



High-Speed Ball Screw for Machine Tools

**BSM**



DN value 170,000

Full ball type demonstrating the pinnacle of high-speed performance



DN value 170,000

Full ball type demonstrating the pinnacle of  
high-speed performance

**High-Speed Ball Screw for Machine Tools**

# **BSM** Series

Our new ball circulation system achieves even higher speeds (DN value 170,000)

Increases the speed of equipment



**Feature 1 High-speed**

Significantly improves the DN value with a newly developed circulation structure.

**Feature 2 Designed to optimize machine tool performance**

Improves load capacity through the groove design.

**Feature 3 Compact with high rigidity**

Achieves higher rigidity and a more compact nut diameter than our conventional products.

With high-speed performance that exceeds prior full ball standards, the BSM achieves even higher load capacity.

# BSM Series

## Feature 1 High-speed

Significantly improves the DN value with a newly developed circulation structure.

DN value greatly improved from 130,000 in conventional products to 170,000. Utilizes a large lead to meet high-speed performance demands.

Maximum feed speed of 121 m/min (for the BSM4030-6)

Maximum Feed Speed Unit: m/min

Screw shaft outer diameter (mm)	Lead (mm)			
	16	20	25	30
φ36	—	90	—	—
φ40	65	81	101	121
φ45	58	73	90	—
φ50	52	66	82	98
φ63	41	—	—	—

## Feature 2 Designed to optimize machine tool performance

Improves load capacity through the groove design.

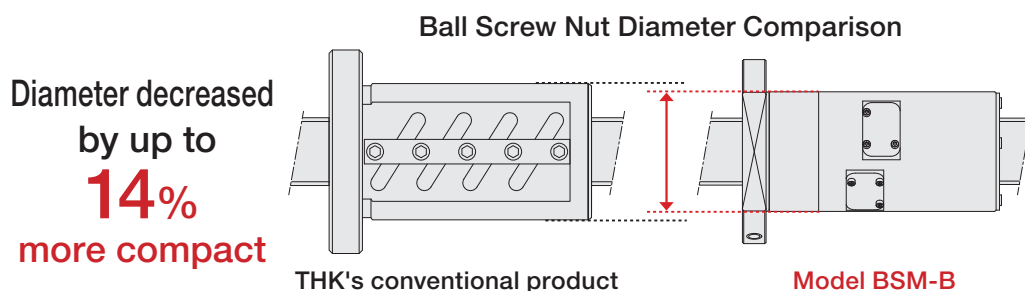
The Model BSM improves load capacity with a unique groove design and double groove structure.

## Feature 3 Compact with high rigidity

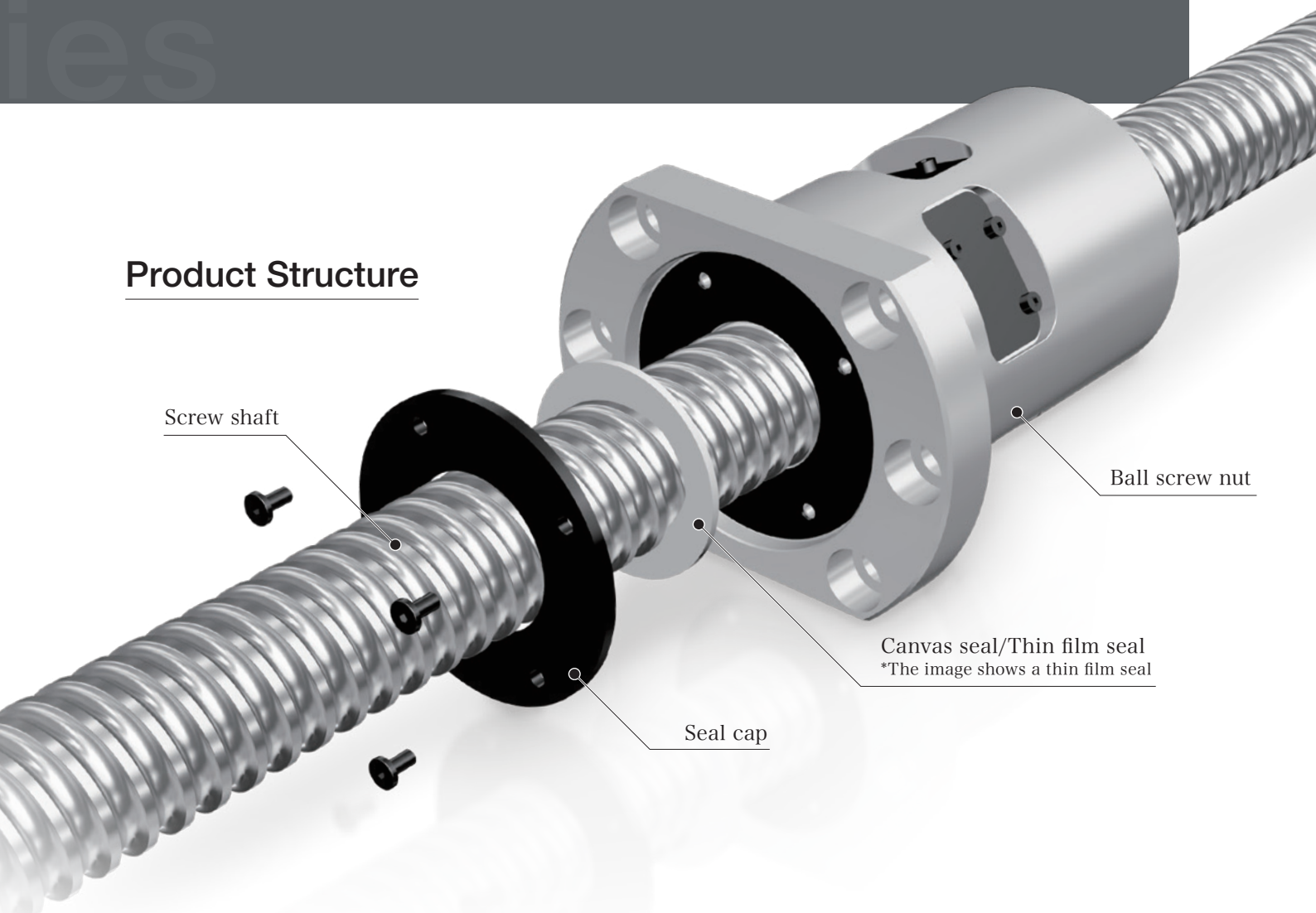
Achieves higher rigidity and a more compact nut diameter than our conventional products.

