

Ball Screw Support Bearings

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13. Ball Screw Support Bearings

NTN ball screw support bearings are dedicated bearings with optimized structures and function to support ball screws.

These bearings are categorized as shown in Table 13.1.

Table 13.1 Bearing types

Type code	Notes	Bore diameter (mm)
BST 2A-BST	Open type angular contact thrust ball bearing with 60° contact angle, generally used with grease lubrication	φ17-φ60
BST LXL/L588 2A-BST LXL/L588	Grease-lubricated sealed angular contact ball bearing with 60° contact angle	φ17-φ60
BSTU LLX/L588	Grease-lubricated sealed double-row thrust angular contact ball bearing unit with 60° contact angle	φ20-φ100
HT	Duplex angular contact ball bearing with 30° contact angle, generally used with grease lubrication	φ6-φ40
AXN	Needle roller bearing with double-direction thrust needle roller bearing, generally used with oil lubrication	φ20-φ50
ARN	Needle roller bearing with double-direction thrust cylindrical roller bearing, generally used with oil lubrication	φ20-φ70

13.1 ULTAGE Angular contact thrust ball bearings BST-1B (LXL/L588), 2A-BST-1B (LXL/L588)

The BST type incorporates the maximum possible number of small balls (compared with those of a standard bearing), has thicker inner and outer rings, and a larger contact angle of 60°. Additionally, since balls are used as the rolling elements, the starting torque of an angular contact thrust ball bearing is less than that of a roller bearing.

Open (BST and 2A-BST type) and light-contact seals (BST LXL and 2A-BST LXL type) are available and resin cages are standard.

The side faces of the bearing are flush ground to provide the same face height difference for both the front and back faces. Therefore, bearings with the same bearing number can be freely combined into DB, DBT and DTBT combinations, etc. (see Fig. 13.2).

Every single bearing is machined to the same face height so that when any arrangement is installed on a ballscrew the unit has optimal preload. For this reason, no time-consuming preload adjustment (adjustment with shims or tightening and loosening while measuring the starting torque) is necessary.

■ Features 2A-BST-1B (LXL/L588)

1. Unique heat treatment greatly improves resistance against rolling contact fatigue, leading to longer service life (approximately two times that of the conventional type).
2. Both sides are sealed to enhance contamination resistance and to preserve the grease (Light-contact seal type).
3. Urea based special grease of long life is used (Light-contact seal type).
4. The combination of a unique heat treatment and special grease reduces fretting (by 80 % or more for sliding mode, 90 % or more for rolling mode, compared to the conventional type) (Light-contact seal type).
5. Pre-greased bearings eliminate the need for further grease packing and allow easier handling (Light-contact seal type).

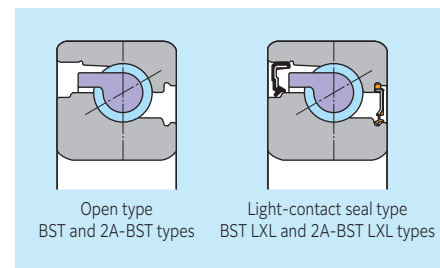


Fig. 13.1

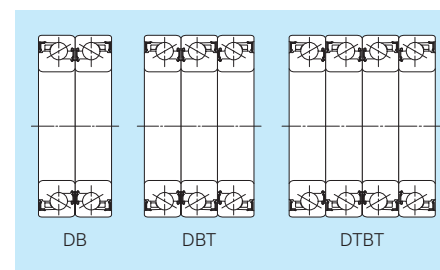
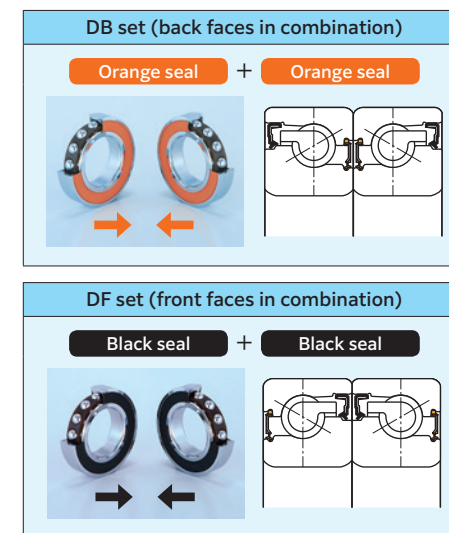


Fig. 13.2 Bearing arrangement

■ Easy handling

BST LXL and 2A-BST LXL types of grease-lubricated sealed angular contact ball bearings eliminate the need for grease filling because they have been packed with grease in advance. You need to only wipe away rust preventive oil before use. Seals in different colors are used for the front and back sides.

The front side (black) and back side (orange) can be identified by the color of a seal, and you can easily check configuration during assembly.



Performance tests

2A-BST-1B (LXL/L588) type bearings combine surface modification with urea based special grease to improve the bearing life and resistance to fretting.

(1) Fretting resistance test (sliding)

Resistance to fretting while sliding is tested by the fretting resistance test. A conceptual drawing of the test is shown in Fig. 13.3, and the test conditions are shown in Table 13.2. In this test, a fixed ball is pushed against a plate, and reciprocated for a fixed period. The volume of ball and plate wear depth are checked after testing as shown in Fig. 13.4.

Due to the combination of a unique heat treatment and a urea based special grease (light-contact seal type), amount of wear is reduced to 1/5 or less compared to the conventional type consisting of standard SUJ2 plate material and lithium based general purpose grease.

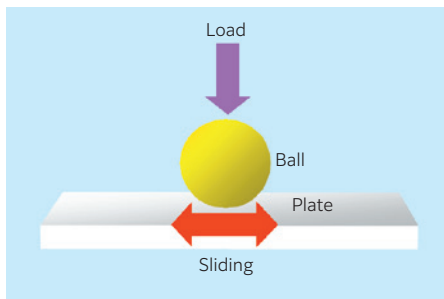


Fig. 13.3 Fretting resistance test (sliding)

Table 13.2 Test conditions

Specification	Conventional type	ULTAGE
Material/Heat treatment	Plate	SUJ2/Standard
	Ball	SUJ2/Special
Lubrication	Grease	Lithium based general purpose
		Urea based special
Load	98 N	
Max. contact surface pressure	2 560 MPa	
Loading cycle (Time)	8.6 × 10 ⁵ cycle (8 h)	
Sliding cycle	30 Hz	
Amplitude	0.47 mm	
Temperature	Room temperature	

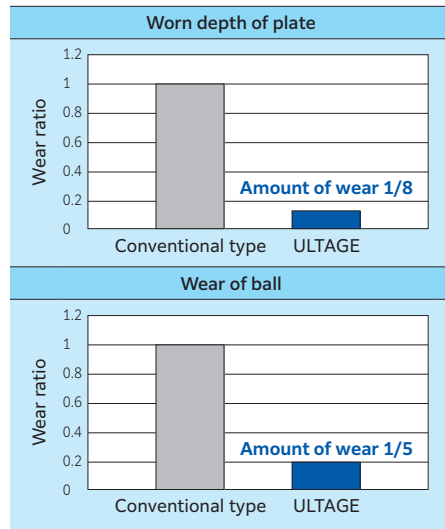


Fig. 13.4 Ratio of fretting corrosion in sliding mode

(2) Fretting resistance test (rolling)

Resistance against fretting while rolling is tested in the rotating and oscillating type fretting corrosion test. A conceptual drawing of the test is shown in Fig. 13.5, and the test conditions are shown in Table 13.3. In this test, a housing raceway washer is fixed, and the shaft raceway washer oscillates. The decrease in the weight of the bearing raceway washer after the test is shown in Fig. 13.6.

Due to the combination of a unique heat treatment and a urea based special grease (light-contact seal type), the amount of wear is reduced to 1/10 or less compared to the conventional type consisting of standard SUJ2 steel rings and lithium based general purpose grease.

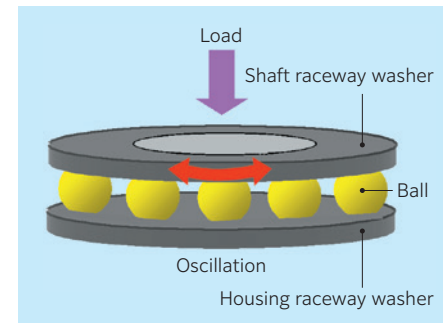


Fig. 13.5 Fretting resistance test (rolling)

Table 13.3 Test conditions

Specification	Conventional type	ULTAGE
Bearing	Thrust ball bearing 51204 (φ20 × φ40 × 14)	
Material/Heat treatment	Raceway washer	SUJ2/Standard
	Ball	SUJ2/Special
Lubrication	Grease	Lithium based general purpose
		Urea based special
Load	2.5 kN	
Max. contact surface pressure	1 700 MPa	
Test time	8 h	
Oscillating cycle	30 Hz	
Oscillating angle	12°	
Temperature	Room temperature	

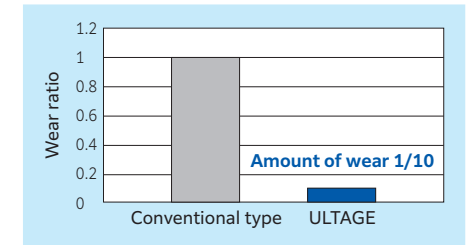


Fig. 13.6 Ratio of fretting corrosion while rolling

(3) Rolling contact fatigue life test

Resistance to rolling contact fatigue life is improved as a result of a special heat treatment, leading to a longer service life compared to the standard heat-treated type model in both clean and contaminated oil (see Fig. 13.7).

Table 13.4 Test conditions

Specification		Conventional type	ULTAGE
Bearing		Deep groove ball bearing 6206 ($\phi 30 \times \phi 62 \times 16$)	
Material/Heat treatment	Raceway ring	SUJ2/Standard	SUJ2/Special
	Ball	SUJ2/Standard	
Lubrication	Oil	Turbine oil ISO VG56	
Radial load		6.86 kN	
Speed		2 000 min ⁻¹	
Atmosphere temperature		60 °C	

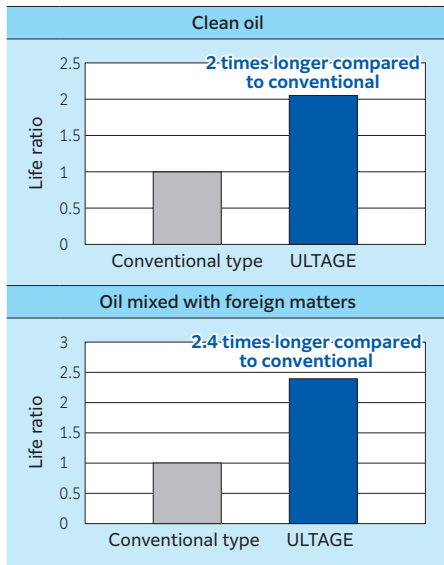


Fig. 13.7 Effect of special heat treatment on rolling contact fatigue life

(4) Grease life test

Service life of the grease has been dramatically extended compared to lithium-based general purpose grease (see Fig. 13.8).

