
JAPAN ZA
NTN
HT
7208 HT DF/GMP5
JAPAN ZC
NTN
HT
7202 HT

Ball Screw Support Bearings

13. Ball Screw Support Bearings CONTENTS

13. Ball Screw Support Bearings

NTN ballscrew bearings are optimized to support a ballscrew.
These bearings are categorized as shown in **Table 13.1**.

Table 13.1 Bearing types

Type code	Notes	Bore diameter
2A-BST	Open type thrust angular contact ball bearing with 60˚ contact angle, lubricated with grease, normally	φ17～φ60
2A-BST LXL/588	Grease-lubricated sealed angular contact ball bearing with 60˚ contact angle	φ17～φ60
HT	Duplex angular contact ball bearing with 30˚ contact angle, lubricated with grease, normally	φ6～φ40
AXN	Needle roller bearing with double-direction thrust needle roller bearing, lubricated with oil, normally	φ20～φ50
ARN	Needle roller bearing with double-direction thrust cylindrical roller bearing, lubricated with oil, normally	φ20～φ70

① Angular contact thrust ball bearing 2A-BST-1B (LXL/L588)

Because balls are used as the rolling elements, the starting torque of a angular contact thrust ball bearing is less than that of a roller bearing. The 2A-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˚. Thus, this type of bearing boasts greater axial rigidity.

Open type (2A-BST type) and light-contact seal type (2A-BST LXL type) are available for these bearings, and resin molding cages are adopted for all of them.

All the side faces of the BST type bearing have been flush-ground to provide the same face height difference for both the front and back faces. As a result, bearings of the same bearing number can be freely combined into DF, DFT or DTFT configurations as illustrated in **Fig. 13.2**, and the adjustment for a relevant preload is no longer necessary.

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

■Features

1. Unique surface modification technique against bearing rings allows drastic improvement in resistance against rolling contact fatigue, leading to longer service life (approximately two times, compared to the conventional type).
2. Seals are provided for both sides of a bearing to enhance the performance of rust prevention and preservation of grease. (Light-contact seal type)
3. Long-life special grease is used. (Light-contact seal type)
4. Unique surface modification technique against bearing rings and special grease reduce fretting (1/5 or less for sliding mode, 1/10 or less for rolling mode, compared to the conventional type). (Light-contact seal type)
5. This grease-packed type bearing eliminates further grease packing and allows easier handling. (Light-contact seal type)

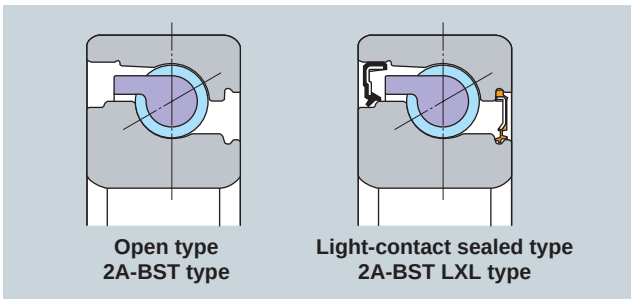


Fig. 13.1

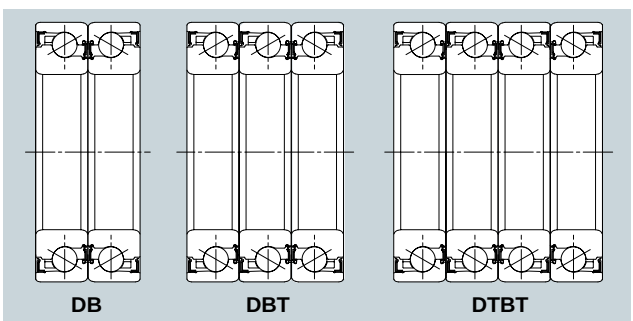
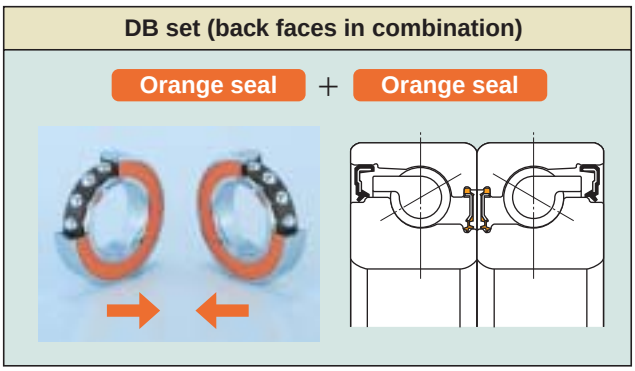


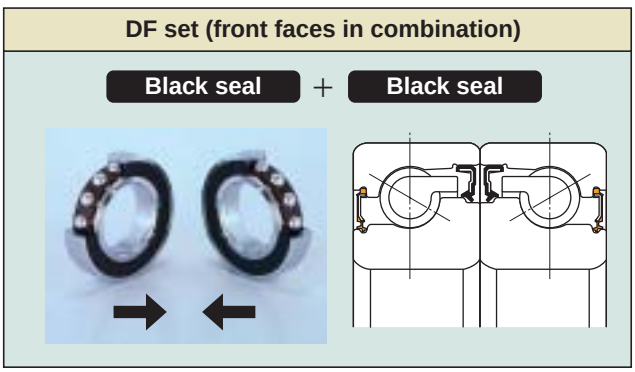
Fig. 13.2 Bearing arrangement

■Easy handling

The grease-lubricated sealed angular contact ball bearings(2A-BST LXL type) eliminate necessity for grease filling, since they have been packed with grease in advance. You should only wipe rust preventive oil away from them 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 assembling direction.





