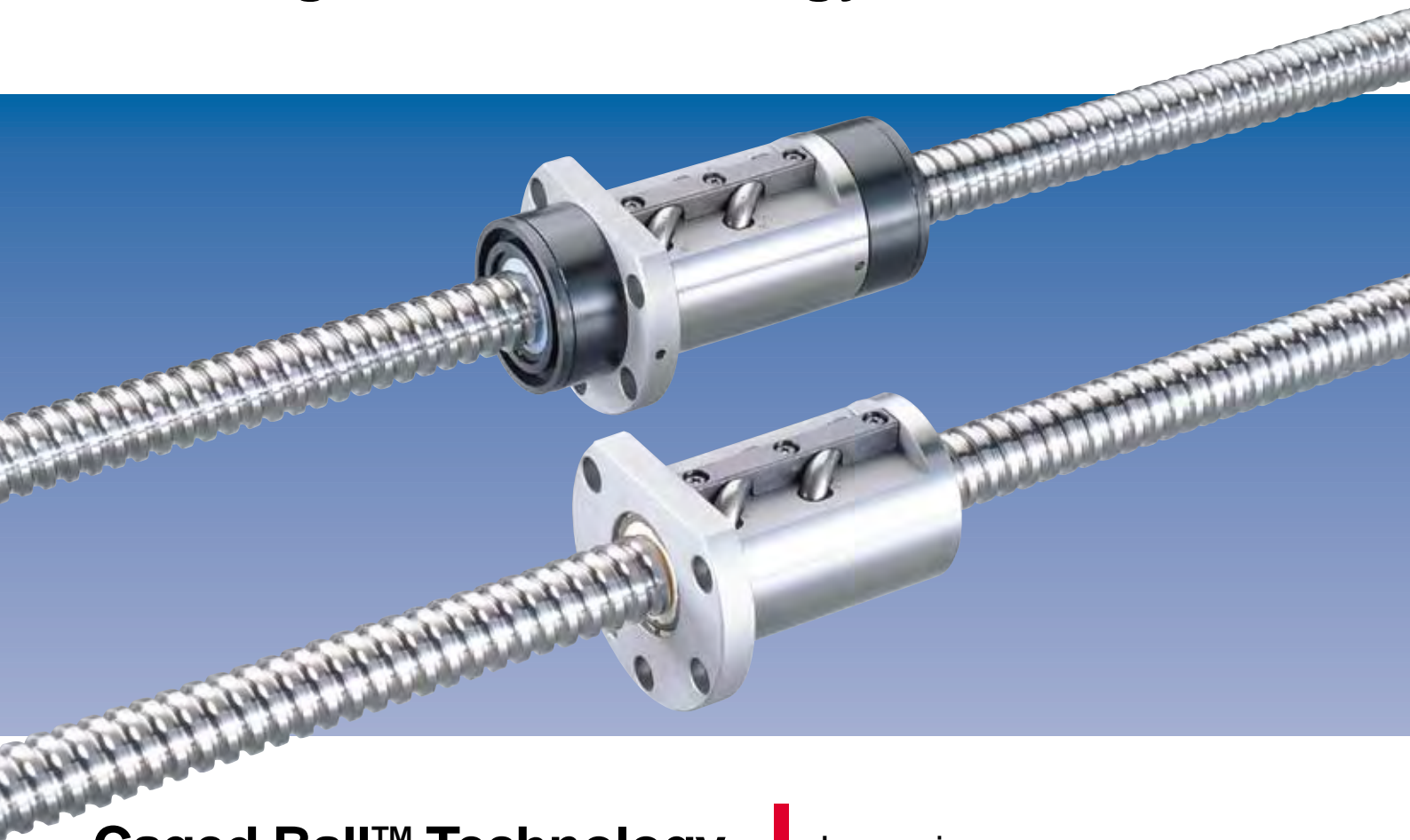


**NEW**

# High speed ball screw with caged ball technology **SBN**



**Caged Ball™ Technology**  
+  
**High speed specification**

Low noise  
Long-term, maintenance free operation  
Low torque fluctuation  
DN value 130,000