Table 13.5 Test conditions

Specification		Conventional type	ULTAGE
Bearing		Deep groove ball bearing TS3-6204ZC3 ($\phi 20 \times \phi 47 \times 14$)	
Lubrication	Grease	Lithium based general purpose	Urea based special
Radial load		67 N	
Axial load		67 N	
Speed		10 000 min ⁻¹	
Atmosphere temperature		150 °C	

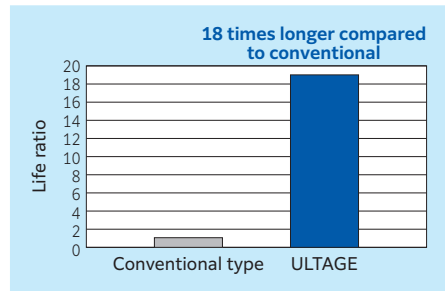


Fig. 13.8 Grease life ratio

(5) Grease leakage test

Light-contact type seals eliminate grease leakage from the bearing (see Fig. 13.9).

Table 13.6 Test conditions

Specification	ULTAGE
Bearing	Thrust angular contact ball bearing 2A-BST40X72-1BLXLD4P4/L588 ($\phi 40 \times \phi 72 \times 15$)
Lubrication Grease	Urea based special
Axial load	3.9 kN
Speed	1 000, 2 000, 3 000 min ⁻¹ running for two hours for each step
Atmosphere temperature	Room temperature

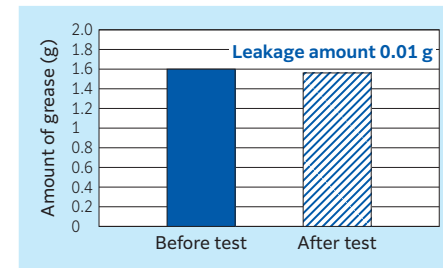


Fig. 13.9 Grease leakage

13.2 **ULTAGE** Double-row thrust angular contact ball bearing unit BSTU

The BSTU type is ball screw support bearing unit with two inner rings and one outer ring, in a back-to-back duplex arrangement. The outer ring has mounting holes for the housing for easier handling and the use of a newly developed seal ensures low torque and high dust resistance.

■ Features

1. Greater load capacity with optimizations made to the internal bearing design.
2. Use of newly developed light-contact seal to achieve both low torque and high dust resistance.
3. The long operating life of the BST type, and use of urea based special grease with excellent fretting resistance.
4. Outer ring mounting hole, and sealed grease lubrication for easier handling.
5. Specifications combining two of these units (D2) are also available for high-load capacity applications.

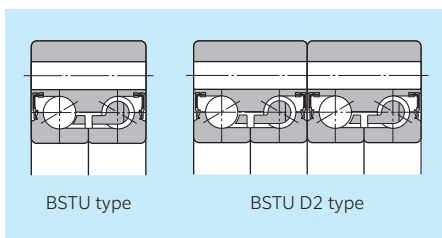


Fig. 13.10 BSTU

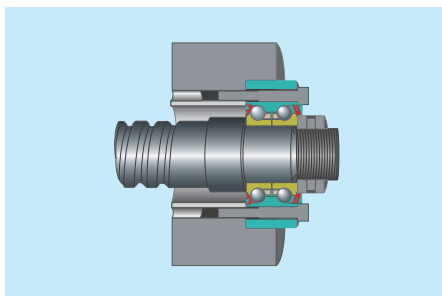


Fig. 13.11 Example of mounted BSTU type

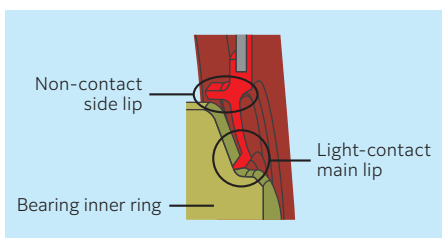


Fig. 13.12 Light-contact seal (code: LX)

■ Performance tests

(1) Bearing operating test

The BSTU type exhibit stable temperature rises up to 5 000 min⁻¹ ($d_{m,n}$ value 0.225×10^6) due to optimizations made to the internal bearing design and the use of a newly developed light-contact seal (see Fig. 13.13).

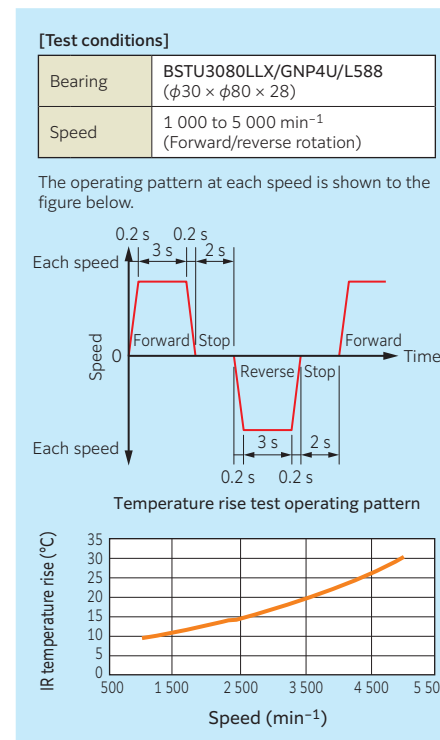


Fig. 13.13 Relation between speed and temperature rise

(2) Torque test, dust test

The BSTU type limits starting torque and has better dust resistance with the use of a newly developed light-contact seal (see Fig. 13.14, Fig. 13.15).

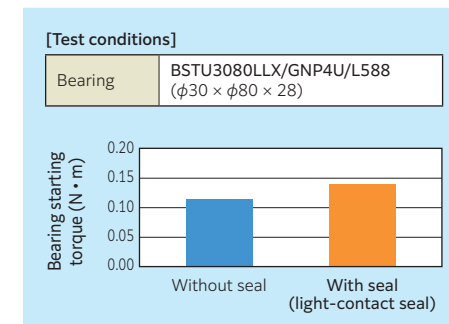


Fig. 13.14 Bearing starting torque

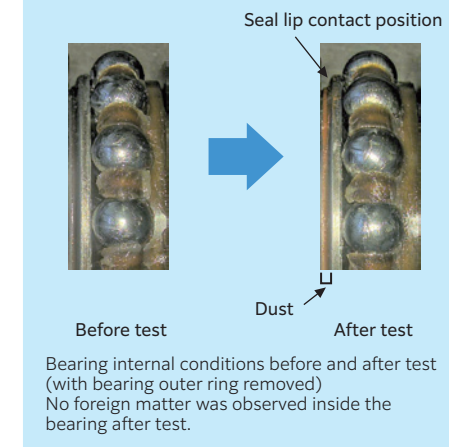
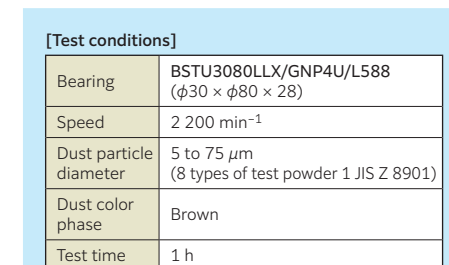


Fig. 13.15 Dust test results

13.3 Duplex angular contact ball bearings HT

HT type duplex angular contact ball bearings feature larger axial load capacity while maintaining the same dimensions as a standard angular contact ball bearing (contact angle: 30°). Bearings smaller than the BST type are available for use in small machines.

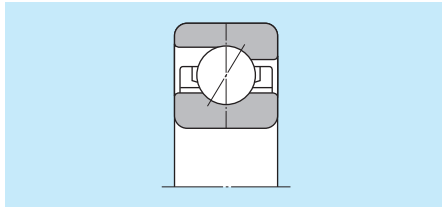


Fig. 13.16 HT

13.4 Needle roller bearings with double-direction thrust needle roller bearings AXN Needle roller bearings with double-direction thrust cylindrical roller bearings ARN

AXN and ARN types bearings have thrust needle roller or thrust cylindrical roller bearings on both sides of a radial needle roller bearing. The outer ring side face of the radial needle roller bearing is used as the raceway of both thrust bearings. These bearings can withstand axial loads in both directions while maintaining compact designs. The radial needle roller bearings are suitable for heavy radial loads.

The axial rigidity of the AXN type is extremely enhanced since the thrust needle roller bearings are used for axial loads.

Likewise, the axial rigidity of the ARN type is improved. Since the axial load capacity of this type is larger than the AXN type, this type is suitable for heavy axial loads. Oil lubrication is recommended for the ARN type.

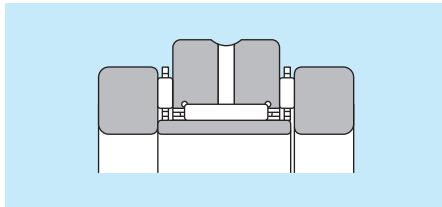


Fig. 13.17 AXN

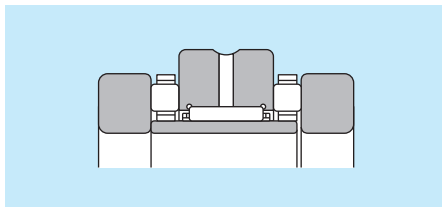


Fig. 13.18 ARN

13.5 Bearing designations

The part number for a ballscrew bearing consists of a type code, dimension code, and various suffixes.

■ BST type

2A - BST 20 × 47 -1B LXL DBT P4 / L588

- Grease code L588: Urea based special grease
- Tolerance class code P5: NTN Class 5
P4: NTN Class 4
UP: Special high precision
- Arrangement code
- Seal code LXL: Light contact rubber seal on both sides
- Identification code
Preload code and added number
-1B: Standard preload
-11B: Light preload
- Outside diameter (mm)
- Nominal bore diameter (mm)
- Bearing type code
- Heat treatment

■ HT type

7 0 04 HT DF / GM P4

- Tolerance class code
P5: JIS Class 5
P4: JIS Class 4
- Internal clearance code
GM: Medium preload
GH: Heavy preload
- Arrangement code
- Internal design code
- Nominal bore diameter
(See dimension table)
- Dimension series code
- Bearing type code

■ AXN and ARN types

AXN 2052 P4

- Tolerance class code
P5: NTN Class 5
P4: NTN Class 4
- Dimension
Bore diameter,
outside diameter (mm)
- Bearing type code
AXN
ARN

■ BSTU type

**P4U
BSTU 30 80 LLX N DX D2 /GN P42U /L588**

- Grease code
- Tolerance class code
- Preload code
- Arrangement code
- Outer ring re-lubricating hole
- Outer ring pullout groove
- Seal code
- Outside diameter (mm)
- Nominal bore diameter (mm)
- Bearing type code

13.6 Bearing accuracy

The precision of ballscrew bearings varies depending on the bearing type.

- **BST type**
Available in NTN Class 5 (tolerance class code P5), Class 4 (tolerance class code P4) each complying with JIS standards, and grade UP (tolerance class code UP). The classes are listed in ascending order.
- **BSTU type**
NTN standard Class 4 (tolerance class code P4U) and Class 42 (tolerance class code P42U) complying with the JIS standards are available.
- **70HT type**
Same precision as the angular contact ball bearing for radial loads. Classes 5 and 4 are available.
- **AXN, ARN types**
NTN standard Classes 4 and 5 complying with the JIS standards are available.