■Performance test

Unique surface modification technique against bearing rings and special grease are used for ball screw supporting thrust angular contact ball bearings in order to lengthen the service life and enhance the resistance against fretting.

(1) Fretting resistance test in sliding mode

Resistance against fretting the sliding mode should be tested in the fretting corrosion test. Conceptual drawing of the test is shown in **Fig. 13.3**, and the test conditions are shown in **Table 13.3**. In this test, a fixed ball is pushed against a plate, and reciprocated horizontal sliding is carried out against the plate for the fixed period. Worn volume of ball after the test and worn plate depth are shown in **Fig. 13.4**.

Thanking to unique surface modification technique against plate and special grease (light-contact seal type), amount of wear is reduced to 1/5 or less, compared to the conventional type (Plate material: SUJ2, Grease: Lithium base general-purpose grease). (**Fig. 13.4**)

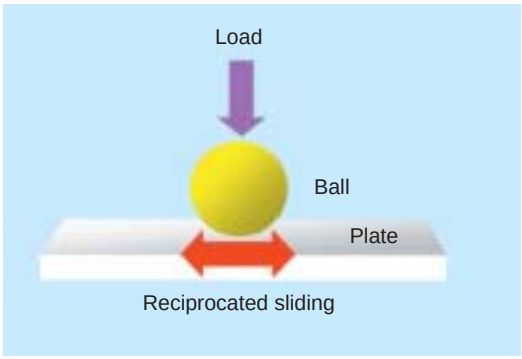


Fig. 13.3 Conceptual drawing of test

Table 13.3 Test conditions

Material	Plate	Conventional type (SUJ2 without surface modification) **ULTAGE series (SUJ2 with surface modification)**
	Ball	SUJ2
Load (N)		98
Max. contact surface pressure (MPa)		2560
Loading frequency ($\times 10^5$cycle)		Test time: 8 h
Sliding cycle (Hz)		30
Amplitude (mm)		0.47
Lubrication		Grease
Atmosphere		Room temperature, in atmosphere

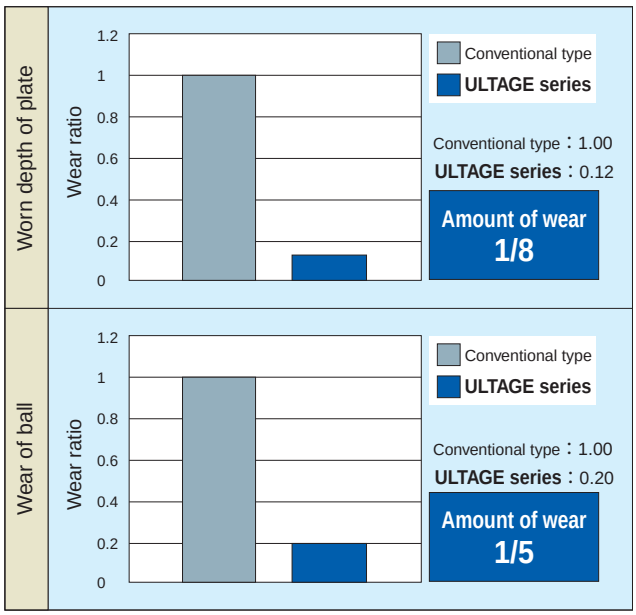


Fig. 13.4 Ratio of fretting corrosion in sliding mode

(2) Fretting corrosion test in rolling mode

Resistance against fretting in the rolling mode should be tested in the rotating and oscillating type fretting corrosion test. Conceptual drawing of the test is **Fig. 13.5**, and the test conditions are shown in Table 13-4. In this test, a housing bearing plate is fixed, and the shaft bearing plate is oscillated. Result of measured decrease in the weight of the bearing plate after the test is shown in **Fig. 13.6**.

Thanking to the synergetic effect of unique surface modification technique against plate and special grease (light-contact seal type), amount of wear is reduced to 1/10 or less, compared to the conventional type (Material of bearing ring: SUJ2, Grease: Lithium base general-purpose grease) (**Fig. 13.6**).

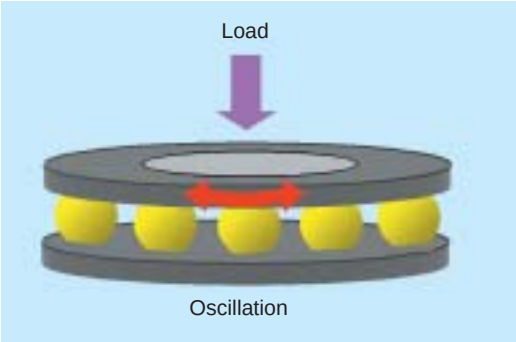


Fig. 13.5 Test conception figure

Table 13.4 Conceptual drawing of test

Bearing (mm)	Evaluated with thrust ball bearing 51204 (φ20×φ40×14)
Load (kN)	2.5
Max. contact surface pressure (MPa)	1700
Test time (h)	8
Oscillating cycle (Hz)	30
Oscillating angle (deg)	12
Lubrication	Grease
Atmosphere	Room temperature, atmosphere

