf) | 4932       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 1.2~3.6    |
| Spacer Ball          | -          |

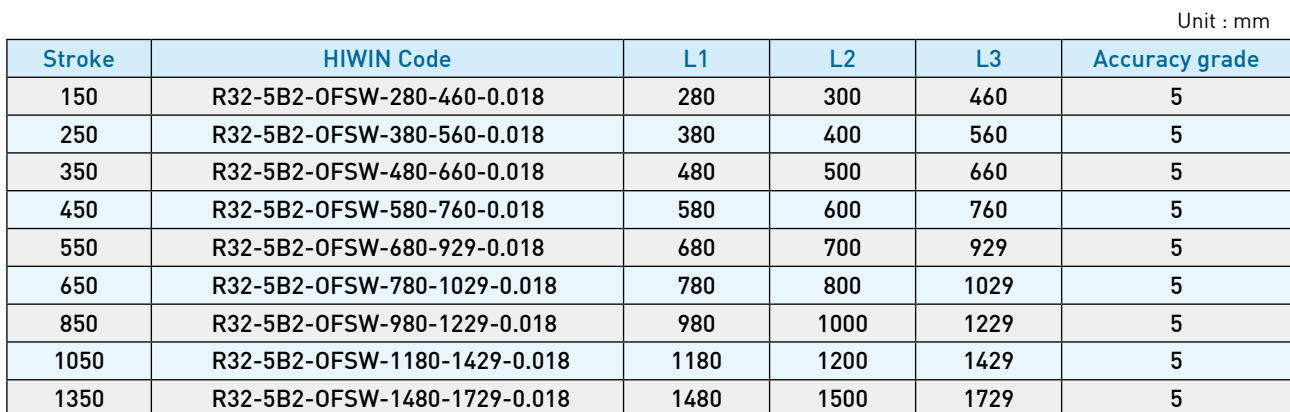
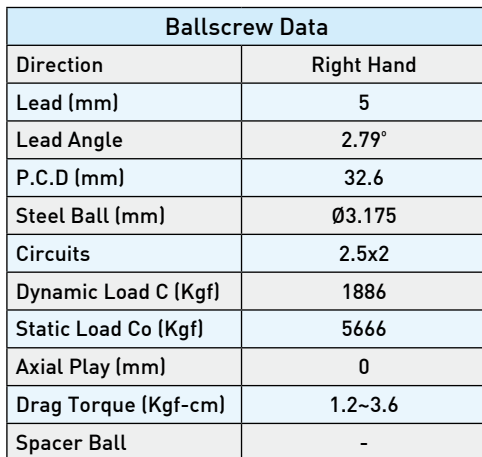


Unit : mm

| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 250    | R28-6B2-OFSW-370-499-0.018   | 370  | 400  | 499  | 5              |
| 450    | R28-6B2-OFSW-570-699-0.018   | 570  | 600  | 699  | 5              |
| 650    | R28-6B2-OFSW-758-933-0.018   | 758  | 800  | 933  | 5              |
| 850    | R28-6B2-OFSW-958-1133-0.018  | 958  | 1000 | 1133 | 5              |
| 1050   | R28-6B2-OFSW-1158-1333-0.018 | 1158 | 1200 | 1333 | 5              |

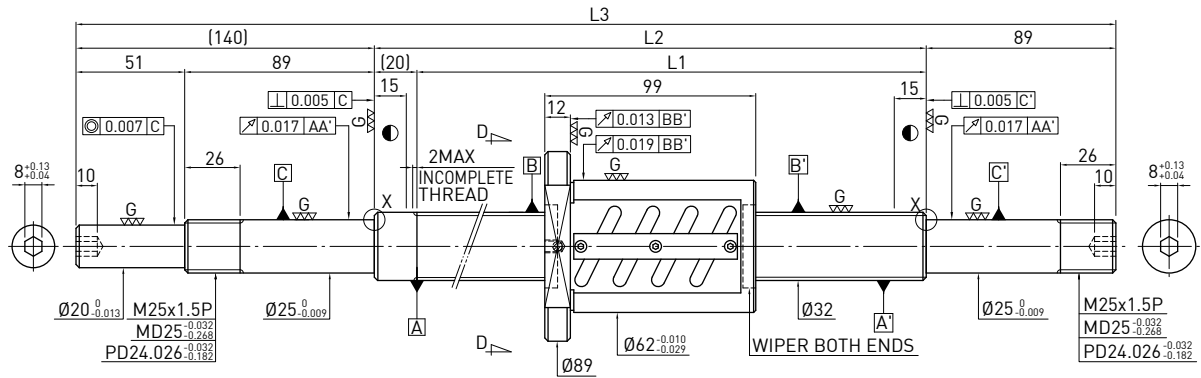


## ◀ Standard

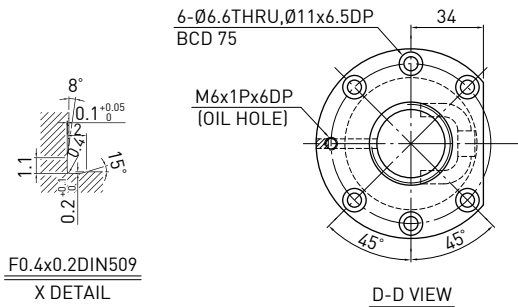


**O F S W TYPE** (SHAFT OD 32, LEAD 6)

◀ Standard



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 6          |
| Lead Angle           | 3.33°      |
| P.C.D (mm)           | 32.8       |
| Steel Ball (mm)      | Ø3.969     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 2556       |
| Static Load Co (Kgf) | 7019       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 2.32~4.82  |
| Spacer Ball          | -          |

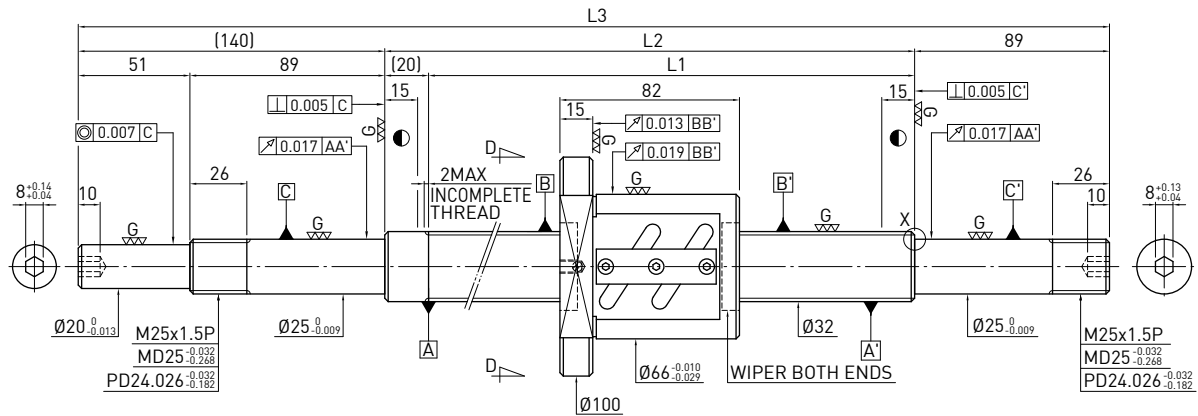


Unit : mm

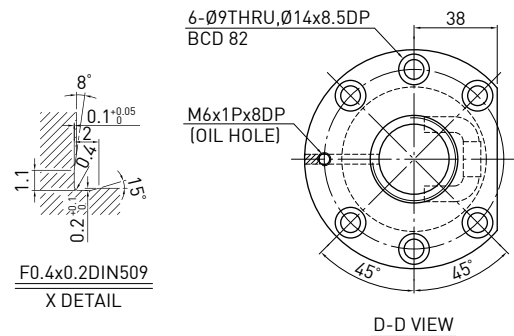
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 250    | R32-6B2-OFSW-380-560-0.018   | 380  | 400  | 560  | 5              |
| 450    | R32-6B2-OFSW-580-760-0.018   | 580  | 600  | 760  | 5              |
| 650    | R32-6B2-OFSW-780-1029-0.018  | 780  | 800  | 1029 | 5              |
| 850    | R32-6B2-OFSW-980-1229-0.018  | 980  | 1000 | 1229 | 5              |
| 1050   | R32-6B2-OFSW-1180-1429-0.018 | 1180 | 1200 | 1429 | 5              |
| 1350   | R32-6B2-OFSW-1480-1729-0.018 | 1480 | 1500 | 1729 | 5              |

**O F S W TYPE** (SHAFT OD 32, LEAD 8)

◀ Standard



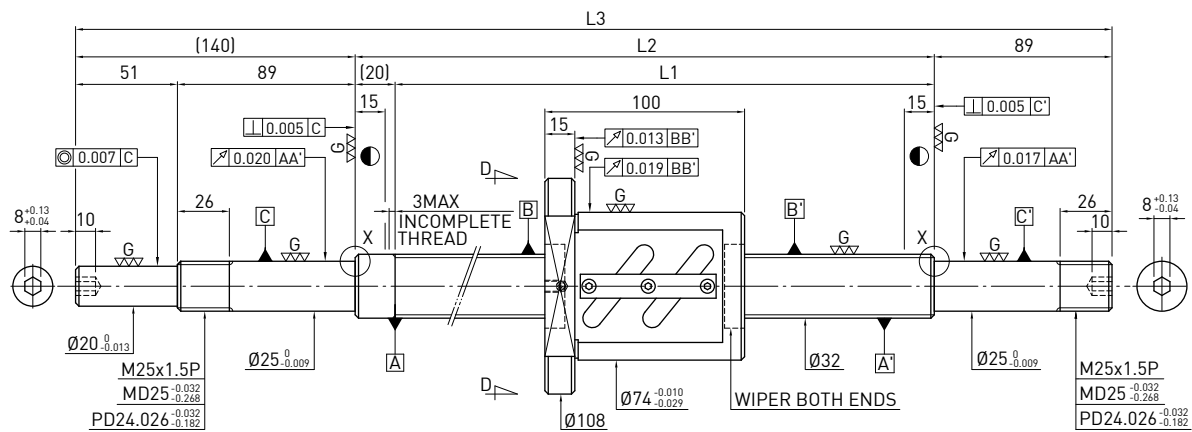
| Ball screw Data      |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 8          |
| Lead Angle           | 4.41°      |
| P.C.D (mm)           | 33         |
| Steel Ball (mm)      | Ø4.763     |
| Circuits             | 2.5x1      |
| Dynamic Load C (Kgf) | 2650       |
| Static Load Co (Kgf) | 5599       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 1.26~5.06  |
| Spacer Ball          | -          |



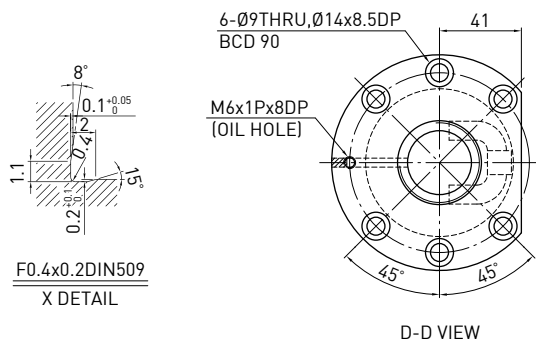
Unit : mm

| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 250    | R32-8B1-OFSW-380-560-0.018   | 380  | 400  | 560  | 5              |
| 450    | R32-8B1-OFSW-580-760-0.018   | 580  | 600  | 760  | 5              |
| 650    | R32-8B1-OFSW-780-1029-0.018  | 780  | 800  | 1029 | 5              |
| 850    | R32-8B1-OFSW-980-1229-0.018  | 980  | 1000 | 1229 | 5              |
| 1350   | R32-8B1-OFSW-1480-1729-0.018 | 1480 | 1500 | 1729 | 5              |
| 1350   | R32-6B2-OFSW-1480-1729-0.018 | 1480 | 1500 | 1729 | 5              |

## ◀ Standard



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 10         |
| Lead Angle           | 5.44°      |
| P.C.D (mm)           | 33.4       |
| Steel Ball (mm)      | Ø6.35      |
| Circuits             | 2.5x1      |
| Dynamic Load C (Kgf) | 2650       |
| Static Load Co (Kgf) | 5599       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 3.58~7.44  |
| Spacer Ball          | -          |

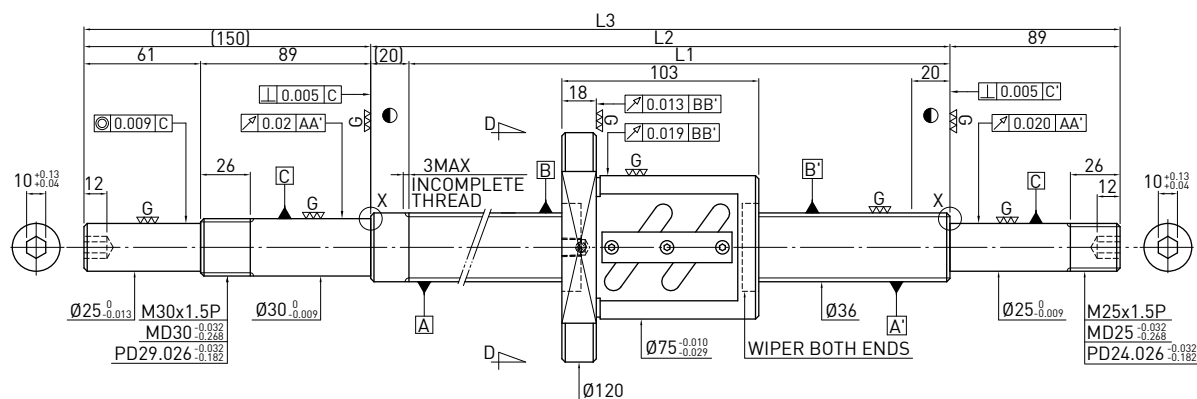


Unit : mm

| Stroke | HIWIN Code                    | L1   | L2   | L3   | Accuracy grade |
|--------|-------------------------------|------|------|------|----------------|
| 250    | R32-10B1-OFSW-380-560-0.018   | 380  | 400  | 560  | 5              |
| 350    | R32-10B1-OFSW-480-660-0.018   | 480  | 500  | 660  | 5              |
| 450    | R32-10B1-OFSW-580-760-0.018   | 580  | 600  | 760  | 5              |
| 550    | R32-10B1-OFSW-680-929-0.018   | 680  | 700  | 929  | 5              |
| 650    | R32-10B1-OFSW-780-1029-0.018  | 780  | 800  | 1029 | 5              |
| 850    | R32-10B1-OFSW-980-1229-0.018  | 980  | 1000 | 1229 | 5              |
| 1050   | R32-10B1-OFSW-1180-1429-0.018 | 1180 | 1200 | 1429 | 5              |
| 1350   | R32-10B1-OFSW-1480-1729-0.018 | 1480 | 1500 | 1729 | 5              |
| 1650   | R32-10B1-OFSW-1780-2029-0.018 | 1780 | 1800 | 2029 | 5              |

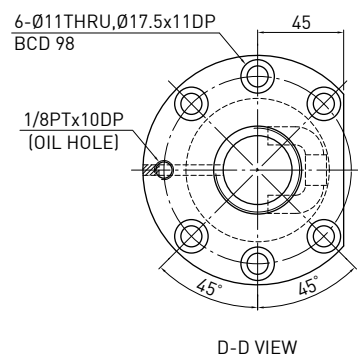
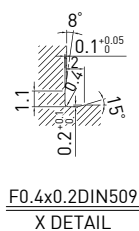
**O F S W TYPE** (SHAFT OD 36, LEAD 10)

◀ Standard



**Ballscrew Data**

| Direction            | Right Hand |
|----------------------|------------|
| Lead (mm)            | 10         |
| Lead Angle           | 4.84°      |
| P.C.D (mm)           | 37.4       |
| Steel Ball (mm)      | Ø6.35      |
| Circuits             | 2.5x1      |
| Dynamic Load C (Kgf) | 2812       |
| Static Load Co (Kgf) | 6334       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 3.91~8.13  |
| Spacer Ball          | -          |

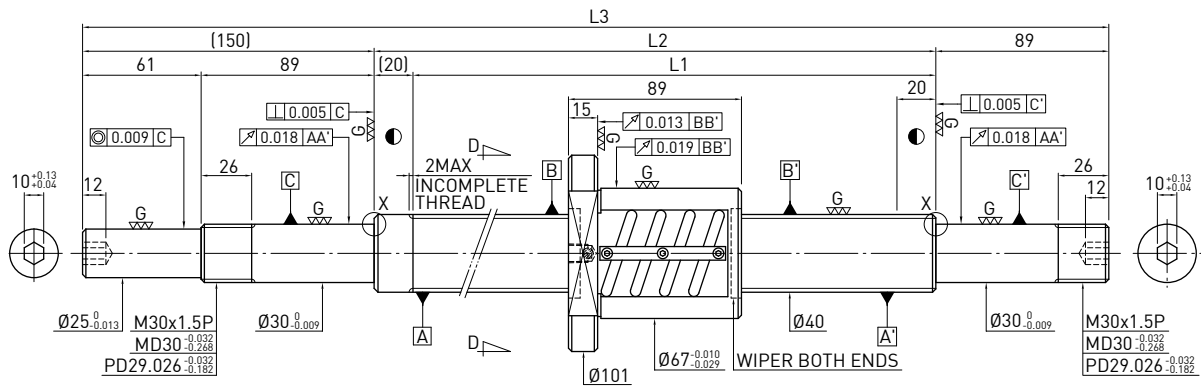


Unit : mm

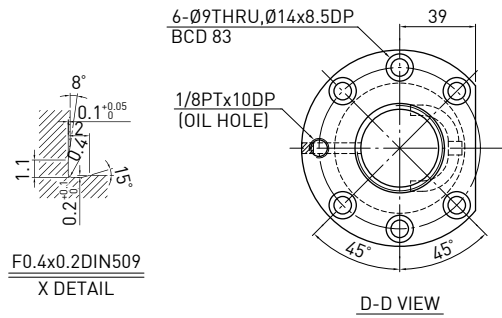
| Stroke | HIWIN Code                    | L1   | L2   | L3   | Accuracy grade |
|--------|-------------------------------|------|------|------|----------------|
| 350    | R36-10B1-OFSW-480-670-0.018   | 480  | 500  | 670  | 5              |
| 550    | R36-10B1-OFSW-680-870-0.018   | 680  | 700  | 870  | 5              |
| 850    | R36-10B1-OFSW-980-1239-0.018  | 980  | 1000 | 1239 | 5              |
| 1250   | R36-10B1-OFSW-1380-1639-0.018 | 1380 | 1400 | 1639 | 5              |
| 1650   | R36-10B1-OFSW-1780-2039-0.018 | 1780 | 1800 | 2039 | 5              |

**O F S W TYPE** (SHAFT OD 40, LEAD 5)

◀ Standard



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 5          |
| Lead Angle           | 2.24°      |
| P.C.D (mm)           | 40.6       |
| Steel Ball (mm)      | Ø3.175     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 2070       |
| Static Load Co (Kgf) | 7134       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 1.81~4.21  |
| Spacer Ball          | -          |

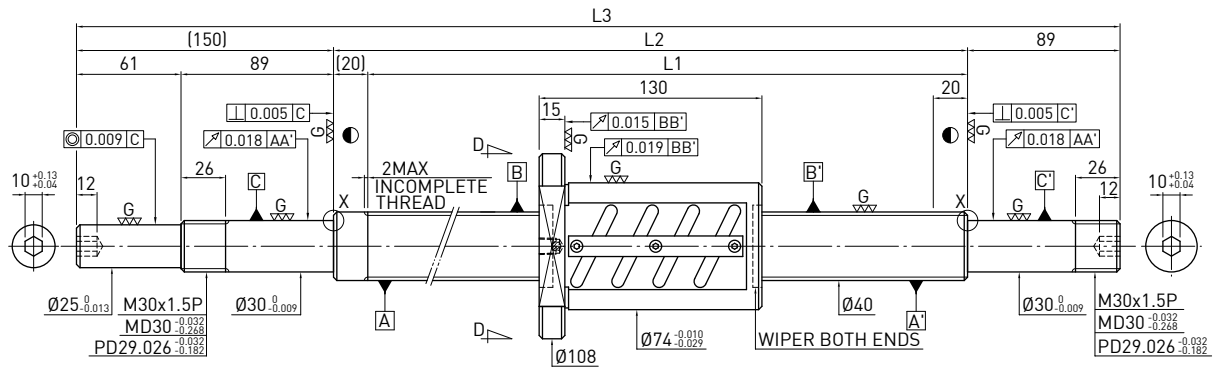


Unit : mm

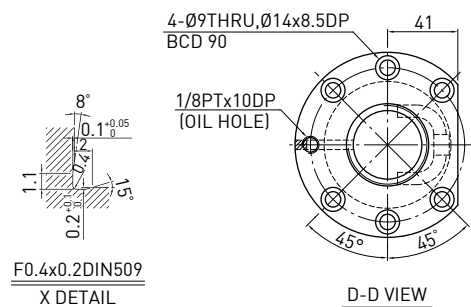
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 250    | R40-5B2-OFSW-380-572-0.018   | 380  | 400  | 572  | 5              |
| 450    | R40-5B2-OFSW-580-772-0.018   | 580  | 600  | 772  | 5              |
| 650    | R40-5B2-OFSW-780-1039-0.018  | 780  | 800  | 1039 | 5              |
| 850    | R40-5B2-OFSW-980-1239-0.018  | 980  | 1000 | 1239 | 5              |
| 1050   | R40-5B2-OFSW-1180-1439-0.018 | 1180 | 1200 | 1439 | 5              |
| 1450   | R40-5B2-OFSW-1580-1839-0.018 | 1580 | 1600 | 1839 | 5              |

**O F S W TYPE (SHAFT OD 40, LEAD 8)**

◀ Standard



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 8          |
| Lead Angle           | 3.55°      |
| P.C.D (mm)           | 41         |
| Steel Ball (mm)      | Ø4.763     |
| Circuits             | 2.5x2      |
| Dynamic Load C (Kgf) | 3634       |
| Static Load Co (Kgf) | 10603      |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 4.24~8.82  |
| Spacer Ball          | -          |

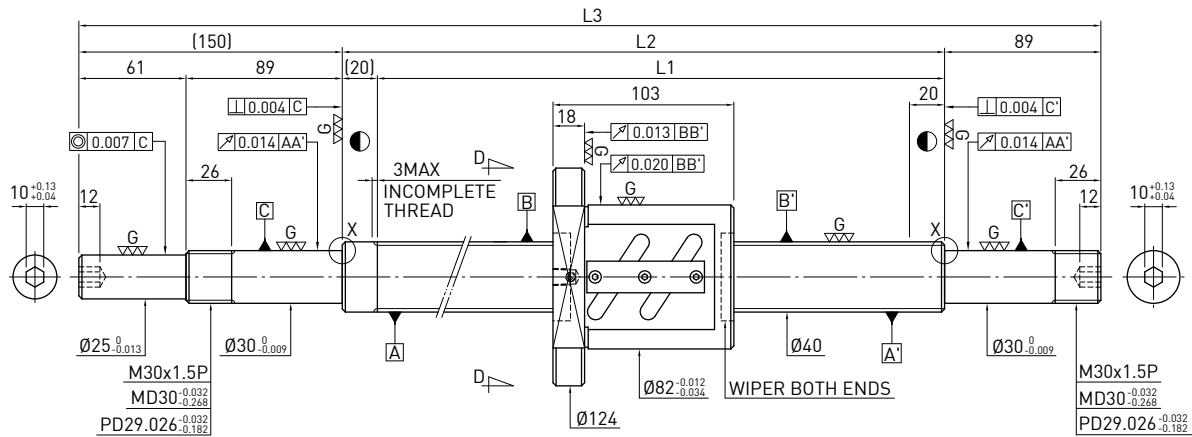


Unit : mm

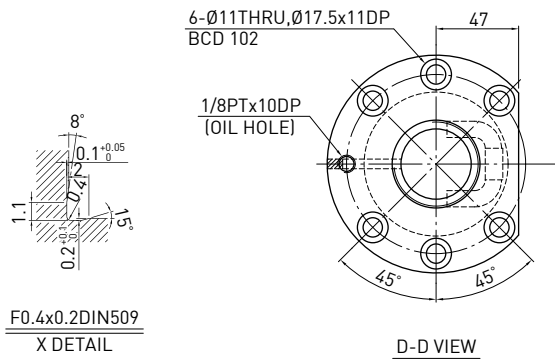
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 200    | R40-8B2-OFSW-380-572-0.018   | 380  | 400  | 572  | 5              |
| 400    | R40-8B2-OFSW-580-772-0.018   | 580  | 600  | 772  | 5              |
| 600    | R40-8B2-OFSW-780-1039-0.018  | 780  | 800  | 1039 | 5              |
| 800    | R40-8B2-OFSW-980-1239-0.018  | 980  | 1000 | 1239 | 5              |
| 1000   | R40-8B2-OFSW-1180-1439-0.018 | 1180 | 1200 | 1439 | 5              |
| 1400   | R40-8B2-OFSW-1580-1839-0.018 | 1580 | 1600 | 1839 | 5              |

**O F S W TYPE** (SHAFT OD 40, LEAD 10)

◀ Standard



| Ball screw Data      |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 10         |
| Lead Angle           | 4.4°       |
| P.C.D (mm)           | 41.4       |
| Steel Ball (mm)      | Ø6.35      |
| Circuits             | 2.5x1      |
| Dynamic Load C (Kgf) | 2958       |
| Static Load Co (Kgf) | 7069       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 4.57~8.49  |
| Spacer Ball          | -          |



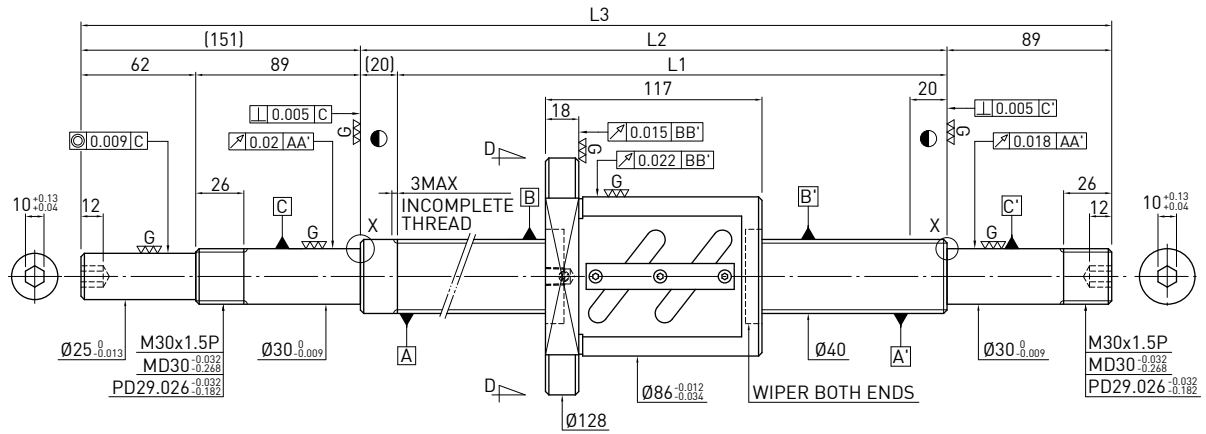
Unit : mm

| Stroke | HIWIN Code                    | L1   | L2   | L3   | Accuracy grade |
|--------|-------------------------------|------|------|------|----------------|
| 350    | R40-10B1-OFSW-480-672-0.018   | 480  | 500  | 672  | 5              |
| 450    | R40-10B1-OFSW-580-772-0.018   | 580  | 600  | 772  | 5              |
| 550    | R40-10B1-OFSW-680-872-0.018   | 680  | 700  | 872  | 5              |
| 650    | R40-10B1-OFSW-780-1039-0.018  | 780  | 800  | 1039 | 5              |
| 850    | R40-10B1-OFSW-980-1239-0.018  | 980  | 1000 | 1239 | 5              |
| 1050   | R40-10B1-OFSW-1180-1439-0.018 | 1180 | 1200 | 1439 | 5              |
| 1250   | R40-10B1-OFSW-1380-1639-0.018 | 1380 | 1400 | 1639 | 5              |
| 1450   | R40-10B1-OFSW-1580-1839-0.018 | 1580 | 1600 | 1839 | 5              |
| 1650   | R40-10B1-OFSW-1780-2039-0.018 | 1780 | 1800 | 2039 | 5              |
| 2250   | R40-10B1-OFSW-2380-2639-0.018 | 2380 | 2400 | 2639 | 5              |

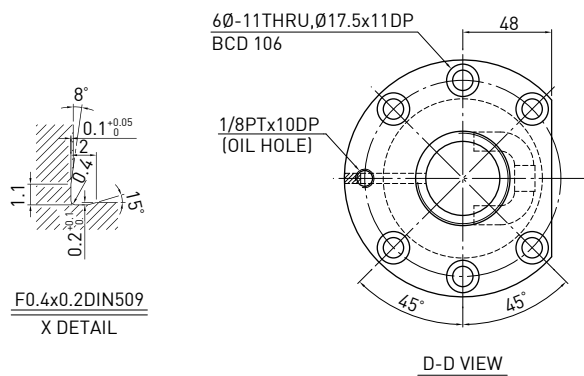


**O F S W TYPE** (SHAFT OD 40, LEAD 12)

◀ Standard



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 12         |
| Lead Angle           | 5.25°      |
| P.C.D (mm)           | 41.6       |
| Steel Ball (mm)      | Ø7.144     |
| Circuits             | 2.5x1      |
| Dynamic Load C (Kgf) | 3425       |
| Static Load Co (Kgf) | 7837       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 5.93~11.01 |
| Spacer Ball          | -          |

