

Main Spindle Bearings

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10. Cylindrical Roller Bearings

In a cylindrical roller bearing, the rollers and raceways are in line contact. Consequently this type of bearing can support a larger radial load than a point-contact ball bearing. Also, its design is suitable for high speed operation.

A cylindrical roller bearing used for the main spindle of a machine tool can have either a double- or single-row configuration, and certain variants have a tapered bore so the radial internal clearance can be adjusted.

10.1 Double-row cylindrical roller bearings

Double-row cylindrical roller bearings are available in two types, NN and NNU, and two series, 30 and 49. The rollers in the NN type bearing are guided by the ribs of the inner ring. The rollers in the NNU type bearing are guided by the ribs of the outer ring. Bearings are available with either a tapered bore (which allows adjustment of radial internal clearance of bearing) or a standard cylindrical bore.

The bearings come in two types, standard type and high speed HS type. Standard cage is machined brass.

The NN30 type bearing, with a bore diameter from 65 to 140 mm, has an optimized internal specification and PEEK resin cage. This allows for high speed and longer life, and is available as a high speed NN30HST6 and as an ultra high speed ULTAGE™ series NN30HSRT6 type.

All of these bearing types can be lubricated with either grease or air-oil.

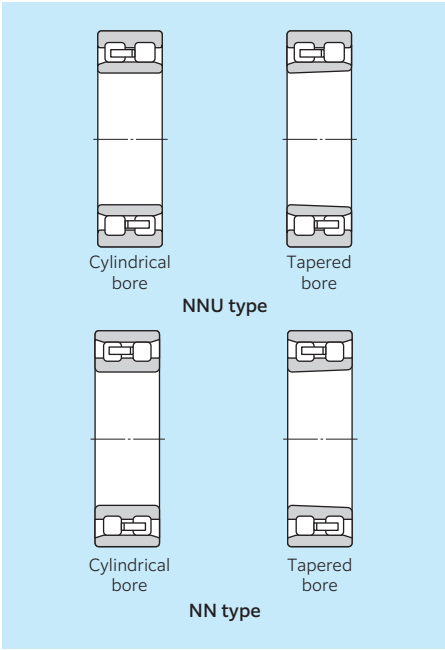


Fig. 10.1

10.2 Single-row cylindrical roller bearings

Single-row cylindrical roller bearings are available in two types, high speed N10HS type and ULTAGE™ series ultra high speed N10HSRT6 type. The N10HS type bearings have high strength machined brass cages, while the N10HSRT6 type bearings have PEEK resin cages, which can be used for both grease lubrication and air-oil lubrication. The ULTAGE™ series eco-friendly ultra high speed N10HSLT6 type is a variation from the ultra high speed N10HSRT6 type bearing and can be used with air-oil lubrication only.

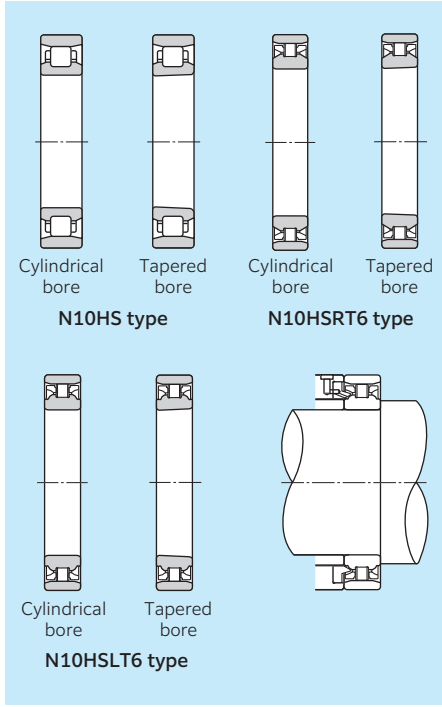


Fig. 10.2

10.3 Bearing designations

NN49, 30, NNU49 types

NN 30 20 HSR T6 K C0NA P4

- **Precision class**
  P5: JIS Class 5 P2: JIS Class 2
  P4: JIS Class 4 UP: Special high precision
- **Internal clearance code**
  See **Table 10.4** through **Table 10.6**
- **External configuration code**
  K: Bore diameter tapered bore, taper ratio 1/12
  No code: Bore diameter cylindrical bore
- **Cage code**
  No code: Machined brass cage
  T6: PEEK resin cage
- **Internal modification code**
  No code: Standard specification
  HS: High speed specification
  HSR: Ultra high speed specification
- **Bore diameter code**
- **Dimension series code**
- **Bearing type code**
  NN: Double-row, inner ring with rib
  NNU: Double-row, outer ring with rib

N10HS, N10HSRT6 types

N 10 20 HSR T6 K C0NA P4

- **Cage code**
  T6: PEEK resin cage (HSR type)
  No code: High strength machined brass cage
- **Internal modification code**
  HS: High speed specification
  HSR: Ultra high speed specification
- **Bearing type code**
  N: Single-row, inner ring with rib

N10HSLT6 type

N 10 20 HSL T6 K C0NA P4 +TKZ

- **Spacer code** (Eco- friendly nozzle)
- **Cage code**
  T6: PEEK resin cage
- **Internal modification code**

(Note) N10HSL: Bearing series code
TKZ: Eco-friendly nozzle, or spacer with nozzle (for N10HSL)

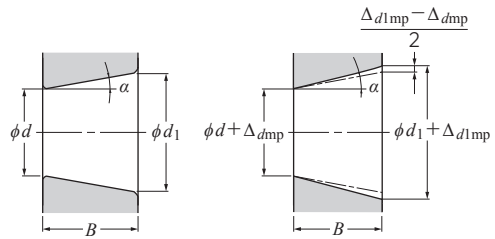
10.4 Accuracy of tapered bore

NTN specifies the accuracies of tapered bores conforming with JIS Classes 4 and 2 as shown in **Table 10.1**. Poor accuracies of the tapered bore lead to misalignment of the inner ring, causing poor performance, premature seizure and spalling. Use of a taper gauge is recommended for higher accuracy of the main spindle. Refer to "6 Handling of Bearings, 6.8 Tapered bore cylindrical roller bearing and main spindle taper angle" in the Technical Data section for more information on taper angle.

Table 10.1 Tolerance of tapered bore bearings Unit: μm

d (mm) over	incl.	Δ_{dmp} Class 4 high	low	Class 2 high	low	$\Delta_{d1mp}-\Delta_{dmp}$ (approx.) Class 4 high	low	Class 2 high	low	V_{dsp} Class 4 max	Class 2 max
18	30	+10	0	+ 6	0	+ 4	0	+3	0	2.5	1.5
30	50	+12	0	+ 7	0	+ 5	0	+3.5	0	2.5	1.5
50	80	+15	0	+ 8	0	+ 6	0	+4	0	3	2
80	120	+20	0	+10	0	+ 7	0	+5	0	4	2.5
120	180	+25	0	+12	0	+ 8	0	+6	0	5	3.5
180	250	+29	0	+14	0	+ 9	0	+7	0	7	4.5
250	315	+32	0	—	—	+10	0	—	—	8	—
315	400	+36	0	—	—	+12	0	—	—	9	—
400	500	+40	0	—	—	+14	0	—	—	10	—

Note: **NTN** standard



Theoretical tapered bore — Tapered bore having single plane mean bore diameter deviation

Tolerance of 1/12 taper angle $4^\circ 46'18.8''\ ^{+24''}_{0}$

$\alpha = 2^\circ 23'9.4''$

$d_1 = d + \frac{1}{12}B$

Δ_{dmp} : Dimensional difference of the mean bore diameter within the flat surface at the theoretical small end of the tapered bore

Δ_{d1mp} : Dimensional difference of the mean bore diameter within the flat surface at the theoretical large end of the tapered bore

V_{dsp} : Variation of bore diameter in a single plane

B : Nominal inner ring width

Fig. 10.3

10.5 Accuracy of cylindrical roller bearings

Table 10.2 Inner rings

Unit: μm

Nominal bore diameter d mm over	incl.	Deviation of mean bore diameter in a single plane Δ_{dmp} Class 5 high	low	Class 4 [1] high	low	Class 2 [1] high	low	Variation of bore diameter in a single plane V_{dsp} Diameter series 9 Class 5	Class 4	Class 2	Diameter series 0 Class 5	Class 4	Class 2	Variation of mean bore diameter V_{dmp} Class 5	Class 4	Class 2	Radial runout of inner ring of assembled bearing K_{ia} Class 5	Class 4	Class 2
								max			max			max			max		
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
250	315	0	−18	—	—	—	—	18	—	—	14	—	—	9	—	—	13	—	—
315	400	0	−23	—	—	—	—	23	—	—	18	—	—	12	—	—	15	—	—
400	500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

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.

Perpendicularity of inner ring face with respect to the bore S_d Class 5	Class 4	Class 2	Deviation of a single inner ring width Δ_{Bs} Single bearing Class 5 high	Class 4 low	Class 2 high	low	Variation of inner ring width V_{Bs} Class 5	Class 4	Class 2
max							max		
8	4	1.5	0	−120	0	−120	5	2.5	1.5
8	4	1.5	0	−120	0	−120	5	3	1.5
8	5	1.5	0	−150	0	−150	6	4	1.5
9	5	2.5	0	−200	0	−200	7	4	2.5
10	6	2.5	0	−250	0	−250	8	5	2.5
10	6	4	0	−250	0	−250	8	5	4
11	7	5	0	−300	0	−300	10	6	5
13	—	—	0	−350	—	—	13	—	—
15	—	—	0	−400	—	—	15	—	—
—	—	—	—	—	—	—	—	—	—

Table 10.3 Outer rings

Unit: μm

Nominal outside diameter D mm over	incl.	Deviation of mean outside diameter in a single plane Δ_{Dmp} Class 5 high	low	Class 4 [2] high	low	Class 2 [2] high	low	Variation of outside diameter in a single plane V_{Dsp} Diameter series 9 Class 5	Class 4	Class 2	Diameter series 0 Class 5	Class 4	Class 2	Variation of mean outside diameter V_{Dmp} Class 5	Class 4	Class 2	Radial runout of outer ring of assembled bearing K_{ea} Class 5	Class 4	Class 2
								max			max			max			max		
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
315	400	0	−20	0	−15	0	−10	20	15	10	15	11	10	10	8	5	20	13	8
400	500	0	−23	—	—	—	—	23	—	—	17	—	—	12	—	—	23	—	—
500	630	0	−28	—	—	—	—	28	—	—	21	—	—	14	—	—	25	—	—
630	800	0	−35	—	—	—	—	35	—	—	26	—	—	18	—	—	30	—	—

2) 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.

Perpendicularity of outer ring outside surface with respect to the face S_D Class 5	Class 4	Class 2	Deviation of a single outer ring width Δ_{Cs} All classes	Variation of outer ring width V_{Cs} Class 5	Class 4	Class 2
max				max		
8	4	1.5	Depends on tolerance of Δ_{Bs} in relation to d of the same bearing	5	2.5	1.5
8	4	1.5		6	3	1.5
9	5	2.5		8	4	2.5
10	5	2.5		8	5	2.5
10	5	2.5		8	5	2.5
11	7	4		10	7	4
13	8	5		11	7	5
13	10	7		13	8	7
15	—	—		15	—	—
18	—	—		18	—	—
20	—	—		20	—	—

10.6 Radial internal clearance of cylindrical roller bearings

■ Non-interchangeable radial internal clearance

Two types of radial internal clearance are available: non-interchangeable radial internal clearance for which the combination of outer ring and inner ring cannot be changed; and interchangeable radial internal clearance that allows for different outer ring and inner ring combinations. The clearances listed are common to both double-row and the single-row cylindrical roller bearings. For machine components including high-precision machine tool main spindle, bearings with non-interchangeable radial internal clearance and a small clearance range are used. If a tapered bore bearing is used and the adjust required internal clearance is close to zero, use of clearance in the range C0NA and C1NA is recommended. Cylindrical bore bearings are also available in the form of a specialized product with non-interchangeable radial internal clearance, in which the internal clearance is further controlled over a small range after assembly. For details, contact **NTN** Engineering.

Table 10.4 Cylindrical bore bearings

Unit: μm

Nominal bore diameter d (mm)		Cylindrical bore bearing					
		C1NA		C2NA		NA [1]	
over	incl.	min	max	min	max	min	max
24	30	5	10	10	25	25	35
30	40	5	12	12	25	25	40
40	50	5	15	15	30	30	45
50	65	5	15	15	35	35	50
65	80	10	20	20	40	40	60
80	100	10	25	25	45	45	70
100	120	10	25	25	50	50	80
120	140	15	30	30	60	60	90
140	160	15	35	35	65	65	100
160	180	15	35	35	75	75	110
180	200	20	40	40	80	80	120
200	225	20	45	45	90	90	135
225	250	25	50	50	100	100	150
250	280	25	55	55	110	110	165
280	315	30	60	60	120	120	180
315	355	30	65	65	135	135	200
355	400	35	75	75	150	150	225
400	450	45	85	85	170	170	255
450	500	50	95	95	190	190	285

1) The code for normal clearance is "NA". Ex: N1006HSNA

Table 10.5 Tapered bore bearings

Unit: μm

Nominal bore diameter d (mm)		Tapered bore bearing [1]					
		C9NA		C0NA		C1NA	
over	incl.	min	max	min	max	min	max
24	30	5	10	10	20	10	25
30	40	5	12	10	20	12	25
40	50	5	15	10	20	15	30
50	65	5	15	10	20	15	35
65	80	10	20	15	30	20	40
80	100	10	25	20	35	25	45
100	120	10	25	20	35	25	50
120	140	15	30	25	40	30	60
140	160	15	35	30	45	35	65
160	180	15	35	30	45	35	75
180	200	20	40	30	50	40	80
200	225	20	45	35	55	45	90
225	250	25	50	40	65	50	100
250	280	25	55	40	65	55	110
280	315	30	60	45	75	60	120
315	355	30	65	45	75	65	135
355	400	35	75	50	90	75	150
400	450	45	85	60	100	85	170
450	500	50	95	70	115	95	190

1) Applies to bearings of JIS Class 5 or higher.

■ Interchangeable radial internal clearance (cylindrical bore)

Table 10.6

Unit: μm

Nominal bore diameter d (mm)		C2		CN (Normal)		C3	
over	incl.	min	max	min	max	min	max
24	30	0	25	20	45	35	60
30	40	5	30	25	50	45	70
40	50	5	35	30	60	50	80
50	65	10	40	40	70	60	90
65	80	10	45	40	75	65	100
80	100	15	50	50	85	75	110
100	120	15	55	50	90	85	125
120	140	15	60	60	105	100	145
140	160	20	70	70	120	115	165
160	180	25	75	75	125	120	170
180	200	35	90	90	145	140	195
200	225	45	105	105	165	160	220
225	250	45	110	110	175	170	235
250	280	55	125	125	195	190	260
280	315	55	130	130	205	200	275
315	355	65	145	145	225	225	305
355	400	100	190	190	280	280	370
400	450	110	210	210	310	310	410
450	500	110	220	220	330	330	440

■ Adjustment of clearance in tapered bore bearings

Mounted internal clearance of a tapered bore bearing can be adjusted by controlling the drive-up of the tapered bore onto the shaft. Two types of adjusting methods area available: repeated adjustment of spacer width and adjustment with using a mounted internal clearance gauge. The clearance gauge is convenient for mass-production. Refer to "6. Handling of Bearings, 6.7 Clearance adjustment for cylindrical roller bearing" in the Technical Data section.

10.7 Recommended fits of high-precision cylindrical roller bearings

In order to maintain the high precision of the bearing at $d_m n$ values less than 0.75×10^6 the fits listed in **Table 10.7** and **Table 10.8** are recommended [$d_m n$: pitch circle diameter across rolling elements (mm) multiplied by speed (min^{-1})].

When the $d_m n$ value is larger than 0.75×10^6 ($d_m n$ value $\geq 0.75 \times 10^6$), consult **NTN** Engineering about the recommended fit. Expansion of the inner ring due to centrifugal force must be considered when determining shaft fit.

Table 10.7 Shaft fits Unit: μm

Nominal bore diameter d (mm) over	incl.	Fit between inner ring and shaft
18	30	0– 4T
30	50	0– 5T
50	80	1T– 6T
80	120	1T– 6T
120	180	2T– 8T
180	250	2T– 8T
250	315	3T–10T
315	400	4T–11T

Note 1: Target the median value.
T: Tight (Interference) fit
Not applicable to tapered bore bearings

Table 10.8 Housing fits Unit: μm

Nominal outside diameter D (mm) over	incl.	Fit between outer ring and housing
30	50	0–3T
50	80	0–4T
80	120	0–4T
120	150	0–5T
150	180	0–5T
180	250	0–6T
250	315	0–7T
315	400	0–8T
400	500	0–9T

Note 1: Target the median value.
T: Tight (Interference) fit

■ Fits of tapered bore bearings

When fitting a tapered bore bearing onto a shaft, carefully and thoroughly adjust the fit of the tapered bore to the shaft to maintain high precision of the bearing.

For details of taper angle adjustment refer to "6. Handling of Bearings, 6.8 Cylindrical roller bearing and main spindle taper angle" in the Technical Data section.

10.8 Recommended lubrication specifications

Cylindrical roller bearings are usually used with grease lubrication or air-oil lubrication. Recommended lubrication specifications are described below.

■ Grease lubrication

- **Recommended brand of grease**
  Refer to "7. Lubrication of Bearings, 7.1 Grease lubrication" in the Technical Data section.

- **Recommended grease fill**
  10 to 15 % of the internal free space shown in the dimension tables
  It is recommended to aim for the lower limit to reduce the running-in operation time.

- **Recommended grease packing method**
  Refer to "6. Handling of Bearings, 6.1 Cleaning and filling with grease" in the Technical Data section.

■ Air-oil lubrication

- **Recommended location of nozzle**
  Refer to "7. Lubrication of Bearings, 7.2 Air-oil lubrication" in the Technical Data section.

- **Recommended specifications of nozzle**
  Nozzle bore diameter.: From 1 to 1.5 mm
  Number of nozzles: One nozzle for each bearing, depth of nozzle bore should be three to six times the nozzle diameter.

- **Recommended specifications of air-oil**
  Oil type: Spindle oil
  Viscosity grade: ISO VG from 10 to 32 (32 is preferable)

Table 10.9 Air and oil amount

Bearing type	$d_m n$ value ($\times 10^6$) Over	Incl.	Oil amount per shot cm^3	Lubrication interval min	Oil consumption cm^3/h	Recommended air consumption NL/min[1)]
NN30	—	1.0	0.02	8	0.15	30 to 40
NN30HS	1.0	1.5		5	0.24	
N10HS N10HSRT6	1.5	2.3		5	0.24	
NN30HST6 NN30HSRT6	—	1.7		15	0.08	
N10HSLT6	—	2.3		10	0.12	20 to 40

1) NL/min (Normal liter/minute) ··· NL means the volume of air at 0 °C and 1 atmosphere.

10.9 ULTAGE Ultra high speed double-row cylindrical roller bearings NN30HSRT6 type

NN30HSRT6 ultra high speed double-row cylindrical roller bearings have higher operating speeds with the same level of rigidity and capacity as the conventional series.

■ Features

1. Optimized internal design to realize high speed and low temperature rise.
2. PEEK resin cage is used for high speed under grease & air-oil lubrication and grease life.

■ Bearing specification

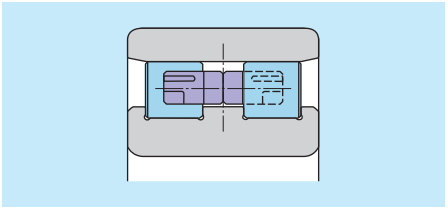
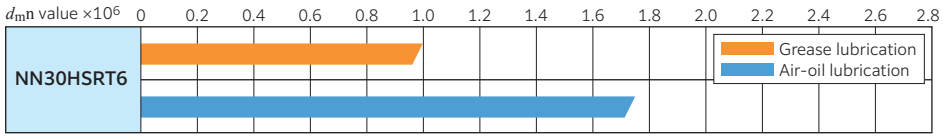


Fig. 10.4 NN30HSRT6 type

■ Permissible speed range



Notes) Permissible speed of each bearing (d_mn value) varies depending on the specifications of the machine for which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline, and then, contact **NTN** Engineering for technical assistance.

■ Cage design

Cage is made of PEEK which is very light and strong (see **Photo 10.1**).

By using a proven cage design made of PEEK material, less deformation of the cage is seen due to centrifugal force. As a result, the high speed operation of the bearing is improved. The grease life of the bearing is improved by including a pocket for grease in the cage.



Photo 10.1 PEEK resin cage

■ Data/Operation test

d_mn value of 1.0 × 10⁶ under grease lubrication and 1.75 × 10⁶ under air-oil lubrication are realized by the optimized internal design (see **Fig. 10.5** and **Fig. 10.6**).

[Test conditions]

Bearing	NN3020HSRT6K NN3020HST6K NN3020HSK (ϕ100×ϕ150×37)
Speed	0 to 8 000 min⁻¹
Mounted radial internal clearance	−5 μm
Lubrication	Grease lubrication
Grease used	MP−1
Jacket cooling	w/

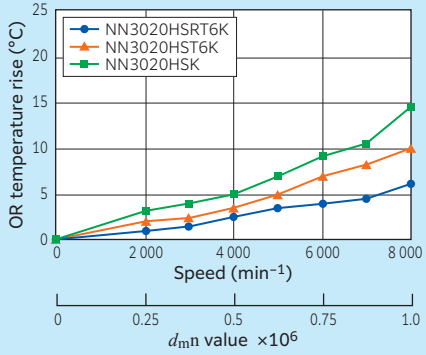


Fig. 10.5 Operation test results (grease lubrication with jacket cooling)

[Test conditions]

Bearing	NN3020HSRT6K NN3020HST6K NN3020HSK (ϕ100×ϕ150×37)
Speed	0 to 15 000 min⁻¹
Mounted radial internal clearance	0 μm
Lubrication	Air- Oil lubrication
Oil	0.02 mL/shot Oil shot interval: 20 min
Air	30 NL/min
Jacket cooling	w/

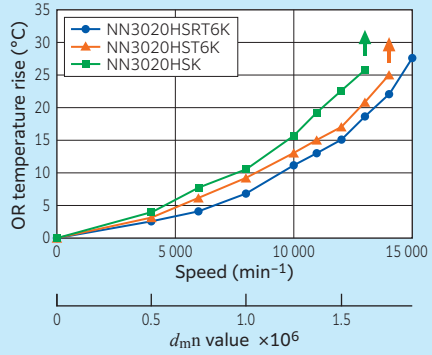
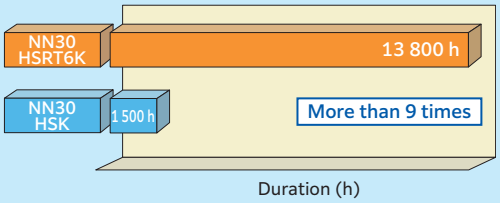


Fig. 10.6 Operation test results (air- oil lubrication with jacket cooling)

■ Data/Durability test

By including a pocket for grease in the cage, the NN30HSRT6K type is capable operating for 13 800 hours under a d_mn value of 1.0 × 10⁶ (see **Fig. 10.7**).



[Test conditions]

Bearing	NN3020HSRT6K NN3020HSK (ϕ100×ϕ150×37)
Speed	8 000 min⁻¹
Mounted radial internal clearance	−5 μm
Lubrication	Grease lubrication
Grease used	MP-1
Jacket cooling	w/

Fig. 10.7 Durability test results

10.10 ULTAGE Ultra high speed single-row cylindrical roller bearings N10HSRT6 type

N10HSRT6 type cylindrical roller bearings have been designed for high speed operation.

■ Features

1. Optimized internal design allows high speed operation and limits temperature rise.
2. PEEK resin cage is suitable for high speed operation.