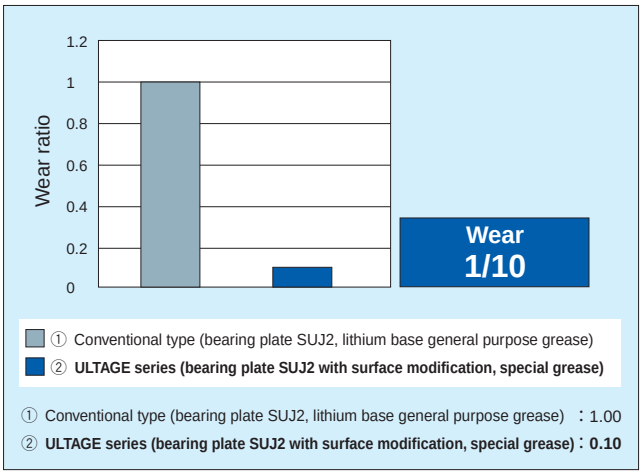


Fig. 13.6 Ratio of fretting corrosion in sliding mode

(3) Rolling contact fatigue life test

Thanking to modification to surface, resistance against rolling contact fatigue is improved, leading to longer service life, compared to the standard heat-treated type model, both for clean oil and oil mixed with foreign matters. (**Fig. 13.7**)

Table 13.5 Test conditions

Bearing (mm)	Evaluated with deep groove ball bearing 6206 (φ30×φ62×16)
Radial load (kN)	6.86
Shaft speed (min^{-1})	2000
Lubrication	VG56 turbine oil
Atmosphere temperature (°C)	60

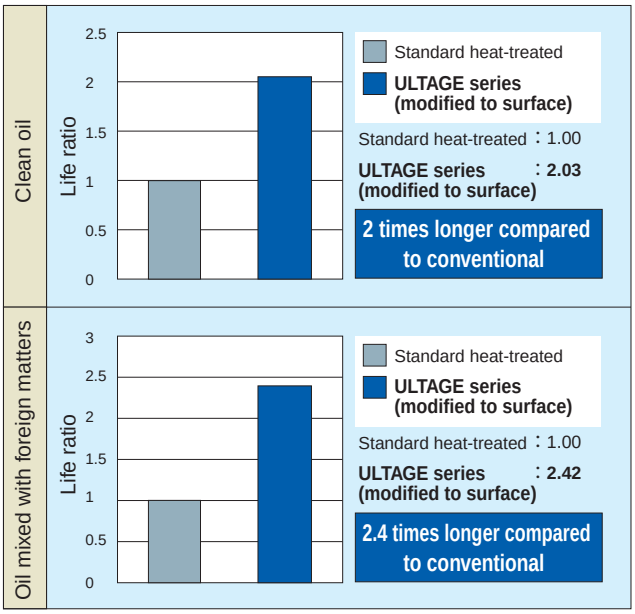


Fig. 13.7 Ratio of rolling contact fatigue depending on modification to surface

(4) Grease life test

Service life of grease has been dramatically extended, compared to lithium base general purpose grease (**Fig. 13.8**).

(Special grease is packed only for light-contact seal type.)

Table 13.6 Test conditions

Bearing (mm)	Evaluated with deep groove ball bearing 6204 (φ20×φ47×14)
Radial load (N)	67
Axial load (N)	67
Shaft speed (min^{-1})	10000
Atmosphere temperature (°C)	150

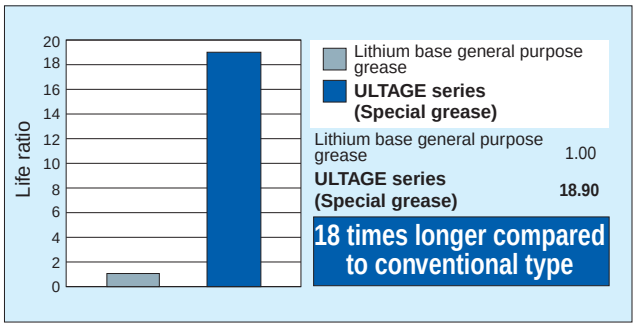


Fig. 13.8 Grease life ratio

(5) Grease leakage evaluation test

Double side light-contact type seals eliminate grease leakage from the inside of a bearing. (**Fig. 13.9**)

Table 13.7 Test conditions

Bearing (mm)	2A-BST40×72-1BDFP4 (φ40×φ72×15)
Axial load (kN)	3.9
Shaft speed (min^{-1})	1000, 2000, 3000 running for two hours for each step
Atmosphere	Room temperature

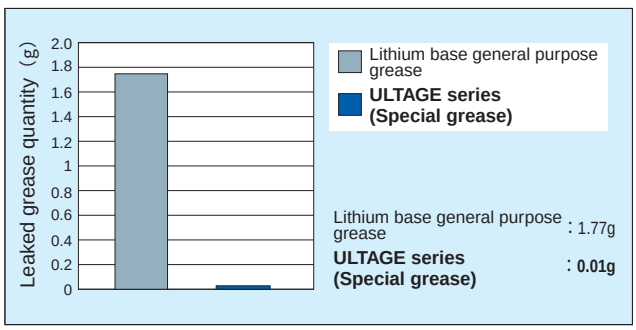


Fig. 13.9 Leaked grease quantity

② Duplex angular contact ball bearing HT

The HT type duplex angular contact ball bearing features larger allowable axial loads, although it has the same dimensions as the standard angular contact ball bearing (contact angle: 30°). Bearings smaller than the BST type are available for use in small products.