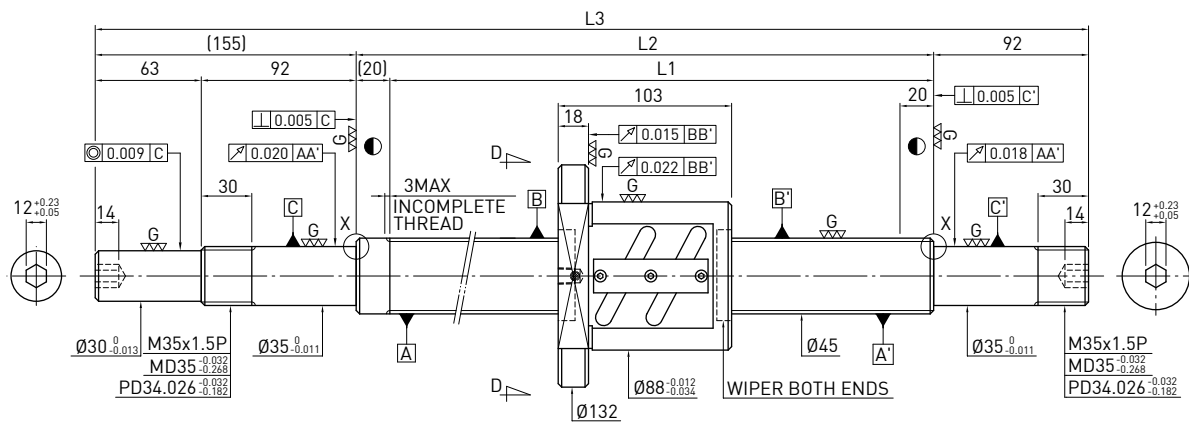


Unit : mm

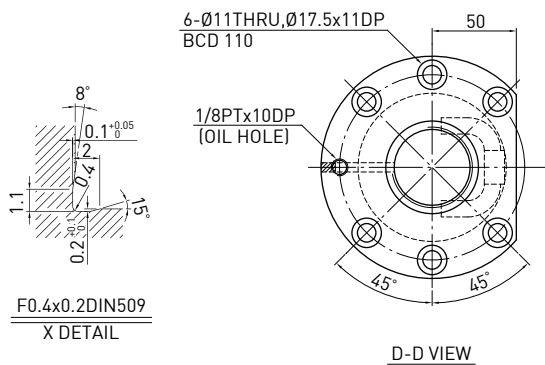
| Stroke | HIWIN Code                     | L1   | L2   | L3   | Accuracy grade |
|--------|--------------------------------|------|------|------|----------------|
| 500    | R40-12B1-OF SW-680-939-0.018   | 680  | 700  | 939  | 5              |
| 800    | R40-12B1-OF SW-980-1239-0.018  | 980  | 1000 | 1239 | 5              |
| 1200   | R40-12B1-OF SW-1380-1639-0.018 | 1380 | 1400 | 1639 | 5              |
| 1600   | R40-12B1-OF SW-1780-2039-0.018 | 1780 | 1800 | 2039 | 5              |
| 2300   | R40-12B1-OF SW-2480-2739-0.018 | 2480 | 2500 | 2739 | 5              |

**O F S W**

◀ Standard



| Ballscrew Data       |            |
|----------------------|------------|
| Direction            | Right Hand |
| Lead (mm)            | 10         |
| Lead Angle           | 3.92°      |
| P.C.D (mm)           | 46.4       |
| Steel Ball (mm)      | Ø6.35      |
| Circuits             | 2.5x1      |
| Dynamic Load C (Kgf) | 3115       |
| Static Load Co (Kgf) | 7952       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 4.58~9.5   |
| Spacer Ball          | -          |

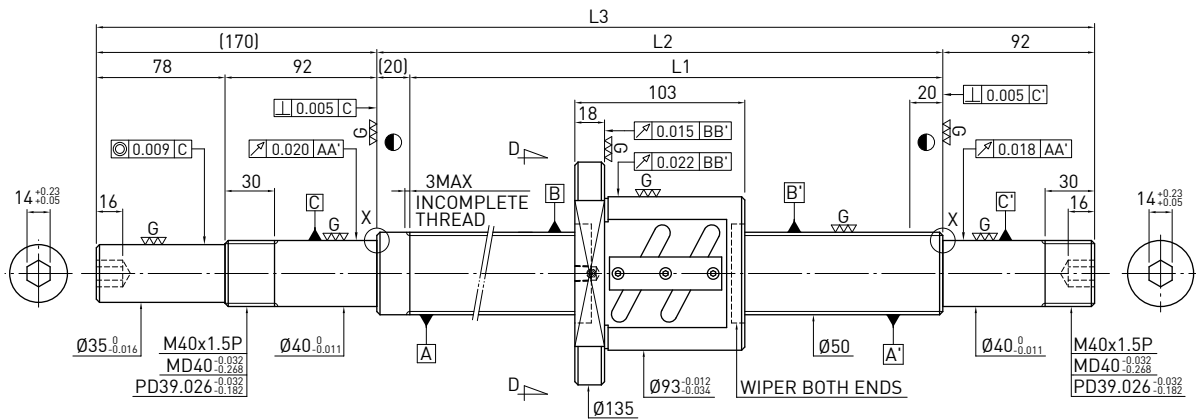


Unit : mm

| Stroke | HIWIN Code                    | L1   | L2   | L3   | Accuracy grade |
|--------|-------------------------------|------|------|------|----------------|
| 550    | R45-10B1-OFSW-680-947-0.018   | 680  | 700  | 947  | 5              |
| 850    | R45-10B1-OFSW-980-1247-0.018  | 980  | 1000 | 1247 | 5              |
| 1250   | R45-10B1-OFSW-1380-1647-0.018 | 1380 | 1400 | 1647 | 5              |
| 1650   | R45-10B1-OFSW-1780-2047-0.018 | 1780 | 1800 | 2047 | 5              |
| 2350   | R45-10B1-OFSW-2480-2747-0.018 | 2480 | 2500 | 2747 | 5              |

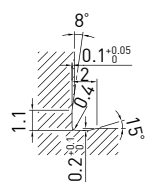
**O F S W TYPE** (SHAFT OD 50, LEAD 10)

◀ Standard

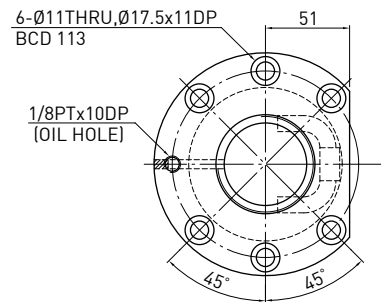


**Ball screw Data**

| Direction            | Right Hand |
|----------------------|------------|
| Lead (mm)            | 10         |
| Lead Angle           | 3.54°      |
| P.C.D (mm)           | 51.4       |
| Steel Ball (mm)      | Ø6.35      |
| Circuits             | 2.5x1      |
| Dynamic Load C (Kgf) | 3263       |
| Static Load Co (Kgf) | 8835       |
| Axial Play (mm)      | 0          |
| Drag Torque (Kgf-cm) | 4.84~11.28 |
| Spacer Ball          | -          |



F0.4x0.2DIN509  
X DETAIL



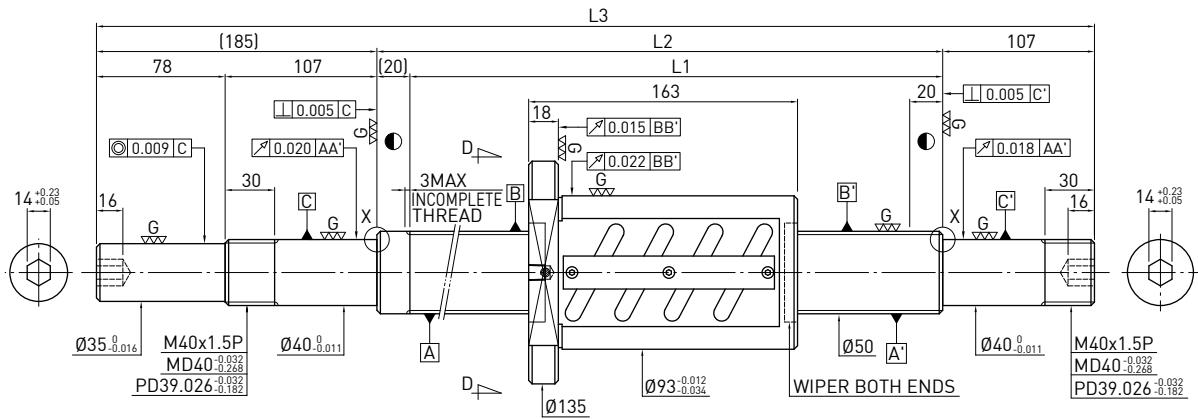
D-D VIEW

Unit : mm

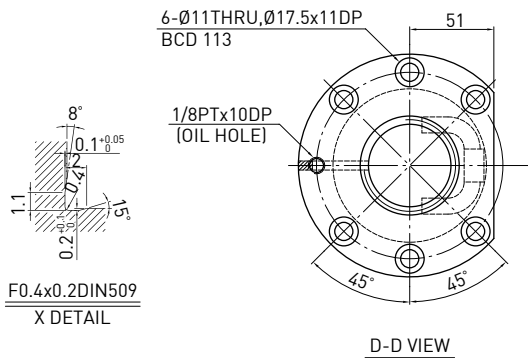
| Stroke | HIWIN Code                    | L1   | L2   | L3   | Accuracy grade |
|--------|-------------------------------|------|------|------|----------------|
| 450    | R50-10B1-OFSW-580-862-0.018   | 580  | 600  | 862  | 5              |
| 650    | R50-10B1-OFSW-780-1062-0.018  | 780  | 800  | 1062 | 5              |
| 850    | R50-10B1-OFSW-980-1262-0.018  | 980  | 1000 | 1262 | 5              |
| 1050   | R50-10B1-OFSW-1180-1462-0.018 | 1180 | 1200 | 1462 | 5              |
| 1350   | R50-10B1-OFSW-1480-1762-0.018 | 1480 | 1500 | 1762 | 5              |
| 1850   | R50-10B1-OFSW-1980-2262-0.018 | 1980 | 2000 | 2262 | 5              |
| 2450   | R50-10B1-OFSW-2580-2862-0.018 | 2580 | 2600 | 2862 | 5              |

**O F S W TYPE** (SHAFT OD 50, LEAD 10)

◀ Standard



| Ballscrew Data       |             |
|----------------------|-------------|
| Direction            | Right Hand  |
| Lead (mm)            | 10          |
| Lead Angle           | 3.54°       |
| P.C.D (mm)           | 51.4        |
| Steel Ball (mm)      | Ø6.35       |
| Circuits             | 2.5x2       |
| Dynamic Load C (Kgf) | 5923        |
| Static Load Co (Kgf) | 17670       |
| Axial Play (mm)      | 0           |
| Drag Torque (Kgf-cm) | 10.48~17.48 |
| Spacer Ball          | -           |



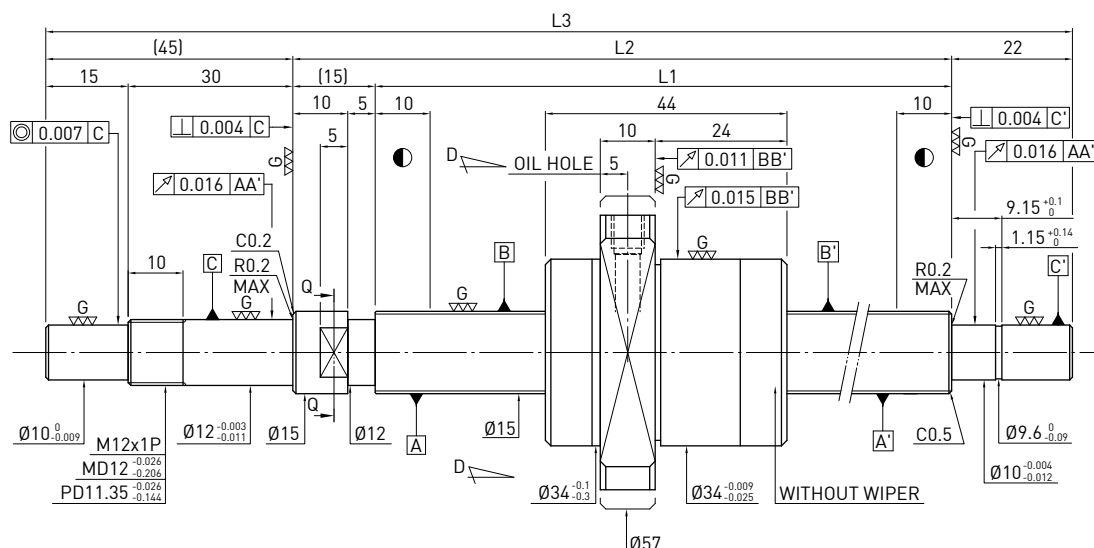
Unit : mm

| Stroke | HIWIN Code                    | L1   | L2   | L3   | Accuracy grade |
|--------|-------------------------------|------|------|------|----------------|
| 350    | R50-10B2-OFSW-580-892-0.018   | 580  | 600  | 892  | 5              |
| 550    | R50-10B2-OFSW-780-1092-0.018  | 780  | 800  | 1092 | 5              |
| 750    | R50-10B2-OFSW-980-1292-0.018  | 980  | 1000 | 1292 | 5              |
| 950    | R50-10B2-OFSW-1180-1492-0.018 | 1180 | 1200 | 1492 | 5              |
| 1250   | R50-10B2-OFSW-1480-1792-0.018 | 1480 | 1500 | 1792 | 5              |
| 1750   | R50-10B2-OFSW-1980-2292-0.018 | 1980 | 2000 | 2292 | 5              |
| 2350   | R50-10B2-OFSW-2580-2892-0.018 | 2580 | 2600 | 2892 | 5              |

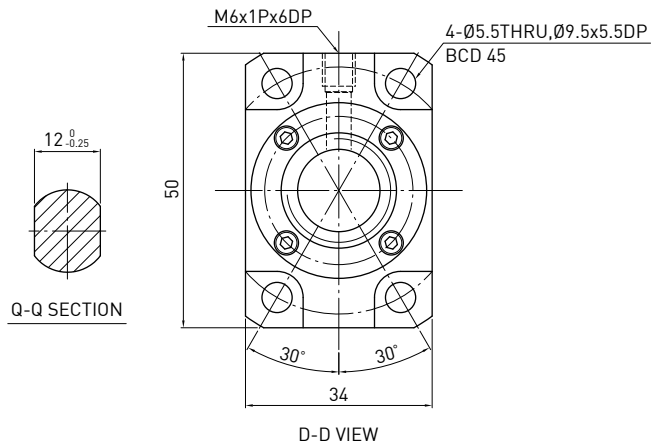
## 6.5 High Lead Ground Ballscrew

**F S H TYPE** (SHAFT OD 15, LEAD 10)

◀ High Lead



| Ballscrew Data       |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 10         |               |
| Lead Angle           | 11.53°     |               |
| P.C.D (mm)           | 15.6       |               |
| Steel Ball (mm)      | Ø3.175     |               |
| Circuits             | 2.8x2      |               |
| Dynamic Load C (Kgf) | 776        | 1231          |
| Static Load Co (Kgf) | 1244       | 2487          |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.2~1      | -             |
| Spacer Ball          | 1 : 1      | -             |

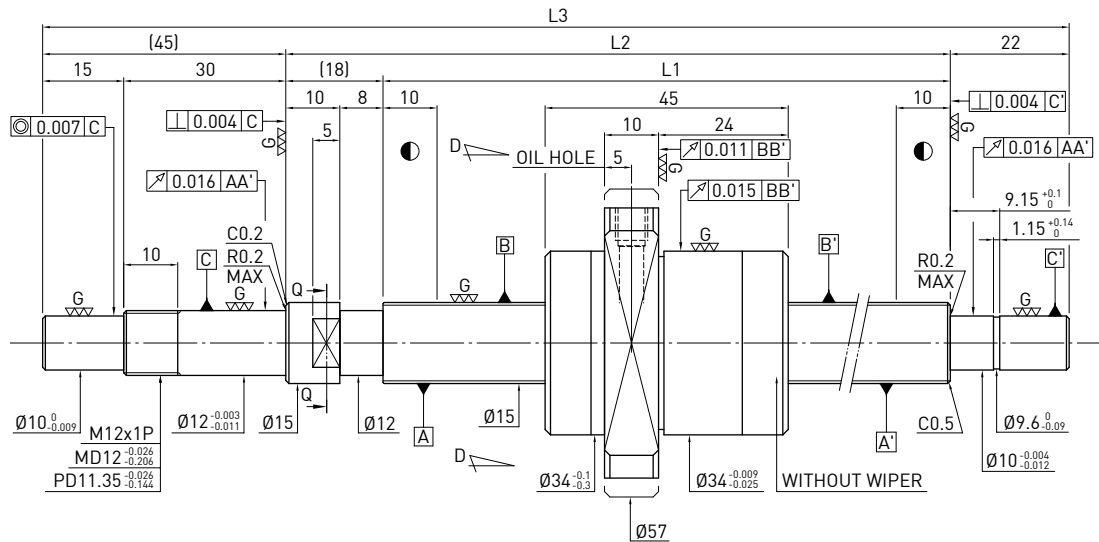


Unit : mm

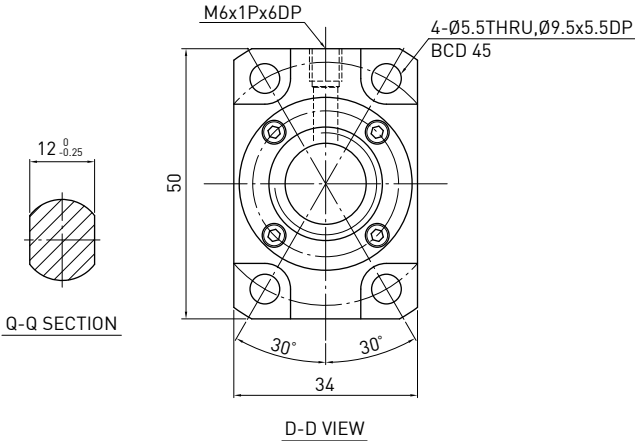
| Stroke | HIWIN Code                  | L1  | L2  | L3  | Accuracy grade |
|--------|-----------------------------|-----|-----|-----|----------------|
| 150    | R15-10U2-DFSH-239-321-0.018 | 239 | 254 | 321 | 5              |
| 200    | R15-10U2-DFSH-289-371-0.018 | 289 | 304 | 371 | 5              |
| 250    | R15-10U2-DFSH-339-421-0.018 | 339 | 354 | 421 | 5              |
| 300    | R15-10U2-DFSH-389-471-0.018 | 389 | 404 | 471 | 5              |
| 350    | R15-10U2-DFSH-439-521-0.018 | 439 | 454 | 521 | 5              |
| 400    | R15-10U2-DFSH-489-571-0.018 | 489 | 504 | 571 | 5              |
| 450    | R15-10U2-DFSH-539-621-0.018 | 539 | 554 | 621 | 5              |
| 500    | R15-10U2-DFSH-589-671-0.018 | 589 | 604 | 671 | 5              |
| 550    | R15-10U2-DFSH-639-721-0.018 | 639 | 654 | 721 | 5              |
| 600    | R15-10U2-DFSH-689-771-0.018 | 689 | 704 | 771 | 5              |
| 700    | R15-10U2-DFSH-789-871-0.018 | 789 | 804 | 871 | 5              |
| 800    | R15-10U2-DFSH-889-971-0.018 | 889 | 904 | 971 | 5              |

**D F S H TYPE** (SHAFT OD 15, LEAD 20)

◀ High Lead



| Ball screw Data      |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 20         |               |
| Lead Angle           | 22.2°      |               |
| P.C.D (mm)           | 15.6       |               |
| Steel Ball (mm)      | Ø3.175     |               |
| Circuits             | 1.8x2      |               |
| Dynamic Load C (Kgf) | 520        | 825           |
| Static Load Co (Kgf) | 781        | 1562          |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.2~0.9    | -             |
| Spacer Ball          | 1 : 1      | -             |

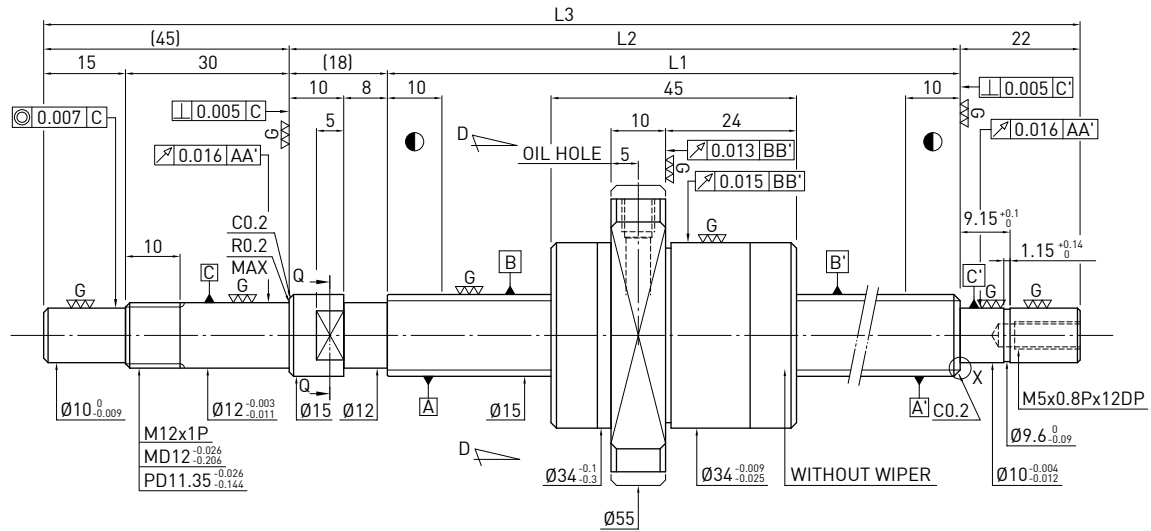


Unit : mm

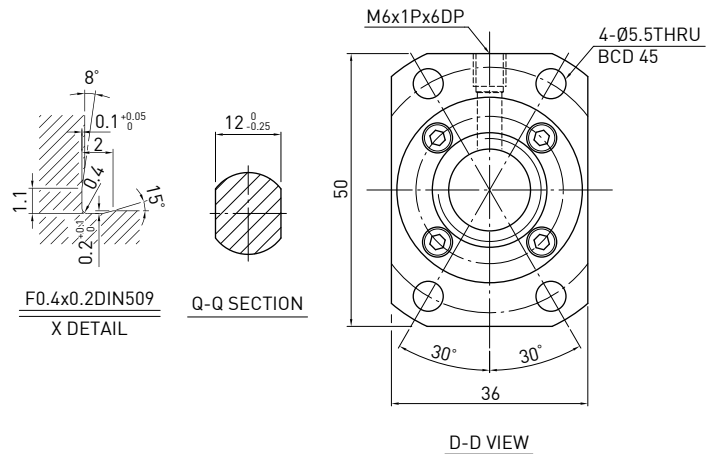
| Stroke | HIWIN Code                  | L1  | L2  | L3  | Accuracy grade |
|--------|-----------------------------|-----|-----|-----|----------------|
| 150    | R15-20A2-DFSH-236-321-0.018 | 236 | 254 | 321 | 5              |
| 200    | R15-20A2-DFSH-286-371-0.018 | 286 | 304 | 371 | 5              |
| 250    | R15-20A2-DFSH-336-421-0.018 | 336 | 354 | 421 | 5              |
| 300    | R15-20A2-DFSH-386-471-0.018 | 386 | 404 | 471 | 5              |
| 350    | R15-20A2-DFSH-436-521-0.018 | 436 | 454 | 521 | 5              |
| 400    | R15-20A2-DFSH-486-571-0.018 | 486 | 504 | 571 | 5              |
| 450    | R15-20A2-DFSH-536-621-0.018 | 536 | 554 | 621 | 5              |
| 500    | R15-20A2-DFSH-586-671-0.018 | 586 | 604 | 671 | 5              |
| 550    | R15-20A2-DFSH-636-721-0.018 | 636 | 654 | 721 | 5              |
| 600    | R15-20A2-DFSH-686-771-0.018 | 686 | 704 | 771 | 5              |
| 700    | R15-20A2-DFSH-786-871-0.018 | 786 | 804 | 871 | 5              |
| 800    | R15-20A2-DFSH-886-971-0.018 | 886 | 904 | 971 | 5              |

**F S H TYPE (SHAFT OD 15, LEAD 20)**

◀ High Lead



| Ballscrew Data       |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 20         |               |
| Lead Angle           | 22.2°      |               |
| P.C.D (mm)           | 15.6       |               |
| Steel Ball (mm)      | Ø3.175     |               |
| Circuits             | 1.8x1      |               |
| Dynamic Load C (Kgf) | 342        | 543           |
| Static Load Co (Kgf) | 459        | 917           |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.15~0.8   | ~0.24         |
| Spacer Ball          | 1 : 1      | -             |

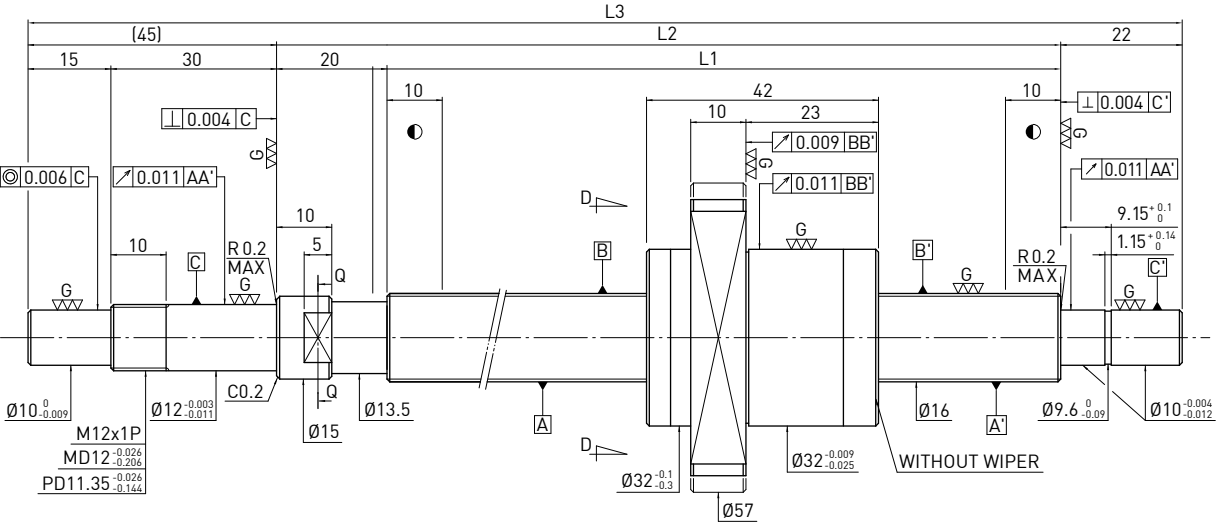


Unit : mm

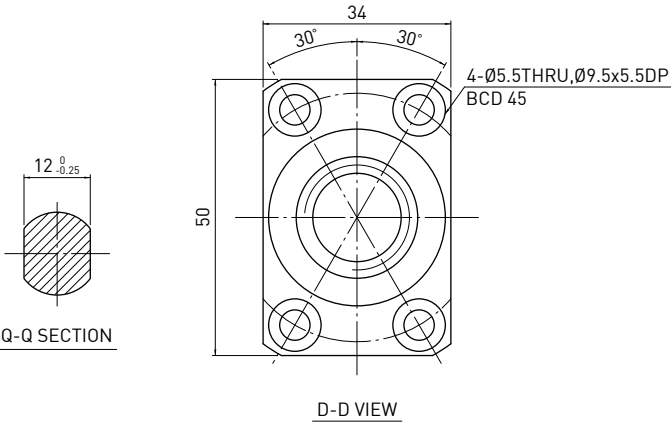
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 100    | R15-20S1-FSH-186-271-0.018   | 186  | 204  | 271  | 5              |
| 150    | R15-20S1-FSH-236-321-0.018   | 236  | 254  | 321  | 5              |
| 200    | R15-20S1-FSH-286-371-0.018   | 286  | 304  | 371  | 5              |
| 250    | R15-20S1-FSH-336-421-0.018   | 336  | 354  | 421  | 5              |
| 300    | R15-20S1-FSH-386-471-0.018   | 386  | 404  | 471  | 5              |
| 350    | R15-20S1-FSH-436-521-0.018   | 436  | 454  | 521  | 5              |
| 400    | R15-20S1-FSH-486-571-0.018   | 486  | 504  | 571  | 5              |
| 450    | R15-20S1-FSH-536-621-0.018   | 536  | 554  | 621  | 5              |
| 500    | R15-20S1-FSH-586-671-0.018   | 586  | 604  | 671  | 5              |
| 550    | R15-20S1-FSH-636-721-0.018   | 636  | 654  | 721  | 5              |
| 600    | R15-20S1-FSH-686-771-0.018   | 686  | 704  | 771  | 5              |
| 700    | R15-20S1-FSH-786-871-0.018   | 786  | 804  | 871  | 5              |
| 800    | R15-20S1-FSH-886-971-0.018   | 886  | 904  | 971  | 5              |
| 1000   | R15-20S1-FSH-1086-1171-0.018 | 1086 | 1104 | 1171 | 5              |