■ Accuracy of BST type

Table 13.7 Inner rings

Unit: μm

Nominal bore diameter <i>d</i>	Deviation of mean bore diameter in a single plane Δ_{dmp}						Radial runout K_{ia}			Perpendicularity of inner ring face with respect to the bore S_d			Axial runout S_{ia}			Width deviation Δ_{Bs}			Width variation V_{Bs}			
	Class 5		Class 4 ¹⁾		Class UP ¹⁾		Class 5	Class 4	Class UP	Class 5	Class 4	Class UP	Class 5	Class 4	Class UP	Class 5	Class 4	Class UP	Class 5	Class 4	Class UP	
mm over incl.	high	low	high	low	high	low	max			max			max			max			max			
10 18	0	-5	0	-4	0	-3.5	3.5	3	2	7	3	2	5	3	2	0	-120	0	-100	5	2.5	2
18 30	0	-6	0	-5	0	-3.5	4	3	2	8	4	3	5	3	2	0	-120	0	-100	5	2.5	2
30 50	0	-8	0	-6	0	-5	5	4	3	8	4	3	6	3	2	0	-120	0	-100	5	3	2
50 80	0	-9	0	-7	0	-5	5	4	4	8	5	4	7	4	3	0	-150	0	-150	6	4	3

1) The dimensional difference Δ_{ds} of the measured bore diameter applied to Classes 4 and UP is the same as the tolerance of dimensional difference Δ_{dmp} of the mean bore diameter within a plane.

Table 13.8 Outer rings

Unit: μm

Nominal outside diameter <i>D</i>	Deviation of mean outside diameter in a single plane Δ_{Dmp}						Radial runout K_{ea}			Perpendicularity of outer ring outside surface with respect to the face S_D			Axial runout S_{ea}			Width deviation Δ_{Cs}			Width variation V_{Cs}		
	Class 5		Class 4 ²⁾		Class UP ²⁾		Class 5	Class 4	Class UP	Class 5	Class 4	Class UP	All classes			All classes			Class 5	Class 4	Class UP
mm over incl.	high	low	high	low	high	low	max			max			max			max			max		
30 50	0	-7	0	-6	0	-5	7	5	4	8	4	3	Depends on tolerance of S_{ia}			Depends on tolerance of Δ_{Bs} in relation to d of the same bearing			5	2.5	2
50 80	0	-9	0	-7	0	-5	8	5	4	8	4	3	in relation to d of the same bearing			same bearing			6	3	2
80 120	0	-10	0	-8	0	-7	10	6	4	9	5	4							8	4	3

2) The dimensional difference Δ_{Ds} of the measured outside diameter applied to Classes 4 and UP is the same as the tolerance of dimensional difference Δ_{Dmp} of the mean outside diameter within a plane.

Note: This standard is the NTN standard.

■ Accuracy of BSTU type (Class P42U)

Table 13.9 Inner rings

Unit: μm

Nominal bore diameter <i>d</i>	Deviation of mean bore diameter in a single plane Δ_{dmp}		Variation of bore diameter in a single plane V_{dsp}	Perpendicularity of inner ring face with respect to the bore V_{dmp}	Radial runout K_{ia}	Variation of mean bore diameter S_d	Axial runout S_{ia}	Deviation of a single inner ring width Δ_{Bs}		Width variation V_{Bs}
	high	low						high	low	
mm	max		max	max	max	max	max	max	max	
20	0	-5	2.5	2.5	3	4	2	0	-125	2
25	0	-5	2.5	2.5	3	4	2	0	-125	2
30	0	-5	2.5	2.5	3	4	2.5	0	-125	2.5
35	0	-5	2.5	2.5	4	4	2.5	0	-125	2.5
40	0	-5	2.5	2.5	4	4	2.5	0	-125	2.5
90	0	-8	4	4	5	5	3	0	-125	3
100	0	-8	4	4	5	5	3	0	-125	3

Table 13.10 Outer rings

Unit: μm

Nominal outside diameter <i>D</i>	Deviation of mean outside diameter in a single plane Δ_{Dmp}		Variation of outside diameter in a single plane V_{Dsp}	Perpendicularity of outer ring outside surface with respect to the face V_{Dmp}	Radial runout K_{ea}	Variation of mean outside diameter S_D	Axial runout S_{ea}	Deviation of a single outer ring width Δ_{Cs}		Width variation V_{Cs}
	high	low						high	low	
mm	max		max	max	max	max	max	max	max	
68	0	-10	3.5	3.5	5	4	5	0	-250	3
75	0	-10	3.5	3.5	5	4	5	0	-250	3
80	0	-10	3.5	3.5	5	4	5	0	-250	3
90	0	-10	4	4	6	5	6	0	-250	4
100	0	-10	4	4	6	5	6	0	-250	4
115	0	-10	4	4	6	5	6	0	-250	4
190	0	-15	8	6	10	7	10	0	-250	7
200	0	-15	8	6	10	7	10	0	-250	7

Note: This standard is the NTN standard.

■ Accuracy of BSTU type (Class P4U)

Table 13.11 Inner rings

Unit: μm

Nominal bore diameter d mm	Deviation of mean bore diameter in a single plane Δ_{dmp}		Variation of bore diameter in a single plane V_{dsp}	Perpendicularity of inner ring face with respect to the bore V_{dmp}	Radial runout K_{ia}	Variation of mean bore diameter S_d	Axial runout S_{ia}	Deviation of a single inner ring width Δ_{Bs}		Width variation V_{Bs}
	high	low	max	max	max	max	max	high	low	max
	20	0	-5	2.5	2.5	3	4	4	0	-125
25	0	-5	2.5	2.5	3	4	4	0	-125	2.5
30	0	-5	2.5	2.5	3	4	4	0	-125	2.5
35	0	-5	2.5	2.5	4	4	4	0	-125	3
40	0	-5	2.5	2.5	4	4	4	0	-125	3
90	0	-8	4	4	5	5	5	0	-125	4
100	0	-8	4	4	5	5	5	0	-125	4

Table 13.12 Outer rings

Unit: μm

Nominal outside diameter D mm	Deviation of mean outside diameter in a single plane Δ_{Dmp}		Variation of outside diameter in a single plane V_{Dsp}	Perpendicularity of outer ring outside surface with respect to the face V_{Dmp}	Radial runout K_{ea}	Variation of mean outside diameter S_D	Axial runout S_{ea}	Deviation of a single outer ring width Δ_{Cs}		Width variation V_{Cs}
	high	low	max	max	max	max	max	high	low	max
	68	0	-10	3.5	3.5	5	4	5	0	-250
75	0	-10	3.5	3.5	5	4	5	0	-250	3
80	0	-10	3.5	3.5	5	4	5	0	-250	3
90	0	-10	4	4	6	5	6	0	-250	4
100	0	-10	4	4	6	5	6	0	-250	4
115	0	-10	4	4	6	5	6	0	-250	4
190	0	-15	8	6	10	7	10	0	-250	7
200	0	-15	8	6	10	7	10	0	-250	7

Note: This standard is the NTN standard.

■ Accuracy of HT type

Table 13.13 Inner rings

Nominal bore diameter d	Deviation of mean bore diameter in a single plane						Variation of bore diameter in a single plane						Variation of mean bore diameter			Inner ring radial runout								
	Δ_{dmp}						V_{dsp}						V_{dmp}			K_{ia}								
	mm over incl.		Class 5 high low		Class 4 ¹⁾ high low		Class 2 ¹⁾ high low		Diameter series 9		Diameter series 0, 2		Class 5 max		Class 4 max		Class 2 max		Class 5 max		Class 4 max		Class 2 max	
2.5	10	0	-5	0	-4	0	-2.5	5	4	2.5	4	3	2.5	3	2	1.5	4	2.5	1.5					
10	18	0	-5	0	-4	0	-2.5	5	4	2.5	4	3	2.5	3	2	1.5	4	2.5	1.5					
18	30	0	-6	0	-5	0	-2.5	6	5	2.5	5	4	2.5	3	2.5	1.5	4	3	2.5					
30	50	0	-8	0	-6	0	-2.5	8	6	2.5	6	5	2.5	4	3	1.5	5	4	2.5					

1) The dimensional difference Δ_{ds} of the measured bore diameter applied to Classes 4 and 2 is the same as the tolerance of dimensional difference Δ_{dmp} of the mean bore diameter within a plane. However, the dimensional difference is applied to diameter series 0 and 2 for Class 4, and also to all the diameter series for Class 2.
2) Applies to individual raceway rings manufactured for combined bearing use.

Table 13.14 Outer rings

Nominal outside diameter D	Deviation of mean outside diameter in a single plane						Variation of outside diameter in a single plane						Mean single plane outside diameter deviation			Outer ring radial runout								
	Δ_{Dmp}						V_{Dsp}						V_{Dmp}			K_{ea}								
	mm over incl.		Class 5 high low		Class 4 ³⁾ high low		Class 2 ³⁾ high low		Diameter series 9		Diameter series 0, 2		Class 5 max		Class 4 max		Class 2 max		Class 5 max		Class 4 max		Class 2 max	
18	30	0	-6	0	-5	0	-5	6	5	4	5	4	4	3	2.5	2	6	4	2.5					
30	50	0	-7	0	-6	0	-4	7	6	4	5	5	4	4	3	2	7	5	2.5					
50	80	0	-9	0	-7	0	-4	9	7	4	7	5	4	5	3.5	2	8	5	4					

3) The dimensional difference Δ_{Ds} of the measured outside diameter applied to Classes 4 and 2 is the same as the tolerance of dimensional difference Δ_{Dmp} of the mean outside diameter within a plane. However, the dimensional difference is applied to diameter series 0 and 2 for Class 4, and also to all the diameter series for Class 2.

■ Accuracy of AXN and ARN types

Table 13.15 Inner ring and outer ring

Nominal bearing bore dia. d or nominal bearing outside dia. D	Deviation of mean bore ¹⁾ diameter in a single plane				Thrust inner ring bore ¹⁾ dia. deviation		Deviation of mean outside ²⁾ diameter in a single plane				Deviation of the bearing height		Outer ring width deviation		Radial inner ring ¹⁾ radial runout		
	Δ_{dmp}				Δ_{dis}		Δ_{Dmp}				Δ_{Ts}		Δ_{Cs}		K_{ia}		
	mm over incl.		Class 5 high low		Class 4 high low		high low		Class 5 high low		Class 4 high low		high low		Class 5 max		Class 4 max
18	30	0	-6	0	-5	+61	+40	-	-	-	-			4	3		
30	50	0	-8	0	-6	+75	+50	-	-	-	-			5	4		
50	80	0	-9	0	-7	+90	+60	0	-9	0	-9	0	-370	0	-130	5	4
80	120	-	-	-	-	-	-	0	-10	0	-10			-	-		
120	150	-	-	-	-	-	-	0	-11	0	-11			-	-		

1) Applicable only to dimension d . 2) Applicable only to dimension D .