The Model BSM-B conserves space with a slimmer nut compared to our conventional products.

Rigidity was also improved by extending the overall length and increasing the number of loaded circuits.



## Product Structure

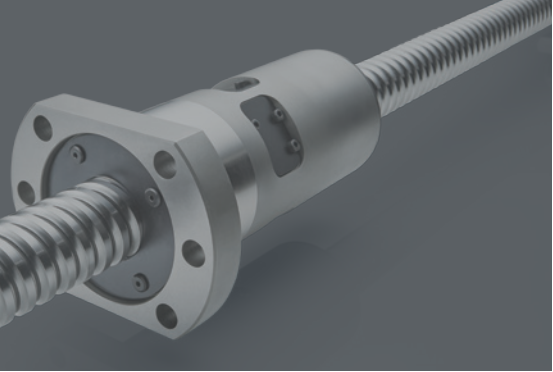


## Model BSM Lineup

Screw shaft outer diameter	Lead			
	16	20	25	30
ø36	-	○	-	-
ø40	●	●○	●○	●○
ø45	●	●○	●○	-
ø50	●	●○	●○	●○
ø63	●	-	-	-

● : BSM ○ : BSM-B (Slim Nut Type)

# Product Specifications



## Lead Accuracy

Accuracy controlled according to conventional JIS (Japanese Industrial Standard) parameters.

Accuracy Standards Correspondence Table

		Lead Angle Accuracy (Permissible Value)					
Accuracy standards	JIS	C0	C1	C2*	C3	C5	C7*
		Cp0	Cp1	—	Cp3	Cp5	—

\*THK standard lead accuracy

## Axial Clearance

BSM utilizes offset preloading and therefore is only available with an axial clearance of G0.

Unit: mm

Clearance symbol	G0
Axial clearance	0 or less

## Static Safety Factor

For ball screws, a static safety factor based on the calculated maximum axial load and static load rating must be considered. Vibrations, impacts, or inertia due to starting and stopping may result in an unexpectedly large load. Therefore, please confirm that a sufficient static safety factor has been ensured when selecting a model. Estimates for the static safety factor are shown in the table below.

### Static Safety Factor $f_s$

$$f_s = \frac{C_{0a}}{F_{a\max}}$$

$f_s$  : Static safety factor  
 $C_{0a}$  : Basic static load rating<sup>1</sup> (kN)  
 $F_{a\max}$  : Permissible axial load (kN)

### Estimates of the Static Safety Factor ( $f_s$ )

Load conditions <sup>2</sup>	Lower limit of $f_s$
Without vibrations or impacts	2
With vibrations or impacts	5

<sup>1</sup>The basic static load rating ( $C_{0a}$ ) is a static load with a constant direction and magnitude whereby the sum of the permanent deformation of a ball and that of a rolling groove on a contact area under the maximum stress is 0.0001 times that of the ball diameter. With the ball screw, it is defined as the axial load. (Specific values of each ball screw model are indicated in the dimensional tables for the corresponding model.)

<sup>2</sup>Vibrations and impacts are typically caused by factors such as acceleration and deceleration, sudden starting and stopping, vibrations and impacts from an external machine, and changes in processing power over time.

## Nominal Life and Service Life in Hours

### Basic Dynamic Load Rating $C_a$

The basic dynamic load rating ( $C_a$ ) is used to calculate the life of a ball screw when it moves under a load. The basic dynamic load rating ( $C_a$ ) indicates the load for which the nominal life ( $L$ ) equals  $10^6$ (rev) when a group of identical ball screws independently operate under that load when it is applied in the axial direction with a constant direction and size. (The basic dynamic load rating ( $C_a$ ) is listed in the specification table for each model.)

### ■ Nominal Life $L$ (Total Rotations)

A ball screw's nominal life is obtained from the following equation using the basic dynamic load rating.

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

$L$  : Nominal life (total rotations)<sup>\*1</sup> (rev)  
 $C_a$  : Basic dynamic load rating (kN)  
 $F_a$  : Applied axial load (kN)  
 $f_w$  : Load factor

\*1 Nominal life is determined by load calculations assuming adequate lubrication and ideal assembly conditions. Product life can be impacted by accuracy and deformation issues in the mounting materials.