**F S H TYPE** (SHAFT OD 16, LEAD 16)

◀ High Lead



| Ballscrew Data       |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 16         |               |
| Lead Angle           | 17.06°     |               |
| P.C.D (mm)           | 16.6       |               |
| Steel Ball (mm)      | Ø3.175     |               |
| Circuits             | 1.8x2      |               |
| Dynamic Load C (Kgf) | 544        | 863           |
| Static Load Co (Kgf) | 843        | 1685          |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.2~1      | -             |
| Spacer Ball          | 1 : 1      | -             |



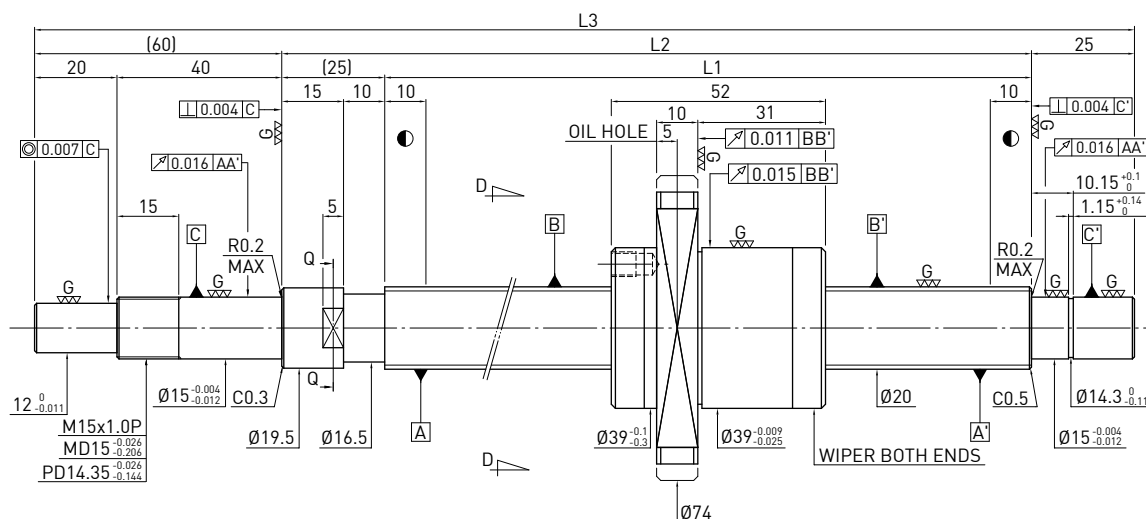
Unit : mm

| Stroke | HIWIN Code                 | L1  | L2  | L3  | Accuracy grade |
|--------|----------------------------|-----|-----|-----|----------------|
| 150    | R16-16S2-FSH-234-321-0.018 | 234 | 254 | 321 | 5              |
| 200    | R16-16S2-FSH-284-371-0.018 | 284 | 304 | 371 | 5              |
| 250    | R16-16S2-FSH-334-421-0.018 | 334 | 354 | 421 | 5              |
| 300    | R16-16S2-FSH-384-471-0.018 | 384 | 404 | 471 | 5              |
| 350    | R16-16S2-FSH-434-521-0.018 | 434 | 454 | 521 | 5              |
| 400    | R16-16S2-FSH-484-571-0.018 | 484 | 504 | 571 | 5              |
| 450    | R16-16S2-FSH-534-621-0.018 | 534 | 554 | 621 | 5              |
| 500    | R16-16S2-FSH-584-671-0.018 | 584 | 604 | 671 | 5              |
| 550    | R16-16S2-FSH-634-721-0.018 | 634 | 654 | 721 | 5              |
| 600    | R16-16S2-FSH-684-771-0.018 | 684 | 704 | 771 | 5              |
| 700    | R16-16S2-FSH-784-871-0.018 | 784 | 804 | 871 | 5              |
| 800    | R16-16S2-FSH-884-971-0.018 | 884 | 904 | 971 | 5              |

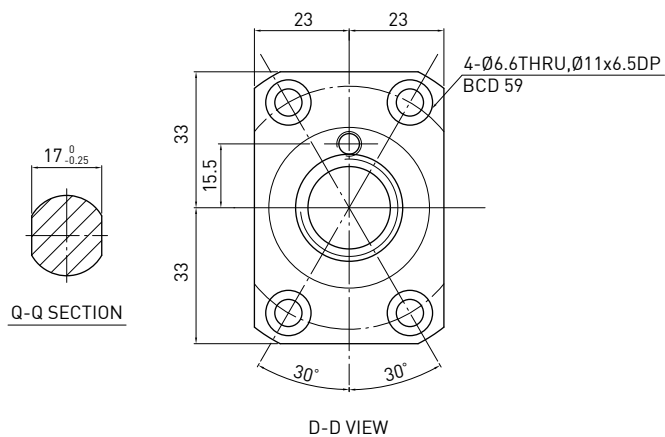


**F S H TYPE** (SHAFT OD 20, LEAD 20)

◀ High Lead



| Ball screw Data      |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 20         |               |
| Lead Angle           | 17.17°     |               |
| P.C.D (mm)           | 20.6       |               |
| Steel Ball (mm)      | Ø3.175     |               |
| Circuits             | 1.8x2      |               |
| Dynamic Load C (Kgf) | 612        | 971           |
| Static Load Co (Kgf) | 1061       | 2122          |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.1~1      | -             |
| Spacer Ball          | 1 : 1      | -             |

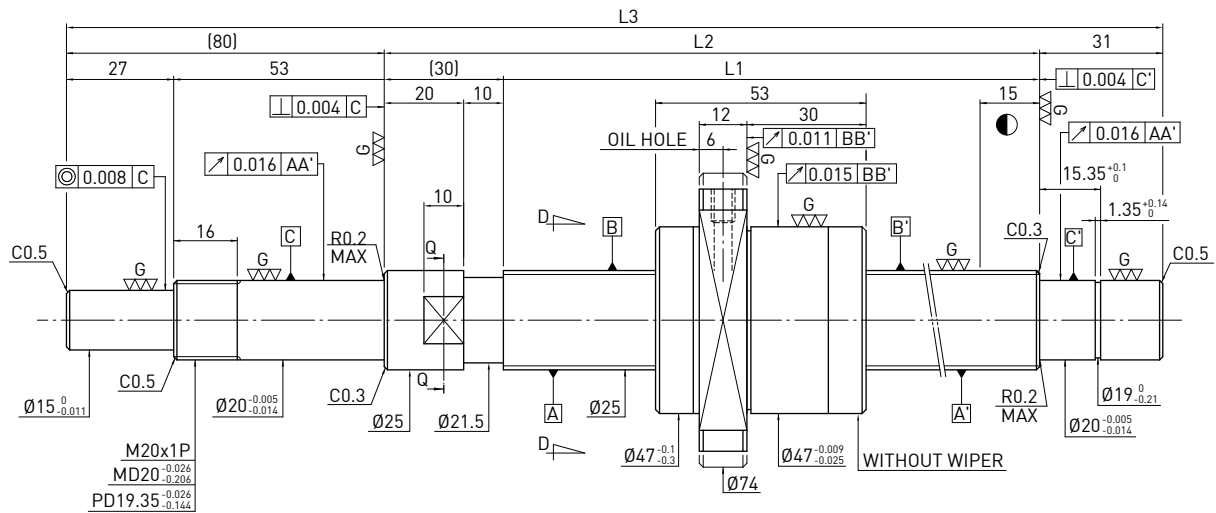


Unit : mm

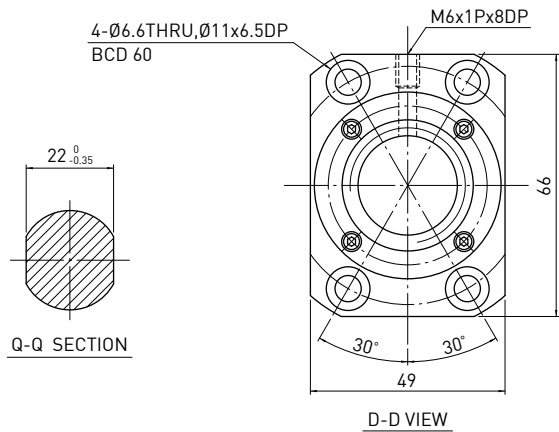
| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 300    | R20-20S2-FSH-410-520-0.018   | 410  | 435  | 520  | 5              |
| 400    | R20-20S2-FSH-510-620-0.018   | 510  | 535  | 620  | 5              |
| 500    | R20-20S2-FSH-610-720-0.018   | 610  | 635  | 720  | 5              |
| 600    | R20-20S2-FSH-710-820-0.018   | 710  | 735  | 820  | 5              |
| 700    | R20-20S2-FSH-810-920-0.018   | 810  | 835  | 920  | 5              |
| 800    | R20-20S2-FSH-910-1020-0.018  | 910  | 935  | 1020 | 5              |
| 900    | R20-20S2-FSH-1010-1120-0.018 | 1010 | 1035 | 1120 | 5              |
| 1000   | R20-20S2-FSH-1110-1220-0.018 | 1110 | 1135 | 1220 | 5              |
| 1100   | R20-20S2-FSH-1210-1320-0.018 | 1210 | 1235 | 1320 | 5              |

**F S H TYPE** (SHAFT OD 25, LEAD 20)

◀ High Lead



| Ball screw Data      |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 20         |               |
| Lead Angle           | 13.76°     |               |
| P.C.D (mm)           | 26         |               |
| Steel Ball (mm)      | Ø4.763     |               |
| Circuits             | 1.8x2      |               |
| Dynamic Load C (Kgf) | 1146       | 1819          |
| Static Load Co (Kgf) | 1968       | 3936          |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.2~1      | -             |
| Spacer Ball          | 1 : 1      | -             |



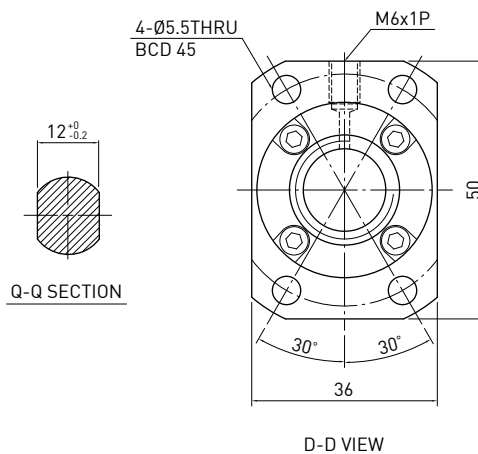
Unit : mm

| Stroke | HIWIN Code                   | L1   | L2   | L3   | Accuracy grade |
|--------|------------------------------|------|------|------|----------------|
| 500    | R25-20S2-FSH-610-751-0.018   | 610  | 640  | 751  | 5              |
| 600    | R25-20S2-FSH-710-851-0.018   | 710  | 740  | 851  | 5              |
| 800    | R25-20S2-FSH-910-1051-0.018  | 910  | 940  | 1051 | 5              |
| 1000   | R25-20S2-FSH-1110-1251-0.018 | 1110 | 1140 | 1251 | 5              |
| 1200   | R25-20S2-FSH-1310-1451-0.018 | 1310 | 1340 | 1451 | 5              |
| 1400   | R25-20S2-FSH-1510-1651-0.018 | 1510 | 1540 | 1651 | 5              |
| 1600   | R25-20S2-FSH-1710-1851-0.018 | 1710 | 1740 | 1851 | 5              |

**D F S H TYPE** (SHAFT OD 16, LEAD 32)

[illegible]

| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 32         |           |
| Lead Angle           | 31.53°     |           |
| P.C.D (mm)           | 16.6       |           |
| Steel Ball (mm)      | Ø3.175     |           |
| Circuits             | 0.7x2      |           |
| Dynamic Load C (Kgf) | 432        |           |
| Static Load Co (Kgf) | 755        |           |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.15~1.0   | 0.24 MAX  |
| Spacer Ball          | 1 : 1      | -         |

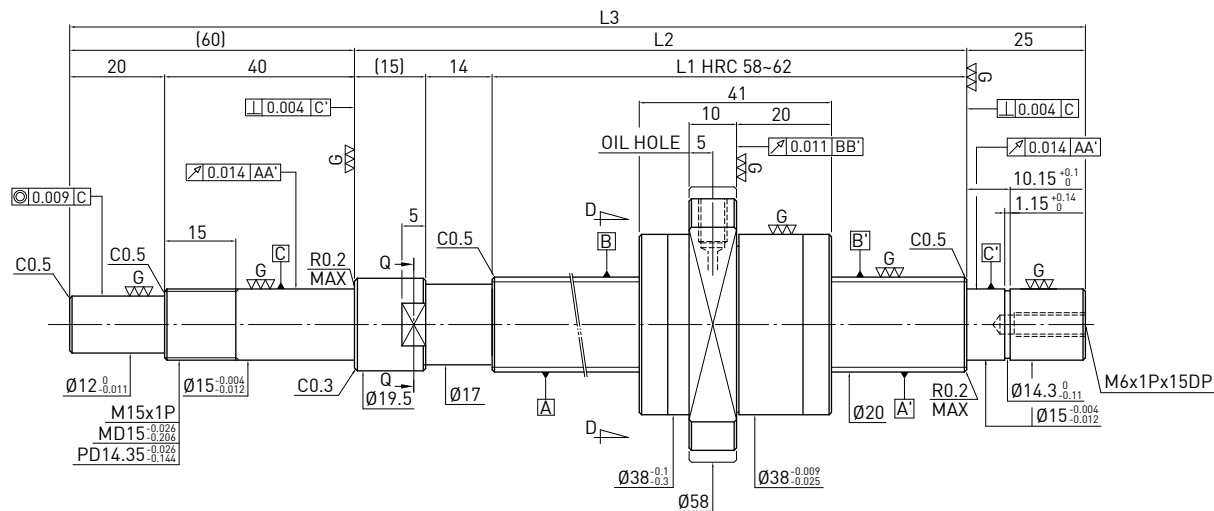


Unit : mm

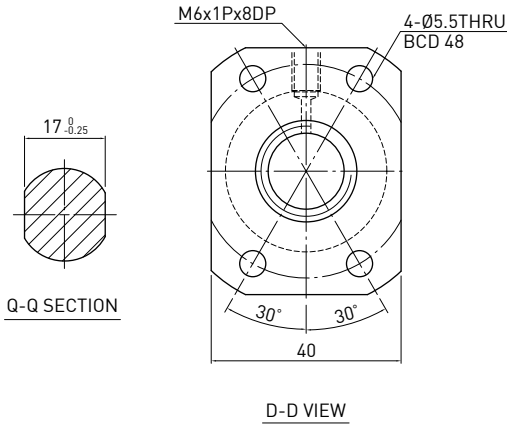
| Stroke | HIWIN Code                     | L1   | L2   | L3   | Accuracy grade |
|--------|--------------------------------|------|------|------|----------------|
| 300    | 2R16-32V2-DFSH-382-471-0.018   | 382  | 404  | 471  | 5              |
| 500    | 2R16-32V2-DFSH-582-671-0.018   | 582  | 604  | 671  | 5              |
| 800    | 2R16-32V2-DFSH-882-971-0.018   | 882  | 904  | 971  | 5              |
| 1200   | 2R16-32V2-DFSH-1282-1371-0.018 | 1282 | 1304 | 1371 | 5              |

**D F S H TYPE** (SHAFT OD 20, LEAD 40)

◀ Ultra High Lead



| Ballscrew Data       |            |           |
|----------------------|------------|-----------|
| Direction            | Right Hand |           |
| Lead (mm)            | 40         |           |
| Lead Angle           | 31.47°     |           |
| P.C.D (mm)           | 20.8       |           |
| Steel Ball (mm)      | Ø3.175     |           |
| Circuits             | 0.7x2      |           |
| Dynamic Load C (Kgf) | 500        |           |
| Static Load Co (Kgf) | 987        |           |
| Axial Play (mm)      | 0          | 0.005 MAX |
| Drag Torque (Kgf-cm) | 0.2~1.2    | 0.3 MAX   |
| Spacer Ball          | -          | -         |

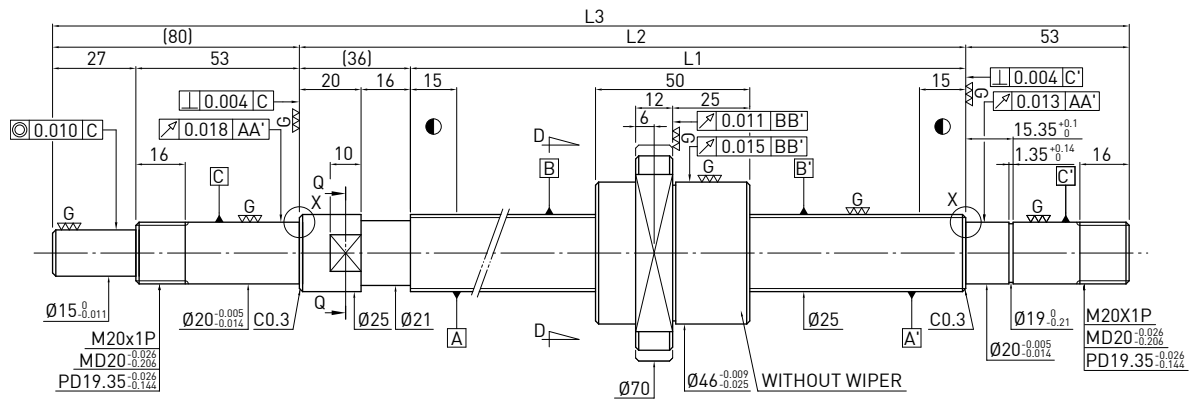


Unit : mm

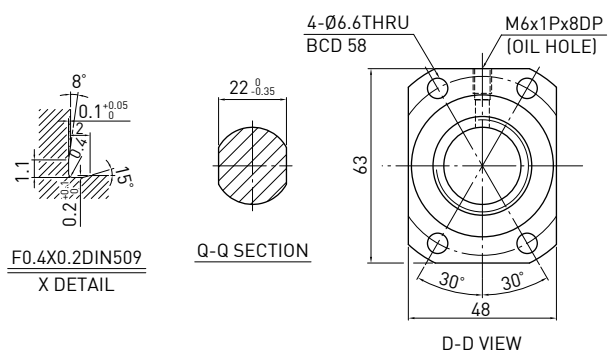
| Stroke | HIWIN Code                      | L1   | L2   | L3   | Accuracy grade |
|--------|---------------------------------|------|------|------|----------------|
| 400    | 2R20-40V2-DFSH-506- 620-0.018   | 506  | 535  | 620  | 5              |
| 600    | 2R20-40V2-DFSH-706- 820-0.018   | 706  | 735  | 820  | 5              |
| 800    | 2R20-40V2-DFSH-906- 1020-0.018  | 906  | 935  | 1020 | 5              |
| 1000   | 2R20-40V2-DFSH-1106- 1220-0.018 | 1106 | 1135 | 1220 | 5              |
| 1200   | 2R20-40V2-DFSH-1306- 1420-0.018 | 1306 | 1335 | 1420 | 5              |
| 1600   | 2R20-40V2-DFSH-1706- 1820-0.018 | 1706 | 1735 | 1820 | 5              |

**D F S H TYPE** (SHAFT OD 25, LEAD 50)

◀ Ultra High Lead



| Ballscrew Data       |            |               |
|----------------------|------------|---------------|
| Direction            | Right Hand |               |
| Lead (mm)            | 50         |               |
| Lead Angle           | 31.67°     |               |
| P.C.D (mm)           | 25.8       |               |
| Steel Ball (mm)      | Ø3.969     |               |
| Circuits             | 0.7x2      |               |
| Dynamic Load C (Kgf) | 719        |               |
| Static Load Co (Kgf) | 1475       |               |
| Axial Play (mm)      | 0          | 0.005 or less |
| Drag Torque (Kgf-cm) | 0.3~2.19   | ~0.5          |
| Spacer Ball          | 1 : 1      | -             |



Unit : mm

| Stroke | HIWIN Code                     | L1   | L2   | L3   | Accuracy grade |
|--------|--------------------------------|------|------|------|----------------|
| 700    | 2R25-50V2-DFSH-844-1013-0.018  | 844  | 880  | 1013 | 5              |
| 1000   | 2R25-50V2-DFSH-1144-1313-0.018 | 1144 | 1180 | 1313 | 5              |
| 1500   | 2R25-50V2-DFSH-1644-1813-0.018 | 1644 | 1680 | 1813 | 5              |
| 2000   | 2R25-50V2-DFSH-2144-2313-0.018 | 2144 | 2180 | 2313 | 5              |

## 7 Rolled Ballscrews

### 7.1 Introduction

HIWIN Rolled Ballscrews are made by the rolling process of the screw spindle instead of the grinding process. Rolled ballscrews not only have the benefit of low friction and smooth running for the linear feed system compared with traditional screws, but also can be supplied by quick stock delivery and lower production price.

HIWIN uses the most advanced technology in the ballscrew rolling process. By maintaining the homogeneous manufacturing procedure of selecting materials, rolling, heat treating, machining and assembling.

HIWIN rolled ballscrews can be classified into two grades. They are :

- Precision rolled grade (PR)
- High precision rolled grade (HR)

In general, both grades use the same preload method as the precision ground ballscrews, except that there are some differences in the lead error definition and the geometric tolerance. Each grade of the rolled ballscrews can be ordered according to the same nut dimension of the precision ground ballscrew. The dimensions of general type rolled ballscrews are listed in section 7.4. The geometric tolerances are shown in Table 7.4 and Table 7.6. If the ends of the spindle are unmachined, the geometric tolerance does not apply. The production scale of each type of the ballscrews and the accuracy classification are described in the following sections (the unit of length used is in mm).

### 7.2 Precision Rolled Ballscrews

Table 7.1 gives the lead accuracy of the precision rolled ballscrews. The lead accuracy is measured by the accumulated lead error of any portion of 300 mm in length. The maximum axial plays of the precision rolled ballscrews are shown in Table 7.2. These ballscrews can be preloaded as the precision ground ones. The categories of the precision rolled ballscrews are listed in Table 7.3.

Fig. 7.1 and Table 7.4 show the geometric tolerance of the general rolled ballscrews. has a variety of the precision rolled ballscrews for our customers' urgent requirement.

Table 7.1 Accuracy grade of precision rolled ballscrew

Unit : mm

| Cumulative  | PR1    | PR2   | PR3  | PR4   |
|-------------|--------|-------|------|-------|
| Error/300mm | ±0.023 | ±0.05 | ±0.1 | ±0.21 |

Table 7.2 Maximum axial play of precision rolled ballscrew

Unit : mm

| Ball diameter | ≤ 2  | 2.381<br>3.175 | 3.969 | 4.763 | 6.35 | 7.144 | 7.938 | 9.525 |
|---------------|------|----------------|-------|-------|------|-------|-------|-------|
| Axial play    | 0.06 | 0.07           | 0.10  | 0.12  | 0.15 | 0.16  | 0.17  | 0.18  |

### 7.3 High Precision Rolled Ballscrews

The lead accuracy of the high precision rolled ballscrew is shown in table 7.5.

Fig. 7.2 and Table 7.6 show the geometric tolerances of preloaded high precision rolled ballscrews. Since the spindles of these ballscrews are made according to the accuracy tolerances, the geometric tolerances can be maintained at the highest precision level. Preload method of this type is the same as that of the precision ground type. Thus, they are comparable to the relative grade precision ground ballscrews, with lower price and shorter delivery period.

Table 7.7 gives the axial backlash of standard non-preloaded high precision rolled ballscrews. Table 7.8 shows the dimensions of the high precision rolled ballscrews. Since the rolled ballscrews have a different heat treatment process, they are hard to machine by regular machine tools. Hence, we provide the service of machining the journal ends to satisfy your requirements.

Table 7.3 Category of HIWIN precision rolled ballscrew

Unit : mm

| Nominal diameter do (mm) | Lead |     |   |   |   |      |   |   |    |    |    |    |    |    |    |    | Max.screw length |
|--------------------------|------|-----|---|---|---|------|---|---|----|----|----|----|----|----|----|----|------------------|
|                          | 2    | 2.5 | 3 | 4 | 5 | 5.08 | 6 | 8 | 10 | 12 | 16 | 20 | 25 | 32 | 40 | 50 |                  |
| 8                        | ●    | ■   | ● |   |   |      |   |   |    |    |    |    |    |    |    |    | 800              |
| 10                       | ●    | ■   | ● | ● | ● |      |   |   |    |    |    |    |    |    |    |    | 1000             |
| 12                       | ●    | ■   | ● | ■ | ● | ●    |   |   |    | ●  |    |    |    |    |    |    | 1200             |
| 14                       |      | ■   | ● | ● | ● |      |   |   |    |    |    |    |    |    |    |    | 1400             |
| 15                       |      |     |   |   | ● |      |   |   | ●  |    |    | ●  |    |    |    |    | 1500             |
| 16                       | ■    | ■   |   |   | ■ | ■    |   |   | ■  |    | ●  |    |    |    |    |    | 1600             |
| 20                       |      | ■   |   |   | ■ | ■    | ● | ● | ●  |    |    | ●  |    |    |    |    | 2000             |
| 25                       |      |     |   |   | ■ | ■    |   | ● | ■  |    |    |    | ●  |    |    |    | 2500             |
| 28                       |      |     |   |   | ● |      | ● |   |    |    |    |    |    | ●  |    |    | 2500             |
| 32                       |      |     |   |   | ■ | ■    | ● | ● | ●  |    |    | ●  |    |    |    |    | 3200             |
| 36                       |      |     |   |   | ● | ●    | ● | ● | ●  | ●  |    | ●  |    |    |    |    | 3600             |
| 40                       |      |     |   |   | ■ | ■    | ● | ● | ●  | ●  |    | ●  |    |    | ●  |    | 4000             |
| 45                       |      |     |   |   |   |      |   |   | ●  | ●  |    | ●  |    |    |    |    | 4600             |
| 50                       |      |     |   |   | ● |      | ● |   | ●  | ●  | ●  | ●  |    |    | ●  | ●  | 5000             |
| 55                       |      |     |   |   |   |      |   |   | ●  |    |    |    |    |    |    |    | 5500             |
| 63                       |      |     |   |   |   |      |   |   | ■  |    | ●  | ■  |    |    | ●  |    | 5750             |

■ : Right and left hand ballscrews    ● : Right hand ballscrews only

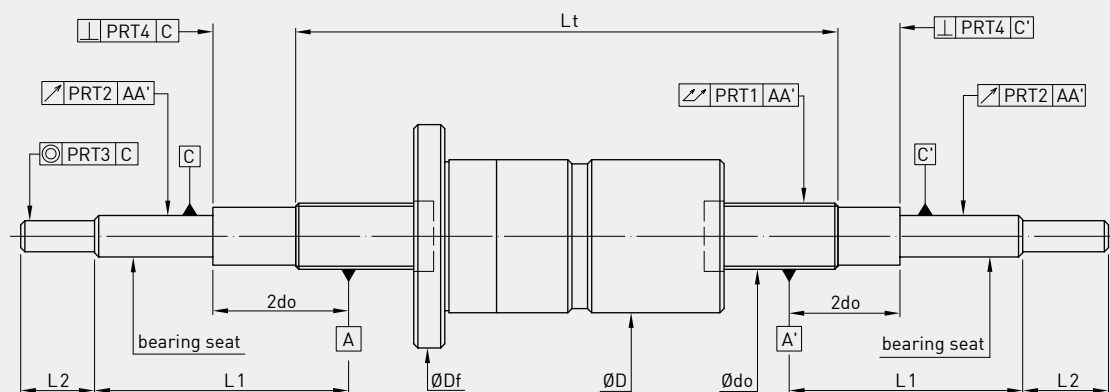


Fig. 7.1 Geometric tolerance of HIWIN precision rolled ballscrew

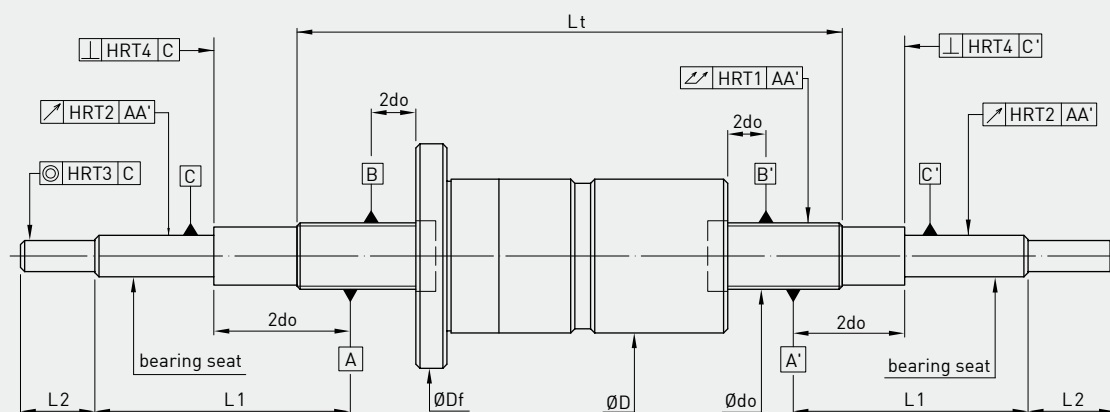


Fig. 7.2 Geometric tolerance of HIWIN high precision rolled ballscrew

Table : 7.4 Geometric tolerance range of HIWIN precision rolled ballscrew

Unit :  $\mu\text{m}$ 

| Nominal<br>diameter<br>d0 ( mm ) | PRT1  |      |      |      |       | PRT2 |       |       | PRT3 |       |       | PRT4 |
|----------------------------------|-------|------|------|------|-------|------|-------|-------|------|-------|-------|------|
|                                  | Lt/do |      |      |      |       | L1   |       |       | L2   |       |       |      |
|                                  | ≤ 20  | ≤ 40 | ≤ 60 | ≤ 80 | ≤ 100 | < 50 | < 125 | < 200 | < 50 | < 125 | < 200 |      |
| 12/14                            | 60    | 80   | 120  | 200  | 320   | 40   | -     |       | 12   | -     | -     | 6    |
| 16                               | 60    | 80   | 120  | 200  | 320   | 40   | -     | -     | 12   | -     | -     | 6    |
| 20                               | 60    | 80   | 120  | 200  | 320   | 40   | 50    | -     |      | 16    | -     | 6    |
| 25/28                            | 60    | 80   | 120  | 200  | 320   | 40   | 50    | -     |      | 16    | -     | 6    |
| 32/36                            | 60    | 80   | 120  | 200  | 320   | 40   | 50    | -     |      | 16    | -     | 6    |
| 40/45                            | 60    | 80   | 120  | 200  | 320   | 40   | 50    | -     |      | 16    | -     | 6    |
| 50                               | 60    | 80   | 120  | 200  | 320   | 40   | 50    | 63    |      |       | 20    | 6    |
| 63                               | 60    | 80   | 120  | 200  | 320   | 40   | 50    | 63    |      |       | 20    | 8    |