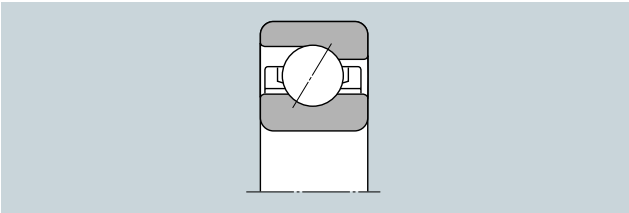


Fig. 13.10 HT

③ Needle roller bearing with double-row thrust needle roller bearing AXN Needle roller bearing with double-row thrust cylindrical roller bearing ARN

The AXN or ARN type bearing has thrust needle roller bearings or thrust cylindrical roller bearings on both sides of the radial needle roller bearing. The outer ring side of the radial needle roller bearing is used as the raceway of either bearing above. These bearings can withstand axial loads in both directions, in spite of their compact designs. Since the needle roller bearings are used for these types for radial loads, they can withstand heavy loads, and are suitable for purposes of radial heavy loads.

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

In the ARN type, rigidity is extremely enhanced, since the thrust cylindrical roller bearings are used for axial loads. Since the axial load capacity of this type is larger than the AXN type, this type is suitable for purposes of axial heavy loads. Oil lubrication is recommended for this type.

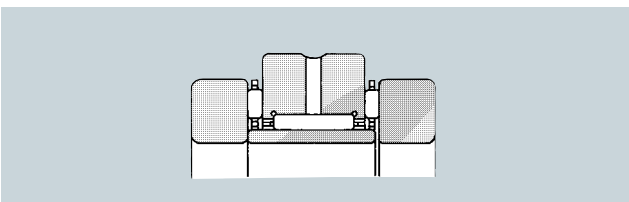


Fig. 13.11 AXN

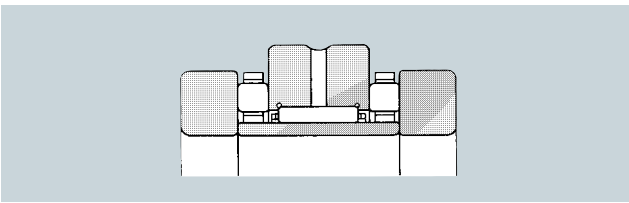
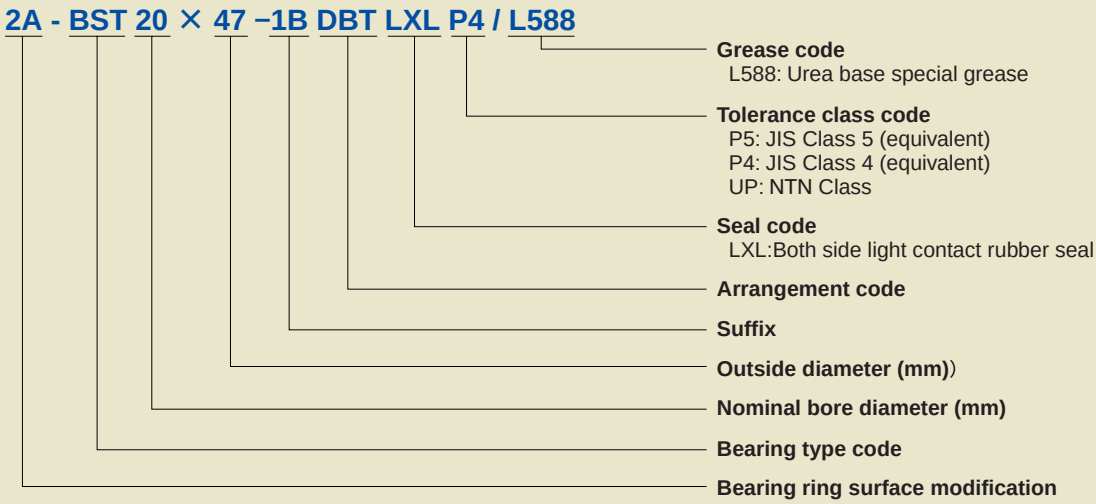


Fig. 13.12 ARN

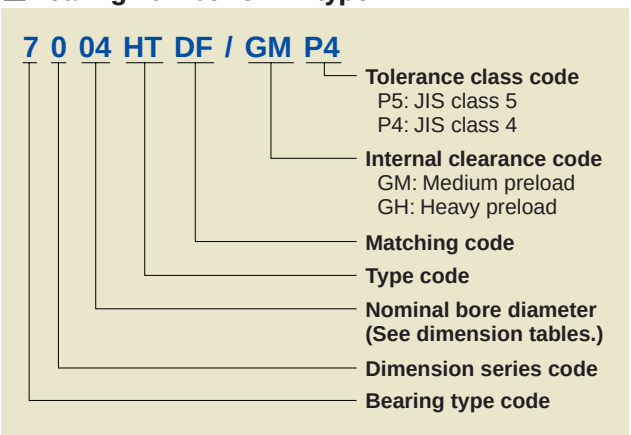
④ Bearing number

The bearing number of a ballscrew bearing comprises of a type code, dimension code, and suffix.The bearing number of a ballscrew bearing comprises of a type code, dimension code, and suffix.