### Load Factor ( $f_w$ )

Vibrations/impact	Speed (V)	$f_w$
Faint	Very low $V \leq 0.25$ m/s	1.0 to 1.2
Weak	Slow $0.25$ m/s < $V \leq 1.0$ m/s	1.2 to 1.5
Medium	Medium $1.0$ m/s < $V \leq 2.0$ m/s	1.5 to 2.0
High	High $2.0$ m/s < $V$	2.0 to 3.5

### ■ Service Life in Hours $L_h$

Once the nominal life ( $L$ ) has been obtained, the service life in hours ( $L_h$ ) can be calculated using the following equation, if the stroke length and the number of cycles are constant.

$$L_h = \frac{L \times Ph}{2 \times \ell_s \times n_1 \times 60}$$

$L_h$  : Service life in hours (h)     $n_1$  : Cycles per minute (min<sup>-1</sup>)  
 $\ell_s$  : Stroke length (mm)     $Ph$  : Lead (mm)

## Lubrication

### Standard Grease

BSM models are filled with Multemp HRL as standard.

\*Non-standard greases are also available. Contact THK for details.

Note regarding centralized lubrication:

- Prior to using a centralized lubrication system, confirm that grease has filled all system piping.

### QZ Lubricator

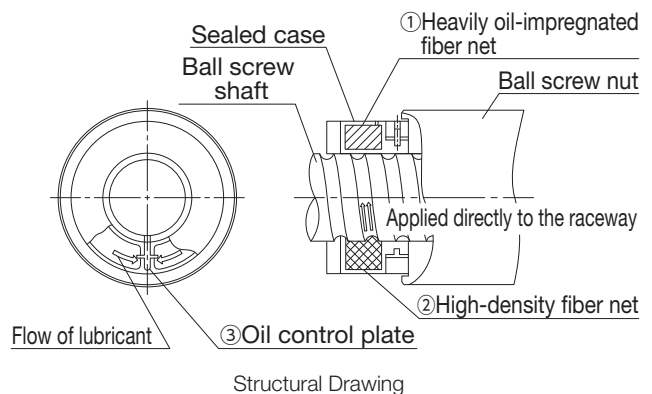
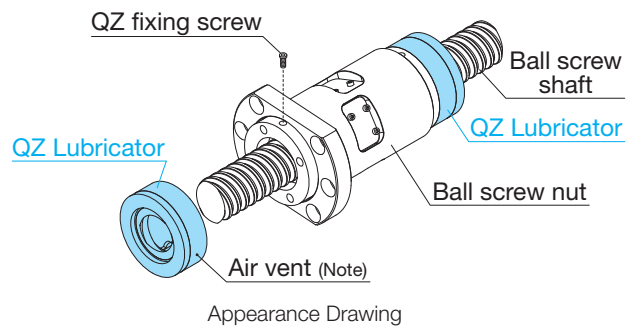
The QZ Lubricator feeds the right amount of lubricant to the ball screw shaft raceway. This allows an oil film to continuously form between the balls and the raceway, significantly improving lubrication and extending maintenance intervals.

The structure of the QZ Lubricator consists of three major components: (1) a heavily oil-impregnated fiber net (stores the lubricant), (2) a high-density fiber net (applies the lubricant to the raceway), and (3) an oil-control plate (adjusts the oil flow). The lubricant contained in the QZ Lubricator is fed by the capillary phenomenon, which is used also in felt pens and many other products.

Features

- Since it compensates for oil loss, the lubrication maintenance interval can be significantly extended.
- It is an eco-friendly lubrication system that does not contaminate the surrounding area, as it feeds the right amount of lubricant to the ball raceway.

Note) There are also QZ Lubricator types with air holes. Take care that the air holes are not blocked by grease or other materials.



## Contamination Protection

### Thin Film Seal (TT)

Contamination protection seals (thin film seals) are standard equipment on BSM models. Thin film seals protect against foreign impurities and lubricant discharge through direct contact. In addition, with little sliding resistance, it will not easily generate heat.

### Canvas Seal CC

Canvas seals are made from resin with high slidability and superior wear resistance. They prevent foreign material from entering the nut through elastic contact with the outer diameter of the ball screw shaft and the groove.

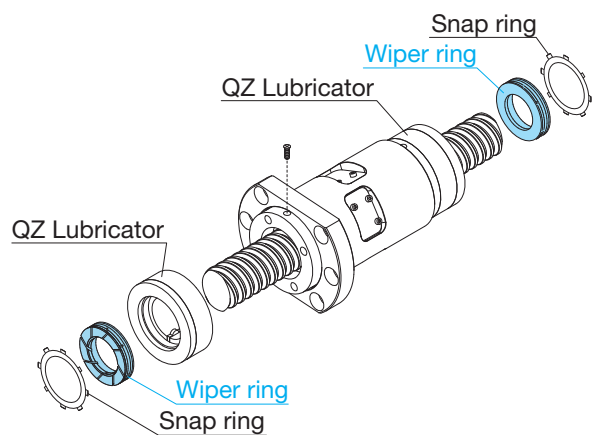
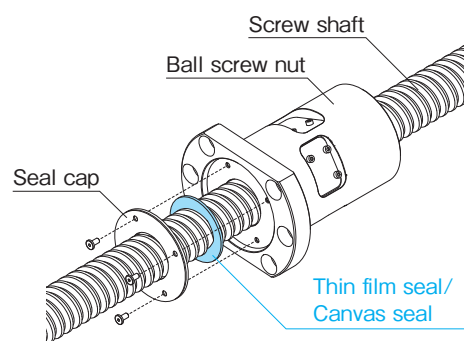
### Wiper Ring W

The wiper ring W is made from special resin with superior wear resistance. It makes elastic contact with the outer diameter of the ball screw shaft and the groove and prevents foreign impurities from entering the ball screw nut by redirecting contaminants through eight slits.