Table 7.5 Lead accuracy of HIWIN high precision rolled ballscrew

Unit :  $\mu\text{m}$ 

| Accuracy Grade     |                  | HR1     |    |
|--------------------|------------------|---------|----|
| Thread length (mm) | Item             | $\pm E$ | e  |
|                    | above      below |         |    |
| -                  | 315              | 23      | 23 |
| 315                | 400              | 25      | 25 |
| 400                | 500              | 27      | 26 |
| 500                | 630              | 30      | 29 |
| 630                | 800              | 35      | 31 |
| 800                | 1000             | 40      | 35 |
| 1000               | 1250             | 46      | 39 |
| 1250               | 1600             | 54      | 44 |
| 1600               | 2000             | 65      | 51 |
| 2000               | 2500             | 77      | 59 |
| 2500               | 2800             | 93      | 69 |

Fig 7.6 Geometric tolerance range of HIWIN high precision rolled ballscrew

Unit :  $\mu\text{m}$ 

| Nominal diameter<br>d0(mm) | HRT1  |      | HRT2 |       |       | HRT3 |       |       | HRT4 |
|----------------------------|-------|------|------|-------|-------|------|-------|-------|------|
|                            | Lt/do |      | L1   |       |       | L2   |       |       |      |
|                            | ≤ 20  | ≤ 40 | < 50 | < 125 | < 200 | < 50 | < 125 | < 200 |      |
| 16                         | 50    | 64   | 25   | -     | -     | 10   | -     | -     | 5    |
| 20                         | 50    | 64   | 25   | 32    | -     |      | 12    | -     | 5    |
| 25                         | 50    | 64   | 25   | 32    | -     |      | 12    | -     | 5    |
| 32                         | 50    | 64   | 25   | 32    | -     |      | 12    | -     | 5    |
| 40                         | 50    | 64   | 25   | 32    | -     |      | 12    | -     | 5    |
| 50                         | 50    | 64   | 25   | 32    | 40    |      | -     | 16    | 5    |

Table 7.7 Axial play of standard non-preloaded high precision rolled ballscrews

Unit : mm

| Accuracy grade  | HR1  |
|-----------------|------|
| Max. axial play | 0.02 |

Table 7.8 Category of the high precision rolled ballscrews

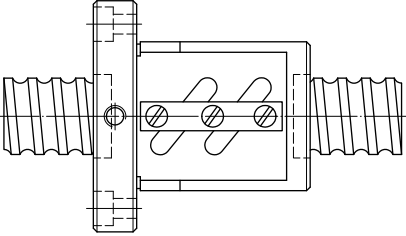
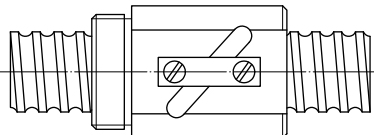
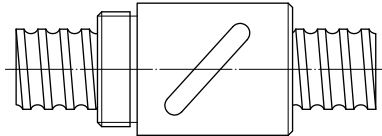
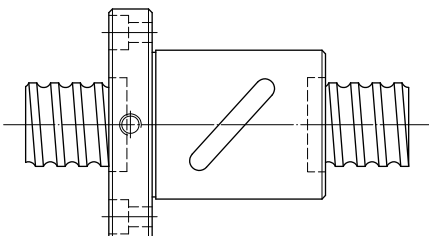
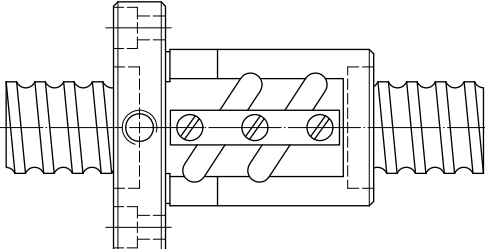
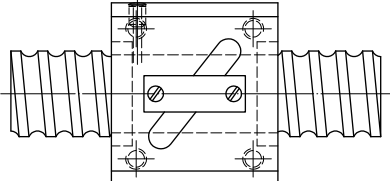
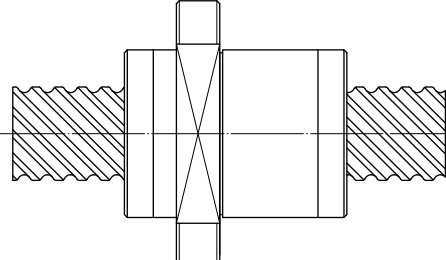
Unit : mm

| Nominal diameter<br>d0 (mm) | Lead |    | Max.screw length |
|-----------------------------|------|----|------------------|
|                             | 5    | 10 |                  |
| 16                          | ■    |    | 640              |
| 20                          | ■    |    | 800              |
| 25                          | ■    | ●  | 1000             |
| 32                          | ■    | ●  | 1200             |
| 40                          | ■    | ●  | 1600             |
| 50                          |      | ●  | 3000             |

■ : Right and left hand ballscrews    ● : Right hand ballscrews only



## 7.4 General Type of Rolled Ballscrews

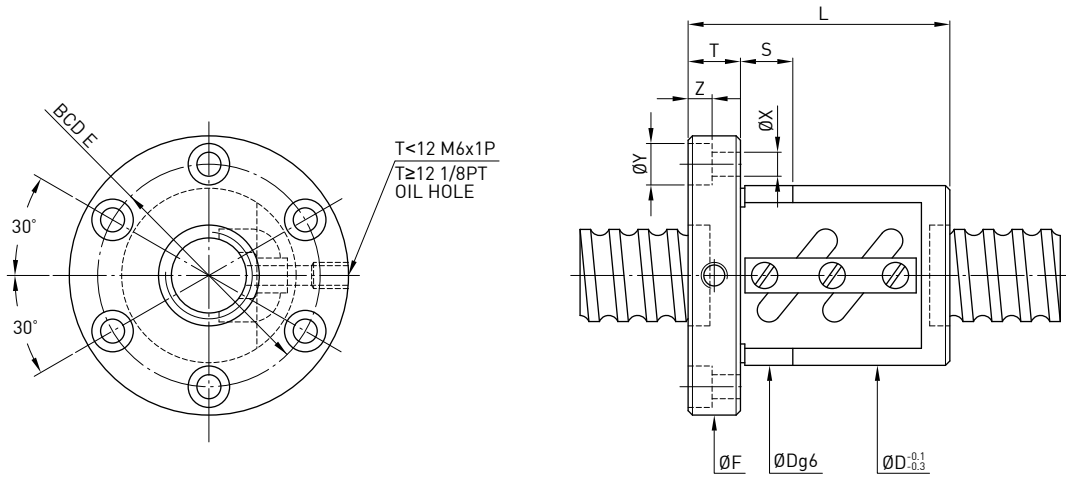
| page | General Type   |   | page |
|------|--|---|------|
| 138  | <p>★ ★ <b>FSW</b></p>  <p>Flange end, single nut,<br/>tube within the nut diameter</p>  | <p><b>RSV</b></p>  <p>Round, single nut,<br/>tube above the nut diameter</p>    | 139  |
| 140  | <p><b>RSB</b></p>  <p>Round, single nut, bonded return tube</p>                        | <p>★ ★ <b>FSB</b></p>  <p>Flange end, single nut, bonded return tube</p>       | 141  |
| 142  | <p>★ ★ <b>FSV</b></p>  <p>Flange end, single nut,<br/>tube above the nut diameter</p> | <p><b>SSV</b></p>  <p>Square, single nut,<br/>tube above the nut diameter</p> | 143  |
| page | High Lead Type   |   | page |
| 144  | <p>★ ★ <b>FSH</b></p>  <p>Large lead, flange mounted, single nut, end cap</p>        |   | 144  |

\*Different design required by the drawing approval, please contact with HIWIN engineers for the other type listed above.

\*Double asterisks(★ ★): Self-Lubricating Ballscrew E2 design is available, except the shaft diameter under 16mm or ball diameter under 2.381mm.

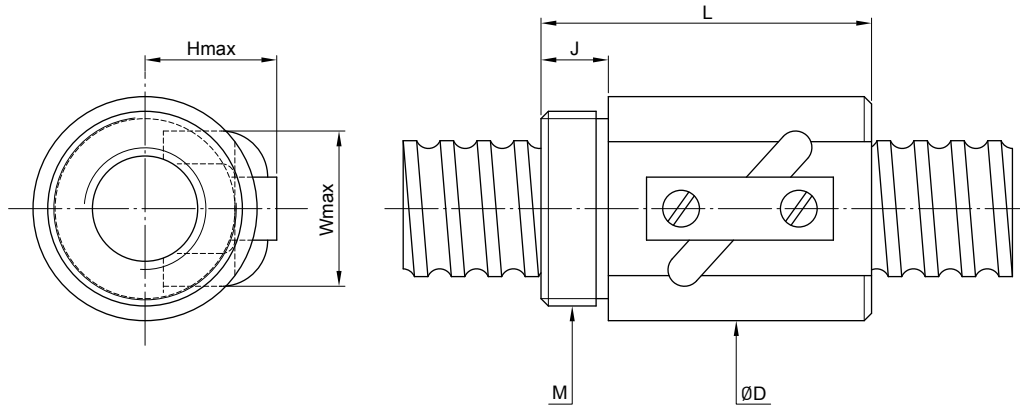
7.5 Dimensions for Rolled Ballscrews

F S W TYPE



| Model    | Size         |      | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C ( kgf ) | Static Load<br>Co ( kgf ) | Nut |     | Flange |       |    |      |      |     | Fit |
|----------|--------------|------|-----------|----------|---|---------------------------|-----|-----|--------|-------|----|------|------|-----|-----|
|          | Nominal Dia. | Lead |           |          |   |                           | L   | D   | F      | BCD-E | T  | Bolt |      |     |     |
|          |              |      |           |          |   |                           |     |     |        |       |    | X    | Y    | Z   | S   |
| 8-2.5B1  | 8            | 2.5  | 2.000     | 2.5x1    | 218   | 317                       | 34  | 26  | 47     | 35    | 8  | 5.5  | 9.5  | 5.5 | 8   |
| 10-2.5B1 | 10           |      |           | 2.5x1    | 252   | 405                       | 34  | 28  | 52     | 38    | 8  | 5.5  | 9.5  | 5.5 | 8   |
| 10-4B1   |              | 4    | 2.381     | 2.5x1    | 304   | 466                       | 41  | 30  | 53     | 41    | 10 | 5.5  | 9.5  | 5.5 | 10  |
| 12-4B1   | 12           |      |           | 2.5x1    | 344   | 574                       | 41  | 30  | 50     | 40    | 10 | 5.5  | 9.5  | 5.5 | 12  |
| 16-5B1   | 16           | 5    | 3.175     | 2.5x1    | 679   | 1226                      | 43  | 40  | 64     | 51    | 10 | 5.5  | 9.5  | 5.5 | 12  |
| 20-5C1   | 20           |      |           | 3.5x1    | 1001  | 2149                      | 50  | 44  | 68     | 55    | 12 | 5.5  | 9.5  | 5.5 | 12  |
| 25-5B2   | 25           | 10   | 4.763     | 2.5x2    | 1534  | 3975                      | 60  | 50  | 74     | 62    | 12 | 5.5  | 9.5  | 5.5 | 12  |
| 25-10B1  |              |      |           | 2.5x1    | 1459  | 2983                      | 65  | 60  | 86     | 73    | 16 | 6.6  | 11   | 6.5 | 12  |
| 32-5B2   | 32           | 5    | 3.175     | 2.5x2    | 1702  | 5098                      | 60  | 58  | 84     | 71    | 12 | 6.6  | 11   | 6.5 | 12  |
| 32-10B2  |              | 10   | 6.350     | 2.5x2    | 4379  | 10345                     | 98  | 74  | 108    | 90    | 16 | 9    | 14   | 8.5 | 15  |
| 40-10B2  | 2.5x2        |      |           | 4812     | 12732   | 102                       | 84  | 125 | 104    | 18    | 11 | 17.5 | 11   | 15  |     |
| 50-10C2  | 50           |      |           | 3.5x2    | 7146  | 22477                     | 126 | 94  | 135    | 114   | 18 | 11   | 17.5 | 11  | 20  |
| 63-10C2  | 63           |      |           | 3.5x2    | 7869  | 28290                     | 128 | 110 | 152    | 130   | 20 | 11   | 17.5 | 11  | 20  |

**R S V TYPE**



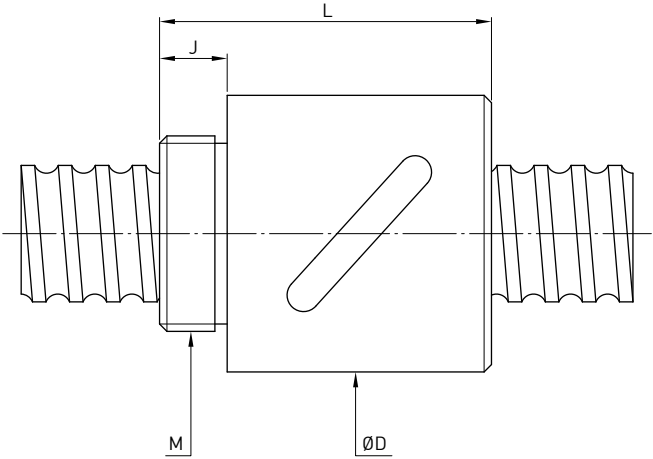
| Model     | Size         |       | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C ( kgf ) | Static Load<br>Co ( kgf ) | Nut   |     | Mounting Thread | Mounting Thread Length | Return Tube Width | Return Tube Height |
|-----------|--------------|-------|-----------|----------|---|---------------------------|-------|-----|-----------------|------------------------|-------------------|--------------------|
|           | Nominal Dia. | Lead  |           |          |   |                           | L     | D   |                 |                        |                   |                    |
| 8-2.5B1   | 8            | 2.5   | 2.000     | 2.5x1    | 218   | 317                       | 28    | 18  | M18x1P          | 10                     | 15                | 15                 |
| 10-2.5B1  | 10           |       |           | 2.5x1    | 252   | 405                       | 30    | 20  | M18x1P          | 10                     | 17                | 17                 |
| 10-4B1    |              |       |           | 4        | 2.5x1   | 305                       | 466   | 32  | 23              | M22x1P                 | 10                | 20                 |
| 12-4B1    | 12           | 2.381 | 2.5x1     |          | 344   | 574                       | 32    | 25  | M24x1P          | 10                     | 22                | 21                 |
| 16-5B1    | 16           |       | 5         | 3.175    | 2.5x1   | 679                       | 1226  | 40  | 31              | M28x1.5P               | 10                | 23                 |
| 16-5.08B1 |              | 5.08  | 2.5x1     |          | 763   | 1399                      | 45    | 30  | M25x1.5P        | 13                     | 24                | 21                 |
| 16-5.08C1 |              |       | 3.5x1     |          | 1013  | 1945                      | 45    | 30  | M25x1.5P        | 13                     | 24                | 21                 |
| 20-5C1    | 20           | 5     | 3.5x1     |          | 1001  | 2149                      | 45    | 35  | M32x1.5P        | 12                     | 27                | 22                 |
| 25-5B2    | 25           |       | 2.5x2     |          | 1534  | 3975                      | 58    | 40  | M38x1.5P        | 16                     | 31                | 25                 |
| 25-10B2   |              | 10    | 4.763     |          | 2.5x2   | 2663                      | 6123  | 94  | 45              | M38x1.5P               | 16                | 38                 |
| 32-5B2    |              | 32    | 5         | 3.175    | 2.5x2   | 1702                      | 5098  | 60  | 54              | M50x2P                 | 18                | 38                 |
| 32-10B2   | 10           |       | 6.350     | 2.5x2    | 4379  | 10345                     | 95    | 58  | M52x2P          | 18                     | 44                | 36                 |
| 40-10B2   |              |       |           | 2.5x1    | 4812  | 12732                     | 102   | 65  | M60x2P          | 25                     | 52                | 41                 |
| 50-10C2   |              | 50    |           | 3.5x2    | 7146  | 22477                     | 130   | 80  | M75x2P          | 30                     | 62                | 46                 |
| 63-10C2   |              | 63    |           | 3.5x2    | 7869  | 28290                     | 132   | 95  | M90x2P          | 40                     | 74                | 52                 |
| 63-12C3   | 12           |       |           | 7.938    | 3.5x3   | 16828                     | 58535 | 205 | 102             | M95x3P                 | 35                | 75                 |

R

S

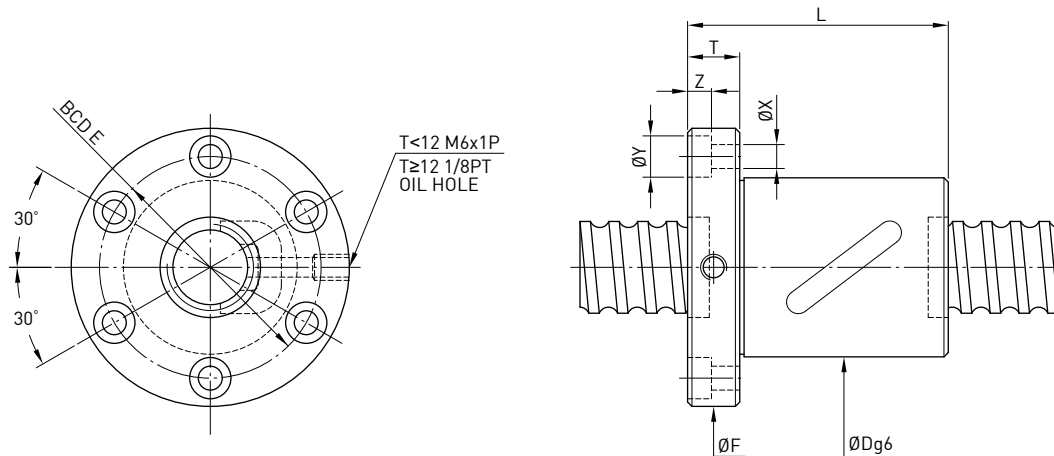
B

TYPE



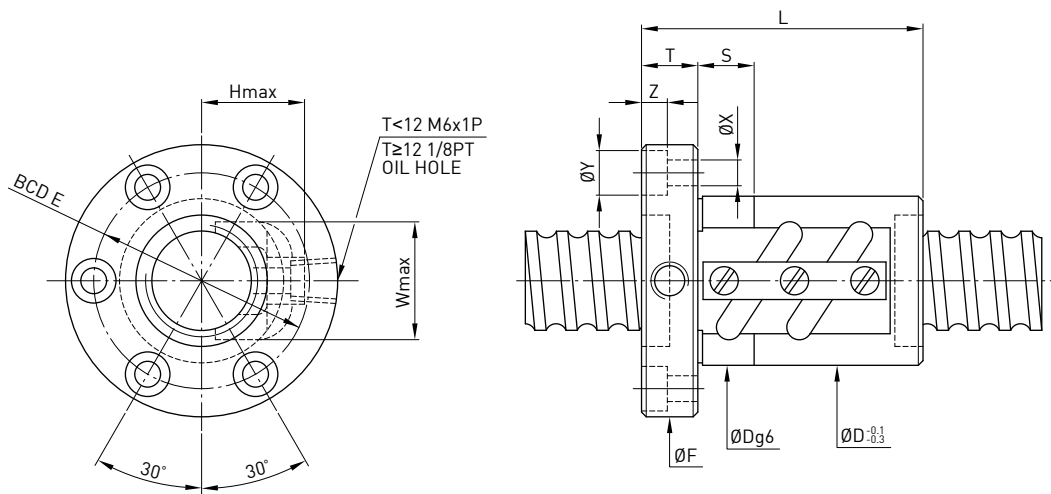
| Model    | Size         |      | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C ( kgf ) | Static Load<br>Co ( kgf ) | Nut |        | Mounting Thread | Mounting Thread Length |
|----------|--------------|------|-----------|----------|---|---------------------------|-----|--------|-----------------|------------------------|
|          | Nominal Dia. | Lead |           |          |   |                           | L   | D      | M               | J                      |
| 8-2.5B1  | 8            | 2.5  | 2.000     | 2.5x1    | 218   | 317                       | 24  | 22     | M18x1P          | 7.5                    |
| 10-2.5B1 | 10           |      |           | 2.5x1    | 252   | 405                       | 24  | 24     | M20x1P          | 7.5                    |
| 10-4B1   |              | 4    | 2.381     | 2.5x1    | 304   | 466                       | 34  | 26     | M22x1P          | 10                     |
| 12-4B1   | 12           |      |           | 2.5x1    | 344   | 574                       | 34  | 28     | M25x1.5P        | 10                     |
| 16-5B1   | 16           | 5    | 3.175     | 2.5x1    | 679   | 1226                      | 42  | 36     | M30x1.5P        | 12                     |
| 20-5C1   | 20           |      |           | 3.5x1    | 1001  | 2149                      | 54  | 40     | M36x1.5P        | 14                     |
| 25-5B2   | 25           |      |           | 2.5x2    | 1534  | 3975                      | 69  | 46     | M42x1.5P        | 19                     |
| 32-5B2   | 32           | 5    | 6.350     | 2.5x2    | 1702  | 5098                      | 69  | 54     | M50x2P          | 19                     |
| 32-10B2  |              | 10   |           | 2.5x2    | 4379  | 10345                     | 105 | 68     | M62x2P          | 19                     |
| 40-10B2  | 2.5x2        |      |           | 4812     | 12732   | 110                       | 76  | M70x2P | 24              |                        |
| 50-10C2  | 50           |      |           | 3.5x2    | 7146  | 22477                     | 135 | 88     | M82x2P          | 29                     |
| 63-10C2  | 63           |      | 3.5x2     | 7869     | 28290   | 135                       | 104 | M95x2P | 29              |                        |

**F S B TYPE**



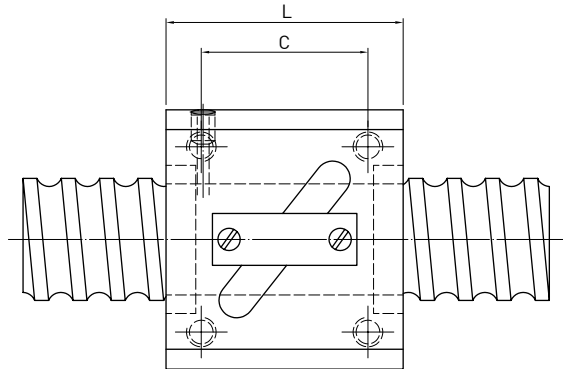
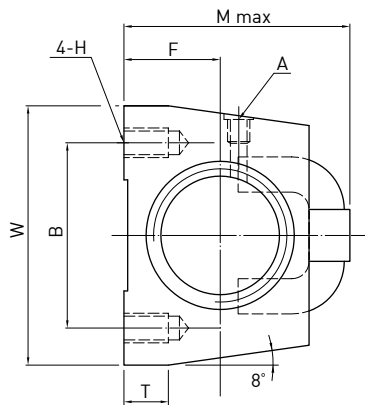
| Model    | Size         |      | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C ( kgf ) | Static Load<br>Co ( kgf ) | Nut |     | Flange |       |     |      |      |     |
|----------|--------------|------|-----------|----------|---|---------------------------|-----|-----|--------|-------|-----|------|------|-----|
|          | Nominal Dia. | Lead |           |          |   |                           | L   | D   | F      | BCD-E | T   | Bolt |      |     |
|          |              |      |           |          |   |                           |     |     |        |       |     | X    | Y    | Z   |
| 8-2.5B1  | 8            | 2.5  | 2.000     | 2.5x1    | 218   | 317                       | 34  | 22  | 43     | 31    | 8   | 5.5  | 9.5  | 5.5 |
| 10-2.5B1 | 10           |      |           | 2.5x1    | 252   | 405                       | 34  | 24  | 46     | 34    | 8   | 5.5  | 9.5  | 5.5 |
| 10-4B1   | 12           | 4    | 2.381     | 2.5x1    | 304   | 466                       | 41  | 26  | 49     | 37    | 10  | 5.5  | 9.5  | 5.5 |
| 12-4B1   |              |      |           | 2.5x1    | 344   | 574                       | 41  | 28  | 51     | 39    | 10  | 5.5  | 9.5  | 5.5 |
| 12-4C1   | 3.5x1        |      |           | 459      | 803   | 44                        | 30  | 50  | 40     | 10    | 4.5 | 8    | 4.5  |     |
| 14-4C1   | 3.5x1        |      |           | 498      | 943   | 40                        | 31  | 50  | 40     | 10    | 4.5 | 8    | 4.5  |     |
| 14-5B1   | 14           | 5    | 3.175     | 2.5x1    | 636   | 1095                      | 40  | 32  | 50     | 40    | 10  | 4.5  | 8    | 4.5 |
| 16-4B1   | 16           | 4    | 2.381     | 2.5x1    | 390   | 744                       | 41  | 35  | 56     | 43    | 10  | 5.5  | 9.5  | 5.5 |
| 16-5B1   |              | 5    | 3.175     | 2.5x1    | 679   | 1226                      | 43  | 36  | 60     | 47    | 10  | 5.5  | 9.5  | 5.5 |
| 16-10B1  |              | 10   |           | 2.5x1    | 667   | 1194                      | 52  | 36  | 60     | 47    | 12  | 6.6  | 11   | 6.5 |
| 20-4C1   | 20           | 4    | 2.381     | 3.5x1    | 582   | 1329                      | 40  | 40  | 60     | 50    | 10  | 4.5  | 8    | 4.5 |
| 20-5B1   |              | 5    | 3.175     | 2.5x1    | 745   | 1526                      | 40  | 40  | 60     | 50    | 10  | 4.5  | 8    | 4.5 |
| 20-5C1   |              |      |           | 3.5x1    | 1001  | 2149                      | 50  | 40  | 64     | 51    | 12  | 5.5  | 9.5  | 5.5 |
| 25-5B1   | 2.5x1        |      |           | 845      | 1987  | 40                        | 43  | 67  | 55     | 10    | 5.5 | 9.5  | 5.5  |     |
| 25-5B2   | 2.5x2        |      |           | 1534     | 3975  | 60                        | 46  | 70  | 58     | 12    | 5.5 | 9.5  | 5.5  |     |
| 32-5B2   | 32           | 10   | 6.350     | 2.5x2    | 1702  | 5098                      | 60  | 54  | 80     | 67    | 12  | 6.6  | 11   | 6.5 |
| 32-10B2  |              |      |           | 2.5x2    | 4379  | 10345                     | 98  | 68  | 102    | 84    | 16  | 9    | 14   | 8.5 |
| 40-10B2  | 40           |      |           | 2.5x2    | 4812  | 12732                     | 102 | 76  | 117    | 96    | 18  | 11   | 17.5 | 11  |
| 50-10C2  | 50           |      |           | 3.5x2    | 7146  | 22477                     | 126 | 88  | 129    | 108   | 18  | 11   | 17.5 | 11  |
| 63-10C2  | 63           |      |           | 3.5x2    | 7869  | 28290                     | 128 | 104 | 146    | 124   | 20  | 11   | 17.5 | 11  |