## High speed ball screw with caged ball technology

# SBN

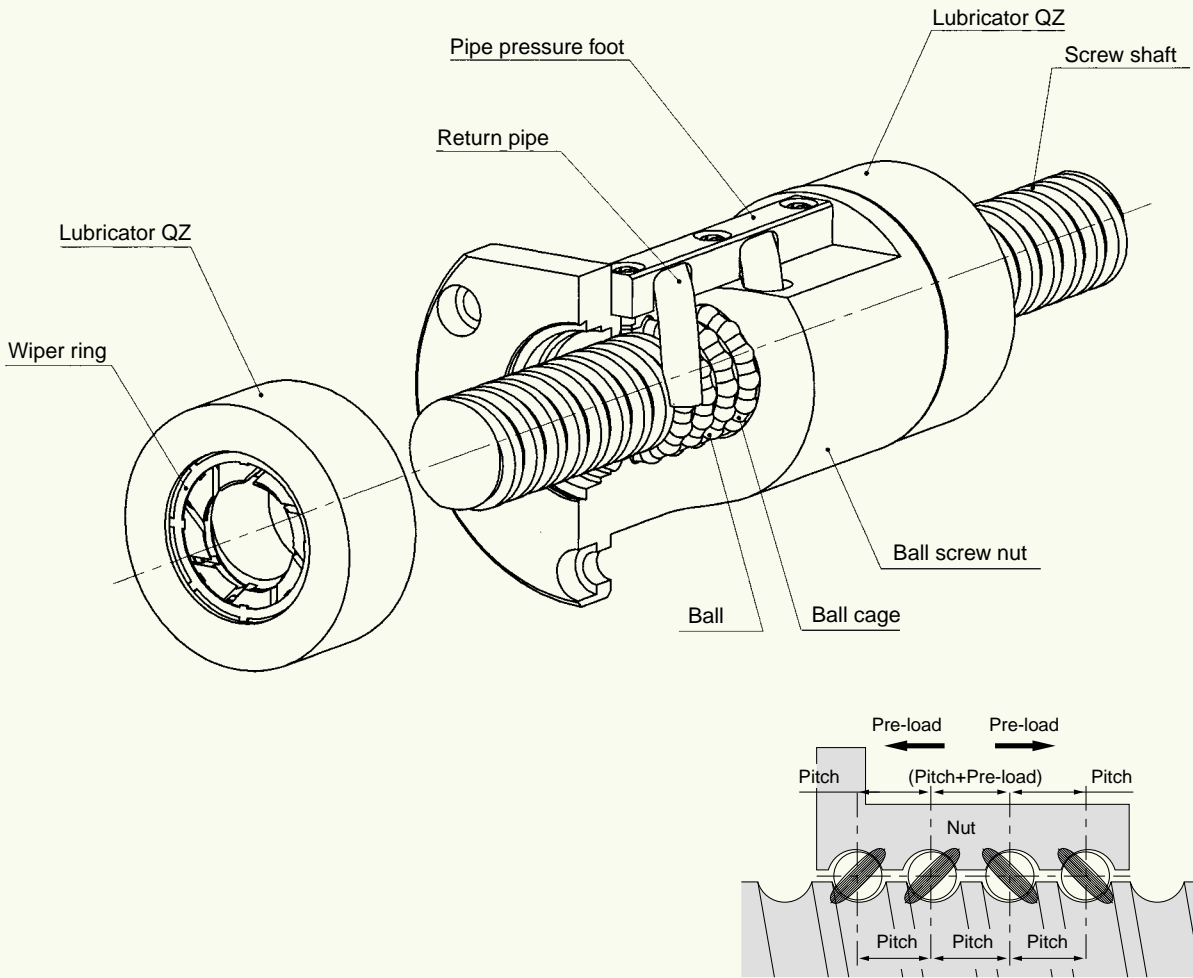


Fig.1 Structure of type SBN

### Structure

A high-speed ball screw SBN is provided with caged ball technology in order to eliminate collisions and friction between balls and improve lubrication longevity. By doing this, low noise, excellent torque characteristics and long periods without maintenance were achieved. Increasing the strength of the circulating part by making an ideal cycle which can pick up the ball at a direction tangential with the return pipe, permissible DN values of 130,000 were realized. (\*: DN value = ball center diameter × number of rotations per minute)

Using an offset pre-load method that shifts the lead at the center of the nut allows for a shorter and more compact nut compared to the double nut used for the shim pre-load method.

With full use of the LM guide with Caged Ball™ technology developed as a result of our extensive experience and new manufacturing techniques, the ball screw with a ball cage, corresponding to high speed demands in the market, performs extremely well with regards to the following features.