Features

- Eight slits around the outer circumference sweep away foreign material in succession and prevent contamination.
- The seal is in contact with the ball screw shaft, so it prevents the discharge of grease.
- A spring maintains contact with the ball screw shaft at a fixed pressure, minimizing heat generation.
- The wiper ring W is made from material with superior wear and chemical resistance, allowing extended use without a decrease in performance.

Note) The wiper ring W can only be applied to products with a QZ Lubricator.

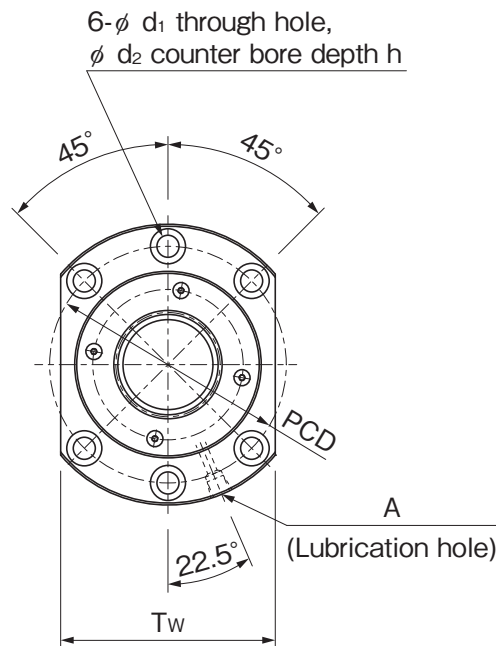


QZ Lubricator + Wiper ring

# Dimensional Table

## BSM(Standard Nut Type)

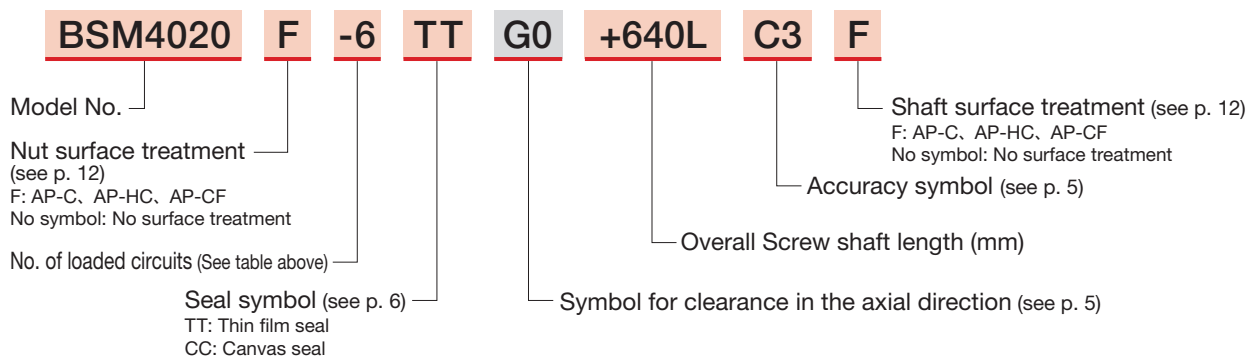
DN value 170000

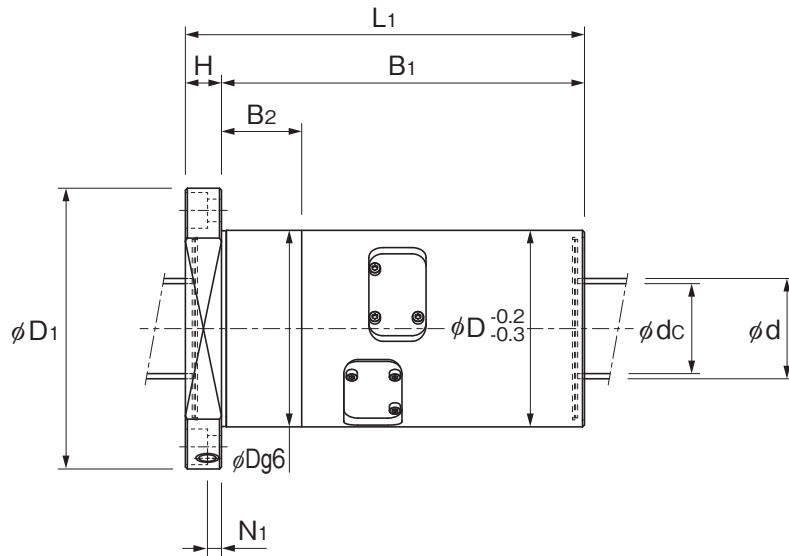


Model No.	Screw shaft outer diameter $d$	Lead $Ph$	Ball center-to-center diameter $d_p$	Thread minor diameter $d_c$	No. of loaded circuits Rows $\times$ turns	Basic load rating		Rigidity
						$C_a$ (kN)	$C_{0a}$ (kN)	$K$ (N/ $\mu$ m)
BSM 4016	40	16	42	34.1	4 (1 $\times$ 4)	58.2	139	1220
BSM 4020	40	20	41.75	34.4	6 (2 $\times$ 3)	68.5	180.7	1718
	40	20	42	34.1	4 (1 $\times$ 4)	58.1	139.5	1222
BSM 4025	40	25	42	34.1	6 (2 $\times$ 3)	79.8	192	1752
BSM 4030	40	30	42	34.1	6 (2 $\times$ 3)	79.4	193.5	1758
BSM 4516	45	16	47	39.1	4 (1 $\times$ 4)	61.6	156.4	1339
BSM 4520	45	20	46.75	39.4	6 (2 $\times$ 3)	72.4	203.1	1884
BSM 4525	45	25	47	39.1	6 (2 $\times$ 3)	84.6	215.7	1921
BSM 5016	50	16	52	44.1	4 (1 $\times$ 4)	64.7	173.9	1454
BSM 5020	50	20	51.75	44.4	6 (2 $\times$ 3)	75.9	225.6	2045
BSM 5025	50	25	52	44.1	6 (2 $\times$ 3)	88.9	254.7	2085
BSM 5030	50	30	52	44.1	6 (2 $\times$ 3)	88.6	240.6	2090
BSM 6316	63	16	65.7	55.9	4 (1 $\times$ 4)	112.7	339	2112