Unit: μm

Perpendicularity of inner ring face with respect to the bore			Axial runout			Deviation of a single inner ring width				Width variation				
S_d			S_{ia}			Δ_{Bs}				V_{Bs}				
Class 5 max			Class 4 max		Class 2 max	Single bearing		Duplex bearing ²⁾		Class 5 max		Class 4 max	Class 2 max	
7	3	1.5	7	3	1.5	0	-	40	0	-	250	5	2.5	1.5
7	3	1.5	7	3	1.5	0	-	80	0	-	250	5	2.5	1.5
8	4	1.5	8	4	2.5	0	-	120	0	-	250	5	2.5	1.5
8	4	1.5	8	4	2.5	0	-	120	0	-	250	5	3	1.5

Unit: μm

Perpendicularity of outer ring outside surface with respect to the face			Axial runout			Deviation of a single outer ring width			Width variation			
S_D			S_{ea}			Δ_{Cs}			V_{Cs}			
Class 5 max			Class 4 max		Class 2 max	All classes			Class 5 max		Class 4 max	Class 2 max
8	4	1.5	8	5	2.5	Identical to Δ_{Bs} relative to d of the same bearing			5	2.5	1.5	
8	4	1.5	8	5	2.5				5	2.5	1.5	
8	4	1.5	10	5	4				6	3	1.5	

Unit: μm

Outer ring ²⁾ radial runout		Perpendicularity of outer ring ²⁾ outside surface with respect to the face		Thrust inner ring and ¹⁾ outer ring thickness variation ²⁾	
K_{ea}		S_D		S_{ia}, S_{ea}	
Class 5 max		Class 4 max	Class 5 max		Class 4 max
-	-	-	-	3	2
-	-	-	-	3	2
8	5	8	4	4	3
10	6	9	5	4	3
11	7	10	5	5	4

Ball Screw Support Bearings

Ball Screw Support Bearings

13.7 Standard preload and axial rigidity

Standard preloads for each type of ball screw support bearings are shown in the dimension tables. In the AXN and ARN types, rigidity is enhanced by tightening the thrust raceways on both sides to supply preload. A bearing that allows preset preload by tightening the bearing raceways to adjust the clearance A between the thrust bearing ring and radial bearing ring (see Fig. 13.19) is also available. Ask NTN for details.

Axial rigidity of the BST type DB duplex arrangement and the AXN type at the standard preload are shown in Fig. 13.20 and Fig. 13.21.

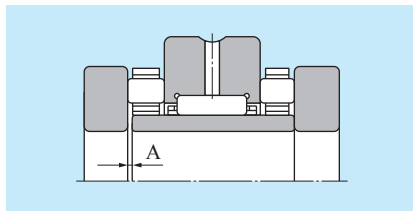


Fig. 13.19

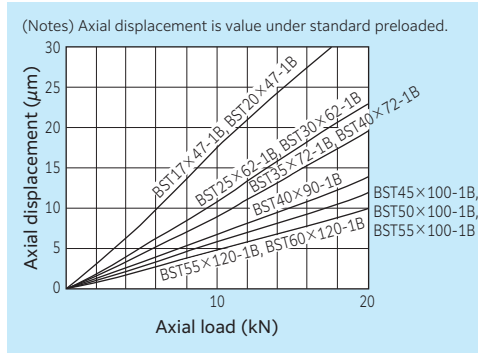


Fig. 13.20 BST type axial rigidity diagram

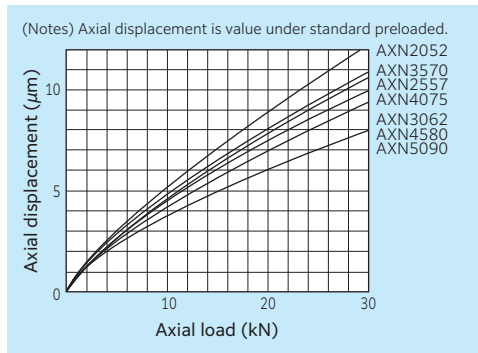


Fig. 13.21 AXN type axial rigidity diagram

13.8 Shaft and housing fits

Recommended fits and tolerances of shaft and housing shoulder squareness are shown in Table 13.16 and Table 13.17.

Table 13.16 Shaft and housing fits

Type code	Types and tolerance class	
	Shaft outside diameter	Housing
BST HT	h5	H6
BSTU		
AXN ARN	j5	J6

Table 13.17 Tolerance of shoulder squareness
Unit: μm

Diameter classification mm		Type code			
over	incl.	BST	BSTU	HT	AXN, ARN
—	30	4	4	4	4
30	80	4	4	4	5
80	120	5	5	—	6
120	180	—	6	—	7
180	200	—	7	—	—

13.9 Applications

The BST type is mainly installed on ball screws of machine tool feed systems, and two to four row arrangements are used in many cases. This type is popular because greased sealed angular contact ball bearings are easy to handle. Bearing combinations include the back-to-back arrangement, where the inner ring is tightened to achieve the required preload, and the front arrangement, where the outer ring is tightened. Examples of bearing arrangement are shown in Fig. 13.22 through Fig. 13.24.

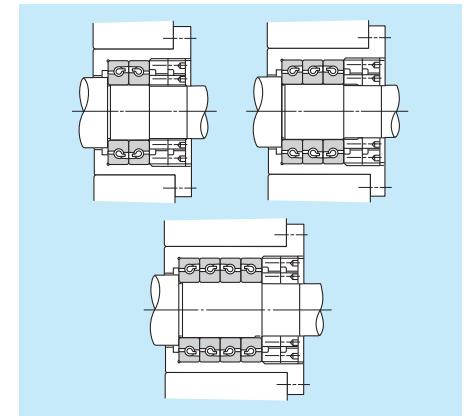


Fig. 13.22

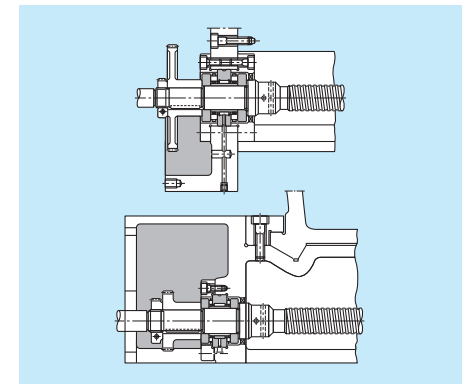


Fig. 13.23

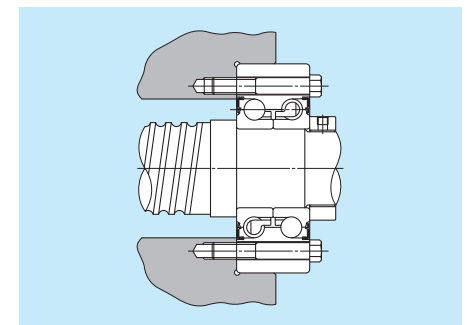


Fig. 13.24

13.10 Starting torque of BST type

Reference starting torque values for BST type bearings are shown in Table 13.18 and Table 13.19.

Table 13.18 Open type BST and 2A-BST types

Part number	Starting torque (reference) N • mm {kgf • cm}			
	DF type DB type	DFT type DBT type	DTFT type DTBT type	DFTT type DBTT type
BST17X47-1B 2A-BST17X47-1B	175 {1.8}	245 {2.5}	355 {3.6}	275 {2.8}
BST20X47-1B 2A-BST20X47-1B	175 {1.8}	245 {2.5}	355 {3.6}	275 {2.8}
BST25X62-1B 2A-BST25X62-1B	305 {3.1}	420 {4.3}	615 {6.3}	470 {4.8}
BST30X62-1B 2A-BST30X62-1B	305 {3.1}	420 {4.3}	615 {6.3}	470 {4.8}
BST35X72-1B 2A-BST35X72-1B	380 {3.9}	510 {5.2}	755 {7.7}	590 {6.0}
BST40X72-1B 2A-BST40X72-1B	380 {3.9}	510 {5.2}	755 {7.7}	590 {6.0}
BST40X90-1B 2A-BST40X90-1B	960 {9.8}	1 305 {13.3}	1 930 {19.7}	1 500 {15.3}
BST45X75-1B 2A-BST45X75-1B	430 {4.4}	580 {5.9}	860 {8.8}	665 {6.8}
BST45X100-1B 2A-BST45X100-1B	1 165 {11.9}	1 580 {16.1}	2 340 {23.9}	1 815 {18.5}
BST50X100-1B 2A-BST50X100-1B	1 165 {11.9}	1 580 {16.1}	2 340 {23.9}	1 815 {18.5}
BST55X100-1B 2A-BST55X100-1B	1 165 {11.9}	1 580 {16.1}	2 340 {23.9}	1 815 {18.5}
BST55X120-1B 2A-BST55X120-1B	1 490 {15.2}	2 010 {20.5}	2 970 {30.3}	2 310 {23.5}
BST60X120-1B 2A-BST60X120-1B	1 490 {15.2}	2 010 {20.5}	2 970 {30.3}	2 310 {23.5}

Table 13.19 Light-contact sealed type BST LXL/L588 and 2A-BST LXL/L588 types

Part number	Starting torque (reference) N • mm {kgf • cm}			
	DF type DB type	DFT type DBT type	DTFT type DTBT type	DFTT type DBTT type
BST17X47-1BLXL 2A-BST17X47-1BLXL	215 {2.2}	295 {3.0}	420 {4.3}	355 {3.4}
BST20X47-1BLXL 2A-BST20X47-1BLXL	215 {2.2}	295 {3.0}	420 {4.3}	355 {3.4}
BST25X62-1BLXL 2A-BST25X62-1BLXL	365 {3.7}	510 {5.2}	745 {7.6}	570 {5.8}
BST30X62-1BLXL 2A-BST30X62-1BLXL	365 {3.7}	510 {5.2}	745 {7.6}	570 {5.8}
BST35X72-1BLXL 2A-BST35X72-1BLXL	460 {4.7}	610 {6.2}	900 {9.2}	705 {7.2}
BST40X72-1BLXL 2A-BST40X72-1BLXL	460 {4.7}	610 {6.2}	900 {9.2}	705 {7.2}
BST40X90-1BLXL 2A-BST40X90-1BLXL	1 155 {11.8}	1 570 {16.0}	2 315 {23.6}	1 805 {18.4}
BST45X75-1BLXL 2A-BST45X75-1BLXL	520 {5.3}	695 {7.1}	1 040 {10.6}	805 {8.2}
BST45X100-1BLXL 2A-BST45X100-1BLXL	1 400 {14.3}	1 890 {19.3}	2 815 {28.7}	2 175 {22.2}
BST50X100-1BLXL 2A-BST50X100-1BLXL	1 400 {14.3}	1 890 {19.3}	2 815 {28.7}	2 175 {22.2}
BST55X100-1BLXL 2A-BST55X100-1BLXL	1 400 {14.3}	1 890 {19.3}	2 815 {28.7}	2 175 {22.2}
BST55X120-1BLXL 2A-BST55X120-1BLXL	1 780 {18.2}	2 410 {24.5}	3 570 {36.4}	2 770 {28.2}
BST60X120-1BLXL 2A-BST60X120-1BLXL	1 780 {18.2}	2 410 {24.5}	3 570 {36.4}	2 770 {28.2}

13.11 Recommended lubrication specifications

BST and HT types ball screw support angular contact ball bearings are generally lubricated with grease (BST LXL type bearings with light-contact seals are packed with grease). AXN and ARN types bearings are generally lubricated with circulated oil.