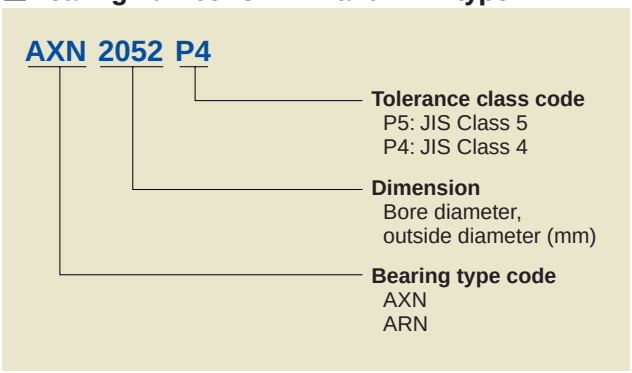
■Bearing number of 2A-BST type



■Bearing number of HT type



■Bearing number of AXN and ARN type



⑤ Bearing precision

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

- **2A-BST type**
  NTN class 5 (tolerance class code P5), class 4 (tolerance class code P4) and grade UP (tolerance class code UP), each complying with JIS standards, are available. The classes are listed in ascending order.
- **70HT type**
  Same precision as the main spindle angular contact ball bearing. Classes 5 and 4 are available.
- **AXN, ARN types**
  Meet **NTN** standard classes 4 and 5, complying with the JIS standards.

■Accuracies of 2A-BST type

Table 13.8 Inner rings

Unit: μm

Nominal bore diameter d		Single plane mean bore diameter deviation Δ_{dmp}						Width variation V_{Bs}			Radial runout K_{ia}			Face runout with bore S_d			Axial runout S_{ia}			Width deviation Δ_{Bs}					
mm		Class 5		Class 4❶		Class UP❶		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	
over	incl.	high	low	high	low	high	low	max			max			max			max			high	low	high	low	high	low
10	18	0	−5	0	−4	0	−3.5	5	2.5	2	3.5	3	2	7	3	2	5	3	2	0	−120	0	−120	0	−100
18	30	0	−6	0	−5	0	−3.5	5	2.5	2	4	3	2	8	4	3	5	3	2	0	−120	0	−120	0	−100
30	50	0	−8	0	−6	0	−5	5	3	2	5	4	3	8	4	3	6	3	2	0	−120	0	−120	0	−100
50	80	0	−9	0	−7	0	−5	6	4	3	5	4	4	8	5	4	7	4	3	0	−150	0	−150	0	−150

❶ The tolerance of outside diameter deviation Δ_{ds} applicable to classes 4 and UP is the same as the tolerance of single plane mean outside diameter deviation Δ_{dmp}.

Table 13.9 Outer rings

Unit: μm

Nominal bore diameter d		Single plane mean outside diameter deviation Δ_{Dmp}						Width variation V_{Cs}			Radial runout K_{ea}			Outside surface inclination S_D			Axial runout S_{ea}	Width deviation Δ_{Cs}
mm		Class 5		Class 4❶		Class UP❶		Class 5	Class 4	Class UP	Class 5	Class 4	Class UP	Class 5	Class 4	Class UP	All classes	All classes
over	incl.	high	low	high	low	high	low	max			max			max				
30	50	0	−7	0	−6	0	−5	5	2.5	2	7	5	4	8	4	3	Identical to S_i relative to d on the same bearing.	Identical to Δ_{Bs} relative to d on the same bearing.
50	80	0	−9	0	−7	0	−5	6	3	2	8	5	4	8	4	3		
80	120	0	−10	0	−8	0	−7	8	4	3	10	6	4	9	5	4		

❷ The tolerance of outside diameter deviation Δ_{Ds} applicable to classes 4 and UP is the same as the tolerance of single plane mean outside diameter deviation Δ_{Dmp}.

■Accuracies of HT type

Table 13.10 Inner rings

Nominal bore diameter d mm over	incl.	Single plane mean bore diameter deviation Δ_{dmp} Class 5 high	low	Class 4 ❶ high	low	Class 2 ❶ high	low	Single radial plane bore diameter variation V_{dp} Diameter series 9 Class 5 max	Class 4 max	Class 2 max	Diameter series 0,2 Class 5 max	Class 4 max	Class 2 max	Mean bore diameter deviation V_{dmp} Class 5 max	Class 4 max	Class 2 max	Inner ring radial runout K_{ia} 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
50	80	0	−9	0	−7	0	−4	9	7	4	7	5	4	5	3.5	2	5	4	2.5
80	120	0	−10	0	−8	0	−5	10	8	5	8	6	5	5	4	2.5	6	5	2.5
120	150	0	−13	0	−10	0	−7	13	10	7	10	8	7	7	5	3.5	8	6	2.5
150	180	0	−13	0	−10	0	−7	13	10	7	10	8	7	7	5	3.5	8	6	5
180	250	0	−15	0	−12	0	−8	15	12	8	12	9	8	8	6	4	10	8	5

❶ The tolerance of bore diameter deviation Δ_{ds}, applicable to classes 4 and 2, is the same as the tolerance of mean bore diameter deviation Δ_{dmp}. This applies to the diameter series 0.2 for class 4, and all the diameter series for class 2.
❷ Applicable to individual bearing rings manufactured for duplex bearings.