## Model Number Coding

Select an option Fixed symbol





Unit: mm

	Nut dimensions												Lubrication hole A	Nut mass (kg)	Shaft mass (kg/m)	Permissible rotational speed (min <sup>-1</sup> )
	Outer diameter D	Flange diameter D <sub>1</sub>	Overall length L <sub>1</sub>	H	N <sub>1</sub>	B <sub>1</sub>	B <sub>2</sub>	PCD	d <sub>1</sub>	d <sub>2</sub>	h	Tw				
	86	128	149	18	7	131	30	106	11	17.5	11	96	Rc1/8 (PT1/8)	4.9	9	4040
	86	128	140	18	7	122	30	106	11	17.5	11	96		4.8	8.8	4070
	86	128	180	18	7	162	40	106	11	17.5	11	96		6.3	9.2	4040
	86	128	171	18	7	153	40	106	11	17.5	11	96		5.7	8.8	4040
	86	128	200	18	7	182	40	106	11	17.5	11	96		6.8	8.9	4040
	92	134	149	18	7	131	30	112	11	17.5	11	102		5.5	11.5	3610
	92	134	140	18	7	122	30	112	11	17.5	11	102		5.3	11.2	3630
	92	134	171	18	7	153	40	112	11	17.5	11	102		6.4	11.2	3610
	98	140	149	18	7	131	30	118	11	17.5	11	107		6	14.3	3260
	98	140	140	18	7	122	30	118	11	17.5	11	107		5.8	14	3280
	98	140	171	18	7	153	40	118	11	17.5	11	107		7	14	3260
	98	140	199	18	7	181	40	118	11	17.5	11	107		7.9	14.2	3260
	122	180	150	28	14	122	20	150	18	26	17.5	138		10.2	22.1	2580

Note: The groove on the screw shaft cannot be cut on both ends. Contact THK if you require such a design.

The rigidity values in the table represent spring constants, each obtained from the load and the elastic deformation when providing a preload equal to 10% of the basic axial dynamic load rating (Ca) and applying an axial load three times greater than the preload.

These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

If the applied preload (Fa<sub>0</sub>) is not 0.1 Ca, the rigidity value (K<sub>N</sub>) is obtained from the following formula.

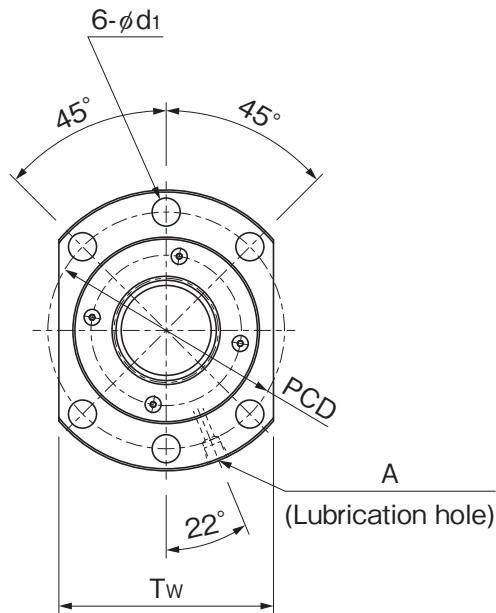
$$K_N = K \left( \frac{F_{a0}}{0.1Ca} \right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table