**F S V TYPE**



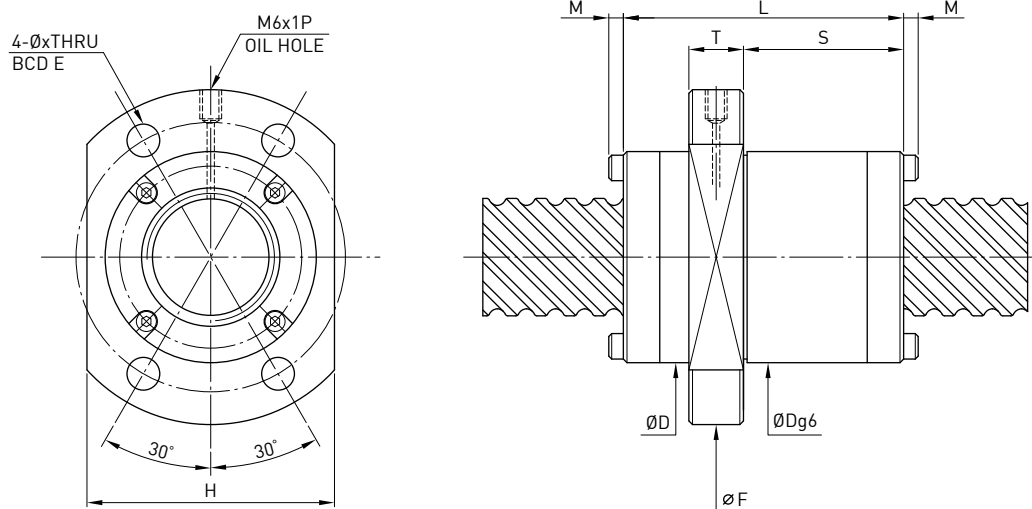
| Model    | Size         |       | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C ( kgf ) | Static Load<br>Co ( kgf ) | Nut |     | Flange |     |       | Return Tube |    | Bolt |      |     | Fit |
|----------|--------------|-------|-----------|----------|---|---------------------------|-----|-----|--------|-----|-------|-------------|----|------|------|-----|-----|
|          | Nominal Dia. | Lead  |           |          |   |                           | L   | D   | F      | T   | BCD-E | W           | H  | X    | Y    | Z   |     |
| 8-2.5B1  | 8            | 2.5   | 2.000     | 2.5x1    | 218   | 317                       | 34  | 18  | 41     | 8   | 29    | 15          | 15 | 5.5  | 9.5  | 5.5 | 8   |
| 10-2.5B1 | 10           |       |           | 2.5x1    | 252   | 405                       | 34  | 20  | 43     | 8   | 31    | 17          | 17 | 5.5  | 9.5  | 5.5 | 8   |
| 10-4B1   |              | 4     | 2.381     | 2.5x1    | 304   | 466                       | 41  | 23  | 46     | 10  | 34    | 20          | 20 | 5.5  | 9.5  | 5.5 | 10  |
| 12-4B1   | 12           |       |           | 2.5x1    | 344   | 574                       | 41  | 25  | 48     | 10  | 36    | 22          | 21 | 5.5  | 9.5  | 5.5 | 12  |
| 16-5B1   | 16           | 5     | 3.175     | 2.5x1    | 679   | 1226                      | 43  | 31  | 55     | 10  | 42    | 23          | 25 | 5.5  | 9.5  | 5.5 | 12  |
| 20-5C1   | 20           |       |           | 3.5x1    | 1001  | 2149                      | 50  | 35  | 59     | 12  | 46    | 27          | 22 | 5.5  | 9.5  | 5.5 | 12  |
| 25-5B2   | 25           |       |           | 2.5x2    | 1534  | 3975                      | 60  | 40  | 64     | 12  | 52    | 31          | 25 | 5.5  | 9.5  | 5.5 | 12  |
| 32-5B2   | 32           | 10    | 6.350     | 2.5x2    | 1702  | 5098                      | 60  | 54  | 80     | 12  | 67    | 38          | 29 | 6.6  | 11   | 6.5 | 12  |
| 32-10B2  |              |       |           | 2.5x2    | 4379  | 10345                     | 98  | 58  | 92     | 16  | 74    | 44          | 36 | 9    | 14   | 8.5 | 15  |
| 40-10B2  | 40           |       |           | 3.5x2    | 4812  | 12732                     | 102 | 65  | 106    | 18  | 85    | 52          | 41 | 11   | 17.5 | 11  | 15  |
| 50-10C2  | 50           | 3.5x2 |           | 7146     | 22477   | 126                       | 80  | 121 | 18     | 100 | 62    | 46          | 11 | 17.5 | 11   | 20  |     |
| 63-10C2  | 63           | 3.5x2 |           | 7869     | 28290   | 128                       | 95  | 137 | 20     | 115 | 74    | 52          | 11 | 17.5 | 11   | 20  |     |

**S S V TYPE**



| Model   | Size         |      | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C ( kgf ) | Static Load<br>Co ( kgf ) | W   | F  | L   | B  | C  | T    | M (max) |
|---------|--------------|------|-----------|----------|---|---------------------------|-----|----|-----|----|----|------|---------|
|         | Nominal Dia. | Lead |           |          |   |                           |     |    |     |    |    |      |         |
| 14-4B1  | 14           | 4    | 2.381     | 2.5x1    | 376   | 682                       | 34  | 13 | 35  | 26 | 22 | 6    | 30      |
| 14-4C1  |              |      |           | 3.5x1    | 498   | 943                       | 34  | 13 | 35  | 26 | 22 | 6    | 30      |
| 14-5B1  |              | 5    | 3.175     | 2.5x1    | 636   | 1095                      | 34  | 13 | 35  | 26 | 22 | 6    | 31      |
| 16-5B1  | 16           |      |           | 2.5x1    | 679   | 1226                      | 42  | 16 | 36  | 32 | 22 | 21.5 | 32.5    |
| 20-5B1  | 20           |      |           | 2.5x1    | 745   | 1526                      | 48  | 17 | 35  | 35 | 22 | 9    | 39      |
| 20-10B1 |              | 10   | 4.763     | 2.5x1    | 1280  | 2314                      | 48  | 18 | 58  | 35 | 35 | 9    | 46      |
| 25-5B1  | 25           | 5    | 3.175     | 2.5x1    | 845   | 1987                      | 60  | 20 | 35  | 40 | 22 | 9.5  | 45      |
| 25-10B2 |              | 10   | 6.350     | 2.5x2    | 3816  | 7968                      | 60  | 23 | 94  | 40 | 60 | 10   | 54      |
| 28-6B1  | 28           | 6    | 3.969     | 2.5x1    | 1203  | 2796                      | 60  | 22 | 42  | 40 | 18 | 10   | 50      |
| 28-6B2  |              |      |           | 2.5x2    | 2184  | 5592                      | 60  | 22 | 67  | 40 | 40 | 10   | 50      |
| 32-10B1 | 32           | 10   | 6.350     | 2.5x1    | 2413  | 5172                      | 70  | 26 | 64  | 50 | 45 | 12   | 62      |
| 32-10B2 |              |      |           | 2.5x2    | 4379  | 10345                     | 70  | 26 | 94  | 50 | 60 | 12   | 67      |
| 36-10B2 | 36           |      |           | 2.5x2    | 4592  | 11403                     | 86  | 29 | 96  | 60 | 60 | 17   | 67      |
| 45-12B2 | 45           | 12   | 7.144     | 2.5x2    | 5963  | 16110                     | 100 | 36 | 115 | 75 | 75 | 20.5 | 80      |

**F S H TYPE**



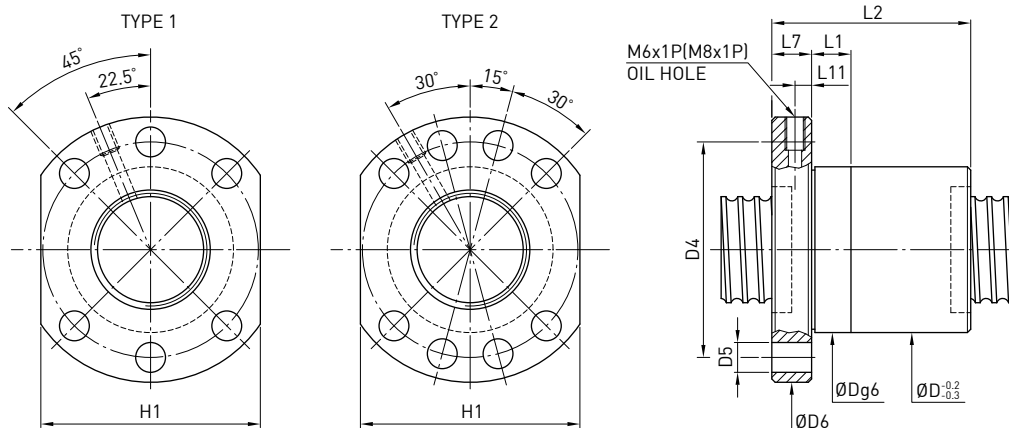
| Model   | Size         |      | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C ( kgf ) | Static Load<br>Co ( kgf ) | Nut |     | Flange |     |     |    | Bolt | Fit  |   |
|---------|--------------|------|-----------|----------|---|---------------------------|-----|-----|--------|-----|-----|----|------|------|---|
|         | Nominal Dia. | Lead |           |          |   |                           |     |     |        |     |     |    |      |      |   |
| 16-16S2 | 16           | 16   | 3.175     | 1.8x2    | 710   | 1380                      | 32  | 48  | 53     | 10  | 42  | 38 | 4.5  | 26   | 0 |
| 16-16S4 |              |      |           | 1.8x4    | 1290  | 2760                      |     |     |        |     |     |    |      |      |   |
| 16-16S2 |              |      |           | 1.8x2    | 710   | 1380                      | 33  | 48  | 58     | 10  | 45  | 38 | 6.6  | 26   | 0 |
| 16-16S4 |              |      |           | 1.8x4    | 1290  | 2760                      |     |     |        |     |     |    |      |      |   |
| 20-20S2 | 20           | 20   |           | 1.8x2    | 800   | 1740                      | 39  | 48  | 62     | 10  | 50  | 46 | 5.5  | 27.5 | 0 |
| 20-20S2 |              |      |           | 1.8x2    | 800   | 1740                      | 38  | 58  | 62     | 10  | 50  | 46 | 5.5  | 32.5 | 3 |
| 20-20S4 |              |      |           | 1.8x4    | 1450  | 3480                      |     |     |        |     |     |    |      |      |   |
| 25-25S2 | 25           | 25   |           | 1.8x2    | 1210  | 2800                      | 47  | 67  | 74     | 12  | 60  | 56 | 6.6  | 39.5 | 3 |
| 25-25S4 |              |      | 1.8x4     | 2190     | 5600  |                           |     |     |        |     |     |    |      |      |   |
| 32-32S2 | 32           | 32   | 1.8x2     | 1720     | 4280  | 58                        | 85  | 92  | 15     | 74  | 68  | 9  | 48   | 0    |   |
| 32-32S4 |              |      | 1.8x4     | 3110     | 8530  |                           |     |     |        |     |     |    |      |      |   |
| 40-40S2 | 40           | 40   | 1.8x2     | 2810     | 7170  | 72                        | 102 | 114 | 17     | 93  | 84  | 11 | 60   | 0    |   |
| 40-40S4 |              |      | 1.8x4     | 5100     | 14330   |                           |     |     |        |     |     |    |      |      |   |
| 50-50S2 | 50           | 50   | 1.8x2     | 4120     | 10890   | 90                        | 125 | 135 | 20     | 112 | 104 | 14 | 83.5 | 0    |   |
| 50-50S4 |              |      | 1.8x4     | 7470     | 21780   |                           |     |     |        |     |     |    |      |      |   |



## 7.6 Dimensions for Stock Rolled Ballscrews

**F S I TYPE** (DIN 69051 part 5 form B)

◀ Stock



| Model   | Size         |      | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C [ kgf ] | Static Load<br>Co [ kgf ] | D  | D4 | Flange Hole No. | D5  | D6  | H1 | L1 | L2  | L7 | L11 | M-Oil Hole |
|---------|--------------|------|-----------|----------|---|---------------------------|----|----|-----------------|-----|-----|----|----|-----|----|-----|------------|
|         | Nominal Dia. | Lead |           |          |   |                           |    |    |                 |     |     |    |    |     |    |     |            |
| 16-5T3  | 16           | 5    | 3.175     | 3        | 664   | 1196                      | 28 | 38 | 6               | 5.5 | 48  | 40 | 10 | 40  | 10 | 5   | M6x1P      |
| 20-5T3  | 20           |      |           | 3        | 733   | 1495                      | 36 | 47 | 6               | 6.6 | 58  | 44 | 10 | 44  | 10 | 5   | M6x1P      |
| 20-5T4  |              |      |           | 4        | 939   | 1993                      | 36 | 47 | 6               | 6.6 | 58  | 44 | 10 | 52  | 10 | 5   | M6x1P      |
| 25-5T3  | 25           |      |           | 3        | 880   | 2082                      | 40 | 51 | 6               | 6.6 | 62  | 48 | 10 | 44  | 10 | 5   | M6x1P      |
| 25-5T4  |              |      |           | 4        | 1127  | 2776                      | 40 | 51 | 6               | 6.6 | 62  | 48 | 10 | 52  | 10 | 5   | M6x1P      |
| 25-10T3 |              | 10   | 4.763     | 3        | 1430  | 2914                      | 40 | 51 | 6               | 6.6 | 62  | 48 | 16 | 65  | 10 | 5   | M6x1P      |
| 32-5T3  | 32           | 5    | 3.175     | 3        | 1008  | 2773                      | 50 | 65 | 6               | 9   | 80  | 62 | 10 | 46  | 12 | 6   | M6x1P      |
| 32-5T4  |              |      |           | 4        | 1291  | 3697                      | 50 | 65 | 6               | 9   | 80  | 62 | 10 | 53  | 12 | 6   | M6x1P      |
| 32-5T6  |              |      |           | 6        | 1830  | 5545                      | 50 | 65 | 6               | 9   | 80  | 62 | 10 | 66  | 12 | 6   | M6x1P      |
| 32-10T3 |              | 10   | 6.350     | 3        | 2264  | 4803                      | 50 | 65 | 6               | 9   | 80  | 62 | 16 | 74  | 12 | 6   | M6x1P      |
| 32-10T4 |              |      |           | 4        | 2900  | 6404                      | 50 | 65 | 6               | 9   | 80  | 62 | 16 | 85  | 12 | 6   | M6x1P      |
| 40-5T4  | 40           | 5    | 3.175     | 4        | 1414  | 4621                      | 63 | 78 | 8               | 9   | 93  | 70 | 10 | 53  | 14 | 7   | M8x1P      |
| 40-5T6  |              |      |           | 6        | 2004  | 6932                      | 63 | 78 | 8               | 9   | 93  | 70 | 10 | 66  | 14 | 7   | M8x1P      |
| 40-10T3 |              | 10   | 6.350     | 3        | 2652  | 6367                      | 63 | 78 | 8               | 9   | 93  | 70 | 16 | 74  | 14 | 7   | M8x1P      |
| 40-10T4 |              |      |           | 4        | 3396  | 8489                      | 63 | 78 | 8               | 9   | 93  | 70 | 16 | 87  | 14 | 7   | M8x1P      |
| 50-5T4  | 50           | 5    | 3.175     | 4        | 1562  | 5940                      | 75 | 93 | 8               | 11  | 110 | 85 | 10 | 57  | 16 | 8   | M8x1P      |
| 50-5T6  |              |      |           | 6        | 2214  | 8910                      | 75 | 93 | 8               | 11  | 110 | 85 | 10 | 70  | 16 | 8   | M8x1P      |
| 50-10T3 |              | 10   | 6.350     | 3        | 3045  | 8334                      | 75 | 93 | 8               | 11  | 110 | 85 | 16 | 78  | 16 | 8   | M8x1P      |
| 50-10T4 |              |      |           | 4        | 3899  | 11112                     | 75 | 93 | 8               | 11  | 110 | 85 | 16 | 89  | 16 | 8   | M8x1P      |
| 50-10T6 |              |      |           | 6        | 5526  | 16668                     | 75 | 93 | 8               | 11  | 110 | 85 | 16 | 112 | 16 | 8   | M8x1P      |

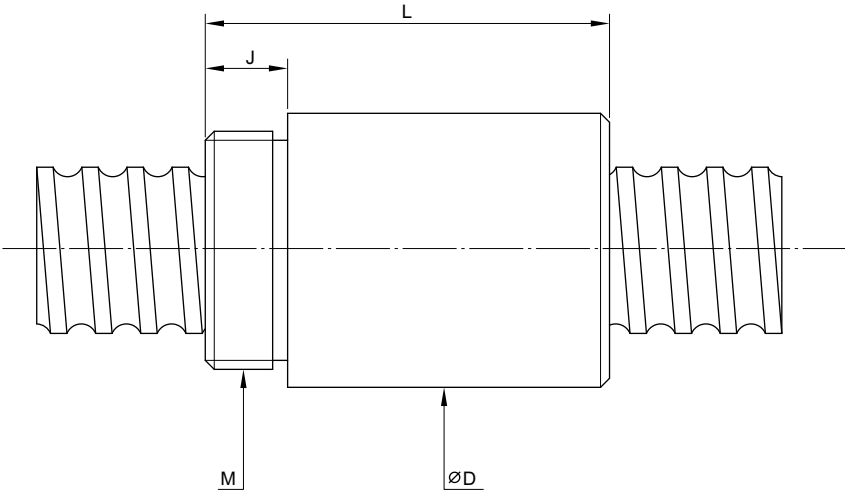
R

S

I

TYPE (with V-thread)

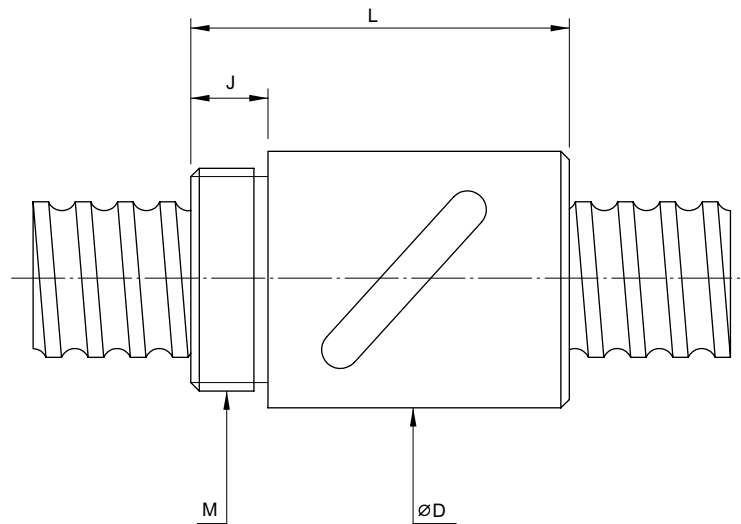
◀ Stock



| Model    | Size         |      | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C ( kgf ) | Static Load<br>Co ( kgf ) | L    | D    | M      | J   |
|----------|--------------|------|-----------|----------|---|---------------------------|------|------|--------|-----|
|          | Nominal Dia. | Lead |           |          |   |                           |      |      |        |     |
| 8-2.5T2  | 8            | 2.5  | 2.000     | 2        | 133   | 178                       | 23.5 | 17.5 | M15x1P | 7.5 |
| 10-2.5T2 | 10           |      |           | 2        | 178   | 263                       | 25   | 19.5 | M17x1P | 7.5 |
| 10-4T2   | 10           | 4    | 2.381     | 2        | 198   | 282                       | 32   | 24   | M22x1P | 10  |

**F S B TYPE** (with V-thread)

◀ Stock

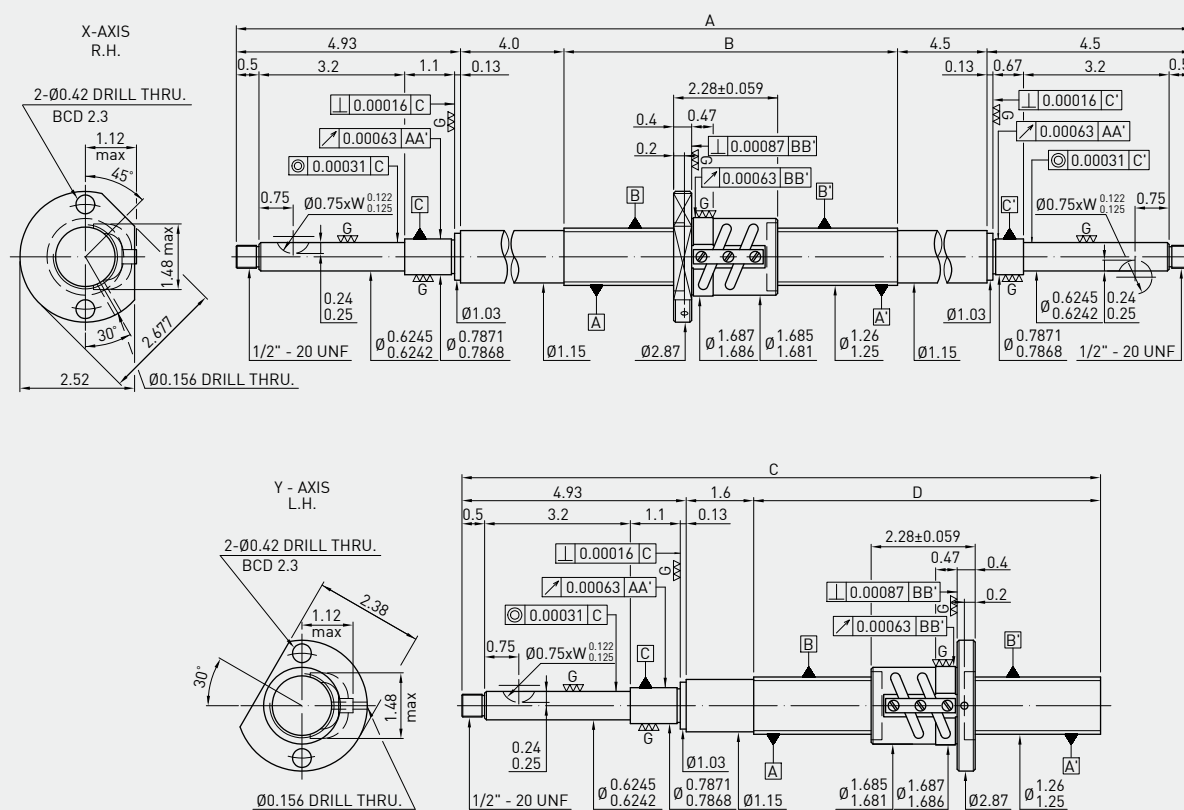


| Model  | Size         |      | Ball Dia. | Circuits | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C ( kgf ) | Static Load<br>Co ( kgf ) | L  | D    | M      | J  |
|--------|--------------|------|-----------|----------|---|---------------------------|----|------|--------|----|
|        | Nominal Dia. | Lead |           |          |   |                           |    |      |        |    |
| 12-4B1 | 12           | 4    | 2.381     | 2.5x1    | 344   | 574                       | 34 | 25.5 | M20x1P | 10 |

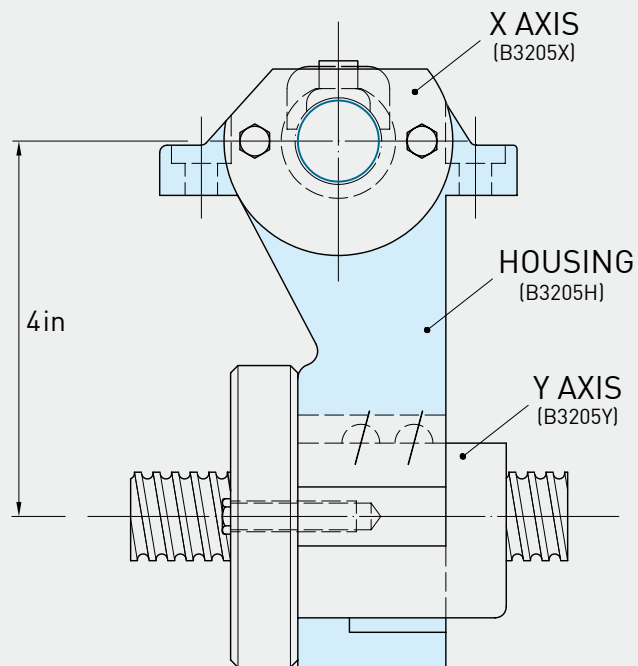
## 8

**Ballscrew Retrofit Kits for Manual Milling Machine****8.1 Precision Ground Ballscrew Set**

1. Precision ground, lead accuracy within  $\pm 0.0005''$  /ft.
2. Stock size meet various CNC systems' requirements.
3. High strength and long service life.



unit: inch



| Traverse Screw (X Axis) in |    |       |             |
|----------------------------|----|-------|-------------|
| Traverse Screw             | A  | B     | Part Number |
| 32                         | 42 | 24.07 | B3205X-32   |
| 36                         | 46 | 28.07 | B3205X-36   |
| 42                         | 52 | 34.07 | B3205X-42   |
| 48                         | 58 | 40.07 | B3205X-48   |

| Crossfeed Screw (Y Axis) in. |      |       |             |
|------------------------------|------|-------|-------------|
| Table Size                   | C    | D     | Part Number |
| 9                            | 20.3 | 13.77 | B3205Y-9    |
| 12                           | 23.3 | 16.77 | B3205Y-12   |
| 16                           | 27.3 | 20.77 | B3205Y-16   |

|                                      |                        |
|--------------------------------------|------------------------|
| P.C.Dia.                             | 1.28"                  |
| Ball Dia.                            | 0.125"                 |
| Lead Angle                           | 2.84°                  |
| Circuits                             | 2.5x2                  |
| Lead                                 | 5TPI                   |
| Static Load                          | 12491 lbf              |
| Dynamic Load(1x10 <sup>6</sup> revs) | 4158 lbf               |
| Lead Accuracy                        | 0.0003"/2π; 0.0005"/ft |
| Drag Torque(Preload)                 | 3.5in-lb (280lbs)      |

## 9 Multi-Solutions

### 9.1 E2 Self - lubricant



#### • Features :

##### • Cost savings :

The E2 series saves cost by eliminating piping joint systems, change and waste disposal, and by reducing oil purchases.

##### • Greatly extends the maintenance period :

The E2 series will supply proper lubrication for long periods of time extending the maintenance period.

##### • Easy maintenance :

The special construction of the E2 design requires no tools to replace the oil cartridge. There is no disassembly required when adding the E2 option.

##### • Ideal lubrication position :

The lubrication point is located inside the ball nut allowing for the lubrication to be firmly applied onto the ball tracks.

##### • Effortless and flexible installation :

The lubrication performs properly in every direction so there are no restrictions when installing the E2.

##### • Clean and environmentally friendly :

Prevents oil leakage, making the E2 the ideal solution for clean room environments.

##### • Interchangeable oil selection :

The replaceable oil cartridge can be refilled with any approved lubrication oil.

##### • Applications for special environments

The lubrication oil can be combined with grease for better results, especially in dusty, dirty, or wet environments.

##### • Characteristic of lubrication oil

The E2 self-lubrication cartridge is equipped with synthetic hydrocarbon based oil. The lubricate oil has a viscosity grade of ISO VG680.

The E2 is compatible with mineral, hydrocarbon, and ester based greases. The E2 can accept synthetic oils with stable characteristics. A high viscosity grade will work well in conditions where there are high and low temperatures.

The low fluid draft factor prevents excessive power consumption and deters against corrosion and rust.

A compatible lubricate oil with the same viscosity grade can also be used in the replaceable cartridge.

#### • Application :

- Machine tools
- Industrial machinery : printing machine, paper-processing machine, automatic machine, textile machine, cutting and grinding machines, etc.
- Electronic machinery : robots, measuring equipment, X-Y tables, etc.
- Miscellaneous: medical equipment, factory automation equipment, etc.

#### • Specification number :

Example: R40 - 10B2 - FSW**E2** - 800 - 1000 - 0.008



**HIWIN** E2 code

#### • Specification :

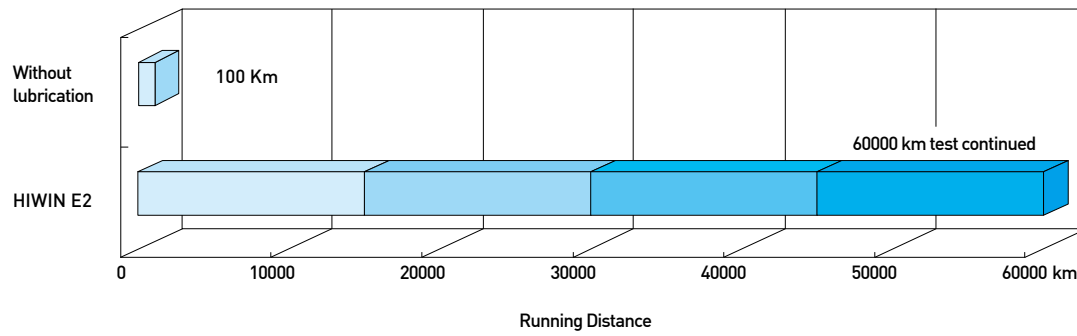
Nut type : FSV, FDV, FSW, FDW, PFDW, OFSW, DFSV, FSH

Please contact HIWIN engineers with other specification needs.

In order to get the good lubrication efficiency; please notify HIWIN engineers of the ballscrew installation direction.