Table 13.11 Outer rings

Nominal outside diameter D mm over	incl.	Single plane mean outside diameter deviation Δ_{Dmp} Class 5 high	low	Class 4 ❸ high	low	Class 2 ❸ high	low	Single radial plane outside diameter deviation V_{Dp} Diameter series 9 Class 5 max	Class 4 max	Class 2 max	Diameter series 0,2 Class 5 max	Class 4 max	Class 2 max	Mean single plane outside diameter deviation V_{Dmp} Class 5 max	Class 4 max	Class 2 max	Outer ring radial runout K_{ea} Class 5 max	Class 4 max	Class 2 max
18	30	0	−6	0	−5	0	−4	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
80	120	0	−10	0	−8	0	−5	10	8	5	8	6	5	5	4	2.5	10	6	5
120	150	0	−11	0	−9	0	−5	11	9	5	8	7	5	6	5	2.5	11	7	5
150	180	0	−13	0	−10	0	−7	13	10	7	10	8	7	7	5	3.5	13	8	5
180	250	0	−15	0	−11	0	−8	15	11	8	11	8	8	8	6	4	15	10	7
250	315	0	−18	0	−13	0	−8	18	13	8	14	10	8	9	7	4	18	11	7

❸ The tolerance of outside diameter deviation Δ_{Ds}, applicable to classes 4 and 2, is the same as the tolerance of mean outside diameter deviation Δ_{Dmp}. This applies to the diameter series 0.2 for class 4, and all the diameter series for class 2.

Unit: μm

Face runout with bore S_d			Axial runout S_{ia}			Width variation ΔB_s Single bearing				Duplex bearing❷		Width variation VB_s		
Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2		Class 5	Class 4	Class 5	Class 4	Class 2
max			max			上	下	上	下	上	下	max		
7	3	1.5	7	3	1.5	0	−40	0	−40	0	−250	5	2.5	1.5
7	3	1.5	7	3	1.5	0	−80	0	−80	0	−250	5	2.5	1.5
8	4	1.5	8	4	2.5	0	−120	0	−120	0	−250	5	2.5	1.5
8	4	1.5	8	4	2.5	0	−120	0	−120	0	−250	5	3	1.5
8	5	1.5	8	5	2.5	0	−150	0	−150	0	−250	6	4	1.5
9	5	2.5	9	5	2.5	0	−200	0	−200	0	−380	7	4	2.5
10	6	2.5	10	7	2.5	0	−250	0	−250	0	−380	8	5	2.5
10	6	4	10	7	5	0	−250	0	−300	0	−380	8	5	4
11	7	5	13	8	5	0	−300	0	−350	0	−500	10	6	5

Unit: μm

Outside surface inclination S_D			Axial runout S_{ea}			Width variation ΔC_s	Width variation VC_s		
Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	All classes	Class 5	Class 4	Class 2
max			max				max		
8	4	1.5	8	5	2.5	Identical to ΔB_s 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
9	5	2.5	11	6	5		8	4	2.5
10	5	2.5	13	7	5		8	5	2.5
10	5	2.5	14	8	5		8	5	2.5
11	7	4	15	10	7		10	7	4
13	8	5	18	10	7		11	7	5

■Accuracies of AXN and ARN type

Table 13.12 Inner ring and outer ring

Unit: μm

Nominal bearing bore dia. d or nominal bearing outside dia. D mm		Mean bore dia. ❶ deviation Δd_{mp}				Thrust inner ❶ ring bore dia. deviation Δd_{is}		Mean outside dia. ❷ deviation ΔD_{mp}				Bearing height deviation ΔT_s		Outer ring width deviation ΔC_s		Radial ❶ inner ring radial runout K_{ia}		Outer ❷ ring radial runout K_{ea}		Outer ring ❷ outside surface inclination S_D		Thrust inner ring ❶ and outer ring ❷ thickness variation S_{ia}, S_{ea}	
		Class 5		Class 4				Class 5		Class 4						Class 5 Max.	Class 4 Max.	Class 5 Max.	Class 4 Max.	Class 5 Max.	Class 4 Max.	Class 5 Max.	Class 4 Max.
Over	Incl.	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low								
18	30	0	−6	0	−5	+61	+40	−	−	−	−					4	3	−	−	−	−	3	2
30	50	0	−8	0	−6	+75	+50	−	−	−	−					5	4	−	−	−	−	3	2
50	80	0	−9	0	−7	+90	+60	0	− 9	0	−7	0	−370	0	−130	5	4	8	5	8	4	4	3
80	120	−	−	−	−	−	−	0	−10	0	−8					−	−	10	6	9	5	4	3
120	150	−	−	−	−	−	−	0	−11	0	−9					−	−	11	7	10	5	5	4

❶ To be found in accordance with the dimension class d. ❷ To be found in accordance with the dimension class D.

⑥ Basic preload and axial rigidity

Basic preloads of the ball screw support bearings, set for each bearing type, are shown in the dimensions tables. The preloads can be altered depending on the required rigidity. Contact NTN, in such a case. In the AXN and ARN types, rigidity is normally enhanced by tightening the thrust bearing rings on both sides to supply preload. Preloads and torques are shown in the dimensions tables to help the control of the basic preload. Bearing type that allows the acquisition of preset preload by tightening the bearing raceways to adjust the clearance A between the both thrust bearing rings and radial bearing rings (**Fig. 13.13**) is also available. For details, refer to NTN.