Oil lubrication

Recommended type of oil

Hydraulic oils or other industrial oils used for lubrication of sliding surfaces with viscosity grade ISO VG 32 or higher are recommended.

Oil quantity

Recommended oil quantity depends on the lubricating method. As a general guideline, the oil flow rate should be 5 to 10 cm³/min. Increase the amount of oil if slippage is expected.

Grease lubrication

Recommended type of grease

Lithium-mineral oil based general purpose grease of which base oil viscosity is high (for example, Alvania Grease S2).

Recommended grease fill

25 % of the capacity shown in the dimensions tables

Recommended grease filling method

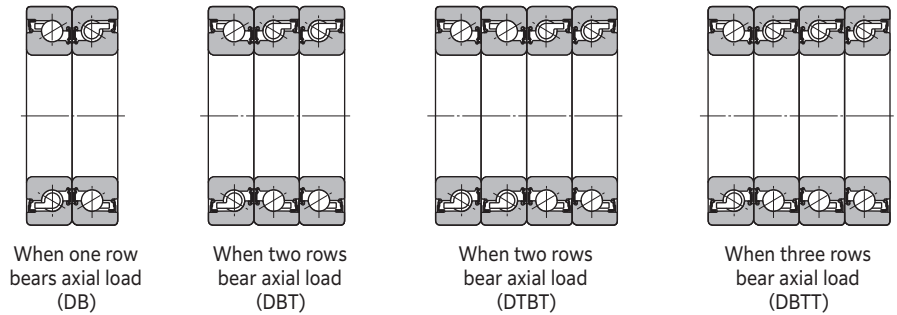
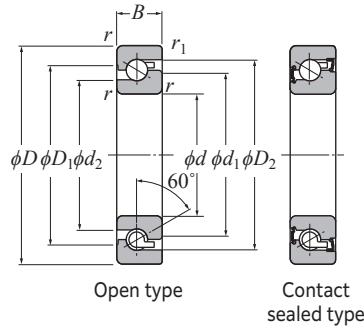
Refer to "6. Handling of Bearings, 6.1 Rinsing of bearings and grease filling" in the Technical Data section.

Dynamic equivalent axial load $P_a = XF_r + YF_a$

Number of rows in bearing arrangement	2		3			4			
	1	2	1	2	3	1	2	3	4
$F_a / F_r \leq 2.17$	X 1.90	—	1.43	2.32	—	1.17	1.90	2.52	—
	Y 0.55	—	0.76	0.35	—	0.88	0.55	0.26	—
$F_a / F_r > 2.17$	X 0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
	Y 1	1	1	1	1	1	1	1	1

Static equivalent axial load

$P_{0a} = F_a + 3.98F_r$



Contact angle 60° **d** 17–60 mm

Part number	Boundary dimensions					Basic dynamic rated load $C_a^{(2)}$			Basic static rated load $C_{0a}^{(2)}$			Dimensions				Internal free space cm^2 Single-row (approx.)	Allowable axial load $^{(2)}$ (static) kN kgf			Allowable speed min^{-1}	
	mm					kN kgf			kN kgf			mm								grease lubrication	oil lubrication
	d	D	B	$r_{s \text{ min}^{-1}}$	$r_{ls \text{ min}^{-1}}$	1-row	2-row	3-row	1-row	2-row	3-row	d_1	d_2	D_1	D_2		1-row	2-row	3-row		
BST17X47-1B	17	47	15	1	0.6	24.3	39.5	52.5	37.5	75.0	113	29.9	27.1	37.1	40.7	25.7	51.5	77.0	6 500	10 000	
BST17X47-1BLXL						2 470	4 000	5 350	3 850	7 650	11 500		25.7		41.2	2 620	5 250	7 850	—	—	
BST20X47-1B	20	47	15	1	0.6	24.3	39.5	52.5	37.5	75.0	113	29.9	27.1	37.1	40.7	25.7	51.5	77.0	6 500	10 000	
BST20X47-1BLXL						2 470	4 000	5 350	3 850	7 650	11 500		25.7		41.2	2 620	5 250	7 850	—	—	
BST25X62-1B	25	62	15	1	0.6	29.2	47.5	63.0	59.0	118	177	44.4	41.6	51.6	55.2	40.0	80.5	121	4 600	7 000	
BST25X62-1BLXL						2 980	4 850	6 450	6 050	12 100	18 100		40.2		55.7	4 100	8 200	12 300	—	—	
BST30X62-1B	30	62	15	1	0.6	29.2	47.5	63.0	59.0	118	177	44.4	41.6	51.6	55.2	40.0	80.5	121	4 600	7 000	
BST30X62-1BLXL						2 980	4 850	6 450	6 050	12 100	18 100		40.2		55.7	4 100	8 200	12 300	—	—	
BST35X72-1B	35	72	15	1	0.6	31.0	50.5	67.0	70.0	140	210	52.4	49.6	59.6	63.2	47.5	95.0	143	3 900	6 000	
BST35X72-1BLXL						3 150	5 150	6 850	7 150	14 300	21 400		48.2		63.7	4 850	9 700	14 600	—	—	
BST40X72-1B	40	72	15	1	0.6	31.0	50.5	67.0	70.0	140	210	52.4	49.6	59.6	63.2	47.5	95.0	143	3 900	6 000	
BST40X72-1BLXL						3 150	5 150	6 850	7 150	14 300	21 400		48.2		63.7	4 850	9 700	14 600	—	—	
BST40X90-1B	40	90	20	1	0.6	58.5	95.0	126	130	261	390	64.8	60.7	75.2	80.4	88.5	177	265	3 100	5 400	
BST40X90-1BLXL						6 000	9 700	12 900	13 300	26 600	40 000		59.1		81.6	9 000	18 000	27 000	—	—	
BST45X75-1B	45	75	15	1	0.6	32.0	52.0	69.5	77.5	155	232	58.4	55.6	65.6	69.2	52.5	105	158	3 500	6 000	
BST45X75-1BLXL						3 300	5 350	7 100	7 900	15 800	23 700		54.2		69.7	5 350	10 700	16 100	—	—	
BST45X100-1B	45	100	20	1	0.6	62.0	101	134	153	305	460	75.8	71.7	86.2	91.4	104	208	315	2 700	4 400	
BST45X100-1BLXL						6 350	10 300	13 700	15 600	31 000	47 000		70.1		92.6	10 600	21 200	32 000	—	—	
BST50X100-1B	50	100	20	1	0.6	62.0	101	134	153	305	460	75.8	71.7	86.2	91.4	104	208	315	2 700	4 400	
BST50X100-1BLXL						6 350	10 300	13 700	15 600	31 000	47 000		70.1		92.6	10 600	21 200	32 000	—	—	
BST55X100-1B	55	100	20	1	0.6	62.0	101	134	153	305	460	75.8	71.7	86.2	91.4	104	208	315	2 700	4 400	
BST55X100-1BLXL						6 350	10 300	13 700	15 600	31 000	47 000		70.1		92.6	10 600	21 200	32 000	—	—	
BST55X120-1B	55	120	20	1	0.6	66.5	108	143	183	365	550	90.8	86.7	101.2	106.4	124	249	375	2 300	3 700	
BST55X120-1BLXL						6 750	11 000	14 600	18 700	37 500	56 000		85.1		107.6	12 700	25 400	38 000	—	—	
BST60X120-1B	60	120	20	1	0.6	66.5	108	143	183	365	550	90.8	86.7	101.2	106.4	124	249	375	2 300	3 700	
BST60X120-1BLXL						6 750	11 000	14 600	18 700	37 500	56 000		85.1		107.6	12 700	25 400	38 000	—	—	

1) Minimum allowable value for corner radius dimension r or r_1 .

2) The number of rows means the number of bearings that bear the axial load.

Ball Screw Support Bearings

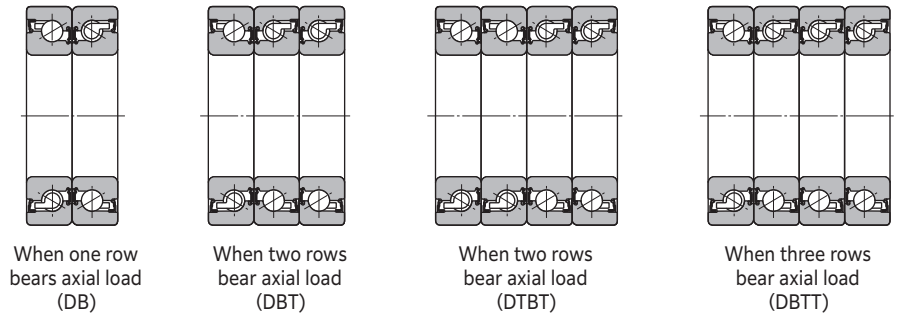
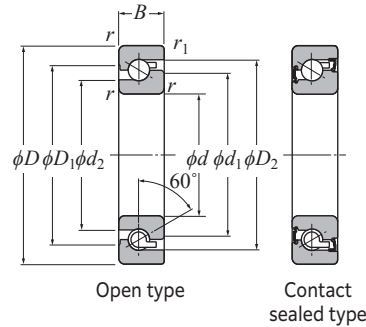
Ball Screw Support Bearings

Dynamic equivalent axial load $P_a = XF_r + YF_a$

Number of rows in bearing arrangement	2		3			4			
	1	2	1	2	3	1	2	3	4
$F_a / F_r \leq 2.17$	X 1.90	—	1.43	2.32	—	1.17	1.90	2.52	—
	Y 0.55	—	0.76	0.35	—	0.88	0.55	0.26	—
$F_a / F_r > 2.17$	X 0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
	Y 1	1	1	1	1	1	1	1	1