# Dimensional Table

## BSM-B(Slim Nut Type)

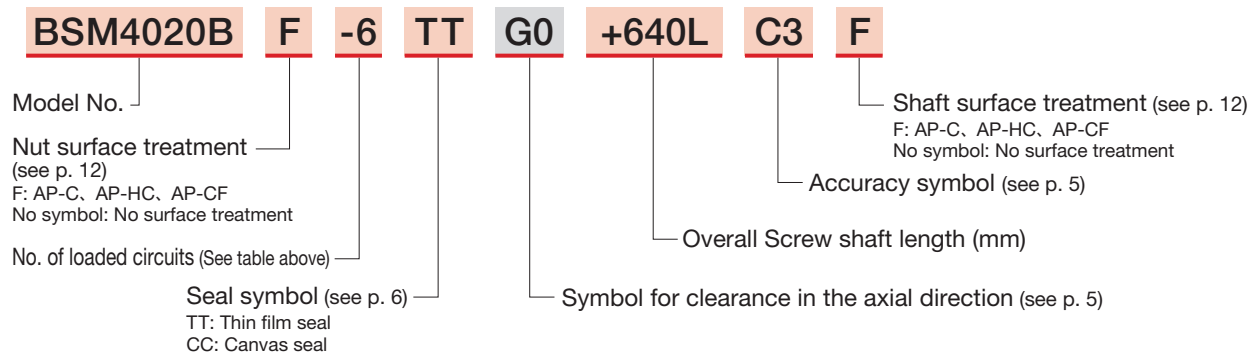
DN value 170000

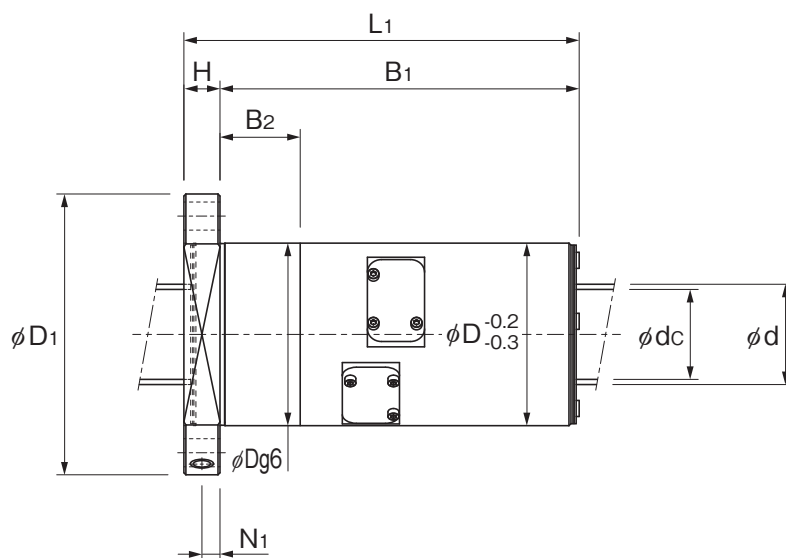


Model No.	Screw shaft outer diameter d	Lead Ph	Ball center-to-center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows × turns	Basic load rating		Rigidity
						Ca (kN)	C <sub>0a</sub> (kN)	K (N/μm)
BSM 3620B	36	20	37.75	30.4	8 (2×4)	85.6	210.3	2143
BSM 4020B	40	20	42	34.1	8 (2×4)	105.4	279.1	2367
BSM 4025B	40	25	42	34.1	6 (2×3)	79.8	192	1752
BSM 4030B	40	30	42	34.1	6 (2×3)	79.4	193.5	1758
BSM 4520B	45	20	47	39.1	8 (2×4)	111.6	313.9	2596
BSM 4525B	45	25	47	39.1	6 (2×3)	84.6	215.7	1921
BSM 5020B	50	20	52	44.1	8 (2×4)	117.2	348.7	2820
BSM 5025B	50	25	52	44.1	6 (2×3)	88.9	254.7	2085
BSM 5030B	50	30	52	44.1	6 (2×3)	88.6	240.6	2090

## Model Number Coding

Select an option Fixed symbol





Unit: mm

	Nut dimensions											Nut mass (kg)	Shaft mass (kg/m)	Permissible rotational speed (min <sup>-1</sup> )
	Outer diameter D	Flange diameter D <sub>1</sub>	Overall length L <sub>1</sub>	H	N <sub>1</sub>	B <sub>1</sub>	B <sub>2</sub>	PCD	d <sub>1</sub>	Tw	Lubrication hole A			
	73	114	178	18	9	160	40	93	11	86	Rc1/8 (PT1/8)	4.4	7	4500
	80	136	179	20	10	159	40	112	14	103		5.6	8.5	4040
	80	136	169	20	10	149	40	112	14	103		4.9	8.8	4040
	80	136	199	20	10	179	40	112	14	103		5.7	8.9	4040
	85	141	179	20	10	159	40	117	14	107		6	10.9	3610
	85	141	169	20	10	149	40	117	14	107		5.7	11.2	3610
	90	146	180	22	11	158	40	122	14	110		5.9	13.7	3260
	90	146	169	22	11	147	40	122	14	110		5.5	14	3260
	90	146	198	22	11	176	40	122	14	110		6.3	14.2	3260

\* The L<sub>1</sub> and B<sub>1</sub> dimensions are for when a thin film seal (TT) is attached. These dimensions will differ when a canvas seal (CC) is attached. See p. 11 for all dimensions.

Note: The groove on the screw shaft cannot be cut on both ends. Contact THK if you require such a design.

The rigidity values in the table represent spring constants, each obtained from the load and the elastic deformation when providing a preload equal to 10% of the basic axial dynamic load rating (Ca) and applying an axial load three times greater than the preload.

These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

If the applied preload (Fa<sub>0</sub>) is not 0.1 Ca, the rigidity value (K<sub>N</sub>) is obtained from the following formula.

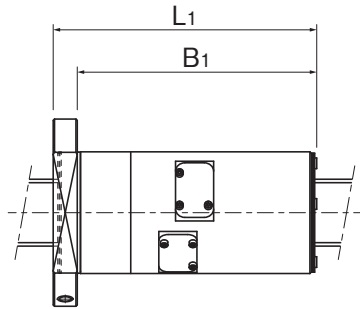
$$K_N = K \left( \frac{F_{a0}}{0.1Ca} \right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table

## Dimensions with Accessories

### ■ Thin Film Seal (TT) / Canvas Seal (CC)

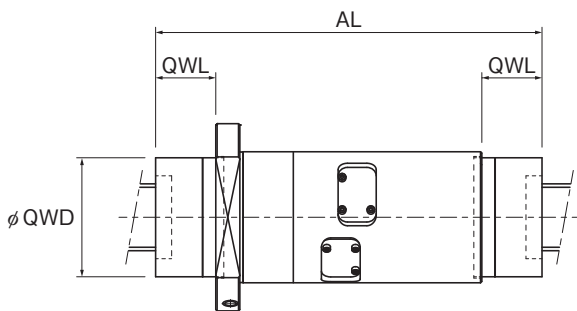
For Model BSM-B only. The  $L_1$  and  $B_1$  dimensions will differ when a thin film seal (TT) or canvas seal (CC) is attached.