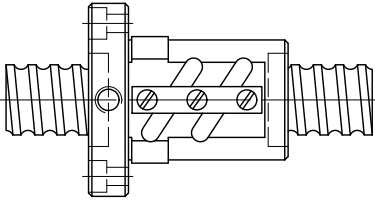
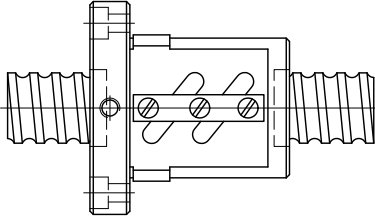
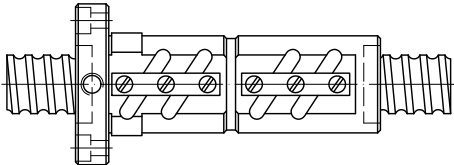
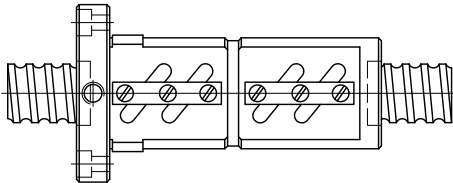
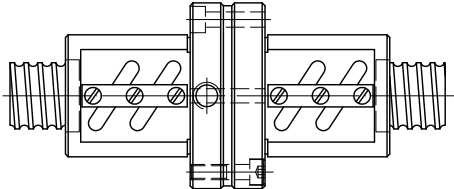
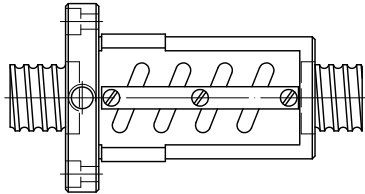
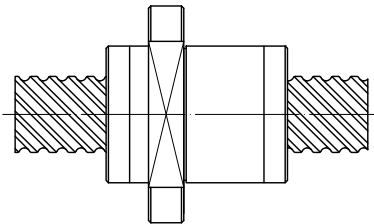
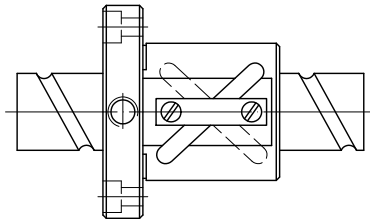
• Performance :

Test condition 1 :  
specification :  $\varnothing 50 \times 30$   
speed : 2500 rpm ( 75 m/min)  
stroke : 1180 mm



\* Note : above test with no grease added

**HIWIN E2 Precision Ground Ballscrews**

| General Type  |  |
|---|--|
| <div><b>FSV</b></div> <div></div> <div>Flange end, single nut,<br/>tube above nut diameter</div>           | <div><b>FSW</b></div> <div></div> <div>Flange end, single nut,<br/>tube within nut diameter</div>                          |
| <div><b>FDV</b></div> <div></div> <div>Flange end, double nut,<br/>tube above nut diameter</div>           | <div><b>FDW</b></div> <div></div> <div>Flange end, double nut,<br/>tube within nut diameter</div>                         |
| <div><b>PFDW</b></div> <div></div> <div>Flange to flange, double nut,<br/>tube within nut diameter</div> | <div><b>OFSW</b></div> <div></div> <div>Offset pitch preload, flange end,<br/>single nut, tube within nut diameter</div> |
| High Lead Type  |  |
| <div><b>FSH</b></div> <div></div> <div>Large lead, flange mounted,<br/>single nut, end cap</div>         | <div><b>DFSV</b></div> <div></div> <div>Double start, flange end,<br/>single nut, tube above nut diameter</div>          |

\*Different design required by the drawing approval, please contact with HIWIN engineers for the other type listed above.  
(The specifications in this catalogue are subject to change without notification.)



## 9.2 R1 Rotating Nut



### • Application:

Semi-conductor industries, Robots, Wood machines, Laser cutting machines, Transporting equipment.

### • Features:

#### 1. Compact and high positioning:

It is a compact design using nut and support bearing as an integral unit. 45-degree steel ball contact angle make a better axial load. Zero backlash and higher stiffness construction give a high positioning.

#### 2. Simple installation:

It is installed simply by fixing the nut on the housing with bolts.

#### 3. Rapid feed:

No inertial effect produced by the integral unit rotating and the shaft fixed. Can select smaller power to meet the rapid feed requirement.

#### 4. Stiffness:

Have a higher trust and moment stiffness, because the integral unit have an angular contact construction. There is no backlash while rolling.

#### 5. Quietness:

Special end cap design allows steel balls circulating inside the nut. Noise generated by high speed operation lower than ordinary ballscrew.

### • Specification:

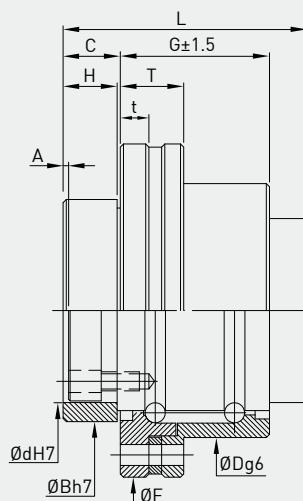
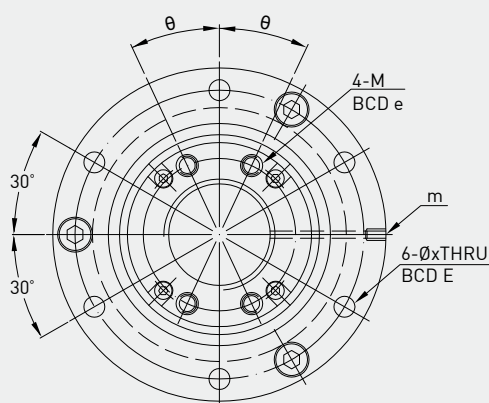
Example: 2R40-40S2-DFSHR1-800-1000-0.018



**HIWIN** R1 code

## R1 ROTATING NUT

China Patent No. 422327  
Germany Patent No. 10108647.4  
Taiwan Patent No.166845  
U.S.A. Patent No. 6406188B1



| Model   | Bearing           |                  | Nut |    |    |      | Flange |    |   |       | Bolt  |    |          |     | Bush |    |      |   | Oil hole |
|---------|-------------------|------------------|-----|----|----|------|--------|----|---|-------|-------|----|----------|-----|------|----|------|---|----------|
|         | Dynamic Load(kgf) | Static Load(kgf) | D   | G  | L  | C    | F      | T  | t | BCD-E | BCD-e | θ  | M        | X   | d    | B  | H    | A |          |
| 16-16S2 | 1299              | 1826             | 52  | 25 | 44 | 11.4 | 68     | 13 | 6 | 60    | 26    | 20 | M4x0.7P  | 4.5 | 33   | 40 | 11   | 2 | M4x0.7P  |
| 20-20S2 | 1762              | 2531             | 62  | 30 | 50 | 12   | 78     | 13 | 6 | 70    | 31    | 20 | M5x0.8P  | 4.5 | 39   | 50 | 11   | 2 | M4x0.7P  |
| 25-25S2 | 1946              | 3036             | 72  | 37 | 63 | 16.5 | 92     | 13 | 6 | 81    | 38    | 20 | M6x1P    | 5.5 | 47   | 58 | 15.5 | 3 | M4x0.7P  |
| 32-32S2 | 3150              | 5035             | 80  | 47 | 80 | 21   | 105    | 20 | 9 | 91    | 48    | 25 | M6x1P    | 6.6 | 58   | 66 | 20   | 3 | M6x0.75P |
| 40-40S2 | 4800              | 8148             | 110 | 62 | 98 | 22.5 | 140    | 20 | 9 | 123   | 61    | 25 | M8x1.25P | 9   | 73   | 90 | 21.5 | 3 | M6x0.75P |

## 9.3 Heavy Load Drive



### • Application:

High-load ball screw can be used for application on injection molding machines, die casting machines, general presses, power cylinders, robot ...

### • Features:

#### 1. Heavy Load

A. 2~3 times load capacity than general standard series.

B. High axial load and acceleration.

C. Special lubrication design for short stroke.

#### 2. Accuracy

JIS C5 and JIS C7

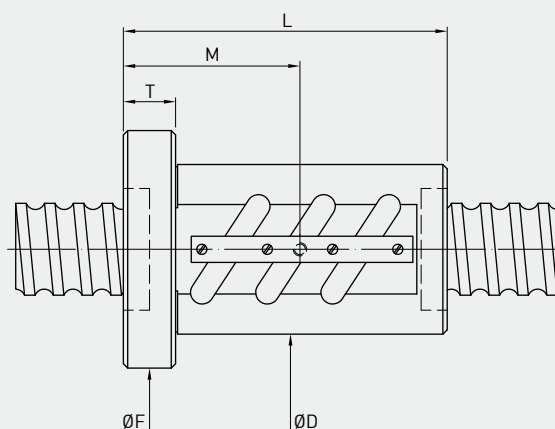
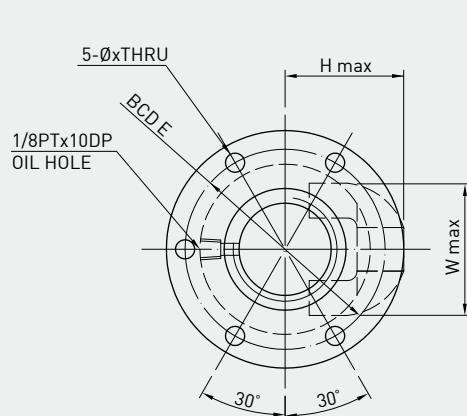
#### 3. High Speed Operation and High Life

Enforced ball circulation systems for high speed condition and achieve long service life.

#### 4. Option

Design in HIWIN Self-lubricant E2 Series.

## BALLSCREW FOR HEAVY-LOAD DRIVE



| Model No. | Shaft diameter | Lead | Turns<br>Circuits | Dynamic<br>C N (kgf) |         | Static<br>Co N (kgf) |          | D   | L   | F   | T  | E   | X  | H   | W   | M   |
|-----------|----------------|------|-------------------|----------------------|---------|----------------------|----------|-----|-----|-----|----|-----|----|-----|-----|-----|
| 50-16B2   | 50             | 16   | 2.5x2             | 235000               | [24000] | 497000               | [50700]  | 95  | 165 | 127 | 28 | 110 | 9  | 68  | 69  | 101 |
| 50-16B3   |                |      | 2.5x3             | 334000               | [34100] | 746000               | [76100]  | 95  | 213 | 127 | 28 | 110 | 9  | 68  | 69  | 117 |
| 55-16B2   | 55             |      | 2.5x2             | 255000               | [26000] | 535000               | [54600]  | 100 | 165 | 132 | 28 | 115 | 9  | 71  | 74  | 101 |
| 55-16B3   |                |      | 2.5x3             | 361000               | [36800] | 804000               | [82000]  | 100 | 213 | 132 | 28 | 115 | 9  | 71  | 74  | 117 |
| 63-16B2   | 63             |      | 2.5x2             | 280000               | [28600] | 613000               | [62500]  | 105 | 165 | 137 | 28 | 120 | 9  | 73  | 82  | 101 |
| 63-16B3   |                |      | 2.5x3             | 398000               | [40600] | 918000               | [93700]  | 105 | 213 | 137 | 28 | 120 | 9  | 73  | 82  | 117 |
| 80-16B2   | 80             | 16   | 2.5x2             | 322000               | [32900] | 765000               | [78100]  | 120 | 170 | 158 | 32 | 139 | 11 | 81  | 98  | 106 |
| 80-16B3   |                |      | 2.5x3             | 458000               | [46700] | 1150000              | [117000] | 120 | 218 | 158 | 32 | 139 | 11 | 81  | 98  | 122 |
| 80-25B3   | 100            | 25   | 2.5x3             | 650000               | [66300] | 2010000              | [205000] | 145 | 338 | 185 | 40 | 165 | 11 | 102 | 100 | 140 |
| 100-16B3  |                | 16   | 2.5x3             | 493000               | [50300] | 1430000              | [146000] | 140 | 218 | 178 | 32 | 159 | 11 | 91  | 117 | 122 |
| 100-25B3  |                |      | 2.5x3             | 738000               | [75300] | 2596000              | [264900] | 159 | 338 | 199 | 40 | 179 | 11 | 109 | 118 | 140 |
| 100-25B4  |                |      | 2.5x4             | 945000               | [96400] | 3461000              | [353200] | 159 | 413 | 199 | 40 | 179 | 11 | 109 | 118 | 165 |

## 9.4 High Speed (High Dm-N Value)



HIWIN high-speed ballscrews is a represent of the unique core technology of HIWIN whose design is based on the development of the optimized bi-arc contact profile and multi-circuit continuing ball circulation system. It possesses the characteristics of high feeding speed, high accelerating, strong stiffness, high loading, less vibration, and low noise. With the constant temperature design, it could prevent the deformation to satisfy the requirement in high accuracy positioning.

### • Application:

It can be installed into mold cutting, machining center, machine tools with speedy feeding, and other types of machine with request of high positioning accuracy in high speed.

### • Features:

#### 1. High speed feeding

Dm-N value is up to 150,000 (i.e. spiral rate=7.8 m/sec); feeding rate is 90m/min.

#### 2. High positioning accuracy

The accuracy is up to the requirement of JIS C3.

#### 3. Acceleration

Over 1.0 g (9.8 m/sec<sup>2</sup>) to avoid time consuming between accelerating and decelerating.

#### 4. Heavy stiffness

Optimized screw profile and structure design.

#### 5. Heavy load

Multi-load ball distribution design.

#### 6. Low vibration noise

Using the best slender ratio and high-speed circulation to lower noise.

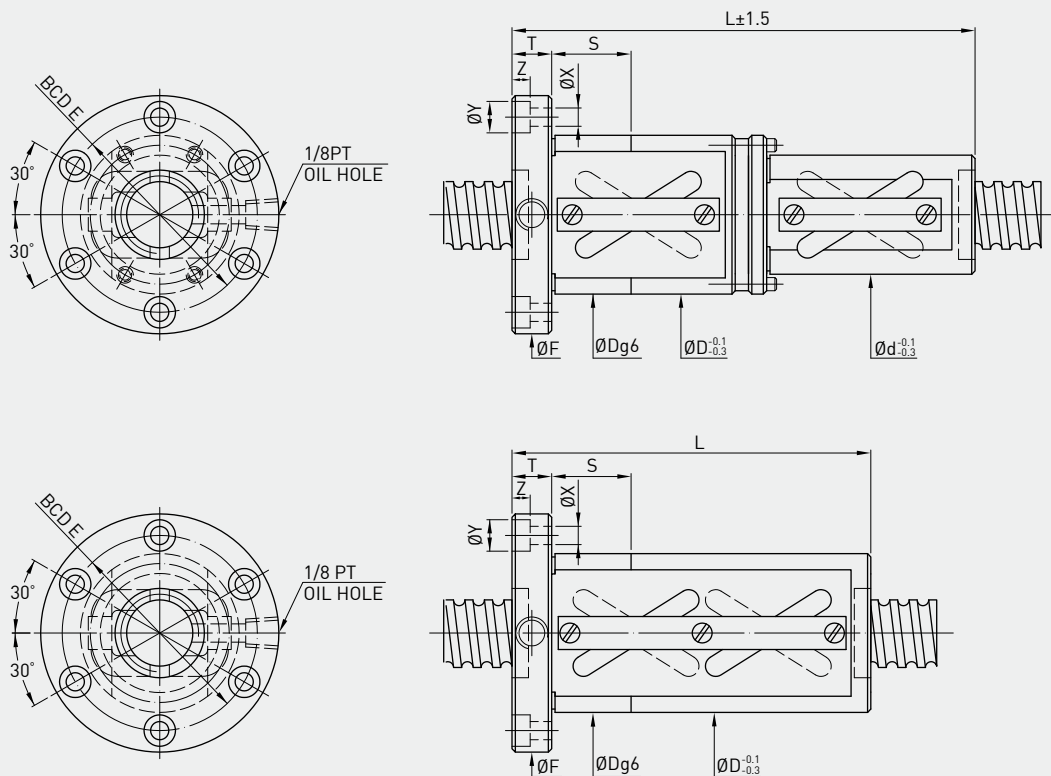
#### 7. Constant temperature

The efficient heat transfer can restrain the thermal deformation and improve the stability.

#### 8. Environment friendly

Optional self-lubricant function can reduce the lubricant consumption and to diminish the environment pollution caused by lubricant discard. It also solves the problem that lubricant thickens unevenly by deformation of oil film in spiral path.

## BALLSCREW FOR HIGH-Dm-N DRIVE



| Model   | Nominal Dia. | Lead  | Ball Dia. | Circuits | Nut Type | Dynamic Load<br>1x10 <sup>6</sup> revs<br>C(kgf) | Static Load<br>Co(kgf) | Start Type | D     | d   | L   | F   | T   | BCD-E | X    | Y    | Z    | S    |    |
|---------|--------------|-------|-----------|----------|----------|--|------------------------|------------|-------|-----|-----|-----|-----|-------|------|------|------|------|----|
| 36-20C1 | 36           | 20    | 6.350     | 3.5x1    | OFSW     | 4478   | 10201                  | 2          | 94    | -   | 121 | 136 | 18  | 114   | 11   | 17.5 | 11   | 30   |    |
| 36-20B2 |              |       |           | 2.5x2    | PFDW     | 5447   | 13597                  | 2          | 94    | 76  | 191 | 136 | 18  | 114   | 11   | 17.5 | 11   | 30   |    |
| 40-20C1 | 40           |       |           | 7.144    | 3.5x1    | OFSW   | 4810                   | 11367      | 2     | 96  | -   | 121 | 138 | 18    | 116  | 11   | 17.5 | 11   | 30 |
| 40-20B2 |              |       |           |          | 2.5x2    | OFSW   | 6537                   | 16238      | 2     | 96  | -   | 161 | 138 | 18    | 116  | 11   | 17.5 | 11   | 30 |
| 40-25B2 |              | 25    | 2.5x2     |          | PFDW     | 6743   | 17002                  | 2          | 98    | 80  | 230 | 140 | 18  | 118   | 11   | 17.5 | 11   | 30   |    |
| 40-30B2 |              | 30    | 2.5x2     |          | PFDW     | 6743   | 17002                  | 2          | 98    | 80  | 250 | 140 | 18  | 118   | 11   | 17.5 | 11   | 30   |    |
| 40-32B3 |              | 32    | 6.350     | 2.5x3    | PFDW     | 7771   | 21823                  | 3          | 96    | 78  | 270 | 142 | 22  | 118   | 13   | 20   | 13   | 30   |    |
| 45-20C1 | 20           | 7.144 |           | 3.5x1    | OFSW     | 4845   | 12823                  | 2          | 98    | -   | 122 | 140 | 18  | 118   | 11   | 17.5 | 11   | 30   |    |
| 45-20B2 |              |       |           | 2.5x2    | OFSW     | 6585   | 18318                  | 2          | 98    | -   | 162 | 140 | 18  | 118   | 11   | 17.5 | 11   | 30   |    |
| 45-25C1 |              |       |           | 25       | 7.144    | 3.5x1  | OFSW                   | 5501       | 14394 | 2   | 101 | -   | 141 | 143   | 18   | 121  | 11   | 17.5 | 11 |
| 45-25B2 |              |       | 2.5x2     |          |          | PFDW   | 6691                   | 19186      | 2     | 101 | 83  | 230 | 143 | 18    | 121  | 11   | 17.5 | 11   | 30 |
| 45-30B2 | 30           | 2.5x2 | PFDW      |          |          | 6691   | 19186                  | 2          | 101   | 83  | 250 | 143 | 18  | 121   | 11   | 17.5 | 11   | 30   |    |
| 45-32B3 |              | 32    | 6.350     | 2.5x3    | PFDW     | 7857   | 24730                  | 3          | 98    | 80  | 270 | 144 | 22  | 120   | 13   | 20   | 13   | 30   |    |
| 50-20C1 | 20           | 7.144 |           | 3.5x1    | OFSW     | 5027   | 14278                  | 2          | 101   | -   | 122 | 143 | 18  | 121   | 11   | 17.5 | 11   | 40   |    |
| 50-20B2 |              |       |           | 2.5x2    | OFSW     | 6831   | 20397                  | 2          | 101   | -   | 162 | 143 | 18  | 121   | 11   | 17.5 | 11   | 40   |    |
| 50-25C1 |              |       |           | 25       | 7.144    | 3.5x1  | OFSW                   | 5782       | 16033 | 2   | 103 | -   | 141 | 145   | 18   | 123  | 11   | 17.5 | 11 |
| 50-25B2 |              |       | 2.5x2     |          |          | PFDW   | 7033                   | 21370      | 2     | 103 | 85  | 230 | 145 | 18    | 123  | 11   | 17.5 | 11   | 40 |
| 50-30C1 | 30           | 7.144 | 3.5x1     |          |          | OFSW   | 5782                   | 16033      | 2     | 103 | -   | 160 | 145 | 18    | 123  | 11   | 17.5 | 11   | 40 |
| 50-30B2 |              |       | 2.5x2     | PFDW     | 7033     | 21370  | 2                      | 103        | 85    | 250 | 145 | 18  | 123 | 11    | 17.5 | 11   | 40   |      |    |
| 50-32B3 |              |       | 32        | 6.350    | 2.5x3    | PFDW   | 8148                   | 27525      | 3     | 101 | 83  | 270 | 147 | 22    | 123  | 13   | 20   | 13   | 40 |
| 55-20C1 | 20           | 7.144 | 3.5x1     |          | OFSW     | 5158   | 15733                  | 2          | 103   | -   | 122 | 145 | 18  | 123   | 11   | 17.5 | 11   | 40   |    |
| 55-20B2 |              |       | 2.5x2     |          | OFSW     | 7009   | 22476                  | 2          | 103   | -   | 162 | 145 | 18  | 123   | 11   | 17.5 | 11   | 40   |    |
| 55-25C1 |              |       | 25        |          | 7.144    | 3.5x1  | OFSW                   | 6181       | 17670 | 2   | 105 | -   | 141 | 147   | 18   | 125  | 11   | 17.5 | 11 |
| 55-25B2 |              |       |           | 2.5x2    |          | PFDW   | 7518                   | 23553      | 2     | 105 | 87  | 230 | 147 | 18    | 125  | 11   | 17.5 | 11   | 40 |
| 55-30C1 | 30           | 7.144 |           | 3.5x1    |          | OFSW   | 6181                   | 17670      | 2     | 105 | -   | 160 | 147 | 18    | 125  | 11   | 17.5 | 11   | 40 |
| 55-30B2 |              |       | 2.5x2     | PFDW     | 7518     | 23553  | 2                      | 105        | 87    | 250 | 147 | 18  | 125 | 11    | 17.5 | 11   | 40   |      |    |
| 55-32B3 |              |       | 32        | 6.350    | 2.5x3    | PFDW   | 8332                   | 30207      | 3     | 103 | 85  | 270 | 149 | 22    | 125  | 13   | 20   | 13   | 40 |

## 9.5 Cool Type

### 9.5.1 Extra High Dm-N Value Ballscrew - Cool Type I



#### • Cool type I :

- New era for high speed ballscrew - achieving extra high Dm-N value (up to 200,000) and high positioning accuracy.
- Cool type I and a hollow shaft design.
- High speed machine tools and machining center.

#### • Design Principle:

The cool type series feature using forced cooling fluid to pass through the nut, which minimize heat generation and thermal expansion during ballscrew operation.

##### • Cool type I as shown in the Figure 9.1:

Flowing fluids are circulated in passages that inside the nut, and exchanging heat with the cooler as shown in the Figure 9.2 In cooperation with hollow shaft design, it makes high quality of thermal control and maintains high accuracy. That combination is the most suitable for high-speed machine tools.

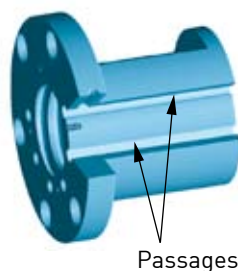


Fig. 9.1 Cool type I

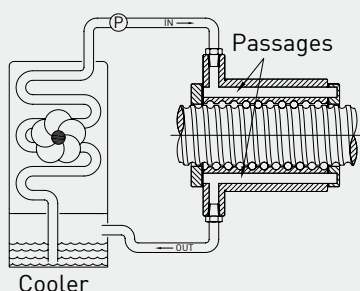


Fig. 9.2 Cool type I with cooler

#### • Specification:

1. We recommend shaft diameter above  $\varnothing 32\text{mm}$  to cool type design.
2. Nut type: FSV, FSW, PFDW, OFSW, DFSV, FSH, FSI, etc.
3. Please contact HIWIN with other specification you need.
4. The cool type I, compared with the standard specifications, will make a minor external dimension change of the nut, please contact HIWIN.

#### • Specification number:

Example: R50 - 30C1 - OFSWC1 - 1180 - 1539 - 0.008



C1: HIWIN cool type ballscrew for type I

#### • Performance Comparison:

For high-speed machine tools, hollow shaft design only is not enough against heat generation and thermal expansion, because nut itself is a heat source, as shown in Figure 9.3.

##### Test condition :

specification :  $\varnothing 50$ , lead 30 mm  
 speed : 2500 rpm ( 75 m/min),  
 back and forth feed continuously  
 acceleration :  $9.8 \text{ m/sec}^2$   
 stroke : 1180 mm  
 preload : 205 kgf  
 moving weight : 300 kgf  
 cooling rate : oil 2.5 liter/min  
 inlet temperature :  $16^\circ\text{C}$   
 room temperature :  $25^\circ\text{C}$

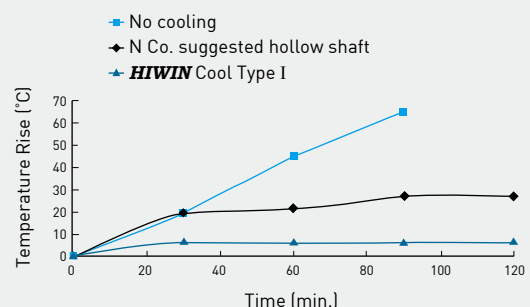


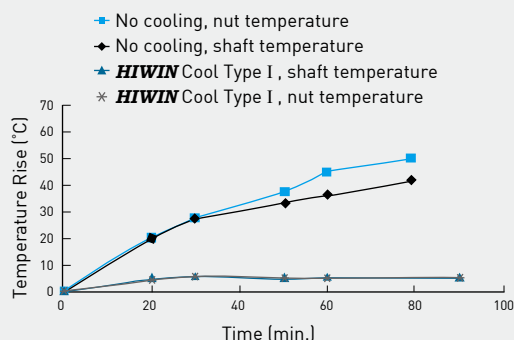
Fig. 9.3 Nut temperature rise

### Cool type I Performance (1)

Specification: Ø50, lead 30 mm

Dm-N value: 150,000

Acceleration: 9.8 m/sec<sup>2</sup>



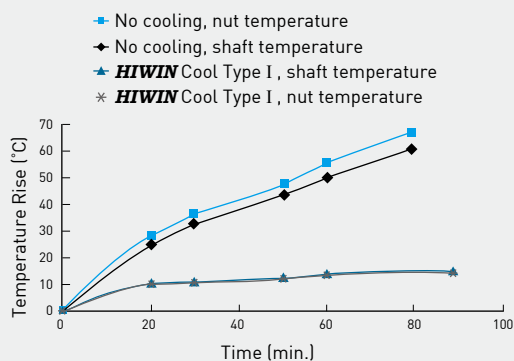
Cool type I : Temperature rise of ballscrew

### Cool type I Performance (2)

Specification: Ø50, lead 30 mm

Dm-N value: 200,000

Acceleration: 9.8 m/sec<sup>2</sup>



Cool type I : Temperature rise of ballscrew

## • Features:

### 1. Optimized design for high reliability

Use of computer simulation and FEM analysis, the cool type ballscrew features well thermal protection and high reliability.

### 2. Promote higher speed rotation and extra high Dm-N value (up to 200,000)

Cool type ballscrew will eliminate high-speed rotation aftereffect, i. e., thermal problem, and promote higher speed rotation.

### 3. Prevent thermal distortion

Optimized heat transfer design to minimize heat generation and prevent thermal distortion.

### 4. Strengthen durability

When operating repeatedly, friction between balls cause heat generation. That may be made balls oxidized or decarburized, and shortened the service life. Cool type ballscrew will strengthen durability under a cooling environment.

### 5. Extended lubricant life cycle

When using lubrication, minimum heat generation further inhibits deterioration in the quality of lubrication and extends the lubricant life cycle.

### 6. Keep temperature uniform and reduce warm-up time

When high-speed operation, nut and shaft cooling effect indeed keep feed-system temperature constant and reduce warm-up time.

### 7. Higher feeding accuracy

Cooling effect of cool type ballscrew will stabilize against thermal expansion and equalize feeding accuracy.

× 10<sup>-7</sup>  
(Pa)  
0.004  
0.180  
0.360  
0.540  
0.710  
0.899  
1.079  
1.259  
1.439  
1.619



FEM analysis for cool type ballscrew

## 9.5.2 High Load Ballscrew - Cool Type II



Germany Patent No. 20119457.0  
Taiwan Patent No. 193878

### • Cool type II :

- New era for ballscrew applied in electric - driven injection machine, presses, power units, and other replaceable hydraulic drives.
- Electric-driven injection machine, presses, power units and other replaceable hydraulic drives.

### • Design Principle :

The cool type series feature using forced cooling fluid to pass through the nut, which minimize heat generation and thermal expansion during ballscrew operation.

#### • Cool type II as shown in the Figure 9.4:

Flowing fluids are circulated through a space, which inside the nut, and exchanging heat with the cooler as shown in the Figure 9.5. It is the most suitable for electric-driven injection machine, presses, and power units. The cool type II, compared with the standard specifications, will make a minor external dimension change of the nut. Please contact HIWIN .

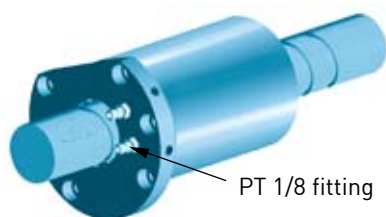


Fig. 9.4 Cool type II

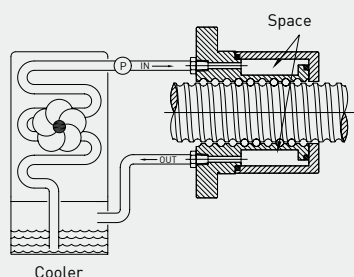


Fig. 9.5 Cool type II with cooler

### • Specification :

1. We recommend shaft diameter above  $\varnothing 32\text{mm}$  to cool type design.
2. Nut type: FSV, FSW, PFDW, OFSW, DFSV, FSH, FSI, etc.
3. Please contact HIWIN with other specification you need.
4. The cool type II, compared with the standard specifications, will make a minor external dimension change of the nut, please contact HIWIN.