■ Bearing specification

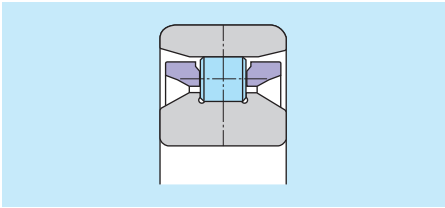
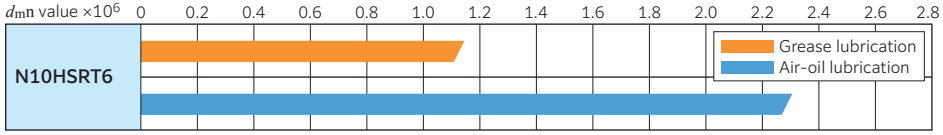


Fig. 10.8 N10HSRT6 type

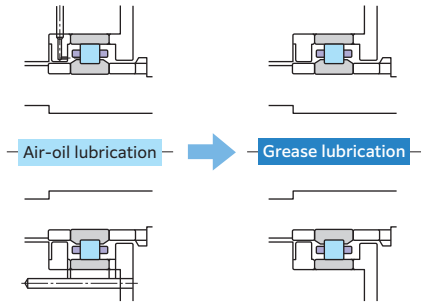
■ Permissible speed range



Notes) Permissible speed of each bearing ($d_m n$ value) varies depending on the specifications of the machine for which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline, and then, contact **NTN** Engineering for technical assistance.

■ Simplified main spindle configuration / adoption of simplified lubrication system

Due to an optimized internal structure, the N10HSR type bearings can reliably run at a higher speed with grease lubrication. The grease lubrication system greatly contributes to reduction in pollution of the surrounding environments by virtually eliminating oil mist (see **Fig. 10.9**).

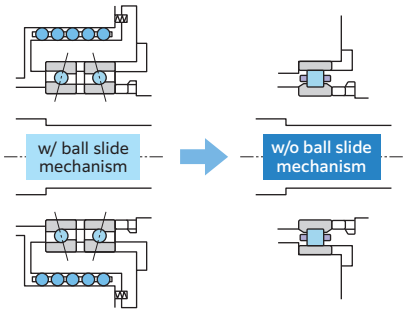


Capable of replacing air-oil lubricated bearings up to $d_m n$ value of 1.15×10^6.

Fig. 10.9 Modification of lubrication system

■ Simplified main spindle configuration / simplified main spindle rear structure

N10HSR (N10HSL) type bearings can replace angular contact ball bearings on the rear side of the main spindle. This arrangement decreases the number of bearing rows (two rows to one row) and eliminates the ball slide mechanism, greatly contributing to simplification of the rear structure (see **Fig. 10.10**).



Capable of replacing angular contact ball bearings up to $d_m n$ value of 2.3×10^6 [air-oil lubrication] or 1.15×10^6 [grease lubrication].

Fig. 10.10 Simplified main spindle rear structure

■ Data/High speed operation test

Due to an optimized internal design, the N10HSR type is capable of high speed operation with $d_m n$ value of 1.15 × 10^6 [grease lubrication] or 2.3 × 10^6 [air-oil lubrication] (see **Fig. 10.11** through **Fig. 10.14**).

[Test conditions]

Bearing	N1011HSRT6 N1011HS (ϕ55×ϕ90×18)
Speed	0 to 16 000 min^{-1}
Mounted radial internal clearance	0 μm
Lubrication	Grease lubrication
Jacket cooling	w/o

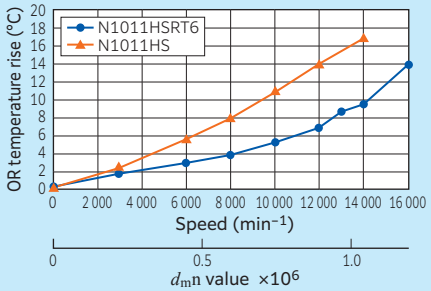


Fig. 10.11 High speed test results (grease lubrication without jacket cooling)

[Test conditions]

Bearing	N1011HSRT6 N1011HS (ϕ55×ϕ90×18)
Speed	0 to 16 000 min^{-1}
Mounted radial internal clearance	0 μm
Lubrication	Grease lubrication
Jacket cooling	w/

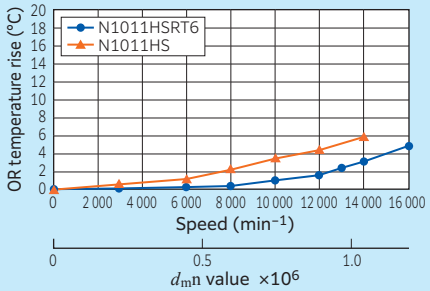


Fig. 10.12 High speed test results (grease lubrication with jacket cooling)

[Test conditions]

Bearing	N1016HSRT6 N1016HS (ϕ80×ϕ125×22)
Speed	6 000 to 22 000 min^{-1}
Mounted radial internal clearance	0 μm
Lubrication	Air-oil lubrication
Oil consumption	0.02 mL/shot (oil shot intervals, 5 min)
Air consumption	40 NL/min
Jacket cooling	w/o

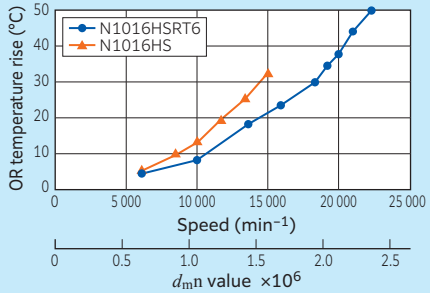


Fig. 10.13 High speed test results (air-oil lubrication without jacket cooling)

[Test conditions]

Bearing	N1016HSRT6 N1016HS (ϕ80×ϕ125×22)
Speed	6 000 to 22 000 min^{-1}
Mounted radial internal clearance	0 μm
Lubrication	Air-oil lubrication
Oil consumption	0.02 mL/shot (oil shot intervals, 5 min)
Air consumption	40 NL/min
Jacket cooling	w/

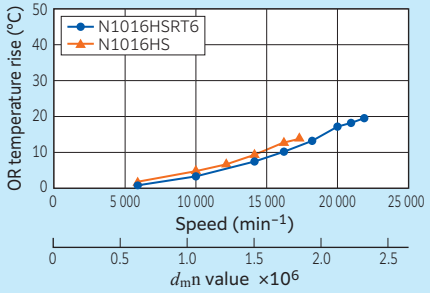


Fig. 10.14 High speed test results (air-oil lubrication with jacket cooling)

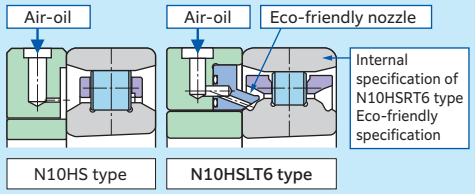
10.11 ULTAGE Eco-friendly air-oil lubricated ultra high speed single-row cylindrical roller bearings N10HSLT6 type

The eco-friendly air-oil lubricated N10HSLT6 type was developed by applying **NTN**'s unique eco-conscious technology to the proven N10HSRT6 type bearing design. The N10HSLT6 type boasts limited emission of oil mist and reduced air and oil consumption. This improves operating environments, saves energy while allowing higher speed machining operation.

■ Features

1. Optimized internal design allows high speed operation and limits temperature rise.
2. Adoption of the eco-friendly nozzle design has led to:
   Lower noise level (up to 7 dBA reduction)
   50 % reduction in air consumption
   50 % reduction in oil consumption.

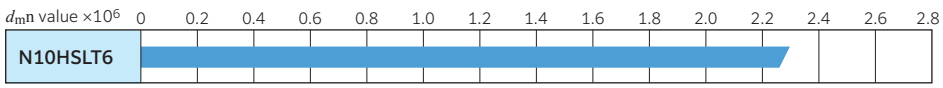
■ Bearing specification



NOTE) The N10HSLT6 type is delivered as packed together with the spacer with the eco-friendly nozzle. The bearing type code N10HSLT6 represents the bearing proper, while a spacer code stands for an eco-friendly nozzle proper or a spacer having a built-in nozzle. For more details, see "10.3 Bearing designations".

Fig. 10.15 N10HSLT6 type

■ Permissible speed range



Notes) Permissible speed of each bearing (d_mn value) varies depending on the specifications of the machine for which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline, and then, contact **NTN** Engineering for technical assistance.

■ Data/High speed operation test

Even with decreased air consumption and oil consumption, the N10HSL type bearings can reliably operate at high speed of d_mn value 2.3 × 10⁶ (see **Fig. 10.16** and **Fig. 10.17**).

[Test conditions]

Bearing	N1016HSLT6 N1016HS (ϕ80×ϕ125×22)	
Speed	6 000 to 22 000 min^{-1}	
Mounted radial internal clearance	0 μm	
Oil consumption	0.02 mL/shot	
	N1016HS	5 min intervals
	N1016HSL	10 min intervals
Air consumption	N1016HS	40 NL/min
	N1016HSL	20 NL/min
Jacket cooling	w/o	

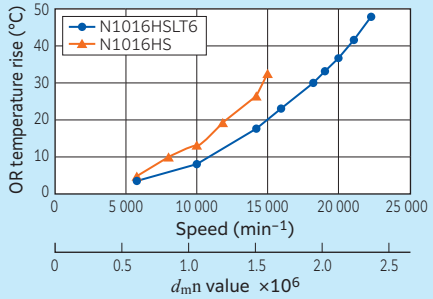


Fig. 10.16 Hgh speed test results (without Jacket cooling)

[Test conditions]

Bearing	N1016HSLT6 N1016HS (ϕ80×ϕ125×22)	
Speed	6 000 to 23 000 min^{-1}	
Mounted radial internal clearance	0 μm	
Oil consumption	0.02 mL/shot	
	N1016HS	5 min intervals
	N1016HSL	10 min intervals
Air consumption	N1016HS	40 NL/min
	N1016HSL	20 NL/min
Jacket cooling	w/	

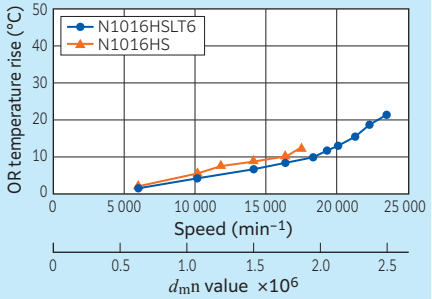
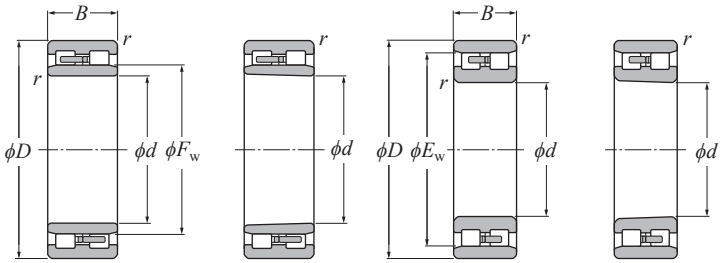


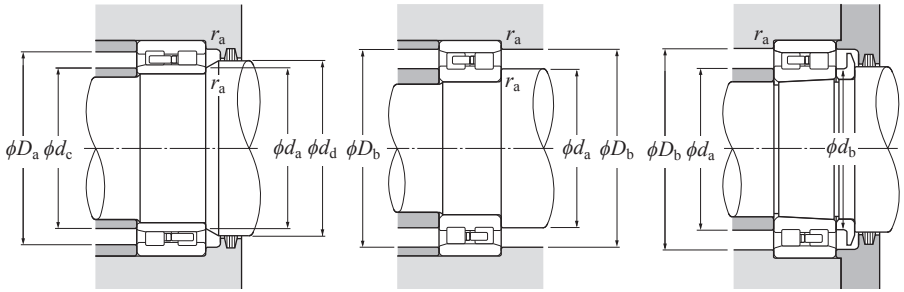
Fig. 10.17 High speed test results (with Jacket cooling)

Dynamic equivalent radial load
$P_r = F_r$

Static equivalent radial load
$P_{0r} = F_r$



NNU Type: Cylindrical bore, Tapered bore
NN Type: Cylindrical bore, Tapered bore



d 25–95 mm

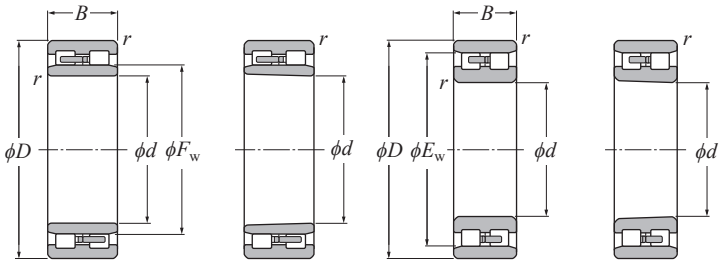
Part number NNU Type cylindrical bore	Part number NNU Type tapered bore [1]	Part number NN Type cylindrical bore	Part number NN Type tapered bore [1]	Boundary dimensions mm d	D	B	$r_{s\,min}$ [2]	Basic load ratings dynamic kN C_r	static kN C_{0r}	dynamic kgf C_r	static kgf C_{0r}	Allowable speed min^{-1} grease lubrication	oil lubrication	Dimensions mm F_w	E_w	Abutment and fillet dimensions mm d_a min	d_b min	d_c max	d_d min	D_a max	D_b max	D_b min	r_{as} max	Mass kg (approx.) NNU Type cylindrical bore	NNU Type tapered bore	NN Type cylindrical bore	NN Type tapered bore	Internal free space cm^3 NN Type
—	—	NN3005	NN3005K	25	47	16	0.6	28.6	30.0	2 910	3 050	19 300	23 400	—	41.3	29	30	—	—	—	43	42	0.6	—	—	0.124	0.121	3.72
—	—	NN3005HS	NN3005HSK	25	47	16	0.6	28.6	30.0	2 910	3 050	22 600	31 100	—	41.3	29	30	—	—	—	43	42	0.6	—	—	0.124	0.121	3.72
—	—	NN3006	NN3006K	30	55	19	1	34.0	37.0	3 500	3 800	16 300	19 800	—	48.5	35	36.5	—	—	—	50	49	1	—	—	0.199	0.193	6.38
—	—	NN3006HS	NN3006HSK	30	55	19	1	34.0	37.0	3 500	3 800	19 100	26 300	—	48.5	35	36.5	—	—	—	50	49	1	—	—	0.199	0.193	6.38
—	—	NN3007	NN3007K	35	62	20	1	42.0	47.5	4 250	4 850	14 300	17 300	—	55	40	41.5	—	—	—	57	56	1	—	—	0.242	0.235	8.09
—	—	NN3007HS	NN3007HSK	35	62	20	1	42.0	47.5	4 250	4 850	16 700	23 100	—	55	40	41.5	—	—	—	57	56	1	—	—	0.242	0.235	8.09
—	—	NN3008	NN3008K	40	68	21	1	48.0	55.5	4 900	5 650	12 800	15 600	—	61	45	47	—	—	—	63	62	1	—	—	0.312	0.303	9.68
—	—	NN3008HS	NN3008HSK	40	68	21	1	48.0	55.5	4 900	5 650	15 000	20 700	—	61	45	47	—	—	—	63	62	1	—	—	0.312	0.303	9.68
—	—	NN3009	NN3009K	45	75	23	1	57.5	68.5	5 850	7 000	11 600	14 000	—	67.5	50	52	—	—	—	70	69	1	—	—	0.405	0.393	13.3
—	—	NN3009HS	NN3009HSK	45	75	23	1	57.5	68.5	5 850	7 000	13 600	18 700	—	67.5	50	52	—	—	—	70	69	1	—	—	0.405	0.393	13.3
—	—	NN3010	NN3010K	50	80	23	1	59.0	72.5	6 000	7 400	10 700	13 000	—	72.5	55	57	—	—	—	75	74	1	—	—	0.433	0.419	14.6
—	—	NN3010HS	NN3010HSK	50	80	23	1	59.0	72.5	6 000	7 400	12 500	17 300	—	72.5	55	57	—	—	—	75	74	1	—	—	0.433	0.419	14.6
—	—	NN3011	NN3011K	55	90	26	1.1	77.0	96.5	7 850	9 850	9 600	11 600	—	81	61.5	63.5	—	—	—	83.5	82	1	—	—	0.651	0.631	20.5
—	—	NN3011HS	NN3011HSK	55	90	26	1.1	77.0	96.5	7 850	9 850	11 200	15 500	—	81	61.5	63.5	—	—	—	83.5	82	1	—	—	0.651	0.631	20.5
—	—	NN3012	NN3012K	60	95	26	1.1	78.5	102	8 050	10 400	9 000	10 900	—	86.1	66.5	68.5	—	—	—	88.5	87	1	—	—	0.704	0.683	21.1
—	—	NN3012HS	NN3012HSK	60	95	26	1.1	78.5	102	8 050	10 400	10 500	14 500	—	86.1	66.5	68.5	—	—	—	88.5	87	1	—	—	0.704	0.683	21.1
—	—	NN3013	NN3013K	65	100	26	1.1	83.0	111	8 450	11 400	8 400	10 200	—	91	71.5	73.5	—	—	—	93.5	92	1	—	—	0.76	0.74	22.2
—	—	NN3013HST6	NN3013HST6K	65	100	26	1.1	80.5	107	8 200	10 900	9 900	13 600	—	91	71.5	73.5	—	—	—	93.5	92	1	—	—	0.69	0.66	21.4
—	—	NN3013HSRT6	NN3013HSRT6K	65	100	26	1.1	80.5	107	8 200	10 900	12 100	21 200	—	91	71.5	73.5	—	—	—	93.5	92	1	—	—	0.69	0.66	21.4
—	—	NN3014	NN3014K	70	110	30	1.1	105	143	10 700	14 600	7 700	9 300	—	100	76.5	79	—	—	—	103.5	101	1	—	—	1.04	1.01	33.0
—	—	NN3014HST6	NN3014HST6K	70	110	30	1.1	102	137	10 400	14 000	9 000	12 400	—	100	76.5	79	—	—	—	103.5	101	1	—	—	0.99	0.96	30.4
—	—	NN3014HSRT6	NN3014HSRT6K	70	110	30	1.1	102	137	10 400	14 000	11 000	19 300	—	100	76.5	79	—	—	—	103.5	101	1	—	—	0.99	0.96	30.4
—	—	NN3015	NN3015K	75	115	30	1.1	107	149	10 900	15 200	7 300	8 900	—	105	81.5	84	—	—	—	108.5	106	1	—	—	1.14	1.11	35.0
—	—	NN3015HST6	NN3015HST6K	75	115	30	1.1	107	149	10 900	15 200	8 500	11 800	—	105	81.5	84	—	—	—	108.5	106	1	—	—	1.05	1.02	31.2
—	—	NN3015HSRT6	NN3015HSRT6K	75	115	30	1.1	107	149	10 900	15 200	10 400	18 300	—	105	81.5	84	—	—	—	108.5	106	1	—	—	1.05	1.02	31.2
—	—	NN3016	NN3016K	80	125	34	1.1	128	179	13 100	18 200	6 800	8 300	—	113	86.5	89.5	—	—	—	118.5	114	1	—	—	1.52	1.47	45.0
—	—	NN3016HST6	NN3016HST6K	80	125	34	1.1	125	172	12 700	17 500	8 000	11 000	—	113	86.5	89.5	—	—	—	118.5	114	1	—	—	1.43	1.38	43.0
—	—	NN3016HSRT6	NN3016HSRT6K	80	125	34	1.1	125	172	12 700	17 500	9 700	17 100	—	113	86.5	89.5	—	—	—	118.5	114	1	—	—	1.43	1.38	43.0
—	—	NN3017	NN3017K	85	130	34	1.1	135	194	13 800	19 800	6 500	7 900	—	118	91.5	94.5	—	—	—	123.5	119	1	—	—	1.61	1.56	48.8
—	—	NN3017HST6	NN3017HST6K	85	130	34	1.1	131	187	13 400	19 100	7 600	10 500	—	118	91.5	94.5	—	—	—	123.5	119	1	—	—	1.51	1.46	44.4
—	—	NN3017HSRT6	NN3017HSRT6K	85	130	34	1.1	131	187	13 400	19 100	9 300	16 300	—	118	91.5	94.5	—	—	—	123.5	119	1	—	—	1.51	1.46	44.4
—	—	NN3018	NN3018K	90	140	37	1.5	158	228	16 200	23 200	6 000	7 300	—	127	98	101	—	—	—	132	129	1.5	—	—	2.07	2.01	64.1
—	—	NN3018HST6	NN3018HST6K	90	140	37	1.5	158	228	16 200	23 200	7 100	9 700	—	127	98	101	—	—	—	132	129	1.5	—	—	1.97	1.91	57.6
—	—	NN3018HSRT6	NN3018HSRT6K	90	140	37	1.5	158	228	16 200	23 200	8 600	15 200	—	127	98	101	—	—	—	132	129	1.5	—	—	1.97	1.91	57.6
—	—	NN3019	NN3019K	95	145	37	1.5	162	238	16 500	24 200	5 800	7 000	—	132	103	106	—	—	—	137	134	1.5	—	—	2.17	2.10	67.0

1) A bearing number with suffix **K** indicates a tapered bore bearing (taper ratio 1/12). 2) Minimum allowable value for corner radius dimension *r*.

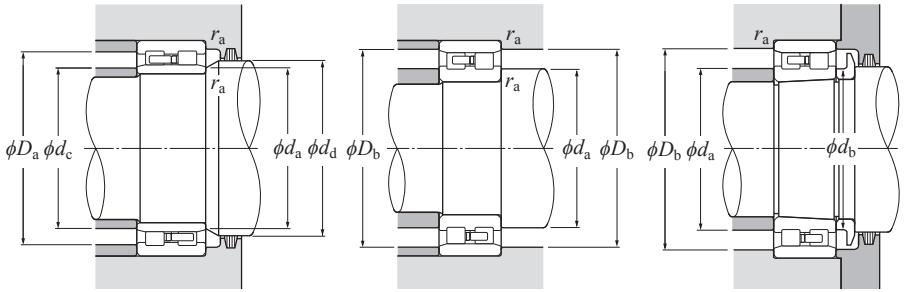
Remarks: A part number containing a suffix **HSRT6** means an **ULTAGE™ series**.