Unit: mm

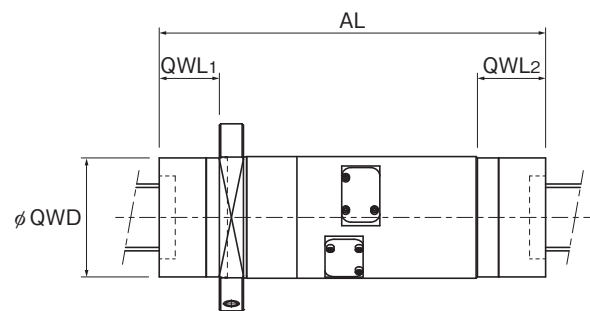
Model No.	BSM-B_TT (with thin film seal)		BSM-B_CC (With canvas seal)	
	$L_1$	$B_1$	$L_1$	$B_1$
BSM 3620B-8	178	160	178	160
BSM 4020B-8	179	159	180	160
BSM 4025B-6	169	149	171	151
BSM 4030B-6	199	179	200	180
BSM 4520B-8	179	159	181	161
BSM 4525B-6	169	149	171	151
BSM 5020B-8	180	158	181	159
BSM 5025B-6	169	147	171	149
BSM 5030B-6	198	176	199	177

### ■ QZ Lubricator



Unit: mm

Model No.	Amount of protrusion with QZ	Outer diameter of protrusion with QZ attached	Overall length of nut with QZ
	QWL	QWD	
BSM 4016-4	40.4	79	230
BSM 4020-4	40.4	79	261
BSM 4020-6	40.4	79	221
BSM 4025-6	40.4	79	252
BSM 4030-6	40.4	79	281
BSM 4516-4	50	84	249
BSM 4520-6	50	84	240
BSM 4525-6	50	84	271
BSM 5016-4	45	89	239
BSM 5020-6	45	89	230
BSM 5025-6	45	89	261
BSM 5030-6	45	89	289
BSM 6316-4	45	113	240






Unit: mm

Model No.	Amount of protrusion with QZ		Outer diameter of protrusion with QZ attached	Overall length of nut with QZ
	QWL <sub>1</sub>	QWL <sub>2</sub>		
BSM 3620B-8	38	44	69	255
BSM 4020B-8	40.4	46.4	79	261
BSM 4025B-6	40.4	46.4	79	252
BSM 4030B-6	40.4	46.4	79	281
BSM 4520B-8	50	56	84	281
BSM 4525B-6	50	56	84	271
BSM 5020B-8	45	51	89	271
BSM 5025B-6	45	51	89	261
BSM 5030B-6	45	51	89	289

## Surface Treatment

Depending on the environment it is used in, the BSM/BSM-B will require anti-rust treatment.  
Please contact THK regarding anti-rust treatment.

	Features	Appearance
<b>AP-C</b>	<p>AP-C treatment is a type of industrial black chrome plating designed to increase corrosion resistance. It costs less and achieves higher corrosion resistance than martensitic stainless steel.</p>	
<b>AP-HC</b>	<p>Equivalent to industrial-use hard chrome plating, AP-HC achieves almost the same level of corrosion resistance as martensite stainless steel. It is also highly wear-resistant because the plating hardness is extremely high, at 750 HV or higher.</p>	
<b>AP-CF</b>	<p>A complex plating combining black chrome and special fluorocarbon resin coating, suitable when high corrosion resistance is required.</p>	



## Handling

1. Please use at least two people to move any product weighing 20 kg or more, or use a cart or another method of conveyance. Otherwise, it may cause injury or damage the unit.
2. Do not disassemble the parts. This will result in loss of functionality.
3. Tilting the screw shaft and nut may cause them to fall under their own weight.
4. Take care not to drop or strike this product. Otherwise, it may cause injury or damage the unit. Even if there is no outward indication of damage, a sudden impact could prevent the unit from functioning properly.
5. When assembling, be sure not to remove the nut from the screw shaft.
6. Wear appropriate safety gear, such as protective gloves and safety shoes, when handling the product.

## Precautions on Use

1. Prevent foreign materials, such as cutting chips or coolant, from entering the product. Failure to do so could damage the product.
2. Prevent foreign materials, such as cutting chips, coolant, corrosive solvents, or water from getting in the product by using a bellows or cover when the product is used in an environment where such a thing is likely.
3. Do not use this product if the external temperature exceeds 80° C. If used above this temperature, there is a risk that the resin and rubber parts may deform or become damaged (except for the heat-resistant type).
4. If foreign materials such as cutting chips adhere to the product, replenish the lubricant after washing the product.
5. Slight oscillations can inhibit the formation of an oil film between the raceways and the area of contact for the balls, resulting in fretting. Therefore, be sure to use a type of grease with high fretting resistance. We recommend periodically rotating the nut once to help ensure that a film forms between the raceways and balls.
6. Do not forcibly drive a pin, key, or any other positioning device into the product. This could create indentations in the raceways and impair the product's function.
7. Skewing or misalignment of the nut and the element that supports the shaft can drastically reduce service life. Inspect the components carefully and make sure they are mounted correctly.
8. If any balls fall out of the nut, contact THK. Do not use the product in that condition.
9. If the unit will be mounted vertically, install safety equipment or take other measures to prevent it from falling. It could fall under its own weight.
10. Do not exceed the permissible rotation speed when using the product. This could damage the product or otherwise cause it to malfunction. Please use the product within the range of speeds we have specified.
11. Do not allow the nut to overshoot. The product may malfunction if any of the balls fall out, the circulation components become damaged, or any indentations form in the ball raceways. Continuing to use the product under these circumstances may lead to premature wear or damage to the circulation components.
12. Use ball screws in conjunction with guide elements such as an LM Guide or ball spline. Failure to do so could damage the product.
13. If the mounting material lacks sufficient rigidity or accuracy, the bearing load can be focused in one area, and bearing functionality will dramatically decrease. Therefore, give sufficient consideration to the rigidity and accuracy of the housing and base.