### • Specification number:

Example: R63 - 16B3 - RSWC2 - 400 - 600- 0.05



C2 : HIWIN cool type ballscrew for type II

### • Performance Comparison:

#### Test condition :

specification :  $\varnothing 50$ , lead 30 mm  
speed : 1500 rpm ( 45 m/min),  
back and forth feed continuously  
acceleration :  $4.9 \text{ m/sec}^2$   
stroke : 300 mm  
preload : 205 kgf  
moving weight : 300 kgf  
cooling rate : oil 2.5 liter/min  
inlet temperature :  $16^\circ\text{C}$   
room temperature :  $25^\circ\text{C}$

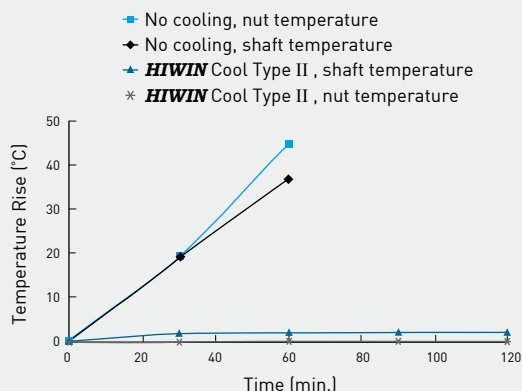


Fig. 9.6 Cool type II : Temperature rise of ballscrew

### • Features :

#### 1. Optimized design for high reliability

Use of computer simulation and FEM analysis, the cool type ballscrew features well thermal protection and high reliability.

#### 2. Promote higher speed rotation and extra high Dm-N value (up to 200,000)

Cool type ballscrew will eliminate high-speed rotation aftereffect, i. e., thermal problem, and promote higher speed rotation.

#### 3. Prevent thermal distortion

Optimized heat transfer design to minimize heat generation and prevent thermal distortion.

#### 4. Strengthen durability

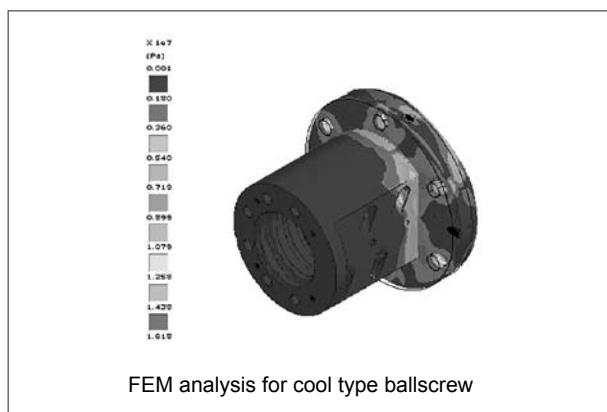
When operating repeatedly, friction between balls cause heat generation. That may be made balls oxidized or decarburized, and shortened the service life. Cool type ballscrew will strengthen durability under a cooling environment.

#### 5. Extended lubricant life cycle

When using lubrication, minimum heat generation further inhibits deterioration in the quality of lubrication and extends the lubricant life cycle.

#### 6. Higher feeding accuracy

Cooling effect of cool type ballscrew will stabilize against thermal expansion and equalize feeding accuracy.



### Average Life Cycle for Injection Machine Ballscrew

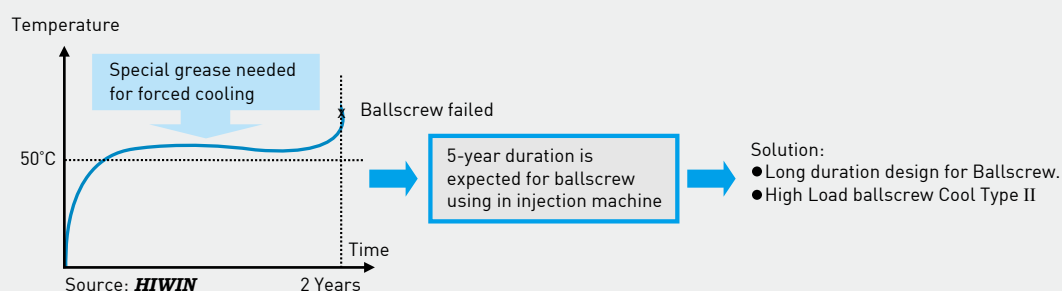
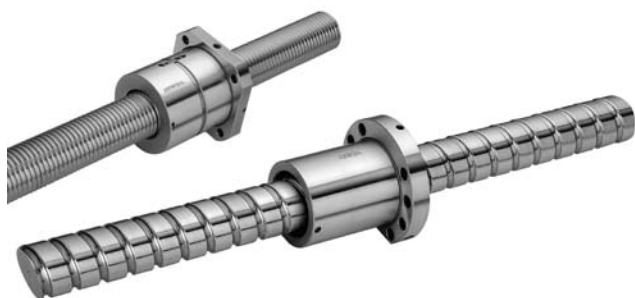


Fig 9.7 Life cycle for ballscrew using in general injection machine



## 9.6 Super S Series



U.S.A. Patent No. 6561054  
Taiwan Patent No. 231845  
Taiwan Patent No. 233472  
Taiwan Patent No. 245857  
Taiwan Patent No. 115652  
Japan Patent No. 3117738

### • Application:

CNC Machinery, Industrial Machinery, Electronic Machinery, Precision Machine and other High Speed Machinery.

### • Features :

#### 1. Low noise (5~7dB lower than traditional series)

The patent design of return unit can absorb noises caused by the impact of the ballnut's balls, greatly reducing the noise intensity.

#### 2. Space-saving and weight-lightening design

The ballnut diameter is 18%~32% smaller than traditional series.

#### 3. Dm-N value up to 220,000

The patent design of the return unit can improve the strength of the return structure, achieving a Dm-N value of up to 220,000.

#### 4. High acceleration and deceleration velocity

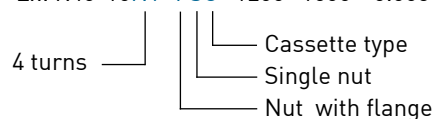
The pathway of specialized return unit, as well as the ballnut's strengthened design diminish the impact experienced by the balls. Hence, it can sustain peak performance in more rigorous operating environments, such as high acceleration and deceleration.

#### 5. Accuracy grade

Precision ground ballscrews available in JIS Grade C0~C7; Rolled ballscrews available in JIS Grade C6~C10.

### • Pattern Nomenclature :

Ex: R40-10K4 -FSC -1200 -1600 - 0.008



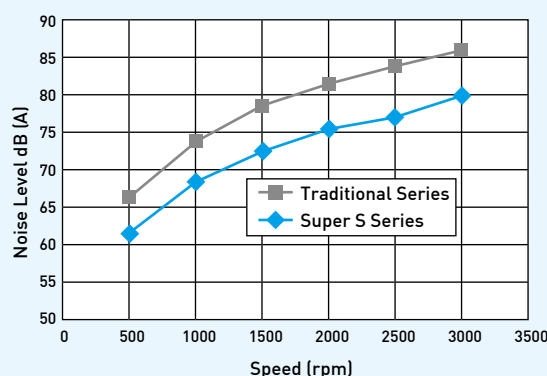
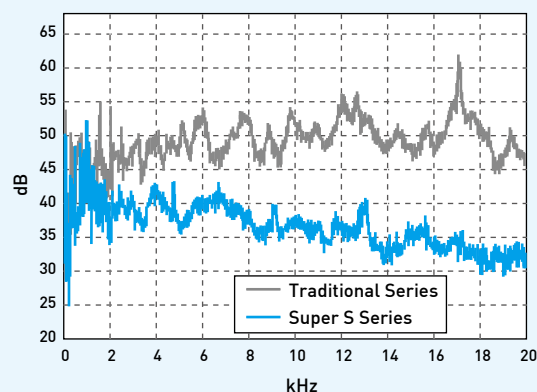
### • Performance :

Specification: 2R40 - 40K4 - DFSC - 1200 -1600 - 0.008

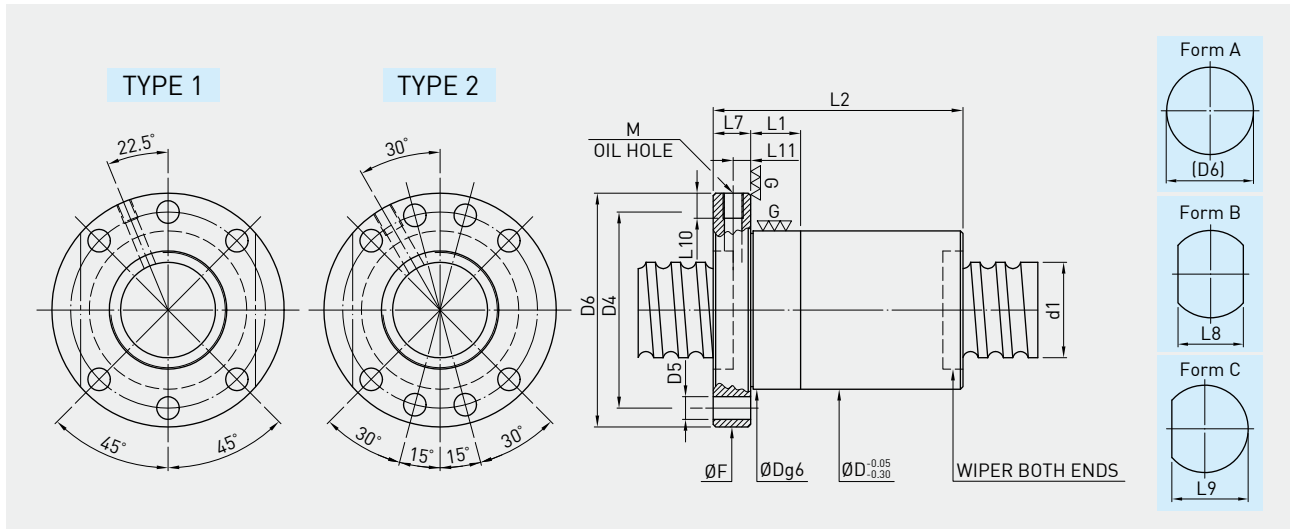
Lead: 40 mm

Acceleration: 1g (9.8m/sec<sup>2</sup>)

Dm-N Value: 120,000

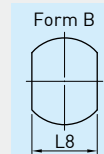
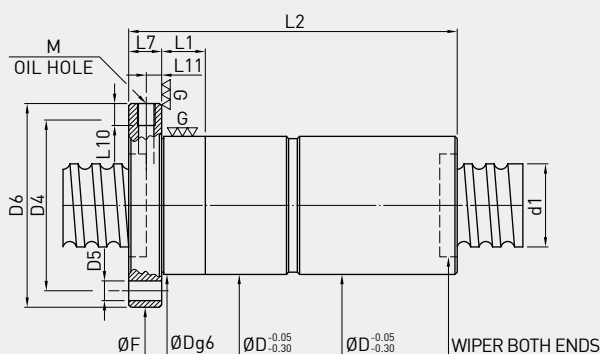
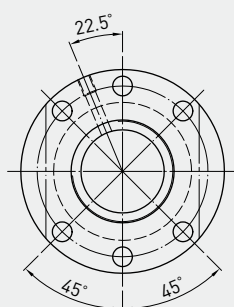


## FSC TYPE



| Model   | Size         |       | Ball Dia. | Circuits | Dynamic Load C(KN) | Static Load Co(KN) | Nut   |      |     | Flange |             |             |             |    |       |       | Oil Hole |     |     |    |    |    |       |    |    |
|---------|--------------|-------|-----------|----------|--------------------|--------------------|-------|------|-----|--------|-------------|-------------|-------------|----|-------|-------|----------|-----|-----|----|----|----|-------|----|----|
|         | Nominal Dia. | Lead  |           |          |                    |                    | D     | L1   | L2  | TYPE   | Form A (D6) | Form B (L8) | Form C (L9) | L7 | D4    | D5    | M        | L10 | L11 |    |    |    |       |    |    |
| 15-10K3 | 15           | 10    | 3.175     | K3       | 960                | 1930               | 30    | 10   | 44  | 1      | 55          | 41          | 48          | 10 | 45    | 5.5   | M6x1P    | 8   | 5   |    |    |    |       |    |    |
| 20-10K3 | 20           | 10    | 3.175     | K3       | 1130               | 2660               | 36    | 10   | 48  | 1      | 58          | 44          | 51          | 10 | 47    | 6.6   | M6x1P    | 8   | 5   |    |    |    |       |    |    |
| 20-20K2 |              | 20    |           | K2       | 760                | 1730               |       | 10   | 57  |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 25-10K3 | 25           | 10    | 3.175     | K3       | 1260               | 3370               | 40    | 10   | 51  | 1      | 62          | 48          | 55          | 10 | 51    | 6.6   | M6x1P    | 8   | 5   |    |    |    |       |    |    |
| 25-25K2 |              | 15    |           | K2       | 810                | 2170               |       | 10   | 70  |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 25-12K4 |              | 12    |           | 3.969    | K4                 | 2200               |       | 5640 | 43  |        |             |             |             |    |       |       |          |     |     | 10 | 68 | 65 | 51    | 58 | 10 |
| 32-5K4  | 32           | 5     | 3.175     | K4       | 1850               | 5970               | 48    | 10   | 38  | 1      | 70          | 55          | 62          | 12 | 59    | 9     | M6x1P    | 8   | 6   |    |    |    |       |    |    |
| 32-8K5  |              | 8     | K5        | 3080     | 9460               | 10                 | 63    |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 32-20K3 |              | 20    | 3.969     | K3       | 1900               | 5430               | 50    | 20   | 88  |        | 80          | 62          | 71          | 12 | 65    |       |          |     |     |    |    |    |       |    |    |
| 32-32K2 |              | 32    | 4.763     | K2       | 1280               | 3530               | 20    | 88   | 86  |        | 65          | 75.5        | 14          | 71 |       |       |          |     |     |    |    |    |       |    |    |
| 32-10K5 |              | 10    |           | K5       | 3850               | 10890              | 10    | 79   |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 32-12K5 |              | 12    |           | K5       | 3840               | 10870              | 20    | 89   |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 32-10K5 |              | 10    | 6.35      | K5       | 5640               | 14490              | 57    | 10   | 77  |        | 87          | 69          | 78          | 14 | 72    |       |          |     |     |    |    |    |       |    |    |
| 32-12K5 |              | 12    |           | K5       | 5620               | 14450              |       | 20   | 87  |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 32-16K4 |              | 16    |           | K4       | 4570               | 11390              |       | 20   | 90  |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 32-20K4 |              | 20    |           | K4       | 4530               | 11310              |       | 20   | 107 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 36-10K5 |              | 36    | 10        | 6.35     | K5                 | 6010               | 16440 | 61   | 20  |        | 80          | 2           | 91          | 68 | 79.5  |       |          |     |     | 14 | 76 | 9  | M8x1P | 10 | 7  |
| 36-12K5 |              |       | 12        |          | K5                 | 5990               | 16420 |      | 20  |        | 87          |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 36-16K5 | 16           |       | K5        |          | 5960               | 16350              | 20    |      | 108 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 36-20K5 | 20           |       | K5        |          | 5920               | 16270              | 20    |      | 128 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 36-36K2 | 36           |       | K2        |          | 2540               | 6540               | 20    |      | 95  |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 38-10K6 | 38           | 10    | 6.35      | K6       | 7270               | 21060              | 63    | 20   | 90  | 2      | 93          | 70          | 81.5        | 14 | 73    | 9     | M8x1P    | 10  | 7   |    |    |    |       |    |    |
| 38-12K6 |              | 12    |           | K6       | 7260               | 21030              |       | 20   | 99  |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 38-16K5 |              | 16    |           | K5       | 6140               | 17340              |       | 20   | 108 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 38-20K5 |              | 20    |           | K5       | 6100               | 17260              |       | 25   | 128 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 38-25K4 |              | 25    |           | K4       | 4940               | 13560              |       | 25   | 126 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 38-40K2 | 40           | K2    | 2590      | 6560     | 25                 | 102                | 65    | 2    | 93  | 70     | 81.5        | 14          | 78          | 9  | M8x1P | 10    | 7        |     |     |    |    |    |       |    |    |
| 40-10K6 | 10           | K6    | 7270      | 21060    | 20                 | 90                 |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 40-12K6 | 12           | K6    | 7260      | 21030    | 20                 | 99                 |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 40-16K5 | 16           | K5    | 6140      | 17340    | 20                 | 108                |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 40-20K5 | 20           | K5    | 6100      | 17260    | 25                 | 128                |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 40-25K4 | 25           | K4    | 4940      | 13560    | 25                 | 108                | 74    | 2    | 105 | 80     | 92.5        | 16          | 88          | 11 | M8x1P | 10    | 8        |     |     |    |    |    |       |    |    |
| 40-40K2 | 40           | K2    | 2590      | 6560     | 25                 | 102                |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 45-10K6 | 10           | K6    | 8010      | 25760    | 20                 | 90                 |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 45-12K6 | 12           | K6    | 8000      | 25730    | 20                 | 101                | 70    | 2    | 105 | 80     | 92.5        | 16          | 88          | 11 | M8x1P | 10    | 8        |     |     |    |    |    |       |    |    |
| 45-16K5 | 16           | K5    | 6780      | 21240    | 20                 | 107                |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 45-20K5 | 20           | K5    | 6750      | 21170    | 25                 | 128                |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 45-25K5 | 25           | K5    | 6700      | 21060    | 25                 | 154                | 74    | 2    | 109 | 84     | 96.5        | 16          | 88          | 11 | M8x1P | 10    | 8        |     |     |    |    |    |       |    |    |
| 45-30K4 | 30           | K4    | 5440      | 16570    | 25                 | 150                |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 45-40K3 | 40           | K3    | 4100      | 12020    | 25                 | 145                |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 45-16K5 | 16           | 7.144 | K5        | 7810     | 23230              | 20                 | 119   | 74   | 2   | 109    | 84          | 96.5        | 16          | 88 | 11    | M8x1P | 10       | 8   |     |    |    |    |       |    |    |
| 45-20K5 | 20           | K5    | 7770      | 23150    | 25                 | 139                |       |      |     |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 50-10K6 | 50           | 10    | 6.35      | K6       | 8290               | 28160              | 75    | 20   | 90  | 2      | 110         | 85          | 97.5        | 16 | 93    | 11    | M8x1P    | 10  | 8   |    |    |    |       |    |    |
| 50-12K6 |              | 12    |           | K6       | 8290               | 28130              |       | 20   | 101 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 50-16K6 |              | 16    |           | K6       | 8260               | 28070              |       | 20   | 126 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 50-20K6 |              | 20    |           | K6       | 8230               | 28000              |       | 25   | 148 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 50-25K5 |              | 25    |           | K5       | 6960               | 23070              |       | 25   | 154 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 50-30K4 |              | 30    |           | K4       | 5650               | 18170              |       | 25   | 148 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |
| 50-40K3 |              | 40    |           | K3       | 4390               | 13750              |       | 25   | 145 |        |             |             |             |    |       |       |          |     |     |    |    |    |       |    |    |

## TYPE 1



| Model   | Size         |      | Ball Dia. | Circuits | Dynamic Load C(KN) | Static Load Co(KN) | Nut |      |     | Flange |             |             |             |    |    |     | Oil Hole |     |     |    |     |      |    |    |    |       |    |   |
|---------|--------------|------|-----------|----------|--------------------|--------------------|-----|------|-----|--------|-------------|-------------|-------------|----|----|-----|----------|-----|-----|----|-----|------|----|----|----|-------|----|---|
|         | Nominal Dia. | Lead |           |          |                    |                    | D   | L1   | L2  | TYPE   | Form A (D6) | Form B (L8) | Form C (L9) | L7 | D4 | D5  | M        | L10 | L11 |    |     |      |    |    |    |       |    |   |
| 15-10K3 | 15           | 10   | 3.175     | K3       | 960                | 1930               | 30  | 10   | 92  | 1      | 55          | 41          | 48          | 10 | 45 | 5.5 | M6x1P    | 8   | 5   |    |     |      |    |    |    |       |    |   |
| 20-10K3 | 20           | 10   | 3.175     | K3       | 1130               | 2660               | 36  | 10   | 100 | 1      | 58          | 44          | 51          | 10 | 47 | 6.6 | M6x1P    | 8   | 5   |    |     |      |    |    |    |       |    |   |
| 20-20K2 |              | 20   |           | K2       | 760                | 1730               |     | 10   | 118 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 25-10K3 | 25           | 10   | 3.175     | K3       | 1260               | 3370               | 40  | 10   | 106 | 1      | 62          | 48          | 55          | 10 | 51 | 6.6 | M6x1P    | 8   | 5   |    |     |      |    |    |    |       |    |   |
| 25-25K2 |              | 15   |           | K2       | 810                | 2170               |     | 10   | 144 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 25-12K4 |              | 12   |           | 3.969    | K4                 | 2200               |     | 5640 | 43  |        |             |             |             |    |    |     |          |     |     | 10 | 140 | 65   | 51 | 58 | 10 | 54    |    |   |
| 32-5K4  | 32           | 5    | 3.175     | K4       | 1850               | 5970               | 48  | 10   | 80  | 1      | 70          | 55          | 62          | 12 | 59 | 9   | M6x1P    | 8   | 6   |    |     |      |    |    |    |       |    |   |
| 32-8K5  |              | 8    | K5        | 3080     | 9460               | 10                 | 130 |      |     |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 32-20K3 |              | 20   | 3.969     | K3       | 1900               | 5430               | 50  | 20   | 180 |        |             |             |             |    |    |     |          |     |     | 80 | 62  | 71   | 12 | 65 |    |       |    |   |
| 32-32K2 |              | 32   | K2        | 1280     | 3530               | 20                 | 180 |      |     |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 32-10K5 |              | 10   | 4.763     | K5       | 3850               | 10890              | 56  | 10   | 162 |        |             |             |             |    |    |     |          |     |     | 86 | 65  | 75.5 | 14 | 71 | 9  | M6x1P | 8  | 6 |
| 32-12K5 |              | 12   | K5        | 3840     | 10870              | 20                 |     | 182  |     |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 32-10K5 |              | 10   | 6.35      | K5       | 5640               | 14490              | 57  | 10   | 158 |        |             |             |             |    |    |     |          |     |     | 87 | 69  | 78   | 14 | 72 | 9  | M8x1P | 10 | 7 |
| 32-12K5 |              | 12   |           | K5       | 5620               | 14450              |     | 20   | 178 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 32-16K4 |              | 16   |           | K4       | 4570               | 11390              |     | 20   | 184 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 32-20K4 |              | 20   |           | K4       | 4530               | 11310              |     | 20   | 218 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 36-10K5 | 36           | 10   | 6.35      | K5       | 6010               | 16440              | 61  | 20   | 164 | 2      | 91          | 68          | 79.5        | 14 | 76 | 9   | M8x1P    | 10  | 7   |    |     |      |    |    |    |       |    |   |
| 36-12K5 |              | 12   |           | K5       | 5990               | 16420              |     | 20   | 178 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 36-16K5 |              | 16   |           | K5       | 5960               | 16350              |     | 20   | 220 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 36-20K5 |              | 20   |           | K5       | 5920               | 16270              |     | 20   | 260 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 36-36K2 |              | 36   |           | K2       | 2540               | 6540               |     | 20   | 194 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 38-10K6 | 38           | 10   | 6.35      | K6       | 7270               | 21060              | 63  | 20   | 184 | 2      | 93          | 70          | 81.5        | 14 | 78 | 9   | M8x1P    | 10  | 7   |    |     |      |    |    |    |       |    |   |
| 38-12K6 |              | 12   |           | K6       | 7260               | 21030              |     | 20   | 202 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 38-16K5 |              | 16   |           | K5       | 6140               | 17340              |     | 20   | 220 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 38-20K5 |              | 20   |           | K5       | 6100               | 17260              |     | 25   | 260 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 38-25K4 |              | 25   |           | K4       | 4940               | 13560              |     | 25   | 256 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 38-40K2 | 40           | K2   | 2590      | 6560     | 25                 | 208                |     |      |     |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 40-10K6 | 40           | 10   | 6.35      | K6       | 7270               | 21060              | 65  | 20   | 184 | 2      | 93          | 70          | 81.5        | 14 | 78 | 9   | M8x1P    | 10  | 7   |    |     |      |    |    |    |       |    |   |
| 40-12K6 |              | 12   |           | K6       | 7260               | 21030              |     | 20   | 202 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 40-16K5 |              | 16   |           | K5       | 6140               | 17340              |     | 20   | 220 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 40-20K5 |              | 20   |           | K5       | 6100               | 17260              |     | 25   | 260 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 40-25K4 |              | 25   |           | K4       | 4940               | 13560              |     | 25   | 256 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 40-40K2 |              | 40   |           | K2       | 2590               | 6560               |     | 25   | 208 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 45-10K6 | 45           | 10   | 6.35      | K6       | 8010               | 25760              | 70  | 20   | 184 | 2      | 105         | 80          | 92.5        | 16 | 88 | 11  | M8x1P    | 10  | 8   |    |     |      |    |    |    |       |    |   |
| 45-12K6 |              | 12   |           | K6       | 8000               | 25730              |     | 20   | 206 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 45-16K5 |              | 16   |           | K5       | 6780               | 21240              |     | 20   | 218 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 45-20K5 |              | 20   |           | K5       | 6750               | 21170              |     | 25   | 260 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 45-25K5 |              | 25   |           | K5       | 6700               | 21060              |     | 25   | 312 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 45-30K4 |              | 30   | K4        | 5440     | 16570              | 25                 | 340 |      |     |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 45-40K3 |              | 40   | K3        | 4100     | 12020              | 25                 | 294 |      |     |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 45-16K5 |              | 16   | 7.144     | K5       | 7810               | 23230              | 74  | 20   | 242 |        | 109         | 84          | 96.5        | 16 | 93 | 11  | M8x1P    | 10  | 8   |    |     |      |    |    |    |       |    |   |
| 45-20K5 |              | 20   | K5        | 7770     | 23150              | 25                 |     | 282  |     |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 50-10K6 | 50           | 10   | 6.35      | K6       | 8290               | 28160              | 75  | 20   | 184 | 2      | 110         | 85          | 97.5        | 16 | 93 | 11  | M8x1P    | 10  | 8   |    |     |      |    |    |    |       |    |   |
| 50-12K6 |              | 12   |           | K6       | 8290               | 28130              |     | 20   | 206 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 50-16K6 |              | 16   |           | K6       | 8260               | 28070              |     | 20   | 256 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 50-20K6 |              | 20   |           | K6       | 8230               | 28000              |     | 25   | 300 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 50-25K5 |              | 25   |           | K5       | 6960               | 23070              |     | 25   | 312 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 50-30K4 |              | 30   |           | K4       | 5650               | 18170              |     | 25   | 300 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |
| 50-40K3 |              | 40   |           | K3       | 4390               | 13750              |     | 25   | 294 |        |             |             |             |    |    |     |          |     |     |    |     |      |    |    |    |       |    |   |

**A****Ballscrew Failure Analysis****A1 Preface**

In recent years, more and more ballscrews are installed in various machines to meet the requirements of higher accuracy and better performance. Ballscrews become one of the most widely used power transmission components. In CNC machines, ballscrews help improve their positioning accuracy and elongate their service life. Ballscrews are also increasingly used to replace ACME screws in manually operated machines.

A ballscrew is normally preloaded to minimize the backlash of machine movement. Even a high precision ballscrew will not provide good accuracy and long service life if it is not installed properly.

This article discusses primary ballscrew problems and their precautions. Some measuring procedures are also discussed to help users locate the cause of an abnormal backlash.

**A2 The Cause and Precautions of Ballscrew Problems**

Three major categories of ballscrew problems and their precautions are discussed as follows.

**A2-1 Too much play****1. No preload or insufficient preload :**

The ball nut will rotate and move downward by its own weight when a non-preloaded ballscrew is held vertically with the screw spindle constrained. A significant backlash may exist in a non-preloaded ballscrew unit. Therefore non-preload ballscrews are only used in the machinery, where low operation resistance but not positioning accuracy is the major concerned.

HIWIN can determine the correct amount of preload based on different applications. We can also preset the amount of preload before shipment. Be sure to clearly specify the operation condition of your application when you order a ballscrew unit.

**2. Too much torsional displacement :****(1) Incorrect material selection:**

Table 4.11 lists those materials normally used in ballscrew spindles and ball nuts.

**(2) Incorrect heat treatment, hardened layer too thin, non-homogeneous hardness distribution, or material too soft:**

Standard hardness of steel balls, ball nuts, and screw spindles are HRC 62-66, 58-62, and 58-62, respectively.

**(3) Incorrect design-L/D ratio too high, etc:**

The lower the L/D (length/diameter) ratio, the more rigid the spindle is. L/D ratio should be limited to under 60.

(The accuracy grade related to this L/D range is shown in Table

4.12) There will be a significant deflection (torsional displacement )

if the L/D ratio is too high. The ballscrew installation shown in Fig A-1 is supported at one end only. This kind of "non-rigid" design should be avoided if possible.

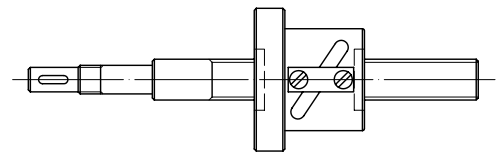


Fig. A-1 The installation of ballscrews.

**3. Inappropriate bearing selection :**

Angular ball bearings should be used in ballscrew installation. A ball bearing with high pressure angle specially designed for ballscrew installation is even a better choice. A regular deep groove ball bearing will generate a significant amount of axial play when axially loaded. It should not be used in this application.

**4. Inappropriate bearing installation :**

- (1) If the bearing is not attached to the screw spindle properly, it would cause axial play under load. This problem may be caused by the bearing journal of the screw spindle being too long or the non-threaded part of the screw spindle being too short.

- (2) The perpendicularity between the bearing seating face and the thread axis of the bearing locknut on the ballscrew, or the parallelism between the opposite faces of the locknut is out of tolerance causing the bearing to tilt. The thread for bearing lock nut and the seating face of a bearing in the ballscrew journal should be machined in one setting to ensure the perpendicularity. It is even better if they can be ground.
- (3) Two lock nuts and a spring washer should be used in the bearing installation to prevent them from getting loose in operation.