Dynamic equivalent radial load
$P_r = F_r$

Static equivalent radial load
$P_{0r} = F_r$



NNU Type: Cylindrical bore, Tapered bore
NN Type: Cylindrical bore, Tapered bore



d 100–180 mm

Part number: NNU Type cylindrical bore	NNU Type tapered bore [1]	NN Type cylindrical bore	NN Type tapered bore [1]	Boundary dimensions mm: *d*	*D*	*B*	$r_{s\,min}$ [2]	Basic load ratings dynamic kN: C_r	static kN: C_{0r}	dynamic kgf: C_r	static kgf: C_{0r}	Allowable speed min^{-1}: grease lubrication	oil lubrication	Dimensions mm: F_w	E_w	Abutment and fillet dimensions mm: d_a min	d_b min	d_c max	d_d min	D_a max	D_b max	D_b min	r_{as} max	Mass kg (approx.): NNU Type cylindrical bore	NNU Type tapered bore	NN Type cylindrical bore	NN Type tapered bore	Internal free space cm^3: NN Type
NNU4920	**NNU4920K**	**NN4920**	**NN4920K**	100	140	40	1.1	145	260	14 800	26 500	6 000	7 200	113	129	106.5	110	111	115	133.5	133.5	131	1	1.83	1.75	1.75	1.67	49.8
—	—	**NN3020**	**NN3020K**	100	150	37	1.5	170	256	17 300	26 100	5 600	6 700	—	137	108	111	—	—	—	142	139	1.5	—	—	2.26	2.19	67.5
—	—	**NN3020HST6**	**NN3020HST6K**	100	150	37	1.5	165	247	16 900	25 200	6 500	9 000	—	137	108	111	—	—	—	142	139	1.5	—	—	2.14	2.07	61.6
—	—	**NN3020HSRT6**	**NN3020HSRT6K**	100	150	37	1.5	165	247	16 900	25 200	8 000	14 000	—	137	108	111	—	—	—	142	139	1.5	—	—	2.14	2.07	61.6
NNU4921	**NNU4921K**	**NN4921**	**NN4921K**	105	145	40	1.1	147	268	15 000	27 400	5 700	6 900	118	134	111.5	115	116	120	138.5	138.5	136	1	1.91	1.82	1.82	1.73	50.2
—	—	**NN3021**	**NN3021K**	105	160	41	2	220	320	22 400	33 000	5 300	6 400	—	146	114	117	—	—	—	151	148	2	—	—	2.89	2.80	91.9
—	—	**NN3021HST6**	**NN3021HST6K**	105	160	41	2	220	320	22 400	33 000	6 200	8 500	—	146	114	117	—	—	—	151	148	2	—	—	2.75	2.66	82.7
—	—	**NN3021HSRT6**	**NN3021HSRT6K**	105	160	41	2	220	320	22 400	33 000	7 100	11 300	—	146	114	117	—	—	—	151	148	2	—	—	2.75	2.66	82.7
NNU4922	**NNU4922K**	**NN4922**	**NN4922K**	110	150	40	1.1	152	284	15 500	28 900	5 500	6 600	123	139	116.5	120	121	125	143.5	143.5	141	1	1.99	1.90	1.90	1.81	53.9
—	—	**NN3022**	**NN3022K**	110	170	45	2	254	375	25 900	38 000	5 000	6 000	—	155	119	123	—	—	—	161	157	2	—	—	3.69	3.56	115
—	—	**NN3022HST6**	**NN3022HST6K**	110	170	45	2	254	375	25 900	38 000	5 800	8 000	—	155	119	123	—	—	—	161	157	2	—	—	3.50	3.37	103
—	—	**NN3022HSRT6**	**NN3022HSRT6K**	110	170	45	2	254	375	25 900	38 000	6 700	10 600	—	155	119	123	—	—	—	161	157	2	—	—	3.50	3.37	103
NNU4924	**NNU4924K**	**NN4924**	**NN4924K**	120	165	45	1.1	203	360	20 700	37 000	5 000	6 000	134.5	154.5	126.5	130	133	137	158.5	158.5	156.5	1	2.75	2.62	2.63	2.51	82.5
—	—	**NN3024**	**NN3024K**	120	180	46	2	258	390	26 300	40 000	4 600	5 600	—	165	129	133	—	—	—	171	167	2	—	—	3.98	3.83	130
—	—	**NN3024HST6**	**NN3024HST6K**	120	180	46	2	251	380	25 600	38 500	5 400	7 500	—	165	129	133	—	—	—	171	167	2	—	—	3.76	3.61	117
—	—	**NN3024HSRT6**	**NN3024HSRT6K**	120	180	46	2	251	380	25 600	38 500	6 200	9 900	—	165	129	133	—	—	—	171	167	2	—	—	3.76	3.61	117
NNU4926	**NNU4926K**	**NN4926**	**NN4926K**	130	180	50	1.5	244	440	24 900	45 000	4 600	5 500	146	168	138	142	144	148	172	172	170	1.5	3.69	3.52	3.52	3.35	112
—	—	**NN3026**	**NN3026K**	130	200	52	2	315	475	32 000	48 500	4 200	5 100	—	182	139	143	—	—	—	191	183	2	—	—	5.92	5.71	182
—	—	**NN3026HST6**	**NN3026HST6K**	130	200	52	2	315	475	32 000	48 500	4 900	6 800	—	182	139	143	—	—	—	191	183	2	—	—	5.55	5.34	164
—	—	**NN3026HSRT6**	**NN3026HSRT6K**	130	200	52	2	315	475	32 000	48 500	5 700	9 000	—	182	139	143	—	—	—	191	183	2	—	—	5.55	5.34	164
NNU4928	**NNU4928K**	**NN4928**	**NN4928K**	140	190	50	1.5	251	470	25 600	48 000	4 300	5 200	156	178	148	152	154	158	182	182	180	1.5	3.94	3.76	3.76	3.58	117
—	—	**NN3028**	**NN3028K**	140	210	53	2	330	515	33 500	52 500	4 000	4 800	—	192	149	153	—	—	—	201	194	2	—	—	6.44	6.21	199
—	—	**NN3028HST6**	**NN3028HST6K**	140	210	53	2	330	515	33 500	52 500	4 700	6 400	—	192	149	153	—	—	—	201	194	2	—	—	6.11	5.91	176
—	—	**NN3028HSRT6**	**NN3028HSRT6K**	140	210	53	2	330	515	33 500	52 500	5 400	8 500	—	192	149	153	—	—	—	201	194	2	—	—	6.11	5.91	176
NNU4930	**NNU4930K**	**NN4930**	**NN4930K**	150	210	60	2	380	690	39 000	70 500	3 900	4 800	168.5	196.5	159	164	166	171	201	201	198.5	2	6.18	5.90	5.90	5.62	192
—	—	**NN3030**	**NN3030K**	150	225	56	2.1	370	585	38 000	60 000	3 700	4 500	—	206	161	166	—	—	—	214	208	2	—	—	7.81	7.53	237
—	—	**NN3030HS**	**NN3030HSK**	150	225	56	2.1	370	585	38 000	60 000	4 300	6 000	—	206	161	166	—	—	—	214	208	2	—	—	7.81	7.53	237
NNU4932	**NNU4932K**	**NN4932**	**NN4932K**	160	220	60	2	395	740	40 500	75 500	3 700	4 500	178.5	206.5	169	174	176	182	211	211	208.5	2	6.53	6.23	6.24	5.94	199
—	—	**NN3032**	**NN3032K**	160	240	60	2.1	415	660	42 000	67 500	3 500	4 200	—	219	171	176	—	—	—	229	221	2	—	—	8.92	8.59	287
—	—	**NN3032HS**	**NN3032HSK**	160	240	60	2.1	415	660	42 000	67 500	4 100	5 600	—	219	171	176	—	—	—	229	221	2	—	—	8.92	8.59	287
NNU4934	**NNU4934K**	**NN4934**	**NN4934K**	170	230	60	2	400	765	41 000	78 000	3 600	4 300	188.5	216.5	179	184	186	192	221	221	218.5	2	6.87	6.55	6.56	6.24	212
—	—	**NN3034**	**NN3034K**	170	260	67	2.1	490	775	49 500	79 000	3 200	3 900	—	236	181	187	—	—	—	249	238	2	—	—	12.6	12.2	379
NNU4936	**NNU4936K**	**NN4936**	**NN4936K**	180	250	69	2	510	965	52 000	98 500	3 200	3 800	202	234	189	195	199	205	241	241	236	2	9.90	9.46	9.45	9.01	299
—	—	**NN3036**	**NN3036K**	180	280	74	2.1	630	995	64 000	102 000	3 000	3 600	—	255	191	197	—	—	—	269	257	2	—	—	16.6	16.0	478

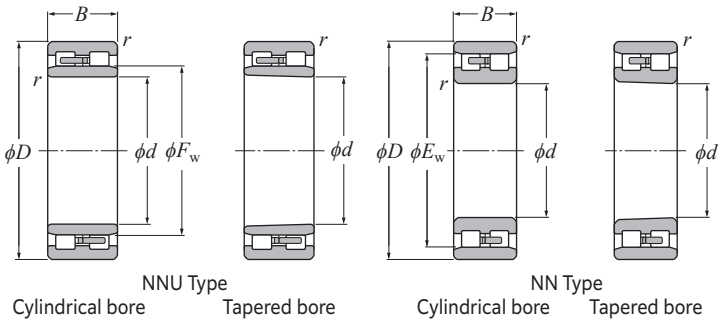
1) A bearing number with suffix **K** indicates a tapered bore bearing (taper ratio 1/12).
2) Minimum allowable value for corner radius dimension *r*.

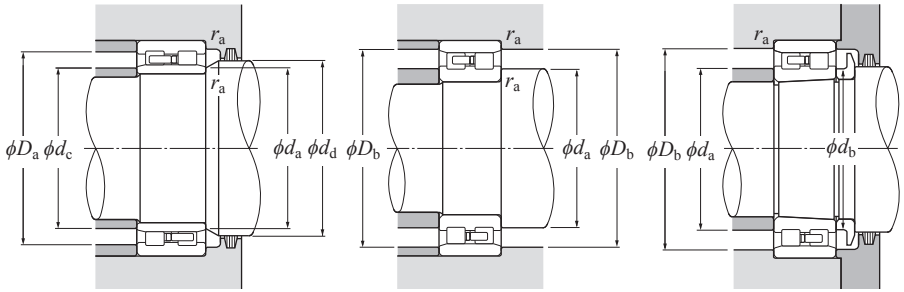
Remarks: A part number containing a suffix **HSRT6** means an **ULTAGE™ series**.

Double-row cylindrical roller bearings

Dynamic equivalent radial load
$P_r = F_r$

Static equivalent radial load
$P_{0r} = F_r$





d 190–500 mm

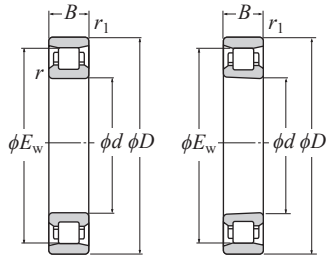
Part number NNU Type cylindrical bore	Part number NNU Type tapered bore [1]	Part number NN Type cylindrical bore	Part number NN Type tapered bore [1]	Boundary dimensions mm *d*	*D*	*B*	$r_{s\,min}$ [2]	Basic load ratings dynamic kN C_r	static kN C_{0r}	dynamic kgf C_r	static kgf C_{0r}	Allowable speed min^{-1} grease lubrication	oil lubrication	Dimensions mm F_w	E_w	Abutment and fillet dimensions mm d_a min	d_b min	d_c max	d_d min	D_a max	D_b max	D_b min	r_{as} max	Mass kg (approx.) NNU Type cylindrical bore	NNU Type tapered bore	NN Type cylindrical bore	NN Type tapered bore	Internal free space cm^3 NN Type
NNU4938	NNU4938K	NN4938	NN4938K	190	260	69	2	525	1 030	53 500	105 000	3 000	3 600	212	244	199	205	209	215	251	251	246	2	10.4	9.94	9.93	9.47	303
—	—	NN3038	NN3038K	190	290	75	2.1	640	1 040	65 500	106 000	2 800	3 300	—	265	201	207	—	—	—	279	267	2	—	—	18.0	17.4	504
NNU4940	NNU4940K	NN4940	NN4940K	200	280	80	2.1	615	1 180	63 000	120 000	2 900	3 500	225	261	211	218	222	228	269	269	264	2	14.7	14.0	14.0	13.3	437
—	—	NN3040	NN3040K	200	310	82	2.1	725	1 170	74 000	119 000	2 600	3 100	—	282	211	218	—	—	—	299	285	2	—	—	21.6	20.8	649
NNU4944	NNU4944K	NN4944	NN4944K	220	300	80	2.1	650	1 300	66 000	132 000	2 600	3 100	245	281	231	238	242	248	289	289	284	2	15.9	15.2	15.2	14.5	485
—	—	NN3044	NN3044K	220	340	90	3	905	1 480	92 000	151 000	2 300	2 800	—	310	233	240	—	—	—	327	313	2.5	—	—	29.3	28.2	877
NNU4948	NNU4948K	NN4948	NN4948K	240	320	80	2.1	680	1 410	69 500	144 000	2 300	2 800	265	301	251	258	262	269	309	309	304	2	17.2	16.4	16.4	15.6	518
—	—	NN3048	NN3048K	240	360	92	3	945	1 600	96 500	163 000	2 200	2 600	—	330	253	261	—	—	—	347	333	2.5	—	—	32.8	31.6	973
NNU4952	NNU4952K	NN4952	NN4952K	260	360	100	2.1	1 000	2 070	102 000	211 000	2 200	2 600	292	336	271	279	288	296	349	349	339	2	29.6	28.3	28.3	27.0	850
—	—	NN3052	NN3052K	260	400	104	4	1 180	1 990	120 000	203 000	2 100	2 500	—	364	276	285	—	—	—	384	367	3	—	—	47.4	45.8	1 370
NNU4956	NNU4956K	NN4956	NN4956K	280	380	100	2.1	1 030	2 200	105 000	224 000	1 900	2 300	312	356	291	299	308	316	369	369	359	2	31.6	30.2	30.2	28.8	897
—	—	NN3056	NN3056K	280	420	106	4	1 200	2 080	122 000	212 000	1 800	2 100	—	384	296	305	—	—	—	404	387	3	—	—	51.1	49.3	1 500
NNU4960	NNU4960K	NN4960	NN4960K	300	420	118	3	1 330	2 800	136 000	285 000	1 800	2 100	339	391	313	323	335	343	407	407	394	2.5	48.6	46.4	46.4	44.2	1 360
—	—	NN3060	NN3060K	300	460	118	4	1 470	2 560	150 000	261 000	1 600	2 000	—	418	316	326	—	—	—	444	421	3	—	—	70.8	68.6	2 000
NNU4964	NNU4964K	NN4964	NN4964K	320	440	118	3	1 370	2 970	140 000	305 000	1 600	2 000	359	411	333	343	355	363	427	427	414	2.5	51.4	49.1	49.0	46.7	1 450
—	—	NN3064	NN3064K	320	480	121	4	1 500	2 670	153 000	272 000	1 500	1 800	—	438	336	346	—	—	—	464	441	3	—	—	76.2	73.5	2 200
NNU4968	NNU4968K	—	—	340	460	118	3	1 410	3 150	144 000	320 000	1 500	1 800	379	—	353	363	375	383	447	—	—	2.5	54.2	51.7	—	—	—
—	—	NN3068	NN3068K	340	520	133	5	1 800	3 200	183 000	325 000	1 500	1 800	—	473	360	371	—	—	—	500	477	4	—	—	102	98.5	2 950
NNU4972	NNU4972K	—	—	360	480	118	3	1 430	3 250	146 000	330 000	1 500	1 800	398	—	373	383	394	402	467	—	—	2.5	57.0	54.4	—	—	—
—	—	NN3072	NN3072K	360	540	134	5	1 830	3 300	187 000	340 000	1 400	1 600	—	493	380	391	—	—	—	520	497	4	—	—	107	103	3 600
NNU4976	NNU4976K	—	—	380	520	140	4	1 810	4 050	185 000	415 000	1 400	1 600	425	—	396	408	420	430	504	—	—	3	84.5	80.6	—	—	—
—	—	NN3076	NN3076K	380	560	135	5	1 870	3 450	191 000	355 000	1 300	1 500	—	512	400	411	—	—	—	540	516	4	—	—	113	109	3 340
NNU4980	NNU4980K	—	—	400	540	140	4	1 870	4 300	191 000	435 000	1 300	1 500	445	—	416	428	440	450	524	—	—	3	88.2	84.1	—	—	—
—	—	NN3080	NN3080K	400	600	148	5	2 260	4 150	230 000	420 000	1 200	1 400	—	547	420	432	—	—	—	580	551	4	—	—	146	141	4 230
NNU4984	NNU4984K	—	—	420	560	140	4	1 930	4 500	197 000	460 000	1 200	1 500	465	—	436	448	460	470	544	—	—	3	92.0	87.7	—	—	—
—	—	NN3084	NN3084K	420	620	150	5	2 300	4 300	235 000	440 000	1 100	1 400	—	567	440	452	—	—	—	600	571	4	—	—	154	148	4 520
NNU4988	NNU4988K	—	—	440	600	160	4	2 380	5 550	243 000	565 000	1 100	1 400	492	—	456	469	487	497	584	—	—	3	127	121	—	—	—
—	—	NN3088	NN3088K	440	650	157	6	2 680	5 100	274 000	520 000	1 100	1 300	—	596	464	477	—	—	—	626	601	5	—	—	178	172	5 000
NNU4992	NNU4992K	—	—	460	620	160	4	2 460	5 850	251 000	595 000	1 100	1 300	512	—	476	489	507	517	604	—	—	3	132	126	—	—	—
—	—	NN3092	NN3092K	460	680	163	6	2 830	5 350	288 000	545 000	1 000	1 200	—	622	484	498	—	—	—	656	627	5	—	—	202	195	6 030
NNU4996	NNU4996K	—	—	480	650	170	5	2 530	5 900	258 000	600 000	1 000	1 200	534	—	500	514	531	541	630	—	—	4	156	149	—	—	—
NNU49/500	NNU49/500K	—	—	500	670	170	5	2 670	6 400	272 000	650 000	1 000	1 200	556	—	520	534	551	561	650	—	—	4	162	155	—	—	—

1) A bearing number with suffix **K** indicates a tapered bore bearing (taper ratio 1/12).
2) Minimum allowable value for corner radius dimension *r*.

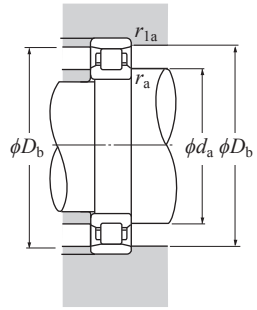
Cylindrical Roller Bearings Dimension Tables
NTN

Main Spindle Bearings

High speed single-row cylindrical roller bearings



Cylindrical bore Tapered bore



Dynamic equivalent radial load
$P_r = F_r$

Static equivalent radial load
$P_{0r} = F_r$

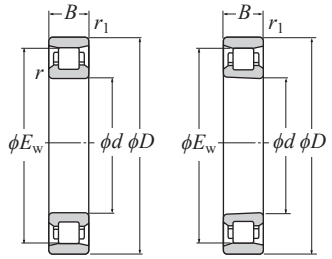
d 30–80 mm

Part number [1) 3)]		Boundary dimensions mm						Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable speed min^{-1}		Abutment and fillet dimensions mm					Mass (approx.) kg	Internal free space cm^3	Part number [1) 3)]	
cylindrical bore	tapered bore	d	D	B	$r_{s\,min}$ [2)]	$r_{1s\,min}$ [2)]	E_w	C_r	C_{0r}	C_r	C_{0r}	grease lubrication	oil lubrication	d_a min	D_b max	D_b min	r_{as} max	r_{1as} max	cylindrical bore		cylindrical bore	tapered bore
N1006HS	**N1006HSK**	30	55	13	1	0.6	48.5	19.1	17.6	1 950	1 790	20 500	32 100	35	50	49	1	0.6	0.143	4.33	**N1006HS**	**N1006HSK**
N1007HS	**N1007HSK**	35	62	14	1	0.6	55	23.5	22.5	2 390	2 300	18 000	28 200	40	57	56	1	0.6	0.190	5.06	**N1007HS**	**N1007HSK**
N1008HS	**N1008HSK**	40	68	15	1	0.6	61	26.9	26.3	2 750	2 680	16 100	25 300	45	63	62	1	0.6	0.235	7.10	**N1008HS**	**N1008HSK**
N1009HS	**N1009HSK**	45	75	16	1	0.6	67.5	32.5	32.5	3 300	3 350	14 500	22 800	50	70	69	1	0.6	0.298	8.85	**N1009HS**	**N1009HSK**
N1010HS	**N1010HSK**	50	80	16	1	0.6	72.5	33.0	34.5	3 400	3 550	13 400	21 100	55	75	74	1	0.6	0.323	10.8	**N1010HS**	**N1010HSK**
N1011HS	**N1011HSK**	55	90	18	1.1	1	81	43.5	46.0	4 400	4 700	12 100	18 900	61.5	83.5	82	1	1	0.473	15.0	**N1011HS**	**N1011HSK**
N1012HS	**N1012HSK**	60	95	18	1.1	1	86.1	44.5	48.5	4 550	4 950	11 300	17 700	66.5	88.5	87	1	1	0.505	15.3	**N1012HS**	**N1012HSK**
N1013HS	**N1013HSK**	65	100	18	1.1	1	91	47.0	53.5	4 800	5 450	10 600	16 600	71.5	93.5	92	1	1	0.538	19.0	**N1013HS**	**N1013HSK**
N1014HS	**N1014HSK**	70	110	20	1.1	1	100	57.5	65.5	5 850	6 700	9 700	15 200	76.5	103.5	101	1	1	0.745	22.0	**N1014HS**	**N1014HSK**
N1015HS	**N1015HSK**	75	115	20	1.1	1	105	59.0	69.0	6 000	7 050	9 200	14 400	81.5	108.5	106	1	1	0.787	26.5	**N1015HS**	**N1015HSK**
N1016HS	**N1016HSK**	80	125	22	1.1	1	113	70.5	82.0	7 200	8 400	8 500	13 400	86.5	118.5	114	1	1	1.05	31.1	**N1016HS**	**N1016HSK**

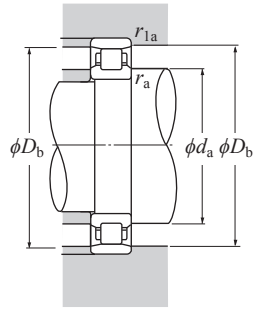
1) A bearing number with suffix **K** indicates a tapered bore bearing (taper ratio 1/12).
2) Minimum allowable value for corner radius dimension r or r_1.
3) **N10HS** differs from standard **N10** in internal construction.

Main Spindle Bearings

High speed single-row cylindrical roller bearings



Cylindrical bore　　Tapered bore



Dynamic equivalent radial load
$P_r = F_r$

Static equivalent radial load
$P_{0r} = F_r$

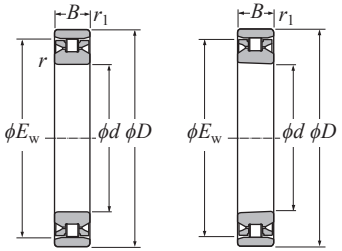
d 85–160 mm

Part number [1) 3)]		Boundary dimensions mm						Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Abutment and fillet dimensions mm d_a min	D_b max	D_b min	r_{as} max	r_{1as} max	Mass (approx.) kg cylindrical bore	Internal free space cm^3	Part number [1) 3)]	
cylindrical bore	tapered bore	d	D	B	$r_{s\,min}$ [2)]	$r_{1s\,min}$ [2)]	E_w	C_r	C_{0r}	C_r	C_{0r}										cylindrical bore	tapered bore
N1017HS	**N1017HSK**	85	130	22	1.1	1	118	72.0	86.0	7 350	8 800	8 100	12 800	91.5	123.5	119	1	1	1.10	33.4	**N1017HS**	**N1017HSK**
N1018HS	**N1018HSK**	90	140	24	1.5	1.1	127	87.0	105	8 900	10 700	7 600	11 900	98	132	129	1.5	1	1.43	40.0	**N1018HS**	**N1018HSK**
N1019HS	**N1019HSK**	95	145	24	1.5	1.1	132	89.0	110	9 100	11 200	7 300	11 400	103	137	134	1.5	1	1.50	46.5	**N1019HS**	**N1019HSK**
N1020HS	**N1020HSK**	100	150	24	1.5	1.1	137	91.0	115	9 300	11 700	7 000	11 000	108	142	139	1.5	1	1.55	53.5	**N1020HS**	**N1020HSK**
N1021HS	**N1021HSK**	105	160	26	2	1.1	146	121	149	12 300	15 200	6 600	10 400	114	151	148	2	1	1.96	56.2	**N1021HS**	**N1021HSK**
N1022HS	**N1022HSK**	110	170	28	2	1.1	155	139	173	14 200	17 700	6 200	9 800	119	161	157	2	1	2.44	68.8	**N1022HS**	**N1022HSK**
N1024HS	**N1024HSK**	120	180	28	2	1.1	165	142	182	14 500	18 500	5 800	9 100	129	171	167	2	1	2.61	87.5	**N1024HS**	**N1024HSK**
N1026HS	**N1026HSK**	130	200	33	2	1.1	182	173	220	17 700	22 400	5 300	8 300	139	191	183	2	1	3.95	118	**N1026HS**	**N1026HSK**
N1028HS	**N1028HSK**	140	210	33	2	1.1	192	182	240	18 600	24 400	5 000	7 800	149	201	194	2	1	4.19	130	**N1028HS**	**N1028HSK**
N1030HS	**N1030HSK**	150	225	35	2.1	1.5	206	205	273	20 900	27 800	4 700	7 300	161	214	208	2	1.5	5.10	151	**N1030HS**	**N1030HSK**
N1032HS	**N1032HSK**	160	240	38	2.1	1.5	219	228	305	23 300	31 500	4 400	6 900	171	229	221	2	1.5	6.30	172	**N1032HS**	**N1032HSK**

1) A bearing number with suffix **K** indicates a tapered bore bearing (taper ratio 1/12).
2) Minimum allowable value for corner radius dimension r or r_1.
3) **N10HS** differs from standard **N10** in internal construction.