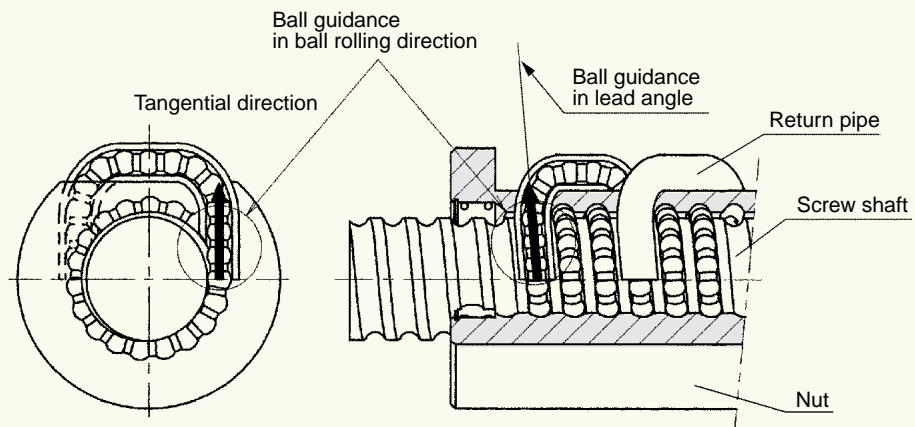
## Features

### High speed correspondence

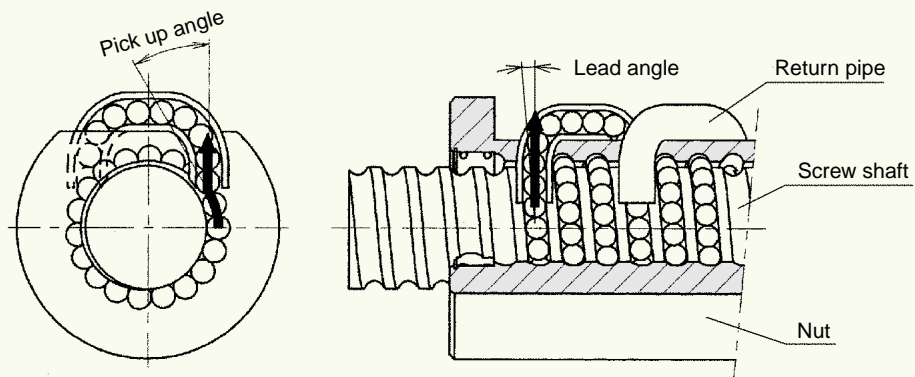
The SBN type return pipe is the ideal circulation method and doesn't have a lip so that the ball is picked up in a tangential direction and a flexible ball track can be held.

The design, with enough strength in the return pipe and the ball cage, makes the use with DN value 130,000 possible.

#### Type SBN



#### Conventional type



## Low noise

The ball cage between balls eliminates collision noise.

The return pipe does not have a lip so that the ball is picked up at a tangential direction and collision noise is eliminated.

These devices result in low noise and high sound quality.

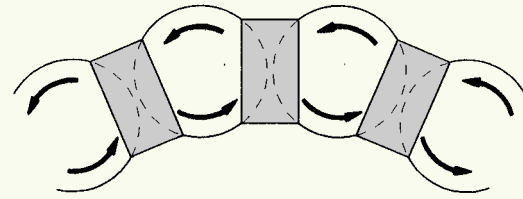
## Long-term maintenance-free operation

The ball cage acts as a lubricant reservoir. Adding the optional wire ring and the lubricator QZ\* makes long-term maintenance-free operation possible even in adverse environments (foreign matter or coolant).

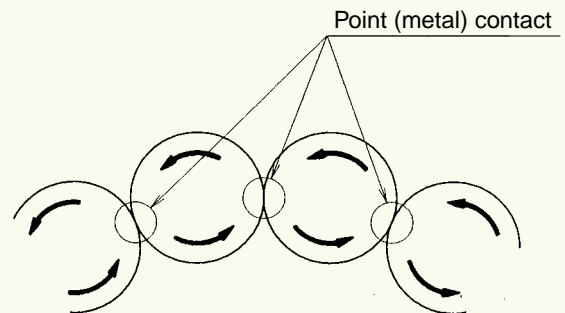
(\* : Please contact **THK** regarding the wiper ring and the lubricator QZ for ball screw.)

## Excellent sliding

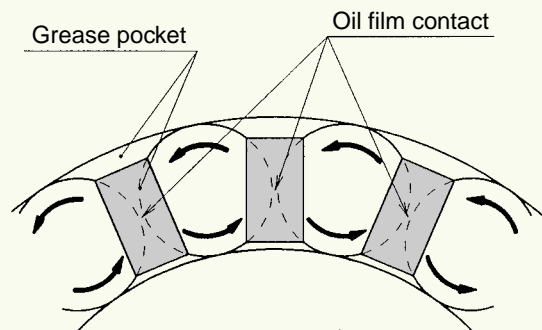
The ball cage eliminates ball to ball friction of balls and improves the torque characteristics greatly. A pre-load dynamic torque fluctuation is reduced and it is possible to achieve excellent sliding.



Caged ball technology



Conventional construction



Grease pocket

## ■ High speed & load durability

Type SBN uses a new re-circulation tube and caged ball technology to achieve smooth circulation which maintains high speed and improved load durability.