Axial rigidity of the 2A-BST type DB duplex arrangement and the AXN type at the basic preload are shown in **Figs. 13.14** and **13.15**.

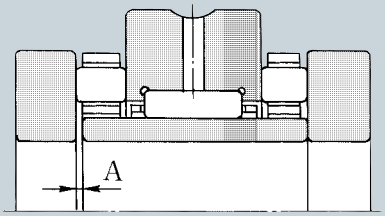


Fig. 13.13

(Notes) Axial displacement is measured under standard preloaded.

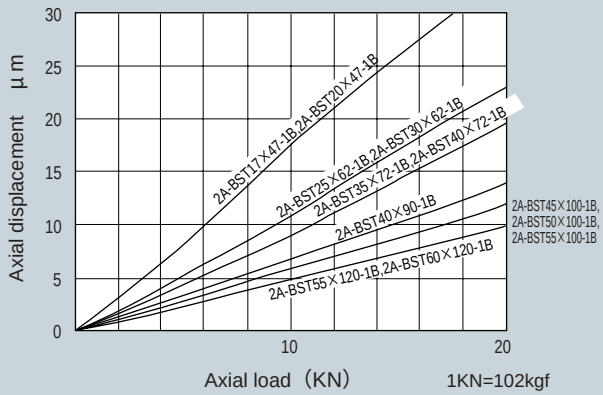


Fig. 13.14 BST type rigidity chart

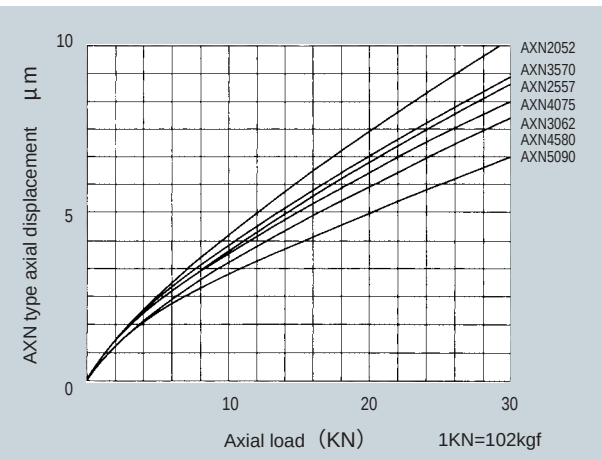


Fig. 13.15 AXN type rigidity chart

⑦ Fit and squareness of shoulders of shaft and housing

Recommended fit for each ball screw support type bearing and tolerance of shaft and housing shoulder squareness are shown in **Figs. 13.13** and **13.14**.

Table 13.13

Type code	Type and fit grade	
	Shaft outside diameter	Housing
BST HT	h5	H6
AXN ARN	j5	J6

Table 13.14 Tolerance of shoulder squareness Unit: μm

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

⑧ Applications

The 2A-BST type bearing is mainly used as the ball screw support bearing to be installed to a ball screw of the machine tool feed system, and two to four rows duplex arrangement is used in many cases. This type is popular because of its easy handling, and greased sealed angular contact ball bearings have been adopted recently. The back-to-back duplex arrangement that allows acquisition of the specified preload by tightening the inner ring is commonly adopted because of its easy assembly. Face-to-face duplex arrangement may be adopted if more precise alignment is required. It is not commonly used for machine tools. Examples of bearing arrangement are shown in **Figs. 13.16** and **13.17**.