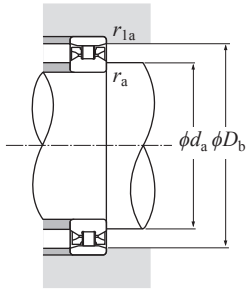
Main Spindle Bearings

ULTAGE Ultra high speed single-row cylindrical roller bearings



Cylindrical bore

Tapered bore



Dynamic equivalent radial load
$P_r = F_r$

Static equivalent radial load
$P_{0r} = F_r$

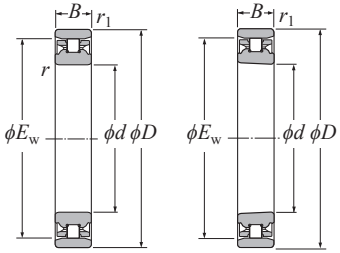
d 45–100 mm

Part number [1]		Boundary dimensions mm						Basic load ratings dynamic kN		static kgf		Allowable speed min^{-1}		Abutment and fillet dimensions mm					Internal free space cm^3	Part number [1]	
cylindrical bore	tapered bore	d	D	B	$r_{s\,min}$ [2]	$r_{1s\,min}$ [2]	E_w	C_r	C_{0r}	C_r	C_{0r}	grease lubrication	oil lubrication	d_a min	D_b max	D_b min	r_{as} max	r_{1as} max		cylindrical bore	tapered bore
N1009HSRT6	**N1009HSRT6K**	45	75	16	1	0.6	67.5	23.3	22.5	2 380	2 290	18 900	37 700	50	70	69	1	0.6	9.2	**N1009HSRT6**	**N1009HSRT6K**
N1011HSRT6	**N1011HSRT6K**	55	90	18	1.1	1	81	26.7	28.7	2 730	2 930	15 400	30 900	61.5	83.5	82	1	1	15.7	**N1011HSRT6**	**N1011HSRT6K**
N1012HSRT6	**N1012HSRT6K**	60	95	18	1.1	1	86.1	26.4	28.9	2 700	2 950	14 400	28 900	66.5	88.5	87	1	1	17.0	**N1012HSRT6**	**N1012HSRT6K**
N1013HSRT6	**N1013HSRT6K**	65	100	18	1.1	1	91	28.1	32.0	2 860	3 250	13 600	27 200	71.5	93.5	92	1	1	17.9	**N1013HSRT6**	**N1013HSRT6K**
N1014HSRT6	**N1014HSRT6K**	70	110	20	1.1	1	100	32.5	37.5	3 300	3 850	12 400	24 700	76.5	103.5	101	1	1	23.3	**N1014HSRT6**	**N1014HSRT6K**
N1016HSRT6	**N1016HSRT6K**	80	125	22	1.1	1	113	42.5	50.0	4 300	5 100	11 000	21 900	86.5	118.5	114	1	1	31.6	**N1016HSRT6**	**N1016HSRT6K**
N1018HSRT6	**N1018HSRT6K**	90	140	24	1.5	1.1	127	53.0	64.5	5 450	6 550	9 700	19 500	98	132	129	1.5	1	41.1	**N1018HSRT6**	**N1018HSRT6K**
N1020HSRT6	**N1020HSRT6K**	100	150	24	1.5	1.1	137	56.0	70.5	5 700	7 200	9 000	18 000	108	142	139	1.5	1	45.1	**N1020HSRT6**	**N1020HSRT6K**

1) A bearing number with suffix **K** indicates a tapered bore bearing (taper ratio 1/12).
2) Minimum allowable value for corner radius dimension r or r_1.

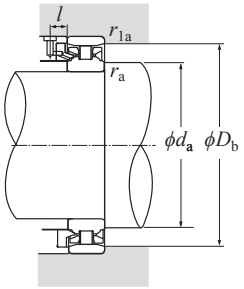
Main Spindle Bearings

ULTAGE Eco-friendly ultra high speed single-row cylindrical roller bearings
Air-oil lubrication only



Cylindrical bore

Tapered bore



Dynamic equivalent radial load
$P_r = F_r$

Static equivalent radial load
$P_{0r} = F_r$

d 55–100 mm

Part number [1]		Boundary dimensions mm						Basic load ratings dynamic / static kN		dynamic / static kgf		Allowable speed min^{-1} oil lubrication	Abutment and fillet dimensions mm						Part number [1]	
cylindrical bore	tapered bore	d	D	B	$r_{s\,min}$ [2]	$r_{1s\,min}$ [2]	E_w	C_r	C_{0r}	C_r	C_{0r}		d_a min	D_b max	D_b min	r_{as} max	r_{1as} max	l [3] min	cylindrical bore	tapered bore
N1011HSLT6	**N1011HSLT6K**	55	90	18	1.1	1	81	26.7	28.7	2 730	2 930	30 900	61.5	83.5	82	1	1	8.5	**N1011HSLT6**	**N1011HSLT6K**
N1012HSLT6	**N1012HSLT6K**	60	95	18	1.1	1	86.1	26.4	28.9	2 700	2 950	28 900	66.5	88.5	87	1	1	8.5	**N1012HSLT6**	**N1012HSLT6K**
N1013HSLT6	**N1013HSLT6K**	65	100	18	1.1	1	91	28.1	32.0	2 860	3 250	27 200	71.5	93.5	92	1	1	8.5	**N1013HSLT6**	**N1013HSLT6K**
N1014HSLT6	**N1014HSLT6K**	70	110	20	1.1	1	100	32.5	37.5	3 300	3 850	24 700	76.5	103.5	101	1	1	10	**N1014HSLT6**	**N1014HSLT6K**
N1016HSLT6	**N1016HSLT6K**	80	125	22	1.1	1	113	42.5	50.0	4 300	5 100	21 900	86.5	118.5	114	1	1	10	**N1016HSLT6**	**N1016HSLT6K**
N1018HSLT6	**N1018HSLT6K**	90	140	24	1.5	1.1	127	53.0	64.5	5 450	6 550	19 500	98	132	129	1.5	1	10	**N1018HSLT6**	**N1018HSLT6K**
N1020HSLT6	**N1020HSLT6K**	100	150	24	1.5	1.1	137	56.0	70.5	5 700	7 200	18 000	108	142	139	1.5	1	10	**N1020HSLT6**	**N1020HSLT6K**

1) A bearing number with suffix **K** indicates a tapered bore bearing (taper ratio 1/12).
2) Minimum allowable value for corner radius dimension r or r_1.
3) For the details of spacer dimensions, please contact **NTN** Engineering.

Cylindrical Roller Bearings Dimension Tables NTN

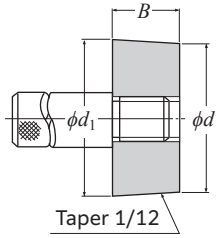
Main Spindle Bearings

10.12 Taper gauge and mounted internal clearance adjustment gauge for NTN precision cylindrical roller bearings

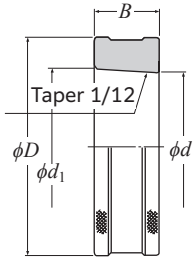
As the need increases for machine tools of higher speed and precision, a higher degree of precision is required of machine tool bearings. For a precision bearing to exhibit its full performance, it must be installed correctly. In particular, when a tapered bore bearing is used, the corresponding taper on the shaft must be finished to a high degree of precision. **NTN** recommends the ring gauge for the tapered shaft be finished to the same precision as for bearings. Note that the contact area between tapered faces should be 80 % or greater.

NTN also offers a plug gauge that permits verification of the precision of the ring gauge. Remember that the radial internal clearance of a cylindrical roller bearing needs to be correctly adjusted. Too large a radial clearance can diminish the precision of the main spindle, while too small a radial clearance can lead to abnormal heat generation and premature spalling of the bearing. To ensure adequate internal clearance, use a mounted internal clearance adjustment gauge.

Dimension table for taper gauge



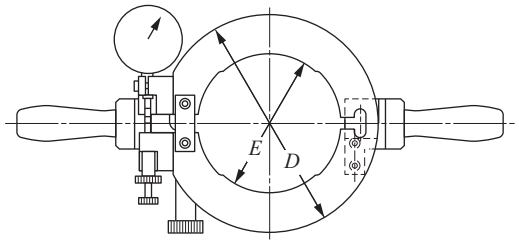
Plug gauge (TA type)



Ring gauge (TB type)

Part number		Applicable bearing		Boundary dimensions mm				Mass (approx.) kg	
Plug gauge	Ring gauge			d	d_1	D	B	TA type	TB type
TANN3006K	**TBNN3006K**	N1006HSK	NN3006K	30	31.583	70	19	0.5	0.2
TANN3007K	**TBNN3007K**	N1007HSK	NN3007K	35	36.667	75	20	0.6	0.3
TANN3008K	**TBNN3008K**	N1008HSK	NN3008K	40	41.750	80	21	0.7	0.3
TANN3009K	**TBNN3009K**	N1009HSK	NN3009K	45	46.917	85	23	0.7	0.4
TANN3010K	**TBNN3010K**	N1010HSK	NN3010K	50	51.917	90	23	0.8	0.5
TANN3011K	**TBNN3011K**	N1011HSK	NN3011K	55	57.167	95	26	0.9	0.7
TANN3012K	**TBNN3012K**	N1012HSK	NN3012K	60	62.167	100	26	1.0	0.8
TANN3013K	**TBNN3013K**	N1013HSK	NN3013K	65	67.167	105	26	1.1	0.9
TANN3014K	**TBNN3014K**	N1014HSK	NN3014K	70	72.500	110	30	1.3	1.3
TANN3015K	**TBNN3015K**	N1015HSK	NN3015K	75	77.500	115	30	1.4	1.4
TANN3016K	**TBNN3016K**	N1016HSK	NN3016K	80	82.833	125	34	1.9	1.7
TANN3017K	**TBNN3017K**	N1017HSK	NN3017K	85	87.833	130	34	2.0	1.9
TANN3018K	**TBNN3018K**	N1018HSK	NN3018K	90	93.083	140	37	2.6	2.4
TANN3019K	**TBNN3019K**	N1019HSK	NN3019K	95	98.083	145	37	2.7	2.6
TANN3020K	**TBNN3020K**	N1020HSK	NN3020K	100	103.083	150	37	2.8	2.8
TANN3021K	**TBNN3021K**	N1021HSK	NN3021K	105	108.417	160	41	3.6	3.5
TANN3022K	**TBNN3022K**	N1022HSK	NN3022K	110	113.750	165	45	4.1	4.0
TANN3024K	**TBNN3024K**	N1024HSK	NN3024K	120	123.833	170	46	4.1	4.7
TANN3026K	**TBNN3026K**	N1026HSK	NN3026K	130	134.333	180	52	4.8	6.4
TANN3028K	**TBNN3028K**	N1028HSK	NN3028K	140	144.417	190	53	5.2	7.4
TANN3030K	**TBNN3030K**	N1030HSK	NN3030K	150	154.667	210	56	7.2	8.4
TANN3032K	**TBNN3032K**	N1032HSK	NN3032K	160	165.000	220	60	8.1	10

Dimension table for mounted internal clearance adjustment gauge



Part number	Applicable bearing		Boundary dimensions mm		
			E	D	width B
SBNN3007-2	N1007HSK	NN3007K	55	101	23
SBNN3008-2	N1008HSK	NN3008K	61	107	23
SBNN3009-2	N1009HSK	NN3009K	67.5	114	23
SBNN3010-2	N1010HSK	NN3010K	72.5	120	23
SBNN3011-2	N1011HSK	NN3011K	81	131	25
SBNN3012-2	N1012HSK	NN3012K	86.1	138	25
SBNN3013-2	N1013HSK	NN3013K	91	145	25
SBNN3014-2	N1014HSK	NN3014K	100	156	28
SBNN3015-2	N1015HSK	NN3015K	105	161	28
SBNN3016-2	N1016HSK	NN3016K	113	175	30
SBNN3017-2	N1017HSK	NN3017K	118	185	30
SBNN3018-2	N1018HSK	NN3018K	127	195	33
SBNN3019-2	N1019HSK	NN3019K	132	204	33
SBNN3020-2	N1020HSK	NN3020K	137	210	33
SBNN3021-2	N1021HSK	NN3021K	146	220	36
SBNN3022-2	N1022HSK	NN3022K	155	235	40
SBNN3024-2	N1024HSK	NN3024K	165	250	40
SBNN3026-2	N1026HSK	NN3026K	182	275	45
SBNN3028-2	N1028HSK	NN3028K	192	285	45
SBNN3030-2	N1030HSK	NN3030K	206	305	50
SBNN3032-2	N1032HSK	NN3032K	219	320	50



Main Spindle Bearings

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Dimension Tables

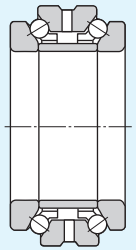
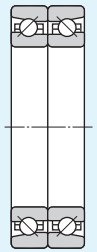
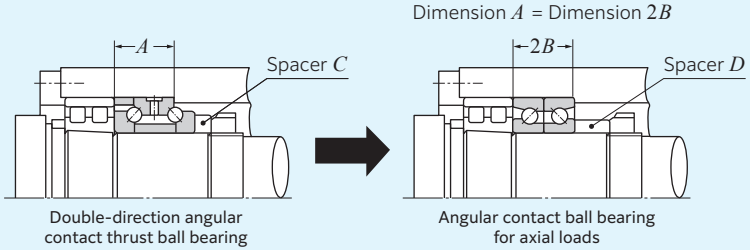
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11. Angular Contact Ball Bearings for Axial Loads

11.1 Types and features

NTN provides a range of thrust bearings for the main spindles. This includes 5629 and 5620 types for high axial rigidity (contact angle 60°) and ULTAGE™ series HTA U (A) types high speed duplex angular contact ball bearings for axial loads with optimized internal design (contact angle 40°, 30°). These bearings are used in conjunction with NN30, NN49, or NNU49 type double-row cylindrical roller bearings (matched bearings must have the same bore and outside diameter).

Table 11.1 Types of angular contact ball bearings for axial loads

	Double-direction thrust type 5629 and 5620	ULTAGE™ series duplex type HTA0U (A) DB, HTA9U (A) DB
Cross section		
Contact angle	60°	40°, 30°
Cage type	High strength machined brass	Machined phenol resin, polyamide resin, high strength machined brass
Features	These bearings can withstand axial loads in both directions. Due to a larger contact angle, rigidity in axial directions is enhanced. The structure of these bearings is not suitable for grease-lubricated vertical shaft applications.	These duplex angular contact ball bearings have similar designs as the double-direction angular contact thrust ball bearings, but differ in terms on their inner ring widths (see the diagrams below). Since their contact angles are lower at 40° and 30°, the series boast high speed capability. However, their axial rigidity is less than double-direction angular contact thrust ball bearings with 60° contact angle.
Interchangeability	A double-direction angular contact thrust ball bearing can be readily interchanged with a duplex angular contact ball bearing simply by replacing spacer C with spacer D; the dimensions of the shaft and housing remain unchanged. 	

11.2 Standard cage types

Table 11.2 Standard cage of angular contact ball bearing for axial loads

Bearing types	Machined phenol resin cage	High strength machined brass cage
5629	——	562920 to 562944
5620	——	562005 to 562040
HTA9U (A)	HTA920U to HTA938U	HTA940U to HTA964U
HTA0U (A)	HTA010U to HTA038U [1)]	HTA040U to HTA064U

1) Some varieties use polyamide resin cages, so please contact **NTN** Engineering.
Notes: Cage types may be subjected to change without notice. For details, contact **NTN** Engineering.

11.3 Bearing designations

562 0 20M / GN P4

- **Tolerance class code** P5: **NTN** Class 5, P4: **NTN** Class 4
- **Preload code** GN: Normal preload, GM: Medium preload
- **Bore code (refer to the dimensions tables)**
  without M: Tapered shaft small side diameter type (Ex.: 562020→ϕ100 mm bore)
  with M: Tapered shaft large side diameter type (Ex.: 562020→ϕ103 mm bore)
- **Dimension series code**
- **Bearing type**

5S- HTA 0 20 U A T2 DB / GN P4L

- **Tolerance class code**
  P5: **NTN** Class 5 P4: **NTN** Class 4
  L: Outer ring outside diameter tolerance for axial load
- **Preload code**
  GN: Normal preload
  GM: Medium preload
- **Duplex arrangement code**
  DB: back-to-back (double-row)
  DTBT: tandem back-to-back (four-row)
- **Cage code**
  No code: Standard cage
  T2: Polyamide resin cage
  L1: High strength machined brass cage
- **Contact angle code**
  No code: 40°
  A: 30°
- **Bearing series:** ULTAGE™
- **Nominal bore diameter** (see the dimension tables)
- **Dimension series code**
- **Bearing type**
- **Material code**
  5S: Material of rolling element is ceramics
  No code: Bearing steel

11.4 Accuracy of double-direction angular contact thrust ball bearings

Table 11.3 Inner rings

Unit: μm

Nominal bore diameter d mm over	incl.	Deviation of mean bore diameter in a single plane Δ_{dmp} Class 5 high	low	Class 4 [1] high	low	Perpendicularity of inner ring face with respect to the bore S_d Class 5 max	Class 4 max	Axial runout S_{ia} Class 5 max	Class 4 max	Width variation V_{Bs} Class 5 max	Class 4 max	Deviation of the bearing height Δ_{Ts} Class 5 high	low	Class 4 high	low
18	30	0	− 6	0	− 5	8	4	5	3	5	2.5	0	− 300		
30	50	0	− 8	0	− 6	8	4	5	3	5	3	0	− 400		
50	80	0	− 9	0	− 7	8	5	6	5	6	4	0	− 500		
80	120	0	−10	0	− 8	9	5	6	5	7	4	0	− 600		
120	180	0	−13	0	−10	10	6	8	6	8	5	0	− 700		
180	250	0	−15	0	−12	11	7	8	6	10	6	0	− 800		

1) The dimensional difference Δ_{ds} of the measured bore diameter applied to Class 4 is the same as the tolerance of dimensional difference Δ_{dmp} of the mean bore diameter within a plane. The applied to diameter series 0.

Table 11.4 Outer rings

Unit: μm

Nominal outside diameter D mm over	incl.	Deviation of mean outside diameter in a single plane Δ_{Dmp} Class 5 high	Class 4 [2] low	Perpendicularity of outer ring outside surface with respect to the face S_D Class 5 max	Class 4 max	Axial runout S_{ea} Class 5 max	Class 4 max	Width variation V_{Cs} Class 5 max	Class 4 max
30	50	− 30	− 40	8	4	Depends on tolerance of S_{ia} in relation to d of the same bearing		5	2.5
50	80	− 40	− 50	8	4			6	3
80	120	− 50	− 60	9	5			8	4
120	150	− 60	− 75	10	5			8	5
150	180	− 60	− 75	10	5			8	5
180	250	− 75	− 90	11	7			10	7
250	315	− 90	−105	13	8			11	7

2) The dimensional difference Δ_{Ds} of the measured outside diameter applied to Class 4 is the same as the tolerance of dimensional difference Δ_{Dmp} of the mean outside diameter within a plane. The applied to diameter series 0.

Note: This standard is the **NTN** standard.

11.5 Accuracy of angular contact ball bearings for axial loads

Table 11.5 Inner rings

Unit: μm

Nominal bore diameter d mm over	incl.	Deviation of mean bore diameter in a single plane Δ_{dmp} Class 5 high	low	Class 4 [1] high	low	Variation of bore diameter in a single plane V_{dsp} Diameter series 9 Class 5 max	Class 4 max	Diameter series 0 Class 5 max	Class 4 max	Variation of mean bore diameter V_{dmp} Class 5 max	Class 4 max	Perpendicularity of inner ring face with respect to the bore S_d Class 5 max	Class 4 max	Axial runout S_{ia} Class 5L max	Class 4L max
18	30	0	− 6	0	− 5	6	5	5	4	3	2.5	8	4	5	3
30	50	0	− 8	0	− 6	8	6	6	5	4	3	8	4	5	3
50	80	0	− 9	0	− 7	9	7	7	5	5	3.5	8	5	6	5
80	120	0	−10	0	− 8	10	8	8	6	5	4	9	5	6	5
120	150	0	−13	0	−10	13	10	10	8	7	5	10	6	8	6
150	180	0	−13	0	−10	13	10	10	8	7	5	10	6	8	6
180	250	0	−15	0	−12	15	12	12	9	8	6	11	7	8	6
250	315	0	−18	0	−14	18	14	14	11	9	8	13	8	10	8
315	400	0	−23	0	−16	23	17	18	12	12	9	15	10	13	10

1) The dimensional difference Δ_{ds} of the measured bore diameter applied to Class 4 is the same as the tolerance of dimensional difference Δ_{dmp} of the mean bore diameter within a plane. The applied to diameter series 0.

Unit: μm

Overall width variation of assembled bearing Δ_{Bs} Class 5 high	Class 4 low	Width variation V_{Bs} Class 5 max	Class 4 max	Nominal bore diameter d mm over	incl.
0	−240	5	2.5	18	30
0	−240	5	3	30	50
0	−300	6	4	50	80
0	−400	7	4	80	120
0	−500	8	5	120	150
0	−500	8	5	150	180
0	−600	10	6	180	250
0	−700	13	8	250	315
0	−800	15	10	315	400

Table 11.6 Outer rings

Unit: μm

Nominal outside diameter D mm over	incl.	Deviation of mean outside diameter in a single plane Δ_{Dmp} Class 5L high	low	Class 4L high	low	Class 5 high	low	Class 4 [2] high	low	Axial runout S_{ea} Class 5 max	Class 4 max	Overall width variation of assembled bearing Δ_{Cs} All classes	Width variation V_{Cs} Class 5 max	Class 4 max
30	50	−25	−36	0	− 7	0	− 6	8	5	Depends on tolerance of Δ_{Bs} in relation to d of the same bearing		5	2.5
50	80	−30	−43	0	− 9	0	− 7	10	5			6	3
80	120	−36	−51	0	−10	0	− 8	11	6			8	4
120	150	−43	−61	0	−11	0	− 9	13	7			8	5
150	180	−43	−61	0	−13	0	−10	14	8			8	5
180	250	−50	−70	0	−15	0	−11	15	10			10	7
250	315	−56	−79	0	−18	0	−13	18	10			11	7
315	400	−62	−87	0	−20	0	−15	20	13			13	8
400	500	−68	−95	0	−23	−	−	23	15			15	10	

2) The dimensional difference Δ_{Ds} of the measured outside diameter applied to Class 4 is the same as the tolerance of dimensional difference Δ_{Dmp} of the mean outside diameter within a plane. The applied to diameter series 0.

Note: This standard is the **NTN** standard.

11.6 Standard preload

The initial internal clearance or initial preload must be selected with consideration of the lubricating method, maximum speed, and required axial rigidity. Although usage with normal preload (GN) within the allowable speed range is possible for both grease lubrication and air-oil lubrication, ask **NTN** Engineering to recommend the appropriate preload if axial rigidity is required and you want to inhibit temperature rise of the main spindle. The standard preloads are summarized in **Table 11.7**.