### High speed durability test

#### Test condition

|                  |   |
|------------------|---|
| Model Number     | SBN3210-7                                     |
| Rotational speed | 3900 (min <sup>-1</sup> ) (DN value: 130,000) |
| Stroke           | 400mm   |
| Lubricant        | AFG grease                                    |
| Apply            | 12cm <sup>3</sup> (applied every 1000km)      |
| Load             | 1.73kN  |
| Acceleration     | 1G  |

#### Test result

**No problems after 5000km travel**

### Load durability test

#### Test condition

|                  |                           |
|------------------|---------------------------|
| Model Number     | SBN3210-7                 |
| Rotational speed | 1500 (min <sup>-1</sup> ) |
| Stroke           | 300mm                     |
| Lubricant        | AFG grease                |
| Apply            | 12cm <sup>3</sup>         |
| Load             | 17.3kN                    |
| Acceleration     | 0.5G                      |

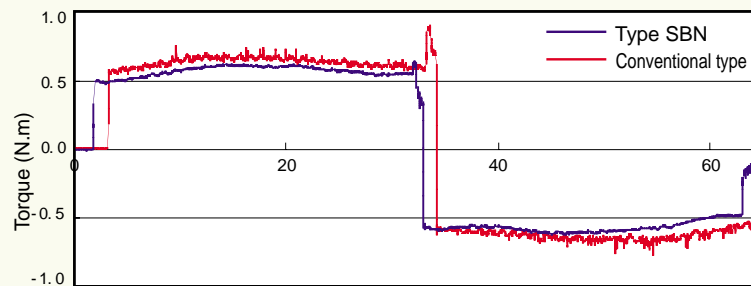
#### Test result

**Operated for 2.5 times estimated life span without a problem (Currently in operation)**

## ■ Smooth rotation

Type SBN uses caged ball technology, so it is possible to get smoother rotation compared to conventional types.

| Category              | Data                |
|-----------------------|---------------------|
| Shaft diameter / lead | 32 / 10 mm          |
| Rotational speed      | 60min <sup>-1</sup> |

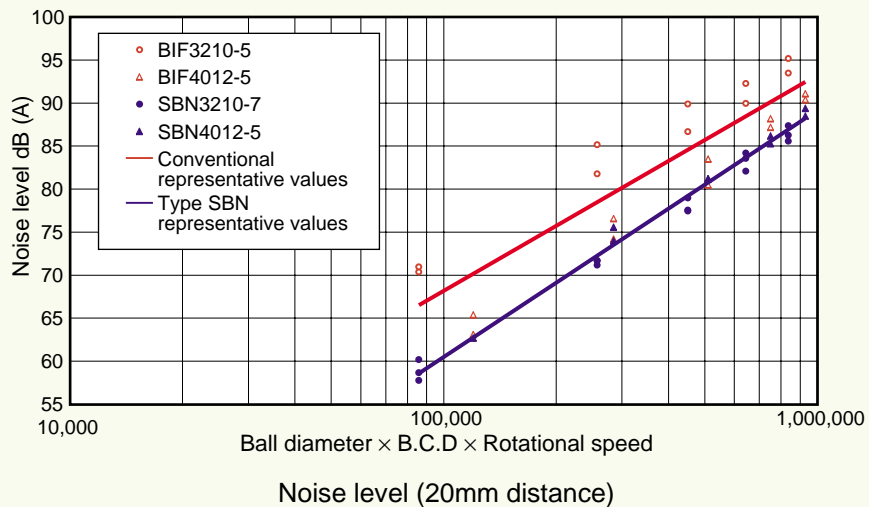
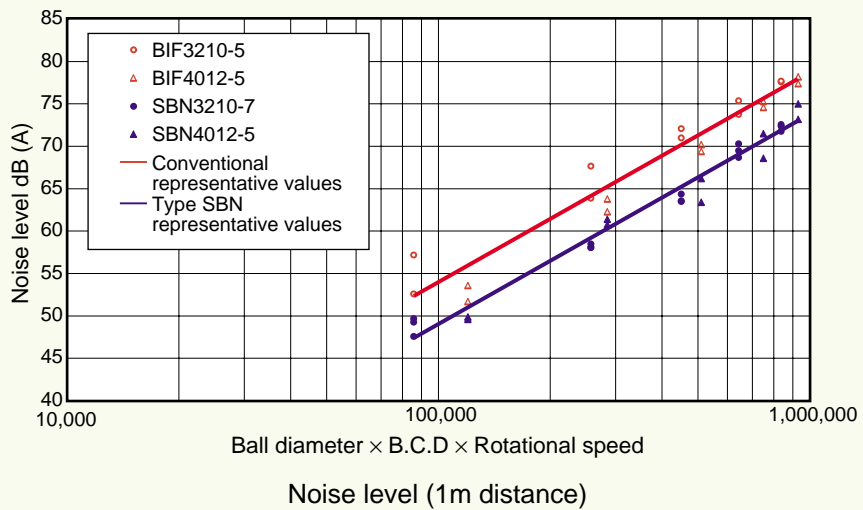
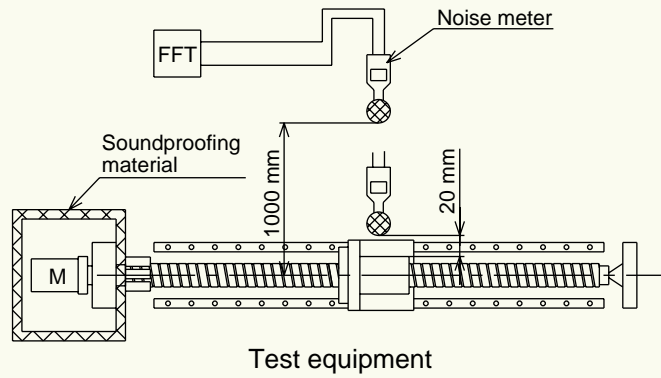