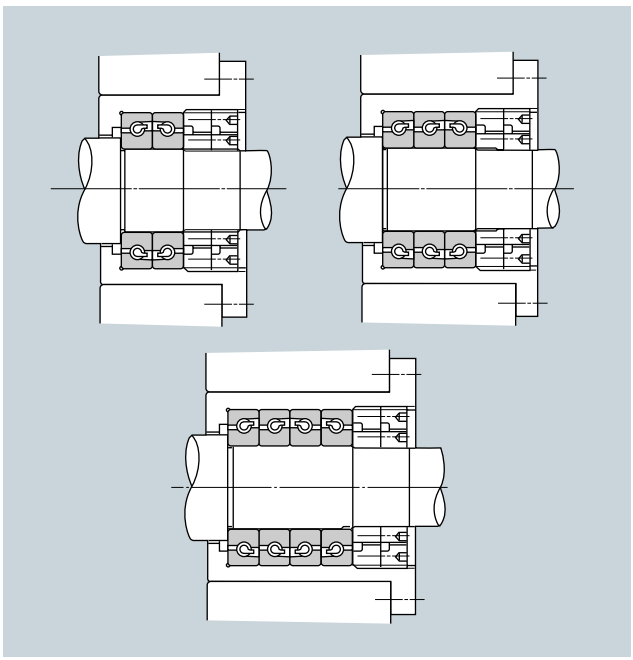


Fig. 13.16

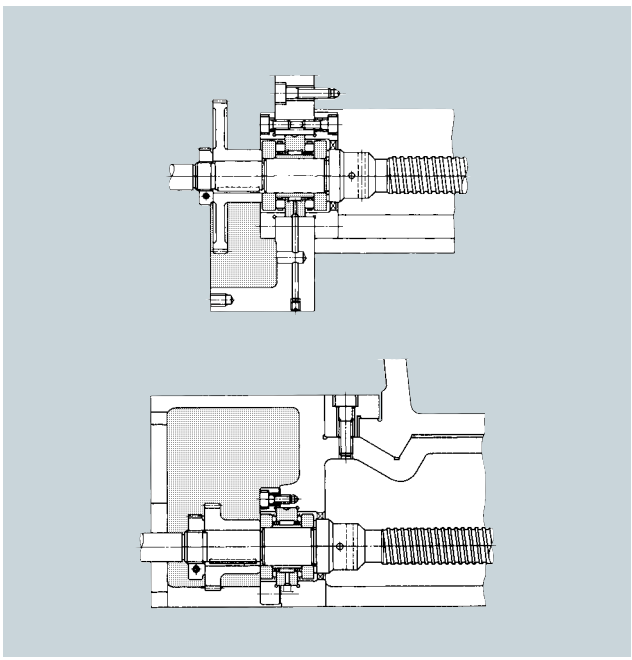


Fig. 13.17

⑨ Starting torque of 2A-BST type

Starting torques (references) of the 2A-BST type are shown in **Tables 13.15** and **13.16**.

Table 13.15 Open type 2A-BST

	Starting torque (reference) N・mm {kgf・cm}			
	DF type DB type	DFT type DBT type	DTFT type DTBT type	DFTT type DBTT type
2A-BST17X47-1B	175 {1.8}	245 {2.5}	355 {3.6}	275 {2.8}
2A-BST20X47-1B	175 {1.8}	245 {2.5}	355 {3.6}	275 {2.8}
2A-BST25X62-1B	305 {3.1}	420 {4.3}	615 {6.3}	470 {4.8}
2A-BST30X62-1B	305 {3.1}	420 {4.3}	615 {6.3}	470 {4.8}
2A-BST35X72-1B	380 {3.9}	510 {5.2}	755 {7.7}	590 {6.0}
2A-BST40X72-1B	380 {3.9}	510 {5.2}	755 {7.7}	590 {6.0}
2A-BST40X90-1B	960 {9.8}	1305 {13.3}	1930 {19.7}	1500 {15.3}
2A-BST45X75-1B	430 {4.4}	580 {5.9}	860 {8.8}	665 {6.8}
2A-BST45X100-1B	1165 {11.9}	1580 {16.1}	2340 {23.9}	1815 {18.5}
2A-BST50X100-1B	1165 {11.9}	1580 {16.1}	2340 {23.9}	1815 {18.5}
2A-BST55X100-1B	1165 {11.9}	1580 {16.1}	2340 {23.9}	1815 {18.5}

Table 13.16 Light-contact sealed type 2A-BST LXL

	Starting torque (reference) N・mm {kgf・cm}			
	DF type DB type	DFT type DBT type	DTFT type DTBT type	DFTT type DBTT type
2A-BST17X47-1BLXL	215 {2.2}	295 {3.0}	420 {4.3}	355 {3.4}
2A-BST20X47-1BLXL	215 {2.2}	295 {3.0}	420 {4.3}	355 {3.4}
2A-BST25X62-1BLXL	365 {3.7}	510 {5.2}	745 {7.6}	570 {5.8}
2A-BST30X62-1BLXL	365 {3.7}	510 {5.2}	745 {7.6}	570 {5.8}
2A-BST35X72-1BLXL	460 {4.7}	610 {6.2}	900 {9.2}	705 {7.28}
2A-BST40X72-1BLXL	460 {4.7}	610 {6.2}	900 {9.2}	705 {7.2}
2A-BST40X90-1BLXL	1155 {11.8}	1570 {16.0}	2315 {23.6}	1805 {18.4}
2A-BST45X75-1BLXL	520 {5.3}	695 {7.1}	1040 {10.6}	805 {8.2}
2A-BST45X100-1BLXL	1400 {14.3}	1890 {19.3}	2815 {28.7}	2175 {22.2}
2A-BST50X100-1BLXL	1400 {14.3}	1890 {19.3}	2815 {28.7}	2175 {22.2}
2A-BST55X100-1BLXL	1400 {14.3}	1890 {19.3}	2815 {28.7}	2175 {22.2}

⑩ Recommended specifications of lubrication

The ball screw support angular contact ball bearing 2A-BST type and HT type are generally lubricated with grease. (2A-BST LXL type with light-contact seal is packed with grease.) The AXN and ARN type bearings are generally lubricated with circulated oil.

■Grease lubrication

- **Recommended brand of grease**
  Lithium-mineral oil base general purpose grease of which base oil viscosity is high (for example, Alvania Grease S2, Showa Shell Sekiyu).

- **Recommended grease filling amount**
  25% of the capacities shown in the dimensions tables

- **Recommended grease filling method**
  Refer to 6. Handling of Bearing, 6-1 (1) Rinsing of bearings and grease filling) in the Technical Data section.

■Oil lubrication

- **Recommended brand of oil**
  Hydraulic oil and oil for industrial and other purposes used for lubrication of sliding surfaces with viscosity grade ISO VG 68 or better is recommended.
- **Oiling quantity**
  Recommended oiling quantity depends on the lubricating methods. As for the circulated oiling, adjust the oiling quantity, referring to the guideline from 5 to 10 cm3/min.