Static equivalent axial load

$P_{0a} = F_a + 3.98F_r$



Contact angle 60° d 17–60 mm

Part number	Boundary dimensions					Basic dynamic rated load $C_a^{(2)}$			Basic static rated load $C_{0a}^{(2)}$			Dimensions				Internal free space cm^2 Single-row (approx.)	Allowable axial load $^{(2)}$ (static) kN kgf			Allowable speed	
	mm					kN kgf			kN kgf			mm					1-row 2-row 3-row			grease lubrication	oil lubrication
	d	D	B	$r_{s \min}^{(1)}$	$r_{ls \min}^{(1)}$	1-row	2-row	3-row	1-row	2-row	3-row	d_1	d_2	D_1	D_2		1-row	2-row	3-row	min ⁻¹	
2A-BST17X47-1B	17	47	15	1	0.6	24.3	39.5	52.5	37.5	75.0	113	29.9	27.1	37.1	40.7	25.7	51.5	77.0	6 500	10 000	
2A-BST17X47-1BLXL						2 470	4 000	5 350	3 850	7 650	11 500					2 620	5 250	7 850		—	
2A-BST20X47-1B	20	47	15	1	0.6	24.3	39.5	52.5	37.5	75.0	113	29.9	27.1	37.1	40.7	25.7	51.5	77.0	6 500	10 000	
2A-BST20X47-1BLXL						2 470	4 000	5 350	3 850	7 650	11 500					2 620	5 250	7 850		—	
2A-BST25X62-1B	25	62	15	1	0.6	29.2	47.5	63.0	59.0	118	177	44.4	41.6	51.6	55.2	40.0	80.5	121	4 600	7 000	
2A-BST25X62-1BLXL						2 980	4 850	6 450	6 050	12 100	18 100					4 100	8 200	12 300		—	
2A-BST30X62-1B	30	62	15	1	0.6	29.2	47.5	63.0	59.0	118	177	44.4	41.6	51.6	55.2	40.0	80.5	121	4 600	7 000	
2A-BST30X62-1BLXL						2 980	4 850	6 450	6 050	12 100	18 100					4 100	8 200	12 300		—	
2A-BST35X72-1B	35	72	15	1	0.6	31.0	50.5	67.0	70.0	140	210	52.4	49.6	59.6	63.2	47.5	95.0	143	3 900	6 000	
2A-BST35X72-1BLXL						3 150	5 150	6 850	7 150	14 300	21 400					4 850	9 700	14 600		—	
2A-BST40X72-1B	40	72	15	1	0.6	31.0	50.5	67.0	70.0	140	210	52.4	49.6	59.6	63.2	47.5	95.0	143	3 900	6 000	
2A-BST40X72-1BLXL						3 150	5 150	6 850	7 150	14 300	21 400					4 850	9 700	14 600		—	
2A-BST40X90-1B	40	90	20	1	0.6	58.5	95.0	126	130	261	390	64.8	60.7	75.2	80.4	88.5	177	265	3 100	5 400	
2A-BST40X90-1BLXL						6 000	9 700	12 900	13 300	26 600	40 000					9 000	18 000	27 000		—	
2A-BST45X75-1B	45	75	15	1	0.6	32.0	52.0	69.5	77.5	155	232	58.4	55.6	65.6	69.2	52.5	105	158	3 500	6 000	
2A-BST45X75-1BLXL						3 300	5 350	7 100	7 900	15 800	23 700					5 350	10 700	16 100		—	
2A-BST45X100-1B	45	100	20	1	0.6	62.0	101	134	153	305	460	75.8	71.7	86.2	91.4	104	208	315	2 700	4 400	
2A-BST45X100-1BLXL						6 350	10 300	13 700	15 600	31 000	47 000					10 600	21 200	32 000		—	
2A-BST50X100-1B	50	100	20	1	0.6	62.0	101	134	153	305	460	75.8	71.7	86.2	91.4	104	208	315	2 700	4 400	
2A-BST50X100-1BLXL						6 350	10 300	13 700	15 600	31 000	47 000					10 600	21 200	32 000		—	
2A-BST55X100-1B	55	100	20	1	0.6	62.0	101	134	153	305	460	75.8	71.7	86.2	91.4	104	208	315	2 700	4 400	
2A-BST55X100-1BLXL						6 350	10 300	13 700	15 600	31 000	47 000					10 600	21 200	32 000		—	
2A-BST55X120-1B	55	120	20	1	0.6	66.5	108	143	183	365	550	90.8	86.7	101.2	106.4	124	249	375	2 300	3 700	
2A-BST55X120-1BLXL						6 750	11 000	14 600	18 700	37 500	56 000					12 700	25 400	38 000		—	
2A-BST60X120-1B	60	120	20	1	0.6	66.5	108	143	183	365	550	90.8	86.7	101.2	106.4	124	249	375	2 300	3 700	
2A-BST60X120-1BLXL						6 750	11 000	14 600	18 700	37 500	56 000					12 700	25 400	38 000		—	

1) Minimum allowable value for corner radius dimension r or r_1 .

2) The number of rows means the number of bearings that bear the axial load.

ULTAGE Angular contact thrust ball bearings **BST type, 2A-BST type**
Preload and axial rigidity

Contact angle 60° d 17–60 mm

Part number	Standard preload: -1B											
	Two-row (DF/DB types)				Three-row (DFT/DBT types)				Four-row (DTFT/DTBT types)			
	Preload		Axial rigidity		Preload		Axial rigidity		Preload		Axial rigidity	
	N	kgf	N/μm	kgf/μm	N	kgf	N/μm	kgf/μm	N	kgf	N/μm	kgf/μm
BST17X47 2A-BST17X47	2 060	210	635	65	2 840	290	930	95	4 100	420	1 270	130
BST20X47 2A-BST20X47	2 060	210	635	65	2 840	290	930	95	4 100	420	1 270	130
BST25X62 2A-BST25X62	3 250	330	980	100	4 400	450	1 370	140	6 450	660	1 960	200
BST30X62 2A-BST30X62	3 250	330	980	100	4 400	450	1 370	140	6 450	660	1 960	200
BST35X72 2A-BST35X72	3 800	390	1 130	115	5 200	530	1 620	165	7 650	780	2 260	230
BST40X72 2A-BST40X72	3 800	390	1 130	115	5 200	530	1 620	165	7 650	780	2 260	230
BST40X90 2A-BST40X90	7 050	720	1 470	150	9 600	980	2 110	215	14 100	1 440	2 940	300
BST45X75 2A-BST45X75	4 200	430	1 230	125	5 700	580	1 770	180	8 450	860	2 500	255
BST45X100 2A-BST45X100	8 250	840	1 720	175	11 200	1 140	2 450	250	16 500	1 680	3 450	350
BST50X100 2A-BST50X100	8 250	840	1 720	175	11 200	1 140	2 450	250	16 500	1 680	3 450	350
BST55X100 2A-BST55X100	8 250	840	1 720	175	11 200	1 140	2 450	250	16 500	1 680	3 450	350
BST55X120 2A-BST55X120	9 900	1 010	2 010	205	13 400	1 370	2 890	295	19 800	2 020	4 050	415
BST60X120 2A-BST60X120	9 900	1 010	2 010	205	13 400	1 370	2 890	295	19 800	2 020	4 050	415

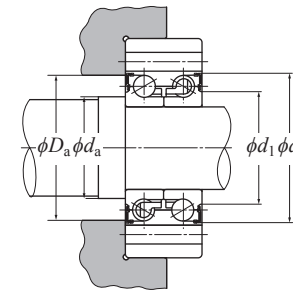
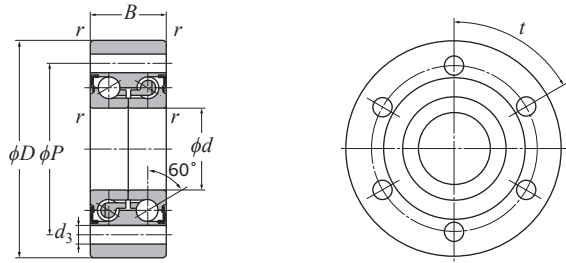
Part number	Light preload: -11B											
	Two-row (DF/DB types)				Three-row (DFT/DBT types)				Four-row (DTFT/DTBT types)			
	Preload		Axial rigidity		Preload		Axial rigidity		Preload		Axial rigidity	
	N	kgf	N/μm	kgf/μm	N	kgf	N/μm	kgf/μm	N	kgf	N/μm	kgf/μm
BST17X47 2A-BST17X47	1 000	102	490	50	1 370	140	735	75	1 960	200	980	100
BST20X47 2A-BST20X47	1 000	102	490	50	1 370	140	735	75	1 960	200	980	100
BST25X62 2A-BST25X62	1 470	150	735	75	1 960	200	1 080	110	2 940	300	1 470	150
BST30X62 2A-BST30X62	1 560	159	735	75	2 160	220	1 080	110	3 150	320	1 470	150
BST35X72 2A-BST35X72	1 760	180	885	90	2 350	240	1 270	130	3 550	360	1 770	180
BST40X72 2A-BST40X72	1 860	190	885	90	2 550	260	1 270	130	3 700	380	1 770	180
BST40X90 2A-BST40X90	2 370	240	980	100	3 230	330	1 470	150	4 700	480	2 060	210
BST45X75 2A-BST45X75	2 000	200	980	100	2 650	270	1 370	140	3 900	400	1 960	200
BST45X100 2A-BST45X100	2 880	290	1 180	120	3 800	390	1 770	180	5 700	580	2 450	250
BST50X100 2A-BST50X100	3 010	310	1 180	120	4 100	420	1 770	180	6 100	620	2 450	250
BST55X100 2A-BST55X100	3 010	310	1 180	120	4 100	420	1 770	180	6 100	620	2 450	250
BST55X120 2A-BST55X120	3 520	360	1 370	140	4 800	490	2 060	210	7 050	720	2 840	290
BST60X120 2A-BST60X120	3 520	360	1 370	140	4 800	490	2 060	210	7 050	720	2 840	290

NOTE: 1. Preloads listed are indicative of bearing combination specified.
2. The axial rigidity indicated is in the axial direction under the specified preload.

Ball Screw Support Bearings

Ball Screw Support Bearings

ULTRAGE Double-row thrust angular contact ball bearing unit
BSTU LLX type



Dynamic equivalent radial load
 $P_a = XF_r + YF_a$

e	$F_a/F_r \leq e$		$F_a/F_r > e$	
	X	Y	X	Y
2.17	1.90	0.55	0.92	1

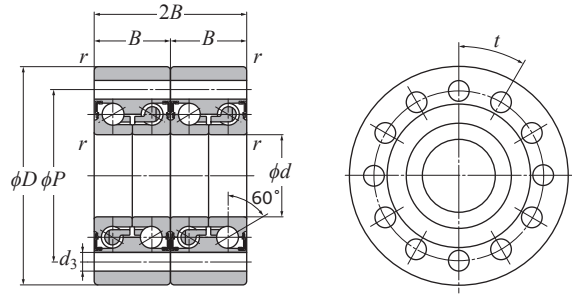
Static equivalent radial load
 $P_{0a} = F_a + 3.98 F_r$

Contact angle 60° d 20–100 mm

Part number	Boundary dimensions						Basic load ratings				Allowable axial load kN	Allowable speed min ⁻¹ grease lubrication	Reference dimensions		Abutment and fillet dimensions		Outer ring mounting bolt		Preload		Mass kg	Bearing friction torque N·m (approx.)	Axial rigidity N/μm	Moment rigidity N·m/mrad	Inertia of inner ring kg·cm ²	Part number	
	mm						dynamic kN	static kgf	dynamic kgf	static kgf			d_1	d_2	D_a max	d_a min	Screws	Quantity × t	N	kgf							
	d	D	B	$r_{s \min}^1$	P	d_3	C_a	C_{0a}	C_a	C_{0a}									(static)	mm							mm
BSTU2068LLX	20	68	28	0.6	53	6.8	31.0	48.0	3 200	4 900	24.0	2 450	6 000	30.1	43	42	26	M6	4×90°	2 100	215	0.60	0.2	675	150	0.25	BSTU2068LLX
BSTU2575LLX	25	75	28	0.6	58	6.8	34.0	58.0	3 450	5 950	28.5	2 910	5 000	36.1	49	48	32	M6	4×90°	2 400	245	0.72	0.3	790	230	0.45	BSTU2575LLX
BSTU3080LLX	30	80	28	0.6	63	6.8	36.5	68.5	3 700	6 950	33.0	3 350	4 500	41.1	54	53	37	M6	6×60°	2 700	275	0.78	0.3	900	315	0.68	BSTU3080LLX
BSTU30100LLX	30	100	38	0.6	80	8.8	73.5	121	7 500	12 400	61.5	6 250	4 000	47.1	65	64	39	M8	8×45°	4 800	490	1.71	0.8	1 040	500	1.99	BSTU30100LLX
BSTU40100LLX	40	100	34	0.6	80	8.8	52.0	106	5 300	10 800	50.5	5 150	3 500	54.1	68.9	68	49	M8	4×90°	3 200	325	1.46	0.4	1 050	610	2.16	BSTU40100LLX
BSTU40115LLX	40	115	46	0.6	94	8.8	89.0	167	9 050	17 000	82.5	8 400	3 200	61.1	80.2	80	52	M8	12×30°	5 800	590	2.57	1.0	1 260	960	5.52	BSTU40115LLX
BSTU90190LLX	90	190	55	0.6	165	11	158	415	16 100	42 000	195	19 900	1 700	116.1	138.7	137	104	M10	8×45°	8 200	835	7.95	1.5	2 010	4 700	60.0	BSTU90190LLX
BSTU100200LLX	100	200	55	0.6	175	11	160	435	16 300	44 500	205	20 900	1 500	128.1	150.7	150	116	M10	8×45°	8 800	895	8.47	1.7	2 130	5 800	83.8	BSTU100200LLX

1) Minimum allowable value for corner radius dimension r.