Torque data

## ■ Noise level data

Type SBN maintains quiet operation under high-speed rotation by adopting caged ball technology that eliminates collisions of adjacent metal balls.

| Item             | Description             |
|------------------|-------------------------|
| Lubricator       | THK AFG grease          |
| Measure distance | As shown in graph below |



## Accuracy standard

The THK high-speed ball screw with caged ball technology is manufactured to a level of accuracy compliant with the JIS B1192 standard (precision ball screws). It is manufactured to high-accuracy C0 grade. The reliability of lead accuracy measurement is guaranteed by the use of a laser measurement device. For details on standard values, refer to the general catalogue.

## Load ratings and life

### Basic load rating Ca

Basic load rating Ca is used to calculate the life span of a ball screw when the nut moves due to being subject to a load.

The Ca basic load rating is called the axial directional load when revolving each of a set of identical ball screws having a rated life span of 90% at 106 rev. (1,000,000 revolutions).

### Life calculation

From the basic load rating and axial directional load, the life span of a ball screw is calculated using the following equation.

$$L = \left( \frac{Ca}{fw \cdot Fa} \right)^3 \times 10^6$$

L : Rated life span                      rev  
 Ca : Basic load rating                      N  
 Fa : Axial directional load                      N  
 Fw : Load factor (Table 1)

Table 1 Load Factor (fw)

| Vibration and collision | Velocity (v)                              | fw      |
|-------------------------|---|---------|
| Slight                  | At very low speed<br>$V \leq 0.25$ m/s    | 1.0~1.2 |
| Small                   | At low speed<br>$0.25 < V \leq 1.0$ m/s   | 1.2~1.5 |
| Medium                  | At medium speed<br>$1.0 < V \leq 2.0$ m/s | 1.5~2.0 |
| Large                   | At high speed<br>$V > 2.0$ m/s            | 2.0~3.5 |

The life span can be calculated as in the following equation, when you know the rotational life span L, and the stroke length and reciprocating frequency are fixed.

$$Lh = \frac{L \times \ell}{2 \times \ell_s \times n_1 \times 60}$$

Lh : Life in terms of time                      hr  
 Coa : Stroke length                      mm  
 Fa : Number of reciprocating motions per minute                      min<sup>-1</sup>  
 ℓ : Lead                      mm

### Basic static load rating Coa

If the ball screw is subject to an excessive load or large collision load when in a static or moving state, localized permanent deformation will occur between the raceway surface and steel balls. This will prevent smooth motion if the amount of permanent deformation exceeds a specific limit.

In general, operation is regarded to be no problem if the extent of permanent deformation is 0.0001 times the diameter of the steel balls, and the load at this level is called basic static load rating Coa. Consideration of a static stability factor such as in table 2 is required with regards to the axial directional load resulting from operating conditions.

Table 2 Static Stability Factor (Fs)

| Applicable machine                 | Load condition   | Lower limit of Fs  |
|------------------------------------|--|--------------------|
| General-purpose industrial machine | When no vibration and collision<br>When subject to vibration and collision | 1.0~1.3<br>2.0~3.0 |
| Machine tool                       | When no vibration and collision<br>When subject to vibration and collision | 1.0~1.5<br>2.5~7.0 |

$$f_s \leq \frac{Coa}{Fa}$$

fs : Static stability factor (Table 2)  
 Coa : Basic static load rating                      kN  
 Fa : Axial directional load                      kN  
 ℓ : Lead

## Notes on use

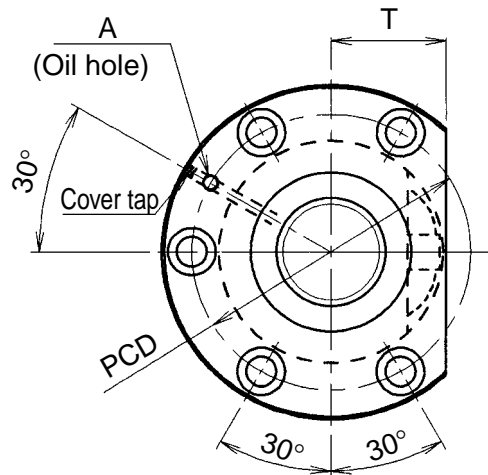
### Permissible rotational frequency

When the rotational frequency becomes high, the screw shaft nears natural frequency leading to resonating and in some cases resulting in movement failure. It is therefore necessary to consider using the ball screw below resonance point (critical speed). (For details, refer to the general catalogue.) Furthermore, the DN value is also limited regardless of the method of mounting. It is necessary to consider both of these points. (Permissible DN value of 130,000 for type SBN.)