**5. The ball nut housing or the bearing housing is not rigid enough :**

The ball-nut-mounted housing or the bearing-mounted housing may deflect under components' weight or machining load if it is not rigid enough. The test illustrated in Fig A-4 (d) can be used to check the rigidity of the ball-nut-mounted housing. Similar test can be used to check the rigidity of the bearing-mounted housing.

**6. The ball nut housing or the bearing housing is not mounted properly :**

- (1) Components may become loose due to vibration or lack of locating pin(s). Solid pins instead of spring pins should be used for locating purpose.
- (2) Ball-nut-seated screws are not seated firmly because the screws are too long or the thread holes on housing are too short.
- (3) Ball-nut-seated screws become loose due to vibration and lack of a spring washer.

**7. Parallelism or flatness of the housing surface is out of tolerance :**

In a machine assembly, a shim bar is frequently located between the housing location surface and the machine body for adjustment purpose. The clearance of table movement may vary at different locations if the parallelism or flatness of any matching component is out of tolerance no matter they are ground or scraped.

**8. The motor and the ballscrew spindle are not assembled properly :**

- (1) There will be a relative rotation between the motor shaft and the ballscrew spindle if the connecting coupling is not installed firmly or the coupling itself is not rigid enough.
- (2) Driving gears are not engaged properly or driving mechanism is not rigid. A timing belt should be used to prevent slipping if the ballscrew is to be driven by a belt.
- (3) Key is loose in the groove. Any inappropriate match among the hub, key, and key seat may cause these components to generate backlash.

**A2-2 Unsmooth operation**

**1. Defects from ballscrew manufacturing :**

- (1) The track surface of the ballscrew spindle or the ball nut is too rough.
- (2) The roundness of the bearing balls, the ball nut or the ballscrew spindle is out of tolerance.
- (3) The lead or the pitch circle diameter of the ball nut / the spindle is out of tolerance.
- (4) The return tube is not attached to the ball nut appropriately.
- (5) Uneven bearing ball size or hardness. The above problems should not be found in the manufacturers of top quality.

**2. Foreign objects enter the ball path :**

- (1) Packing material is trapped in the ball path. Various materials and anti-rust paper are normally used to pack ballscrew units for shipment. It is possible to have these foreign materials or other objects trapped in the ball path if proper procedures are not done while installing or aligning the ballscrew unit. This may cause the bearing balls to slide instead of rolling or even cause the ball nut to jam up completely.
- (2) Machined chips get in the ball track. The chips or dust generated during machining processes may be trapped in the bearing ball track if wiper kits are not used to keep them away from the surface of the ballscrew unit. This may cause unsmooth operation, deteriorate accuracy and reduce service life.

**3. Over-travel :**

Over-travel can damage the return tube and cause it to collapse or even break. When this happens, the bearing balls will not circulate smoothly. They may break and damage the groove on the ball nut or the ballscrew spindle under severe circumstances. Over-travel may happen during set-up or as the result of a limit switch failure or a machine collision. To prevent further damage, an over-traveled ballscrew should be checked or repaired by the manufacturer before it goes back to service.

**4. Damaged return tube:**

The return tube may collapse and cause the same problems as mentioned above if it is hit heavily during installation.

**5. Misalignment:**

Radial load exists if the center line of the ball nut's housing and the screw spindle's bearing support housing are not aligned properly. The ballscrew unit may bend if this misalignment is too big. An abnormal wear may still happen even if the misalignment is not significant enough to cause a noticeable bending. The accuracy of a ballscrew unit will deteriorate rapidly if it is misaligned. The higher the preload is set in the nut, the more demanding the alignment accuracy is required in the ballscrew.

**6. The ball nut is not mounted properly on the nut housing:**

Eccentric load exists when the mounted ball nut is tilted or misaligned. If this is the case, the motor current may fluctuate during rotation.

**7. Ballscrew unit is damaged during transportation****A2-3 Fracture****1. Broken bearing ball :**

Cr-Mo steel is the most commonly used material for bearing balls. It takes about 1,400kg (3,080LB) to 1,600kg (3,520LB) to break a steel ball of 3.175 mm (1/8 in) diameter. The temperature of an under-lubricated or non-lubricated ballscrew raises substantially during operation. This temperature raise could make the bearing balls brittle or break which cause damage to the grooves of the ball nut or the ballscrew spindle consequently.

Therefore, lubricant replenishment should be considered during the design process. If an automatic lubricating system is not available, a periodical grease replenishment should be scheduled as part of maintenance program.

**2. Collapsed or broken return tube :**

Over-travel of the ball nut or an impact on the return tube could cause the return tube to collapse or break. This may block the path of bearing balls and cause them to slide instead of rolling and break eventually.

**3. Ballscrew spindle end breaks :**

- (1) Inappropriate design: Sharp corners on the ballscrew spindle should be avoided to reduce local stress concentration. (Fig. A2) shows some of the appropriate screw end designs.
- (2) Bend of screw spindle journal: The seating surface of the bearing of the ballscrew and the thread axis of the bearing's lock nut are not perpendicular to each other or the opposite sides of the lock nut are not parallel to each other. This will cause the end of screw spindle to bend and eventually break. The amount of deflection at the end of the ballscrew spindle (Fig A-3) before and after the bearing's lock nut being tightened should not exceed 0.01 mm (0.0004 in).
- (3) Radial force or fluctuating stress: Misalignment in the ballscrew installation creates abnormal fluctuating shear stress and causes the ballscrew to fail prematurely.

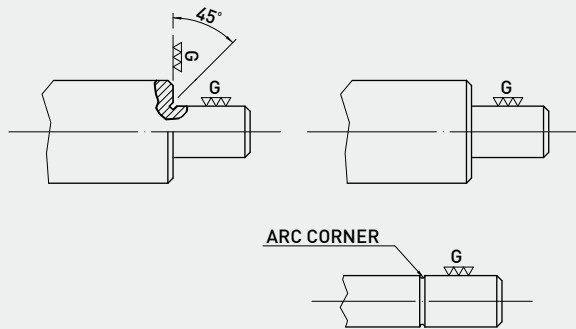


Fig A-2 The design of ballscrew spindle end

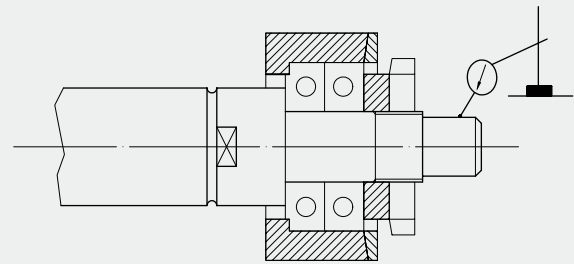


Fig A-3 The Deflection of Ballscrew Spindle

## A3 Locating the Cause of an Abnormal Backlash

The following measurement procedures can be performed to locate the cause of an abnormal backlash in the ballscrew installation.

1. Glue a gauge ball in the center hole at one end of the screw spindle. Use the flat plate of a dial indicator to check the axial movement of this gauge ball in axial direction while rotating the screw spindle (Fig A-4(a)). The movement should not exceed 0.003mm (0.00012 in), if the bearing hub, the ball nut, and the ball nut housing are all installed properly.
2. Use a dial indicator to check the relative movement between the bearing housing and the bearing seat while rotating the ballscrew (Fig A-4(b)). Any dial indicator reading other than zero indicates that either the bearing hub is not rigid enough or it is not installed properly.
3. Check the relative movement between the machine table and the ball nut housing (Fig A-4(c)).
4. Check the relative movement between the ball nut housing and the ball nut flange (Fig A-4(d)).

Contact the ballscrew manufacturer if an unsatisfactory backlash still exists while all the above checks are ok. The preload or the rigidity of the ballscrew may have to be increased.

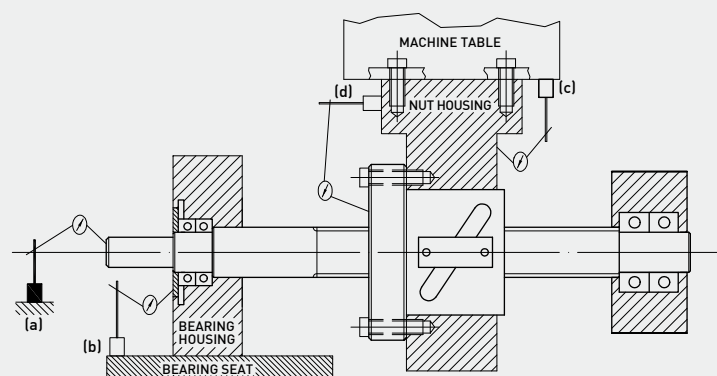


Fig. A-4 Locating the Cause of an Abnormal Backlash

## B Standard Housing Dimension Tolerance

Unit:  $\mu\text{m}=0.001\text{mm}$ 

| Dimensional range (mm) |       | E            |              | F          |            |             | G          |            |          | H        |          |          |           |           | Js    |       | J         |            | K         |            | M         |          | N          |            | P          |            | R           |     | Dimensional range (mm) |       |
|------------------------|-------|--------------|--------------|------------|------------|-------------|------------|------------|----------|----------|----------|----------|-----------|-----------|-------|-------|-----------|------------|-----------|------------|-----------|----------|------------|------------|------------|------------|-------------|-----|------------------------|-------|
| Over                   | Incl. | E10          | E11          | F6         | F7         | F8          | G6         | G7         | H5       | H6       | H7       | H8       | H9        | H10       | Js6   | Js7   | J6        | J7         | K6        | K7         | M6        | M7       | N6         | N7         | P6         | P7         | R6          | R7  | Over                   | Incl. |
| 3                      | 6     | +68<br>+20   | +95<br>+20   | +18<br>+10 | +22<br>+10 | +28<br>+10  | +12<br>+4  | +16<br>+4  | +5<br>0  | +8<br>0  | +12<br>0 | +18<br>0 | +30<br>0  | +48<br>0  | ±4    | ±6    | +5<br>-3  | +6<br>-6   | +2<br>-6  | +3<br>-9   | -1<br>-9  | 0<br>-12 | -5<br>-13  | -4<br>-16  | -7<br>-8   | -12<br>-20 | -11<br>-23  | 3   | 6                      |       |
| 6                      | 10    | +83<br>+25   | +115<br>+25  | +22<br>+13 | +28<br>+13 | +35<br>+13  | +14<br>+5  | +20<br>+5  | +6<br>0  | +9<br>0  | +15<br>0 | +22<br>0 | +36<br>0  | +58<br>0  | ±4.5  | ±7.5  | +5<br>-4  | +8<br>-7   | +2<br>-7  | +5<br>-10  | -3<br>-12 | 0<br>-15 | -7<br>-16  | -4<br>-19  | -12<br>-21 | -9<br>-24  | -13<br>-28  | 6   | 10                     |       |
| 10                     | 14    | +102<br>+32  | +142<br>+32  | +27<br>+16 | +34<br>+16 | +43<br>+16  | +17<br>+6  | +24<br>+6  | +8<br>0  | +11<br>0 | +18<br>0 | +27<br>0 | +43<br>0  | +70<br>0  | ±5.5  | ±9    | +6<br>-5  | +10<br>-8  | +2<br>-9  | +6<br>-12  | -4<br>-15 | 0<br>-18 | -9<br>-20  | -5<br>-23  | -15<br>-26 | -11<br>-29 | -16<br>-31  | 10  | 14                     |       |
| 14                     | 18    |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 14  | 18                     |       |
| 18                     | 24    | +124<br>+40  | +170<br>+40  | +33<br>+20 | +41<br>+20 | +53<br>+20  | +20<br>+7  | +29<br>+7  | +9<br>0  | +13<br>0 | +21<br>0 | +33<br>0 | +52<br>0  | +84<br>0  | ±6.5  | ±10.5 | +8<br>-5  | +12<br>-9  | +2<br>-11 | +6<br>-15  | -4<br>-17 | 0<br>-21 | -11<br>-24 | -7<br>-28  | -14<br>-31 | -14<br>-35 | -20<br>-41  | 18  | 24                     |       |
| 24                     | 30    |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 18  | 24                     |       |
| 30                     | 40    | +150<br>+50  | +210<br>+50  | +41<br>+25 | +50<br>+25 | +64<br>+25  | +25<br>+9  | +34<br>+9  | +11<br>0 | +16<br>0 | +25<br>0 | +39<br>0 | +62<br>0  | +100<br>0 | ±8    | ±12.5 | +10<br>-6 | +14<br>-11 | +3<br>-13 | +7<br>-18  | -4<br>-20 | 0<br>-25 | -12<br>-28 | -8<br>-33  | -21<br>-37 | -17<br>-42 | -25<br>-50  | 30  | 40                     |       |
| 40                     | 50    |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 30  | 40                     |       |
| 50                     | 65    | +180<br>+60  | +250<br>+60  | +49<br>+30 | +60<br>+30 | +76<br>+30  | +29<br>+10 | +40<br>+10 | +13<br>0 | +19<br>0 | +30<br>0 | +46<br>0 | +74<br>0  | +120<br>0 | ±9.5  | ±15   | +13<br>-6 | +18<br>-12 | +4<br>-15 | +9<br>-21  | -5<br>-24 | 0<br>-30 | -14<br>-33 | -9<br>-39  | -26<br>-45 | -21<br>-51 | -30<br>-62  | 50  | 65                     |       |
| 65                     | 80    |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 50  | 65                     |       |
| 80                     | 100   |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 80  | 100                    |       |
| 100                    | 120   | +212<br>+72  | +292<br>+72  | +58<br>+36 | +71<br>+36 | +90<br>+36  | +34<br>+12 | +47<br>+12 | +15<br>0 | +22<br>0 | +35<br>0 | +54<br>0 | +87<br>0  | +140<br>0 | ±11   | ±17.5 | +16<br>-6 | +22<br>-13 | +4<br>-18 | +10<br>-25 | -6<br>-28 | 0<br>-35 | -16<br>-38 | -10<br>-45 | -30<br>-52 | -24<br>-59 | -73<br>-41  | 100 | 120                    |       |
| 120                    | 140   |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 100 | 120                    |       |
| 140                    | 160   | +245<br>+85  | +335<br>+85  | +68<br>+43 | +83<br>+43 | +106<br>+43 | +39<br>+14 | +54<br>+14 | +18<br>0 | +25<br>0 | +40<br>0 | +63<br>0 | +100<br>0 | +160<br>0 | ±12.5 | ±20   | +18<br>-7 | +26<br>-14 | +4<br>-21 | +12<br>-28 | -8<br>-33 | 0<br>-40 | -20<br>-45 | -12<br>-52 | -36<br>-61 | -28<br>-68 | -50<br>-90  | 140 | 160                    |       |
| 160                    | 180   |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 140 | 160                    |       |
| 180                    | 200   |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 160 | 180                    |       |
| 200                    | 225   | +285<br>+100 | +390<br>+100 | +89<br>+50 | +96<br>+50 | +122<br>+50 | +44<br>+15 | +61<br>+15 | +20<br>0 | +29<br>0 | +46<br>0 | +72<br>0 | +115<br>0 | +185<br>0 | ±14.5 | ±23   | +22<br>-7 | +30<br>-16 | +5<br>-24 | +13<br>-33 | -8<br>-37 | 0<br>-37 | -22<br>-51 | -14<br>-60 | -41<br>-70 | -33<br>-79 | -60<br>-109 | 200 | 225                    |       |
| 225                    | 250   |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 200 | 225                    |       |
|                        |       |              |              |            |            |             |            |            |          |          |          |          |           |           |       |       |           |            |           |            |           |          |            |            |            |            |             | 225 | 250                    |       |



Unit:  $\mu\text{m}=0.001\text{mm}$ 

| Dimensional range (mm) |       | a     | c    | d    | e    | f    |     | g   |     | h   |     |     |     |      |      |      | js    |      | j   |     | k   |     | m   |     | n   |     | p   |     |      | r    |       | Dimensional range (mm) |  |
|------------------------|-------|-------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|-------|------------------------|--|
| Over                   | Incl. | a13   | c12  | d6   | e6   | f5   | f6  | g5  | g6  | h5  | h6  | h7  | h8  | h9   | h10  | js5  | js6   | j5   | j6  | k5  | k6  | m5  | m6  | n5  | n6  | p5  | p6  | r6  | r7   | Over | Incl. |                        |  |
| 3                      | 6     | -270  | -70  | -30  | -20  | -10  | -10 | -4  | -4  | 0   | 0   | 0   | 0   | 0    | 0    | ±2.5 | ±4    | +3   | +6  | +6  | +9  | +9  | +12 | +13 | +16 | +17 | +20 | +23 | +27  | 3    | 6     |                        |  |
|                        |       | -450  | -190 | -38  | -28  | -15  | -18 | -9  | -12 | -5  | -8  | -12 | -18 | -30  | -48  |      |       | -2   | -2  | +1  | +1  | +4  | +4  | +8  | +8  | +12 | +12 | +15 | +15  |      |       |                        |  |
| 6                      | 10    | -280  | -80  | -40  | -25  | -13  | -13 | -5  | -5  | 0   | 0   | 0   | 0   | 0    | 0    | ±3   | ±4.5  | +4   | +7  | +7  | +10 | +12 | +15 | +16 | +19 | +21 | +24 | +28 | +34  | 6    | 10    |                        |  |
|                        |       | -500  | -230 | -49  | -34  | -19  | -22 | -11 | -14 | -6  | -9  | -15 | -22 | -36  | -58  |      |       | -2   | -2  | +1  | +1  | +6  | +6  | +10 | +10 | +15 | +15 | +19 | +19  |      |       |                        |  |
| 10                     | 14    | -290  | -95  | -50  | -32  | -16  | -16 | -6  | -6  | 0   | 0   | 0   | 0   | 0    | 0    | ±4   | ±5.5  | +5   | +8  | +9  | +12 | +15 | +18 | +20 | +23 | +26 | +29 | +34 | +41  | 10   | 14    |                        |  |
| 14                     | 18    | -560  | -275 | -61  | -43  | -20  | -27 | -14 | -17 | -8  | -11 | 18  | -27 | -43  | -70  |      |       | -3   | -3  | +1  | +1  | +7  | +7  | +12 | +12 | +12 | +18 | +18 | +23  | +23  | 14    | 18                     |  |
| 18                     | 24    | -300  | -110 | -65  | -40  | -20  | -20 | -7  | -7  | 0   | 0   | 0   | 0   | 0    | 0    | ±4.5 | ±6.5  | +5   | +9  | +11 | +15 | +17 | +21 | +24 | +28 | +31 | +35 | +41 | +49  | 18   | 24    |                        |  |
| 24                     | 30    | -630  | -320 | -78  | -53  | -29  | -33 | -16 | -20 | -9  | -13 | -21 | -33 | -52  | -84  |      |       | -4   | -4  | +2  | +2  | +8  | +8  | +15 | +15 | +22 | +22 | +28 | +28  | 24   | 30    |                        |  |
| 30                     | 40    | -310  | -120 | -80  | -50  | -25  | -25 | -9  | -9  | 0   | 0   | 0   | 0   | 0    | 0    | ±5.5 | ±8    | +6   | +11 | +13 | +18 | +20 | +25 | +28 | +33 | +37 | +42 | +50 | +59  | 30   | 40    |                        |  |
|                        |       | -700  | -370 |      | -66  | -36  | -41 | -20 | -25 | -11 | -16 | -25 | -39 | -62  | -100 |      |       | -5   | -5  | +2  | +2  | +9  | +9  | +17 | +17 | +26 | +26 | +34 | +34  | 40   | 50    |                        |  |
| 50                     | 65    | -320  | -130 | -96  | -60  | -30  | -30 | -10 | -10 | 0   | 0   | 0   | 0   | 0    | 0    | ±6.5 | ±9.5  | +6   | +12 | +15 | +21 | +24 | +30 | +33 | +39 | +45 | +51 | +60 | +60  | 50   | 65    |                        |  |
|                        |       | -800  | -440 | 100  |      | -43  | -49 | -23 | -29 | -13 | -19 | -30 | -46 | -74  | -120 |      |       | -7   | -7  | +2  | +2  | +11 | +11 | +20 | +20 | +32 | +32 | +43 | +43  | 65   | 80    |                        |  |
| 65                     | 80    | -360  | -170 | -119 | -79  | -43  | -49 | -23 | -29 | -13 | -19 | -30 | -46 | -74  | -120 | ±7.5 | ±11   | +6   | +13 | +18 | +25 | +28 | +35 | +38 | +45 | +52 | +59 | +73 | +73  | 80   | 100   |                        |  |
|                        |       | -820  | -450 | -120 | -94  | -51  | -58 | -27 | -34 | -15 | -22 | -35 | -54 | -87  | -140 |      |       | -9   | -9  | +3  | +3  | +13 | +13 | +23 | +23 | +37 | +37 | +54 | +54  | 100  | 120   |                        |  |
| 80                     | 100   | -380  | -170 | -120 | -72  | -36  | -36 | -12 | -12 | 0   | 0   | 0   | 0   | 0    | 0    | ±9   | ±12.5 | +7   | +14 | +21 | +28 | +33 | +40 | +45 | +52 | +61 | +68 | +90 | +105 | 140  | 160   |                        |  |
|                        |       | -920  | -520 | -142 | -94  | -51  | -58 | -27 | -34 | -15 | -22 | -35 | -54 | -87  | -140 |      |       | -11  | -11 | +3  | +3  | +15 | +15 | +27 | +27 | +43 | +43 | +65 | +65  | 160  | 180   |                        |  |
| 100                    | 120   | -410  | -180 | -142 | -94  | -51  | -58 | -27 | -34 | -15 | -22 | -35 | -54 | -87  | -140 | ±9   | ±12.5 | +7   | +14 | +21 | +28 | +33 | +40 | +45 | +52 | +61 | +68 | +90 | +105 | 140  | 160   |                        |  |
|                        |       | -950  | -530 | -145 | -85  | -43  | -45 | -14 | -14 | 0   | 0   | 0   | 0   | 0    | 0    |      |       | -11  | -11 | +3  | +3  | +15 | +15 | +27 | +27 | +43 | +43 | +65 | +65  | 160  | 180   |                        |  |
| 120                    | 140   | -460  | -200 | -145 | -85  | -43  | -45 | -14 | -14 | 0   | 0   | 0   | 0   | 0    | 0    | ±9   | ±12.5 | +7   | +14 | +21 | +28 | +33 | +40 | +45 | +52 | +61 | +68 | +90 | +105 | 140  | 160   |                        |  |
|                        |       | -1090 | -600 |      | -170 | -110 | -61 | -68 | -32 | -39 | -18 | -25 | -40 | -63  | -100 |      |       | -160 | -11 | -11 | +3  | +3  | +15 | +15 | +27 | +27 | +43 | +43 | +65  | +65  | 160   | 180                    |  |
| 140                    | 160   | -520  | -210 | -170 | -110 | -61  | -68 | -32 | -39 | -18 | -25 | -40 | -63 | -100 | -160 | ±9   | ±12.5 | +7   | +14 | +21 | +28 | +33 | +40 | +45 | +52 | +61 | +68 | +90 | +105 | 140  | 160   |                        |  |
|                        |       | -1150 | -610 | -170 | -110 | -61  | -68 | -32 | -39 | -18 | -25 | -40 | -63 | -100 | -160 |      |       | -11  | -11 | +3  | +3  | +15 | +15 | +27 | +27 | +43 | +43 | +65 | +65  | 160  | 180   |                        |  |
| 160                    | 180   | -580  | -230 | -170 | -110 | -61  | -68 | -32 | -39 | -18 | -25 | -40 | -63 | -100 | -160 | ±9   | ±12.5 | +7   | +14 | +21 | +28 | +33 | +40 | +45 | +52 | +61 | +68 | +90 | +105 | 140  | 160   |                        |  |
|                        |       | -1210 | -630 | -170 | -110 | -61  | -68 | -32 | -39 | -18 | -25 | -40 | -63 | -100 | -160 |      |       | -11  | -11 | +3  | +3  | +15 | +15 | +27 | +27 | +43 | +43 | +65 | +65  | 160  | 180   |                        |  |

**D****HIWIN Ballscrew Data Inquiry (A)**

Company \_\_\_\_\_ Date \_\_\_\_\_  
Address \_\_\_\_\_  
Telephone \_\_\_\_\_ Fax. \_\_\_\_\_  
Machine Type \_\_\_\_\_ Application \_\_\_\_\_  
Attached Drawing Yes \_\_\_\_\_ (Drawing No. \_\_\_\_\_) No. \_\_\_\_\_  
Please fill or check following items.

**1. Load Condition**

(a) Working Axial Load

Max. \_\_\_\_\_ kgf , at \_\_\_\_\_ rpm for \_\_\_\_\_ % of operation time

Normal. \_\_\_\_\_ kgf , at \_\_\_\_\_ rpm for \_\_\_\_\_ % of operation time

Min. \_\_\_\_\_ kgf , at \_\_\_\_\_ rpm for \_\_\_\_\_ % of operation time

(Total of operation time ratio should be 100%)

(b) Max. Axial Static Load \_\_\_\_\_ kgf

(c) Deviated Load, if any (Please avoid this load condition, if possible)

Radial Load \_\_\_\_\_ kgf Moment Load \_\_\_\_\_ kgf-cm

**2. Operation Conditions**

(a) Stroke \_\_\_\_\_ mm , Motor power used \_\_\_\_\_ kw

(b) Life Expectancy \_\_\_\_\_ x10<sup>6</sup> revs, \_\_\_\_\_ km, \_\_\_\_\_ hr

(c) Rotation Shaft \_\_\_\_\_ Nut \_\_\_\_\_

(d) Mounting Method \_\_\_\_\_ Mounting Span \_\_\_\_\_ mm

(e) Shock/Vibration: Smooth \_\_\_\_\_ Normal \_\_\_\_\_ Vibration \_\_\_\_\_

**3. Main Dimensions**

(a) Screw Shaft O.D. \_\_\_\_\_ mm Turning Direction: R \_\_\_\_\_ L \_\_\_\_\_

(b) Lead \_\_\_\_\_ mm (Pitch \_\_\_\_\_ mm) No. of Starts \_\_\_\_\_

(c) Total Length \_\_\_\_\_ mm Effective Threaded Length \_\_\_\_\_ mm

(d) Nut Type \_\_\_\_\_ Seal \_\_\_\_\_

(e) Support Bearing: Ball \_\_\_\_\_ Roller \_\_\_\_\_

**4. Lead Accuracy, Axial Clearance, Preload and Stiffness**

(a) Target Point of Accumulated Lead Tp: \_\_\_\_\_ mm

(b) Accuracy Grade \_\_\_\_\_ (Lead Deviation: \_\_\_\_\_ mm/300mm)

(c) Axial play \_\_\_\_\_ mm max.

(d) Preload \_\_\_\_\_ kgf (or Drag Torque \_\_\_\_\_ kgf-cm)

(e) Nut Stiffness Kn \_\_\_\_\_ kgf/ $\mu$ m**5. Other Conditions**

(a) Lubrication: Grease \_\_\_\_\_ Oil \_\_\_\_\_

(b) Ambient Temperature \_\_\_\_\_ ☐ °C ☐ °F

(c) Special Conditions \_\_\_\_\_

**E**

## HIWIN Ballscrew Request Form (B)

### Request for quotation

Customer Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
 \_\_\_\_\_ Country: \_\_\_\_\_  
 Desired Delivery Date: \_\_\_\_\_ Delivery Point: \_\_\_\_\_  
 Type of Ball Screw: (1) \_\_\_\_\_ Quantity: \_\_\_\_\_  
 (2) \_\_\_\_\_ Quantity: \_\_\_\_\_

### Required Specifications:

- (1) ☐ Single Start ☐ Double Start ☐ Triple Start ☐ Four Start  
 (2) Direction of Turn: ☐ Right ☐ Left  
 (3) Shaft Diameter: \_\_\_\_\_  
 (4) Lead: \_\_\_\_\_  
 (5) Circuit: \_\_\_\_\_  
 (6) Nut Type: \_\_\_\_\_  
 (7) ☐ Internal ☐ External ☐ Endcap  
 (8) Thread Length: \_\_\_\_\_  
 (9) Overall Length: \_\_\_\_\_  
 (10) Accuracy Grade: \_\_\_\_\_  
 (Lead Deviation: \_\_\_\_\_ mm/300mm)  
 (11) Speed: \_\_\_\_\_ rpm  
 (12) ☐ Rolled ☐ Ground

\* Please refer to HIWIN catalog P.36 for nut information.

Customer Special Requirement

### ● Please answer the following questions.

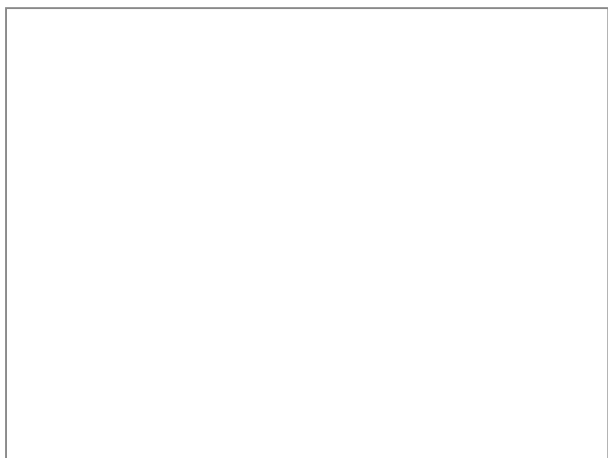
Your kind answers would be very helpful in preparing quotation promptly.

- (a) In what kind of application is this ballscrew used ?
- (b) Is this ballscrew used for the X, Y, or Z axis? Vertically or horizontally ?
- (c) How many ballscrews are needed for each machine and what is the annual requirement ?
- (d) If this is not a new project, whose ballscrews are you using currently ?

MEMO

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