## Lubrication

1. Thoroughly wipe-off anti-rust oil and feed lubricant before using the product.
2. Do not mix different lubricants. Even grease containing the same type of thickening agent may, if mixed, interact negatively due to disparate additives or other ingredients.
3. When using the product in locations exposed to constant vibrations or in special environments such as in clean rooms, vacuums, and low/high temperatures, use a lubricant suitable for its use/environment.
4. When lubricating products that do not feature a grease nipple or Lubrication hole, directly coat the raceways with lubricant and perform several warm-up strokes to ensure that the grease permeates the interior.
5. Grease viscosity can vary depending on the temperature. Please keep in mind that the torque of the ball screw may be affected by changes in viscosity.
6. After lubrication, the rotational torque of the ball screw may increase due to the stirring resistance of the grease. Before commencing operations, make sure to run the unit through several warm-up cycles to ensure that the grease is adequately integrated and dispersed.
7. Excess grease may spatter after lubrication. Wipe off spattered grease as necessary.
8. Grease deteriorates over time, which decreases the lubricity, so perform regular grease inspections and regreasing based on frequency of use.
9. The greasing interval varies depending on the usage conditions and environment. Grease the system approximately every 100 km of travel distance (3 to 6 months). Final greasing interval/amount should be set at an actual machine.
10. Depending on the mounting orientation and nut lubrication port position, the lubricant may not circulate sufficiently. Take note of this during the design process.
11. It is necessary to use effective lubricant when using a ball screw. Using the product without lubrication may increase wear on the rolling elements and shorten the service life.

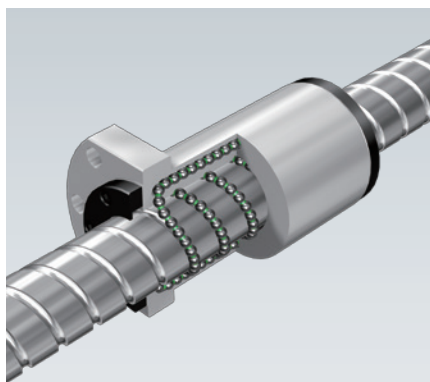
## Storage

When storing the ball screw, pack it as designated by THK and store it indoors in a horizontal position away from high or low temperatures and high humidity. Please note that if the product has been kept in storage for an extended period of time, the lubricant inside may have deteriorated. Please therefore ensure that you replenish the lubricant before re-use.

## Disposal

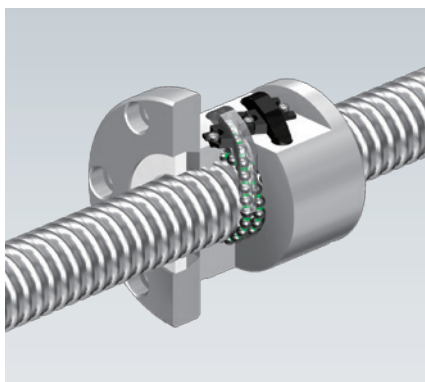
The product should be treated as industrial waste and disposed of appropriately.

## Recommended Products



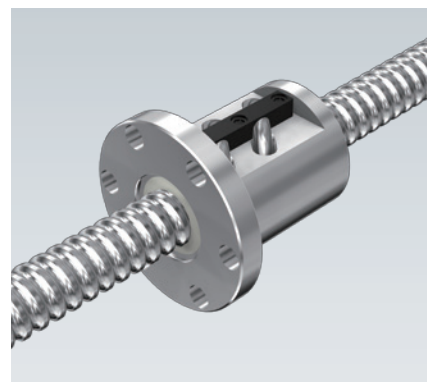
### Precision Caged Ball Screw **SBK**

- Maximum DN value of 210,000  
The top class of high-speed performance among THK products.
- Single nut, offset preload
- Low-noise, long-term maintenance-free operation
- Twenty-one products are available with a combination of shaft diameters from  $\phi 15$  to  $\phi 55$  and leads from 10 mm to 50 mm.



### Precision Caged Ball Screw **SBN-V**

- DN values: Small: 130,000, Medium: 160,000
- Single nut, offset preload
- Low-noise, long-term maintenance-free operation
- Twenty-three products are available with a combination of shaft diameters from  $\phi 16$  to  $\phi 50$  and leads from 4 mm to 20 mm.



### Precision Ball Screw **BIF-V**

- DN values: Small: 100,000, Medium: 130,000
- Single nut, offset preload
- Fifty-three products are available with a combination of shaft diameters from  $\phi 16$  to  $\phi 50$  and leads from 4 mm to 20 mm.

## High-Speed Ball Screw for Machine Tools **BSM**

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