Table 11.7 Standard preload

Unit: N {kgf}

Bore number	5629		5620		HTA9UDB		HTA9UADB		HTA0UDB		HTA0UADB		Bore number
	Normal GN	Medium GM	Normal GN	Medium GM	Normal GN	Medium GM	Normal GN	Medium GM	Normal GN	Medium GM	Normal GN	Medium GM	
	GN	GM	GN	GM	GN	GM	GN	GM	GN	GM	GN	GM	
05			294 {30}	685 {70}					390 {40}	685 {70}	147 {15}	294 {30}	05
06													06
07			490 {50}	785 {80}							294 {30}	590 {60}	07
08													08
09									685 {70}	1 270 {130}			09
10			980 {100}	1 670 {170}									10
11	—	—			—	—	—	—			490 {50}	885 {90}	11
12													12
13													13
14			1 470 {150}	2 450 {250}					980 {100}	1 570 {160}	590 {60}	1 470 {150}	14
15													15
16										1 960 {200}			16
17											885 {90}	1 960 {200}	17
18									1 470 {150}	2 450 {250}			18
19													19
20	1 470 {150}	2 450 {250}	1 960 {200}	3 250 {330}	980 {100}	1 670 {170}	685 {70}	1 270 {130}			980 {100}	2 450 {250}	20
21													21
22									1 960 {200}	3 450 {350}			22
24	1 960 {200}	2 940 {300}			1 270 {130}	2 450 {250}	885 {90}	1 770 {180}					24
26							980 {100}	1 960 {200}	2 940 {300}	5 400 {550}	1 470 {150}	3 450 {350}	26
28													28
30					1 960 {200}	3 450 {350}	1 270 {130}	2 450 {250}					30
32									3 900 {400}	7 350 {750}	2 450 {250}	4 900 {500}	32
34													34
36	2 450 {250}	3 900 {400}	2 450 {250}	3 900 {400}	3 450 {350}	5 900 {600}	1 770 {180}	3 450 {350}	4 900 {500}	9 300 {950}			36
38											3 450 {350}	6 850 {700}	38
40					3 900 {400}	6 850 {700}	2 450 {250}	4 900 {500}					40
44	2 940 {300}	4 400 {450}							6 850 {700}	12 700 {1 300}	3 900 {400}	7 850 {800}	44
48													48
52	—	—	—	—	4 900 {500}	8 850 {900}	3 450 {350}	6 850 {700}	8 850 {900}	15 700 {1 600}			52
56											5 900 {600}	11 800 {1 200}	56
60					5 900 {600}	11 800 {1 200}	4 400 {450}	8 850 {900}	10 800 {1 100}	17 700 {1 800}			60
64													64

11.7 Fits of angular contact ball bearings for axial loads

Fits given in **Table 11.8** are recommended for angular contact ball bearings for axial loads. To maintain high accuracy, provision of interference between the shaft and the bore of inner ring is essential. The fit of the housing and bearing should be same as that for cylindrical roller bearings, since an angular contact ball bearing is normally used together with a cylindrical roller bearing.

Table 11.8 Shaft fits

Unit: μm

Nominal bore diameter d (mm) over	incl.	Fits of inner ring to shaft
2.5	10	0–2T
10	18	0–2T
18	30	0–2.5T
30	50	0–3T
50	80	0–3.5T
80	120	0–4T
120	180	0–5T
180	250	0–6T

Note 1: Target the median value.
2: For high speed applications where $d_m n$ value exceeds 0.75×10^6, the fit should be increased. For such an arrangement, consult **NTN** Engineering.
T: Tight (Interference) fit

■ Checking concentricity of outside diameter of outer ring after bearing

Controlling concentricity of outer ring assembly is necessary for reduction of axial runout of the main spindle. Measure and control the concentricity of outer ring shown in **Fig. 11.1** and "6. Handling of Bearings, 6.2 Mounting" in the Technical Data section.

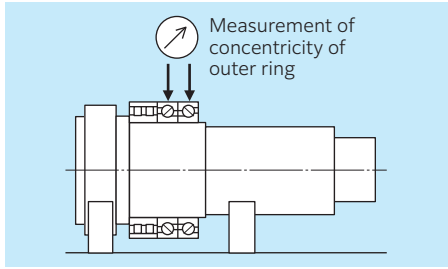


Fig. 11.1 Concentricity

11.8 Recommended lubrication specifications

Angular contact ball bearings for axial loads are usually used with grease lubrication or air-oil lubrication. Recommended specifications of the lubrication methods are described below.

■ Grease lubrication

- **Recommended brand of grease**
  Refer to "7. Lubrication of Bearings, 7.1 Grease lubrication" in the Technical Data section.
- **Recommended grease filling amount**
  $d_m n$ value ≤ 0.65 × 10^6
  15 to 20 % of the capacity shown in the dimensions tables
  $d_m n$ value > 0.65 × 10^6
  12 to 17 % of the capacity shown in the dimensions tables
- **Recommended grease filling method**
  Refer to "6. Handling of Bearings, 6.1 Cleaning and filling with grease" in the Technical Data section.

  Notes: High-strength machined brass cages are used for 5629/5620 types. Thus, if they are used for grease-lubricated vertical shafts, the cage on one side may hang onto the rolling elements, possibly causing seizure. Use of the HTA U type with resin cages or oil lubrication (including feeding of lubricating oil) is recommended.

■ Air-oil lubrication

- **Recommended location of nozzle**
  Refer to "7. Lubrication of Bearings 7.2 Recommended location of nozzle for air-oil lubrication" in the Technical Data section.
- **Recommended specifications of nozzle**
  Nozzle bore diameter : From 1 to 1.5 mm
  Number of nozzles: One nozzle for each bearing, depth of nozzle bore should be three to six times of nozzle bore diameter.
- **Recommended specifications of air-oil**
  Oil type: Spindle oil
  Viscosity grade: ISO VG from 10 to 32 (32 is preferable)

Table 11.9 Air and oil amount

Bearing types	$d_m n$ value (×10^6) Over	Incl.	Oil amount per shot mL	Lubrication intervals min	Oil consumption mL/h	Recommended air consumption NL/min[1)]
HTA9U (A)	—	1.0	0.03	8	0.23	20 to 40
HTA0U (A)	1.0	1.25		5	0.36	
5S-HTA0U (A)						

1) NL/min (Normal liter/minute) ··· NL means the volume of air at 0 °C and 1 atmosphere.

11.9 ULTAGE Angular contact ball bearings for axial loads HTA U type

The HTA U type is an angular contact ball bearing for axial loads. It maintains rigidity and load bearing capacity, and features improved high speed performance.

■ Features

1. Optimized internal design to minimize the temperature rise especially at high speed range.
2. Improved polyamide resin cage pocket design where the ball contacts to have improved lubrication performance under grease or air-oil lubrication.

■ Bearings specification

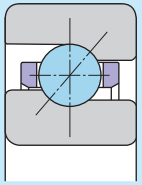
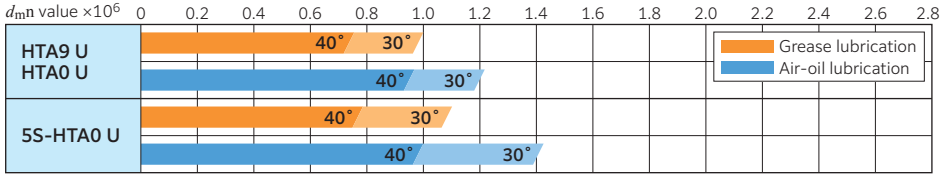


Fig. 11.2 HTA U type

■ Permissible speed range



Notes) Permissible speed of each bearing ($d_m n$ value) varies depending on the specifications of the machine for which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline, and then, contact **NTN** Engineering for technical assistance.

■ Data/Axial rigidity

Minimizes drops in axial rigidity while supporting faster speeds (see **Fig. 11.3**).

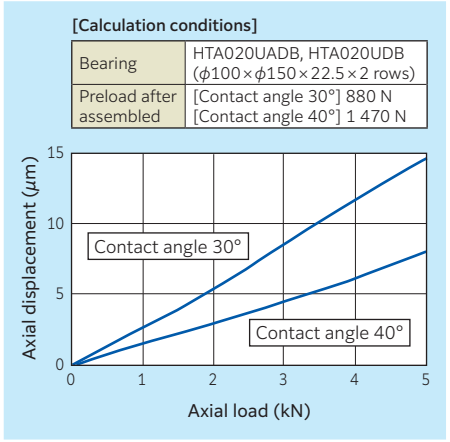


Fig. 11.3 Axial rigidity diagram

■ Data/Allowable axial load

A contact angle of 30° has a larger allowable axial load, compared to a contact angle of 40°(see **Fig. 11.4**).

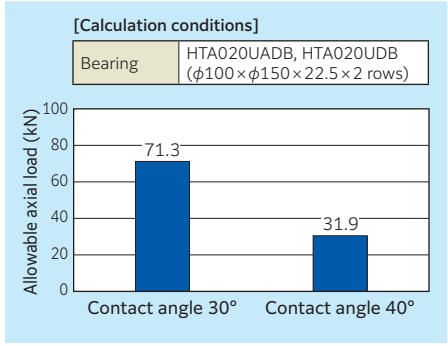


Fig. 11.4 Comparison of allowable axial load

■ Data/Operation test

$d_m n$ value of 1.0×10^6 under grease lubrication and 1.25×10^6 under air-oil lubrication are realized by the optimized internal design (Both specification: steel ball, contact angle 30°) (see **Fig. 11.5** and **Fig. 11.6**).

[Test conditions]

Bearing	HTA020UADB ($\phi100 \times \phi150 \times 22.5 \times 2$ rows)
Speed	0 to 8 000 min^{-1}
Preload after assembled	880 N
Lubrication	Grease lubrication
Grease used	MP-1
Jacket cooling	w/, w/o

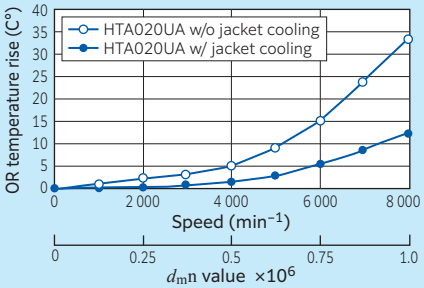


Fig. 11.5 Operation test results (contact angle 30°, grease lubrication)

[Test conditions]

Bearing	HTA020UADB ($\phi100 \times \phi150 \times 22.5 \times 2$ rows)
Speed	0 to 10 000 min^{-1}
Preload after assembled	880 N
Lubrication	Air-oil lubrication
Oil consumption	0.03 mL/shot Oil shot interval 5 min
Air consumption	40 NL/min
Jacket cooling	w/, w/o

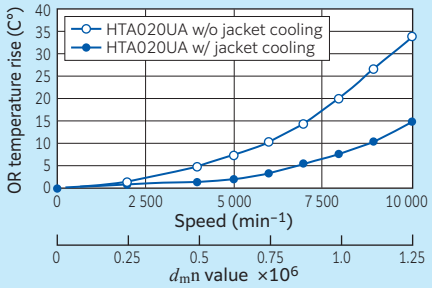


Fig. 11.6 Operation test results (contact angle 30°, air-oil lubrication)

[Test conditions]

Bearing	HTA020UDB ($\phi100 \times \phi150 \times 22.5 \times 2$ rows)
Speed	0 to 6 000 min^{-1}
Preload after assembled	1 470 N
Lubrication	Grease lubrication
Grease used	MP-1
Jacket cooling	w/, w/o

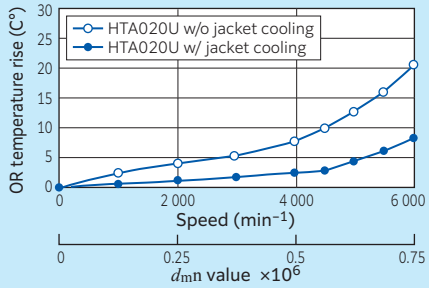


Fig. 11.7 Operation test results (contact angle 40°, grease lubrication)

[Test conditions]

Bearing	HTA020UDB ($\phi100 \times \phi150 \times 22.5 \times 2$ rows)
Speed	0 to 7 500 min^{-1}
Preload after assembled	1 470 N
Lubrication	Air-oil lubrication
Oil consumption	0.03 mL/shot Oil shot interval 5 min
Air consumption	40 NL/min
Jacket cooling	w/, w/o

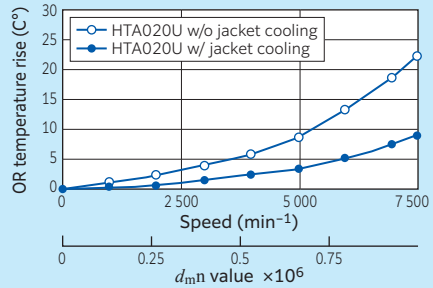
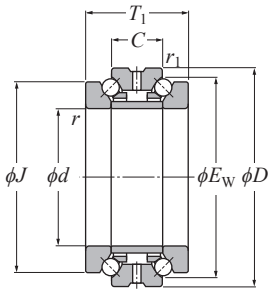
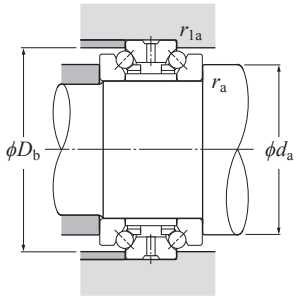


Fig. 11.8 Operation test results (contact angle 40°, air-oil lubrication)

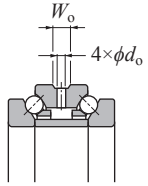
Double-direction angular contact thrust ball bearings 5629 type





Dynamic equivalent axial load
$P_a = F_a$

Static equivalent axial load
$P_{0a} = F_a$



Contact angle 60° d 100–220 mm

Part number		Boundary dimensions mm							Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable speed min^{-1}		Mass (approx.) kg		Reference dimensions mm		Abutment and fillet dimensions mm				Part number	
		d																						
small size	large size	small size	large size	D	T_1	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_a	C_{0a}	C_a	C_{0a}	grease lubrication	oil lubrication	small size	large size	J	E_w [2]	d_a min	D_b max	r_{as} max	r_{1as} max	small size	large size
562920	**562920M**	100	104	140	48	24	1.1	0.6	58.0	179	5 900	18 200	3 200	4 200	2.04	1.8	126	129	114	134.5	1	0.6	**562920**	**562920M**
562921	**562921M**	105	109	145	48	24	1.1	0.6	59.5	188	6 050	19 200	3 000	4 100	2.12	1.87	131	134	119	139.5	1	0.6	**562921**	**562921M**
562922	**562922M**	110	114	150	48	24	1.1	0.6	59.5	193	6 100	19 700	2 900	3 900	2.21	1.95	136	139	124	144.5	1	0.6	**562922**	**562922M**
562924	**562924M**	120	124	165	54	27	1.1	0.6	72.0	242	7 350	24 700	2 600	3 500	3.06	2.75	150	154.5	138	159.5	1	0.6	**562924**	**562924M**
562926	**562926M**	130	134	180	60	30	1.5	1	83.0	284	8 450	28 900	2 400	3 200	4.11	3.7	163	168	150	173.5	1.5	1	**562926**	**562926M**
562928	**562928M**	140	144	190	60	30	1.5	1	84.0	297	8 600	30 500	2 300	3 100	4.38	3.94	173	178	160	183.5	1.5	1	**562928**	**562928M**
562930	**562930M**	150	155	210	72	36	2	1	118	410	12 100	41 500	2 100	2 800	6.88	6.2	190	196.5	174	202	2	1	**562930**	**562930M**
562932	**562932M**	160	165	220	72	36	2	1	121	430	12 300	44 000	2 000	2 600	7.26	6.53	200	206.5	184	212	2	1	**562932**	**562932M**
562934	**562934M**	170	175	230	72	36	2	1	123	450	12 500	46 000	1 900	2 500	7.64	6.88	210	216.5	194	222	2	1	**562934**	**562934M**
562936	**562936M**	180	186	250	84	42	2	1	173	605	17 600	62 000	1 700	2 300	11.2	10	227	234	207	242	2	1	**562936**	**562936M**
562938	**562938M**	190	196	260	84	42	2	1	174	625	17 700	63 500	1 700	2 200	11.7	10.5	237	344	217	252	2	1	**562938**	**562938M**
562940	**562940M**	200	207	280	96	48	2.1	1.1	205	735	20 900	75 000	1 600	2 100	16.3	14.7	252	261	231	270	2	1	**562940**	**562940M**
562944	**562944M**	220	227	300	96	48	2.1	1.1	211	795	21 500	81 000	1 400	1 900	17.7	16	272	281	251	290	2	1	**562944**	**562944M**

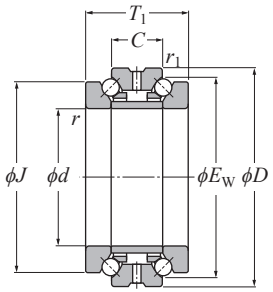
Dimensions of oil hole and oil groove unit: mm

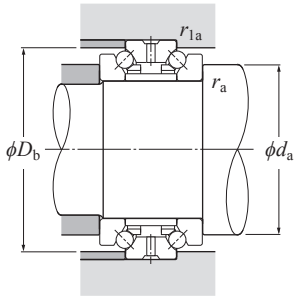
Nominal outside diameter D		Oil groove width	Oil hole diameter
over	incl.	W_o	d_o
140	190	8	4
190	260	12	6
260	320	14	6

1) Minimum allowable value for corner radius dimension r or r_1.
2) Maximum circumscribed circle diameter of balls.

Main Spindle Bearings

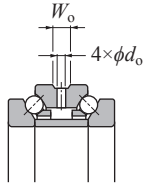
Double-direction angular contact thrust ball bearings 5620 type





Dynamic equivalent axial load
$P_a = F_a$

Static equivalent axial load
$P_{0a} = F_a$



Contact angle 60° d 25–200 mm

Part number		Boundary dimensions mm							Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable speed min^{-1}		Mass (approx.) kg		Reference dimensions mm		Abutment and fillet dimensions mm				Part number	
		d																						
small size	large size	small size	large size	D	T_1	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_a	C_{0a}	C_a	C_{0a}	grease lubrication	oil lubrication	small size	large size	J	E_w [2]	d_a min	D_b max	r_{as} max	r_{1as} max	small size	large size
562005	562005M	25	27	47	28	14	0.6	0.3	14.6	28.3	1 490	2 890	10 400	14 000	0.197	0.177	40	41.3	33	44	0.6	0.3	562005	562005M
562006	562006M	30	32	55	32	16	1	0.6	15.5	32.5	1 580	3 350	8 700	11 700	0.301	0.28	47	48.5	40	50.5	1	0.6	562006	562006M
562007	562007M	35	37	62	34	17	1	0.6	21.8	48.5	2 230	4 950	7 700	10 300	0.394	0.35	53	55	45.5	57.5	1	0.6	562007	562007M
562008	562008M	40	42	68	36	18	1	0.6	26.4	58.5	2 690	5 950	7 000	9 400	0.482	0.44	58.5	61	50	63.5	1	0.6	562008	562008M
562009	562009M	45	47	75	38	19	1	0.6	28.8	69.0	2 930	7 000	6 200	8 300	0.605	0.54	65	67.5	56.5	70.5	1	0.6	562009	562009M
562010	562010M	50	52	80	38	19	1	0.6	29.6	74.0	3 000	7 550	5 700	7 700	0.638	0.59	70	72.5	61.5	75.5	1	0.6	562010	562010M
562011	562011M	55	57	90	44	22	1.1	0.6	41.0	99.0	4 200	10 100	5 200	7 000	0.988	0.9	78	81	67.5	84	1	0.6	562011	562011M
562012	562012M	60	62	95	44	22	1.1	0.6	41.5	103	4 250	10 500	4 900	6 500	1.06	0.96	83	86.1	72.5	89	1	0.6	562012	562012M
562013	562013M	65	67	100	44	22	1.1	0.6	43.0	111	4 400	11 300	4 600	6 100	1.08	1	88	91	77.5	94	1	0.6	562013	562013M
562014	562014M	70	73	110	48	24	1.1	0.6	52.5	140	5 350	14 300	4 200	5 600	1.53	1.4	97	100	85	104	1	0.6	562014	562014M
562015	562015M	75	78	115	48	24	1.1	0.6	54.5	150	5 550	15 300	3 900	5 300	1.61	1.5	102	105	90	109	1	0.6	562015	562015M
562016	562016M	80	83	125	54	27	1.1	0.6	63.5	178	6 500	18 200	3 700	4 900	2.2	2	110	113	96.5	119	1	0.6	562016	562016M
562017	562017M	85	88	130	54	27	1.1	0.6	64.5	184	6 550	18 800	3 500	4 700	2.31	2.1	115	118	102	124	1	0.6	562017	562017M
562018	562018M	90	93	140	60	30	1.5	1	74.5	216	7 600	22 000	3 300	4 400	3.05	2.7	123	127	109	133.5	1.5	1	562018	562018M
562019	562019M	95	98	145	60	30	1.5	1	75.0	223	7 650	22 700	3 100	4 200	3.18	2.9	128	132	114	138.5	1.5	1	562019	562019M
562020	562020M	100	103	150	60	30	1.5	1	76.0	229	7 750	23 400	3 000	4 000	3.32	3	133	137	119	143.5	1.5	1	562020	562020M
562021	562021M	105	109	160	66	33	2	1	87.0	266	8 900	27 100	2 800	3 800	4.19	3.7	142	146	127	152	2	1	562021	562021M
562022	562022M	110	114	170	72	36	2	1	106	315	10 800	32 500	2 700	3 600	5.35	4.9	150	155	133	162	2	1	562022	562022M
562024	562024M	120	124	180	72	36	2	1	109	335	11 100	34 500	2 500	3 300	5.73	5.2	160	165	143	172	2	1	562024	562024M
562026	562026M	130	135	200	84	42	2	1	154	460	15 700	47 000	2 300	3 100	8.58	7.6	177	182	155	192	2	1	562026	562026M
562028	562028M	140	144	210	84	42	2	1	159	495	16 200	50 500	2 200	2 900	9.1	8.1	187	192	165	202	2	1	562028	562028M
562030	562030M	150	155	225	90	45	2.1	1.1	163	525	16 600	53 500	2 000	2 700	11.2	10	200	206	178	215	2	1	562030	562030M
562032	562032M	160	165	240	96	48	2.1	1.1	191	620	19 500	63 000	1 900	2 500	13.6	11.9	212	219	189	230	2	1	562032	562032M
562034	562034M	170	175	260	108	54	2.1	1.1	224	735	22 900	75 000	1 800	2 400	18.5	16.5	230	236	203	250	2	1	562034	562034M
562036	562036M	180	186	280	120	60	2.1	1.1	259	865	26 400	88 000	1 600	2 200	24.7	21.8	248	255	219	270	2	1	562036	562036M
562038	562038M	190	196	290	120	60	2.1	1.1	262	890	26 700	91 000	1 600	2 100	25.5	23	258	265	229	280	2	1	562038	562038M
562040	562040M	200	207	310	132	66	2.1	1.1	300	1 030	30 500	105 000	1 500	2 000	32.7	29.7	274	282	243	300	2	1	562040	562040M

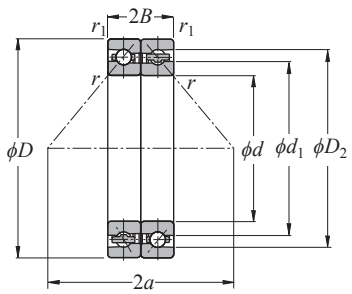
Dimensions of oil hole and oil groove unit: mm

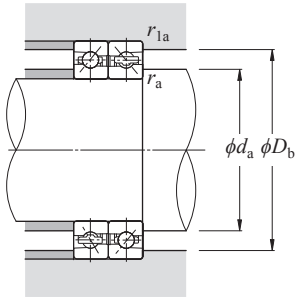
Nominal outside diameter D over	incl.	Oil groove width W_o	Oil hole diameter d_o
	50	4.5	2
50	80	6	3
80	150	8	4
150	210	12	6
210	260	14	6
260	320	16	8

1) Minimum allowable value for corner radius dimension r or r_1.
2) Maximum circumscribed circle diameter of balls.