### Recommended grease

Using a ball screw at high rotational speeds generates a large amount of heat. AFG grease is recommended for operation at high speeds.

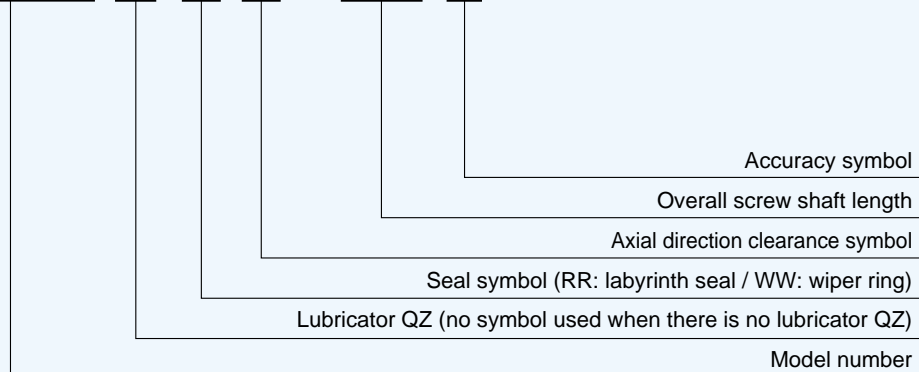
# Type SBN



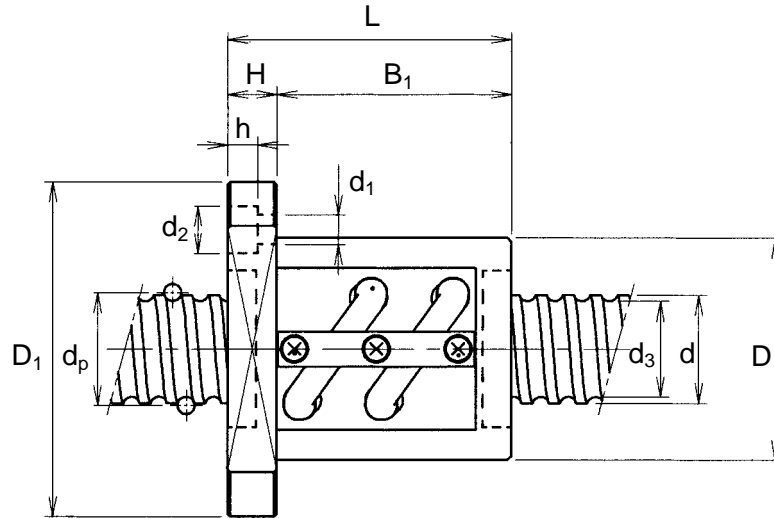
| Model number | Screw shaft outer diameter<br>d | Lead<br>l | Load circuit number<br>Row _ winding | Ball center diameter<br>dp | Screw shaft root diameter<br>d <sub>3</sub> | Basic rated load |           |
|--------------|---------------------------------|-----------|--------------------------------------|----------------------------|---|------------------|-----------|
|              |                                 |           |                                      |                            |   | Ca<br>kN         | Coa<br>kN |
| SBN3210-7    | 32                              | 10        | 1 × 3.5                              | 33.75                      | 26.4  | 34.8             | 73.4      |
| SBN3212-5    | 32                              | 12        | 1 × 2.5                              | 34                         | 26.1  | 30.2             | 58.3      |
| SBN3610-7    | 36                              | 10        | 1 × 3.5                              | 37.75                      | 30.4  | 36.8             | 83.0      |
| SBN3612-7    | 36                              | 12        | 1 × 3.5                              | 38                         | 30.1  | 42.9             | 93.0      |
| SBN3616-5    | 36                              | 16        | 1 × 2.5                              | 38                         | 30.1  | 32.1             | 66.2      |
| SBN4012-5    | 40                              | 12        | 1 × 2.5                              | 42                         | 34.1  | 33.9             | 73.6      |
| SBN4016-5    | 40                              | 16        | 1 × 2.5                              | 42                         | 34.1  | 33.8             | 73.9      |
| SBN4512-5    | 45                              | 12        | 1 × 2.5                              | 47                         | 39.2  | 35.8             | 83.2      |
| SBN4516-5    | 45                              | 16        | 1 × 2.5                              | 47                         | 39.2  | 35.8             | 83.4      |
| SBN5012-5    | 50                              | 12        | 1 × 2.5                              | 52                         | 44.1  | 37.6             | 92.8      |
| SBN5016-5    | 50                              | 16        | 1 × 2.5                              | 52                         | 44.1  | 37.5             | 93.0      |
| SBN5020-5    | 50                              | 20        | 1 × 2.5                              | 52                         | 44.1  | 37.5             | 93.3      |