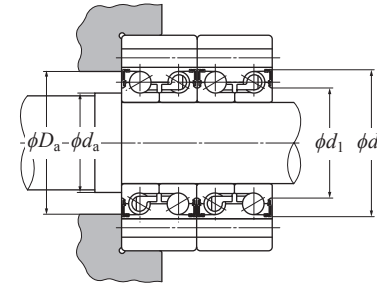
ULTAGE Double-row thrust angular contact ball bearing unit
BSTU LLX D2 type



Contact angle 60° d 20–40 mm

Part number	Boundary dimensions						Basic load ratings				Allowable axial load		Allowable speed min ⁻¹ grease lubrication	Reference dimensions		Abutment and fillet dimensions		Outer ring mounting bolt		Preload		Mass kg (approx.)	Bearing friction torque N·m (approx.)	Axial rigidity N/μm	Moment rigidity N·m/mrad	Inertia of inner ring kg·cm ²	Part number
	mm						dynamic kN	static kgf	dynamic kN	static kgf	kN	kgf		d ₁	d ₂	D _a max	d _a min	Screws	Quantity × t	N	kgf						
	d	D	2B	r _{s min} ¹⁾	P	d ₃	C _a	C _{0a}	C _a	C _{0a}	(static)																
BSTU2068LLXD2	20	68	56	0.6	53	6.8	50.5	96.0	5 150	9 800	48.0	4 900	6 000	30.1	43	42	26	M6	8×45°	4 200	430	1.20	0.5	1 350	340	0.50	BSTU2068LLXD2
BSTU2575LLXD2	25	75	56	0.6	58	6.8	55.0	116	5 600	11 900	57.0	5 820	5 000	36.1	49	48	32	M6	8×45°	4 800	490	1.44	0.5	1 580	510	0.90	BSTU2575LLXD2
BSTU3080LLXD2	30	80	56	0.6	63	6.8	59.0	137	6 000	13 900	65.0	6 700	4 500	41.1	54	53	37	M6	12×30°	5 400	550	1.56	0.6	1 800	690	1.36	BSTU3080LLXD2
BSTU40100LLXD2	40	100	68	0.6	80	8.8	84.0	212	8 600	21 600	101	10 300	3 500	54.1	68.9	68	49	M8	8×45°	6 350	650	2.92	0.8	2 100	1 310	4.32	BSTU40100LLXD2
BSTU40115LLXD2	40	115	92	0.6	94	8.8	144	335	14 700	34 000	165	16 800	3 200	61.1	80.2	80	52	M8	12×30°	11 600	1 180	5.14	2.0	2 520	2 150	11.0	BSTU40115LLXD2

1) Minimum allowable value for corner radius dimension r.



Dynamic equivalent radial load
 $P_a = XF_r + YF_a$

e	$F_a/F_r \leq e$		$F_a/F_r > e$	
	X	Y	X	Y
2.17	—	—	0.92	1

Static equivalent radial load
 $P_{0a} = F_a + 3.98 F_r$

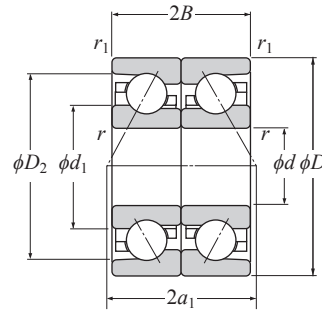
Duplex angular contact ball bearings HT type

Dynamic equivalent axial load $P_a = XF_r + YF_a$

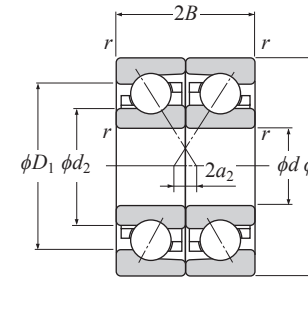
Number of rows in bearing arrangement	2		3			4				
	1	2	1	2	3	1	2	3	4	
$F_a / F_r \leq 0.80$	X	0.81	—	0.61	0.99	—	0.50	0.81	1.07	—
	Y	0.63	—	0.88	0.40	—	1.02	0.63	0.30	—
$F_a / F_r > 0.80$	X	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
	Y	1	1	1	1	1	1	1	1	1

Static equivalent axial load

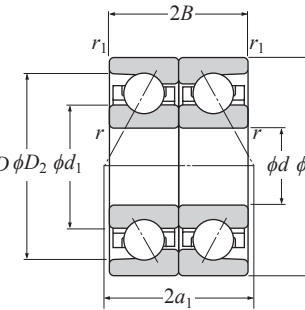
$P_{0a} = 1.52F_r + F_a$



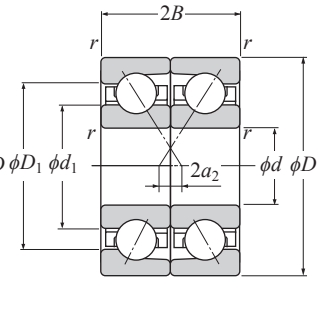
Back-to-back (DB) Drawings 1



Face-to-face (DF) Drawings 1



Back-to-back (DB) Drawings 2



Face-to-face (DF) Drawings 2

Contact angle 30° d 6–40 mm

Part number	Boundary dimensions		Basic load ratings				Dimensions				Load center	Drawing number	Allowable axial load ²⁾				Medium preload (GM)						Heavy preload (GH)																	
	Back-to-back (DB)	Face-to-face (DF)	mm		dynamic kN	static kgf	mm		DB	DF			(static) kN		kgf		Preload ³⁾		Axial rigidity ⁴⁾		Starting torque		Preload ³⁾		Axial rigidity ⁴⁾		Starting torque													
	d	D	$2B$	$r_{s \min}^{-1}$	$r_{ls \min}^{-1}$	C_a	C_{0a}	C_a	C_{0a}	d_1	d_2	D_1	D_2	a_1	a_2	1-row	2-row	N	kgf	N/ μ m	kgf/ μ m	N-mm (approx.)	N	kgf	N/ μ m	kgf/ μ m	N-mm (approx.)													
79M6ADB 79M6ADF	6	15	10	0.2	0.1	2.27	2.09	232	213	10.0	8.4	11.1	12.9	11.1	1.1	1	1.83	187	3.66	374	20	2	27	3	37	3.8	55	5.6	0.4	0.6	39	4	53	5.5	48	4.9	67	6.8	1.0	1.1
70M6DB 70M6DF	6	17	12	0.3	0.15	2.96	2.41	300	246	9.8	—	13.2	14.8	12.7	0.7	2	1.01	103	2.02	206	29	3	39	4	37	3.8	53	5.4	0.8	1.0	49	5	67	7	45	4.6	65	6.6	1.5	2.2
79M8ADB 79M8ADF	8	19	12	0.3	0.15	3.25	3.25	330	335	12.6	10.9	14.4	16.4	13.9	1.9	1	2.14	219	4.28	438	29	3	39	4	48	4.9	68	6.9	0.7	0.9	59	6	80	8	62	6.3	88	9.0	1.7	2.3
70M8DB 70M8DF	8	22	14	0.3	0.15	4.85	4.40	495	445	12.8	—	17.2	19.1	15.8	1.8	2	1.53	156	3.06	312	49	5	67	7	52	5.3	75	7.6	1.6	2.2	98	10	133	14	67	6.9	97	9.9	4.0	5.7
7000HTDB 7000HTDF	10	26	16	0.3	0.15	6.75	6.30	690	640	15.5	—	20.3	22.7	18.4	2.4	2	3.10	314	6.20	628	147	15	200	20	82	8.4	116	11.8	7.4	9.7	196	20	266	27	92	9.4	131	13.3	11.0	14.7
7001HTDB 7001HTDF	12	28	16	0.3	0.15	7.35	7.45	750	760	18.1	—	22.9	25.4	20.0	4.0	2	3.25	331	6.50	662	147	15	200	20	88	9.0	125	12.7	7.2	9.5	196	20	266	27	99	10.1	140	14.3	10.8	14.4
7002HTDB 7002HTDF	15	32	18	0.3	0.15	8.45	9.50	860	970	21.1	—	25.9	28.4	22.7	4.7	2	4.00	407	8.00	814	147	15	200	20	100	10.2	141	14.4	6.9	9.1	294	30	400	41	131	13.4	187	19.1	18.1	24.7
7203HTDB 7203HTDF	17	40	24	0.6	0.3	15.2	16.4	1550	1670	25.0	—	32.0	36.2	28.8	4.8	2	5.85	595	11.7	1190	294	30	400	41	126	12.9	180	18.4	20.5	27.9	390	40	530	54	141	14.4	201	20.5	30.5	40.8
7004HTDB 7004HTDF	20	42	24	0.6	0.3	14.1	17.0	1440	1730	28.4	—	34.7	38.1	30.3	6.3	2	7.55	770	15.1	1540	294	30	400	41	139	14.2	199	20.3	19.3	26.2	490	50	665	68	170	17.3	242	24.7	39.3	53.1
7204HTDB 7204HTDF	20	47	28	1.0	0.6	19.8	23.1	2020	2360	30.5	—	38.6	42.7	34.1	6.1	2	9.50	970	19.0	1940	490	50	665	68	168	17.2	240	24.5	41.5	56.1	785	80	1070	109	203	20.7	289	29.5	79.7	108
7205HTDB 7205HTDF	25	52	30	1.0	0.6	22.4	28.8	2280	2940	35.0	—	43.0	47.2	37.7	7.7	2	11.5	1170	23.0	2340	490	50	665	68	188	19.2	269	27.4	39.7	53.7	785	80	1070	109	226	23.1	323	32.9	76.4	104
7206HTDB 7206HTDF	30	62	32	1.0	0.6	31.0	41.5	3150	4200	41.7	—	51.4	56.3	43.1	11.1	2	16.3	1660	32.6	3320	490	50	665	68	197	20.0	281	28.6	41.3	55.8	785	80	1070	109	235	24.0	336	34.2	79.4	108
7207HTDB 7207HTDF	35	72	34	1.1	0.6	41.0	56.0	4200	5750	47.9	—	59.2	64.9	48.2	14.2	2	21.9	2230	43.8	4470	885	90	1200	122	255	26.0	363	37.1	96.4	130	1470	150	2000	204	311	31.7	443	45.2	196	265
7208HTDB 7208HTDF	40	80	36	1.1	0.6	49.0	71.0	5000	7200	54.0	—	66.0	72.2	52.9	16.9	2	27.1	2770	54.2	5540	885	90	1200	122	272	27.8	389	39.6	95.8	129	1470	150	2000	204	331	33.8	473	48.2	195	264

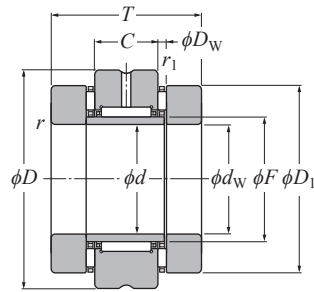
1) Minimum allowable value for corner radius dimension r or r_1 .