Main Spindle Bearings

ULTAGE Angular contact ball bearings for axial loads (steel ball spec.) HTA9UA type





Dynamic equivalent axial load
$P_a = F_a$

Static equivalent axial load
$P_{0a} = F_a$

Contact angle 30° d 100–320 mm

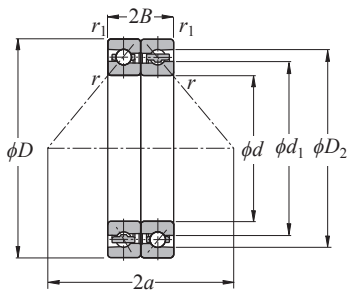
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm				Part number
	d	D	$2B$	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_a	C_{0a}	C_a	C_{0a}	(static)	(static)			$2a$	Two row (approx.)	Two row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	
HTA920UADB	100	140	36	1.1	0.6	44.0	109	4 500	11 100	66.0	6 750	8 300	10 400	87.6	24	0.81	115.3	129.0	110	134	1	0.6	HTA920UADB
HTA921UADB	105	145	36	1.1	0.6	45.5	115	4 650	11 700	70.0	7 150	8 000	10 000	90.5	24	0.85	120.3	134.0	115	139	1	0.6	HTA921UADB
HTA922UADB	110	150	36	1.1	0.6	46.0	118	4 650	12 000	72.0	7 350	7 700	9 600	93.4	26	0.88	125.3	139.0	120	144	1	0.6	HTA922UADB
HTA924UADB	120	165	40.5	1.1	0.6	53.5	140	5 450	14 300	87.5	8 900	7 000	8 800	102.9	36	1.23	137.4	152.4	130	159	1	0.6	HTA924UADB
HTA926UADB	130	180	45	1.5	1	64.0	173	6 500	17 600	103	10 500	6 500	8 100	112.4	50	1.65	149.4	165.8	142	172.5	1.5	1	HTA926UADB
HTA928UADB	140	190	45	1.5	1	64.0	177	6 500	18 000	106	10 800	6 100	7 600	118.1	53	1.75	159.4	175.7	152	182.5	1.5	1	HTA928UADB
HTA930UADB	150	210	54	2	1	89.5	243	9 100	24 800	143	14 600	5 600	6 900	131.4	85	2.74	173.1	193.2	164	202.5	2	1	HTA930UADB
HTA932UADB	160	220	54	2	1	91.5	256	9 300	26 100	151	15 400	5 300	6 600	137.1	90	2.89	183.1	203.2	174	212.5	2	1	HTA932UADB
HTA934UADB	170	230	54	2	1	93.0	268	9 500	27 300	159	16 200	5 000	6 300	142.9	94	3.05	193.1	213.2	184	222.5	2	1	HTA934UADB
HTA936UADB	180	250	63	2	1	140	400	14 300	41 000	239	24 400	4 700	5 800	156.2	138	4.78	206.4	231.5	194	242.5	2	1	HTA936UADB
HTA938UADB	190	260	63	2	1	143	420	14 600	43 000	252	25 700	4 400	5 600	162.0	144	5.00	216.4	241.5	204	252.5	2	1	HTA938UADB
HTA940UADB	200	280	72	2.1	1.1	169	500	17 200	51 000	305	31 000	4 200	5 200	175.2	197	7.00	230.6	258.2	217	270	2	1	HTA940UADB
HTA944UADB	220	300	72	2.1	1.1	173	535	17 700	54 500	330	33 500	3 800	4 800	186.7	213	7.60	250.6	277.9	237	290	2	1	HTA944UADB
HTA948UADB	240	320	72	2.1	1.1	178	570	18 100	58 000	350	35 500	3 600	4 500	198.3	229	8.15	270.6	297.9	257	310	2	1	HTA948UADB
HTA952UADB	260	360	90	2.1	1.1	234	745	23 800	76 000	460	47 000	3 200	4 000	224.7	378	14.3	298.9	331.5	277	350	2	1	HTA952UADB
HTA956UADB	280	380	90	2.1	1.1	241	795	24 500	81 000	490	50 000	3 000	3 800	236.3	403	15.2	318.9	351.4	297	370	2	1	HTA956UADB
HTA960UADB	300	420	108	3	1.1	305	1 020	31 500	104 000	610	62 000	2 800	3 500	262.7	675	23.5	347.1	385.2	320	410	2.5	1	HTA960UADB
HTA964UADB	320	440	108	3	1.1	310	1 060	32 000	108 000	635	65 000	2 600	3 300	274.2	715	24.8	367.1	405.0	340	430	2.5	1	HTA964UADB

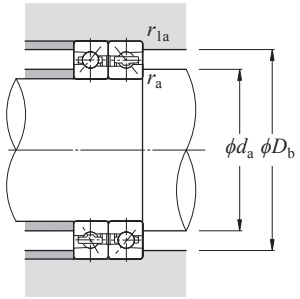
1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Axial Loads Dimension Tables NTN

Main Spindle Bearings

ULTAGE Angular contact ball bearings for axial loads (steel ball spec.) HTA9U type





Dynamic equivalent axial load
$P_a = F_a$

Static equivalent axial load
$P_{0a} = F_a$

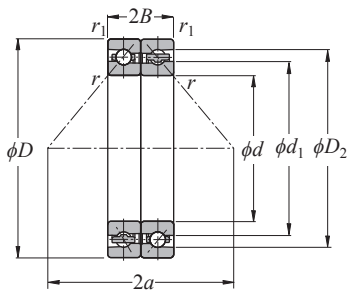
Contact angle 40° d 100–320 mm

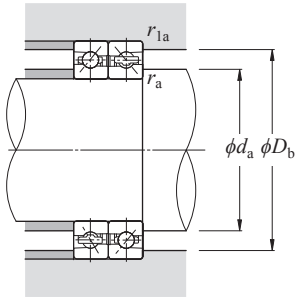
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm				Part number
	d	D	$2B$	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_a	C_{0a}	C_a	C_{0a}	(static)	(static)			$2a$	Two row (approx.)	Two row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	
HTA920UDB	100	140	36	1.1	0.6	52.5	121	5 350	12 300	29.3	2 990	6 300	7 900	119.1	24	0.81	115.3	129.0	110	134	1	0.6	HTA920UDB
HTA921UDB	105	145	36	1.1	0.6	53.5	128	5 500	13 000	31.0	3 150	6 000	7 600	123.3	24	0.85	120.3	134.0	115	139	1	0.6	HTA921UDB
HTA922UDB	110	150	36	1.1	0.6	54.0	131	5 500	13 400	32.0	3 250	5 800	7 300	127.5	26	0.88	125.3	139.0	120	144	1	0.6	HTA922UDB
HTA924UDB	120	165	40.5	1.1	0.6	63.0	156	6 450	15 900	39.0	4 000	5 300	6 700	140.3	36	1.23	137.4	152.3	130	159	1	0.6	HTA924UDB
HTA926UDB	130	180	45	1.5	1	75.5	193	7 700	19 600	44.5	4 550	4 800	6 100	153.1	50	1.65	149.4	165.7	142	172.5	1.5	1	HTA926UDB
HTA928UDB	140	190	45	1.5	1	75.5	197	7 700	20 100	46.0	4 700	4 500	5 800	161.5	53	1.75	159.4	175.7	152	182.5	1.5	1	HTA928UDB
HTA930UDB	150	210	54	2	1	106	270	10 800	27 600	62.5	6 350	4 200	5 300	178.7	85	2.74	173.1	193.1	164	202.5	2	1	HTA930UDB
HTA932UDB	160	220	54	2	1	108	284	11 000	29 000	65.5	6 700	3 900	5 000	187.1	90	2.89	183.1	203.1	174	212.5	2	1	HTA932UDB
HTA934UDB	170	230	54	2	1	110	298	11 200	30 500	69.0	7 050	3 800	4 800	195.5	94	3.05	193.1	213.1	184	222.5	2	1	HTA934UDB
HTA936UDB	180	250	63	2	1	166	445	16 900	45 500	104	10 600	3 500	4 400	212.7	138	4.78	206.4	231.4	194	242.5	2	1	HTA936UDB
HTA938UDB	190	260	63	2	1	170	470	17 300	48 000	110	11 200	3 300	4 200	221.1	144	5.00	216.4	241.4	204	252.5	2	1	HTA938UDB
HTA940UDB	200	280	72	2.1	1.1	200	555	20 400	56 500	134	13 700	3 100	4 000	238.3	197	7.00	230.6	258.2	217	270	2	1	HTA940UDB
HTA944UDB	220	300	72	2.1	1.1	205	595	20 900	60 500	145	14 800	2 900	3 700	255.1	213	7.60	250.6	278.2	237	290	2	1	HTA944UDB
HTA948UDB	240	320	72	2.1	1.1	210	635	21 500	64 500	155	15 800	2 700	3 400	271.8	229	8.15	270.6	298.0	257	310	2	1	HTA948UDB
HTA952UDB	260	360	90	2.1	1.1	276	830	28 200	84 500	203	20 700	2 400	3 100	306.2	378	14.3	298.9	331.5	277	350	2	1	HTA952UDB
HTA956UDB	280	380	90	2.1	1.1	284	885	29 000	90 500	218	22 200	2 300	2 900	323.0	403	15.2	318.9	351.6	297	370	2	1	HTA956UDB
HTA960UDB	300	420	108	3	1.1	365	1 130	37 000	115 000	266	27 100	2 100	2 600	357.3	675	23.5	347.1	385.0	320	410	2.5	1	HTA960UDB
HTA964UDB	320	440	108	3	1.1	370	1 180	37 500	120 000	279	28 400	2 000	2 500	374.1	715	24.8	367.1	405.0	340	430	2.5	1	HTA964UDB

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

Main Spindle Bearings

ULTAGE Angular contact ball bearings for axial loads (steel ball spec.)
HTA0UA type





Dynamic equivalent axial load
$P_a = F_a$

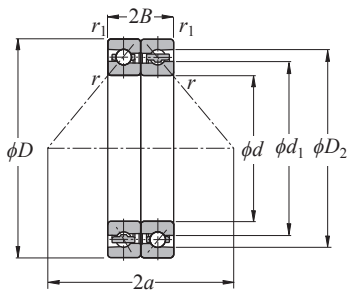
Static equivalent axial load
$P_{0a} = F_a$

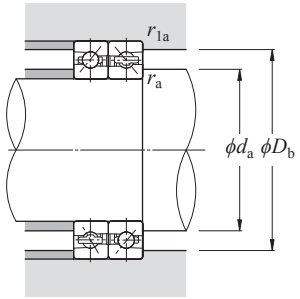
Contact angle 30° *d* 50–320 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm				Part number
	d	D	$2B$	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_a	C_{0a}	C_a	C_{0a}	(static)	(static)			$2a$	Two row (approx.)	Two row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	
HTA010UADB	50	80	28.5	1	0.6	27.5	48.5	2 810	4 950	23.2	2 370	15 400	19 200	52.1	9	0.24	60.7	73.2	57.5	74.0	1	0.6	HTA010UADB
HTA011UADB	55	90	33	1.1	0.6	29.8	57.5	3 050	5 850	27.7	2 820	13 800	17 200	58.6	13	0.39	68.2	80.8	65.0	84.0	1	0.6	HTA011UADB
HTA012UADB	60	95	33	1.1	0.6	31.0	63.0	3 200	6 400	30.5	3 100	12 900	16 100	61.5	13	0.41	73.2	85.8	70.0	89.0	1	0.6	HTA012UADB
HTA013UADB	65	100	33	1.1	0.6	31.5	65.0	3 250	6 650	32.0	3 250	12 100	15 200	64.4	14	0.44	78.2	90.8	75.0	94.0	1	0.6	HTA013UADB
HTA014UADB	70	110	36	1.1	0.6	38.5	82.0	3 950	8 350	40.0	4 100	11 100	13 900	70.3	18	0.61	85.3	99.1	80.0	104	1	0.6	HTA014UADB
HTA015UADB	75	115	36	1.1	0.6	41.0	91.5	4 200	9 300	45.5	4 650	10 500	13 200	73.2	19	0.65	90.3	104.1	85.0	109	1	0.6	HTA015UADB
HTA016UADB	80	125	40.5	1.1	0.6	47.0	105	4 800	10 700	52.0	5 300	9 800	12 200	79.8	26	0.88	97.4	112.5	90.0	119	1	0.6	HTA016UADB
HTA017UADB	85	130	40.5	1.1	0.6	48.0	108	4 850	11 100	54.5	5 550	9 300	11 600	82.7	28	0.93	102.4	117.5	95.0	124	1	0.6	HTA017UADB
HTA018UADB	90	140	45	1.5	1	55.5	127	5 650	13 000	63.5	6 500	8 700	10 900	89.3	38	1.22	109.4	125.8	102	132.5	1.5	1	HTA018UADB
HTA019UADB	95	145	45	1.5	1	56.0	131	5 700	13 400	66.0	6 750	8 300	10 400	92.1	39	1.27	114.4	130.8	107	137.5	1.5	1	HTA019UADB
HTA020UADB	100	150	45	1.5	1	58.0	140	5 900	14 300	71.0	7 250	8 000	10 000	95.1	39	1.34	119.5	135.9	112	142.5	1.5	1	HTA020UADB
HTA021UADB	105	160	49.5	2	1	66.5	163	6 800	16 600	82.5	8 400	7 500	9 400	101.6	49	1.74	126.5	144.2	119	152.5	2	1	HTA021UADB
HTA022UADB	110	170	54	2	1	82.5	200	8 400	20 400	100	10 200	7 100	8 900	108.3	66	2.14	133.1	153.3	124	162.5	2	1	HTA022UADB
HTA024UADB	120	180	54	2	1	83.0	206	8 450	21 000	104	10 600	6 700	8 300	114.1	67	2.32	143.3	163.4	134	172.5	2	1	HTA024UADB
HTA026UADB	130	200	63	2	1	119	293	12 200	29 900	144	14 700	6 100	7 600	127.3	108	3.39	156.4	181.6	144	192.5	2	1	HTA026UADB
HTA028UADB	140	210	63	2	1	123	315	12 600	32 000	156	15 900	5 700	7 100	133.1	114	3.60	166.4	191.5	154	202.5	2	1	HTA028UADB
HTA030UADB	150	225	67.5	2.1	1.1	127	330	12 900	34 000	169	17 200	5 300	6 700	142.6	141	4.46	178.9	204.1	167	215	2	1	HTA030UADB
HTA032UADB	160	240	72	2.1	1.1	148	390	15 100	40 000	196	20 000	5 000	6 300	152.1	168	5.40	190.6	218.3	177	230	2	1	HTA032UADB
HTA034UADB	170	260	81	2.1	1.1	170	450	17 400	46 000	226	23 000	4 700	5 800	165.3	238	7.20	204.7	235.0	187	250	2	1	HTA034UADB
HTA036UADB	180	280	90	2.1	1.1	197	530	20 100	54 000	265	27 000	4 300	5 400	178.5	285	10.6	218.9	251.7	197	270	2	1	HTA036UADB
HTA038UADB	190	290	91	2.1	1.1	200	545	20 400	55 500	275	28 000	4 200	5 200	184.3	300	11.0	228.9	261.7	207	280	2	1	HTA038UADB
HTA040UADB	200	310	99	2.1	1.1	224	610	22 800	62 500	310	31 500	3 900	4 900	197.5	436	13.8	243.0	278.5	217	300	2	1	HTA040UADB
HTA044UADB	220	340	108	3	1.1	281	775	28 600	79 000	385	39 500	3 600	4 500	216.6	550	18.1	266.3	306.9	240	330	2.5	1	HTA044UADB
HTA048UADB	240	360	108	3	1.1	289	825	29 500	84 000	415	42 500	3 300	4 200	228.1	650	18.9	286.3	326.8	260	350	2.5	1	HTA048UADB
HTA052UADB	260	400	123	4	1.5	345	1 040	35 000	106 000	520	53 500	3 000	3 800	253.0	850	28.4	314.6	360.3	283	388	3	1.5	HTA052UADB
HTA056UADB	280	420	123	4	1.5	350	1 110	36 000	113 000	565	57 500	2 900	3 600	264.6	900	30.2	334.6	380.3	303	408	3	1.5	HTA056UADB
HTA060UADB	300	460	142.5	4	1.5	400	1 330	41 000	135 000	670	68 500	2 600	3 300	291.8	1 265	43.6	362.9	414.0	323	448	3	1.5	HTA060UADB
HTA064UADB	320	480	142.5	4	1.5	405	1 360	41 500	139 000	700	71 500	2 500	3 100	303.3	1 340	45.8	382.9	433.9	343	468	3	1.5	HTA064UADB

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

ULTAGE Angular contact ball bearings for axial loads (steel ball spec.) HTA0U type





Dynamic equivalent axial load
$P_a = F_a$

Static equivalent axial load
$P_{0a} = F_a$

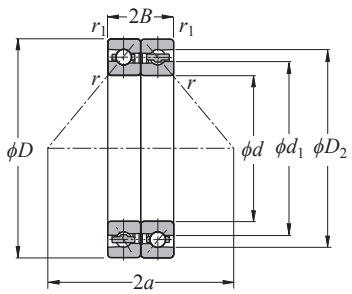
Contact angle 40° *d* 50–320 mm

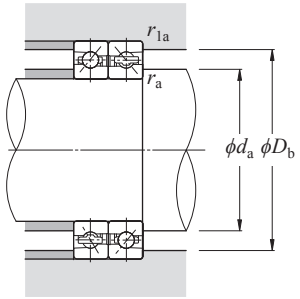
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm				Part number
	d	*D*	*2B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_a	C_{0a}	C_a	C_{0a}	(static)	(static)			*2a*	Two row (approx.)	Two row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	
HTA010UDB	50	80	28.5	1	0.6	33.0	55.5	3 350	5 650	12.3	1 250	11 500	14 600	69.2	9	0.24	60.7	73.1	57.5	74.0	1	0.6	HTA010UDB
HTA011UDB	55	90	33	1.1	0.6	35.5	64.0	3 600	6 500	14.3	1 460	10 300	13 100	77.7	13	0.39	68.2	80.7	65.0	84.0	1	0.6	HTA011UDB
HTA012UDB	60	95	33	1.1	0.6	37.0	69.5	3 800	7 100	15.7	1 600	9 700	12 300	81.9	13	0.41	73.2	85.7	70.0	89.0	1	0.6	HTA012UDB
HTA013UDB	65	100	33	1.1	0.6	37.5	72.0	3 850	7 350	16.4	1 670	9 100	11 500	86.1	14	0.44	78.2	90.7	75.0	94.0	1	0.6	HTA013UDB
HTA014UDB	70	110	36	1.1	0.6	46.0	91.0	4 700	9 300	21.5	2 190	8 300	10 600	94.0	18	0.61	85.3	99.0	80.0	104	1	0.6	HTA014UDB
HTA015UDB	75	115	36	1.1	0.6	49.0	101	5 000	10 300	24.0	2 450	7 900	10 000	98.2	19	0.65	90.3	104.0	85.0	109	1	0.6	HTA015UDB
HTA016UDB	80	125	40.5	1.1	0.6	56.0	117	5 700	11 900	28.4	2 900	7 300	9 300	106.7	26	0.88	97.4	112.4	90.0	119	1	0.6	HTA016UDB
HTA017UDB	85	130	40.5	1.1	0.6	56.5	120	5 800	12 300	29.4	3 000	7 000	8 800	110.9	28	0.93	102.4	117.4	95.0	124	1	0.6	HTA017UDB
HTA018UDB	90	140	45	1.5	1	65.5	141	6 700	14 400	32.0	3 250	6 500	8 300	119.5	38	1.22	109.4	125.7	102	132.5	1.5	1	HTA018UDB
HTA019UDB	95	145	45	1.5	1	66.5	146	6 800	14 900	33.5	3 400	6 300	7 900	123.7	39	1.27	114.4	130.7	107	137.5	1.5	1	HTA019UDB
HTA020UDB	100	150	45	1.5	1	68.5	156	7 000	15 900	35.5	3 600	6 000	7 600	128.0	39	1.34	119.5	135.8	112	142.5	1.5	1	HTA020UDB
HTA021UDB	105	160	49.5	2	1	79.0	181	8 050	18 400	42.5	4 350	5 700	7 200	136.5	49	1.74	126.5	144.1	119	152.5	2	1	HTA021UDB
HTA022UDB	110	170	54	2	1	98.0	222	10 000	22 700	50.0	5 100	5 400	6 800	145.1	66	2.14	133.1	153.2	124	162.5	2	1	HTA022UDB
HTA024UDB	120	180	54	2	1	98.5	228	10 000	23 300	52.0	5 300	5 000	6 300	153.6	67	2.32	143.3	163.3	134	172.5	2	1	HTA024UDB
HTA026UDB	130	200	63	2	1	142	325	14 400	33 000	74.0	7 550	4 500	5 800	170.8	108	3.39	156.4	181.5	144	192.5	2	1	HTA026UDB
HTA028UDB	140	210	63	2	1	146	345	14 900	35 500	79.5	8 100	4 300	5 400	179.2	114	3.60	166.4	191.4	154	202.5	2	1	HTA028UDB
HTA030UDB	150	225	67.5	2.1	1.1	150	370	15 300	37 500	85.0	8 650	4 000	5 200	191.9	141	4.46	178.9	204.0	167	215	2	1	HTA030UDB
HTA032UDB	160	240	72	2.1	1.1	176	435	17 900	44 000	103	10 500	3 800	4 800	204.7	168	5.40	190.6	218.2	177	230	2	1	HTA032UDB
HTA034UDB	170	260	81	2.1	1.1	202	500	20 600	51 000	116	11 800	3 500	4 400	221.9	238	7.20	204.7	234.9	187	250	2	1	HTA034UDB
HTA036UDB	180	280	90	2.1	1.1	234	585	23 900	60 000	140	14 300	3 300	4 100	239.1	285	10.6	218.9	251.6	197	270	2	1	HTA036UDB
HTA038UDB	190	290	91	2.1	1.1	237	605	24 100	61 500	145	14 800	3 100	4 000	247.4	300	11.0	228.9	261.6	207	280	2	1	HTA038UDB
HTA040UDB	200	310	99	2.1	1.1	265	680	27 100	69 000	159	16 200	2 900	3 700	264.6	436	13.8	243.0	278.4	217	300	2	1	HTA040UDB
HTA044UDB	220	340	108	3	1.1	335	860	34 000	87 500	201	20 500	2 700	3 400	290.3	550	18.1	266.3	306.7	240	330	2.5	1	HTA044UDB
HTA048UDB	240	360	108	3	1.1	345	915	35 000	93 000	216	22 000	2 500	3 200	307.0	650	18.9	286.3	326.6	260	350	2.5	1	HTA048UDB
HTA052UDB	260	400	123	4	1.5	405	1 160	41 500	118 000	275	28 000	2 300	2 900	339.9	850	28.4	314.6	360.1	283	388	3	1.5	HTA052UDB
HTA056UDB	280	420	123	4	1.5	420	1 230	42 500	125 000	293	29 900	2 100	2 700	356.7	900	30.2	334.6	380.1	303	408	3	1.5	HTA056UDB
HTA060UDB	300	460	142.5	4	1.5	475	1 470	48 500	150 000	355	36 000	2 000	2 500	391.7	1 265	43.6	362.9	413.7	323	448	3	1.5	HTA060UDB
HTA064UDB	320	480	142.5	4	1.5	480	1 520	49 000	155 000	365	37 000	1 900	2 400	408.5	1 340	45.8	382.9	433.7	343	468	3	1.5	HTA064UDB

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

Main Spindle Bearings

ULTAGE Angular contact ball bearings for axial loads (ceramic ball spec.)
5S-HTA0UA type





Dynamic equivalent axial load
$P_a = F_a$

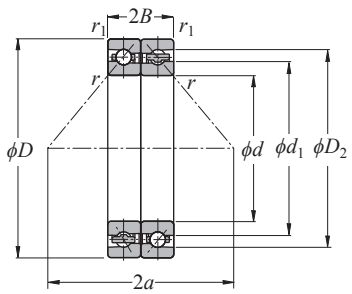
Static equivalent axial load
$P_{0a} = F_a$