## Model Number Coding

**SBN3210-7 QZ RR G0 + 1200L C5**







| Outer diameter<br>D | Flange diameter<br>D1 | Length<br>L | Nut dimension |     |     |                                     |    | Oil hole<br>A | Maximum<br>permissible<br>rotation speed<br>min <sup>-1</sup> |
|---------------------|-----------------------|-------------|---------------|-----|-----|-------------------------------------|----|---------------|---|
|                     |                       |             | H             | B1  | PCD | d <sub>1</sub> × d <sub>2</sub> × h | T  |               |   |
| 74                  | 108                   | 120         | 15            | 105 | 90  | 9 × 14 × 8.5                        | 38 | M6            | 3850  |
| 76                  | 121                   | 117         | 18            | 99  | 98  | 11 × 17.5 × 11                      | 39 | M6            | 3800  |
| 77                  | 120                   | 123         | 18            | 105 | 98  | 11 × 17.5 × 11                      | 40 | M6            | 3400  |
| 81                  | 124                   | 140         | 18            | 122 | 102 | 11 × 17.5 × 11                      | 42 | M6            | 3400  |
| 81                  | 124                   | 140         | 18            | 122 | 102 | 11 × 17.5 × 11                      | 42 | M6            | 3400  |
| 84                  | 126                   | 119         | 18            | 101 | 104 | 11 × 17.5 × 11                      | 43 | M6            | 3050  |
| 84                  | 126                   | 144         | 18            | 126 | 104 | 11 × 17.5 × 11                      | 43 | M6            | 3050  |
| 90                  | 130                   | 119         | 18            | 101 | 110 | 11 × 17.5 × 11                      | 46 | PT1/8         | 2750  |
| 90                  | 130                   | 140         | 18            | 122 | 110 | 11 × 17.5 × 11                      | 46 | PT1/8         | 2750  |
| 95                  | 141                   | 119         | 22            | 97  | 117 | 14 × 20 × 13                        | 48 | PT1/8         | 2500  |
| 95                  | 141                   | 143         | 22            | 121 | 117 | 14 × 20 × 13                        | 48 | PT1/8         | 2500  |
| 95                  | 141                   | 169         | 22            | 147 | 117 | 14 × 20 × 13                        | 48 | PT1/8         | 2500  |

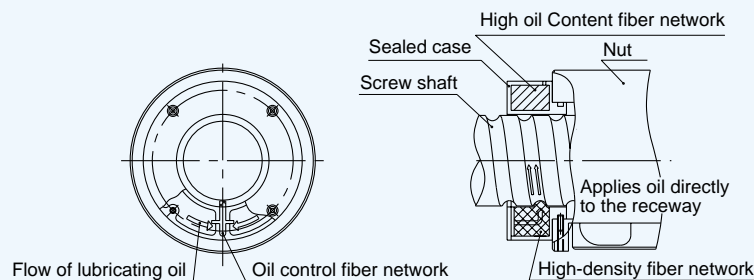
### ●Heat generation

When using a ball screw at high rotating speeds, ball screw temperature can get excessively high. THK recommends AFG grease for low heat generation.

Type SBN can be equipped with lubricator QZ, which is a ball screw lubricator system containing a high-density fiber net with high oil content for longer maintenance-free periods, as well as a contact seal and wiper ring offering superb contamination protection capabilities for ball screws.

## ■ Lubricator QZ

Lubricator QZ is a new lubricating system that can supply an appropriate amount of lubricating oil to the parts requiring it.



### < Features >

- **Enables longer maintenance-free intervals**

Normally, a small amount of oil is lost from ball screws during operation. By adding the lubricator QZ, oil lost over long periods is automatically replaced, greatly lengthening maintenance-free intervals.

- **Lubricator QZ is environmentally conscious**

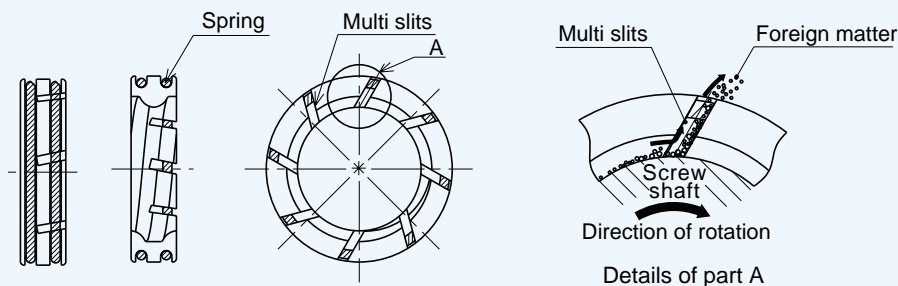
Because lubricator QZ uses a high-density fiber net to supply the appropriate amount of oil to the appropriate positions, there is no excess oil, making it an environmentally conscious design.