2) The number of rows means the number of bearings that bear the axial load.

3) Preloads listed are indicative of bearing combination specified.

4) The axial rigidity indicated is in the axial direction under the specified preload.

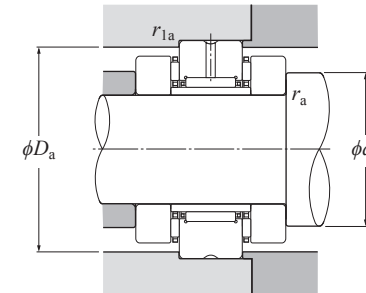
Needle roller bearings
with double-direction thrust needle roller bearings AXN type



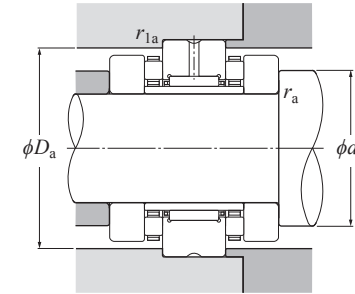
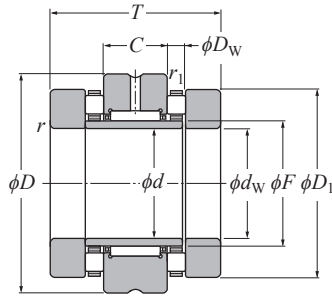
d 20-50 mm

Part number	Boundary dimensions										Basic load ratings				Basic load ratings		Allowable speed		Radial internal clearance		Abutment and fillet dimensions				Preload N	Starting ²⁾ torque N·mm (approx.)	Mass kg (approx.)	Part number		
	mm										dynamic	static	dynamic	static	dynamic	static	grease	oil	min	max	d _a	D _a	r _{as}	r _{1as}						
	d	d _w	D	D ₁ <small>$\begin{matrix} -0.20 \\ -0.50 \end{matrix}$</small>	T	C	F	D _w	r _s min ¹⁾	r _{1s} min ¹⁾	C _r	C _{0r}	C _r	C _{0r}	C _a	C _{0a}	lubrication	lubrication	min	max	min	max	max	max						
AXN2052	20	20 ^{$\begin{matrix} +0.061 \\ +0.040 \end{matrix}$}	52	42	40	16	25	2	0.6	0.6	15.1	22.4	1 540	2 280	14.6	58.0	1 490	5 900	1 800	7 000	10	30	39	46	0.6	0.6	1 300	330	0.40	AXN2052
AXN2557	25	25 ^{$\begin{matrix} +0.061 \\ +0.040 \end{matrix}$}	57	47	44	20	30	2	0.6	0.6	22.1	34.0	2 260	3 500	16.3	69.5	1 660	7 100	1 500	6 000	10	30	44	51	0.6	0.6	1 450	400	0.52	AXN2557
AXN3062	30	30 ^{$\begin{matrix} +0.061 \\ +0.040 \end{matrix}$}	62	52	44	20	35	2	0.6	0.6	24.8	41.5	2 520	4 250	17.8	81.5	1 820	8 300	1 400	5 500	10	40	50	56	0.6	0.6	1 600	550	0.59	AXN3062
AXN3570	35	35 ^{$\begin{matrix} +0.075 \\ +0.050 \end{matrix}$}	70	60	48	20	40	3	1	0.6	26.4	47.0	2 700	4 800	27.4	110	2 790	11 300	1 200	4 700	10	40	56	64	1	0.6	2 450	900	0.80	AXN3570
AXN4075	40	40 ^{$\begin{matrix} +0.075 \\ +0.050 \end{matrix}$}	75	65	48	20	45	3	1	0.6	28.0	52.5	2 860	5 400	29.8	128	3 050	13 100	1 100	4 300	10	40	62	69	1	0.6	2 650	1 050	0.89	AXN4075
AXN4580	45	45 ^{$\begin{matrix} +0.075 \\ +0.050 \end{matrix}$}	80	70	54	25	50	3	1	0.6	38.5	74.5	3 950	7 550	31.5	143	3 250	14 500	1 000	3 900	10	40	67	74	1	0.6	2 800	1 200	1.00	AXN4580
AXN5090	50	50 ^{$\begin{matrix} +0.075 \\ +0.050 \end{matrix}$}	90	78	54	25	55	3	1	0.6	41.0	82.0	4 150	8 400	38.0	186	3 850	19 000	900	3 500	15	50	75	83	1	0.6	3 400	1 600	1.42	AXN5090

1) Minimum allowable value for corner radius dimension r or r₁.
2) Starting torque value relative to the standard preload.



Needle roller bearings with double-direction thrust cylindrical roller bearings ARN type



d 20–70 mm

Part number	Boundary dimensions										Basic load ratings				Basic load ratings				Allowable speed		Radial internal clearance		Abutment and fillet dimensions				Preload N	Starting torque ²⁾ N·mm	Mass kg	Part number
	mm										dynamic radial kN	static radial kN	dynamic axial kgf	static axial kgf	grease lubrication min ⁻¹	oil lubrication min ⁻¹	min	max	da min	Da max	ras max	r1as max								
	d	d _w	D	D ₁	T	C	F	D _w	r _{s min¹⁾}	r _{1s min¹⁾}													C _r	C _{0r}	C _a	C _{0a}				
ARN2052T2	20	20	52	42	46	16	25	5	0.6	0.6	15.1	22.4	1 540	2 280	27.3	68.0	2 790	6 900	1 800	7 000	10	30	39	46	0.6	0.6	2 500	430	0.44	ARN2052T2
ARN2062	20	20	62	52	60	20	30	7.5	1	0.6	22.1	34.0	2 260	3 500	53.5	129	5 450	13 100	1 500	6 000	10	30	48	56	1	0.6	4 950	1 150	0.91	ARN2062
ARN2557T2	25	25	57	47	50	20	30	5	0.6	0.6	22.1	34.0	2 260	3 500	27.8	72.5	2 840	7 400	1 500	6 000	10	30	44	51	0.6	0.6	2 600	500	0.56	ARN2557T2
ARN2572	25	25	72	62	60	20	35	7.5	1	0.6	24.8	41.5	2 520	4 250	54.5	139	5 550	14 200	1 200	4 900	10	40	56	66	1	0.6	5 050	1 400	1.22	ARN2572
ARN3062T2	30	30	62	52	50	20	35	5	0.6	0.6	24.8	41.5	2 520	4 250	31.0	87.0	3 150	8 900	1 400	5 500	10	40	49	56	0.6	0.6	2 900	650	0.63	ARN3062T2
ARN3080	30	30	80	68	66	20	40	9	1	0.6	26.4	47.0	2 700	4 800	74.5	190	7 600	19 400	1 100	4 400	10	40	63	73	1	0.6	6 900	2 100	1.54	ARN3080
ARN3570T2	35	35	70	60	54	20	40	6	1	0.6	26.4	47.0	2 700	4 800	43.0	121	4 350	12 400	1 200	4 800	10	40	56	64	1	0.6	3 950	1 050	0.85	ARN3570T2
ARN3585	35	35	85	73	66	20	45	9	1	0.6	28.0	52.5	2 860	5 400	82.0	222	8 350	22 600	1 000	4 100	10	40	68	77	1	0.6	7 600	2 500	1.67	ARN3585
ARN4075T2	40	40	75	65	54	20	45	6	1	0.6	28.0	52.5	2 860	5 400	45.5	135	4 650	13 800	1 100	4 400	10	40	61	69	1	0.6	4 200	1 250	0.93	ARN4075T2
ARN4090	40	40	90	78	75	25	50	9	1	0.6	38.5	74.5	3 950	7 550	85.0	238	8 650	24 200	950	3 800	10	40	73	87	1	0.6	7 850	2 850	2.15	ARN4090
ARN4580T2	45	45	80	70	60	25	50	6	1	0.6	38.5	74.5	3 950	7 550	48.5	150	4 900	15 300	1 000	4 000	10	40	66	74	1	0.6	4 450	1 550	1.16	ARN4580T2
ARN45105	45	45	105	90	82	25	55	11	1	0.6	41.0	82.0	4 150	8 400	121	340	12 300	34 500	850	3 300	15	50	83	96	1	0.6	11 200	4 350	3.16	ARN45105
ARN5090	50	50	90	78	60	25	55	6	1	0.6	41.0	82.0	4 150	8 400	62.5	215	6 350	21 900	900	3 600	15	50	75	83	1	0.6	5 800	2 050	1.48	ARN5090
ARN50110	50	50	110	95	82	25	60	11	1.1	0.6	41.0	85.0	4 200	8 700	125	365	12 800	37 000	800	3 100	15	50	88	101	1	0.6	11 600	4 900	3.38	ARN50110
ARN55115	55	55	115	100	82	25	65	11	1.1	0.6	45.0	98.0	4 550	10 000	130	385	13 200	39 500	750	2 900	15	50	93	106	1	0.6	12 000	5 500	3.61	ARN55115
ARN60120	60	60	120	105	82	25	70	11	1.1	0.6	45.0	91.5	4 600	9 350	134	410	13 700	42 000	700	2 700	15	50	98	111	1	0.6	12 400	6 000	3.81	ARN60120
ARN65125	65	65	125	110	82	25	75	11	1.1	0.6	55.0	104	5 600	10 600	138	435	14 100	44 500	650	2 600	15	50	103	116	1	0.6	12 800	6 500	4.00	ARN65125
ARN70130	70	70	130	115	82	25	80	11	1.1	0.6	57.0	119	5 800	12 200	142	460	14 500	47 000	650	2 500	15	50	106	121	1	0.6	13 200	7 000	4.25	ARN70130

1) Minimum allowable value for corner radius dimension r or r₁.
2) Starting torque value relative to the standard preload.

Ball Screw Support Bearings

Ball Screw Support Bearings