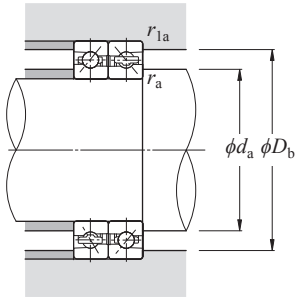
Contact angle 30° d 50–130 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm				Part number
	d	D	$2B$	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_a	C_{0a}	C_a	C_{0a}	(static)	(static)			$2a$	Two row (approx.)	Two row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	
5S-HTA010UADB	50	80	28.5	1	0.6	27.5	33.5	2 810	3 400	15.7	1 600	17 300	22 200	52.1	9	0.22	60.7	73.2	57.5	74.0	1	0.6	5S-HTA010UADB
5S-HTA011UADB	55	90	33	1.1	0.6	29.8	39.5	3 050	4 050	18.6	1 900	15 500	19 900	58.6	13	0.36	68.2	80.8	65.0	84.0	1	0.6	5S-HTA011UADB
5S-HTA012UADB	60	95	33	1.1	0.6	31.0	43.5	3 200	4 450	20.5	2 090	14 500	18 600	61.5	13	0.39	73.2	85.8	70.0	89.0	1	0.6	5S-HTA012UADB
5S-HTA013UADB	65	100	33	1.1	0.6	31.5	45.0	3 250	4 600	21.6	2 200	13 600	17 500	64.4	14	0.41	78.2	90.8	75.0	94.0	1	0.6	5S-HTA013UADB
5S-HTA014UADB	70	110	36	1.1	0.6	38.5	57.0	3 950	5 800	27.2	2 770	12 500	16 000	70.3	18	0.57	85.3	99.1	80.0	104	1	0.6	5S-HTA014UADB
5S-HTA015UADB	75	115	36	1.1	0.6	41.0	63.5	4 200	6 450	30.5	3 150	11 800	15 200	73.2	19	0.60	90.3	104.1	85.0	109	1	0.6	5S-HTA015UADB
5S-HTA016UADB	80	125	40.5	1.1	0.6	47.0	73.0	4 800	7 400	35.0	3 600	11 000	14 100	79.8	26	0.83	97.4	112.5	90.0	119	1	0.6	5S-HTA016UADB
5S-HTA017UADB	85	130	40.5	1.1	0.6	48.0	75.0	4 850	7 650	36.5	3 750	10 500	13 400	82.7	28	0.87	102.4	117.5	95.0	124	1	0.6	5S-HTA017UADB
5S-HTA018UADB	90	140	45	1.5	1	55.5	88.5	5 650	9 000	43.0	4 400	9 800	12 500	89.3	38	1.15	109.4	125.8	102	132.5	1.5	1	5S-HTA018UADB
5S-HTA019UADB	95	145	45	1.5	1	56.0	91.0	5 700	9 300	44.5	4 550	9 400	12 000	92.1	39	1.20	114.4	130.8	107	137.5	1.5	1	5S-HTA019UADB
5S-HTA020UADB	100	150	45	1.5	1	58.0	97.0	5 900	9 900	48.0	4 900	9 000	11 500	95.1	39	1.26	119.5	135.9	112	142.5	1.5	1	5S-HTA020UADB
5S-HTA021UADB	105	160	49.5	2	1	66.5	113	6 800	11 500	55.5	5 650	8 500	10 900	101.6	49	1.64	126.5	144.2	119	152.5	2	1	5S-HTA021UADB
5S-HTA022UADB	110	170	54	2	1	82.5	139	8 400	14 100	67.0	6 850	8 000	10 300	108.3	66	2.00	133.1	153.3	124	162.5	2	1	5S-HTA022UADB
5S-HTA024UADB	120	180	54	2	1	83.0	143	8 450	14 500	70.0	7 150	7 500	9 600	114.1	67	2.17	143.3	163.4	134	172.5	2	1	5S-HTA024UADB
5S-HTA026UADB	130	200	63	2	1	119	203	12 200	20 700	97.0	9 900	6 800	8 700	127.3	108	3.13	156.4	181.6	144	192.5	2	1	5S-HTA026UADB

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

ULTAGE Angular contact ball bearings for axial loads (ceramic ball spec.) 5S-HTA0U type





Dynamic equivalent axial load
$P_a = F_a$

Static equivalent axial load
$P_{0a} = F_a$

Contact angle 40° d 50–130 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm				Part number
	d	D	$2B$	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_a	C_{0a}	C_a	C_{0a}	(static)	(static)			$2a$	Two row (approx.)	Two row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	
5S-HTA010UDB	50	80	28.5	1	0.6	33.0	38.5	3 350	3 900	14.6	1 490	12 200	15 400	69.2	9	0.22	60.7	73.1	57.5	74.0	1	0.6	5S-HTA010UDB
5S-HTA011UDB	55	90	33	1.1	0.6	35.5	44.5	3 600	4 500	17.1	1 740	10 900	13 800	77.7	13	0.36	68.2	80.7	65.0	84.0	1	0.6	5S-HTA011UDB
5S-HTA012UDB	60	95	33	1.1	0.6	37.0	48.0	3 800	4 900	18.7	1 910	10 200	12 900	81.9	13	0.39	73.2	85.7	70.0	89.0	1	0.6	5S-HTA012UDB
5S-HTA013UDB	65	100	33	1.1	0.6	37.5	50.0	3 850	5 100	19.6	2 000	9 600	12 100	86.1	14	0.41	78.2	90.7	75.0	94.0	1	0.6	5S-HTA013UDB
5S-HTA014UDB	70	110	36	1.1	0.6	46.0	63.0	4 700	6 450	25.6	2 610	8 800	11 100	94.0	18	0.57	85.3	99.0	80.0	104	1	0.6	5S-HTA014UDB
5S-HTA015UDB	75	115	36	1.1	0.6	49.0	70.5	5 000	7 150	28.7	2 930	8 300	10 500	98.2	19	0.60	90.3	104.0	85.0	109	1	0.6	5S-HTA015UDB
5S-HTA016UDB	80	125	40.5	1.1	0.6	56.0	81.0	5 700	8 250	34.0	3 450	7 700	9 800	106.7	26	0.83	97.4	112.4	90.0	119	1	0.6	5S-HTA016UDB
5S-HTA017UDB	85	130	40.5	1.1	0.6	56.5	83.5	5 800	8 500	35.0	3 600	7 300	9 300	110.9	28	0.87	102.4	117.4	95.0	124	1	0.6	5S-HTA017UDB
5S-HTA018UDB	90	140	45	1.5	1	65.5	98.0	6 700	10 000	38.0	3 900	6 900	8 700	119.5	38	1.15	109.4	125.7	102	132.5	1.5	1	5S-HTA018UDB
5S-HTA019UDB	95	145	45	1.5	1	66.5	101	6 800	10 300	39.5	4 050	6 600	8 300	123.7	39	1.20	114.4	130.7	107	137.5	1.5	1	5S-HTA019UDB
5S-HTA020UDB	100	150	45	1.5	1	68.5	108	7 000	11 000	42.5	4 300	6 300	8 000	128.0	39	1.26	119.5	135.8	112	142.5	1.5	1	5S-HTA020UDB
5S-HTA021UDB	105	160	49.5	2	1	79.0	125	8 050	12 800	50.5	5 150	6 000	7 500	136.5	49	1.64	126.5	144.1	119	152.5	2	1	5S-HTA021UDB
5S-HTA022UDB	110	170	54	2	1	98.0	154	10 000	15 700	59.5	6 100	5 600	7 100	145.1	66	2.00	133.1	153.2	124	162.5	2	1	5S-HTA022UDB
5S-HTA024UDB	120	180	54	2	1	98.5	158	10 000	16 100	61.5	6 300	5 300	6 700	153.6	67	2.17	143.3	163.3	134	172.5	2	1	5S-HTA024UDB
5S-HTA026UDB	130	200	63	2	1	142	225	14 400	23 000	88.0	9 000	4 800	6 100	170.8	108	3.13	156.4	181.5	144	192.5	2	1	5S-HTA026UDB

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

Main Spindle Bearings



Ball Screw Support Bearings

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ARN type ····· 360

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	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 a 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 stand out 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 stand out so that when any arrangement is installed on a ball screw 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).

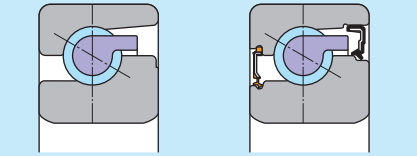


Fig. 13.1

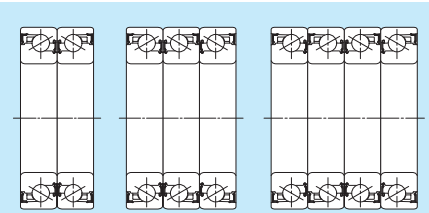
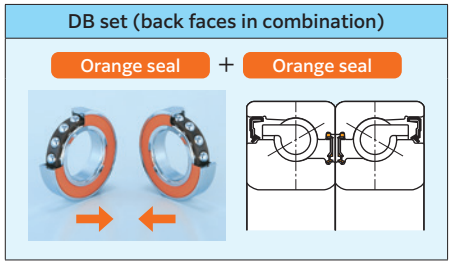


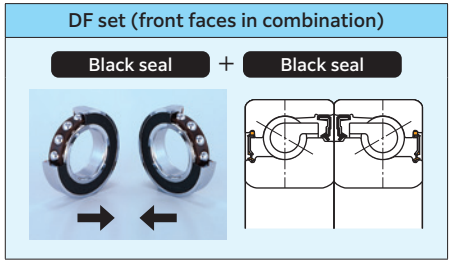
Fig. 13.2 Bearing arrangement

■ 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.

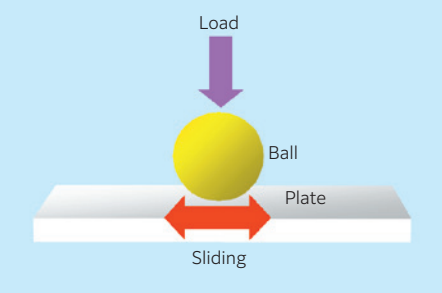


Fig. 13.3 Fretting resistance test (sliding)

Table 13.2 Test conditions

Specification		Conventional type	ULTAGE™
Material/ Heat treatment	Plate	SUJ2/Standard	SUJ2/Special
	Ball	SUJ2/Standard	
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	

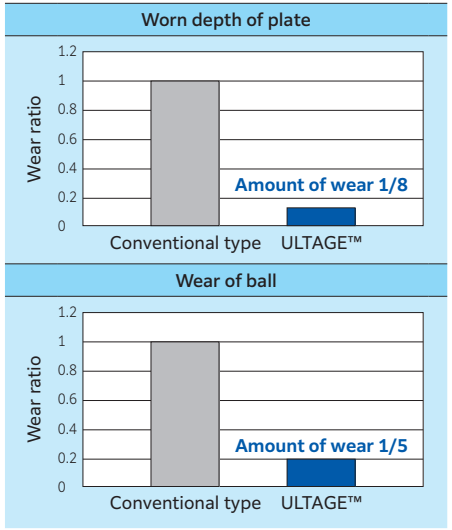


Fig. 13.4 Ratio of fretting corrosion in sliding mode

Ball Screw Support Bearings

(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.

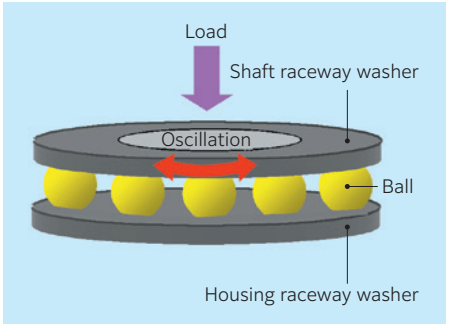


Fig. 13.5 Fretting resistance test (rolling)

Table 13.3 Test conditions

Specification		Conventional type	ULTAGE™
Bearing		Thrust ball bearing 51204 (ϕ20 × ϕ40 × 14)	
Material/ Heat treatment	Raceway washer	SUJ2/Standard	SUJ2/Special
	Ball	SUJ2/Standard	
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	

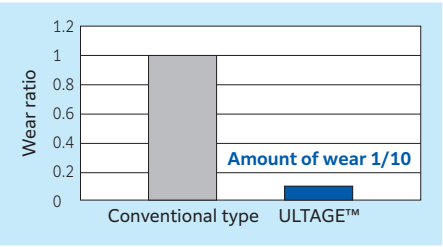


Fig. 13.6 Ratio of fretting corrosion while rolling

(3) Rolling contact fatigue life test

Resistance to rolling contact fatigue 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 (ϕ30 × ϕ62 × 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	

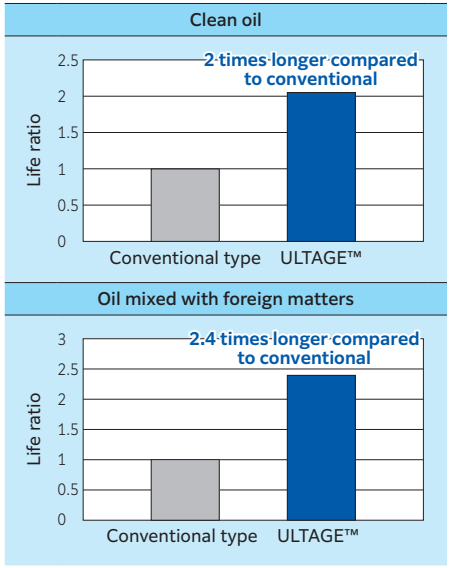


Fig. 13.7 Effect of special heat treatment on rolling contact fatigue life

(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 TS3-6204ZZC3 (ϕ20 × ϕ47 × 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	

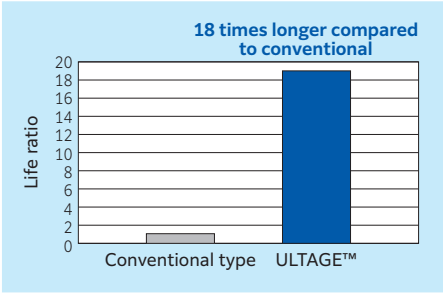


Fig. 13.8 Grease life ratio

(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-BST40X72-1BLXLDFP4/L588 (ϕ40 × ϕ72 × 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

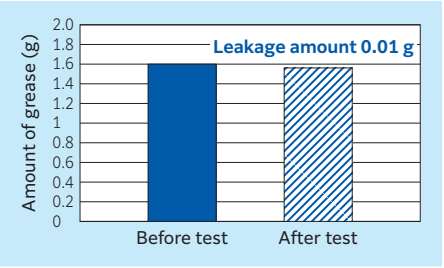


Fig. 13.9 Grease leakage

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.

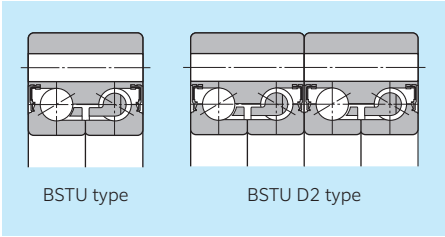


Fig. 13.10 BSTU

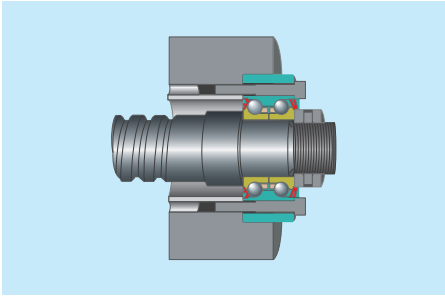


Fig. 13.11 Example of mounted BSTU type

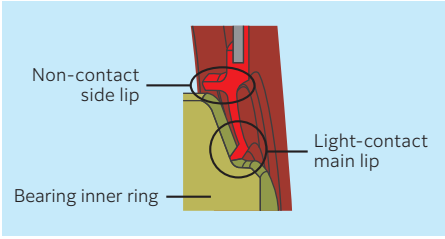


Fig. 13.12 Light-contact seal (code: LX)

■ Performance tests

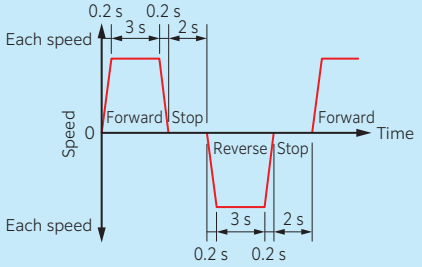
(1) Bearing operating test

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**).

[Test conditions]

Bearing	BSTU3080LLX/GNP4U/L588 (ϕ30 × ϕ80 × 28)
Speed	1 000 to 5 000 min^{-1} (Forward/reverse rotation)

The operating pattern at each speed is shown to the figure below.



Temperature rise test operating pattern

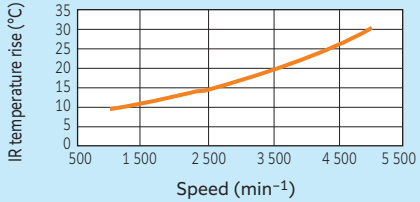


Fig. 13.13 Relation between speed and temperature rise

(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** and **Fig. 13.15**).

[Test conditions]

Bearing	BSTU3080LLX/GNP4U/L588 (ϕ30 × ϕ80 × 28)

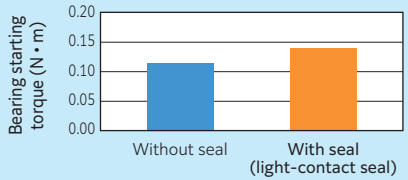
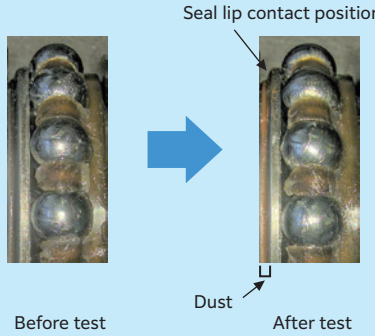


Fig. 13.14 Bearing starting torque

[Test conditions]

Bearing	BSTU3080LLX/GNP4U/L588 (ϕ30 × ϕ80 × 28)
Speed	2 200 min^{-1}
Dust particle diameter	5 to 75 μm (8 types of test powder 1 JIS Z 8901)
Dust color phase	Brown
Test time	1 h



Bearing internal conditions before and after test (with bearing outer ring removed)
No foreign matter was observed inside the bearing after test.

Fig. 13.15 Dust test results

13.3 Angular contact ball bearings HT

HT type 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.

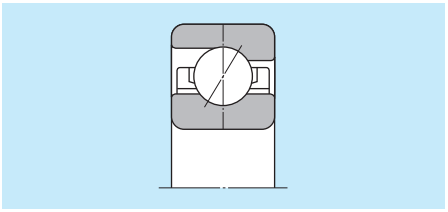


Fig. 13.16 HT

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.

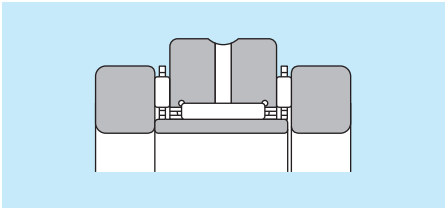


Fig. 13.17 AXN

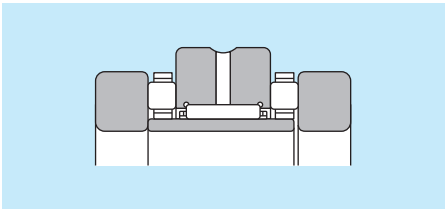


Fig. 13.18 ARN

13.5 Bearing designations

The part number for a ball screw support 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
- Preload 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

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

- Grease code
- Tolerance class code: P4U: **NTN** Class 4, P42U: **NTN** Class 42
- 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 ball screw support 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. JIS 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 d mm		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]																	
over	incl.	high	low	high	low	high	low	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
								max			max			max			high	low	high	low	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 D mm		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]												
over	incl.	high	low	high	low	high	low	Class 5	Class 4	Class UP	Class 5	Class 4	Class UP	All classes	All classes	Class 5	Class 4	Class UP
								max			max					max		
30	50	0	−7	0	−6	0	−5	7	5	4	8	4	3	Depends on tolerance of S_{ia} in relation to d of the same bearing	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			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 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	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 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	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	2.5
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	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.

Ball Screw Support Bearings NTN

Ball Screw Support Bearings

Accuracy of HT type

Table 13.13 Inner rings

Unit: μm

Nominal bore diameter d mm over	incl.	Deviation of mean bore diameter in a single plane Δ_{dmp} Class 5 high	low	Class 4 [1] high	low	Class 2 [1] high	low	Variation of bore diameter in a single plane V_{dsp} 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	Variation of mean bore diameter 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

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

Unit: μm

Nominal outside diameter D mm over	incl.	Deviation of mean outside diameter in a single plane Δ_{Dmp} Class 5 high	low	Class 4 [3] high	low	Class 2 [3] high	low	Variation of outside diameter in a single plane V_{Dsp} 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	−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 differnce 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

Unit: μm

Nominal bearing bore dia. d or nominal bearing outside dia. D mm over	incl.	Deviation of mean bore [1] diameter in a single plane Δ_{dmp} Class 5 high	low	Class 4 high	low	Thrust inner ring bore [1] dia. deviation Δ_{dis} high	low	Deviation of mean outside [2] diameter in a single plane Δ_{Dmp} Class 5 high	low	Class 4 high	low	Deviation of the bearing height Δ_{Ts} high	low	Outer ring width deviation Δ_{Cs} high	low	Radial inner ring [1] radial runout K_{ia} 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.
Note: This standard is the **NTN** standard.

Unit: μm

Perpendicularity of inner ring face with respect to the bore S_d Class 5 max	Class 4 max	Class 2 max	Axial runout S_{ia} Class 5 max	Class 4 max	Class 2 max	Deviation of a single inner ring width Δ_{Bs} Single bearing Class 5 high	Class 4 low	Duplex bearing [2] Class 5 high	Class 4 low	Width variation V_{Bs} 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 S_D Class 5 max	Class 4 max	Class 2 max	Axial runout S_{ea} Class 5 max	Class 4 max	Class 2 max	Deviation of a single outer ring width Δ_{Cs} All classes	Width variation V_{Cs} 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 K_{ea} Class 5 max	Class 4 max	Perpendicularity of outer ring [2] outside surface with respect to the face S_D Class 5 max	Class 4 max	Thrust inner ring and [1] outer ring thickness variation [2] S_{ia}, S_{ea} 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

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 clamp the thrust raceways on both sides to supply preload. A bearing that allows preset preload by clamp 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**.

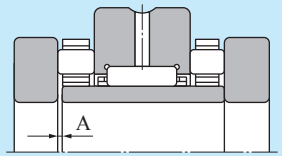


Fig. 13.19

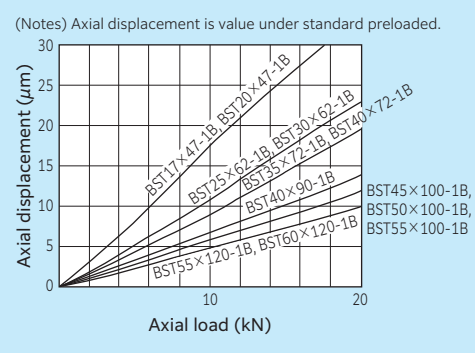


Fig. 13.20 BST type axial rigidity diagram

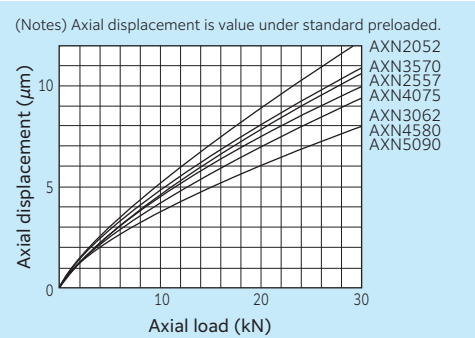


Fig. 13.21 AXN type axial rigidity diagram

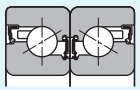
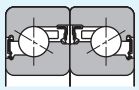
13.8 Proper control of preload (BST type)

When applying preload to a BST type, clamp through the inner ring for back-to-back duplex (DB, DTBT, etc.) and the outer ring for face-to-face duplex (DF, DTFT, etc.) with a clamp force 2 to 3 times as large as the preload.

When fastening the outer rings of face-to-face duplex with the front cover, check the outer ring width of the mating bearings on the bearing inspection sheet, and assemble so that the front cover drive-up is 0.02 to 0.03 mm relative to the sum of the outer ring width dimensions.