- **The best oil for each application can be used**

Lubricator QZ permits the use of the most suitable oil for the operating environment. For further details contact . (Applicable lubricating oil standard = ISO VG220)

## ■ Wiper Ring

The wiper ring adopts a specialized resin with friction resistant properties that forms an elastic contact on the outer shaft and screw grooves, thus protecting the slits in 8 places from contamination and preventing foreign matter from penetrating into the ball screw nut.



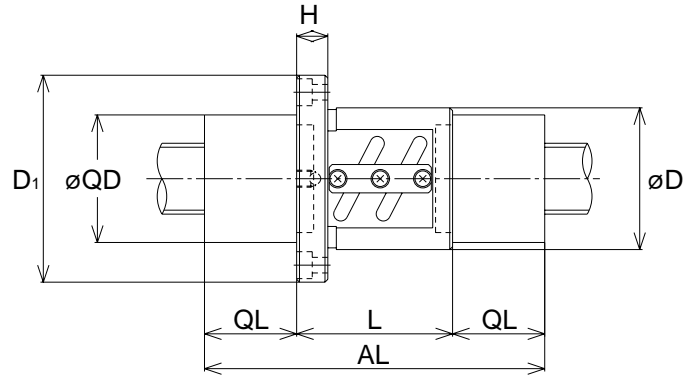
Structure of wiper ring

### < Features >

- Prevents foreign matter penetrating the ball screw nut.
- Suppresses heat generation by fixed-pressure contact with screw shaft.
- Excellent resistance to friction, collision and chemicals.
- Incorporating lubricator QZ makes long-term maintenance-free operation a reality, even in adverse environments.

Note: The wiper ring cannot be fitted when processing the type SBN surface.

# SBN with options



| Model number | Nut dimensions  |                   |                                   |                         | QZ dimensions   |                         |                              |
|--------------|-----------------|-------------------|-----------------------------------|-------------------------|-----------------|-------------------------|------------------------------|
|              | Nut length<br>L | Flange width<br>H | Flange diameter<br>D <sub>1</sub> | Nut outer diameter<br>D | QZ Length<br>QL | QZ outer diameter<br>QD | QZ device total length<br>AL |
| SBN3210-7    | 120             | 15                | 108                               | 74                      | 31              | 73                      | 182                          |
| SBN3212-5    | 117             | 18                | 121                               | 76                      | 33              | 73                      | 183                          |
| SBN3610-7    | 123             | 18                | 120                               | 77                      | 33              | 64                      | 189                          |
| SBN3612-7    | 140             | 18                | 124                               | 81                      | 35              | 64                      | 210                          |
| SBN3616-5    | 140             | 18                | 124                               | 81                      | 32              | 64                      | 204                          |
| SBN4012-5    | 119             | 18                | 126                               | 84                      | 38              | 66                      | 195                          |
| SBN4016-5    | 144             | 18                | 126                               | 84                      | 42              | 66                      | 228                          |
| SBN4512-5    | 119             | 18                | 130                               | 90                      | 35.5            | 79                      | 190                          |
| SBN4516-5    | 140             | 18                | 130                               | 90                      | 35.5            | 79                      | 211                          |
| SBN5012-5    | 119             | 22                | 141                               | 95                      | 38.5            | 79                      | 196                          |
| SBN5016-5    | 143             | 22                | 141                               | 95                      | 38.5            | 79                      | 220                          |
| SBN5020-5    | 169             | 22                | 141                               | 95                      | 40.5            | 79                      | 250                          |

# THK High speed ball screw with ball cage

## SBN

### Precautions During Use

#### \* Handling

\* Since the ball screw is a precision component, dropping or subjecting it to strong impacts can result in damage or changes in function. In addition, since the balls and ball cage will come out if the ball screw nut is disengaged from the screw shaft (ball screw section), please handle with care.

#### \* Assembly

\* If components are forcibly driven onto the screw shaft or nut, indentations may be formed in the rolling surface. Adequate caution is therefore required so as not to allow excessive force to be applied to the screw shaft and ball screw nut during part assembly.

\* If the screw shaft support and nut section are off-center or shifted out of position, the service life of the product may be shortened considerably. Adequate caution is therefore required with respect to assembled part accuracy and assembly accuracy.

#### \* Coolant

\* When this product is used in an environment in which there is the risk of coolant or other similar substance entering the nut section, please consult with THK since product function may be impaired depending on the type of coolant.


#### \* Operating Temperature Range

\* Since the SBN type uses a special resin, avoid using at temperatures above 80°C.

#### \* Lubrication

\* Although the ball screw can be used as is since it contains grease (with the exception of special cases), please replenish the grease prior to shipment following trial operation at your firm.

\* In the case of using in special environments, such as using in locations constantly subjected to the effects of vibrations, or using in a clean room, vacuum or under extremely low or high temperatures, ordinary grease may not be able to be used. In such cases, please inquire to THK.

\* "LM Guide", "Ball Cage", "  " and "QZ" are the registered trademarks of THK Co., Ltd.

\* Appearance and specifications are subject to change without notice. Please inquire in advance at the time of use.

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