The clamp method for the BST type is shown in **Table 13.16**.

Table 13.16 Clamp method for BST type

		back-to-back duplex	face-to-face duplex
Cross section			
Inner ring	Nut clamp force	2 to 3 times as large as the preload	see **Table13.17**
Outer ring	Front cover drive-up	see **Table13.17**	0.02–0.03 mm[1)]
	Nut clamp force	see **Table13.17**	2 to 3 times as large as the preload

1) As shown in **Fig.13.22**, measuring the total width dimension before tightening the outer ring includes the axial clearance. For this reason, use the front cover drive-up to adjust the width of the outer ring to the sum of the outer ring width dimensions on the bearing inspection sheet for the bearing to be combined.

Table 13.17 Nut clamp force and front cover drive-up

Bearing bore diameter (mm)	Nut clamp force (N)	Nut tightening torque <reference value> (N·m)	Front cover drive-up (mm)
6	1 470	2	0.01–0.02
8		2	
10	2 200	4	
12		5	
15	2 900	8	
17		9	
20	2 940–4 900	10–17	
25		13–22	
30		15–26	
35		18–30	
40	4 900–9 800	34–68	
45		38–75	
50		42–83	
55	9 800–14 700	92–138	
60		100–150	

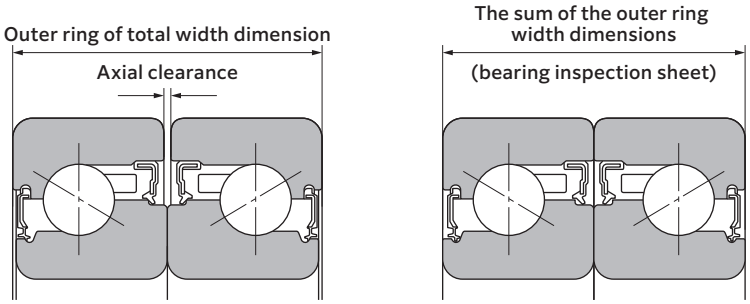


Fig.13.22 Outer ring width control of face-to-face duplex BST type

13.9 Shaft and housing fits

Recommended fits and tolerances of shaft and housing shoulder squareness are shown in **Table 13.18** and **Table 13.19**.

Table 13.18 Shaft and housing fits

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

Table 13.19 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	–	–

13.10 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.

■ 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 to 30 % of the internal free space shown in the dimension tables
- **Recommended grease filling method**
  Refer to "6. Handling of Bearings, 6.1 Rinsing of bearings and grease filling" in the Technical Data section.

■ 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 cm^3/min. Increase the amount of oil if slippage is expected.

13.11 Starting torque of BST type

Reference starting torque values for BST type bearings are shown in **Table 13.20** and **Table 13.21**.

Table 13.20 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 13.21 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}

13.12 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 rings are clamped to achieve the required preload, and the front arrangement, where the outer rings are clamped. Examples of bearing arrangement are shown in **Fig. 13.23** through **Fig. 13.25**.

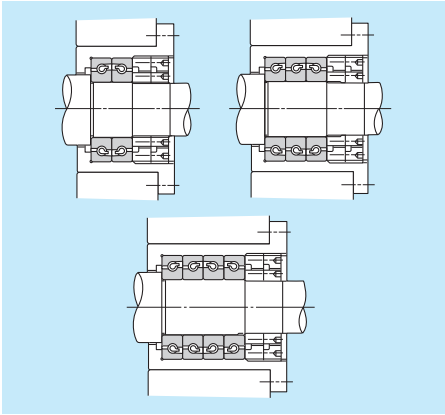


Fig. 13.23

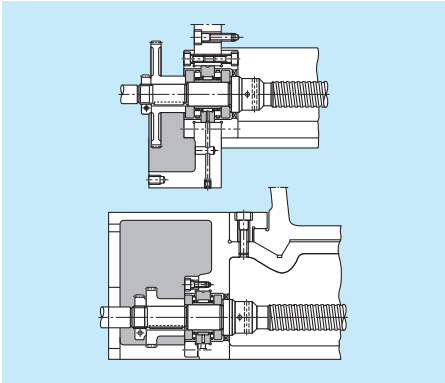


Fig. 13.24

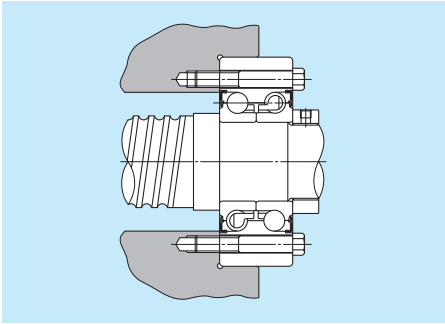
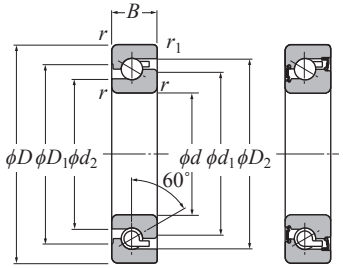


Fig. 13.25

Dynamic equivalent axial load $P_a = XF_r + YF_a$

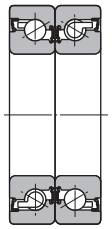
Number of rows in bearing arrangement		2		3			4			
Number of rows subjected to axial load		1	2	1	2	3	1	2	3	4
$F_a/F_r \le 2.17$	X	1.90	—	1.43	2.32	—	1.17	1.90	2.52	—
	Y	0.55	—	0.76	0.35	—	0.88	0.55	0.26	—
$F_a/F_r > 2.17$	X	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
	Y	1	1	1	1	1	1	1	1	1

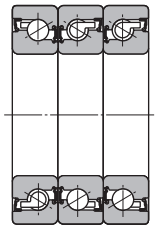
Static equivalent axial load
$P_{0a} = F_a + 3.98F_r$

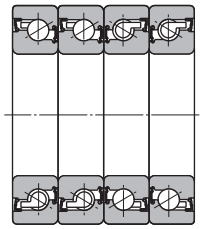


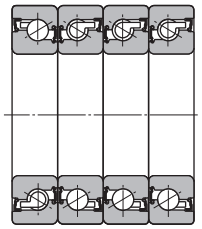
Open type

Contact sealed type


When one row bears axial load (DB)


When two rows bear axial load (DBT)


When two rows bear axial load (DTBT)


When three rows bear axial load (DBTT)

Contact angle 60° d 17–60 mm

Part number	Boundary dimensions mm					Basic dynamic rated load C_a 2) kN kgf			Basic static rated load C_{0a} 2) kN kgf			Dimensions mm				Internal free space cm³	Allowable axial load 2) (static) kN kgf			Allowable speed min⁻¹	
	d	D	B	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	1-row	2-row	3-row	1-row	2-row	3-row	d_1	d_2	D_1	D_2	Single-row (approx.)	1-row	2-row	3-row	grease lubrication	oil lubrication
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	4.4	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	4.4	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	5.9	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	5.9	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	6.7	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	6.7	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	15	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	7.4	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	18	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	18	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	18	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	21	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	21	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		—

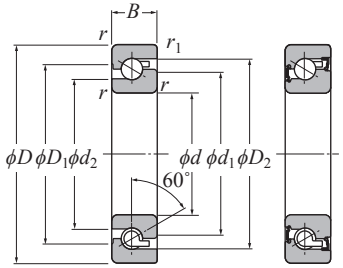
1) Minimum allowable value for corner radius dimension r or r_1.

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

Dynamic equivalent axial load $P_a = XF_r + YF_a$

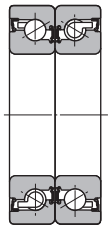
Number of rows in bearing arrangement		2		3			4			
Number of rows subjected to axial load		1	2	1	2	3	1	2	3	4
$F_a/F_r \le 2.17$	X	1.90	—	1.43	2.32	—	1.17	1.90	2.52	—
	Y	0.55	—	0.76	0.35	—	0.88	0.55	0.26	—
$F_a/F_r > 2.17$	X	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
	Y	1	1	1	1	1	1	1	1	1

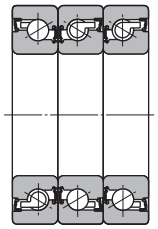
Static equivalent axial load
$P_{0a} = F_a + 3.98F_r$

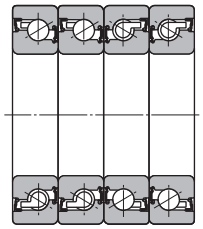


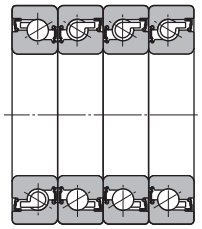
Open type

Contact sealed type


When one row bears axial load (DB)


When two rows bear axial load (DBT)


When two rows bear axial load (DTBT)


When three rows bear axial load (DBTT)

Contact angle 60° d 17–60 mm

Part number	Boundary dimensions mm					Basic dynamic rated load C_a [2] kN kgf			Basic static rated load C_{0a} [2] kN kgf			Dimensions mm				Internal free space cm^3 Single-row (approx.)	Allowable axial load [2] (static) kN kgf			Allowable speed min^{-1}	
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [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	grease lubrication	oil lubrication
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	4.4	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		25.7		41.2		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	4.4	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		25.7		41.2		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	5.9	40.0	80.5	121	4 600	7 000
2A-BST25X62-1BLXL						2 980	4 850	6 450	6 050	12 100	18 100		40.2		55.7		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	5.9	40.0	80.5	121	4 600	7 000
2A-BST30X62-1BLXL						2 980	4 850	6 450	6 050	12 100	18 100		40.2		55.7		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	6.7	47.5	95.0	143	3 900	6 000
2A-BST35X72-1BLXL						3 150	5 150	6 850	7 150	14 300	21 400		48.2		63.7		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	6.7	47.5	95.0	143	3 900	6 000
2A-BST40X72-1BLXL						3 150	5 150	6 850	7 150	14 300	21 400		48.2		63.7		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	15	88.5	177	265	3 100	5 400
2A-BST40X90-1BLXL						6 000	9 700	12 900	13 300	26 600	40 000		59.1		81.6		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	7.4	52.5	105	158	3 500	6 000
2A-BST45X75-1BLXL						3 300	5 350	7 100	7 900	15 800	23 700		54.2		69.7		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	18	104	208	315	2 700	4 400
2A-BST45X100-1BLXL						6 350	10 300	13 700	15 600	31 000	47 000		70.1		92.6		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	18	104	208	315	2 700	4 400
2A-BST50X100-1BLXL						6 350	10 300	13 700	15 600	31 000	47 000		70.1		92.6		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	18	104	208	315	2 700	4 400
2A-BST55X100-1BLXL						6 350	10 300	13 700	15 600	31 000	47 000		70.1		92.6		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	21	124	249	375	2 300	3 700
2A-BST55X120-1BLXL						6 750	11 000	14 600	18 700	37 500	56 000		85.1		107.6		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	21	124	249	375	2 300	3 700
2A-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.

ULTAGE Angular contact thrust ball bearings BST type, 2A-BST type

Preload and axial rigidity

Contact angle 60° d 17–60 mm

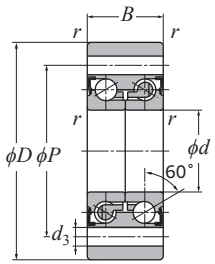
Part number	Standard preload: -1B											
	Two-row (DF/DB types) Preload		Two-row (DF/DB types) Axial rigidity		Three-row (DFT/DBT types) Preload		Three-row (DFT/DBT types) Axial rigidity		Four-row (DTFT/DTBT types) Preload		Four-row (DTFT/DTBT types) Axial rigidity	
	N	kgf	N/μm	kgf/μm	N	kgf	N/μm	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

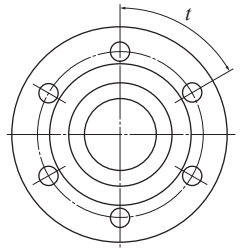
NOTE: 1. Preloads listed are indicative of bearing combination specified.
2. The axial rigidity indicated is in the axial direction under the specified preload.

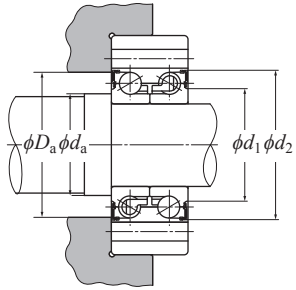
Ball Screw Support Bearings Dimension Tables
NTN

Part number	Light preload: -11B											
	Two-row (DF/DB types) Preload		Two-row (DF/DB types) Axial rigidity		Three-row (DFT/DBT types) Preload		Three-row (DFT/DBT types) Axial rigidity		Four-row (DTFT/DTBT types) Preload		Four-row (DTFT/DTBT types) 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

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







Dynamic equivalent radial load

$P_a = XF_r + YF_a$

e	$F_a/F_r \le e$		$F_a/F_r > e$	
	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

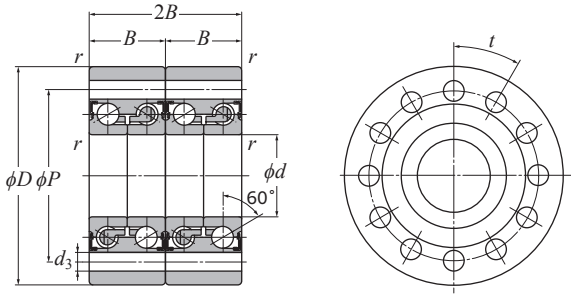
Part number	Boundary dimensions mm						Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	Reference dimensions mm		Abutment and fillet dimensions mm		Outer ring mounting bolt		Preload N	kgf	Mass kg	Bearing friction torque N·m	Axial rigidity N/μm	Moment rigidity N·m/mrad	Inertia of inner ring $kg·cm^2$	Part number
	d	D	B	$r_{s\,min}$[1]	P	d_3	C_a	C_{0a}	C_a	C_{0a}	(static)	(static)		d_1	d_2	D_a max	d_a min	Screws	Quantity × t			(approx.)	(approx.)				
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

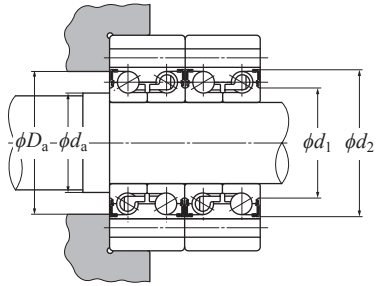
1) Minimum allowable value for corner radius dimension *r*.

Ball Screw Support Bearings Dimension Tables NTN

Ball Screw Support Bearings

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





Dynamic equivalent radial load

$P_a = XF_r + YF_a$

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

Static equivalent radial load

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

Contact angle 60° d 20–40 mm

Part number	Boundary dimensions mm						Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	Reference dimensions mm		Abutment and fillet dimensions mm		Outer ring mounting bolt		Preload N	kgf	Mass kg	Bearing friction torque N·m	Axial rigidity N/μm	Moment rigidity N·m/mrad	Inertia of inner ring $kg \cdot cm^2$	Part number
	d	D	$2B$	$r_{s\,min}$ [1]	P	d_3	C_a	C_{0a}	C_a	C_{0a}	(static)			d_1	d_2	D_a max	d_a min	Screws	Quantity × t			(approx.)	(approx.)				
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.

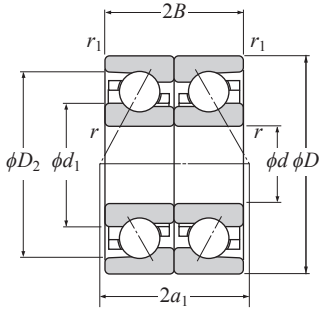
Ball Screw Support Bearings

Angular contact ball bearings HT type

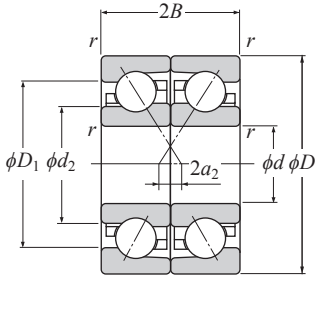
Dynamic equivalent axial load $P_a = XF_r + YF_a$

Number of rows in bearing arrangement		2		3			4			
Number of rows subjected to axial load		1	2	1	2	3	1	2	3	4
$F_a/F_r \le 0.80$	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

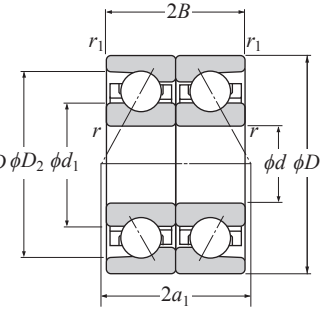
Static equivalent axial load
$P_{0a} = 1.52F_r + F_a$



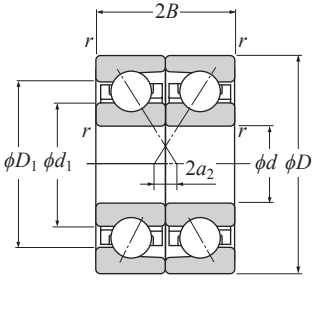
Back-to-back (DB)
Drawings 1



Face-to-face (DF)
Drawings 1



Back-to-back (DB)
Drawings 2



Face-to-face (DF)
Drawings 2

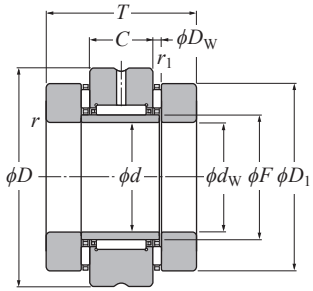
Contact angle 30° d 6–40 mm

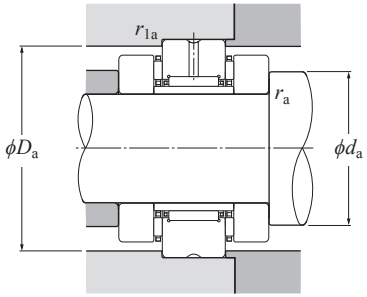
Part number		Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Dimensions mm				Load center mm		Drawing number	Allowable axial load (static) 2) kN 1-row	kN 2-row	kgf 1-row	kgf 2-row	Medium preload (GM) Preload 3) N DB	DF	kgf DB	DF	Axial rigidity 4) N/μm DB	DF	kgf/μm DB	DF	Starting torque N·mm (approx.) DB	DF	Heavy preload (GH) Preload 3) N DB	DF	kgf DB	DF	Axial rigidity 4) N/μm DB	DF	kgf/μm DB	DF	Starting torque N·mm (approx.) DB	DF
Back-to-back (DB)	Face-to-face (DF)	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	DB a_1	DF a_2						DB DBT	DF DFT	DB DBT	DF DFT	DB DBT	DF DFT	DB DBT	DF DFT	DB	DBT	DB	DBT	DB DBT	DF DFT	DB DBT	DF DFT	DB DBT	DF DFT	DB DBT	DF DFT	DB	DBT
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	1 550	1 670	25.0	—	32.0	36.2	28.8	4.8	2	5.85	595	11.7	1 190	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	1 440	1 730	28.4	—	34.7	38.1	30.3	6.3	2	7.55	770	15.1	1 540	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	2 020	2 360	30.5	—	38.6	42.7	34.1	6.1	2	9.50	970	19.0	1 940	490 50	665 68	168 17.2	240 24.5	41.5	56.1	785 80	1 070 109	203 20.7	289 29.5	79.7	108
7205HTDB	**7205HTDF**	25	52	30	1.0	0.6	22.4	28.8	2 280	2 940	35.0	—	43.0	47.2	37.7	7.7	2	11.5	1 170	23.0	2 340	490 50	665 68	188 19.2	269 27.4	39.7	53.7	785 80	1 070 109	226 23.1	323 32.9	76.4	104
7206HTDB	**7206HTDF**	30	62	32	1.0	0.6	31.0	41.5	3 150	4 200	41.7	—	51.4	56.3	43.1	11.1	2	16.3	1 660	32.6	3 320	490 50	665 68	197 20.0	281 28.6	41.3	55.8	785 80	1 070 109	235 24.0	336 34.2	79.4	108
7207HTDB	**7207HTDF**	35	72	34	1.1	0.6	41.0	56.0	4 200	5 750	47.9	—	59.2	64.9	48.2	14.2	2	21.9	2 230	43.8	4 470	885 90	1 200 122	255 26.0	363 37.1	96.4	130	1 470 150	2 000 204	311 31.7	443 45.2	196	265
7208HTDB	**7208HTDF**	40	80	36	1.1	0.6	49.0	71.0	5 000	7 200	54.0	—	66.0	72.2	52.9	16.9	2	27.1	2 770	54.2	5 540	885 90	1 200 122	272 27.8	389 39.6	95.8	129	1 470 150	2 000 204	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.

Ball Screw Support Bearings

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





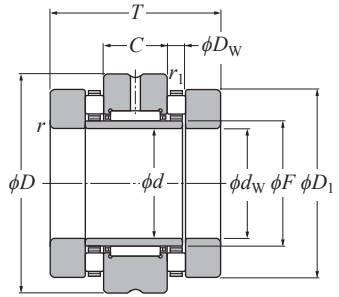
d 20–50 mm

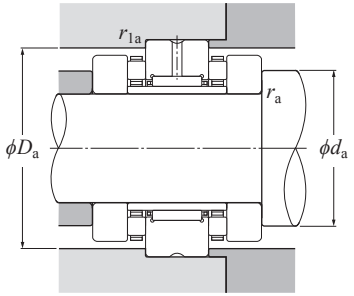
Part number	Boundary dimensions mm										Basic load ratings dynamic radial kN	Basic load ratings static radial kN	Basic load ratings dynamic radial kgf	Basic load ratings static radial kgf	Basic load ratings dynamic axial kN	Basic load ratings static axial kN	Basic load ratings dynamic axial kgf	Basic load ratings static axial kgf	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Radial internal clearance μm min	Radial internal clearance μm max	Abutment and fillet dimensions mm d_a min	Abutment and fillet dimensions mm D_a max	Abutment and fillet dimensions mm r_{as} max	Abutment and fillet dimensions mm r_{1as} max	Preload N	Starting[2] torque N·mm (approx.)	Mass kg (approx.)	Part number
	d	d_w	*D*	D_1 $^{-0.20}_{-0.50}$	*T* $^{0}_{-0.370}$	*C* $^{0}_{-0.130}$	*F*	D_w	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}	C_a	C_{0a}	C_a	C_{0a}												
AXN2052	20	20 $^{+0.061}_{+0.040}$	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 $^{+0.061}_{+0.040}$	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 $^{+0.061}_{+0.040}$	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 $^{+0.075}_{+0.050}$	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 $^{+0.075}_{+0.050}$	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 $^{+0.075}_{+0.050}$	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 $^{+0.075}_{+0.050}$	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 r_1.
2) Starting torque value relative to the standard preload.

Ball Screw Support Bearings

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





d 20–70 mm

Part number	Boundary dimensions mm										Basic load ratings dynamic radial kN	static radial kN	dynamic radial kgf	static radial kgf	Basic load ratings dynamic axial kN	static axial kN	dynamic axial kgf	static axial kgf	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Radial internal clearance μm min	Radial internal clearance μm max	Abutment and fillet dimensions mm d_a min	D_a max	r_{as} max	r_{1as} max	Preload N	Starting[2] torque N·mm (approx.)	Mass kg (approx.)	Part number
	d	d_w	D	D_1 −0.20 −0.50	T 0 −0.370	C 0 −0.130	F	D_w	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}	C_a	C_{0a}	C_a	C_{0a}												
ARN2052T2	20	20 +0.061 +0.040	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 +0.061 +0.040	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 +0.061 +0.040	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 +0.061 +0.040	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 +0.061 +0.040	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 +0.061 +0.040	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 +0.075 +0.050	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 +0.075 +0.050	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 +0.075 +0.050	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 +0.075 +0.050	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 +0.075 +0.050	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 +0.075 +0.050	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 +0.075 +0.050	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 +0.075 +0.050	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 +0.090 +0.060	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 +0.090 +0.060	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 +0.090 +0.060	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 +0.090 +0.060	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 r_1.
2) Starting torque value relative to the standard preload.